SECTION 07543

ADHERED THERMOPLASTIC (PVC) MEMBRANE ROOFING

PART 1 - GENERAL CONDITIONS

1.01 DESCRIPTION

A. Scope: Install an adhered thermoplastic (PVC) membrane roof system, including, but not limited to, isocyanurate insulation, primed gypsum barrier board, tapered expanded polystyrene (EPS) insulation, flashings, and other components to comprise a watertight roof system. The roof system shall comply with the herein specified Roofing Manufacturer's standard written and detail requirements (Sika Sarnafil as the basis of design).

1. System Type One:
   a. Over the properly prepared metal deck, install R-19.1 (3.1" / LTTR) isocyanurate insulation board. The insulation shall be mechanically-attached into the metal deck using Roofing Manufacturer approved attachment components at a rate of one (1) fastener and plate every four (4) square feet (8 per 4Ft. X 8Ft. board). Note: Perimeter and corner attachment shall be increased in accordance with Factory Mutual Data Sheet 1-28/29 requirements.
   b. Install tapered expanded polystyrene (EPS) insulation per the roof plan drawing and/or approved shop drawings. The tapered EPS shall be installed directly over the isocyanurate insulation and shall be adhered using VOC compliant, urethane low-rise foam adhesive in accordance with Factory Mutual Class 1-90 wind uplift criteria.
   c. Install a layer of Georgia-Pacific ¼" Dens-Deck Prime, or approved equal gypsum barrier board. The barrier board shall be installed directly over the tapered expanded polystyrene (EPS) insulation and shall be adhered in accordance with the requirements as listed in Item "b" above.
   d. Install a layer of 72-mil PVC membrane (EnergySmart White). The PVC membrane shall be installed directly over the gypsum barrier board and shall be adhered using water-based, VOC compliant bonding adhesive. The membrane shall meet or exceed Cool Roof Rating Council (CRRC) requirements for Title 24 compliance.
   e. At all internal gutter locations, install 48-mil, fiberglass reinforced PVC membrane gutter liner. The membrane liner shall fully encapsulate the gutter's internal waterway and shall be adhered using VOC compliant flashing adhesive in accordance with the Roofing Manufacturer's standard written and detail requirements.
2. System Type Two:
   a. Over the properly prepared concrete deck/substrate, install R-19.1 (3.1" / LTTR) isocyanurate insulation. The insulation shall be adhered to the concrete deck using VOC compliant, urethane low-rise foam adhesive in accordance with Factory Mutual Class 1-90 wind uplift criteria.
   b. Install tapered expanded polystyrene (EPS) insulation per the roof plan drawing and/or approved shop drawings. The tapered EPS shall be installed directly over the isocyanurate insulation and shall be adhered in accordance with the requirements as described in Item "a" above.
   c. Install a layer of Georgia-Pacific ¼" Dens-Deck Prime, or approved equal gypsum barrier board. The barrier board shall be installed directly over the tapered expanded polystyrene (EPS) insulation and shall be adhered in accordance with the requirements as listed in Items "a/b" above.

d. Install a layer of 72-mil PVC membrane (EnergySmart White). The PVC membrane shall be installed directly over the gypsum barrier board and shall be adhered using water-based, VOC compliant bonding adhesive. The membrane shall meet or exceed Cool Roof Rating Council (CRRC) requirements for Title 24 compliance.

3. Perform all flashing and detail work in strict accordance with the Roofing Manufacturer's standard written and detail requirements (as indicated within the project detail drawings and/or specification requirements, those specific project requirements shall supersede any corresponding standard/minimum requirement).

B. Related Work: The work includes but is not necessarily limited to the installation of:
1. Deck/Substrate Preparation
2. Isocyanurate Insulation
3. Tapered Expanded Polystyrene Insulation
4. Dens-Deck Prime Barrier Board
5. Urethane Low-Rise Foam Adhesive (Insulation/Barrier Board)
6. Membrane Adhesive
7. Flashing Adhesive
8. Fasteners
9. PVC Roof Membrane ("EnergySmart" White)
10. PVC Flashing Membrane
11. PVC Walkway Membrane
12. Roof Related Metal Flashings
13. Sealants
14. Treated Wood Nailers (by others)

1.02 QUALITY ASSURANCE

A. The Roofing Manufacturer shall have directly produced the specified PVC membrane and flashing components for a period equal to or greater than that of the specified warranty term (20 years) prior to beginning work of this Section; and shall have the capability to provide the specified products in compliance with the delivery and quantity criteria for the Project.

B. This roof system shall be applied only by a Roofing Contractor authorized by the Roofing Manufacturer. The Roofing Contractor shall have a minimum of five (5) years documented experience with the specified PVC Roofing Manufacturer.

C. The Roofing Manufacturer shall perform periodic in-progress inspections for the duration of this project. The inspections shall be performed at no additional cost to County.

D. Upon completion of the installation and the delivery to Roofing Manufacturer by the Applicator of a certification that all work has been done in strict accordance with the contract specifications and Roofing Manufacturer's requirements, an inspection shall be made by a Technical Representative of the Roofing Manufacturer to review the installed roof system.

E. There shall be no deviation made from the Project Specification without prior written approval by the Architect and the Roofing Manufacturer.

F. All work pertaining to the installation of PVC membrane and flashings shall only be completed by Applicator personnel trained and authorized by the Roofing Manufacturer in those procedures.

1.03 SUBMITTALS

A. See Section 01350 – Submittals, for submittal procedures.

B. Product Data:
   1. Samples of each primary component to be used in the roof system and the manufacturer's current literature for each component.
   2. Letter from the Roofing Manufacturer confirming that the Roofing Contractor (Applicator) is an authorized applicator of the specified roof system per the requirements of Section 1.02 B.
   3. Sample copy of Roofing Manufacturer's warranty.
   4. Sample copy of Applicator's warranty.

C. Shop Drawings: Setting plan for tapered insulation.

1.04 CODE REQUIREMENTS

The applicator shall submit evidence that the proposed roof system meets the requirements of the local building code and has been tested and approved or listed by the following test organizations. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance, as required in the "Submittals" section of this specification.

A. Underwriters Laboratories, Inc. (UL) - Northbrook, IL
   1. Class A assembly

B. Factory Mutual Research Corporation (FM) – Norfolk, MA
   Class 1-90 (attachment criteria only)

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All products delivered to the job site shall be in the original unopened containers or wrappings bearing all seals and approvals.

B. Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.

C. Membrane rolls shall be stored lying down on pallets and fully protected from the weather with clean canvas tarpaulins. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weldability.

D. All adhesives shall be stored at temperatures between 40°F (5°C) and 80°F (27°C).

E. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers or supplied by material manufacturer/supplier.

F. All materials which are determined to be damaged by the Architect or Roofing Manufacturer are to be removed from the job site and replaced at no cost to County.

1.06 JOB CONDITIONS

A. PVC materials may be installed under certain adverse weather conditions but only after consultation with the Roofing Manufacturer, as installation time and system integrity may be affected.

B. Only as much of the new roofing as can be made weathertight each day, including all flashing and detail work, shall be installed. All seams shall be cleaned and heat welded before leaving the job site that day.

C. 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.

D. All surfaces to receive new insulation, barrier board, membrane or flashings shall be dry. Should surface moisture occur, the Applicator shall provide the necessary equipment to dry the surface prior to application.

E. 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.

F. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops 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 County.

G. The Applicator is cautioned that certain PVC membranes are incompatible with asphalt, coal tar, heavy oils, roofing cements, creosote and some preservative materials. Such materials shall not remain in contact with PVC membranes. The Applicator shall consult the Roofing Manufacturer regarding compatibility, precautions and recommendations.

H. 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 polyester felt or plywood over insulation board shall be provided for all new roof areas that receive rooftop traffic during construction. The Contractor shall designate a single-source, responsible party to oversee the protection of all in-progress and/or completed roof sections for the duration of this project. In the event that any "trade-damage" should occur, the designee shall immediately notify all parties involved to determine the corrective steps to be taken. No roofing work shall proceed until all "trade-damage" items have been resolved to the satisfaction of the Roofing Manufacturer and the Architect.

I. Prior to and during application, all dirt, debris and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air and/or similar methods.

J. The Applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.

K. All roofing, insulation, barrier board, 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 City, State and Federal requirements.

L. All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Applicator and properly transported to a legal dumping area authorized to receive such material.

M. The Applicator shall take precautions that storage and/or application of materials and/or equipment does not overload the roof deck or building structure.

N. Flammable adhesives shall not be stored and not be used in the vicinity of open flames, sparks and excessive heat.

O. All rooftop contamination that is anticipated or that is occurring shall be reported to the Roofing Manufacturer to determine the corrective steps to be taken.

P. The Applicator shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages in writing to the Architect for corrective action prior to installation of the PVC roof system.

Q. Applicator shall immediately stop work if any unusual or concealed condition is discovered and shall immediately notify the Architect.

R. Site cleanup, including both interior and exterior building areas that have been affected by construction, shall be completed to the satisfaction of the Architect and County.

S. The Applicator shall conduct fastener pullout tests in accordance with the latest revision of the SPRI/ANSI Fastener Pullout Standard to help verify condition of deck/substrate and to confirm expected pullout values.

T. Protective wear shall be worn when using solvents or adhesives or as required by job conditions.

1.07 BIDDING REQUIREMENTS

A. Bidders Responsibility

Bidders must have held their roofing Contractors license for a minimum of five (5) years, with a continuous "Good-Standing" status to qualify to bid on this project. Any discrepancy between measurements and conditions listed within this specification, roof plans, and details, and those actually incurred on the job will be the responsibility of the Applicator.

1.08 WARRANTIES

A. Roofing Manufacturer's 20 Year Full System Warranty (NDL / Labor & Material)

Upon successful completion of all the work to the Roofing Manufacturer's, the Architect's and the County's satisfaction, the 20 Year Full System warranty shall be issued from the date of certificate of occupancy. The System warranty shall cover the roof membrane, all associated accessories that comprise the roof system, and all contractor labor. The warranty shall be non-prorated, and shall not exclude ponding/standing water and no time limit shall be assigned for any such ponding/standing water during the warranty term.

B. Roofing Contractor Two Year Warranty

The Contractor shall supply the County with a separate two-year workmanship warranty. 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 County (The Contractor warranty obligation shall run directly to the County).

PART 2 - PRODUCTS

2.01 GENERAL

A. The components of the Adhered PVC roof system are to be products of Sika Sarnafil and/or products utilized by Sika Sarnafil to complete the specified roof system.

B. Substitutions: No equivalent (identical) exists in the opinion of Architect. Refer to Section 01640 – Substitutions and Product Options. In addition to Section 01640 requirements provide the following:

1. Two 12 inch x 12 inch membrane samples and two samples of each component to be used in the roofing system.
2. Latest edition of the roofing system manufacture's specification and installation instructions, including applicable detail drawings.
3. Descriptive list of the materials proposed for use.
4. Letter from the proposed Roofing Manufacturer stating that the Manufacturer has a minimum of 20 years consistent experience in directly producing the proposed roof system. The letter shall also state that the proposed Manufacturer's membrane has maintained a consistent formulation for a minimum of 20 years.
5. Letter from the Cool Roof Rating Council (CRRC) stating that the proposed PVC membrane demonstrates the required Solar Reflectance (0.70) and Emissivity (0.90) as required for listing as an approved product by the CRRC (for both tan and white colored membranes).
6. Letter from the proposed Roofing Manufacturer confirming the number of years it has directly manufactured the proposed roof system under the trade names and/or trademarks as proposed.
7. Complete list of material physical and mechanical properties for each membrane and component including; weights and thicknesses; ultimate elongation; puncture resistance; seam peel strength; breaking strength; tear strength; dimensional stability; and low temperature bend.
8. Sample copy of specified guarantee.
9. Sample copy of Contractor's warranty.
10. Letter from the proposed Roofing Manufacturer confirming that the Contractor is an authorized applicator of the proposed roof system (minimum five years consecutive and active in "good- standing").

2.02 APPROVED MANUFACTURER AND MEMBRANE

A. Sika Sarnafil (a Division of Sika Corp.): Cypress, CA (800) 421-1662

B. G410-18: Fiberglass reinforced membrane with an integral lacquer coating to repel dirt and sustain long-term solar reflectivity.

C. Membrane shall be manufactured by "Extrusion/Spread Coating" process only, producing a monolithic membrane with fully encapsulated fiberglass reinforcement layer.

D. Membrane shall conform to ASTM D4434 (latest revision), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II Grade I (fiberglass reinforcement).

E. Roofing Manufacturer shall certify in writing that the product supplied for this project has a minimum polymer thickness of 72 mils (±2 mils). ASTM +/- tolerance for membrane thickness is not accepted.

F. Membrane shall comply with California Building Code (CBC) Title 24, Section 118 requirements for solar reflectivity and emissivity. Manufacturer and membrane shall be listed in the Cool Roof Rating Council (CRRC) product listing as outlined by the Department of Energy (DOE) and the Environmental Protection Agency (EPA).

G. As manufactured, membrane shall conform to the following physical properties:
1. Color to be **"EnergySmart" White.**
2. Thickness to be **72 mil (1.80 mm).**

Parameters –Adhered Membrane	ASTM Test Method	Minimum Physical Properties Requirements
Reinforcing Material-	-	Fiberglass
Overall Thickness, min., inches (mm)	D638	0.072 (1.80)
Tensile Strength, min., psi (MPa)	D638	1600 (11.1)
Elongation at Break, min. (machine x tranverse)	D638	270% / 250%
Seam strength, min. (% of tensile strength)	D638	80
Retention of Properties After Heat Aging	D3045	-
Tensile Strength, min., (% of original)	D638	95
Elongation, min., (% of original)	D751	90
Tearing Resistance, min., lbf (N)	D1004	14 (63)
Low Temperature Bend, -40°F (-40°C)	D2136	Pass
Accelerated Weathering Test (Xenon Arc)	D2565	10,000 Hours
Cracking (7x magnification)	-	None
Discoloration (by observation)	-	Negligible
Crazing (7 x magnification)	-	None
Linear Dimensional Change, max.	D1204	0.02%
Weight Change After Immersion in Water, max.	D570	2.5%
Static Puncture Resistance, 33 lbf (15 kg)	D5602	Pass
Dynamic Puncture Resistance, 7.3 ft-lbf (10 J)	D5635	Pass

*Failure occurs through membrane rupture not seam failure.

2.03 FLASHING MATERIALS

A. Wall/Curb Flashing
1. G410 PVC Membrane Flashing

Fiberglass reinforced membrane used for adhered flashings to approved substrate. Consult Roofing Manufacturer's Product Data Sheets for additional information.

2. Sarnaclad Metal (PVC Coated)

PVC-coated, heat-weldable sheet metal. 25 gauge, G90 galvanized metal sheet with a 20 mil unsupported PVC membrane laminated on one side. Consult Roofing Manufacturer's Product Data Sheet for additional information.

B. Miscellaneous Flashing
1. Prefabricated PVC Pipe Flashing

Prefabricated vent pipe flashing made from 0.048-inch (48 mil/1.2 mm) thick PVC membrane. Consult Roofing Manufacturer's Product Data Sheet for sizes and additional information.

2. Universal Prefabricated PVC Corners

Prefabricated outside and inside flashing corners made of 0.060 inch (60 mil/1.5 mm) thick membrane that are heat-welded to membrane or PVC clad metal base flashings. Consult Roofing Manufacturer's Product Data Sheet for additional information.

3. Sikaflex 1A Sealant

Proprietary sealant used at flashing terminations. Consult Roofing Manufacturer's Product Data Sheet for additional information.

4. Pre-Cut PVC Coverstrip

Precut flashing made from polyester reinforced PVC membrane. Consult Roofing Manufacturer's Product Data Sheet for additional information.

5. Internal Gutter Liner

Fiberglass reinforced 48-mil PVC membrane used for lining the waterway of internal gutter assemblies. Consult Roofing Manufacturer's Product Data Sheet for sizes and additional information.

2.04 BARRIER BOARD / INSULATION

A. Dens-Deck Prime Barrier Board: ¼" x 4' x 8'

Glass mat faced gypsum with non-asphaltic, highly filled proprietary heat-cured coating on one side. Fire resistant when tested in accordance with ASTM E 84 (flame spread 0, smoke developed 0). Consult Product Data Sheets for additional information.

B. Tapered Expanded Polystyrene (EPS) Insulation:

Rigid, tapered expanded polystyrene insulation board. Type II, 1.5# density (20 PSI, min.), closed-cell foam insulation as manufactured by Premier Industries (or pre-approved equal). Meets ASTM C-578 requirements.

C. Sarnatherm Isocyanurate Insulation: 3.1" x 4' x 4' (R-19.1/LTTR).

Rigid, cellular thermal insulation with polyisocyanurate closed-cell foam core and approved fiberglass facer laminated to both sides. Manufactured to meet the following:

1. ASTM C1289, Class 1, Type II
2. Zero Ozone Depletion Potential (ODP) from blowing agent.
3. Long-Term Thermal Resistance (LTTR) R-Value based on ASTM 1303: 6 per inch, regardless of published values.
4. Total Thermal Resistance: R-Value of 19.1 (3.1 inches)

2.05 ATTACHMENT COMPONENTS

A. Membrane Adhesive

1. V.O.C. Compliant Water Based Adhesive (Sarnacol 2121 Adhesive):

A water-based adhesive used to attach the membrane to the horizontal or near-horizontal substrate. Consult Product Data Sheets for additional information. Application rates are as follows:

	Substrate Rate gallons/100 ft²		Membrane Rate gallons/100 ft²		Total Rate gallons/100 ft² (liters/meter²)	
Dens-Deck Prime	1.75	+	0	=	1.75	(0.71)

Notes: a) There is a significant increase in drying time due to an increase in humidity and/or a decrease in temperature. Do not install when outdoor or substrate temperatures during drying period are expected to fall below 40°F (5°C).

b) Do not allow adhesive to skin-over or surface-dry prior to installation of membrane.

c) Use a water-filled, foam-covered roller to consistently and evenly press the membrane into the adhesive layer.

B. Insulation / Barrier Board Adhesive (Sarnacol 2163 "One-Step" Adhesive).

Asphalt free, solvent free, VOC compliant urethane adhesive. Adhesive shall be approved by the Roofing Manufacturer and shall meet Factory Mutual Class 1-90 wind uplift criteria.

C. Flashing Membrane Adhesive (Stabond Adhesive).

Solvent-based reactivating-type adhesive used to attach the membrane to the flashing substrate. Consult Product Data Sheets for additional information.

2.06 WALKWAY PROTECTION

A. PVC Walk Tread (Sarnatred)

A polyester reinforced, 0.096 inch, weldable membrane with surface embossment. Used as a protection layer from rooftop traffic. Consult Roofing Manufacturer's Product Data Sheet for additional information.

2.07 MISCELLANEOUS ACCESSORIES

A. Sealing Tape Strip

Compressible foam with pressure-sensitive adhesive on one side. Used with metal flashings as a preventive measure against air and windblown moisture entry.

B. Membrane Cleaner

V.O.C. compliant solvent cleaner used for the general cleaning, scuff marks, etc., from the membrane surface. Membrane cleaner is also used daily to clean seam areas prior to hot-air welding in dirty conditions or if the membrane is not welded the same day it is unrolled. Consult Roofing Manufacturer's Product Data Sheet for additional information.

2.08 SEALANTS

A. Multi-Purpose Sealant (for termination details).

B. The following method shall be utilized for temporary overnight tie-ins:

1. Mechanical attachment with rigid bars and compressed sealant.

2.09 MISCELLANEOUS FASTENERS AND ANCHORS

A. All fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum or stainless steel. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1-1/4 inch and shall be approved for such use by the fastener manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch and shall be approved for such use by the fastener manufacturer.

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION CONFERENCE

A. The Architect, Applicator, General Contractor, and Roofing Manufacturer shall attend a pre-scheduled site inspection / job-start meeting.

B. The meeting shall discuss all aspects of the project including but not limited to:
   1. Safety
   2. Set up
   3. Construction schedule
   4. Contract conditions
   5. Coordination of the work
   6. Roof protection plan
   7. Structural Loading Limitations/Requirements
   8. Review of Deck and/or Substrate Conditions
   9. Special Flashing Conditions

3.02 SUBSTRATE CONDITION

A. Applicator shall be responsible for acceptance or provision of proper substrate to receive new roofing materials.

B. Applicator shall verify that the work done under related sections meets the following conditions:
   1. Roof drains and/or scuppers have been reconditioned and/or installed properly.
   2. Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.
   3. All surfaces are smooth and free of dirt, debris and incompatible materials.
   4. All roof surfaces shall be free of water.

3.03 SUBSTRATE PREPARATION

The roof deck and roof construction must be structurally sound to provide support for the new roof system. The Applicator shall load materials on the rooftop in such a manner to eliminate risk of deck overload due to concentrated weight. The Contractor shall ensure that the roof deck is secured to the structural framing according to local building code and in such a manner as to resist all anticipated wind loads in that location.

General Criteria:

The Contractor and Applicator shall determine the condition of the structural metal deck and concrete deck/substrate.

A. Steel Deck:

As indicated on drawings and shall conform and be installed to meet the latest revision of FM's Loss Prevention Data Sheet 1-28 and the Uniform Building Code (UBC) current requirements.

B. Concrete Deck/Substrate:

The roof deck shall be smooth, even, free of dust, dirt, excess moisture or oil and be structurally sound. Sharp ridges, other projections and accumulations of debris above the surface shall be removed to ensure a smooth surface before roofing. Any deteriorated decking shall be repaired.

3.04 SUBSTRATE INSPECTION

A. A dry, clean and smooth substrate shall be prepared to receive the roof system. .

B. The Applicator shall inspect the substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.

C. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.

D. All roof surfaces shall be free of water.

E. Roofing membrane shall be applied over compatible and accepted substrates only.

3.05 WOOD NAILER INSTALLATION (Refer to Section 06100 – Rough Carpentry)

3.06 BARRIER BOARD / INSULATION INSTALLATION

General Criteria:

A. Barrier/insulation boards shall be installed according to the manufacturer's instructions.

B. Barrier/insulation board shall be neatly cut to fit around penetrations and projections.

C. Do not install more barrier/insulation board than can be covered with roofing membrane by the end of the day or the onset of inclement weather.

D. Install tapered insulation around drains creating a drain sump.

E. Mechanical Attachment (Isocyanurate Insulation / First Layer System Type One Only)

Insulation shall be mechanically fastened to the metal deck with approved fasteners and plates at a rate according to Factory Mutual's and the Roofing Manufacturer's recommendations for fastening rates and patterns. The quantity and locations of the fasteners and plates shall also cause the boards to rest evenly on the roof deck so that there are no significant and avoidable air spaces between the boards. Each board shall be installed tightly against the adjacent boards on all sides.

F. Attachment with Urethane Low-Rise Foam Adhesive (Sarnacol 2163:

Tapered EPS insulation and gypsum barrier board shall be adhered to the isocyanurate insulation substrate and subsequent layers (System Type One) and/or concrete deck/substrate (System Type Two) using low-rise foam adhesive according to the manufacturer's instructions. The application methodology shall be maintained throughout the installation as required by Factory Mutual and Sika Sarnafil. The installation shall be such to cause the barrier and insulation boards to rest evenly on the roof deck/substrate so that there are no significant and avoidable air spaces between the boards and the substrate. The maximum board size for isocyanurate and EPS insulation shall be 4 ft x 4 ft and 4 ft x 8 ft for gypsum barrier board. Each barrier and insulation board shall be installed tightly against the adjacent boards on all sides and walked-in-place to assure even and consistent contact with the substrate.

G. System Type Two Only: Perimeter attachment bar (Sarnabar) shall be installed above the adhered roof membrane four (4) feet from the edge of the roof along the entire outside perimeter. The bar shall be fastened 12 inches on center with a membrane cover strip welded over it.

3.07 INSTALLATION OF PVC MEMBRANE

A. Water Based V.O.C. Compliant Adhesive (Sarnacol 2121):

1. Over the properly installed and prepared substrate, water based adhesive shall be poured out of the pail and spread using notched 1/4 inch x 1/4 inch x 1/4 inch rubber squeegees. The water based adhesive shall be applied at a rate according to the Roofing Manufacture's requirements. No adhesive is applied to the back of the PVC roof membrane. Do not allow adhesive to skin-over or surface-dry prior to installation of roof membrane.

   Note:

   a) Water based adhesive shall not be used if temperatures below 40°F (5°C) are expected during application or subsequent drying time.

   b) No adhesive shall be applied in seam areas. All membrane shall be applied in the same manner.

3.08 HOT-AIR WELDING OF SEAM OVERLAPS

A. General:

1. All field seams shall be hot air welded using approved automatic/robotic welding machines only (no hand welding of field seams will be allowed). Seam overlaps should be 3 inches wide when automatic machine-welding and 4 inches wide when hand-welding, except for certain details.
2. Welding equipment shall be provided by or approved by the Roofing Manufacturer.
3. All membrane to be welded shall be clean and dry.

B. Quality Control of Welded Seams

1. The Applicator shall check all welded seams for continuity using a rounded screwdriver. On-site evaluation of welded seams shall be made daily by the Applicator to locations as directed by the Architect or the Roofing Manufacturer's Technical Representative. One-inch wide cross-section samples of welded seams shall be taken three times per day.

3.09 ADHERED MEMBRANE FLASHINGS

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval by the Architect and Roofing Manufacturer. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense.

A. Install fasteners and plates and/or membrane attachment bar according to the Detail Drawings with approved fasteners into the vertical base of walls and curbs.

B. All flashings shall extend a minimum of 8 inches above roofing level unless otherwise accepted in writing by the Architect and the Roofing Manufacturer's Technical Department.

C. All flashing membranes shall be mechanically fastened along the counter-flashed top edge with membrane attachment bar at 6-8 inches on-center.

D. All flashings that exceed 30 inches in height shall receive additional securement. Consult Roofing Manufacturer's Technical Department for securement methods.

E. All flashings shall extend a minimum of 8 inches above finished roof level unless otherwise accepted in writing by the Architect and the Roofing Manufacturer's Technical Department.

F. All flashing membranes shall be mechanically fastened along the counter-flashed top edge with membrane attachment bar at 6-8 inches on-center.

G. All flashings that exceed 30 inches in height shall receive additional securement. Consult Roofing Manufacturer's Technical Department for securement methods.

3.10 METAL FLASHINGS

A. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:
   1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).
   2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - latest issue.

B. Metal, other than that provided by the Roofing Manufacturer, is not covered under the Roofing Manufacturer's warranty.

C. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.

D. Metal shall be installed to provide adequate resistance to bending to allow for normal thermal expansion and contraction.

E. Counter flashings shall overlap base flashings at least 4 inches.

3.11 WALKWAY INSTALLATION

A. PVC Walkway Tread

Roofing membrane to receive PVC Walkway Tread shall be clean and dry. Place chalk lines on deck sheet to indicate location of Walkway. Apply a continuous coat of approved adhesive to the deck sheet and the back of Walkway in accordance with the Roofing Manufacturer's technical requirements and press Walkway into place with a water-filled, foam-covered roller. Clean the deck membrane in areas to be welded. Hot-air weld the entire perimeter of the Walkway to the PVC deck sheet. Check all welds with a rounded screwdriver. Re-weld any inconsistencies. Important: Check all existing deck membrane seams that are to be covered by Walkway with rounded screwdriver and re-weld any inconsistencies before Walkway installation.

3.12 COMPLETION

A. Prior to demobilization from the site, the work shall be reviewed by the Architect, the County and the Applicator. All defects noted and non-compliances with the Specifications or the recommendations of Roofing Manufacturer shall be itemized in a punch list. These items must be corrected immediately by the Applicator to the satisfaction of the Architect, County and the Roofing Manufacturer prior to demobilization.

END OF SECTION