Johns Manville

Single Ply Roofing Systems (TPO)

Mechanically Fastened Guide Specification

1.0 General

1.01 Description

A. **Scope**
   1. Furnish and install a **JM TPO Mechanically Fastened Roofing Membrane** with flashings and all other incidental and accessory items to comprise a roofing system.
   2. All work shall be in strict accordance with standard detail drawings and specifications issued by Johns Manville (JM) for JM TPO roofing systems.

B. **Related Work**
   The work includes but is not necessarily limited to the installation of:
   1. Vapor retarder
   2. Insulation
   3. Slipsheets
   4. Fasteners
   5. Roof membrane
   6. Membrane flashings
   7. Metal flashings
   8. Walkways
   9. Sealants
   10. Adhesives
   11. Wood blocking
   12. Expansion joints
   13. Drains
   14. Fascia and Copings
   15. Plumbing modifications
   16. Mechanical modifications
   17. Electrical modifications

1.02 Submittals

A. The roofing contractor shall submit all required items at the time of bidding in one comprehensive package. This package includes:
   1. Copies of specifications.
   2. Samples of the major components (i.e., membrane, insulation and flashing) of the roofing system.
   3. The JM TPO roofing systems printed product data.
   4. Specimen copies of the JM Peak Advantage Guarantee.
   5. Dimensioned shop drawings of the roof including building height.

1.03 Quality Assurance

A. The roofing contractor must be authorized by JM to install JM TPO roofing systems.
B. The roofing contractor must have been trained by a technical representative of JM and be familiar with the JM TPO product.
C. The roofing contractor shall submit the completed Pre-Installation Notice (PIN) to the JM Technical Services Department for acceptance before ordering material.
D. No deviations shall be made from this specification or JM TPO roofing systems Detail Drawings without prior written authorization from the JM Technical Services Department.
E. Upon completion of the installation, and after written notification to JM that all work has been completed in strict accordance with the contract specifications and the JM requirements, a guarantee evaluation shall be made by a representative of JM for the purpose of determining whether the system installed meets the JM requirements for Guarantee Issuance.

1.04 Delivery, Storage and Handling

A. Deliver all materials to the jobsite in their original, tightly sealed containers or unopened packages.
B. All materials shall be clearly labeled with the name of the manufacturer and product identification.
C. All materials must be protected from damage during transit, handling, storage and installation. Place all materials on pallets and fully protect from moisture.
D. All materials shall be stored in a dry area and protected from the elements. Membrane rolls shall be stored flat on pallets.
E. Adhesive shall be stored at temperatures between 50°F and 80°F (10°C and 27°C).
F. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined by material manufacturer/supplier.
G. All materials determined to have been damaged shall be replaced with new materials.

1.05 Job Conditions

A. This specification is acceptable for use with structures designed to support lightweight roof assemblies. The adequacy of the structural support must be verified by the owner or the technical representative of the owner and is that person's sole responsibility to determine. Potential live loads, such as snow or ponding water, should be considered.
B. JM TPO roofing systems materials may be installed under certain adverse weather conditions such as extremes of high and low temperatures, or high humidity conditions but only after consulting the JM Technical Services Department since special precautions may have to be taken. Installation costs, production rates and material performance may be affected by the foregoing conditions.
C. Only as much new roofing as can be made weathertight each day shall be installed each day. This includes all flashing work.
D. Any substrate to receive new insulation, membrane or flashing shall be thoroughly dry. Should surface moisture occur, the contractor shall provide adequate equipment to dry the substrate.

E. Prior to and during application, the contractor shall ensure that all dirt, debris and dust be removed from surfaces to be roofed for both new and reroofing substrates.
F. On all reroof jobs and for all lightweight deck systems, pullout tests shall be performed by the representative of the owner or roofing contractor to verify the condition of the deck or substrate and to confirm system design pullout values. A minimum of 10 pullout tests for areas up to 500 squares (4645 m^2) is required, thereafter 2 tests per 100 squares (929 m^2) is considered sufficient. Tests should be taken approximately 60% in perimeters and 40% from field areas. A written report of pullout test results shall be submitted to the JM Technical Services Department for review.
G. Precautions shall be taken to prevent wind blow-off or wind damage during the course of the roofing application. This may necessitate additional securement of temporary construction.
H. The contractor shall verify and ensure that all roof drain lines are unblocked before starting work. If any drain blockages are found, they shall be reported to the owner or their representative and the JM Technical Services Department in writing.
I. Temporary waterstops shall be installed at the end of each work day or if inclement weather conditions dictate. These temporary waterstops shall be removed at the start of the next work day and disposed of properly.
J. Do not install the JM TPO roofing membrane in direct contact with any product containing coal tar pitch, creosote, or other harmful materials. Consult the JM Technical Services Department for special installation requirements and see Section 3.07 for slipsheet requirements.
K. Do not allow waste products containing petroleum, grease, acid, solvents, vegetable or mineral oil, animal oil, animal fat, etc. or direct steam venting to come into direct contact with the JM TPO Roofing Membrane. Contact the JM Technical Services Department for recommendations if such conditions exist.
L. The contractor shall follow all safety regulations as recommended by OSHA.
M. All work shall be scheduled and executed without exposing interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks. Arrange work sequences to avoid use of newly constructed roofing for storage, walking surfaces and equipment movement. **Contractor shall provide all necessary protection and barriers to segregate the work areas and prevent damage to adjacent areas. If excessive foot traffic over newly installed membrane is necessary, contractor shall provide plywood or polyester felt protection to prevent damage.**
N. All existing roofing materials to be removed for construction shall be immediately removed from the construction site to a dumping area authorized to receive such debris.
O. Any unusual or concealed conditions discovered during the course of the work is to be reported to the owner or their representative immediately in writing and work shall be halted until the owner or their representative has responded with a solution to the problem.
P. When a system is specified to meet an Underwriter's Laboratories, Inc. or FM Global's rating, all materials used in the system must be UL or FM Global labeled and approved for use for that particular system.
Q. All local building codes and requirements must be followed where applicable. It is the sole responsibility of the roofing contractor to determine any and all local building code requirements and to ensure that the roofing system selected complies with such requirements.
R. Certain project conditions may require some modification to this specification. Contact the JM Technical Services Department if any of the following conditions exist:
   1. Roof height greater than 60' (18.3 m).
   2. Geographical location with roof field area uplift pressures of 46 psf (225 kgs. per sq. meter) or higher, per the FM Global current edition of Loss Prevention Data Sheet 1-28.
   3. Geographical location in a 115 mph (185 km/hr) or greater wind zone, per the ANSI/ASCE 7, 50 year mean recurrence interval wind isotach.
   4. Location with a "D" exposure as determined in ANSI/ASCE 7.
   5. Buildings with high internal humidity, such as swimming pools, textile mills, paper mills, etc.
   6. Buildings which are highly pressurized or have the potential for high internal pressures.

1.06 Peak Advantage Guarantees and Warranties

A. **Peak Advantage Guarantees and Warranties**
JM offers a choice of either material warranties or more comprehensive roofing guarantees to the owner. The desired warranty or guarantee shall be selected from the following list prior to starting the project:

1. **NDL (No Dollar Limit) -** This Guarantee assures the owner that JM, under the Roof Guarantee Agreement, is responsible for maintaining the roof in a watertight condition if leaks occur solely as a result of deterioration of or improper workmanship in applying the JM materials or products. The obligation under the Peak Advantage NDL Guarantee is for a specific number of years (typically 10 or 15 years) and specifies no maximum monetary amount of coverage (No Dollar Limit).
2. **Material Warranty -** This Warranty ensures the owner that JM, under the Material Warranty Agreement, is responsible, at the election of JM, to either re-supply a prorated amount of like material **or** to issue a credit for the prorated cost of the defective material. This Warranty applies only to the JM membrane determined to be defective and only when roof leaks are occurring

due to that defective membrane. The obligation under the Material Warranty is for typically 10 or 15 years and specifies that the monetary obligation shall not exceed the prorated material cost as set forth in the schedule provided in the Material Warranty.

B. **Maintenance**
Long-term performance of a roofing system depends on adequate ongoing maintenance programs. JM requires building owners establish regularly scheduled annual inspections to ascertain the condition of the roof system and to perform those maintenance items required to keep the roofing system performing properly. Records of all maintenance work performed must be retained for the entire warranty period. Please consult JM for specific recommendations.

Part 2 - Products

2.01 General

A. The JM TPO Mechanically Fastened Roofing System components shall be produced or supplied by JM.

B. Components to be used other than those manufactured by JM may be accepted based on chemical compatibility and published performance data. The specifications, installation instructions, limitations and/or restrictions of the respective manufacturers must be reviewed by the designer for acceptability for use with the JM TPO roofing systems products. All of these components may be considered on a case-by-case basis and must be accepted in writing by the JM Technical Services Department.

2.02 Roofing Membrane

A. JM TPO ____ Mechanically Fastened Roofing Membrane ____ mils (____ mm) nominal thickness.

B. JM TPO Membrane shall equal or exceed the minimum physical properties published in the JM TPO roofing systems product data sheets.

2.03 TPO Materials Supplied by JM

A. **Flashing Membrane -** May be JM TPO-45 FR, JM TPO-60 FR, JM TPO-72 FR, or JM TPO-80 FR depending on the thickness of the field sheet.

B. **Flashing Metal -** JM TPO-Coated Metal is manufactured by laminating a non-reinforced TPO membrane to a 24 gauge (0.61 mm) galvanized steel. It is used for flashing and edge metal detailing.

C. **Membrane Fasteners and Plates -** JM TPO roofing systems offer a variety of membrane and insulation fasteners and plates to meet specific job conditions and substrates.

D. **Adhesive -** JM TPO Membrane Adhesive shall be used for bonding the JM TPO flashing membrane to vertical substrates of wood, metal, concrete and some insulations. Both solvent-based and VOC compliant TPO membrane adhesives are available.

E. **JM TPO Sealing Mastic -** JM TPO Sealing Mastic ia a one part, gun grade butyl sealant. It is used to seal JM TPO membranes and flashings to roof drains. It is also used as a caulking and sealant at metal flashings, walls, pipes and gravel stops when protected from the UV exposure. Available in 11 fl. oz. (326 ml) cartridges. Coverage rate equals approximately 25 linear feet (7.6 lineal meters) of ¼" (8 mm) bead per cartridge.

F. **Edge Sealant -** JM TPO Cut Edge Sealant is a polymeric sealant specifically designed for sealing cut edges of TPO membrane.

G. **Membrane Cleaner -** JM TPO Weathered Membrane Cleaner is a clear liquid used for cleaning dirt and other contaminants from the membrane surface.

H. **Prefabricated Details -** JM TPO Universal Inside/Outside Corners, and JM TPO Vent Pipe Boots in sizes to fit pipes from 1" to 6" (25 mm - 150 mm).

I. **Detail Membrane -** JM TPO Detail Membrane is a 12" (300 mm) or 24" (600 mm) wide by 50' (15.3 m) long, non-reinforced .060" (1.5 mm) membrane used for detail work such as wrapping pipes and vertical stacks.

J. **JM TPO Membrane Primer -** JM TPO Membrane Primer is a synthetic rubber based primer designed for preparation of TPO membrane surfaces to be adhered using TPO tape products. It can be used to prime TPO membranes in a one step operation.

K. **Walkway -** Walkway shall be JM TPO Walkpad consisting of TPO membrane with a textured top surface. It is used to protect the roofing membrane system in areas with high rooftop traffic and regular maintenance.

L. **Slipsheets -** JM offers a 9 oz. per sq. yd. (0.31 kgs. per sq. meter) Polyester Mat Protection Material — needle-punched polyester fabric slipsheet for use in its TPO roofing systems. Use of a slipsheet is dependent upon the particular application.

2.04 Insulation Materials

A. **Insulation**
1. Insulation shall be installed as a separation layer over the existing substrate and/or to obtain the desired thermal value.
2. Insulation shall be compatible with JM TPO Membrane.
3. The following roofing insulation boards are acceptable for use in a JM TPO Mechanically Fastened Roofing System:
   a. ENRGY 3, ISO 3, Tapered ENRGY 3, Tapered ISO 3 and Invinsa polyisocyanurate insulations having a non-asphaltic facer meeting or exceeding the requirements of ASTM C 1289 with a minimum compressive resistance of 18 psi (124 kPa).
   b. Fesco, Tapered Fesco or ½" (15 mm) Retro-Fit perlite insulation meeting ASTM C 728.
   c. JM high density wood fiberboard with non-asphaltic binders.
4. Insulation(s) shall have a minimum "R" value of _____.
5. Insulation(s) thickness shall be a minimum of _____ inches (_____ mm).

2.05 Other Materials

A. **Wood Nailers**
1. Nailers shall be #2 or better lumber. Nailers shall conform to the current JM and NRCA recommendations on wood nailers. Creosote and asphaltic preservatives are not acceptable.
2. Wood nailers shall conform to the FM Global Loss Prevention Data Sheet 1-49 recommendations.

B. **Vapor Retarders**
1. Vapor retarders shall meet specified code and/or insurance requirements.
2. Vapor retarders shall be compatible with insulation and other accessories.
3. Vapor retarders shall be acceptable to or manufactured by JM.

2.06 Precautions

A. Do not use JM TPO roofing systems products near fire or flame.
B. Avoid breathing vapors of solvent, sealant and adhesives. Use with adequate ventilation. Avoid prolonged contact of solvents, sealants and adhesives with skin.
C. Do not use open flames to expedite drying of surfaces, sealants or adhesives.
D. Consult Material Safety Data Sheets and container labels for specific safety instructions. MSDS sheets are available by calling the JM Product Information Center at 1-800-654-3103 or through the JM Web site at www.jm.com.
E. Do not paint JM TPO-Coated Metal or membrane with oil-based paint. Consult the JM Technical Services Department for recommendations.
F. Do not allow muriatic acid used to clean masonry to come in direct contact with the JM TPO Roofing Membrane.

Part 3 - Execution

3.01 General

A. When installing JM TPO Mechanically Fastened Roofing Membrane in cooler weather, it is recommended that liquids such as solvents, sealants, etc. be stored at warmer temperatures (50°F [10°C] or more but not exceeding 80°F [27°C]) until just prior to use in order to facilitate the installation.

3.02 Substrate Conditions

The following general conditions apply to the substrate that will receive a JM TPO Mechanically Fastened roofing system for both reroof and new construction:

A. The roof deck must be structurally sound to provide proper securement for mechanical fasteners. Areas showing a loss of integrity because of corrosion, rotting, warping, concrete spalling, etc., must be repaired or replaced prior to installing the roofing system.
B. It is imperative that the roofing contractor make test cuts at each roof area prior to reroofing. The condition of the substrate must be suitable to receive a JM TPO Mechanically Fastened Roofing System. Wet insulation must be removed and replaced. See Single Ply Roofing Institute (SPRI) Guidelines for determining wet insulation.
C. A determination must be made regarding the presence of coal tar pitch within the existing roof assembly. The presence of coal tar pitch requires special precautions. JM recommends against installing a mechanically fastened TPO system on top of coal tar pitch roofs with steel decks. On other deck types, a JM DN Flameguard slipsheet must be installed directly on top of the properly spudded coal tar with all joints butted tightly together or completely taped to prevent volatiles from damaging roof membrane, followed by appropriate insulation.
D. Contact the JM Technical Services Department when substrate is exposed to excessively high humidity and/or a corrosive environment. Special fasteners or details may be required.
E. It is acceptable to install a JM TPO Mechanically Fastened roofing system over the following deck substrates in new construction, provided that an acceptable insulation and/or the appropriate slipsheet is installed over the substrate as needed. In some cases, direct installation of the JM TPO roof system may be acceptable.

1. Structural metal deck (22 gauge [0.76 mm] minimum) shall conform to recommendations outlined in the FM Global Loss Prevention Data Sheet 1-29.
2. Plywood (15⁄32" [12 mm] minimum) or Oriented Strand Board (OSB) (7⁄16" [11mm] minimum) shall be exterior grade (minimum APA rated Structural Sheathing, Exposure 1).
3. Structural concrete and pre-cast, pre-stressed concrete (3,000 psi [20,685 kPa] minimum) shall be cured and dry to industry standards, and the surface shall be smooth and free of moisture or frost. All sharp ridges or other projections above the surface shall be removed before roofing.
4. Lightweight insulating concrete fill and metal formwork (minimum 26 gauge [0.45 mm] metal formwork) - the roof deck shall be cured and dry to the manufacturer of the deck and/or industry standards and shall be smooth and free of ridges and depressions. All necessary venting as recommended by the roof deck manufacturer shall be accomplished.
5. Wood plank (1" [25 mm] minimum) shall conform to the FM Global requirements for Class I decks.
6. Cementitious wood fiber decks - Certain cementitious wood fiber decks may be acceptable to receive a JM TPO Mechanically Fastened roofing system after pullout tests have been completed and appropriate fasteners have been selected. Please consult the JM Technical Services Department for the most recent recommendations.
7. Gypsum concrete deck - shall be cured and dry to the manufacturer and/or industry standards. The surface of the deck shall be smooth and free of ridges and depressions.
8. Contact the JM Technical Services Department for detailed requirements for these deck types and others not listed above.

3.03 Preparation of Existing Substrate

A. General
   1. To prevent delays or interruptions, coordinate work with other trades or suppliers to ensure that components to be incorporated into the JM TPO Mechanically Fastened roofing system are available as the work progresses. Examine substrates to which the roofing materials are to be applied to ensure that their condition is satisfactory for the application of the JM TPO Mechanically Fastened roofing systems. Do not permit voids greater than ¼" (8 mm) wide in the substrate. Concrete substrates shall be cured and free of laitance and curing compounds. Substrates for roofing materials shall be dry and free of oil, asphalt, dirt, grease, sharp edges and debris. Inspect substrates and correct defects before application of roofing membrane.
   2. Blisters, buckles and ridges shall be cut and patched to provide a reasonably level substrate surface.
   3. Gravel over existing nailers must be totally removed prior to installing new nailers and flashings. Verify that the existing nailers are securely anchored to the roof decks.
   4. When an additional thickness of insulation is being added, new nailers must be added to match the height of the new insulation. Nailers must be securely anchored to the roof deck per Section 3.05.
   5. All roof surfaces shall be free of ponding water, ice and snow.
   6. Specifier and/or roofing contractor shall determine the condition of the existing roof deck and roofing. Areas with deteriorated decking or wet insulation or other materials shall have those affected materials removed and replaced.
   7. When removing an existing roof during reroofing, remove only that amount of roofing and flashing that can be made watertight with new JM TPO roofing systems materials in a one-day period or prior to the onset of inclement weather.

3.04 Vapor Retarder Installation (Where Specified)

General

Specific climatic and job conditions may require the use of a vapor retarder. It is the sole responsibility of the design professional to determine the need for a vapor retarder and its type and location in the roofing system. A vapor retarder may often act as an "air barrier" which may have a positive effect in reducing internal air pressure. Air barriers should be strongly considered for buildings subject to high internal air pressure such as airplane hangars and buildings with many loading bays such as warehouse facilities.

The National Roofing Contractor's Association recommends the installation of vapor retarders when interior relative humidity is 45% or greater, and/or the outside mean January temperature is below 40°F (4°C).

Install a vapor retarder over a suitable substrate with all side and end laps and all penetrations sealed in accordance with the instructions provided by the manufacturer. The vapor retarder may be loosely laid or adhered with the adhesive recommended by the manufacturer. In re-roofing where the existing built-up roof is to remain, the built-up roof may be an adequate vapor retarder as long as all splits or tears are repaired in order to provide a total barrier to vapor penetration.

JM recommendations for base sheet attachment must be followed as a minimum. Contact the JM Technical Services Department for specific requirements.

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3.05 Wood Nailers

A. Install nailers at the perimeter of the roof and around all roof penetrations and projections (unless otherwise shown on JM TPO roofing systems Detail Drawings).
B. Nailers shall be firmly anchored to the decks and shall resist a pullout force of 200 lbs./lineal foot (2.9 kN/m) in any direction. A ½" (15 mm) vent space shall be provided between adjacent lengths of nailers. Fasteners shall be installed within 6" (150 mm) of each end. Spacing and fastener embedment shall conform to FM Global Loss Prevention Data Sheet 1-49 recommendations.
C. Height of nailers shall match the surface level of the insulation and roof membrane.
D. All woodwork to be reused shall resist a minimum force of 200 lbs./lineal foot (2.9 kN/m) in any direction and shall be free of rot. If any existing woodwork is questionable, it should be removed and replaced with suitable new materials.

3.06 Insulation Installation

A. **General**
1. Insulation shall be installed in accordance with the current JM published specifications and recommendations for use with mechanically fastened roofing.
2. Insulation shall be secured to the roof deck in accordance with the JM requirements. As a minimum requirement, it shall be secured at a rate of 5 fasteners per 4' x 8'' (1.22 m x 2.44 m) board, 4 fasteners per 4' x 4' (1.22 m x 1.22 m) board or 3' x 4' (0.92 m x 1.22 m) board and two fasteners per 2' x 4' (0.61 m x 1.22 m) board, and with tight joints in parallel courses with end joints staggered. When more than one layer of insulation is to be used, succeeding layers shall be laid staggered in relation to the previous layer of insulation, and all joints shall be staggered.
3. Insulation shall be neatly cut to fit around all penetrations and projections with a maximum allowable gap of ¼" (8 mm).
4. Open joints shall be repaired with like insulation material.
5. When the insulation is installed on steel decks after a complete tear-off, or in new construction, edges shall be checked so that no edges are left unsupported along the flutes.
6. Insulation shall be feathered or tapered to provide a sump area a minimum of 36" x 36" (0.92 m x 0.92 m) at all drains.
7. Install no more insulation in one day than can be covered with the JM TPO Membrane before the end of the day or before the onset of inclement weather.
8. Install tapered insulation in accordance with the JM Tapered Design Group shop drawings.

B. **Mechanical Attachment**
1. All insulation boards must be mechanically attached to "standard" decks unless specifically accepted for hot asphalt securement for the particular application of the JM TPO roofing systems.
2. "Standard" decks shall be defined as 22 gauge (0.76 mm) or heavier steel decks, poured structural concrete 3000 psi (20,685 kPa) or greater, 15/32" (12 mm) or greater plywood, 7/16" (11 mm) or greater OSB, and 1" (25 mm) minimum wood plank. Other deck types may be accepted by JM for mechanical attachment of insulation in certain, specific applications. Contact the JM Technical Services Department in these cases.
3. All insulation must be secured to the structural deck with JM fasteners at rates published by the insulation manufacturer and according to recommendations published by FM Global for mechanically fastened applications as a minimum standard. Additional fastening may be required to provide an acceptable substrate depending upon actual project conditions.

3.07 Slipsheet Installation

When a slipsheet is desired, slipsheet installation shall be in accordance with the following method:
A. Overlap 9 oz. per sq. yd. (0.31 kgs. per sq. meter) polyester fleece a minimum of 4" (100 mm) at each edge. Leave joints untaped. If installing in windy conditions, install fastener and plate in lap area of slipsheet every 3' (0.92 m) o.c. to prevent displacement.
B. The installation of the slipsheet shall be immediately followed by the installation of the roof membrane and fasteners to prevent displacement of the slipsheet.

3.08 Membrane Installation

A. **General**
Unroll the JM TPO roofing membrane and position. Allow the membrane to relax at least 15 minutes when the temperature is above 60°F (16°C), or 30 minutes when the temperature is below 60°F (16°C), prior to installation. Inspect for any damaged membrane. Remove sections of membrane that are creased or damaged.
B. **In-Lap Fastening**
1. Perimeter - When installing JM TPO Mechanically Fastened roofing systems, install a minimum of two perimeter sheets parallel to the perimeter and fastened with JM TPO roofing systems accepted fasteners and plates at the predetermined spacing in the lap area in a line centered approximately 1½" (40 mm) from the edge of the sheet leaving ½" (15 mm) of membrane outside the plate. Weld lap area to membrane with a minimum 1½" (40 mm) wide continuous weld.
Perimeter areas shall be determined by the following methods:

For FM Global insured buildings, follow guidelines in the FM Global Loss Prevention Data Sheet 1-28, i.e. the smaller of 0.1 times the lesser plan dimension or 0.4 times the height, but not less than 4% of the lesser plan dimension, or 3 ft. (0.92 m). For non-FM Global insured buildings where other requirements do not exist, use the current version of ANSI/ASCE 7. Typically, a minimum of 3' (0.92 m) or the lesser of 40% of the building height or 10% of the lesser plan dimension, if greater than 3' (0.92 m).

2. Field Areas
   a. Membrane should run perpendicular to the direction of steel deck flutes and the orientation of wood decks.
   b. All membrane overlaps are recommended to be installed to facilitate the flow of water.
   c. All membrane sheets shall be overlapped a minimum of 5½" (140 mm) to provide space for fastener and plate placement and for a minimum 1½" (40 mm) wide continuous weld.

C. The roofing contractor shall check all welded seams for continuity and integrity samples using a blunt ended seam pick or other suitable blunt object. Seam checks shall be made daily by the contractor. Seam samples 2" (50 mm) wide and 12" (300 mm) long shall be taken a minimum of three times a day from completed seams; at least one must be from the first seam made that day. Each test cut shall be patched by the contractor at no extra charge to the owner. Test cuts shall be used by the roofing contractor to ensure adequate seam strength.

3.09 Welding of Lap Areas

A. **General**
   1. JM TPO roofing systems are welded by hot air welding.
   2. All surfaces to be welded shall be clean and dry. No adhesive shall be present in the lap areas.

B. **Hot Air Welding**
   1. Machines for hot air welding are available from several different sources. Each set of manufacturer's operating instructions shall be followed, as well as all local codes regarding electric grounding, supply and other related functions. Since most automatic welding machines require 218 to 230 volts, the use of a portable generator on the roof is recommended for greater flexibility.
   2. Hand-held welding machines are also available to weld membrane. After the preheated nozzle tip is inserted in the overlap area and the material starts to flow, immediately follow with a hand roller to press the heated membrane surfaces together with slow, even movements. Keep the roller within 1" (25 mm) of the nozzle tip. Angle the hot air tool so that the flowing air faces the roller. The temperature of the hot air tool shall be adjusted so that material from the bottom of the sheet begins to soften and flow from the seam. Seam strength may be tested when cool.

C. **Quality Control of Seams**
   After either seaming method, the seams shall be checked for integrity with a blunt-ended probe. Any openings or "fishmouths" shall be repaired with a hand-held hot air tool fitted with a narrow nozzle tip and with a roller. Each day, several sections of seams shall be pulled apart by the roofing contractor to test the quality of the welds. Should the welds be deficient, a more thorough examination of the work performed must be carried out and necessary repairs made.

3.10 Flashing Installation

A. **Metal Flashing**
   1. JM TPO-Coated Metal flashing shall be installed in accordance with JM TPO roofing systems Detail Drawings.
   2. Complete all metalwork concurrently with roofing and flashings so that a watertight condition exists daily.
   3. JM TPO-Coated Metal transitions are required at all peaks, valleys and slope intersections where the net change in slope is 1½ : 12. In some cases, reinforced membrane may be sufficient for ridges, but should be fastened securely at all transition areas. Contact the JM Technical Services Department for specific recommendations.
   4. Metal shall be installed to provide adequate resistance to bending and to allow for normal thermal expansion and contraction.
   5. All metal joints shall be watertight and staggered over nailer joints to prevent joints in nailers and joints in metal from aligning.
   6. Base flashings shall extend a minimum of 8" (200 mm) above roofing level.
   7. All metal flashings and terminations shall be securely fastened in the plane of the roof deck with fasteners recommended by JM.
   8. Fasteners and roofing nails used to secure flashings to wood nailers shall be stainless steel, galvanized metal or other corrosion-resistant material, with a head diameter of not less than ⅜" (10 mm), and with fastener penetration into the wood nailer of at least 1½" (40 mm).
   9. Scuppers and metal overflows shall be assembled using JM TPO-Coated Metal.
   10. All JM TPO-Coated Metal shall be fabricated to form hemmed edges to prevent sharp metal edges from cutting the membrane, except when used in conjunction with wood nailers.

B. **Membrane Flashings**
   1. All membrane flashings shall be installed concurrently with the roof membrane as the job progresses. Temporary flashings are not allowed without prior written approval from the JM Technical Services Department. Should any water penetrate the new roofing because of incomplete flashings, the affected area shall be removed and replaced at the expense of the contractor.
   2. Membrane flashings shall be fully adhered using JM TPO Membrane Adhesive (solvent-based only).
      a. If the membrane flashings are to be fully adhered using JM TPO Membrane Adhesive, the following conditions must be met:
         1. All surfaces to be fully adhered should be compatible, dry and smooth with no excessive surface roughness. (If an existing asphalt surface is present, an acceptable asphalt barrier should be installed over the existing flashings to fully divorce the JM TPO flashing membrane from any incompatible materials.)
         2. After the proper surface has been prepared, JM TPO Membrane Adhesive shall be applied using a minimum ½" (15 mm) nap paint roller as per the container or the applicable data sheet. Apply adhesive in a smooth, even coating.

            JM TPO Membrane used as a flashing shall be cut to a workable length and shall have an even coating of JM TPO Membrane Adhesive applied as per the container or the applicable data sheet. Carefully roll onto the previously coated substrate, after the adhesive coating the membrane and substrate has dried sufficiently (after approximately 15 - 30 minutes). Coverage rates will vary depending on substrate and environmental conditions such as ambient temperature and humidity.

            Avoid wrinkling the membrane when applying to substrate. After mating membrane to the substrate, carefully roll the membrane with a hand roller to promote maximum positive contact between the membrane and the substrate. Overlap all adjacent flashing sheets a minimum of 2" (50 mm). The JM TPO Flashings shall extend a minimum of 6" (150 mm) onto the field sheet and be adhered securely, or a minimum of 3" (80 mm) in front of the fastener plates with a minimum 1½" (40 mm) weld width. All side laps shall overlap a minimum of 2" (50 mm) with a minimum 1½" (40 mm) weld width.
   3. Areas of the flashing membrane to be welded are not to have JM TPO Membrane Adhesive applied to them.
      a. All flashings shall extend a minimum of 8" (200 mm) above roofing level.
      b. All flashings shall be hot air welded at their connections with the roofing membrane.
      c. JM TPO membrane flashing shall be terminated according to JM TPO roofing systems Detail Drawings.
   4. Outside corners on curbs, etc. must use JM TPO Reinforced Outside Corners. Field wrapping is not acceptable.

3.11 Walkway Installation

Walkways shall be provided in areas where routine rooftop maintenance occurs and in areas where regular rooftop traffic is expected.

A. **JM TPO Walkpad Installation**
   1. Install JM TPO Walkpad material over clean, dry surfaces.
   2. Lay out areas where JM TPO Walkpad material is to be installed with most of the material being oriented so that it is placed between the field seams in maximum lengths of 30' (9.2 m) with each adjacent and abutting section gapped a minimum of 6" (150 mm).
   3. Heat weld (minimum 1½" [40 mm] wide weld) the perimeter of the properly positioned JM TPO Walkpad Material. Check seams for any voids or inconsistencies which might prevent watertightness.
   4. Apply seam sealant at all welded edges.

B. **Precast Pavers**
   1. Install the precast concrete paver system acceptable to JM over one layer of 9 oz. per sq. yd. (0.31 kgs. per sq. meter) polyester fleece, an extra layer of JM TPO Membrane or other acceptable protection layer.

3.12 Waterstops

A. Install temporary cutoffs around incomplete edges of the roofing assembly at the end of each work day and when work must be postponed because of inclement weather. Straighten the insulation line using pieces of insulation loosely laid, and seal the JM TPO membrane to the deck or existing membrane. Use a heavy application of roof cement or hot asphalt at least 6" (150 mm) in width overlayed with an embedded reinforcement. Remove the temporary seals completely when work resumes, cutting out the contaminated membrane. Remove all sealant, contaminated membrane, insulation fillers, etc. from the work area and properly dispose off-site.

Mechanically Fastened Guide Specification

3.13 Maintenance

A. Long-term performance of a roofing system depends on adequate ongoing maintenance programs. JM requires building owners establish regularly scheduled annual inspections to ascertain the condition of the roof system and to perform those maintenance items required to keep the roof system performing properly. Records of all maintenance work performed must be retained for the entire warranty period. Please consult JM for specific recommendations.

General Conditions For Use

JM TPO Roofing Systems Fastening Patterns are used to estimate jobs which conform to the following criteria:

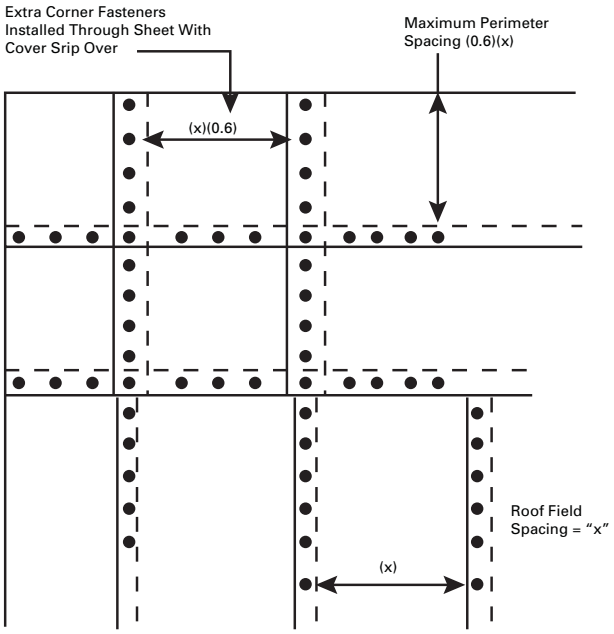
1. All FM Global approved deck types
2. Plywood decks, 15⁄32" (12 mm) thick or greater or OSB decks 7⁄16" (11 mm) or greater
3. Concrete decks, (3,000 psi [20,685 kPa]) or greater
4. Buildings having a maximum height of 100' (30.5 m)
5. Buildings in wind zones having Design Wind Pressures up to 45 psf (220 kgs. per sq. meter) calculated per the most recent version of ANSI/ASCE 7
6. Buildings having exposures "A", "B" and "C". All "D" exposure buildings **must** be calculated and approved by the JM Technical Services Department.

FM Global Loss Prevention Data Sheet 1-28

When jobs are specified to meet FMRC requirements, the requirements to calculate perimeters areas are as follows:

1. The smaller of 0.1 times the lesser plan dimension or 0.4 times the height, but not less than 4% of the lesser plan dimension, or 3 ft. (0.92 m).

2. Only perimeter rolls may be used for these perimeters.



Notes: 1. Fastener spacing along all rows is the same as field spacing.
2. If two layers of membrane are installed in the corner areas, all fasteners must secure the top layer.

Corner Areas

All corners shall be the intersections of the perimeter areas. The perimeter rolls should be "picture-framed" and the perimeter rolls should be fastened all the way into the corner. The other perimeter sheets are fastened all the way into the corner area and overlay the previously fastened perimeter sheets to produce a corner area that is fastened at twice the density of the perimeter area.

Fastening Patterns

Appropriate Steel Deck (22 gauge [0.76 mm] minimum), High Load Fastener and Plate 12" (300 mm) o.c. for field area, perimeter area and corner areas. Half sheets are required in perimeter and corner areas.