SECTION 075417

ADHERED PVC ROOFING SYSTEM

PART 1 GENERAL

1.01 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. PVC Coated Metal: Installed under Section 076000.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Restricted Work Period: Section 011000.

B. Wood Nailers and Blocking: Section 061053.

C. Flashing and Trim: Section 076000.

1.03 REFERENCES

A. ASTM - American Society For Testing and Materials.

B. TIMA - Thermal Insulation Manufacturer's Association.

C. UL - Underwriters Laboratories.

D. FM - Factory Mutual.

1.04 DEFINITIONS

A. Company Field Advisor; An individual meeting the requirements of either subparagraph below:
   1. An employee of the company producing or manufacturing the system (or the company which lists and markets the primary components of the system under their name) who is certified in writing by the company to be technically qualified in design, installation, and servicing of the required products, and has experience in the installation of the required products. Personnel involved solely in sales do not qualify.
   2. An individual employed by an organization (other than the company producing or manufacturing the system), certified in writing by the company producing or manufacturing the system, that the individual is technically qualified in design, installation and servicing of the required products and is capable to act as company field advisor in their behalf, and has experience in the installation of the required products. Personnel involved solely in sales do not qualify.

1.05 SYSTEM DESCRIPTION

A. Fully Adhered System: PVC Membrane fully adhered to coverboard insulation or barrier board with bonding adhesive and insulation mechanically attached or hot mopped or adhesively attached to the structural deck.

1.06 SUBMITTALS

A. Waiver of Submittals: The "Waiver of Certain Submittal Requirements" in Section 013300 does not apply to this Section.

B. Submittals Package: Submit the shop drawings, product data, samples, and quality control submittals specified below at the same time as a package. Partial submittals will not be considered.

C. Shop Drawings for Tapered Insulation: Submit an accurate layout of the tapered insulation showing the slopes to the drains. Show cross section drawings illustrating the location and thickness of tapered insulation pieces and filler pieces. Show thickness of the insulation at high and low points.

D. Product Data: Submit catalog sheets, specifications, and installation instructions for each material specified.
   1. Revise the membrane manufacturer's product data as necessary to suit the requirements of the Contract Documents.
      a. Do not use or submit manufacturer's details unless there is a proposed deviation from the Contract Documents. In such instances, submit the revised detail, labeled as such, for approval. The revised detail shall show the existing conditions and the proposed change and shall be referenced directly to the related detail on the Contract Drawings.
   2. Manufacturer's Warranty: Sample copy of the membrane manufacturer's 10 year system warranty covering workmanship and materials.

E. Samples:
   1. Sheet Membrane: One 6 inch square piece.
   2. Sheet Flashing: One 6 inch square piece.
   3. Insulation: One 6 inch square piece.
   4. Fasteners: Two, each type.
   5. Welded Seam: Two 12 inch square samples of welded seams that are representative of the quality of field welded seams.
      a. Samples must be labeled "Quality Standard Samples".

F. Quality Control Submittals:
   1. Fire Hazard Certification: Submit written certification that the roof system, including the specific insulation, has been tested in conjunction with the type of structural roof deck and roof slope applicable to the project and has achieved an Underwriters Laboratories Class A external fire resistance rating.
      a. Acceptable Certification: Letter from Underwriters Laboratories, or a copy of the Underwriters Laboratories classification listing for the roofing system.

   2. Wind Uplift Certification: Submit written certification that the roof system, including the specific insulation and fasteners, has been tested in

conjunction with the type of structural roof deck applicable to this project, and has achieved a Factory Mutual Class 1-90 Wind Uplift rating.

a. Acceptable Certification: Letter from Factory Mutual, or a copy of the Factory Mutual Approval Report for the roofing system.

3. Material Certification: Submit a letter from the roofing membrane manufacturer certifying that the insulation and insulation fasteners are approved for use with the roofing system.
4. Membrane Manufacturer's Certification:
   a. Submit a letter certifying that the manufacturer has been actively marketing the submitted system for a minimum of 5 years.
   b. Submit the names and addresses of 5 previous roofing projects. Include the type and size of each project, and name and telephone number of a contact person at the project locations.
5. Applicator's Certification:
   a. Letter from the membrane manufacturer certifying that the applicator is licensed or approved to install the roof system.
   b. Names, address, and telephone numbers of 3 buildings where the applicator has installed PVC sheet membrane roof systems that have had the manufacturer's warranty issued. Include the membrane manufacturer's name and the warranty number.
   c. Letter certifying that the job foreman or crew chief and at least two other members of the roofing crew have installed at least 3 PVC sheet membrane roof systems and are thoroughly familiar with all aspects of the installation.

G. Contract Closeout Submittals:
   1. Warranty: Warranties as specified.

1.07 QUALITY ASSURANCE

A. Membrane Manufacturer's Qualifications:
   1. The manufacturer shall have the technical expertise and qualified technical representatives to quickly resolve questions or problems that may arise both during and after the Work is completed.
   2. The manufacturer shall have been actively marketing a mechanically attached PVC roof system in the United States for a minimum of 5 years.
   3. The manufacturer shall provide the names, addresses, and telephone numbers of at least 5 previous projects of comparable size, scope, and complexity as the Work of this Section.
   4. The manufacturer shall require that the roof system be installed by a licensed or approved applicator.

B. Applicator's Qualifications: The application of the roofing system shall be performed by an applicator licensed or approved by the membrane manufacturer. The licensed or approved applicator shall have previously installed at least 3 PVC sheet membrane systems for which the manufacturer's warranty was issued.
   1. Workers: The crew chief or foreman and at least two other members of the roofing crew shall have installed at least 3 PVC sheet membrane roof

systems and shall be thoroughly familiar with all aspects of the installation.

C. Fire Hazard Classification: The sheet membrane roof system shall have an Underwriters Laboratories Class A External Fire Resistance rating; as determined by tests conducted in conformity with UL-790 "Tests for Fire Resistance of Roof Covering Materials".
   1. The roof system, which includes a specific generic type of insulation and in some instances a specific name brand insulation, shall have been tested in conjunction with the type of structural roof deck and roof slope applicable to this project.

D. Material Classification Identification: All materials delivered to the site that are a component of the roofing system shall bear the UL Classification mark.

E. Pre-installation Conference: Before the roofing Work is scheduled to commence, a conference will be called by the Director's Representative at the site for the purpose of reviewing the Drawings and the Specifications and discussing requirements for the Work. The conference shall be attended by the Contractor, the authorized roofing applicator, and the Company Field Advisor.

F. Inspections:
   1. For the purpose of the required inspections, the Contractor shall keep the Company Field Advisor and the Director's Representative advised of the progress of the Work and the anticipated Work schedule as the Work progresses.

G. Welded Seams (Splicing): Job site, and factory welded seams (if any) must be of the same quality and exhibit the same physical characteristics as the quality standard samples which are submitted for approval. The approved samples will be the standard of quality required for all welded seams. Failure to maintain the standard will be cause for rejection of the Work.
   1. The approved samples must exhibit the following minimum physical characteristics:
      a. The welded seams must be at least as strong as the parent material. The mating surfaces of each sheet must remain fully bonded to each other when sufficient peel or shear force is applied to the seam to delaminate or break the parent material.
      b. The welded seam must be a minimum of 1-1/2 inches wide.
      c. There must be complete fusion of the mating surfaces, with no skips, voids, or fishmouths.

1.08 ROOFING MANUFACTURER'S COMPANY FIELD ADVISOR

A. The manufacturer of the roofing system, issuing the final system guarantee on this roofing project, must supply a Company Field Advisor, as a technical representative, with the following minimum qualifications:
   1. Documentation of 5 years of field experience on the same type of roofing system.

2. Documentation of 10 projects where role was a Company Field Advisor; include contact names and phone numbers for each project.
3. Documentation of attendance at a roof specific instructional seminar within the last two years.

B. Secure the services of the Company Field Advisor for a minimum of _____ days at a minimum of _____ hours per day to inspect the workmanship of the roofing system installer.

C. Company Field Advisor Duties and Responsibilities:
1. Become familiar with the Contract Documents and approved submittals prior to the pre-roofing conference.
2. Attend the pre-roofing conference and the beginning of the actual membrane installation for the purpose of:
   a. Rendering technical assistance to the Contractor regarding installation procedures of the system.
   b. Familiarizing the Director's Representative with all aspects of the system including inspection techniques.
   c. Answering questions that might arise.
3. Attend each bi-weekly meeting.
4. Be objective, unbiased and impartial in each inspection, recommendation, conversation, action and written report.
   a. Inspect and approve the existing substrate, flashing, blocking, and related materials as being acceptable for the installation of the roofing system.
   b. Ensure proper fastening patterns and fastener sizes of wood blocking, insulation, edge flashing, and related components.
5. Immediately report non-compliant conditions, if any, to the Director's Representative.
6. Provide to the Director's Representative a written report, submitted prior to leaving the Project Site each day the Company Field Advisor is present. Each daily written report shall contain at a minimum:
   a. Date of report and inspection.
   b. Weather conditions at the start, middle, and end of the work day.
   c. Work performed including Contractor activity, contractor crew size, supervisor's name, area of activity, and progress and quality of the work as observed.
   d. Discussions with Contractor regarding work anomalies and resolution.
   e. Conditions that are not in compliance with the Contract documents.
      1) Continue documenting non-compliance issues in subsequent reports until the issue has been resolved. Document resolution of non-compliance issues when resolved.
7. Report to the Director's Representative in writing failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.
8. Confirm, after completion of the roofing work and based on the Company Field Advisor's inspections and tests, that the Company Field

Advisor has observed no applications procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to the site in the manufacturer's labeled, unbroken containers.

B. Storage and Handling: Store materials in a dry, well ventilated place protected from the weather.
   1. Do not store materials so as to overload the deck or structural assembly.
   2. Store all materials on raised platforms covered with properly secured breathable water resistant covers. Slit shrink wrapping to not permit condensation and cover with breathable tarp.
   3. Remove materials that become wet from the site.
   4. Store volatile liquids in separate storage building or trailer, or remove from the site at the end of each work day.
   5. Store adhesives, and sealants at temperatures between 60 degrees F and 80 degrees F.
   6. Do not remove materials from factory packaging until ready for use.

1.10 PROJECT CONDITIONS

A. Regardless of any temporary power provided in Section 015000, power will not be provided for heat welding equipment. The applicator shall provide portable generators of the size and type recommended by the membrane manufacturer.

B. Do not execute the Work of this Section unless the Director's Representative is present or unless he directs that the Work be performed during his absence.

C. Do not execute the Work of this Section unless the substrate is dry and free of dirt and debris.

D. Moisture Protection:
   1. Cover, seal or otherwise protect the roof and flashings so that water cannot accumulate or flow under completed portions. When and where necessary to accomplish this, provide temporary water cut-offs in accordance with the membrane manufacturer's written specifications.
   2. Limit the removal of existing materials to areas that can be completely re-roofed or temporarily protected within the same day. At the discretion of the Director's Representative, a watertight built-up vapor barrier may be acceptable temporary protection for a maximum of 48 hours.

E. Do not smoke or use open flames near volatile materials.

F. During the progress of the work every effort must be made to keep odors generated by the work from entering the building.
   1. Coordinate the use of materials that could cause odors to permeate the building with the directors representative.

2. Shut off and wrap all air intakes in the vicinity of the work.
3. Insure that all operable windows in the vicinity of the work area closed.

1.11 WARRANTY

A. Warranty Extension: The one year period required by Paragraph 9.8 of the General Conditions is extended to 2 years for the Work of this Section. Refer to Supplementary Conditions.

B. Manufacturer's Warranty: In addition to the 2 year period specified above, furnish the membrane manufacturer's printed 10 year, no dollar limit, full system warranty covering workmanship and materials for the Work of this Section. The warranty shall include, but not be limited to, repair of leakage, and the repair and/or replacement of the roofing system caused by defects in materials or workmanship.

PART 2 PRODUCTS

2.01 PVC SHEET MEMBRANE AND RELATED PRODUCTS

A. PVC Sheet Membrane: UL Classified, polyester reinforced, .060 thick PVC sheet membrane (Polyvinyl Chloride) ASTM D4434-96, Type II, Grade 1. The PVC sheet membrane shall be visually free of streaks, particles of foreign matter, undispersed raw material, pinholes, cracks, and tears, and shall be uniform in thickness. When unrolled, the membrane shall be free of wrinkles, distortions, and blisters.

B. PVC Sheet Flashing: Reinforced, PVC sheet flashing; same material as sheet membrane.

C. Prefabricated PVC Flashing: Membrane manufacturers prefabricated flashings.
1. Inside and outside corners.
2. Pipe flashing.
3. Expansion joint covers.

D. Decorative PVC Trim:.
1. Membrane manufacturers extruded PVC profile simulating the appearance of a standing seam roof and appropriate accessories.
2. Membrane manufacturers extruded PVC profile simulating the appearance of a batten seam roof and appropriate accessories.

E. PVC Sheet Flashing Underlayment: Membrane manufacturer's polyester felt underlayment specifically intended to isolate the PVC from asphalt contaminated surface.

F. Related Products: Furnish the membrane manufacturer's bonding adhesive, seam caulk, nite seal, pourable sealer, and all other products related to the sheet membrane system.

2.02 INSULATION

A. The total insulation thermal resistance averaged over the entire roof area shall produce an R-___.

B. The indicated insulation thickness is nominal, allowing for differences in insulating properties of various name brands. Minor variation in thickness is acceptable, provided the specified thermal value and all other requirements of this Contract are met.

C. Approval of insulation is contingent upon approval by the membrane manufacturer for use with the specified roof system.

D. Uniform Thickness isocyanurate insulation and Tapered isocyanurate insulation: Membrane manufacturers approved closed cell isocyanurate foam core insulation skinned on both sides with factory applied fiberglass facers suitable for installation with hot asphalt and cold adhesive. ASTM C1289-01, Type II, Class 1, Grade 2. UL Classified and Factory Mutual Approved for direct application over steel deck. Minimum LTTR: 6.0 per inch thickness.
   1. Board Size:
      a. Adhesively Secured Insulation: Maximum board size 4 feet x 4 feet.
      b. Mechanically Fastened Insulation: Minimum board size 4 feet x 8 feet.

E. Tapered Insulation System: Membrane manufacturer's approved 1/4 inch per foot factory tapered polyisocyanurate insulation.

F. Coverboard Insulation: Membrane manufacturer's approved asphalt impregnated cellulosic wood fiberboard insulation conforming to ASTM C 208.
   1. Thickness: 3/4 inch.
   2. Minimum R value: 2.05

G. Tapered Cricket System: Membrane manufacturer's approved asphalt impregnated 1/2 inch per foot factory tapered wood fiberboard insulation conforming to ASTM C 208.

H. Tapered Edge Strips: Membrane manufacturer's approved asphalt impregnated 1/2 inch per foot factory tapered wood fiberboard insulation conforming to ASTM C 208.

2.03 BARRIER BOARD

A. Barrier Board: 1/4 inch thick gypsum roof board composed of a silicone treated gypsum core and fiberglass mat surfacing.
   1. Acceptable Product: "Dens-Deck" by Georgia-Pacific Corporation, Gypsum Division, 133 Peachtree Street, N.E., Atlanta, GA 30303, (800) 225-6119.
   2. Adhesively Attached Barrier Board: Maximum board size 4 feet x 4 feet.
   3. Mechanically Attached Barrier Board: Minimum board size 4 feet x 8 feet.

2.05 FASTENERS

A. Insulation and Membrane Fasteners: Unless recommended otherwise by the membrane manufacturer, provide the following type of fastener.
   1. Wood Decks: Factory Mutual approved, hardened, self-tapping, Phillips pan head screws with 3 inch round, square, or hexagonal steel stress plates.
      a. Screws and plates as approved by the membrane manufacturer.
      b. Minimum penetration one inch, minimum pull out resistance from deck 400 pounds unless specified otherwise by the membrane manufacturer.
   2. Steel Decks: Factory Mutual approved, hardened, self-tapping, Phillips pan head screws with 3 inch round, square or hexagonal steel stress plates.
      a. Screws and plates as approved by the membrane manufacturer.
      b. Minimum penetration 1/2 inch, minimum pull out resistance from deck 400 pounds unless specified otherwise by the membrane manufacturer.
   3. Concrete Decks: Factory Mutual approved, hardened, self-tapping, Phillips pan head screws with 3 inch round, square, or hexagonal steel stress plates, or Factory Mutual approved hammer driven spike type fasteners with 3 inch round, square, or hexagonal steel stress plates.
      a. Fasteners and plates as approved by the membrane manufacturer.
      b. Minimum penetration one inch, minimum pull out resistance from deck 400 pounds. unless specified otherwise by the membrane manufacturer.
   4. Structural Wood Fiber Decks/Gypsum Decks/Lightweight Concrete Decks: Factory Mutual approved, 1/4 inch diameter magnesium aluminum threadless fastener with self piercing carbon steel mandrel, "TPR PEEL RIVET" by Creative Construction Components, Inc., 523 Baldwin St., P.O. Box 636, Elmira, NY 14901. Insert TPR through 3 inch round, square or hexagonal steel stress plates.
      a. Minimum penetration 2 inches.
      b. Structural Wood Fiber Decks: Minimum pullout resistance 300 pounds.
      c. Gypsum Decks: Minimum pullout resistance 350 pounds.
      d. Lightweight Concrete Decks: Minimum pullout resistance 350 pounds.

B. Base Flashing Fasteners (For Top Edge Of Flashing):
   1. Masonry Surfaces: Hardened masonry nails or drive pins thru 1-1/4 inch sheet metal discs.
   2. Sheet Metal Surfaces. Hardened, self tapping, #10 sheet metal screws thru 1-1/4 inch sheet metal discs.
   3. Wood Surfaces: "Cap Nail" annular ring roofing nail with one inch dia or square solid cap, by Simplex Nails Inc., Americus, GA 31709.

C. Compression Clamp: Stainless steel worm drive hose clamp.

D. Metal Termination Bar and Fasteners:
   1. Termination Bar: Factory fabricated one inch wide x .100 inches thick mill finish aluminum bar, with 1/4 inch x 3/8 inch slotted holes 8 inches oc and with a 1/4 inch wide 45 degree sealant and stiffener flange. "AL200 Pressure Bar" by JBD Supply, 1424 Maple Avenue, N.E., Canton, OH 44705.
   2. Fasteners:
      a. Concrete or Masonry: Hard aluminum alloy or stainless steel screws with 1/4 inch dia plastic expansion shield or 1/4 inch dia aluminum hammer driven expansion anchor. Length as required to securely hold the compression bar tight against the flashing surface.
      b. Wood and Sheet Metal: Hard aluminum alloy or stainless steel screw. Length as required to securely hold the compression bar tight against the flashing surface.

E. Metal Anchor Bar and Edge Retainer:
   1. Anchor Bar: 1 inch wide roll formed and punched 14 gauge galvanized steel bar.
   2. Edge Retainer: Continuous 5/32 inch round flexible thermoplastic rod.

2.06 EXPANSION JOINT MATERIALS

A. Prefabricated Expansion Joint Cover: Neoprene foam bellows welded to PVC cover with galvanized metal flanges.

B. Expansion Joint Filler: Neoprene or polyethylene joint filler 25 percent wider than the width of the joint.

C. Expansion Joint Tube: 2 inch diameter polyethylene tube.

2.07 ROOF DRAINS

A. Retro-Fit Roof Drains: Metal roof drains designed specifically for installation into an existing roof drain and conductor pipe. Formed with a large PVC coated flashing flange welded to an expandable drop tube or with an expandable rubber boot to form a watertight seal between the drop tube and the existing conductor pipe. The drain shall include clamping ring and an aluminum strainer.

2.08 MISCELLANEOUS MATERIALS

A. Pipe Flashing: Membrane manufacturers prefabricated pipe boot.

B. Compression Clamp (for factory fabricated flashings only): Stainless steel or cadmium plated steel worm drive clamp.

C. Expansion Joint Tube: Compressible neoprene or polyethylene tube, twice the diameter of the width of the expansion joint.

D. Walkway, Protection Pads: Membrane manufacturers prefabricated walkway pad.

E. Pitch Pocket Filler Materials:
1. Mortar : ASTM C 270, Type S.
2. Pourable Sealer: Membrane manufacturer's 2 component liquid urethane.

F. Sealant: One-part, low modulus, silicone sealant: Dow Corning's 790, General Electric's Silpruf, Pecora's 864, or Sonneborn's Omniseal.

2.09 MATERIALS FOR VAPOR BARRIER

A. Materials For Repair Of Existing Vapor Barrier:
1. Primer: Quick drying asphalt primer; ASTM D 41.
2. Asphalt Fiberglass Base Sheet: Non porous asphalt coated glass fiber base sheet: ASTM 4601-98, Type I.
3. Plastic Roof Cement: Non-asbestos bearing, fibrated, flashing grade; ASTM D 4586.
4. Bitumen: Steep asphalt; ASTM D 312, Type III.
5. Interply Adhesive: Membrane manufacturers cold process solvent based modified adhesive.
   a. Asphalt content: 42 percent ASTM D 4479-93
   b. Density: 8 lbs/gal ASTM D 1475-90
   c. Asbestos content: None.

B. Materials For Vapor Barrier and Underlayment On Steel Decks:
1. Fasteners: Membrane manufacturer and Factory Mutual approved, hardened, self-tapping, Phillips truss head screws with round, square or hexagonal steel stress plates. Plate size as recommended by the membrane manufacturer.
   a. Minimum penetration 1/2 inch, minimum pull out resistance from deck 400 pounds unless specified otherwise by the membrane manufacturer.
2. Vapor Barrier Underlayment: Isocyanurate insulation one inch thick. As specified in "INSULATION".
3. Vapor Barrier Underlayment: 1/4 inch thick gypsum roof board composed of a silicone treated gypsum core with fiberglass facers. "Dens-Deck" by Georgia-Pacific Corporation, Gypsum Division, 133 Peachtree Street, N.E., Atlanta, GA 30303, (800) 225-6119.
4. Steep Asphalt: ASTM D 312, Type III.
5. Interply Adhesive: Membrane manufacturers cold process solvent based modified adhesive. Asphalt content: 42 percent ASTM D 4479-93.
6. Asphalt Fiberglass Base Sheet: Non porous asphalt coated glass fiber base sheet: ASTM 4601-98, Type I.

C. Materials For Vapor Barrier Over Concrete Decks:
1. Primer: Quick drying asphalt primer; ASTM D 41.
2. Bitumen: Steep asphalt; ASTM D 312, Type III.
3. Interply Adhesive: Membrane manufacturers cold process modified adhesive. Asphalt content: 42 percent ASTM D 4479-93.

4. Asphalt Fiberglass Base Sheet: Non porous asphalt coated glass fiber base sheet: ASTM 4601-98, Type I.

D. Materials For Vapor Barrier On Wood, Structural Wood Fiber Decks, Gypsum Decks and Lightweight Concrete Fill:
1. Fasteners for securing to wood decks: Annular ring roofing nails with one inch solid cap, "Cap Nail" by Simplex Nails Inc., Americas, GA 31709, (912) 924-2767.
2. Fasteners for securing to structural woodfiber decks: "Tube Lok Nail" by Simplex Nails, Inc., Americas, GA 31709, (912) 924-2767.
3. Fasteners for securing to gypsum decks and lightweight fill: "Tube-Lok Nail" by Simplex Nails, Inc., Americus, GA 31709, (912) 924-2767.
3. Rosin Paper: Minimum weight 4 pounds per square.
4. Bitumen: Steep Asphalt: ASTM D 312, Type III.
5. Interply Adhesive: Membrane manufacturers cold process modified adhesive. Asphalt content: 42percent ASTM D 4479-93.
6. Asphalt Fiberglass Base Sheet: Non porous asphalt coated glass fiber base sheet: ASTM 4601-98, Type I.

PART 3 EXECUTION

3.01 SURFACE

A. Ensure roof drain strainers are in place and secured during removal of insulation and other debris. Provide cast iron strainers where existing strainers are missing.

B. Cleaning: Before the roofing installation commences, sweep and/or vacuum all surfaces as required to remove all dirt, dust, loose aggregate, foreign matter, and debris left from removals of existing roofing.

C. Testing Existing Roof Drains and Conductor Pipes: Before commencing with the work, water test existing roof drains and conductor pipes and submit a written report to the Director's Representative, indicating which drains or conductors, if any, are not functioning properly. Repair of existing drains and conductors is not included in the Work. Repair Work (if any) may, at the Director's option, be accomplished by an Order on Contract.

D. Testing Pull Out Resistance of Fasteners: Before commencing with the roofing work, in the presence of the Director's Representative, install 3 fasteners thru a sample of the approved insulation into the structural deck. Test the pull out resistance of each fastener with a pull out tester such as "Fabco Pull Tester" by Fabco Fastening Systems, West Newton, PA 15089.
1. Test the fasteners at locations selected by the Director's Representative.
2. Do not proceed with the roofing work if the pull out resistance of the fasteners is less than that specified in this Section.

E. Patching Existing Vapor Barrier: Remove all loose and/or deteriorated portions of the existing vapor barrier. Patch all defective areas with fiberglass felt

embedded in and coated with asphalt plastic roof cement. Extend the patch a minimum of 6 inches beyond the defect on all sides.

F. Preparing Existing Roof Membrane:
1. Gravel Surfaced Roofs: Remove loose aggregate surfacing, dirt, debris and surface moisture by power sweeping and vacuuming. Only firmly bonded gravel may be left in place. Remove high spots of the gravel to produce a reasonably level and smooth surface.
2. Smooth Surface Roofs: Remove dirt, debris, and surface moisture.
3. Cut open blisters so they lay flat. Where blisters will not lay flat, cut off raised or loose portions.
4. Where shown and directed cut open the existing roofing membrane and remove wet insulation. Fill the void left by the removals, with insulation to match the existing thickness.
   a. If roofing system is not installed the same day, patch all defective areas with 2 plies of fiberglass felt embedded in and coated with asphalt plastic cement. Extend the patch a minimum of 6 inches beyond the defect on all sides.

3.02 HEATING BITUMEN

A. Preparation:
1. The heating process shall be strictly regulated by means of an automatic thermostatic control of an approved type for positive temperature control. Kettles or tankers shall be the immersion tube type, fired by Liquid LP gas, and shall have 100 percent safety shutoff.
2. Equip each kettle with a fume recovery system.
3. Equip each kettle or tanker with a recording thermometer that will graphically indicate and record on a chart the maximum and minimum temperatures to which materials have been heated. Recording thermometers shall be capable of accurately recording temperatures as high as 600 degrees F and as low as 0 degrees F. The thermometers shall be properly maintained at all times. Kettles or tankers without recording thermometers in good working conditions shall not be used. At the end of each working day, turn the chart from the thermometer on each kettle or tanker over to the Director's Representative. If any bitumen is overheated, remove it from the site in the presence of the Director's Representative. If any underheated or overheated bitumen has been applied on the roof, remove that portion of the roof.
4. Do not locate heating kettles on the roof. Move hot asphalt onto roofs with hot tanks 55 gallon maximum.

B. Heating Asphalt:
1. Heat the bitumen in accordance with the Equiviscous Temperature information furnished by the bitumen manufacturer for that specific run of bitumen.
2. In no case shall the asphalt be heated to or above the actual COC Flash Point (ANSI/ASTM D-92); or the finished blowing temperature for more than 4 hours.

3. Maintain the temperature of the bitumen at the point of application within the Equiviscous Temperature Range. Use insulated pipes, buckets, luggers, and other insulated roofers equipment as required by the field conditions.
4. If the Equiviscous Temperature information is not furnished by the bitumen manufacturer, heat the bitumen as follows:
   a. Steep Asphalt, Type III: Do not heat the asphalt above 500 degrees F. The temperature at the point of application shall be between 375 degrees F and 475 degrees F.

3.03 INSTALLING VAPOR BARRIER

A. Installing Vapor Barrier and Vapor Barrier Underlayment Board On Steel Decks:
1. Install one layer of vapor barrier underlayment board over the steel deck. Install the underlayment with the long edges running in the same direction as the flutes of the deck with edge joints bearing on the solid portions of the deck. Stagger end joints. Butt edges and ends snugly.
2. Secure the underlayment to the deck with in accordance with FM Loss prevention Data 1-28 including enhanced perimeter and corner fastener spacing. Set the fasteners with sufficient force to hold the board firmly against the deck surface. Check each fastener to insure that it is securely anchored to the deck.
3. Over the underlayment install 2 plies of fiberglass felt. Install the felts shingle fashion. Lap the felts 19 inches over each preceding ply.
4. Embed each ply of felt in a solid mopping of hot steep asphalt applied at the rate of 25 pounds per square. Broom the surface for complete embedment.

6. Embed each ply in interply adhesive applied to the substrate in accordance with the manufacturer's printed instructions.
7. If insulation will not be installed the same day the vapor barrier is installed, apply a glaze coat of asphalt or adhesive over the vapor barrier.

B. Installing Vapor Barrier On Concrete Decks or Existing Vapor Barriers:
1. Apply asphalt primer at the rate of one gallon per square before application of vapor barrier.
2. Install 2 plies of asphalt fiberglass felt shingle fashion. Lap plies 19 inches over each preceding ply.
3. Embed each ply in a solid mopping of hot steep asphalt applied at the rate of 20 pounds per square. Broom in each ply to complete embedment.
4. If the insulation will not be installed the same day the vapor barrier is installed, apply a glaze coat of steep asphalt over the vapor barrier.

C. Install one ply of asphalt fiberglass base sheet over the entire deck surface. Lap edges and ends a minimum of 2 inches.
1. Adhere the base sheet to the deck with one foot diameter spots of hot steep asphalt spaced 24 inches apart.
2. Over the base sheet install one ply of fiberglass felt. Lap edges and ends 2 inches.

3. Embed the felt in a solid mopping of hot steep asphalt applied at the rate of 20 pounds per square. Broom the felts for complete embedment.
4. Glaze coat the entire surface with hot steep asphalt applied at the rate of 20 pounds per square.

D. Install one ply of rosin paper over the deck. Lap edges and ends 2 inches and fasten with occasional nailing.
1. Install one ply of asphalt fiberglass base sheet. Lap plies 2 inches over each preceding ply.
2. Secure the base sheet to the deck with occasional nailing.
3. Over the base sheet install one ply of fiberglass felt. Lap edges and ends 2 inches.
4. Embed the felt in a solid mopping of hot steep asphalt applied at the rate of 20 pounds per square. Broom the felts for complete embedment.
5. Glaze coat the entire surface with hot steep asphalt applied at the rate of 20 pounds per square.

E. Extend the vapor barrier at all curbs, walls, and wood blocking to a height equal to the thickness of the insulation.
1. Unless approved otherwise by the Director's Representative follow immediately with the installation of the insulation and roofing membrane.

3.04 INSTALLING INSULATION

A. Keep insulation absolutely dry at all times. Discard insulation that contains moisture.
1. Install only as much insulation as can be covered with roofing membrane the same day.
2. Discard all units with broken corners or similar defects.
3. At roof drains, terminate the insulation with tapered edge strips so that all flashing and coverstrip joint laps can be made within the tapered portion.

B. Installing Mechanically Attached Insulation or Barrier Board: Mechanically attach insulation in accordance with Factory Mutual Loss Prevention Data Sheets 1-28 and 1-29 including enhanced perimeter and corner fastener spacing. Set the fasteners with sufficient force to hold the insulation firmly against the deck surface. Do not allow the fastener to crush the insulation. Check each fastener to insure that it is securely anchored to the deck. Remove loose or defective fasteners.
1. Before installing the fasteners, predrill the correct size hole as recommended by the fastener manufacturer through the insulation and into the deck. Drill the hole 1/2 inch deeper than the fastener penetration.

C. Installing Insulation with Asphalt: Set insulation boards, in a full hot mopping of Type III steep asphalt applied at the rate of 30 pounds per square. Press insulation into the bitumen to a firm and uniform bearing.

D. Installing Adhesively Secured Insulation: Set each board in cold adhesive applied in accordance with manufacturer's printed instructions. Press insulation into the adhesive immediately and as necessary thereafter to assure proper bonding.

E. Installing Ridged Insulation: Install each layer of insulation with joints staggered. Butt edges and ends snugly so there are no gaps between the insulation boards. Discard boards with broken corners and boards that are warped.

F. Installing Tapered Insulation System: Install the tapered insulation following the manufacturer's shop drawings and instructions for laying out the tapered insulation system. Install each layer of insulation with joints staggered. Butt edges and ends snugly so that there are no gaps between the insulation boards.

G. Install coverboard insulation over the uniform thickness and tapered insulation.

H. Install the cricket insulation over the coverboard insulation. Cut and fit the cricket insulation in accordance with the manufacturer's instructions. Install tapered edge strips around the perimeter of the crickets.

I. Installing Barrier Board:
   1. Mechanically fasten the barrier board with the long jointly running in a continuous straight line with end joints staggered. Butt edges and ends snugly so there are no gaps between the boards.

3.05 INSTALLING PVC SHEET MEMBRANE

A. Installing PVC Sheet Membrane:
   1. The substrate shall be inspected and approved by the membrane manufacturers technical representative prior to membrane installation.
   2. Do not install the membrane on days with cooler temperatures or high humidity, without the approval by the membrane manufacturers technical representative and the Director's Representative.
   3. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances that are not compatible with PVC.
   4. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.
   5. To avoid accidental water entrapment, start at the high point of the roof and work towards the low point. Lap the sheets so the flow of water is not against the edges of the sheet.
   6. Position the membrane so it is free of buckles and wrinkles. Lap edges and ends of sheets as recommended by the manufacturer, but not less than 3 inches.
   7. Adhere the PVC membrane to the insulation with bonding adhesive.
      a. Apply bonding adhesive to both mating surfaces at the rate recommended by the manufacturer. Do not leave any skips or voids.
      b. Allow the adhesive to dry in accordance with the manufacturer's instructions.

c. Install the flashing so it is free of wrinkles, voids, and blisters.
d. Do not allow bonding adhesive to come in contact with areas to be hot air welded.
e. Do not allow the flashing to bridge where it changes direction from vertical to horizontal.

8. Install membrane and flashing sheets simultaneously. Splice all seams as the membrane and flashings are being installed (same working day).
9. At gravel stops turn the membrane over the front edge of the nailer. Secure the membrane to the vertical portion of the nailer.
10. At parapet walls, intersecting building walls and curbs secure the membrane to the structural deck with edge retainer and anchor bar fastened 12 inches oc.

B. Splicing PVC Sheet Membrane and Flashing:
1. Splice all side and end laps of the sheet membrane and flashing, and all connections to PVC coated metal (if any).
a. Hot air weld all splices with automatic hot air welders. Hand held welders may only be used for small localized areas and for areas that are inaccessible to automatic welders.
2. Before splicing seams remove all dirt, dust, and foreign matter from the splice area. Solvent wash all areas that are contaminated with ground-in dirt or foreign matter. If detergent washing is required, wash off all detergent residue with clean water and allow the splice area to dry completely before welding.
3. Each day before welding the roofing membrane, test weld scrap samples from the actual rolls of membrane to be installed on that day to insure that the welders are calibrated properly and that the membrane has not cured.
4. Where a spliced seam running in one direction passes beneath or above a sheet of membrane running perpendicular to the seam (T joint), hand weld the seam at the intersection and use a small roller to insure that there are no voids or pin holes at the intersection caused by the raised seam edge. Apply lap sealant at the edges of the seam. Extend the lap sealant a minimum of 6 inches beyond each intersecting corner.
5. Samples of welded seams must be taken each day that seams are welded. Refer to FIELD QUALITY CONTROL.

C. Bonding PVC Membrane Underlayment and Flashing:
1. Before installing flashing, adhere PVC sheet flashing underlayment to the substrate with bonding adhesive so that all contaminated surfaces are completely hidden.
2. Adhere the PVC membrane flashing to the underlayment with bonding adhesive.
3. Applying Bonding Adhesive:
a. Apply bonding adhesive to both mating surfaces at the rate recommended by the manufacturer. Do not leave any skips or voids.
b. Allow the adhesive to dry in accordance with the manufacturer's instructions.
c. Install the flashing so it is free of wrinkles, voids, and blisters.

d. Do not allow bonding adhesive to come in contact with areas to be hot air welded.
e. Do not allow the flashing to bridge where it changes direction from vertical to horizontal.

D. Phasing of Membrane Installation:
1. At the end of each working day temporarily seal the loose edge of the membrane so that water does not flow beneath the completed portion. Spud off all existing aggregate (if any) in the area to be sealed, remove all dirt, dust and foreign matter. Install the temporary seal.
a. Apply the membrane manufacturer's nite seal over the area to be sealed. Embed the membrane into the nite seal. Apply a continuous weight over the membrane and nite seal. Before the work resumes cut off and discard all portions of the membrane that have been embedded in the nite seal.
2. Install flashings as the membrane is being installed (same working day). If the flashing can not be completely installed in one day, progress the installation until the flashing is in a watertight condition.

E. Installing and Flashing Retrofit Roof Drains:
1. Before installing retrofit drain, apply water cut off mastic on the bottom side of the drain flange.
2. Place drain over the membrane and into existing drain conductor.
3. Tighten backflow seal rod nuts.
4. Fasten drain flange to the roof deck.
5. Hot air weld PVC flashing to the drain flange and to the membrane.
6. Install drain strainer.

F. Flashing Roof Drains:
1. Remove the existing clamping ring, and flashings. Clean the contact area of the drain body down to bare metal. Residual contaminants including bitumen will not be permitted.
2. Form drain sump with tapered edge strips. Apply the manufacturer's water cut off mastic around the perimeter of the drain body at clamping ring location. Embed the membrane flashing into the mastic. Install the clamping ring and strainer.
3. Secure the clamping ring with the existing bolts. Provide bolts to match existing to replace any bolts damaged or broken during the Work.

G. Installing PVC Base Flashing:
1. Install the flashing so it extends onto the roof surface a minimum of 3 inches beyond the fasteners that secure the roofing membrane. Terminate the flashing on the vertical surface where shown on the drawings.
2. Adhere the flashing to the vertical surface with bonding adhesive. Splice the flashing to the roof membrane.
3. At inside and outside corners splice a prefabricated PVC patch over the corners. Position the patch so it wraps around the corner onto each vertical surface and onto the roof surface a minimum of 3 inches.

4. Secure the top edge of the flashing with fasteners 12 inches oc.

H. Installing Coverstrips At PVC Coated Metal Base Flashing:
1. Install the metal base flashing over the roofing membrane. Strip in the horizontal portion of the base flashing with a reinforced PVC coverstrip. Extend the coverstrip onto the roof surface a minimum of 3 inches beyond the metal flange.
2. Hot air weld the coverstrip to the PVC coated metal base flashing and to the roof membrane.

I. Installing Termination Bar:
1. Where base flashing does not terminate beneath a cap flashing, seal the top edge as follows:
   a. Install a continuous metal termination bar over the top edge of flashing and secure one foot oc. Leave a 1/4 inch gap between ends for expansion and do not span across expansion joints.
   b. Apply a bead of sealant along the top edge.

J. Installing Formed PVC Pipe Flashing:
1. Wherever possible flash pipes with the manufacturer's premolded pipe flashing.

2. Clean existing pipe of all contaminates or wrap pipe with manufacturers separation tape.
3. Install flashing over the membrane extending a minimum of 2 inches out from the pipe base. Turn the flashing up 1/2 inch onto the pipe.
4. Coat the pipe, with bonding adhesive.
5. Wrap a second piece of flashing around the pipe. Extend the flashing 1/2 inch onto the horizontal portion of previously installed flashing. Hot air weld the flashing to the membrane and to the wrapped flashing. Install compression clamp around top of flashing. Apply lap sealant at the top edge of the flashing.

K. Installing Coverstrips At PVC Coated Metal Gravel Stop:
1. Install the gravel stop over the roofing membrane. Strip in the horizontal portion of the gravel stop with a reinforced PVC coverstrip. Extend the coverstrip onto the roof surface a minimum of 3 inches beyond the horizontal metal flange.
2. Hot air weld the coverstrip to the PVC coated metal gravel stop and to the roofing membrane.

L. Installing PVC Gravel Stop Flashing:
1. Install the canted water dam portion of the gravel stop over the roofing membrane. Strip in the water dam with one strip of reinforced sheet flashing. Extend the flashing over the front edge of the water dam a minimum of one inch and out past the base of the cant a minimum of 3 inches.
2. Adhere the flashing to the water dam with bonding adhesive and hot air weld the flashing to the roofing membrane.
3. Install the fascia portion of the gravel stop.

M. Installing PVC Coated Metal Pitch Pocket:
1. Fasten the PVC coated metal pitch pocket over the roofing membrane and into wood nailers.
2. Install PVC sheet flashing over the pitch pocket flange and a minimum of 3 inches beyond the horizontal flanges of the pitch pocket.
3. Hot air weld the flashing to the roofing membrane and to the pitch pocket.
4. Fill the bottom half of the pitch pocket with mortar. Fill the remaining portion of the pitch pocket with the membrane manufacturer's pourable sealer.

N. Installing PVC Flashing at Building Wall Expansion Joint:
1. Adhere the flashing to the vertical surface with bonding adhesive and secure the top edge of the flashing as detailed on the drawings. Extend the flashing into the expansion joint.
2. Install the roof membrane down into the expansion joint and up the wall. Mechanically attach the membrane and flashing to the wall 12 inches on center.
3. Install expansion joint filler tube at intersection of deck and building wall.
4. Secure membrane to the deck with anchor bar and edge retainer secured with fasteners 12 inches oc.
5. Install reinforced flashing so it extends onto the roof surface a minimum of 2 inches beyond the anchor bar and 2 inches up the wall past the joint filler. Hot air weld the flashing to the membrane and wall flashing.

O. Installing PVC Flashing at Expansion Joint Thru Field of Roof:
1. Fasten prefabricated expansion joint thru the membrane into wood blocking. Hot air weld the integral PVC flashing to the membrane.
1. Extend roof membrane across and down into the structural expansion joint. Fasten anchor bars on each side of joint thru the membrane into wood blocking.
2. Install expansion joint filler tube into membrane depression.
3. Install PVC flashing so it extends over the filler tube on each side of and onto the roof membrane a minimum of 3 inches beyond the fasteners that secure the roof membrane.
4. Hot air weld the flashing to the roofing membrane.

P. Installing Decorative PVC Trim:
1. Hot air weld decorative standing seam trim directly to the membrane where indicated on the drawings. Utilize welders specifically intended for welding this trim. Join all sections of trim with the manufacturers supplied dowels.
2. Hot air weld posts for batten seam type trim directly to the membrane where indicated on the drawings. Fasten base rail to each post. Install trim over base rail and rivet trim end lap to base rail. Install membrane joint cover over trim end laps.

Q. Installing Walkway Pads:

1. Install the walkway pads in accordance with the membrane manufacturer's instructions.

3.05 FIELD QUALITY CONTROL

A. In the presence of the Director's Representative closely examine and probe all seams in the membrane and flashing.
   1. Probe the edges of all welded seams with a blunt tipped cotter pin removal tool. Use sufficient hand pressure to detect, marginal welds, voids, skips, and fishmouths. Repair all defective areas.
   2. Each day that seams are welded, a minimum of two, 2 inch wide x 8 inch long cross section sample must be taken thru the completed seams. Cut the sample in the presence of and where directed by the Director's Representative. Failure of the samples to maintain the standard of quality of the approved samples will be cause for rejection of the Work.
   3. Repair all areas of welded seams where samples have been taken.

END OF SECTION