siplast®

Parafast® PVC RhinoBond® Attachment Systems

Technical Guide

Table of Contents

I. Siplast Engineered Roof Systems. Innovation. Commitment. Performance.

Siplast's approach to commercial roofing has always been to provide owners and specifiers with lasting solutions based on high-performance products of consistent quality. We focus on quality design, careful application, excellent service, and products appropriate for the specific requirements of each Siplast project.

Since the 1960s, our roofing and waterproof systems have protected the most mission-critical facilities with redundant, robust membrane systems and highly engineered liquid-applied membranes. In that time frame, Siplast has introduced numerous innovations to meet the changing needs of building owners. In that spirit, we are proud to offer a synthetic membrane solution backed by the same service and commitment the industry expects from Siplast: **Parasolo**™.

Parasolo Synthetic Roof Membrane Systems
Parasolo Roof Membrane Systems are appropriate in situations where a synthetic membrane meets the needs of the building owner. With Parasolo, owners of these facilities can enjoy the benefits of the partnership approach to roofing that has been the Siplast standard for decades.

Parasolo PVC membranes offer excellent thermoplastic properties for roofing applications. Parasolo KEE is a premium PVC formulation with the highest quality combination of PVC and KEE plasticizers, offering the ultimate thermoplastic roof membrane protection.

All Parasolo PVC membranes are available in both smooth and fleece-back versions, in thicknesses of 50, 60, and 80 mils, and sheet widths of 5 and 10 feet. Parasolo PVC is installed in:

1. Mechanically fastened applications.
2. Adhered applications.
3. RhinoBond®[1] applications.
4. Hybrid applications in conjunction with Siplast Paradiene SBS base ply membrane configurations.

Parasolo PVC Roof Membrane is one of several Siplast solutions for cool roofing applications. Parasolo is California Title 24 Part 6 compliant, meets the reflectance requirements of the U.S. Energy Star Program, and qualifies for LEED credit for reflectance and emittance.

[1]RhinoBond® is a registered trademark of OMG.

General Policy
The following recommendations are based on past field experience under a wide variety of environmental and substrate conditions. They are meant as a guide to assist owners, specifiers, and roofing contractors in their consideration of the proper treatment of various roofing and waterproofing conditions. As each project is unique, these recommendations are not intended as absolute. Regional or specific job variances may take priority in some cases. Therefore, each project should be considered individually, with specifications tailored to meet specific job conditions.

Siplast will provide standard 10-year and 20-year membrane guarantees for a roofing/waterproofing system applied in accordance with the recommendations in this guide when the system is constructed according to the appropriate Siplast specification by a Siplast Select Contractor, provided all required pre-job procedures have been followed. Guarantees that require coverage type and terms beyond the standard guarantee offering should be reviewed and approved in writing by Siplast prior to bid. Siplast will issue no verbal or written guarantee other than those published by Siplast.

On non-guaranteed systems, Siplast assumes no responsibility other than to supply quality materials in its usual manner. Siplast will provide no inspection services on non-guaranteed Siplast systems, nor will we write letters stating that we have examined plans, specifications, or details for such systems and found them acceptable for application of our materials.

Final responsibility for the design and appropriateness of any roofing or waterproofing system lies with the architect, engineer, roof consultant, and owner. By publishing the specifications and design criteria contained in this guide, Siplast should not be construed as having created any warranty, expressed or implied, other than that contained in our published Membrane Guarantee.

The information contained herein supersedes all previously published recommendations and specifications. Siplast reserves the right to change or modify any of the contents of this guide without prior notice.

Where it is noted in this guide to contact Siplast, please call **1-800-922-8800** for assistance.

II. Roof Design Considerations

General Requirements
Proper roof system design and selection requires the consideration of many factors. Although Siplast's expertise is in materials manufacturing, we have decades of extensive experience in the practical aspects of roofing. Our experience suggests that careful consideration of the following will help provide a fundamentally sound basis for design and selection of Parasolo PVC mechanically attached single-ply roof systems.

Siplast does not practice architecture, engineering, or specialized roof consulting. This section is provided for guidance purposes only based on Siplast's experience in the roofing industry. There are many factors that may affect roof design, including specific job site conditions, local building codes, building use, etc., which must be taken into account. Siplast recommends consulting with a design professional to determine specific roofing needs and requirements for each particular project.

Sustainable Design
ENERGY STAR® is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. It is designed to help buyers and consumers save energy and money, and to protect the environment through energy-efficient products and practices. Energy-efficient choices can help building owners save significantly on energy costs and greenhouse gas emissions, without sacrificing features, style, or comfort. ENERGY STAR helps consumers, contractors, architects, and property owners make more knowledgeable, energy-efficient choices.

The LEED® (Leadership in Energy and Environmental Design) Green Building Rating System is a voluntary standard for developing high-performance, energy-efficient sustainable buildings. The LEED Certification System is a program that awards building points for satisfying specified green-building criteria and requirements.

Green Globes® is a web-based program for green building guidance and certification that includes an onsite assessment by a third party and is an alternative to the LEED rating system.

Building Utilization
Building utilization can have a significant impact on roof system selection and design. The most common building utilization considerations are as follows: extremes in internal temperature/humidity, positive internal pressure, rooftop traffic/mechanical abuse, rooftop-exhausted contaminants, photovoltaic (PV) solar applications, and the use of the roof as living space.

Internal Temperature/Humidity
Extremes in internal temperature/humidity are most often associated with cold storage/freezer buildings, swimming pool facilities, drying kilns, food processing plants, paper/pulp mills, and smelting/blast furnace facilities. What makes these building applications unusual is that the pronounced difference in vapor pressure between the building interior and the exterior can cause a pronounced vapor flow through the roof assembly. This can result in the accumulation of condensation within the roof assembly, and severe deterioration of both the roof assembly itself and the structural deck.

Relevant design considerations include:
- Incorporation of a vapor retarder at deck level to control vapor flow into and through the roof assembly.
- Ensuring that there is a vapor-tight seal between the roof and side walls/penetrations.
- Utilization of closed-cell foam insulation to minimize potential for condensation-related degradation of roof system components.
- Limitation of penetrations through the roof deck.
- Avoidance of roof system attachment that will compromise the integrity of the vapor retarder.

Positive Internal Pressure
Positive internal pressure is most often associated with manufacturing/clean-room facilities, mechanical air-handling rooms, aircraft hangars, distribution centers with multiple overhead doors, and high-rise office/residential towers. In all these instances, positive internal pressures can adversely act on the underside of the roof system. This effect is most pronounced in mechanically attached systems but can also cause attachment/adhesion concerns with other types of roof system installations.

Conditions where the positive internal pressure is constant may cause the roof system to billow up, i.e., form a mattress effect, and may reduce the overall uplift resistance of the roof system.

Conditions where the positive internal pressure is applied suddenly may cause failure of the roof system due to pressure impact.

Relevant design considerations include:
- Use of air-impermeable deck construction, such as poured-in-place concrete or lightweight insulating concrete over steel deck.
- Alternatively, installation of an air barrier at deck level beneath mechanically attached insulation with attachment sufficient to balance positive pressure.
- Ensuring that there is an air-tight seal between roof and side walls/penetrations.

Rooftop Traffic/Physical Abuse
Roofing installations that can be expected to experience a high degree of roof traffic due to equipment maintenance, vandalism or other unauthorized access, frequent hailstorms or high winds, and prolonged periods of temperature extremes or rapid fluctuations in temperature may require a more durable roof system than a conventional single-ply thermoplastic applied over low-density foam insulation.

Relevant design considerations include:
- Use of thicker membrane or a more robust membrane system such as a multi-ply SBS-modified bitumen system.
- Use of a high compressive strength cover board.
- Use of a higher compressive strength insulation substrate.
- Application of a concrete paver or insulated paver overlay for extreme conditions.

Contamination
Many roofing installations are exposed to oil, grease, and chemical contamination in excess of normal airborne contaminants. These conditions are most often associated with restaurants, food processing plants, chemical and pharmaceutical plants, refineries, machining and manufacturing facilities, and airports.

Most roofing materials are degraded by certain families of contaminants, and will become brittle, swell and soften, or dissolve, depending on the material formulation and contaminant type.

Unforeseen combinations of contaminants, environmental exposure effects, and variation in contaminant concentration prevent an absolute prediction of resistance to contamination in all but the most common situations.

Relevant design/maintenance considerations include:
- Isolation of contaminated roof area with expectation of more frequent roof membrane replacement.
- Periodic cleaning of the roofing membrane with approved cleaning agents using low to moderate pressure.
- Limitation of rooftop spillage/exhaust of contaminating materials, i.e., grease traps.

Refer to siplast.com for chemical resistance information. Siplast guarantees on any Siplast membrane, including PVC, do not cover damage due to exposure to chemical contaminants.

III. Tear–Off or Re–Cover

The decision to tear-off or to re-cover an existing roof system is not always clear. Although not an exhaustive list, the following additional design elements typically require consideration for any re-roofing project:
- Replacement of damaged roof decking or structural components.
- Improvement of roof access.
- Removal of unused rooftop equipment and associated equipment mountings.
- Remounting of rooftop equipment to allow proper roofing and flashing technique.
- Matching of architectural elements such as special perimeter metalwork.
- Repair of deteriorated parapet and penthouse walls.
- Protection of roofing membrane by means of concrete paver overlay or walkway pad system.

Tear-Off/Replace
Factors that support the tear-off approach include:
- Two or more existing roofs (building code restriction).
- Structural weight limitation.
- More than 25% of existing roof area is wet.
- Flashing height limitations.
- Need to maximize long-term performance.

The basis for any tear-off project is to provide a sound substrate for the installation of a new roof system and minimize potential damage from tear-off activities. At a minimum, attention to the following considerations is recommended:
- Thoroughly inspect decking, flashing substrates, and wood nailers before installing new materials.
- Plan a tear-off strategy so that roof drainage patterns are never blocked, and so that construction traffic is directed away from new roof areas.
- Protect newly roofing materials adjacent to tear-off areas from exposure to dirt, debris, and damage.

Re-Cover
Factors that support the re-cover approach include:
- Need to minimize cost.
- Disposal restrictions.
- Difficult access to the roof.
- Only one roof system in place.

The most important consideration in designing any re-cover project is to eliminate defects in the existing roof assembly so that their effect on the new roof system is minimized. At a minimum, attention to the following considerations is recommended:
- Raise all perimeter flashings, penetrations, and equipment to provide required flashing heights.
- Address drainage deficiencies to provide positive drainage.
- Remove and replace all wet roofing materials.
- Concentrate on thorough surface preparation.

Re-Covering Over Coal Tar Pitch Roofing or Asphalt-based Substrates
Coal tar pitch has oils and vapors that can be harmful to various roofing membranes and may discolor white thermoplastic membranes. Coal tar pitch may also "cold flow" through fastener holes into the substrate. For these reasons, Siplast does not recommend re-covering over existing coal tar pitch roofs.

Re-covering Over Asphalt-based Roofing
Asphalt and asphalt residue may discolor PVC membranes. For this reason, Siplast recommends a definitive separation between asphaltic materials (including BUR and hot-mop applied SBS and APP-modified bitumens) and thermoplastic membranes.

IV. Roof Decks

It is the responsibility of the engineer, architect, building owner, or roofing contractor to determine the fitness of a deck for a specific roof system installation. Additionally, Siplast is not responsible for moisture-related problems associated with any deck materials. Most common structural roof deck types are suitable substrates for the installation of a Parasolo PVC roof system.

Structural Steel
- Minimum 22-gauge (standard FM-approved steel decking is 22-gauge in thickness).
- 24-26 gauge decks require Siplast approval. Thinner-gauge steel decks usually require additional or specialized mechanical fasteners to achieve comparable roof attachment performance.
- 18-gauge, 20-gauge, and 22-gauge Grade E high-strength steel decks may require fewer mechanical fasteners to achieve comparable roof attachment performance.

Structural Concrete
- Minimum 2,500 psi compressive resistance (1724 Newtons /cm^2).
- Minimum 2" (51 mm) thickness (pre-cast), minimum 4" (102 mm) thickness (poured-in-place).
- Cannot be wet or frozen. If the deck is determined to be wet, it must be allowed to dry.
- For insulated decks, wood nailers of equivalent thickness to the roof insulation must be provided at perimeters and projection openings to act as an insulation stop and to provide for the nailing of the flanges of metal flashing components.
- Ridges and other irregularities typically require grinding to provide a smooth and even substrate surface.
- For non-insulated decks, nailers must be flush with deck surfaces.
- When applying rigid insulation directly to the deck in hot asphalt, prime with deck asphalt primer at the appropriate application rate and allow the primer to dry prior to the application of the rigid insulation.

Pre-Cast Concrete Decks
- These decks are usually manufactured as planks or slabs and constructed of steel-reinforced Portland cement and solid aggregate; often they are made with hollow cores to minimize their weight.
- All deformed panels must be replaced.
- Joints must be filled with a masonry grout to correct imperfections between slabs and feathered to provide a slope not greater than 1/8:12 for adhered insulated assemblies.
- If the joints cannot be grouted and finished smooth, then a leveling course of lightweight insulating concrete should be considered.

Pre-Stressed Concrete Decks
- Siplast recommends the application of lightweight insulating concrete fill or rigid insulation over all pre-stressed concrete decks prior to installation of the roof system because variations in camber and thickness of pre-stressed concrete members may make securement of the roof system difficult and result in membrane stress.

Poured Structural Concrete Decks
- Poured structural concrete decks should be properly cured prior to application of the roof system; 28 days is normally required for proper curing. Check curing agents for compatibility with roofing materials. Prior to the installation of the roof assemblies, Siplast recommends the evaluation of surface moisture and deck's dryness through the use of ASTM D4263 or a hot bitumen test.
- Poured structural concrete decks should be poured over removable forms or must provide for bottom side drying. Poured-in-place structural concrete decks that are poured over non-vented metal decks or pans that remain in place can trap moisture in the deck under the roof system.
- The underside of the concrete decks, either the vented metal forms or exposed concrete, should remain unobstructed to allow the escape of water vapor. Materials that retard the flow of vapor should not be installed directly below the deck. Foil-faced insulation secured to the bottom of the deck, spray-on fireproofing, or paint, which obstruct the venting of the concrete, are just three examples of things that can trap moisture in the concrete deck below the roof.
- Siplast recommends that a vapor retarder be used directly over any poured structural concrete installed over non-removable form decks or any impermeable substrate, and requires the use of a vapor retarder for lightweight aggregate structural concrete decks in this configuration.

- Roofing professionals must take care with structural concrete decks utilizing both conventional and lightweight aggregates. The selection of the deck material and its suitability for use is the responsibility of the designer of record, who must make appropriate design accommodations to address high moisture content encountered in conventional and lightweight structural concrete. Siplast is not responsible for moisture-related problems associated with any deck materials.

Wood Planking
- Minimum 1" (25 mm) nominal thickness.
- Tongue and groove or splined edges required.
- All boards must have a bearing on rafters at each end and be securely fastened.
- Lumber should be kiln dried.
- Check compatibility of preservatives or fire retardants used to treat decking with roofing materials.
- Decking should be kept dry and roofed promptly after installation.

Plywood
- Minimum 15/32" (12 mm) thickness.
- Panels shall be attached with approved fasteners at required spacing.
- Plywood sheathing shall comply with roof deck design requirements and local codes for roof deck construction.
- The panels must be gapped and secured in accordance with APA-The Engineered Wood Association Construction Guide recommendations. Tongue and groove edges or full blocking required.
- Plywood sheathing shall be C-D Exposure 1 APA Rated, minimum 4 ply.
- Plywood sheathing shall comply with Structural 1 performance rating.
- Panels must be installed with a 1/8" to 1/4" (3 mm – 6 mm) gap between panels and must match vertically at joints to within 1/8" (3 mm).
- Moisture content not to exceed 16%.
- Decking should be kept dry and roofed promptly after installation.
- Must be installed over joists spaced not greater than 24" (610 mm) o.c.
- Rigid insulation above the plywood deck may be necessary to prevent condensation from adversely affecting the deck.
- Fastener withdrawal values should meet industry standards for the specific plywood grade and thickness.
- Pull tests are recommended to verify fastener pull-out values will meet design minimum requirements.

Oriented Strand Board (OSB)
- Minimum 15/32" (12 mm) thickness.
- Deck shall be attached with approved fasteners at required spacing. Consult local building codes for specific requirements.
- OSB shall comply with roof deck design requirements and local codes for roof deck construction.
- The panels must be gapped and secured in accordance with APA-The Engineered Wood Association Construction Guide recommendations. Tongue and groove edges or full blocking required.
- OSB shall comply with Structural 1 performance rating.
- Oriented strand board (OSB) shall be C-D Exposure 1 APA Rated.
- Must be installed over joists not greater than 24" (610 mm) o.c.
- Insulation above the plywood deck may be necessary to prevent condensation from adversely affecting the roof.
- Insulation above the wood deck may be necessary to prevent condensation from adversely affecting the deck.
- Pull tests are recommended to verify fastener pull-out values will meet design minimum requirements.
- Panels must be installed with a 1/8" to 1/4" (3 mm – 6 mm) gap between panels and must match vertically at joints to within 1/8" (3 mm).
- Moisture content not to exceed 16%.
- Decking should be kept dry and roofed promptly after installation.

Note: OSB fastener withdrawal values may vary greatly by manufacturer and with exposure to moisture. OSB exposed to daily condensation or nightly dew may result in significant loss of pull out values. Siplast will not accept any liability for substandard or moisture-damaged OSB.

Gypsum Concrete
- Minimum 2" (51 mm) thickness.
- Steel reinforcing mesh and permanent form boards required for poured-in-place monolithic decks.
- Steel-reinforced edges required for pre-cast decking units.
- An average fastener withdrawal resistance as recommended by the fastener manufacturer must be obtained. If proper mechanical attachment cannot be achieved, please contact Siplast for assistance with installation recommendations.
- If surface is either wet or frozen, a poured gypsum deck is not suitable to receive a roof.
- Pull tests are recommended to verify fastener pull-out values will meet design minimum requirements.

Cementitious Wood Fiber
- Minimum 2" (51 mm) thickness.
- Tongue and groove panel edges required.
- Should not be installed over high humidity occupancies.
- All structural wood fiber deck panels must be anchored against uplift and lateral movement.

- Pull tests are recommended to verify fastener pull-out values will meet design minimum requirements.
- Contact Siplast for recommendations on cementitious wood fiber composite decks.

Lightweight Insulating Concrete (LWIC)

ZIC and NVS Aggregate
Lightweight Insulating Concrete
The standard ZIC System is a 1:6 ratio of Portland cement volume to concrete aggregate volume. ZIC is used in new construction applications over slotted galvanized metal decking. The standard ZIC System requires a minimum 2-inch thickness of ZIC over the top of the Insulperm Insulation Board. Pours having a cement to aggregate ratio of 1:6 should have a minimum dry density of 22 pounds per cubic foot. The construction should allow for venting on the underside or topside surface vents. In constructions with a vented deck and vented perimeter, roof vents are not required. ZIC lightweight insulating concrete substrates must be installed by a Siplast Select Lightweight Insulating Concrete Contractor according to Siplast requirements. The finished pour should be smooth, surface dry, and free of depressions or projections.

The NVS System is a 1:3.5 ratio of Portland cement volume to NVS Concrete Aggregate volume. The patented NVS System has been engineered for use over non-venting substrates and in reroofing and re-cover applications. Because of its higher compressive and tensile strengths, NVS requires only a 1-inch minimum thickness over the top of the Insulperm Insulation Board. Pours having a minimum cement to aggregate ratio of 1:3.5 must have a minimum dry density of 35 pounds per cubic foot. The roof construction should allow for perimeter and topside venting.

NVS Premix, a specially formulated product containing NVS Concrete Aggregate, additives, and Type I Portland cement is available packaged in a 40-pound bag. When mixed with water, it becomes NVS Lightweight Insulating Concrete. NVS Premix is ideal for small jobs and difficult jobsite conditions.

NVS lightweight insulating concrete substrates must be installed by a Siplast Select Lightweight Insulating Concrete Contractor according to Siplast requirements. The finished pour should be smooth, surface dry, and free of depressions or projections.

Insulcel and Zonocel
Lightweight Insulating Cellular Concrete
The Insulcel System is a lightweight insulating concrete system that mixes Insulcel-PB pregenerated cellular foam with a Portland cement/water slurry to produce an economical roof insulation system appropriate for jobs located in climates that are conducive to proper curing of cellular concrete. Insulcel Insulating Concrete is placed at a minimum 2-inch thickness over the top of the substrate or Insulperm Insulation Board. Insulcel can be installed over non-slotted or slotted galvanized corrugated metal decks, structural concrete substrates and, where appropriate, over existing roofs in re-cover applications. Insulcel lightweight insulating concrete substrates should be installed by a Siplast Select Lightweight Insulating Concrete Contractor according to Siplast requirements. The finished pour should be smooth, surface dry, and free of depressions or projections.

The Zonocel System is a combination of Insulcel-PB pregenerated cellular foam and concrete aggregates mixed with a Portland cement/water slurry. Zonocel is used in new construction applications over slotted galvanized metal decking. Zonocel is placed at a minimum 2-inch thickness over the top of Insulperm Insulation Board. Zonocel lightweight insulating concrete substrates should be installed by a Siplast Select Lightweight Insulating Concrete Contractor according to Siplast requirements. The finished pour should be smooth, surface dry, and free of depressions or projections.

Parasolo PVC Membrane Systems Installed over Lightweight Insulating Concrete
In all cases in which lightweight insulating concrete is installed or present beneath a Parasolo Membrane System secured using the RhinoBond System, the mechanical fasteners must extend through the lightweight insulating concrete and engage into an approved deck/substrate.

Non-Acceptable Substrates
Note: The following are some examples of non-acceptable roof substrates, but should not be considered a complete list. Contact Siplast regarding the suitability of unusual deck substrates.
- Metal roof panels, unless secured to structural purlins.
- Transite roof panels.
- Fiberglass roof panels.

V. Parapet Walls

Most common structural wall types are suitable substrates for the installation of Parasolo PVC membrane flashing.

Brick/Block Masonry
- Standard-finish brick and concrete block with standard tooled mortar joints.
- Split-face block, textured block and brick, and deeply tooled mortar joints may require a cementitious coating or plywood facing to provide a smooth and even substrate surface.

Structural Concrete
- Steel trowel, wood float, or removable form finish.
- Ridges and other irregularities may require grinding to provide a smooth and even substrate surface.

Stucco/EIFS
- Stucco finish and EIFS systems must be removed to the underlying substrate surface. Stucco/EIFS finishes/systems are not suitable as a substrate for any Siplast membrane or flashing system.

Plywood/Oriented Strand Board (OSB)
- Plywood must be exterior grade, minimum 4-ply, and not less than 15/32" (12 mm) thick.
- OSB must comply with Structural 1 rating and be not less than 7/16" (11 mm) thick.
- Tongue and groove edges.
- Adhesives should only be used with untreated plywood/OSB.
- Surface of plywood/OSB should be dry to the touch with no visible liquid, snow or ice at the time roofing is installed.
- Moisture content not to exceed 16%.

Sheet Metal
- Minimum 24-gauge steel.
- Minimum 0.032" (8 mm) aluminum.
- Corrugated panels require overlay of 15/32" (12 mm) plywood or an approved gypsum or cement panel.

Gypsum Panel
- Minimum 1/2" (13 mm) thickness.
- Underlying substrate must allow for securement of flashing at prescribed spacing. Mechanical attachment to gypsum panels themselves is not acceptable.
- Use of gypsum panel requires Siplast approval.

Re-Covering Over Asphalt-Based Roofing
- Asphalt and asphalt residue may discolor PVC membranes. For this reason, Siplast recommends a definitive separation between asphaltic materials (including BUR and hot-mop applied SBS and APP-modified bitumens) and thermoplastic membranes.

VI. Roof Drainage

Providing positive roof drainage is an important design consideration. Standing water can result in deck deflection and possible structural damage. In addition, in the event of an opening through the roofing membrane, standing water can significantly worsen damage to the roof system, the building itself, and interior contents by providing a reservoir of water ready to gravitate through the membrane opening. Providing structural slope in the deck assembly, installing a tapered lightweight insulating concrete system, installing a tapered rigid insulation system, or adding drains are the most common methods of achieving positive drainage.

National building codes generally require a minimum 1/4:12 slope to drain in order to provide positive drainage and accommodate deck irregularities. Although existing buildings may or may not be required by code to achieve this degree of roof slope, providing positive slope-to-drain remains an important design consideration.

In situations where roof edge conditions, window/door height above the roof surface, parapet wall height, weep hole locations, rooftop equipment mountings, or other factors prevent the installation of a full slope-to-drain system, a combination of additional drain locations, tapered saddles, and crickets to direct drainage to drain points should be considered.

Design and installation of roof drainage systems should comply with the International Energy Conservation Code (IECC) and the International Plumbing Code (IPC).

VII. Expansion Joints

The function of a structural expansion joint is to minimize the effect of stresses and movements on building components and to prevent these stresses from adversely affecting the roof. The design, location, and use of building structural expansion joints must be considered at the time of original building design and are the responsibility of the architect, engineer, and building owner.

Expansion Joints:
- Must be continuous along the break in the structure and not terminated short of the end of the roof deck.
- Should never be bridged with insulation.
- Construction ties must be removed in order for expansion joints to function properly.
- Extend expansion joints at least 8" (203 mm) above the roof surface on curbs and use metal expansion joint covers. Alternately, a low-profile expansion joint can be used; see Parasolo PVC details.
- Design drainage flow patterns so they are not

blocked by any structural expansion joints.
- Where possible, position walkways on roof access points to limit roof traffic over expansion joints. Provide protective coverings for expansion joints at locations of anticipated roof traffic.
- Expansion joints for roofing application should be designed to incorporate underlying wood nailers.
- Avoid designs that require slope-to-drain over expansion joints.

VIII. Area Dividers

Area dividers are not structural expansion joints. They can be installed to separate different roof systems and can be either a curb or low-profile type. Contact Siplast for recommendations regarding area dividers.

IX. Equipment Mountings

Proper mounting of equipment is an important consideration. In general, rooftop equipment should be mounted in such a way as to provide:
- Adequate flashing height for both new and anticipated re-cover roof system applications.
- Sufficient clearance around and beneath the equipment to facilitate roof system installation.
- Compatibility with roofing and flashing materials so that standard flashing methods can be readily applied.

Alternatively, lightweight equipment and gas/conduit lines can be installed over wood blocking or other prefabricated devices that do not penetrate the roof system. Do NOT use this type of application for heavy equipment or heavy gas/conduit lines, or where movement can damage the substrate or membrane.

X. Fire Resistance

Resistance to exterior fire exposure is an important design consideration. Typically, an ANSI/UL 790 or ASTM-E108 Class A, B or C roof fire rating is required by building code. Occasionally, depending on the use of the building, special resistance to fire applied from within the building is required. This is normally expressed in the form of hourly ratings, and usually requires the use of a specialized roof assembly. Refer to current Parasolo listings in the appropriate UL directory or Factory Mutual Approval Listing to verify roof assembly requirements for specific fire ratings.

XI. Wind Performance

Roof systems should be capable of resisting the forces generated by the maximum anticipated wind speed for a specific building.

The following are common references and approvals typically used in roof system design:

Factory Mutual Approvals
- Testing based on methods described in Approval Standards 4450 and 4470.
- Measures resistance to upward pressure applied to the roof system.
- Factory Mutual Loss Prevention Data Sheets 1-28 and 1-29 provide specific design and installation guidelines.

DORA (Directory of Roofing Assemblies)
The Directory of Roof Assemblies (DORA) is a web application database of roof systems tested in accordance with standards referenced in Chapter 15 of the International Building Code (IBC). This service lists wind uplift load capacity for single ply and modified bitumen roof systems.
- Sponsored by SPRI and administered by InterTek.
- Available at https://www.dora-directory.com/

American Society of Civil Engineers (ASCE) document ASCE 7, "Minimum Design Loads for Buildings and Other Structures"
- A comprehensive analysis of wind forces acting on buildings.
- Requires detailed calculations to determine actual wind pressures at different regions of the roof.
- Referenced by building codes. Check with local code agency for the latest version that has been adopted.

Important Note: Most states/jurisdictions have not adopted ASCE 7-16. If you are in an area that requires ASCE 7-16, please contact Siplast for assistance.

XII. Vapor Retarders

Vapor retarders can be an important component of a properly designed roof assembly. The decision to use a vapor retarder is the responsibility of the architect, engineer, or owner. As a general rule, vapor retarders are advisable as follows: (1) over heated buildings in regions where January temperatures average 40ºF (40ºC) or below, (2) over structures with high interior relative humidity, or (3) in any similar situation where a vapor drive can be expected. The designer should, however, study each project individually and consider all relevant conditions when making a decision. Improperly specified or constructed vapor retarders can have a deleterious effect on membrane performance.

XIII. Air Barriers

1. Designers should consider requiring an air barrier:
   a. On all air porous decks, with openings in the walls or area directly below the roof deck that exceeds 10% of the total wall area.
   b. When the internal pressurization of the building is in excess of 5 lbs. per ft2 (239 Pa).
   c. When the building height exceeds 50’ (30.5 m).
   d. When buildings have large openings or overhangs.
   e. In conditions where positive internal pressure is applied suddenly, and as such where the roof system may fail due to pressure impact.
2. Refer to FM Global Loss Prevention Data Sheets 1-28 and 1-29 for specific installation procedures for all roofs with large openings.
3. For roofs to be guaranteed by Siplast:
   a. Air barriers are required for all extended-length guarantees on buildings where large wall openings greater than 10% of the total wall area can be open during a windstorm, including opening due to storm damage.

Parasolo™ PVC Design Tables

Parafast RhinoBond - New Construction or Tear-Off							
Deck Type	Attachment	Insulation/Substrate					Membrane Type
	Mechanically[4]	Polyiso-cyanurate	Gypsum Board	Wood Fiber	EPS/XPS[5]	None	Smooth
Steel[1]	Yes	Yes	Yes	Yes	Yes		Yes
Wood[2]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Structural Concrete	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lightweight Insulating Concrete[3]	Contact Siplast					Yes	Smooth

1. Minimum 22-gauge steel deck required.
2. Minimum ½” (12 mm) plywood or 1” (25 mm) nominal wood plank required. The Parafast RhinoBond Attachment System is not acceptable over OSB substrates, unless attached into structural joists or purlins.
3. Extreme care must be taken to remove all concrete debris and dust prior to roof system installation.
4. Parafast Fasteners and Parafast RhinoBond XHD Plates are used to mechanically attach rigid insulation to roof decks. The special coating on the plates allows for Parasolo membrane to be welded to each plate using the RhinoBond magnetic induction welding tool. RhinoBond Plates are different in type and color: PVC plates are black in color while TPO plates are amber in color. The appropriate PVC plates must be used with PVC membranes.
5. An approved cover board is required over EPS/XPS. The use of EPS/XPS in the RhinoBond assembly is acceptable, but not without a coverboard.

Parasolo™ PVC Attachment Table

Parafast RhinoBond - Insulated Assemblies - Attachment to Wood/Plywood							
Deck Type	**Fastener**	**Plate***	**Minimum Pull Out Value (lbs)**	**Max Building Height (ft)**	**Fasteners per 4 x 8 ft. (1.2 m x 2.4 m) Insulation Panel**		
					Field	Perimeter	Corner
1/2" (13mm) Plywood	Parafast #14	Parafast RhinoBond PVC XHD Plates	350	20	8	12	16
				60	12	18	24
5/8" (15mm) Plywood	Parafast #14	Parafast RhinoBond PVC XHD Plates	450	20	8	12	16
				60	12	18	24
3/4" (19mm) Plywood	Parafast #14	Parafast RhinoBond PVC XHD Plates	525	20	6	9	12
				60	12	18	24
1" (25mm) Nominal Wood Plank	Parafast #14	Parafast RhinoBond PVC XHD Plates	450	20	6	9	12
				60	12	18	24
2" (50mm) Nominal Wood Plank	Parafast #14	Parafast RhinoBond PVC XHD Plates	800	20	6	9	12
				60	12	18	24
*Parafast RhinoBond PVC XHD TreadSafe Plates may be substituted provided that at least 2.0" (51 mm) thick insulation is installed above the deck. A 5/8" (15.8 mm) diameter pilot hole must be drilled through the cover board when using TreadSafe plates with gypsum or wood fiber top layer insulations.							

Notes:

1. Confirm quality and condition of roof decking by visual inspection, and by fastener pull-out testing. Remove and replace all deteriorated decking.
2. Parafast Fasteners and Parafast RhinoBond XHD Plates are used to mechanically attach rigid insulation to roof decks. The special coating on the plates allows for Parasolo membrane to be welded to each plate using the RhinoBond magnetic induction welding tool. RhinoBond Plates are different in type and color: PVC plates are black in color while TPO plates are amber in color. The appropriate PVC plates must be used with the PVC membranes.
3. The Parafast RhinoBond Attachment System is not acceptable over OSB substrates, unless attached into underlying structural joists or purlins. See Parasolo PVC attachment table on page 14.
4. Fasteners shall be of sufficient length to penetrate the plywood sheathing a minimum of 3/4" (19 mm) and 1" (25 mm) embedment into the plank deck. Fasteners shall not be driven through the joints of the wood plank.
5. Pull-out values below the minimum listed above may be compensated for with additional fasteners. The cause for the low values shall be assessed to determine if additional fasteners are appropriate. Contact Siplast for further assistance.

Parasolo™ PVC Attachment Table

Parafast RhinoBond - Securement into Wood Joists						
Fastener Spacing Along Wood Joists	Wood Joist Spacing[1]	Plate Type[2]	Fastener Type	Fastener Embedment[3]	Uplift	Membranes Qualified For Uplift at Left
12” (305 mm)	96” (2.44 m)	Parafast RhinoBond PVC XHD	Parafast #14	1” (25 mm) into 2 x 8 in. (51 x 203 mm) support [1.5” (38 mm) through plywood decking joint and into lumber]	60 psf	None
24” (610 mm)	48” (1.22 m)	Parafast RhinoBond PVC XHD	Parafast #14	1” (25 mm) into 2 x 8 in. (51 x 203 mm) support [1.5” (38 mm) through plywood decking joint and into lumber]	75 psf	None
36” (914 mm)	24” (610 mm)	Parafast RhinoBond PVC XHD	Parafast #14	0.75” (19 mm) into 2 x 8 in. (51 x 203 mm) support [1.25” (32 mm) through plywood decking joint and into lumber]	105 psf	None
24” (610 mm)	24” (610 mm)	Parafast RhinoBond PVC XHD	Parafast #14	0.75” (19 mm) into 2 x 8 in. (51 x 203 mm) support [1.25” (32 mm) through plywood decking joint and into lumber]	105 psf	None
18” (452 mm)	24” (610 mm)	Parafast RhinoBond PVC XHD	Parafast #14	0.75” (19 mm) into 2 x 8 in. (51 x 203 mm) support [1.25” (32 mm) through plywood decking joint and into lumber]	165 psf	Parasolo PVC Smooth, Parasolo PVC KEE Smooth

1. Parafast RhinoBond test results with fasteners driven into 2 x 8 in (51 X 203 mm) wood joists over 15/32” (11.9 mm) plywood. Siplast does not take responsibility for the fastening of the wood substrate to the structure below.
2. Membrane must be attached to the Parafast RhinoBond PVC XHD Plates that are installed directly into the structural wood joists with Parafast #14 Fasteners. The special PVC coating on the plates allows for Palasolo PVC membrane to be welded to each plate using the RhinoBond magnetic induction welding tool. Parafast RhinoBond Plates are different in type and color: PVC plates are black in color, while TPO plates are amber in color. The appropriate PVC plate must be used with PVC membranes.
3. Fastener pull-out testing must be conducted. Minimum 1” (25 mm) Parafast Purlin Fastener embedment is required. Fastener pullout tests shall be conducted with approved fasteners. A minimum of 15 fastener withdrawal tests shall be performed for up to 50,000 square feet (4,650 square meters) of which eight are to be in perimeter and corner zones. Seven additional pullouts shall be performed for each additional 50,000 square feet (4,650 m^2). A report indicating each pullout value with a roof plan noting locations of the pullouts shall be submitted to Siplast. Roof sections with low pullout results will require additional pullout tests or the addition of purlins.

Parasolo™ PVC Design Tables

Parafast RhinoBond - Re-Cover Applications							
Existing Roofing System Type	**Attachment**	**Insulation/Substrate**					**Membrane Type**
	Mechanically[2]	Polyiso-cyanurate	Gypsum Board	Wood Fiber	EPS/XPS[3]	None	Smooth
Single-Ply Membrane	yes	yes	yes	yes	yes	yes[5] Contact Siplast	Smooth
Smooth BUR/MB	yes	yes	yes	yes	yes	yes Contact Siplast	Smooth
Granule-Surfaced BUR/MB	yes	yes	yes	yes	yes		Smooth
Gravel-Surfaced BUR/MB[1]	yes	yes	yes	yes	yes		Smooth
Standing Seam Metal[4]	yes	yes	yes	yes	yes		Smooth

1. All loose gravel must be removed.
2. Parafast Fasteners and Parafast RhinoBond XHD Plates are used to mechanically attach rigid insulation to roof decks. The special coating on the plates allows for Parasolo membrane to be welded to each plate using the RhinoBond magnetic induction welding tool. RhinoBond Plates are different in type and color: PVC plates are black in color while TPO plates are amber in color. The appropriate PVC plates must be used with PVC membranes.
3. A cover board is required over EPS/XPS. The use of EPS/XPS in the RhinoBond assembly is acceptable, but not without a coverboard.
4. When overlaying standing seam metal, minimum 16-gauge purlin attachment is required.
5. Existing single-ply must be cut into grids.

Parasolo™ PVC Attachment Table

Parafast RhinoBond - Metal Retrofit[1]				
Max. Purlin & Fastener Row Spacing	Purlin Type[2,3]	Parafast Purlin Fastener & Parafast RhinoBond PVC XHD Plate Spacing (o.c.)[4]		
		Field[5]	Perimeter	Corner
5' (1.52 m)	Min. 16 ga. (50 ksi)	24" (610 mm)	10" (254 mm)	8" (203 mm)
	Min. 14 ga. (50 ksi)	24" (610 mm)	12" (305 mm)	9" (229 mm)
	Min. 12 ga. (36 ksi)	24" (610 mm)	12" (305 mm)	9" (229 mm)

Notes:

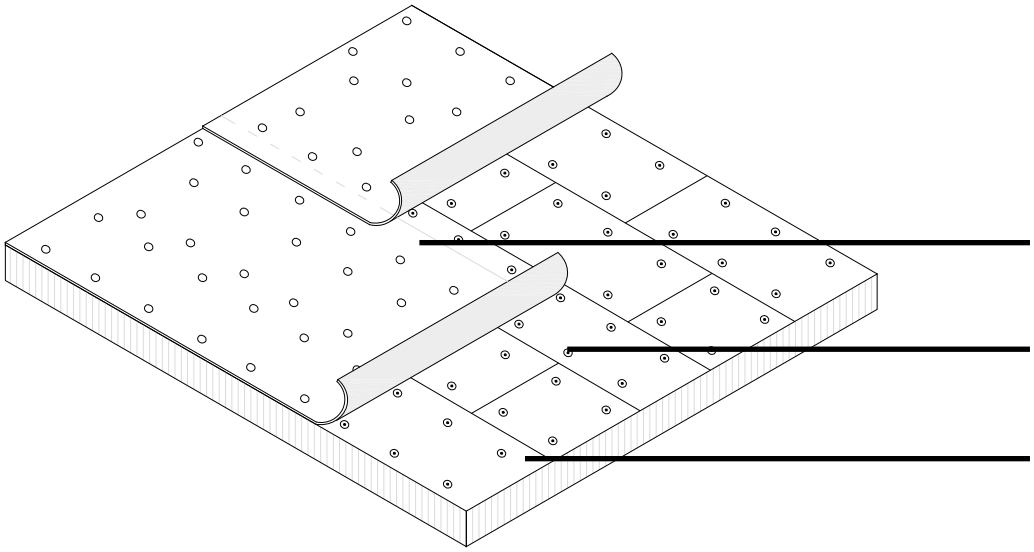
1. Consult FM Approvals, ROOFNAV listings, and FM LPDS 1-28 and 1-29 for detailed installation requirements.
2. Membrane must be attached to the Parafast RhinoBond PVC XHD Plates that are installed directly into the structural purlins with the appropriate Parafast Purlin Fasteners. The special PVC coating on the plates allows for Palasolo PVC membrane to be welded to each plate using the RhinoBond magnetic induction welding tool. Parafast RhinoBond Plates are different in type and color: PVC plates are black in color, while TPO plates are amber in color. The PVC plates must be used with PVC membranes.
3. The attachment capacity of the purlins to the secondary structure must be greater than the attachment capacity of the metal panels to the purlins.
4. Fastener pull-out testing must be conducted. Minimum 1" (25 mm) Parafast Purlin Fastener embedment is required. Fastener pullout tests shall be conducted with approved fasteners. A minimum of 15 fastener withdrawal tests shall be performed for up to 50,000 square feet (4,650 square meters) of which eight are to be in perimeter and corner zones. Seven additional pullouts shall be performed for each additional 50,000 square feet (4,650 m^2). A report indicating each pullout value with a roof plan noting locations of the pullouts shall be submitted to Siplast. Roof sections with low pullout results will require additional pullout tests or the addition of purlins.
5. Fasteners should be offset 12" (305 mm) between rows.

Parasolo™ PVC Attachment Table

Parafast RhinoBond - Attachment to Steel & Concrete							
Deck Type[1]	Min. Pull-Out Values[2]	Fastener	Plate[3]	Min. Penetration	Fasteners per 4 x 8 ft (1.2 m x 2.4 m) Insulation Panel[4]		
					Siplast Minimum	60 psf Uplift to 90 psf Uplift	105 psf Uplift to 120 psf Uplift
22-ga. Steel (33 ksi)	450 lbf (204 kgf)	Parafast XHD #15	3" (76 mm) Parafast RhinoBond XHD Plates	3/4" (19 mm) Thru Deck	6, 9, 12	6, 10, 15	N/A
	600 lbf (272 kgf)	Parafast SXHD #21		1" (25 mm) Thru Deck	6, 9, 12	6, 10, 15	N/A
22-ga. Steel (80 ksi)	450 lbf (204 kgf)	Parafast XHD #15	3" (76 mm) Parafast RhinoBond XHD Plates	3/4" (19 mm) Thru Deck	6, 9, 12	6, 10, 15	8, 15, 20
	750 lbf (272 kgf)	Parafast SXHD #21		1" (25 mm) Thru Deck	6, 9, 12	6, 10, 15	8, 15, 20
Structural Concrete (Min 2500 psi)	700 lbf (317 kgf)	Parafast HD #14	3" (76 mm) Parafast RhinoBond XHD Plates	1" (25 mm) Into Deck [3/16" (4.7 mm) Pre-drilled hole required]	6, 9, 12	6, 10, 15	8, 15, 20
	900 lbf (408 kgf)	Parafast CD-10		1" (25 mm) Into Deck [7/32" (5.5 mm) Pre-drilled hole required]	6, 9, 12	6, 10, 15	8, 15, 20
Lightweight Insulating Concrete, 22-ga. Standard Deck Form	450 lbf (204 kgf)	Parafast XHD #15	3" (76 mm) Parafast RhinoBond XHD Plates	3/4" (19 mm) Thru Form	6, 9, 12	N/A	N/A
	350 lbf (159 kgf)	Parafast HD #14		3/4" (19 mm) Thru Form	6, 9, 12	N/A	N/A
Lightweight Insulating Concrete, 24-ga. Standard Deck Form	350 lbf (159 kgf)	Parafast XHD #15 3	3" (76 mm) Parafast RhinoBond XHD Plates	3/4" (19 mm) Thru Form	6, 9, 12	N/A	N/A
	350 lbf (159 kgf)	Parafast HD #14		3/4" (19 mm) Thru Form	6, 9, 12	N/A	N/A

1. The Parafast RhinoBond Attachment System is not acceptable over gypsum, cementitious wood fiber, or OSB substrates, but it is acceptable over structural or lightweight insulating concrete decks as noted above. However, other methods of attachment may be more appropriate, depending on the project type. Contact Siplast for possible alternatives.
2. Confirm quality and condition of roof deck by visual inspection, and by fastener pull-out testing. Remove and replace all deteriorated decking.
3. Membrane must be attached to the Parafast RhinoBond PVC XHD Plates that are installed directly into the structural wood joists with Parafast #14 Fasteners. The special PVC coating on the plates allows for Palasolo PVC membrane to be welded to each plate using the RhinoBond magnetic induction welding tool. RhinoBond Plates are different in type and color: PVC plates are black in color, while TPO plates are amber in color. The appropriate PVC plate must be used with PVC membranes.
4. When installing Parafast RhinoBond Fasteners into lightweight insulating concrete that is poured over structural concrete, the fastener must penetrate a minimum of 1" (25 mm) into the underlying structural concrete deck. A 7/32" (5.5 mm) pre-drilled hole is required for Parafast CD-10 fasteners. A 3/16" (4.8 mm) pre-drilled hole is required for Parafast HD #14 fasteners.

Insulated & Non-Insulated Parafast PVC RhinoBond Attachment System Specification Plate



Membrane Type
SP = PVC

Construction Type
N = New R = Recover T = Tear Off (Complete)

Insulation
I = Insulated N = Non-Insulated

SP RB N I 60

Membrane Attachment
RB = RhinoBond

Membrane (Thickness and Type)
50 = 50 Mil Smooth 60 = 60 Mil Smooth 80 = 80 Mil Smooth 50KEE = 50 Mil KEE Smooth 60KEE = 60 Mil KEE Smooth 80KEE = 80 Mil KEE Smooth

Membrane Type	Membrane Attachment	Construction Type	Insulation
SP	RB	N R[1] T	I N

1. For a non-insulated re-cover smooth membrane only: Slip sheet or fire barrier required; 3 or 6 oz/yd² (85 or 170 g) Parasolo Polymat or approved fire-resistant slip sheet.
2. New & tear-off only. Contact Siplast for additional requirements.

XIV. Design Considerations & Application Guidelines: Parafast RhinoBond Attachment Systems

Part 1 – General

1.01 System Description

a. The Parafast RhinoBond Attachment System is an easy-to-use system that fastens Parasolo PVC synthetic membranes to the substrate below using a microprocessor-controlled induction welding machine. The synthetic roof membrane is welded directly to the specially coated, 3" (76 mm) diameter Parafast RhinoBond PVC plate.

1.02 Specification Designations

a. See page 17.

1.03 Regulatory Requirements & Pre-Job Conference

a. Conform to all applicable building and jurisdictional codes, including roof assembly wind uplift and fire-resistance requirements and slope limitations.
b. Siplast recommends at least ¼:12 of slope with proper grading and placement of drainage outlets.
c. Follow local jurisdiction requirements for disposing of used or expired adhesives, sealants, and other products subject to disposal regulations.
d. Potential problems in roofing applications, as well as potential conditions that may be detrimental to installation and performance of the roof system, should be resolved prior to the start of the application. This can best be accomplished by a pre-job meeting with the architect, roofing contractor, general contractor, all other subcontractors whose work will involve the roof system/related systems, and the manufacturer's representative.
e. The following are common items of discussion at a pre-job conference:
    1. Submittals of materials, drawings, and project documents.
    2. Roof deck conditions.
    3. Flashing and expansion joint details.
    4. Insurance underwriters or building code requirements.
    5. Unusual project conditions.
    6. Protection of the roof, building, building occupants, and contents during and after application.
    7. Application techniques.
    8. Coordination and scheduling of other trades that will be working on the project.
    9. Designation by the roofing contractor of a qualified person responsible for quality control. This person should be on the project full time during application of the roof system.
    10. Scheduling of material shipments, material storage, and rooftop loading.

1.04 Delivery, Storage, & Protection

a. Deliver products to site in original containers with seals unbroken and labeled with manufacturers name, product brand name, and type.
b. Store materials in a weather-protected environment, clear of the ground and moisture, in accordance with Siplast instructions. Store all adhesives, coatings, and sealants/caulks to protect them from freezing. Frozen material must be discarded and replaced. Properly seal all liquid material containers after use.
c. Outside storage of roofing materials:
    1. All materials stored outside must be raised above ground or roof level on pallets and covered with a tarpaulin or other waterproof and "breathable" material. Insulation products should be properly stored and weighted to avoid weather and wind damage.
    2. Factory-installed plastic covers are not designed for rooftop storage. Use "breathable" type covers, such as canvas tarpaulins, to protect from weather and moisture. If condensation is present or may accumulate inside of the factory shroud, cut and allow to vent.
    3. Cover and protect materials at the end of each day's work or conditions will be conducive to the formation of condensation.
    4. Do not remove any protective tarpaulins until immediately before material will be installed. Extreme heat or cold conditions may require special storage. Reference product data sheets for product storage requirements.
d. Follow Siplast directions and requirements for protection of roofing materials prior to and during installation.
e. Do NOT use materials that are wet or damaged to the extent that they will no longer serve their intended purposes. Remove all damaged materials from the job site.
f. When staging materials on the roof during application, ensure that the deck and structure are not temporarily overloaded by the weight of construction materials.
g. At the job site, no more material should be stored than what will be used within two weeks. For periods longer than two weeks, the materials should be properly warehoused; i.e., dry, ventilated, on pallets, etc. No more material should be stored on the rooftop than can be used within five days. When prolonged inclement weather threatens, i.e., rainy seasons, no more roofing materials should be supplied to the rooftop than can be used within two days.

1.05 Environmental Requirements & Restrictions

a. Do not apply roofing materials during inclement or threatening weather.

b. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during the same day.
c. Be aware that high or gusting winds make the installation of some materials more difficult.
d. Material installation during periods of high ambient temperature and/or humidity levels [typically above 90°F (32°C) and/or 90% relative humidity] can result in poor installation quality due to condensation on the membrane surface or excessively fast adhesive drying rates in hot, dry weather. Do not install materials when moisture, such as liquid water, dew, condensate, snow or ice, is present on the roof deck or substrate to which the materials are to be applied.
e. Material installation during periods of low ambient temperatures, typically below 45°F (7.2°C), can result in poor installation quality. To avoid these problems:
    1. Store accessory materials in a warming box.
    2. Use as soon as possible after removal from warming box.
    3. Allow adhesives to properly cure.
    4. Adjust welder settings to ensure proper welds for applicable ambient conditions.

1.06 Working Environment

a. Work should only begin when the contractor has decided to his/her satisfaction that all specifications are workable as specified, and that the contractor can meet project and code requirements.
b. The contractor should only begin roofing work when the substrate(s) have been prepared as necessary, and are ready to accept the roofing materials installed as specified.
c. Provide a safe working environment, including, but not limited to, adequate fall protection, restriction of unauthorized access to the work area, and protection of the building and its occupants.
d. Safe work practices should be followed, including, but not limited to: keeping tools in good operating order, providing adequate ventilation if adhesives are used, and daily housekeeping to remove debris and other hazards. See Section 1.07 for further details on safety.
e. Protect the building, contents, surrounding area, building occupants, and contractor personnel during work. Coordinate all work operations with the building owner and building occupants so that adequate interior protection, as necessary, is provided and disruption to normal building operations is minimized.
f. Where heavy wheeled or other traffic over the partially completed roofing is unavoidable, provide and use adequate plank or plywood, set over a minimum thickness of rigid board insulation to protect the newly installed roof.
g. Provide temporary water cut-offs and tie-ins at the end of each workday. Remove all temporary work at the beginning of the next workday.
h. When tearing off an existing membrane, limit removal to the area that will be completely reroofed that day with the new roof system.
i. If conditions are uncovered or created that would be detrimental to the proper execution of specified work, immediately notify the building owner and the designer of record of these conditions for consultation on acceptable remedy or resolution of the problem.

1.07 Safety Considerations & Warnings

a. As with any construction project, safety is a key element. All applicable safety standards and good roofing practices must be followed. Read and understand Siplast's Design & Application Guidelines before starting application. Follow all precautions and directions.
b. Only properly trained and professionally equipped roofing contractors experienced in the installation of each PVC roofing application should install these systems. Never allow contact between the heated surface of a hot welder or other tool and the applicator's hair, skin, or clothing. Always wear protective gear, including but not limited to: hardhats, eye protection, heavy-duty gloves, and snug-fitting clothing.
c. Solvent-containing accessories may be combustible and should always be kept from heat, flame, or any source of ignition. Empty containers must be disposed of in posted toxic substance landfills in accordance with local, state, and federal regulations.
d. Thoroughly train all personnel in first-aid procedures, and always comply with all OSHA safety standards and fire codes. Use extreme caution when working around equipment, such as gas lines or HVAC units, which have electrical or gas connections.
e. PVC roof membranes may be slippery when wet. Exercise caution when walking on PVC membranes during or after a rain shower, or if moisture is present in the form of dew, frost or ice. Pay attention while walking on light-colored surfaces as ice or frost build-up may not be as visible as on a dark surface.

Part 2 – Products

2.01 Membrane

a. Parasolo PVC.
b. Parasolo PVC KEE.

2.02 Flashing -Wall & Curb

a. Parasolo membrane flashing should be of the same type and thickness as the roofing membrane.
b. PVC Fleece-Back membranes are optional flashing membranes for all PVC roof systems, respectively. These membranes may be a solution when a contaminated substrate is encountered.

2.03 Flashing Accessories

a. Parasolo preformed flashing accessories must be of the same type as the roofing membrane. Parasolo KEE accessories may be used with Parasolo membranes.
b. All Parasolo accessories must be stored indoors and protected from moisture and extreme temperatures. See specific instructions on packaging for further details.

2.04 Fasteners

a. Parafast Fasteners and RhinoBond PVC Fasteners, Plates. Refer to the Parafast RhinoBond Attachment Tables. For expanded specification requirements, contact Siplast.
b. Use fasteners that are suitable for the deck type, and ensure the deck is of the required thickness and condition to ensure reliable installation and performance.
c. Fasteners used in flashings should be dictated by the substrate.

2.05 Adhesives, Sealants, Primers, & Cleaners

a. Adhesives.
    1. Solvent-Based.
        i. Parasolo PVC Bonding Adhesive (Membrane Flashing).
    3. Low-Rise Foam (LRF).
        i. Para-Stik Insulation Adhesive (insulation only).
        ii. Parafast Insulation Adhesive (Bag-in-Box)(Insulation only).
        iii. Parafast Insulation Adhesive C (insulation only).
        iv. Parafast Adhesive Canister (insulation & fleece-back membrane).

b. Sealants
    1. Parasolo FlexSeal Caulk Grade Sealant.
    2. Parasolo Water-Block.

c. Cleaners.
    1. Parasolo PVC Membrane Conditioner.

2.06 Traffic Protection

a. Parasolo PVC Walkway Roll.
    1. This product heat-welds directly to Siplast Parasolo PVC roofing membranes.
    2. The Siplast Walkway Roll is available in standard gray with a “herringbone” traction surface.
    3. The Parasolo PVC Walkway Roll features a 2” (51 mm) welding strip (smooth border) along each longitudinal edge that is compatible with hand or automatic welders.

2.07 Rigid Insulation

a. The selection of insulation type, thickness, and configuration is the responsibility of the architect, engineer, owner, or roof consultant. Siplast reserves the right to accept or reject any roof insulation as an acceptable substrate for Siplast guaranteed roof systems. Siplast must supply rigid insulation components if a Siplast Membrane/System Guarantee is required.
b. Insulation boards of the types listed below are acceptable for use in Parasolo Roof Systems guaranteed by Siplast. The minimum thickness of rigid insulation panels should be based upon flute span and/or code requirements. Refer to the Siplast Base Sheet & Rigid Insulation Usage Guide and the Siplast Parasolo Guarantee Guide for detailed information on the use of rigid insulation products.
    1. Paratherm® polyisocyanurate insulation is made of glass fiber-reinforced cellulosic felt (organic) facers bonded to a core of polyisocyanurate foam. Meets or exceeds the requirements of ASTM C1289 Type II, Class 1, Grade 2 (20 psi), and available in Grade 3 (25 psi). A cover board is recommended for all roof constructions that include the use of polyisocyanurate insulation. If a cover board will not be used, Grade 3 (25 psi) product is strongly recommended for direct-to-iso applications.
    2. Paratherm tapered polyisocyanurate is made of glass fiber-reinforced cellulosic felt (organic) facers bonded to a core of polyisocyanurate foam. It is available in various slope profiles, including, 1/8:12 (1%), 1/4:12 (2%), and 1/2:12 (4%). Meets or exceeds the requirements of ASTM C1289 Type II, Class 1, Grade 2 (20 psi), and available in Grade 3 (25 psi). A cover board is recommended for all roof constructions that include the use of polyisocyanurate insulation. If a cover board will not be used, Grade 3 (25 psi) product is strongly recommended for direct-to-iso applications.
    3. Paratherm CG flat stock panels and Paratherm CG tapered panels are made of coated glass-fiber mat (inorganic) facer laminated to a closed-cell polyisocyanurate foam core. Meets or exceeds the requirements of ASTM C1289 Type II, Class 2, Grade 2 (20 psi) and available in Grade 3 (25 psi). A cover board is recommended for all roof constructions that include the use of polyisocyanurate insulation. If a cover board will not be used, Grade 3 (25 psi) product is strongly recommended for direct-to-iso applications.
    4. Expanded Polystyrene Insulation (EPS) panels are formed by expanding polystyrene beads into blocks and cutting the blocks into sheets. EPS panels must meet or exceed the requirements of ASTM C578, Type II (nominal 1.5 lb density and minimum 15 psi (110 kPa) compressive strength). A cover board is recommended for all roof constructions that include the use of EPS insulation.
    5. Extruded Polystyrene Insulation (XPS) panels are formed from a polystyrene polymer that is extruded to the desired panel thickness. XPS panels must meet or exceed the requirements

of ASTM C578, Type IV (1.55 lb density and minimum 25 psi (172.3 kPa) compressive strength). A cover board is recommended for all roof constructions that include the use of EPS insulation.

2.08 Cover/Re-cover Boards

a. The cover/re-cover board types listed below are acceptable for use in Parasolo Roof Systems guaranteed by Siplast. A cover board is recommended for all roof constructions that incorporate a high thermal value insulation such as polyisocyanurate, EPS, and XPS and is required for specific roof constructions that require extended guarantee coverage. Refer to the Siplast Base Sheet & Rigid Insulation Usage Guide and the Siplast Parasolo Guarantee Guide for detailed information on the use of rigid insulation products.
   1. Paratherm HD Insulation is a ½" (12.7 mm) thick high-density polyisocyanurate cover board made of coated glass-fiber mat facers bonded to a high-density closed cell polyisocyanurate foam core. Meets or exceeds the requirements of ASTM C1289 Type 2, Class 4, Grade 1 (80 psi).
   2. DensDeck®[1] and DensDeck Prime Roof Board is made of glass mat facings front and back that are embedded into a water-resistant and moisture-resistant treated gypsum core. Meets the requirements of ASTM C1177.
   3. USG SECUROCK®[2] Brand Gypsum-Fiber Roof Board is a high-performance, non-combustible, moisture and mold resistant, gypsum roof board that meets the requirements of ASTM C1278.
   4. USG SECUROCK Brand Cement Roof Board is a high-performance cementitious roof board.
   5. STRUCTODEK®[3] High Density Fiberboard Roof Insulation Cover Board with Primed Red Coating is a wood fiberboard panel that meets the requirements of ASTM C208, Type II, Grade 1 and 2.

2.09 Base Sheets

a. Not typically required.

2.10 Protection Layer

a. Not applicable.

2.11 Other Accessories

a. The following items may also be required, depending on the project:
   1. Wood Nailers: New wood nailers must be #2 or better lumber. Do NOT use asphaltic or creosote-treated lumber.
   2. Roofing Nails: Galvanized or non-ferrous type and size as required to suit application.
   3. Temporary Sealant: Polyurethane foam sealant or similar as required to provide temporary watertight sealing of roofing.
   4. Fire Barrier: Gypsum panels, min. 1/4" (6.3 mm) thick (DensDeck, DensDeck Prime or SECUROCK Roof Board).
   5. Approved fire-resistant slip-sheet.

Part 3 – Execution

3.01 Site Conditions

a. Obtain verification that the building structure can accommodate the added weight of the new roof system.
b. Confirm the adequacy of the new roof system to provide positive slope-to-drain. Eliminate ponding areas by the addition of drainage locations or by providing additional pitch to the roof surface.
c. Prepare substrate surfaces thoroughly prior to application of new roofing materials. This is particularly important for re-cover and reroofing applications. Providing a smooth, even, sound, clean, and dry substrate minimizes the likelihood that underlying deficiencies will cause premature deterioration or even failure of the new roof system.
d. All defects in the roof deck or substrate must be corrected by the responsible parties before new roofing work commences. Verify that the deck surface is dry, sound, clean, smooth, and free of depressions, waves, or projections.
e. Protect building surfaces against damage and contamination from roofing work.
f. Where work must continue over completed roof areas, protect the finished roof system from damage.
g. Deck preparation is the sole responsibility of the building owner or roofing contractor. All defects in the roof deck or substrate must be corrected before roofing work commences.

3.02 Preparation Of Roofing Area – New & Tear-off Applications

a. Remove all existing roofing materials to the roof decking, including flashings, metal edgings, drain leads, pipe boots, and pitch pockets, and clean substrate surfaces of all asphalt and adhesive contaminants.
b. Confirm quality and condition of roof decking by visual inspection and by fastener pull-out testing by an individual trained by the roof fastener manufacturer. Siplast recommends these test results to be kept on file as part of the acceptability of the substrate surface for a Siplast Guarantee. Submission of results to Siplast is not required.
c. Secure all loose decking. Remove and replace all deteriorated decking.
d. Remove abandoned equipment and equipment supports.
e. Confirm that height of equipment supports will

[1]DensDeck® is a registered trademark of Georgia-Pacific.
[2]SECUROCK® is a registered trademark of USG.
[3]STRUCTODEK® is a registered trademark of Blue Ridge Fiberboard.

allow the installation of full-height flashings.

f. Refer to Section 3.06 for air/vapor retarders.

3.03 Preparation of Roofing Area – Re-Cover Applications

a. Remove all surfacing and debris from the roof surface.
b. Remove blisters and ridges from the roof membrane.
c. When re-covering over an existing single-ply roof, that roof must be first cut into maximum 10’ x 10’ (3 m x 3 m) areas before the application of new slip sheet and/or membrane.
    1. PVC must be separated from existing PVC roofs and other types of single-ply membranes and asphaltic membranes that have active sealants, including asphalt cement, single-ply adhesives, or other non-compatible materials. This can be accomplished by installing a polymat, insulation, cover board, or fleece-back PVC membrane.
    2. Installation over an existing mechanically attached membrane is only acceptable if all existing fasteners are flush and do not cause ridging/tenting of the existing membrane.
d. Remove all existing flashings, including metal edgings, drain leads, pipe boots, and pitch pockets, and clean substrate surfaces of all asphalt and adhesive contaminants. If the wall/curb flashings are in good condition and tightly adhered to the substrate, new PVC flashing materials may be installed over these to a height of 30” (762 mm) without adhesives for sheets up to 10’ (3 m) wide (dry hung). New PVC flashing materials must be installed over a layer of polymat or insulation board.
e. The existing roof surface must be free of visible moisture, such as ponding water, ice, or snow.
f. It is strongly recommended that the building owner have a moisture survey performed to ascertain the condition and suitability of the existing roofing materials to receive a re-cover system. Siplast will not be responsible for damage to the roof system resulting from moisture in the existing roof system. Remove and replace all existing roofing materials that contain moisture.
g. Confirm quality and condition of roof decking by visual inspection if possible, and by fastener pull-out testing. Remove and replace all deteriorated decking.
h. Test cuts
    1. Take test cuts to verify the existing roof construction and condition. Generally three test cuts should be made for roofs under 100 squares (920 m^2) and one test cut per 100 squares (920 m^2) above the minimum amount.
    1. Test cuts must be representative of the roof system(s).
i. Remove abandoned equipment and equipment supports.
j. Raise equipment supports to allow the installation of full-height flashings.
k. Re-cover installations over coal tar pitch roofs are not recommended.

3.04 Wood Nailer Installation

a. General
    1. Siplast recommends perimeter blocking and flashing be installed in accordance with the most current version of ANSI/SPRI ES-1 and FM Global Property Loss Prevention Data Sheet 1-49.
    2. Additionally, Siplast does not guarantee the attachment of the wood nailers, nor the performance of the wood nailers or any leaks that may be caused by nailer installation.

3.05 Gypsum Board Installation

a. General
    1. Gypsum fire barrier board must typically be installed when required by design professional or code authority to address code or approval requirements.
b. Placement
    1. Butt gypsum boards together with a 1/4” (6.3 mm) maximum space between adjoining boards. Fit gypsum boards around penetrations and perimeter with a 1/4” (6.3 mm) maximum space between board and penetration.
    2. Install gypsum boards in pieces a minimum of 2’ x 2’ (610 mm x 610 mm) in size. Every piece must be properly secured to the substrate.
    3. Gypsum boards installed in multiple layers must have the joints between boards staggered in all directions a minimum of 6” (152 mm) between layers.
    4. Gypsum boards installed over steel decking must have boards placed perpendicular to deck flutes with edges over the flute surface for bearing support.
    5. Do NOT use gypsum boards that are wet, warped, or buckled; they must be discarded. Boards that are broken, cracked, or crushed must not be installed unless the damaged area is first removed and discarded.
    6. Remove and replace gypsum boards that become wet or damaged after installation.
    7. Install no more gypsum board than can be properly covered with roofing membrane by the end of each day.
c. Securement
    1. Mechanical Attachment of Insulation.
        i. Use appropriate type and length of Parafast Fastener for the structural deck type. Refer to the Parafast RhinoBond Attachment System Attachment Table in this Manual.

3.06 Air/Vapor Retarder Installation

a. General
    1. Air/Vapor retarder components must typically be installed when required by the design professional to address internal building air

pressure or humidity conditions.

b. Application – Loose-Applied
   1. Install the air/vapor retarder components loose-applied to the deck or fire-barrier board so that wrinkles and buckles are not formed.
   2. Overlap vapor retarder components per applicable installation recommendations of the supplier. If minimum 6-mil polyethylene is used, overlap a minimum of 6" (152 mm).
   3. Seal perimeter and penetration areas with foam sealant.
   4. Seal all perimeter nailers with adhered roof membrane placed over the nailer and covering the exterior face of the nailer by 1" (25 mm).
   5. Install insulation boards over the air/vapor retarder and mechanically attach the boards to the deck.

c. Application – Adhered
   1. Apply compatible adhesive to the structural deck or fire barrier board per air/vapor retarder manufacturer's recommendations.
   2. Install the vapor retarder components loose applied to the deck or fire barrier board so that wrinkles and buckles are not formed. Broom air/vapor barrier components to ensure embedment into the adhesive.
   3. Overlap vapor retarder components a minimum of 6" (152 mm) for side and end laps. Adhere laps together with compatible adhesive.
   4. Seal perimeter and penetration areas with foam sealant.
   5. Install insulation boards over the vapor barrier and mechanically attach the boards to the deck or adhere the boards to the air/vapor retarder with compatible adhesive to achieve the desired roof system uplift resistance.

3.07 Slip Sheet Installation

a. Do not use polyester slip sheets with the Parafast RhinoBond Attachment System.

3.08 Re-Cover Board/Insulation Installation

a. General
   1. Refer to Section 2.08 of this Manual for specific Siplast requirements on cover/re-cover boards.
   2. Install insulation board and re-cover board as required in accordance with the Design Tables in this Manual.
   3. Extruded or expanded polystyrene insulation is to be used under a fleece-back membrane, with an approved slip sheet or cover board.

b. Placement
   1. Butt insulation boards together with a 1/4" (6.3 mm) maximum space between adjoining boards. Fit insulation boards around penetrations and perimeter with a 1/4" (6.3 mm) maximum space between board and penetration. Do not kick insulation boards into place.
   2. Install insulation boards in pieces a minimum of 2' x 2' (610 mm x 610 mm) in size. Every piece must be properly secured to the substrate.
   3. Insulation boards installed in multiple layers must have the joints between boards staggered in all directions a minimum of 6" (152 mm) between layers.
   4. Insulation boards installed over steel decking must have boards placed perpendicular to deck flutes with edges over flute surface for bearing support.
   5. Install tapered insulation to provide a sump area a minimum of 36" x 36" (914 mm x 914 mm) where applicable.
   6. Do NOT install insulation boards that are wet, warped, or buckled; they must be discarded. Insulation boards that are broken, cracked, or crushed must not be installed unless the damaged area is first removed and discarded.
   7. Remove and replace insulation boards that become wet or damaged after installation.
   8. Install no more insulation than can be properly covered by the end of each day with roofing membrane.
   9. EPS, XPS, or polyisocyanurate insulation may be used to fill in flutes of steel decking.

c. Securement
   1. Mechanical Attachment of Insulation.
      i. Use appropriate number, type, and length of Parafast Fastener for structural deck type. See Parasolo Insulation Attachment Tables in this Manual.
      ii. Install fastener so as to firmly secure the plate to the insulation surface without overdriving.
   2. Supplemental Adhesion of Insulation Using Foam Adhesive
      i. For supplemental securement of saddles or crickets to insulation with low-rise foam adhesive, Siplast recommends a 1" (25 mm) bead width spaced 12" (305 mm) o.c.

3.09 Parafast RhinoBond Attachment System

a. Insulation, Overlay/Re-cover Board Layout for New Construction or Complete Tear-off.
   1. For new construction over a metal deck or tear-off down to a metal deck, install insulation boards so that all edges are supported by the high flutes of the decking with no more than ¼" (6.3 mm) gap between adjoining boards. Butt the insulation and overlay/re-cover boards together with no more than a ¼" (6.3 mm) gap between boards.
   2. Overlay/re-cover boards may be installed using all full-size overlay boards in a staggered pattern. These overlay/re-cover boards include gypsum (DensDeck and SECUROCK roof board). Overlay/re-cover boards are required when using EPS or XPS as the insulation system.
   3. When installing the Parafast RhinoBond Attachment System over tapered insulation, it

is critical to ensure that the RhinoBond plates are flat or flush against the insulation surface to ensure proper welding of the plate to the membrane. For this reason, it is preferable to install the tapered insulation first and cover the tapered system with conventional base layers of flat stock and/or overlay/re-cover boards.

4. Do NOT install insulation boards that are wet, warped, or buckled; they must be discarded. Insulation boards that are broken, cracked, or crushed shall not be installed unless the damaged area is first removed and discarded.
5. Remove and replace insulation boards that become wet or damaged after installation.
6. Install no more insulation than can be properly covered by the end of each day with roofing membrane.
7. Do not align seams with rows of plates, as the step-down that is created will cause an incomplete weld of the Parafast RhinoBond Plate. Keep a 2" (51 mm) separation between the Parafast RhinoBond Plate and membrane seam.
8. Do not straddle plates over insulation joints, as the gaps will create an incomplete weld of the RhinoBond Plate.

b. Insulation, Overlay/Re-cover Board Layout in a Re-cover Application
   1. Contact Siplast for specifications to re-cover over an existing single-ply roof with no additional insulation or overlay/re-cover board.

Note: When installing Parasolo PVC, an approved separation board must first be installed, separating the existing roof from the new installation.

2. Install new insulation, overlay/re-cover board, staggering a minimum 6" (152 mm) to prevent continuous vertical joints through the full new insulation thickness. Butt the insulation and overlay/re-cover boards together with no more than a ¼" (6.3 mm) gap between boards.
3. Do NOT install insulation boards that are wet, warped, or buckled; they must be discarded. Insulation boards that are broken, cracked, or crushed shall not be installed unless the damaged area is first removed and discarded.
4. Remove and replace insulation boards that become wet or damaged after installation.
5. Install no more insulation than can be properly covered by the end of each day with roofing membrane.

3.10 Parafast RhinoBond Attachment System Installation

a. Use the appropriate length and type of Parafast RhinoBond Fasteners and Plates for the structural deck. See the Parafast RhinoBond Attachment System Attachment Table in this Manual.
b. Parafast RhinoBond Fastening Plates are different in type and color: **PVC plates are black in color.** The appropriate plate must be used with the appropriate membrane.
c. Mechanical attachment for the three distinct areas or zones of a roof:
   1. Roofs have three distinct areas or zones; field, perimeter, and corners. Each of these areas have their own attachment rates.
   2. These zones or areas have to be determined before the insulation, cover, or overlay board's fasteners are installed. A building's perimeter edges and corner areas or zones are determined by the height and width and other conditions referenced by ASCE-7 and FM Global Loss Prevention Bulletin 1-29.
d. Securing the Parafast RhinoBond Attachment System
   1. Insulation and overlay/re-cover boards are to be mechanically attached to the structural deck in accordance with the Parafast RhinoBond Attachment Table. Install the proper number of fasteners per insulation or overlay/re-cover board per roof zone or area.
   2. Fasteners installed in a straight row in one direction with even spacing makes locating fasteners under the membrane easier and speeds installation in the field of the roof.
   3. Snap chalk lines to lay out prescriptive grid pattern for field, perimeters, and corners. Consider fabricating a "template" with a termination bar marked with grid measurements to speed up chalk-lining of the grid patterns.

Note: Siplast Paratherm polyiso cyanurate boards are manufactured with grid marks.

4. Install the fasteners into the substrate using the appropriate grid pattern as established by the Parafast RhinoBond Fastening Patterns in this Manual.
5. Fasteners must be tight enough that the Parafast RhinoBond Plate doesn't turn or rock.
6. Overdriven fasteners that distort the face or top of the plate must be removed and discarded. A new Parafast RhinoBond Fastener and Plate must be reinstalled next to the original, but not into the same space and hole.
7. Underdriven or "high" fasteners must be re-driven to proper depth.
8. When installation of the Parafast RhinoBond Fasteners and Plates are complete, the area should be blown or broomed clean to remove any dirt or debris from the substrate surface or contaminates from the plate's bonding surface. This is critical so as not to have debris puncture the membrane from beneath or to impair the welding of the membrane to the Parafast RhinoBond Plate.

3.11 Parasolo Membrane Installation

a. Substrates must be inspected and accepted by the contractor as suitable to receive and hold roof membrane materials.
b. Placement
   1. Place roof membrane so that wrinkles and

buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent securement.
2. Full-width rolls can be installed throughout the field and perimeter of the roof. Half sheets are not necessary.
3. Best practice is to install membrane so that the side laps run across the roof slope lapped toward drainage points.
4. All exposed sheet corners must be rounded a minimum of 1" (25 mm).
5. For selvage edge laps of Parasolo PVC membranes, overlap the roof membrane a minimum of 3" (76 mm) and heat weld the laps.

c. Membrane Securement
1. Roof membrane must be mechanically secured at the perimeter, at the base of internal walls and curbs, and at all penetrations with Parafast Fasteners with RhinoBond Plates at 12" (152 mm) o.c. maximum spacing. Membrane may be heat-welded to coated metal flanges. A minimum of 4 fasteners per penetration is required. Note: This assembly must be placed no closer than 4.5" (113 mm) from vertical flashings and a maximum of 6" (152 mm) away to facilitate the proper placement of the RhinoBond induction welder. Specific details are available for these conditions in this Manual. Alternatively, standard mechanical base attachment can be used 12" (152 mm) o.c.
2. The metal plates must be placed within ¼"–¾" (6.3 mm – 19 mm) of the membrane edge. Plates must not be placed closer than ¼" (6.3mm) to the membrane edge.
3. Fasteners must be installed to achieve the proper embedment depth. Install fasteners vertical to the deck, without lean or tilt.
4. Since fastening patterns are different in the field, perimeter and corner areas, treat each as a separate zone and weld each zone separately. This helps ensure that all plates are welded as you move from zone to zone. Refer to the Parafast RhinoBond Attachment System Attachment Table in this Manual.

d. Membrane Surface Preparation for Seaming
1. Proper preparation of the area to be heat-welded is critical to forming a good, long-lasting seam. Heat-welding uses the thermoplastic nature of the material to melt two pieces of material together, fusing it into a single piece. In order to properly fuse these two discreet pieces together, the materials must be clean and dry; if not clean and dry, contaminants will interfere with the weld and, generally, the result is a poor or false weld.
2. Satisfactory heat welding requires that the membrane be clean of dirt and contaminates, and free from dew, rain, and other sources of moisture.
3. Factory-fresh membrane typically will not require cleaning prior to welding, provided that welding is performed immediately after placement of the membrane. Membrane that has been exposed for a longer period of time will require additional cleaning methods, depending on the type of contamination present.
   i. Any material rolled out and put into place needs to be welded the same day, including welding of any detail work.
   ii. Membrane that has been exposed overnight or for more than 12 hours, or has otherwise become contaminated, will require cleaning.

f. Seam Cleaning
1. Light Contamination: Membrane that has been exposed for a few days or less to air-borne debris, foot traffic, or dew or light precipitation can usually be cleaned with a cloth moistened with Parasolo PVC Membrane Conditioner, MEK (methyl ethyl ketone) or acetone. Be sure to wait for cleaner to dry/flash-off prior to welding.
2. Dirt-Encrusted Contamination: Membrane that is dirt-encrusted will require the use of a low-residue cleaner such as Formula 409® and a mildly abrasive scrubbing pad to remove the dirt. Rinse area thoroughly with clean water and allow to dry. This must be followed by cleaning with a cloth moistened with Parasolo PVC Membrane Conditioner, MEK (methyl ethyl ketone) or acetone. Be sure to wait for cleaner to dry/flash-off prior to welding.
3. Weather or Oxidized Contamination: Membrane that is weathered/oxidized will require the use of a low-residue cleaner such as Formula 409 and a mildly abrasive scrubbing pad to remove the weathered/oxidized top surface layer. This must be followed by cleaning with a cloth moistened with Parasolo PVC Membrane Conditioner, MEK (methyl ethyl ketone) or acetone. Be sure to wait for cleaner to dry/flash-off prior to welding.
4. Chemical-Based Contamination: Membrane that is contaminated with bonding adhesive, asphalt, flashing cement, grease and oil, and most other contaminants usually cannot be cleaned sufficiently to allow an adequate heat weld to the membrane surface. Removal and replacement of the membrane is required in these situations.
5. If Siplast Low-Rise Foam Adhesive is accidentally spilled on the surface of the finished roof, use the following procedure to clean the roof:
   i. Carefully scrape off the adhesive without rupturing the underlying roof membrane.
   ii. After removal of adhesive, cover the affected area with either Parasolo PVC smooth or

[1]Formula 409® is a registered trademark.

Summary of Seam Cleaning Recommendations

Type of Contamination	Membrane Cleaner	Method	Notes/Tips
Light	Parasolo PVC Membrane Conditioner, MEK or acetone	• Clean with cloth moistened with membrane cleaner. • Allow solvents to flash off.	• Rinse area thoroughly with clean water. • Use white terry cloth. Avoid use of industrial cleaning cloths. • Colored cloths can transfer the dye in the cloth to the area to be welded and should not be used. • Do not over-use cloths. Dispose of cloths when dirty. • Use scrub brushes sparingly as they can damage the membrane. • Drying time for cleaner increases 3-5 minutes for every 10^{F} drop in temperature.
Dirt-Encrusted	Parasolo PVC Membrane Cleaner, MEK or acetone	• Scrub with low-residue cleaner (Formula 409®) using a mildly abrasive pad. • Clean with cloth moistened with membrane cleaner. • Allow solvents to flash off.	
Weather and/or Oxidized	Parasolo PVC Membrane Conditioner, MEK or acetone	• Scrub with low-residue cleaner (Formula 409) using a mildly abrasive pad. • Clean with cloth moistened with membrane cleaner. • Allow solvents to flash off.	
Chemical Based	Not Recommended. Contact Siplast.	• Remove and replace membrane.	

fleece-back membrane.

g. Heat Welding Equipment
   1. Successful hot air welding requires the use of specialized, properly maintained and adjusted equipment operated by experienced personnel familiar with hot air welding techniques. Achieving consistent welds is a function of ensuring that the roofing membrane surface is clean and prepared for heat welding, conducting test welds to determine proper equipment settings, and evaluating weld quality after welding has been completed.
   2. Welding equipment consists of three main components: power supply, hot air welder (either automatic or hand-held), and extension cords. The newest automatic welding equipment provides improved control of speed, temperature, pressure, and membrane. The use of the latest model of automatic welder is highly recommended. Older models may not achieve consistent welds. Follow the equipment manufacturer's recommendations regarding correct equipment operation and adjustment.
      i. Current generation automatic hot-air welder (recommended).
         1. Minimum Power Supply: 220 volts, 30 amps, 10,000 watt continuous.
      ii. Current generation hand-held hot-air welder (recommended).
         1. Minimum Power Supply: 110 volts, 15 amps, 2500 watt continuous.
      iii. Commercial Grade 10,000-watt voltage-controlled generator (minimum).
         1. THD (Total Harmonic Distortion) rating should be six or less for quality welds.
         2. 240v & 120v outlets.
         3. GFCI line cords.
         4. Volt meters.
      iv. Extension Cords
         1. Automatic Welders: #10 wire with a standard plug configuration. Maximum 100' (30.5 m) in length.
         2. Hand-Held Welders: #12 wire with a standard plug configuration. Maximum 100' (30.5 m) in length.
         3. For longer lengths, consult an electrician for line voltage drop. Heavier-gauge extension cords are likely to be required.
   3. Stable power supply: Adequate wattage and consistent voltage are critical to obtaining consistent hot air welds and to prevent damage to the welder. The use of a contractor-supplied portable generator is recommended. House-supplied power is acceptable for hand welders only. Do not connect to a power source that is:
      i. Used for other equipment that cycles on

and off.
   ii. Is subject to momentary disruptions or power surges.
   iii. Incapable of providing sufficient power.
      1. THD greater than six may lead to fluctuations which may impact welding.
4. Silicone Hand Roller (used in conjunction with hand-held welders).
   i. Ensure that the roller is in good condition. Rollers with rounded edges should be replaced.

Note: Outdated welding equipment and inadequate or fluctuating electrical power are the most common causes of poor seam welds.

h. Equipment Maintenance
   1. Owner maintenance of welding equipment includes keeping the equipment safe from physical abuse and damage from the elements, keeping the welding nozzles clean from membrane residue, keeping the air filters free from clogging, and replacing heating elements when needed.
      i. Follow the equipment manufacturer's recommendations regarding other aspects of equipment maintenance and repair (i.e., motor brushes, switches, belts, etc.).
      ii. Store welding equipment in weather tight tool boxes. Tool boxes for automatic welders in particular should be fitted with cushioning foam material to protect the welder during transit and hoisting operations.
      iii. Clean welding nozzles on a daily basis with a wire brush. Nozzles have a tendency to retain membrane residue on their surfaces. This buildup of residue can interfere with welding if not removed.
      iv. Clean air filters on a weekly basis. Clogged air filters restrict air flow. This prevents the welding tool from operating efficiently, and can cause the fan motor to overheat.
      v. Heating elements are readily field-replaceable. Heating elements are vulnerable to both physical and thermal shock, particularly if the welder is shut off without first being allowed to cool down.

i. Equipment Settings
   1. Setting up the hot air robotic welder properly is key to having a properly installed roof, and performing test welds is one of the most important steps to ensure that you are obtaining a properly welded roof. Making appropriate adjustments before you begin the final welding process ensures that the correct combinations are achieved.
   2. Test welds should be performed at the beginning of every work period:
      i. Just before welding in the morning.
      ii. Upon returning from lunch in the afternoon.
      iii. When there has been a significant change in weather (e.g., air temperature, wind speed, cloud cover, etc.).
   3. The correct speed and temperature settings for automatic welders are determined by preparing test welds at various settings. The welds are tested by application of pressure causing the seam to peel apart. A satisfactory weld will fail by exposing the scrim reinforcement called a "film tearing bond." A deficient weld fails by separating between the two layers of the membrane.
   4. Adjustments to equipment settings. Many factors will affect the settings: thicker membranes, lower air temperatures, and overcast skies will generally require a slower speed than would be required with thinner membranes, higher air temperatures, and sunny skies. The slower speed provides additional heat energy to compensate for heat-draining conditions. For initial automatic air welder setting, use the formula below:
      i. Speed Formula: Start at (ambient temp/10) + 2 = FPM (Feet Per Minute)
      ii. Example: 70/10 + 2 = 9 FPM

Note: This formula serves as a starting point. Adjustments may need to be made accordingly. New equipment may run faster and hotter. Remember, settings required for a good weld will change based on equipment type, weather conditions, and membrane thickness.

   5. Cautions & Warnings
      i. Do not touch the welding nozzle and heat shield, and avoid keeping unprotected skin in the flow of hot air. The welding nozzle, heat shield, and hot air being expelled from hot air welders is very hot and can result in severe burns.
      ii. Any attempt to run a robotic welder at a speed greater than 16 ft. (9.6 m)/minimum may result in defective seam welds.
      iii. Setting the speed of the welder too fast can pose potential problems with the ability of the operator to maintain control of the welder. This is particularly true in reroofing or over uneven substrates.
      iv. Robotic welders running too fast may not allow the operator to monitor the weld width and ensure that critical T-joint areas have been correctly creased.
      v. The operator must keep in mind the relationship between ambient temperature, automatic air welder speed, heat setting, and how much weight is on the machine in order to achieve a film tearing bond (weld).

j. Test Welds
   1. Take 2 pieces of "bag fresh" Parasolo membrane approximately 18" (457 mm) long.
   2. Set the automatic welder's speed and heat. For full size welders, such as the BAK Lar-On, Siplast suggests starting at the following settings:
      i. Temperature between 800˚F (427˚C) and 1,148˚F (620˚C). Speed 10-16 feet (3.05-

4.88 m) per minute. New equipment may run faster and hotter.
   ii. For an initial setting, use the formula below as a general guideline.

Speed Formula: Start at (ambient temp/10) + 2 = FPM (Feet per Minute).

Example Scenario: Start by setting the speed at 10 FPM and the temperature at 600°F (315˚C) degrees and do a test weld. Bump temperature up 100°F (38˚C) to 700°F (371˚C) keeping same 10 FPM. Perform another test weld. Continue doing this in 100°F (38˚C) degree increments keeping speed the same until machine is maxed out [typically 1,148˚F (620˚C)] and find the weld window. Set up machine in the middle of the weld window.

Note: Remember, settings required for a good weld will change based on equipment type, weather conditions, and membrane thickness.

1. Weld the 18" (457 mm) pieces together and then allow the membrane to cool for at least 10 minutes. Cut 1" (25 mm) wide strips across the welded material. The welds are tested by application of pressure causing the seam to peel apart.
2. An acceptable weld will fail by exposing the scrim reinforcement. This is called a "film tearing bond" or "FTB". The film tearing bond will be between 1" (25 mm) and 1.5" (38 mm) wide.
3. A partial weld will fail by partially separating between the two layers of the membrane.
4. An unacceptable weld will fail by separating between the two layers of the membrane. This is also known as a "cold weld" or "false weld".
5. During cooler temperatures it is even more critical to perform test welds in the morning, after any extended break such as lunch, or after significant change in weather (e.g., air temperature, wind speed, cloud cover, etc.).
6. Hand welding during colder temperatures also needs to be adjusted.
   i. Perform test welds on membrane you will be using that day.
   ii. Do not use scrap material to create test welds.
   iii. Perform daily quality control including probing and checking seams at the end of the day.

k. Adjustments to the Hot Air Robotic Welder Settings
   1. Many factors will affect the settings, including overcast skies and lower air temperatures. This will generally require a slower speed and lower heat settings. The slower speed and heat provides the additional heat energy to compensate for heat-draining conditions.
   2. The correct speed and temperature settings for automatic welders are determined by preparing test welds at various speed and heat settings.
   3. Only make one change at a time and avoid changing heat and speed together.
   4. If you are welding at 1,148˚F (620˚C) and do not get a good weld, do not automatically adjust the speed because the temperature may be too high. Lowering the temperature or increasing speed may be a necessary adjustment.
   5. If the weld is greater than 1.5" (38 mm), you may have the temperature too high and this could lead to a failed weld over time.
   6. Having too much weight on the automatic hot-air welder combined with too high a speed setting can potentially cause wrinkle issues in the weld area.

l. Automatic Hot Air Welding of Field Seams
   1. Successful automatic welding is primarily a function of proper machine adjustment and ensuring a consistent power supply.
   2. Membrane MUST be cleaned and free from all dirt and debris prior to hot air welding of seams.
   3. Verify correct power supply voltage with a voltmeter.
   4. Determine proper welder speed and temperature settings by performing the test weld procedure.
   5. Mark all locations where automatic welding starts and stops to identify locations of possible weld discontinuities. These areas should be carefully probed and repaired as required.
   6. The weld must provide a maximum film-tearing bond of 1.5" (38 mm) and a minimum 1" (25 mm) film-tearing bond.
   7. Membrane laps must be heat-welded together. All welds must be continuous, without voids or partial welds. Welds must be free of burns or scorch marks; however, seaming of PVC membrane should exhibit bleed-out when properly welded.
   8. All reinforced membrane field seams should be made using an automatic hot air welder.
   9. Attend to all T-joints by carefully pressing each joint down by silicone roller edge or other hard-edged tool immediately after the T-joint has emerged from the automatic welder.
      i. 80-mil PVC membrane T-joints require the installation of a heat-welded membrane cover patch.

m. Hand-Held Welding of Seams
   1. Successful hand welding is a skill that involves individual technique, normally developed and refined over time. Operator should be proficient in different nozzle configurations. Correct selection of welder temperature and nozzle width can have an effect on the quality of the hand weld.
   2. Membrane MUST be cleaned and free from all dirt and debris prior to hand-welding.
   3. During basic hand welding, the hot air welder

is held in one hand, and a hard silicone roller is typically held in the other hand. When hand welding with a roller, finger pressure is often used to place and tack the upper piece of membrane in position. However, a silicone roller must always be used for final welding. Tack welding and back-tacking is not permitted in the field welding of seams.

4. The membrane must be heat-welded together using the "two-pass method". Weld from the interior on the first pass and finish the weld with the second pass.
5. The welding nozzle is introduced between the two layers of membrane, and the silicone roller is rolled back and forth perpendicular to the nozzle mouth to press the membrane together and accomplish the weld. The roller should remain flat to ensure proper compression.
6. All welds must be continuous, without voids or partial welds. PVC membrane should exhibit bleed-out when properly welded.
7. The ability to achieve satisfactory welds with the hot air welder being held in either hand facilitates welding at various angles and in various situations.
8. The weld must provide a maximum film-tearing bond of 1.5" (38 mm) and a minimum 1" (25 mm) film-tearing bond.
9. Depending on the type of welding being performed, the temperature setting will vary, as will the width of the welding nozzle.

n. Seam Probing

1. Seam probing is the physical inspection of a hot air weld area by running a suitable blunt probe along the length of a seam with horizontal pressure applied into the bottom edge of the weld. Seam probing checks the integrity of the weld to help ensure a water-tight roof system and is critical to locating small skips in a welded lap. Seam probing is NOT a replacement for conducting test welds.
2. All hot air welded seams must be physically probed with a blunt or dull cotter key puller hand tool (sharp points or edges must be filed down).
3. Contractors are responsible for initial probing of their welds. DO NOT wait for Siplast Technical Services to find issues with the welds during the roof inspection after the roof is already completed. This could lead to more difficult and costly repairs requiring re-inspection by Siplast.
4. Probing MUST be conducted daily.
5. Initial probing should be done on hands and knees.
6. Subsequent probing may be completed with a cotter key hand tool that can be affixed to standard extension handle, which allows the tool to be used from a standing position.
7. Exercise care when handling and walking with the seam probe to avoid injuries from the point end.
8. Continuous use of the probe will cause it to become sharper. Ensure that the point is blunted/rounded off at all times.
9. Allow the seam to cool down at least 30 minutes or to ambient temperature before probing. Premature probing can damage seams because the welds may still be warm.
10. Run the probing tool parallel to the edge of the seam applying ample pressure at the base of the weld. Use caution to avoid damaging the membrane surface with the point of the probing tool.
11. When probing, extra attention must be given to all membrane seam intersections, heat-welded seams above insulation joints and areas where the robotic welder stops and starts again.
12. Mark all voids, open welds or cold-welds using a water-soluble marker or crayon so repairs can be made.
13. Repair all voids, open welds or cold-welds routinely throughout the day but no later than the end of each workday using a hand-welder.
14. To make a minor repair on a seam, use a T-Joint Cover Patch, the same material type being used for the field sheet.
15. If repairs are needed for an entire open seam, use reinforced membrane a minimum of 4" (102 mm) wide. Finish the detail by heat-welding T-Joint Cover Patches at each corner. Any damage caused to the field sheet (not in the seams) must be patched with reinforced membrane.
16. All repaired seams should be probed after they have cooled completely to determine if the weld is acceptable. If the repaired seam is not acceptable, repair areas as necessary until corrected.

3.12 RhinoBond Purlin Attachment, Metal Retrofit System

a. General

1. The Parafast RhinoBond Fastener System can be used for metal retrofit applications. The RhinoBond Purlin Attachment Metal Retrofit System secures the membrane to the purlins without penetrating the roofing membrane.
2. The fasteners are installed into the purlins for maximum uplift resistance without being placed in the seams of the membrane. Once the fasteners are in place, unroll the membrane and weld the membrane to the specially coated RhinoBond plates using the Parafast RhinoBond induction welding tool. The membrane seams are then hot air welded.

b. Approved insulation flute fill must be of appropriate size and inserted in the existing metal standing seam roof panel to provide a level substrate for installation of the approved cover or insulation boards. For FM Global insured buildings where

insulation is being applied directly to a steel deck, refer to FM Global specifications/requirements.

c. The selection of insulation type, thickness, and configuration is the responsibility of the architect, engineer, owner, or roof consultant. Siplast reserves the right to accept or reject any roof insulation as an acceptable substrate for Siplast roof systems.
d. Placement of rigid insulation. See section 3.08 B 1-9 in this Manual.
e. Standard Insulation Attachment Requirements
    1. Mechanical attachment of insulation
        i. For installation of Parafast insulation fasteners and plates, refer to the insulation attachment table in this Manual.
        ii. Use fasteners that are suitable for the deck type, and ensure the deck is of the required thickness and condition to ensure reliable installation and performance.
f. Purlin Membrane Attachment requirements
    1. For RhinoBond plates to be mechanically attached to purlins with Parasolo fasteners, see the Parafast RhinoBond Membrane Purlin Attachment Table in this Manual.
g. Purlins of 18 gauge thickness or heavier require Parafast Purlin Fasteners.
h. Fastener pull-out testing must be conducted by the roof fastener manufacturer.
i. Perimeter and Corner Areas
    1. Use the formula calculation as follows: Perimeter area width is throughout the perimeter and corner region. The width of this region is defined as the least of the following two measurements: 0.1 x Building Width or 0.4 x Building Height. The minimum width is 5’ (1.5 m). This is the FM Global Formula Calculation.
j. Notes and Definitions
    1. The ridge area is defined as the high point in the roof area formed by two intersecting planes. When the sum of the slopes is a minimum of 4” (102 mm) in 12” (305 mm) or 30°, each side of the ridge shall be treated as a perimeter area.
    2. The high point of the roof that forms the ridges requires special attention and should be treated as a perimeter area.
k. Over- and under-driving of fasteners: Special care should be taken when fastening plates, so as not to overdrive or under-drive the fasteners into the purlin. Overdriving the fasteners will result in a deformation or “cupping” of the plate and will result in an uneven or inadequate bond to the membrane when welded. Under-driving the fastener will result in a loose plate with insufficient clamping force and a protruding fastener head that could cause damage to the membrane during welding and through normal roof traffic.

Note: Newly installed seams should be oriented to allow the robotic welder to run down-slope.

l. Supplemental Securement
    1. Roof membrane must be mechanically secured at the perimeter, at the base of internal walls and curbs, and at all penetrations with Parafast Membrane Fasteners and appropriate Plates at a 12” (305 mm) o.c. maximum spacing. Membrane may be heat welded to coated metal flanges.

Note: A minimum of 4 fasteners per penetration is required.

    2. Alternatively, membrane may be extended vertically 3” (76 mm) up walls and curbs and secured to the wall/curb substrate within 2” (51 mm) of the plane of the roof with a Parafast Termination Bar second with approved fasteners at a 12” (305 mm) o.c. maximum spacing. This detail is required to be used for all pressurized buildings.
    3. Mechanically attach membrane with screws and plates to the roof deck at locations of deck angle changes in excess of 1:12.
    4. Fasteners must be installed to achieve the proper embedment depth. Install fasteners vertical to the deck, or horizontal to the wall/curb without lean or tilt.
    5. Install fasteners so that the plate is drawn down tightly to the membrane surface. Properly installed fasteners will not allow the plate/termination bar to move (under-driving), but will not cause wrinkling of the membrane (over-driving).
    6. Parafast SHD (#15) Fasteners and the appropriate RhinoBond plate may be used for base attachment. Membrane attachment may also be run vertically. Consult the details in this Manual for further instructions.
m. Membrane Surface Preparation for Seaming. See section 3.11 D in this Manual.
n. Field Seaming and Cautionary Warnings. See section 3.11 E in this Manual.

3.13 Flashing Installation

Refer to the construction details that depict flashing requirements for typically encountered conditions. Install flashing materials as shown in the construction details.

a. General
    1. Flash all perimeter, curb, and penetration conditions with Parasolo PVC Coated Metal, membrane flashing, and flashing accessories as appropriate to the site condition.
    2. All Parasolo PVC Coated Metal and membrane flashing corners must be reinforced with preformed corners or non-reinforced membrane.
    3. All flashing membranes and accessories are to be heat-welded using a hand welder. Refer to Section 3.11 M.
    4. When using bonding adhesive, be sure to use adhesive specific to membrane and ambient weather conditions.
    5. Minimum flashing height is 8” (203 mm).
    6. The maximum distance from the wall that horizontal mechanical attachment should be

installed is 6” (152 mm). When you must go past 6” (152 mm), move the attachment to the vertical substrate.

7. Alternatively, Parafast fasteners and Rhino-Bond plates can be used where applicable for base termination on a mechanically attached system. Place plates and fasteners out from wall a minimum 4.5” (114 mm) to a maximum of 6” (152 mm) with spacing of 12” (305 mm), which allows the field sheet to be used as a wall flashing.
8. Installation of Parasolo PVC flashing membrane over asphalt-based substrates must have a polymat slip sheet or approved insulation boards, metal, wood, etc., under the PVC flashing membrane.
9. For membranes installed over granule-surfaced modified bitumen flashings, a polymat separator sheet must be installed for dry-hung flashings. In adhered applications, a barrier board must be installed.
10. When using Parasolo adhesives, use any one of the following substrates: polyisocyanurate insulation and high density (without foil facer), high density fiberboard roof insulation, gypsum roof board, cured structural concrete absent of curing and sealing compound, untreated OSB, untreated CDX plywood, Type X gypsum board, and dry, sound masonry absent of curing or sealing compounds.
11. DensGlass® Gold gypsum board is NOT to be used as a substrate for adhered attachment on parapet walls, according to the manufacturer.
12. Use fire-treated plywood/wood for parapet walls only if covered with an approved gypsum board for adhered Parasolo membranes only.

b. Parasolo PVC Coated Metal Flashing
   1. Parasolo PVC Coated Metal flashing allows much of the metal-work used in typical roofing applications to benefit from the security of heat-welded membrane seaming, with a corresponding reduction in required metalwork maintenance during the life of the roof system.
   2. Parasolo PVC Coated Metal must be designed in accordance with Siplast details, the applicable building code and tested for resistance in accordance to the applicable ANSI/SPRI/FM 4435/ES-1, “Wind Design Standard for Edge Systems Used with Low Slope Roof systems.”
   3. Parasolo PVC Coated Metal sections used for roof edging, base flashing, and coping must be butted together with a 1/4” (6 mm) gap to allow for expansion and contraction. Heat weld a 6” (152 mm) wide non-reinforced membrane strip to both sides of the joint. A 2” (51 mm) wide aluminum tape can be installed over the joint as a bond-breaker, to prevent welding in this area.
   4. Parasolo PVC Coated Metal used for sealant pans and scupper inserts, and corners of roof edging, base flashing, and coping, must be overlapped or provided with separate metal pieces to create a continuous flange condition, and pop-riveted securely. Coated metal flashings must be stripped in using 6” (152 mm) membranes.
   5. Parasolo PVC Coated Metal base flashings must be provided with Minimum 4” (102 mm) wide flanges screwed to wood nailers. Parasolo PVC Coated Metal base flashings must be formed with a 1” (25 mm) cant.
   6. Parasolo PVC Coated Metal flashings are attached to wood nailers or otherwise mechanically attached to the roof deck, or to the wall or curb substrate, in accordance with construction detail requirements.
   7. When installing Parasolo PVC Coated Metal on walls or curbs that completely cover the existing flashing, the flashing does not need to be removed provided that it is in good condition and tightly adhered.

c. Parasolo Adhered Reinforced Membrane Flashing -Smooth Surface
   1. The thickness of the flashing membrane must be the same as the thickness and type of the roofing membrane.
   2. Apply the adhesive only when the adhesive, substrate, membrane, and outside temperatures are above 40°F (4.4°C) and rising. Application temperatures above 50°F (10°C) are recommended to allow easier adhesive application.
   3. Porous substrates may require double application of adhesive.
   4. Application of bonding adhesive
      i. Adhesives can be applied using a roller, brush, or spray equipment. Use of a 3/8” (9.5 mm) solvent-resistant nap roller or brush is recommended. When using a roller, avoid taking the roller head out of the bucket, dropping it in one place, and beginning to roll. Instead, remove the roller filled with adhesive and drop the roller on three areas to be glued, and then connect the adhesive drop areas. This will avoid an excess amount of adhesive in one place, and it will flash off faster and more uniformly. When spraying bonding adhesive, refer to the Siplast adhesive product data sheets for viscosity and then contact spray equipment manufacturer for proper nozzle tip sizes and flow rates. Apply bonding adhesive to both the substrate surface and the underside of the flashing membrane.
      ii. Parasolo PVC Bonding Adhesive is for application of smooth membranes and requires a coverage rate of approximately 120 ft^2/gal (11.2 m^2/ 4 liters). This will cover both surfaces, yielding approximately 60 ft^2 (5.6 m^2) of finished, mated surface per gallon.
   5. Apply the adhesive only when the adhesive, substrate, membrane, and outside tem-

peratures are above 40°F (4.4°C) and rising. Application temperatures above 50°F (10°C) are recommended to allow easier adhesive application.

6. Carefully position the membrane flashing prior to application to avoid wrinkles and buckles.
   i. Please note that solvent-based adhesives must be allowed to dry until tacky to the touch before mating flashing membrane.
7. Heat-weld all laps in Palasolo smooth-reinforced flashing membrane in accordance with heat-welding guidelines.
8. Porous substrates may require a double application of adhesive.
9. Prevent seam contamination by keeping the adhesive application a few inches back from the seam area.
10. For standard solvent-based adhesives, mate membrane to the substrate coated with adhesive once the bonding adhesive has flashed off and is tacky to the touch. Water-based adhesives must be allowed to flash off completely; install membrane within one hour of drying, depending on ambient temperature conditions.
11. Roll membrane with a silicone roller to ensure complete bonding between adhesive and membrane.
12. Corner Curb Wraps, consisting of a preformed combination corner and flashing pieces that are 12" (305 mm) in height, and can be ordered in various lengths. These flashings may be dry hung or adhered in place. For adhered flashing applications, apply adhesive to both the underside of the substrate and the flashing membrane to adhere the membrane.

d. Loose (Dry-Hung) Reinforced Membrane Flashings
   1. Carefully position the Palasolo smooth or fleece-back reinforced flashing membrane prior to application to avoid wrinkles and buckles.
   2. All laps in Palasolo smooth reinforced flashing membrane must be heat-welded in accordance with heat-welding guidelines. All fleece-back membrane flashings with non-selvage edges must be stripped in using 8" (203 mm) wide flashing strips.
   3. Maximum flashing height is 30" (762 mm) without adhesives for sheets up to 10' (3 m) wide unless incremental attachment is used.

e. Non-Reinforced Membrane Flashing.
   1. Non-reinforced membrane can be used as a field-fabricated penetration/reinforcement flashing only where pre-formed corners and pipe boots cannot be properly installed.
   2. Penetration flashing constructed of non-reinforced membrane is typically installed in two sections, a vertical piece that extends up the penetration and a horizontal piece that extends onto the roofing membrane. The two pieces are overlapped and heat welded together.
   3. The non-reinforced vertical membrane flashing may be adhered to the penetration surface.
   4. All round and square pipe type flashings require Parasolo FlexSeal™ Caulk Grade Sealant or Parasolo Water-Block between the penetration and the membrane. Add and tighten stainless steel band and seal top of membrane with Parasolo FlexSeal Caulk Grade Sealant.
   5. T-joint Patches
      i. T-joint patches are to be a minimum 4" (102 mm) in size and made of non-reinforced material. They must be completely hot-air welded over the T-joint at the intersection of the three pieces of reinforced membrane. During installation, care must be taken to "crease-in" the unsupported membrane at the three step-off locations.
      ii. Pre-fabricated or field-fabricated non-reinforced membranes that match the membrane being used in the field of the roof are acceptable for T-joints.
      iii. T-joint patches are required on 80-mil PVC membranes only.

f. Roof Edging.
   1. Where required, metal roof edging should be designed in accordance with the applicable building code and tested for resistance in accordance to the applicable ANSI/SPRI/FM 4435/ES-1, "Wind Design Standard for Edge Systems Used with Low Slope Roof systems." When not required, refer to Items 2 and 4.
   2. Flash roof edges with Parasolo PVC Coated Metal flanged edging with minimum 3" (76 mm) wide flange nailed 4" (102 mm) o.c. or Parafast screws 12" (305 mm) o.c. into wood nailers with a reinforced flashing strip welded to the coated metal and to the field of the roof.
      i. For Parasolo PVC Membranes, an 8" (203 mm) reinforced heat-weldable flashing strip must be used. Cover tape products are not acceptable for use with Siplast PVC membranes.
   3. Metal roof edging must be provided with a continuous cleat to secure the lower fascia edge. Secure the continuous hook strip to the building a maximum of 4" (102 mm) o.c.
   4. Alternatively, flash roof edges with a two-piece snap-on fascia system, adhering roof membrane to metal cant with bonding adhesive and face-nailing the membrane 8" (203 mm) o.c. prior to installing the snap-on fascia.
   5. Flash roof edge scuppers with a scupper insert of Parasolo PVC Coated Metal or a Parasolo pre-fabricated coated metal scupper that is mechanically attached to the roof edge and integrated as part of the metal edging.

g. Parapet and Building Walls.
   1. There are 3 options for flashing parapet and building walls: adhered membrane flashings, metal flashings, and loose-hung flashings.
   2. Secure membrane flashing at the horizontal top edge with a termination bar. Apply Paraso-

lo FlexSeal Caulk Grade Sealant between the wall surface and membrane flashing underneath all termination bars. Exposed termination bars must be mechanically fastened 6" (152 mm) o.c. (20-year maximum guarantee). Termination bars that are counter flashed are required for extended-length guarantees and must be fastened 6" (152 mm) o.c.

3. Roof membrane must be mechanically attached along the base of walls that are flashed with membrane flashing. Attach with screws and plates/termination bar. Use a fastener spacing in accordance with the in-lap attachment requirements with a maximum 12" (305 mm) o.c. spacing.
4. Metal counter flashings with adhered or dry hung membrane wall flashings are required on 20-year guarantees or longer. (They are not required for guarantees of less than 20 years.) All termination bars, either exposed or covered, must be sealed with Parasolo FlexSeal Caulk Grade Sealant or Parasolo Water-Block.
5. Flash wall scuppers with a scupper insert of Parasolo PVC Coated Metal that is mechanically attached to the wall and integrated as part of the wall flashing. Refer to Scupper section for other detail options.
6. Where required, metal cap flashings should be designed in accordance with the applicable building code and tested for resistance in accordance with the applicable ANSI/SPRI/FM. 4435/ES-1, "Wind Design Standard for Edge Systems Used with Low Slope Roof systems."
7. Maximum flashing height without intermediate fastening:
   - 30" (762 mm) – Loose-Applied Flashing
   - 54" (1.4 m) – Adhered Flashing
8. Metal cap flashings must have continuous cleats or be face-fastened 12" (305 mm) o.c. on both the inside and outside of the walls.

h. Round and Square Tube Penetrations
   1. Four options are available for penetration flashings: stepped pipe boots, split pipe boots, square tube wraps, and field fabrication with unreinforced membrane and target. The Parapro 123 Flashing System may also be used for flashing penetrations through a Parasolo PVC KEE System. See 3.13 for more information.
   2. Prior to flashing application, the field membrane must be mechanically attached at the base of each penetration with screws and plates a maximum of 12" (305 mm) o.c., with a minimum of four fasteners per penetration.
   3. Install Parasolo Water-Block behind the flashing membrane at the top of the flashing, add the draw band and apply Parasolo FlexSeal Caulk Grade sealant around the top of the flashing. All flashings using PVC materials require the installation of a stainless steel draw band around the top of the flashing.

i. Fluid-Applied Penetration Flashings (Parasolo PVC KEE Systems only)
   1. Penetrations through a Parasolo PVC KEE System may be flashed using the Parapro 123 Flashing System as a premium flashing option (see the Parapro 123 Flashing System Installers Guide and published details for more information).
      i. Ensure that the Parasolo PVC KEE field sheet fits tightly around the penetration. Fill voids where the membrane terminates at penetrations with Parasolo Flexseal Caulk Grade and allow the sealant to cure.
      ii. The Parasolo PVC KEE field sheet must be mechanically attached at the base of each penetration with appropriate screws and Parafast RhinoBond PVC Plates a maximum of 12" (305 mm) o.c., with a minimum of four fasteners per penetration. Galvalume plates are not approved as a substrate for Parapro Flashing Resin.
      iii. Remove all foreign materials from the penetration by grinding or sanding. Refer to the substrate preparation chart in the Parapro 123 Flashing System Installers Guide for more information on approved substrates and preparation requirements.
      iv. Using Siplast Pro Prep or Parasolo PVC Membrane Conditioner and a clean shop rag, wipe the area of the penetration and the Parasolo PVC KEE field sheet to receive the flashing materials and allow to dry.
      v. Using masking tape, mask off the area to receive the flashing, including the top termination of the flashing and the area a minimum of 3 inches onto the field sheet beyond the outermost edge of the Parafast RhinoBond PVC Plates.
      vi. Cut the Pro Fleece reinforcement for the penetration.
      vii. Mix the Pro Catalyst and Parapro Flashing Resin as detailed in the mixing instructions and apply a base coat of catalyzed Parapro Flashing Resin to the vertical penetration surfaces, extending onto the field membrane a minimum of 2 inches.
      viii. Apply the pre-cut Pro Fleece to the vertical penetration surfaces by embedding the fleece in the resin, extending the fleece a minimum of 2 inches onto the field membrane. Saturate all fleece surfaces to be lapped with catalyzed Parapro Flashing Resin. Strips of fleece must overlap by at least 2 inches (50 mm).
      ix. Apply a generous base coat of catalyzed Parapro Flashing Resin to the horizontal surface to be flashed. Apply the pre-cut Pro Fleece to the horizontal surface by embedding the fleece in the resin. Saturate all fleece surfaces to be lapped with catalyzed Parapro Flashing Resin. Strips of fleece

must overlap by at least 2 inches (50 mm). Care should be taken to ensure that a sufficient base coat of resin is applied to allow for full adhesion and saturation of the Pro Fleece, especially over and at the perimeter of the fastener plates to avoid tenting and voids once the Pro Fleece is installed. Top coat the embedded Parapro Fleece with an additional layer of catalyzed Parapro Flashing Resin. Remove the masking tape before the resin sets completely.

j. Irregularly Shaped Penetrations
   1. Metal Sealant Pans /Pre-Formed PVC Accessories
      i. Flash irregularly shaped penetrations with flanged sealant pans formed of Parasolo PVC Coated Metal, secured to the deck through the roof membrane with screws 6" (152 mm) o.c., a minimum of two per side.
      ii. Strip in metal flanges with 8" (203 mm) wide membrane flashing strips and vertical pop riveted seams with 4" (102 mm) unreinforced membrane.
      iii. Fill sealant pans with non-shrink quick-set grout. Top off sealant pans with a 2" (51 mm) minimum thickness of an approved Parasolo Sealant. If using Parasolo FlexSeal Caulk Grade Sealant, after priming, increase the grout to within 1/2" (13 mm) from the top of the pocket, and install the Parasolo FlexSeal to the very top or overfill the pocket.
      iv. Installation of pre-formed PVC sealant pans requires the flange of the PVC sealant pan to be fastened with a minimum of 4 fasteners per penetration. A PVC membrane target is installed around the base of the sealant pan over the flanges of the PVC sealant pan and heat welded to the flanges. Install the fasteners near the outside edge of the flanges to allow for proper heat welding of the target. The outside edge of the target membrane is heat welded to the field membrane.
      v. If a preformed sealant pan is cut to install around the penetration, the cut must be stripped in with a minimum 4" (102 mm) wide non-reinforced membrane. The non-reinforced strip-in membrane must extend a minimum of 2" (51 mm) beyond the outside edge of the sealant pan flange and be fully welded.

k. Curbs
   1. Flashings can be applied two different ways, either with adhesive applied to the membrane and substrate, or loose-applied (dry-hung) up to 30" (762 mm) high.
   2. Secure membrane flashing at the top edge with a termination bar. Apply Parasolo FlexSeal Caulk Grade Sealant or Parasolo Water-Block between the curb surface and membrane flashing. Exposed termination bars must be mechanically fastened 6" (152 mm) o.c. Termination bars that are counter flashed may be fastened 12" (305 mm) o.c. If wood is present at the top of the curb, install ring shank nails 12" (305 mm) o.c. after wrapping the membrane to the inside of the curb. This can be used in lieu of the termination bar if nailed on the top or preferably the inside of the curb.
   3. Roof membrane must be mechanically attached along the base of curbs and ducts that are flashed with membrane flashing with screws and plates/termination bar at 12" (305 mm) o.c.
   4. Metal counter flashing must be used for extended guarantee lengths. All termination bars must be sealed with Parasolo FlexSeal Caulk Grade Sealant or Parasolo Water-Block.

l. Expansion Joints
   1. Roof membrane must be mechanically attached along the base of raised curb expansion joints with screws and plates a minimum of 12" (305 mm) o.c.
   2. Field-fabricated expansion joint bellows must be twice the width of the expansion joint opening to allow for proper expansion/contraction.

m. Roof Drains
   1. Roof drains must be fitted with compression clamping rings and strainer baskets. Both traditional cast iron and aluminum drains, as well as retrofit-type cast aluminum and molded plastic drains, are acceptable.
   2. Roof drains must be provided with a minimum 36" x 36" (914 mm x 914 mm) sumped area if possible. Slope of tapered insulation within the sumped area must not exceed 4:12.
   3. Extend the roofing membrane over the drain opening. Locate the drain and cut a hole in the roofing membrane directly over the drain opening. Provide a 1/2" (13 mm) membrane flap extending past the drain flange into the drain opening. Punch holes through the roofing membrane at drain bolt locations.
   4. For cast iron and aluminum drains, the roofing membrane must be set in a full bed of Parasolo FlexSeal Caulk Grade Sealant or Parasolo Water-Block on the drain flange prior to securing with the compression clamping ring.
   5. For fleece-back roof membrane applications, the fleece-back membrane is cut just short of the drain flange. A separate smooth reinforced membrane drain flashing sheet is heat welded to the roofing membrane and set into the drain above in a full bed of Parasolo FlexSeal Caulk Grade Sealant or Parasolo Water-Block and secured as above.
   6. Do NOT locate lap seams within the sump area. Where lap seams must be located within the sump area, a separate smooth reinforced membrane drain flashing a minimum of 9" (229 mm) larger than the sump area must be

installed. The membrane flashing must be heat welded to the roof membrane. Alternatively, if the seam does not run under the clamping ring, it can be covered with a 6” (152 mm) wide reinforced membrane strip heat welded to the membrane.

7. Tighten the drain compression clamping ring in place.

n. Retrofit Drain Inserts
   1. Drain inserts must only be used in the event the original drain is damaged and cannot be repaired without complete replacement of the drain. Drain inserts will reduce water flow. Consult the design professional to ensure that adequate drainage is maintained.
   2. Clean the drain lines a minimum of 24” (610 mm) where the drain insert is to be installed. Failure to clear this section of drain line can prevent the sealing of the drain and degrade the performance of the drain seal and is required.
   3. All drains must be provided with a drain sump of 36” (914 mm) x 36” (914 mm) minimum dimension, if possible. Fasteners must be installed 12” (305 mm) o.c. or a minimum of 4 per penetration.
   4. The drain insert is installed on top of the roofing membrane and is secured to the roof deck 6” (152 mm) o.c. with appropriate fasteners.
   5. A separate reinforced membrane drain flashing sheet is heat welded to the roofing membrane. The drain flashing sheet is heat welded to a compatible drain flange.
   6. Install the drain clamping ring if applicable.
   7. All drains must be provided with a strainer basket.
   8. Roof drains must be open and functioning.

o. Scuppers
   1. Parasolo Coated Metal roof edge scuppers must be provided with a minimum 4” (102 mm) wide flange nailed to wood nailers, with hemmed edges and secured with continuous clips in accordance with the gravel stop assembly.
   2. Parasolo Coated Metal wall scuppers must be provided with 4” (102 mm) wide flanges, with additional corner pieces pop-riveted to the flanges to create a continuous flange. All flange corners must be rounded.
   3. Scuppers must be set in a bed of Parasolo FlexSeal Caulk Grade Caulking or Parasolo Water-Block for additional resistance to movement.
   4. Install wall scuppers over the roof and flashing membrane and secure to the roof deck/wall with appropriate fasteners 6” (152 mm) o.c., a minimum of 2 fasteners per side.
   5. All corners must be reinforced with Parasolo PVC Universal Corners or field fabricated from Parasolo non-reinforced materials.
   6. Strip in scupper with flashing membrane target sheet.
   7. Alternatively, a wall scupper box may be field flashed using non-reinforced flashing membrane heat welded to membrane on the wall face and roof deck. Be sure that all corners are reinforced with universal corners or non-reinforced Parasolo material. Fully adhere to the scupper box and terminate on the outside wall face with a termination bar and Parasolo FlexSeal Caulk Grade Sealant or Parasolo Water-Block.

p. Heater Stacks
   1. The temperature of any heater stack that comes into contact with the Parasolo membrane or flashing should not exceed 140°F (60°C).
   2. Field-fabricated two-piece membrane flashings of Parasolo non-reinforced flashing are typically installed at heater stacks. PVC cone-type prefabricated pipe flashing may work in these applications.
   3. Heat stacks must be equipped with either cone-shaped or vertical tube-type flashing sleeves so that the membrane flashing is not directly in contact with the heater stack.
   4. Mechanically attach the roof membrane to the structural deck with Parafast screws and plates around the penetration base prior to flashing installation.
   5. All stack flashings must be secured at their top edge by a stainless-steel clamping band over Parasolo FlexSeal Caulk Grade Sealant or Parasolo Water-Block. Seal the detail with Parasolo Caulk Grade Sealant.
   6. Field-fabricated membrane flashings may be adhered to the flashing sleeve with Parasolo adhesives. Make sure to use the correct bonding adhesive with the membrane being installed.

q. Wood Support Blocking
   1. Wood support blocking, typically 4” (102 mm) x 4” (102 mm), is usually installed under light-duty or temporary roof-mounted equipment, such as electrical conduit, gas lines, and condensation and drain lines.
   2. Install wood support blocking over a protective layer of Parasolo PVC walkway pads. Place wood blocking on oversized slip sheet, fold two sides vertically, and fasten with roofing nails into the blocking.
   3. Do not use pre-fabricated pipe stands with rubber-like bases.

r. Satellite Dish Support Bases
   1. Install non-penetrating satellite dish support bases over a protective layer of PVC membrane.

s. Lightning Suppression
   1. Secure lightning suppression cable to the roof surface by means of 2” (51 mm) wide Parasolo PVC Flashing membrane strips heat-welded to the roof membrane.

2. Secure lightning rod to reinforced Parasolo membrane patch that is heat welded in place. Securement should not penetrate the roof membrane.

3.13 Traffic Protection

a. Parasolo PVC Walkway rolls must be cut into the appropriate lengths and installed at all roof access locations, including ladders, hatchways, stairs, and doors. Install walkway rolls at other designated locations, including roof-mounted equipment work locations and areas of repeated rooftop traffic.
b. Walkway rolls must be spaced 6" (152 mm) to allow for drainage. Edges of walkway rolls or pads must be placed 6" (152 mm) from any seam.
c. Heat-weld walkway rolls to the roof membrane surface continuously around the walkway roll or pad perimeter.

3.14 Temporary Closures

a. The roofing installation must be made watertight at the end of each day's activity to prevent water infiltration into the completed roof system installation.
b. Complete all flashings and terminations as the roofing installation progresses.
c. Remove all temporary night-seal materials prior to continuing with the roof installation and dispose of properly.

3.15 Field Quality Control

a. Field quality control should be performed in accordance with NRCA's Quality Control and Quality-Assurance Guidelines for the Application of Membrane Roof Systems.
b. Inspect completed roof sections on a daily basis. It is the contractor's responsibility to probe all heat-welded seams and perform an adequate number of seam cuts to ascertain seam consistency.
c. Immediately correct all defects, irregularities, and deficiencies identified during inspections. All voids that are found must be patched over per specifications. Do NOT re-weld seam voids more than 24 hours after initial welding of the seam.
d. Remedial work must be performed with like materials and in a manner consistent with the balance of the roofing installation so as to minimize the number of repair patches.

3.16 Clean-Up

a. Remove bonding adhesive, bituminous markings, and other contaminants from finished surfaces. In areas where other finished surfaces are soiled by asphalt or any other source of soiling caused by work of this or other sections, consult manufacturer of surfaces for cleaning advice and conform to those instructions.
b. Cut and remove any sheet membrane contaminated with solvent-based adhesive, bituminous markings, and other contaminants from finished surface.
c. Cleaning the adjacent area with an all-purpose cleaner, then rinse off soapy residue.
d. Wipe/Clean with Parasolo PVC Membrane Conditioner, MEK (methyl ethyl ketone) or acetone. Refer to Section 3.11 F.
e. Complete the repair by installing a patch of like material to specific system requirements.

3.17 Maintenance

a. Upon completion of the roof system, the owner should establish a semi-yearly inspection and maintenance program in accordance with standard good roofing practice and guarantee requirements.
b. Repair of any damage or defect should follow Siplast recommendations.

Siplast
1000 Rochelle Blvd.
Irving, Texas 75062
469-995-2200
Facsimile: 469-995-2205

In Canada:
201 Bewicke Ave., Suite 208
Vancouver, BC,
Canada V7M 3M7
604-929-7687

Customer Service in
North America:
Toll Free 1-800-922-8800

www.siplast.com

For information on Siplast Roofing and Waterproofing Systems, scan our QR Code.

September 2019