SECTION 07 95 13

POLYVINYL-CHLORIDE ROOFING

This document is intended to note the Owners Design Requirements (ODR) for the titled specification section. Design professional to review and integrate ODR into the project's technical specifications. This ODR document should not be viewed as a standalone technical specification.

PART 1 - GENERAL

- The new roof system(s) shall consist of the following:
  - Insulation Systems:
    - Install tapered insulation boards, 1/4 inch per foot slope minimum, in all areas where water is trapped and ponding behind curbs and other areas;
    - Install a layer of 1/4 inch cover board over the new insulation system.
  - Roof system consisting of a reinforced 80 mil PVC membrane over the cover board/insulation system, into the underlying metal deck substrate. All membrane layout and attachment shall meet manufacturer's FMG I-90 wind uplift criteria.
  - PVC membrane flashing fully adhered up to the bottom edge of perimeter parapet cap flashings. Use asphalt compatible membrane as necessary.
- Post Construction: Roof survey verification shall include the following (minimum) elevation points:
  - At each corner of each roof area.
  - At each roof drain (lowest point).
  - At ridge of each roof slope and at each cricket.
- Roofing System Design
  - Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
    - Corner Uplift Pressure: 225 lbf/sq. ft.
    - Perimeter Uplift Pressure: 150 lbf/sq. ft.
    - Field-of-Roof Uplift Pressure: 90 lbf/sq. ft.
  - FMG Approvals Listing
    - Provide membrane roofing, base flashings, and component materials that comply with requirements in FMG Approvals 4450 and FMG Approvals 4470 as part of a membrane roofing system, and that are listed in FMG Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG Approvals markings.
      - Fire/Windstorm Classification: Class 1A-90.
      - Design Wind loads: Class 1-28.
      - Roof Deck Securement and Above-Deck Roof Components: Class 1-29.
      - Perimeter Flashing: Class 1-49.
      - Roof Loads for new construction: Class 1-54.
      - Hail Resistance: MH.
  - Incorporate into the overall roofing design the following FMG Data Sheets: I-28 (Design Wind Loads), I-29 (Roof Deck Securement and Above-Deck Roof Components), I-49 (Perimeter Flashing) and I-54 (Roof Loads and New Construction).
  - Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
  - Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR

"Roof Products Qualified Product List" for low-slope roof products.

- Energy Performance: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.
- Membrane shall contain "JET-A" fuel chemical resistance

♦ WARRANTY

- CONTRACTOR shall provide a warranty of the manufacturer's standard form, with specified modifications as set forth herein, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
- Warranty shall be "edge to edge", no dollar limit, no restrictions or exclusions.
- Provide a special warranty that includes roofing membrane, base flashings, roofing membrane accessories, fasteners, sealant and other components of membrane roofing system.
- Warranty shall include additional warranties for:
  - a. Puncture resistance
  - b. Energy Star compliance/Reflectivity
  - c. 90 MPH Wind Speed
- Warranty Period: 25 years from date of Substantial Completion (80 mil. Membrane)

PART 2 - PRODUCTS

♦ MEMBRANE ROOFING

- Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following:
  - Carlisle-Syntec.
  - Flex.
  - Johns Manville.
  - Sarnafil.
- Fully adhered:
  - Heat weld-able thermoplastic roofing membrane.
- Membrane shall conform to the following physical properties:
  - Exposed Face Color: White.
    - Meeting CRRC requirements for reflectivity and emissivity.
  - Thickness: 80 Mils, +/- 3%, nominal.
- Warning Strip: Provide 4 inch wide single-ply membrane in safety yellow color.

♦ PVC CLAD METAL FLASHING

- A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. PVC clad metal is a 25 gauge, G90 galvanized metal sheet with a 20 mil (1 mm) unsupported PVC membrane laminated on one side.

♦ ROOF INSULATION

- General: Preformed roof insulation boards provided by PVC membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated

and that produce Factory Mutual Global (FMG) Approvals-approved roof insulation.

- Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- R-Value: As indicated on Drawings, R30 minimum in a minimum of two (2) layers.
- Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
  - Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
- Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless noted otherwise, with Owner's approval.
- Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where required to achieve positive slope to drain as indicated on drawings and as required. Fabricate to slopes 1/4 inch (min) except where noted otherwise, with Owner's approval.
- Insulation board shall not be longer than 4 ft x 8 ft.

♦ HIGH DENSITY ROOF INSULATION

- General: Provide high density (psi) insulation board where indicated on drawings, where recommended by roofing manufacturer for warranty requirements and at all areas supporting loads from equipment and other items imposing loads.

♦ ATTACHMENT COMPONENTS

- General Requirements: Attachment component materials shall be compatible with roofing membrane and provided by the membrane manufacturer.
- Field Membrane Adhesives:
  - A solvent-based adhesive used to attach the membrane to the horizontal or near-horizontal substrate. Consult Product Data Sheets for additional information and application rates:
  - Due to an increase in viscosity when outdoor temperatures during installation approach 40°F (5°C), add 0.5 gal/100 ft² (0.2 l/m²) to rate for estimating purposes.
  - Do not allow adhesives to skin-over or surface to-dry prior to installation of membrane.
  - Use a water-filled, foam-covered lawn roller to consistently and evenly press the membrane into the adhesive layer.
- Membrane Flashing Adhesives: VOC compliant adhesive to attach the flashing membrane to vertical substrates.
- Insulation/Coverboard Adhesives:
  - Full spread applied insulation or coverboard adhesive materials shall be compatible with both the roofing membrane and insulation material. Insulation adhesive shall be approved for specified wind uplift in writing from Factory Mutual Global (FMG):
    - Insulation adhesive, spray-applied, low rise, two component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
    - Or as approved by the manufacturer of the roofing membrane.
- Mechanical Fastening
  - As required by the membrane manufacturer to mechanically attach roofing system components to various substrates.

- Additional Fasteners Criteria:
  - a. The fastener must be FMG approved.
  - b. Alternate fasteners and insulation fastening plates must be recommended by the respective manufacturer, accepted by primary manufacturer PRIOR to installation, and must be promoted by the same manufacturer as a complete fastener assembly.
- Insulation plate is used with various fasteners to attach insulation boards to the roof deck. Insulation plate is a 3 inch (75 mm) square, 26 gauge stamping of SAE 1010 steel with an AZ 55 Galvalume coating.
- Membrane plate - Barbed - 20 gauge, 2 inch (50mm) round steel disc with AZ 55 galvalume coating used with fasteners to attach the membrane to the roof deck. As required by manufacturer to meet wind uplift criteria.
- A #12 corrosion-resistant fastener used with insulation plates to attach insulation boards to steel roof decks. Fastener #12 has a modified buttress thread. The shank diameter is approximately 0.168 inch (4 mm) and the thread diameter is approximately 0.214 inch (5 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) and is #3 Phillips design for positive engagement.
- A #15, heavy-duty, corrosion-resistant fastener used with insulation plate, stop bar or anchor bar to attach insulation or membrane to the steel roof deck. Fastener #15 has a shank diameter of approximately 0.21 inch (5.3 mm) and the thread diameter is approximately 0.26 inch (6.6 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) and is #3 Phillips design for positive engagement.
- Concrete fastener - A 0.215 inch (5.5mm), split diameter, flat head fastener, to attach roofing components to structural concrete roof decks. Utilize insulation plates and membrane plates with opening to fit fastener.
- Stop bar - An extruded aluminum, low-profile bar used with certain fasteners to attach to the roof deck or to walls/curbs at terminations, penetrations and at incline changes of the substrate. Stop bar is a 1 inch (25 mm) wide, flat aluminum bar 1/8 inch (3 mm) thick that has predrilled holes every 6 inches (152 mm) on center.
- Anchor bar – An FMG-approved heavy duty 14 gauge, galvanized or stainless, rolled formed steel bar used to attach membrane to roof decks. The formed steel is pre-punched with holes every 1 inch on center to allow various fastener spacing options.
- Hold down cord – A 5/32 inch diameter, red colored, flexible thermoplastic extrusion that is welded to the top surface of the PVC membrane and against the side of the anchor bar, used to hold the membrane in position.

- Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion- resistance provisions in FMG Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

♦ TAPERED INSULATION

- Tapered insulation shall consist of polyisocyanurate insulation or Expanded Polystyrene and shall be approved by the prime material manufacturer.
- Polyisocyanurate – Meeting Federal Specification HH-I-1972, and having non-asphaltic glass

facers.

- Expanded Polystyrene:
  - Polystyrene shall be separated from any contact with PVC membrane at all times.
  - For use as fill in crickets only.
- Insulation shall be compatible with insulation adhesive and the primary membrane.

♦ COVERBOARD

- Coverboard shall be compatible with insulation adhesive, membrane adhesive and the roofing membrane.
- ¼ inch (6mm) inch thick, minimum high-density polyisocyanurate gypsum core material.
  - Cover board – Mechanically fastened applications.
  - Cover board primed – Adhered applications.
  - Compressive Strength – 90 psi minimum.
  - Products: Subject to compliance with requirements, provide the following or other manufacturer's standard product:
    - Johns Manville; Invinsa Roof Board.
    - Georgia-Pacific Corporation; Dens Deck.
    - USG Corporation; Securock.
- Fasteners: Factory-coated steel and metal or plastic plates complying with corrosion-resistance provisions in FMG Approvals 4470, designed for fastening substrate board to roof deck.
- Used as an overlayment between substrate and insulation layers. The board shall be installed with all joints staggered. Mechanically fasten or adhered to suitable substrate.
- Used as an underlayment to the roof membrane. The board may be adhered or mechanically fastened over insulation, as required, by the roofing material manufacturer to comply with all requirements for agencies listed herein.
- Fasteners: Factory-coated steel and metal or plastic plates complying with corrosion-resistance provisions in FMG Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing manufacturer.
- Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent.

♦ THERMAL SEPARATION BOARD

- Thermalboard shall be compatible with insulation adhesive, membrane adhesive and the roofing membrane.
- 5/8 inch thick, minimum fiberglass impregnated faced gypsum core material.
  - Thermal board – Mechanically fastened applications.
  - Thermal board primed – Adhered applications.
  - Compressive Strength – 100 psi minimum.
  - Products: Subject to compliance with requirements, provide the following or other manufacturer's standard product:
    - Johns Manville; Invinsa Roof Board.
    - Georgia-Pacific Corporation; Dens Deck.
    - USG Corporation; Securock.

- Fasteners: Factory-coated steel and metal or plastic plates complying with corrosion-resistance provisions in FMG Approvals 4470, designed for fastening substrate board to roof deck.
- Used as an overlayment between substrate and insulation layers. The board shall be installed with all joints staggered. Mechanically fasten or adhered to suitable substrate.
- Used as an underlayment to the roof membrane. The board may be adhered or mechanically fastened over insulation, as required, by the roofing material manufacturer to comply with all requirements for agencies listed herein.
- Fasteners: Factory-coated steel and metal or plastic plates complying with corrosion-resistance provisions in FMG Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing manufacturer.
- Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent.

♦ SEALANTS AND CAULKING

- Elastomeric Sealant: Locations where in contact with roofing membrane; One-Part urethane, conforming to Federal Spec. #TT-S-00230C and/or TT-S-001543A.
- Silicone Sealant: Other locations where not in contact with roofing membrane, unless noted otherwise.

♦ WALKWAY PROTECTION

- Heavy-Duty Walkway Protection – Polyester-reinforced, 36 inch minimum width, 96 mil (minimum) thick weldable membrane with surface embossment used as a protection layer from rooftop traffic.
- Color - Yellow. As selected by Owner from manufacturer's various colors available.
- Walkway protection shall not be installed over membrane seams.
- Install walkway protection under all equipment supports and other items resting on roof membrane.
- Install walkway protection at bottom of all ladders, stairs, and landings.
- Walkway protection shall be fully adhered and shall be located to extend from the all sides of (motorized) mechanical equipment, and shall extend a minimum of two (2) rows of manufacturer's standard width.
- Install walkway protection to extend under roof access safety ladders and other roof access items, a minimum of 12 inches.

♦ AUXILIARY MEMBRANE ROOFING MATERIALS

- General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
  - Liquid–Type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- Bonding Adhesive: Manufacturer's standard, solvent based.
- Slip Sheet: Manufacturer's standard, of thickness required for application.
- Pre – Fabricated Flashing - Prefabricated inside and outside corners made of PVC membrane.
- Penetration Flashing - Prefabricated membrane penetration flashings made of PVC membrane.

- Use one-piece unit
- Where it is technically not feasible to install a one-piece unit, CONTRACTOR may use a split-field welded unit or field fabricated unit.

- Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8" inch (25 by 3 mm) thick; with anchors.
- Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.
- Prefabricated expansion joint cover with foam tubing, galvanized metal nailing flanges and membrane welding tabs.
- Mechanical Hot-Air Welder - High-quality, electrically-powered, self-propelled machine used to seal long lengths of PVC membrane seams.
- 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 (32 mm) 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 (25 mm) and shall be approved for such use by the fastener manufacturer. Pull test shall be performed to verify existing deck performance and to meet uplift requirements.
- Aluminum Tape - A 2 inch (50 mm) wide pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and the membrane and as a bond-breaker under the coverstrip at Sarnaclad joints.
- Solvent Cleaner - A high quality solvent cleaner used for the general cleaning of residual asphalt, scuff marks, etc., from the membrane surface. Solvent cleaner is also used daily to clean seam areas prior to hot-air welding in tear off or dirty conditions or if the membrane is not welded the same day it is unrolled. Consult Manufacturer's Product Data Sheet for additional information.
- Safety Warning stripe - a 4-inch wide red adhered strip of PVC membrane shall be installed adjacent to parapets as shown on drawings, or at six (6) feet away from parapets (with drop-off) where not shown on drawings.

PART 3 - EXECUTION

♦ EXAMINATION

- After removal of existing roofing membrane and rigid insulation down to substrate examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
  - Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
  - Verify that blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
  - Minimum height requirements for flashings shall be 8 inches (unless noted otherwise and as noted in paragraph 1.6.C.2).

- Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 5 Section 05310 "Steel Deck."
- Verify that minimum concrete drying period recommended by roofing system manufacturer has passed (at new concrete repair where applicable.)
- Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 (at new concrete repair where applicable).
- Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed (at new concrete repair where applicable).
- Perform Pull-Out test for all fasteners in concrete deck; and metal deck; must meet minimum requirements of FM Global uplift requirements.
- Pipe penetrations shall be 12 inches on center (unless noted otherwise).
- Pipe shall have at least an 8 inch boot (unless noted otherwise).
- All curbs shall be at least 8 inches above roof surface (unless noted otherwise).

- Proceed with installation only after unsatisfactory conditions have been corrected and documented.

♦ PREPARATION

- Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove all sharp projections.
- Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of each workday or when rain is forecast. Remove and discard all temporary seals before beginning work on adjoining roofing.

♦ COVER BOARD AND THERMAL SEPARATION BOARD

- Install board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
  - Fasten board to top flanges of steel deck according to recommendations in FMG Approvals' "RoofNav" and FMG Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
  - Fasten board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

♦ INSULATION INSTALLATION

- Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
- Install tapered insulation under area of roofing to conform to slopes indicated.
- Install insulation under area of roofing to achieve required R-Value thickness (2 inches

minimum).

- Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

- Provide sumps at roof drains per the details on the drawings.
- Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
  - Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- Adhered Insulation: Install each of layer of insulation and adhere to substrate as follows:
  - Insulation shall be installed in accordance with the insulation manufacturer's current published specifications and recommendations for use with mechanically fastened and adhered requirements for various substrates. Insulation shall be secured/adhered in accordance with Factory Mutual Global (FMG), membrane manufacturer and insulation manufacturer's requirements.
    - Mechanically fastened at metal/wood substrates; and at roof perimeter, at curbs, at penetrations and where shown on drawings.
    - Adhered at concrete substrates.
    - Multiple layers may have first layer mechanically fastened and subsequent layers adhered.
  - All insulation shall be installed in parallel courses with end joints staggered. When more than one layer of insulation is to be used, succeeding layers are to be laid staggered in relation to the previous layer of insulation and all joints shall be staggered a minimum of 12 inches.
  - Insulation shall be neatly cut to fit around all penetrations and projections with a maximum allowable gap of 1/4 inch.
  - Open joints shall be repaired with like insulation material.
  - Install insulation on steel deck so edges are left supported along the flutes at all times.
  - Insulation shall be set back, feathered or tapered to provide a sump area a minimum of 24 inch x 24 inch at all single roof drains, and 24 inch x 48 inch at dual roof drains and as shown on drawings.
  - Install no more insulation in one day than can be covered with the completed membrane and completed flashings.
  - Tapered Insulation:
    - Install tapered insulation with proper slope and per drainage design.
    - Install all tapered insulation after installation of the first layer of insulation.
  - All insulation shall be securely attached to the underlying substrate prior to the installation of the membrane or flashings.

♦ COVERBOARD OVER INSULATION

- Coverboard shall be installed in accordance with the roofing manufacturer's current published specifications and recommendations for use with the specified roofing system.
- Secured to the roof deck thru underlying insulation or lightweight concrete in accordance with

Factory Mutual Global (FMG), membrane manufacturer and insulation manufacturer's requirements for mechanically fastened or fully adhered requirements.

- All boards shall be installed in parallel courses with end joints staggered. The board shall be staggered in respect to the previous layer of insulation and all joints shall be staggered a minimum of 12 inches.
- Cut to fit around all penetrations and projections with a maximum allowable gap of 1/4 inch.
- Open joints shall be repaired with like material.
- Insulation shall be set back, feathered or tapered to provide a sump area as shown on the detail drawings for each drain location and substrate type.

♦ INSULATION/COVERBOARD SUBSTRATE INSPECTION

- The applicator shall inspect the substrate to receive the PVC membrane roof system.
- The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, and oil and grease contamination. Roofing shall not start until all defects have been corrected.
- All roof substrates shall be free of water, ice and snow.
- PVC membrane shall be applied over compatible and accepted substrates only.

♦ INSTALLATION OF PVC MEMBRANE

- The surface of the insulation, coverboard or substrate shall be inspected prior to installation of the PVC roof membrane. The substrate shall be clean, dry, free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.
- Start installation of membrane roofing in presence of membrane roofing system manufacturer's representative.
- Unroll the sheet roofing and position without stretching the membrane. Allow the membrane to relax at least 15 minutes when the temperature is above 60 degrees F., or 30 minutes when the temperature is below 60 degrees F., prior to installation. Inspect for any damaged membrane. Remove sections of membrane that are creased or damaged. Lap sheets a minimum of 5 inches, for In-Lap Fastening, leaving space for mechanical fasteners and discs and space for a 2 inches minimum weld stagger end laps.
- Fully Adhered Membrane
  - Membrane is to be fully adhered according to manufacturer and Factory Mutual Global's (FMG) requirements over specified substrate.
  - Adhesive: Over the properly installed and prepared substrate, adhesive shall be poured out of the pail and spread using solvent resistant 3/4 inch (19 mm) nap paint rollers with a sturdy frame. The adhesive shall be applied at a rate according to manufacturer's requirements. Adhesive is applied to the back of the membrane. Do not allow adhesive to skin-over or surface-dry prior to installation of membrane.
  - Apply adhesive to the area of substrate to be flashed. Let adhesive dry sufficiently to produce strings when touched with a dry, clean finger. Adjacent rolls overlap previous rolls by 3 inches (75 mm). This process is repeated throughout the roof area. Immediately after application into adhesive, each roll shall be pressed firmly into place with a water-filled, foam-covered lawn roller by frequent rolling in two directions. Do not allow adhesive to skin-over or surface-dry prior to installation of membrane.

- Weld coverstrips at all seams that do not have a factory selvage edge:
  - Adhesives shall not be used if temperatures below 40°F (5°C) are expected during application or subsequent drying time.
  - No adhesive shall be applied in seam areas. All membrane shall be applied in the same manner.
- Install termination bar according to manufacturer's requirements for uplift criteria with approved fasteners into the structural deck at perimeter field, walls, and curbs.

- In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
  - Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane only after substantial completion.
  - Verify field strength of seams a minimum of twice daily and repair seam sample areas.
  - Repair tears, voids, and lapped seams in roofing that does not comply with requirements
  - Welded seams shall be a minimum of 1-1/2 inch wide on all mechanical welds and 2 inch hand welded.
- Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
- Install membrane roofing and auxiliary materials to tie in to existing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

♦ HOT-AIR WELDING OF SEAM OVERLAPS

- General:
  - All seams shall be hot-air welded. Seam lap welds should be 1 ½ inches (40 mm) wide when automatic machine-welding and 2 inches (50 mm) wide when hand-welding, except for certain details.
  - Welding equipment shall be provided by or approved by manufacturer. All mechanics intending to use the equipment shall have successfully completed a training course provided by the roof manufacturer's technical Representative prior to welding.
  - All membrane to be welded shall be clean and dry.
- Hand-Welding - Hand-welded seams shall be completed in two stages. Hot-air welding equipment shall be allowed to warm up for at least one minute prior to welding:
  - The back edge of the seam shall be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.
  - The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow," the hand roller is positioned perpendicular to the nozzle and pressed lightly. For straight seams, the 1-1/2 inch (40 mm) wide nozzle is recommended for use. For corners and compound connections, the 3/4 inch (20 mm) wide nozzle shall be used.
  - Exercise care when heat welding to avoid melting the back of the membrane.

- Machine Welding:
  - Machine welded seams are achieved by the use of roofing manufacturer's automatic welding equipment. When using this equipment, roofing manufacturer's instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable generator is recommended. No other equipment shall be operated off the generator.
  - Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.
- Quality Control of Welded Seams:
  - The Applicator shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark gray material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the Applicator to locations as directed by the OWNER'S Representative or roofing manufacturer's representative. One inch (25 mm) wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no extra cost to the OWNER.

♦ FLASHING INSTALLATION

- Metal Flashing:
  - PVC coated metal flashing shall be installed in accordance with the manufacturer's standard detail drawings.
  - Complete all metalwork concurrently with roofing and flashings so that a watertight condition exists daily.
  - Metal transitions are required at all peaks, valleys and slope intersections where the net change in slope exceeds 1 1/2" in 12". In some cases, reinforced membrane may be sufficient for ridges, but should be fastened securely at all transition areas.
  - Metal shall be installed to provide adequate resistance to bending and to allow for normal thermal expansion and contraction.
  - All metal joints are to be watertight and staggered over nailer joints to prevent joints in nailers and joints in metal from aligning.
  - Metal Clad Base flashings shall extend a minimum of 8" above roofing level.
  - All metal flashings and terminations shall be securely fastened in the plane of the roof deck with fasteners approved by the manufacturer.
  - Scuppers and metal overflows are to be assembled using PVC coated metal.
  - All PVC coated metal shall be fabricated to form hemmed edges or feathered edges to prevent sharp metal edges from cutting the membrane.
- Membrane Flashings:
  - Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
  - Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry.
  - Flash penetrations and field-formed inside and outside corners with cured or uncured

sheet flashing.

- Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- Terminate and seal top of sheet flashings.
- All membrane flashings are to be installed concurrently with the roof membrane as the job progresses. Temporary flashings are not allowed. Should any water penetrate the new roofing because of incomplete flashings, the affected area shall be removed and replaced at the CONTRACTOR's expense.
- Membrane flashings shall be fully adhered to vertical walls using membrane adhesive.
- Membrane flashings, which are fully adhered with membrane adhesive, must meet the following conditions:
  - All surfaces to be fully adhered must be compatible, dry and smooth with no excessive surface roughness.
  - After the proper surface has been prepared, Membrane Adhesive shall be applied using a minimum 1/2" nap paint rollers at a rate of approximately two and a half gallons per 100 square feet of surface area depending on the type of substrate. Apply adhesive in smooth, even coatings, avoiding globs, puddles or other types of irregularities. Apply adhesive to the area of substrate to be flashed. Let adhesive dry sufficiently to produce strings when touched with a dry, clean finger. Membrane used as a flashing shall be cut to a workable length and shall have an even coating of Membrane Adhesive applied to it at a rate of approximately 1/2 gallon per 100 square feet. Carefully roll onto the previously coated substrate after the adhesive coating the membrane has dried sufficiently as indicated above. Coverage rates will vary depending on substrate and environmental conditions.
  - Avoid wrinkling membrane when applying to flashing. The amount of adhesive which can be successfully applied to the membrane will vary depending on ambient temperatures, humidity and manpower. After mating membrane to the substrate, carefully roll the membrane with a hand roller to promote maximum positive contact between the membrane and the substrate. Overlap all adjacent flashing sheets a minimum of 2". The flashings shall extend a minimum of 6" onto the field sheet and adhered securely, or a minimum of 3" in front of the fastener plates with a minimum 2" weld. All side laps are to overlap a minimum of 2" and welded.
  - Areas of the flashing membrane to be welded are not to have Membrane Adhesive applied to them.

♦ WALKWAY INSTALLATION

- Install Walkway Material over clean, dry surfaces:
  - At main roof access paths, to roof drains (leave gaps near drains to allow for flow) access hatch and around all sides of HVAC equipment.
  - At areas requiring greater slip resistance.
  - At all sides of grease hoods to a distance of at least 48" away from unit.
  - At other areas as shown on drawings.
  - At all Non-Penetrating Antenna and camera mounts.
  - At base of and extending under all ladders and stairs, extend at least 48" away from

bottom of step.

- Layout areas where walkway Material is to be installed with most of the material being oriented so that it is placed between the field seams in maximum lengths of 30 feet with each adjacent and abutting section gapped a minimum of 6".
- Fully-Adhere the properly positioned Walkway Material.
- Apply seam sealant at all welded edges.

♦ FIELD QUALITY CONTROL

- Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- As indicated in the paragraph 1.8, the manufacturer shall inspect the completed membrane every two (2) weeks during the project. Upon completion of the roof system, an authorized technical representative will make an inspection of the installation and issue all punchlist items in writing for completion. Each of the manufacturer's inspection reports and punchlist shall be made available to the OWNER'S representative, OWNER, and Consultant for review.
- The CONTRACTOR shall generate and provide a daily report, including but not limited to, project area work, work preformed, work force at site, weather conditions, and any special conditions encountered.
- The CONTRACTOR shall perform and document a final inspection and survey performed by the CONTRACTOR and his Nevada licensed surveyor prior to requesting a final inspection by the OWNER'S representative, OWNER, and Consultant.
  - Submit roof plan with survey results to the Owner for approval.
- Additional inspections, at CONTRACTOR's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- Finished roof survey and verification of positive damage, as noted in paragraph 1.8.L.12.
- Patches shall be limited to a maximum of three patches on any 100 square foot area. Excessive patching or damage to the finished roof membrane shall be grounds for the OWNER to require the replacement of the entire roofing membrane at the CONTACTOR'S expense.

♦ COMPLETION

- Prior to demobilization from the site, the work shall be reviewed by the OWNER'S Representative and the Applicator. All defects noted and non-compliances with the Specifications or the recommendations of manufacturer shall be itemized in a punch list. These items must be corrected immediately by the Applicator to the satisfaction of the OWNER'S Representative and manufacturer prior to demobilization.
- All Warranties referenced in this Specification shall have been submitted and have been accepted at time of contract award.

♦ TEMPORARY CUT-OFF

- All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. All temporary waterstops 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. The new membrane shall be carried into the waterstop. The waterstop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be

sealed in a continuous heavy application of sealant as described in Section 2.9. 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 off site. None of these materials shall be used in the new work.

- If inclement weather occurs while a temporary waterstop is in place, the Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.
- 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.

♦ PROTECTING AND CLEANING

- The contractor shall restrict work on the finished membrane as follows:
  - No work including staging or access to other portions of the work shall be permitted on the finished membrane.
  - All roofing work shall commence at the furthest point from worker access and progress back towards the access point.
  - If staging, access or work is required on the finished membrane, the General Contractor shall provide protection along the access path and under the work extending 48" beyond the required work area. Provide adequate protection board (board material as approved by the General Contractor) over a heavy canvas tarp with sand bag ballasts as required to prevent the protection board from becoming airborne during strong winds.
  - Walkway Material is not considered adequate protection from other trades.
- Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to OWNER.
- Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- Fire extinguisher shall be located in vicinity of work activity; three (3) each 10lb MP (min) as referenced elsewhere in the specification.
- CONTRACTOR shall employ fire sprinkler system CONTRACTOR to perform tests to verify the system does not leak as a result of this project.
- CONTRACTOR shall verify all roof drains are watertight by capping inlet, ponding water to 4 feet minimum away from drain. Water shall be held for 20 minutes while CONTRACTOR confirms system is watertight. CONTRACTOR shall then release water to confirm system is free of debris. OWNER shall be present during test.
- CONTRACTOR is liable for all collateral & coincidental damages to other's property caused by construction activities, failure of materials and/or installation for the duration of the construction period.

♦ ROOFING INSTALLER'S WARRANTY

- This Warranty is made subject to the following terms and conditions:

- Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
  - Lightning;
  - Peak gust wind speed of 90 mph;
  - Fire;
  - Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
  - Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
  - Vapor condensation on bottom of roofing; and
  - Activity on roofing by others, including construction CONTRACTORs, maintenance personnel, other persons, and animals, whether authorized or unauthorized by OWNER.
- When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by OWNER or by another responsible party so designated.
- Roofing Installer shall guarantee that Roofing Installer will, at Roofing Installer's own expense, make or cause to be made such repairs to, or replacement of, building and property that are damaged as a result of a failure of the roofing and associated work.
- During Warranty Period, if OWNER allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If OWNER engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified OWNER in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
- During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
- OWNER shall promptly notify Roofing Installer/manufacturer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
- OWNER reserves and has the right to make emergency repairs.
- This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off OWNER from other remedies and resources lawfully available to OWNER in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with OWNER or a subcontract with OWNER'S CONTRACTOR.

This document is intended to note the Owners Design Requirements (ODR) for the titled specification section. Design professional to review and integrate ODR into the project's technical specifications. This ODR document should not be viewed as a standalone technical specification.

END OF SECTION