

1.0 General Information

1.1 This section provides application information, and outlines specifications currently available from Johns Manville (JM) Roofing Systems, for APP (Atactic Polypropylene) modified bitumen roofing products. APP modified bitumen products may be installed by heat welding and select products in JM MBR Cold Application Adhesive.

1.2 All general information contained in this section and in the current JM Commercial/Industrial Roofing Systems Manual shall be considered part of these specifications.

1.3 Specifications are available for systems installed over insulation, nailable, non-nailable and lightweight fill substrates. JM offers systems that can be installed by heat welding or in JM MBR Cold Application Adhesive.

1.4 For heat-weld application, all safety procedures must be reviewed prior to application. **All contractors must understand, review and adhere to the information contained in the following sources:**

- Johns Manville Safety Guidelines for Heat Weld Application
- ARMA Guide to Torch Safety
- ARMA Torch Safety Video

1.5 JM does not recommend the use of traditional asphalt cut-back mastics under any APP modified bitumen product. The use of cut-back mastics over the modified bitumen product (e.g., to strip in the edges of a base flashing) is acceptable. JM has developed two adhesives — MBR Cold Application Adhesive and MBR Utility Cement — that are compatible with all of the JM APP bitumen products. They should be used whenever a cold adhesive application is necessary or preferred.

1.6 Each specification in this section is eligible to receive a JM Peak Advantage Guarantee. Refer to the information on guarantees in the current JM Commercial/Industrial Roofing Systems Manual, or contact a JM representative for additional information.

1.6.1 This manual clearly differentiates between **requirements** and **recommendations**. This manual has been written to assist the specifier to develop a comprehensive bid package. The information is presented in an explanatory fashion rather than the authoritative, instructive manner commonly utilized in construction specifications. When experience, technical knowledge or established testing procedures support a policy or position, it is clearly identified, (i.e., “JM requires” or “is not acceptable”). When the use of a particular product or practice is desirable, the reference is stated as an opinion rather than an absolute fact (i.e., “JM recommends” or JM suggests”).

It is mandatory that all requirements be complied with; however, it may not be necessary to follow all recommendations to qualify for a guarantee.

1.7 Drainage of water off any roof membrane is necessary to prolong the service life of the system. JM, therefore, has the following policy:

Drainage: Design and installation of the deck and/or membrane substrate must result in the roof draining freely, to outlets numerous enough and so located as to remove water promptly and completely. Areas where water ponds for more than 24 hours are unacceptable and will not be eligible for a JM Peak Advantage Guarantee.

1.8 Flashings: Refer to Section 3 of the current JM Commercial/Industrial Roofing Systems Manual for APP Flashing Specifications and Details. APP details will begin with the prefix “WFE.”

2.0 Membrane Substrate

2.1 The surface on which the APP modified bitumen roofing membrane is to be applied should be one of the following JM products: DuraBoard, JM APP Base Sheet, Ventsulation Felt, DuraFoam, PermaPly 28 or an approved structural substrate. GlasPly Premier and GlasPly IV may be used in selected specifications. (See “Roof Finder Index,” in this section.) The surface must be clean, smooth, flat and dry.

3.0 Roofing Over Non-nailable Decks

3.1 These specifications are for use over any type of structural deck which is not nailable, and which offers a suitable surface to receive the roof. Poured and precast concrete decks require priming with JM Concrete Primer prior to the application of hot asphalt.

3.2 These specifications are also for use over JM roof insulations – DuraBoard, Fesco Board, Tapered Fesco Board, DuraFoam, Fesco Foam, Tapered Fesco Foam, ENRGY 3, Tapered ENRGY 3 and ½" (13 mm) Retro-Fit Board or other insulations that offer a suitable surface to receive the roof. **For heat-weld application directly to the insulation, the top layer of insulation must be DuraBoard or DuraFoam.**

3.3 These specifications are denoted by an “I” as the third character in the specification designation (e.g., 3CIN-W). See the “Roof Finder Index” in this section for further information.

4.0 Roofing over Nailable Decks

4.1 These specifications are for use over any type of structural deck (without roof insulation) which can receive and adequately retain nails or other types of mechanical fasteners recommended by the deck manufacturer. Examples of such decks are wood and plywood. Certain specifications are suitable for use over lightweight insulating concrete decks or over fills made of lightweight insulating concrete. Consult the “Roof Decks” section of the current JM Commercial/Industrial Roofing Systems Manual, or contact a JM Technical Services Specialist for approval of the lightweight concrete to be used.

4.2 These specifications are denoted by an “N” or an “L” as the third character in the specification designation (e.g., 3CNN-W or 3PLN-W). See the “Roof Finder Index” in this section for further information.

4.3 Over wood board decks, one ply of sheathing paper must be used under the base felt, next to the deck. Sheathing paper is not required on plywood decks.

4.4 All of the specifications in this section require the use of a nailable base felt. Use nails or fasteners appropriate to the type of deck. See the “Roof Decks” section of the current JM Commercial/Industrial Roofing Systems Manual.

5.0 General Guidelines for Application of Materials

5.1 The proper application of roofing materials is as important to the satisfactory performance of the roofing system as the materials themselves. JM strongly recommends the following guidelines for the application of APP modified bitumen roofing materials be followed. **Always follow all recommended safety procedures when applying any heat-welded product.**

- A. Never use wet or damaged materials.
- B. Never apply any roofing materials during rain or snow, or to wet or damp surfaces. Moisture trapped within the roofing system may cause severe damage to the roofing membrane, insulation and deck.
- C. Take special care when applying any APP modified bitumen in cold weather (below 40°F [4°C]). All rolls must be stored on end in a heated trailer or building. Only rolls needed for immediate application should be exposed to ambient conditions.
- D. Never throw or drop rolls of APP in cold weather; sudden shocks can cause cracking of the APP coating asphalt.
- E. Do not double stack (with or without pallets) in cold weather.
- F. Remove all packaging from product and dispose of properly. Be sure to have the appropriate side of the product in position to be heat welded (polyolefin side down).
- G. APP modified bitumen sheets shall be rolled or scrolled into place as they are heat welded.
- H. Do not use traditional cut-back asphalt cements under APP modified bitumen products. The use of these mastics over the top of APP products is acceptable; however, the MBR cement products are preferred.
- I. Install the entire roofing system at one time. Phased construction may result in blisters due to entrapment of moisture, as well as poor adhesion due to dust or foreign materials that have collected on the exposed felts of an incomplete roofing system.
- J. All smooth APP-surfaced products must be coated with a JM-approved coating. Acceptable roof coatings for APP systems may be found in the built-up roofing Paragraph 6.9 of Section 3b.
- K. **Always comply with published safety procedures for all products being used. See the “Introduction” section of the current JM Commercial/Industrial Roofing Systems Manual, MSDS and container labels for health and safety recommendations.**

6.0 Roofing Products

6.1 JM manufactures different products for a variety of roofing needs: membranes, flashing, venting and vapor retarders.

6.2 Roofing felts are furnished in rolls consisting typically of one square. Flashing materials are sold in square feet.

6.3 JM APP Base Sheet or PermaPly 28 are acceptable base plies in all JM APP systems. **Note:** For applications over lightweight insulating concrete, Ventsulation Felt is recommended. There should be a minimum of one vent for every 1,000 ft² (92.9 m²) of roof area.

6.4 The only roof insulations to which a JM APP product may be directly heat welded are DuraBoard and DuraFoam. All other insulations require the use of a base ply mechanically fastened, hot mopped or cold applied over the insulation. For insulation application instructions, refer to Section 3a of this manual.

6.5 For more information on these products, refer to Section 2 of the current JM Commercial/Industrial Roofing Systems Manual.

7.0 Heat-weld Application

7.1 The surface over which the APP membrane is to be installed must be firm, dry, smooth, flat and free of debris and loose material. All surfaces must be designed and installed in accordance with manufacturer’s, industry and acceptable association standards.

7.2 Drainage: Design and installation of the deck and/or the substrate must result in the roof draining freely and to outlets numerous enough and so located as to remove water promptly and completely. Areas where water ponds for more than 24 hours are unacceptable and will not be eligible for a JM Peak Advantage Guarantee.

7.3 Roofing shall commence at the lowest point of the roof deck with laps installed so that water flows over and not against the lap. Align the roll in the course to be followed and unroll completely. Then reroll both ends to the middle of the roll (scrolling). Using the heat-welding apparatus, apply the heat to the surface of the coiled portion of the roll until the surface reaches the proper application temperature (approximately 330°F [166°C]). The flame should be moved from side to side and the membrane slowly unrolled while pressing the heated portion of the roll into the underlying surface.

Apply the heat across the full width of the roll and along the 4" (102 mm) side lap area of the previously installed roll, making an "L" shape. As the surface of the roll is heated, it will develop a sheen.

The generation of smoke is an indication that the material is being overheated. Repeat the operation with subsequent rolls, while maintaining a 4" (102 mm) side lap and a 6" (152 mm) end lap. On mineral-surfaced membranes, prior to seaming the 6" (152 mm) end lap, the granules must be embedded by heating the end lap area and then pressing the granules into the compound using a rounded-point trowel or an embedding tool. All laps should be rolled with a lap roller and a $\frac{1}{8}$ " (3 mm) to $\frac{3}{8}$ " (10 mm) bleed out of APP compound should extend beyond the lap. Check all laps for proper adhesion. **Caution: Never adhere APP products with hot asphalt.**

8.0 Cold Adhesive Application

8.1 There are situations where the use of heat welding and hot asphalt are undesirable or prohibited. In such cases, it may be necessary to use alternative materials such as cold adhesives (typically referred to as "cold process cements" or "cold application cements/adhesives"). JM research and development staff has determined that traditional cut-back asphalt mastics, as well as some of the newer "modified bitumen adhesives," can have an adverse effect on APP modified bitumen products. This is due to the very high levels of solvent used in most of these cements. Softening, blisters and excessive granule loss can occur as the solvent from the cement passes through the membrane. This can cause accelerated aging of the underlying waterproofing with the potential for premature membrane failure.

8.2 Through the evaluation of numerous alternate adhesive systems, JM has developed a viable cold application system for use with APP modified bitumen products.

9.0 Health and Safety

9.1 JM develops and maintains Material Safety Data Sheets (MSDS) for all of its products. These MSDS contain health and safety information for development of appropriate product handling procedures to protect the users of our products. These sheets are available on the JM Web site (www.jm.com). They should be read and understood by all involved personnel prior to using and handling JM materials. In addition to the MSDS, JM products have health and safety precautions printed on the product label or packaging. The user is strongly urged to familiarize himself with this information prior to using the product, and observe certain precautions during use.

10.0 One-Part Cold Adhesive Application

10.1 MBR Cold Application Adhesive and MBR Utility Cement are similar in consistency and application to traditional built-up roofing cold process cements. These adhesives form a durable, elastomeric and waterproof layer once cured.

10.2 MBR Cold Application Adhesive is used in the field of the roof and is used to adhere roofing plies, modified bitumen sheets and roof insulation. Fiber glass ply sheets, such as GlasPly Premier and GlasPly IV, **cannot** be used with this material. The adhesive is ready to use as shipped and does not require mixing. Do not thin with additional solvents.

10.3 The adhesive is applied at a nominal rate of $1\frac{1}{2}$ gal/100 ft² (0.61 l/m²) over nonporous substrates, e.g., primed concrete or fiber glass base felts. If applied to porous materials, such as insulations, the application rate will increase, depending on the absorbency of the material.

10.4 Position several rolls, beginning at the low edge of the work area, and unroll completely. Once the material has had time to relax, reroll the material from both ends (scroll) prior to applying the MBR Cold Application Adhesive.

10.5 The simplest means of adhesive application is by pouring a 2" to 4" (51 mm - 102 mm) wide bead of the adhesive along the substrate, about 12" (305 mm) from the lower edge of the work area. The adhesive is spread with a $\frac{1}{4}$ " (6 mm) (max.) saw-toothed rubber squeegee to obtain a uniform bed of adhesive. (The Roofer-Rite Brand squeegee has been found to work very well for these applications.) Spread the adhesive first toward the lower edge of the work area. Then, continue to spread the adhesive up the roof until the bed of adhesive is wide enough to receive several sheets.

11.0 One-part Cold Adhesive Membrane Specifications

11.1 Refer to Section 3k for membrane construction recommendations.

12.0 Steep Slope Requirements – Heat Welded Systems

12.1 Heat-welded APP roofing membranes can be applied on inclines up to 6" per ft (500 mm/m) when proper precautions are taken. On non-nailable decks, wood nailers must be used. Nailers act as insulation stops for the roof insulation and as a facility to back nail the membrane.

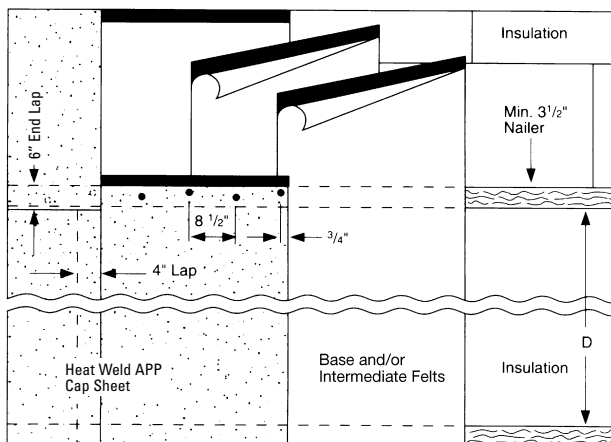
On slopes up to 2½" per ft (208 mm/m), the roofing sheets may be installed either perpendicular or parallel to the roof incline.

12.2 Non-nailable Decks: On decks with a slope over 2½" per ft (208 mm/m), the roofing felts must be installed parallel to the incline and must be back nailed. Pressure-treated wood nailers shall be attached to the deck, run perpendicular to the incline, be capable of retaining the nails securing the roofing sheets, have the same thickness as the insulation and be at least 3½" (89 mm) wide. They should be securely attached to the deck with mechanical fasteners to resist a pullout force of 200 pounds (890 N). Wood nailers shall be provided at the ridge and at the following approximate intermediate points:

Incline (Inches/Foot)	Nailer Spacing (D)
0" - 2½" (0 mm/m - 208 mm/m)	Not required
2½" - 6" (208 mm/m - 500 mm/m)	32' (9.8 m) (max.) face to face

12.3 Nail the modified bitumen cap sheet at the end lap across the width of the sheet, with the first nail spaced ¾" (19 mm) from the leading edge of the sheet, and the remaining nails spaced approximately 8½" (216 mm) o.c. The nails shall be staggered across the width of the nailer to reduce the risk of the sheet tearing along the nail line. Nails must have an integral 1" (25 mm) (min.) diameter cap. Where capped nails are not used, fasteners must be driven through caps having a 1" (25 mm) (min.) diameter. All nails are to be covered by the lap of the next sheet.

12.4 Nailers must also be used around the roof perimeter, openings and penetrations, for nailing felts, gravel stops, roof fixtures and fascia systems.



12.5 Nailable and Lightweight Concrete Decks: On decks with a slope over 2½" per ft (208 mm/m), the roofing felts must be installed parallel to the incline. Nail the end laps of the modified bitumen cap sheet across the width of the sheet on 8½" (216 mm) centers. All nails are to be covered by the lap of the next sheet.

12.6 Steep Slope Requirements – Systems Incorporating Asphalt or Adhesive

12.7 APP roofing membranes that incorporate asphalt adhered base/intermediate felts can be applied on inclines up to 3" per ft (250 mm/m) when proper precautions are taken. On non-nailable decks, wood nailers must be used. Nailers act as insulation stops for the roof insulation and as a facility to nail the membrane.

On slopes up to ½" per ft (42 mm/m), the roofing sheets may be installed either perpendicular or parallel to the roof incline.

12.8 Non-nailable Decks: On decks with a slope over ½" per ft (42 mm/m), the roofing felts must be installed parallel to the incline and must be back nailed. Pressure-treated wood nailers shall be attached to the deck, run perpendicular to the incline, be capable of retaining the nails securing the roofing sheets, have the same thickness as the insulation and be at least 3½" (89 mm) wide. They should be securely attached to the deck with mechanical fasteners to resist a pullout force of 200 pounds (890 N). Wood nailers shall be provided at the ridge and at the following approximate intermediate points:

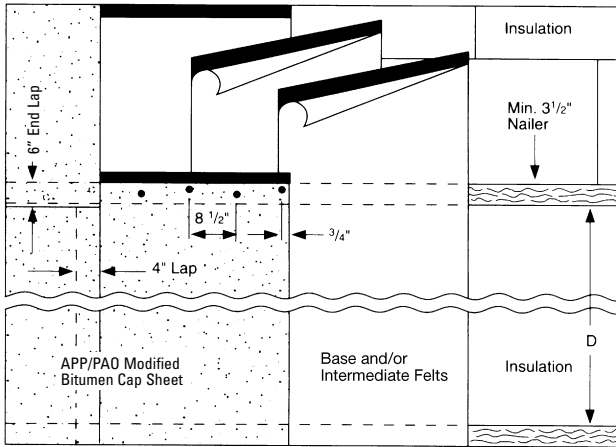
Incline (Inches/Foot)	Nailer Spacing (D)	Type of Asphalt
0" - ½" (0 mm/m - 42 mm/m)	Not required	Type III or IV*
½" - 2" (41.6 mm/m - 167 mm/m)	32' (9.8 m) (max.) face to face	Type IV
2" - 3" (167 mm/m - 208 mm/m)	10' (3.1 m) (max.) face to face	Type IV

* Consult with a JM Technical Service Specialist regarding projects in hot climates as Type III asphalt may not be permitted in some areas.

Nailers may also be laid out to conform to the roll length being used. For slopes between ½" to 2" per ft (42 to 167 mm/m), nailers should be spaced to accommodate full-length modified bitumen rolls. For slopes between 2" to 3" per ft (167 to 250 mm/m), the nailers should be spaced to accommodate half-length rolls.

12.9 Cut the modified bitumen cap sheet to conform to the nailer spacing. Nail the end lap across the width of the sheet, with the first nail spaced ¾" (19 mm) from the leading edge of the sheet, and the remaining nails spaced approximately 8½" (216 mm) o.c. The nails shall be staggered across the width of the nailer to reduce the risk of the sheet tearing along the nail line. Nails must have an integral 1" (25 mm) (min.) diameter cap. Where capped nails are not used, fasteners must be driven through caps having a 1" (25 mm) (min.) diameter. All nails are to be covered by the lap of the next sheet.

12.10 Nailers must also be used around the roof perimeter, openings and penetrations, for nailing felts, gravel stops, roof fixtures and fascia systems.



12.11 Nailable and Lightweight Concrete Decks: On decks with a slope over $\frac{1}{2}$ " per ft (42 mm/m), the roofing felts must be installed parallel to the incline. Nail the end laps of the modified bitumen cap sheet across the width of the sheet on $\frac{8}{16}$ " (216 mm) centers. All nails are to be covered by the lap of the next sheet. For slopes from $\frac{1}{2}$ " to 2" per ft (42 to 167 mm/m), a full-length sheet can be used. For slopes from 2" to 3" per ft (167 to 250 mm/m), a half-length sheet should be used.

Incline (Inches/Foot)	Type of Asphalt
0" - $\frac{1}{2}$ " (0 mm/m - 42 mm/m)	Type III or IV*
$\frac{1}{2}$ " - 2" (42 mm/m - 167 mm/m)	Type IV
2" - 3" (167 mm/m - 250 mm/m)	Type IV

* Consult with a JM Technical Services Specialist regarding projects in hot climates as Type III asphalt may not be permitted in some areas.

13.0 Phase Construction

13.1 One of the greatest hazards of roof construction is the application of a roofing system in "phases," where a partially completed roof system is left exposed to the weather overnight or longer. This can lead to entrapped moisture which can cause premature failure of the membrane.

13.2 When the installation of the cap sheet is delayed for any reason, the following procedures should be followed:

- Prior to the application of the modified bitumen cap sheet, the surface of the membrane must be examined thoroughly for the presence of any moisture. If moisture is present, the application of the cap sheet is not to proceed until the moisture has been removed or evaporated and the surface is dry.
- The surface of the membrane must be properly cleaned and primed if contaminated by dirt, dust or debris. The primer must be completely dry prior to installation of the modified bitumen cap sheet.

13.3 Under no circumstances shall the installation of the modified bitumen cap sheet be delayed more than 5 days after completion of the intermediate plies of the roofing system.

13.4 Only multiple felt (two felts with modified cap sheet) should be considered for the delay in application of the modified bitumen cap sheet. Single ply felt or base felt systems must receive the modified bitumen cap sheet on the same day.

14.0 Cold Weather Application

14.1 APP modified bitumens require special application techniques when they are being installed in cold weather. The following precautions shall be taken when the ambient temperature drops below 50°F (10°C), and are mandatory below 40°F (4°C):

- Modified bitumen products shall be kept warm, or warmed prior to installation. Store these materials indoors or in heated storage units or warming boxes. If these facilities are not available, placing the materials in direct sunlight may help. Make certain that modified bitumen rolls are stored on end only; do not store rolls on their side.
- When the conditions are extreme (below 40°F [4°C]), the rolls must be heated or completely unwound and allowed to warm on the roof for 15 to 20 minutes. This shall be done with the darker side of the sheet up. The sheet may then be installed using conventional application techniques.
- When the ambient temperature is below 40°F (4°C), extra care must be used when handling and storing APP modified products. During cold weather, these modified bitumen products must be stored on end in a heated trailer or building, and only the rolls needed for immediate application should be outside. Materials must be kept dry. Never throw or drop rolls of modified bitumen products during cold weather. Sudden shocks can cause cracking of the asphalt. DO NOT DOUBLE STACK (with or without pallets). For heat-weld applied products, heat the substrate prior to rolling the molten modified bitumen into place. Special attention should be given to the lap area so proper adhesion can be obtained.
- The adhesive can be installed in temperatures between 40°F and 100°F (4°C and 38°C). However, when the temperature is below 50°F (10°C), the adhesive must be stored in a warm area (approximately 70°F [21°C]), for 24 hours before being used, to facilitate spreading. Note: Temperature affects the cure rate of the adhesive. Even in cooler weather, the product will develop bond strengths comparable to fully adhered single ply systems in a relatively short time. The membrane ultimately will develop adhesive bonds that exceed those of systems using asphalt as the adhesive.

15.0 Temporary Roof Coverings

15.1 At times, an owner or general contractor may require the building to be closed at a time when the weather is not conducive to good roof construction, or the roof area may have to be used as a work platform during construction. Historically, this situation has led to phase construction, which has resulted in premature roof failure.

15.2 When the complete roof cannot be installed in one operation, the following procedures are recommended:

- Nailable Decks:
 - Apply one layer of an approved JM base felt, lapping the felt 2" (51 mm), and nailing 9" (229 mm) o.c. along the lap and 12" (305 mm) o.c. through the center of the sheet. (Sheathing paper should first be installed on wood board decks.)

2. Mop one ply of an approved JM ply felt in ASTM D 312, Type III asphalt and apply a glaze coat of 10 - 15 lb/100 ft² (0.49 - 0.73 kg/m²) of Type III asphalt.
3. An alternate would be to heat weld one layer of an APP modified bitumen cap sheet (smooth or mineral surfaced) over the base felt. **No** glaze coat of asphalt is applied.
4. When the permanent roof is to be installed, inspect the roof and remove all damaged and blistered areas. Apply a layer of approved JM base felt nailed through the temporary roof and into the deck as the first layer of the roofing system. As an alternate, a layer of approved JM roof insulation may be mechanically fastened (with appropriate fasteners) through the temporary roof into the deck.
5. Proceed with installing the appropriate permanent roof specification.

B. Steel Decks:

1. Apply a minimum layer of Fesco Board of adequate thickness to the steel deck using appropriate length UltraFast fasteners.
2. Install a ply of a JM ply or base felt and an additional ply of fiber glass felt, both in hot steep asphalt.
3. Finish with a 10 - 15 lb/100 ft² (0.49 - 0.73 kg/m²) glaze coat of hot steep asphalt.
4. When the permanent roof is to be applied, inspect the roof area. If the insulation has not been damaged and is dry, remove any blistered or damaged felt. Prime the temporary roof with JM Concrete Primer at the rate of 1 gal/100 ft² (0.4 l/m²) and then solid mop a layer of insulation board to the temporary roof with hot asphalt. Then apply the permanent roof system.
5. If the membrane and/or roof insulation has been excessively damaged, remove all unusable material and replace.

C. Non-nailable Decks, Other than Steel:

1. Prepare the deck as would be done for a permanent roof.
2. Solid mop two plies of approved JM ply felt in hot Type III asphalt.
3. Finish with a 10 - 15 lb/100 ft² (0.49 - 0.73 kg/m²) glaze coat of Type III asphalt.
4. When the permanent roof is to be installed, inspect and repair all defects in the temporary roof. Clean the surface of the temporary roof and prime with JM Concrete Primer if the surface is unusually worn. Proceed with the installation of the permanent roof.
5. As an alternate to step 2, spot mop an approved JM base sheet using a mechanical spot mopping machine. Next, solid mop one ply of approved JM ply felt in hot Type III asphalt. When the permanent roof is to be installed, remove the entire temporary roof, prime the deck as required in the "Roof Decks" section of this manual, and proceed with the installation of the permanent roof.

15.3 The decision as to whether or not a temporary roof is to be left in place is a judgment factor that must be made by the building owner or his representative. Although a JM representative may make suggestions in this area, JM will not be responsible for any problems that may develop with the roofing system due to the fact that the temporary roof is left in place.

16 Protected Roofing Membrane Assemblies (PRMA)

16.1 General Information. All general information contained in this section and the current JM Commercial/Industrial Roofing Systems Manual shall be considered part of these specifications.

JM APP modified bitumen specifications are eligible for use with protected roofing membrane assemblies. When these specifications are modified, the last digit of the specification designation should be changed to a "P" to denote "Protected" (e.g., 3CIP-W).

Flashings: All flashings must conform to the requirements stated in this section and the current JM Commercial/Industrial Roofing Systems Manual. The flashing material must extend above the top of the extruded polystyrene insulation a minimum of 8" (203 mm). The standard flashing details for modified bitumen roofing can be found in Section 3.

Drainage: Design and installation of the deck and/or roof substrate must result in the roof draining freely, to outlets numerous enough and so located as to remove water promptly and completely. Areas where water ponds for more than 24 hours are unacceptable, and will not be eligible for a JM Roofing System Guarantee.

16.2 When designing a protected membrane roofing system, the designer must make sure that positive drainage exists on the roof. Even though some extruded polystyrene roof insulation products are designed with integral drainage channels, they will retard the flow of water due to the contact between the membrane and the insulation. JM recommends a minimum of ¼" per ft (20.8 mm/m) slope be obtained on the finished roof membrane. This will greatly reduce the amount of water that will be retained against the membrane after a rain.

16.3 Ballast Requirements (for use with extruded polystyrene roof insulation):

16.4 The ballast should be similar to ASTM D 448, Gradation #57. The following gradation is typical:

Passing ½" (13 mm).....	10 - 60%
Passing ¾" (19 mm).....	100%

16.5 Ballast is applied at a rate of approximately 10 to 12 lb/ft² (49 - 59 kg/m²) in the field of the roof over a layer of filter fabric. Twenty (20) lb/ft² (97.6 kg/m²) of ballast is required over a 4' (1.22 m) wide area at the roof perimeter and at all penetrations. The following fabrics have been found to be acceptable:

- A. Confil 689H – 3.0 oz./yd. (93.5 g/m) black polyester from International Paper Company.
- B. Rufon P3B – 3.0 oz./yd. (93.5 g/m) black polypropylene from Phillips Fiber Corporation.

16.6 JM makes no claims as to the quality of these products nor their performance when exposed on the roof. See the product warranty supplied by the fabric manufacturer.

16.7 When pavers are used as ballast, the pavers must be placed on supports or pedestals. These supports or pedestals can either be commercially available products or 6" (152 mm) square pieces of JM DynaTred Plus (to give a minimum ½" [13 mm] air space). These supports should be located at the intersection of the corners of the paver blocks, such that where the four corners come together, all rest on the same 6" (152 mm) square piece of DynaTred Plus or pedestal. The ½" (13 mm) air space between the pavers and the insulation will allow moisture vapor to vent to the atmosphere. If the moisture is not allowed to vent to the atmosphere, the top surface of the insulation will begin to absorb water and the thermal performance will be reduced. **ROOF AREAS THAT HAVE PAVERS IN DIRECT CONTACT WITH THE INSULATION ARE EXCLUDED FROM COVERAGE UNDER A JM PEAK ADVANTAGE GUARANTEE, INCLUDING THE THERMAL OVERLAY PORTION OF THE GUARANTEE.**

16.8 The use of pavers in high traffic areas, to and around equipment and other maintenance areas, is strongly recommended.

16.9 It is the owner's and/or specifier's responsibility to determine if the building structure can support the required amount of ballast and still meet the code design requirements for anticipated dead and live loads (including snow, wind, etc.).

16.10 Decks (PRMA)

16.11 Precast slabs and prestressed "T" or "TT" decks require a minimum of one layer of approved JM roof insulation as a leveling course prior to the installation of the roof membrane.

16.12 For lightweight insulating concrete, gypsum decks, etc., consult a JM Technical Services Specialist for specifications and guarantee information.

16.13 For information on roof deck requirements not mentioned here, refer to the "Roof Decks" section of the current JM Commercial/Industrial Roofing Systems Manual, or contact a JM Technical Services Specialist.

16.14 Warning: Extruded polystyrene insulation is combustible and may constitute a fire hazard if improperly used or installed. It should be adequately protected. Use only as directed by the specific instructions for this product. This material should NEVER be exposed to an open flame or other source of ignition.

16.15 All roof deck systems over which the protected system is installed should provide an adequate fire barrier for the extruded polystyrene insulation.

16.16 For proper protection of plastic foam in storage, consult the National Fire Protection Association (NFPA) standards or the authority having jurisdiction.

16.17 Installing Ballasted PRMA Roof Insulation Over Modified Bitumen Roof Membranes

16.18 The following are general recommendations for installing ballasted PRMA roof insulation over modified bitumen roof membranes.

Materials per 100 ft² (9.29 m²) of Membrane Area

Insulation:	Extruded polystyrene roof insulation 100 ft ² (9.29 m ²) per layer
Fabric:	12' wide, 105 ft ² (3.66 m wide, 9.75 m ²) 10' wide, 106 ft ² (3.05 m wide, 9.84 m ²) 8' wide, 107 ft ² (2.44 m wide, 9.94 m ²)
Ballast:	¾" (19 mm) stone or crushed rock, 1,000 - 1,200 lb/100 ft ² (49 - 59 kg/m ²)*

* Additional ballast is required at the perimeter and at penetrations.

16.19 Insulation: Place extruded polystyrene roof insulation directly on the membrane with channel side down. The insulation boards should be tightly butted together. The maximum allowable gap between boards is ⅜" (10 mm). The boards shall be installed to within approximately ¾" (19 mm) of all projections and cant strips.

16.20 For multilayer installations, install subsequent layers, unattached over the first layer. Stagger all joints in relation to the underlying layer. The bottom layer in multi-layer applications must be at least 2" (51 mm) thick and as thick or thicker than the top layer.

16.21 Fabric: Loose lay an approved fabric over the extruded polystyrene roof insulation, with all joints lapped a minimum of 12" (305 mm). There should not be any end laps within 6' (1.83 m) of the perimeter. The fabric should extend 2" to 3" (51 - 76 mm) above the stone at the perimeter and at penetrations.

8A.16.22 Wetting the fabric is helpful in holding it in place on the insulation until the ballast is installed.

16.23 Ballast: Apply the correct size ballast at the rate of 1,000 - 1,200 lb/100 ft² (10 - 12 lb/ft² [48.8 - 58.6 kg/m²]), over the fabric, as the fabric is being laid out in the field of the roof. For a width of 4' (1.22 m) at the roof perimeter or penetrations, install ballast at a rate of 20 lb/ft² (98 kg/m²) or pavers at a rate of 22 lb/lin ft (32.7 kg/lin m). If pavers are used, the fabric is not required. Pavers must be placed on pedestals. Pedestals can be either commercially available products or 6" (152 mm) square pieces of JM DynaTred Plus.

16.24 Ballast should be washed ¾" (19 mm) gravel or crushed stone, with fines (smaller than ½" [13 mm]) accounting for not less than 10% or more than 60%. This gradation is similar to ASTM D 448, Gradation #57.

17.0 Safety Guidelines for Heat-welded Modified Bitumen

17.1 Heat-welded modified bitumen products require special safety precautions prior to, during and after installation. When working with an open flame, contractors must use extra care and extreme caution to prevent accidents. Carelessness can lead to loss of life, injury and loss of property. The following safety recommendations should be followed:

1. All contractors must be licensed and insured in the geographic area where they will conduct business. The work area must be properly prepared before the welding process begins and weather conditions must be favorable. Procedures and equipment must comply with all applicable code requirements including guidelines mandated by the Occupational Safety and Health Administration (OSHA).

2. The roofing contractor must ensure that all mechanics or applicators involved with the application of heat welded modified bitumens are properly trained not only in application and equipment handling, but also safety measures. The contractor should verify that all roofing applicators involved with open flame application maintain and carry a valid **Certified Roofing Torch Applicator (CERTA)** card as evidence of proper training. Further, the general contractor, jobsite superintendents and the building owner or its representative must also be knowledgeable and/or advised of the proper and necessary safety precautions applicable to heat welded roofing products.

3. All mechanics or applicators must carry, review, understand and adhere to the safety information and guidelines contained in "Torch Applied/Do's and Don'ts" as published and supplied by the Asphalt Roofing Manufacturers Association (ARMA) which may be supplemented or amended, as well as the ARMA/NRCA "Guide to Torch Safety on Modified Bitumen" videotape. These are available from ARMA at: ARMA, 4041 Powder Mill Road, Ste. 404, Calverton, MD 20705-3016 (Ph. 301-348-2002). Do not begin application procedures until you read and fully understand these safety procedures and installation practices.

4. Written notice must be given to the local fire department where required and any required or necessary permits must be obtained. Even if not required, it is always recommended to give notice to the fire department, particularly when using LP gas.

5. Supervisors must ensure that all roofing applicators wear adequate protective equipment, including nonsynthetic long-sleeved shirts, boots, long pants with no cuffs that extend over the top of the boot, heat-resistant gloves, safety glasses and a face shield during application.

6. Never heat weld directly to, or near (e.g., the 35' [10.67 m] rule) combustible materials or surfaces. Extra care must be taken to identify all potentially combustible and flammable material and similar combustible and flammable aspects of a building's use and design. Be aware of insulation type, parapet walls, curbs, cants, wood, edge strips, expansion joints, electrical wires and conduits, gas lines, chemicals, grease, oil, vapors, exhausts, spills or other materials that could ignite. Combustible materials present on a roof must be moved and materials that are not moveable must be protected from the heat-weld process and other fire hazards with fire blankets or shields. Be sure to identify similar materials on adjoining buildings and exercise proper precautions. A fiber glass base sheet should be installed to minimize the risk of fire. Always use combustion-resistant cant strips or other fire-resistant materials.

7. Never heat weld near or into vents, openings or cracks around edges, corners, voids or other penetrations in the building or near any rooftop equipment. Shut off fans and cover openings.

8. Never leave lighted torches unattended.

9. Use only equipment that is specifically designed for heat-welded roofing applications, and be sure the equipment is listed by a nationally recognized independent testing laboratory. The equipment must be operated in accordance with the manufacturer's instructions and in accordance with all applicable codes and regulations. All mechanics must be properly trained and familiar with all safety precautions in the use and handling of tanks, regulators and LP gas. Be familiar with National Fire Protection Association (NFPA) 58 "**Standard for the Storage and Handling of Liquefied Petroleum Gases**" and appropriate publications of the National Propane Gas Association, (NPGA) 1600 Eisenhower Lane, Ste. 100, Lisle, IL 60532 (Ph. 630-515-0600), and the National Fire Protection Association, 11 Tracy Dr., Avon, MA 02322 (Ph. 800-344-3555). Do not work in areas where LP gas can accumulate. Proper ventilation in accordance with OSHA and the National Institute for Occupational Safety and Health (NIOSH) is required. Ensure that all equipment is in good working condition and inspected daily.

10. Maintain at least one fully charged 20 lb (9.1 kg) (min.) ABC-type dry chemical fire extinguisher for each roofing mechanic on the project, and have more available near the application area (e.g. within 50' [15.24 m]) based on jobsite conditions. Roofing mechanics must have fire extinguisher use training at least annually per OSHA 29 CFR1910.157.

11. Follow fire protection and prevention procedures mandated or recommended by OSHA and/or the National Roofing Contractors Association (NRCA) and ensure compliance with all other federal, state and local regulations, including but not limited to those listed in OSHA 29 CFR1962.1 150, 152.1, 153 and 191-110 as they apply to heat-weld application.

12. A fire watch of sufficient length must be kept during and after all heat welding is completed. A fire watch is never shorter than **1 hour** after all application has been completed for a given day. A fire watch may need to be longer depending on the size of the roofing project and the design or configuration of the building. Special attention should be given to potential hot spots or smoldering material, such as carts, wall flashings and around penetrations, rooftop equipment and the roof perimeter. The person performing the fire watch should use an infrared heat-sensing device to detect hot spots and smoldering materials. For more information, contact the NFPA. Should fire result, take immediate, appropriate action; notify the owner of fire response.

13. Remember, it is the contractor's responsibility to observe all fire prevention and safety policies and practices during the installation of the roof system, as well as provide training to their personnel for proper roofing and safety practices as well as responding to emergency situations at the job site. Always keep a first aid kit on the job site; individuals administering first aid must be properly qualified per OSHA 29 CFR1910.151(b).

JOHNS MANVILLE DOES NOT SUPERVISE BUILDING OWNERS, CONTRACTORS, MECHANICS OR ANY OTHER PERSON IN THE APPLICATION OF HEAT-WELDED APPLIED MODIFIED BITUMENS AND ASSUMES NO RESPONSIBILITY FOR FIRE DAMAGE OR ANY OTHER DAMAGES.