

DIVISION 07 – SECTION 2216

Low Slope

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Board insulation under [built-up][modified bituminous][single ply][metal panel][xxx] roof system.

B. Related Sections:

1. Division 01: Administrative, procedural, and temporary work requirements.
2. Section [075113 - Built-Up Asphalt:] [__ - ____:]
Built-up roofing system.
3. Section [075300 - Modified Bituminous Membrane:] [__ - ____:]
Modified bituminous roofing system.
4. Section [075300 - Elastomeric Membrane Roofing:] [__ - ____:]
Single ply roofing system.
5. Section [075400 - Thermoplastic Membrane Roofing:] [__ - ____:]
Single ply roofing system.
6. Section [077100 – Roof Specialties:] [__ - ____:]
Re-Cover roofing system.

C. General Notes:

1. The design and construction of the roof deck and supporting structure is the responsibility of the project architect, engineer, general contractor and the building owner. The structure must be designed to resist all live, dead, snow, wind and construction loadings without excessive deflections as dictated by the governing building codes.
2. The selection and use of insulations, as well as other roofing system components, to meet the requirements for any given project is at the sole discretion of the owner, his designated agent or representative.
3. Only skilled, trained workmen familiar with rigid polyisocyanurate products and the various other components of the roofing system be used to perform the required work.
4. Wind uplift ratings are based on specifications developed by FM Global. Ratings are noted as "1-60", meaning an ultimate uplift test force of 60 pounds per square foot and "1-90", meaning an ultimate uplift test force of 90 pounds per square foot. Wind loading forces for design consideration must be developed from nationally recognized building codes. The roofing system designer must give consideration to the anticipated wind loadings on field, perimeter and corner areas to provide adequate uplift resistance of the roofing system with allowances for appropriate factors of safety.

D. **WARNING:**

1. Polyisocyanurate is an organic material which will burn when exposed to an ignition source of sufficient heat and intensity and may contribute to flames spreading.

2. Do not use wet insulation products within a roofing assembly. Installation of wet insulation or other roofing system components shall cause the manufacturer warranties to become void. Insulation that has become wet may experience dimensional stability problems and every precaution must be taken in order to determine if the insulation is still useable.

1.2 REFERENCES

- A. American Society for Testing and Materials. (ASTM International) (www.astm.org):
 1. C209 Test Methods for Cellulosic Fiber Insulating Board.
 2. C518 Test Method for Measurement of Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 3. C1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 4. D41 Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
 5. D312 Standard Specification for Asphalt Used in Roofing.
 6. D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 7. D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 8. D2126 Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 9. E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 10. E96 Standard Test Method for Water Vapor Transmission of Materials.
- B. Canadian Standards Association/Underwriters Laboratories of Canada. (CAN/ULC) (www.ulc.ca)
 1. S770 Standard Test Method Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.
 2. S704 Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.
- C. Factory Mutual Insurance Co. (FM) (www.fmglobal.com):
 1. 4450 Approval Standard for Class I Insulated Steel Decks.
 2. Approval Guide.
 3. RoofNav.
- D. Polyisocyanurate Insulation Manufacturers Association. (PIMA) (www.polyiso.org):
 1. 101 Technical Bulletin 101 describes the industry accepted procedure for determining R-value for impermeably faced polyisocyanurate products.
- E. Underwriters Laboratories, Inc. (UL) (www.ul.com):
 1. 263 Fire Tests of Building Construction and Materials.
 2. 790 Standard Test Methods for Fire Tests of Roof Coverings.
 3. 1256 Fire Test of Roof Deck Constructions.
 4. UL online certifications directory.

1.3 SUBMITTALS

(These submittals are intended for the Owner's record purposes and are not intended to be reviewed by the Architect.)

A. Submittals for Review:

1. Product Data: Manufacturer's descriptive data and performance characteristics.
2. Samples: Submit 12"x12" samples(s) of each board type required.
3. Reference Manufacturer's data sheets for fastening patterns.

B. Quality Control Submittals:

1. Certificates: Manufacturer's certification that material meets specification requirements.
2. Certificates of Compliance: Certification from an independent testing laboratory that insulation meets fire hazard classification requirements.

(Include the following for sustainable design submittals.)

C. Sustainable Design Submittals:

1. Recycled Content: Certification of post consumer and pre consumer recycled content.
2. Regional Material: Certification that materials have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project sight.
3. (Sealants and adhesives) Low-Emitting Materials: Certify volatile organic compound (VOC) content.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacture: Rmax Operating, LLC; Corporate office: 13524 Welch Road, Dallas, TX 75224, Toll Free Tel: (800) 527-0890, Tel: (972) 387-4500, Fax (972) 385-4673, Web: www.rmaxinc.com, E-mail: rmax@rmaxinc.com
- B. Substitutions: [Under provisions of Division 01.] [Not permitted.]

2.2 MATERIALS

(Include the following for each type of insulation product that is being specified and edit to suit project requirements.)

A. Board Insulation:

1. Product: **Multi-Max® FA-3**
 - a. Meet ASTM C1289, Type II, Class 1.
 - b. Class 1 rated, tested to FM 4450; as listed in FM Approval Guide.
 - c. Class A rated for external flame, tested to UL 790; as listed in UL Online Certifications Directory.
 - d. Class A rated for internal flame, tested to UL 1256; as listed in UL Online Certifications Directory.
 - e. Listed and labeled, tested to UL 263; as listed in UL Online Certifications Directory.

- f. Description: Rigid polyisocyanurate foam core utilizing CFC-, HCFC-, and HFC-free blowing agent that has zero ozone depletion potential and negligible global warming potential, bonded to glass fiber/organic mat facings on both sides.
 - g. Physical properties:
 1. Compressive strength: [Grade 1][Grade 2][Grade 3] tested to ASTM D1621.
 2. Nominal Density: 2.0 pcf, tested to ASTM D1622.
 3. Water vapor transmission: Maximum 1.0 perms, tested to ASTM E96.
 4. Water absorption: Maximum 1 percent by volume, tested to ASTM C209.
 5. Dimensional stability: Maximum 2 percent linear change, tested to ASTM D2126 for 7 days at 158 degrees F and 98 percent relative humidity.
 6. Flame spread/smoke developed rating: Maximum 60/160, tested to ASTM E84.
 7. Service Temperature: -40°F to 250°F.
 - h. Thermal resistance: Minimum long-term thermal resistance (LTTR) value of [xxx] tested to CAN/ULC-S770.
 - i. Size: 48 x[96][48] inches.
2. Product: **Ultra-Max®**
- a. Meet ASTM C1289, Type II, Class 2.
 - b. Class 1 rated, tested to FM 4450; as listed in FM Approval Guide.
 - c. Class A rated for external flame, tested to UL 790; as listed in UL Online Certifications Directory.
 - d. Class A rated for internal flame, tested to UL 1256; as listed in UL Online Certifications Directory.
 - e. Listed and labeled, tested to UL 263; as listed in UL Online Certifications Directory.
 - f. Description: Rigid polyisocyanurate foam core utilizing CFC-, HCFC-, and HFC-free blowing agent that has zero ozone depletion potential and negligible global warming potential, bonded to polymer filled glass fiber mat facings on both sides.
 - g. Physical properties:
 1. Compressive strength: [Grade 1][Grade 2][Grade 3] tested to ASTM D1621.
 2. Nominal Density: 2.0 pcf, tested to ASTM D1622.
 3. Water vapor transmission: Maximum 1.0 perms, tested to ASTM E96.
 4. Water absorption: Maximum 1 percent by volume, tested to ASTM C209.
 5. Dimensional stability: Maximum 2 percent linear change, tested to ASTM D2126 for 7 days at 158 degrees F and 98 percent relative humidity.
 6. Flame spread/smoke developed rating: Maximum 60/160, tested to ASTM E84.
 7. Service Temperature: -40°F to 250°F.
 - h. Thermal resistance: Minimum long-term thermal resistance (LTTR) value of [xxx] tested to CAN/ULC-S770.
 - i. Size: 48 x[96][48] inches.
3. Product: **Tapered Therमारoof®-3**
- a. Meet ASTM C1289, Type II, Class 1.
 - b. Class 1 rated, tested to FM 4450; as listed in FM Approval Guide.

- c. Class A rated for external flame, tested to UL 790; as listed in UL Online Certifications Directory.
 - d. Class A rated for internal flame, tested to UL 1256; as listed in UL Online Certifications Directory.
 - e. Listed and labeled, tested to UL 263; as listed in UL Online Certifications Directory.
 - f. Description: Rigid polyisocyanurate foam core utilizing CFC-, HCFC-, and HFC-free blowing agent that has zero ozone depletion potential and negligible global warming potential, bonded to glass fiber/organic mat facings on both sides.
 - g. Top surface tapered to [1/8] [1/4] [1/2] inches per foot.
 - h. Physical properties:
 - 1. Compressive strength: Minimum 16psi; tested to ASTM D1621.
 - 2. Nominal Density: 2.0 pcf, tested to ASTM D1622.
 - 3. Water vapor transmission: Maximum 1.0 perms, tested to ASTM E96.
 - 4. Water absorption: Maximum 1 percent by volume, tested to ASTM C209.
 - 5. Dimensional stability: Maximum 2 percent linear change, tested to ASTM D2126 for 7 days at 158 degrees F and 98 percent relative humidity.
 - 6. Flame spread/smoke developed rating: Maximum 60/160, tested to ASTM E84.
 - 7. Service Temperature: -40°F to 250°F.
 - i. Thermal resistance: Minimum long-term thermal resistance (LTTR) value of [xxx] tested to CAN/ULC-S770.
 - j. Size: 48 x 48 Inches
4. Product: **Tapered Ultra-Max®**
- a. Meet ASTM C1289, Type II, Class 2.
 - b. Class 1 rated, tested to FM 4450; as listed in FM Approval Guide.
 - c. Class A rated for external flame, tested to UL 790; as listed in UL Online Certifications Directory.
 - d. Class A rated for internal flame, tested to UL 1256; as listed in UL Online Certifications Directory.
 - e. Listed and labeled, tested to UL 263; as listed in UL Online Certifications Directory.
 - f. Description: Rigid polyisocyanurate foam core utilizing CFC-, HCFC-, and HFC-free blowing agent that has zero ozone depletion potential and negligible global warming potential, bonded to polymer filled glass fiber mat facings on both sides.
 - g. Top surface tapered to [1/8] [1/4] [1/2] inches per foot.
 - h. Physical properties:
 - 1. Compressive strength: Minimum 16psi; tested to ASTM D1621.
 - 2. Nominal Density: 2.0 pcf, tested to ASTM D1622.
 - 3. Water vapor transmission: Maximum 1.0 perms, tested to ASTM E96.
 - 4. Water absorption: Maximum 1 percent by volume, tested to ASTM C209.
 - 5. Dimensional stability: Maximum 2 percent linear change, tested to ASTM D2126 for 7 days at 158 degrees F and 98 percent relative humidity.
 - 6. Flame spread/smoke developed rating: Maximum 60/160, tested to ASTM E84.
 - 7. Service Temperature: -40°F to 250°F.

- i. Thermal resistance: Minimum long-term thermal resistance (LTTR) value of [xxx] tested to CAN/ULC-S770.
 - j. Size: 48 x 48 Inches
5. Product: **Nailable Base-3**
- a. Meet ASTM C1289, Type V.
 - b. Class 1 rated, tested to FM 4450; listed in FM Approval Guide. (*2" or greater*)
 - c. Description: Rigid polyisocyanurate foam core utilizing CFC-, HCFC-, and HFC-free blowing agent that has zero ozone depletion potential and negligible global warming potential, bonded to APA-rated nailing panel on top surface and glass fiber/organic mat facing on bottom surface.
 - d. Physical properties:
 - 1. Compressive strength: Minimum 16 psi, tested to ASTM D1621.
 - 2. Nominal Density: 2.0 pcf, tested to ASTM D1622.
 - 3. Water vapor transmission: Maximum 1.0 perms, tested to ASTM E96.
 - 4. Water absorption: Maximum 1 percent by volume, tested to ASTM C209.
 - 5. Dimensional stability: Maximum 2 percent linear change, tested to ASTM D2126 for 7 days at 158 degrees F and 98 percent relative humidity.
 - 6. Flame spread/smoke developed rating: Maximum 60/160, tested to ASTM E84.
 - 7. Service Temperature: -40°F to 250°F.
 - e. Thermal resistance: Minimum long-term thermal resistance (LTTR) value [xxx] tested to CAN/ULC-S770.
 - f. Size: 48 x 96 inches.
6. Product: **Thermarroof® Composite-3**
- a. Meet ASTM C1289, Type III.
 - b. Class 1 rated, tested to FM 4450; as listed in FM Approval Guide. (*1.5" or greater*)
 - c. Class A rated for external flame, tested to UL 790; as listed in UL Online Certifications Directory.
 - d. Class A rated for internal flame, tested to UL 1256; as listed in UL Online Certifications Directory.
 - e. Listed and labeled, tested to UL 263; as listed in UL Online Certifications Directory.
 - f. Description: Rigid polyisocyanurate foam core utilizing CFC-, HCFC-, and HFC-free blowing agent that has zero ozone depletion potential and negligible global warming potential, bonded to glass fiber/organic mat facing on one side and a 1/2" perlite board on the other side.
 - g. Physical properties:
 - 1. Compressive strength: Minimum 16 psi, tested to ASTM D1621.
 - 2. Nominal Density: 2.0 pcf, tested to ASTM D1622.
 - 3. Water vapor transmission: Maximum 1.0 perms, tested to ASTM E96.
 - 4. Water absorption: Maximum 1 percent by volume, tested to ASTM C209.
 - 5. Dimensional stability: Maximum 2 percent linear change, tested to ASTM D2126 for 7 days at 158 degrees F and 98 percent relative humidity.

- 6. Flame spread/smoke developed rating: Maximum 60/160, tested to ASTM E84.
 - 7. Service Temperature: -40°F to 250°F.
 - h. Thermal resistance: Minimum long-term thermal resistance (LTTR) value of [xxx] tested to CAN/ULC-S770.
 - i. Size: 48 x [48][96] inches.
7. Product: **Thermarroof® Plus-3**
- a. Meet ASTM C1289, Type I, Class 1.
 - b. Description: Rigid polyisocyanurate foam core utilizing CFC-, HCFC-, and HFC-free blowing agent that has zero ozone depletion potential and negligible global warming potential, bonded to reinforced aluminum foil facers on both sides.
 - c. Physical properties:
 - 1. Compressive strength: [Grade 1][Grade 2][Grade 3] tested to ASTM D1621.
 - 2. Nominal Density: 2.0 pcf, tested to ASTM D1622.
 - 3. Water vapor transmission: Maximum 0.3 perms, tested to ASTM E96.
 - 4. Water absorption: Maximum 1 percent by volume, tested to ASTM C209.
 - 5. Dimensional stability: Maximum 2 percent linear change, tested to ASTM D2126 for 7 days at 158 degrees F and 98 percent relative humidity.
 - 6. Flame spread/smoke developed rating: Maximum 60/160, tested to ASTM E84.
 - 7. Service Temperature: -40°F to 250°F.
 - d. Thermal resistance: Minimum thermal resistance value of [xxx] conditioned to PIMA Technical Bulletin No. 101 and tested to ASTM C518.
 - e. Size: 48 x[96][48] inches.

2.3 ACCESSORIES

(Include the following for insulation which is attached to a wood or steel roof decks.)

- A. Mechanical Fasteners: Approved for use by FM Global in a Class 1 roof deck assembly. Fasteners must also be acceptable to the membrane supplier.

- 1. #12 or #14 FM approved roofing screw with plate.
 - a. SFS Intec Plates
 - b. OMG Plates

Note: Check with manufacturer on approved fastening pattern for specific plates.

- 2. FM approved roofing screw without plates
 - a. Dekfast Nailboard Fasteners
 - b. OMG FastenMaster Headlok

(Include the following for insulation which is attached to primed concrete, cementitious wood fiber or wood decks.)

- B. Hot Bitumen: Asphalt used for such applications shall be ASTM D312, Type III or IV. Asphalt should be applied at its recommended equiviscous temperature (EVT) plus or minus 25°F. The contractor must be prepared to use sufficient quantities of bitumen in flood coat application to fill all deck low-spots so that insulation panels are firmly embedded. These quantities cannot exceed 30 pounds per square at final application.

- C. Cold Applied Adhesives: Polyurethane and polyisocyanurate foam adhesives that are air cured may be used to secure insulation products to appropriate roof deck surfaces. If the roof deck is concrete, the maximum panel size shall be 48 by 48 inches by the nominal thickness. It is important that the contractor use these adhesives in strict accordance with recommended procedures provided by adhesive manufacturer.
- D. NOTE: Do not use cold liquid applied adhesives for attachment of insulation to roof decks or to other layers of insulation. The use of cold liquid applied adhesives to attach insulations to any surface shall release manufacture from any liability for its insulation.

PART 3 – EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

- A. Insulation is shipped in polyethylene wrapped bundles, approximately 48 inches high. These wrapping materials are not adequate for weather protection of the insulation at the job site. Cover the bundles with a tarpaulin or other suitable "breathable" protection cover.
- B. Insulation bundles shall be stored on pallets at least 4 inches above the ground level.
- C. Insulation bundles, when placed on the roof deck for storage, shall be stacked on pallets at least 4 inches above the deck.
- D. Insulation bundles will be unloaded from trucks by a fork-lift truck or similar equipment with suitable forks to slide under bundles. Never roll or tumble bundles off delivery trucks.

3.2 PROJECT CONDITIONS

- A. Do not install insulation on roof deck when water of any type is present. Do not apply insulation material when it is damp or wet.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacture for optimum result. Do not install products under environmental conditions outside manufacturer's absolute limits.
- C. No insulation or membrane system should be installed on a roof deck until all other trades are finished on the roof.

3.3 APPLICATION OF ROOF DECKS

- A. Deck Design:
 - 1. Insulation may be applied over steel, poured-in-place concrete, precast concrete, gypsum concrete, cementitious wood fiber and wood decks.
 - 2. The roof deck must be designed to resist all live, dead, snow and wind loadings without excessive deflections as dictated by the governing building codes. The roof deck should be designed to resist the construction loads without excessive deflections. The deck shall be adequately tied into the building structure to resist wind uplift forces and prevent lateral movement of various sections.
 - 3. Roof decks shall be prepared to receive the roofing system as specified and approved by the membrane supplier. Manufacture does not formally approve the use of any particular roof deck for any membrane roofing system.
 - 4. The roof deck must be designed for proper drainage.

- B. Deck Surfaces:
 - 1. Deck surfaces shall be smooth.
 - 2. All finished surfaces of poured-type decks shall be free of fins, ridges or depressions that will affect the placement or performance of the insulation.
 - 3. Deck surfaces shall be free of all ponded water or other surface moisture.
 - 4. Concrete roof decks should be cured and dry.
 - 5. Deck surfaces shall be swept clean of all debris and trash prior to installing the insulation.
 - 6. Do not leave sawdust or other extraneous materials in the flutes of steel decks.
 - 7. All deck surface irregularities, such as low or high spots, voids or joints between precast units, shall be grouted with appropriate non-shrink grout to return the surface to a proper flat uninterrupted surface to receive the insulation.
- C. Insulation Stops/Deck Penetrations:
 - 1. All roof deck openings, edges and eaves shall have treated wood nailers installed as insulation stops. Treated wood nailers should be at least 6 inches wide and of a thickness equal to the thickness of the insulation. Wood preservative treatment chemicals shall be of a type that is compatible with the roof membrane system.
 - 2. All roof deck penetrations or projections, as well as curb construction, shall be completed prior to the application of the insulation.

3.4 MOISTURE CONTROL

- A. Construction processes, such as curing of plaster or concrete or the use of propane-fired heaters, can generate enough moisture under certain conditions to condense in the roofing system and cause permanent damage. Adequate ventilation should be provided to preclude this possibility or a vapor retarder should be used to limit moisture-laden air from migrating into the roofing system. Manufacture will not assume responsibility for insulation performance when installed under these or similar high-moisture conditions.
- B. The use and placement of a vapor retarder within any insulated roofing assembly must follow the recommendations of the National Roofing Contractors Association in the latest edition of the "NRCA Roofing and Waterproofing Manual". The decision to use a vapor retarder and the selection of the details of the retarder construction is left to the building architect, designer, building owner or their designated representative or agent.
- C. Using two layers of insulation and offsetting joints will further reduce moisture migration into a roofing system.
- D. All concrete decks should be completely isolated from the insulation by a vapor retarder, regardless of the age of the deck. Penetration of any vapor retarder, i.e. fastening through the vapor retarder, will compromise the integrity of the retarder and allow water vapor to penetrate into the roofing system. A combination of vapor retarder, insulation, and roofing membrane that are compatible with hot bitumen applications must be selected. The selection of these elements must include limitation of the insulation to a panel size of 48 by 48 inches.

3.5 INSULATION INSTALLATION

A. General Installing Guidelines

1. Examine deck material for suitability to receive insulation.
2. Verify that all horizontal roof components such as vents, returns, roof hatches ect. are secured properly and installed in conformance with contract drawings and submittals.
3. Verify that insulation is dry, clean and free of foreign material that will damage insulation or impede installation.
4. Do not score, slash or otherwise cut either facing of the insulation product in order to force the panel to conform to deck irregularities or “lay” in a pool of molten mopping bitumen exceeding 30 pounds per square.
5. Do not shave, rasp or carve facers off any insulation panel.
6. Do not force rigid insulation to bend over roof ridges, deck irregularities or conform to deck low points such as drainage swales. Insulation panels must be cut, not scored, to fit around such details. Do not cut or trim of insulation panels with the “score and snap” method.
7. Cant strips for completion of roof edge details must be placed on top of the fully supported insulation product, not underneath.
8. No more insulation shall be laid than can be covered with the completed membrane system by the end of the work for the day.

B. Built-Up Roof (BUR) Membranes:

1. Approved products for use:
 - a. Multi-Max FA-3
 - b. Ultra-Max
 - c. Tapered Thermarroof-3
 - d. Tapered Ultra-Max
 - e. Nailable Base-3
 - f. Thermarroof Composite-3
2. Insulation may be fastened to wood or steel roof decks with one (1) screw and plate type mechanical fastener every four (4) square feet, see NRCA Specification Plate INS-N (Nailable Deck) or INS-S (Steel Deck).
3. Refer to FM Global RoofNav, latest edition, for specific fastener requirements under built-up roof membranes. Refer to FM Global "Loss Prevention Data Sheet 1-28/1-29" for special considerations at perimeters and corners of roofs. Insulation shall not be mechanically attached to precast or poured in place concrete decks.
4. *(Nailable Base-3 is not include in the following)* Insulation limited to 48"x48" may be adhered to primed concrete, cementitious wood fiber or wood decks with hot bitumen according to the following NRCA specifications:
 - a. Specification Plates INS-N or INS-1-N: ATTACHMENT OF INSULATION TO A NAILABLE DECK
 - b. Specification Plates INS-1-C: SECUREMENT OF INSULATION TO A NON-NAILABLE (e.g. CONCRETE) DECK.

5. Insulations used under built-up membrane systems should be protected by an overlay of wood fiber board, perlite or a vented base sheet as specified in Technical Bulletin #9 of the NRCA.
 6. A venting-type base sheet should be applied prior to application of built-up roof membranes over the perlite side of Thermarroof Composite-3.
- C. Fully Adhered Single-Ply Membranes:
1. Approved products for use:
 - a. Multi-Max FA-3
 - b. Tapered Thermarroof-3

NOTE: The direct attachment of fully adhered single-ply membrane systems is not recommended for Ultra-Max, Tapered Ultra-Max, Nailable Base-3, Thermarroof Composite-3 or Thermarroof Plus-3.
 2. Insulation may be fastened to wood or steel decks with one (1) screw and plate type mechanical fastener every two point nine (2.9) square feet. Reduced fastener requirements may be allowed for certain thicknesses of Multi-Max FA-3. Refer to the Product Data Sheet for proper fastening pattern and insulation thickness requirements. Refer to FM Global "Loss Prevention Data Sheet 1-28/1-29" for special considerations at perimeters and corners of roofs. Insulation shall not be mechanically attached to precast or poured in place concrete decks.
 3. Insulation limited to 48"x48" may be adhered to primed concrete, cementitious wood fiber or wood decks with hot bitumen according to the following NRCA specifications:
 - a. Specification Plates INS-N or INS-1-N: ATTACHMENT OF INSULATION TO A NAILABLE DECK
 - b. Specification Plates INS-1-C: SECUREMENT OF INSULATION TO A NON-NAILABLE (e.g. CONCRETE) DECK.
 4. Fully adhered systems must be installed according to the membrane & adhesive manufacture's recommendations.

NOTE: Adhesives must be allowed to completely flash all solvents prior to adhering the membrane.
- D. Mechanically Attached Single-Ply Membranes:
1. Approved products for use:
 - a. Multi-Max FA-3
 - b. Ultra-Max
 - c. Tapered Thermarroof-3
 - d. Tapered Ultra-Max
 - e. Thermarroof Composite-3
 - f. Thermarroof Plus-3
 2. Insulation shall be pre-attached to wood or steel decks with one (1) screw and plate type mechanical fastener every eight (8) square feet. The attachment of the membrane shall provide the additional fastening required to restrain the system. Consult membrane supplier specifications for any additional fastener requirements for the insulation.

3. Fully adhered portions of the mechanically attached membrane shall be installed as outlined in Section 3.5-C.
 4. NOTE: Certain design applications may call for the use of vapor and/or air barriers between the roofing insulation and the roof deck when installing a mechanically fastened single-ply. The use of such sheets or films may cause the system to behave as a fully adhered roofing system and thus require significantly more fasteners in the insulation. Please consult the membrane supplier for recommendations when using air and/or vapor barriers with mechanically fastened single-plyes.
- E. Loose-laid Ballasted Single-Ply Membranes:
1. Approved Products for use:
 - a. Multi-Max FA-3
 - b. Ultra-Max
 - c. Tapered Thermarroof-3
 - d. Tapered Ultra-Max
 - e. Thermarroof Composite-3
 - f. Thermarroof Plus-3
 2. Insulations do not need to be pre-attached to the deck before laying membrane or ballast.
 3. Ballast must be placed at the specified application rate by the membrane supplier to restrain the entire assembly.
 4. Adequate walkway protection must be placed down to support and to roll stone carts into position when ballasting membrane as outlined in section 3.6.
- F. Modified Bitumen Membranes:
1. Approved Products for use:
 - a. Multi-Max FA-3
 - b. Ultra-Max
 - c. Tapered Thermarroof-3
 - d. Tapered Ultra-Max
 - e. Thermarroof Composite-3
 2. Insulation may be fastened to wood or steel decks with one (1) screw and plate type mechanical fastener every four (4) square feet. Refer to FM Global RoofNav for specific fastener requirements under modified bitumen membranes. Refer to FM Global "Loss Prevention Data Sheet 1-28/1-29" for special considerations at perimeters and corners of roofs. Insulation shall not be mechanically attached to precast or poured in place concrete decks.
 3. Insulation limited to 48"x48" may be adhered to primed concrete, cementitious wood fiber or wood decks with hot bitumen according to the following NRCA specifications:
 - a. Specification Plates INS-N or INS-1-N: ATTACHMENT OF INSULATION TO A NAILABLE DECK
 - b. Specification Plates INS-1-C: SECUREMENT OF INSULATION TO A NON-NAILABLE (e.g. CONCRETE) DECK.

4. An overlay of wood fiberboard, perlite or heavy vented base sheet suitable and approved by the membrane supplier is required for torch-applied modified bitumen membrane systems placed over Multi-Max FA-3, Ultra-Max, Tapered Thermarroof-3 , Tapered Ultra-Max or the mat facer side of Thermarroof Composite-3.
 5. Insulations used under hot-mopped down modified bitumen membrane systems should be protected by an overlay of wood fiber board, perlite or a vented base sheet as specified in Technical Bulletin #9 of the NRCA.
 6. A venting-type base sheet should be applied prior to application of modified bitumen membranes over the perlite side of Thermarroof Composite-3.
- H. Multi-Layer Insulation Systems:
1. For single-ply systems over insulation mechanically fastened to the roof deck, use a suitable cover board whenever the thickness of the insulation exceeds 3.0", otherwise the insulation should be installed in multiple layers.
 2. For hot-applied BUR and Modified Bitumen systems, two layers of insulation shall be used whenever the total insulation requirement exceeds 3.0". A two layer system may be installed on a roof deck by mechanically attaching the first layer and then attaching the second layer in hot bitumen. Refer to corresponding sections for details of installation for the selected roof membrane.
 3. When the total thickness is 4" or less, the minimum thickness of any layer must be 1.5" to resist a specified wind load of 1-90.
 4. When the total thickness is over 4" and less than or equal to 12", the minimum thickness of any layer must be 2" to resist a specified wind load of 1-90.
 5. Joints should be offset between the various layers of insulation as well as between the insulation and a cover board.

3.6 ROOF PROTECTION:

- A. Completed portions of the membrane/insulation system shall not be used for storage surfaces or work surfaces without adequate protection first placed over the membrane.
- B. Walkways must be laid on any completed area used for access to the construction area or roof top equipment.
- C. Note: Plywood of 3/4" thickness or greater may be used as a temporary protection layer during construction. Thin OSB panels (i.e. thickness less than 3/4-inch) are considered inadequate for proper protection of an installed roofing system.

END OF SECTION