

## PART 1 - GENERAL

### 1.1 Section Includes

- .1 Installation of a new roof system over prepared substrate.
- .2 Existing roofing components and related appurtenances to be removed as specified in preparation for installation of a new low slope, conventional roofing system, including but not limited to:

#### PHASE ONE - 2016 Work:

- .1 On Roof Areas 1.1, 1.2, 1.4, 2.2, 3.1, 4.1, and 4.2:
  - .1 Existing flat metal roof deck,
  - .2 13mm (0.5") gypsum roof board, mechanically fastened,
  - .3 1 ply mod. bit. vapour retarder and flashings, self-adhered,
  - .4 51mm (2.0") polyiso insulation, in roofing adhesive,
  - .5 Tapered polyiso insulation, min. 25mm (1.0"), in adhesive,
  - .6 13mm (0.5") gypsum roof board, in roofing adhesive,
  - .7 1 ply mod. bit. base sheet field membrane, self-adhered,
  - .8 1 ply mod. bit. base sheet flashings, self-adhered,
  - .9 1 ply mod. bit. cap sheet membrane, torched applied,
  - .10 1 ply mod. bit. cap sheet flashings, torched applied,
  - .11 Prefinished metal flashings and trim.
- .2 On Roof Area 1.8:
  - .1 Existing sloped metal roof deck,
  - .2 13mm (0.5") gypsum roof board, mechanically fastened,
  - .3 1 ply mod. bit. vapour retarder and flashings, self-adhered,
  - .4 51mm (2.0") polyiso insulation, in roofing adhesive,
  - .5 51mm (2.0") polyiso insulation, offset in roofing adhesive,
  - .6 13mm (0.5") gypsum roof board, in roofing adhesive,
  - .7 1 ply mod. bit. base sheet field membrane, self-adhered,
  - .8 1 ply mod. bit. base sheet flashings, self-adhered,
  - .9 1 ply mod. bit. cap sheet membrane, torched applied,
  - .10 1 ply mod. bit. cap sheet flashings, torched applied,
  - .11 Prefinished metal flashings and trim.
- .3 On Roof Area 2.1:
  - .1 Existing concrete roof deck,
  - .2 1 ply mod. bit. vapour retarder and flashings, self-adhered,
  - .3 51mm (2.0") polyisocyanurate insulation, in roofing adhesive,
  - .5 Tapered polyiso insulation, min. 25mm (1.0"), in adhesive,
  - .5 13mm (0.5") siliconized gypsum roof board, in roofing adhesive,
  - .6 1 ply modified bitumen base sheet field membrane, self-adhered,
  - .7 1 ply modified bitumen base sheet flashings, self-adhered,
  - .8 1 ply granular mod. bit. cap sheet membrane, torched applied,
  - .9 1 ply granular mod. bit. cap sheet flashings, torched applied,
  - .10 Prefinished metal flashings and trim.

PHASE TWO - 2017 Work:

- .1 On Roof Areas 1.3, 1.5, 1.9, 1.10, and 2.3:
  - .1 Existing flat metal roof deck,
  - .2 13mm (0.5") gypsum roof board, mechanically fastened,
  - .3 1 ply mod. bit. vapour retarder and flashings, self-adhered,
  - .4 51mm (2.0") polyiso insulation, in roofing adhesive,
  - .5 Tapered polyiso insulation, min. 25mm (1.0"), in adhesive,
  - .6 13mm (0.5") gypsum roof board, in roofing adhesive,
  - .7 1 ply mod. bit. base sheet field membrane, self-adhered,
  - .8 1 ply mod. bit. base sheet flashings, self-adhered,
  - .9 1 ply mod. bit. cap sheet membrane, torched applied,
  - .10 1 ply mod. bit. cap sheet flashings, torched applied,
  - .11 Prefinished metal flashings and trim.
- .2 On Roof Areas 1.6 and 1.7:
  - .1 Existing sloped metal roof deck,
  - .2 13mm (0.5") gypsum roof board, mechanically fastened,
  - .3 1 ply mod. bit. vapour retarder and flashings, self-adhered,
  - .4 51mm (2.0") polyiso insulation, in roofing adhesive,
  - .5 51mm (2.0") polyiso insulation, offset in roofing adhesive,
  - .6 13mm (0.5") gypsum roof board, in roofing adhesive,
  - .7 1 ply mod. bit. base sheet field membrane, self-adhered,
  - .8 1 ply mod. bit. base sheet flashings, self-adhered,
  - .9 1 ply mod. bit. cap sheet membrane, torched applied,
  - .10 1 ply mod. bit. cap sheet flashings, torched applied,
  - .11 Prefinished metal flashings and trim.

## 1.2 REFERENCES

- .1 ASTM International Inc.
  - .1 ASTM C1177/C1177M-13, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  - .2 ASTM C1396/C1396M-14, Standard Specification for Gypsum Board.
  - .3 ASTM D41/D41-11, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
  - .4 ASTM D312/D312M-15, Standard Specification for Asphalt Used in Roofing.
  - .5 ASTM D6162/D6162M-00A(2015)e1, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.
  - .6 ASTM D6163/D6163M-00(2015)e1, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements.
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
  - .2 CGSB 37-GP-56M-80(1985), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
  - .3 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
- .3 Canadian Roofing Contractors Association (CRCA)

- .1 CRCA Roofing Specifications Manual-2012.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA A123.21-14, Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane Roofing Systems
  - .2 CSA A231.1-14/A231.2-14, Precast Concrete Paving Slabs/Precast Concrete Paving.
  - .3 CSA B149.1-15, Natural Gas and Propane Installation Code
  - .4 CSA O121-08 (R2013), Douglas Fir Plywood.
  - .5 CSA O151-09 (R2014), Canadian Softwood Plywood.
- .5 Factory Mutual (FM Global)
  - .1 FM Approvals - Roofing Products.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .7 Underwriters Laboratories' of Canada (ULC)
  - .1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .2 CAN/ULC-S702.2-10, Standard for Mineral Fibre Thermal Insulation for Buildings.
  - .3 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

### 1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meeting one week prior to beginning waterproofing Work, with roofing contractor's representative, consultant, and Departmental Representative in accordance with Section 01 32 16 to:
  - .1 Verify project requirements and schedule.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

### 1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Health and Safety Plan for project: to Section 01 35 29.
- .3 Product Data:
  - .1 Provide two copies of most recent technical roofing components data sheets for roof system describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide two copies of WHMIS MSDS, and indicate VOC content for:
    - .1 Primers.
    - .2 Achieves.
    - .3 Sealants.
    - .4 Liquid applied resins.

- .4 Warranties:
  - .1 Sample copy of manufacturer's System Warranty.
  - .2 Sample copy of Contractor's Workmanship Warranty.
- .5 Provide shop drawings:
  - .1 Indicate tapered insulation details.
  - .2 Provide layout for tapered insulation.
- .6 Manufacturer's Certificate: certify that products meet or exceed specified requirements.
- .7 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.
- .8 Manufacturer's field report: in accordance with Section 01 45 00.
- .9 Compatibility statement: written declaration that specified materials and components are compatible and meet manufacturer's requirements for system warranty.
- .10 Observation Reports: indicate materials installed, procedures followed, ambient temperatures, wind velocity during application, and weather conditions.

#### 1.5 QUALITY ASSURANCE

- .1 Installer qualifications:
  - .1 Company or person specializing in application of modified bituminous roofing systems with minimum 5 years documented experience and pre-approved by manufacturer for installation.
  - .2 Minimum three certified and carded applicators on site during performance of work.
  - .3 Be a member in good standing with Ontario Industrial Roofing Contractors Association (OIRCA).
  - .4 Arrange for final review at project completion with manufacturer's representative.

#### 1.6 FIRE PROTECTION

- .1 Fire Extinguishers:
  - .1 Maintain one stored pressure rechargeable type with hose and shut-off nozzle,
  - .2 ULC labelled for A, B and C class protection.
  - .3 Size 9 kg or greater on roof per torch applicator, within 6 m (19.7 ft) of torch applicator.
- .2 Maintain fire watch for 2 hours after each day's roofing operations cease.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00.

- .2 Storage and Handling Requirements:
  - .1 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.
  - .2 Provide and maintain dry, off-ground weatherproof storage.
  - .3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.
  - .4 Remove only in quantities required for same day use.
  - .5 Place plywood runways over completed Work to enable movement of material and other traffic.
  - .6 Store sealants at +5 degrees C minimum.
  - .7 Store insulation protected from daylight, weather, and deleterious materials.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets and packaging materials in accordance with Section 01 74 20.
  - .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
  - .2 Fold up metal banding, flatten and place in designated area for recycling.

#### 1.8 FIELD CONDITIONS

- .1 Ambient Conditions
  - .1 Do not install roofing when temperature remains below -18°C for torch application, or to manufacturers' recommendations.
  - .2 Minimum temperature for solvent-based adhesive is -5 degrees C.
- .2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.
- .3 Only install as much new roofing as can be made weather-tight each day, including all flashing and detail work. All seams to be sealed or heat welded before leaving job site that work day.
- .4 Arrange and plan work sequence logically to avoid use of newly installed roof as a walking surface for equipment movement and storage. Protect finished work from damage.
- .5 Keep and store flammable adhesives and primers away from open flames, sparks and excessive heat.
- .6 Verify functionality of existing roof drains before starting work. Report blockages in writing to Departmental Representative for corrective action prior to installation of roof system.
- .7 Landscaped areas damaged by construction activities to be repaired at no additional cost to contract amount.
- .8 Take precautions when using primer and adhesives at or near rooftop vents, louvres, or air intakes. Avoid odours from entering building. Coordinate operation or temporary closing-off of vents and air intakes with Departmental Representative.
  - .1 Install such materials outside of normal operating hours where feasible.

- .2 Keep lids on cans and containers at all times when not in use.

## 1.9 WARRANTY

- .1 For Work of this Section 07 52 00 - Modified Bituminous Membrane Roofing:
  - .1 Contractor Workmanship Warranty:
    - .1 For all low slope roof replacement areas, provide Departmental Representative with Contractor's Warranty for Workmanship on a Canadian Roofing Contractors Association (CRCA) approved form, signed, authorized, and executed.
    - .2 Workmanship warranty period is extended to from 12 months to 24 months from date of Substantial Completion.
  - .2 Roof Replacement System Warranty:
    - .1 For all low slope roof replacement areas, provide Departmental Representative with manufacturer's total system warranty for Labour, Material and Workmanship.
    - .2 System warranty period is extended to from 1 year to 20 years from date of Substantial Completion.
- .2 Cost of all warranties to be included in Contract Amount.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE CRITERIA

- .1 Compatibility between components of roofing system is essential. Provide written declaration to Departmental Representative stating that materials and components, as assembled in system, meet this requirement.
- .2 Roofing System: to CSA A123.21 for wind uplift resistance.
- .3 All major roof system components to be supplied from same manufacturer or approved for use in system by same manufacturer to meet specified roof system warranty requirements.

### 2.2 CARPENTRY

- .1 Refer to Section 06 10 00.

### 2.3 DECK OVERLAY BOARD

- .1 Glass Mat, Gypsum Board: to ASTM C1177/C1177M, 12.7 mm (0.5") thick.
  - .1 Compressive strength: 3447 kPa (500 psi).
  - .2 Top surface: factory pre-primed.
  - .3 Panel size: 1.22 x 2.44 m (4' x 8'), with square edges.

## 2.4 FASTENERS

- .1 Deck screws:
  - .1 FM Approved screw and plate assemblies.
  - .2 Epoxy coated carbon steel or solid stainless steel, self tapping deck fasteners and galvanized plates must meet FM Approval for wind uplift and corrosion resistance.
  - .3 Approved and recommended by membrane manufacturer.

## 2.5 DECK PRIMER

- .1 Asphalt primer: Composed of SBS synthetic polymers, bitumen, adhesive enhancing resins, and volatile solvents to CGSB 37-GP-9Ma or ASTM D41/D41M for improved surface adhesion.
  - .1 Approved by manufacturer for membrane attachment type.

## 2.6 VAPOUR RETARDER

- .1 Base sheet membrane and flashing: to CGSB 37-GP-56M, glass fibres to ASTM D6163M.
  - .1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer prefabricated sheet, glass mat reinforcement.
  - .2 Type 2 - covered, self-adhered.
  - .3 Class C - plain surfaced.
  - .4 Grade 1 - standard service.
  - .5 Top and bottom surfaces:
    - .1 sanded/polyethylene release film.
  - .6 Base sheet membrane properties: to CGSB 37-GP-56M.
    - .1 Strain energy (longitudinal/transversal): 1.3/1.3 kN/m.
    - .2 Breaking strength (longitudinal/transversal): 11/8.5 kN/m.
    - .3 Ultimate elongation (longitudinal/transversal): 4/4 %.
    - .4 Tear resistance: 30 N.
    - .5 Cold bending at -30°C : no cracking.
    - .6 Softening point: 115°C.
    - .7 Static puncture resistance: 160 N.
    - .8 Dimensional Stability: 0/0 %.

## 2.7 ADHESIVE

- .1 Adhesive for securing deck overlay board and insulation: low rise, one or two component polyurethane foamable adhesive for roofing applications.
  - .1 Two component adhesive mixed on site with manufacturer's recommended equipment.

## 2.8 POLYISOCYANURATE - BASE INSULATION

- .1 Polyisocyanurate foam insulation:
  - .1 Closed cell to CAN/ULC-S704, Type II 137.9 kPa (20 psi), bonded to inorganic coated glass facers, flame spread classification: less than 500.
- .2 Base Insulation Thickness:

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- .1 Roof Areas 1.1, 1.2, 1.3, 1.4, 1.5, 1.9, 1.10, 2.1, 2.2, 2.3, 3.1, 4.1, and 4.2: 51 mm (2.0") thick, continuous flat.
- .2 Roof Areas 1.6, 1.7, and 1.8: 51 mm (2.0") thick, continuous flat.
- .3 Tapered Insulation Drain Sumps:
  - .1 Prefabricated and factory cut polyisocyanurate insulation sumps at all existing roof drain locations:
    - .1 Roof Areas 1.1, 1.2, 1.3, 1.4, 1.5, 1.9, 1.10, 2.1, 2.2, 2.3, 3.1, 4.1, and 4.2: 2.44 x 2.44 m (8' x 8'), tapered from 51 mm (2.0") at 2% down to a 610 x 610 mm (2' x 2') central flat area 32 mm (1.25") thick.
- .4 Maximum Board Size: 1.22 x 1.22 m (4' x 4'), square edge, butt lap.

## 2.9 POLYISOCYANURATE - OVERLAY INSULATION

- .1 Polyisocyanurate foam insulation:
  - .1 Closed cell to CAN/ULC-S704, Type II 137.9 kPa (20 psi), bonded to inorganic coated glass facers, flame spread classification: less than 500.
- .2 Overlay Insulation Thickness:
  - .1 Roof Areas 1.1, 1.2, 1.3, 1.4, 1.5, 1.9, 1.10, 2.1, 2.2, 2.3, 3.1, 4.1, and 4.2: Tapered polyisocyanurate insulation boards sloped from maximum 76 mm (3.0") down to minimum 25 mm (1.0") thick. Remaining area receive continuous flat insulation 25 mm (1.0") thick. Slope insulation at 1% or 2% as indicated by layout on roof plan drawings.
  - .2 Roof Areas 1.6, 1.7, and 1.8: 51 mm (2.0") thick, continuous flat.
- .3 Tapered Insulation Drain Sumps:
  - .1 Prefabricated and factory cut polyisocyanurate insulation sumps at all existing roof drain locations:
    - .1 Roof Areas 1.6, 1.7, and 1.8: 2.44 x 2.44 m (8' x 8'), tapered from 51 mm (2.0") at 2% down to a 610 x 610 mm (2' x 2') central flat area 32 mm (1.25") thick.
- .4 Tapered Insulation Crickets:
  - .1 Provide crickets on sloped roof sections at all rooftop penetrations, sleepers, and curbs wider than 305 mm (1'-0") to improve drainage flow. Custom cut to suit each installation location.
  - .2 Prefabricate crickets tapered at 8% from 51 mm (2.0") down to 0 mm (0") over 610mm (2'-0"), in 2.44 m (8'-0") board lengths. Cut crickets on angle on site to suit existing condition at each location.
- .5 Maximum Board Size: 1.22 x 1.22 m (4' x 4'), square edge, butt lap.
- .6 Submit tapered shop drawings for review before fabrication and delivery.

## 2.10 COVER BOARD

- .1 Glass Mat, Gypsum Board: to ASTM C1177/C1177M, 12.7 mm (0.5") thick.
  - .1 Compressive strength: 3447 kPa (500 psi).
  - .2 Top surface: factory pre-primed.



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- .3 Panel size: 1.22 x 2.44 m (4' x 8'), with square edges.

## 2.11 MEMBRANE

- .1 Base sheet membrane and flashing: to CGSB 37-GP-56M combination of polyester and glass fibres to ASTM D6162M.
  - .1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer prefabricated sheet, composite glass and polyester reinforcement.
  - .2 Type 2 - covered, self-adhered.
  - .3 Class C - plain surfaced.
  - .4 Grade 2 - heavy duty service.
  - .5 Top and bottom surfaces:
    - .1 sanded/polyethylene release film.
  - .6 Base sheet membrane properties: to CGSB 37-GP-56M.
    - .1 Strain energy (longitudinal/transversal): 7.8/7.2 kN/m.
    - .2 Breaking strength (longitudinal/transversal): 15/15.5 kN/m.
    - .3 Ultimate elongation (longitudinal/transversal): 60/65 %.
    - .4 Tear resistance: 125 N.
    - .5 Cold bending at -30°C : no cracking.
    - .6 Softening point: 110°C.
    - .7 Static puncture resistance: 560N.
    - .8 Dimensional Stability: 0.2/0.1 %.
- .2 Cap sheet membrane and flashing: to CGSB 37-GP-56M combination of polyester and glass fibres to ASTM D6162M.
  - .1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer, prefabricated sheet, composite glass and polyester reinforcement.
  - .2 Type 1 - exposed, torch applied.
  - .3 Class A - granule surfaced.
    - .1 Colour for granular surface: chosen by Departmental Representative from standard colour range.
  - .4 Grade 2 - heavy duty service.
  - .5 Bottom surface: thermofusible polyfilm.
  - .6 Cap sheet membrane properties: to CGSB 37-GP-56M.
    - .1 Strain energy (longitudinal/transversal): 7.8/7.2 kN/m.
    - .2 Breaking strength (longitudinal/transversal): 15/13.5 kN/m.
    - .3 Ultimate elongation (longitudinal/transversal): 60/65 %.
    - .4 Tear resistance: 125 N.
    - .5 Cold bending at -30°C: No cracking.
    - .6 Softening point: 110°C.
    - .7 Static puncture resistance: 560 N.
    - .8 Dimensional Stability: 0.2/ 0.0 %.

## 2.12 PMMA RESIN FLASHINGS

- .1 Flexible, polymethylmethacrylate (PMMA) based resin system combined with a thixotropic agent for use in combination with fleece fabric to form a monolithic, reinforced flashing membrane:
  - .1 PMMA Primer: to suit substrate surfaces, vertically and horizontally.
  - .2 PMMA Resin: polymethylmethacrylate based resin combined with a thixotropic agent.
  - .3 PMMA Catalyst: powder catalyst as recommended for humidity.
  - .4 Thixotropic agent: liquid additive used to increase viscosity of

PMMA-based resin products.

.5 Fleece reinforcement: non-woven, 110 g/m<sup>2</sup>, needle punched, polyester fabric reinforcement.

.6 Colour finish resin: pigmented, polymethylmethacrylate (PMMA) based resin for use as a wearing coat over field of finished roof membrane.

.1 Colour: chosen by Departmental Representative from standard pallet of available colours.

.7 Anti-Skid Surfacing: No. 11 ceramic granules suitable for broadcast into horizontal PMMA based wearing layer.

.1 Colour: chosen by Departmental Representative from standard pallet of available colours.

.8 Cleaning solution/solvent: clear solvent to clean and prepare transition areas of in-place catalyzed resin to receive subsequent coats of resin and to clean substrate materials to receive resin.

.9 Preparation paste: PMMA based paste used for remediation of depressions in substrate surfaces or other irregularities.

.10 Repair mortar: Two component, PMMA based, aggregate filled mortar used for remediation of depressions or patching concrete substrates.

.11 Tape: White, flexible, coated cotton cloth tape designed for treatment of insulation panel joints, deck-to-wall transitions and joints in flashing substrates.

## 2.13 ROOFING ACCESSORIES

.1 Retrofit roof drains: Prefabricated spun copper retrofit roof drain inserts with integral 102 mm (4.0") wide flanges, complete with vandal-proof cast aluminum domes, brass diameter matching ferrules and related installation hardware.

.1 Use with mechanical compression seal connectors installed to drain stem throat from roof top side and inserted into existing drainage pipe.

.2 Provide internal control flow inserts at all roof drains with existing control flow devices.

.2 Roof penetrations and stacks: prefabricated units with spun aluminum or copper flashing sleeves, complete with removable caps and pre-molded insulation where indicated on drawings.

.3 Firestop Sealant: One component, neutral cure silicone sealant to ASTM E84 and CAN4-S115M, designed for firestop applications at joints and through-wall penetrations.

.4 Termination Bars: Prefabricated extruded TB-120 aluminum, 1.5mm (0.060") thick with 6 x 9.5 mm (1/4" x 3/8") slotted holes at 203 mm (8") o/c.

.5 Polystyrene Insulation:

.1 Extruded polystyrene (XPS) insulation to CAN/ULC-S701, Type 4, thickness 25 mm (1.0"), square edges.

.6 Concrete Pavers:

.1 Paving slabs: to CSA A231.1, 600 x 600 x 50 mm thick, precast concrete paving slabs having non-slip finish.

.7 Stone Wool Fibre Batt Insulation:

.1 Non-combustible, water resistant, vapour permeable, semi rigid stone wool batt insulation made from slag and basalt rock, conforming to

- CAN/ULC-S702.2, with a density of 45 kg/m<sup>3</sup> (2.8 lb/ft<sup>3</sup>).
- .2 Thickness as indicated or to fill cavity voids.
- .3 Surface: unfaced.
- .8 Sealing compound: rubber asphalt type as recommended by manufacturer.
- .9 Walkway Pads:
  - .1 Walkways to consist of one additional ply of fully bonded cap sheet membrane squares or prefabricated modified bitumen roof treads approved by membrane manufacturer.
  - .2 Colour to be different from field membrane and as selected by Departmental Representative from standard colour range.
- .10 Sealants: to Section 07 92 00.

### PART 3 - EXECUTION

#### 3.1 QUALITY OF WORK

- .1 Do examination, preparation and roofing Work in accordance with roofing manufacturer's Specification Manual and CRCA Roofing Specification Manual, particularly for fire safety precautions.
- .2 Do priming in accordance with manufacturers written recommendations.
- .3 The interface of the walls and roof assemblies will be fitted with durable rigid material plywood providing connection point for continuity of air barrier.
- .4 Assembly, component and material connections will be made in consideration of appropriate design loads.

#### 3.2 EXAMINATION OF ROOF DECKS

- .1 Verification of Conditions:
  - .1 Review with Departmental Representative deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed.
- .2 Evaluation and Assessment:
  - .1 Prior to beginning of work ensure:
    - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.
    - .2 Curbs have been built.
    - .3 Roof drains have been installed at proper elevations relative to finished roof surface.
    - .4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

- .3 Remediate corrosion to metal connectors and decking with rust proofing, galvanization, deck overlays, and new metal decking to Section 05 01 30.

### 3.3 PROTECTION OF IN-PLACE CONDITIONS

- .1 Cover walls, walks , adjacent roofs and adjacent work where materials hoisted or used.
- .2 Use warning signs and barriers. Maintain in good order until completion of Work.
- .3 Clean off drips and smears of bituminous material immediately.
- .4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.
- .5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Departmental Representative.
- .6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.
- .7 Do not install roofing materials during rain or snowfall.

### 3.4 PREPARATION FOR ROOFING

- .1 Preparation:
  - .1 Divide work into logical sections and only tear-off as much existing roof as can be made watertight in same working day to prevent damage to building interior.
  - .2 Prior to removal of any roof components, all existing openings (drains, vents, air intakes, etc.) to be covered or plugged to prevent any debris or contaminate from entering building below. All such coverings are to be removed at end of each working day and reinstalled prior to next day's start up.
  - .3 Disconnect and reconnect Electrical Services and Mechanical Equipment as required. Coordinate in advance with Departmental Representative.
    - .1 Any rooftop equipment requiring disconnection to be responsibility of Contractor.
- .2 Existing Roof Removal:
  - .1 On All Roof Areas: Remove existing roof system components down to expose existing roof deck in preparation for installation of new roof system.
  - .2 At areas designated for roof removal and replacement, remove existing projection and perimeter metal flashings, ballast, gravel, roof membrane and flashings, insulation, vapour retarder and flashings, and old appurtenances. Dispose removed items to an appropriate site for building material waste and recycling.
  - .3 All unused and abandoned pitch pockets, vents, curbs, sleepers, projections, etc. are to be removed from designated areas and disposed of.

- .1 Obtain verification and authorization from Departmental Representative before removing and disposing of any suspected unused or abandoned projections.
  - .2 Install new roof decking as required to close off any deck openings prior before proceeding with new roof system installation.
- .3 Substrate Review:
  - .1 Exposed roof deck surfaces to be reviewed by Contractor with Departmental Representative. Ensure to review entire roof area to satisfy warranty requirements of manufacturer for new roof system.
    - .1 Notify Departmental Representative of review at least forty-eight (48) hours prior to site review.
  - .2 Report anomalies found that may impact soundness and structural integrity of roof system to Departmental Representative immediately. Areas with damaged decking must be replaced or repaired before any further work may take place on that particular section.
  - .3 Ensure roof decks are firm, straight, smooth, dry, free of snow, ice, frost, oils, or other contaminants. Decking must be properly cleaned of any dust and debris prior to proceeding with new installation. Test whether specified adhesion to deck will be obtained where required.
  - .4 Prior to application of vapour retarder, examine deck and ensure any defect of level or construction is correct before proceeding with work.
  - .5 Verify that roof drains have been installed at proper elevations relative to finished roof surface to allow for sufficient drainage of roof surface.
  - .6 Review securement of existing projections and equipment (electrical conduit, gas lines, etc.). If inadequate securement is found, inform Departmental Representative and halt work around that area until situation is rectified.
  - .7 Review securement of existing plywood sheathing, wood blocking, and cant strips. Do not install new roofing unless such items are adequately secured to withstand stresses imposed by thermal movement of new roofing components.

### 3.5 CARPENTRY

- .1 On All Roof Replacement Areas: Refer to detail drawings for carpentry requirements.
- .2 Install wood blocking and plywood to accommodate required slopes, insulation, roofing membranes, and prefinished sheet metal and trim.
  - .1 Carpentry alterations to be performed to accepted trade practices.
- .3 Add new wood blocking as necessary to maintain minimum heights at perimeters and roof curbs.
  - .1 At Existing Roof Curbs: Minimum height to be 203 mm (8") above finished roof membrane.
  - .2 At metal roof curbs: Install new galvanized bent metal extension, metal C-Channel, prefab curb extension, or prefab curb adapter or reducer to raise curb as required to suit new height.
- .4 At Existing Parapets: Minimum height to be 102 mm (4") above finished roof membrane, unless otherwise indicated on detail drawings.

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- .5 Replace any seriously damaged or deteriorated wood at perimeters and projections with new wood blocking or plywood, good one side, to match existing.
- .6 Ensure existing wood blocking remaining at perimeters and curbs is securely fastened to existing substrate before installing new blocking and plywood.
- .7 Install wood blocking as required to ensure that all roof curbs and sleepers supporting H.V.A.C. and mechanical equipment are level.
- .8 Wood to wood, wood to metal, wood to masonry or concrete to be secured at 305 mm (12") on center with alternating fasteners staggered.
- .9 Avoid protruding fastener heads. Where possible, all fasteners to be flush with or slightly sunk below surface of wood blocking being secured.
- .10 All wood blocking and plywood is to be considered part of roof, and to be made watertight by end of each work day to eliminate moisture infiltration into roof system.

### 3.6 DECK OVERLAY BOARD

- .1 On Roof Areas 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 2.2, 2.3, 3.1, 4.1, and 4.2: Adhere a layer of deck overlay board in beads of polyurethane foamable roofing adhesive to metal roof deck as per manufacturer's written instructions.
- .2 Non-Asphaltic adhesive primer may be used to increase adhesion to metal deck or on highly absorbent substrates. Consult manufacturer on use of suitable epoxy coatings, chlorinated rubber, wash primer or other adhesive primers.
- .3 Do not use wet or damaged deck overlay panels. Panels must be dry for proper installation.
- .4 Custom cut deck overlay boards at perimeters and projections to suit. Install boards tightly together with no gaps between adjacent boards larger than 3 mm (0.125").
  - .1 Cut boards as required to fit snug at all perimeters, walls, and roof projections.
  - .2 Cut straight lines using proper tools and snap chalk lines.
  - .3 Cut boards cleanly where slope changes direction. Do not break boards by stepping on them to acquire changes in deck slope.
- .5 Install sheet panels over metal decking with long axis of each sheet perpendicular to direction of deck flutes or ribs.
  - .1 Align side edges of roof board panels over center of top deck flutes
  - .2 Butt sheets tightly together with end joints staggered by half width of sheet.
- .6 Mechanical fasteners to penetrate top flutes only, by no less than 19 mm (3/4") and by no more than 32 mm (1.25").
  - .1 Check underside of metal deck before installation to eliminate damaging any existing conditions below deck.

- .7 Where cover board is field primed, allow sufficient time for applied primers to dry and flash-off. Roof board surface must be thoroughly dry before installation of membrane.

### 3.7 VAPOUR RETARDER

- .1 On All Roof Replacement Areas: Install one (1) ply modified bitumen vapour retarder with flashings as per Manufacturer's written guidelines. Installation to be free of blisters, wrinkles and fish-mouths.
  - .1 Vapour retarder must be installed on same day as primer application.
  - .2 Do not install when it is raining or snowing, on wet/humid surfaces, or when inclement weather is expected shortly.
  - .3 Deck substrate must be clean, dry, and free of dirt, dust, grease, or other contaminants.
- .2 Primer Installation:
  - .1 Prime exposed surfaces to receive vapour retarder membrane and flashings. Apply primer to clean and dry surfaces with a paint brush, roller or sprayer at temperatures 0°C (31°F) and above.
  - .2 Apply primer at a coverage rate between of 0.1 to 0.5 L/m<sup>2</sup> (0.25 to 1.22 gallon/100 ft<sup>2</sup>) as recommended by membrane manufacturer for surface type.
  - .3 Ensure all substrates are fully covered with primer with no areas bare and avoid pooling.
  - .4 Allow primer to dry completely prior to installation of new vapour retarder membrane.
- .3 Field Membrane Installation:
  - .1 Begin application at bottom of roof slope. Position membrane rolls for alignment and unroll to apply membrane. Do not immediately remove release sheet on self-adhered membranes until satisfied with alignment.
  - .2 Overlap each preceding row of membrane sheet by min. 76 mm (3") on side laps and by a min. 152 mm (6") at end laps. Stagger end laps of adjacent rows by at least 305 mm (12").
  - .3 Use a 34 kg (75 lbs) roller to press membrane down onto substrate including laps. Finish by aligning edge of roller with lower end of side laps and rolling up membrane.
    - .1 Do not cut membrane to remove trapped air bubbles. Squeeze out air bubbles by pushing roller to edge of laps.
  - .4 All side and end laps of base sheet to be heat welded or torched.
  - .5 Carry vapour retarder up all vertical surfaces at parapets and projections a minimum of 152 mm (6") to allow for encapsulating of new insulation with roof membrane as indicated on detail drawings.
  - .6 **INSTALL MEMBRANE GUSSET REINFORCEMENT AT ALL INSIDE AND OUTSIDE CORNERS ON TOP OF BASE SHEET MEMBRANE.**
- .4 Membrane Flashing Installation:
  - .1 Ensure all substrates are fully covered with primer leaving no areas bare and allow to completely dry.
  - .2 Install membrane flashing onto substrate in strips one membrane roll wide (1 m or 40") and extend over perimeters as shown on detail drawings
  - .3 Field measure and cut flashing membrane to length required for flashing at each detail and roll up for installation.
  - .4 Once aligned in position, peel back a portion of release sheet and press

- membrane onto substrate for initial adherence. Hold membrane flashing tight and peel back release sheet by pulling diagonally.
- .5 Overlap each preceding flashing sheet by min. 76 mm (3") on side laps and align bottom edge to a chalk reference line along base sheet membrane. Lap membrane flashing onto field membrane a minimum 102 mm (4").
- .6 Use a weighted roller to press membrane down onto substrate including laps. Finish by aligning edge of roller with lower end of side laps and rolling up membrane.
  - .1 Do not cut membrane to remove trapped air bubbles. Squeeze out air bubbles by pushing roller to edge of laps.
- .7 All side and end laps of base sheet to be heat welded or torched.

### 3.8 BASE INSULATION

- .1 On All Roof Replacement Areas: Install a layer of base insulation boards over prepared vapour retarder in accordance with insulation manufacturer's instructions.
- .2 Do not install warped, curled, damaged, or wet insulation boards.
- .3 Install base insulation boards in parallel rows and butt tightly together with joints staggered by one half board length.
  - .1 Where multiple layers of insulation are required, stagger all board joints at least 305 mm (12") between rows.
- .4 At all existing and new roof drain locations, delete a section of base insulation in a 2.44 x 2.44 m (8' x 8') area centered around each drain.
  - .1 At each drain location, install a new 2.44 x 2.44 m (8' x 8') prefabricated, tapered insulation drain sump over prepared substrate.
- .5 Adhere base insulation to substrate using continuous beads of polyurethane foamable roofing adhesive. Follow manufacturer's installation instructions.
- .6 Install continuous ribbons of polyurethane adhesive in parallel lines to meet CSA A123.21 requirements. Use a "Z" pattern over an application area no larger than 3.66 m (12'-0") at a time. Minimum securement pattern:
  - .1 Adhesive ribbons to be no less than 13 mm (1/2") to 19 mm (3/4") in width at time of application.
  - .2 Parallel rows of adhesive ribbons to be no more than 305 mm (1'-0") apart in field of roof.
  - .3 Along 3.05 m (10'-0") wide perimeter zones, rows of adhesive to be no more than 127 mm (6") apart.
  - .4 Rows of adhesive to be no more than 102 mm (4") apart in corner zones.
- .7 Do not allow rising foam adhesive to skin-over. Place insulation panels immediately into wet adhesive.
- .8 Walk-in board panels to ensure positive adhesion of substrate across full panel. Repeat walk-in every five (5) minutes until insulation is firmly attached.
- .9 Custom cut insulation boards as required at perimeters and projections to suit. Field cuts to be neat and provide tight fit around penetrations, projections, and at perimeters.



- .10 For uneven surfaces, trimming or slitting of boards may be necessary. Fill all gaps larger than 3 mm (1/8") with insulation slivers.

### 3.9 OVERLAY INSULATION

- .1 On All Roof Replacement Areas: Install a continuous layer of overlay insulation boards over base insulation in accordance with insulation manufacturer's instructions.
- .2 Install tapered overlay insulation according to layout on reviewed shop drawings and roof plan drawing(s). Report any discrepancies to Departmental Representative before proceeding.
- .3 Do not install warped, curled, damaged, or wet insulation boards.
- .4 Install overlay insulation boards in parallel rows and butt tightly together with joints staggered by one half board length.
  - .1 Where multiple layers of insulation are required, stagger all board joints at least 305mm (12") between rows.
- .5 Adhere overlay insulation to substrate using continuous beads of polyurethane foamable roofing adhesive. Follow manufacturer's installation instructions.
- .6 Install continuous ribbons of polyurethane adhesive in parallel lines to meet CSA A123.21 requirements. Use a "Z" pattern over an application area no larger than 3.66m (12'-0") at a time. Minimum securement pattern:
  - .1 Adhesive ribbons to be no less than 13 mm (1/2") to 19 mm (3/4") in width at time of application.
  - .2 Parallel rows of adhesive ribbons to be no more than 305 mm (1'-0") apart in field of roof.
  - .3 Along 3.05 m (10'-0") wide perimeter zones, rows of adhesive to be no more than 127 mm (5") apart.
  - .4 Rows of adhesive to be no more than 102mm (4") apart in corner zones.
- .7 Do not allow rising foam adhesive to skin-over. Place insulation panels immediately into wet adhesive.
- .8 Walk-in board panels to ensure positive adhesion of substrate across full panel. Repeat walk-in every five (5) minutes until insulation is firmly attached.
- .9 Custom cut insulation boards as required at perimeters and projections to suit. Field cuts to be neat and provide tight fit around penetrations, projections, and at perimeters.
- .10 For uneven surfaces, trimming or slitting of boards may be necessary. Fill all gaps larger than 3 mm (1/8") with insulation slivers.
- .11 Install tapered insulation crickets over top of overlay insulation in ribbons of polyurethane adhesive.
  - .1 Provide crickets at all penetrations wider or longer than 305 mm (1'-0") to improve drainage flow.

### 3.10 COVER BOARD

- .1 On All Roof Replacement Areas: Install a layer of cover board panels in ribbons of polyurethane foamable roofing adhesive over rigid insulation as per manufacturer's written instructions and to meet FM 1-90 requirements.
- .2 Do not use wet or damaged cover board panels. Panels must be dry for proper installation.
- .3 Determine and mark, as required, areas to receive new cover board installation to avoid over application of quick adhesive.
- .4 Custom cut cover board panels at perimeters and projections to suit. Install cover boards tightly together with no gaps between insulation boards larger than 3 mm (0.125").
  - .1 Cut boards as required to fit snug at all perimeters, walls, and roof projections.
  - .2 Cut straight lines using proper tools and snap chalk lines.
  - .3 Cut boards cleanly where slope changes direction. Do not break boards by stepping on them to acquire changes in deck slope.
- .5 Install cover board panels in parallel rows and butt tightly together with end joints staggered by a half width of panel. Stagger panel end joints with joints of rigid insulation below by min. 152mm (6").
- .6 Install continuous ribbons of polyurethane adhesive in parallel lines to meet CSA A123.21 requirements. Use a "Z" pattern over an application area no larger than 3.66 m (12'-0") at a time. Minimum securement pattern:
  - .1 Adhesive ribbons to be no less than 13 mm (1/2") to 19 mm (3/4") in width at time of application.
  - .2 Parallel rows of adhesive ribbons to be no more than 305mm (1'-0") apart in field of roof.
  - .3 Along 3.05 m (10'-0") wide perimeter zones, rows of adhesive to be no more than 127 mm (5") apart.
  - .4 Rows of adhesive to be no more than 102 mm (4") apart in corner zones. Do not allow rising foam adhesive to skin over. Place roof board panels immediately into wet adhesive.
- .7 Walk-in board panels to ensure positive adhesion to substrate across full panel. Repeat walk-in every five (5) minutes until insulation is firmly attached.
- .8 Where cover board is field primed, allow sufficient time for applied primers to dry and flash-off. Roof board surface must be thoroughly dry before installation of membrane.

### 3.11 MODIFIED BITUMEN MEMBRANE APPLICATION

- .1 On All Roof Replacement Areas: Install a two (2) ply, SBS modified bitumen membrane system over top of prepared substrate. Base sheet layer to be self-adhered with self-adhered flashings. Cap sheet layer and flashings to be torch applied with torch applied flashings.

- .2 All membrane and flashing applications to be free of installation defects including sags, blisters, wrinkles, and fish-mouths.
- .3 General Requirements for Application:
  - .1 Tools, Rollers, & Squeegees: Use membrane manufacture's recommended tools and accessories. Keep tools clean during performance of work and frequently replace application roller tips and squeegee heads with new when clogged.
  - .2 Surface Review: Apply over wood, metal, gypsum board and concrete decks which are clean, smooth, and free of snow, ice, moisture, and debris. Concrete decks must have all holes filled with quick drying cement and rough patches removed.
  - .3 Application of Primer: Priming is required for all substrates prior to installation. Avoid pooling primer and allow to completely dry before membrane installation.
  - .4 First Roll Starting Point: Base sheet to begin at drain level with side lap aligned to center of drain. Run rolls perpendicular to slope. Cap sheet to be installed over base sheet covering base sheet overlap. Center of cap sheet to align up with center of drain.
  - .5 Relaxing of Roll Membrane: ALL ROLL MEMBRANES ARE TO BE FULLY UNROLLED AND ALLOWED TO RELAX FOR MINIMUM 15 MINUTES PRIOR TO INSTALLATION. Wait longer in cooler temperatures. Trace zig-zag pattern with torch over membranes covered with thermal-fusible film.
  - .6 Alignment of Rolls: Completely unroll first roll and align with edge of roof. Reroll membrane from both ends to center and apply as per specifications.
  - .7 Stagger Sheets: Offset end laps between base and cap sheets a min. of 610 mm (24"). Offset side laps between base and cap sheets a min. of 305 mm (12"), centered alignment preferred. Laps in same membrane layer to be min. 76 mm (3") wide for side laps and min. 305 mm (12") wide for end laps.
  - .8 Procedure to Seal Voids: Where voids are created by overlapping rolls of membrane, cut off corner of salvage edge where covered by next roll of material.
  - .9 Salvage Edge Protection: Granules along edge of membrane to be primed prior to application of adhesive to provide good adhesion of laps.
  - .10 Bleed-Out at Seams: When torch applying membrane, provide consistent, continuous bleed-out along all seams, no less 3 mm (1/8") and no greater than 6 mm (1/4") in width.
  - .11 All Seams: Check all seams in all sheets with a round nosed trowel while work is in progress. Repair found deficiencies immediately and before continuing roof installation.
  - .12 Base Sheet Seams: Butter all seams and laps. Provide additional bitumen at point of 90° upturns in base sheet flashings. Recheck self-adhered membrane seams left exposed within forty-eight (48) hours of installation to repair any revealed seam deficiencies with clean, heated trowel.
  - .13 Cap Sheet Seams: At all end laps and membrane flashing overlaps, degranulate area (embed granules) of surface to be bonded by embedding ceramic granules into bitumen of membrane using clean, heated trowel to push in. Measure and use straight chalk lines to mark outline of areas requiring degranulation. Achieve a uniform black surface of bitumen across 100% of embedment areas to be overlapped.
  - .14 Reinforcement: Required at all corners, vents, drains, HVAC units, and gravel stops.

- .15 Primer Application: Sanded membrane left exposed overnight or longer to be primed before continuing membrane installation to ensure good adhesion.
- .16 Torch Application: During windy periods, slow application rate down to ensure good bond with proper level of heat. Stop and periodically check for proper adhesion.
- .4 Base Sheet Field Membrane, Self-adhered Installation:
  - .1 Prime surfaces at roof projections and around perimeters to receive new base sheet membrane and flashings.
  - .2 Field measure and cut membrane to length of run required and roll up for installation.
  - .3 Starting at low point of roof, perpendicular to slope, unroll base sheet membrane and position.
  - .4 Once aligned in desired position, peel back a portion of release under film and press membrane onto substrate for initial adherence. Hold membrane tight and peel back release under film by pulling diagonally to remove fully and discard. Broom sheet into place to ensure full contact with substrate
  - .5 Overlap each preceding flashing sheet by min. 76 mm (3") on side laps and align bottom edge to a chalk reference line along base sheet membrane. Lap membrane flashing onto field membrane a minimum 102 mm (4").
  - .6 Use a membrane manufacturer recommended weighted roller to press membrane down onto substrate including laps. Finish by aligning edge of roller with lower end of side laps and rolling up membrane.
    - .1 Squeeze out air bubbles by pushing roller to edge of laps.
  - .7 All side and end laps of base sheet to be heat welded as required with hot air gun or torch.
- .5 Base Sheet Flashing, Self-adhered Installation:
  - .1 Prime surfaces at roof projections and around perimeter to receive new base sheet membrane flashings.
  - .2 Install membrane flashing onto substrate in strips one membrane roll wide (1m or 40") and extend over perimeters as shown on detail drawings
  - .3 Field measure and cut flashing membrane to length required for flashing at each detail and roll up for installation.
  - .4 Install base sheet flashing starting at outside face of perimeter, running across perimeter detail, and down onto flat of roof.
  - .5 Once aligned in position, peel back a portion of release sheet and press membrane onto substrate for initial adherence. Hold membrane flashing tight and peel back release sheet by pulling diagonally.
  - .6 Overlap each preceding flashing sheet by min. 76 mm (3") on side laps and align bottom edge to a chalk reference line along base sheet membrane. Lap membrane flashing onto field membrane a minimum 102 mm (4").
  - .8 Use a membrane manufacturer recommended weighted roller to press membrane down onto substrate including laps. Finish by aligning edge of roller with lower end of side laps and rolling up membrane.
    - .1 Squeeze out air bubbles by pushing roller to edge of laps.
  - .9 Provide preliminary securement of membrane on outside edge or perimeters before installation of finish metal flashings and trim. Fasten top edge of membrane flashings on outside face of perimeter details with round top nails spaced every 229 mm (9") o/c.
  - .10 MEMBRANE GUSSET REINFORCEMENT TO BE INSTALLED ON TOP OF BASE SHEET

MEMBRANE AT ALL INSIDE AND OUTSIDE CORNERS. DEPARTMENTAL REPRESENTATIVE TO REVIEW GUSSET INSTALLATION BEFORE INSTALLATION OF CAP SHEET MEMBRANE.

- .11 All side and end laps of base sheet flashing to be heat welded as required with hot air gun or torch to satisfaction of QA Observer.
- .6 Cap Sheet Field Membrane, Torch Installation:
  - .1 Complete installation of base sheet flashing prior to installing membrane cap sheet and cap sheet flashings.
  - .2 Field measure and cut membrane to length of run required and roll up for installation.
  - .3 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and re-roll from both ends.
  - .4 Unroll and install cap sheet carefully in straight and parallel rows keeping majority of flame on membrane roll.
  - .5 Cap sheet to be torched across flat of roof, overtop of base sheet, and terminated at perimeters and vertical surfaces ensuring a good bond.
  - .6 Lap sheets 76 mm (3") for side laps and a minimum 152 mm (6") for end laps. Offset joints in cap sheet 305mm (12") minimum from those of base sheet.
  - .7 All side and end laps of cap sheet to be heat welded with hot air gun or torch.
- .7 Cap Sheet Flashing, Torch Installation:
  - .1 Cap sheet membrane flashing to be torched up and over perimeter details.
  - .2 Install membrane flashing onto substrate in strips one membrane roll wide (1m or 40") and extend up perimeters as shown on detail drawings
  - .3 Field measure and cut flashing membrane to length required for flashing at each detail and roll up for installation.
  - .4 Set cap sheet to offset base sheet flashing joints by 50% and extend a minimum of 152 mm (6") onto roof. All end lap joints to be a minimum 76 mm (3").
  - .5 Align bottom edge to a chalk reference line along cap sheet membrane.
  - .6 Install cap sheet flashing onto field membrane a minimum 102 mm (4") at base of perimeter detail. Run flashing up vertical and across perimeter detail to outside edge.
  - .7 Overlap each preceding cap sheet flashing sheet by min. 76 mm (3") on side laps. Offset joints in cap sheet flashing 305 mm (12") minimum from those of base sheet flashing.
  - .8 Properly secure flashings to their support, without sags, blisters, fish-mouths or wrinkles with terminations as indicated on drawings and details.
  - .9 All side and end laps of cap sheet flashing to be heat welded with hot air gun or torch.

### 3.12 LIQUID APPLIED PMMA RESIN FLASHINGS

- .1 On Roof Replacement Area 1.1: Where specifically indicated in detail drawings and at any other junctions where conventional installation of membrane flashings are not feasible, install new liquid applied resin flashing system.
  - .1 Install continuous PMMA resin flashings over top of finished modified bitumen membrane along west wall of Roof Areas 2.1 and 4.1 where indicated in detail drawings.
  - .2 Provide coloured and granule textured top coat.

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- .2 Resin system to be a layered application consisting of two coats of thixotropic catalyzed polymethylmethacrylate (PMMA) resin encapsulating a layer of polyester fleece reinforcement.
- .3 Installation of liquid applied flashing system to manufacturer's written instructions.
- .4 Ensure that substrates are free from gross irregularities, loose, unsound or foreign material such as dirt, ice, snow, water, grease, oil, bituminous products, release agents, laitance, paint, loose particles/friable matter, rust or any other material that would be detrimental to adhesion of catalyzed primer and/or resin to substrate.
  - .1 Concrete substrates to receive an application of specified PMMA roofing system to have a maximum moisture content of 6% and a maximum internal relative humidity of 75%.
- .6 Preparation of Steel and/or Aluminum Substrates:
  - .1 Grind to generate a "white-metal" surface and remove loose particles. Extend preparation area a minimum of 13 mm (0.5") beyond termination of roofing/flashing system. Do not used cleaner/solvent after grinding. Notch steel surfaces to provide a rust-stop where detailed.
- .7 Preparation/Mixing/Catalyzing Resin Products:
  - .1 Pour desired quantity of resin into a clean container and using a spiral mixer or mixing paddle, stir liquid for time period specified by resin manufacturer.
  - .2 Calculate amount of catalyst powder needed using manufacturer's guidelines and add pre-measured catalyst to resin component.
  - .3 Mix again for time period specified by resin manufacturer, ensuring that product is free from swirls and bubbles.
  - .4 Ensure that air is not entrained into product during mixing process. To avoid aeration, do not use a spiral mixer unless spiral section of mixer can be fully contained in liquid during mixing process.
  - .5 Mix only enough product to ensure it can be applied before expiration of resin pot life.
- .8 Primer Application:
  - .1 Apply primer resin using a roller or brush at minimum rate specified by primer manufacturer over poured reinforced concrete substrates.
  - .2 Apply primer resin using a roller or brush at increased rate specified by primer manufacturer over gypsum board and granule surfaced membrane substrates.
  - .3 Increase application rates over other absorbent substrates. Do not let resin pool or pond. Do not under-apply or over-apply primers as this may interfere with proper primer catalyzation.
  - .4 Make allowances for saturation of roller covers and application equipment.
- .9 Paste Application:
  - .1 Allow primer to set and apply catalyzed preparation paste using a trowel.
  - .2 Before application of resin over catalyzed paste surface, specified cleaner/solvent, wipe surface of paste using specified cleaner/solvent and allow to dry.
  - .3 Treat surface again if not followed up by resin application within 60 minutes.

- .10 Flashing Membrane Application:
  - .1 Using masking tape, mask perimeter of area to receive flashing system.
  - .2 Apply resin primer to substrates requiring additional preparation and allow primer to set.
  - .3 Pre-cut fleece to ensure a proper fit at transitions and corners prior to membrane application.
  - .4 Apply an even, generous base coat of flashing resin using a roller at minimum rate specified by resin manufacturer to prepared surfaces requiring flashing coverage.
  - .5 Work fleece into wet, catalyzed resin using a brush or roller to fully embed fleece in resin and remove trapped air.
  - .6 Lap fleece layers a minimum of 51 mm (2") and apply an additional coat of catalyzed resin between layers of overlapping fleece.
  - .7 Using a roller, apply an even top coat of catalyzed resin at minimum rate specified by resin manufacturer immediately following embedment of fleece, ensuring full saturation of fleece.
  - .8 Ensure that flashing resin is applied to extend a 6 mm (0.25") beyond fleece. Remove tape before catalyzed resin sets. Make allowances for saturation of roller covers and application equipment.
  - .9 Should work be interrupted for more than 12 hours or surface of catalyzed resin becomes dirty or contaminated by elements, wipe surface to be lapped with new flashing resin using specified cleaner/solvent.
  - .10 Allow surface to dry for a minimum 20 minutes and a maximum 60 minutes before continuing work.
- .11 Skid Resistant Surfacing:
  - .1 Over horizontal area of new resin flashing, apply an additional top coat of catalyzed roof resin at minimum rate specified by manufacturer; and broadcast granules into resin at a rate recommended by manufacturer before resin sets.
  - .2 Apply a clear coat of resin over granular surface if required by system manufacturer.

### 3.13 ROOF PENETRATIONS AND ACCESSORIES

- .1 On All Roof Replacement Areas: Install vent stack flashings, support flashings, and other roof penetration flashings, and seal with roof membrane in accordance with manufacturer's instructions and as indicated on detail drawings.
- .2 Prime all metal flanges with modified bitumen compatible primer, and allow any solvents to flash-off and dry completely prior to installation.
- .3 Set metal flange in bed of manufacturer recommended and system compatible roofing cement applied over base sheet membrane, ensuring a positive bond.
- .4 Install an additional ply of base sheet membrane flashing over metal flange prior to installing cap sheet membrane. Additional ply of base membrane to extend minimum 152 mm (6") past all edges of metal flange.
- .5 Install cap sheet ply over base flashing ensuring a full bond to base ply membrane.

- .6 Apply continuous bead of manufacturer's recommended and system compatible sealant around penetration at point where membrane terminates.

### 3.14 ROOF DRAINS

- .1 General Practice:
  - .1 Ensure roof drains, rain gutters, and down pipes are clear of debris and are free flowing prior to installation of new roof system.
    - .1 Any blockages are to be reported prior to start of Work. Once Work has begun, Contractor assumes responsibility for free flowing drains and clearing blockages at no additional cost to Departmental Representative.
    - .2 Where required for new roof drains and interior plumbing, Contractor to provide interior plumbing and hook-up to existing storm water drainage system and co-ordinate installation of same with Departmental Representative.
  - .2 Prior to installation of new roof, ensure that all drains are located at a height where new roof system is able to clear majority of roof top water caused by rainfall within a seventy-two (72) hour period.
  - .3 Once work has begun, no roof area to be left overnight without adequate provision for drainage.
  - .4 Install drains in accordance with detail drawings and as per manufacturer's written instructions and guidelines.
- .2 Roof Drain Installation:
  - .1 On All Roof Replacement Areas: Drain body insert to be secured to substrate with minimum four (4) fasteners per drain as required to properly secure drain body.
    - .1 At all existing roof drains, reinstate existing control flow weir devices. Supplement damaged devices with new to suit.
    - .2 Affix mechanical connector seal to bottom of drain stem before insert retrofit drain body down into existing storm drainage pipe.
  - .2 Set metal flange of drain body into continuous bed of manufacturer recommended and system compatible roofing cement applied over base sheet membrane.
  - .3 Mechanically secure drain body to deck and substrate with min. four (4) fasteners per drain through drain flange or by underdeck clamping ring.
  - .4 Install target patch of membrane reinforcement over metal drain flange. Use a square of 1 x 1 m (39" x 39") base sheet membrane and install over drain at a 45° angle to direction of base sheet rolls.
  - .5 Install cap sheet over base sheet membrane with drain in center of roll and without seams in drain area.
    - .1 End laps of cap sheet to be min. 915 mm (36") from drains.
    - .2 Where seams of cap sheet do not align properly with drain location, install cap sheet over drain area first and picture-frame cap sheet into remainder of roof.
    - .3 At drain sump areas larger than 1.22 x 1.22 m (4' x 4'), install cap sheet over sump area first without any endlaps and picture-frame into remainder of roof.
  - .6 Place Clamping Ring over raised bolt studs. Install stainless steel self locking nuts to tighten Clamping Ring against membrane flashings until secure.
  - .7 Install ballast guard strainer dome and secure with cotterless pin or wing nut screw.



### 3.15 MISCELLANEOUS MECHANICAL AND ELECTRICAL

- .1 Contractor responsible for all Mechanical and Electrical Work required to perform complete installation of new roofing. Include for all costs associated with HVAC disconnection, removal, and reconnection, including modification of gas and conduit lines in Contract Amount.
  - .1 Coordinate any planned disruptions in advance with Departmental Representative to minimize inconvenience.
- .2 HVAC and Rooftop Equipment: Disconnect, lift (if necessary), modify, and reconnect all Heating, Ventilation, Air Conditioning, and Mechanical units as required to for new roof system.
  - .1 Modify existing sleepers, curbs, and supports as required to suit new roof system installation and configuration as detailed. Ensure modified sleepers, curbs, and supports are made watertight with new membrane and flashings as required.
  - .2 Remove and dispose of identified and designated abandoned, redundant, and unused HVAC equipment from roof and worksite.
- .3 Gas Lines and Conduits: Disconnect, modify, and reconnect all gas lines, electrical lines, and conduits as required to suit new roof installation height and configuration of projection detailing.
  - .1 All gas line work must be performed by a qualified Gas Fitter and must conform to requirements of CSA B149.1-15.
  - .2 Re-install gas lines and conduits at a height of 150 mm (6") to 200 mm (8") above finished roof surface. Secure all loose cabling and conduits off surface of roof membrane.
  - .3 Ensure that all gas line penetrations are separated from all electrical line penetrations with their own roof flashing supports. Provide any new sleeves, goosenecks, or curbs required and flash-in as indicated in detail drawings.
  - .4 At threaded gas line piping, which cannot be permanently enclosed or covered, construct new insulated and waterproof dog house detail with removable lid for periodic thread inspection.
  - .5 Paint all gas lines on areas of roof work with exterior grade, yellow paint for metal surfaces.
- .4 Underdeck Securement: Where existing sections of roof decking are to be removed, ensure any cabling, conduits, and attachments (plumbing, electrical wiring, lighting fixtures, etc.) secured to underside are disconnected, removed, and relocated.
  - .1 Notify Departmental Representative, if necessary, to have interior services disconnected, removed, and relocated by Departmental Representative.
- .5 Temporary Security: Provide overnight security, at no additional cost to Departmental Representative where removal of any venting or HVAC equipment results with an opening in roof deck that cannot be permanently sealed on same day. Security company must be preapproved by Departmental Representative in advance.

### 3.16 TEMPORARY WATER CUT-OFFS

- .1 All membrane flashings to be installed concurrently with roof membrane to keep

system watertight during performance of work.

- .2 Temporary waterproof seals to be placed on daily work as required. All temporary water-stops to be constructed to provide a one hundred (100) percent watertight seal.
- .3 New roofing membrane to be carried into water-stop. Water-stop to be sealed to roof deck and/or substrate to prevent water travel and infiltration under new or existing roofing.
- .4 Edge of roof membrane to be sealed in a continuous heavy application of sealant. Temporary seals to be removed and cleaned up before proceeding with remaining work.
- .5 When work resumes, cut out and dispose of all contaminated membrane. All sealant, contaminated membrane, insulation fillers, etc. to be removed from work area and properly disposed of off site. Reuse of these materials in new work is strictly prohibited.
- .6 If inclement weather occurs while a temporary water-stop is in place, provide all necessary labour required to monitor situation and maintain watertight condition.
- .7 If any water is allowed to penetrate under newly completed roofing, then affected area to be cut out, removed, and replaced with new materials at Contractor's own expense.

### 3.17 METAL FLASHINGS

- .1 On All Roof Replacement Areas: After installation of roof membrane and membrane flashings, install new perimeter metal and metal flashings to Section 07 62 00 and as indicated on detail drawings.

### 3.18 SEALANTS

- .1 On All Roof Replacement Areas: After installation of roof membrane and membrane flashings, install sealants to Section 07 92 00.

### 3.19 FIELD QUALITY CONTROL

- .1 Quality Assurance Observation:
  - .1 QA Observation and testing of roofing application will be carried out by QAO agency and testing laboratory designated by Departmental Representative.
  - .2 Where directed by Departmental Representative or QA Observer, provide reasonable number of roof cut-out samples in field to assess installation and repair to no additional cost to Contract Amount.
  - .3 Departmental Representative will pay for testing sent out for laboratory analysis to Section 01 45 00.
- .2 Cooperate with designated QA Observation agency and provide all facilities and access required to observe performance of roof work.

### 3.20 CLEAN UP

- .1 On All Roof Replacement Areas: Clean up and remove from job site on a daily basis, all rubbish and surplus materials resulting from this work.
- .2 Drag a magnetic bar across work area and grounds to ensure removal of all discarded fasteners and sharp metal debris.
- .3 Remove bituminous markings from finished surfaces.
- .4 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their instructions.
- .5 Repair or replace defaced or disfigured finishes caused by work of this section.
- .6 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
  - .1 Place materials defined as hazardous or toxic in designated containers.
  - .2 Clearly label location of salvaged material's storage areas and provide barriers and security devices.
  - .3 Ensure emptied containers are sealed and stored safely.
  - .4 Divert unused aggregate materials from landfill to local quarry/facility for reuse as reviewed by Departmental Representative.
  - .5 Unused paint material must be disposed of at official hazardous material collections site as reviewed by Departmental Representative.
  - .6 Unused adhesive, sealant, and painting materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
  - .7 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.
  - .8 Dispose of unused sealant material at official hazardous material collections site approved by Departmental Representative.
  - .9 Dispose of unused asphalt material at official hazardous material collections site approved by Departmental Representative.
  - .10 Divert unused gypsum materials from landfill to recycling facility as reviewed by Departmental Representative.

END