

## 1.0 General Information

**1.1** The following section provides the application specifications currently available from Johns Manville (JM) for thermoplastic fleece backed (TPO and PVC) membranes with redundant built-up and SBS (Styrene-Butadiene-Styrene) modified bitumen plies for hot asphalt applications.

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

**1.3** Specifications are available for systems installed over insulation, nailable, non-nailable and lightweight insulating fill substrates.

**1.4** Each specification in this section is eligible to receive a JM Peak Advantage® Guarantee. The system must be installed by a JM Peak Advantage Roofing Contractor who is approved for built-up roofing systems. Refer to the information on guarantees in the current JM Single Ply Roofing Systems Manual, or contact the nearest JM sales representative.

**1.5** 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 undesirable or questionable, the reference is stated as an opinion rather than an absolute fact, (i.e., “**JM recommends**” or “**JM suggests**”). **Please contact JM Technical Service at (800) 922-5922 with any questions.**

**1.6 Flashings:** In addition to this guide please reference the PH (PVC Hybrid) and TH (TPO Hybrid) details in the JM Single Ply Roofing Systems manual.

**1.7** We stress that to obtain a roofing system that will perform properly, workmanship is equally as important as the use of quality materials properly designed into a good roofing specification. The most perfectly manufactured product cannot perform its function if it is not properly installed. The recommendations which are contained in this manual cannot substitute for the knowledge, skill, experience and integrity expected of a qualified professional roofing contractor or the technical expertise of trained architects and engineers.

**1.8** JM is not responsible for and will not accept, under any circumstances, any responsibility for the adequacy of a building design, INCLUDING ADEQUACY OF ANY STRUCTURE SUPPORTING THE WEIGHT OF ANY ROOFING SYSTEM. Review of the plans and specifications by a JM representative shall be for the sole purpose of making suggestions or recommendations concerning details for the application of JM roofing systems and products.

**1.9** Under no circumstances will JM be responsible for any failure of the roofing systems due to structural defects, damage from other building trades or for failure due to errors in design of any building element.

## 2.0 Membrane Substrate

**2.1** The surface on which the built-up, SBS modified bitumen, and/or thermoplastic fleece backed roofing membrane is to be applied should be one of JM’s roof insulations (Fesco, Tapered Fesco, Fesco Foam, Tapered Fesco Foam, ENRGY 3, Tapered ENRGY 3, or ½" [13 mm] Retro-Fit Board) or an approved structural substrate. The surface must be clean, smooth, flat and dry. (Built-up roofing and SBS modified bitumen should not be applied directly to foam plastic insulations, as referenced in the National Roofing Contractors Association [NRCA] Bulletin #9 of September 1988 and September 1998).

## 3.0 Thermoplastic Membrane with Redundant Bituminous Systems 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 require coating with JM Concrete Primer prior to the application of hot asphalt. Precast concrete panels also require a layer of approved roof insulation prior to installing a roof membrane.

**3.2** These specifications are also for use over JM roof insulations (Fesco, Tapered Fesco, Fesco Foam, Tapered Fesco Foam, ENRGY 3, Tapered ENRGY 3 and ½" [13 mm] Retro-Fit Board) or other approved insulations that offer a suitable surface to receive the roof. These specifications are not to be used over lightweight insulating concrete decks or over a fill made of lightweight insulating concrete.

**3.3** Non-nailable specifications are denoted by an “I” as the third character in the specification designation (e.g., 4GIT). See the “Roof Finder Index” in Section 3b for more information.

## 4.0 Built-up Thermoplastic Membrane with Redundant Bituminous Systems over Nailable Decks

**4.1** These specifications are for use over any type of structural deck (with or without 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 eligible for use over lightweight insulating concrete decks or over fill made of lightweight insulating concrete. Contact a JM Technical Services Specialist for approval of the lightweight fill to be used.

**4.2** Nailable specifications are denoted by an “N” or an “L” as the third character in the specification designation (e.g., 4GNT, 4GLT). See the “Roof Finder Index” in Section 3b for more information.

**4.3** One ply of sheathing paper must be used over wood board decks under the base felt.

**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 for more information.

## 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 roof membrane as the materials themselves. JM suggests the following guidelines for application of all roofing materials.
- A. Don't use wet or damaged materials.
  - B. Never apply any roofing materials during rain or snow, or to wet surfaces. Moisture trapped within the roofing system as a result of this can cause severe damage to the roof membrane and insulation. Any product that has moisture contamination or is wet should be removed and discarded.
  - C. Review the guidelines for application of roofing, roof insulations, coatings and accessories shown in the current JM Single Ply Roofing Systems Manual.
  - D. Always start application at the low edge of the roof per the individual specification diagram.
  - E. Good roofing procedure restricts the application of hot asphalt to a maximum of 6' (1.83 m) in front of the roll.
  - F. When using mechanical felt laying equipment, be sure that all orifices are open.
  - G. All roofing ply felts should be well broomed into the hot asphalt utilizing a broom or some other device.
  - H. Take special care when applying BUR coated felts in cold weather. Check the temperature of the asphalt at the mop, asphalt spreader, and cart to determine that it is at the proper application temperature.
  - I. Roll or scroll SBS modified bitumen sheets into a full mopping of hot asphalt. Back mopping and flopping into a full coating of asphalt is also acceptable for certain SBS products. SBS base sheets with polyester reinforcement must be allowed to relax in an unrolled position prior to installation.
  - J. Roll out and cut all thermoplastic fleece backed membranes to specified lengths and allow them to relax.
  - K. Do not mix different grades of asphalt or dilute asphalt with any material.
  - L. Heat the asphalt according to the manufacturer's recommendations. Check the temperature of the asphalt at the kettle and at the point of application. Have accurate thermometers on all roofing kettles. Adhere to the guidelines for the heating of asphalts in this section of the manual.
  - M. Always install water cutoffs at the end of each day's work to prevent moisture infiltration into the completed work area. Water cut-offs should be completely removed prior to resuming work.
  - N. Heed the cold weather application procedures in **Paragraph 14.0** of this section.
  - O. It is essential that traffic be minimized on a freshly laid roof, while the asphalt is still fluid. Asphaltic displacement through the porous fiber glass ply felts, SBS modified bitumen, and under the thermoplastic fleece backed membrane can result from rooftop traffic during asphalt "set" time. Depending on specific job factors, this set time can be as little as 45 minutes. Asphaltic displacement can result in "phantom" leaks and blistering of the membrane.
  - P. **Always comply with published safety procedures for all products being used. See the "Introduction" section of the current JM Single Ply Roofing Systems Manual, MSDS and container labels for health and safety recommendations.**

## 6.0 Roofing Felts (Base and Ply Sheets)

- 6.1** JM manufactures different fiber glass roofing felts for a variety of roofing needs: vapor retarders, roof plies, base sheets and special felts for venting.
- 6.2** Roofing felts are furnished in rolls consisting of one or more squares. A "factory" square of roofing contains sufficient material to cover 100 ft<sup>2</sup> (9.29 m<sup>2</sup>) of roof surface accounting for nominal side and end laps.
- 6.3** For more information on these products, refer to Section 2 of the current JM Single Ply Roofing Systems Manual.

## 7.0 Thermoplastic Fleece Backed (TPO and PVC)

- 7.1** JM TPO and PVC Fleece Backed has polyester fleece embedded into the back side of the roofing membrane.
- 7.2** JM PVC Fleece Backed is furnished in 50, 60, and 80 mil thicknesses and delivered in 6' (1.83 m) and 10' (3.05 m) widths. 50 mil and 60 mil membrane is 90' (27.43 m) in length. 80 mil membrane is 75' (22.86 m) long for 6' (1.83 m) widths and 60' (18.29 m) long for 10' (3.05 m) widths.
- 7.3** JM TPO Fleece Backed for hot asphalt application has a 8oz polyester fleece for staining protection against the asphalt. The membrane is furnished in 60 and 80 mil thickness and delivered in 10' (3.05 m) widths. 60 mil membrane is 75' (22.86 m) long, and the 80 mil membrane is 50' (15.24m).

## 8.0 Roofing Asphalts

- 8.1** JM BUR, SBS modified bitumen, and thermoplastic fleece back products are designed to be installed with hot asphalt (refer to the table in **Section 8.9**). PermaMop<sup>®</sup>, coal tar pitch and coal tar asphalt are not permitted.
- 8.2** Asphalt can come from a variety of crude sources. Many of these sources produce high-quality mopping grade asphalts and many do not. Various physical properties of asphalts can affect the performance of the roofing system. For this reason, JM qualifies asphalt sources throughout the country and requires that only these asphalts be used to assure good performance and compatibility with the roofing products being used.
- JM requires the use of approved asphalt within systems which require a JM Peak Advantage Guarantee. These approved asphalts are periodically tested to assure conformance to both ASTM and JM asphalt specifications. For the names of approved asphalt suppliers in your area, contact a JM sales representative.

## 8.3 Health and Safety

See Section 1 of the JM Single Ply Roofing Systems Manual for health and safety information.

- 8.4** JM recommends the use of only two grades in BUR and SBS modified bitumen with thermoplastic fleece backed specifications — Type III and Type IV. The slope of the roof, as well as the climate, governs the grade of asphalt to be used. The success or failure of a roofing system depends greatly on the use of the proper grade of asphalt, as called for in the roofing specification.

## 8.5 Heating

Asphalts are susceptible to damage from overheating. Overheating, even for short periods, can “crack” or degrade the asphalt (a drop in softening point and slight oiliness is a symptom). Fall back in softening point can result in slippage of felts in the roofing system. As the softening point decreases, the viscosity or “holding power” of the interply asphalt decreases, resulting in slippage. If the overheating is more gradual, the asphalt may “age” prematurely, losing the beneficial light oils that help the roofing system weather and stay waterproof. Since asphalts are thermoplastic, their viscosity varies with temperature. Application temperature must be in the range which will permit an adequate film of asphalt, whether applied by mop or machine.

**8.6** The JM Technical Center, in conjunction with the National Roofing Contractors Association (NRCA) and the Asphalt Roofing Manufacturing Association (ARMA), has been involved in considerable research developing guidelines for the proper heating and application of hot asphalt. These guidelines use the principle of Equisviscous Temperature (EVT).

**8.7** In conjunction with these guidelines, the following information is printed on the cartons of asphalt, or on the bill of lading for asphalt shipments.

1. The Softening Point as determined by ASTM D 312.
2. The Minimum Flash Point (FP) of the asphalt as determined by ASTM D 92.
3. The Equisviscous Temperature. As currently defined by ASTM, this is the temperature at which the asphalt viscosity is 125 centistokes. Asphalt applied within  $\pm 25^{\circ}\text{F}$  ( $\pm 14^{\circ}\text{C}$ ) of the EVT at the point of application will provide a nominal 23-25 pounds of asphalt per 100 ft<sup>2</sup> (1.12 - 1.22 kg/m<sup>2</sup>).
4. The Finished Blowing Temperature (FBT). This is the temperature at which the blowing of the asphalt is completed.

**NOTE:** Work done by NRCA has shown that different EVT values should be used for mop-applied asphalt and machine-applied asphalt. Mop applied asphalt should be applied at an EVT based on 125 centipoise, while machine-applied asphalt should be applied using an EVT based on 75 centipoise. ASTM is currently evaluating incorporating this information into its specifications. Some asphalt suppliers are now including both EVT values on their product. If only the 125 centipoise (centistokes) value is provided, then for machine application, the asphalt should be applied at a 25°F (14°C) higher temperature than the 125 centipoise values.

**8.8** JM requires adherence to the following guidelines when the above information is furnished:

1. Use the proper softening point asphalt as specified for the roof slope, type of roofing system and climate.
2. For optimum application, the asphalt should be at the Equisviscous Temperature,  $\pm 25^{\circ}\text{F}$  ( $\pm 14^{\circ}\text{C}$ ), at the point of application. **However, SBS modified bitumen products require installation in asphalt with a minimum temperature of 400°F (204°C) at point of application.**
3. Never heat the asphalt to or above the Flash Point, to avoid danger of fire.
4. Heating above the Finished Blowing Temperature shall be strictly regulated, never for longer than four hours to preclude excessive asphalt degradation.

**8.9** The characteristics per ASTM D 312 of the various grades of asphalt are as follows:

Product	ASTM Type	Softening Point		Flash Point
		Min.	Max.	C.O.C.**
140°F (60°C) (dead level)	I	135°F (57°C)	151°F (66°C)	475°F (246°C)
170°F (77°C) (flat)	II	158°F (70°C)	176°F (80°C)	475°F (246°C)
190°F (88°C) (steep)	III	185°F (85°C)	205°F (96°C)	475°F (246°C)
220°F (104°C) (special steep)	IV	210°F (99°C)	225°F (107°C)	475°F (246°C)

\*\* Cleveland Open Cup Method.

Product	Penetration (dmm)				Ductility @ 77°F (25°C) 5 cm/Min.		
	32°F (0°C) 60 Sec. 200g.		77°F (25°C) 5 Sec. 100g.				
	Min.	Max.	Min.	Max.			
140°F (60°C)	3	—	18	60	90	180	10.0
170°F (77°C)	6	—	18	40	—	100	3.0
190°F (88°C)	6	—	15	35	—	90	2.5
220°F (104°C)	6	—	12	25	—	75	1.5

**8.10** If Equisviscous Temperature is not available, nominal heating temperature guidelines of the asphalt are as follows:

### Recommended Temperatures

Asphalt Type	Heating	Application for BUR
140°F (60°C)	425°F (218°C)	335°F to 405°F (168°C to 207°C)
170°F (77°C)	450°F (232°C)	350°F to 415°F (177°C to 213°C)
190°F (88°C)	500°F (260°C)	365°F to 435°F (185°C to 224°C)
220°F (104°C)	500°F (260°C)	400°F to 475°F (204°C to 246°C)

**8.11** Use of insulated buckets, high boys, and circulating lines for cold weather application can help maintain a proper EVT when temperatures are low and the distance from the asphalt source to the point of application is great.

**8.12** When asphalts are applied within the EVT temperature ranges, the proper amount of asphalt will be placed between the plies. The recommended quantity of asphalt has been indicated on each specification in the current JM Single Ply Roofing Systems Manual. Regardless of the exact quantity of asphalt applied, it is important that the asphalt be continuous, so felt does not touch felt, and that there be full adhesion between all plies of the system. JM considers a  $\pm 25\%$  deviation from the asphalt quantity of 22 pounds per square listed to be acceptable.

## 9.0 Hot Asphalt Application

**9.1** The BUR and SBS Modified Bitumen sheets must be firmly and uniformly placed in a full mopping of hot asphalt, without voids, and with all edges well sealed.

**9.2** The thermoplastic fleece backed membrane must be firmly and uniformly placed in a full mopping of hot asphalt, without voids. **Asphalt must not be applied to the selvage edges of the thermoplastic fleece back membrane to allow a minimum 1.5" (38.1 mm) weld.** If the weld is not 1.5" (38.1 mm), then the entire seam must be stripped-in using a detail strip.

## 10.0 Mop-applied Asphalt

**10.1** There are several application techniques that can be used when the asphalt is installed by mopping. The modified bitumen sheet can be rolled, scrolled or flopped into the asphalt. Regardless of the application technique employed, the crucial factor is that the SBS modified bitumen sheets and thermoplastic fleece backed membrane make complete contact and embed in the hot asphalt. This can be accomplished by lightly brooming the modified bitumen sheet immediately after it has been installed. It is also good roofing practice to "scuff in" the side and end laps to assure that they are completely sealed.

### 10.2 Rolling Technique

When rolling the modified bitumen sheet or the thermoplastic fleece backed membrane into the asphalt, the mechanic should mop no more than 6' (1.83 m) in front of the roll to ensure that the temperature of the asphalt does not cool and fall below the temperature necessary for good embedment. If the asphalt is allowed to cool too much, an inadequate bond may result. In addition, the viscosity of the asphalt increases, which can result in a wavy appearance or excessive quantities of asphalt. Excessive asphalt can increase the potential for slippage of the membrane.

**10.3** When using this application technique, brooming of the modified bitumen sheet and thermoplastic fleece backed membrane is especially important at the end of the sheet where there may not be sufficient weight from the roll to provide the necessary pressure to embed the sheet into the asphalt.

### 10.4 Scrolling Technique

The scrolling technique is also used by many roofing mechanics. This technique was originally used to allow the modified bitumen and thermoplastic fleece backed sheets to relax. Although this is not required with fiber glass and fiber glass/polyester composite-reinforced SBS modified bitumen products, this method is occasionally used. The modified bitumen thermoplastic fleece backed roll is completely unwound, usually turned upside down, and allowed to "relax." After the sheet has warmed, it is then turned right-side-up, placed on the roof in the area where it is to be installed and rerolled or scrolled from both ends. The product is then mopped into place using the same mopping techniques and precautions described for rolling the product into place.

## 10.5 Mop and Flop Technique

Another application technique, called "mop and flop," is frequently used in the western portion of the United States. The modified bitumen sheet is cut to short lengths, usually between 12' and 16' (3.66 m and 4.88 m) long. It is placed upside down, adjacent to the roof area where it will be installed, along the laying line of the preceding course. The entire area to be covered by the sheet is then mopped with hot asphalt, as well as the lap area of the upside-down sheet. Mechanics then pick the sheet up by the ends and "flop" it, right side up, into the hot asphalt, making certain to align it with the asphalt line created by the sheet itself. Again, brooming the sheet and scuffing the lap are recommended.

**10.6** Polyester-reinforced SBS modified bitumen sheets should be unrolled and allowed to relax. Rerolling or scrolling of the sheet is then employed to set the sheet. **The "mop and flop" technique is not acceptable for polyester-reinforced SBS modified bitumen sheets.**

## 10.7 Butterfly Technique

The thermoplastic membrane is unrolled and allowed to relax. Then the membrane is folded lengthwise down the roll. Asphalt is applied to the substrate and the membrane is then set into the hot asphalt using the same techniques and precautions described for rolling the product into place. Then the other half of membrane is folded back over the adhered membrane and asphalt is applied to the substrate. The membrane is then set into the hot asphalt and the entire sheet is broomed in.

## 11.0 Mechanically Applied Asphalt

**11.1** The asphalt can be applied using a mechanical asphalt spreader, which can increase productivity. Some contractors have found that installing the material with a felt layer can also improve production.

## 12.0 Heat Welding Thermoplastic Fleece Backed Seams

This section describes welding and fastening methods used to install JM TPO or PVC roofing systems. Included: hot-air welding membrane sections, prefabricated JM TPO and PVC-Coated Metal parts, fasteners used to anchor the roof to the roof deck, and adhesive application of the membrane.

**12.1** Before welding, ensure area is clean and dry. Remove dirt or contamination before welding by using low sudsing soap and water followed by membrane cleaner, or just membrane cleaner. As a last resort, cut away the affected sheet section and replace with new material. Hot air welding equipment is required to make all field seams. Welding speeds will be slower in high humidity conditions or at low temperatures.

**12.2** Hot air welding works by applying very hot air to the membrane surfaces, softening and fusing the surfaces together, thereby creating a permanently fused, bonded sheet. One of the major advantages of hot air welding is the fact that the seam comes to full weld strength immediately.

**12.3** *Seams must be loaded in shear and not in peel. A shear load is in the plane (horizontal) of the roof membrane. A peel load is lifting the seam perpendicular to the roof.* All roofs expand and contract during temperature changes. This can produce mechanical stress in the membrane. It is important to make welds that do not cause peel stresses to occur. The correct and incorrect methods for welding at the roof surface and side corners are described below.

**Correct:** Weld the membrane to the horizontal surface of the JM TPO or PVC-Coated Metal or membrane flashing, producing only horizontal stress (shear stress) on the welded seam. This also helps transfer stress to the roof structure.

**Incorrect:** The weld is subject to vertical stress (peel stress). Peel stresses weaken, and may eventually rupture the welded seam.

**12.4** Membranes can be hot air welded in many different conditions, including cold weather. A hand-held hot air welder is especially useful when welding membrane sections at corners or on vertical surfaces. Hand-held hot air welders are also used to weld membrane sections together or to weld membrane to JM TPO or PVC-Coated Metal, which has factory-laminated PVC membrane on its top side and a protective coating on the back.

**12.5** With either method, perform a 2" (5.08 cm) test weld before beginning each day's application and any time the hot air welder has been turned off for any length of time to check peel strength, consistency, weld width, etc. and to adjust the welder. First, adjust the temperature of the hot air welder to produce a shiny membrane surface without burning the membrane. Fully insert the nozzle tip of the hot air welder into the seam, moving it slowly backwards. As the membrane softens, press the membrane surfaces together with a silicone rubber roller from the inside edge to the outside edge of the seam. Take care to produce a continuous weld with no air pockets.

**12.6** If the membrane surface is overheated, a good weld cannot be achieved. The burned or discolored membrane must be patched. To repair a burned section, cut away the damaged material at least 1" (2.54 cm) beyond the burned edges. Patches should be cut to extend at least 3" (7.62 cm) beyond all damaged edges. Allow for a minimum 1½" (3.81 cm) weld width on all sides. Center the patch over the cut area and weld to the membrane, using normal welding procedures. Cut all patches in a square or rectangular shape with round corners for a neat, finished roof appearance.

**12.7** The t-joint occurs where three layers of membrane overlap. Voids may occur along the edge of the middle layer of membrane. To close the void, gently lift the upper membrane sheet and apply sufficient hot air to heat the membrane surfaces. Then, using the edge of a silicone rubber roller, roll and fuse the upper membrane surface into the lower membrane. A crease developed along the intersection of the two surfaces indicates a proper weld. JM recommends patching all t-joints – to include base flashing – using a 7" (17.78 cm) rounded piece of reinforced field membrane or JM TPO or PVC T-Joint Patch.

**12.8** Hot air welded seams may be tested as soon as the seams cool. After welding, carefully test every seam and t-joint along its entire length. Do this by running a blunted scratch awl, cotter key puller, or other round-tipped blunted tool along the seam edge while applying firm, steady pressure. It is imperative to avoid scoring the membrane that has just been welded. Any penetration of the probe into the seam indicates a void in the weld which must be repaired.

Continuous seam probing will tend to sharpen the tip of the probe, so it is important to blunt the tip of the probe regularly. Test all welded seams for integrity and continuity before the end of each work day. In addition to probing, take seam samples to verify seam quality as necessary. Cut the samples across the seam 6" (15.24 cm) on each side of the seam and 2" (5.08 cm) wide. Peel these samples by hand to test seam strength. Good seams will be virtually impossible to peel and should delaminate the TPO or PVC film from the reinforcing scrim. Cut and test a minimum of three seam samples each day – in the morning, at noon and at day's end. Take additional test cuts when weather conditions change or after work interruptions when the automatic hot air welder has been shut off.

## 13.0 Flashing Heat Welded Thermoplastic Fleece Backed Seams

**13.1** This section describes the procedures and materials used to install fully adhered JM TPO and PVC roofs. Included are flashing installation and membrane installation for asphalt adhered roof membranes.

### 13.2 Installation Preparation - Nailers

After properly preparing the roof deck, install wood nailers when required. Place nailers on the perimeter of the roof, along the top of parapet walls and, where required, around roof penetrations and along roof expansion joints. Set the height of the nailers flush with the roof insulation. Space fasteners for wood nailers per the job specifications, but not greater than 24" (60.96 cm) o.c. with at least three fasteners per nailer, depending on nailer length. Each fastener must resist a minimum pullout force of 200 lb/ft (298 kg/m) in any direction. JM TPO or PVC-Coated Metal is fastened to wood nailers. When using membrane flashings, fasten the field sheet to the deck with a fastener/plate system as shown in Detail PB-25.

### 13.3 JM TPO and PVC-Coated Metal

Preformed JM TPO or PVC-Coated Metal is fastened around the roof perimeter (edge and base flashings) and roof penetrations. Welding the membrane to JM TPO or PVC-Coated Metal at these points provides a watertight seal.

JM TPO or PVC-Coated Metal (along with wall fastening strips) is manufactured in 10' (3.05 m) lengths. Leave a ¾" to ½" (9.53 mm to 1.27 cm) maximum gap between each length to allow for thermal expansion. Apply aluminum tape over all joints in JM TPO or PVC-Coated Metal prior to heat welding the joint covers and membrane in place. The following are instructions for installing JM TPO or PVC-Coated Metal, wall fastening strips and gravel stops.

### 13.4 Gravel Stops (TH-FE or PH-FE details)

The top of the gravel stop must be at least 1½" (3.81m) above the nailer height. This may vary depending on roof conditions. The bottom edge of the flashing should extend at least 1" (2.54 cm) below the nailer on the vertical fascia surface. If the vertical gravel stop face exceeds 4" (10.16 cm), fasten per the job specifications but not less than a 20 gauge to 24 gauge (0.91 mm to 0.61 mm) continuous galvanized steel clip on the fascia. Fasten continuous steel cleats per the job specifications but not less than two roofing nails between flashing lengths. This provides a rigid support for the gravel stop and helps align the section. Use lengths of gravel stop to quickly position each cleat. Fasten the gravel stop to the wood nailer with roofing nails spaced 6" (15.24 cm) o.c. and staggered. Leave a ¾" to ½" (9.53 mm to 1.27 cm) gap for expansion between gravel stop lengths. Apply aluminum tape to the joint prior to heat welding the joint covers and membrane in place. Johns Manville recommends installing two fasteners per butt joint to prevent rocking. This will also secure the edges at the break.

### 13.5 Membrane Flashings (TH-FW or PH-FW details)

Install all membrane flashings at the same time as the roof membrane. Do not use temporary flashings. If water penetrates the flashings, immediately replace all affected materials. Use only JM TPO or PVC fully adhered or mechanically attached flashings or prefabricated flashings, depending on job circumstances. Secure the mechanically attached flashings to the parapet wall at a maximum vertical distance of 18" (45.72 cm) o.c., and horizontally to the parapet at maximum spacing of 12" (30.48 cm) o.c. Secure adhered flashings to the parapet wall at 60" (152.4cm) vertical intervals. All adhered surfaces must be compatible with JM TPO or PVC roofing membranes. If existing asphalt flashing remains, secure either 15/32" (1.91 cm) thick plywood, ¾" (1.43 cm) OSB, approved gypsum boards,

26-gauge (0.45 mm) galvanized metal (if using adhered flashings), or polyester fleece ("slip sheet") to the asphaltic surface as a barrier before applying JM TPO and PVC Membrane flashings. **Paper slip sheets are not acceptable for use as asphalt barriers.** Apply adhesive as noted in Section 3, "Fully Adhered Systems". **Do not apply adhesive to any flashing areas that will be welded.** Extend all flashings a minimum of 8" (20.32 cm) above the roof level. Contact JM Technical Services for recommendations if this cannot be done. Terminate all JM TPO or PVC Membrane flashings per the applicable detail.

#### 14.0 Cold Weather Application (Below 50°F [10°C])

##### 14.1 General Instructions for Cold Weather Bituminous Installations

Roof applications utilizing asphalt below 45°F (7°C) require special measures to ensure proper performance of the roofing system. JM strongly recommends that the following guidelines be followed when applying built-up or SBS Modified bitumen roofing systems in cold weather:

- A. Use extra care to ensure that any moisture is removed from the deck surface. The presence of moisture may cause poor adhesion or skips in the mopping asphalt which in turn can entrap moisture within the roofing system.
- B. Store materials in a heated warehouse or closed and heated trailer immediately prior to installing.
- C. Do not overheat the asphalt. Insulated asphalt lines and insulated rooftop equipment should be used. Set up job site equipment to minimize the distance between asphalt heating source and application point.
- D. Do not mop more than 4' (1.22 m) ahead of the roll. Embed the rolls into the hot asphalt immediately.
- E. Squeegee all fiber glass ply felts to ensure adhesion.
- F. Install only as much roofing material as can be completed and covered in one day.
- G. The use of temporary roofs should be strongly considered if construction schedules require roof applications in cold or rainy weather.

##### 14.2 General Suggestions for Cold Weather PVC Fleece Backed Installation

1. Store all JM TPO or PVC materials in warm, dry area away from sparks and open flames, to avoid condensation problems which could affect weld quality.
2. Take at least twice the usual number of seam samples to test for peel resistance since the possibility of inferior welds is greater.
3. Thoroughly dry all weld surfaces prior to welding.
4. Exercise caution when walking on dew, frost, ice or snow covered roofs since the membrane may be extremely slippery.

#### 15.0 Temporary Roof Coverings

**15.1** At times an owner or general contractor may require the building be closed 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. In the past this situation has led to phase construction which has resulted in premature roof failure. When a completed roof system cannot be installed in one operation it is recommended that the following procedures be observed:

##### A. Nailable Decks:

1. Apply one layer of approved JM base felt, lapping the felt 9" (229 mm), and nailing 18" (458 mm) o.c. along the lap and 18" (458 mm) o.c. through the center of the sheet. (Sheathing paper should first be installed on wood board decks.)
2. Mop one ply of approved JM ply felt in ASTM D 312, Type III asphalt and apply a glaze coat of 10 - 15 lb/100 ft<sup>2</sup> (0.49 - 0.73 kg/m<sup>2</sup>) of the same grade asphalt.
3. When installing the permanent roof, 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.
4. Proceed with installing the appropriate permanent roof specification.

##### B. Steel Decks:

1. Apply a minimum layer of approved JM insulation, in adequate thickness, to the steel deck using the appropriate mechanical fasteners.
2. Install two plies of fiber glass felt both set in hot Type III asphalt to the insulation.
3. Finish with a 10 - 15 lb/100 ft<sup>2</sup> (0.49 - 0.73 kg/m<sup>2</sup>) glaze coat of hot Type III asphalt.
4. When applying the permanent roof, inspect the roof area. If the insulation has not been damaged and is dry, remove any blistered or damaged felt. Solid mop a layer of insulation board to the temporary roof with hot Type III asphalt; then apply the permanent roof system. In some regions of the country, a JM base felt may be machine spot mopped or mechanically attached with appropriate insulation screws and plates directly to the sound, temporary roof followed by an asphaltic roofing membrane. Consult a JM Technical Services Specialist for acceptability.
5. If the temporary 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 fiber glass ply felt in hot ASTM D 312, Type III asphalt.
3. Finish with a 10 - 15 lb/100 ft<sup>2</sup> (0.49 - 0.73 kg/m<sup>2</sup>) glaze coat of ASTM D 312, Type III roofing asphalt.
4. When installing the permanent roof, 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 and proceed with the installation of the permanent roof.
5. As an alternate to step 2 above, spot mop an approved JM base sheet using a mechanical spot mop machine. Next, solid mop one ply of an approved JM ply felt in hot ASTM D 312, Type III asphalt. When installing the permanent roof, 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.

**15.2** The decision whether a temporary roof should be left in place is a judgment factor that must be made by the building owner or their 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 temporary roof being left in place. **It is recommended that the temporary roof be cut in a 6' (1.83 m) grid.**

## 16.0 Phase Construction

**16.1** 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.

**16.2** When the installation of the thermoplastic fleece backed membrane is delayed for any reason, the following procedures should be followed:

- A. Glaze low spots and valleys with Type III or IV asphalt at the rate of 10 - 15 lb/100 ft<sup>2</sup> (0.49 - 0.73 kg/m<sup>2</sup>).
  - B. Prior to the application of the thermoplastic fleece backed membrane, examine the surface of the membrane thoroughly for the presence of any moisture. If moisture is present, the application of the thermoplastic fleece backed membrane is not to proceed until the moisture has been removed or evaporated and the surface is dry. If frothing or bubbling of the hot asphalt occurs, construction must stop immediately.
  - C. 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 thermoplastic fleece backed membrane.
  - D. Caution must also be exercised to avoid traffic over the newly installed thermoplastic fleece backed membrane while the asphalt is still fluid. This can also contribute to the formation of voids.
- 16.3 Under no circumstances shall the installation of the thermoplastic fleece backed membrane be delayed more than five days after installing the SBS modified bitumen intermediate plies and six months after installing the BUR intermediate plies to the roofing system.**

**16.4** Only multiple felt systems (two or three felts with thermoplastic fleece backed membrane) or DynaBase®, DynaPly® and DynaLastic® 180 S should be considered as the base felt(s) for the delay in application of the thermoplastic fleece backed membrane. Single ply felt or base felt systems must receive the thermoplastic fleece backed membrane on the same day.

## 17.0 Health and Safety

**17.1 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 MSDS are available on the JM Web site, [www.jm.com/roofing](http://www.jm.com/roofing) and 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 become familiar with this information prior to using the product, and observe certain precautions during use.**