

PART 1 - GENERAL

1.1 **NOTES TO DESIGN AUTHORITY**

- .1 **THE FOLLOWING SAMPLE SPECIFICATION IS PROVIDED AS A GUIDE TO LOW SLOPE ROOFING AT THE U OF T ST. GEORGE CAMPUS.**
- .2 **IT IS THE RESPONSIBILITY OF THE DESIGN AUTHORITY ON EACH PROJECT TO INSURE COMPLIANCE WITH LOCAL, PROVINCIAL AND NATIONAL, BUILDING, FIRE AND PLUMBING CODES, ASHRAE REQUIREMENTS FOR THERMAL RESISTANCE AS WELL AS ADHERENCE TO THE CITY OF TORONTO BYLAWS FOR GREEN ROOFS AND LOCAL HERITAGE REQUIREMENTS.**
- .3 **IT IS THE RESPONSIBILITY OF THE DESIGN AUTHORITY ON EACH PROJECT TO PERFORM ALL NECESSARY CALCULATIONS FOR WIND UPLIFT, DRAINAGE, SLOPE TO DRAIN AND FIRE RESISTANCE.**
- .4 **ALTHOUGH A LIGHTWEIGHT INSULATED CONCRETE SYSTEM IS THE PREFERRED SUSTAINABLE ASSEMBLY OF THE U OF T, PROJECT SIZE AND SITE ACCESS MAY REQUIRE THE DESIGN AND INSTALLATION OF A CONVENTIONAL MODIFIED BITUMINOUS ROOF ASSEMBLY. SINGLE PLY ROOF ASSEMBLIES ARE ONLY TO BE CONSIDERED ON ROOFS WITH A MINIMUM OF A 3 IN 12 SLOPE.**
- .5 **THE DESIGN of a LIGHTWEIGHT INSULATED CONCRETE ROOFING SYSTEM FOR NEW CONSTRUCTION, REPLACEMENT OR ALTERATIONS TO EXISTING U OF T BUILDINGS **SHALL BE REVIEWED & APPROVED** BY IRC BUILDING SCIENCES GROUP INC. PRIOR TO ISSUANCE FOR TENDER.**

1.2 RELATED SECTIONS

- .1 Section 01110 – Summary of Work
- .2 Section 07620 – Sheet Metal Flashing and Trim
- .3 Section 07900 – Sealants

1.3 REFERENCES

The latest edition of all listed references shall apply:

- .1 ASTM C578 – Rigid, Cellular Polystyrene Thermal Insulation.
- .2 ASTM C726 – Mineral Fibre Roof Insulation Board.
- .3 ASTM C1177/C1177M – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .4 ASTM D41 – Asphalt Primer Used in Roofing, Damp-proofing, and Waterproofing.
- .5 ASTM D2822 – Asphalt Roof Cement.
- .6 ASTM D4601 – Standard Specification for Asphalt-Coated Glass Fibre Base Sheet Used in Roofing.
- .7 ASTM D6162 – Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements
- .8 ASTM D6163 – Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements
- .9 ASTM D6164 – Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
- .10 ASTM D6298 – Fibreglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheet with a Factory Applied Metal Surface.

- .11 CGSB 37-GP-9Ma – Primer, Asphalt, Unfilled, for Asphalt Roofing, Damp-proofing and Waterproofing.
- .12 CAN/CSA A123.16 – Asphalt-Coated Glass-Base Sheets.
- .13 CAN/CGSB 37-GP-56M – Membrane Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
- .14 CAN/ULC S701 – Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .15 CAN/ULC S702 – Thermal Insulation, Mineral Fibre, for Buildings.
- .16 FM (Factory Mutual) – Roof Assembly Classifications.
- .17 Canadian Roofing Contractors Association – Roofing Specifications Manual.
- .18 NRCA (National Roofing Contractors Association) – Roofing and Waterproofing Manual.
- .19 ULC (Underwriters Laboratories of Canada) – List of Equipment and Materials for Building Materials, Fire Resistance, and Fire-stop Systems and Components.
- .20 Conform to National Plumbing Codes and requirements of Provincial and Municipal Authorities. Most stringent requirements shall govern where in conflict.

1.4 SUBMITTALS

- .1 **Section 01330 – Submittal Procedures.**
- .2 Provide initial schedule within five (5) working days after Contract award, showing anticipated progress stages and final completion of work. Work shall not commence before work schedule is provided.
- .3 Product Data: Provide characteristics on membrane materials, flashing materials, insulation, vapour retarders, and deck overlay board.
- .4 Submit shop drawings for tapered insulation layout to the Consultant for review prior to prefabrication.
- .5 Sample copy of Manufacturer's warranty.
- .6 Sample copy of Contractor's warranty.
- .7 Certifications by manufacturers of roofing and insulating materials that all materials supplied comply with all requirements of the identified ASTM and other industry standards or practices.
- .8 Certification from the Contractor that the system specified meets all identified code and insurance requirements as required by the Specification.
- .9 Material Safety Data Sheets (MSDS)

1.5 CONTRACTOR QUALIFICATION

- .1 Roofing Contractor and his staff must be certified by the membrane manufacturer and pre-approved by the Owner and Consultant prior to tender.
- .2 Roofing Contractor must be a member in good standing with the Ontario Roofing Contractors Association (OIRCA) and have a minimum ten (10) years relevant experience with similar roof materials and/or in accordance to a pre-qualified list.

1.6 QUALITY ASSURANCE

- .1 Perform Work in accordance with manufacturer's written instructions.
- .2 The Contractor shall arrange for a technical representative of the manufacturer to review the installed roof system wherever a Standard or System Warranty has been specified.
- .3 There shall be no deviation made from the Project Specification or the approved shop drawings without prior written approval by the Owner, the Owner's Representative, and the manufacturer.

1.7 REGULATORY REQUIREMENTS

- .1 Conform to applicable local code for roof assembly fire hazard, green and heritage requirements.
- .2 UL: Class B Fire Hazard Classification.
- .3 FM: Roof Assembly Classification, of Class 1 Construction, minimum wind uplift requirement of I-90, in accordance with FM Construction Bulletin 128. (Design Authority to Calculate Wind Uplift Requirements on Every Project)

1.8 SPECIAL SITE INSTRUCTIONS

- .1 ***NO BITUMEN KETTLES, TORCHES OR OPEN FLAMES ARE ALLOWED ON SITE. ALL ROOF COMPONENTS TO BE MECHANICALLY FASTENED OR ADHERED IN ADHESIVE.***
- .2 Interior Protection for work to be provided by Contractor.
- .3 Minimize disruptions to regular building activities. Noisy Work to be performed outside of regular office/operating hours. Arrange special access and times to project site with Designee.
- .4 Staging area to be determined on site with Consultant and Building Owner.
- .5 All salvaged copper flashings, cleats, and hook strips from the designated roof replacement areas to be recycled and subsequent value credited to the Building Owner.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 All work to be conducted from the exterior using swing-stage, hoist, etc. If cranes or boom-trucks are required, written approval and permits are required from the U of T prior to arrival of any vehicle used for this purpose.
- .2 Site storage is limited. Location of storage to be coordinated with and approved by Owner.
- .3 All materials shall be delivered and stored in their original packaging bearing the manufacturers label, grade and product weight, including all other related standards, specifications, and the like.
- .4 All materials shall be adequately protected from inclement weather conditions and stored in a dry, well ventilated and weather protected location.
- .5 Only materials to be installed on the same day shall be removed from the protected location to the work site.
- .6 During extreme temperature, materials shall be stored in a heated location with a 4.4°C minimum temperature and removed only as needed.
- .7 Modified bitumen rolls shall be kept clear of all flame and/ or spark's when not being applied directly to the roof structure.

- .8 All materials in a rolled configuration shall be stored on end, elevated off the ground on a pallet or skid, to protect the bottom surface from foreign debris and moisture.
- .9 When possible, the Contractor should restrict stock piling of material in one location on the roof surface to prevent exceeding the specified deck live load capacity.
- .10 Handle and store products in a manner to prevent damage and deterioration.
- .11 Remove and replace damaged products at own expense and to the satisfaction of the Consultant.

1.10 ENVIRONMENTAL REQUIREMENTS

- .1 Do not apply roofing membrane to damp or frozen deck surfaces.
- .2 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.
- .3 Only as much of the new roofing as can be made weather-tight each day, including all flashing and detail work, shall be installed. All seams shall be heat welded before leaving the job site that day.
- .4 All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.
- .5 All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.
- .6 Uninterrupted water-stops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Water-stops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.
- .7 Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Contractor shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over felt or plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.
- .8 Prior to and during application, all dirt, debris and dust shall be removed from surfaces by vacuuming, sweeping, blowing with compressed air, and/or similar methods.
- .9 The Contractor shall follow all safety regulations as required by OHS (Occupational Health and Safety) and any other applicable authority having jurisdiction.
- .10 All roofing, insulation, flashings and metal work removed during construction shall be immediately taken off site to a legal dumping area authorized to receive such materials. Hazardous materials, such as materials containing asbestos, are to be removed and disposed of in strict accordance with applicable Municipal, Provincial, and Federal requirements.
- .11 All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Contractor and properly transported to a legal dumping area authorized to receive such material.
- .12 The Contractor shall take precautions that storage and/or application of materials and/or equipment does not overload the roof deck or building structure.

- .13 Flammable adhesives and deck primers shall not be stored and not be used in the vicinity of open flames, sparks and excessive heat.
- .14 All rooftop contamination that is anticipated or that is occurring shall be reported to the manufacturer to determine the corrective steps to be taken.
- .15 The Contractor shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Contractor shall report any such blockages in writing to the Owner's Representative for corrective action prior to the installation of the roof system.
- .16 The Contractor shall immediately stop work if any unusual or concealed condition is discovered and shall immediately notify Owner of such condition in writing for correction at the Owner's expense.
- .17 Site clean-up, including both interior and exterior building areas that have been affected by construction, shall be completed to the Owner's satisfaction.
- .18 All landscaped areas damaged by construction activities shall be repaired at no cost to the Owner.
- .19 Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Adhesive odours could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odour while ventilating the building. Keep lids on unused cans at all times.
- .20 Protective wear shall be worn when using solvents or adhesives or as required by job conditions.

1.11 EXAMINATION

- .1 Examine the Drawings and Specifications to determine the extent of the work involved, together with other necessary data affecting the work, as in no circumstances will any claims against the Owner be allowed resulting from failure to ascertain the extent of such work herein described or implied.

1.12 QUALITY OBSERVATION ASSURANCE

- .1 An independent Quality Assurance Observation agency, approved by the University of Toronto will be retained to observe the installation. All observations must be performed by either a Registered Roof Observer (RRO) or a Registered Roof Consultant (RRC) as recognized by RCI (The Institute for Roofing, Waterproofing and Building Envelope) employed by an independent Engineering firm licenced in the Province of Ontario. The Engineering firm is required to carry \$5 million professional liability (Errors & Omission Insurance). The RRO and/or RRC must possess a certificate for fall arrest protection awareness issued by Canadian Occupational Health & Safety and a CPIC Clearance Certificate.
- .2 Arrange site meeting with the Observer no less than three weeks prior to commencement of work on site. Obtain the Observer's instructions with reference to procedures to be followed. Contractor to provide Observer with the following at this meeting:
 - .1 Notice of Project
 - .2 A sample copy of the Warranty
 - .3 A copy of the letter and completed project warranty form sent to the "Warranty Holder" advising them of the project starting
 - .4 Bonds and Insurance in the Owner's Name
 - .5 WSIB Clearance Certificate
 - .6 A Contact List complete with 24-hour emergency phone numbers

- .7 A Work Schedule listing start date, number of working days and manpower for the project shop drawings for tapered insulation, if applicable
- .8 A complete Material List
- .9 MSDS information pertaining to ALL materials being used on site
- .10 The appropriate securement patterns for mechanically fastening of the insulation, if applicable
- .11 A list of the “Trained and Carded Membrane Approved Applicators” who will be working on site
- .3 Cooperate with the Observer and afford all facilities necessary to permit full QA observation of the work. Act immediately on instructions given by the Observer.
- .4 Make cut-outs when required and make good roofing without additional costs to the Owner.

1.13 SAFETY AND PROTECTION

- .1 The latest edition of all listed references shall apply:
 - .1 CAN/CSA S269.2M – Access Scaffolding for Construction Purposes.
 - .2 FCC No. 301 – Standard for Construction Operations.

1.14 WARRANTY

- .1 Contractor shall supply the Owner with a two (2) year Contractor OIRCA Warranty for workmanship. In the event any work related to roofing, flashing, or metal is found to be within the Contractor warranty term, defective or otherwise not in accordance with the Contract Documents, the Contractor shall repair that defect at no cost to the Owner. The Applicator's warranty obligation shall run directly to the Owner, and a copy shall be sent to the manufacturer.
- .2 Contractor shall provide the Owner with a twenty-five (25) year Manufacturer's Labour, Material and Workmanship NDL (No Dollar Limit) System Warranty.
- .3 Owner shall notify both the membrane manufacturer and the Contractor of any leak that occurs during the time period when both warranties are in effect.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Note all membrane materials, membrane flashings and where applicable the insulations and vapour barrier are to be supplied by the same manufacturer meeting manufacturer's respective material compatibility requirements to achieve the required System Warranty.
- .2 Components to be used that are other than those supplied or manufactured by the membrane manufacturer may be submitted for review and acceptance by the membrane manufacturer.
- .3 The membrane manufacturer's acceptance of any other product is only for a determination of compatibility with the products and not for inclusion in the manufacturer's warranty.
- .4 The specifications, installation instructions, limitations, and/or restrictions of the respective manufacturers must be reviewed by the Owner's Representative for acceptability for the intended use with the membrane manufacturer's products.

2.2 DECK OVERLAY BOARD

- .1 Deck Overlay Boards on Metal and Wood Plank Deck: Board size shall be 4' x 8' x 0.5" (1.2m x 2.4m x 13mm), glass mat faced, siliconized gypsum roof board with factory applied primer, Dens-Deck Prime by Georgia-Pacific, Securerock by CGC or approved equivalent.
- .2 Overlay Board Fastener: Dekfast or equivalent mechanical fasteners of appropriate length and with plates in a fastening pattern meeting FM standards. Where fasteners are not practical or will be visible on the underside of metal deck, polyurethane adhesive is to be used to adhere the overlay board to the substrate. Acceptable adhesives are; INSTA-STIK Adhesive by Flexible Products Company-Roofing Group (DOW), OlyBond500 Adhesive by OMG Roofing Products, Para-Stik Adhesive by Siplast, Duotack by Soprema or Warranty Provider approved equivalent.

2.3 VAPOUR RETARDER

- .1 Base Sheet: Adhesive grade or self adhering modified bitumen, minimum thickness 3.0mm, with minimum 180g/m², random fibre glass mat or non-woven polyester, impregnated and coated with SBS modified bitumen, and conforming to CGSB 37-GP-56M.
- .2 Base Sheet Flashing: Adhesive grade modified bitumen, minimum thickness 3.0mm, with minimum 180g/m², random fibre glass mat or non-woven polyester, impregnated and coated with SBS modified bitumen, and conforming to CGSB 37-GP-56M.
- .3 Vapour Retarder Adhesive: Solvent based adhesive; Brush Grade for horizontal surfaces and Trowel Grade for sloped surfaces.

2.4 (a) LIGHTWEIGHT INSULATED CONCRETE SYSTEM

- .1 *Insulation Boards: Type I expanded polystyrene, minimum 1" (25mm) in thickness, with thirty 1" (25 mm) diameter holes and thirty slots, or thirty hole-slot combinations per board. Individual boards to no more than 4' x 4' (1.2m x 1.2m) in size. Boards to be factory cut and mitred by Plasti-Fab Inc., Everst Supply Inc., Beacon or approved equivalent. Where possible thermal resistance of a minimum of R = 25 is preferred. Where possible, a minimum roof slope of 1% is required.*
- .2 *Portland Cement: Portland cement conforming to Type I, II or III as defined by ASTM C 150.*
- .3 *Vermiculite Aggregate: Vermiculite concrete aggregate conforming to ASTM C 332 with a ratio of 1:3.5 by volume.*
- .4 *Water Purity: Potable water containing no more than 250ppm of free chloride ions or other*

2.5 (a) INSULATION SUMPS FOR LIGHTWEIGHT INSULATED CONCRETE SYSTEM

- .1 *Insulation Sumps: 8' x 8' (2.4m x 2.4m) insulation sump with 2' x 2' (610mm x 610mm) central flat is to be installed over the prepared substrate. New insulation sumps to run from 2" (51mm) in thickness at the outer edge down to 1" (25mm) at the central flat. Central flat to be 1" (25mm) thick.*
 - .1 *The new insulation sumps to be manufactured of rigid mineral wool fibreboard insulation with bitumen saturated and lightly sanded surface meeting the requirements of CAN/CGSB 2.51.31M and ASTM C726. Standard of acceptance is ProtecRSS-X2 Sump by ModulR TS Inc., TopRock DD Plus by Roxul, SopraRock DD Plus by Soprema or approved equivalent.*
 - .2 *Filler Insulation: Rigid mineral wool fibre board with appropriate thickness for installation under new insulation sump as required.*
- . *Insulation Sump Adhesive: Low rise polyurethane adhesive; INSTA-STIK Adhesive by Flexible Products Company-Roofing Group (DOW), OlyBond500 Adhesive by OMG Roofing Products, Para-Stik Adhesive by Siplast, Duotack by Soprema or approved equivalent.*

2.4 (b) RIGID BOARD INSULATION

- .1 *Rigid Insulation Type: Tapered, closed-cell polyisocyanurate foam rigid insulation boards, Type II, Class 1 to ASTM C1289, manufactured with HCFC blowing agent (Pentane) bonded to glass fibre reinforced facers on top and bottom surfaces during the manufacturing process:*
 - .1 *Approved and listed by Factory Mutual Global wind uplift classification and compressive strength of 20 psi, and meeting FM4470 approval requirements for Class 1 fire as a component in roof deck construction.*
 - .2 *Meet the physical property requirements of ASTM C 1289 and CAN/ULC S-704.*
 - .3 *Dimensional stability change of less than 2% conforming to ASTM D 2126.*
 - .4 *Conformity to CAN/ULC S704 and Can/ULC S770 for Long Term Thermal Resistance in polyisocyanurate insulation.*
 - .5 *Acceptable Products:*
 - .1 *Atlas ACFoam III polyisocyanurate by Atlas Roofing Corp.,*
 - .2 *Paratherm polyisocyanurate by Siplast,*
 - .3 *Colgrip polyisocyanurate by Soprema or approved equivalent.*
- .2 *Rigid Insulation Thickness:*
 - .1 *Insulation thickness to be in accordance with minimum Ashrae Requirements and U of T requirement of a minimum of R = 25.*
 - .2 *Unless otherwise noted on roof plan drawings, tapered insulation to have a slope of 1%; 0.125" (3mm) vertically per linear foot (305mm) horizontally.*
 - .3 *Tapered insulation to be factory cut and mitred, and supplied by Accu-plane Enterprises Inc., Beacon Roofing Supply, Everest Supply Inc., Posi-slope Enterprises Inc. or approved equivalent. Submit all shop drawings to Consultant for review prior to prefabrication.*
- .3 *Rigid Insulation Drain Sumps:*

MASTER SPECIFICATION: Tapered, closed-cell, polyisocyanurate foam rigid insulation boards, Type II, Class 1 to Section 07209, LOW SLOPE MEMBRANE ROOFING to Section 07209, manufactured with HCFC blowing agent (Pentane) bonded to glass fibre reinforced facers on top and bottom surfaces during the manufacturing process:

.2 *Acceptable Products:*

- .1 *Atlas ACFoam III polyisocyanurate by Atlas Roofing Corp.,*
- .2 *Paratherm polyisocyanurate by Siplast,*
- .3 *Colgrip polyisocyanurate by Soprema or approved equivalent.*

.2 *Size: 8' x 8' (2.4m x 2.4m) tapered down at 2% to a 2' x 2' (610mm x 610mm) central flat area. Central flat to be min. 1" (25mm) thick.*

.3 *Thickness: To suit height of drain sump curb at each drain*

.4 *Rigid Insulation Adhesive: Ribbons of one or two component polyurethane foamable adhesive:*

- .1 *INSTA-STIK Adhesive by Flexible Products Company-Roofing Group (DOW),*
- .2 *OlyBond500 Adhesive by OMG Roofing Products,*
- .3 *Para-Stik Adhesive by Siplast,*
- .4 *Duotack by Soprema or approved equivalent.*

2.5 (b) COVER BOARD

.1 *Cover Board: Board size no larger than 4'x8' (1.2m x 1.2m), 0.5" thick (13mm):*

- .1 *Glass mat faced, siliconized gypsum roof board with factory applied primer; DensDeck Prime by Georgia-Pacific,*
- .2 *Fibre reinforced, gypsum roof board with homogenous composition; Securock by USG or approved equivalent'*

.2 *Cover Board Fasteners: Self tapping, epoxy coated carbon steel or solid stainless steel deck screws approved by membrane Manufacturer to meet warranty requirements, complete with securement plates in a fastening pattern meeting FM requirements:*

- .1 *#12 Dekfast Fasteners by Dekfast Product Group,*
- .2 *#14 Soprafix fasteners by Soprema,*
- .3 *Parafast Roofing Fasteners by Siplast or approved equivalent.*

.3 *Cover Board Adhesive: Ribbons of one or two component polyurethane foamable adhesive:*

- .5 *INSTA-STIK Adhesive by Flexible Products Company-Roofing Group (DOW),*
- .6 *OlyBond500 Adhesive by OMG Roofing Products,*
- .7 *Para-Stik Adhesive by Siplast,*
- .8 *Duotack by Soprema or approved equivalent.*

2.6 MEMBRANE & MEMBRANE FLASHING

.1 *Venting Base Sheet (lightweight insulated concrete assembly):*

- .1 *Mechanically secured fibreglass, asphalt coated fibreglass base sheet meeting ASTM D4601, Type II; Parabase FS by Siplast, Sopraglass 100 by Soprema or approved equivalent.*

.2 *Base Sheet:*

- .1 *Adhesive grade modified bitumen, minimum thickness 3.0mm, with minimum 180g/m², random fibre glass mat or non-woven polyester, impregnated and coated with SBS*

- .3 Base Sheet Flashing:
 - .1 Self-adhering grade modified bitumen, minimum 3.0mm thick, with random fibre glass mat impregnated and coated with SBS modified bitumen, and coated with self-adhesive bitumen layer and polyolefin release film on bottom surface, and conforming to CGSB 37-GP-56M

OR

 - .2 Adhesive grade modified bitumen, minimum thickness 3.0mm, with minimum 180g/m², random fibre glass mat or non-woven polyester, impregnated and coated with SBS modified bitumen, and conforming to CGSB 37-GP-56M
- .4 Cap Sheet:
 - .1 Adhesive grade modified bitumen, minimum thickness 3.6mm, with minimum 250g/m², fibreglass scrim/polyester composite impregnated and coated with SBS modified bitumen, and conforming to CGSB 37-GP-56M
- .5 Cap Sheet Flashing:
 - .1 Adhesive grade modified bitumen, minimum thickness 3.6mm, with minimum 250g/m², fibreglass scrim/polyester composite impregnated and coated with SBS modified bitumen, and conforming to CGSB 37-GP-56M
- .6 Membrane Primer:
 - .1 Solvent based primer to prepare surfaces before the installation of membranes; Standard of Acceptance is PA-1125 Primer by Siplast, Elastocol Stick by Soprema or approved equivalent.
- .7 Membrane Adhesive:
 - .1 Solvent based adhesive; Standard of Acceptance is PA-311 adhesive by Siplast or Colply Adhesive Brush for horizontal surfaces and Colply Adhesive Trowel Grade for sloped surfaces by Soprema or approved equivalent.

2.7 LIQUID APPLIED RESIN FLASHING MEMBRANE

- .1 Polymethylmethacrylate (PMMA) Primers: as recommended by the membrane manufacturer.
- .2 PMMA Roofing Flashing (Soprema):
 - .1 Resin for flashing applications: a one-component polyurethane/bitumen resin for use in combination with fleece fabric to form a monolithic, reinforced flashing membrane; Alsan Flashing from Soprema or approved equivalent
 - .2 Fleece for flashing reinforcement: A woven, 100 g/m², polyester fabric reinforcement as supplied by the membrane system manufacturer; Flashing Reinforcement by Soprema or approved equivalent.
- .3 PMMA Roofing Flashing (Siplast):
 - .1 Catalyst: Pro Catalyst by Siplast.
 - .2 Resin for flashing applications: A flexible, polymethylmethacrylate (PMMA) based resin

- .3 Resin for field membrane: A flexible, polymethylmethacrylate (PMMA) based resin for use in combination with fleece fabric to form a monolithic, reinforced roofing membrane; Parapro Roof Resin by Siplast.
- .4 Fleece for membrane and flashing reinforcement: A non-woven, 110 g/m², needle-punched polyester fabric reinforcement as supplied by the membrane system manufacturer; Pro Fleece by Siplast.
- .5 Clear finish resin: A clear, flexible, polymethylmethacrylate (PMMA) based resin for use as a wearing coat over colored quartz; Pro Clear Finish by Siplast.
- .6 Thixotropic agent: A liquid additive used to increase the viscosity of the PMMA-based resin products, allowing the resins to be applied over vertical or sloped substrates; Pro Thixo by Siplast.
- .4 Anti-Skid Surfacing:
 - .1 Ceramic granules: No. 11 grade specification ceramic granules suitable for broadcast into the PMMA based wearing layer; No. 11 Granules by Siplast or approved equivalent from Soprema.
- .5 PMMA Accessories:
 - .1 Cleaning solution/solvent: A clear solvent used 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; Pro Prep by Siplast or approved equivalent from Soprema.
 - .2 Tape: A white, flexible, coated cotton cloth tape designed for treatment of insulation panel joints, deck/wall transitions and joints in flashing substrates; Pro Tape by Siplast or approved equivalent from Soprema.

2.8 ROOF ACCESSORIES

- .1 Roofing accessories to be manufactured from spun aluminum or copper as required, and complete with removable caps where applicable. All units are to have foamed in place closed cell urethane foam insulation sprayed into the unit at the plant under controlled conditions. Flanges to be primed with rubberized primer. Standard of acceptance is Thaler Metal Industries or approved equivalent.

Detail Type:

Prefab Unit:

New roof drain	RD-4C-FLAT by Thaler Metal Industries
Retro roof drain	RD-4C-RR-FLAT by Thaler Metal Industries
Plumbing stack	SJ-31 by Thaler Metal Industries
Relief vent	RV-2 by Thaler Metal Industries
“B” Vent or tall cone	MEF-4A by Thaler Metal Industries
Light post support (w/ thru wire)	MERS-730 by Thaler Metal Industries
Security camera support	MERS-730 by Thaler Metal Industries
Post and rail support (square HSS)	ARS-115 by Thaler Metal Industries
Guy wire support	ARS-300 by Thaler Metal Industries

~~Roof access ladder (bolt to base) ARS-500 by Thaler Metal Industries~~

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| Miscellaneous support (sq. base plate) | ARS-550 by Thaler Metal Industries |
| Split flashing for round penetration | SPJ-2 by Thaler Metal Industries |
| Ductwork support | MERS-800 (850) by Thaler Metal Industries |
| Conduit and gas line penetrations | Copper gooseneck see IRC detail drawing |
| Gas line supports | See IRC detail drawing |
| Walkway paver or splash pad | See IRC detail drawing |
- .2 Install relief vents on all N.V.S. roof areas ensuring one vent for every 1000ft² of roof area and a minimum of two vents per roof or as indicated on roof plan.
- .3 Concrete Pavers: MPA air entrained precast concrete with maximum absorption 5% with formed pedestals. 24" x 24" x 2" PEDSLABS by Brooklin Concrete or approved equivalent.
- .4 Pourable Sealer: Elastomeric pourable sealer as supplied by Membrane Manufacturer.
- .5 Scupper Drain: fabricated from 24 gauge galvanized metal to suit and complete with gravel stop edge on three sides, open-top collector head, and 5" x 5" (127 x 127mm) open-faced pre-finished metal rain water leaders, except for the first 4' (1.2m). Cap with prepainted metal to match flashings.
- .6 Overflow Scupper Drain: fabricated from 24 gauge galvanized metal to suit and complete with gravel stop edge on four sides of pipe mouth where it meets the base flange. Cap with prepainted metal to match flashings.
- .7 Sheet Metal Flashings and Trim: As per Section 07620.
- .8 Sealants: As per Section 07900.

2.9 FASTENERS AND PLATES

- .1 Insulation to steel and wood deck:
- .1 Tru-Fast Ultra Solid Stainless Steel fastener to penetrate substrate by 3/4" (19mm). Plates to be 3" diameter. Tru-Fast Galvalume stress plate.
- .2 Wood to steel, wood to wood or steel to steel:
- .1 Tru-Fast Ultra Solid Stainless Steel fastener to penetrate substrate by minimum 3/4" (19mm).
- .3 Wood/steel to concrete or concrete block:
- .1 Perma-Grip Tap Grip H.D. Truss Head fastener with Perma-Coat Z3 corrosion protection to penetrate substrate by 1 1/4" (32mm).
- .2 Tru-Fast Tap Grip H.D. Truss Head fastener with Perma-Coat Z3 corrosion protection to penetrate substrate by 1 1/4" (32mm).
- .4 Steel/aluminum to aluminum:
- .1 Tru-Fast DP with Trucote PC-3 corrosion protection fastener c/w EPDM galvanized steel sealing washers to penetrate substrate by 3/4" (19mm).

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- 5 Termination bar for membrane:
- .1 Extruded aluminum, 0.060" thick x 1" wide x 10' long with 1/4" x 3/8" slotted holes on 8" (203mm) o/c. Acceptable material: TB-120 aluminum termination bar by Tru-Fast.
- .6 Termination bar fastener for wood, steel or aluminum:
- .1 Tru-Fast Ultra Solid Stainless Steel fastener to penetrate substrate by 3/4" (19mm) c/w EPDM galvanized steel sealing washers or Construction Fasteners Inc. Woodgrip #14 screw complete with Senti coating on threads, Chromagard colour match head and EPDM washer
- .7 Termination bar fastener for concrete or masonry:
- .1 Tru-Fast Tap Grip Truss Head fastener with Perma-Coat Z3 corrosion protection to penetrate substrate by 1 1/4" (32mm) c/w EPDM galvanized steel sealing washers.
- .8 Pre-painted metal flashing to steel or wood:
- .1 Construction Fasteners Inc. Woodgrip #14 screw complete with Senti coating on threads, Chromagard colour match head and EPDM washer or approved equal. Fastener to penetrate substrate by minimum 3/4".
- 9 Membrane to wood:
- Galvanized round top nails with minimum 1" diameter heads to penetrate the substrate a minimum 1 1/4" (32mm).
- .10 Venting Sheet Membrane to Lightweight Concrete:
- .1 NVS fasteners as manufactured by O M G , Siplast, Soprema or approved equivalent. Specialty fasteners are as specified in the scope of work or as required in drawings.
- .11 All fasteners and plates to meet the requirements of Factory Mutual 4470 Standard for wind uplift and corrosion resistance.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- .1 Execute roofing work which is not specifically covered by these Specifications in accordance with applicable standards in Canadian Roofing Contractors Association (CRCA) and the National Roofing Contractors Association Roofing Specification Manual, in accordance with the Canadian Modified Bitumen Manufacturer's Association's recommendations, in accordance with the manufacturer's pre-printed and published specifications and to ULC Design No. S-107, to FM 1-28 and 1.49 criteria, compliance with local fire insurance requirements and/or local building codes, except where specified otherwise.
- .2 Do priming for asphalt roofing in accordance with CAN/CGSB 37-GP-15M and as recommended by membrane manufacturer.
- .3 Procedures for application of materials should be in accordance with manufacturer's recommendations; otherwise the Consultant should be notified if any conflict with this Specification arises.
- .4 All work shall be carried out in accordance with drawings, specifications and contract documents.
- .5 Adhesives or sealants and liquid primers will not be applied until surfaces are dry.
- .6 Inspect the underside of roof deck when installing fasteners, where possible, to avoid accidental damage.
- .7 While work is in progress, all steps must be taken to safeguard the building from damage due to the elements.
- .8 Advise the Consultant of adjustments to specified roofing procedures recommended by the Manufacturer or due to site conditions. Written approval is needed to make any adjustments to the specified procedures.

3.2 EXAMINATION OF SITE CONDITIONS

- .1 Inspect existing conditions and substrates upon which work of this section is dependent. Report to the Consultant in writing any defects or discrepancies. Commencement of work implies acceptance of existing conditions and assuming full responsibility for the finished condition of the work.

Defective work resulting from application to unsatisfactory conditions will be considered the responsibility of those performing the work of this section.

3.3 PREPARATION

- .1 Examine all roof decks and site conditions to ensure that they are in satisfactory condition for the commencement of the work of this section.
- .2 Examine work of other trades for defects and discrepancies and report them to the owner/consultant in writing. Do not proceed with work until surfaces are satisfactory.
- .3 ***(On Roof Replacement or Alterations) The existing roof system shall be removed including all membranes, insulation, flashings and associated debris to expose the decking ensuring proper and adequate adhesion of the new roof assembly.***

Once the existing roofing systems are removed, the deck shall be reviewed by the Contractor and Consultant. The entire roof area is to be reviewed in order to satisfy warranty requirements of the manufacturer of the new roof system. The Consultant is to be notified 48 hours prior to testing.

- .5 Prior to the removal of any roof components, all existing openings (drains, vents, air intakes, etc.) shall be covered or plugged to prevent any debris or contaminate from entering the building below. All such coverings are to be removed at the end of each working day and reinstalled prior to the next day's start up.**
- .6 At areas designated for removal and replacement, the existing roof gravel, projection and perimeter flashings, roof membrane, insulation, vapour retarder, and old appurtenances are to be removed down to the existing structural deck and disposed of to an appropriate site.**
- .7 All unused and abandoned pitch pockets, vents, curbs, sleepers, projections, etc. are to be removed from the designated areas and disposed of. Obtain verification and authorization from the Owner before removing any suspected unused or abandoned projections. New decking is to be installed as required to close off any openings prior to the installation of the new roofing system.**
- .8 Disconnect Electrical Services as required.**
- .9 Disconnect Mechanical Equipment as required.**
- .10 Ensure that projections and any equipment (electrical conduit, gas lines etc.) are correctly secured to the decking where applicable. If any inadequate securement is found, the Consultant is to be informed and work around that area is to be halted until the situation has been rectified.**
- .11 Any rooftop equipment requiring disconnection shall be the responsibility of the Contractor in consultation with the owner unless otherwise specified in this document.**
- .12 Ensure roof drains have been installed at proper elevations relative to finished roof surface in order to allow for sufficient drainage of the roof surface.
- .13 Prior to application of vapour retarder, examine deck and ensure any defect of level or construction is correct before proceeding with the work.
- .14 Inspect wood blocking, cants and the like. Do not install roofing unless such items are adequately installed to withstand stresses imposed by thermal movement of the roof components.
- .15 Apply each part of roofing system when surfaces are free of moisture for successful application. Consult with manufacture's printed instructions for successful application.
- .16 All details supplied with this scope of work package are acceptable installations. Any deviance from these details must first approved by the Consultant prior to installation.

3.4 PROTECTION

- .1 Cover walls and adjacent work where materials are hoisted and used.
- .2 Use warning signs and barriers. Maintain in good order until completion of work.
- .3 Protect roof from traffic and damage by placing suitable runways over all new membrane work. Comply with precautions deemed necessary by Consultant.
- .4 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.

- buildings and all grounds in the vicinity during roofing operations. Contractor shall protect against dust infiltration and other such occurrences. Garbage chutes are to be located as to minimize their exposure to the building and its occupants. Protect walls by means of tarpaulins where garbage chutes and hoisting equipment is located. Cover dumpsters and bins.
- .6 Only use equipment that will not adversely affect the deck (damage or alter).
 - .7 Roof access is to be unobstructed. Doorways and fire routes are to be kept clear of any obstacles.
 - .8 Examine and repair or replace damage caused by work of this contract with materials and finish to match original to Consultant's approval.
 - .9 All non-used materials are to be removed and stored at a location that will prevent any damage (moisture, ultraviolet breakdown, etc.).
 - .10 All materials for the project are to be delivered to the site. Materials are to arrive in undamaged condition with the original manufacturer's label intact and clearly visible for easy verification of materials to specified materials.
 - .11 When temperatures fall below 40°F, any materials such as membrane, adhesives and sealants that are affected by cool temperatures are to be stored in heated storage areas.
 - .12 Protect rolls from flattening by storing on ends on skids.
 - .13 Moisture sensitive products and exposed building substrates are to be protected with all work being halted during inclement weather including but not limited to rain fall, snow, drizzle, fog and hail.
 - .14 Protect all openings and safeguard all vents, stacks, and drains from weather and contamination from debris.
 - .15 Defective work resulting from application of material on unsatisfactory surface will be considered the responsibility of the Contractor.

3.5 CARPENTRY (GC REQUIREMENT FOR NEW CONSTRUCTION & ROOFING CONTRACTOR ON RE-ROOFING)

- .1 The minimum height above the finished roof at curb locations and at wall bases is to be 8" (203mm). The minimum height at parapets is to be 6" (152mm) above the finished roof.
- .2 ***(On Roof Replacement or Alterations) Contractors are to add new wood blocking as necessary to maintain minimum heights at perimeters and curbs. Contractor to replace any seriously damaged or deteriorated wood at perimeters and projections with new construction grade spruce wood blocking or exterior grade, good one side plywood to match existing. Determination of the suitability to re-use or replace existing wood to be at the sole discretion of the Consultant.***
 - .1 ***Ensure existing wood blocking remaining at perimeters and curbs is securely fastened to existing substrate before installing any new blocking.***
- .3 ***Contractor to install wood blocking as required to ensure that all curbs and sleepers for H.V.A.C. and mechanical equipment are level.***
- .4 ***All new and existing wood blocking and plywood is to be considered part of the roof, and to be made watertight by the end of each working day to eliminate moisture infiltration into the roof system.***

~~.5 All fasteners to be flush or slightly sunk with surface of wood blocking being secured~~

- .6 As indicated on drawings install blocking and cant strips to accommodate slopes and insulation, roofing, and sheet metal.**
- .7 Carpentry alterations will be performed to accepted trade practice.**
- .8 Before proceeding, installation of vapour retarders is to be in place.**
- .9 Wood to wood, wood to metal, wood to masonry or concrete to be secured at 12" (305mm) on center staggered.**

3.6 DECK OVERLAY BOARD (METAL DECK AND WOOD PLANK DECK)

- .1 Mechanically fasten or adhere the deck overlay board with plates over metal or wood deck as per manufacturer's written instructions and meeting FM guidelines.
- .2 Install sheets of the deck overlay board with long axis of each sheet perpendicular to the direction of the steel deck flutes.
- .3 Butt sheets tightly together with end joints staggered by half the width of one sheet.
- .4 Mechanical fasteners to penetrate top flutes only, by no less than $\frac{3}{4}$ " (19mm) and by no more than 1" (25mm).
- .5 Polyurethane adhesive is to be applied to manufacturers printed instructions and in accordance with Factory Mutual guidelines.
- .6 Check underside of deck before installation to eliminate damaging any existing conditions below the deck.
- .7 Cut new deck overlay board as required at perimeters and projections.
- .8 Apply appropriate primer to top surface of the deck overlay boards as per manufacturer's written instructions and allow to dry prior to the installation of the new vapour retarder.

3.7 VAPOUR RETARDER

- .1 Install a continuous layer of modified bitumen base sheet and base sheet flashings over prepared substrate.
- .2 The substrate must be clean, dry, and free of dust, grease, or other contaminants.
- .3 Vapour retarder must be installed on the same day as the primer application. Do not install when rain or snow is present or imminent, or on wet/damp surfaces.
- .4 Field Sheet Installation:
 - .1 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and re-roll from both ends.
 - .2 Apply cold adhesive using notched squeegee at rate recommended by manufacturer. Adhesive to be applied evenly, without skips, voids, or excessive amounts at any location.
 - .3 Unroll and install base sheet carefully in straight, parallel rows.
 - .4 Lap sheets 3" (76mm) for side laps and a minimum 6" (152mm) for end laps ensuring that the polyethylene top film is properly hot air welded to form a watertight seal.
 - .5 Application to be free of blisters, wrinkles and fish-mouths

- .5 Flashing Installation:
- .1 Prime substrate to receive self-adhering base sheet flashing with specified primer at rate recommended by manufacturer. Avoid pools and heavy areas and allow primer to dry a minimum 30 minutes or until staining does not occur to the touch and surface becomes tacky.
 - .2 Ensure complete coverage of the primer to both prepared substrates and to the field sheet membrane prior to placement of the membrane flashing.
 - .3 Install membrane flashing onto substrate in 40" (1m) wide strips extending over perimeters as shown on detail drawings.
 - .4 Unroll and install membrane flashing onto substrate by removing the release paper and discarding.
 - .5 Using weighted roller as recommended by manufacturer, roll all surfaces of roof membrane to ensure continuous adhesion with membrane to substrate. Firmly press the membrane into the substrate to ensure proper bond.
 - .6 Lap membrane flashing onto field membrane a minimum 6" (152mm). Side laps between adjacent sheets to be a minimum of 5" (127mm) wide.
- .6 Self adhering modified bitumen flashings may be used at perimeters or projections where cold adhesive may be an issue.
- .7 All side and end laps of the base sheet and base sheet flashing shall be hot air welded to the satisfaction of the Consultant.
- .8 INSTALL MEMBRANE GUSSET REINFORCEMENT AT ALL INSIDE AND OUTSIDE CORNERS.
- .9 New vapour retarder to act as a temporary roof membrane providing complete, continuous waterproofing to the roof prior to the wet installation of the new N.V.S insulation system. Contractor to ensure temporary roof membrane is watertight and has sufficient temporary drainage prior to installation of the new N.V.S. insulation system. Water damage caused to building and its contents by roof leaks after this stage will be rectified by Contractor at no expense.

3.8 (a) FLAT LIGHTWEIGHT INSULATED CONCRETE

- .1 *Install a flat N.V.S. insulation system over the prepared surface. The N.V.S. insulation system is to consist of expanded polystyrene insulation boards and a top pour of light weight insulating concrete. N.V.S. insulation system work must be done by a qualified Installer.*
- .2 *IT IS THE RESPONSIBILITY OF THE N.V.S. CONTRACTOR TO TAKE ALL NECESSARY PRECAUTIONS TO AVOID ACCIDENTALLY CONTAMINATING ADJACENT WALLS AND ROOF AREAS WITH N.V.S. CONCRETE SLURRY. N.V.S. Contractor must clean up all accidental spills immediately and restore the affected areas to original condition at no cost to the Building Owner. All clean-ups must be to the satisfaction of the Consultant AND Owner.*
- .3 *Prior to installing the new expanded polystyrene insulation, a pour of the light weight concrete a minimum of 0.125" (3mm) thick is to be applied to the substrate.*

Embed a continuous layer of 5" (127mm) flat N.V.S. insulation boards into the minimum 0.125" (3mm) layer of concrete to create a foundation for the lightweight concrete top pour. Install N.V.S. insulation to achieve a minimum R-value of 20 across each roof.

- .5 Install lightweight concrete slurry over top of the insulation boards. The slurry is to have a minimum thickness of 1.25" (32mm) over the entire surface.
- .6 Trowel the light weight concrete slurry around all projections (curbs, chimneys, sleepers, etc.) wider or longer than 1" (25mm) to form a drainage cricket/saddle.
- .7 The slurry top coat is to be allowed to dry completely to attain a minimum fastener pullout resistance of 40 psi prior to the installation of the new venting base sheet. IRC Building Sciences and the manufacturer are to be present during pull-strength tests on each roof area.
- .8 Prior to the application of the roof membrane system, scrape any ridges, trowel markings or other protrusions, and fill any voids as required to create a smooth surface for the membrane.
- .9 Installation of NVS insulation system to be in accordance with the manufacturer's written guidelines and instructions.

3.9 (a) TAPERED N.V.S. INSULATION

- .1 Install a tapered N.V.S. insulation system over the prepared surface. The N.V.S. insulation system is to consist of expanded polystyrene insulation boards and a tapered top pour of light weight insulating concrete. N.V.S. insulation system work must be done by a qualified Installer.
- .2 IT IS THE RESPONSIBILITY OF THE N.V.S. CONTRACTOR TO TAKE ALL NECESSARY PRECAUTIONS TO AVOID ACCIDENTALLY CONTAMINATING ADJACENT WALLS AND ROOF AREAS WITH N.V.S. CONCRETE SLURRY. N.V.S. Contractor must clean up all accidental spills immediately and restore the affected areas to original condition at no cost to the Building Owner. All clean-ups must be to the satisfaction of the Consultant.
- .3 Prior to installing the new expanded polystyrene insulation, a pour of the light weight concrete a minimum of 0.125" (3mm) thick is to be applied to the substrate.
- .4 Embed a layer of minimum 5" (127mm) N.V.S. insulation boards in a stair step pattern away from the drain into the minimum 0.125" (3mm) layer concrete to create a foundation for the light weight concrete top pour. The maximum rise between steps in the insulation is to be 1" (25mm).
- .5 All boards shall be placed in position and walked in to ensure adequate slurry protrudes through the holes. Do not slide boards into place.
- .6 All insulation boards are to be installed in parallel courses with adjacent boards being butted tightly together.
- .7 Install the lightweight concrete slurry over top of the insulation boards. The slurry coat is to have a minimum thickness of 1" (25mm) and is to be trowelled to attain a minimum 1% slope; 0.125" (3mm) vertical rise per linear foot (305mm) horizontally.
- .8 The N.V.S. insulation to have a minimum thickness of 2" (51mm) at drain locations; 1" (25mm) of Insulperm board and 1" (25mm) of N.V.S. top coat. Install N.V.S. Insulation to achieve a minimum R-value of 25 across each roof.
- .9 Trowel the light weight concrete slurry around all projections (curbs, chimneys, sleepers, etc.) wider or longer than 1" (25mm) to form a drainage cricket/saddle.
- .10 The slurry top coat is to be allowed to dry completely to attain a minimum fastener pullout

- Distance of 40 lbs (18 kg) per fastener prior to the installation of the new roofing base sheet.
- .11 *Prior to the application of the roof membrane system, scrape any ridges, trowel markings or other protrusions, and fill any voids as required to create a smooth surface for the membrane.*
 - .12 *Installation of NVS insulation system to be in accordance with the manufacturer's written guidelines and instructions.*

3.10 (a) INSULATION SUMPS FOR N.V.S.

- .1 *Install wood block frame of appropriate height center around each existing drain location to accommodate a new 8' x 8' (2.4 x 2.4m) tapered insulation drainage sump.*
- .2 *Install 1 ply of modified bitumen base sheet flashing overtop of the new wood frame to make watertight.*
- .3 *Drainage sumps shall be fully adhered to the vapour barrier inside wood frame after installation of N.V.S. insulation system.*
- .4 *At all drain locations on the roof replacement areas, a new 8' x 8' (2.4m x 2.4m) insulation sump with 2' x 2' (610mm x 610mm) central flat is to be installed over the prepared substrate.*
- .5 *New insulation sumps to run from 2" (51mm) in thickness at the outer edge down to 1" (25mm) at the central flat. Central flat to be 1" (25mm) thick.*
- .6 *Install new rigid mineral wool fibre board filler of appropriate thickness under new insulation sump as required.*
- .7 *Fully adhere the insulation sump to the vapour retarder in a full bed of adhesive and ensure to achieve proper coverage rate.*

3.11 (a) VENTING BASE SHEET (LIGHTWEIGHT INSULATED CONCRETE ASSEMBLY)

- .1 *Overtop of the tapered N.V.S. insulation system, install a new venting base sheet prior to installation of new modified bitumen membrane.*
- .2 *Venting base sheet shall be laid free of wrinkles, voids or pockets.*
- .3 *Install the venting base sheet along the flat of the roof, turn up at perimeter details, and extend to the outside edge of the perimeter.*
- .4 *The venting base sheet shall be secured by means of N.V.S. compatible mechanical fasteners with a minimum 40 p.s.i. pullout strength.*
- .5 *Mechanically fasten venting base sheet at 9" (229mm) o.c. on all side and end laps, and at 12" (305mm) o.c. in the field.*

3.8 (b) RIGID BOARD INSULATION

- .1 *Overtop of prepared deck overlay board and vapour retarder substrate, install a layer of tapered polyisocyanurate insulation in accordance with tapered insulation layout on roof plan and insulation supplier's shop drawings.*
- .2 *Do not use warped or curled insulation boards. For uneven surfaces, trimming or slitting of boards may be necessary.*
- .3 *Install insulation boards in parallel rows and with joints staggered by one half board length. Where multiple layers of insulation are installed, stagger all end joints by min. 6" (152mm).*

no gaps between insulation boards larger than 0.125" (3mm).

- .5 Fully adhere insulation to vapour retarder 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 FM requirements. Use a "Z" pattern over an application area no larger than 12'-0" (3.66m) at a time. Minimum securement pattern:
 - .1 Adhesive ribbons to be no less than 1/2" (13mm) to 3/4" (19mm) in width at time of application.
 - .2 Parallel rows of adhesive ribbons to be no more than 1'-0" (305mm) apart in field of roof.
 - .3 Along 10'-0" (3.05m) wide perimeter zones, rows of adhesive to be no more than 6" (127mm) apart.
 - .4 Rows of adhesive to be no more than 4" (102mm) 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.

3.9 (b) COVER BOARD

- .1 Install a layer of cover board panels in beads of polyurethane foamable roofing adhesive over rigid insulation as per manufacturer's written instructions and to meet FM requirements.
- .2 Install continuous ribbons of polyurethane adhesive in parallel lines centered over top of deck flutes or ribs to meet FM requirements. Use a "Z" pattern over an application area no larger than 12'-0" (3.66m) at a time to minimum securement pattern:
 - .1 Adhesive ribbons to be no less than 1/2" (13mm) to 3/4" (19mm) in width at time of application.
 - .2 Parallel rows of adhesive ribbons to be no more than 1'-0" (305mm) apart in field of roof.
 - .3 Along 10'-0" (3.05m) wide perimeter zones, rows of adhesive to be no more than 6" (127mm) apart.
 - .4 Rows of adhesive to be no more than 4" (102mm) apart in corner zones.
 - .5 Do not allow rising foam adhesive to skin over. Place roof board panels immediately into wet adhesive.
 - .6 Install panels in parallel rows and butt tightly together with end joints staggered by a half width of sheet. Stagger panel end joints with joints of rigid insulation below by min. 6" (152mm).
- .3 Cut new deck overlay board as required at perimeters and projections.
- .4 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.

3.12 GENERAL MODIFIED BITUMEN INSTALLATION PROCEDURES

.2 Basic Rules For Application:

- .1 Surface Inspection: Modified Bitumen membranes can be applied over wood, metal, gypsum board and concrete decks which must be clean, smooth, and free of snow, ice, moisture, and debris.
- .2 Application of Primer: Priming is required for all substrates prior to the installation of a modified bitumen membrane. The primer is to be applied at a rate of approximately $\frac{1}{2}$ gal/100ft² with a roller or sprayer. Contractor is to allow primer to dry prior to adhering membrane to the prepared substrate. Drying time will vary according to the deck and weather conditions.
- .3 First Roll Starting Point: Low Slope and Flat Roofs: Base sheet to begin at drain level with the side lap aligned with the centre of the drain, rolls to run perpendicular to the slope (where applicable). Cap sheet to be installed over the base sheet and cover the overlap in the base sheet. Center of cap sheet to align up with centre of the drain.
- .4 Alignment of Rolls: The first roll to be completely unrolled and aligned with the edge of the roof. Where required, the membranes are to be unrolled and allowed to relax for the required time. The membrane is to be re-rolled from both ends to the centre, then applied as per specifications.
- .5 Staggering of Sheets: End laps between base and cap sheets to be staggered approximately 24" (610mm). Side laps between base and cap sheets are to be offset 12" (305mm). Laps in the membrane (base and cap) are to be 3" (76mm) wide for side laps and 6" (152mm) wide for end laps.
- .6 End Lap and Side Lap Sealing at Areas of potential moisture infiltration at voids created by overlapping rolls of membrane:
- .7 Procedure to Seal Voids
 - .1 Prior to installation, the corner of the salvage edge covered by the next roll of material is to be cut off when the membrane is unrolled.
 - .2 This procedure to be carried out for the application of membranes (base sheets, cap sheets and flashings).
- .8 Salvage Edge Protection: Granular along the edge of the membrane to be primed prior to the application of adhesive to provide good adhesion of the laps.
- .9 Membrane Flashings:
 - .1 Base flashings to extend 6" (152mm) onto the base sheet from the bottom of the perimeter detail.
 - .2 Cap flashings to extend 9" (229mm) onto the cap sheet from the bottom of the perimeter detail.
- .10 Seams: Seams in all sheets to be checked with a round nosed trowel while work is in progress. Deficiencies found to be repaired prior to installing the covering layer or leaving the roof area at the end of the day.
- .11 Reinforcement: Reinforcement is required at corners, vents and drains, mechanical units, and gravel stops.

.3 Potential Defects/Deficiencies:

- .1 Delamination of Materials: The membrane may not be fully bonded to the substrate due to:

- .1 moisture present on the substrate.
 - .2 dirt, dust or other contaminate on the substrate acting as a parting agent.
 - .3 inadequate application of primer or adhesive.
-
- .2 Mis-alignment of Rolls: This occurs when the roll of membrane being applied swerves and the alignment to the starting line is lost. This can occur when the roll is not unrolled, aligned and re-rolled straight. When a roll becomes mis-aligned it is to be cut at the point where the swerve begins and restarted.
 - .3 Wrinkles: Wrinkles are undulations located on the surface of the membrane after it has been applied. Depending on its origin, a wrinkle may have different appearances. With a Fully Adhered System, defects can be:
 - .1 Cross-Sheet undulations: These appear as wrinkles, but are waves which occur when the membrane is installed in a stop and go fashion.
 - .2 Continuous Ridging of the Membrane: These wrinkles are formed by movement of the substrate underneath the membrane. The contractor is responsible for ensuring that the substrate is secure prior to installing the membrane.
 - .4 Blisters: A blister is a pocket of air under the membrane where full adhesion was not attained or trapped moisture was released from the substrate. In isolated areas, no overlap location and low traffic areas, blisters pose any threat to the water tight integrity of the membrane. Large blisters should be removed and repaired. The repair consists of adhering any loose membrane, then applying a patch extending a minimum 6" beyond the cut out area on all sides.

3.13 MEMBRANE INSTALLATION

- .1 Install two ply modified bitumen membrane system overtop of prepared substrate. All membrane to be installed as per the manufacturer's written instructions and as per the guidelines below.
- .2 MEMBRANE GUSSET REINFORCEMENT TO BE INSTALLED ON TOP OF BASE SHEET MEMBRANE AT ALL INSIDE AND OUTSIDE CORNERS. CONSULTANT TO REVIEW GUSSET INSTALLATION BEFORE INSTALLATION OF CAP SHEET MEMBRANE.
- .3 ALL REQUIRED RELIEF VENTS TO BE INSTALLED DURING THE INSTALLATION OF THE BASE SHEET MEMBRANE.
- .4 Base Sheet, Cold Adhesive Installation:
 - .1 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and re-roll from both ends.
 - .2 Apply cold adhesive using notched squeegee at rate recommended by manufacturer. Adhesive to be applied evenly, without skips, voids, or excessive amounts at any location.
 - .3 Unroll and install base sheet into the prepared substrate and broom sheet into place to ensure full contact with substrate.
 - .4 All side and end laps of the base sheet shall be heat welded with hot air gun to the satisfaction of the consultant.
 - .5 Lap sheets 3" (76mm) for side laps and a minimum 6" (152mm) for end laps. Turn sheet up at perimeters a minimum of 3" (76mm).

.6 Application to be free of blisters, wrinkles, and fish mouths.

.7 Minimum temperature of adhesive at time of application is 70°F (21°C).

.5 Base Sheet Flashing, Self Adhered Installation:

- .1 Complete installation of base sheet flashing prior to installing membrane cap sheet and cap sheet flashings.
- .2 Prime substrate to receive self-adhering base sheet flashing with specified primer at rate recommended by manufacturer. Avoid pools and heavy areas and allow primer to dry a minimum 30 minutes or until staining does not occur to the touch and surface becomes tacky.
- .3 Ensure complete coverage of the primer to both prepared substrates and to the field base sheet membrane prior to placement of the base sheet flashing.
- .4 Install base sheet flashing onto substrate in 40" (1m) wide strips extending over perimeters as shown on detail drawings.
- .5 Unroll and install base sheet flashing onto substrate by removing the release paper and discarding.
- .6 Using weighted roller as recommended by manufacturer, roll all surfaces of roof membrane to ensure continuous adhesion with membrane to substrate. Firmly press the membrane into the substrate to ensure proper bond.
- .7 All side and end laps of the base sheet flashing shall be heat welded with hot air gun to the satisfaction of the consultant.
- .8 Lap base sheet flashing onto base sheet membrane a minimum 6" (152mm). Side laps between adjacent sheets to be a minimum of 5" (127mm) wide.
- .9 Where indicated on details, secure top edge of membrane to substrate with fastening bar and fasteners spaced every 9" (229mm) o/c.

.6 Base Sheet Flashing, Cold Adhesive Installation:

- .1 Complete installation of base sheet flashing prior to installing membrane cap sheet and cap sheet flashings.
- .2 Apply cold adhesive using notched squeegee at rate recommended by manufacturer. Adhesive to be applied evenly, without skips, voids, or excessive amounts at any location.
- .3 Ensure complete coverage of adhesive to both prepared substrates and to the field base sheet membrane prior to placement of the base sheet flashing.
- .4 Install base sheet flashing onto substrate in 40" (1m) wide strips extending over perimeters as shown on detail drawings.
- .5 Unroll and install base sheet into the prepared substrate and broom sheet into place to ensure full contact with substrate.
- .6 All side and end laps of the base sheet flashing shall be heat welded with hot air gun to the satisfaction of the consultant.

- .8 Where indicated on details, secure top edge of membrane to substrate with fastening bar and fasteners spaced every 9" (229mm) o/c.
- .9 Application to be free of blisters, wrinkles, and fish-mouths.
- .10 Minimum temperature of adhesive at time of application is 70°F (21°C).
- .7 Cap Sheet, Cold Adhesive Installation:
 - .1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and re-roll from both ends.
 - .2 Apply cold adhesive using notched squeegee at rate recommended by manufacturer. Adhesive to be applied evenly, without skips, voids, or excessive amounts at any location.
 - .3 Unroll cap sheet into fresh adhesive and broom into place ensuring continuous contact between base and cap sheet membranes.
 - .4 Withhold adhesive application 2" (51mm) from side and end laps. Hot air weld all side and end laps and ensure continuous bitumen bleed out.
 - .5 Lap sheets 3" (76mm) for side laps and a minimum 6" (152mm) for end laps. Offset joints in cap sheet 12" (305mm) minimum from those in base sheet.
 - .6 Application to be free of blisters, wrinkles and fish-mouths.
 - .7 Ensure membrane application is done in accordance with manufacturer's recommendations.
- .8 Cap Sheet Flashing, Cold Adhesive Installation
 - .1 Cap sheet flashing to be installed using adhesive at the rate recommended by the roofing manufacturer.
 - .2 Install adhesive to roof and wall surface using notched trowel. Cover backside of membrane with thin layer of adhesive.
 - .3 Once adhesive has become tacky, fit membrane into place and use roller to ensure continuous adhesion between base and cap sheet membrane.
 - .4 Set cap sheet to offset base sheet flashing joints by 50% and extend a minimum of 6" (152mm) onto roof. All end lap joints shall be a minimum 3" (76mm).
 - .5 All side and end laps of the cap sheet flashing shall be heat welded with hot air gun to the satisfaction of the consultant.
 - .6 Properly secure flashings to their support without sags, blisters, fish-mouths or wrinkles with termination and fasteners as indicated on detail drawings.
 - .7 Ensure all work is done in accordance with the manufacturer's recommendations.

3.14 LIQUID APPLIED RESIN FLASHING MEMBRANE

- .1 At all junctions where installation of membrane flashings is not possible, install new liquid applied resin flashing system.
- .2 ~~Resin system shall be a layered application consisting of two coats of thixotropic~~

- reinforcement.
- .3 Installation of liquid applied flashing system to follow in **STRICT ACCORDANCE** with 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 the catalyzed primer and/or resin to the substrate.
 - .5 Some surfaces may require scarification, shot-blasting, or grinding to achieve a suitable substrate. Wipe surfaces with a clean cloth saturated with the specified cleaner/solvent to remove grease, oils or dust that may affect adhesion and to cured PMMA surfaces to receive a subsequent coat of resin.
 - .6 Concrete substrates to receive an application of the specified PMMA roofing system shall have a maximum moisture content of 6% and a maximum internal relative humidity of 75%.
 - .7 Preparation of Steel/Aluminum Substrates:
 - .1 Grind to generate a "white-metal" surface and remove loose particles. Extend preparation area a minimum of ½" (13mm) beyond the termination of the roofing/flashing system. Do not use cleaner/solvent after grinding. Notch steel surfaces to provide a rust-stop where detailed.
 - .8 Preparation of Wood/Plywood Flashing Substrates to receive Resin:
 - .1 Tape the joints between plywood or wood panels using the specified tape and prime wood/plywood surfaces to receive the specified flashing system with the specified PMMA-based primer and allow primer to set prior to application of the flashing system.
 - .9 Preparation of Cover Board Substrates:
 - .1 Ensure that the insulation panels have been properly secured. Inspect the surface of the panel insulation system to ensure that edges are level and even between adjoining panels. Tape the panel joints and panel terminations at nailers, walls, perimeter and penetrations using the specified tape, centering the tape strips over the joints or panel edges.
 - .10 Preparation/Mixing/Catalyzing Resin Products:
 - .1 Pour the desired quantity of resin into a clean container and using a spiral mixer or mixing paddle, stir the liquid for the time period specified by the resin manufacturer.
 - .2 Calculate the amount of catalyst powder needed using the manufacturer's guidelines and add the pre-measured catalyst to the resin component.
 - .3 Mix again for the time period specified by the resin manufacturer, ensuring that the product is free from swirls and bubbles.
 - .4 Ensure that air is not entrained into the product during the mixing process. To avoid aeration, do not use a spiral mixer unless the spiral section of the mixer

- .5 Mix only enough product to ensure that it can be applied before expiration of resin pot life.
- .11 Primer Application:
- .1 Apply primer resin using a roller or brush at the minimum rate specified by the primer manufacturer over poured reinforced concrete substrates.
- .2 Apply primer resin using a roller or brush at the increased rate specified by the primer manufacturer over cover boards 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.
- .12 Base Flashing Application:
- .1 Using masking tape, mask the perimeter of the area to receive the 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 the minimum rate specified by the resin manufacturer to prepared surfaces requiring flashing coverage.
- .5 Work the fleece into the wet, catalyzed resin using a brush or roller to fully embed the fleece in the resin and remove trapped air.
- .6 Lap fleece layers a minimum of 2" (51mm) 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 the minimum rate specified by the resin manufacturer immediately following embedment of the fleece, ensuring full saturation of the fleece.
- .8 Ensure that the flashing resin is applied to extend a 0.25" (6mm) beyond the fleece. Remove the tape before the catalyzed resin sets. Make allowances for saturation of roller covers and application equipment.
- .9 Should work be interrupted for more than 12 hours or the surface of the catalyzed resin becomes dirty or contaminated by the elements, wipe the surface to be lapped with new flashing resin using the specified cleaner/solvent.
- .10 Allow the surface to dry for a minimum 20 minutes and a maximum 60 minutes before continuing work.

3.15 ROOF PENETRATIONS

- .1 Install roof penetration flashings and seal with membrane in accordance with the manufacturer's recommendations and as indicated on detail drawings.

- .2 Prime all metal flanges and allow to solvents to flash off prior to installation.
- .3 Set metal flange in full layer of rubberized sealing compound ensuring a positive bond.
- .4 Install an additional ply of base sheet membrane over the flange as per the manufacturer's written instruction prior to installing the field cap sheet membrane. The additional ply of membrane to extend a minimum of 6" (152mm) past the edge of the flange.
- .5 Install cap ply to the base ply flashing ensuring a full bond to the base ply and apply bead of sealing compound at the termination point.

3.16 CONCRETE PAVERS

- .1 Install a minimum of two concrete pavers at both the top and bottom of each roof access ladder, stairways, in front of all entrances, in front of all equipment service panels and as indicated on the drawings.
- .2 Pavers are to be set on a layer of 1" Type 4 extruded polystyrene insulation 2" less than dimension of paver (i.e. – 22" x 22" insulation under 24" x 24" paver)

3.17 METAL FLASHINGS

- .1 After the installation of the roof membrane and membrane flashings, new perimeter metal and metal flashings shall be installed as detailed in Sheet Metal Flashings Section and as indicated on detail drawings.

3.18 SEALANTS

- .1 As per Section 07900 – Sealants.

3.19 DRAINS

- .1 General:
 - .1 Make all joints watertight and gastight.
 - .2 Install new drains as per the manufacturer's specifications and detail drawings.
 - .3 Ensure that the drains are clear of debris and free flowing prior to the installation of the insulation and the membrane.
 - .4 Any blockages are to be reported prior to the start of work. Once work has begun, the Contractor assumes responsibility for free flowing drains and the cost associated with clearing.
 - .5 Prior to the installation of new insulation and membrane, ensure that all new and retro drains are located at a height where the roof is able to clear the majority of roof top water caused by rainfall within a 72 hour period.
 - .6 No roof area shall be left overnight without adequate provision for drainage at the existing roof drain locations.
 - .7 All plumbing to be executed in accordance with relevant Provincial Building Codes and Local Building Codes.
- .2 Drain Installation:
 - .1 ***(On Roof Replacement or Alterations) Remove any other components of the existing roof drain which may prevent the retrofit drain flange from sitting flush***

- .2 Install new base membrane over the drain location prior to installing the drain as per drawing detail and membrane installation methods.
 - .3 Primed drain body to be set into a bed of mastic.
 - .4 ***(On Roof Replacement or Alterations) Insert the retrofit drain body down into the existing drain pipe until the retrofit drain flange is embedded into the surface of the target membrane. If the drain body is too long, it may be shortened by cutting the copper drain stem prior to installing the U-Flow Seal connection.***
 - .5 The drain body is to be secured to the substrate with a minimum of 4 fasteners per drain or additional as required to secure the drain body.
 - .6 Install the reinforcement ply of base sheet membrane and cap ply membrane as per roofing membrane manufacturer's flashing requirements. Use the U-Flow hole puncher tool to make neat membrane penetrations for the drain studs.
 - .7 Place the Clamping Ring over the raised studs. Install stainless steel self locking nuts to tighten the Clamping Ring against the membrane flashing until secure.
 - .8 Install ballast guard strainer dome and secure in place with the cotterless pin or wing nut screw. At paver ballasted areas, drain cover to be flush with the surrounding pavers and secured with a flush mounted screw.
- .3 Scupper Drain Installation:
- .1 Install new metal open-top scupper drain at existing scupper location as indicated on roof plan.
 - .2 The new scupper is to be fabricated from 24 gauge galvanized metal to suit and complete with gravel stop edge on three sides. Solder all joints to make continuous water tight seal. Face of scupper to be encapsulated with pre-finished metal cover.
 - .3 Affix a pre-finished metal open-top collector head at each scupper drain and install new 4" x 4" (102 x 102mm) pre-finished metal rain water leaders.
 - .4 The rain water leaders shall be open-faced, except for the first 4' (1.2m). Colour shall match with existing.
 - .5 At the base of the rain water leaders, install concrete paver on rigid insulation as splash pad.
- .4 Overflow Scupper Drain Installation:
- .1 Install new overflow scupper drains at perimeters where indicated on the roof plan drawing.
 - .2 Solder all joints to make continuous water tight seal.
 - .3 Face of scupper to be encapsulated with prefinished metal cover.
 - .4 Locate mouth opening of new overflow scupper 1" (25mm) above the finished roof membrane on tapered/sloped roof sections and 3" (76mm) above flat roof sections.

3.20 TEMPORARY WATER CUT-OFFS

- .1 Temporary waterproof seals will be placed on daily work. Only areas which can be made watertight in the same day will be removed to ensure protection of the interior. Temporary seals

- WILL BE REMOVED BEFORE PROCEEDING WITH THE REMAINING WORK.
- .2 All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses.
 - .3 All temporary water-stops shall be constructed to provide a 100% watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation.
 - .4 The new membrane shall be carried into the water-stop. The water-stop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing.
 - .5 The edge of the membrane shall be sealed in a continuous heavy application of sealant.
 - .6 When work resumes, the contaminated membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work area and properly disposed of offsite. None of these materials shall be used in the new work.
 - .7 If inclement weather occurs while a temporary water-stop is in place, the Contractor shall provide the labour necessary to monitor the situation to maintain a watertight condition.
 - .8 If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the Contractor's expense.

3.21 CLEAN-UP

- .1 Clean up and remove from job site on a daily basis, all rubbish and surplus materials resulting from this work.

END OF SECTION – 07550

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