



ROLL GOOD MECHANICALLY FASTENED ROOFING SYSTEM

TABLE OF CONTENTS

SECTION 1 - - - GENERAL	3
Introduction and Warranties	3
Requirements	4
Tools	4
Drainage/Slope	4
Weather Considerations	4
Delivery	5
Handling	5
Storage	5
Chemical Resistance	5
Substrate Separation	6
Paint Application	6
Vapor Barriers	6
Overburden	6
HVAC Cleaners	7
SECTION 2 - - - QUALITY ASSURANCE	8
Pre-Job Assessment	8
Core Cuts	8
Pullout Tests	8
Fastener Selection and Deck Types	8 – 10
Plate Selection	8
Fastener Selection Based on Deck Type	9
Fastener Spacing Table	10
Deck/Substrate Criteria	11
Decks to Which the Membrane May be Applied Directly	11
Decks Requiring Rigid Board Insulations, Fan Fold Boards, Cover Boards and/or Slip Sheets	11
Approved Membranes	11
Approved Rigid Board Insulations, Cover Boards and Fan Fold Boards	12 – 13
Rigid Board Insulations	12
Cover Boards	12
Fan Fold Boards	13
Approved Slip Sheets	13

SECTION 3 - - - SYSTEM INSTALLATION	14
Substrate Preparation	14
New Construction	14
Reroofing	15 – 17
Tear-Off	15
Re-Cover	15 – 17
Installation	17 – 28
Wood Nailer (General)	17
Wood Nailer (Pressure-Treated)	17
Rigid Board Insulation, Fan Fold, Cover Board and Approved Slip Sheet Installation	18 – 19
Membrane Installation	20 – 26
General Considerations	20
Roof Perimeter/Corner Membrane Attachment: General	21
Walls Less than 2 Feet Tall or No Walls Present	22 – 23
Walls 2 Feet Tall or Taller	24 – 25
Duro-Bond® or RhinoBond® Systems	25 – 26
Hot-Air Welding	27
Walls	27 – 28
Walls Mechanically Fastened	27 – 28
Walls Adhered	28
Slope Transitions	29
Penetrations	29
Flashings	29
Pitch Pans	29
Two-Way Air Vents	29
Drains and Scuppers	30
Expansion Joints	30
Walkway Pads	30
Cautions and Warnings	31

SECTION 1 - - - GENERAL

INTRODUCTION

The following is the information required to install the *Roll Good Mechanically Fastened Roofing System*. Each installation should be in compliance with the Detail Drawings, instructions, material descriptions, and other information stated herein. Refer to *Section 2* for approved products.

This specification meets standard installation requirements for the following warranties.

Supreme Warranties:			
Warranty Name	Membranes Covered	Minimum Mil Thickness	Border Color
15-Year NDL Warranty (15 Years Consequential Damages)	Duro-Last, Duro-Fleece Plus®	40	Green
20-Year NDL Warranty (15 Years Consequential Damages and 5 Years Material)	Duro-Last, Duro-Fleece Plus	50	Orange
20-Year NDL Warranty (15 Years Consequential Damages and 5 Years Material and Labor)	Duro-Last, Duro-Fleece Plus	50	Purple

Basic Warranties: Do not include consequential damages.			
Warranty Name	Membranes Covered	Minimum Mil Thickness	Border Color
15-Year NDL Warranty	Duro-Last, Duro-Fleece®, Duro-Fleece Plus, Duro-Tuff®, Duro-Last EV	40	Burgundy
20-Year NDL Warranty	Duro-Last, Duro-Fleece, Duro-Fleece Plus, Duro-Tuff, Duro-Last EV	50	Blue

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-Last, Duro-Fleece, Duro-Fleece Plus, Duro-Tuff, Duro-Last EV	40	Pink
20-Year Residential Material Limited Warranty	Duro-Last, Duro-Fleece, Duro-Fleece Plus, Duro-Tuff, Duro-Last EV	50	Pink/Blue-Framed

Ultra, 25 and 30-Year Warranties are available. Refer to the Duro-Last website at www.duro-last.com for additional requirements.

SECTION 1

REQUIREMENTS

1. The Duro-Last Roofing System must be installed by an authorized Duro-Last contractor (hereafter referred to as “contractor”).
2. The contractor is responsible for following all applicable building, plumbing, and electrical codes.
3. A Duro-Last Quality Assurance Technical Representative (“DL QA Tech Rep”) will inspect the installed Duro-Last Roofing System in order to issue a warranty, or finalize a preinspection warranty, on a commercial or industrial project. 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-Last 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, in writing, prior to being used.
5. It is the contractor’s responsibility to determine fastening requirements in accordance with Duro-Last’s specifications. Refer to *Section 2* and *Section 3* for complete instructions.
6. A “T-Lap” is an intersection of 3 or more layers of approved Duro-Last® membranes (hereafter referred to as “membrane”). Patches are required at T-Laps where all 3 layers are each 50 mils thick or greater. If any layer is less than 50 mils thick, then a patch is not required. Refer to Detail Drawing RG1066. The minimum size of a patch is 4 x 4 inches or 4-inch diameter. T-Lap patches can be made with membrane of any thickness.

TOOLS

The contractor should have the following tools for efficient and proper installation of a selected Duro-Last Roofing System. Contact the Duro-Last Quality Assurance Department with questions regarding tool requirements.

Safety equipment (such as fall protection)	Equipment necessary to raise materials to the roof
Automatic and hand welders (hot-air) with a spare heating element	Silicone hand roller
Extension cords – cord length of 100 ft (30 m), #12/3 wire 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 and 25 ft) (30 and 7.5 m), chalk line, markers, lumber crayon
2-inch flat chisels, pry bar	Vise clamps, nail aprons, caulk gun, screw drivers
Tack claw	Ladders
Tarps	Pull tester
Core cutter	Panduit banding tool
Detergent-based cleaning fluid and rags	Push broom, heavy duty squeegee

DRAINAGE/SLOPE

Good roofing practices incorporate the use of positive drainage. The contractor is responsible to make sure the roofing system drainage meets all local and applicable building code requirements.

WEATHER CONSIDERATIONS

Only install as many Duro-Last Roofing System materials as can be covered with membrane by the end of the working day or onset of inclement weather. Do not allow any Duro-Last Roofing System materials to be installed over a wet substrate.

SECTION 1

DELIVERY

A complete Duro-Last Roofing System and related materials will be delivered to the location designated by the contractor. Pallets of 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 Duro-Last 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-Last Roofing System onto the roof. It is the contractor's responsibility to ensure that overloading of the roof does not occur.

STORAGE

The membrane and other Duro-Last Roofing System materials should be kept clean and dry. Duro-Last 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 where water falls onto from higher structures. Follow the storage guidelines stated in the Product Data Sheet or Safety Data Sheet (SDS) of each product. Keep combustible materials away from heat, sparks, and open flames. Follow precautions outlined on the containers or supplied by the material manufacturer.

CHEMICAL RESISTANCE

Duro-Last Roofing Systems are resistant to the chemicals listed below. If any other chemicals are present on a particular roof, please contact the Duro-Last Engineering Services Department.

Acid rain	Citric acid	Linseed oil	Soda pop
Aluminum chloride	Coconut oil	Magnesium chloride	Sodium hydroxide (dilute)
Ammonium hydroxide	Coffee	Milk	Sodium persulfate
Ammonium chloride	Cooking grease	Muriatic acid	Sodium hypochlorite
Ammonium nitrate	Copper sulfate	Oleic acid	Soldering acid (dilute)
Ammonium sulfate	Corn oil	Olive oil	Soldering flux
Battery acid	Cotton seed oil	Paint – acrylic	Soybean oil
Beef fat	Diatomaceous earth	Paint – latex	Stone
Beer	Ferric chloride	Palm oil	Sulfuric acid (dilute)
Bird droppings	Fertilizer solution	Paper	Tree sap
Bleach (dilute)	Fiberglass mat	Phosphoric acid (dilute)	Urine
Borax	Fruit juice	Polyethylene	Vegetable oil
Boric acid	Furnace residue	Polypropylene	Wine
Butter	Hydrochloric acid (dilute)	Potassium chloride	Yeast
Calcium chloride	Hydrogen peroxide (dilute)	Rain	Yogurt
Calcium hydroxide	Ice cream	Salt water	Zinc chloride
Calcium hypochlorite	Incinerator ashes	Sea water	Zinc oxide
Chromic acid	Lard	Sewer sludge	

SECTION 1

SUBSTRATE SEPARATION

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

Over the substrates listed below, install Duro-Guard® rigid board insulations, cover boards, fan fold boards and/or slip sheets prior to the installation of the membrane.

Acrylic coatings	Extruded polystyrene	Modified-bitumen	Shingles
Aluminum-coated asphalt	Granulated cap sheet	Old Duro-Last roofs	Thermoplastic polyolefin (TPO)
Coated or smooth asphalt	Hypalon (CSPE)	Polyurethane	Sprayed urethane foam
Expanded polystyrene	Mineral-surfaced cap sheet	Coal tar pitch	PVC/CPA membranes

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

CPE roofing	Gypsum-based cover boards	Glass fiber boards
Cellular glass boards	Polyisocyanurate insulation boards	Wood decks
EPDM (clean)	Lightweight/structural concrete decks (smooth)*	
Gypsum*	Pre-stressed concrete decks (smooth)*	

* New construction (less than 3 years old) decks require the use of an approved vapor barrier prior to installation of any Duro-Last Roofing System. Refer to *Substrate Preparation* in *Section 3*.

PAINT APPLICATION

The membrane may be painted, although the performance and maintenance of the paint is not covered by the Duro-Last Warranty. Refer to *Chemical Resistance* in *Section 1* for compatible paint types.

Vinyl edge and termination products must not be painted. These include vinyl fascia bar, vinyl fascia bar cover, vinyl drip edge, vinyl gravel stop and vinyl 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 supplied by Duro-Last may only be painted if they are made from PVC-clad metal or bonderized steel. The performance and maintenance of the paint is not covered by the Duro-Last Warranty.

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 applicable specifications, building codes, regulations and ordinances are complied with and followed. 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 3M® Construction Seaming Tape.
 2. Tape all penetrations with 2-inch wide 3M All Weather Flashing Tape.
 3. Fastener density must not exceed 1 fastener per 2 square feet.

OVERBURDEN

Any product (e.g. wood block, conduit, etc.) placed on top of, and in contact with, the membrane must have an approved separation sheet between it and the membrane. Separation sheets must be cut to the size of, or larger than, the products that lie on them. Separation sheets include sacrificial pieces of membrane, Roof Trak® III Walkway Pad, Drainage Mat or Ballast Mat. Other materials may be accepted, but only after the contractor has requested a deviation from Duro-Last, and Duro-Last has approved such deviation, in writing, prior to being used.

SECTION 1

HVAC CLEANERS

Cleaning rooftop air conditioning units is necessary maintenance, but the use of incompatible cleaners can potentially be harmful to Duro-Last Roofing Systems. Building and HVAC maintenance personnel should be informed to use only cleaners that are compatible with the Duro-Last Roofing System.

Below are two lists of cleaners that have been tested for compatibility with Duro-Last Roofing Systems. Compatibility testing is based on each product's current chemical formulation.

If a particular cleaner is being used and is not shown, please discontinue using the cleaner and send a sample to Duro-Last to verify compatibility.

INCOMPATIBLE CLEANERS	
MANUFACTURER	PRODUCT NAME
Nu-Calgon	Evap Pow'r®-C *
Nu-Calgon	CalClean® *
Nu-Calgon	Nu-Brite® *
DuBois	Double-Cut Topaz™ *
Zep®	Orange Gel Degreaser *
DiversiTech®	Triple-D™ Universal Coil Cleaner *
RectorSeal® Corporation	Renewz™ Coil Cleaner *
Atlantic Chemical Equipment Company	Super Degreasing Solvent *
Atlantic Chemical Equipment Company	Foam n' Clean Coil Cleaner *

COMPATIBLE CLEANERS	
MANUFACTURER	PRODUCT NAME
Atlantic Chemical Equipment Company	Super Klean® Cleaner/Degreaser *
Atlantic Chemical Equipment Company	Evap-Klean Plus *
DiversiTech®	Pro-Green™ Self-Rinsing Evaporator Coil Cleaner *
SELIG Industries	BGT Coil Cleaner *
Alberson's	Roof Tile Cleaner RTC 5000 *
Spic and Span®	Multi-Surface & Floor Cleaner *
Simple Green®	Industrial Cleaner & Degreaser *

* Remove any remaining cleaners from the membrane by thoroughly rinsing with water. Excess water must be mopped and disposed of properly. Always use as directed on product labels and follow all disposal procedures.

SECTION 2 - - - QUALITY ASSURANCE

PRE-JOB ASSESSMENT

When re-covering an existing roofing system, the contractor is responsible to conduct an inspection of the roof to determine the 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 selected Duro-Last 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. Duro-Last's warranty inspections do not check for moisture content of the roofing system.

PULLOUT TESTS

1. Fastener pullout tests must be conducted to verify the integrity of the deck and to establish fastening patterns for mechanically fastened membrane roofing system materials. Utilize Duro-Last-supplied fasteners and an approved testing unit with current certification.
2. It is the responsibility of the contractor to make sure that fastener pullout tests are performed prior to ordering of the Duro-Last Roofing System. The tests can be performed by either the fastener manufacturer or by the contractor.
3. Locations of tests should be evenly distributed throughout the roof and include areas where the integrity of the deck is in question. The tests should be documented on a roof drawing showing the location and value of each test.
4. The number of pullout tests required is as follows: perform a minimum of 10 tests for roof areas up to 50,000 square feet and five additional tests for each additional 50,000 square feet or portion thereof. Areas with low pullout results will require additional pullout tests. This is required for each roof level or independent roof area.

FASTENER SELECTION AND DECK TYPES

The following tables summarize the appropriate fasteners and plates to use for different deck types and different Duro-Last Roofing System materials. Other materials may be accepted, but only after the contractor has requested a deviation from Duro-Last, and Duro-Last has approved such deviation, in writing, prior to being used. Unless otherwise specified within this document or Detail Drawings, all fasteners must be either e-coated or galvanized.

PLATE SELECTION

Refer to the following table when determining which Duro-Last plates to use and where to use them.

	Poly-Plate	Cleat Plate®	Square Metal Plate	Insulation Plate	Induction Weld Plate (Duro-Bond® or RhinoBond®)	Auger Fastener Plate
Membrane Fastening						
Roof Membrane	Yes ¹	Yes	No	No	Yes	Yes
Wall Membrane	Yes ²	Yes	Yes	No	Yes	NA
Base of Walls/Penetrations	Yes ^{1,2}	Yes	Yes	No	Yes	Yes
Rigid Board Insulations	Yes ²	Yes	Yes	Yes	Yes ³	Yes
Cover Boards	Yes ²	Yes	Yes - Preferred	No	Yes ³	Yes

¹ Poly-Plates must not be used on installations over new concrete decks. Use steel Cleat Plate.

² Poly-Plates are acceptable, but not recommended for these applications since they have a higher profile than the other plate options and may form a visible bulge under the membrane.

³ Can be used over Duro-Guard polyisocyanurate rigid board insulations, cover boards and concrete decks. Other boards and decks may require a barrier beneath the plate. Contact the Duro-Last Engineering Services Department for assistance.

SECTION 2

FASTENER SELECTION BASED ON DECK TYPE

When determining which fastener type to use for a specific deck type, refer to this table.

Deck Type	Fastener Type	Notes
Steel	Duro-Last HD Screws Duro-Last EHD Screws	Must penetrate a minimum of 1 inch from the top surface of deck. Factory Mutual projects require fastener rows to run perpendicular to the flutes.
Wood	Duro-Last HD Screws Duro-Last EHD Screws	Must penetrate a minimum of 1 inch from the top surface of deck.
Structural Concrete	Duro-Last Concrete Nail Duro-Last Concrete Screw Duro-Last HD Screws Duro-Last EHD Screws	Duro-Last Poly-Plates must not be used on installations over new concrete decks. Use steel Cleat Plate.
		Must penetrate a minimum of 1 inch from the top surface of deck. Pre-drill a minimum of 1/2 inch deeper than the required depth of the fasteners using a 3/16-inch bit.
Gypsum	Auger Fastener	Minimum pullout requirements must be met.
		Pre-drill required for auger fasteners. Use a 7/16 – 9/16-inch bit.
		Must penetrate a minimum of 1-1/2 inches from the top surface of deck. Factory Mutual designed systems require minimum of 2-inch penetration.
		Fastener rows spaced greater than 60 inches are not permitted on gypsum decks.
Cementitious Wood Fiber (CWF), (Tectum)	Auger Fastener	Minimum pullout requirements must be met.
		Do not pre-drill.
		Must penetrate a minimum of 1-1/2 inches from the top surface of deck. Factory Mutual designed systems require minimum of 2-inch penetration.
		Fastener rows spaced greater than 60 inches are not permitted on CWF decks.
Lightweight Concrete	Auger Fastener Duro-Last Concrete Screw Duro-Last Concrete Nail Duro-Last HD Screws Duro-Last EHD Screws	Duro-Last Poly-Plates must not be used on installations over new lightweight concrete decks. Use steel Cleat Plate.
		Minimum pullout requirements must be met.
		Pre-drill required. Augers: Use a 7/16 – 9/16-inch bit. Others: Use a 3/16-inch bit.
		Must penetrate a minimum of 1-1/2 inches from the top surface of deck. Factory Mutual designed systems require minimum of 2-inch penetration.
		Fastener rows spaced greater than 60 inches are not permitted on lightweight concrete decks.
Wall Type	Fastener Type	Notes
Cinder and Concrete Block	Zinc Plated Metal Anchors Duro-Last Concrete Screw Duro-Last Concrete Nail Duro-Last HD Screws Duro-Last EHD Screws	Must penetrate a minimum of 1 inch from the top surface. Pre-drill a minimum of 1/2 inch deeper than the required depth of the fasteners using a 3/16-inch bit (1/2-inch bit for metal anchors).

SECTION 2

FASTENER SPACING TABLE

Fastener spacing must be determined based on the table below and the results of the fastener pullout tests. If the average pullout value is less than 150 lb, contact the Duro-Last Engineering Services Department for assistance.

1. It is the contractor's responsibility to determine fastening requirements. It is recommended that the contractor 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 tall or taller. Refer to the *Perimeter/Corner Roll Requirements for Building Roof Areas 40 Feet and Taller* Table in *Section 3* for perimeter/corner membrane attachment.
 - b. Building is located in an area with design wind speeds greater than the following:
 - i. ASCE 7-05: 110 mph
 - ii. ASCE 7-10: 150 mph
 - c. A High Wind Warranty is required.
 - d. Average fastener pullout resistance is less than 150 lb.
2. Fastener spacing varies between the field, perimeter and corner areas of the roof with the fastener spacing decreasing in the perimeter and corner areas. The *Fastener Spacing for Building Roof Areas less than 40 Feet Tall* Table lists fastener spacing for field, perimeter and corner areas.
3. 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 roof area. The perimeter and corner widths must not be less than 5 feet wide. The corner area is measured from each outer corner and is equal to the width.

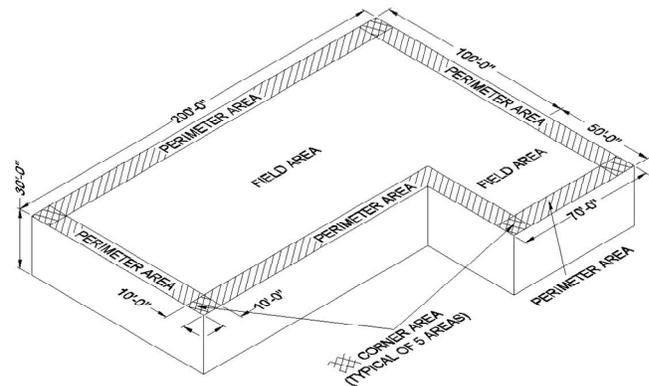
Example: Determine Perimeter and Corner Width

Building Width: 100 feet
 Building Length: 200 feet
 Building Height: 30 feet

Step 1. Find 40% of the height:
 $0.40 \times 30 \text{ feet} = 12 \text{ feet}$

Step 2. Find 10% of the width:
 $0.10 \times 100 \text{ feet} = 10 \text{ feet}$.

Result: The perimeter and corner width is the lesser of these two results: = 10 feet.



Fastener Pullout Resistance (lb)	Roll Good Fastener Spacing for Building Roof Areas less than 40 Feet Tall (60 psf Design) (120-inch rolls are <u>not</u> approved for use with all deck types. Refer to page 9.)								
	120-inch Rolls			60 or 64-inch Rolls			30 or 32-inch Rolls		
	Field	Perimeter	Corner	Field	Perimeter	Corner	Field	Perimeter	Corner
450	9"	NA	NA	18"	9"	6	18"	18"	15
425	9"	NA	NA	18"	9"	6	18"	18"	15
400	6"	NA	NA	15"	9"	6	18"	18"	12
375	6"	NA	NA	15"	9"	6	18"	18"	12
350	6"	NA	NA	15"	9"	6	18"	18"	12
325	6"	NA	NA	12"	6"	6	18"	15"	9
300	6"	NA	NA	12"	6"	NA	18"	15"	9
275	6"	NA	NA	12"	6"	NA	18"	12"	9
250	NA	NA	NA	9"	6"	NA	18"	12"	9
225	NA	NA	NA	9"	NA	NA	18"	9"	6
200	NA	NA	NA	6"	NA	NA	18"	9"	6
175	NA	NA	NA	6"	NA	NA	15"	9"	6
150	NA	NA	NA	6"	NA	NA	12"	6"	6
Less than 150	Contact the Duro-Last Engineering Services Department								

SECTION 2

DECK/SUBSTRATE CRITERIA

The membrane may be installed directly to some decks while Duro-Guard rigid board insulations, cover boards, fan fold boards and/or slip sheets must be used on others to provide a proper separation. In all cases, the substrate onto which the membrane is to be applied must be smooth and level without significant surface irregularities or depressions. It must be clean, dry, and free of grease, moisture, dust and loose debris. Acceptable substrates are listed below. Refer to *Substrate Preparation* in *Section 3* for the proper preparation and the installation requirements for each type of substrate.

DECKS TO WHICH THE MEMBRANE MAY BE APPLIED DIRECTLY

1. Structural Concrete (poured in place or precast).*
2. Gypsum (poured in place or precast).*
3. Lightweight Concrete (insulating or cellular).*
4. Wood (plywood, OSB or lumber).

* New construction (less than 3 years old) decks require the use of an approved vapor barrier prior to installation of any Duro-Last Roofing System. Refer to *Substrate Preparation* in *Section 3*.

DECKS REQUIRING RIGID BOARD INSULATIONS, FAN FOLD BOARDS, COVER BOARDS AND/OR SLIP SHEETS

1. Any approved deck that does not meet the requirements due to contamination, roughness, etc.
2. Steel.
3. Cementitious Wood Fiber (tectum).

APPROVED MEMBRANES

1. Duro-Last membrane incorporates a weft-inserted, knitted scrim within PVC films to provide exceptional strength and waterproofing. Refer to the Product Data Sheet for the physical properties of the membrane.
2. Duro-Fleece membrane, in addition to a fleece backing, incorporates a weft-inserted, knitted scrim within PVC films to provide exceptional strength and waterproofing. Refer to the Product Data Sheet for the physical properties of the membrane.
3. Duro-Fleece Plus membrane, in addition to a fleece backing, incorporates a weft-inserted, knitted scrim within PVC films to provide exceptional strength and waterproofing. Refer to the Product Data Sheet for the physical properties of the membrane.
4. Duro-Tuff membrane incorporates a weft-inserted, knitted scrim within PVC films to provide exceptional strength and waterproofing. Refer to the Product Data Sheet for the physical properties of the membrane.
5. Duro-Last EV membrane incorporates a weft-inserted, knitted scrim within KEE-containing films to provide exceptional strength and waterproofing. Refer to the Product Data Sheet for the physical properties of the membrane. **Note that Duro-Last EV membrane must not be used with any other Duro-Last membranes.**

SECTION 2

APPROVED RIGID BOARD INSULATIONS, COVER BOARDS AND FAN FOLD BOARDS

Only Duro-Guard rigid board insulations, fan fold boards, and/or cover boards may be used in conjunction with the membrane.

1. When multiple layers of rigid board 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, Duro-Guard rigid board insulations and/or cover boards must have an adequate span rating, as published by the manufacturer, for the profile of the steel deck.
3. It is recommended to use Duro-Guard products in any Duro-Last Roofing System. If Duro-Guard products are not used, then the proposed substitution should be approved, in writing, by the Duro-Last Engineering Services Department.

RIGID BOARD INSULATIONS

1. Polyisocyanurate (ISO)
 - a. Duro-Guard ISO products, supplied by Duro-Last.
 - b. Polyisocyanurate rigid board insulation that meets ASTM C1289 Class II; Grade 2 (20 psi) or Grade 3 (25 psi) requirements.
2. Polystyrene (EPS and XPS)
 - a. An approved Duro-Guard rigid board insulation, fan fold board, cover board and/or slip sheet must always be used between bare polystyrene and the membrane.
 - b. Products
 - i. Duro-Guard EPS and/or XPS products, supplied by Duro-Last.
 - ii. Expanded polystyrene (EPS) products, either type II (1.5 pcf), Type VIII (1.25 pcf), or Type IX (2.0 pcf) that meet ASTM C578 requirements.
 - iii. Extruded polystyrene (XPS) products with minimum density of 16 psi that meet ASTM C578 requirements.
 - c. Type VIII EPS must always be covered with Duro-Guard rigid board insulations and/or cover board, or fan fold board with a minimum of 1.5 pcf density, and must not be used directly below the membrane.

COVER BOARDS

1. Duro-Guard Cover Boards (minimum thickness of 1/4 inch)
 - a. DensDeck® Prime Roof Board, manufactured by Georgia-Pacific.
 - b. DensDeck Roof Board, manufactured by Georgia-Pacific.
 - c. SECUROCK® Gypsum-Fiber Roof Board, manufactured by USG Corporation.
 - d. SECUROCK Glass-Mat Roof Board, manufactured by USG Corporation.
 - e. DEXcell® Cement Roof Board, manufactured by National Gypsum Company.
 - f. DEXcell Glass Mat Roof Board, manufactured by National Gypsum Company.
 - g. DEXcell FA Glass Mat Roof Board, manufactured by National Gypsum Company.
 - h. Continuus EVERBOARD™ QB, manufactured by Continuus Material Recovery, LLC.
 - i. Continuus EVERBOARD QB+, manufactured by Continuus Material Recovery, LLC.
 - j. Continuus EVERBOARD HB, manufactured by Continuus Material Recovery, LLC.
 - k. Continuus EVERBOARD HB+, manufactured by Continuus Material Recovery, LLC.
 - l. ROXUL® TOPROCK® DD Roof Board, manufactured by ROXUL, Inc.
 - m. ISO HD, 1/2-inch thick, supplied by Duro-Last.

SECTION 2

FAN FOLD BOARDS

1. Only Duro-Guard fan fold Boards are to be used in warranted Duro-Last Roofing Systems. Other fan fold boards may be accepted, but only after the contractor has requested a deviation from Duro-Last, and Duro-Last has approved such deviation, in writing, prior to being used. Other fan fold boards, if approved for use, may require the use of an approved slip sheet.

Duro-Guard fan fold boards are manufactured with approved compatible facers on both sides of the boards. If these facers delaminate or are damaged enough to expose the inner polystyrene core, an approved slip sheet must be installed over the affected area prior to installing any membrane.

2. Duro-Guard Fan Fold Boards
 - a. EPS Fan Fold, 1/2-inch thick, supplied by Duro-Last.
 - b. XPS Fan Fold – K (Crush Fold), 3/8-inch thick, supplied by Duro-Last.
 - c. XPS Fan Fold – A (Hybrid Crush/Cut Fold), 3/8-inch thick, supplied by Duro-Last.

APPROVED SLIP SHEETS

Only the following slip sheets are to be used in warranted Duro-Last Roofing Systems. Other slip sheets may be accepted, but only after the contractor has requested a deviation from Duro-Last, and Duro-Last has approved such deviation, in writing, prior to being used.

1. Refer to the slip sheet's Product Data Sheet for applicability and installation information.
2. Slip Sheets
 - a. Atlas® FR-10 Fire Barrier Slip Sheet.
 - b. Atlas FR-50 Fire Barrier Slip Sheet.
 - c. Duro-Weave™ Separation Slip Sheet.
 - d. Duro-Blue Separation Slip Sheet.
 - e. Geotextile Slip Sheet.
 - f. VersaShield® Solo™.

SECTION 3 - - - SYSTEM INSTALLATION

SUBSTRATE PREPARATION

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

NEW CONSTRUCTION

1. Structural Concrete Decks (poured in place or pre-cast)
 - a. Deck must be cured and dry prior to installation of any Duro-Last Roofing System.
 - b. Duro-Last Poly-Plates must not be used on installations over concrete decks. Use steel Cleat Plate.
 - c. Approved vapor barrier required.
2. Lightweight Concrete Decks (insulating or cellular)
 - a. Deck must be cured and dry prior to installation of any Duro-Last Roofing System. Do not leave the deck exposed beyond the maximum exposure time as defined by the lightweight concrete manufacturer.
 - b. Do not allow the deck to be exposed to precipitation.
 - c. Duro-Last Poly-Plates must not be used on installations over lightweight concrete decks. Use steel Cleat Plate.
 - d. Approved vapor barrier required.
3. Gypsum Decks (poured in place or pre-cast)
 - a. Deck must be cured and dry prior to the installation of any Duro-Last Roofing System.
 - b. Approved vapor barrier required.
 - c. **Fastener rows spaced greater than 60 inches are not permitted on gypsum decks.**
4. Wood Decks (plywood, OSB or lumber)
 - 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 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 of the wood.
 - c. H-clips must be covered with an approved slip sheet or duct tape.
5. Cementitious Wood Fiber (CWF) deck panels
 - a. Joints between panels greater than 1/4 inch wide should be grouted or filled with compatible material recommended by panel manufacturer.
 - b. **Fastener rows spaced greater than 60 inches are not permitted on CWF decks.**
6. Steel Decks
 - a. Duro-Guard rigid board insulations, fan fold boards and/or cover boards must be used to provide a proper substrate on which to apply the membrane.
 - b. Duro-Guard rigid board insulations, fan fold boards and/or cover boards must have an adequate span rating, as published by the manufacturer, for the profile of the steel deck.
 - c. Factory Mutual projects require fastener rows to run perpendicular to the flutes.

SECTION 3

REROOFING

Tear-Off

1. Deck attachment must meet all current building code requirements.
2. If the deck cannot be adequately prepared for the direct application of the membrane, Duro-Guard rigid board insulations, fan fold boards and/or cover boards must be used.
3. If rock ballast is removed from an existing roofing system, confirm that the existing insulation or cover board is properly secured to the deck. If not, it must be secured as described in the *Insulation and Cover Board Installation* section below.
4. **Phenolic foam insulation must be completely removed.**
5. **Extreme caution must be used to prevent the membrane from being contaminated by asphalt or bitumen.** Asphalt and bitumen are incompatible with the membrane and proper separation must be provided between these products and the membrane. Should the membrane become soiled with asphalt or bitumen, the affected membrane must be cleaned immediately, using approved procedures. If the asphalt or bitumen cannot be properly cleaned from the membrane, new membrane should be ordered and installed.

A list of approved cleaners is below. If a particular cleaner is being used and is not shown, please discontinue using the cleaner and send a sample to Duro-Last to verify compatibility.

- a. Wash Safe Roof Wash
- b. Simple Green® Industrial Cleaner & Degreaser
- c. Spic and Span® Multi-Surface & Floor Cleaner
 - i. Always read Safety Data Sheets (SDS) prior to using any cleaners.
 - ii. Prepare cleaner as directed on 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. Rinse immediately with a power-washer at a maximum of 1,000 psi, or use a garden hose with spray nozzle attachment. **Do not allow cleaner to sit for any extended period of time on the membrane.**

Re-Cover

1. Existing Built-Up Roofing System (BUR) or Modified-Bitumen Roofing System
 - a. **Extreme caution must be used to prevent the membrane from being contaminated by asphalt or bitumen.** Asphalt and bitumen are incompatible with the membrane and proper separation must be provided between these products and the membrane. Should the membrane become soiled with asphalt or bitumen, the affected membrane must be cleaned immediately, using approved procedures. If the asphalt or bitumen cannot be properly cleaned from the membrane, new membrane should be ordered and installed.
 - b. Blisters, buckles and other surface irregularities must be repaired or removed if there is a possibility of the existing roof affecting the performance of the new Duro-Last Roofing System. The new Duro-Last Roofing System should slope to drains without any obstructions.
 - c. 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 in compliance with applicable codes.
 - d. If the existing roofing system is smooth-surfaced or has a granular cap sheet and is free of sharp edges, any Duro-Guard rigid board insulations, fan fold boards, cover boards and/or approved slip sheets may be used to provide separation of the roofing system and new membrane. In this instance, Duro-Fleece and Duro-Fleece Plus may be installed directly over the existing roofing system without any separation.

SECTION 3

- e. Existing roofing systems with rock/gravel surfaces will require an adequate surface preparation. Duro-Guard EPS/XPS fan fold boards may be used when the surface is pea gravel or crushed stone which is 1/4 to 3/8 inch in size and has been leveled and maintained at 4 psf. For larger rock/gravel, utilize rigid board insulations as a separator. A cover board may be installed over the rigid board insulation.
 - f. If the rock/gravel surfacing is removed, Duro-Guard rigid board insulations, fan fold boards and/or cover boards must be used. If embedded rock/gravel remains that protrudes out of the deck more than 1/4 inch, do not use fan fold board. Instead, use Duro-Guard rigid board insulations and/or cover boards.
Note: Removing the rock/gravel surfacing may affect the roofing system's fire rating and limit your choice of rigid board insulations and/or cover boards. Contact the Duro-Last Engineering Services Department for questions concerning fire-rated assemblies.
 - g. When installing Duro-Guard EPS or XPS rigid board insulation over coal tar pitch, asphalt or modified-bitumen roofing systems, Duro-Weave Separation Slip Sheet must be used between the insulation and existing roofing system.
2. Existing Single-Ply Membrane Roofing System
 - a. Cut the existing membrane free from the entire roof perimeter and at the base of all walls and curbs. Slice the existing membrane between rows of fasteners prior to installing the new Duro-Last Roofing System.
 - b. Loose or high fasteners must be repaired.
 - c. With the exception of EPDM, existing single-ply membranes must be covered with either Duro-Guard rigid board insulations, fan fold boards, cover boards and/or approved slip sheets.
 - d. If the existing roofing system is single-ply PVC and was installed directly over polystyrene insulation without a slip sheet, the existing membrane must be removed and any damaged insulation replaced, and high fasteners must be repaired or removed. Duro-Guard rigid board insulations, fan fold boards, cover boards and/or approved slip sheets must then be installed.
 3. Metal Roof Retrofit
 - a. 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.
 - b. Metal roof panels must be clean, smooth, and free of sharp edges and loose, foreign material. Damaged areas and other factors affecting the installation of any Duro-Last Roofing System must be repaired prior to the installation of the membrane.
 - c. In order to provide a proper substrate for installation and to adequately separate the membrane from the metal roof, the space between the ribs of the metal roof can be filled with insulation. An additional layer(s) must be added to create a clean, flat and continuous substrate. The product used as the top layer must have a span rating adequate for any gaps that may exist between the filler insulation and the metal ribs. Products to use for the top layer include:
 - i. Duro-Guard EPS rigid board insulation with a density of at least 1.5 pcf (1-inch minimum thickness) that meets ASTM C578. EPS must have an approved facer or be covered with an approved slipsheet, Duro-Guard ISO or cover board.
 - ii. Duro-Guard ISO rigid board insulation with a density of at least 1.5 pcf (1-inch minimum thickness) that meets ASTM C1289.
 - iii. Duro-Guard cover board (1/4-inch minimum thickness).
 - iv. Duro-Guard ISO HD, Duro-Guard EPS Fan Fold or Duro-Guard XPS Fan Fold may be used only if there are no gaps greater than 1/4 inch between the filler insulation and the metal ribs.
 - v. Duro-Guard EPS Flute Fill Combo may be used to fill the flutes and cover the metal roof with a single, custom-fit rigid board insulation. It must have a density of at least 1.5 pcf (1-inch minimum thickness above the top flute) that meets ASTM C578. EPS must have an approved facer or be covered with an approved slipsheet, Duro-Guard ISO or cover board.
 - vi. Plywood or oriented strand board (OSB) as described below.

SECTION 3

- d. Plywood or OSB boards may be used to cover the metal roof. The span rating of the boards must be adequate for any gaps that will be covered and the minimum thickness of the board depends on how it will be used.

If the board is used as a cover board over insulation, and the membrane will be fastened to the underlying metal deck, plywood or OSB with a minimum thickness of 7/16 inch may be used. Attach the board with a minimum of 9 fasteners per 4x8-foot board to prevent warping.

If the board is applied directly to the metal roof in order to form a substrate into which the membrane and other roofing system components will be fastened, the board must be plywood with a minimum thickness of 5/8 inch. The plywood must be fastened to meet local building code requirements. Fastener pullout tests must be conducted prior to installing the membrane in order to determine the fastening pattern.

- e. High-density wood fiberboard is an acceptable cover board on metal roof retrofits when the roof slope is at least 1:12 (8%). High-density wood fiberboard is not acceptable for use as flute filler.

INSTALLATION**WOOD NAILER (GENERAL)**

Wood nailers must be #2 grade lumber, or better, and must withstand a minimum force of 180 pounds per lineal foot (per building code). Any pull values greater than 270 pounds will allow for a fastener spacing of 18 inches on center. Pull values less than 270 pounds will require additional fasteners. **The contractor is responsible for meeting building codes.**

Wood nailers are required along perimeter edges where 1 inch, 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.

WOOD NAILER (PRESSURE-TREATED)

Prior to 2003, wood was treated with Chromated Copper Arsenate (CCA) to provide protection against decay from insects, fungi, microorganisms and moisture. The Environmental Protection Agency (EPA) deemed this chemical to have negative environmental concerns. The lumber industry worked with the EPA to provide an alternative, which had less environmental concerns, but still provided the needed protection. The resulting alternatives to CCA are Alkaline Copper Quarternary (ACQ) and Copper Azoles (CA). These new preservatives can be harmful to metal edge systems, metal flashings and fasteners.

Duro-Last does not recommend, or require, the use of pressure-treated lumber that is used for nailers in their roofing systems. If pressure-treated lumber is used, the following product guidelines must be followed in order to minimize the possibility of ACQ and CA causing corrosion within the roofing system.

Acceptable Products*

- Hot-dipped galvanized fasteners complying with ASTM A153 and connectors complying with ASTM A653, Class G185
- Duro-Last e-coated fasteners (i.e. HD or EHD Screws)
- Type 304 or Type 316 stainless-steel fasteners and connectors (recommended for maximum corrosion resistance)
- 400-series stainless-steel fasteners

* All fasteners must be FM-compliant.

Unacceptable Products

- Aluminum fasteners
- Aluminum edge systems or flashings**
- Carbon-steel fasteners
- Electroplated-galvanized steel fasteners and connectors
- Uncoated metal edge systems or flashings**
- Painted metal edge systems or flashings**
- GALVALUME® metal edge systems or flashings**

** Product may be used if separated from the pressure-treated lumber by an approved separation layer, such as the membrane or an approved vapor barrier.

SECTION 3

RIGID BOARD INSULATION, FAN FOLD, COVER BOARD AND APPROVED SLIP SHEET INSTALLATION

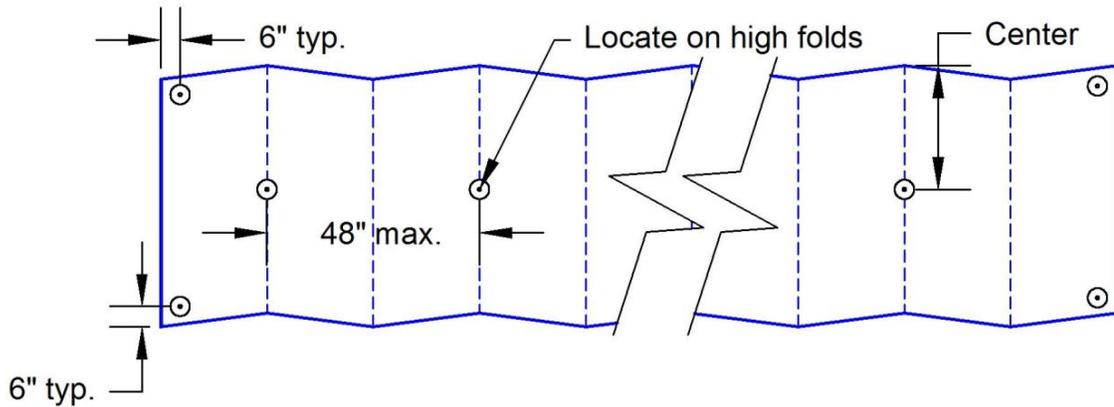
1. Refer to *Approved Rigid Board Insulations, Cover Boards and Fan Fold Boards* and *Approved Slip Sheets* in *Section 2* for approved products. Other materials may be accepted, but only after the contractor has requested a deviation from Duro-Last, and Duro-Last has approved such deviation, in writing, prior to being used.
2. The use of multiple layers of rigid board insulation with joints staggered 50% between layers is recommended to eliminate thermal bridging.
3. Rigid board insulations and fan fold boards must be neatly fitted to the deck and around penetrations. Rigid board insulations and fan fold boards should be installed tightly against adjacent boards and it is recommended to stagger all joints between boards 50% from row to row. No gap should exceed 1/4 inch in width.
4. Cover boards must be neatly fitted to the deck and around penetrations. Cover boards may require a small gap between boards. Consult the cover boards' Product Data Sheets for gapping requirements. No gap should exceed 1/4 inch in width.
5. Attachment of rigid board insulations, fan fold boards, cover boards and approved slip sheets using mechanical fasteners.
 - a. Refer to *Section 2* for approved fasteners and plates.
 - b. Fastener pullout tests must be conducted as described in *Section 2*.
 - c. When installing multiple layers (which may include rigid board insulations, cover boards and thermal barriers), it is acceptable to loosely lay the underlying boards and mechanically fasten through the top layer and all subsequent layers at once.
 - d. Fasten rigid board insulation per Detail Drawing #1020.
 - i. 4-foot x 8-foot: minimum of 5 fasteners per board.
 - ii. 4-foot x 4-foot: minimum of 4 fasteners per board.
 - iii. 2-foot x 4-foot: minimum of 2 fasteners per board.
 - e. Fasten cover boards per Detail Drawing #1020, with exception of ISO HD fastened at rigid board insulation patterns.
 - i. 4-foot x 8-foot: minimum of 4 fasteners per board.
 - ii. 4-foot x 4-foot: minimum of 4 fasteners per board.
 - iii. 2-foot x 4-foot: minimum of 2 fasteners per board.

SECTION 3

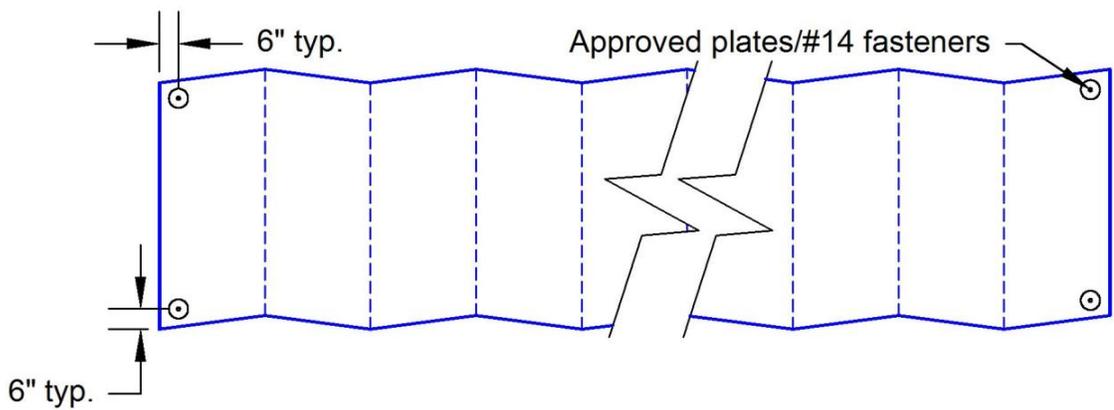
f. Fasten fan fold boards per Detail Drawing #1030.

i. Membrane laps spaced 60 inches or less.

a. 4-foot x 50-foot (50-foot parallel to membrane laps): minimum of 16 fasteners per board.

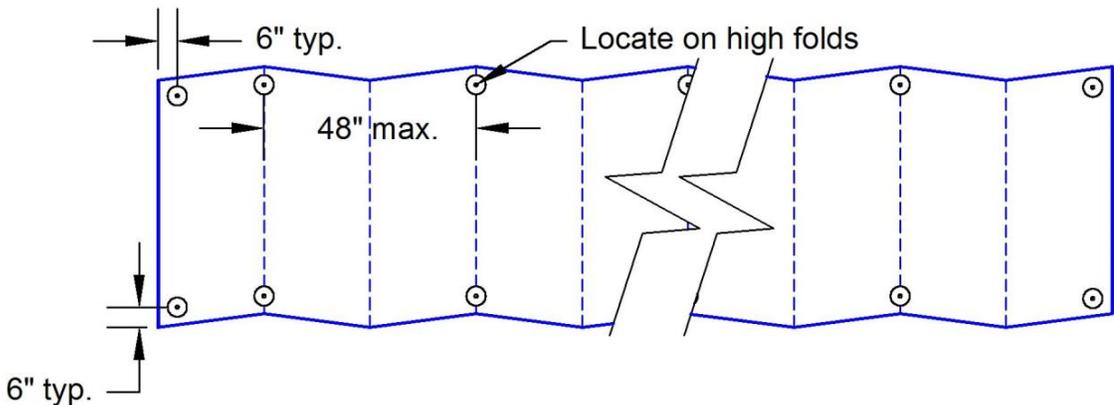


b. 4-foot x 50-foot (50-foot perpendicular to membrane laps): minimum of 4 fasteners per board.



ii. Membrane laps spaced greater than 60 inches.

a. 4-foot x 50-foot (membrane laps ran either direction): minimum of 28 fasteners per board.



g. Fasten slip sheets as required by their individual Product Data Sheets.

SECTION 3

MEMBRANE INSTALLATION

1. General Considerations

- a. Refer to *Deck/Substrate Criteria* in *Section 2* for substrate criteria.
- b. Refer to *Section 2* for approved fasteners and plates.
- c. Factory Mutual projects require fastener rows to run perpendicular to the flutes on steel decks.
- d. The maximum width of membrane rolls that may be used is based on the fastener pullout resistance and the fastening pattern determined using the *Fastener Spacing for Building Roof Areas less than 40 Feet Tall* Table in *Section 2*. It is the responsibility of the contractor to make sure that fastener pullout tests are performed prior to ordering of any Duro-Last Roofing System. The tests can be performed by either the fastener manufacturer or by the contractor.
- e. It is recommended that the membrane be overlapped to allow for water to flow over rather than against each lap.
- f. Each type of membrane, except for Duro-Fleece and Duro-Fleece Plus, is marked at 6-inch intervals to assist with fastener placement.
- g. Install fasteners and plates so that the edge of the plate is flush with the edge of the membrane. The maximum spacing between fasteners must be in accordance with the *Fastener Spacing Table* in *Section 2*.
- h. Position the next roll so that the membrane overlaps the fastened edge of the installed membrane section by 6 inches. Uncut rolls will have a black lap line located 6 inches from one edge of the roll to help with overlap alignment.
- i. The seam between the two sections of membrane must be heat-welded with a minimum weld width of 1-1/2 inches.
- j. A "T-Lap" is an intersection of 3 or more layers of membrane. Patches are required at T-Laps where all 3 layers are each 50 mils thick or greater. If any layer is less than 50 mils thick, then a patch is not required. Refer to Detail Drawing RG1066. The minimum size of a patch is 4 x 4 inches or 4-inch diameter. T-Lap patches may be any thickness of membrane.
- k. When rows of fasteners are added through the top of the membrane, they must be covered by membrane stripping which is heat-welded to the membrane. The cover strip must be wide enough to accommodate a 1-1/2-inch wide weld on all sides. Stripping may be any thickness of membrane.
- l. Due to increased wind uplift pressures in the perimeter and corner areas of the roofing system, more fasteners are required in these areas than in the main field area of the roofing system. Options for effectively increasing the number of fasteners in the perimeter and corner areas are discussed below.

SECTION 3

2. Roof Perimeter/Corner Membrane Attachment: **General**

- a. It is the contractor’s responsibility to determine fastening requirements. It is recommended that the contractor contact the Duro-Last Engineering Services Department for assistance in determining the fastening requirements when any of the following conditions apply:
 - i. Building roof area is 40 feet tall or taller. Perimeter/corner roll requirements are listed in the table below (regardless of wall height). Contact the Duro-Last Engineering Services Department for fastener spacing.
 - ii. Building is located in an area with design wind speeds greater than the following:
 - b. ASCE 7-05: 110 mph
 - c. ASCE 7-10: 150 mph
 - iii. A High Wind Warranty is required.
 - iv. Average fastener pullout resistance is less than 150 lb.
- b. On buildings with multiple roof levels, treat all roof edges as perimeter edges if they stand 3 feet or more above adjacent roof areas.
- c. The perimeter/corner fastening requirements can be met by using narrower membrane rolls, adding rows of fasteners through the top of installed membrane or by using Duro-Bond or RhinoBond induction welding techniques. These options are described below.
- d. **120-inch fastener row spacing is not acceptable within 7 feet of any perimeter edge.**

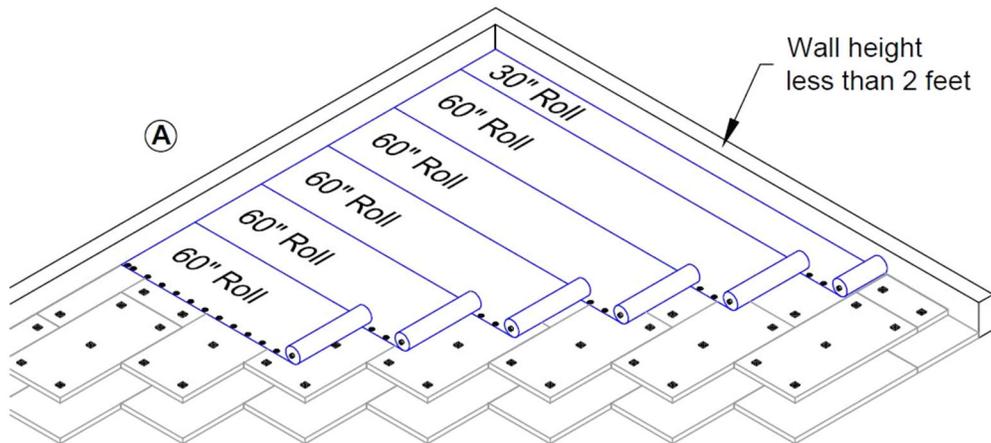
Roll Good Perimeter/Corner Roll Requirements for Building Roof Areas 40 Feet and Taller (regardless of wall height) (Contact the Duro-Last Engineering Services Department for Fastener Spacing)		
Roof Height	60 or 64-inch Rolls (Field Area)	120-inch Rolls (Field Area)
40 to less than 80 ft.	<u>Two</u> 30 or 32-inch rolls adjacent to <u>parallel</u> perimeter edges	<u>Two</u> 30 or 32-inch rolls, then <u>one</u> 60 or 64-inch roll adjacent to <u>all</u> perimeter edges (picture frame layout)
80 to less than 100 ft.	<u>Three</u> 30 or 32-inch rolls adjacent to <u>parallel</u> perimeter edges	<u>Three</u> 30 or 32-inch rolls, then <u>one</u> 60 or 64-inch roll adjacent to <u>all</u> perimeter edges (picture frame layout)
100 ft. and above	Contact the Duro-Last Engineering Services Department	120-inch rolls are <u>not</u> allowed

SECTION 3

3. Roof Perimeter/Corner Membrane Attachment (building roof area less than 40 ft. tall): **Walls less than 2 feet tall or no walls present**

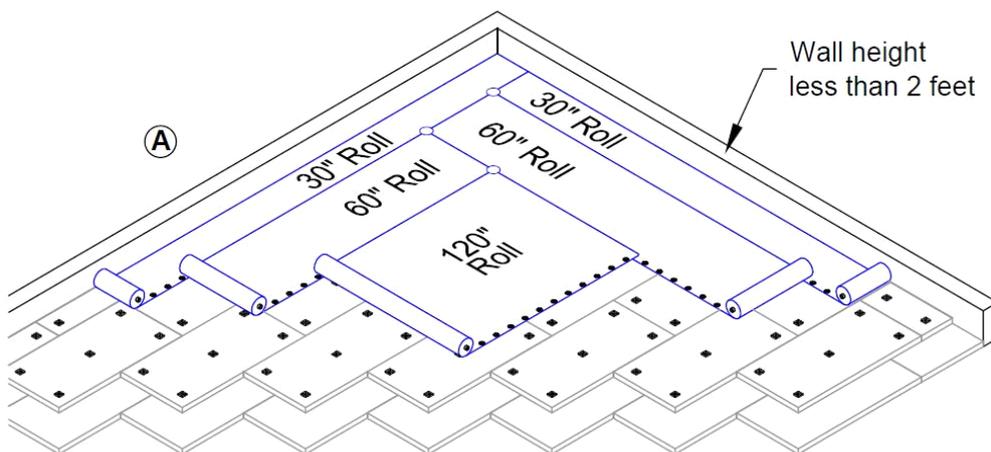
a. Utilizing 30, 32, 60 and 64-inch wide rolls:

- i. Install one 30 or 32-inch wide roll adjacent to perimeter edges that run parallel to fastening rows.
- ii. Install 60 or 64-inch wide rolls in the remaining area of the roof.
- iii. Refer to Detail Drawing RG1053, drawing "A".



b. Utilizing 30, 32, 60, 64 and 120-inch wide rolls:

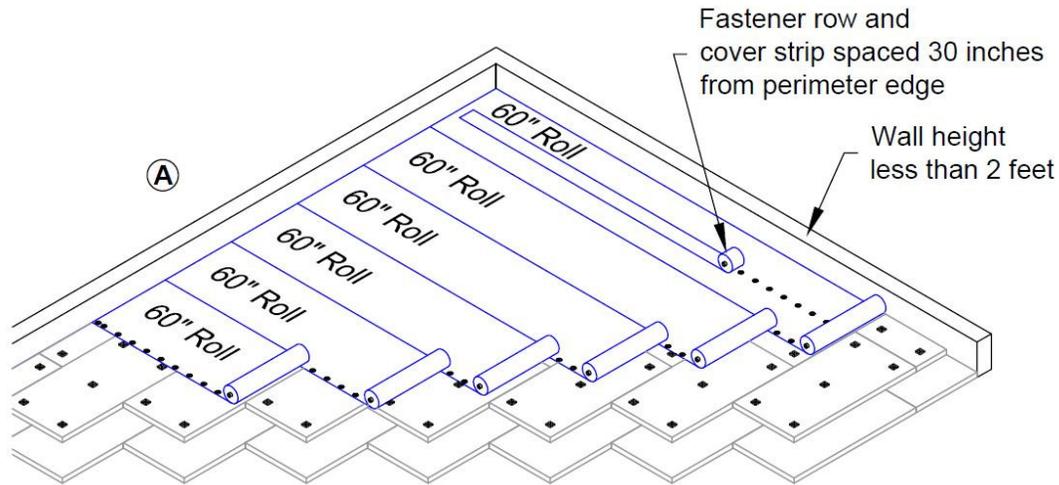
- i. Install one 30 or 32-inch wide roll adjacent to perimeter edges.
- ii. Install one 60 or 64-inch wide roll adjacent to the 30 or 32-inch wide roll.
- iii. Install 120-inch wide rolls in the remaining area of the roof.
- iv. Refer to Detail Drawing RG1052, drawing "A".



SECTION 3

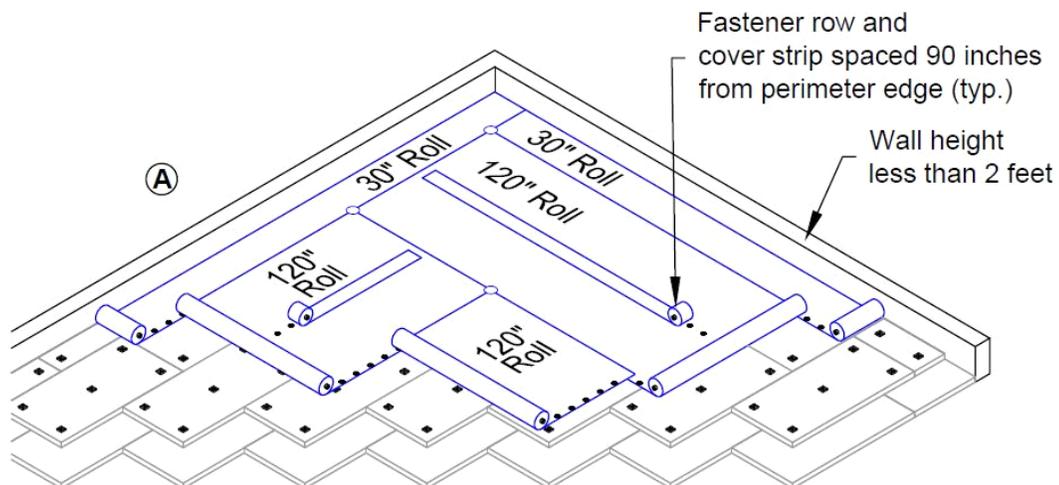
c. Utilizing 60 and 64-inch wide rolls only:

- i. Install 60 or 64-inch wide rolls in the entire roof area.
- ii. Add rows of fasteners, with cover strips, 30 inches from the perimeter edges and parallel to the edges.
- iii. Refer to Detail Drawing RG1055, drawing "A".



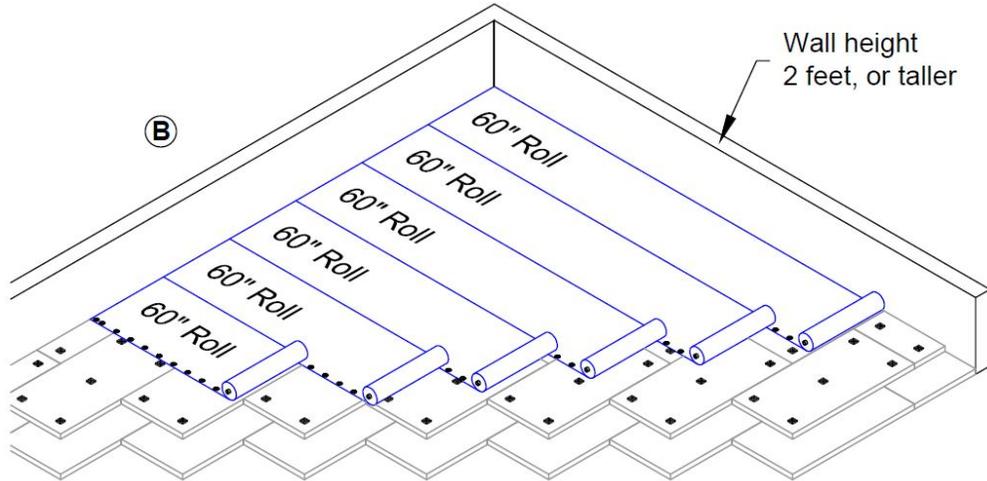
d. Utilizing 30, 32 and 120-inch wide rolls:

- i. Install one 30 or 32-inch wide roll adjacent to perimeter edges.
- ii. Install 120-inch wide rolls in the remaining area of the roof.
- iii. Add rows of fasteners, with cover strips, 90 inches from the perimeter edges and parallel to the edges.
- iv. Refer to Detail Drawing RG1054, drawing "A".

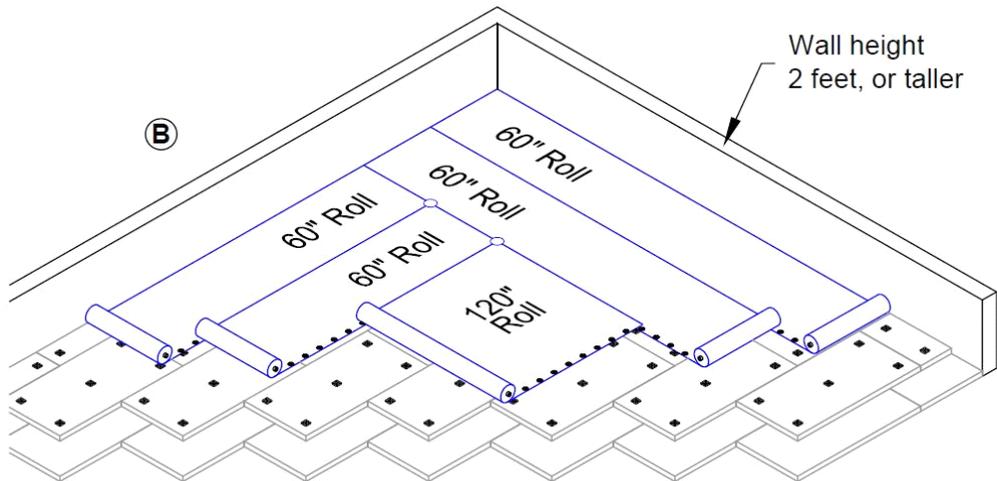


SECTION 3

4. Roof Perimeter/Corner Membrane Attachment (building roof area less than 40 ft. tall): **Walls 2 feet tall or taller**
 - a. Utilizing 60 and 64-inch wide rolls only:
 - i. Install 60 or 64-inch wide rolls in the entire roof area.
 - ii. Refer to Detail Drawing RG1053, drawing "B".

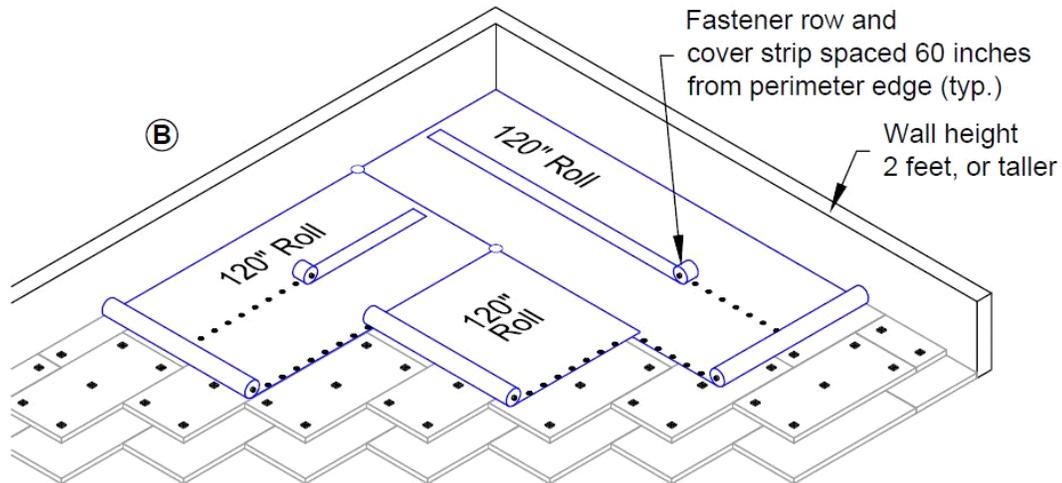


- b. Utilizing 60, 64 and 120-inch wide rolls:
 - i. Install two 60 or 64-inch wide rolls adjacent to perimeter walls.
 - ii. Install 120-inch wide rolls in the remaining area of the roof.
 - iii. Refer to Detail Drawing RG1052, drawing "B".



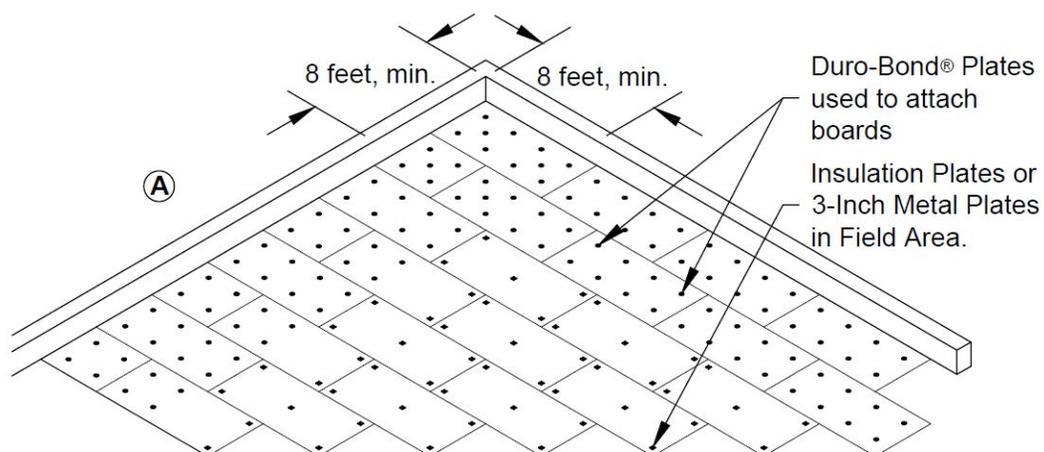
SECTION 3

- c. Utilizing 120-inch wide rolls only:
 - i. Install 120-inch wide rolls in the entire roof area.
 - ii. Add rows of fasteners, with cover strips, 60 inches from the perimeter walls and parallel to the walls.
 - iii. Refer to Detail Drawing RG1054, drawing "B".



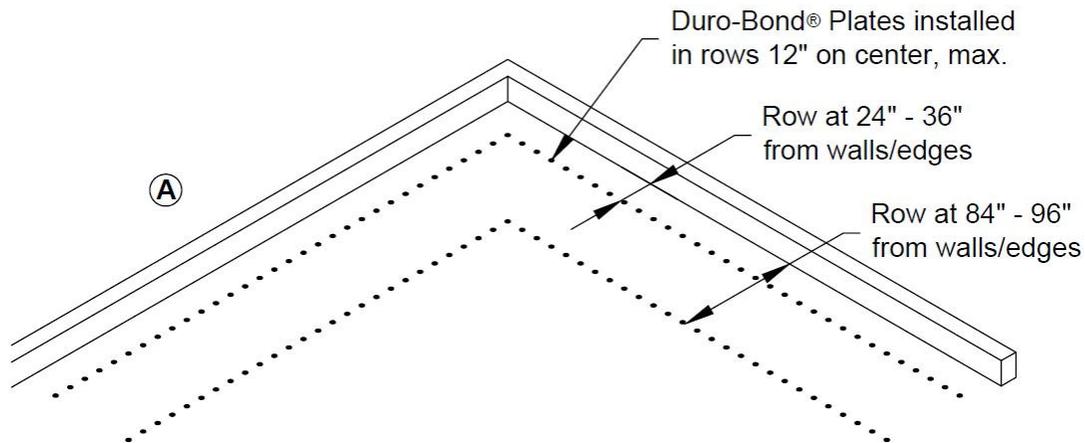
5. Roof Perimeter/Corner Membrane Attachment (building roof area less than 40 ft. tall): **Duro-Bond or RhinoBond (induction weld) systems (excludes Duro-Fleece and Duro-Fleece Plus)**

- a. The additional fastening requirement adjacent to roof perimeters may also be met by using induction welding techniques. This type of membrane attachment is utilized by the Duro-Bond or RhinoBond Systems which use polymer-coated plates to which the membrane is attached by induction welding. These plates can be used to install Duro-Guard rigid board insulation and/or cover boards, or can be installed in rows when used in an overlay application utilizing Duro-Guard fan fold board or an approved slip sheet. Due to the high temperatures that the plates reach during welding, an appropriate barrier is required between the plates and certain slip sheets, polystyrene rigid board insulations and fan fold products. Refer to the *Duro-Bond Roofing System* for approved substrates and additional information.
- b. When attaching rigid board insulations and/or cover boards, use 8 fasteners per 4 x 8-foot board in the perimeter areas and 10 fasteners per 4 x 8-foot board in the corner areas. The perimeter areas must extend a minimum of 8 feet into the roof. The corner areas must be at least 8 x 8 feet. Refer to Detail Drawing RG1057. This fastening pattern is for a maximum 60-psf design pressure. If the roofing system must be installed to meet a higher uplift pressure, contact the Duro-Last Engineering Services Department for assistance.



SECTION 3

- c. When using Duro-Blue, Duro-Weave or Geotextile slip sheets, Duro-Guard EPS or XPS rigid board insulations, or fan fold boards, an appropriate barrier layer must be installed beneath the plates. The Duro-Bond Cardboard Disc, a piece of membrane or Atlas FR-10 may be used for this purpose. The barrier piece must extend at least 1/2 inch beyond the edge of the plate. Install the first row of fasteners at a maximum of 12 inches on center between 24 to 36 inches from the roof perimeter. Install the second row of fasteners at 12 inches on center between 84 to 96 inches from the roof perimeter. Refer to Detail Drawing RG1058. This fastening pattern is for a maximum 60-psf (field area) design pressure. If the roofing system must be installed to meet a higher uplift pressure, contact the Duro-Last Engineering Services Department for assistance.



- d. On metal retrofit applications where the metal panels do not provide adequate fastener pullout resistance, the plates may be fastened into steel purlins as long as the purlins are spaced no more than 60 inches apart. The first purlin must fall within 3 feet of the perimeter edge. Install the plates a maximum of 6 inches on center into the purlins. This fastening pattern is for a maximum 60-psf (field area) design pressure. If the selected Duro-Last Roofing System must be installed to meet a higher uplift pressure, contact the Duro-Last Engineering Services Department for assistance.

SECTION 3

HOT-AIR WELDING

1. Seams created by using hot-air may be completed using either an automatic or hand-held hot-air welder. The seam must be continuous and at least 1-1/2 inches wide.
2. Testing of membrane seams should always be performed prior to welding sections of membrane together. Perform the tests whenever a welder is turned on or after a significant change in the weather. Weld together two pieces of membrane a minimum of two feet 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 should be a minimum of 1-1/2 inches wide.
3. After a 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 weld membrane 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 different 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.**

Leister Varimat V2				
Membrane (all mils)	Ambient Temperature	Welding Temperature	Air Volume	Drive Speed
Duro-Last	70° F (21° C)	1,148° F (620° C)	100%	17 ft./min. (5 m/min.)
Duro-Fleece	70° F (21° C)	1,148° F (620° C)	100%	10 ft./min. (3 m/min.)
Duro-Fleece Plus	70° F (21° C)	1,148° F (620° C)	100%	10 ft./min. (3 m/min.)
Duro-Tuff	70° F (21° C)	1,148° F (620° C)	100%	10 ft./min. (3 m/min.)
Duro-Last EV	70° F (21° C)	1,148° F (620° C)	100%	10 ft./min. (3 m/min.)

Note: Always use the slower speed when welding different types of membrane together.

6. Hand-Held Welders
 - a. Average welding rates for all membranes using a Leister Triac® 1G3 hand-welder with a 1-1/2-inch (40 mm) tip and setting between 7 and 9 are between 2 to 3 feet per minute. **These rates are approximate and can vary.**

WALLS

The membrane may be adhered or mechanically fastened onto walls. Surface preparation requirements on walls are the same as described in *Substrate Preparation* above. Refer to Detail Drawings for installation references of edge terminations.

1. Walls Mechanically Fastened
 - a. Any slope equal to or greater than 12 inches per foot will be considered a parapet wall. Rolls may be a maximum of 32 inches wide when installed horizontally across a wall. Rolls may be a maximum of 64 inches wide when installed vertically up a wall. Refer to Detail Drawings RG6012 and RG6013.
 - b. Situate the membrane at the base of the wall so that enough membrane extends onto the roof to cover plates in the roof-to-wall transition and to accommodate the 1-1/2-inch wide hot-air weld between the wall membrane and roof membrane.
 - c. A row of fasteners must be installed at the roof-to-wall transition. These fasteners may be installed into the deck or the wall. When fastened into the deck, use the same fastener spacing that is being used to install the roof membrane in the perimeter and corner areas.
 - d. When installing rows of fasteners into walls, use the following fastener spacing.

SECTION 3

- i. Concrete: 18 inches o.c., maximum.
 - ii. 22-gauge, or thicker, steel: 18 inches o.c., maximum.
 - iii. Plywood or other material with pullout value 300 lb, or greater: 18 inches o.c., maximum.
 - iv. Plywood or other material with pullout value between 175 and 300 lb: 12 inches o.c., maximum.
 - v. For any wall with material pullout value less than 175 lb. contact the Duro-Last Engineering Services Department.
- e. After the membrane is attached, seam adjacent sections of the wall membrane together with hot-air welds. At the base of the wall, tack weld the wall membrane to the roof membrane at the roof-to-wall transition to prevent the membrane from bridging. Tack welds must be placed between the fasteners at the roof-to-wall transition. Seam the edge of the wall membrane to the roof membrane with a continuous hot-air weld at least 1-1/2 inches wide.
2. Walls Adhered
- a. The maximum width membrane roll that may be used on parapet walls is 64 inches.
 - b. When adhering membrane to walls, utilize an approved Duro-Last membrane adhesive. Other materials may be accepted, but only after the contractor has requested a deviation from Duro-Last, and Duro-Last has approved such deviation, in writing, prior to being used.
 - c. Adhesive must be applied to both the substrate and bottom side of the membrane. Refer to the Product Data Sheet of the adhesive being used for acceptable substrates, coverage rates and application guidelines.
 - d. After the membrane is applied to the wall, apply pressure to the membrane with a push broom or squeegee to complete the bond.
 - e. If extending up a wall more than 5 feet, rows of mechanical fasteners must be installed at each 5-foot increment. The membrane may be installed so that the rows of fasteners on the wall run either horizontally or vertically.
 - f. Situate the membrane at the base of the wall so that enough membrane extends onto the roof to cover plates in the roof-to-wall transition and to accommodate the 1-1/2-inch wide hot-air weld between the wall membrane and roof membrane.
 - g. A row of fasteners must be installed in the roof-to-wall transition. These fasteners may be installed into the deck or the wall. When fastened into the deck, use the same fastener spacing that is being used to install the roof membrane in the perimeter and corner areas.
 - h. When installing rows of fasteners into walls, use the following fastener spacing.
 - i. Concrete: 18 inches o.c., maximum.
 - ii. 22-gauge, or thicker, steel: 18 inches o.c., maximum.
 - iii. Plywood or other material with pullout value 300 lb, or greater: 18 inches o.c., maximum.
 - iv. Plywood or other material with pullout value between 175 and 300 lb: 12 inches o.c., maximum.
 - v. For any wall with material pullout value less than 175 lb. contact the Duro-Last Engineering Services Department.
 - i. After the membrane is attached, seam adjacent sections of the wall membrane together with hot-air welds. At the base of the wall, tack weld the wall membrane to the roof membrane at the roof-to-wall transition to prevent the membrane from bridging. Tack welds must be placed between the fasteners at the roof-to-wall transition. Seam the edge of the wall membrane to the roof membrane with a continuous hot-air weld a minimum of 1-1/2 inches wide.

SECTION 3

SLOPE TRANSITIONS

1. The membrane must be mechanically fastened with approved fasteners at all slope transitions that meet or exceed a change in slope of 1 inch vertically per 12 inches horizontally. The fastener spacing must be the same as that being used to fasten the membrane adjacent to the transition.

PENETRATIONS

1. The membrane must be fastened at the base of all roof penetrations. Such penetrations include, but are not limited to, pipes, drains, curbs, pitch pans, and expansion joints.
2. The fastener spacing around penetrations must be the same as that being used to fasten the membrane adjacent to the penetration. A minimum of one fastener is required.
3. Stack Flashings, Drain Boots, and Outside Corners cannot be field-fabricated.

FLASHINGS

1. The membrane must not contact surfaces which maintain or exceed temperatures of 120° F 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 above the top of the roofing system surface. Refer to *Pitch Pans* Section for pitch pan installation criteria.

PITCH PANS

1. Use pitch pans only when standard flashings cannot be used.
2. Use a Duro-Last supplied, or Duro-Last approved, sealant to seal pitch pans. Other materials may be accepted, but only after the contractor has requested a deviation from Duro-Last, and Duro-Last has approved such deviation, in writing, prior to being used.
3. All pitch pans must be terminated a minimum of 4 inches above the top of the roofing system surface.
4. Refer to Details Drawings 4030, 4040 and 4045 for installation references.

TWO-WAY AIR VENTS

1. Install Duro-Last Two-Way Air Vents between fastener rows and at high points of roof area. Vents must not be installed within 7 feet of the building edge. Never install vents in low, or drainage areas.
 - a. A minimum of one Duro-Last Two-Way Air Vent must be installed for every 1,000 square feet of roof area, or portion thereof, but with a minimum of two Duro-Last Two-Way Air Vents per roof area.
 - b. Duro-Last Two-Way Air Vent Placement
 - i. Corners – Duro-Last Two-Way Air Vents must first be installed within 8 to 10 feet of the outer corners. Install Duro-Last Two-Way Air Vents at opposite corners whenever possible.
 - ii. Remaining Roof Area – Starting at 8 to 10 feet from the building edge, evenly distribute the remaining Duro-Last Two-Way Air Vents throughout the remaining roof area. (Smaller roof areas may not have additional Duro-Last Two-Way Air Vents.)
2. Two-Way Air Vents must not be used on refrigerated buildings, freezer buildings or adhered roofing systems.
3. Two-Way Air Vents are not required on open-air structures (e.g. carports) or roofing systems with overburden (e.g. ballast, paver, vegetation, etc.).

SECTION 3

DRAINS AND SCUPPERS

1. Drain Assemblies With Clamping Rings
 - a. All existing roofing system materials must be removed from drain bowl and clamping ring.
 - b. Use a Duro-Last supplied or Duro-Last approved sealant (1/2 tube minimum) between the membrane and drain bowl assembly as shown in Detail Drawing 2011. Other materials may be accepted, but only after the contractor has requested a deviation from Duro-Last, and Duro-Last has approved such deviation, in writing, prior to being used.
 - c. After the 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.
 - d. Refer to Detail Drawing 2011 for installation reference.
2. Drain Boots
 - a. If a drain boot is to be used, apply a Duro-Last supplied, or Duro-Last approved, sealant (1/2 tube minimum) to the outside of the drain boot and insert it into the drain. Other materials may be accepted, but only after the contractor has requested a deviation from Duro-Last, and Duro-Last has approved such deviation, in writing, prior to being used.
 - b. Install a pair of composite drain rings (CDRs) to compress the boot to the pipe.
 - c. Refer to Detail Drawing 2020 for installation references.
3. Scuppers
 - a. Refer to Detail Drawings 2030, 2041, 2060, 2061 and 2070 for installation references.

EXPANSION JOINTS

1. Refer to Detail Drawings 1140, 1150, 1160, 1170 and 6160 for installation references.

WALKWAY PADS

1. Duro-Last Roof Trak® III Walkway Pads are recommended at all roof access points, service units and high traffic areas. The potential for third party damage to the Duro-Last Roofing System may increase if the building owner chooses not to utilize the Duro-Last Roof Trak III Walkway Pad.
Note: Prior to inspection of the installation by Duro-Last, attach only one side of any Walkway Pads that will be covering field seams. This will allow the Duro-Last Quality Assurance Technical Representative to inspect the entire field seam. After the inspection, hot-air weld the remaining side to complete the attachment of the pad.

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 roof subassembly or building.
2. Duro-Last recommends the use of vapor barriers, however it is the responsibility of the contractor to ensure that all applicable specifications, building codes, regulations and ordinances are complied with and followed. 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 Safety Data Sheet (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 membrane from being contaminated by asphalt or bitumen.** Asphalt and bitumen are incompatible with the membrane and proper separation must be provided between these products and the membrane. Should the membrane become soiled with asphalt or bitumen, the affected membrane must be cleaned immediately, using approved procedures. If the asphalt or bitumen cannot be properly cleaned from the membrane, new membrane should be ordered and installed.
5. The membrane must not be in contact with substrates that maintain or exceed temperatures of 120° F, including insulated chimney pipes and combustible fuel pipes. Refer to the appropriate Detail Drawings for information regarding the proper termination.
6. Duro-Last does not approve of covering 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.
7. Phenolic foam is not an approved insulation in new construction or re-roofing applications. **The Duro-Last Roofing System must not, under any circumstances, be installed over phenolic foam.**
8. Perlite and wood fiberboards are not acceptable substrates for Duro-Last Roofing Systems.
9. **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.
10. The Duro-Last Roofing 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 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. Roofs are subjected to hot embers, slag, burning debris or incompatible chemicals.
11. It is required that Duro-Guard EPS/XPS fan fold boards be used for all Duro-Last Roofing Systems where a fan fold board will be installed. Failure to use a Duro-Guard EPS/XPS fan fold board can prohibit the issuance of a warranty.
12. It is required that approved slip sheets be used for all Duro-Last Roofing Systems where a slip sheet will be installed. Failure to use approved slip sheets can prohibit the issuance of a warranty.