DURO-TECH™ TPO ADHERED ROOFING SYSTEM

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SECTION 1 - - - GENERAL

INTRODUCTION

Created by Duro-Last®, the Duro-TECH™ TPO Adhered Roofing System ("System") is an installation process for adhering Duro-TECH TPO membranes ("TPO membranes"). Each installation of thermoplastic polyolefin ("TPO") products must comply with the detail drawings ("Details"), instructions, material descriptions, and other information stated herein.

Refer to Section 2 on page 15 for approved products.

WARRANTIES

This specification meets standard installation requirements for the following warranties:

DURO-TECH TPO ADHERED ROOFING SYSTEM WARRANTIES

Basic Warranties
Include material and labor
Do not include consequential damages

Warranty Name	Membranes Covered	Minimum Mil Thickness	Border Color
15-Year NDL Warranty	Duro-TECH TPO Duro-TECH TPO Fleece	45 mil (1.14 mm) 100 mil (2.54 mm)	Gray/Green
20-Year NDL Warranty	Duro-TECH TPO Duro-TECH TPO Fleece	60 mil (1.52 mm) 115 mil (2.92 mm)	Gray/Blue
25-Year NDL Warranty	Duro-TECH TPO Duro-TECH TPO Fleece	80 mil (2.03 mm) 135 mil (3.43 mm)	Gray/ Olive Green

Residential Warranties
Do not include consequential damages and only cover materials

Warranty Name	Membranes Covered	Minimum Mil Thickness	Border Color
15-Year Residential Material Limited Warranty	Duro-TECH TPO Duro-TECH TPO Fleece	45 mils (1.14 mm) 100 mil (2.54 mm)	Gray/Fuchsia
20-Year Residential Material Limited Warranty	Duro-TECH TPO Duro-TECH TPO Fleece	60 mils (1.52 mm) 115 mil (2.92 mm)	Gray/Light Blue

Material Only Warranties
Do not include consequential damages

Warranty Name	Membranes Covered	Minimum Mil Thickness	Border Color
15-Year Material Only	Duro-TECH TPO Duro-TECH TPO Fleece	45 mil (1.14 mm) 100 mil (2.54 mm)	Gray/Black
20-Year Material Only	Duro-TECH TPO Duro-TECH TPO Fleece	60 mil (1.52 mm) 115 mil (2.92 mm)	Gray/Black

ULTRA WARRANTIES

All Hail, High Wind, and Hail and High Wind Warranties have additional installation requirements beyond the scope of this specification.

Hail Warranties must comply with this specification and the Hail Warranty Requirements located on the Duro-Last website.

High Wind Warranties must comply with this specification and the following Engineering documents prior to ordering:

- Wind Uplift Calculations ("Wind Calc")
- Warranty Letter of Intent

High Wind Warranties Do not include consequential damages			
Warranty Name	**Membranes Covered**	**Minimum Mil Thickness**	**Border Color**
15-Year NDL High Wind	Duro-TECH TPO Duro-TECH TPO Fleece	45 mil (1.14 mm) 100 mil (2.54 mm)	Gray/Yellow
20-Year NDL High Wind	Duro-TECH TPO Duro-TECH TPO Fleece	60 mil (1.52 mm) 115 mil (2.92 mm)	Gray/Purple

Hail Warranties Do not include consequential damages			
Warranty Name	**Membranes Covered**	**Minimum Mil Thickness**	**Border Color**
15-Year NDL Hail	Duro-TECH TPO Duro-TECH TPO Fleece	60 mil (1.52 mm) 115 mil (2.92 mm)	Gray/Orange

Hail and High Wind Warranties Do not include consequential damages			
Warranty Name	**Membranes Covered**	**Minimum Mil Thickness**	**Border Color**
15-Year Hail and High Wind	Duro-TECH TPO Duro-TECH TPO Fleece	60 mil (1.52 mm) 115 mil (2.92 mm)	Gray/Burgundy

REQUIREMENTS

1. The System must be installed by an authorized Duro-Last Contractor (“Contractor”).
2. The TPO membrane must be installed over properly prepared decks/substrates. The decks/substrate must be compatible with the roofing TPO membrane.
3. Perimeter edge termination Details must include sealant as shown in the adhered Details. Any other type of edge termination must be approved in writing by Duro-Last prior to installation.
4. The 2 or 4-inch vinyl gravel stop or vinyl drip edge must not be used on adhered installations.
5. A Duro-Last Technical Representative must inspect the System for compliance before a commercial/industrial warranty is issued. Note: Duro-Last does not perform destructive testing unless visual inspection necessitates a need for further investigation.
6. All materials used in the installation of the System must be products of Duro-Last, or accepted products as defined and described in the specification. Other materials must be accepted in writing by the Duro-Last Engineering Services Department prior to being used in the System.
7. The Contractor must comply with applicable codes.
8. For buildings 40 ft (12 m) or taller and/or located within high wind zones (greater than 110 mph (177 km/h)) or special wind regions:
    a. It is recommended that the Duro-Last Engineering Services Department be involved in determining the fastening requirements. Typically, the current ASCE 7 specification will be used to determine the fastening requirements. When appropriate, specifications set forth by entities such as FM Global, SPRI or State/Local Agencies will be utilized.
    b. The Peel Stop Detail described in Details TAS9060 and TAS9060A may be required when the TPO membrane is adhered to certain substrates. Refer to Membrane Installation on page 15 and Details TAS9060 and TAS9060A for requirements.
    c. It is the Contractor’s responsibility to verify the accuracy of information provided to Duro-Last, including but not limited to pull test results, building height, and roof dimensions. Measurements used during the quotation phase of a project must be checked for accuracy by the installing Contractor.

CONTRACTOR TOOLS

TOOLS	
The following tools are required for efficient and proper installation	
Safety equipment (such as fall protection)	Equipment necessary to raise materials to the roof
Automatic & hand welders (hot-air) with spare heating elements	Silicone hand roller
Extension cords – cord length of 100 ft (30.5 m), #12/3 wire (2 mm) with ground	Ground fault interrupter
Variable speed power screw driver with reverse	P-3 screwdriver tips
Electric hammer drill with depth gauge	R-3 square drive tips for concrete screws
Metal snips, hacksaw, keyhole saw, hammers, scissors, utility knives with retractable blades	Measuring tapes (100 ft and 25 ft) (30.5 m and 7.5 m), chalk line, markers, lumber crayon
2-in. (51-mm) flat chisels, pry bar	Vise clamps, nail aprons, caulk gun, screw drivers
Tack claw	Ladders
Tarps	Pull tester
Core cutter	Panduit® banding tool
Approved cleaning fluid and rags	Push broom, heavy duty squeegee
Paint roller 3/8-in. (10 mm) medium-nap solvent-resistant roller	

MEMBRANE DESCRIPTION

The TPO membrane is a thermoplastic polyolefin blend, which is reinforced with a high-strength weft-inserted polyester scrim that has a thread pattern of 9 x 9 threads per inch. Refer to the individual PDSs for test results and physical properties of the membrane.

APPLICABILITY

The System consists of the TPO membrane, fasteners, custom-fabricated corners, parapet flashings, stack flashings, curb flashings, and other related Duro-Last-approved products. The System consists of products manufactured by Duro-Last, or accepted products as defined and described in this specification. Alternate materials must be pre-approved by the Duro-Last Engineering Services Department prior to their use.

DRAINAGE/SLOPE

Good roofing practices incorporate the use of positive drainage. The Contractor is responsible to make sure the roofing system drainage meets applicable codes. **Ponding water areas are excluded from Duro-TECH TPO warranties.**

WEATHER CONSIDERATIONS

Only install as many TPO roofing components as can be covered with TPO membrane by the end of the working day or before the onset of inclement weather.

Do **not** allow any TPO roofing components to be installed over a wet substrate.

DELIVERY

A complete System and related materials will be delivered to the location designated by the Contractor. Pallets of TPO membrane and accessory products will be labeled with manufacturer's/supplier's name, product name, and identification. Each shipment should be checked for damages and/or shortages at the time of delivery. The freight agent should note damaged materials and/or shortages on the freight bill. Concealed damage should be reported to the freight agent immediately.

Materials damaged in shipping, handling, or storage must not be used.

HANDLING

Once the System is delivered, the Contractor is responsible for all handling and installation. Adequate personnel and equipment should be available to safely lift and place the System onto the roof. It is the Contractor's responsibility to ensure that overloading of the roof does not occur.

TPO is extremely flammable. Keep all TPO components away from ignition sources, heat, sparks, and open flames. Do not smoke while installing TPO components.

STORAGE

The TPO membrane and other System materials should be kept clean and dry. The System materials should be stored on pallets and covered with tarps.

Care should be taken to place materials away from areas where water may pond or areas onto which water falls from higher structures. Follow the Product Data Sheet ("PDS"), Safety Data Sheet ("SDS"), and manufacturer storage guidelines and precautions for each product.

TPO is extremely flammable. Keep all TPO components away from ignition sources, heat, sparks, and open flames. Do not smoke while installing TPO components.

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CHEMICAL RESISTANCE

Chemical Resistance				
Duro-TECH TPO membranes are resistant to the chemicals listed below. If any other chemicals are present on a particular roof, contact the Duro-Last Engineering Services Department.				
• % indicates the maximum acceptable concentration of the listed chemical compound.				
Acetic acid (10% – 97%)	Calcium chlorate	Gelatin	Oxalic acid (aqueous) (50%)	Sodium chlorite (2% – 20%)
Acetone	Calcium chloride (50%)	Glucose	Paraffin	Sodium cyanide
Acetophenone	Calcium hydroxide	Glycerin	Paraffin wax	Sodium dichromate
Acriflavine (2%)	Calcium hypochlorite bleach (20%)	Glycol	Phenol	Sodium ferricyanide
Acrylic emulsions	Calcium nitrate	Hydrobromic acid (2% – 30%)	Phosphoric acid (95%)	Sodium ferrocyanide
Aluminum chloride	Calcium phosphate (50%)	Hydrofluoric acid (40%)	Potassium bicarbonate	Sodium fluoride
Aluminum fluoride	Calcium sulfate	Hydrogen peroxide (3% – 30%)	Potassium borate (1%)	Sodium hydroxide (10% – 50%)
Aluminum sulfate	Calcium sulfite	Hydrogen sulfide	Potassium bromate (10%)	Sodium hypochlorite (20%)
Alums (all types)	Carbon dioxide (wet and dry)	Hydroquinone	Potassium bromide	Sodium nitrate
Ammonia (aqueous)	Carbon monoxide	Inks	Potassium carbonate	Sodium silicate
Ammonia gas (dry)	Carbonic Acid	Iodine tincture	Potassium chlorate	Sodium sulfate
Ammonium carbonate	Castor oil	Isopropyl alcohol	Potassium chloride	Sodium sulfide (25%)
Ammonium chloride	Cetyl alcohol	Ketones	Potassium chromate (40%)	Sodium sulfite
Ammonium fluoride (20%)	Chrome alum	Lactic acid	Potassium cyanide	Stannous chloride
Ammonium hydroxide (10%)	Chromic acid (10% – 80%)	Lanolin	Potassium dichromate (40%)	Stannic chloride
Ammonium metaphosphate	Citric acid (10%)	Lead acetate	Potassium ferricyanide	Starch
Ammonium nitrate	Copper chloride	Linseed oil	Potassium ferrocyanide	Sugars and syrups
Ammonium persulfate	Copper cyanide	Magnesium carbonate	Potassium fluoride	Sulfamic acid
Ammonium sulfate	Copper fluoride	Magnesium chloride	Potassium hydroxide (10% – 50%)	Sulfates of calcium and magnesium
Ammonium sulfide	Copper sulfate	Magnesium hydroxide	Potassium nitrate	Sulfates of potassium and sodium
Ammonium thiocyanate	Cottonseed oil	Magnesium nitrate	Potassium perborate	Sulfur
Amyl alcohol	Cuprous chloride	Magnesium sulfate	Potassium perchlorate (10%)	Sulfuric acid (10%)
Aniline	Cyclohexanol	Magnesium sulfite	Potassium permanganate (20%)	Tallow
Anisole	Diethanolamine	Mercuric chloride	Potassium sulfate	Tannic acid (10%)
Antimony chloride	Ethanolamine	Mercuric cyanide	Potassium sulfide	Tartaric acid
Barium carbonate	Ethyl acetate	Mercurous nitrate	Potassium sulfite	Trichloroacetic acid (10%)
Barium chloride	Ethyl alcohol	Mercury	Propyl alcohol	Triethanolamine
Barium hydroxide	Ethylene glycol	Methyl Alcohol	Pyridine	Urea
Barium sulfate	Ethylene oxide	Methyl ethyl ketone	Silicone oil	Whiskey
Barium sulfide	Ferric chloride	Methylene chloride	Sodium acetate	White paraffin
Beer	Ferric nitrate	Milk and its products	Sodium bicarbonate	Wines
Benzoic acid	Ferric sulfate	Nickel chloride	Sodium bisulfate	Yeast
Benzyl alcohol	Ferrous chloride	Nickel nitrate	Sodium bisulfite	Zinc chloride
Bismuth carbonate	Ferrous sulfate	Nickel sulfate	Sodium borate	Zinc oxide
Borax	Fluorosilicic acid	Nitric acid (10%)	Sodium bromide oil solution	Zinc sulfate
Brine	Formaldehyde (40%)	Nitrobenzene	Sodium carbonate	EPS
Butyl alcohol	Formic acid	Oleic acid	Sodium chlorate	XPS
Calcium carbonate	Fructose	Olive oil	Sodium chloride	

CHEMICAL INCOMPATIBILITY

Chemical Incompatibility		
These chemicals may damage or compromise the membrane.		
Do **not** allow the following chemicals to directly contact the TPO membrane.		
Amyl acetate	Dichloroethylene	Lubricating oil (**petroleum-based**)
Amyl chloride	Diisooctyl phthalate	Mineral oil
Animal fats	Ethyl ether	Motor oil (**conventional and synthetic**)
Aqua regia	Ethyl chloride	Nitric acid (**fuming**)
Aviation gasoline (**80 – 100 octane**)	Ethylene dichloride	Nitric acid
Aviation turbine fuel	Furfural	50/50 Nitric/hydrochloric acid
Benzene	Gasoline (**higher octane = greater effect**)	50/50 Nitric/sulfuric acid
Bromine liquid	Gas liquor	Petrol (**gasoline**)
Bromine water	Gear box oil	Petroleum ether (**B.P. 100-140 C**)
Butyl acetate	Grease lubrication (**petroleum-based**)	Sulfuric acid
Carbon disulfide	Hexane	50/50 Sulfuric/nitric acid
Carbon tetrachloride	Heptane	Tetrahydrofuran
Chlorine (**gas**)	Hydrobromic acid	Tetralin
Chlorobenzene	50/50 Hydrochloric/nitric acid	Toluene
Chloroform	Hydrofluoric acid	Transformer oil
Chlorosulfonic acid	Hydraulic fluid	Trichloroethylene
Chromic/sulfuric acid	Iso-octane	Turpentine
Cyclohexanone	Naphthalene	Wet chlorine gas
Decalin	Jet fuel (**kerosene-based**)	White spirit
Dibutyl phthalate	Kerosene	Xylene

GENERAL TPO PRECAUTIONS AND INFORMATION

TPO is extremely flammable. Keep all TPO components away from ignition sources, heat, sparks, and open flames. Do not smoke while handling or installing TPO components.

The TPO membrane must not contact surfaces which maintain or exceed temperatures of 150° F (65° C).

After opening, allow TPO membrane products to lay flat for at least 30 minutes prior to installation.

SUBSTRATE SEPARATION

The TPO membrane is defect-free when it leaves the factory. Certain substrates are not compatible with the TPO membrane and may cause premature failure of the TPO membrane.

Over the substrates listed below, install rigid board insulations or cover boards prior to the installation of the TPO membrane.

Substrates Requiring Rigid Board Insulations or Cover Boards			
Acrylic Coatings	EPS/XPS Insulation Boards (“EPS/XPS”) **(EPS/XPS must be covered by approved polyisocyanurate insulation boards and/or cover boards)**	Hypalon Membranes	Shingles
Aluminum Coated Asphalt	Granulated Cap Sheet	PVC/CPA Membranes	Sprayed Urethane Foam
Coated or Smooth Asphalt	Mineral Surfaced Cap Sheet	TPO Membranes	
Modified Bitumen	Coal Tar Pitch	Polyurethane	

The TPO membrane is compatible with the following substrates, and no separation is required.

Substrates That Do Not Require Separation		
Polyisocyanurate Insulation Boards (“ISO”)	Gypsum-Based Cover Boards	Glass Fiber Board
Wood Decks	Lightweight/structural concrete decks (smooth)*	
Cellular Glass Boards	Pre-stressed concrete decks (smooth)*	

* New construction (less than 1 year old) decks require the use of an approved vapor barrier prior to installation of any System. Water-based adhesives must not be used directly above vapor barriers. Refer to Substrate Preparation on page 14.

PAINT APPLICATION

TPO membrane cannot be painted. Vinyl edge and termination products cannot be painted, including: Fascia Bar, Fascia Cover, and Termination Bar.

Duro-Last is not responsible for repair or replacement of these products if they have been painted. Contact the Duro-Last Quality Assurance Department with any questions.

Metal products may only be painted if they are made from bonderized steel. The performance and maintenance of the paint is not covered by the Duro-TECH warranties.

VAPOR BARRIERS

Duro-Last recommends the use of vapor barriers in certain situations; however, it is the responsibility of the Contractor to ensure that all requirements are met. A roofing professional, such as a consultant or architect, may be utilized for roofing system design prior to installing any roofing system.

If a vapor barrier is required, the following products must be used:

a. Duro-Last Vapor Barrier

b. Duro-Last Torch Down Vapor Barrier

c. Duro-Last Duro-Blue® Separation Slip Sheet

   1. Tape all seams with 2-inch wide (51-mm) 3M® Construction Seaming Tape.
   2. Tape all penetrations with 2-inch wide (51-mm) 3M All Weather Flashing Tape.
   3. Fastener density must not exceed 1 fastener per 2 ft^2 (0.19 m^2).

SECTION 2 - - - QUALITY ASSURANCE

PRE-JOB INSPECTION

When recovering an existing roofing system, the authorized Duro-Last Contractor is responsible to conduct an inspection of the proposed job site roof conditions to determine the needed adhesive type, fastener type and length, evaluate the moisture content of the existing roofing system, and to note damaged areas to be repaired prior to installation of the System.

CORE CUTS

1. The Contractor is responsible for performing a series of core cuts in order to evaluate the condition of the existing roofing system and determine fastener lengths, when applicable. The Contractor and/or building owner are responsible for the repair of all core cuts.
2. Duro-Last does not approve of covering any existing roofing system that contains excess moisture. Excess moisture is defined as any water observed within a core cut or squeezed from a core sample.
3. DL QA Tech Reps do not check for moisture content of the roofing system.

PULLOUT TESTS

1. Fastener pullout tests must be conducted on the roof deck with approved fasteners to verify the integrity of the deck and to establish fastening patterns that meet the requirements of the System. Contact the Duro-Last Engineering Services Department with any questions.
2. It is the responsibility of the Duro-Last Contractor to make sure pullout tests are performed on site. The tests can be performed by either the fastener manufacturer or the authorized Duro-Last Contractor. The sections of decking where integrity is in question should be the locations for the tests. The pullout tests must be documented on a roof drawing showing the location and pullout value of each test. In situations where new construction prevents on-site pullout tests, a pre-assembled deck representing the proposed deck type should be constructed and tested.
3. The number of pullout tests required will be as follows: perform a minimum of 10 tests for up to 50,000 ft^2 (4,645 m^2) and five additional pull tests for each additional 50,000 ft^2 (4,645 m^2) or portion thereof, on each project. Areas of low pullout results will require additional pullout tests.
4. It is the responsibility of the Duro-Last Contractor to verify pullout values prior to installation.

FASTENER SELECTION AND DECK TYPES

The fasteners used to attach insulation, recover board and TPO membrane must be supplied by Duro-Last. The following tables summarize the appropriate fasteners to use for different deck types and roofing system components.

PLATE SELECTION

When determining which plates to use and where to use them, refer to this table.

	Poly-Plate	Cleat Plate®	HD Seam Plate	3-Inch Square Metal Plate	Insulation Plate
Membrane Fastening					
Peel Stop*	No	Yes	Yes	Yes	No
Parapet Flashings	Yes	Yes	Yes	Yes	No
Base of Walls/Penetrations	Yes	Yes	Yes	Yes	No
Insulation Boards	No	No	No	Yes **	No
Cover Boards	No	No	No	Yes **	No

* Refer to Detail TAS9060 for Peel Stop requirements.

** 3-inch Square Metal Plates must be used to fasten insulation and cover boards when TPO membranes are adhered.

FASTENER SELECTION AND DECK TYPES

The following table summarizes the appropriate fasteners to use for different deck types and different roofing system materials.

All #14 and #15 fasteners must penetrate a minimum of 1 inch (25 mm) from the top surface of the deck or parapet.

#14 Screws: Pre-drill using a 3/16-in. (5-mm) bit, a minimum of 1/2 in. (13 mm) past the required depth of the fasteners.
#15 Screws: Pre-drill using a 7/32-in. (6-mm) bit, a minimum of 1/2 in. (13 mm) past the required depth of the fasteners.
Pre-drilling larger pilot holes may occasionally be required.

All fasteners must be either e-coated or galvanized, unless otherwise specified within this document or relevant Details.

NOTE: Reference the pullout test chart. Minimum pullout test values must be attained.

Approved Decks/Parapets and Fasteners		
Deck Type	**Fastener Type**	**Notes**
Steel	#14 HD Screws #15 EHD Screws	As stated above.
Wood	#14 HD Screws #15 EHD Screws	As stated above.
Structural or Lightweight Structural Concrete	#14 Concrete Nails #14 Concrete Screws #14 HD Screws #15 EHD Screws	As stated above.
Gypsum	Auger Fastener	Pre-drill required for auger fasteners. Use a 7/16–9/16-inch (11 – 14-mm) bit. Must penetrate a minimum of 1-1/2-inch (38 mm) from the top surface of deck. Factory Mutual designed systems require minimum of 2-inch (50 mm) penetration.
Cementitious Wood Fiber (Tectum)	Auger Fastener	***Do not pre-drill.*** Must penetrate a minimum of 1 1/2-inch (38 mm) from the top surface of deck. Factory Mutual designed systems require minimum of 2-inch (50 mm) penetration.
Lightweight Insulating Concrete (Over Structural Deck)	Auger Fastener #14 Concrete Nails #14 Concrete Screws #14 HD Screws #15 EHD Screws	Pre-drill required. Augers: Use a 7/16–9/16-inch (11 – 14-mm) bit. Auger Fasteners must penetrate a minimum of 1-1/2-inch (38-mm) from the top surface of deck. Factory Mutual-designed Systems require minimum of 2-inch (50-mm) penetration with Auger Fasteners.
Parapet Type	**Fastener Type**	**Notes**
Cinder and Concrete Block Parapet	Zinc Plated Metal Anchors #14 Concrete Nails #14 Concrete Screws #14 HD Screws #15 EHD Screws	Pre-drill required. Metal Anchors: Use a 7/16–9/16-inch (11 – 14-mm) bit.

DECK / SUBSTRATE CRITERIA

APPROVED DECKS

1. **Steel Deck:**
   An approved substrate is required on steel decks. Refer to Approved Insulations and Cover Boards on page 8.

2. **Poured Structural Concrete:**
   If the concrete is structurally sound, clean, smooth, dry, free of sharp edges, dust, contaminants, oil, grease, and loose foreign material which may affect the installation of the System and its performance, the TPO membrane may be adhered directly to the poured-in-place concrete deck.

   Note: New construction (less than 1 year old) decks require the use of an approved vapor barrier prior to installation of any System. Water-based adhesives must not be used directly above vapor barriers. Refer to Substrate Preparation on page 14.

3. **Precast/Prestressed Concrete Deck:**
   If the concrete is structurally sound, clean, smooth, dry, free of sharp edges, dust, contaminants, oil, grease, and loose foreign material which may affect the installation of the System and its performance, the TPO membrane may be adhered directly to the precast/prestressed concrete deck. All joints between sections of concrete units must be grouted. Height variations from adjoining concrete units must be trowelled smooth.

   Note: New construction (less than 1 year old) decks require the use of an approved vapor barrier prior to installation of any System. Water-based adhesives must not be used directly above vapor barriers. Refer to Substrate Preparation on page 14.

4. **Gypsum:**
   An approved substrate is required over gypsum decks. Refer to Approved Insulations and Cover Boards on page 8.

5. **Lightweight Concrete:**
   An approved substrate is required over lightweight concrete decks. Refer to Approved Insulations and Cover Boards on page 8.

6. **Cementitious Wood Fiber Deck:**
   An approved substrate is required over cementitious wood fiber decks. Refer to Approved Insulations and Cover Boards on page 8.

7. **Plywood/OSB Deck:**
   If the plywood is structurally sound, clean, smooth, dry, free of sharp edges, splinters, dust, contaminants, oil, grease, and loose foreign material which may affect the installation of the System and its performance, the TPO membrane may be adhered directly to the plywood deck. Gaps exceeding 1/4 inch (6 mm) wide in the plywood deck must be filled or covered with an approved substrate.

8. **Lumber Deck:**
   If the lumber is structurally sound, clean, smooth, dry, free of sharp edges, splinters, dust, contaminants, oil, grease, and loose foreign material which may affect the installation of the System and its performance, the TPO membrane may be adhered directly to the lumber deck. Gaps exceeding 1/4-inch (6-mm) wide in the lumber deck must be filled or covered with approved filler. Height variations from adjoining lumber units must be feathered smooth.

NOTE: If the above-listed decks do not meet the requirements for direct-to-deck adhesion, a Duro-TECH-approved substrate will be required.

APPROVED INSULATIONS AND COVER BOARDS

ISO AND EPS/XPS

1. Must be installed in accordance with Details TAS9060 and TAS9060A.
2. **EPS/XPS must be covered by approved ISO and/or cover boards.**
3. ISO must be a minimum of 2.0 pcf (14 psi) when tested in accordance with ASTM D1621 and as certified by the insulation manufacturer.
4. EPS/XPS must be a minimum of 1.5 pcf and 15 – 21 psi when tested in accordance with ASTM C303 and ASTM D1621, respectively.
5. On steel decks, use at least the minimum thickness required by the insulation manufacturer to span the flutes (1-inch (25-mm) minimum).
6. When attaching the insulation with fasteners and plates, 3-inch Square Metal Plates must be used.

GYPSUM-BASED COVER BOARDS

1. Must be installed in accordance with Details TAS9060 and TAS9060A.
2. Cover board must be a minimum of 1/4 inch (6 mm) thick.
3. On steel decks, use at least the minimum thickness required by the product manufacturer to span the flutes.
4. When attaching the cover board with fasteners and plates, 3-Inch Square Metal Plates must be used.

APPROVED ADHESIVES

1. Must be installed in accordance with the adhesive PDS.
   - TECH-Bond™ TPO Bonding Adhesive
   - TECH-Bond™ LVOC TPO Bonding Adhesive
   - TECH-Bond™ TPO Spray Adhesive

SECTION 3 - - - IMPLEMENTATION

SUBSTRATE PREPARATION

RECOVER – EXISTING SINGLE PLY ROOFS

The building owner/representative and Duro-Last Contractor must verify the conditions of the roof deck and the existing roof assembly. Deteriorated decking, wood blocking, insulation and all saturated materials must be removed and replaced.

1. A Duro-Last-approved substrate board must be mechanically fastened over the existing assembly. Refer to Approved Insulations and Cover Boards for more information.
2. The existing single-ply TPO membrane must be cut free from the entire roof perimeter, cut free around all penetrations, and cut in between fastener rows prior to the installation of the TPO membrane. When reroofing after a tear-off, caution should be used to prevent the TPO membrane from contacting incompatible materials. Refer to Substrate Separation on page 10.
3. If the existing roofing system is mechanically fastened, ensure that the existing fasteners are not loose or backing out. If necessary, cut the TPO membrane open and resecure or remove all loose fasteners.

RECOVER – EXISTING BITUMEN ROOFING

The building owner/representative and Duro-Last Contractor must verify the conditions of the roof deck and the existing roof assembly. Deteriorated decking, wood blocking, insulation and all saturated materials must be removed and replaced.

1. Gravel surface roofs must be leveled to ensure insulation lays flat. If the gravel is removed by power brooming or vacuuming, additional methods of leveling may be required to provide a suitable level surface for the recover board. **CAUTION**: Removing more than the loose gravel may affect the resulting fire rating. All blisters must be cut and fastened down or removed prior to the installation of the recover board.
2. Smooth or granular surface roofs. All blisters must be cut and fastened down or removed prior to the installation of the recover board.
3. A TPO-approved insulation (1-inch (25 mm) minimum) or substrate board must be installed over the existing roofing system.

New Construction

The building owner/representative and Duro-Last Contractor must ensure that the deck/substrate is structurally sound and meets standard industry construction practices prior to the application of the System.

INSTALLATION

WOOD NAILER

Wood nailers must be #2 grade lumber or better, or plywood, and both forms of nailers must withstand a minimum of 180 lbf/ft (2,626.9 N/m). Any pull values greater than 270 lbf/ft (3,940.4 N/m) will allow for a fastener spacing of 18 inches (457 mm) on center. Pull values less than 270 lbf/ft (3,940.4 N/m) will require additional fasteners. **The Contractor is responsible for meeting building codes.**

Wood nailers are required along perimeter edges where 1 inch (25 mm), or greater, thickness of insulation is used. The top of the nailer must be flush with the top of the insulation. Wood nailers are not required at roof-to-wall transitions.

Duro-Last requires that for nailers and other lumber supports identified as ACQ or CA treated, only stainless-steel fasteners be used. Additionally, for all new construction, untreated lumber should be used for nailers with standard e-coated fasteners. Further, treated lumber dating 2003 or earlier is acceptable for use with e-coated fasteners as lumber prior to 2003 is unlikely to contain the copper-based treatments.

INSULATION AND COVER BOARD INSTALLATION

1. **EPS/XPS must be covered by approved ISO and/or cover boards.**
2. Insulation and cover board products must be neatly fitted to the roof deck and its penetrations. Insulation and cover boards should be installed tightly against adjacent boards and all joints staggered a minimum of 6 inches (152 mm) from row to row. No gap should exceed 1/4 inch (6 mm) in width. No more insulation or cover board products should be installed than can be covered with TPO membrane and completed before the end of the day's work or before the onset of inclement weather.
3. **When mechanically fastening** insulation and/or cover boards to the approved substrate, **a minimum of 250 lbf (113 kgf) of pull out resistance per fastener is required. Special design consideration may be required if pull out resistance is less than the minimum 250 lbf (113 kgf).** Duro-Last requires a minimum of 1 fastener for every 2 ft^2 (0.2 m^2) of board in perimeter areas and 1 fastener for every 3.2 ft^2 (0.3 m^2) of board in the field area. The width of the perimeter area is determined by either the lesser of 40% times the building height or 10% times the width of the roof, but must never be less than 4 ft. (1.2 m) wide. Fasteners and plates must be Duro-Last-approved for substrate attachment. 3-Inch Square Metal Plates must be used when fastening insulation and cover boards. Refer to Details for insulation fastener spacing and patterns.
4. **When adhering** insulation and/or cover boards with low-rise foam, refer to the approved adhesive product data sheets located on the Duro-Last website. Installation will be in compliance with the adhesive manufacturer recommendations and requirements.
5. ISO and cover boards may be **attached using hot (Type III or IV) asphalt** in accordance with asphalt manufacturer's instructions, and NRCA and ARMA recommendations. The ISO and/or cover board must rest evenly on the approved deck/substrate so that there are no air spaces between the board and the deck/substrate. The maximum board size with hot asphalt attachment is 4 x 4 ft (1.2 x 1.2 m). Precautions should be used to protect the TPO membrane from coming in contact with asphalt that has been pushed-up to the board surface. This can be accomplished by taping over the seams of the insulation boards. Remove all asphalt from the substrates before attaching the TPO membrane.

   The following requirements must be met when attaching insulation and/or cover boards using asphalt:

   a. The proposed board must be compatible with the roof substrate, TPO membrane and the asphalt.
   b. ISO and/or cover boards must **NOT** be attached directly to steel decks with asphalt.
   c. EPS/XPS must **NOT** be attached with asphalt in any circumstances.

MEMBRANE INSTALLATION

1. Refer to Peel Stop Detail TAS9060 and TAS9060A to determine when a Peel Stop is required. A Peel Stop is a row of 6-inch-on-center (152 mm) fasteners installed 2 ft (0.6 m) from an exterior roof edge regardless of parapet wall height. This includes roofs that are located within a main roof and exceed the height of the main roof by 3 ft (0.9 m) or higher.
2. The surface of the deck/substrate must be inspected prior to the installation of the TPO membrane. The deck/substrate must be clean, smooth, dry, and free of sharp edges, dust, contaminants, oil, grease, and loose, foreign material that may affect the installation of the System and its performance. All damaged, broken or wet materials must be removed and replaced.
3. The TPO membrane may be applied as described in the following steps. Application techniques may vary as long as the requirements described within this specification are met.

   a. Cut the TPO membrane to length and allow material for edge termination where required.
   b. Let the TPO membrane relax for at least 30 minutes.
   c. Fold the TPO membrane back onto itself to expose half of the roof area to be covered by that roll.
   d. Apply adhesive per the PDS coverage rate in front of the fold along its length on both the deck and back of TPO membrane. Be careful not to apply more of the adhesive than can be covered prior to the adhesive setting up. Changing rooftop conditions throughout the day may affect the amount of time it takes adhesives to dry. Refer to adhesive PDSs on page 15.

e. Lift the top layer of TPO membrane and, starting at the fold, use a stiff squeegee or broom to push the TPO membrane into the adhesive. Care must be used to avoid wrinkles and air pockets. Apply the TPO membrane to cover the adhesive that has been applied.

f. Repeat steps “c”, “d”, and “e” for the second half of the roll.

g. As each new roll is added, overlap the adjacent roll a minimum of 4 inches (102 mm).

h. Be careful not to contaminate the TPO membrane with adhesive where seams will be welded together.

HEAT (HOT-AIR) WELDING

1. Position the TPO membrane so that the top membrane overlaps the bottom membrane a minimum of 4-inches (102 mm). Ensure the welding area is dry, clean and free of foreign material.
2. Weld the top TPO membrane to the bottom TPO membrane using an automatic welding machine, and/or heat (hot-air) welder and silicone roller. A minimum 1-1/2-inch (40-mm) wide heat (hot-air) weld is required.
3. All field-welded seams must be inspected with a tack claw or similar tool (cotter key extractor), and all deficiencies repaired prior to inspection by Duro-Last.

WALLS AND PENETRATIONS

The TPO Membrane may be adhered or mechanically fastened onto the walls. The previous sections which outlined acceptable products and proper substrate preparation, also apply to the walls.

1. **Walls Mechanically Fastened**
   a. When mechanically fastening TPO membrane to a parapet wall, position the deck sheet as shown in Detail TAS6000, use separate parapet flashing as shown and install termination bar.

   b. When using Detail TAS6000, install a termination bar as shown. Order a separate wall flashing and add a minimum 6-inch (152-mm) skirt to the width of the wall flashing needed to cover the desired height (8-inch (203-mm) minimum above the deck) and/or width of the wall. Weld the 6-inch (152 mm) skirt to the TPO deck membrane.

2. **Walls Adhered**
   a. Adhesive must be applied to both the wall/substrate and to the TPO membrane. Refer to the adhesive PDS being used for coverage rates between both surfaces. The actual coverage may vary depending upon the type of substrate and atmospheric conditions.

   b. It is not acceptable to adhere the same roll of TPO membrane that is covering the roof deck to a wall. Instead, a separate roll must be used and mechanical fasteners installed through one of the rolls at the roof-to-wall transition.

   c. The minimum height of termination of the TPO membrane is 8 inches (203 mm) above the deck. If the membrane will extend up the wall for more than 60 inches (1,524 mm), a row of mechanical fasteners must be installed. The TPO membrane must never extend up the wall more than 60 inches (1,524 mm) without a row of fasteners. Refer to the appropriate Details for information regarding the proper termination.

   d. A row of mechanical fasteners is required at all transitions on the wall except at the top of the wall if the TPO membrane will extend to the outside face of the wall. These rows of fasteners can be approved fasteners with the appropriate plate or termination bar.

   e. It is recommended that rolls be kept small for easier handling. The installer may wish to install the TPO membrane on the walls prior to installing on the roof deck. This will avoid potential problems with keeping the new TPO membrane on the roof deck clean while working on the walls.

3. **Roof Penetrations**
   a. Mechanical fastening is required at all roof penetrations. These include, but are not limited to, pipes, drains, curbs, pitch pans, and expansion joints.

   b. The pullout resistance of the fasteners determines the fastener spacing of the transition points. To determine the spacing, refer to the pullout chart in the System specification.

FLASHINGS

1. The TPO membrane must not contact surfaces which maintain or exceed temperatures of 150° F (65° C) including all insulated chimney pipes, exhaust pipes, and combustible fuel pipes.
2. All flashings, with the exception of pitch pans, must be terminated at a minimum of 8 inches (203 mm) above the roof surface. Refer to Pitch Pans section for pitch pan installation criteria.

PITCH PANS

1. Use pitch pans only when standard Duro-Last flashings cannot be used.
2. Only Duro-TECH TPO Caulk and Duro-TECH TPO Pourable Sealer may be used when creating a pitch pan.
3. All pitch pans must be terminated at a minimum of 4 inches (102 mm) above the roof surface.
4. Refer to Details TAS4030, TAS4040 and TAS4045 for installation references.

TWO-WAY AIR VENTS

1. The Duro-TECH TPO Two-Way Air Vents must not be installed on an adhered application.

ROOF DRAINS AND SCUPPERS

1. Drain Assemblies with Clamping Rings
   a. All existing roofing materials must be removed from drain bowl and clamping ring.
   b. Use approved TPO caulk or sealant between the TPO membrane and bowl as shown in Detail TAS2011 (1/2 tube minimum).
   c. After the TPO membrane is properly installed onto the bowl and the clamping ring set in place, all bolts securing the ring must be installed to provide constant, even compression on the sealant. If bolts are broken or missing, replacements must be installed.
2. Duro-Last Drain Boots
   a. Apply one-half (1/2) tube of sealant minimum to the outside of the Drain Boot and insert it into the drain.
   b. Install Composite Drain Rings (“CDRs”) as low into the drain as possible.
3. Refer to Detail TAS2021 for installation references.

EXPANSION JOINTS

1. Refer to Details TAS1140, TAS1150, TAS1160, TAS1170 and TAS6160 for installation references.

WALKWAY PAD

1. Duro-TECH TPO Walkway Pad (“Walkway pad”) is recommended at all roof access points, service units and high traffic areas. The risk of potential third-party damage to the System may increase should the building owner choose not to utilize the Walkway Pad.

   Note: Prior to inspection of the installation by Duro-Last, attach only one side of any Walkway Pad that will be covering any field seams. This will allow the Duro-Last Technical Representative to inspect the entire field seam. After the inspection, heat (hot-air) weld the remaining side to complete the attachment of the Walkway Pad.

CAUTIONS AND WARNINGS

1. Duro-Last is not responsible for damage that may occur as a result of moisture created from condensation occurring within or beneath a roof deck subassembly or building.
2. Duro-Last recommends the use of vapor barriers, however it is the responsibility of the Duro-Last Contractor of record to ensure that all applicable specifications, building codes, regulations and ordinances are complied with and followed. A roofing professional, such as a consultant or architect, should be utilized for correct System design prior to installing any System.
3. Refer to the SDS prior to using any adhesive for information regarding the safe use of the product. It may be necessary to shut down air intake systems and block the intake vents to prevent fumes from entering the building.
4. Asphalt-based products are incompatible with the TPO membrane. Should the TPO membrane become soiled with roofing asphalt, the affected TPO membrane must be cleaned immediately, using approved cleaners and procedures. If the asphalt cannot be properly cleaned from the TPO membrane, the affected TPO membrane must be removed and new TPO membrane installed. **Note: Extreme caution must be taken not to contaminate the roof area with loose asphalt.**
5. **TPO is extremely flammable.** The TPO Membrane must not be in contact with substrates that maintain or exceed temperatures of 150° F (65° C), including all insulated chimney pipes and combustible fuel pipes. Refer to the appropriate Details for information regarding the proper termination.
6. Do not cover existing roofing systems that contain excess moisture. This is water observed by taking core cuts, seeing standing water in the core or having water flowing into the cut, or squeezing the core sample and getting water droplets.
7. Phenolic foam is not an approved insulation in new construction or re-roofing applications. The System may not, under any circumstance, be installed over phenolic foam.
8. Perlite and wood/mineral fiber-boards are not acceptable substrates for the TPO membrane.
9. If asbestos is encountered, the building owner must be notified at once. The owner is solely responsible for determining the proper course of action.
10. The System must not be installed over areas of roofs if one or more of the following conditions exist:
    a. The building structure is not sufficient to handle the load of the completed system.
    b. It is not possible to find an approved fastener that will properly hold in the substrate.
    c. Roofs are subject to hot embers, slag, or burning debris.
    d. Incompatible chemicals exhausted directly onto the roof or may come in contact with the roof in liquid form. Refer to Chemical Resistance on page 8.
    e. Steam is exhausted directly onto the roof that is in excess of 150° F (65° C).
11. Refer to the applicable Safety Data Sheet for additional information.
12. Refer to the appropriate warranty form on the Duro-Last website for information on exclusions and requirements.

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