

## SECTION 07533

### MECHANICALLY ATTACHED SINGLE-PLY ETHYLENE PROPYLENE ROOFING

PART GENERAL

#### SYSTEM DESCRIPTION

Furnish and install mechanically attached Hi-Tuff/EP Roofing system in accordance with drawings and specifications approved by Stevens Roofing Systems.

#### RELATED SECTIONS

Section 03300 - Cast-In-Place Concrete.

Section 03510 - Gypsum Concrete.

Section 03520 - Lightweight Insulating Concrete Deck.

Section 04200 - Unit Masonry.

Section 05310 - Steel Roof Deck.

Section 06100 - Rough Carpentry.

Section 15430 - Plumbing Specialties.

Section 16670 - Lightning Protection Systems.

#### REFERENCES

Approval Guide; Factory Mutual Engineering and Research.

ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

ASTM D 471 - Standard Test Method for Rubber Property-Effect of Liquids.

ASTM D 573 - Standard Test Method for Rubber-Deterioration in an Air Oven.

ASTM D 751 - Standard Test Methods for Coated Fabrics.

ASTM D 816 - Standard Test Methods for Rubber Cements.

ASTM D 1149 - Standard Test Method for Rubber Deterioration-Surface Ozone Cracking in a Chamber.

ASTM D 1204 - Standard Test Method for Linear Dimensional Changes of Non-Rigid Thermoplastic Sheeting or Film at Elevated Temperature.

ASTM D 2136 - Standard Test Method for Coated Fabrics--Low-Temperature Bend Test.

ASTM D 2137 - Standard Test Method for Rubber Property-Brittleness Point of Flexible Polymers and Coated Fabrics.

Fire Resistance Directory; Underwriters Laboratories Inc. (UL).

Fed. Std. 101, Method 2031 - Puncture Resistance; Part of Fed. Std. 101, Test Procedures for Packaging Materials.

#### DEFINITIONS

American Society Civil Engineers (ASCE) Exposure Class A: This classification applies to large city centers with at least 50 percent of the buildings having a height in excess of 70 feet. Use of this exposure category shall be limited to those areas for which representative terrain prevails in the upwind direction for a distance of at least one-half mile or 10 times the height of the building or structure, whichever is greater. Possible channeling effects or increased velocity pressures due to the building or structure being located in the wake of adjacent buildings shall be taken into account.

American Society Civil Engineers (ASCE) Exposure Class B: Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of a single-family dwelling or larger. Use of this exposure category shall be limited to those areas for which representative terrain prevails in the upwind direction for a distance of at least 1,500 feet or 10 times the height of the building or structure, whichever is greater.

American Society Civil Engineers (ASCE) Exposure Class C: Open terrain with scattered obstructions having heights

generally less than 30 feet. This category includes flat, open country and grasslands.

American Society Civil Engineers (ASCE) Exposure Class D: Flat, unobstructed areas exposed to winds flowing over large bodies of water. This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shoreline a distance of 1,500 feet or 10 times the height of the building or structure, whichever is greater.

#### SUBMITTALS

Submit under provisions of Section 01300.

##### Product Data:

Product data sheets for each material required, including:

- Membrane.
  - Membrane fasteners.
  - Insulation.
  - Insulation fasteners.
  - Metal accessories.
  - Calks and sealants.
  - Unreinforced flashing material.
  - Preformed corners and boots.
  - Other required materials.
- Manufacturer's standard details for each applicable project condition.
- Manufacturer's installation instructions.

Shop Drawings: Submit roof drawing indicating which details will be employed in the project. Include:

- Outline and size of the roof.
- Membrane sheet layout.
- Location and type of penetrations.
- Perimeter and penetration flashing detail references.
- Copy of any non-manufacturer-standard details to be used. Details that do not conform to manufacturer's standard details shall be shown as to their anticipated construction.
- Indicate elevation changes in parapet walls, fire walls, adjacent roof areas, and similar roof geometry.

##### Samples:

Membrane: 3 x 6 inch.

Fasteners: Each type required.  
Insulation: 12 x 12 inch.  
Metal accessories.

Quality Control Submittals: Submit the following to the manufacturer, and after manufacturer's acceptance, to the Architect for project record.

Manufacturer's written approval of this specification and of any deviations from this specification or drawings or previously approved details. The manufacturer's approval does not constitute a waiver of the requirements of this specification or the drawings. Do not proceed with such deviation without the written approval of the Architect.

Completed request for warranty, by manufacturer-authorized installer.

Samples and data sheets of all materials not supplied or approved by manufacturer.

Type and thickness of insulation.

Shop drawings specified above.

Pull test results on lightweight cementitious decks.

#### QUALITY ASSURANCE

Installer: Roofing contractor authorized by Stevens Roofing Systems.

#### Roof Covering:

Classified by Underwriters Laboratories as a Class A roofing material for use in construction of Class A roofing assemblies.

Meet test requirements for FM Class 1A fire and I-60 wind resistance.

Meet test requirements for FM Class 1A fire and I-90 wind resistance.

#### DELIVERY AND STORAGE

Deliver materials with appropriate packaging labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions.

Store materials in their original undamaged packaging. Maintain storage conditions in accordance with the manufacturer's requirements.

#### WARRANTY

Provide "Standard Hi-Tuff" material (membrane) only warranty, 5-year period.

Provide "Standard Hi-Tuff" material (membrane) only warranty, 10-year period.

Provide "Standard Hi-Tuff" material and labor warranty, 5-year period.

Provide "Standard Hi-Tuff" material and labor warranty, 10-year period.

Metal work other than Stevens Edge Metal Systems is not covered by warranty.

Drain sleeves are not covered under Warranty.

## PART PRODUCTS

### MANUFACTURER

Provide "Hi-Tuff/EP Roofing System" manufactured by Stevens Roofing Systems; 9 Sullivan Road, Holyoke, MA 01040-2800: ASD. Tel: (800) 860-3491 or (413) 533-8100; Fax: (413) 552-0924.

### MEMBRANE MATERIAL

#### Membrane:

Scrim-reinforced, thermoplastic polyolefin (TPO)-based sheet 76.5 inches wide by appropriate length.

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Packaging to bear the UL label.

Thickness, nominal (ASTM D 751): 0.045 inch.

Breaking strength (ASTM D 751, Grab Method): 225 lbf.

Elongation, ultimate (Test performed on unreinforced Hi-Tuff/EP membrane; ASTM D 412, Die C): 500 percent

Tear strength (ASTM D 751, Procedure B, 8 x 8 inch sample): 55 lbf.

Brittleness test (ASTM D 2137, at minus 45 deg C): Pass.

Dimensional stability, percent change max. (ASTM D 1204 B: 1 hr at 212 deg F, W: 6 hrs at 176 deg F): Black plus/minus 0.5 percent; white plus/minus 0.3 percent.

Factory seam strength (ASTM D 816, Method B): Sheet failure.

Water absorption (ASTM D 471, 158 deg F for 7 days, maximum percent weight change): Plus 2.0 percent.

Ozone resistance (performed on unreinforced Hi-Tuff/EP membrane; ASTM D 1149, 70 hrs at 100 deg F): Pass.

Weather resistance (Xenon arc: 4000 hrs, EMMAQUA: 4,000,000 Langleys): Pass.

Puncture resistance (FTM 101B, Method 2031): 250 lbf.

Heat aging, black membrane (ASTM D 573, 28 days at 212 deg F): Break: 225 lbf. Elongation: 500 percent.

Color: White.

Color: Black.

Color: \_\_\_\_\_.

#### ACCESSORY MATERIALS

##### Flashing:

Same membrane as specified above except for perimeter use of Hi-Tuff/EP Metal for gravel stops or drip edges.

Field-fabricated vent stacks, pipes, drains, and corners: Unreinforced 0.055-inch-thick, ethylene propylene-based membrane.

Vent stacks, pipes, drains, and corners:

Prefabricated pipe boots and inside and outside corners provided by manufacturer.

Bonding adhesive: Hi-Tuff/EP Bonding Adhesive.

Contact cement to adhere Hi-Tuff/EP membrane and flashings to various substrates e.g., insulation surfaces, masonry surfaces, plywood, concrete, or metal.

It is not acceptable to use bonding adhesive in the seams.

Perimeter Sheets: As specified under Part 3 of this Specification.

Hi-Tuff/EP All-Purpose Sealant: To serve as a water cut-off mastic, pitch-box sealer, and as a caulk to seal Hi-Tuff/EP membrane to metal.

No other product is authorized for miscellaneous caulking applications that are in contact with Hi-Tuff/EP system components or that are intended to seal penetrations through the membrane system.

Hi-Tuff/EP Seam Caulk: To seal exposed cut edges of reinforced membrane.

Hi-Tuff/EP Seam Cleaner: To remove contaminants from the surface of the Hi-Tuff/EP membrane where hot-air welding is to occur.

Insulation: Accepted in writing by Stevens Roofing Systems, and approved by their manufacturer for Hi-Tuff/EP mechanically attached installations.

Extruded polystyrene.

Expanded polystyrene.

Isocyanurate foam.

High density fiber board.

Thickness: \_\_\_\_\_.

Thickness: As indicated on the drawings.

Barrier Board (Not Warranted by Stevens Roofing Systems): Approved by their manufacturer for Hi-Tuff/EP mechanically attached installations.

Perlite.

Fiberglass faced gypsum board for roofing.

Moisture resistant gypsum sheathing.

Thickness: 1/2 inch.

Thickness: 5/8 inch.

Thickness: 3/4 inch.

Slip Sheet: Approved by Stevens Roofing Systems; use if required by manufacturer.

Tapered Edge Strips: High density fiber board.

Mechanical fasteners: Shall be supplied by Stevens Roofing Systems.

Steel decks: Hi-Tuff 2-3/8-inch Barbed Metal Seam Plate and Hi-Tuff XHD fasteners.

Structural concrete decks: Hi-Tuff CD-10 Spikes and 2-3/8 inch Barbed Metal Seam Plates.

Steel and concrete decks: Hi-Tuff 2-inch diameter barbed plates made of 22 gage Galvalume with Hi-Tuff #14-10 All-Purpose screws.

Steel and wood decks:

Steel decks:

Wood decks:

Insulation: Hi-Tuff PIF Preassembled Insulation Fastener with 3-inch plate.

Insulation: 3-inch metal plates with Hi-Tuff #14-10 All-Purpose screws.

Membrane: 2-inch Hi-Tuff ASAP plate and coated steel screw.

Membrane: Hi-Tuff 2-inch diameter barbed plates made of 22 gage Galvalume with Hi-Tuff #14-10 All-Purpose screws.

Membrane: Hi-Tuff 2-3/8-inch Barbed Metal Seam Plate and Hi-Tuff XHD fasteners.

Fastener length: In accordance with manufacturer's recommendations (from 1-1/4 inch to 12 inches long).

Normal weight structural concrete decks: Hi-Tuff CD-10 Spikes or Hi-Tuff All-Purpose Screws and 2 inch Barbed Seam Plates.

Lightweight cementitious decks:

Membrane: Plastic Hi-Tuff NTB seam fasteners with integral 2-inch plates. Length in accordance with manufacturer's recommendations (from 3 to 8 inches in length).

Insulation: NTB's with specialized or integral 3-inch plastic plates.

Final approval of fastener type subject to pull tests specified in Part 3 - Execution.

Termination Bar: Hi-Tuff Termination Bar fastened 6-inches o.c.

Stevens Edge Metal Systems: Stevens Edge Metal installed per standard HT details.

Roof Walkways: Material and application as required by roofing manufacturer.

PART EXECUTION

GENERAL

Do not deviate from this specification without written approval of the manufacturer.

Should deviations or changes occur without the manufacturer's approval, the project is not authorized for installation and will not be eligible for Warranty coverage.



Do not deviate from this specification without written approval of the Architect.

#### EXAMINATION

Verify that surfaces to be bonded are dry, clean and free of debris. Suitable surfaces are smooth, solid masonry, wood, and metal, plus insulation board fastened to the specific manufacturer's recommendations for receiving adhered roofing membranes and accepted by Stevens Roofing Systems for adhered application of Hi-Tuff/ASAP Fasteners.

Verify that positive roof slope exists in all areas.

Verify that rooftop mechanical units are to have their condensation lines piped to drains, or off the roof.

Verify that rooftop grease units will have approved grease containment systems or a regularly scheduled maintenance program.

Block off or shut down positive pressure building ventilation systems during application to prevent sheet from billowing during application.

Verify that steel deck is scheduled to be covered with an approved insulation mechanically fastened to deck with Stevens Roofing Systems approved fasteners.

Verify that wood plank decks are scheduled to be covered with an approved insulation mechanically fastened to deck with Stevens Roofing Systems approved fasteners.

Plywood: Verify that plywood is Exterior grade with an A or B finish side up and with no joint gaps greater than 1/4 inch, and that thickness, structural grade, and fastening are in accordance with requirements of the contract documents.

Install slip plates over all gaps or uneven joints where membrane seams will cross to minimize welding inconsistency.

Concrete: Verify that concrete is dry, fully cured, and prepared smooth with dust removed. The membrane shall have a fastened expansion joint detail (as per Standard HT Details) where deck joints exceed 1/4 inch or when

crossing a building expansion joint.

Lightweight Cementitious Decks:

Perform pull tests in accordance with the Hi-Tuff Pull-Test Worksheet and submit to Stevens Roofing Systems prior to job start for evaluation and establishment of a fastening pattern. Verify that lightweight cementitious deck is scheduled to be covered with an approved insulation mechanically fastened to deck with Stevens Roofing Systems approved fasteners.

Correct unsuitable conditions before proceeding with installation. Commencing installation signifies acceptance by Contractor of substrate.

SUBSTRATE PREPARATION

Prior to the start of work, the substrate shall be smooth and free of debris, sharp edges, and other surface irregularities that will be detrimental to the installation. Any unevenness or joint gaps greater than 1/4 inch in the membrane substrate can cause inconsistent membrane welds and shall be avoided. When such conditions occur fill with appropriate and properly secured insulation or material approved by manufacturer's technical review department.

Reroofing over existing roof:

Make test cuts to determine existing condition and deck suitability. Remove noticeably damp, wet, or deteriorated materials.

Existing surface shall be dry, reasonably smooth and even, blisters cut, and loose aggregate removed prior to installation of approved insulation board.

Nailers: Verify the following.

Nailers are installed at gravel stops or drip edges. Nailers are pressure-preservative treated (fire-retardant-treated where required). Creosote and asphaltic preservatives are not acceptable.

Nailer is anchored with a suitable fastener for the application having a minimum withdrawal resistance of 100 lbs, staggered 6 inch on center within 8 feet of an outside corners and 12 inches on center along other perimeter areas.

Nailer thickness matches the top surface of adjacent

construction plus/minus 1/4 inch. This permissible variation shall not contribute to ponding.

**Existing Flashings:** Remove and completely clean off wherever new Hi-Tuff Roofing System terminations and water stops are to be installed. Existing flashings may be left in place up to Hi-Tuff termination areas when in good structural condition and solidly attached to the substrate.

**Flashing Substrates:** The Contractor shall be responsible for the suitability of the substrate surface to accept the membrane. The substrate shall be smooth and free of sharp edges and other surface irregularities that will be detrimental to the 100 percent adhesion of the flashing membrane.

#### FASTENERS, GENERAL

Install fasteners with a depth-sensing screw gun to prevent overdriving or underdriving, unless otherwise approved or required by project conditions. Use the Olympic adapter tool for installing Hi-Tuff/ASAP Fasteners.

#### INSULATION INSTALLATION

Handle and secure insulation boards so as to not damage or rupture the facer and surface. Cut out damaged areas and replace with structurally sound insulation, properly secured in place.

Install boards with the longest dimension perpendicular to the direction of the membrane seams and with end joints staggered. Butt boards as closely as possible with no gaps over 1/4-inch.

Mechanically attach boards.

Employ fastener pattern and spacing in accordance with approved submittals.

Provide additional fasteners as necessary to conform to the substrate surface geometry.

**Tapered Insulation:** Install tapered boards under a layer of flat insulation boards; maintain smooth transition at changes of slope.

**Tapered Insulation:** Install tapered edge strips at

termination of tapered insulation boards to provide a smooth transition to the flat areas.

#### MEMBRANE INSTALLATION

Attachment of Hi-Tuff/EP Membrane: Space fasteners in accordance with standard HT Details and approved submittals.

Lightweight cementitious decks: Space fasteners in accordance with Stevens Roofing Systems requirements based on pull tests.

Hi-Tuff/EP Perimeter Sheets: Install perimeter sheets and full-sheet in accordance with fastener pattern specified below, approved shop drawings. Install fasteners along the edge of the membrane through the insulation, and into the roof deck.

At perimeters that are to receive a gravel stop or metal edging, bring membrane over the outside edge and terminate 12 inches on center unless otherwise stated in the appropriate detail.

#### Field sheets:

Unroll membrane on the area to be covered. Install fasteners along the leading edge of the membrane, as illustrated in Standard HT Details, through the insulation, and into the roof deck.

Adjoining rolls of membrane shall overlap the fastened edge of the installed membrane by 4-1/2 inches in accordance with standard details for fastener location and specific deck type penetration requirements.

Adjoining rolls of membrane shall overlap the fastened edge of the installed membrane by 5-1/2 inches in accordance with standard details for fastener location and specific deck type penetration requirements.

Cap sheets are never to be installed at a width of greater than 38 inches. (A cap sheet is defined as a sheet that is welded on both parallel seam edges without any mechanical fastening actually installed through either edge).

#### FASTENING PATTERNS FOR STEEL, CONCRETE, AND PLYWOOD DECK

##### Buildings up to 70 feet high:

Two half-sheets, fastened 12 inches oc, parallel to entire perimeter ("picture frame").

Field sheets fastened 18 inches on center.  
Fasten around penetrations that exceed 2 feet in length or diameter at 12 inches on center.

Buildings over 70 feet to 110 feet high:

Two half-sheets, fastened 12 inches on center at outside edge, followed by one full-width field sheet fastened 9 inches oc, with all three sheets in "picture frame" layout.

Field sheets fastened 18 inches on center.  
Fastener spacing for flashing terminations (e.g., termination bars) shall not exceed 6 inches on center.

Buildings over 110 feet to 200 feet high:

Two half-sheets, fastened 12 inches oc, followed by two full-width field sheet fastened 9 inches oc, all in "picture frame" layout.

Field sheets fastened 12 inches on center.  
Fastener spacing for flashing terminations (e.g., termination bars) shall not exceed 6 inches on center.

Fasten around projections over 2 feet in length or diameter at 9 inches on center.

Buildings over 200 feet to 350 feet high:

Three half-sheets, fastened at 12 inches oc, followed by four full-width field sheet fastened 9 inches oc, all in "picture frame" layout.

Field sheets fastened to steel deck at 9 inches on center.

Field sheets fastened to concrete deck at 12 inches on center.

Field sheets fastened to plywood deck at 12 inches on center.

Fastener spacing for flashing terminations (e.g., termination bars) shall not exceed 6 inches oc

Fasten around projections over 2 feet in length or diameter at 9 inches on center.

Buildings over 350 feet high: Fasten approved insulation with 1 fastener per 2 square feet. Adhere membrane sheets to insulation. Fasten sheets as follows:

Three half-sheets, fastened at 12 inches oc, followed by four full-width field sheet fastened 9 inches oc, all in "picture frame" layout.

Field sheets fastened to steel deck at 9 inches on center.

Field sheets fastened to concrete deck at 12 inches on center.

Field sheets fastened to plywood deck at 12 inches on center.

Fastener spacing for flashing terminations (e.g., termination bars) shall not exceed 6 inches on center.

Fasten around projections over 12 inches in length or diameter at 6 inches on center.

#### SEALING OF MEMBRANE

Lap splice: Membrane shall be overlapped and hot-air welded without any contaminants (adhesive, dirt, debris, etc.) in the seam.

Hot-air welding: An automatic hot-air welder and hand-held welder which are functionally in top condition are a necessity for Hi-Tuff applications. Use hand-held welders for small work and repairs. Use automatic hot-air welders for field seaming. Caulk cut edges by applying Hi-Tuff/EP Seam Caulk from a squeeze bottle.

Welding of Membrane After Exposure: As with any material after exposure, membrane will require cleaning prior to seaming. The approved method for cleaning membrane prior to hot-air welding is as follows:

Remove any visible dirt and debris with a clean rag and water. For heavily contaminated surfaces, scrubbing with a detergent cleaner (e.g. Fantastik or 409) followed by a water rinse may be necessary.

With a clean scrub pad saturated with Hi-Tuff/EP Seam Cleaner, aggressively agitate the seaming area. With a clean white rag, follow with a final one swipe pass over the seaming area, careful to not redeposit any contaminants back onto the cleansed sheet surface.

Allow Hi-Tuff/EP Seam Cleaner to completely flash off (i.e. membrane should be completely dry). Follow the standard hot-air welding procedures with an approximate 20 percent reduction in speed.

Final weld strength may not be achieved for several days.

Flashing: Perimeters, curbs, vents, expansion joints, drains, and other details shall be flashed as shown in

Standard HT Detail Drawings. Under no condition shall flashings cover weep holes or any form of through-wall drainage.

Apply Hi-Tuff/EP Bonding Adhesive to both underside of flashing membrane and surface to which it is to be bonded, at a rate of approximately one gallon per 60 square feet of surface coverage.

Bonding adhesive shall not be applied to that portion of the flashing that overlaps onto itself. Hot-air welding shall be used throughout the system where membrane overlaps itself.

Hi-Tuff/EP Bonding Adhesive shall be allowed to dry until tacky to finger touch until it does not string or stick to a dry finger. Roll the flashing into the dry adhesive. Take care to ensure that the flashing does not bridge where there is any elevation or directional change. Roll in flashing against substrate to ensure 100 percent adhesion.

All flashing shall be mechanically fastened at the top, under or through appropriate counter flashing with approved fasteners and with an approved HT termination detail as shown in detail drawings.

Hi-Tuff/EP Metal flashing at perimeter shall be made and installed as per Standard HT Details.

Pipe flashings shall be installed in accordance with Standard HT Details. Do not flash to lead.

Remove existing flashings and sleeves.

Expansion joints shall be installed in accordance with Standard HT Details.

Roof drains shall be installed in accordance with Standard HT Details. All bolts shall be properly secured to supply 100 percent continuous compression of the clamping ring. Field seams shall not be run through drains.

Existing drains shall be cleaned or replaced as needed for clamping detail. Remove old leads and packings.

#### Metal Work:

Metal work shall be installed in a manner that prevents damage from buckling or wind.

Metal work shall be sealed and waterproofed in an acceptable manner.

Overnight Seal/Temporary Water Stop: Shall be made by a sealant method approved by Stevens Roofing Systems. To protect the insulation from inclement weather at the-end of a day's work, extend the membrane beyond the

insulation and set into the approved overnight seal material. Contractor shall coordinate installation to ensure the system is made watertight at the end of each work day.

#### FIELD QUALITY CONTROL

Ensure that metal work shall be secured in a manner approved by Stevens Roofing Systems, or in accordance with SMACNA guidelines, to prevent damage from buckling, or wind exposure. All metal work that is part of the waterproofing envelope shall be sealed, structurally sound, and appropriately anchored to prevent leakage.

#### Tests:

Probe the entire lap edge with an approved seam probing tool (Sears cotter-pin extractor) after seam has cooled completely to verify seam consistency. Probing before the seam area has cooled will damage the membrane.

Destructive tests: 3-inch-wide area of seam weld to verify good peel strength. A properly welded seam will have membrane delamination from scrim prior to weld failure. Perform the following destructive tests on welds:

First seam of each working day.

First seam after the automatic hot-air welder has been allowed to cool down.

After any extreme changes in weather conditions.

Manufacturer's Field Service: Upon completion of the installation, an inspection shall be made by a manufacturer's representative to ascertain that the roofing membrane system has been installed according to manufacturer's approved specifications and details. Upon approval of the project, a warranty shall be written.

Upon acceptance through inspection, provide specified warranty.

At the discretion of Stevens Roofing Systems or the Architect, excessive patching as a result of damage to the membrane, or caused by faulty installation, may require total recover in those areas.

#### PROTECTION AND CLEANING

Protect membrane in progress and completed membrane from



foot and vehicular traffic.

Clean soiled surfaces, remove trash and debris, and leave project site in a clean condition.

END OF SECTION