

SECTION 07 54 19 – SINGLE PLY MEMBRANE ROOFING (Fully Adhered)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes installation of a new single ply roofing system, rigid base insulation, and roof accessories.
- B. Termination metal edges, copings, roof flashings, vapor barriers, and pressure-treated wood nailers are included in this section.
- C. Refer to Section 07 60 00 for separate fascia and cap metal components.

1.03 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this section.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashing shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. FM Approvals Listing: Provide membrane roofing, base flashings and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction as applicable. Roof System installation shall include required enhancements listed in current FM Global Properly Loss Prevention Data Sheet 1-29. Provide materials with:
 - 1. Fire/Windstorm Classification: Class 1-60.
 - 2. Hail Resistance: SH.
- D. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

1.05 SUBMITTALS

- A. General: Provide required submittals in accordance with conditions of Contract and Div 1 specifications sections.
- B. Product data, installation instructions, and general recommendations from manufacturer of single ply membrane system for types of roofing required. Include data substantiating that materials comply with requirements.

- C. Samples for verification: For the following:
 1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
 2. Roof insulation.
 3. Metal termination bars.
 4. Vapor retarders.
 4. Flashing assemblies & pieces.
 5. Walkway pad.
 6. Fascia and Coping assemblies.

- D. Shop drawings showing roof configuration, sheet layout, seam locations, colors (as applicable), details at perimeter, and special conditions.
 1. Indicate layout of tapered insulation materials, with slopes & elevations of high pts.
 2. Base flashings and membrane terminations.
 3. Insulation fastening patterns for corner, perimeter, and field roof locations.
 4. Fascias and trim profiles, construction, dimensions and installation details.
 5. Locations and extents of walkway pads.

- E. Qualification Data: For qualified installer (refer to QUALITY ASSURANCE, Item A).

- D. **Installer Certificates: Signed by roofing system manufacturer certifying that installer is approved, or licensed by manufacturer to install roof system.**

- G. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" article.
 1. Submit evidence of compliance with performance requirements.

- H. **Pre-roofing Conference records. Contractor shall submit a copy of manufacturer's "Pre-Installation Notice (PIN) for review & acceptance prior to ordering materials for project.**

- I. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

- J. Research/Evaluation Reports: For components of membrane roofing system.

- K. Test data for pullout resistance of fastening systems.

- L. **Contractor shall provide written evidence that he has reviewed the project specifications & drawings, reviewed the conditions in the field including details, & will abide & uphold Warranty/Guarantee provision as specified. Statement shall be on Contractor's letterhead & shall be signed by an officer of the corporation.**

- M. Maintenance Data: For roofing system to include in maintenance manuals.

- N. Inspection Report: copy of roofing system manufacturer's written inspection reports to be provided for each time manufacturer's representative in on site including for completed roofing installation intermediate and final acceptance inspection. **Provide a schedule for manufacturer's inspection visits, and include these dates in overall project schedule. Provide each report to architect and Owner's independent inspecting agency within five days of each site visit.**

- O. Manufacturer shall provide written evidence that he has reviewed the project specifications and drawings and will abide and uphold the Warranty/Guarantee provision as specified and agrees to issue an addendum to the manufacturer's warranty regarding said provisions. In addition, the manufacturer shall state that the warranty shall be issued regardless of any issues between the Contractor and supplier or Contractor and Owner at said time that the manufacturer has been paid in full for materials installed in accordance with the manufacturer's current technical specifications, and the project specifications and drawings. Statement shall be on manufacturer's letterhead and shall be signed by an officer of the corporation.
- P. Submit copy of warranty of roof material manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Obtain primary flexible sheet roofing from a single manufacturer. Provide secondary materials as recommended by manufacturer of primary materials.
- B. Installer: Engage an experienced Installer to apply single ply membrane roofing who has specialized in installing roofing systems for 5 yrs similar to those required for this project. Installer must be acceptable to or licensed by manufacturer of primary roofing material.
 - 1. Work included with single ply membrane roofing, including (but not limited to) insulation, flashing and counter-flashing, expansion joints, and joint sealers, is to be performed by Installer of this work.
- C. Pre-Roofing Conference: **As early as feasible and at a minimum 21 days prior to any materials arriving on site and installation of roofing and associated work, meet at project site, or other mutually agreed location, with Installer, a technical (non-sales) representative of the roofing sheet manufacturer, installers of related work, and other entities concerned with roofing performance, including (where applicable) Owner's insurer, test agencies, Architect, and Owner. Roofing installer will have examined field conditions prior to this meeting, and will make detailing recommendations in conjunction with the roofing manufacturer's technical representative at this meeting. Roofing installer will provide documentation showing proposed staging and material storage locations and protection measures.** Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours' advance notice to participants prior to convening pre-roofing conference.
- D. Certification:
 - 1. Notify Architect and Owner's Independent Testing and Inspection Agency within 48 hours of manufacturer's on-site inspections.
 - 2. All manufacturer's on-site inspection reports shall be submitted to the Architect and Owner within five days hours of manufacturer's on-site inspections.
- E. Exterior Fire Test Exposure: Class A, comply with ASTM E108
- F. UL Listing: Provide labeled materials that have been tested and listed by UL in "Building Materials Directory" or by other nationally recognized testing laboratory for application indicated, with "Class A" rated materials/system for roof slopes shown.
- G. FMG Listing: Provide roofing membrane, base flashings and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
 - a. Fire/Windstorm Classification Class 1-60

b. Hail Resistance: SH

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver roofing materials to project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid materials that con not be applied within its stated shelf life.
- C. **Protect roof insulation materials from physical damage and from sunlight, moisture, soiling, and other sources. Store in a dry location on pallets. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation. Failure to adequately protect materials shall result in material being rejected and replaced at no cost to Owner.**
- D. Store roll goods on pallets in a clean, dry, protected area. Take care to prevent damage To roll ends or edges.
- E. Materials shall be stored above 55 degrees F (12.6 degrees C) a minimum of 24 hours prior to installation.
- E. Materials shall be covered with opaque waterproof tarps, secured to prevent displacement by wind forces. Do not remove any protective tarps until immediately before the material is to be installed.
- F. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.06 PROJECT CONDITIONS

- A. Weather: Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.
- B. Substrate Conditions: Do not begin roofing installation until substrates have been inspected and are determined to be in satisfactory condition.

1.07 WARRANTY

- A. Project Warranty: Submit two executed copies of 20-year "Roofing Warranty" covering work of this section including roofing membrane, composition flashing, roof insulation, and roof accessories, signed by manufacturer of roofing system agreeing to replace any defective materials and workmanship and to repair any leaks as required to maintain the roof in watertight condition without financial limit. The warranty period is for 20 years after date of final acceptance.
 - 1. Include and cover all materials manufactured, sold, provided, recommended &/or approved by the Manufacturer for use in connection with the roof membrane and system (e.g. insulation and fasteners), but shall specifically exclude roof decking, unless such decking is manufactured or provided by Manufacturer (collectively, the

- “Roof System”).
2. Not be pro-rated; shall be without financial limit; shall not be limited due to the Contractor’s failure to install all or any portion of the Roof System in strict compliance with the Manufacturer’s and/or the Project installation requirements; and shall not be voided or limited as a result of repairs made or work performed by any Manufacturer-authorized Contractor during or subsequent to the initial installation of the Roof System.
 3. Not be limited to wind forces of less than the maximum expected wind speed indicated by the isotach map and building location condition factors stated in Factory Mutual Systems - Loss Prevention Data 1-28 (January 2002).
 4. Run to the benefit of and be enforceable and transferable by and among Owner and all Affiliates without restriction or fee. For purposes of the Warranty, the term “Affiliate” shall mean and include any corporation, partnership, limited liability company, trust, real estate investment trust or other entity, whether heretofore, now, or hereafter existing, created, formed or organized, that directly or indirectly through one or more intermediaries controls, is controlled by or under common control with the current Owner of record at said time of Warranty issuance. Should the Owner of record sell the facility or otherwise transfer the Ownership to a non-affiliate, Warranty shall be transferable for the Manufacturer’s (at that time) published Warranty transfer charge (not to exceed \$1,000.00).
 5. Commence not prior to Date of Final Completion {the “Effective Date”(*)}.
 6. Provide that any dispute relating to the interpretation, application, scope or enforceability of the Warranty shall be resolved and settled in accordance with applicable law in any court having jurisdiction thereof.

B. INSTALLING CONTRACTOR’S RESPONSIBILITY:

The Contractor shall guarantee and warrant to Owner the Roof System to the same extent and for a 5-Year period. The Contractor shall, for the duration of this period, investigate and repair all leaks within 24 hours of notification thereof (initial notification by telephone, with follow-up by written notification) and, promptly thereafter, complete other such repairs, restoration and/or replacement to the Roof System as provided by this specification.

C. JOINT RESPONSIBILITY OF MATERIAL MANUFACTURER AND CONTRACTOR:

The Contractor and Manufacturer shall both agree to uphold the above-outlined 24-hour service period for the duration of the Warranty. Neither the Contractor nor the Manufacturer shall be released from its obligations under this Section 1.16 because of the default of the other party. In the event of a default by the Contractor, the Manufacturer and Owner shall jointly approve another roofing Contractor to fulfill the obligations of the Contractor. Upon completion of any investigation, the Contractor and/or the Manufacturer, as the case may be, shall submit to the Owner adequate documentation (e.g. samples, photographs, etc.) depicting and describing the problem encountered upon such investigation. At that time, a determination shall be undertaken as to the probable cause of the leak(s). The Owner, Contractor, and Manufacturer shall jointly inspect the Roof System not later than six (6) months prior to the second, fifth and tenth anniversary (and each additional five-year period for the duration the Warranty, inclusive of any Warranty Alternates accepted by the Owner) of the Effective Date of the Warranty. The Manufacturer and Contractor shall be jointly responsible for correcting all leaks and defects in materials and/or workmanship in the Roof System observed during any such inspection. The Manufacturer/Contractor shall agree to correct, before the expiration date of said Warranty, all obvious deficiencies encountered during the above inspections that may affect roof performance before the Warranty expires. The methods

of repair shall be at the discretion of the Manufacturer, providing the following guidelines are adhered to: The method of repair shall be compatible with the building components and must not affect the aesthetic nature of the roof, as visible from within the building or as viewed from the ground level surrounding the facility.

- D. (*) NOTE: The Effective Date of the Warranty(ies) shall not be prior to the date of Final Completion.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Compatibility: Provide products that are recommended by manufacturers to be fully compatible with indicated substrates, or provide separation materials as required to eliminate contact between incompatible materials.

2.02 SINGLE PLY MEMBRANE

- A. General: Fleece-back, white thermoplastic roof membrane, thicknesses and acceptable products as specifically identified below. Membrane shall be fully adhered using manufacturer's approved glue adhesive.
- B. Membrane Reinforcing: Manufacturer's standard glass fiber or polyester scrim.
- C. Fully-Adhered Membrane: Manufacturer's standard installation.
1. Manufacturers:
 - a. Fibertite-XT-FB (50 mil KEE-component membrane, white).
 - b. Garland- Solarbrite EVFB (60 mil KEE-component membrane, white).
 - d. Johns Manville- fleece back (60 mil KEE-component PVC membrane, white).
 - c. Sika Sarnafil- G410FB (60 mil PVC membrane, white).

2.03 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard product. Product must be capable of achieving bonding to produce required wind rating (see 1.04.G).
- D. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- F. Metal Fascias, Copings and Drip Edges: Pre-fabricated Kynar-coated aluminum (.040 min. thickness) assembly by the same manufacturer as the roof membrane manufacturer or by other manufacturer accepted by roof membrane manufacturer as part of its warranted

roofing system.

1. Low slope membrane roof system metal edge securement, except gutters, shall be designed and installed in accordance with ANSI/SPRI ES-1 Building Code requirements.
- G. Sheet Seaming System: Manufacturer's standard materials for sealing lapped joints, including edge sealer to cover exposed spliced edges as required by membrane mfrg.
- H. Cant Strips, Tapered Edge Strips, and Flashing Accessories: Types recommended by membrane manufacturer, including adhesive tapes, flashing cements, and sealants.
- I. Flashing Material: Manufacturer's standard system compatible with flexible sheet membrane.
- J. Walkway Protection: Manufacturer's heavy duty walkway pads designed specifically for protection of exposed roofing membrane.
- K. Slip Sheet: If recommended by membrane manufacturer in isolated areas for protecting membrane from potential incompatible substrates.
- L. Mechanical Fasteners & Adhesives: Metal plates, caps, battens, accessory components, fastening devices, & adhesives to suit substrate & as recommended by membrane mfrg.
- M. Drain Accessories: clamp rings with dome-type basket strainers.
- N. Lightning Protection System Base Pads: Any slip sheets, base pads, scrims, etc. necessary under lightning system components will be coordinated with the roofing contractor by the Electrical Contractor. Material and installation cost for such items, if needed, will be included in the bid by the Electrical Contractor (not part of this General Trades bid).

2.04 VAPOR RETARDER

- A. Polyethylene and Polypropylene Vapor Retarder: ASTM C 1136-06, 6 mils thickness, minimum, with maximum permeance rating of 0.13 perm.
1. Provide vapor retarder produced by or acceptable to roofing membrane manufacturer.
 2. Available manufacturers if acceptable to the membrane manufacturer:
 - a. Raven Industries – DURA-DKRIM 6WW., Springfield OH
 - b. Lamtec Corp. – WWP-VR, Bud Lake NJ
 - c. Reef Industries – Griffolyn Type -65.
 3. Vapor Retarder Tape: Self-adhesive pressure sensitive vapor retarder tape with flame spread index of 25 or less, smoke developed index of 50 or less provided by or recommended by vapor retarder manufacturer for sealing seams & penetrations.

2.05 INSULATING MATERIALS

- A. General: Preformed roof insulation boards manufactured or approved by membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application of thicknesses indicated. Unless otherwise indicated, insulation thickness shall be tapered insulation board (upper layers) over 3" rigid base layer with staggered joints.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type III, Class 1, Grade 2, felt or glass fiber mat facer on both major surfaces meeting the following requirements:
1. Acceptable Manufacturer: Tested and approved by applicable agencies and approved by roofing manufacturer.

Parameter	Test Method	Value
Compressive Strength	ASTM D-1621	25 PSI
Dimensional Stability (Dimension Change After Installation)	N/A	
Length (inches)		+/- 1/8" MAX
Width (inches)		+/- 1/8" MAX
Thickness (inches)		+/- 1/16" MAX
Squareness (inches)		1/16" MAX
Flatness (inches)		1/16" MAX
Flame Spread	ASTM e-84	<25 Ft.
Moisture Vapor Transmission	ASTM E-96	<1 PERM
Acidity	EPA #9045	6 pH MIN 8 pH MAX

- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to produce slopes indicated on roof plans (generally 1/2" and 1/4 inch per 12 inches) unless otherwise indicated.
- D. Provide pre-formed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain, as well as upslope of any roof-mounted equipment curbs 30" wide or greater.
 1. Any saddles required on the roof plan shall have a four-way slope twice that of roof deck, & in no case shall the width of the saddles be less than 25 percent of the total span between roof drains.
 2. Saddles shall be used for drainage purposes only, shall be placed on top of main roof insulation, and shall be of same materials as the main roof insulation.
 3. Saddles (crickets) shall be factory fabricated and marked for field installation.

2.06 AUXILIARY INSULATION MATERIALS

- A. General: Furnish roof insulation accessories recommended by insulation & membrane roofing system mfg for intended use & compatibility with membrane roofing.
- B. Fasteners: Over metal deck areas, secure insulation over vapor barrier sheet using factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer, meeting the Performance Requirements of this specification section.
- C. Insulation Asphalt Adhesive: Over all concrete deck areas, install base and upper layers of insulation board using hot mopped asphalt (solid mopping, not ribbons). Delivery temperature at roof (not at kettle) shall be maintained at 425-450 F degrees. Asphalt shall be specific product recommended by roof and insulation manufacturer to achieve performance requirements of roof specified herein. Product must be capable of achieving bonding to produce required wind rating (see 1.04.G).
- D. Insulation seam tape- use a self-adhering foil tape recommended by the roof membrane and insulation manufacturers to cover any areas of asphalt bleedout at the top of insulation assemblies. Extend tape beyond edge of bleedout areas to the extent recommended by the roofing membrane manufacturer.
- E. Edge wood blocking- use pressure treated, exterior grade dimensional lumber and plywood sheets to achieve solid blocking to the height required for the installation. Secure

to concrete deck with coated fasteners to achieve required uplift pressure requirements specified herein.

2.07 WALKWAYS

- A. Flexible Walkways: Factory-formed, reinforced thermoplastic, non-porous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick by a minimum of 36 inches wide, and acceptable to the membrane roofing system manufacturer. These shall be secured in place, not loose laid.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Fully remove existing roof system down to structural roof deck. Clean deck as needed to prepare for new material installation method specified herein. Examine substrates, areas, and conditions with installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations remain in place and set and braced at adequate heights for roof system installation.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. **Begin roofing installation only after notifying the Owner and Architect at least 72 hours in advance that roofing will commence. Begin tear-off and installation of new materials with the roofing membrane manufacturer's technical representative on site. This individual shall remain on site to directly observe the installation of a minimum of 400 square feet of the entire system including at least one corner, one penetration, and seam welding. This individual shall provide instruction as required to the roofing installer on fasteners, adhesives, hot asphalt, insulation board, taping, time required for adhesives to set prior to laying membrane sheets, etc.**

3.02 PREPARATION OF SUBSTRATE

- A. General: Comply with manufacturers' instructions for preparation of substrate to receive single ply membrane system.
 - 1. Verify that penetrations, expansion joints, and blocking are in place and secured and that roof drains are properly clamped into position.
- D. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- E. Install flashings and accessory items as shown & as recommended by manufacturer if not shown. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove & discard temporary seals before beginning work on adjoining roofing.
- D. Prime substrate where recommended by manufacturer of materials being installed.

- E. Prevent compounds from entering and clogging drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof drain & conductor plugs when no work is taking place or when rain is forecast.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.
- G. Promptly remove demolished materials from the roof area and properly dispose. All debris shall be removed from the roof area on at least a daily basis.**

3.03 VAPOR RETARDER INSTALLATION

- A. Where indicated on the details, loosely lay polyethylene and/or polypropylene film vapor retarder in a single layer over entire roof deck extending to roof edges and to adjacent vertical walls.
- B. Side and end lap each sheet a minimum of 2" and 6" respectively.
- C. Seal laps with continuous strip of tape recommended by vapor retarder manufacturer.
- D. Seal at penetrations & at roof edges with mfg recommended tape or adhesive.

3.04 INSULATION INSTALLATION

- A. General- over all concrete deck areas: install base and upper layers of insulation board using hot mopped asphalt (solid mopping, not ribbons). **Delivery temperature at roof (not at kettle) shall be maintained at 425-450 F degrees.** Continue insulation over entire surface to be insulated, cutting and fitting tightly around obstructions. Form cant strips, crickets, saddles, and tapered areas with additional material as shown and as required for proper drainage of membrane. After top layer of insulation is in place, cover any areas of asphalt bleed-out with foil tape per roof manufacturer's recommendations.

General- over metal deck areas: extend insulation full thickness over vapor barrier in no less than two layers, or in multiple layers over entire surface to be insulated, cutting and fitting tightly around obstructions. Form cant strips, crickets, saddles, and tapered areas with additional material as shown and as required for proper drainage of membrane. Mechanically fasten through all layers of insulation (through-fastener through entire assembly). Provide number of fasteners and spacing to conform with manufacturer's requirements and for specified uplift resistance. Secure through roof deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

- B. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at end of the workday.
- C. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- D. Install tapered insulation under area of roofing to conform to slopes indicated.
- E. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is greater than 1 ½ inches, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

- F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- H. 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 ¼ inch with insulation.
 - 1. Cut and fit insulation within ¼ inch of nailers, projections, and penetrations.
- J. Do not install more insulation each day than can be covered with membrane before end of day or before start of inclement weather.

3.05 ADHERED MEMBRANE INSTALLATION

- A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
 - 1. Install sheet according to ASTM published guidelines for specific membrane sheet provided.
- B. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: apply to substrate and underside of membrane roofing at a rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing. Note: For water-based bonding adhesive, follow roof system manufacturer's instructions.
- E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld sides & end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continually. Apply lap sealant to seal cut edges of sheet membrane.
 - 2. Verify field strength of seams a min of twice daily and repair seam sample areas. 3. Repair tears, voids, & lapped seams in roofing that does not comply with req's.
- H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.06 BASE FLASHING INSTALLATION

- A. Install sheet flashing and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with sheet flashing.

- D. 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.
- F. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.07 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products at all roof access points, serviceable sides of rooftop units, and in locations indicated.
 - 1. Walkway shall be attached to the roofing membrane by means of roof-system-manufacturer-approved adhesive and shall have a continuous two-inch (2") wide hot-air weld around the perimeter. Constructed seams shall be of the same quality as seams constructed between roof membrane sheets, inclusive of seam sealant, to prevent any ingress of moisture and/or foreign particles between the roof membrane and the walkway membrane.
 - 2. The area of the roof membrane which will receive the walkway membrane shall be free of any defects, i.e., contamination, debris, foreign particles, etc. Where the walkway material crosses membrane seams, membrane seams shall be probed prior to the installation of the walkway material for integrity and repair as required. Do not apply any sealing compound prior to the seaming of the walkway material.
 - 3. Walkways should not be installed over membrane fasteners. In cases where this is necessary, additional protection must be placed between the roofing fastener and the roofing membrane. In areas critical for wind uplift, fasteners shall never be moved or removed due to placement of walkways.

3.08 METAL FASCIAS AND TERMINATIONS

- A. Metal Fascias: Install manufacturer's metal fascias and copings at top of parapets and elsewhere as indicated on the Drawings over wood nailers according to SMACNA standards and Thermoplastic Membrane Roofing manufacturer's written instructions.

3.09 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- C. Testing Agency: Owner may engage a qualified, independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports. All manufacturers' on-site inspection reports shall be submitted to independent testing and inspecting agency within 48 hours of manufacturer's on-site inspection.

3.10 PROTECTION AND CLEANING

- A. At completion of roof system installation, document installed conditions with photographic evidence. Recommend procedure to 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 Architect and Owner. It is intended that damages caused by other trades will be charged to the contractor at fault.
- B. 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 Contract Completion and according to warranty requirements.

- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

- E. Prior to inspection for Contract Completion, wash entire roof by water-washing following maintenance procedures recommended by the manufacturer. Power washers are prohibited. Use manufacturer-recommended cleaning agents in heavily soiled areas if necessary. Remove any debris from roof drains.

END OF SECTION

SECTION 07 60 00 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Two piece metal counter flashing and base flashing (if any).
 - 2. Metal wall flashing and expansion joints.
 - 3. Miscellaneous sheet metal accessories.
 - 4. Reglets and counter-flashing.
 - 5. All gutters, eaves, rakes, fascia, trim conditions.
- B. Related Sections:
 - 1. Section 075419 – Single-Ply Membrane Roofing for accessories installed integral with roofing membrane.

1.03 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg. F. ambient; 180 deg. F. materials surfaces.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.
- C. Samples of the following flashing, sheet metal, and accessory items:
 - 1. 8-inch-square samples of specified sheet materials to be exposed as finished surfaces.
 - 2. 12-inch-long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.
 - 3. (Provide color samples for selection of final color of gutters and downspouts by architect; color to match fascias and copings; based on medium grey.)
- D. Shop drawings showing layout, thickness, weight, profiles, methods of joining, and anchorages details, including major counter-flashings, trim/fascia units, gutters, downspouts and expansion joint systems. Provide layouts at 1/4-inch scale and details at 3-inch scale. (Distinguish between shop and field assembled work).
- E. Warranty: Sample of special warranty.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Engage and experienced installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.
- C. SMACNA and NRCA: Except as otherwise indicated, the workmanship of sheet metal work, method for forming joints, thickness requirements, anchoring, cleating, and provisions for expansion shall conform to the standard details and recommendations of the SMACNA – Architectural Sheet Metal Manual, Sixth Edition and NRCA – Roofing and Waterproofing Manual. If there is a discrepancy between these references and the project specifications and drawings, the more strict requirements shall govern.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in undamaged condition.
- B. Sheet metal flashing and trim shall be stored in a weathertight⁶ and ventilated condition. Utilize opaque tarps to protect materials stored out doors.
- C. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- D. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity except to the extent necessary for the period of sheet metal flashing and trim installation.

1.07 PROJECT CONDITIONS

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.
- B. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak-proof, secure, and non-corrosive installation.

1.08 WARRANTY

- A. Special Warranty on Finishes – Manufacturer’s standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that show evidence of deterioration of factory-applied finishes within the specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D-2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D-4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20-years from date of Contract Completion

PART 2 – PRODUCTS

2.01 SHEET METAL FLASHING AND TRIM MATERIALS

- A. Provide for thermal expansion of running sheet metal work, by overlaps of expansion joints in

fabricated work. Where required for water-tight construction, provide hooked flanges filled with polyisobutylene mastic for 1" embedment of flanges. Space joints at intervals of not more than 50 ft. for steel, 24 ft. for copper or stainless steel, or 30 ft. for zinc alloy or aluminum. Conceal expansion provisions where possible.

- B. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A 775 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359-inch thick (20 gage) except as otherwise indicated.
- C. Sheet Aluminum: ASTM B 209, alloy 3003, temper H14, AA-C22A41 Knyar-coated finish; 0.032-inch thick (20 gage) all areas except for gravel stop bands and vertical fascia bands (.040-inch thick required these areas) or where indicated otherwise on the drawings.
- D. Roof Flashings:
 - 1. Sheet Aluminum: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for use intended.
 - 2. Extruded Aluminum: ASTM B 221, 6063-T5 alloy and temper, or as recommended by manufacturer for use intended and as required for proper application.
 - 3. Pre-painted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and pre-painted by the coil coating process to comply with ASTM A 755. (Industry standard for painted metal).
 - a. Aluminum-zinc ally-coated steel sheet: ASTM A 792/A 792M, Class AZ50 coating designation, grade 40; structural quality.
 - b. Surface: Smooth, flat.
 - c. Exposed Coil-coated Finish
 - i. Two-coat Fluoropolymer: AAMA 621, Fluoropolymer finish containing not less than 70 % PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer written instructions.
 - i. Color: Custom color as selected by the Architect.
 - d. Concealed Finish: Pre-treat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.02 FLEXIBLE SHEET MEMBRANE FLASHING

- A. Elastic Sheet Flashing/Membrane: Non-reinforced flexible, black elastic sheet flashing of 50 to 65 mils' thickness and complying with the following:
 - Shore A Hardness (ASTM D 2240): 50 to 70.
 - Tensile Strength (ASTM D 412): 1200 psi.
 - Tear Resistance (ASTM D 624, Die C): 20 lbs. per linear inch.
 - Ultimate elongation (ASTM D 412): 250 percent.
 - Low temperature brittleness (ASTM D 746): minus 30 deg F (minus 35 deg C).
 - Resistance to ozone aging (ASTM D 1149): no cracks for 10 percent elongated sample for 100 hours in 50 pphm (50.5 mPa) ozone at 104 deg F (70 deg C).
 - Resistance to Heat Aging (ASTM D 573): maximum hardness increase of 15 points, elongation reduction of 40 percent, and tensile strength reduction of 30 percent, for 70 hours at 212 deg F (100 deg C).
- B. Acceptable Products:
 - Neoprene synthetic rubber sheet.
 - Butyl synthetic rubber sheet.
 - EPDM synthetic rubber sheet.

2.03 TWO-PIECE COUNTERFLASHING

- A. Basis of Design Product: Metal-Era, Custom 2-piece counter flashing or comparable product by;
 - 1. Hickman,
 - 2. W.P. Company.
- B. Base member to be installed with masonry work and Thru-Wall Flashing to lay and be sealed to top of this base member.

2.04 MISCELLANEOUS MATERIALS AND ACCESSORIES:

- A. Solder: For use with steel or copper, provide 50 - 50 tin/lead solder (ASTM B 32), with rosin flux.
- B. Solder: For use with stainless steel, provide 60 - 40 tin/lead solder (ASTM B 32), with acid-chloride type flux, except use rosin flux over tinned surfaces.
- C. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- D. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- E. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.
- F. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealers."
- G. Epoxy Seam Sealer: 2-part non-corrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.
- H. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
- I. Paper Slip Sheet: 5-lb. rosin-sized building paper.
- J. Polyethylene Underlayment: Minimum 6-mil carbonated polyethylene film resistant to decay when tested in accordance with ASTM E 154.
- K. Reglets: Watertight metal units anchored into masonry/concrete, compatible with wall materials and flashings, non-corrosive.
- L. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gage required for performance.
- M. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
- N. Roofing Cement: ASTM D 2822, asphaltic.

2.05 FABRICATED UNITS

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, & tool marks, true to line & levels indicated, with exposed edges folded back to form hems.
- B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Provide for thermal expansion. Space joints not more than 50 ft. for steel, 24 feet for copper or stainless steel, or 30 ft. for zinc alloy or aluminum. Conceal expansion provisions, where possible. Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- F. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed or extruded aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.
- G. Shop Finish, Rain Drainage: Provide manufacturer's standard baked-on acrylic shop finish on sheet metal rain drainage units (gutters, downspouts, and similar exposed units); 1.0-mil dry film thickness. (color selected by architect)
- H. Downspout Leaders and Splash-blocks: All downspouts terminating at a rooftop will have splash blocks. Splash-blocks: concrete 12 inches wide by minimum 24 inches long by 3 inches high Fabricated from 4,500 PSI air-entrained concrete, as Manufactured by:
 - a. Baxter Concrete products
 - b. Oberfields Inc.
 - c. Reading Block
- I. Sealants: Provided by installer. See Div 7, Section "Sealants", for additional information.

2.08 GUTTERS AND DOWNSPOUTS

- A. Gutters and downspouts shall be sizes indicated on drawings, and shall be minimum of 0.032" thickness, extruded aluminum. Color selected by Architect. Gutters shall be supported by brackets, fastened directly to fascia or roof deck at 3'-0" spacing. Site extruded factory welded, and fabricated, as manufactured by:
 - 1. Hickman Construction Products, Inc., Cincinnati OH
 - 2. Petersen Aluminum Corp., Woodridge IL

3. Southern Aluminum Finishing Co., Elizabethtown PA

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
 - I. Performance: Water-tight, weatherproof performance of flashing and sheet metal work are required.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install reglets to receive counter-flashing in manner and by methods indicated. Where shown in concrete, Provide reglets to trades of concrete work for installation as work of Division 3 sections. Where shown in masonry, Provide reglets to trades of masonry work, for installation as work of Division 4 sections.
 - I. Install counter-flashing in reglets, either by snap-in seal arrangement or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.
- E. Install elastic flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.
- F. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3-inch overlap, to form a continuous, waterproof system.
- G. Seal all laps in through wall flashings with mastic, and turn up ends to provide water dam to direct water to exterior of wall.

3.02 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

3.03 TESTS

- A. Upon request of the Architect, demonstrate by hose or standing water that all flashing and sheet metal systems are completely watertight.

END

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

- A. In general, seal all openings, and at all other locations which normally require sealant, seal against infiltration from air, water and most insects, including, but not limited to the following:
 1. Construction and expansion joints, joints between dissimilar materials. Joints around windows, door frames, louvers and other penetrations and openings in the exterior wall. Interior walls as required.
 2. Note details on Drawings for additional sealant requirements.
 3. Specification is based on Tremco Manufacturing Company. Acceptable manufacturers are referred to in these Specifications.
- B. Extent of each form and type of joint sealer as required and /or specified herein.

1.03 SYSTEM PERFORMANCES:

- A. Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.04 SUBMITTALS:

- A. Not used.
- B. Product Data from manufacturers for each joint sealer product required, including instructions for joint preparation and joint sealer application. **Indicate specifically where, or in which type of joint, each product will be used on this Project.**
- C. Samples for Initial Selection Purposes: Manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- D. Samples for verification purposes of each type and color of joint sealer required. Install joint sealer samples in 1/2 inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealers.
- E. Certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.
- F. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project name, addresses, names of Architects and Owners, plus other information specified.
- G. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

- H. Product test reports for each type of joint sealers indicated, evidencing compliance with requirements specified.
- I. Sealant Contractor to furnish a 5-year warranty in writing.

1.05 QUALITY ASSURANCE:

- A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this Project.
- B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.
- C. Contractor shall verify compatibility with adjacent surfaces of all sealant applications.
- D. Preconstruction Compatibility and Adhesion Testing: Submit samples of all materials that will contact or affect joint sealers to joint sealer manufacturers for compatibility and adhesion testing, as indicated below:
 - 1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealers to joint substrates.
 - a. Perform tests under normal environmental conditions that will exist during actual installation.
 - 2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.
 - 4. Investigate materials failing compatibility or adhesion tests and obtain joint sealer manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
 - 5. Testing will not be required when joint sealer manufacturer is able to submit joint preparation data required above which is acceptable to Architect/Engineer and is based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.07 PROJECT CONDITIONS:

- A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 deg F (4.4 deg C).
 - 2. When joint substrates are wet due to rain, frost, condensation, or other causes.

- B. Joint Width Conditions: Do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.08 SEQUENCING AND SCHEDULING:

- A. Sequence installation of joint sealers to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

1.09 WARRANTY:

- A. Provide a 5-year joint warranty with manufacturer and sealant contractor, in writing, to replace any or all joints failing within the warranty period at no cost to the owner, labor and material inclusive.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

- A. Not used.
- B. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- C. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Architect/Engineer from manufacturer's standard colors.
- D. Exterior Joints:
 - 1. Other exterior joints as required: Sealant #1, #2, #3, #4, #5, #6 and #7.

2.02 MANUFACTURERS:

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide sealants of one of the following:
 - Tremco, Inc.
 - Sonneborn Building Products Div., Rexnord Chemical Products, Inc.
 - Mameco International, Inc.
 - Pecora Corp.

2.03 MATERIALS:

- A. Sealant #1 shall be a three-part polyepoxide urethane sealant meeting Fed. Spec. TT-S-0227E, Class A, Type II, and/or ASTM C920, Type M, Grade NS, Class 25, use MT, M, A, and O, such as Tremco Dymeric, as manufactured by Tremco Inc., Cleveland, OH.
- B. Sealant #2 shall be a one-part moisture curing modified polyurethane sealant meeting Fed. Spec. TT-S-0023OC, Class A, Type II, and/or ASTM C920, Type S, Grade NS, Class 25, Use NT, M, A and O, such as Tremco Dymonic, as manufactured by Tremco Inc., Cleveland, OH, or Sonneborn NPI.
- C. Sealant #3 shall be a one-part solvent cure acrylic sealant meeting Fed. Spec. TT-S-00230, such as Tremco Mono, as manufactured by Tremco Inc., Cleveland, OH, Acryl R, or Unicrylic 60T.

- D. Sealant #4 shall be a three-part chemically curing polyurethane meeting Fed. Spec. TT-S-00227E, Class A, Type I, (self-leveling), and/or ASTM C920, Type M, Grade P, Class 25, Use T, M, A and O, such as THC-900, as manufactured by Tremco Inc., Cleveland, OH, Sonneborn, or NR-200.
- E. Sealant #5 shall be a one-part low modulus moisture curing silicone meeting Fed. Spec. TT-S-00230C, Type II, Class A, TT-S-001543A, Class A, and/or ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, G, A and O, and capable of withstanding movement of 100% in expansion and 50% in compression in service, such as Spectrem I, as manufactured by Tremco Inc., Cleveland, OH, or Dow 790.
- F. Sealant #6 shall be a one-part neutral cure medium modulus moisture curing silicone meeting Fed. Spec. TT-S-00230C, Type II, Class A, and/or ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, G, A and O, and capable of withstanding movement of 50% in extension and compression in service, such as Spectrem 2, as manufactured by Tremco, Inc., Cleveland, OH, Dow 795 or GE Silpruf.
- G. Sealant #7 shall be a high grade butyl sealant such as Tremco Butyl Sealant as manufactured by Tremco Inc., Cleveland, OH.

2.05 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type which are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonwaxing, nonextruding strips of flexible, nongassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 1. Either open-cell polyurethane foam or closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer, for cold-applied sealants only.
 - 2. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F (-15 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
 - a. Close-cell as manufactured by Hercules.
 - b. Open-cell as manufactured by Denver Foam (Plateau Supply).
 - 3. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.06 MISCELLANEOUS MATERIALS:

- A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or

otherwise have a detrimental effect on sealant adhesion or in-service performance.

- C. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.
- B. Joint dimensions for sealant should be reviewed and installed in accordance with sealant manufacturer's printed instructions. In no case should the sealant application be less than 1/4 inch wide, and 1/4 inch deep.

3.02 PREPARATION:

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
 1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers; oil; grease; waterproofing; water repellents; water; surface dirt; and frost.
 2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 3. Clean ferrous metals of all rust, mill scale and coatings by wire brush, grinding, or sandblasting. Remove oil, grease and/or temporary protective coatings with high performance cleaners, as approved by sealant manufacturer, such as Tremco No. 200 Cleaner.
 4. Sealants shall not be applied to masonry joints where a water repellent or masonry preservative has been applied prior to caulking. Waterproofing treatments should be applied after sealant, when called for.
 5. Do not seal joints until they are in compliance with requirements of the approved manufacturer of the materials, the details as shown on the Drawings, and the specific requirements of other sections of the specification.
 6. Do not adulterate or thin compounds. Deliver to job in manufacturer's labeled containers, unopened.
 7. All exterior joints shall be backed with joint backing material to eliminate back bond. Where width of exterior joint is 1/2" or less, prepare joint so depth of caulking bead is approximately equal to its width. Where width of exterior joint exceeds 1/2", prepare joint so depth of caulking bead is approximately equal to 1/2 its width.
 8. Backing of interior joints will not be required except where depth of joint exceeds 3/4". In such cases, fill with joint backing material to approximately 3/4" from surface.
 9. Sealant compounds shall generally be applied by means of a hand gun. Exercise extreme care to prevent smearing of adjacent surfaces. Use sufficient pressure to fill all voids and joints solidly. Where required by manufacturer's instructions, heat sealant to recommended temperature before application.

10. Seal joints before final coat of paint is applied to adjacent surfaces.
 11. Saddles on thresholds of all types of exterior doors shall be set in a full bed of exterior sealant compound, not less than 3/8" thick. Clean off excess compound after installing.
 12. Remove excess sealant compound and sealant and leave surfaces neat, smooth and clean, without smears on surrounding work. Tool joints where recommended by manufacturer or required by Architect/Engineer.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALERS:

- A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply. Workmanship shall be of the highest quality in accordance with the best practice and in strict compliance with the recommendations of the manufacturers of the material being used.
1. Sealants shall not be applied to masonry joints where a water repellent or masonry preservative has been applied prior to caulking. Waterproofing treatments should be applied after caulking, when called for.
 2. Do not caulk joints until they are in compliance with requirements of the approved manufacturer of the materials, the details as shown on the drawings, and the specific requirements of other sections of the specification.
 3. Do not adulterate or thin compounds. Deliver to job in manufacturer's labeled containers, unopened.
 4. All exterior joints shall be backed with joint backing material to eliminate back bond. Where width of exterior joint is 1/2" or less, prepare joint so depth of caulking bead is approximately equal to its width. Where width of exterior joint exceeds 1/2", prepare joint so depth of bead is approximately equal to 1/2 its width.
 5. Backing of interior joints where depth of joint exceeds 3/4". In such cases, fill with joint backing material to approximately 3/4" from surface.
 6. Sealant compounds shall generally be applied by means of a hand gun per manufacturer's written instructions. Exercise extreme care to prevent smearing of adjacent surfaces. Use sufficient pressure to fill all voids and joints solidly. Where required by manufacturer's instructions, heat sealant to recommended temperature before application.
 7. Seal joints before final coat of paint is applied to adjacent surfaces.
 8. Saddles on thresholds of all types of exterior doors shall be set in a full bed of exterior sealant compound, not less than 3/8" thick. Clean-off excess compound after installing.
 9. Remove excess sealant compound and sealant and leave surfaces neat, smooth and clean, without smears on surrounding work. Tool joints where recommended by manufacturer or required by Architect/Engineer.
 10. Major authorities recommend a 40-degree F minimum application temperature for joint sealant installations because of the possibility of moisture and/or frost contamination on sealing surfaces. However, it is recognized that applications must be made at lower temperature. When this is necessary, steps must be taken to assure clean, dry, frost-free surfaces, and must be approved by the General Contractor and manufacturer.

11. After joints have been completely filled, they shall be neatly tooled to eliminate air pockets or voids, and to provide a smooth, neat appearing finish in intimate contact with interfaces. After tooling, surface of sealant shall be free of ridges, wrinkles, sags, air pockets and embedded impurities.
 12. Immediately clean adjacent materials which have been soiled; leave work in a neat, clean condition.
- B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.
 - C. Solvent-Release-Curing Sealant Installation Standard: Comply with requirements of ASTM C 804 for use of solvent-release-curing sealants.
 - D. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.
 - E. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
 - F. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 1. Install joint fillers (backer rod) of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.
 - d. Use a blunt instrument to prevent punctures to the skin surface.
 2. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.
 3. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.
 - G. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.
 - H. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 1. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.
 2. Provide flush joint configuration per Figure 6B in ASTM C 962, where indicated.
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
 3. Provide Recessed joint configuration per Figure 6C in ASTM C 962, of recess depth

and at locations indicated.

- I. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools which produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.
- J. Installation of Preformed Hollow Neoprene Gaskets: Install gaskets, with minimum number of end joints, in joint recesses with edges free of spalls and sides straight and parallel, both within tolerances specified by gasket manufacturer. Apply manufacturer's recommended adhesive to joint substrates immediately prior to installing gaskets. For straight sections provide gaskets in continuous lengths; where changes in direction occur, adhesively splice gasket together to provide watertight joint. Recess gasket below adjoining joint surfaces by 1/8 inch to 1/4 inch.
- K. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.
- L. After joints have been completely filled, they shall be neatly tooled to eliminate air pockets or voids, and to provide a smooth, neat appearing finish in intimate contact with interfaces. After rolling, surface of sealant shall be free of ridges, wrinkles, sags, air pockets and embedded impurities.

3.04 CLEANING:

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

3.05 PROTECTION:

- A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and installations with repaired areas indistinguishable from original work.
- B. Major authorities recommend a 40 degree F minimum application temperature for joint sealant installations because of the possibility of moisture and/or frost contamination on sealing surfaces. However, it is recognized that applications must be made at lower temperatures. When this is necessary, steps must be taken to assure clean, dry, frost-free surfaces, and must be approved by the General Contractor.

3.06 WORKMANSHIP:

- A. Workmanship shall be of high quality in accordance with the best practice and in strict compliance with the recommendations of the manufacturer of the materials being used. The Contractor shall be prepared to show evidence of workmanship of jobs at least three years old.

END OF SECTION