

FIRESTONE ULTRAPLY™ TPO XR APPLICATION GUIDE

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I. GENERAL

This section of Firestone's Technical Manual provides instructions for the installation of Firestone's UltraPly TPO XR membrane using Firestone's XR Bonding Adhesive, Firestone XR Stick, Firestone Twin Jet Adhesive, Firestone Iso Spray R or hot steep asphalt. Reference to the Design Guide, Technical Information Sheets and other sections of Firestone's Technical Specifications is necessary to ensure that the finished roof system is installed in compliance with Firestone requirements and therefore suitable to receive a Firestone Warranty.

NOTE: IF A PROPOSED APPLICATION FALLS OUTSIDE THIS SPECIFICATION, CONTACT A FIRESTONE TECHNICAL COORDINATOR FOR ADDITIONAL INFORMATION.

II. JOB SITE CONSIDERATIONS (CAUTION AND WARNINGS)

- A. Keep all adhesives, sealants and cleaning materials away from ALL ignition sources (i.e., flames, fire, spark, etc.). Do not smoke while using these materials.
- B. Consult container labels, Material Safety Data Sheets and Technical Information Sheets for specific safety instructions for all products used on the project.
- C. Care must be used when installing fasteners to avoid possible conduits and other piping in and under the deck.
- D. Fumes from adhesive solvents or asphalt may be drawn into the building during installation through rooftop intakes. Refer to Firestone's Technical Information Sheet "Recommended guidelines for application of roofing materials to an Occupied Building".
- E. Store Firestone UltraPly TPO XR membrane in the original undisturbed plastic wrap in a manner to protect it from damage.
- F. Do not use oil-based or bituminous-based roof cement, mastics or caulks in direct contact with Firestone UltraPly TPO XR membrane.
- G. Insulation must be properly stored and protected from ignition sources, moisture, and damage.
- H. Follow all OSHA, NRCA and other industry recommendations for fire protection
- I. When the outside temperature is below 40 °F (4.4 °C), certain combinations of temperature and humidity may cause condensation on the surface of solvent-based adhesives and primers. If this condition occurs, discontinue their application. When the ambient air conditions no longer cause condensation on adhesive surfaces, re-apply additional adhesive or primer and proceed. The consistency of sealants, adhesives, and primers will begin to thicken as the temperature drops. To minimize this, the following is recommended:
 1. Start work with sealants, adhesives, and primers that have been stored between 60 °F and 80 °F (15.5 °C and 26.7 °C). Insulated heated boxes may be helpful.
 2. Conduct test areas to determine if conditions will occur such as condensation on adhesives, or difficulty in dispensing adhesives or sealants.
 3. Do not use heat guns or open flames to accelerate the drying of adhesives and/or primers.
 4. If using water-based bonding adhesive for flashing applications, temperatures of substrates and atmosphere must be at least 40 °F (4.4 °C) and rising. Longer drying times should be expected for lower temperatures and higher humidity.

III. ROOF SUBSTRATE PREPARATION

- A. Correct substrate defects
 1. Defects that require correction before work can commence should be brought to the attention of the General Contractor or Owner in writing, and addressed by them.
 2. For re-roofing applications, remove existing roof system components as specified by the Project designer and documents. Components or conditions that are discovered during installation that could be detrimental to the performance of the new roof system should be brought to the attention of the project designer for corrective action.

3. Good roofing practice requires a complete removal of the existing roof to the structural deck if soundness and integrity of the existing roof system cannot be verified. Recovering an existing roof system with a new roof is an alternative to removing existing roof components. However, non-destructive testing, in conjunction with examination of core cuts, must be performed to determine the condition of the existing roof system and decking.
 4. The building owner or project designer is responsible for assuring that all wet or damaged insulation and/or wet/damaged substrates are removed and replaced in re-roofing applications. A reliable diagnostic technique is taking and evaluating a series of roof cuts. There are three other techniques available to make this determination by indirect means: Nuclear moisture detection; Infrared thermography; and Electric capacitance. These techniques provide measurement of factors that can be associated with the presence of moisture, which can then be correlated to the roofing cuts to verify the results of the non-destructive testing.
- B. Rooftop moisture
Ponding water, snow, frost, dew, and ice must be removed from the substrates/work surfaces before installing the UltraPly TPO XR System.
- C. Prepare surfaces
Acceptable substrates to receive the UltraPly TPO XR Roofing System must be properly prepared before membrane installation. The surface(s) must be relatively even, clean, dry, smooth, and free of sharp edges, fins, loose or foreign materials, oil, grease and other materials that may damage the membrane. Rough surfaces that could damage the membrane must be overlaid with acceptable insulation.
- D. Fill Voids
All surface voids of the immediate substrate to receive UltraPly TPO XR membrane greater than ¼" (6.35 mm) wide must be filled with insulation or other approved filler.
- E. Vapor Retarder (when specified)
Install vapor retarder as specified by the project designer.
- F. Concrete Additives can have a negative impact on the adhesion of asphaltic membranes and insulation products. The concrete supplier/installer should verify that any additives in the mix will not render the deck unsuitable for roofing application. Firestone does not accept surface-applied curing compounds for warranted systems.
- G. Firestone does not accept for warranty any concrete substrates that have been sealed with chemical sealers or silicon surface treatments.

IV. WOOD NAILER LOCATION AND INSTALLATION

Wood nailers shall be installed as specified by the project designer or as noted in Firestone details and the system design guide. Install wood nailers as follows:

- A. Chemical Treated Wood Nailers
Chemical treating for fire resistance or other purposes (other than pressure treating for rot resistance, i.e. CCA, ACZA, CBA, ACQ or other copper treatments) may affect the performance of the Firestone membrane and accessories. Submit MSDS sheets with active ingredients listed for any chemically treated lumber not listed that will contact the membrane to Firestone Roofing Solutions Group to evaluate compatibility.
- B. Position Wood Nailer
Total wood nailer height must match the total thickness of roof insulation installed, with a ⅛" (3.2 mm) gap between each nailer length and at each nailer intersection.
- C. Secure Wood Nailer
Wood nailers shall be firmly fastened to the deck or building. Mechanically fasten wood nailers to resist a minimum 200 lb (890 N) force in any direction typically 12" (305 mm) on center. Refer to attachment requirements as specified by the project designer.
- D. Taper Wood Nailer
The wood nailer shall be tapered (as required) so the top surface of the wood nailer abutting the insulation matches the height of the insulation.

E. Size of Wood Nailer

All wood nailers shall extend into the field of the roof a minimum of ½" (12.8 mm) beyond any metal edged detail.

F. Wood Nailer by Others

Make these specifications and details available when others will install nailers. Work that compromises the integrity of the system may jeopardize the warranty.

NOTE: Because of recent EPA regulations regarding treated wood, new treatments for lumber may be highly corrosive to fasteners. Contact the fastener manufacturer for their recommendations on fasteners if attaching nailers that have been treated with corrosive materials.

V. INSULATION INSTALLATION

In order to assure the effective installation of TPO XR systems, Firestone will require the review and approval of any TPO XR project calling for direct application of TPO XR over Firestone ISOGARD™ / ISO 95+™ GL. Please notify Firestone Technical Services at 1-800-428-4511 should a project call for an application of TPO XR directly over ISOGARD / ISO 95+ GL.

A. Install insulation

Install only as much Firestone insulation as can be covered with roofing membrane and completed/made watertight before the end of the day's work or before the onset of inclement weather.

B. Fit insulation

Neatly fit insulation at all penetrations, projections, and nailers. Insulation should fit loosely; filling any gaps greater than ¼" (6.3 mm) with acceptable insulation or filler. Edges of insulation boards running parallel with the deck should be fully supported by the deck's top flange. Under no circumstance should the membrane be left unsupported over a space greater than ¼" (6.3 mm). Tapered insulation with acceptable facer for bonding must be installed around roof drains to provide proper slope for drainage as shown in Firestone details.

C. Stagger insulation joints

When installing multiple layers of insulation, staggering the joints is preferred. Staggering of insulation joints is not required to receive Firestone warranty.

VI. ATTACHING INSULATION

The insulation shall be attached to decking before installation of UltraPly TPO XR Fully Adhered System. This can be accomplished by Mechanical attachment, Adhesive Attachment or Asphalt attachment depending on the deck type and manufacturers recommendations.

A. Mechanical Attachment can be utilized to attach insulation using Firestone Insulation Plates and fasteners as follows:

1. Refer to Technical Information Sheet of insulation selected for attachment pattern and fastening rates. Refer also to specific code requirement for project fastening requirements.
2. Refer to Technical Information Sheet of fastener selected for attachment to determine deck penetration requirements.
3. When installing a multi-layer insulation assembly, the fastening pattern is determined by the type and thickness of the top layer of insulation.
4. Ensure that the fasteners are fully seated, but not overdriven. Overdriven fasteners will "cup" insulation plates, reducing their efficiency and providing a place for bonding adhesive to puddle.
5. Multiple layers of insulation may be installed using a common fastener. Fasteners should be sized to accommodate the total thickness of insulation plus any required substrate penetration.

B. Adhesive attachment can be utilized to attach insulation using Firestone ISO FIX™ ISO SPRAY R, ISO Twin Pack™, ISO Stick™, Twin Jet or other Firestone accepted insulation adhesives for the application as follows:

1. Apply the adhesive in strict accordance with the instructions provided with the product and the Technical Information Sheets that are part of Firestone's Technical Manual.
2. It may be necessary to prime the substrate prior to installing the insulation in adhesive. Refer to

- insulation adhesive instructions and specifications.
3. If installing on a metal deck (where allowed by specification), the edge of the board parallel with the roof deck must be completely supported by the top deck flange.
 4. The insulation must be **no larger than 4' X 4' (1.2 m X 1.2 m)**.
 5. It is necessary to “walk” insulation boards in and weight them down to ensure complete adhesion to the substrate.
 6. Additional layers of insulation may be installed in the same fashion.
- C. Asphalt attachment can be utilized to attach insulation using Asphalt (ASTM D 312 Type III or IV asphalt) or Firestone SEBS Asphalt as follows:
1. The insulation must be **no larger than 4' X 4' (1.2 m X 1.2 m)**.
 2. The substrate may require priming prior to installing the insulation. Refer to the Design Guide for specific information.
 3. The asphalt shall be at the manufacturer’s specified equiviscous temperature (EVT) at the point of installation. Install a minimum of 30 lb per 100ft² (1.46 kg/m²) or as necessary to ensure that complete adhesion is achieved.
 4. It is necessary to “walk” boards in to ensure complete adhesion of the insulation to the substrate.
 5. Additional layers of insulation may be installed in the same manner.

VII. INITIAL MEMBRANE POSITIONING

A. Fold Method

1. Position membrane: Place UltraPly TPO XR membrane over acceptable substrate without stretching membrane starting at the low point of the roof. Position UltraPly TPO XR membrane panels in “shingle” fashion so seams shed, and do not “buck” water flow.
2. Mark Substrate: Mark the substrate along the top edge of the panel as necessary for snapping of chalk lines in item D below.
3. Fold membrane back: After positioning the UltraPly TPO XR membrane on the substrate in the desired location, fold the membrane back on itself without wrinkling or moving the membrane, exposing the substrate.
4. Snap lines: Using the marks made in B above, snap chalk lines.
5. Install panel: Described in Section 2.08A or 2.08B below.

B. Unroll Method

1. Position membrane: Position the first panel of UltraPly TPO XR membrane over roof area to receive membrane. Position UltraPly TPO XR membrane in “shingle” fashion so seams shed, and do not “buck” water flow. Note: When using the unroll method, it is recommended that the first panel be installed in the fold method to assure proper alignment of subsequent rolls being installed using the unroll method.
2. “Set” the roll: Unroll about 10-20 ft (3.05-6.10 m) of the UltraPly XR Membrane and adjust it to its final position. This “sets” the roll and insures that unrolling the “set” roll will result in proper membrane placement when unrolled. Setting pails of adhesive on membrane at this point will serve to temporarily ballast and keep the roll in its proper position before adhering.
3. Install panel: Described in Section 2.08.1.A or 2.08.1.B below.

VIII. APPLICATION OF XR MEMBRANE USING HOT ASPHALT METHOD

- A. **Apply asphalt to substrate:** Apply asphalt (at the specified equiviscous temperature) to bonding substrate at a minimum of 30 lb per 100 ft² (1.46 kg/m²) +/- 3 lb per 100 ft² lb/100 ft² (.146 kg/m²). Do not apply asphalt to the fleece or seaming area of the UltraPly TPO XR membrane. Apply asphalt completely and evenly on the bonding substrate, avoiding puddles, globs, and uncoated areas.

Notes on application

- The asphalt shall be at the manufacturer’s specified equiviscous temperature (EVT) less 25 °F (14 °C) to 30 °F (17 °C) at the point of installation. Install a minimum of 30 lb per 100 ft² (1.46 kg/m²) and a maximum of 35 lb per 100ft² (1.70 kg/m²) asphalt to ensure that complete adhesion is achieved. Irregular substrates generally require additional quantities of asphalt to assure positive adhesion of the membrane.

- Do not apply hot steep asphalt to substrate directly under the top or overlap portion of the seam. **Do not walk on freshly applied UltraPly TPO XR membrane until asphalt has completely cooled.**
 - Provide sufficient protection of UltraPly TPO XR membrane from asphalt handling equipment. Plan the roof installation to minimize traffic over new roof areas.
- B. While the asphalt is still molten, mate the UltraPly TPO XR membrane to asphalt: Starting at one end of the fold, roll the UltraPly TPO XR membrane into the asphalt evenly, avoiding bridging and wrinkling. Because asphalt cooling rates vary due to ambient air temperatures, the time from asphalt application to membrane installation can vary greatly, and must be adjusted as necessary to assure proper adhesion. When temperatures are such that rapid cooling is occurring, the “Unroll Method” described in section 2.07B should be used.
- C. Without walking on the membrane, using a stiff bristled push broom, broom the freshly installed membrane to insure even and sufficient mating of the membrane into the asphalt.
- D. Adjoining roll ends are to be butted to each other not lapped. Refer to Firestones TPO XR End Lap detail for specific requirements.



Unroll Method using Hot Asphalt



Brooming in the membrane

Additional panel installation: Unroll adjacent panels completely, lapping the selvedge edge over the previous panel to allow for a minimum 1½" (38.1 mm) robotic heat welded seam or 2" (50.8 mm) hand welded seam. Once aligned in the final position, repeat steps used above.

Note: It is important to verify that welds completed at any transition from machine to hand application is completed properly. Validate weld transition is fully bonded and no gaps, fish mouths, pin holes or cold welds exist. Probe all welds to verify weld is completed properly.

IX. MEMBRANE INSTALLATION USING FIRESTONE XR BONDING ADHESIVE

A. Apply XR Bonding Adhesive to bonding substrate

Apply XR Bonding Adhesive to bonding substrate at 70-85 ft²/gal (1.718-2.086 m²/L). **Do not apply bonding adhesive to the fleece or seaming portion of the UltraPly TPO XR membrane.** XR Bonding Adhesive can be applied using: 9" (228 mm) minimum x ½" (12.7 mm) nap solvent-resistant roller designed to apply textured products, drop spreader, power roller, or industrial grade adhesive sprayer. Apply XR Bonding Adhesive evenly on the bonding substrate, avoiding puddles, globs, and uncoated areas.

Notes on application:

- When spraying XR Bonding Adhesive, tip size and pressures may need adjustment to offer desired spray fan. The following specifications are the range acceptable for application in a 12"-14" fan pattern.
- Do not apply XR Bonding Adhesive over ISOGARD / ISO 95+ GL substrate.

Criteria	Pump A	Pump B	Pump C
Pump ratio	56:1	30:1	45:1
Pump feed for all	either-gravity or pressure, not siphon		
Hose size dia./length	½" / 50'	½" / 25'-50'	50'-100'
Spay tip	.725"	.035" - .041"	.031" - .041"
Power	100 psi (air)	5.5hp gas	18 hp gas
Spray pressure-psi	4000-5000	2500-3000	2500-2800

- When drop spreading XR Bonding Adhesive, application drain holes in pail may need to be larger than ⅛" (3.2 mm) to offer desired drop rate.
- When spraying or drop spreading XR Bonding Adhesive, back-rolling XR Bonding Adhesive is required to insure uniform bonding substrate coverage.
- Do not apply XR Bonding Adhesive to substrate directly under the top or overlap portion of the seam. Proper marking of the adhesive coverage area is important to insure making seams in shingle fashion that do not “buck” water.

NOTE: XR Bonding Adhesive is aggressive, and standard paint type rollers may not work for any extended period of time.



Unroll Method using UltraPly XR Bonding Adhesive



Roller application of XR Bonding Adhesive



Weighted compression rolling of XR membrane

- C. Allow XR Bonding Adhesive to flash-off
Allow approximately a 5 minute flash-off period after application of XR Bonding Adhesive before mating membrane to bonding adhesive. Flash-off times may vary depending on ambient conditions. Complete Touch-Push test to ensure that the adhesive is ready for bonding. Adhesive is ready to receive membrane when it is tacky and stringy to the touch. If not, re-apply bonding adhesive and allow a shorter flash-off interval. Flash-off period may need to be adjusted based on ambient air conditions.
- D. Mate the UltraPly TPO XR membrane to XR Bonding Adhesive coated substrate
Starting at one end of the fold, roll the UltraPly TPO XR membrane into the bonding adhesive coated substrate evenly, avoiding bridging and wrinkling.
- E. Roll the freshly bonded membrane
Using a heavy roller, such as a linoleum or lawn roller of approximately 75-150 lb (34-68 kg) with smooth roller surfacing, roll the freshly bonded portion of the UltraPly TPO XR membrane with at least 2 back and forth motions.
- F. Repeat bonding process
Repeat bonding process as required to completely installing the roof.

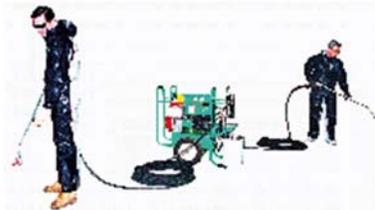
X. MEMBRANE INSTALLATION USING FIRESTONE XR STICK OR ISO SPRAY R ADHESIVE

A. General Conditions

1. Install only as much UltraPly TPO XR membrane (XR100 or XR115) as can be completed and made watertight during the working day.
2. Substrates and ambient conditions shall exceed 40 °F (4 °C) and rising.
3. Substrates to receive XR STICK or ISO SPRAY R Adhesive shall be above 40 °F and rising, clean, smooth, dry, free of sharp edges, loose and foreign materials, oil, grease, and other contaminants.
4. Apply XR STICK or SPRAY R ADHESIVE to bonding substrate only at a coverage rate range of 60-200 ft²/gal (1.4-4.8 m²/L), depending on the application and porosity of the substrate. **Do not apply XR STICK or SPRAY R adhesive to the fleece or seaming portion of the UltraPly TPO XR membrane.**
5. XR STICK is available in 2-part 0.2 gal (750 ml) cartridges or 5 gal (19 L) boxes and can be dispensed using various Firestone approved hand or electric dispensing units, through a static mixing tip as a two component low rise polyurethane foam adhesive in beads or ribbons.



6. ISO SPRAY R Adhesive is available in 15 gal (57 L) or 55 gal (208 L) drums that are dispensed using a heated high or low-pressure spray or bead extruding system as a mixed two component polyurethane adhesive applied with a full coverage spray application or a bead dispensing application. See adhesive TIS for additional equipment information.



7. Apply XR STICK or ISO SPRAY R adhesive evenly on the bonding substrate, avoiding puddles, globs, and uncoated areas.

XI. METHOD OF APPLICATION FOR ULTRAPLY TPO XR ATTACHMENT WITH XR STICK OR ISO SPRAY R ADHESIVE

- A. Starting at the highest roof elevation, unroll and position UltraPly TPO XR membrane. Position UltraPly TPO XR membrane panels so the laps will be completed in “shingle fashion”, and not “buck” or hold water. Unroll UltraPly TPO XR membrane sheet and position in place. Fold sheets in half width-wise.
 - B. Fold the properly positioned panels of UltraPly TPO XR membrane back to expose the substrate to receive ISO SPRAY R or XR STICK Adhesive.
 - C. Dispense ISO SPRAY R or XR STICK Adhesive on the substrate as follows:
 1. Spray Application: fully spray adhesive to obtain full coverage (approx. ⅛" to ¼" thick after foaming).
 2. Bead Application: For extruded bead applications, apply a ¾" to 1" wide bead, when wet, of the adhesive at a rate of 4", 6" or 12" on center depending on application requirements.
 3. **NOTE:** Closer Bead spacing may be required at building corners and edges depending on wind zone. Apply ISO Spray R or XR STICK Adhesive to the substrate achieving a light yellow color foam.
 4. If the ISO SPRAY R or XR STICK does not rise, stop dispensing; troubleshooting is required to determine why the ISO SPRAY R or XR STICK is not rising.
 5. **Do not apply ISO SPRAY R Adhesive or XR STICK to UltraPly XR Membrane.** Keep lap areas of UltraPly TPO XR Membrane clean and free of ISO SPRAY R or XR STICK Adhesive. Remove any adhesive that contaminates the lap areas immediately and clean the lap area with appropriate cleaning materials.
 - D. Allow ISO SPRAY R or XR STICK to rise (within 1 to 3 minutes, depending on ambient conditions), then mate the UltraPly TPO XR Membrane into the freshly installed ISO SPRAY R or XR STICK Adhesive. The rise time will vary based on environmental conditions like temperature and humidity. Shaded areas, and cool overcast days will have longer rise times.
 - E. Roll the freshly mated UltraPly TPO XR Membrane using a 150 lb x 30" or 100 lb x 16" roller (such as linoleum roller or landscaping roller) to ensure proper adhesion.
- NOTE: Roller not to exceed 150 lb**
- F. Performance of ISO SPRAY R or XR STICK Adhesive should be periodically monitored during the workday to verify that sufficient rise, adhesion, and full mating is occurring.
 - G. Do not attempt to apply ISO SPRAY R or XR STICK when unfavorable conditions exist (ie: rain, snow frost, high wind, etc.).

XII. COVERAGE RATE FOR XR STICK OR ISO SPRAY R ADHESIVE

- A. Full Coverage Spray Application
 1. ISO Spray R Adhesive can be spray applied in a full coverage application to the roofing substrate.
 2. Relatively smooth surfaces will result in a coverage rate of approximately 96 ft² per gallon (2.3 m² per L) of mixed (1:1) ISO Spray R Adhesive.
 3. Coverage rates will vary from 96 ft² per gallon (2.3 m² per L) to 60 ft² per gallon (1.4 m² per L) of mixed (1:1, A: B ratio) ISO SPRAY R Adhesive depending on the substrate's porosity.
- NOTE:**
- Coverage rate will be reduced due to irregularities in substrates. Note that the coverage rate for ISO SPRAY R at the roof perimeter and corner sections may vary according to roof system design requirements.
 - Refer to Equipment Supplier's suitability for use of mix/meter/spray two-component polyurethane adhesive.
- B. Bead Coverage Application
 1. Using the approved equipment dispensing a continuous mixed bead width of ¾" (19 mm) to 1" (25 mm), when applied over various substrates, the coverage rates of mixed (1:1) ISO Spray R Adhesive or XR STICK beads will vary depending on the bead spacing:
 2. **4" o.c. bead spacing coverage rate: 60 – 90 ft² per gallon** (1.4 – 2.2 m² per L) of mixed (1:1) ISO Spray R Adhesive or XR STICK depending on the substrate

3. **6" o.c.** bead spacing coverage rate: **90 – 120 ft² per gallon** (2.2 – 2.9 m² per L) of mixed (1:1) ISO Spray R Adhesive or XR STICK depending on the substrate
4. **12" o.c.** bead spacing coverage rate : **170 – 200 ft² per gallon** (4.1 – 4.8 m² per L) of mixed (1:1) ISO Spray R Adhesive or XR STICK depending on the substrate

NOTE:

- Coverage rate may be reduced due to irregularities in substrates.
- Coverage rates will vary if the bead spacing is increased.
- These typical coverage rates are applicable when the XR Stick is properly mixed with 1:1 ratio and applied in the appropriate bead spacing in a serpentine pattern at a bead width of 3/4" to 1" (19 mm to 25.4 mm).
- The coverage rate for ISO Spray R Adhesive or XR STICK at the roof perimeter and corner sections may vary according to roof system design requirements.



Bead application of XR Stick in cartridge on mechanically attached Polyisocyanurate insulation board @ 12" o.c.



Bead application of XR Stick in cartridge on mechanically attached Polyisocyanurate insulation board @ 6" o.c.



Freshly applied beads of XR Stick on mechanically attached Polyisocyanurate insulation board @ 4" o.c.

C. Reaction Time

When applying ISO Spray R Adhesive or XR Stick, the TPO XR membrane must be placed into the adhesive while it is still wet and tacky (before it reaches tack free state). The membrane may be placed into adhesive shortly after it has reached its maximum rise, typically after 2-3 minutes.



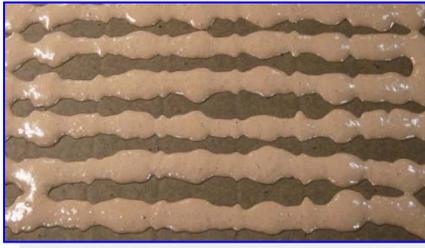
STEP 1) FRESHLY APPLIED ISO SPRAY R ADHESIVE /XR STICK - CREAM STAGE



STEP 2) ALLOW ISO SPRAY R ADHESIVE /XR STICK ADHESIVE TO RISE (1 TO 3 MINUTES)



STEP 3) TACK-FREE STAGE – READY FOR APPLICATION OF ULTRAPLY TPO XR MEMBRANE (AFTER 5 -7 MINUTES).



Close up of 4" Bead Spacing



Close up of 12" Bead Spacing



Roll UltraPly TPO XR into XR Stick or ISO Spray R Adhesive



Apply pressure to the top surface of the membrane to ensure contact with a roller (not to exceed 150 lb/68 kg)

XIII. PERIMETER AND CORNER ENHANCEMENTS FOR XR STICK OR ISO SPRAY R ADHESIVE – BEAD APPLICATION

Building Height	Bead Spacing (Perimeter)	Bead Spacing (Corner)	Bead Spacing (Field)
0-25'	6" o.c – 4' perimeter	4" o.c	12" (305 mm) o.c.
25-50'	6" o.c – 8' perimeter	4" o.c.	12" (305 mm) o.c.
50-75'	6" o.c – 12' perimeter	4" o.c.	12" (305 mm) o.c
75-100'	6" o.c – 16' perimeter	4" o.c	12" (305 mm) o.c
Greater than 100'	Contact your local technical coordinator for bead spacing requirements at 1-800-428-5411		

NOTE:

- When following local building code or regulatory agency’s requirements, the bead spacing of ISO Spray R Adhesive or XR Stick in the perimeter and corner areas may differ from the table above. The coverage rate for XR Stick at the roof perimeter and corner sections may vary according to roof system design and wind uplift requirements. Please refer to Firestone’s code approval guide or contact your Firestone Technical Services Advisor at 1-800-428-5411 for more information.
- Use a ¾ to 1" (19-25 mm) wide bead

XIV. ACCEPTABLE SUBSTRATES FOR ULTRAPLY TPO XR INSTALLED WITH XR STICK OR I.S.O. SPRAY R ADHESIVE

Deck/Substrate	Acceptable	Not-Acceptable	NOTE
Structural Concrete (New)	X		New poured decks must be completely dry prior to application of XR Stick.
Structural Concrete (Existing)	X		
Plywood and OSB	X		
Cementitious Wood Fiber	X		
Gypsum Decks	X		
Lightweight Concrete*	X		
Coal Tar Pitch Built-up Roofs		X	ISOGARD™ HD Cover board required over coal tar BUR.
Existing Asphalt and Modified Bitumen Roofs (Mineral or Smooth Surfaced)	X		Any residual asphalt must be cleaned and scraped as smooth as possible.
Existing Single-Ply Roofs		X	
SBS Base Sheets	X		
Insulations:			
ISOGARD / ISO 95+ G/L or ISOGARD CG / RESISTA	X		
wood fiberboard	X		
Cementitious Wood Fiber	X		
ISOGARD HD	X		
DensDeck™ Products	X		
Expanded / Extruded Polystyrene		X	
Fiberglass		X	
Perlite		X	

- Acceptable Lightweight concrete substrates include cellular or air-entrained concrete. Lightweight concrete substrates with aggregate (such as perlite or vermiculite) are not acceptable.
- DensDeck is a registered Trademark of Georgia-Pacific.

XV. CAUTIONS AND WARNINGS WHEN WORKING WITH XR STICK OR I.S.O. SPRAY R ADHESIVE

- Review the applicable SDS for complete safety information prior to use.
- The foam produced is an organic material. It must be considered as combustible and may constitute a fire hazard. The foam adhesive must not be left exposed or unprotected. Shield from heat and sparks.
- Do not smoke during application.
- Use with adequate ventilation. Avoid breathing vapors. Wear a NIOSH or MSHA approved respirator for organic vapors with pre-filters and solvent-resistant cartridges or supplied airline respirators while spraying. Proper safety training is essential for all persons involved in the installation process. If vapor is inhaled, remove to fresh air and administer oxygen if breathing is difficult. Consult a physician immediately.
- Avoid contact with eyes. Safety glasses or goggles are required.
- If ISO Spray R or XR STICK adhesive is splashed in eyes, immediately flush eyes with plenty of clean water for at least 15 minutes. Contact a physician immediately.
- Avoid contact with skin. Wear long sleeved shirts and long pants. Wash hands thoroughly after handling. In case of contact with skin, thoroughly wash affected area with soap and water or corn oil.

NOTE: Permeation resistant gloves that meet ANSI/ISEA 105-2005 are required when handling the material directly or during application.

- H. Job site storage temperatures in excess of 90 °F (32 °C) may affect product shelf life. Should the components be stored at temperatures lower than 70 °F (21 °C), restore to room temperature prior to use. Do not allow ISO Spray R or XR STICK to freeze (storage below 32 °F (0 °C)).
- I. Use spray booths, windscreens, and/or lower spray pressure with spatter tips when spraying in windy conditions.
- J. Precautions must be taken to prevent ISO Spray R or XR STICK vapors or overspray from entering buildings during application. All air intake vents on roofs must be closed during application of ISO Spray R or XR STICK.
- K. Use desiccant dryers on Part A drums to avoid formation of crystals from exposure to moisture in the air.
- L. ISO Spray R or XR STICK Adhesive does not adhere well to previously unexposed asphalt when applied in bead form.
- M. KEEP OUT OF THE REACH OF CHILDREN.

XVI. Adhere Membrane Using Firestone Twin Jet Adhesive

- A. After allowing the pre-positioned Firestone UltraPly TPO XR Membrane to relax, back-roll the membrane panels to expose the substrate to receive Twin Jet adhesive. (Do not “butterfly” large areas of roof membrane during Twin Jet Adhesive application.) Take care not to move or otherwise disturb Firestone UltraPly TPO XR Membrane from its final intended position while back-rolling.
- B. Dispense Twin Jet onto the substrate as follows:
 - **Bead Application:** Apply Twin Jet Adhesive on the substrate in ¾" - 1" (19- 25 mm) wide beads, spaced maximum 12" (305 mm) on center.
 - **Spatter Application:** Spatter Twin Jet at a rate of 60-70% coverage over the horizontal substrate and 75-85% when used as a base tie-in. Expect to achieve approximately 2200 ft² to 2350 ft² (204 m² to 218 m²) per canister set.
- C. Do not apply Twin Jet Adhesive directly to Firestone UltraPly TPO XR Membrane. Keep lap areas of PVC XR Membrane clean and free of Twin Jet Adhesive overspray. Remove any Twin Jet Adhesive from the seam area before mating the seam, or strip in the contaminated seam area.
- D. Allow Twin Jet Adhesive to rise in height and reach open/mate condition. Mate the TPO XR membrane to the substrate before a skim coat develops on the adhesive (see product TIS for additional information).
- E. Immediately after setting the membrane in the Twin Jet adhesive, broom the membrane to initiate adhesion, then roll thoroughly using a 75 lb to 150 lb (34 kg to 68 kg) roller. It is important that the freshly installed membrane and substrate remain in contact with the Twin Jet adhesive until the adhesive sets to ensure proper adhesion.

XVII. MEMBRANE SEAMING

- A. Clean the Lap Splice Area:

Wearing chemical resistant gloves and using a clean white cotton rag dampened with Firestone SW-100 (Splice Wash), thoroughly clean the salvage edge area of the top sheet and an area on bottom sheet at least 2¾" inches (69.8 mm) wide if the seam area has become contaminated with dirt, debris, moisture or other contaminants. If contaminated with asphalt, the finished seam must be stripped in with an 8" wide piece of UltraPly TPO membrane of the same or greater thickness. Membrane left exposed or unwrapped for more than 12 hours must be cleaned before any welding activity.
- B. Equipment and Test Splice Requirements:
 1. The speed of the welding machine shall be adjusted to provide proper seam strength based on ambient conditions.
 2. Ample power source shall be provided to heat welding equipment. A generator dedicated to the heat welding equipment shall be used on all installations. Refer to the welding and generator equipment requirements in the Technical Information section of this manual for minimum requirements. For specifics, consult the welder manufacturer's data sheets.

3. When weather conditions vary, adjustments to the welding machine must be made. It is recommended that this be done using spare or test material before starting welding of the finished roofing material. In addition, there shall be destructive tests performed daily and at the beginning of welding and after interruptions in the welding process (such as power failure; welder shut down; job site condition change; after break or lunch). There should be periodic checks (including at the start of each work day welding will occur).
4. Welder Settings:
 - a. Standard Setup

The speed of the machine shall be adjusted to provide proper seam strength. Ample power source shall be provided to all heat welding equipment. A generator dedicated to the heat welding equipment shall be used on all installations. Refer to the welding and generator equipment requirements located in the Firestone UltraPly TPO Application Guide. When weather conditions vary, adjustments to the welding machine shall be made. Sample welds should be made by using spare material before welding the finished roofing material. In addition, destructive tests must be performed at the beginning of each workday and every time there is an interruption in the welding process (such as power failure; welder shut down; job site condition change; after break or lunch). It is recommended to perform periodic checks of the weld integrity throughout the day's installation.
 - b. Seam guide

Adjust the wheel guide by placing unit on top of the membrane with the outer edge of the Drive/Pressure wheel in contact with the membrane edge
- C. Hot Air Weld Lap Splices: Horizontal field splices, these areas are to be welded first:
 1. Wherever possible, all field splices on the horizontal surface (including flashing) should be completed using an automatic heat welder that has been designed for hot air welding of thermoplastic membranes. Refer to the welding equipment requirements in the Technical Information Sheets for minimum requirements. For specifics, consult the welder manufacturer's data sheets.
 2. Seam width requirements: Seams made with the automatic welder shall be a minimum of 1½" (38.1 mm) wide. Seams made with hand welders shall be a minimum of 2" (50.8 mm) wide. Use silicone hand rollers to assure proper mating of surfaces as hand welding proceeds. **Note: It is important to verify that welds completed at any transition from machine to hand application is completed properly. Validate weld transition is fully bonded and no gaps, fish mouths, pin holes or cold welds exist. Probe all welds to verify weld is completed properly.**
 3. Vertical field splices: On vertical surface welds, or where an automatic welder is not practical, hand welders shall be used.
- D. End Splices: End lap splices are applied over field membrane sections where no selvedge edge is available, after the side lap splice is completed. Using Firestone TPO Cover Strip or a minimum 8" (203.2 mm) wide strip of standard (non-fleece) 60 mil TPO membrane, splice the butted end joint by welding the strip along its entire length. Seal any cut edges as shown in lap splice details.
- E. Seam Inspection: Probe all completed welds with a dull cotter pin puller type tool to verify seam integrity. Do not probe welds until they have cooled. Any welds found to be insufficiently fused need to be repaired on a daily basis.
- F. T-Joint Patches: T-joint patches shall be installed at all intersections of field seams when membrane is greater than 0.045" (1.14mm) Membrane to receive T-Patch cover shall have the edged eased by heating and rolling to minimize any step. Refer to Lap Splice and T-Joint Detail Section of Firestone's Technical Manual.
- G. Cut Edge Sealant: All membrane lap edges with exposed scrim (cut edges) shall be sealed with Firestone UltraPly TPO Clear Cut Edge Sealant or UltraPly TPO General Purpose Sealant.

XVIII. ADDITIONAL MEMBRANE SECUREMENT AND BASE TIE-IN FLASHING

Provide membrane securement: Secure the membrane at all locations where the membrane undergoes an angle change greater than 1" / 12" (25.4 mm in 304.8 mm). This typically occurs at: roof edges; curbs; wall intersections; parapets, etc. Mechanically fasten with Firestone HD Seam Plates using Firestone Fasteners applied either horizontally into the deck or vertically into the wall in accordance with Firestone Base Tie-In

Details. Refer to the Firestone System Design Guide or Firestone Technical Information Sheets to determine the applicable fastener and penetration requirements for specific substrate conditions.

XIX. FLASHING-PENETRATIONS

A. General

1. Remove all loose existing flashing (i.e., lead flashings, bituminous materials, mastics, etc.).
2. Flash all penetrations that pass through the UltraPly TPO XR membrane in accordance with Firestone standard TPO details as indicated in the Technical Information Manual.
3. The flashing seal must be made directly to the penetration.

B. Pipes, Round Supports, Structural Steel Tubing, etc.:

1. Flash pipes with Firestone UltraPly TPO Pre-molded Pipe Flashing where practical.
2. Refer to the Firestone Technical Information Sheet for minimum and maximum pipe diameters that can be successfully flashed with Firestone UltraPly TPO Pre-Molded Pipe Flashings.
3. Flash inside and outside corners with Firestone pre-molded products per Firestone details
4. Firestone UltraPly TPO Unsupported Flashing is only to be used at non 90 degree inside and outside corners, "T" joints, and field wrapped pipe boots and other special conditions where allowed by Firestone details.

C. Roof Drains (cast iron only):

1. Remove all existing flashing (including lead flashing), roofing materials and cement from the existing drain in preparation for UltraPly TPO 96 or 120 membrane and Firestone Water Block Seal.
2. Provide a clean even finish on the mating surfaces between the clamping ring and the drain bowl.
3. Install tapered insulation with acceptable bonding surfaces around the drain to provide a smooth transition from the roof surface to the drain. Slope into drain shall not exceed 1"/12" (25.4 mm in 304.8 mm).
4. A minimum 4' X 4' (1.2m x 1.2m) UltraPly TPO 96 or 120 membrane sheet shall be centered over the drain area per detail UTXR-D-1 because UltraPly TPO XR membrane cannot be sealed properly to roof drains use UltraPly TPO 96 or 120 membrane at these locations.
 - When using Asphalt to apply UltraPly TPO XR, stop asphalt at end of XR membrane. The UltraPly TPO 96 or 120 must be set in ULTRAPLY TPO BONDING ADHESIVE at the drain area.
 - 20 year warranty roof assemblies will require a second layer of standard UltraPly TPO 96 or 120 membrane installed in the sump area. See 20 year detail PUT-D-1
5. Position the UltraPly TPO 96 or 120 membrane, then cut a hole for the roof drain to allow a ½" (12.7 mm) minimum and ¾" (19.1 mm) maximum inside the clamping ring.
6. Using a punch, or other suitable device, make round holes (sized to receive clamping bolts) in the membrane to align with clamping bolts. Do not cut the membrane back to the bolt holes.
7. Install Firestone Water Block Seal on the clamping ring seat flange below the membrane. Use a minimum of one half of a 10-ounce (295 CC) tube for a 10" (254 mm) drain.
8. Install the roof drain clamping ring and clamping bolts. Tighten the clamping bolts to achieve constant compression of the Water-block Seal.
9. Contact Firestone Roofing Solutions Group for flashing of other drain types.

D. Pipe Clusters and Unusual Shaped Penetrations

1. Fabricate Firestone UltraPly TPO Coated metal penetration pockets to allow a minimum clearance of 1" (25.4 mm) between the penetrations and all sides.
2. Secure Firestone QuickSeam or weldable penetration pockets and flash per current Firestone details.
3. Fill penetration pockets with Firestone Pourable Sealer to shed water away from penetrations. Firestone Pourable Sealer shall be poured to a depth of 2" (51 mm) minimum.
4. Firestone UltraPly TPO unsupported flashing may also be used for some details.

E. "Hot" Pipes (greater than 140 °F [60 °C])

1. Protect UltraPly TPO components from direct contact with steam or heat sources that exceed the in-service temperature of 140 °F (60 °C).
2. Pipes and roof penetrations exceeding 140 °F (60 °C) shall be flashed to an intermediate, or separator, sleeve to protect UltraPly TPO components from these direct heat sources.

F. Flexible Penetrations

1. Flexible roof penetrations shall be flashed by means of a watertight “gooseneck”.
2. Watertight “gooseneck” shall be set in Water Block Seal, secured to deck, and flashed in accordance with Firestone Details.

G. Scuppers

1. Remove any existing scuppers, and install a new scupper sleeve fabricated from Firestone UltraPly TPO coated metal.
2. Secure new scupper to the structure.
3. Flash new scupper in accordance with Firestone Details.

H. Expansion Joints

1. Install expansion joints in accordance with Firestone details where specified by project designer.
2. Flash expansion joints in accordance with Firestone details.

XX. FLASHING- WALLS, PARAPETS, MECHANICAL EQUIPMENT CURBS, ETC.

- A. General: Using the largest piece(s) of continuous Firestone UltraPly TPO 96 or 120 membrane practical, flash all walls, parapets, curbs, etc, to the height specified by the project designer.
- B. Evaluate bonding substrate; add acceptable bonding substrate as required: The following substrates require the installation of 5/8" (15.9 mm) exterior grade or “Wolmanized” plywood anchored in accordance with project designer’s requirements: Interior Gypsum board; Stucco; Cobblestone; Textured masonry, exterior gypsum panels, Corrugated metal panels; all other uneven or loose substrates.
- C. Curb and base flashing with UltraPly TPO 96 or 120 membrane:
 1. Apply UltraPly Bonding Adhesive, Firestone Water-based Bonding Adhesive, or XR Bonding Adhesive at about the same time to both the membrane flashing and the surface to receive the flashing at about the same time to allow approximately the same drying time.
NOTE: When using TPO 96 or 120 Membrane as flashing and XR Bonding Adhesive as the adhesive, it must be applied to both surfaces as a contact adhesive. Application of Firestone’s XR Bonding Adhesive is to one surface only when attaching UltraPly TPO XR Membrane in the field.
NOTE: Firestone’s XR Bonding Adhesive requires the use of a solvent resistant paint roller. Application can be maximized through the use of a roller designed for medium to semi-rough textured surfaces.



Example: Wooster 9" Texture Maker or similar Paint Roller

2. Apply Firestone’s XR Bonding Adhesive by rolling the adhesive on the mating surfaces evenly, avoiding puddles or globs, at the specified coverage rate. Refer to the Technical Information Sheets for the specific adhesive.
3. Allow flash off period for bonding adhesive.
4. Test bonding adhesive for readiness. Touch the bonding adhesive surface with a clean, dry finger to be certain that the adhesive does not stick or string. As you are touching the adhesive, push straight down to check for stringing, and push forward on the adhesive at an angle to ensure that the adhesive is ready throughout its thickness. If either motion exposes wet or stringy adhesive when the finger is lifted, then the adhesive is not ready for mating. Flash off time will vary depending on ambient air conditions. This is especially true for water-based adhesives. Firestone Water-based Bonding Adhesive will change appearance from opaque to nearly transparent, indicating it is ready for mating. Coverage rate will differ with varying substrates and/or climatic conditions.
5. Roll membrane flashing up the vertical bonding adhesive coated substrate evenly and carefully taking care to avoid wrinkles.

6. Broom the membrane flashing after mating using a stiff push broom to insure proper contact and mating.
7. Complete the splice between the membrane base flashing and the main roof UltraPlyTPO XR membrane by hot air welding. Complete lap splices in accordance with Firestone details.
8. Install termination of base flashing in accordance with Firestone Details.
9. Install Intermediate Attachment over membrane flashing 36" (91.44 cm) on center in accordance with Firestone Details.

NOTE: Intermediate Attachment may be eliminated if:

- Wall surface is smooth without noticeable high spots or depressions: such as plywood, poured or pre-cast concrete, hollow core block or masonry walls where mortar joints are flush with masonry surface, **AND**
- The termination of membrane flashing is a Termination Bar or membrane flashing extending completely under coping to the outside wall to the outside face edge.

XXI. FLASHING- GRAVEL STOPS OR ROOF EDGE METALS

- A. Use Firestone prefabricated Coping, AnchorGard, EdgeGard or other product as indicated. Install in accordance with Firestone details.
- B. Use UltraPly TPO Coated Metal per Firestone details.
 1. When using UltraPly TPO Coated Metal perimeter UltraPly TPO XR sheet must be placed parallel to metal edge with salvage edge positioned to weld to the edge metal.
 2. Coated metal edge detail must provide enough room to permit "T" patch or strip-in of details with sufficient width wood nailer for support.
- C. Use other metals formed as needed for special conditions and flashed using TPO QuickSeam Flashing:
 1. Install gravel stop metal as specified by project designer. Flange of gravel stop metal shall be flashed using TPO QuickSeam Flashing (**For a maximum 20-year warranty**).
 2. Apply Firestone TPO QuickPrime Plus to flange of gravel stop/edge metal with QuickScrubber or QuickScrubber Plus pad and handle with long back and forth strokes with heavy pressure on splicing area to receive the TPO QuickSeam Flashing. Stir the TPO QuickPrime Plus before and during use. Dip the Firestone QuickScrubber or QuickScrubber Plus pad into TPO QuickPrime Plus, keeping the pad flat. Change pads every 200' (61 m) or when pad no longer holds the proper amount of TPO QuickPrime Plus.
 3. Allow a brief flash-off time (usually less than 10 minutes) for the TPO QuickPrime Plus before applying TPO QuickSeam Flashing.
 4. Install TPO QuickSeam Flashing centered over the flange edge of the gravel stop/edge metal using. Roll the TPO QuickSeam Flashing using a silicone coated rubber roller immediately after installation of TPO QuickSeam Flashing.

XXII. MEMBRANE REPAIR

- A. Repair punctures/cuts/damage to UltraPly TPO XR membrane. The repair material shall be heat welded UltraPly TPO 96 or 120 membrane and extend 2" (50.8 mm) minimum past the damaged area in all directions. Round all corners of the repair piece. Example: A pinhole will require a minimum 4" X 4" (101.6 mm X 101.6 mm) patch.
- B. Clean the membrane: When making a repair to UltraPly TPO XR membrane that has been in service for some time, it is necessary to remove accumulated field dirt. Scrub the membrane with a scrub brush and warm soapy water, followed by rinsing with clear water and wipe with clean cotton rags. For membrane with significant accumulation of dirt, cleaning with acetone and clean cotton cloths may be required. Firestone SW-100 Splice Wash may then be used.
- C. Install splice per 2.09.1 for splicing procedures.

XXIII. TEMPORARY CLOSURE (NOT WARRANTED BY FIRESTONE)

- A. Temporary closures to ensure that moisture does not damage any completed section of the new roofing system are the responsibility of the roofing contractor.

- B. Completion of flashings, terminations, and temporary closures should be completed as required to provide a watertight condition.
- C. Any material contaminated by temporary closure shall be removed and discarded before resumption of installation.

XXIV. ROOF WALKWAYS

- A. Install walkways in locations as specified by the project designer in accordance with Firestone requirements.
- B. Walkways shall consist of 30" (762 mm) wide Firestone UltraPly TPO Walkway, or Firestone X-Tred™ Walkway Pad.
- C. Heat weld the edges of the walkway material to the UltraPly TPO XR membrane using the welding procedures in Section 2.08.1

XXV. SHEET METAL WORK

- A. For specific installation instructions for the Firestone prefabricated metal edge treatments: Firestone Coping, AnchorGard, EdgeGard or UltraPly TPO Coated Metal or System, refer to the respective Technical Information Sheet.
- B. For all other sheet metal work not supplied by Firestone, refer to fabrication and installation requirements established by the project designer.

XXVI. CLEAN UP

- A. If cleaning is required, the UltraPly TPO XR membrane may be cleaned by gently scrubbing with a non-abrasive scrubber and a soap and water solution followed by rinsing the area completely with clean water.
- B. Firestone SW-100 Splice Wash may also be used sparingly with clean cotton cloths to clean to the membrane,

End of Section