Siplast Thermoplastic Roof Systems

Design Guide

siplast®

With you every step of the way

This guide is intended as a reference tool for architects, engineers, and consultants with regard to general design considerations. This document does not include information regarding specific applications or installation instructions. For specific installation information by application type, please refer to one of the following guides.

Parasolo Adhered Systems Application Guide

Parasolo Mechanically-Attached Systems Application Guide

Parasolo Rhinobond Systems Application Guide

Parasolo Hybrid Systems Application Guide

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I. Siplast Engineered Thermoplastic 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 product design and excellent service. Since the 1980s, our roofing and waterproofing systems have protected mission-critical facilities with robust membrane systems and highly engineered liquid-applied membranes.

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 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 membrane guarantees for a roofing system applied in accordance with the general recommendations in this guide when the system is constructed according to the appropriate Siplast specification by a Siplast Select Contractor, provided all required pre- and post- 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. 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 suitability of any roofing system for a particular project lies with the architect, engineer, roof consultant, and owner.

By publishing the specifications and design criteria contained in this guide, Siplast is not providing any guarantee or warranty, expressed or implied, other than that contained in our published guarantees.

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.

Parasolo Thermoplastic Roof Membrane Systems

Parasolo Roof Membrane Systems are appropriate in situations where a synthetic membrane meets the needs of the designer and/or building owner. With Parasolo membranes, 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 a high quality combination of PVC and KEE plasticizers, offering the ultimate thermoplastic roof membrane protection.

Parasolo TPX membranes also offer excellent thermoplastic properties for roofing applications. The Parasolo TPX membrane formulation has been tested to withstand conditions that exceed the most rigorous proposed ASTM standards for TPO membranes.

Parasolo PVC, PVC KEE, and TPX 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 and TPX are installed via:

1. Mechanically attached applications.
2. Adhered applications.
3. RhinoBond®[1] applications.
4. Hybrid applications in conjunction with Siplast Paradiene SBS modified bitumen base plies.

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

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Parasolo PVC, PVC KEE and TPX Roof Membranes are three of several Siplast solutions for cool roofing applications. White Parasolo PVC, PVC KEE and TPX membranes meet 2016 Title 24, Part 6, Cool Roof Requirements of the California Code of Regulation and may help qualify a project for LEED credits (reflectance and emittance).

II. Roof Design Considerations

General Requirements

Proper roof system selection and design 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 selection of Parasolo PVC, PVC KEE and TPX 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

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/physical damage or abuse, rooftop-exhausted contaminants, photovoltaic (PV) solar applications, and the use of the roof as living or usable 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 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.
- Ensure 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, and appropriate treatment 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 result in damage to 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 Damage or 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 hail storms or high winds, and prolonged periods of temperature extremes or rapid fluctuations in temperature may require a more durable roof system.

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 higher compressive strength insulation substrate.
- Use of a high compressive strength cover board.
- Application of a concrete paver or insulated paver overlay for extreme conditions.

Contamination

Many roofing installations are exposed to oil, grease, and/or 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.

Certain families of contaminants degrade most roofing materials, and can cause the membrane to become brittle, swell and soften, or dissolve, depending on the material formulation and contaminant type.

Unforeseen combinations of contaminants, environmental exposure effects, cleaning compounds, 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 areas 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 www.siplast.com for chemical resistance information. Siplast guarantees on any Siplast membrane, including Parasolo PVC, PVC KEE and TPX, do not cover damage due to exposure to chemical contaminants.

III. 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 for wind uplift resistance 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.
- FM Global Property 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 the local code agency for the latest version that has been adopted.

Canadian Standards Association (CSA) document CSA A123.21:20 "Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane-Roofing Systems"

- A comprehensive analysis of wind forces acting on buildings.
- Requires detailed calculations to determine actual wind pressures at different regions of the roof.
- Developed in compliance with the Standards Council of Canada requirements for the National Standards of Canada.

Siplast guarantees cover leaks due to winds speeds up to 63 miles per hour only. Additional wind coverage may be available for purchase on eligible systems. Contact Siplast for more information.

IV. 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 specific roof assembly. Refer to current Parasolo listings in the appropriate UL directory or RoofNAV listing to verify roof assembly requirements for specific fire ratings.

V. 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 cause damage to the roof system, the building itself, and interior contents by providing a reservoir of water that can 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.

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.

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

VI. 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 techniques.
- Matching of architectural elements such as special perimeter metalwork.
- Repair of deteriorated parapet and penthouse walls.
- Protection of the roofing membrane by means of a concrete paver overlay or walkway pad system.

Tear-Off/Replace

Factors that support the tear-off approach include:

- The presence of two or more existing roofs (building code restriction).
- Structural weight limitation.
- More than 25% of the existing roof area is wet. If less than 25%, removal and replacement of wet areas is still necessary.
- 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 applied roofing materials adjacent to tear-off areas from exposure to dirt, debris, and damage.

Re-Cover

Factors that support the re-cover approach include:

- Desire to minimize cost;
- Desire to retain existing components that provide thermal value;
- 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 or damaged 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 some white thermoplastic membranes. Coal tar pitch may also “cold flow” through fastener holes into the substrate. For these reasons, Siplast does not typically recommend recovering over existing coal tar pitch roofs.

Re-covering Over Asphalt-based Roofing

Asphalt and asphalt residue may discolor PVC/PVC KEE/TPX 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.

VII. 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, PVC KEE or Parasolo TPX 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 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, peel 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 before the application of rigid insulation panels applied in hot asphalt.

Precast 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 are 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.

Prestressed 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 prestressed 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 before application of the roof system. 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 dryness through appropriate means. Depending upon the composition of the concrete, extended drying time may be required.
- 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 must be attached with approved fasteners at required spacing.
- Plywood sheathing should 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 minimum C-D Exposure 1 APA Rated, minimum 4 ply.
- Plywood sheathing must comply with Structural 1 performance rating.
- Panels must be gapped in accordance with plywood industry standards.
- Moisture content shall not exceed 16% by weight.
- Decking should be kept dry and roofed promptly after installation.
- Plywood must be installed over joists spaced not greater than 24" (610 mm) o.c. A vapor retarder and 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.

Gypsum Concrete

- Minimum 2" (51 mm) thickness.
- Steel reinforcing mesh and permanent form boards are required for poured-in-place monolithic decks.
- Steel-reinforced edges are required for precast decking units.
- Fastener withdrawal tests are recommended to verify fastener pull-out values will meet design minimum requirements. 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 the surface is either wet or frozen, a poured gypsum deck is not suitable to receive a roof.

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.

- Fastener withdrawal 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 Applicator 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 NVS System has been engineered for use over non-venting substrates and in reroofing and recover 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 Applicator 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 Applicator 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 the 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, PVC KEE and TPX Membrane Systems Installed over Lightweight Insulating Concrete
In all cases in which lightweight insulating concrete is installed or present beneath a mechanically attached or Rhinobond Parasolo Membrane 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.

- Metal roof panels, unless secured to structural purlins.
- Transite roof panels.
- Fiberglass roof panels.

Contact Siplast regarding the suitability of unusual deck substrates.

VIII. 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.

IX. Air Barriers

1. Designers should consider specifying an air barrier:
   a. On all air porous (permeable?) decks, with openings in the walls or areas directly below the roof deck that exceed 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.

X. Wood Nailers

Install treated wood nailers wherever specifications require the use of gravel stops or other perimeter metal components, curbing, wood cants, insulation stops, or the mechanical fastening of roofing membrane. Mechanically attach the nailers to the structural deck or supporting members following current FM Global requirements and local building code regulations. Nailers should be flush with the deck surface or, if insulation is used, nailers should be of the same thickness as the insulation. Nailers should be treated with a preservative compatible with thermoplastic membranes. Where pressure treated lumber is used over steel decks or in conjunction with metal accessories, a compatible separation layer should be considered for placement between the nailer and metal surfaces. Mechanical fasteners and connectors used to anchor wood nailers to roof decks and to fasten metal flanges to the nailers should be treated or pre-coated to meet current maximum corrosion resistance guidelines as recommended by the NRCA.

XI. Parapet Walls

Most common structural wall types are suitable substrates for the installation of Parasolo PVC/PVC KEE/TPX membrane flashings.

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 should not exceed 16% by weight.

Sheet Metal

- Minimum 24-gauge steel.
- Minimum 0.032" (8 mm) aluminum.
- Corrugated panels require an 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.
- The use of gypsum panels as a substrate for flashings requires Siplast approval.

Re-Covering Over Asphalt-Based Roofing

- Asphalt and asphalt residue may discolor PVC, PVC KEE and TPX 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.

XII. 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 building structure itself as well as roofing components. 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.
- Whenever possible, extend expansion joints at least 8" (203 mm) above the roof surface on curbs and use metal expansion joint covers. Alternatively, a low-profile expansion joint can be used; see Parasolo PVC and TPX 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.

XIII. Independent Wall Flashing Treatments

Flashing assemblies should be isolated from vertical surfaces at transitional areas between decks and walls where the deck is independently supported from the wall, or where the potential exists for differential movement between wall supported decks and vertical surfaces. Where these conditions exist, an L-metal component, fabricated of 24-gauge galvanized steel and including a 4-inch flange and 8-inch vertical leg, should be mechanically attached to a nailer that is well secured to the deck. Membrane flashing application should be accomplished following the methods and using the materials required by Siplast. All independent wall flashing details must be adequately counter flashed.

XIV. 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 recover roof system applications.
- Sufficient clearance around and beneath the equipment to facilitate roof membrane or flashing 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 of components can damage the substrate or membrane.

XV. Rooftop Additions

All openings, projections, and rooftop equipment added to a completed Siplast roof that either penetrate or are placed directly on the membrane should be detailed according to Siplast requirements by a Siplast Select Contractor. In such cases, the Siplast Technical Department should be notified prior to commencement of any work. Rooftop additions such as prefabricated curbs, piped supply lines, flanged metal flashings, and lightning protection equipment vary in materials and design and should be individually evaluated prior to installation. Please contact the Siplast Technical Department for specific information.

XVI. Area Dividers

Area dividers are not structural expansion joints and have traditionally been used to minimize the effect of thermal expansion on membranes that can be adversely affected by such or to separate different roof or flashing systems. Area dividers can be either a curb or low-profile type. Contact Siplast for recommendations regarding area dividers.

XVII. Night Seals

Night seals are necessary to ensure that water does not migrate beneath the new membrane during breaks in application. At the end of the day's work, or when precipitation is imminent, a night seal must be installed at all open edges. Such tie-ins should be constructed with compatible materials to withstand protracted periods of service. Night seals must be completely removed prior to the resumption of work.

XVIII. Walkways

For Siplast Thermoplastic Roof Systems, the use of Parasolo PVC / TPX Walkway Rolls is recommended in areas with anticipated high levels of pedestrian traffic or potential mechanical abuse.

With you every step of the way

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