



DURO-TECH TPO INDUCTION WELD ROOFING SYSTEM

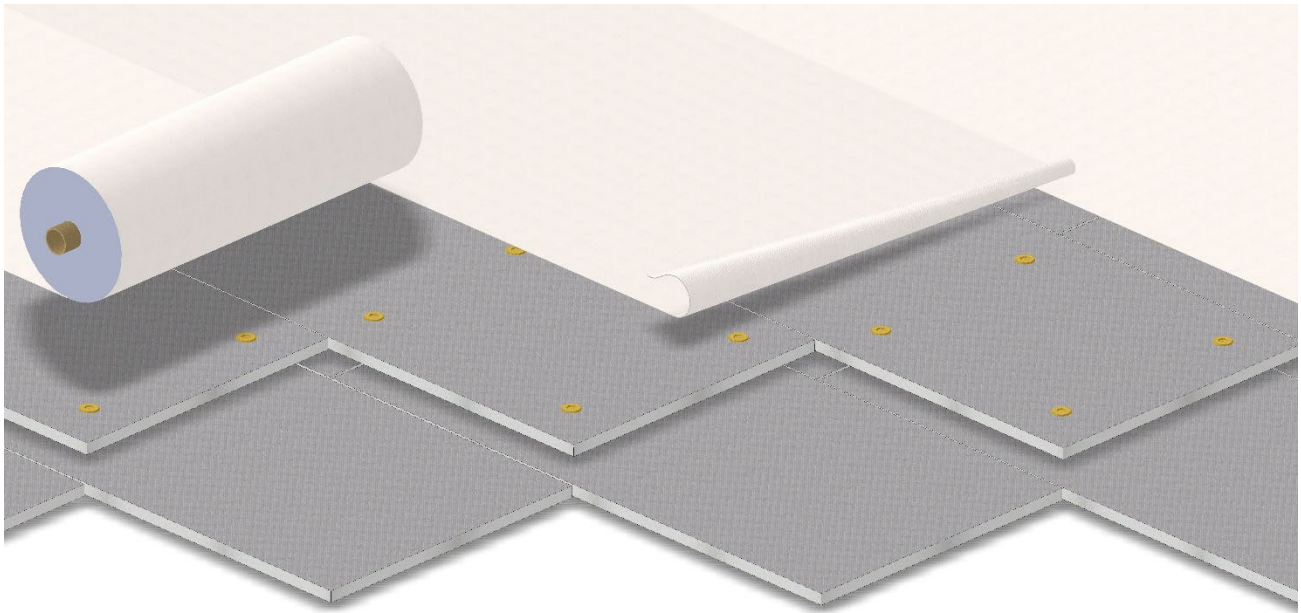


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SECTION 1 – GENERAL

INTRODUCTION

Created by Duro-Last®, the Duro-TECH TPO Induction Weld Roofing System is an installation process for mechanically fastening Duro-TECH™ TPO membranes*, without penetrating the roofing membrane, using specially coated plates.

* This does **not** include Duro-TECH TPO Fleece membranes.

Approved induction plates are used to secure the approved insulations, fan fold boards, cover boards, and slip sheets, in pre-determined attachment patterns. The thermoplastic polyolefin ("TPO") membrane is then welded to the surface of the installed induction plates using approved induction welders.

The following is information required to install the Duro-TECH TPO Induction Weld Roofing System. Each installation of TPO products should comply with the detail drawings ("Details"), instructions, material descriptions, and other information stated herein.

Refer to *Section 2* for approved products.

WARRANTIES

This specification meets standard installation requirements for the following warranties:

DURO-TECH TPO INDUCTION WELD ROOFING SYSTEM WARRANTIES			
Basic Warranties			
Do not include consequential damages			
Warranty Name	Membranes Covered	Minimum Mil Thickness	Border Color
15-Year NDL Warranty	Duro-TECH TPO	45 mil (1.14 mm)	Gray/Green
20-Year NDL Warranty	Duro-TECH TPO	60 mil (1.52 mm)	Gray/Blue
25-Year NDL Warranty	Duro-TECH TPO	80 mil (2.03 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	45 mils (1.14 mm)	Gray/Fuchsia
20-Year Residential Material Limited Warranty	Duro-TECH TPO	60 mils (1.52 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	45 mil (1.14 mm)	Gray/Black
20-Year Material Only	Duro-TECH TPO	60 mil (1.52 mm)	Gray/Black

SECTION 1

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	45 mil (1.14 mm)	Gray/Yellow
20-Year NDL High Wind	Duro-TECH TPO	60 mil (1.52 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	60 mil (1.52 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	60 mil (1.52 mm)	Gray/Burgundy

SECTION 1

REQUIREMENTS

1. The Duro-TECH TPO Induction Weld Roofing System must be installed by an authorized Duro-Last contractor ("contractor").
2. The contractor must comply with applicable codes.
3. A Duro-Last Quality Assurance Technical Representative ("DL QA Tech Rep") will inspect the installed Duro-TECH TPO Induction Weld Roofing System in order to issue a warranty, or finalize a pre-inspection warranty, on a commercial or industrial project. Residential projects do not receive inspections.
 - Duro-Last does not perform destructive testing during the inspection, unless something identified during the visual inspection triggers a need for further investigation.
4. All materials used in the Duro-TECH TPO Induction Weld Roofing System must be products of Duro-Last, or accepted products, as defined and described in this specification. Other materials may be accepted, but only after the contractor has requested a deviation from Duro-Last, and Duro-Last has approved such deviation, prior to being used.
5. It is the contractor's responsibility to determine fastening requirements in accordance with Duro-TECH TPO Induction Weld Roofing System specifications. Refer to *Section 2* and *Section 3* for complete instructions.

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
Approved induction weld machine(s)	Approved induction weld accessories

NOTE: Contact the Duro-Last Quality Assurance Department with questions regarding tool requirements.

DRAINAGE/SLOPE

Good roofing practices incorporate the use of positive drainage. The contractor must comply with applicable codes regarding roofing system drainage. **Ponding water areas are excluded from Duro-TECH TPO warranties.**

WEATHER CONSIDERATIONS

Only install as many Duro-TECH TPO Induction Weld Roofing System materials 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 Duro-TECH TPO Induction Weld Roofing System materials to be installed over a wet substrate.

SECTION 1

DELIVERY

A complete Duro-TECH TPO Induction Weld Roofing 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 thoroughly 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 Duro-TECH TPO Induction Weld Roofing 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 Duro-TECH TPO Induction Weld Roofing System onto the roof.

It is the contractor's responsibility to ensure that overloading of the deck does not occur.

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 Duro-TECH TPO Induction Weld Roofing System materials should be kept clean and dry. Duro-TECH TPO Induction Weld Roofing 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.

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

SECTION 1

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.				
<ul style="list-style-type: none"> % 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	

SECTION 1

CHEMICAL INCOMPATIBILITY

Chemical Incompatibility		
These chemicals may damage or compromise the TPO 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

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.

SECTION 1

HEAT (HOT-AIR) WELDING

Refer to T1010 Detail:

1. Seams created by using heat (hot-air) welding may be completed using either an automatic or hand-held hot-air welder. The seam must be continuous and at least 1-1/2 inch (40 mm) wide.
2. Testing of TPO membrane seams should always be performed prior to welding sections of TPO membrane together. A test weld must be completed before beginning installation and after any significant ambient temperature changes. Weld together 2 pieces of TPO membrane a minimum of 2-feet (0.6-m) long. Once the seam has cooled, pull it apart for inspection. The delamination should occur at the top of the reinforcement fabric and the seam must be continuous and at least 1-1/2 inch (40 mm) wide.
3. After a TPO field membrane seam cools, it must be inspected with a tack claw or similar tool (e.g. cotter key extractor), and all deficiencies repaired prior to inspection by Duro-Last.
4. **Contractors are responsible for calibrating their welders in accordance with the manufacturer's specifications.**
5. Automatic Welders
 - a. Since automatic welders fuse the TPO membranes together at such a rapid rate it is critical that the welding temperature, air volume and drive speed be properly set. Weather and ambient air temperature can also affect performance. Adjustments may need to be made as conditions change.
 - b. The following table shows an example of conditions and settings used to weld TPO membranes together using a Leister® Varimat® V2. **These settings should be used simply as guidelines for initiating seam tests and not as exact settings for every case. These rates are approximate and can vary.**
 - c. Perform regular test welds.

Leister Varimat V2 (220-Volt Walker-Welder)				
Membrane (all mils)	Ambient Temperature	Welding Temperature	Air Volume	Drive Speed
Duro-TECH TPO	70° F (21° C)	1,040° F (560° C)	70%	8-1/2 ft/min. (2.6 m/min.)
NOTE: Always use the slower speed when welding different types of TPO membrane together.				

PAINT APPLICATION

TPO membrane cannot be painted.

Vinyl edge and termination products cannot be painted, including: fascia bar, fascia bar cover, drip edge, gravel stop 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.

SECTION 1

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 (51-mm) wide 3M® Construction Seaming Tape
 2. Tape all penetrations with 2-inch (51-mm) wide 3M All Weather Flashing Tape
 3. Fastener density must not exceed 1 fastener per 2 ft² (0.2 m²)

OVERBURDEN

Any product (e.g. wood block, conduit, etc.) placed on top of, and positioned to be in contact with, the TPO membrane must have an approved separator between it and the TPO membrane. Separators must be cut to at least the size of the products that lie on them. Refer to Detail T4090.

Approved Separators:

- TPO membrane (any thickness)
- Duro-TECH TPO Walkway Pad
- Drainage Mat
- Ballast Mat

HVAC CLEANERS

Cleaning rooftop air conditioning units is a necessary maintenance procedure, but the use of incompatible cleaners can potentially be harmful to the Duro-TECH TPO Induction Weld Roofing System. Use only Duro-TECH TPO LVOC Splice Wash with the Duro-TECH TPO Induction Weld Roofing System.

SECTION 2 – QUALITY ASSURANCE

PRE-JOB ASSESSMENT

When re-covering an existing roofing system, the contractor is responsible for conducting a thorough inspection of the deck and parapet, to determine the necessary fastener type and length, to evaluate the moisture content of the existing roofing system, and to note damaged areas which need to be repaired, prior to installation of the selected Duro-TECH TPO Induction Weld Roofing 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.

FASTENER PULLOUT TESTS

1. Prior to ordering the Duro-TECH TPO Induction Weld Roofing System, the contractor is responsible to ensure fastener pullout tests ("pullout tests") have been conducted with the fastener intended for installation. The fastener manufacturer or the contractor may conduct the required testing. Utilize Duro-Last-supplied fasteners and an approved testing unit with current certification.
2. Locations of pullout tests should be evenly distributed throughout the deck and include areas where the integrity of the deck is in question. Areas with low pullout test results will require additional pullout tests. All pullout tests should be documented on a drawing showing the location and value of each pullout test.
 - The number of required pullout tests is as follows for each deck level or independent deck area:
 - Minimum of 10 tests for deck areas up to 50,000 ft² (468.5 m²)
 - 5 additional tests for each additional 50,000 ft² (468.5 m²) or portion thereof

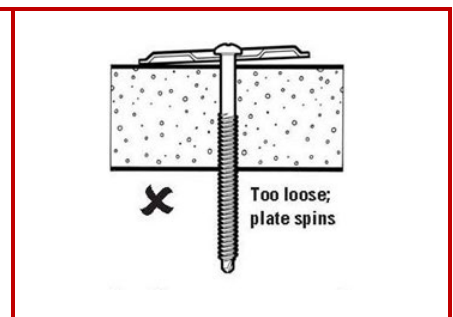
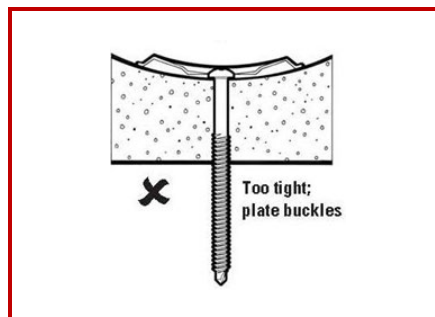
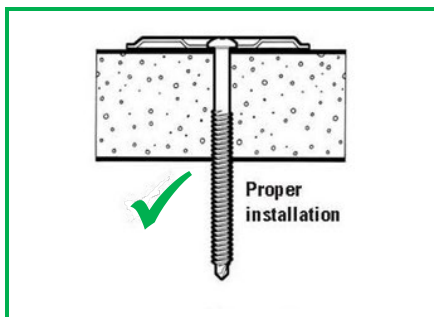
PLATES

Only approved TPO induction plates may be utilized for the Duro-TECH TPO Induction Weld Roofing System membrane installation.

For transitions, 3-Inch Metal Plates, Duro-TECH TPO HD Seam Plates, Poly-Plates, Cleat Plates®, or TPO Induction Plates may be utilized. Refer to appropriate Detail.

Straight line fastening will sometimes require the use of Insulation Plates or 3-Inch Metal Plates for insulations, or 3-Inch Metal Plates for cover boards.

Do not overdrive or underdrive fasteners.



SECTION 2

FASTENER SELECTION AND DECK TYPES

The following table summarizes the appropriate fasteners to use for different deck types and different Duro-TECH TPO Induction Weld 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-inch (5-mm) bit, a minimum of 1/2 inch (13 mm) past the required depth of the fasteners.

#15 Screws: Pre-drill using a 7/32-inch (6-mm) bit, a minimum of 1/2 inch (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 for Duro-TECH TPO Induction Weld Roofing System		
Deck Type	Fastener Type	Notes
Steel	#14 HD Screws #15 EHD Screws	Pre-drilling not required.
		FM® projects require fastener rows to run perpendicular to the flutes.
		Must have a minimum of 1-1/2-in. (38-mm) insulation, above the top flute.
Metal Roofing	#14 HD Screws #15 EHD Screws	Pre-drilling not required.
Purlins	#12 Purlin Screws #14 HD Screws #15 EHD Screws	Pre-drill as required.
		#12 Purlin Screws: Must penetrate 1-3/4 in. (45 mm) from the top surface of the deck.
Wood (Plywood, OSB, or Wood Plank)	#14 HD Screws #15 EHD Screws	Pre-drilling not required.
Structural or Lightweight Structural Concrete	#14 Concrete Nails #14 Concrete Screws #14 HD Screws #15 EHD Screws	Pre-drill as required.
Lightweight Insulating Concrete (Over Structural Deck)	Not applicable	Through-fastening required into structural deck.
Parapet Type	Fastener Type	Notes
Cinder and Concrete Block Parapet	#14 Concrete Screws #14 Concrete Nails #14 HD Screws #15 EHD Screws	Pre-drill as required.

SECTION 2

FASTENER DISTRIBUTION TABLES

Fastener distribution must be determined based on the tables below and the results of the pullout tests.

1. It is the contractor's responsibility to determine fastening requirements, based on pullout tests. The pullout tests can be performed by either the fastener manufacturer or by the contractor.
2. The contractor should contact the Duro-Last Engineering Services Department for assistance in determining the fastening requirements when any of the following conditions apply:
 - a. Building is 40 feet (12.2 m) tall or taller.
 - b. Building is located in an area with design wind speeds greater than the following:
 - i. ASCE® 7-05: 110 mph (177.0 km/h)
 - ii. ASCE 7-10: 150 mph (241.4km/h)
 - c. A High Wind Warranty is required.
 - d. Average fastener pullout resistance is less than 210 lbf (934.1 N).
3. Fastener concentration varies between the Field, Perimeter, and Corner areas of the deck, with the fastener concentration increasing by a minimum of two fasteners in the Perimeter enhancement areas and an additional two fasteners in the Corner enhancement areas. Refer to the tables below for fastener concentration in Field, Perimeter, and Corner areas.
4. The width of the Perimeter and Corner areas is the lesser of either 40% of the building height, at the eaves, or 10% of the overall plan width of the building and/or deck area. The Perimeter and Corner widths must not be less than 5 feet (1.5 m) wide. The Corner area is measured from each outer Corner and is equal to the width.

Example: Determine Perimeter and Corner Width

Building Width: 100 ft (30.5 m)

Building Length: 200 ft (61.0 m)

Building Height: 30 ft (9.1 m)

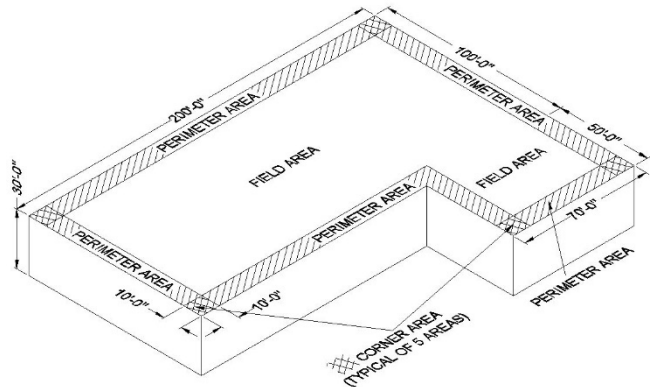
Step 1. Find 40% of the height:

$$0.40 \times 30 \text{ ft (9.1 m)} = 12 \text{ ft (3.6 m)}$$

Step 2. Find 10% of the width:

$$0.10 \times 100 \text{ ft (30.5 m)} = 10 \text{ ft (3 m)}$$

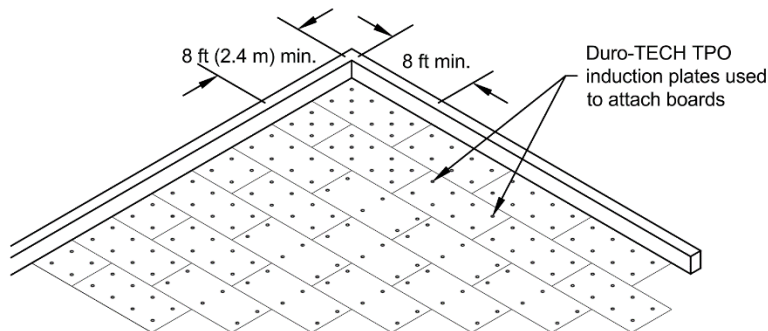
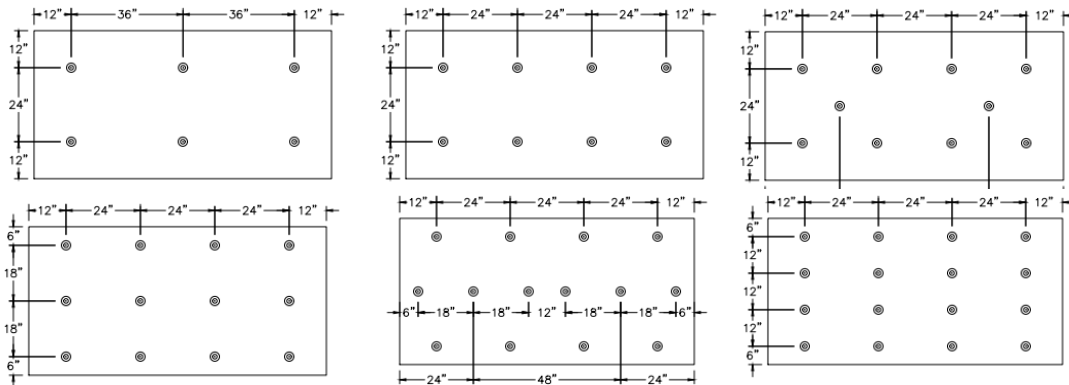
Result: The Perimeter and Corner width is the lesser of these two results: = 10 ft (3 m).



SECTION 2

FASTENER DISTRIBUTION FOR 4 X 8 FT (1.2 X 2.4 M) INSULATION OR COVER BOARDS									
PULLOUT VALUES lbf (N)	UPLIFT PRESSURE IN LB/FT² (KG/M²) – FIELD AREA ONLY								
	-30 (-146.47)	-37.5 (-183.09)	-45 (-219.71)	-52.5 (-256.33)	-60 (-292.95)	-67.5 (-329.56)	-75 (-366.18)	-82.5 (-402.8)	-90 + (-439.42 +)
450 + (2,001.7 +)	6	8	8	10	10	12	14	16	16
425 (1,890.5)	6	8	8	10	10	12	14	16	16
400 (1,779.3)	6	8	8	10	10	12	14	16	–
375 (1,668.1)	6	8	8	10	12	12	14	16	–
350 (1,556.9)	6	8	8	10	12	14	14	–	–
325 (1,445.7)	8	8	10	12	12	16	16	–	–
300 (1,334.5)	8	10	10	14	14	16	16	–	–
275 (1,223.3)	8	10	12	14	14	16	–	–	–
250 (1,112.1)	8	10	12	16	16	–	–	–	–
225 (1,000.9)	10	12	14	16	–	–	–	–	–
210 (934.1)	10	12	14	16	–	–	–	–	–
< 210 (< 934.1)	Contact the Duro-Last Engineering Services Department at 800-248-0280								

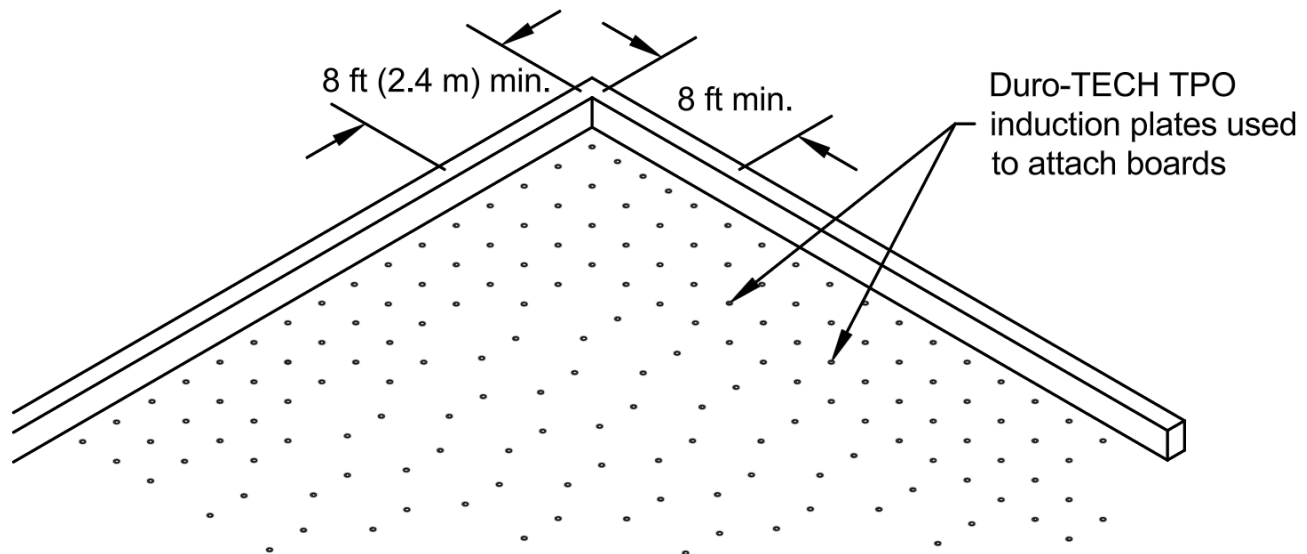
- Refer to the current ASCE 7 version for additional perimeter and corner width requirements.
 - Minimum standards require a minimum additional two fasteners in the Perimeter enhancement areas and another additional two fasteners in the Corner enhancement areas.
- Example: Field uplift pressure of -30 lb/ft² (-146.47 kg/m²) at 6 fasteners will require 8 and 10 fasteners respectively for Perimeter and Corner areas.*



SECTION 2

FASTENER DISTRIBUTION FOR GRID PATTERNS – OTHER SUBSTRATES									
PULLOUT VALUES	UPLIFT PRESSURE IN LB/FT ² (KG/M ²) – FIELD AREA ONLY								
Pound-Force lbf (N)	-30 (-146.47)	-37.5 (-183.09)	-45 (-219.71)	-52.5 (-256.33)	-60 (-292.95)	-67.5 (-329.56)	-75 (-366.18)	-82.5 (-402.8)	-90 + (-439.42 +)
450 + (2,001.7 +)	24 X 36 In. (610 x 914 mm)	24 X 24 In. (610 X 610 mm)	24 X 24 In. (610 X 610 mm)	24 X 20 In. (610 X 508 mm)	24 X 20 In. (610 X 508 mm)	24 X 18 In. (610 X 457 mm)	18 X 18 In. (457 X 457mm)	24 X 12 In. (610 x 305 mm)	24 X 12 In. (610 x 305 mm)
425 (1,890.5)	24 X 36	24 X 24	24 X 24	24 X 20	24 X 20	24 X 18	18 X 18	24 x 12	24 x 12
400 (1,779.3)	24 X 36	24 X 24	24 X 24	24 X 20	24 X 20	24 X 18	18 X 18	24 x 12	–
375 (1,668.1)	24 X 36	24 X 24	24 X 24	24 X 20	24 X 18	24 X 18	18 X 18	24 x 12	–
350 (1,556.9)	24 X 36	24 X 24	24 X 24	24 X 20	24 X 18	18 X 18	18 X 18	–	–
325 (1,445.7)	24 X 24	24 X 24	24 X 20	24 X 18	24 X 18	24 x 12	24 x 12	–	–
300 (1,334.5)	24 X 24	24 X 20	24 X 20	18 X 18	18 X 18	24 x 12	24 x 12	–	–
275 (1,223.3)	24 X 24	24 X 20	24 X 18	18 X 18	18 X 18	24 x 12	–	–	–
250 (1,112.1)	24 X 24	24 X 20	24 X 18	24 x 12	24 x 12	–	–	–	–
225 (1,000.9)	24 X 20	24 X 18	18 X 18	24 x 12	–	–	–	–	–
210 (934.1)	24 X 20	24 X 18	18 X 18	24 x 12	–	–	–	–	–
< 210 (< 934.1)	Contact the Duro-Last Engineering Services Department at 800-248-0280								

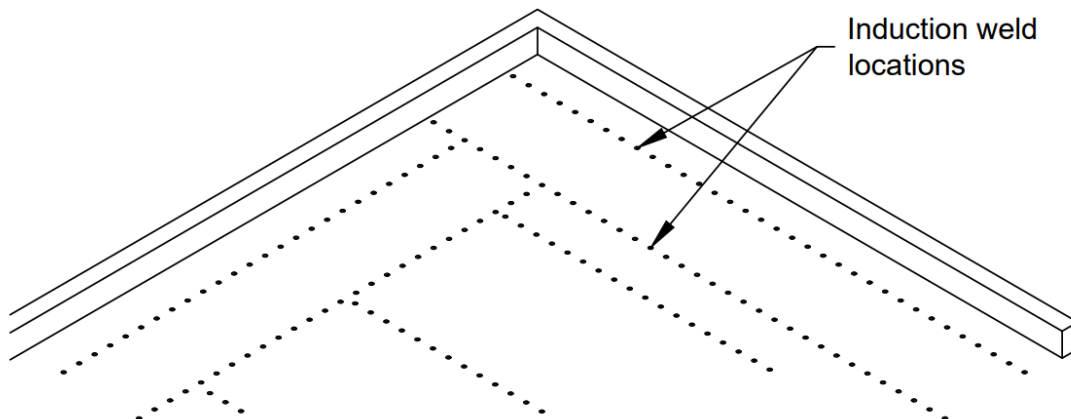
- ♦ Refer to the current ASCE 7 version for additional perimeter and corner width requirements.
- ♦ For Perimeter enhancement, move to the right of the appropriate Field area cell until a greater grid pattern is reached. For Corner enhancement, continue from the Perimeter enhancement cell until the next greater grid pattern is reached.
Example: Field uplift pressure of -30 lb/ft² (-146.47 kg/m²) and pullout test value of 450 lbf (2,001.7 N):
Field value = 24 x 36 inch (610 x 914 mm)
Perimeter enhancement = 24 x 24 inch (610 x 610 mm)
Corner enhancement = 24 x 20 inch (610 x 508 mm)



SECTION 2

FASTENER DISTRIBUTION FOR STRAIGHT LINE ATTACHMENT												
PULLOUT VALUES	DISTANCE	UPLIFT PRESSURE IN LB/FT ² (KG/M ²) – FIELD AREA ONLY										
Pound-Force	Row Spacing	-30 (-146.47)	-37.5 (-183.09)	-45 (-219.71)	-52.5 (-256.33)	-60 (-292.95)	-67.5 (-329.56)	-75 (-366.18)	-82.5 (-402.8)	-90 (-439.42)	-105 (-512.66)	-112.5 (-549.27)
Lbf (N)	Inch (mm)	Fastener Spacing – Inches (mm) on center										
450 + (2,001.7)	* 120 (3,048)	9 (229)	6	6	–	–	–	–	–	–	–	–
	* 96 (2,438)	9 (229)	9	9	6	6	–	–	–	–	–	–
	* 72 (1,829)	15 (381)	12	9	6	6	6	–	–	–	–	–
	60 (1,524)	18 (457)	15	12	9	9	6	6	6	–	–	–
	48 (1,219)	18 (457)	18	15	15	9	9	6	6	6	–	–
	36 (914)	24 (610)	18	18	15	15	12	9	9	6	6	6
400 (1,779.3)	* 120 (3,048)	6 (152)	–	–	–	–	–	–	–	–	–	–
	* 96 (2,438)	9 (229)	6	6	–	–	–	–	–	–	–	–
	* 72 (1,829)	12 (305)	9	9	6	6	–	–	–	–	–	–
	60 (1,524)	12 (305)	9	9	6	6	6	6	–	–	–	–
	48 (1,219)	18 (457)	12	9	9	9	6	6	6	–	–	–
	36 (914)	24 (610)	18	15	12	12	9	9	6	–	–	–
350 (1,556.9)	* 72 (1,829)	9 (229)	6	6	–	–	–	–	–	–	–	–
	60 (1,524)	9 (229)	9	9	6	6	6	–	–	–	–	–
	48 (1,219)	15 (381)	9	9	9	6	6	6	–	–	–	–
	36 (914)	18 (457)	15	12	12	9	9	6	–	–	–	–

- * **Perimeter** and **Corner** areas not to exceed 60-inch (1,524 mm) on center.
- All pullout tests less than 350 lbf (1,556.9 N) will require the use one of the tables shown above.
- Refer to the current ASCE 7 version for additional perimeter and corner width requirements.



APPROVED TPO MEMBRANES

Only Duro-TECH TPO membranes* are approved for use with the Duro-TECH TPO Induction Weld Roofing System. Refer to the PDS for the physical properties of the TPO membrane.

* This does **not** include Duro-TECH TPO Fleece membranes.

APPROVED INSULATING SEPARATORS AND SUBSTRATE MATERIALS

Only approved insulating separators, insulations, cover boards, and/or fan fold boards may be used in conjunction with the TPO membrane.

1. When multiple layers of insulations are used, with or without a cover board, it is acceptable to loosely lay the underlying boards and mechanically fasten through the top layer and all subsequent layers at once.
2. When installing directly over a steel deck, metal roofing, or any type of metal, insulations and/or cover boards must have an adequate span rating, as published by the manufacturer, for the profile of the steel deck. It may be necessary to fill the bottom flute with insulation.
NOTE: Must have a minimum 1-1/2-inch (38-mm) insulation above the top flute.
3. As indicated below, some products will require an approved insulating separator.

INSULATING SEPARATORS (Minimum 4-inch (102-mm) diameter)

Refer to T1020 Detail:

- Duro-Last Induction Insulation Disc
NOTE: Do not allow the insulating separator to directly contact the TPO membrane.
- OMG® 102 mm Cardboard Disc
- Atlas® FR-10
- GAF® VersaShield®
- EPDM membrane (any thickness)
- TPO membrane (any thickness)

DURO-GUARD® INSULATIONS

Refer to T1020 Detail:

1. Polyisocyanurate ("ISO") (minimum 1-inch (25-mm) thickness, minimum 1-1/2-inch (38-mm) thickness over metal)
 - a. Products:
 - i. **ISO insulation** that meets ASTM® C1289, Class II:
 - GRADE 2: 20 psi (0.1 MPa)
 - GRADE 3: 25 psi (0.2 MPa)
2. ISO High-Density ("HD")
 - a. Products:
 - i. **ISO HD** that meets ASTM C1289 Class II:
 - 80 psi (0.1 MPa), minimum
3. Polystyrene (EPS/XPS) (minimum 1-inch thickness) (minimum 1-1/2-inch (38-mm) thickness over metal)
 - **Must be covered with approved ISO, ISO HD, cover board, or slip sheet**
 - **Must have approved insulating separator if using slip sheets other than FR-10 or VersaShield**
 - a. Products:
 - i. **Expanded polystyrene** (EPS) products that meet ASTM D1621.
 - TYPE II (1.5 pcf (24 kg/m³)) (15 – 21 psi (0.10 – 0.14 MPa))
 - TYPE VIII (1.25 pcf (20 kg/m³)) (13 – 18 psi (0.09 – 0.12 MPa))
 - Must **always** be covered with insulation, cover board, or fan fold board with a minimum density of 1.5 pcf (24 kg/m³) (15 – 21 psi (0.10 – 0.14 MPa)).
 - TYPE IX (2.0 pcf (32 kg/m³)) (25 – 33 psi (0.17 – 0.23 MPa))
 - ii. **Extruded polystyrene** (XPS) products
 - Minimum density of 1.5 pcf (24 kg/m³) at 16 psi (0.1 MPa) that meets ASTM C578

SECTION 2

DURO-GUARD COVER BOARDS – 1/4-INCH (6-MM), MINIMUM (900 PSI (6.2 MPA) MINIMUM)

Refer to T1020 Detail:

- DensDeck® Prime Roof Board with EONIC™ Technology, manufactured by Georgia-Pacific®
- DensDeck Roof Board, manufactured by Georgia-Pacific
- SECUROCK® Gypsum-Fiber Roof Board, manufactured by USG® Corporation
- SECUROCK Glass-Mat Roof Board, manufactured by USG Corporation
- DEXcell® Cement Roof Board, manufactured by National Gypsum® Company
- DEXcell Glass Mat Roof Board, manufactured by National Gypsum Company
- DEXcell FA® Glass Mat Roof Board, manufactured by National Gypsum Company
- TOPROCK® DD Roof Board, manufactured by ROCKWOOL®

DURO-GUARD FAN FOLD BOARDS

Refer to T1020 Detail:

1. Duro-Guard Fan Fold Boards (**Must have approved insulating separator**)
 - EPS Fan Fold, supplied by Duro-Last
 - XPS Fan Fold – K (Crush Fold), supplied by Duro-Last

APPROVED SLIP SHEETS

Only the following slip sheets are to be used in warranted Duro-TECH TPO Induction Weld Roofing Systems.

1. Refer to the slip sheet's PDS for applicability and installation information.
2. Slip sheets (*** Must have approved insulating separator**)
 - FR-10, manufactured by Atlas Roofing Corporation
 - VersaShield, manufactured by GAF, Inc.
 - * Duro-Weave® Separation Slip Sheet, supplied by Duro-Last
 - * Duro-Blue® Separation Slip Sheet, supplied by Duro-Last
 - * Geotextile Slip Sheet, supplied by Duro-Last

SECTION 3 – SYSTEM INSTALLATION

DECK/SUBSTRATE PREPARATION

The contractor is responsible for providing a properly prepared surface for the installation of the TPO membrane and any approved insulations, cover boards, fan fold boards, and/or slip sheets.

Any deck or substrate that does **not** meet requirements (due to contamination, roughness, conductivity, etc.) will require an approved insulating separator, insulation, cover board, fan fold board, and/or slip sheet.

NEW CONSTRUCTION

1. Steel Decks

- a. Approved insulations and/or cover boards must be used to provide a proper substrate on which to apply the TPO membrane.
- b. Must have a minimum 1-1/2-inch (38-mm) insulation, cover board may be applied over top.
- c. Approved insulations and/or cover boards must have an adequate span rating, as published by the manufacturer, for the profile of the steel deck. It may be necessary to fill the bottom flute with insulation.
- d. FM projects require fastener rows to run perpendicular to, and into the high flutes.

2. Wood Decks (plywood, OSB, or wood plank)

- a. Deck surface must be smooth, free of splintered wood and level without significant surface irregularities or depressions. Cracks or knotholes larger than 1/4 inch (6 mm) must be repaired.
- b. Carefully examine deck for loose or high fasteners. These must be repaired or replaced so that they are flush with the surface.

3. Structural or Lightweight Structural Concrete Decks

- a. Deck must be cured, dry, and have a smooth surface.
- b. Approved vapor barrier required if deck is less than 1 year old.

4. Lightweight Insulating Concrete Decks (over structural deck)

- a. Deck must be cured, dry, and have a smooth surface.
- b. Do not leave the deck exposed beyond the maximum exposure time as defined by the lightweight insulating concrete manufacturer.
- c. Do not allow the deck to be exposed to precipitation.

SECTION 3

REROOFING

Tear-Off

The contractor is responsible for providing a properly prepared surface for the installation of the TPO membrane and any approved insulations, cover boards, fan fold boards, and/or slip sheets. Refer to *Deck/Substrate Preparation* in *Section 2*.

Any deck that does **not** meet requirements (due to contamination, roughness, conductivity, etc.) will require an approved insulating separator, insulation, cover board, fan fold board, and/or slip sheet.

1. If the deck cannot be adequately prepared for the direct application of the TPO membrane, approved insulations, fan fold boards, and/or cover boards must be used.
2. **Phenolic foam insulation must be completely removed.**
3. Incompatible materials, such as BUR or mod bit, must be immediately cleaned from the TPO membrane. If the TPO membrane cannot be properly cleaned, remove the contaminated TPO membrane or cover with an approved slip sheet, before installing new TPO membrane.
4. Duro-TECH TPO LVOC Splice Wash Cleaner may be used to clean the TPO membrane. If another cleaner is desired, contact Duro-Last to verify compatibility.
 - i. Always read SDS prior to using any cleaners.
 - ii. Prepare cleaner as directed from individual cleaner instructions.
 - iii. Spray application is preferred, but cleaners may also be applied with a mop.
 - iv. Scrub with a stiff-bristle brush.
 - v. **Do not allow cleaner to sit for any extended period of time on the TPO membrane.** Rinse immediately with either:
 - Power-washer
 - maximum pressure of 3,000 psi (20.7 MPa)
 - Fan tip attachment
 - 18-inch
 - Garden hose
 - spray nozzle attachment.

SECTION 3

Re-Cover

The contractor is responsible for providing a properly prepared surface for the installation of the TPO membrane and any approved insulations, cover boards, fan fold boards, and/or slip sheets.

Any deck that does **not** meet requirements (due to contamination, roughness, conductivity, etc.) will require an approved insulating separator, insulation, cover board, fan fold, and/or slip sheet.

- a. Blisters, buckles, and other surface irregularities must be repaired or removed if there is a possibility of the existing roofing system affecting the performance of the new Duro-TECH TPO Induction Weld Roofing System.
- b. Areas with wet insulation and/or cover boards must be removed and replaced with products of similar thickness and the same, or greater R-value, or to comply with applicable codes.
- c. The new Duro-TECH TPO Induction Weld Roofing System should slope to drains without any obstructions.
- d. Re-covers over the following substrates will require approved insulations, cover boards, fan fold boards, and/or slip sheets:

1. **Existing Asphalt-Based Products** (Example: BUR, Mod Bit, or Coal Tar Pitch):

- i. When installing approved EPS/XPS insulation over BUR, mod bit (with or without granule or smooth-surfaced cap sheet), or coal tar pitch, an approved slip sheet must be used between the insulation and existing roofing system. **(NOTE: Must have approved insulating separator)**
- ii. Incompatible materials, such as BUR or mod bit, must be immediately cleaned from the TPO membrane. If the TPO membrane cannot be properly cleaned, remove the contaminated TPO membrane or cover with an approved slip sheet, before installing new TPO membrane.
- iii. Existing roofing systems with 1/4 – 3/8-inch (6 – 10 mm) rock/gravel (example: pea gravel or crushed stone) surfaces must be leveled and maintained at 4 lb/ft² (19.53 kg/m²).
- iv. Systems where rock/gravel was removed must utilize approved insulation, cover boards, and/or fan fold boards.

NOTE: Removing the rock/gravel surfacing may affect the roofing system's fire rating. Contact the Duro-Last Engineering Services Department for questions concerning fire-rated assemblies.

- v. Rock/gravel greater than 3/8 inch (10 mm) must utilize approved insulation and/or cover boards.

2. **Existing Single-Ply Membrane Roofing System:**

- i. Cut the existing membrane free from the entire deck perimeter and at the base of all parapets and curbs. Slice the existing membrane between rows of fasteners prior to installing the new Duro-TECH TPO Induction Weld Roofing System.
- ii. Carefully examine deck for loose or high fasteners. These must be repaired or replaced so that they are flush with the surface.
- iii. Existing membranes must be covered with either approved insulations, cover boards, fan fold boards, and/or slip sheets.
- iv. If the existing roofing system is PVC membrane and was installed directly over polystyrene insulation without a slip sheet, the existing PVC membrane must be removed and any damaged insulation replaced, and high fasteners must be replaced or removed. Approved insulations, cover boards, fan fold boards, and/or slip sheets must then be installed.

3. **Existing Metal Roofing:**

- i. Metal roofing must be clean, smooth, and free of sharp edges and loose, foreign material. Repairs must be completed prior to the installation of the TPO membrane.
- ii. Fastener rows spaced greater than 60 inches (1,524 mm) are not permitted on metal roofing unless attaching directly to purlins.
- iii. It is the responsibility of the contractor to ensure that the weight limitations of the roofing system are not exceeded when installing additional materials over pre-engineered buildings.

SECTION 3

- iv. Provide a proper substrate for installation and to adequately separate the TPO membrane from the metal roofing.
 - 1. At least 1-1/2 inches (38 mm) of insulation must be added above the top flute to create a clean, flat, and continuous substrate.
 - 2. It may be necessary to fill the bottom flute with insulation.
 - 3. The layer directly above the top flutes must have a span rating adequate for any gaps that may exist between the filler insulation and the metal ribs. Refer to *Section 2* for approved substrate materials.
- v. Plywood or oriented strand board (OSB)
 - 1. Used as a cover board over insulation:
 - a. TPO membrane will be fastened to the underlying metal deck
 - i. Contractor must ensure plates installed over plywood or OSB have a 1-1/2-inch (38-mm) separation from metal roofing
 - ii. Plywood or OSB must be a minimum thickness of 7/16 inch (11 mm)
 - iii. Attach with a minimum of 9 fasteners per 4- x 8-foot (1.2- x 2.5-m) board
 - 2. Used as a new substrate:
 - a. TPO membrane will be fastened to the plywood or OSB
 - i. Contractor must ensure plates installed over plywood or OSB have a 1-1/2-inch (38-mm) separation from metal roofing
 - ii. Plywood or OSB must be a minimum thickness of 5/8 inch (16 mm)
 - iii. Plywood or OSB fastening must comply with applicable codes
- vi. High-density wood fiberboard is an acceptable substrate on metal roofing when the deck slope is at least 1:12 (8%).
 - 1. Contractor must ensure plates installed over high-density wood fiberboards have a 1-1/2-inch (38-mm) separation from metal roofing.
 - 2. High-density wood fiberboard is **not** acceptable for use as flute filler.
- 4. **Existing** Polyurethane Foam ("PUF"), Acrylic Coatings, or Silicone Coatings:
 - i. Blisters, buckles, and other surface irregularities must be repaired or removed before covering.

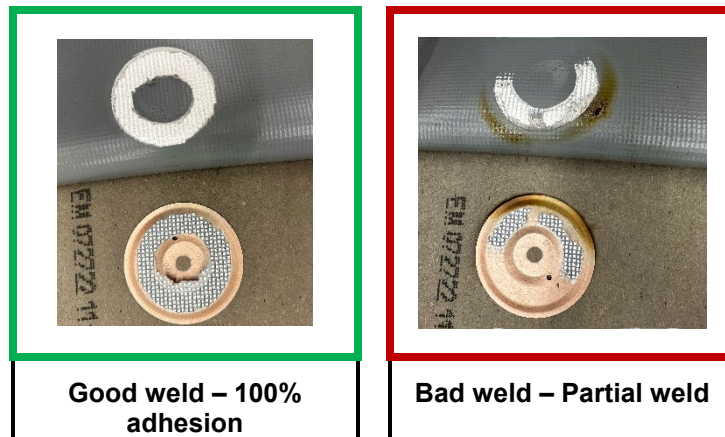
SECTION 3

TEST WELD PROCEDURE

Prior to starting any induction weld project, conduct the manufacturer's recommended testing. A minimum of three test welds must be completed before beginning installation and after any significant ambient temperature changes.

General steps for testing:

1. Using a scrap piece of TPO membrane and a Duro-TECH TPO Induction Plate, perform the manufacturer's recommended testing.
2. Induction weld the TPO membrane to the plate.
3. Immediately apply a clean magnet to the top of the welded TPO membrane for the recommended time.
4. Remove the magnet once the plate has cooled.
5. With two sets of pliers, peel the TPO membrane and plate apart.
6. Look at top of plate to determine adhesion. Adjust settings as needed to obtain 100% adhesion.
(Refer to photos)



SECTION 3

INSTALLATION

The following section outlines the installation process for the Duro-TECH TPO Induction Weld Roofing System.

WOOD NAILERS

Wood nailers are required along perimeter edges where 1-inch (25-mm), or greater, thickness of insulation is used. Refer to T3000-Series and T6000-Series Details.

- Wood nailers must be #2 grade lumber or better, or plywood, and both forms of nailers must withstand a minimum of 180 lbf/ft (2626.9 N/m).
- Wood nailers less than a thickness of 1-1/2 inches (38 mm) must be made of plywood. OSB is not permitted.
- Pull values ≥ 270 lbf (1,201 N) will allow for a fastener concentration of 18 inches (457 mm) on center.
- Pull values < 270 lbf (1,201 N) will require additional fasteners.
- Top of wood nailers must be flush with the top of the insulation or cover board.
- Wood nailers not required at deck-to-parapet transitions.
- Duro-Last does not recommend the use of pressure-treated lumber in their roofing systems.

APPROVED SUBSTRATE MATERIALS AND SLIP SHEETS INSTALLATION

1. Refer to *Approved Insulating Separators, Insulations, Cover Boards, and Fan Fold Boards and Approved Slip Sheets* in *Section 2* for approved products.
2. The use of multiple layers of insulation must have joints staggered a minimum of 6 inches (152 mm) between layers to eliminate thermal bridging.
3. Insulations and fan fold boards (**NOTE: Must have approved insulating separator, if necessary**)
 - Must be neatly fitted to the deck and around penetrations
 - Must be installed tightly against adjacent boards
 - Stagger all joints between boards a minimum of 6 inches (152 mm) from row to row
 - No gap should exceed 1/4 inch (6 mm) in width
4. Cover boards
 - Must be neatly fitted to the deck and around penetrations
 - May require a small gap between boards. Consult the relevant PDS for gapping requirements
 - No gap should exceed 1/4 inch (6 mm) in width
5. Mechanical attachment:
 - a. Refer to *Section 2* for approved fasteners and plates, and pullout test requirements.
 - b. When installing multiple layers (which may include insulations, cover boards, or thermal barriers), it is acceptable to loosely lay the underlying boards and mechanically fasten through the top layer and all subsequent layers at once.
 - c. **Board attachment 4- x 8-feet (1.2- x 2.4-m):** Fasten insulation and/or cover boards as per *Fastener Distribution For 4- x 8-feet (1.2- x 2.4-m) Insulation or Cover Boards* table in *Section 2*.
 - d. **Grid attachment:** Fasten other substrates (such as fan fold boards, slip sheets, etc.) as per *Fastener Distribution for Grid Patterns – Other Substrates* table in *Section 2*.
 - e. **Straight line attachment:** Fasten to substrate as per *Fastener Distribution for Straight Line Attachment* table in *Section 2*.

TPO DECK MEMBRANE INSTALLATION**GENERAL INSTALLATION**

- Refer to Fastener Distribution Tables and Deck/Substrate Criteria in *Section 2*.
- It is recommended that the TPO membrane be overlapped to allow for water to flow over, rather than against, each lap.
 1. After unwrapping and rolling out the TPO membrane, allow at least 30 minutes for the membrane to relax, prior to installation.
 2. Position each roll so that the TPO membrane overlaps the installed TPO membrane section by a minimum of 3 inches (76 mm).
 - Uncut rolls will have a printed lap line located at 3 inches (76 mm) and 6 inches (152 mm) from the edge of the roll.
 - 3-inch (76-mm) lap line: Used for induction weld or adhered roofing systems
 - 6-inch (152-mm) lap line: Used for non-induction weld, mechanically fastened roofing systems
 3. Using an approved induction welding tool, weld each successive TPO membrane roll to the plates of the underlying substrate.
 4. After welding the TPO membrane to the plates, immediately apply a clean magnet over each welded plate.
 5. After cooling for at least 60 seconds, remove the magnets.
 6. The seam between the two sections of TPO membrane must be heat (hot-air) welded with a minimum 1-1/2-inch (40-mm) weld.
 7. A "T-Patch" is required at intersections of three TPO membrane edges and at field welded transitions.
 - Refer to Detail TRG1066.
 - The minimum size of a patch is 4- x 4-inch (102- x 102-mm) or 4-inch (102-mm) diameter.
 - Unreinforced TPO membrane T-Patches may be a maximum of 60 mils (1.52 mm) thick.
 - Reinforced TPO membrane T-Patches may be a maximum of 45 mils (1.14 mm) thick.
 8. After installation, if additional fasteners are added through the top of the TPO membrane, they must be covered by a TPO membrane strip which is heat-welded to the TPO membrane.
 - The TPO membrane strip must be wide enough to accommodate a minimum 1-1/2-inch (40-mm) weld on all sides.
 - TPO membrane strip may be any thickness of TPO membrane.
 9. Only install as many Duro-TECH TPO Induction Weld Roofing System materials as can be covered with TPO membrane by the end of the working day or before the onset of inclement weather.

SECTION 3

TPO PARAPET MEMBRANE INSTALLATION

The TPO membrane may be induction welded, mechanically fastened, or adhered onto parapets. Surface preparation requirements on parapets are the same as described in *Substrate Preparation* in Section 2. Refer to Details for installation references of parapet or edge terminations.

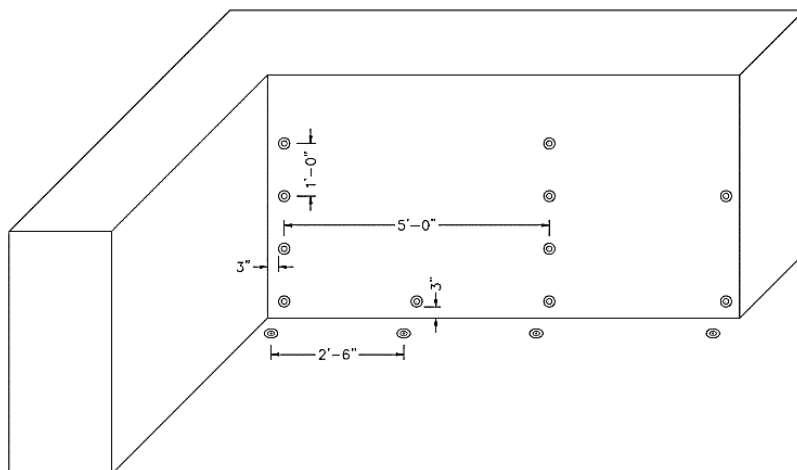
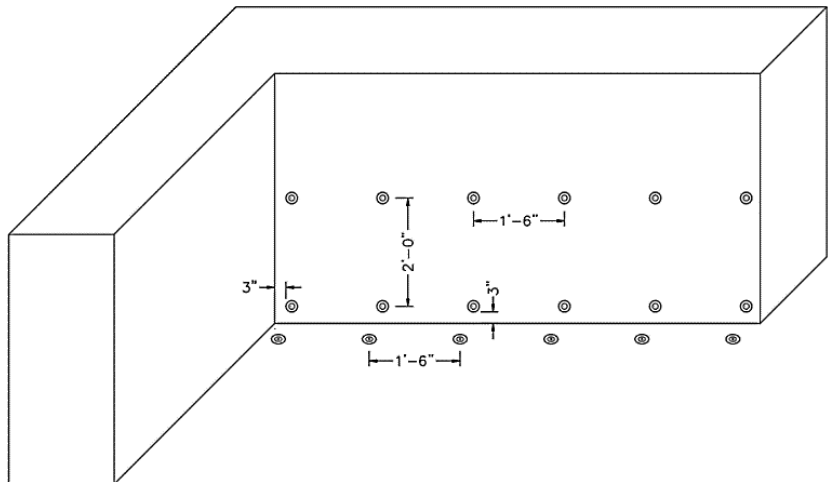
PARAPETS INDUCTION WELDED

As instructed in the T3000-Series and TIW6000-Series Details:

- Approved induction weld plates on the deck must be placed 3 inches (76 mm) away from the parapet.
 - Approved induction weld plates on the parapet must be placed 3 inches (76 mm) away from the deck.
 - From the first row of parapet fasteners and plates, each successive row must be installed no further than 24 inches (610 mm) away, vertically.
 - All rows must be fastened 18 inches (457 mm) on center, maximum.
1. Situate the TPO membrane at the base of the parapet, ensuring:
 - Enough TPO membrane extends onto the deck to cover plates in the deck-to-parapet transition
 - Enough TPO membrane extends to accommodate the 1-1/2-inch (40-mm) wide heat (hot-air) weld between the TPO parapet membrane and TPO deck membrane
 2. Any field welded transitions from deck to parapet will require T-patches.
 3. Follow induction weld process as stated in Section 3.

OPTION 1:

Fastener rows must be 24 in. (610 mm) on center vertically. If the last row falls within 30 in. (762 mm) max. from the top of the parapet, material can either be terminated or wrapped up and over the parapet.

**OPTION 2:**

Fastener rows must be 5 ft (1.5 m) on center horizontally, and 12 in. (305 mm) on center vertically, with base flashing at 30 inches (762 mm) on center.

SECTION 3

PARAPETS MECHANICALLY FASTENED WITH NON-INDUCTION PLATES

As instructed in the T3000-Series, T6000-Series, and TRG6000-Series Details:

1. Any slope equal to or greater than 12 inches/foot (1:1) will be considered a parapet.
 - Parapet rolls may be a maximum of 30-inches (762-mm) wide when installed horizontally.
 - Parapet rolls may be a maximum of 60-inches (1,524-mm) wide when installed vertically.
2. Situate the TPO membrane at the base of the parapet, ensuring:
 - Enough TPO membrane extends onto the deck to cover plates in the deck-to-parapet transition
 - Enough TPO membrane extends to accommodate the 1-1/2-inch (40-mm) wide heat (hot-air) weld between the TPO parapet membrane and TPO deck membrane
3. A row of fasteners must be installed at the deck-to-parapet transition.
 - Fasteners may be installed into the deck or the parapet.
 - When fastened into the deck, utilize the same fastener concentration used to install the TPO membrane in the perimeter and/or corner areas.
4. When installing rows of fasteners into parapets, use the following fastener concentration:
 - i. 18 inches (457 mm) on center, maximum:
 - a. Concrete
 - b. 22-gauge (0.6 mm) steel, or thicker
 - c. Plywood or other material with pullout value 300 lbf (1,334.5 N) or greater
 - ii. 12 inches (305 mm) on center, maximum:
 - a. Plywood or other material with pullout value between 175 – 299 lbf (778.4 – 1,330 N)
 - iii. For any parapet with material pullout value less than 175 lbf (778.4 N), contact the Duro-Last Engineering Services Department.
5. After the TPO membrane is fastened, seam the edge of the TPO parapet membrane to the TPO deck membrane with a continuous heat (hot-air) weld, at least 1-1/2-inch (40-mm) wide.
6. Any field welded transitions from deck to parapet will require T-patches.

SECTION 3

PARAPETS ADHERED

The parapet/substrate must be clean, smooth, dry, and free of sharp edges, dust, contaminants, oil, grease, and loose, foreign material that may affect TPO membrane installation or performance. All damaged, broken, or wet materials must be removed and replaced.

When adhering TPO membrane to parapets, utilize an approved adhesive. Refer to the PDS of the adhesive being used for acceptable substrates, coverage rates and application guidelines.

As instructed in the TAS3000-Series and TAS6000-Series Details:

1. Back seal the TPO membrane at all transitions with a continuous layer of sealant or caulk.
2. Mechanically fasten at 6 inches (152 mm) on center, with 3-Inch Metal Plates, the TPO membrane into the transition, deck or parapet.
NOTE: Only 3-Inch Metal Plates or Termination Bar may be used between an adhered-to-mechanically fastened transition.
3. Apply an approved adhesive to the TPO membrane and parapet substrate, as directed on the adhesive label. Do not apply to areas that will be heat (hot-air) welded.
4. Apply the TPO membrane to the parapet substrate, ensuring that it overlaps the TPO membrane by at least 3 inches (76 mm).
5. Apply pressure to the TPO membrane with a push broom or squeegee to complete the bond.
 - If extending more than 5 feet (1.5 m) up a parapet, rows of mechanical fasteners must be installed at each 5-foot (1.5-m) increment at 12 inches (305 mm) on center, maximum.
 - The TPO membrane may be installed so that the rows of fasteners on the parapet run either horizontally or vertically.
6. After the TPO membrane is adhered, seam the edge of the TPO parapet membrane to the TPO deck membrane with a continuous heat (hot-air) weld, at least 1-1/2-inch (40-mm) wide.
7. After the TPO membrane is adhered and welded, complete the outside or top-of-parapet termination as instructed within adhered Details: TAS4000-Series.
8. Any field welded transitions from deck to parapet will require T-patches.

SECTION 3

EXPANSION JOINTS

As instructed in the T1000-Series Details:

1. Fasten TPO membrane on both sides of the joint.
2. Use the same fastener concentration that is being used to install the adjacent TPO membrane.
3. Install enough excess TPO membrane over the joint to allow for expansion/contraction calculated by a design professional.

SLOPE TRANSITIONS

As instructed in the T1000-Series Details:

1. The TPO membrane must be mechanically fastened with approved plates/fasteners at all slope transitions that meet or exceed a change in slope of 1 inch/foot (1:12).
2. The fastener concentration must be the same as that being used to fasten the TPO membrane adjacent to the transition.

SECTION 3

ACCESSORIES**SLOPE TRANSITIONS (E.G. DECK-TO-PARAPET, DECK-TO-CURB, ETC.)**

As instructed in the T1000-Series Details:

1. The TPO membrane must be mechanically fastened with approved plates/fasteners at all slope transitions that meet or exceed a change in slope of 1 inch/foot (1:12).
2. The fastener concentration must be the same as that being used to fasten the TPO membrane adjacent to the transition.
3. All field-welded transitions must have a T-Patch as listed under TPO DECK MEMBRANE INSTALLATION: GENERAL INSTALLATION. The T-Patch must be welded to the transition with a continuous heat (hot-air) weld a minimum of 1-1/2 inches (40 mm) wide.

All field-welded transitions must have a T-Patch as listed under TPO DECK MEMBRANE INSTALLATION: GENERAL INSTALLATION. It must be welded to the transition with a continuous heat (hot-air) weld a minimum of 1-1/2 inches (40 mm) wide.

PENETRATIONS

1. The TPO membrane must be fastened at the base of all deck penetrations. Such penetrations include, but are not limited to, pipes, drains, curbs, pitch pans, and expansion joints.
2. T-Patches must not be used in place of inside and outside corners.
3. The fastener concentration around penetrations must be the same as that being used to fasten the TPO membrane adjacent to the penetration. A minimum of one fastener is required on round penetrations, and a minimum of one faster per side on rectangular penetrations.
4. **Stack Flashings, Drain Boots, Inside, and Outside Corners cannot be field-fabricated.**
5. Outside and Inside Corners must be installed at all applicable locations.
6. Where applicable, seam the penetration skirt/base to the TPO membrane with a continuous heat (hot-air) weld, at least 1-1/2-inch (40-mm) wide.

CORNERS

As instructed in Detail T1180:

1. Position the Inside and/or Outside Corners into the appropriate transition(s).
2. **Inside and Outside Corners cannot be field-fabricated.**

ROUND FLASHINGS

As instructed in Details T4070, T4080, and T4081:

1. The TPO membrane must not contact surfaces which maintain or exceed temperatures of 150° F (65° C) including insulated chimney pipes, exhaust pipes, and combustible fuel pipes.
2. All flashings, with the exception of pitch pans, must be terminated a minimum of 8 inches (203 mm) above the top of the roofing system surface.
3. **Round Flashings cannot be field-fabricated.**

RECTANGULAR CURBS

As instructed in the T4000-Series Details:

1. Apply TPO membrane curb around the rectangular curb penetration.
2. Apply finishing details along the top of the TPO membrane, as directed.
3. **Inside and Outside Corners cannot be field-fabricated.**

PITCH PANS

As instructed in the T4030, T4040, and T4045 Details:

1. Use pitch pans only when standard flashings cannot be used.

SECTION 3

2. All pitch pans must be terminated a minimum of 4 inches (102 mm) above the top of the roofing system surface.

TWO-WAY AIR VENTS

As instructed in the T5020 Detail:

1. Install Duro-TECH Two-Way Air Vents between fastener rows and at high points of deck area. Vents must not be installed within 7 ft (2.1 m) of the building edge. Never install vents in low or drainage areas.
2. Duro-TECH TPO Two-Way Air Vents must not be used on:
 - Refrigerated buildings
 - Freezer buildings
3. Duro-TECH TPO Two-Way Air Vents are not required on:
 - Open-air structures (e.g. carports)
 - Duro-TECH roofing systems with overburden (e.g. ballast, paver, vegetation, etc.).

SECTION 3

DRAINS AND SCUPPERSDrain Assemblies with Clamping Rings

As instructed in the T2011 Detail:

1. All existing roofing system materials must be removed from drain bowl and clamping ring.
2. Use an approved sealant (1/2 tube minimum) between the TPO membrane and drain bowl assembly.
3. 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.

Drain Boots

As instructed in the T2021 Detail:

1. Apply an approved sealant (1/2 tube minimum) to the outside of the Drain Boot tube and insert it into the drain.
2. Install a pair of composite drain rings (CDRs) to compress the Drain Boot to the pipe.
3. **Drain Boots cannot be field-fabricated.**

Scuppers

As instructed in the T2030, T2060, and T2061 Details, install the Scupper through the parapet.

Outside Corners cannot be field-fabricated.

WALKWAY PADS

1. Duro-TECH TPO Walkway Pads are recommended at all roof access points, service units and high traffic areas.
2. Prior to inspection: Heat (hot-air) weld only one side of any Walkway Pads that will be covering field seams.
3. After inspection: Heat (hot-air) weld the remaining side to complete the attachment of the pad, with a continuous heat (hot-air) weld, at least 1-1/2-inch (40-mm) wide.

SECTION 3

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 deck subassembly or building.
2. Duro-Last recommends the use of vapor barriers, however it is the responsibility of the contractor to comply with applicable codes. A roofing design professional, such as a consultant or architect, may be utilized for roofing system design prior to installing any roofing 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. **Extreme caution must be used to prevent the TPO membrane from being contaminated by asphalt-based products, such as BUR or mod bit.** Asphalt-based products are incompatible with the TPO membrane and proper separation must be provided between these products and the TPO membrane. If the TPO membrane cannot be properly cleaned, cover or remove the contaminated section and install new TPO membrane.
5. The TPO membrane must not be in contact with substrates that maintain or exceed temperatures of 150° F (65° C), including insulated chimney pipes and combustible fuel pipes. Refer to the appropriate Details for information regarding the proper termination.
6. **TPO is extremely flammable.** Keep all TPO components away from ignition sources, heat, sparks, and open flames. Do not smoke while installing TPO components.
7. Do not cover existing roofing systems that contain excess moisture. Excess moisture is defined as any water observed within a core cut or squeezed from a core sample.
8. Phenolic foam is not an approved insulation in new construction or re-roofing applications. The Duro-TECH TPO Induction Weld Roofing System must not, under any circumstances, be installed over phenolic foam.
9. Perlite and wood fiberboards are not acceptable substrates for Duro-TECH TPO Induction Weld Roofing Systems.
10. **If asbestos is encountered, the building owner must be notified at once.** The building owner is solely responsible for determining the proper course of action.
11. The Duro-TECH TPO Induction Weld Roofing System **must not** be installed over areas of decks if one or more of the following conditions exist:
 - a. The building structure is not sufficient to handle the load of the completed roofing system. This is the responsibility of the contractor and should be determined by a roofing design professional.
 - b. It is not possible to find an approved fastener that will properly hold in the substrate.
 - c. Decks are subjected to hot embers, slag, burning debris or incompatible chemicals.
 - d. Decks are made of Cementitious Wood Fiber ("CWF" or Tectum) or Gypsum.
12. Refer to applicable Safety Data Sheet for additional information.
13. Refer to the appropriate Warranty Form on the Duro-Last website for information on exclusions and requirements.

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