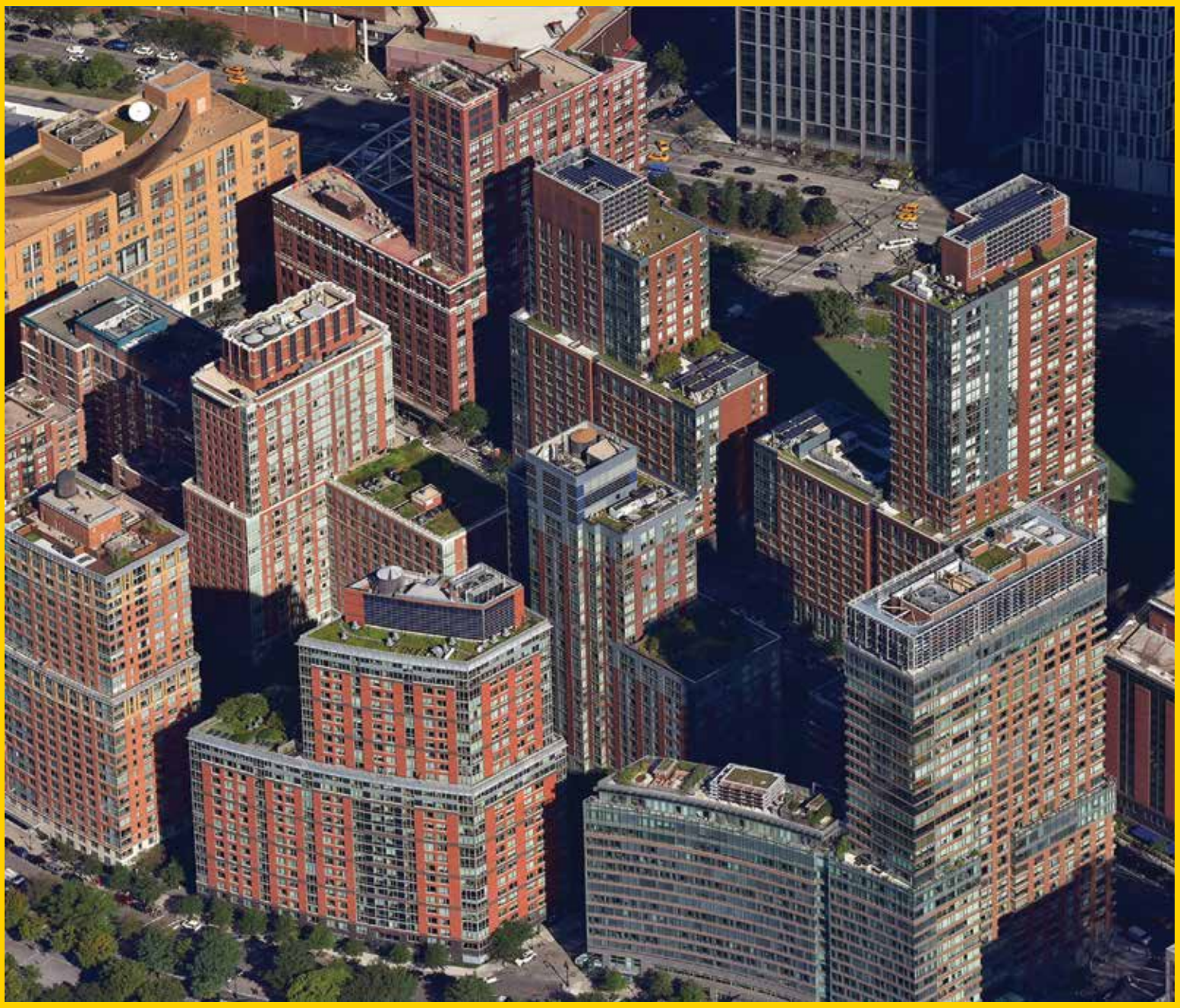

PROTECTED MEMBRANE ROOF (PMR) PLANNING GUIDE

LONGEVITY, PERFORMANCE & SUSTAINABILITY

HYDROTECH

BUILDING TRUST

Sika®

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Make Your Vision a Reality

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Harvey Mudd College - Claremont, CA

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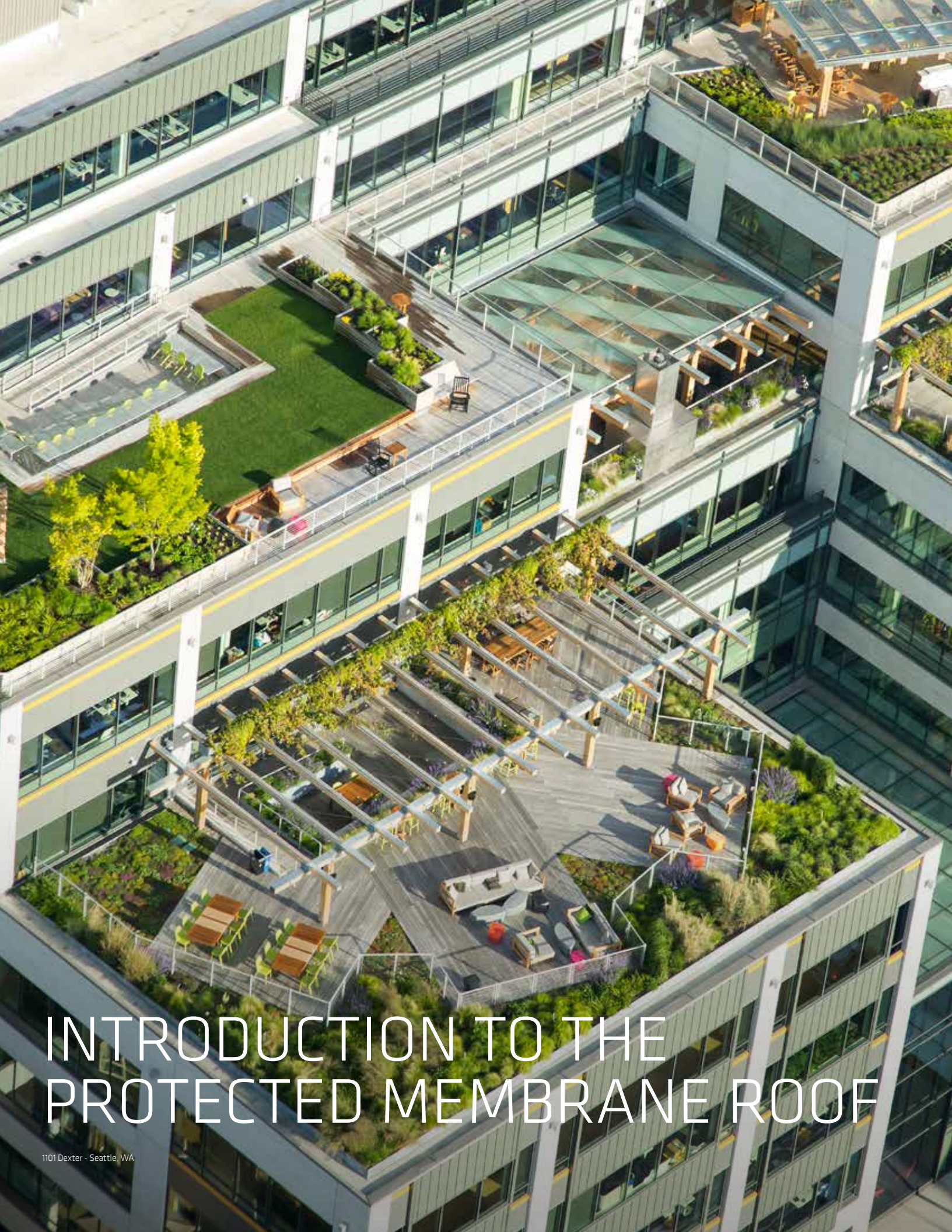


INTRODUCTION TO THE PROTECTED MEMBRANE ROOF

1101 Dexter - Seattle, WA

Introduction

The Goal of this Roofing Guide

It seems simple enough. A roof is expected, at the very least, to keep water from getting into a building. If you're a building owner you may not think about your roof until it leaks. If you're an architect you are expected to get it right, the first time. But the fact remains, over 50% of all building litigation revolves around water entry into the building, so getting it right apparently isn't easy.
There are three (3) keys to a successful roof installation:

1. Good design
2. Quality materials and assemblies
3. Experienced workmanship

The design professional has great control over the first two and can certainly establish the parameters of the third. If any of the three keys miss the mark, it's not a question of if the roof will leak, but when.

No matter if the structure is an office tower, a health care facility, part of a university or museum; these buildings are built to last. Why shouldn't the roof membrane assembly chosen be equal to the task? If your building absolutely "can't leak" and you only want to do this once, then recognize initial cost isn't as important as long-term performance. The initial cost of a quality roof installation will ALWAYS be much less than the cost to replace one that has failed prematurely. Remember, you typically get what you pay for.

The focus of this guide is Hydrotech's flag ship product, Monolithic Membrane 6125® (MM6125®); a hot fluid applied, rubberized asphalt membrane which forms the foundation of each of the Protected Membrane Roof (PMR) Assemblies Hydrotech provides.

Just what is a PMR Assembly? That's a very good question! In the following pages, you'll get a clear understanding of the PMR Assembly and the huge advantages it offers over conventional roof assemblies available in the marketplace.

So, how does Hydrotech contribute to the 3 keys of a successful roof installation?

Good Design – Hydrotech works with the design professional to help them detail and specify the waterproofing and roofing products and assemblies correctly.

Quality Materials & Assemblies – Our Monolithic Membrane 6125 has a proven unbeatable 50+ year track record in critical waterproofing and roofing applications. It is the foundation upon which every Hydrotech PMR Roof Assembly is built.

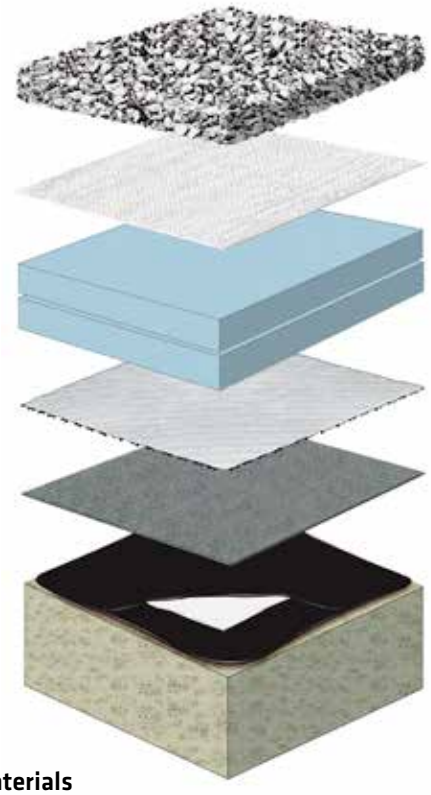
Experienced Workmanship – Our authorized applicators are fully trained in the proper application of our products and assemblies.

Hydrotech takes the risk out of complicated designs, enabling you to do more with your roof space. Consider your roof as an:

- **Occupied amenity space**
- **Stormwater management solution**
- **Vegetated roof**

This Protected Membrane Roof (PMR) Assembly Planning Guide will help you understand what's possible and how to accomplish your design objective.

Good Design



Quality Materials

Experienced Workmanship

Hydrotech's Advantage

People Make the Difference

Hydrotech's sales representatives and staff work closely with design teams from the design/development phase of a project right up through the installation of the products or assembly. Since each project is unique, Hydrotech can assist with the specification and detail development. Here are some of the many issues that must be considered to insure a successful roof assembly:

- Structural requirements
- Slope Issues
- Wind design issues
- Detailing of perimeter/penetrations
- Maintenance issues
- Safety Issues
- USGBC's LEED® credits
- Warranty

Applicator Training

Hydrotech only sells its Monolithic Membrane 6125® (MM6125) roofing/waterproofing, Ultimate Assembly and Garden Roof® materials to authorized applicators.

Hydrotech's authorized contractors have all undergone extensive training provided by Hydrotech's experienced Technical Department and Garden Roof staff. This helps ensure that these quality materials are properly installed the first time.

Approvals / Certifications

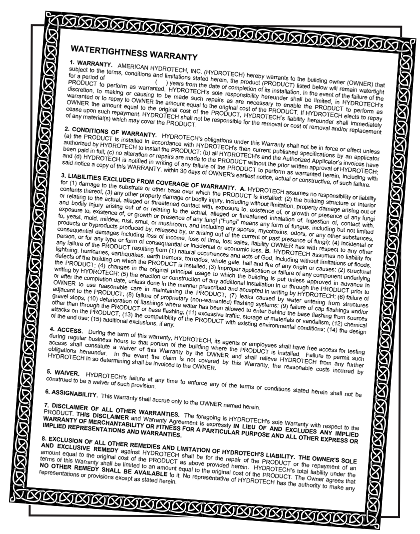
Hydrotech has the following product and assembly approvals:

- MM6125 is manufactured to meet CGSSB-37.50-M89
- MM6125 Environmental Product Declaration (EPD) available
- Underwriters Laboratories – UL & ULC - Class A
- FM Approval as a Class 1 Roof Cover per FM 4477
- Numerous Regional or City approvals as well...
  - City of New York – MEA 217-89-M
  - City of Los Angeles
  - Miami-Dade Approvals / Notice of Acceptance (NOA)
- BBA Approval from the United Kingdom, which states... **"an effective barrier to the transmission of water...for the design life of the roof structure."**
- European Organization for Technical Approvals - ETA-05/0152
- Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)

For more information regarding these and other approvals, please contact Hydrotech.

Hydrotech's Warranty Offering

Hydrotech offers a range of warranty options to an owner providing long term assurance and peace of mind from the watertightness of the membrane, up to and including removal and reinstallation of any supplied overburden.


WATERTIGHTNESS WARRANTY

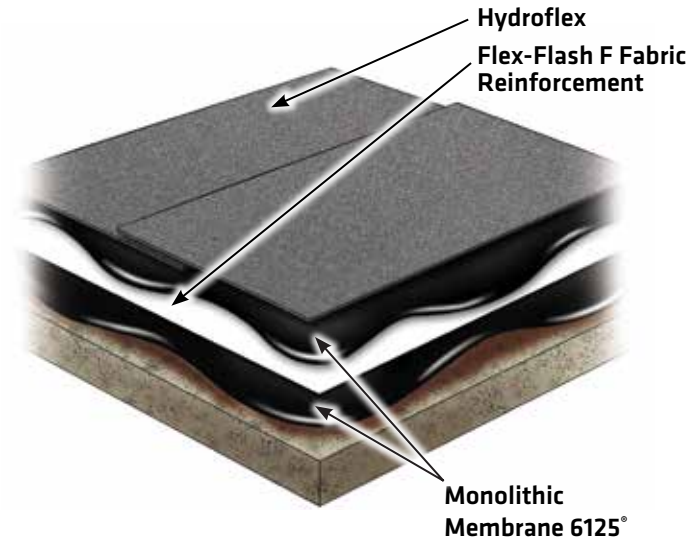
Hydrotech's warranty offering can include:

- Material and Watertightness
- Thermal Retention
- Concrete Pavers and Wood Tile
- Wind Resistance
- Removal and Reinstallation of Overburden
- Vegetation

Monolithic Membrane 6125® Advantage

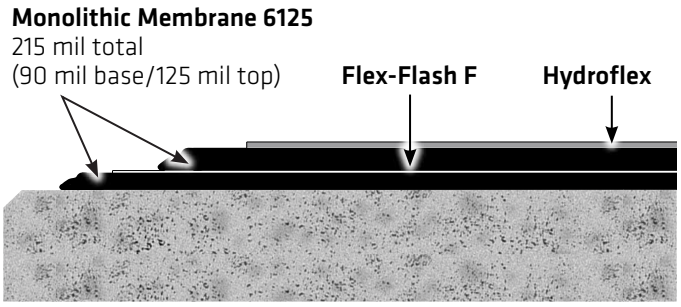
Monolithic Membrane 6125

Hydrotech's Monolithic Membrane 6125® (MM6125®) is a hot fluid applied, rubberized asphalt membrane for waterproofing and roofing in either new construction or retrofit applications. It is the original hot rubberized asphalt and has been keeping structures watertight since 1963. MM6125 is the foundation of each and every Hydrotech Protected Membrane Roof (PMR) Assembly. It is made today using the same original formulation and has never experienced a single material failure...NOT ONE. Since MM6125 was introduced it has been installed only by authorized, trained applicators. You can be confident in specifying Hydrotech's MM6125, not just because of its successful 50+ year track record, but because of the many features and benefits it provides:



MM6125 Features and Benefits

- Developed to perform in a wet (submerged) environment
  - Pools, fountains and other water features
  - Vegetated roofs
  - Blue roofs
- One component – No curing
  - There are no two-part components to mix, therefore no on-site cure failures
  - Once the membrane cools and is protected, the deck can be opened up to subsequent trades, thus speeding up the project
- Fully bonded to the substrate
  - No avenue for water to easily migrate between the substrate and the membrane
  - Should damage occur, it can be quickly traced and the membrane easily repaired
- Monolithic application
  - No seams or laps to fail
- 0° F minimum application temperature
  - Winter applications are possible to dry, frost free substrate
- Ideal for dead level (0 slope) applications
  - No slope required, just positive drainage
  - No warranty restrictions regarding ponding water
- Thick - 215 mil total membrane thickness (fabric reinforced)
  - 2-3 times thicker than other products
  - Perfect for renovation work, scarified or ground concrete surfaces
- Conforms easily to irregular surfaces
  - Bonds to sound concrete, masonry, steel or wood surface and readily conforms to any surface irregularities
- Ease of detailing
  - Triple protection at all critical detailing conditions - accomplished by encapsulating sheet reinforcing between two coats ofmembrane
- Phased installations / tie-ins are easy
  - Ease of tie-ins from one day to the next or even years later, new membrane melts into and becomes one with the existing membrane
- Acid resistance
  - Not affected by acid rain or fertilizers commonly found in the built environment
- Environmentally friendly and sustainable
  - Recycled content of 40% - LEED® recognized
  - When used in a Protected Membrane (PMR) Assembly, can last 2-3 times longer than a conventional roof



*** Membrane shown at actual thickness**

Styrofoam™ XPS Insulation Advantage

DuPont Styrofoam™ XPS Insulation

Styrofoam™ extruded polystyrene insulation was developed in the 1940's. In the early 1970's a patent was obtained and the IRMA – Insulated Roof Membrane Assembly was introduced. Early on this approach was referred to as an "upside down" roof and is known more widely today as the Protected Membrane Roof (PMR) Assembly.

Placing an insulation layer on top of a roof membrane, not beneath it, demands that the insulation be able to withstand direct exposure to a roofs harsh environment. Before Styrofoam™, no existing roof insulation product could be placed above a roof membrane because of one or more performance issues. An insulation in this configuration would need to be resistant to moisture absorption, provide long-term thermal performance, be dimensional stable and durable.

Styrofoam™, an extruded polystyrene was the only answer, and it still is today.

Styrofoam's Features and Benefits

- Excellent moisture resistance
- High compressive strength
- Superior long-term R-Value
  - R = 5 per inch of thickness
- Exceptional durability
  - Helps extend the life of the roof assembly by as much as 2-3 times that of a conventional roof
- Moves dew point condition above the membrane
- Protects the roof membrane from physical abuse during construction and after
- Protects the roof membrane from the detrimental effects from Mother Nature, it helps to...
  - Keep the membrane at a relatively constant temperature, minimizing stress from freeze-thaw cycling and excessive heat
  - Protect the membrane from UV
- Styrofoam™ can also be reused and recycled.

Types

Styrofoam™ extruded polystyrene insulation is typically available in 2' x 8' boards and in nominal thicknesses ranging from 1" to 4", depending on the product type.

- There are numerous types, to meet an applications specific needs...

Styrofoam™ ROOFMATE™ (40 psi)-ASTM C578 Type VI
- Developed for the typical PMR Assembly

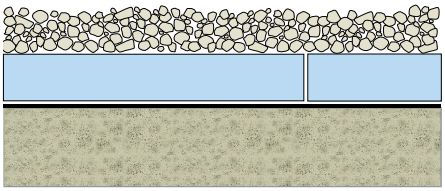
Styrofoam™ PLAZAMATE™ (60 psi)-ASTM C578 Type VII
- Developed for plazas, podium decks and other applications where heavy use or concentrated loads are anticipated (pavers on pedestals)

Styrofoam™ HIGHLOAD™ 100 (100 psi) - ASTM C578 Type V
Styrofoam™ HIGHLOAD™ 60 (60 psi) - ASTM C578 Type VII
Styrofoam™ HIGHLOAD™ 40 (40 psi) - ASTM C578 Type VI
- Developed where high compressive strength is needed to handle various loads or withstand heavy traffic

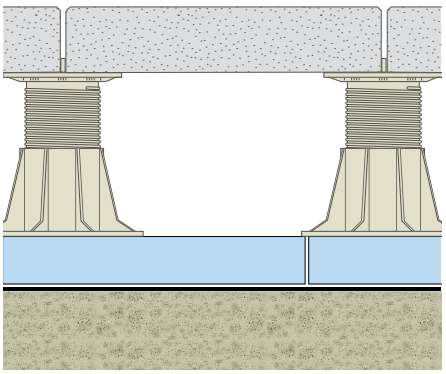
- Other specialty **Styrofoam™** products are also available.

Warranty

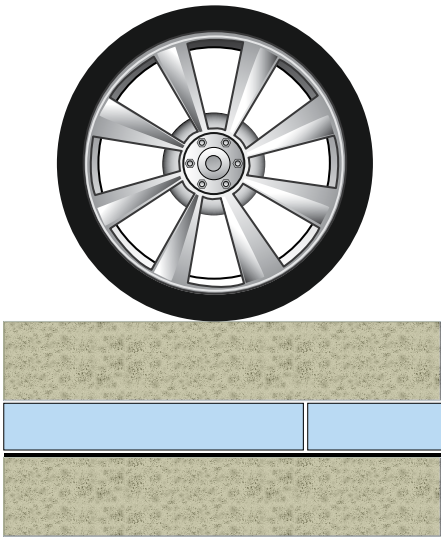
- Up to 30 years in a PMR Assembly
- Thermal resistance will not vary by more than 10%
- Wind resistance - can be designed to meet the local design wind speed, but is warranted up to 70 mph peak gust speed



Styrofoam ROOFMATE (40 psi)



Styrofoam PLAZAMATE (60 psi)



Styrofoam HIGHLOAD 100 (100 psi)

The Protected Membrane Roof (PMR) Advantage

Conventional Roofing Design

With a conventional roof assembly, the roof membrane is typically placed on top of an insulation layer and structural deck. In this configuration, the roof membrane is doing double duty - protecting the building and its contents, as well as the insulation's thermal value.

A conventional roof arrangement can leave the roof membrane vulnerable to sudden temperature changes, high summer roof temperatures, low winter temperatures, freeze thaw, ultraviolet rays, physical abuse from heavy foot traffic and routine maintenance. Exposure to these elements can weaken the integrity of the roof membrane and shorten its life expectancy.

If a breach in the roof membrane occurs and the insulation gets wet, it loses its ability to perform as a thermal barrier. If the membrane is attached to the insulation, failure of the adhesives or delamination of the insulation facer can lead to roof blow off. Replacing the wet insulation and repairing the roof membrane could be quite involved and expensive.

There is a better way - Protect the Membrane!

A better way is possible because of DuPont's Styrofoam™ brand insulation, a closed cell extruded polystyrene that can be placed in a wet environment. Placed on top of Hydrotech's Monolithic Membrane 6125®, it offers protection from the harsh conditions found on a rooftop.

The Protected Membrane Roof (PMR) Assembly

Reversing the arrangement of roofing materials, with the membrane below the insulation, has been referred to for decades as an Insulated Roof Membrane Assembly (IRMA), although it is now most often referred to as a Protected Membrane Roof (PMR).

The two biggest benefits a PMR Assembly provides when compared to a conventional roof is the protection the insulation offers when placed above the roof membrane from both physical abuse and Mother Nature.

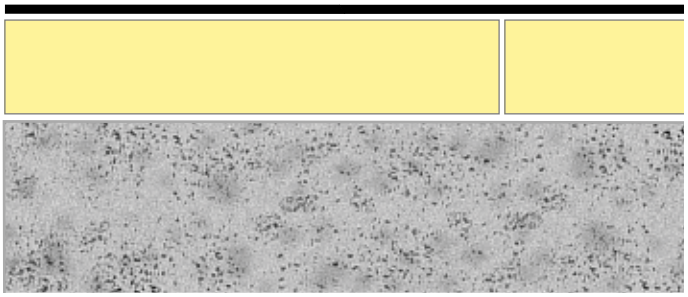
Since the roof membrane is buried it is protected from all that Mother Nature can dish out, including...

- Stress due to temperature swings from day to night and season to season
- Freeze thaw and ice
- Hail storms
- UV (ultraviolet light) and ozone

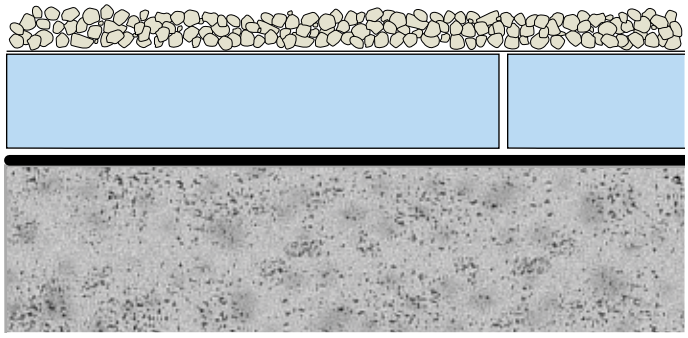
Damage to a roof membrane from physical abuse can come from several factors, such as...

- Rooftop traffic – both during and after construction
- Maintenance traffic due to servicing HVAC, solar arrays, etc.

In a PMR Assembly damage to the membrane from physical abuse is virtually eliminated. The graphics on the following page makes that point clear.



Conventional Roof Assembly - membrane is exposed

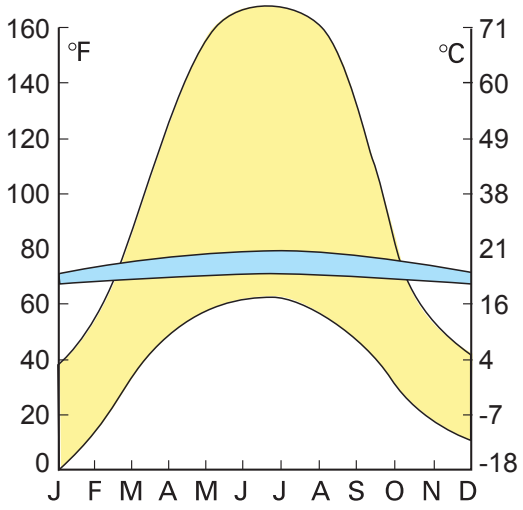


Protected Membrane Roof Assembly - membrane is protected

Membrane Temperature Changes

Let's take a closer look at the temperature stresses a roof assembly can experience. In 1976, The Corps of Engineers, U.S. Army, studied the performance of several cold climate PMR assemblies and compared them to conventional roofs. The CRREL Report 76-2 "Protected Membrane Roofs in Cold Regions," was the result of this study and reported, among other benefits, that the membrane temperature in a protected membrane roof does not change more than 5° to 10 °F (3-5 °C) from the average room temperature throughout the year. Therefore, thermal stress on the membrane is eliminated.

Membrane Field Temperature Observations



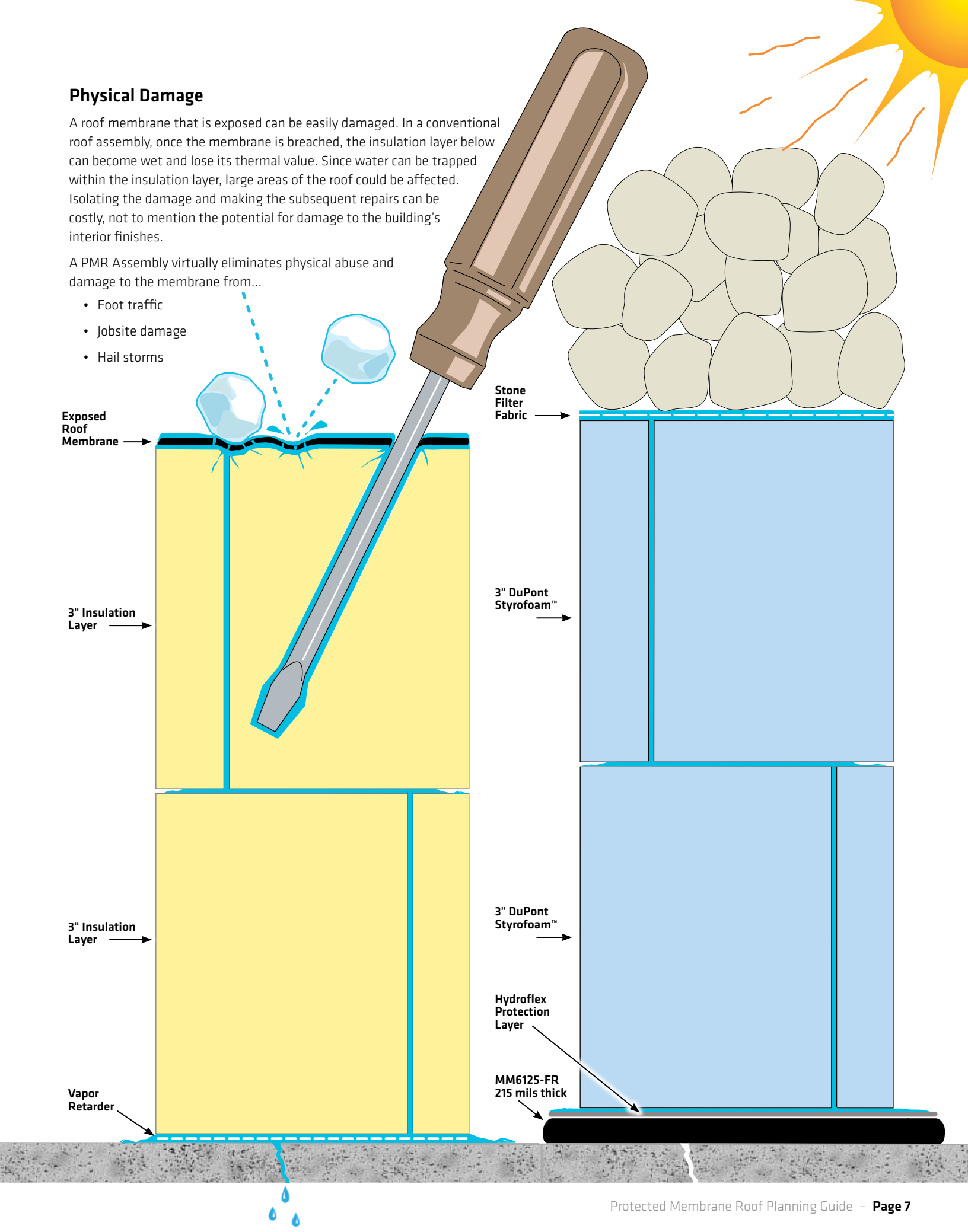
The blue area represents the relatively constant temperature of the membrane in a protected membrane. The yellow area represents the temperature fluctuation of a conventional roof membrane.

Physical Damage

A roof membrane that is exposed can be easily damaged. In a conventional roof assembly, once the membrane is breached, the insulation layer below can become wet and lose its thermal value. Since water can be trapped within the insulation layer, large areas of the roof could be affected. Isolating the damage and making the subsequent repairs can be costly, not to mention the potential for damage to the building's interior finishes.

A PMR Assembly virtually eliminates physical abuse and damage to the membrane from...

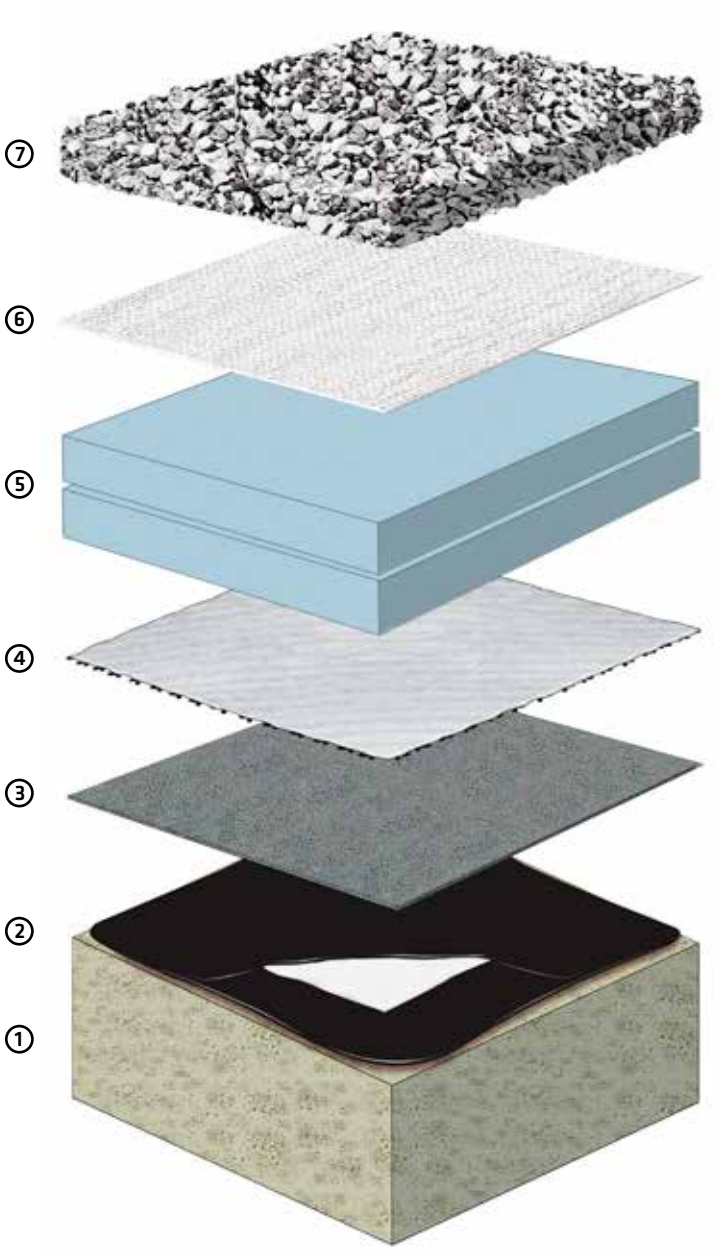
- Foot traffic
- Jobsite damage
- Hail storms



Components of a Protected Membrane Roof

It Starts with the Membrane

A typical Protected Membrane Roof (PMR) Assembly consists of a few basic components; a structural deck, membrane, insulation and ballast. Each component serves a specific basic function. A roof is simply expected to be watertight and properly insulated. However, in this simplicity there is also great flexibility. With the basic roof functions addressed below, a wide choice of ballast or roof surfacings are available to meet a buildings design intent.



⑦ **Ballast –** A typical loose stone ballast roof surface is depicted, however, there are many ways to ballast a PMR Assembly:
- Architectural or ballast concrete pavers
- Wood Tile
- Vegetation and growing media
- And more

⑥ **Stone Filter Fabric –** Its function is to simply keep stone fines or particles from getting into the insulation board joints and helps raft the insulation together.

⑤ **Insulation –** Placed above the roof membrane, only an extruded polystyrene insulation is utilized. DuPont's Styrofoam™ Brand Insulation has been used in PMR assemblies for more than 40+ years because it exhibits excellent moisture resistance, is closed cell, dimensionally stable and has a high R-value.

④ **Drainage Layer (optional) –** When it is necessary to provide an avenue for water to move laterally below the insulation and topping materials, one of Hydrotech's Hydrodrain drainage components, which best meets the design requirements, can be utilized.

③ **layer –** A protection layer is embedded directly into the membrane to protect it from construction abuse during installation. Hydrotech offers several different protection layers such as Hydroflex®, to meet specific project needs

② **Monolithic Membrane 6125 Roofing Membrane –** Only the best: with a track record of over 50 years proven performance worldwide, Hydrotech's Monolithic Membrane 6125® – typically in a fully Fabric Reinforced (FR) Assembly, is the foundation of the PMR Assembly. The membrane also functions as the vapor retarder in the assembly

① **Structural Roof Deck –** Must be designed to support the weight of the roof assembly as well as any other dead and live loads. Acceptable deck types include:
- Cast-in-place concrete
- Precast concrete
- Metal deck with approved substrate board
- Plywood

Top 10 Reasons to Choose a PMR Assembly

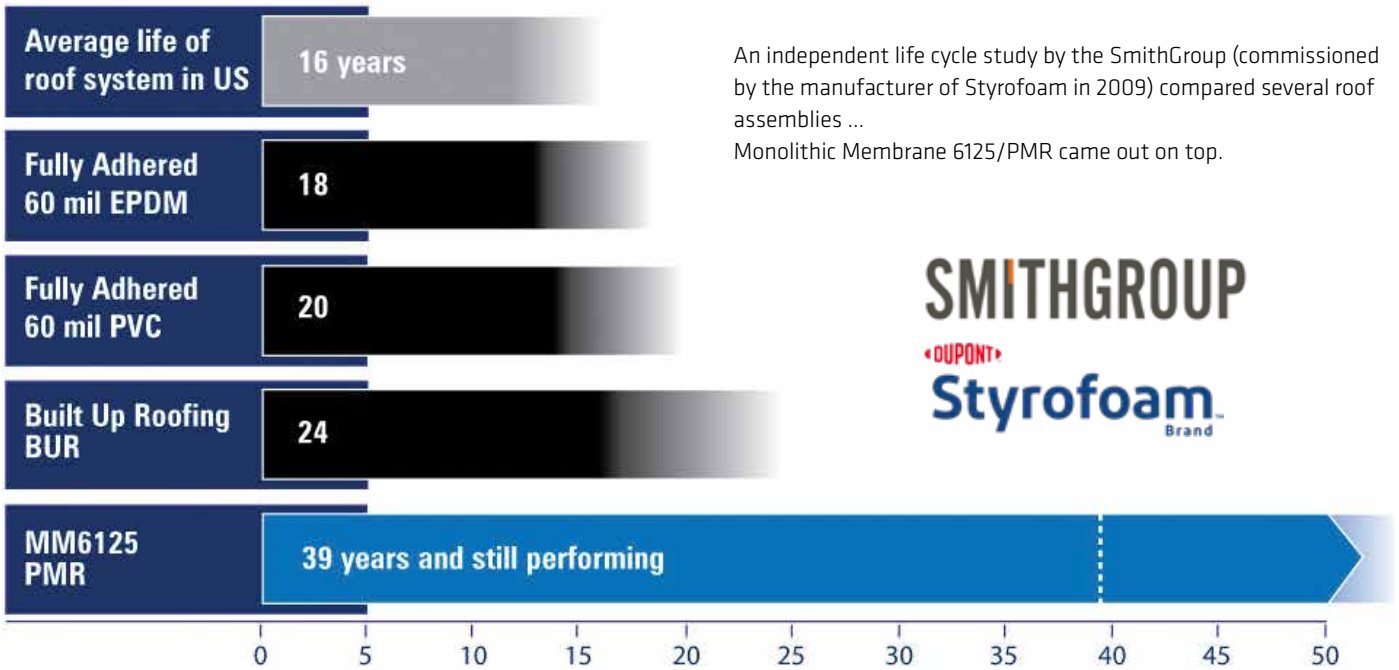
The PMR Assembly Benefits

A Protected Membrane Roof Assembly provides many benefits to the building owner worth considering. Here are the top **10** reasons for choosing a PMR Assembly for your next project...

1. **Proven Performance –** The PMR Assembly has been a proven, time tested roof assembly for more than 50 years, with thousands of successful installations around the world.
2. **Total Roof Life Cost Savings –** While the initial cost might be slightly greater, the life cycle cost of a PMR Assembly can be considerably less than that of a conventional roof, since it can last significantly longer...2-3 times longer! This is possible since the membrane below the insulation is protected from the detrimental effects from Mother Nature and physical abuse.
3. **Lower Maintenance Costs –** Roof maintenance is minimal throughout the service life of a PMR Assembly since the membrane is protected by the insulation layer and topping materials above it.
4. **Design Flexibility –** A wide choice of topping materials and finishes installed over the membrane and insulation is possible to meet the desired roofs function...be it a simple utilitarian roof covered with stone ballast, accessible usable space with architectural concrete pavers or wood tile, or even a vegetated roof.
5. **Future Alterations –** Since the insulation and other topping materials above the membrane are typically loose laid, the roof surface can be easily altered to suit a new roof function or aesthetic.
6. **No Vapor Retarder Needed –** With the membrane located below the insulation (on its warm side) the dew point condition occurs above it, therefore no additional vapor retarder is required in a PMR Assembly. A sound vapor retarder in a conventional roof assembly is critical to its long-term performance.
7. **Reuse / Recycle Option –** A truly sustainable roof provides the best performance for the longest time possible. When it's finally time to replace the roof, the Styrofoam™ insulation can be either reused or recycled, greatly reducing the amount of waste that typically ends up in a landfill. This can be true for most topping materials as well.
8. **Single Source Full Assembly Warranties –** Warranties available typically cover the integrity of the membrane, thermal performance and wind resistance of the insulation, as well as removal and reinstallation of the topping materials provided by Hydrotech for up to 30 years.
9. **Other Work Can Proceed Faster –** Since the MM6125 membrane is installed first (followed by the insulation and ballast), the interior build out can begin immediately.
10. **Total Roof Life Cost Savings –** If you think we mentioned it previously you are correct, but when it comes to the value the PMR Assembly provides, we think it's worth mentioning again. Check out the independent life cycle study done by the SmithGroup below. The full report is available upon request.

"One Time" – Two words that probably best convey the true benefit of a Hydrotech Protected Membrane Roof Assembly to an owner. Perhaps the first roof assembly where the phrase "out of sight, out of mind" isn't a negative, it's just simply assurance knowing it was done right.

Life Cycle Cost Advantage



Anticipated Service Life (per study)

An independent life cycle study by the SmithGroup (commissioned by the manufacturer of Styrofoam in 2009) compared several roof assemblies ...
Monolithic Membrane 6125/PMR came out on top.

SMITHGROUP

DUPONT Styrofoam Brand

Hydrotech's MM6125 proven service life exceeds this study's anticipated service life

XPS vs. EPS - Not Equals

DuPont Styrofoam™ XPS Insulation vs EPS

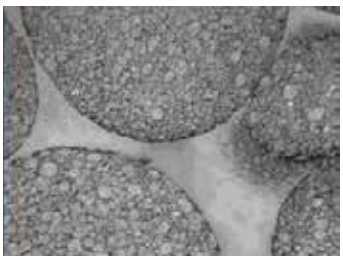
DuPont's Styrofoam™ Extruded Polystyrene Insulation (XPS), was developed over 70 years ago and has been used in Protected Membrane Roof Assemblies since the early 1970's. Some EPS (expanded polystyrene) manufacturers claim that their products are also suitable for PMR Assemblies. Look at the facts and you will see that EPS just doesn't measure up.

Styrofoam Insulation has a...

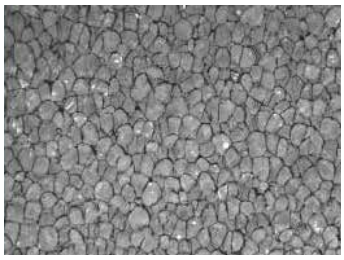
- 40+ years proven performance in PMR Assemblies
- Higher R value (per ASTM C578, R=5 at 75°F per inch)
- Lower water absorption (per ASTM C272)
- High compressive strength

The following is an excerpt from DuPont's **"Just the Facts"** brochure.

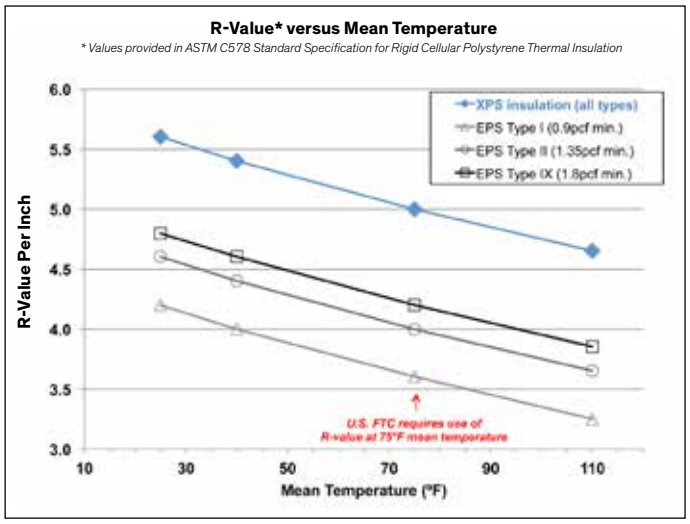
The difference is clear...



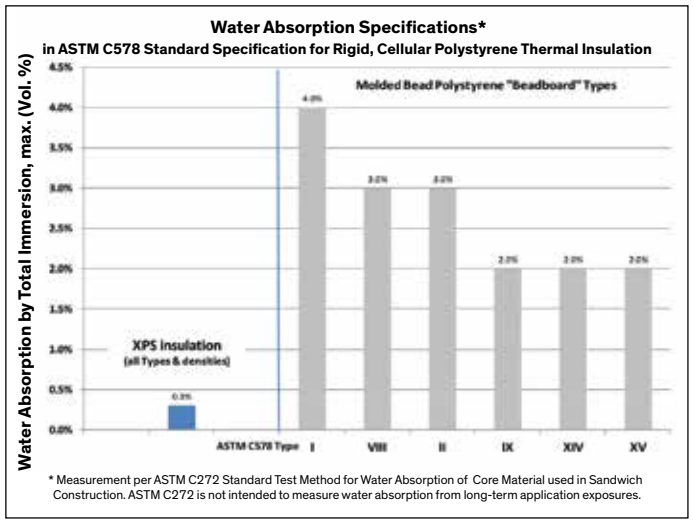
EPS - Open Cell
(mag. 25x)



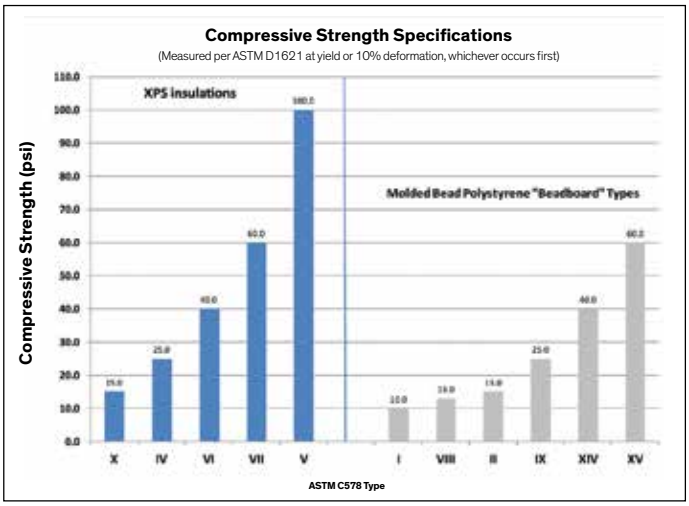
XPS - Closed Cell
(mag. 25x)



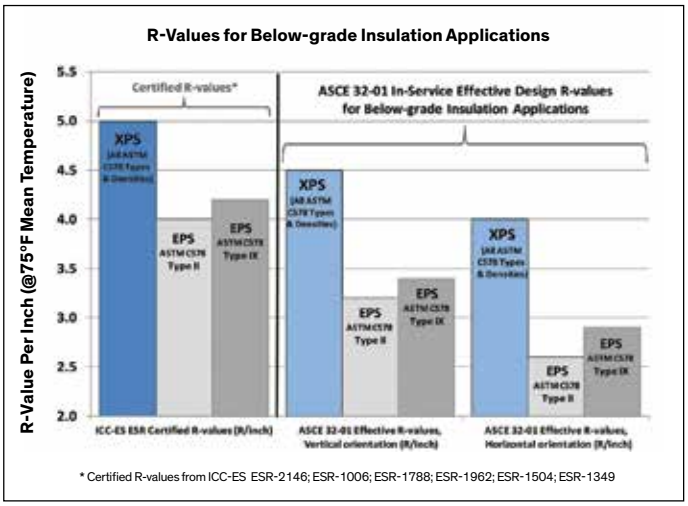
The R-value of most insulation products goes down as the mean temperature test conditions go up. Always compare R-values at the same mean temperature.



Any water absorbed by insulation in an application will directly reduce the insulation's R-value.



Compressive strength is important in load-bearing applications and where physical damage can occur around the jobsite and during construction, such as when installing insulation under concrete slab or backfilling against foundation insulation.



The most comprehensive and objective review of the in-service performance of polystyrene foam insulations used in below-grade applications was conducted by the ASCE 32 Committee.



PROTECTED MEMBRANE ROOF ASSEMBLIES

Hydrotech's Protected Membrane Roof Assemblies

All This is Possible

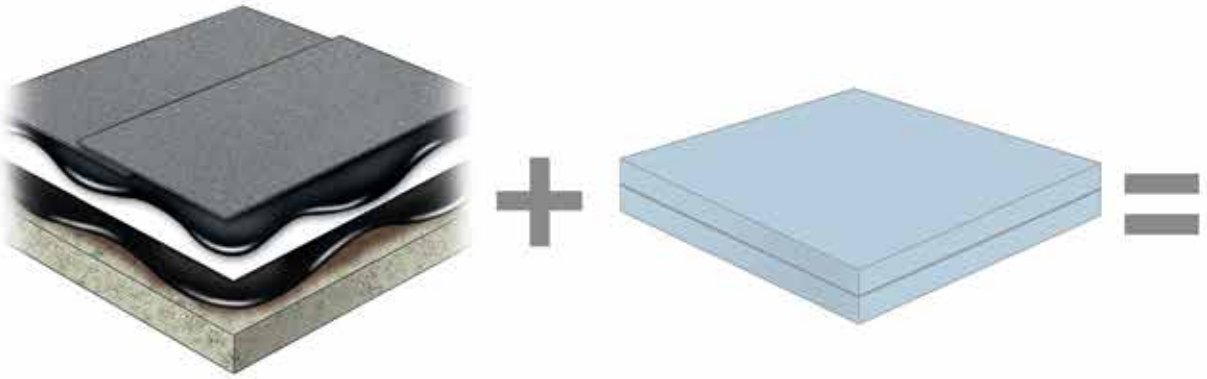
To address the numerous conditions and configurations that can be created on a rooftop, Hydrotech offers a wide range of Protected Membrane Roof (PMR) Assemblies to choose from. These assemblies range from a typical stone ballasted PMR to others that add beauty and/or additional rooftop functionality.

Hydrotech's **Ultimate Assembly**® can create an inviting usable space for people with a wide variety of concrete paving or wood tile finishes for podium decks and rooftops.

Hydrotech's **Garden Roof**® **Assemblies** are often added to podium decks or rooftops for the beauty they offer, many times in conjunction with the Ultimate Assembly. Or, to help address the ever growing need to tackle a building sites stormwater management issues.

Hydrotech's **Blue Roof Assemblies** can provide a rooftop stormwater management solution with clear advantages over the typical methods used on the ground.

Many of these assemblies can be configured as a cool roof as well.

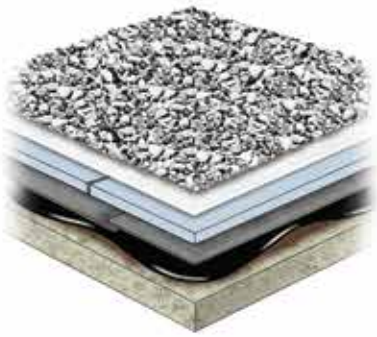


Monolithic Membrane 6125®

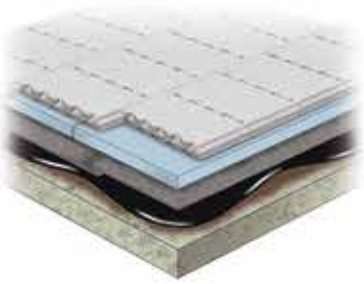
DuPont Styrofoam™

The roof is a blank canvas, what do you envision?

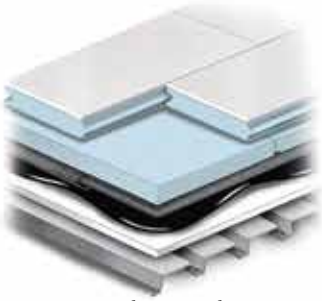
The following information in this chapter is intended to provide a brief introduction to the many PMR Assemblies available from Hydrotech. Please visit Hydrotech's website at www.hydrotechusa.com to get in depth information, specifications, standard guideline details and much more.



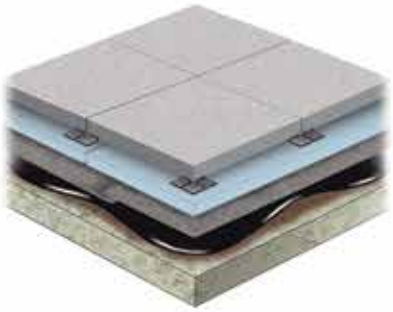
Stone Ballasted



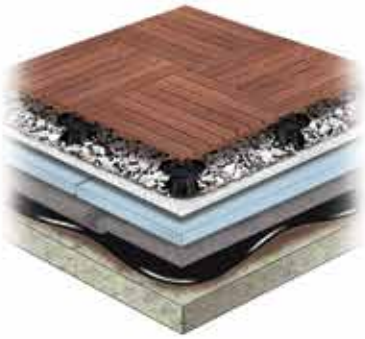
Lightweight Ballasted Pavers



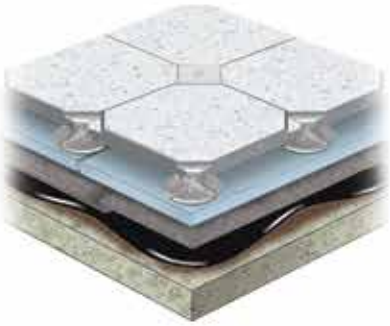
Hydroguard



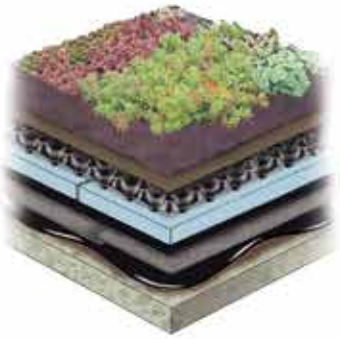
Ultimate Assembly Architectural Pavers



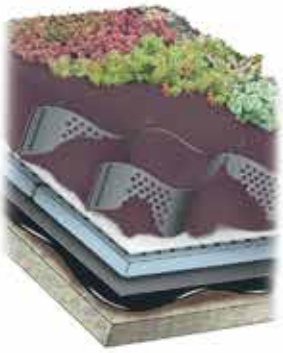
Ultimate Assembly Wood Tiles



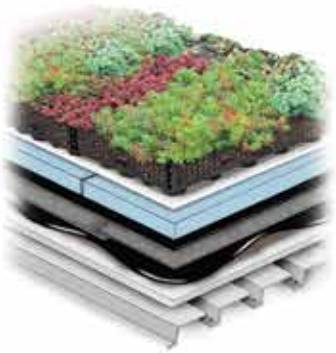
Ultimate Assembly Guardian Pavers



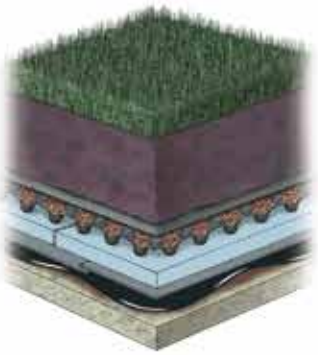
Extensive Garden Roof



Sloped Garden Roof



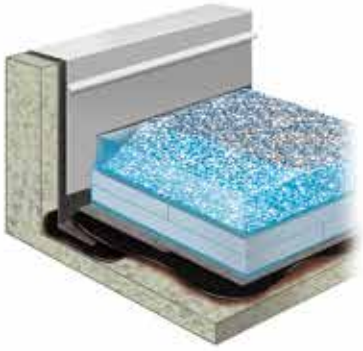
InstaGreen GT-4 Tray



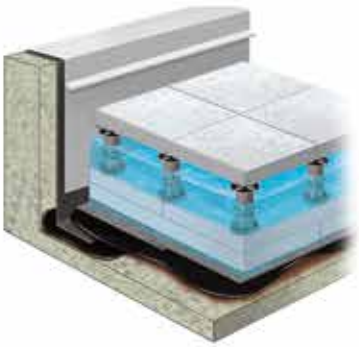
Lawn Garden Roof

Intensive Garden Roof

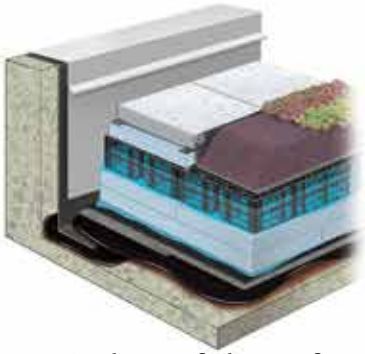
Urban Agriculture Garden Roof



Stone Ballast Blue Roof

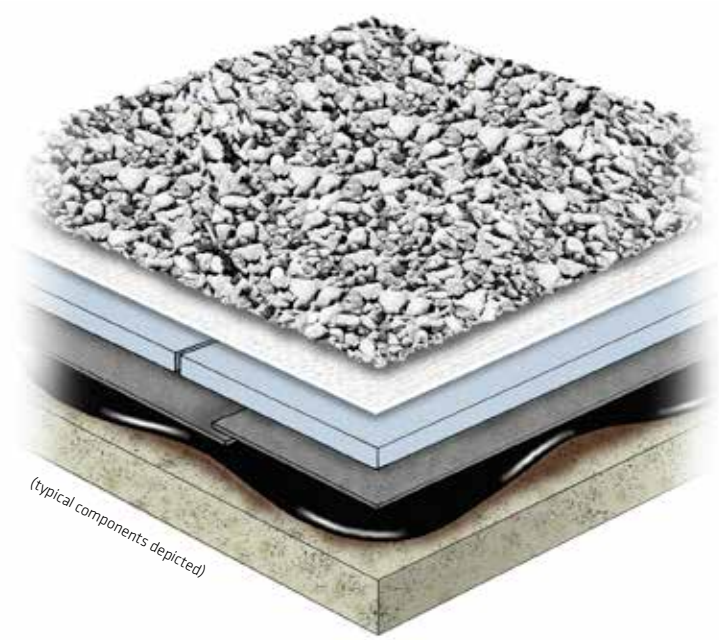


Ultimate Assembly Blue Roof



Garden Roof Blue Roof

Stone Ballasted Assembly



A basic PMR Assembly utilizes crushed or river washed stone as ballasting over the DuPont Styrofoam™ Insulation. Stone provides weight to keep the insulation materials in place over the membrane.

The amount of stone (or weight) needed is determined by the design wind uplift pressures on the roof. Typically, 10-13 pounds per square of stone ballast is needed in the field of the roof. Along the roof perimeter and in the corners where the uplift pressures are typically the greatest, 15-20 pounds per square foot of stone would typically be required.

Enough stone must be used to completely cover the insulation and Stone Filter Fabric below. Stone used for ballast is graded in accordance with ASTM D448 and is typically referred to as #5,#4 or #2 stone.

- #5 stone; nominally 1" size aggregates
- #4 stone; nominally 1 1/2" size aggregates
- #2 stone; nominally 2 1/2" size aggregates

Please refer to DuPont's Tech Solutions 508.2 Ballast Design Guide for PMR Systems.

Pac Bell - San Ramon, CA

Stone Ballasted Assembly - Metal Deck

Please refer to DuPont Tech Solutions 508.2 Ballast Design Guide for PMR Systems.

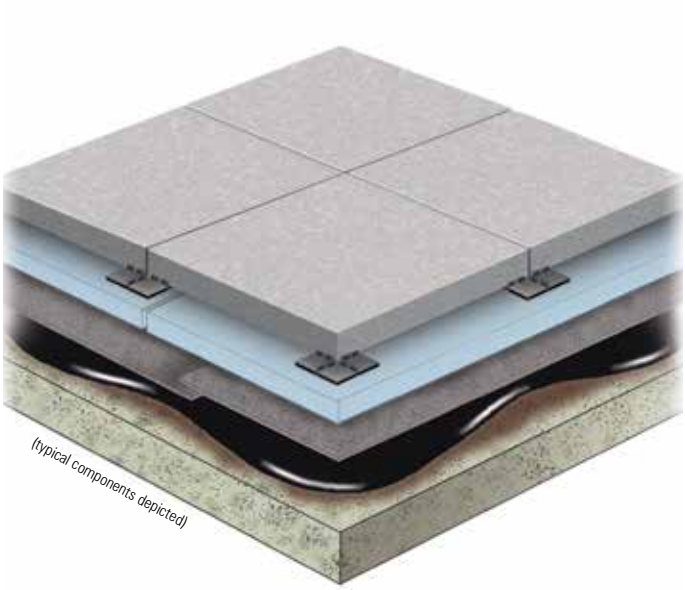
In metal deck applications, Hydrotech's Monolithic Membrane 6125 is applied directly to an approved coverboard such as USG's Securock Gypsum Fiber Roof Board, or other approved substrate board.

If the metal deck/structure is designed with slope the PMR Assembly is straight forward, the insulation and ballast are installed above the membrane.

If the metal deck is flat and slope needs to be incorporated into the roof assembly, it can be provided by adding tapered insulation below the roof substrate board. An additional substrate board may be required on the metal deck to provide fire protection to meet code. The need for a vapor retarder should be considered and determined by the project design professional, based on the roof's specific requirements.

1225 Connecticut Ave - Washington, DC

Paver Ballasted Assembly

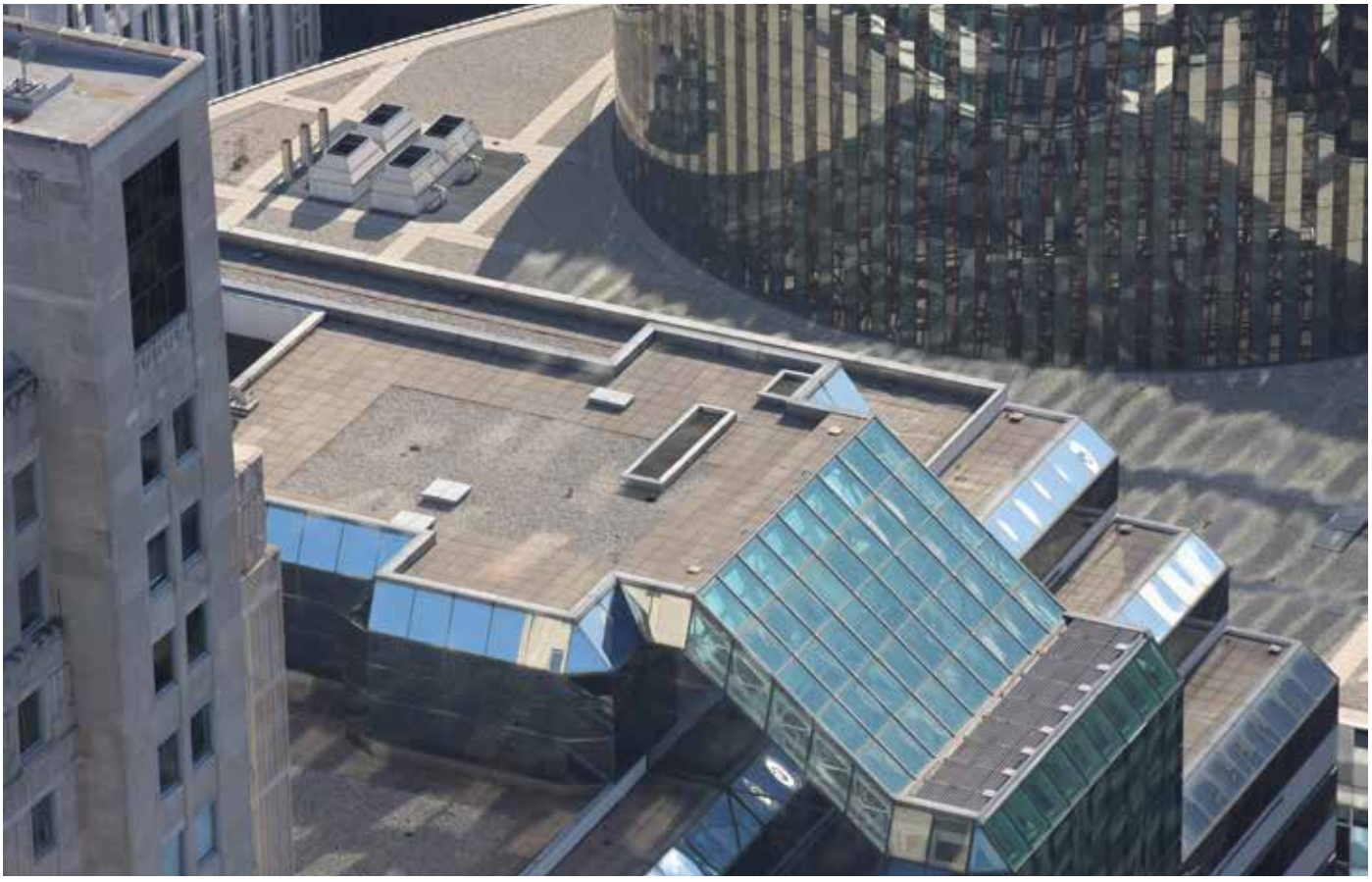


Concrete pavers are another commonly used material for ballasting a PMR Assembly. The typical concrete paver is a 24"x 24" x 2" unit, weighing a minimum of 22 pounds per square foot. If installed over the entire roof surface (or a minimum of 10% of the roof area), they must be set on support tabs to elevate them off the DuPont Styrofoam™Insulation.

Concrete pavers are also used in conjunction with stone ballast to provide additional ballast securement at perimeters and in corners where the uplift pressures are typically greatest. At times it may even be necessary to secure one paver to another with metal strapping, running parallel to the building perimeter. Provided the pavers are less than 10% of the roof area they can be set directly on the DuPont Styrofoam™ Insulation.

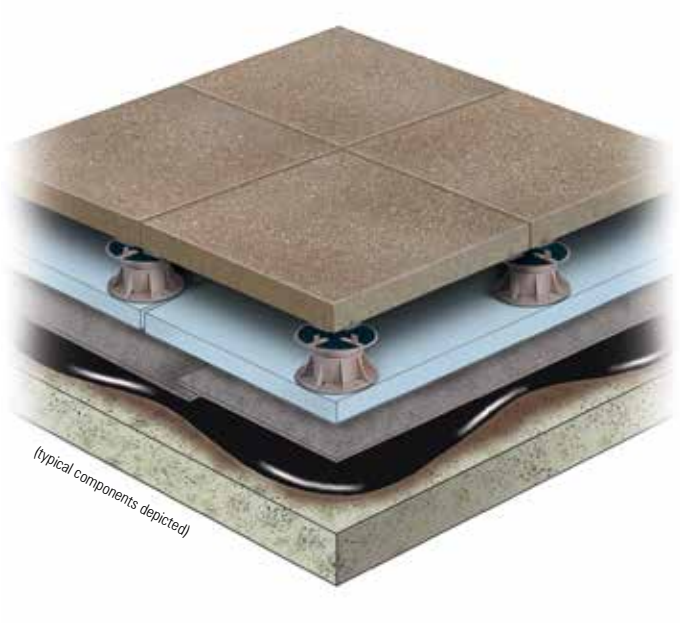
Concrete pavers are also used to provide a foot path on the roof to HVAC units or other areas where maintenance may be required.

For more information please contact Hydrotech for a copy of our Ultimate Assembly® brochure.



203 N. LaSalle - Chicago, IL

Paver Ballasted Ultimate Assembly®



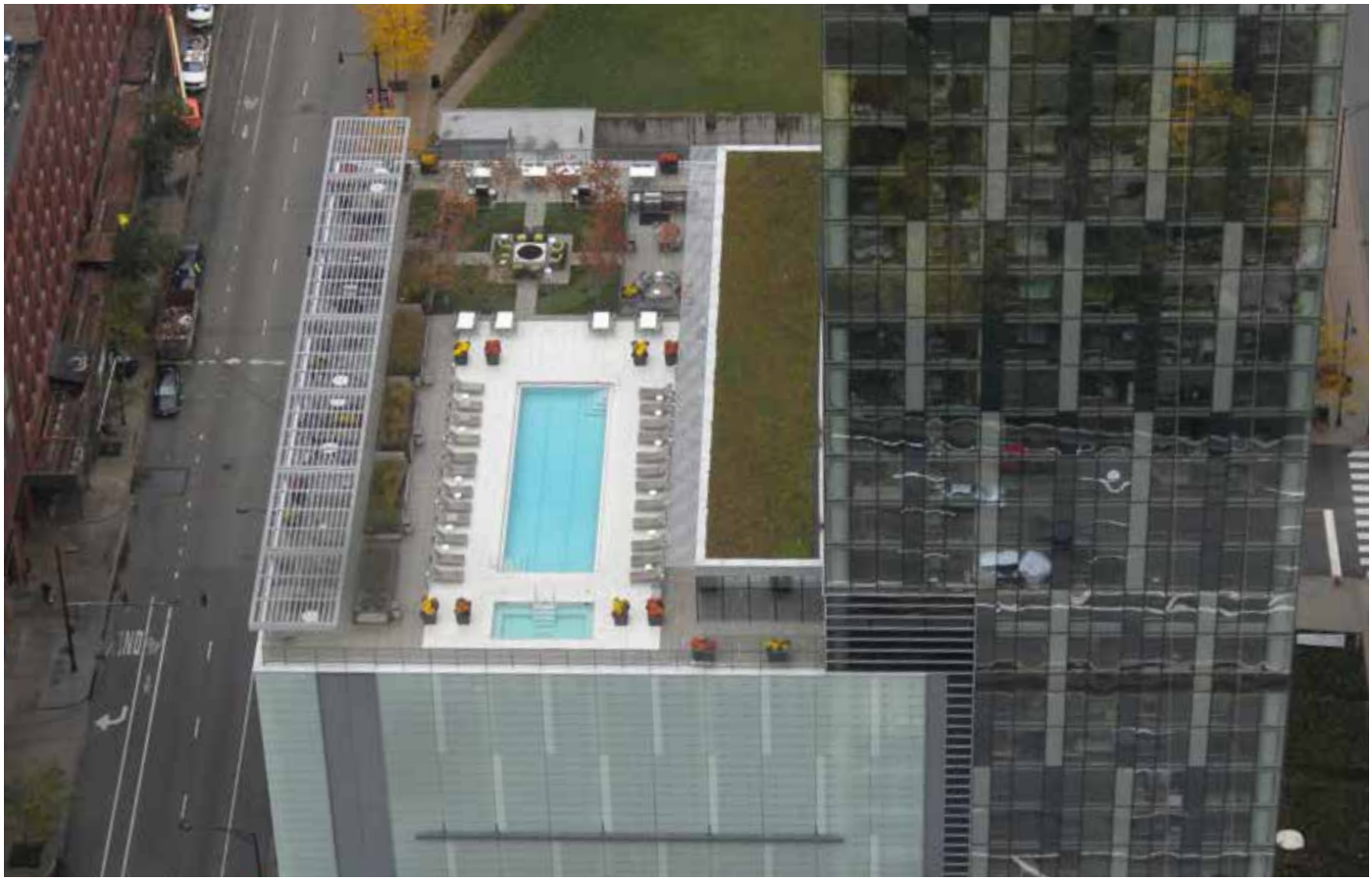
Concrete pavers make an ideal surface for podium decks or roof terraces that will be accessible for use by the building occupants. In this application concrete pavers not only provide the ballast needed for the roof, but an aesthetic finished surface as well. Instead of being installed on support tabs that follow the slope of the roof surface, these pavers are typically supported on pedestals. Pedestals and related accessories elevate the paver to the desired height and compensate for the roof's slope below, so that the pavers can be set level.

This open joint configuration allows water to drain off the paver surface quickly, flowing to concealed drains below, eliminating issues seen with pavers in typical setting bed applications.

Access to the components of the roof assembly below is easy, so maintenance and future alterations are easily accomplished.

A wide range of colors and finishes are available.

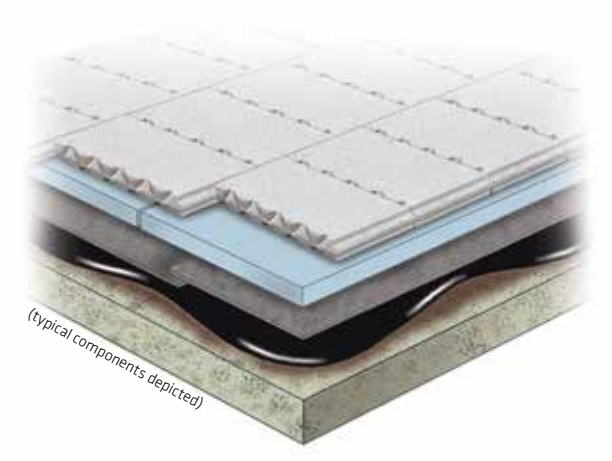
For more information please contact Hydrotech for a copy of our Ultimate Assembly® brochure.



500 N. Lake Shore Drive - Chicago, IL

Other Ultimate Assemblies

These PMR Assemblies can provide enhanced wind ballast performance on a roof, a unique finish for a podium deck or roof terrace or in the case of the Guardian Paver, both.



Lightweight Ballast Pavers

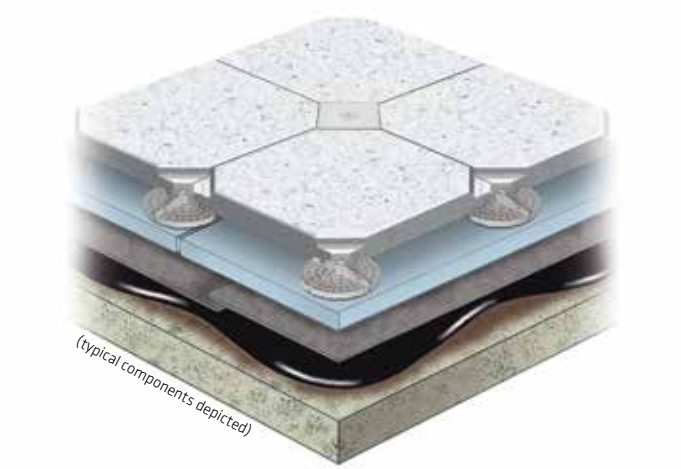
Ventloc Paver Ballast

Hydrotech offers a lightweight concrete paver from Hanover that can provide superior wind uplift resistance and has been tested at wind speeds up to 130 mph. Designed with tongue and groove sides and a patented venting edge they enable the rapid transfer of pressures from above to below, resulting in pressure equalization which greatly enhances the wind uplift resistance of the paver.

The Ventloc Paver is 11 3/4" x 17 5/8" x 2", weighs 11lb/SF and is available in Hanover's standard colors. When a high reflective finish is desired they are also available in the Glacier White finish.

Ventloc is only a roof ballast material and is not intended to be a finished surface for rooftop terraces or other usable space.

For more information please contact Hydrotech for a copy of our Ultimate Assembly® brochure.

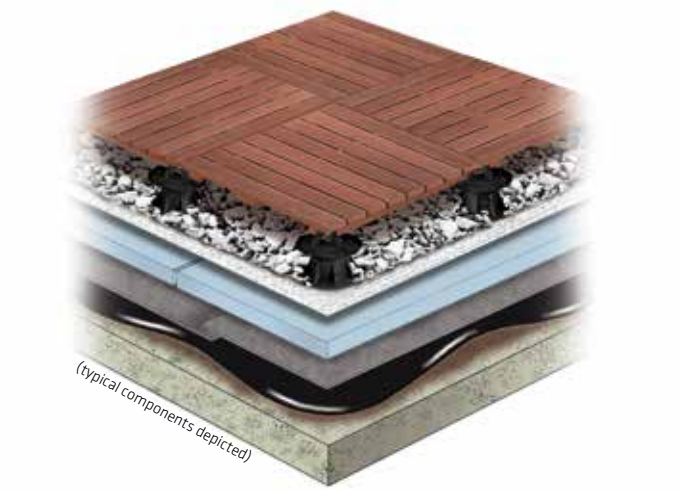


Ultimate Assembly® - Guardian Pavers

Ultimate Assembly® - Guardian Pavers

Hydrotech offers another solution for roofs where high wind uplift resistance is needed, Hanover's Guardian Paver System. This system provides a monolithic interlocked paver surface, supported by pedestals, that can be installed level even if the substrate below is sloped. This assembly is not only ideal for typical roofs, but also on rooftop terraces or podium decks. The Guardian Paver is available in 18" x 36", 24" x 24" and 30" x 30" nominal sizes in either a 2" or 3" thickness. It is available in Hanover's standard colors and in the Glacier White high reflective finish as well.

For more information please contact Hydrotech for a copy of our Ultimate Assembly® brochure.



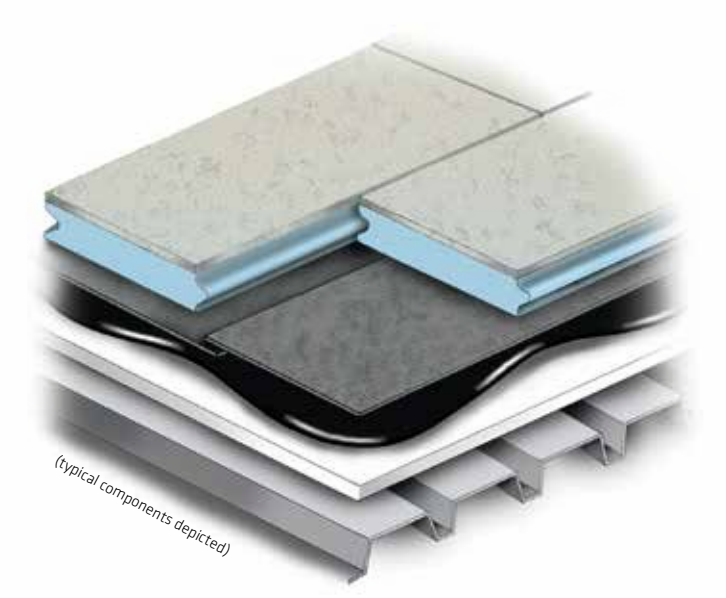
Ultimate Assembly® - Wood Tiles

Ultimate Assembly® - Wood Tiles

As an alternative to concrete pavers in an Ultimate Assembly, Hydrotech offers Bison Wood Tiles. These wood tiles are made from tropical hardwoods, such as Ipe, Cumaru, Massaranduba, Garapa and Mahogany and add warmth and charm to any roof deck. The tiles are typically available in nominal sizes 24" x 24" or 24" x 48". Installed on pedestals, wood tiles can be laid in a parquet pattern, linear pattern or mixed with concrete pavers for a unique look.
In a PMR Assembly, a layer of stone ballast is required under the wood tiles to provide the necessary ballast for the assembly. For more information please contact Hydrotech for a copy of our Wood Tiles and Planter Cubes brochure.

For more information please contact Hydrotech for a copy of our Wood Tile brochure.

Hydroguard® Assembly



Hydroguard is a unique product, combining DuPont Styrofoam™ Insulation with an integral concrete topping. The concrete ballast is a latex modified concrete that is physically and chemically bonded to the insulation. Hydroguard is available in panels 24" x 48" with either 2" or 3" insulation.

Hydroguard Standard is available with a 3/8" thick concrete topping, which provides 4.5 pounds of ballast weight, per square foot. This is perfect over metal deck or other structures where weight may be an issue.

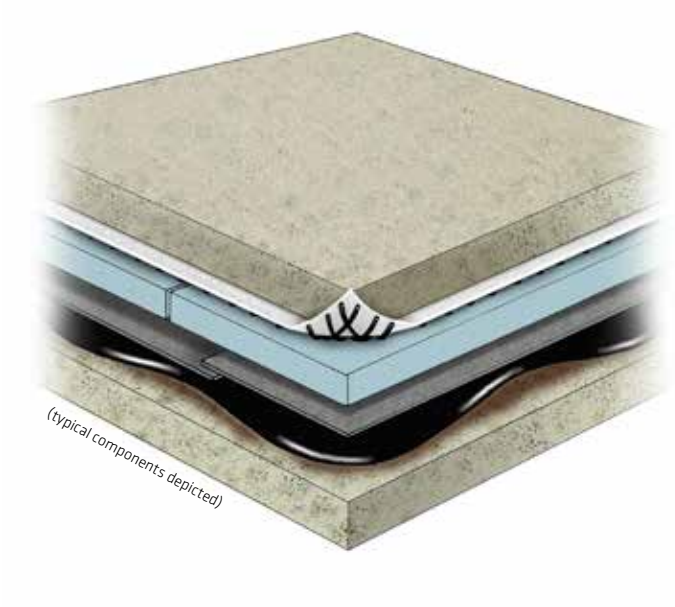
Hydroguard Heavy is also available with a 15/16" thick concrete topping, providing 11 pounds of ballast weight per square foot and is ideal for roofs where more ballast weight is needed.

Additional perimeter securement or ballasting is typically necessary with Hydroguard.

For more information please refer to Hydrotech's Hydroguard Installation Guidelines.

Aurora Justice Center - Aurora, CO

Concrete Topping Split Slab Assembly



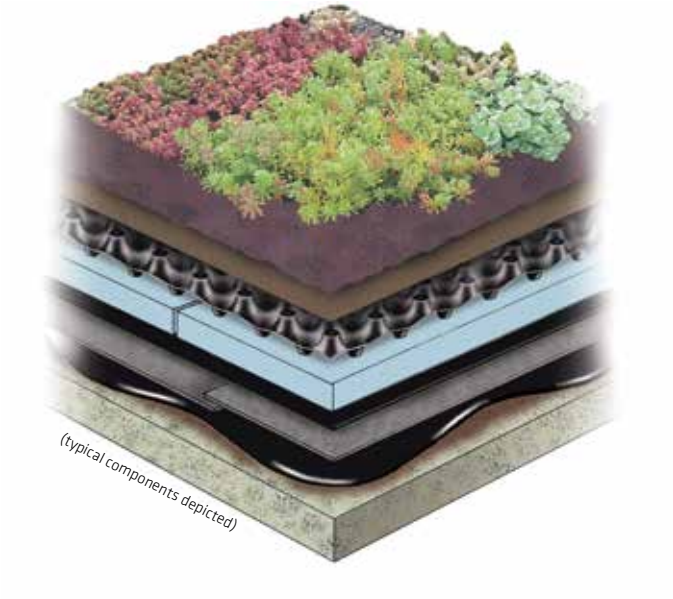
A Concrete Topping Split Slab PMR Assembly is sometimes used in parking deck roof applications and as an alterative to stone or concrete paver ballast where high wind uplift issues are a concern.

Concrete topping slabs have also been used at a buildings perimeter and corners where davits and window washing tracks can be found and uplift pressures are at their highest. This perimeter run of concrete provides an easy walkable surface while protecting the roof assembly below from physical abuse. If a slab accounts for 10% or less of the total roof area the concrete can be placed directly over the Styrofoam™ insulation. Stone or paver ballast is typically placed over the balance of the roof.

In some cases where the concrete topping slab is placed over more than 10% of the roof area, Hydrotech's Hydrodrain 300 is required. The drainage layer should be placed between the insulation and the concrete slab to create a "diffusion open" assembly for the Styrofoam™ and facilitate drainage.

Please refer to Tech Bulletin "Styrofoam™ Insulation and the Air Space" for more information regarding a diffusion open assembly.

Extensive Garden Roof® Assembly

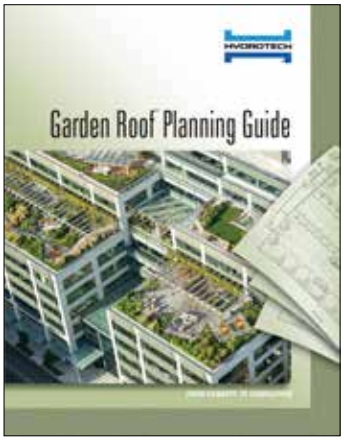


Hydrotech introduced the Garden Roof Assembly more than 20 years ago. Since that time Hydrotech has been involved in thousands of vegetated roofs of various types across the country.

The Extensive Garden Roof Assembly (depicted at left) consists of 3" to 6" of LiteTop Engineered Growing Media installed over a Systemfilter fabric and Gardendrain, a drainage and water retention panel.

An extensive Garden Roof provides many benefits; it's beautiful yet extremely functional. Extensive vegetated roofs are increasingly used as a stormwater management tool. Properly designed they can detain and retain a great amount of the rain water that might otherwise over burden existing storm sewer systems in of our older municipalities.

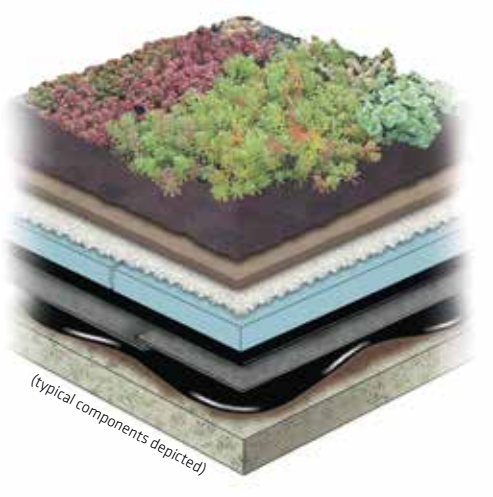
The following pages will provide a glimpse of Hydrotech's Garden Roof Assembly offerings.



For more information, please refer to Hydrotech's Garden Roof® Assembly Planning Guide.

Bellevue City Hall - Bellevue, WA

Other Garden Roof® Assemblies

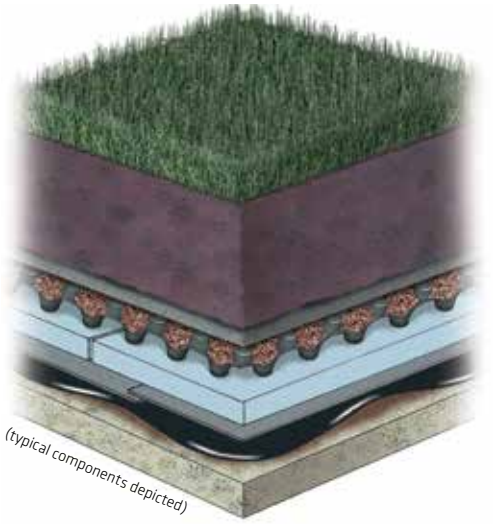


Extensive Rock Wool Garden Roof® Assembly

Extensive Rock Wool Garden Roof® Assembly

The addition of rock wool (mineral wool) to an extensive Garden Roof Assembly can increase its stormwater holding capability to meet some municipalities strong stormwater requirements. The rock wool assembly can also be used to keep the weight or even the height of the assembly to a minimum, since it can reduce the amount of LiteTop growing media needed. Rock wool, available in a 1" thickness, can be installed in multiple layers if needed, to achieve higher stormwater capacities. The rock wool layer is installed over Hydrodrain Max, to provide a drainage avenue between it and the Styrofoam™ insulation below.

The addition of rock wool can also be used to address horticulture issues in drier climates. Its substantial water holding capacity can provide more moisture for plant use.



Lawn Garden Roof® Assembly

Lawn Garden Roof® Assembly

Lawns can be established on roof tops in a PMR configuration. Hydrotech's Lawn Garden Roof Assembly is designed to create the specific environmental requirements needed to successfully establish and maintain turf grasses on a roof top.

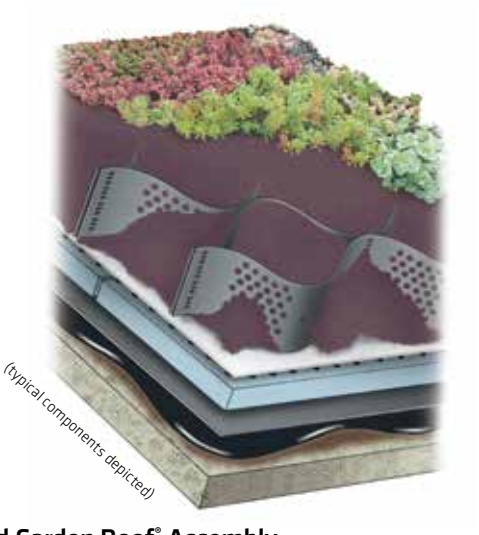
Turf grasses generally require deeper LiteTop media depths than extensive Garden Roof assemblies. The water needs of turfgrasses combined with deeper root structures equate to deeper media profiles. These finished lawn projects need to be mowed and maintained like any at-grade lawn.

InstaGreen GT-4 Tray

InstaGreen® GT-4 Tray

At times, designers need a modular vegetated option and Hydrotech's InstaGreen GT-4 tray can provide that in a protected membrane roof configuration. The plastic tray has an overall height of 5 3/4" and incorporates a 4" growing media layer with a 1 3/4" water reservoir base element. This tray assembly effectively creates a nearly 6" protective vegetative layer over the insulation and the roofing membrane.

These trays interlock to form an unbroken vegetated surface over the roof area. The interlocking feature increases the wind resistance of the individual tray units and the overall roof assembly.



Sloped Garden Roof® Assembly

Sloped Garden Roof® Assembly

While typical PMR Assemblies with stone or paver ballast are restricted to 2:12 slope maximum, a vegetated protected membrane roof can be created on very steep slopes. Hydrotech's Sloped Garden Roof Assembly can be used to create a protected membrane roof on slopes from 3:12 to 7:12 and more when properly engineered.

Utilizing stainless steel cables, Hydrotech's sloped Garden Roof® Assembly with GardNet® is engineered for steeply sloped roofs. The media assembly can vary from 3" to over 12" by varying the thickness or number of GardNet layers used. Deeper media assemblies create opportunities for different landscape materials in this unique protected membrane configuration.

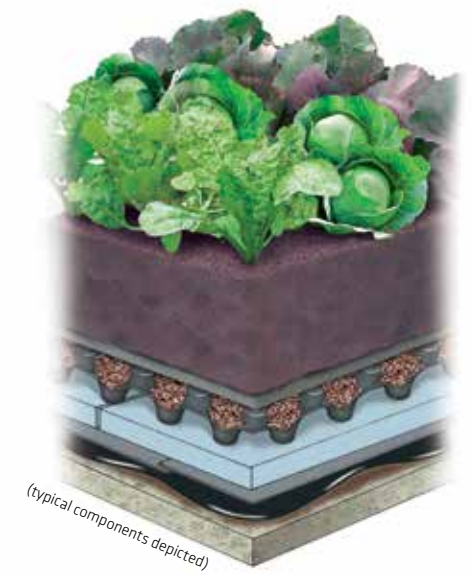
Lawns can also be created using this sloped assembly. By using the appropriate turf grasses, attractive pedestrian spaces can be created using this protected membrane roof assembly.

Intensive Garden Roof® Assembly

Intensive Garden Roof® Assembly

Architects and landscape architects are increasingly taking advantage of the roof top space for more involved landscape treatments. Hydrotech's Intensive Garden Roof® Assembly is designed to meet that design intent by creating an environment on the roof that supports all types of plant materials. Many types of trees, palms, shrubs, groundcovers and perennials can be incorporated into a Hydrotech Intensive Garden Roof installation.

These intensive assemblies are generally much deeper than extensive assemblies. Starting at 6" in media depth, these assemblies are often 36-48" deep and designed to support fully grown tree and other plant materials that are common in at-grade landscape installations.



Urban Agriculture Garden Roof® Assembly

Urban Agriculture Garden Roof® Assembly

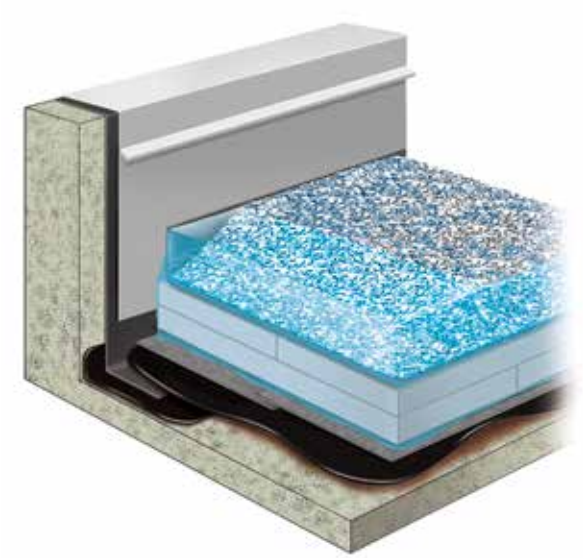
Bringing food production to the rooftop is becoming an increasingly popular activity in urban environments. A wide variety of vegetables, herbs and flowers have been brought to the roofs of buildings such as community centers, supermarkets and schools.

A deeper LiteTop media depth is needed to accommodate the vegetables and herbs. Irrigation is typically installed to provide the volume of water needed by vegetable crops.

Bee keeping has also been incorporated on Urban Agriculture roofs to bring these ever important pollinators closer to the target flowers in vegetable and flower crops. Honey generated from these hives have expanded the range of products that can be produced on Garden Roof installations of this type.

All of these Garden Roof Assemblies are outlined in much greater detail in Hydrotech's Garden Roof Planning Guide. Contact Hydrotech for a copy.

Blue Roof Assemblies



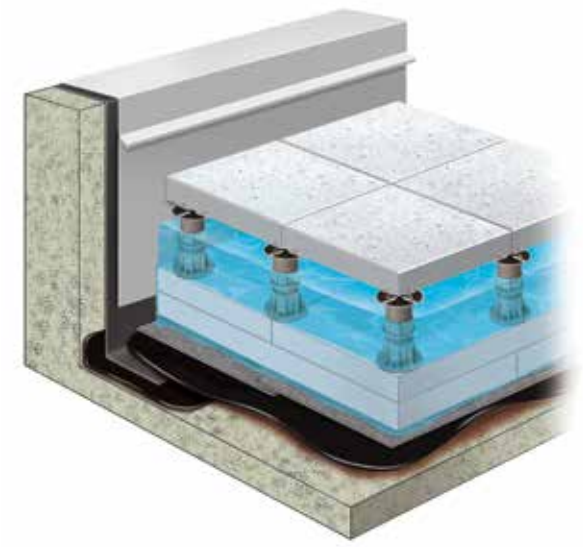
Stone Ballast Blue Roof Assembly

Blue roofs are increasingly being employed to manage stormwater on the roof top. With the ability to temporarily store large amounts of rain water, blue roofs make ideal protected membrane roof assemblies.

Stone Ballast Blue Roof Assembly

Hydrotech's Stone Ballast Blue Roof is the simplest blue roof that can be created. Using standard ballast stone, the water in the blue roof is temporarily stored within the void spaces of the stone and to the required depth above the ballast. A heavier than typical application of stone ballast is designed to keep the loose-laid Styrofoam™ insulation from floating during those rain events when the blue roof is in operation.

A Hydrotech PMR Blue Roof is ideal for those utilitarian roofs that are not designed for tenant use.

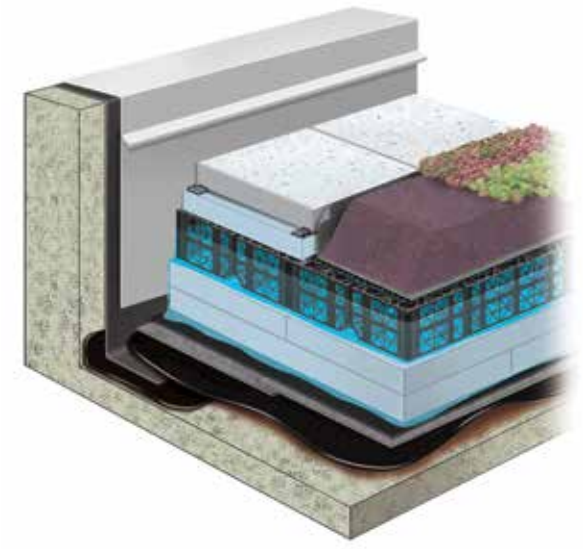


Ultimate Assembly Blue Roof Assembly

Ultimate Assembly Blue Roof Assembly

Hydrotech's Ultimate Assembly® Blue Roof utilizes concrete pavers set with pedestals over the Styrofoam™ insulation. The void space created under the pavers is an ideal location to temporarily store large quantities of stormwater. The paver weight is designed to keep the loose-laid Styrofoam™ insulation from floating during those rain events when the blue roof is in operation. As a result, heavier, thicker pavers are typically required.

A rooftop terrace is a perfect application for this blue roof assembly. Ideally a blue roof assembly should be installed on a flat 0-slope roof deck.



Garden Roof Blue Roof Assembly

Garden Roof® Blue Roof Assembly

This version of Hydrotech's Blue Roof Assembly combines the performance of the Garden Roof® Assembly and free water detained in a voided space into one, creating a high performance stormwater management solution. The core of this assembly is the water storage unit - Permavoid®.

Architectural pavers can be installed to create pedestrian spaces and to provide access to roof parapets and mechanical equipment. Garden Roof® components can be used to create extensive green roofs on top of the Permavoid units. Additionally, LiteTop® within the Garden Roof Assembly can increase the water holding capacity of this composite Blue Roof Assembly.

More information on Hydrotech's Blue Roof Assemblies can be found on page 33, however, all of these Blue Roof Assemblies are outlined in much greater detail in Hydrotech's Blue Roof Brochure. Contact Hydrotech for a copy.

Cool Roof Options

Hydrotech's Cool Roof Options

The roofing industry at large, architects and government agencies typically view white single-ply or modified bitumen sheet membranes as the only cool roof options available. Protected Membrane Roof designs can also satisfy this requirement while also providing many other substantial benefits, most important of all...long term performance.

The solar reflectance and thermal emittance of a surface is referred to as the Solar Reflectance Index number, or SRI. The SRI is defined as an alternative metric for comparing the coolness of roof surfaces. The higher the SRI, the cooler the roof will be in the sun. For example, a clean black roof has an SRI of 0, while a clean white roof has an SRI of 100. An initial SRI value of 82 and a 3 year aged value of 64 is required in order to qualify for LEED® points.

Hydrotech has a number of cool roof assemblies available:

Hydrotech's Protected Membrane Roof (PMR)... with high reflective white aggregate:

There are a number of quarries that produce a very white aggregate with a SRI value greater than 78 in order to qualify for LEED credit. (not available everywhere)

Hydrotech's PMR Assembly...with extra stone ballast or standard weight pavers:

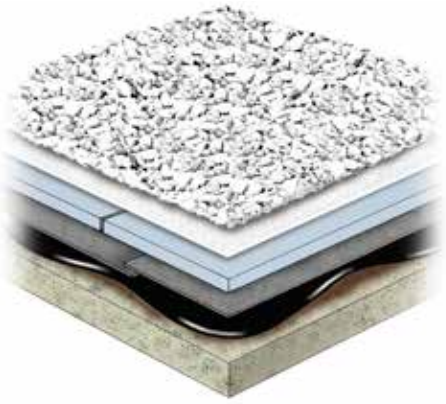
Testing done by the Oak Ridge National Laboratory (ORNL) and reported in "Evaluating the Energy Performance of Ballasted Roof Systems," indicated that a ballasted system with a minimum of 17 LB/SF performed at the same or better level of thermal performance compared to Energy Star rated cool roof products, such as a white TPO membrane

17 lbs/sf = same thermal performance as white TPO

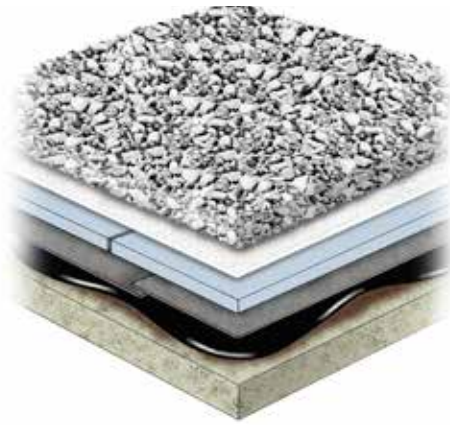
Based on this study, ASHRAE 90.1-2007 Addendum recognized a ballasted roof as a type of cool roof in addition to the traditional types of cool roofs defined by reflectivity and Solar Reflectance Index. The ASHRE 90.1 2007 Addendum wording in Section 5.5.3.1.2 Cool Roof is as follows: "Exceptions to 5.5.3.1.2: 1. Ballasted Roofs with a minimum stone ballast of 17 LB/SF (83 KG/MS) or 23 LB/SF (117 KG/MS) pavers..."

23 lbs/sf = same thermal performance as a white TPO

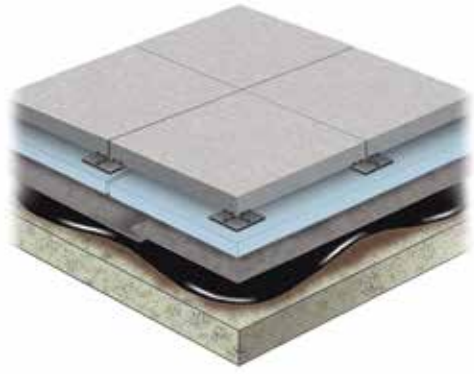
The USGBC is also studying this research as a potential option for LEED credit. Reference...ORNL Report Number UF-04-396 referenced above was prepared for the Single Ply Roofing Industry (SPRI), April 2008 Tech Solutions 512.0 Thermal Advantages of Ballasted Assemblies vs. White Membrane Cool Roofs – DuPont.



White aggregate



Extra ballast (heat sink)

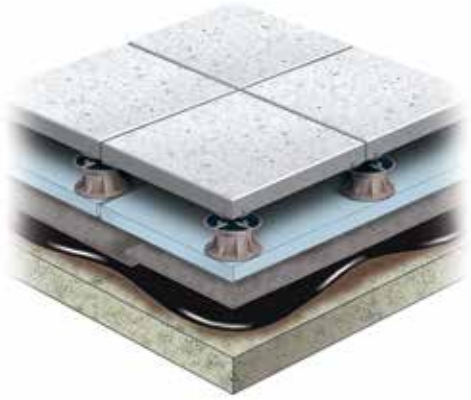


Typical Concrete Paver

Cool Roof Options

Hydrotech's PMR Assembly...with high reflective concrete pavers:

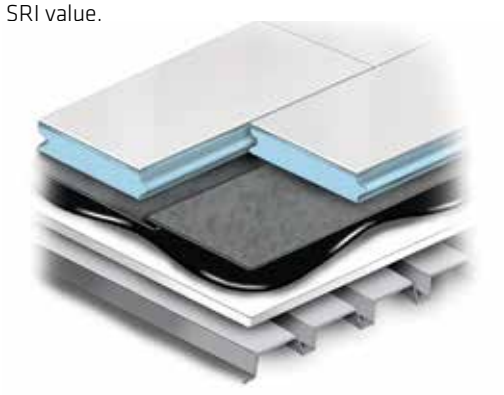
Hanover's Glacier White concrete paver in the Diamond, Finish 13, Stipple and Tudor finishes provide a SRI of 78 or better.



7 World Trade Center - New York, NY

Hydrotech's PMR Assembly...with Hydroguard®:

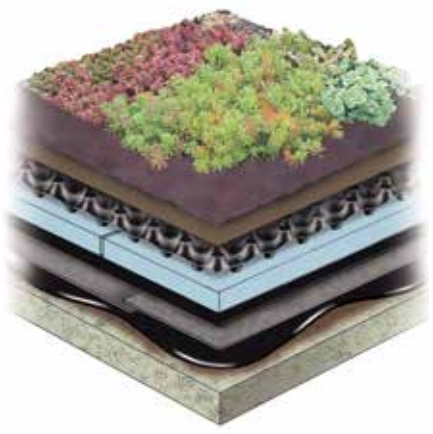
Hydroguard is a lightweight solution for a PMR Assembly, composed of Styrofoam™ insulation topped with a latex modified concrete, weighing only 4.5 LB/SF. Hydroguard protects the roof membrane from temperature extremes and mechanical abuse. A high reflective white coating suitable for concrete can be applied to achieve the desired SRI value.

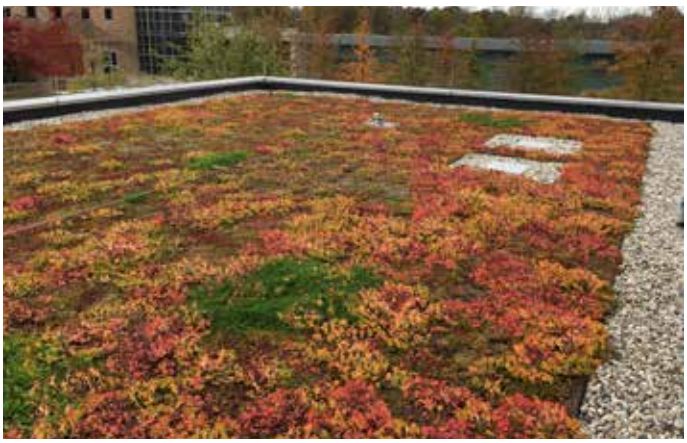


Oriole Park Branch Library - Chicago, IL

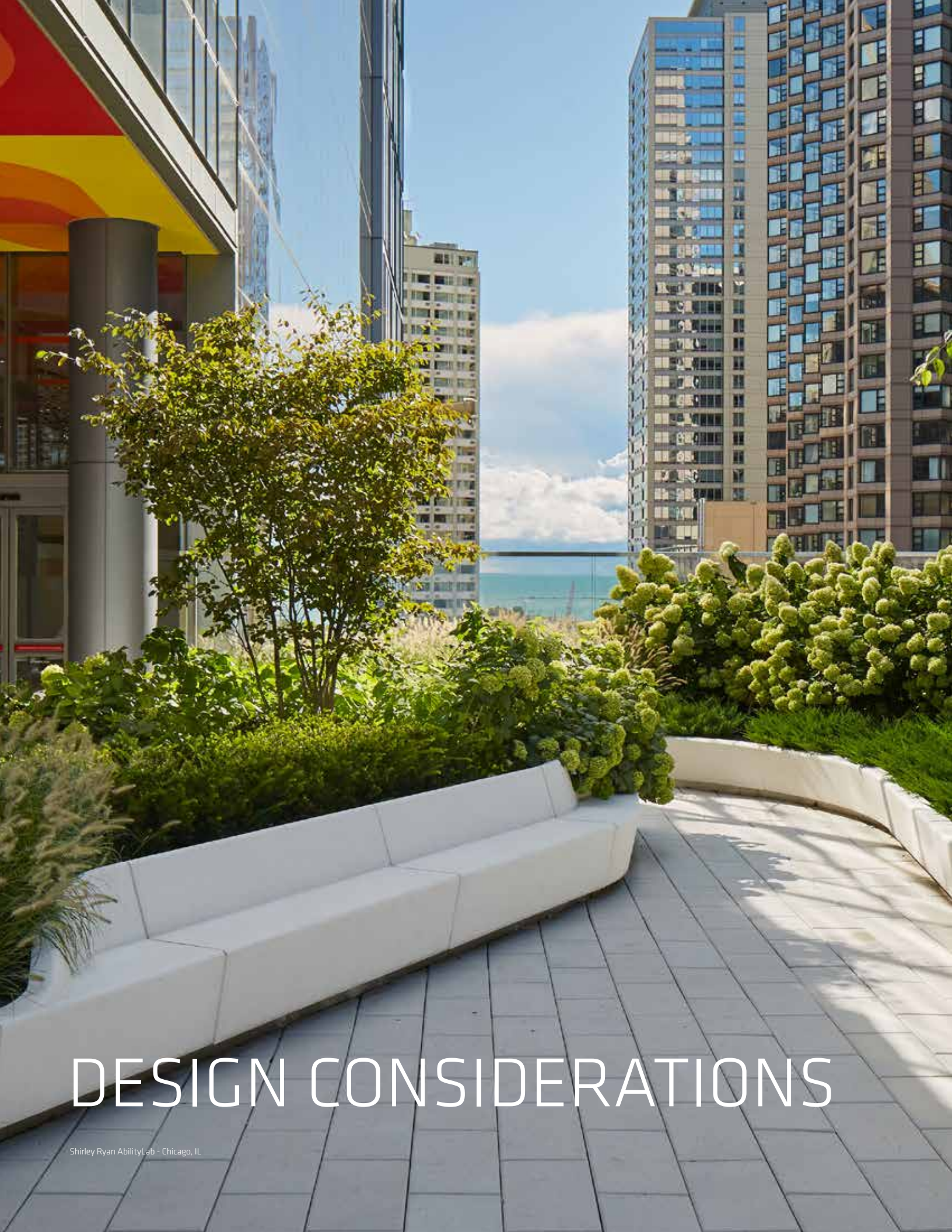
Hydrotech's PMR Assembly...with the Garden Roof® Assembly:

Hydrotech's Garden Roof Assembly should also be a consideration. It helps to mitigate the urban heat island effect more effectively than a white reflective surface and has many other unique benefits as well.





Dow Headquarters - Midland, MI



DESIGN CONSIDERATIONS

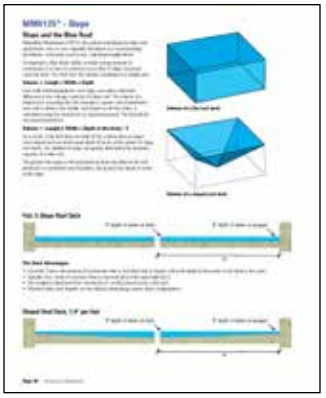
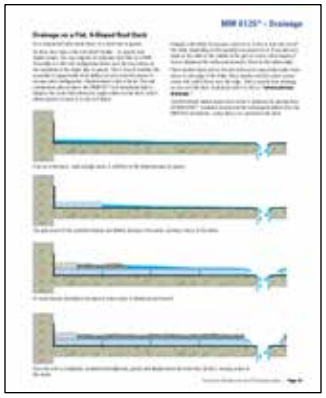
Shirley Ryan AbilityLab - Chicago, IL

Unabriged Version of Planning Guide Available

For a complete copy of the Garden Roof Planning Guide, please send an email to **pmr-guide@hydrotechusa.com**. The full PDF will contain pages of additonal content that includes critical information pertinent to:

- Protected Membrane Roof Design Considerations




LEED™ and Stormwater Management




INSTALLATION

Installation Basics

Membrane Preparation

Before Monolithic Membrane 6125® can be installed, the material must first be melted in a double-jacketed melter. Today's melters employ electronic temperature gauges, automatic shut off mechanisms and other design features, making safety a priority. The typical melter today is air-jacketed meaning the heat source first heats an air chamber that in turn heats up the membrane in the inner chamber. Oil-jacketed melters, where heat transfer oil fills the outer chamber, are also still commonly used. Propane, diesel and electrically operated melters are all currently available. Melters are sized to fit just about any job site condition, a 35 or 100 gallon melter are small enough to fit into an exterior building lift or elevator. Larger 200 or 400 gallon melters are also available to maximize production on a project.

A mechanical agitator inside the melter keeps the melted material moving, ensuring the uniform transfer of heat throughout the membrane. The membrane is brought up to a temperature of 350˚F - 375˚F before it is drawn off from the melter to be applied to the roof substrate.

Hydrotech's **Monolithic Membrane 6125 Pre-Installation and Application Guidelines** along with our **Standard Guideline Roofing or Waterproofing Details** are designed to assist our authorized, trained applicators in the proper application of the product.

Substrate Types

Monolithic Membrane 6125 can be installed to many different types of substrates besides concrete, such as, concrete masonry units (CMU's), wood, plywood, approved gypsum board type products and metal. Concrete, poured in place or precast, accounts for the vast majority of the decks to which MM6125 is best suited. There are many different types of concrete substrates as well, including, structural weight, lightweight structural, lightweight insulating and/or cellular concrete.

The following chart clarifies what type of MM6125 assembly is suitable for the various deck types:

Substrate Type	Fabric Reinforced Assembly (215 mil)	Standard Assembly (180 mil)
Cast in-place concrete (wood troweled finish preferred) - minimum density of 115 pcf.	YES	YES
Composite deck (concrete over metal)	YES	YES
Precast concrete, "T", double "T", panel	YES	YES
Lightweight insulating concrete or cellular concrete	NO	NO
Lightweight cellular concrete with an approved concrete substrate board	With Tech Services Approval	NO
Wood plank	YES	NO
Plywood	YES	NO
Metal deck with gypsum board (or other acceptable substrate board)	YES	NO
Renovation / rehabilitation	Contact Hydrotech	NO

Double Jacketed Melter

Concrete Substrate

Plywood Substrate

USG Securock Over Metal Deck Substrate

Concrete Finish & Curing

A poured-in-place concrete surface (horizontal) should be finished to a rough texture to provide a mechanical bond for the membrane. The texture however, should not be so rough that the membrane cannot be applied at a continuous thickness across the surface. As a minimum, a wood-float or broom finish is required, with a wood-toweled finish preferred. A steel-toweled finish is NOT desirable. Per the International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) Guidelines, a CSP of between 3 and 6 is ideal.

Probably the most important factor in assuring that the concrete will attain its full strength and durability is to insure it is properly cured. There are several curing methods that are acceptable to Hydrotech, including water curing, wet coverings, plastic sheets and liquid applied curing compounds. The vast majority of the time liquid applied curing compounds are used due to their easy of application and low cost. There are many different types of curing compounds available, however, most are not acceptable to Hydrotech because they leave a film on the concrete surface that would interfere with the bond of the membrane to the concrete. Sodium silicate-based curing compounds do not leave a surface film and are acceptable.

In renovation work any existing membrane bonded to the concrete surface must first be removed. The best method for removing an existing membrane depends on the type of membrane and how it was applied.

Simple Substrate Detailing

Monolithic Membrane 6125® detailing is simplified, with a minimum of 3 layers of protection in every condition.

Typical shrinkage cracks do not have to be detailed prior to the field application of the membrane.

For cracks over 1/16" but less than 1/4" and cold joints, a 6" strip of Flex-Flash F or Flex-Flash UN is centered over the crack or joint, embedded into and top coated over with MM6125.

Precast concrete joints (side and end) need to be filled with a backer rod and sealant prior to detailing with Flex-Flash UN.

Monolithic Membrane 6125 Application

On a horizontal deck the membrane is applied with a straight rubber bladed squeegee. As a rule of thumb, an evenly applied 1.4 lbs of membrane per square foot will ensure proper coverage (215 mils). An authorized applicator has many ways to ensure proper coverage is achieved.

The typical MM6125-FR (fabric reinforced) assembly consists of first applying a coat of MM6125 to the substrate at a minimum thickness of 90 mils (2.3mm), into which is immediately embedded a layer of Flex-Flash F reinforcing fabric. A second coat of MM6125, at a minimum thickness of 125 mils (3.2mm), is then applied, totally encapsulating the Flex-Flash F within the membrane.

Hydrotech's MM6125 Standard Assembly consists of one layer of membrane at 180 mils, minimum 125 mils. There are limited applications for this assembly, please see the chart on the previous page.

Concrete finish - wood trowel or broomed

Shrinkage cracks > 1/16" and < 1/4"

Cold or control joints

MM6125-FR Fabric Reinforced

Installation Basics

The following two pages are intended to give you a brief description of a typical application on a poured in place concrete substrate. Keep in mind every project is different.

Deck Preparation

The Hydrotech authorized applicator typically determines at the beginning of the day's work the size of the area they expect to complete that day. Once the area has been determined, the concrete substrate must be cleaned prior to the installation of the Monolithic Membrane 6125® membrane assembly. Typically, the concrete substrate would be broom cleaned of any debris and dirt and then blown with an air compressor to remove any remaining dust. The substrate must be clean prior to the application of the membrane.

Surface Conditioner

Hydrotech's Surface Conditioner should be spray applied to the concrete surface and allowed to thoroughly dry, prior to the installation of MM6125. Surface conditioner is only required on concrete substrates. It is applied in a light application, "tanning" the concrete surface, not blackening it.

Simple Detailing

Detailing work is completed first. This consists of either Hydrotech's Flex-Flash F (fabric) or Flex-Flash UN (uncured neoprene) reinforcing sheets encapsulated between two layers of MM6125. Flex-Flash F is typically used to reinforce cracks and changes in plane. Flex-Flash UN is used as reinforcing at drains, expansion joints or any transitions between dissimilar construction materials. It is also used as a flashing for exposed parapets, walls and curbs in roofing installations.

Flex-Flash MB, a torch grade modified bitumen sheet membrane, may also be installed as exposed flashing.

MM6125 Field Application

Once all the detailing work has been completed MM6125 can be installed over the field of the deck, fully overlapping the detailing conditions. The membrane is typically applied as a fabric reinforced assembly at a thickness of 215 mils. The first coat of MM6125 is installed at 90 mils with Flex-Flash F embedded into it, and the second layer of membrane is installed at 125 mils.

Separation/Protection Course Installation

To complete the installation of the roof membrane assembly the separation/protection course such as Hydrotech's Hydroflex 10 or 30 is installed. The Hydroflex sheet is embedded into the MM6125 membrane while it is still warm and tacky so that a good bond is attained between them. The Hydroflex products are intended to protect the membrane from light foot traffic and construction abuse. Hydrotech has other products available that can take heavier construction traffic and abuse if needed.

Surface conditioner applied

All detailing is done first

Membrane application in field of deck

Protection layer installed

Leak Detection

Hydrotech strongly recommends that the roof be tested for breaches, either by flood testing or electric conductivity testing (preferred), prior to installing the subsequent topping materials. This helps to ensure the installation is watertight before any overburden is placed.

Insulation Layer

DuPont Styrofoam™ insulation is typically installed in panels 2" or 3" thick to meet the thermal value required by the building code. With an R-value of 5 per inch of thickness, it is not unusual to see 4-6 inches (or more) of Styrofoam™ insulation installed. A stone filter fabric is installed directly over the insulation prior to the placement of stone/gravel or paver ballast. For multi-layer applications, the thinner board is placed on the bottom.

Topping or Overburden Layer

Stone/Gravel Ballast: In a stone or gravel ballasted PMR Assembly, properly sized aggregate is installed at the weight and depth required, per DuPont's ballast wind design guidelines, based on each roofs specific requirements. Typically, more ballast will be required at the corners and perimeters of a roof, where the wind uplift forces are greater than in the field of the roof.

Ballast or Architectural Concrete Pavers: If the roof is not accessible to the occupants of the building then a standard concrete ballast paver set on tabs or a lightweight interlocking concrete paver is typically used.

If the roof also functions as usable space, such a podium deck or roof terrace, architectural finished concrete pavers set on pedestals are typically used. Pedestals are used to elevate the pavers to the desired grade. Other components can be used to compensate for a sloped deck which results in a level finished surface.

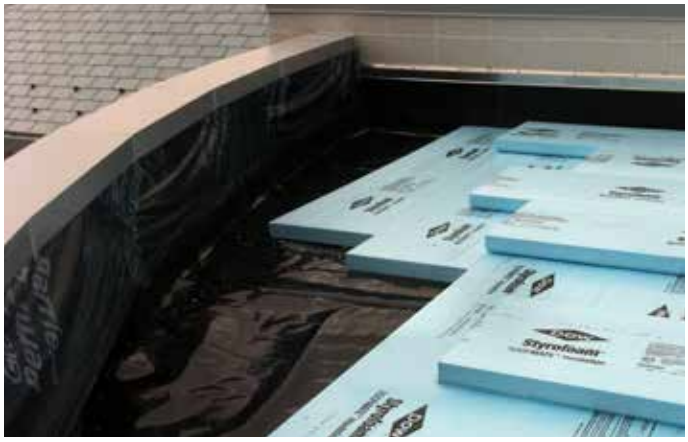
With any concrete paver, the ballast weight and installation must meet DuPont's wind design guidelines.

Vegetated Roof Applications: In Hydrotech's Garden Roof® PMR Assemblies the various components are installed over the insulation and must provide the necessary ballast needed to meet DuPont's ballast wind design guidelines. These may include Gardendrain®, Systemfilter®, LiteTop® engineered growing media and plant materials. These components are varied to address the particular objectives of the vegetated roof project.

Other Topping Layers: There are many ways to finish off a PMR Assembly that are not covered here, such as, Blue Roofs, Wood Tile, and Cool Roofs, just to name a few.

Hydrotech has many resources available to help with the proper specification and detailing of the assemblies offered.

Electric conductivity testing



Styrofoam™ Insulation installed

Stone ballast installed

Concrete pavers installed

Typical Detailing Conditions

Common Detailing

Detailing work utilizes Hydrotech's Flex-Flash F (fabric) or Flex-Flash UN (uncured neoprene) reinforcing sheets encapsulated between two layers of MM6125. Flex-Flash F is typically used to reinforce cracks and changes in plane. Flex-Flash UN is used as a reinforcing at drains, expansion joints and any transitions between dissimilar construction materials. It is also used as a flashing for exposed parapets, walls and curbs. Hydrotech's Flex-Flash MB, a modified bitumen sheet membrane may also be used in exposed flashing conditions. Hydrotech's MM6125 membrane is NOT acceptable for use as an exposed flashing.

Good roofing practice dictates that all flashings terminate 8"-12" on the vertical, above the topping materials. In all cases the application of the membrane in the field of the roof overlaps and ties into the detailing conditions.

Hydrotech has several acceptable methods for flashing curbs, parapets and other conditions. For additional detailing information please refer to Hydrotech's installation guidelines and details.

Pipe / Penetration Detailing

All penetrations (pipes, angles, vents, etc.) passing though the membrane must be rigid and properly secured to, or cast into the deck. For conduit or larger diameter pipes, a piece of Flex-Flash UN is placed at the base, extending a minimum of 4" in either direction of the penetration, with a hole in the center 1" less in diameter than the pipe diameter. This insures that the flashing comes up onto the penetrations to form a good seal. A second sheet of flashing wraps the pipe penetration and is typically terminated with a metal band clamp.

Typical Drain Detailing

Drains should be set in the deck, depressed ¾" below the deck level, 4' from the drain, to promote good drainage after all the detailing work has been completed.

With the clamping ring removed, membrane is applied around the drain, from the inside edge of the drain bowl, out several feet around the drain in all directions. Typically a 3'x3' sheet of Flex-Flash UN will suffice. The reinforcing sheet is set into membrane, centered over the drain bowl. Once the drain clamping ring is placed, the Flex-Flash UN should be coated with membrane up to the clamping ring, totally encapsulating it.

Typical Curb Detailing

Curb flashing can be detailed with Flex-Flash UN, extending down the curb and out onto the deck a minimum of 3". The UN should be set in MM6125, 3" on the horizontal and 3" up the vertical leg. The Flex-Flash UN is set in bonding adhesive on the vertical the full height of the curb.

Typical Parapet Detailing

Parapet flashing with Flex-Flash UN is handled like a curb, with the flashing extending much higher on the vertical. To protect the membrane flashing, it is advisable to cover it with sheet metal counter flashing. An alternative approach would be to cover it with Hydrotech's Hydroguard® (see photo at right). Other flashing methods utilizing Hydrotech's Flex-Flash MB, a modified bituminous sheet membrane, are available as well.

Pipe / davit detailed

Drain (and overflow drain) detailed

Curb flashing installed

Parapet detailing

Expansion Joint Detailing – Field Fabricated

Expansion joints can be detailed in a number of different ways, depending on the various structural or design considerations of each project. It's considered good roofing practice to curb the expansion joint above the finished roof surfacing so water is not able to flow across the joint. In some applications (such as, roof terraces or podium decks) the expansion joint can be buried under the topping materials, but it is still advisable to curb it as high as possible.

Field fabricated expansion joints are typically detailed with Flex-Flash UN and MM6125 membrane. Expansion joints <1" in width with a total design movement of <50% are handled with one layer of Flex-Flash UN embedded into and top-coated over with MM6125 membrane. With expansion joints that are > 1"but < 2" with a total designed movement of no more than 50%, two sheets of Flex-Flash UN are utilized.
For expansion joints with widths greater than 2" or with greater anticipated movement, Hydrotech recommends using a pre-engineered expansion joint (available from others).

Field fabricated expansion joint

Expansion Joint Detailing – Pre-Engineered Type

There are a number of prefabricated expansion joints that are available in the market today. These are engineered to accommodate greater widths and movement than a field fabricated expansion joint can handle. Some pre-engineered expansion joints are designed to tie directly into the MM6125 membrane, while others cap over curbs placed on either side of the joint. The curbs are flashed with Flex-Flash UN and tied into the MM6125 roof membrane on the deck.

Prefabricated expansion joint

Beneath Curb Detailing

Where a concrete curb is to be poured or a CMU wall constructed in the field of a roof, it is easy to run the MM6125 membrane underneath it. MM6125 and Flex-Flash F reinforcement is used to detail the rebar. The membrane should be brought up the rebar vertically 2"-3". Once the detailing is complete a protection layer is embedded into the membrane to protect it. To move water from one side of the curb to the other, drainage channels or scuppers can be blocked out at the base of the wall or curb.

Through wall curb detailing

HydroSeal PMMA Flashing

Hydrotech also offers HydroSeal Resin, a fluid applied PMMA flashing product to help handle a variety of flashing conditions that do not lend themselves to typical membrane detailing or flashing terminations. The HydroSeal resin and fleece reinforcement form a monolithic, self-flashing reinforced flashing membrane in conjunction with Hydrotech's MM6125 membrane flashing. This product can also be used to flash curbs and parapets in lieu of Flex-Flash UN (uncured neoprene) flashing product.

Hydrotech's HydroSeal Matrix is used to form a monolithic, self-adhering and self-terminating reinforced membrane for flashing and repairs where HydroSeal Resin, reinforced with HydroSeal Fleece, would be difficult or impossible to install (i.e., over bolt heads, back-to-back angles, etc.

For more information on detailing various conditions, please refer to Hydrotech's standard guideline details which can be found on our website, in either PDF or CAD format. For atypical detailing conditions, please contact Hydrotech for assistance.

HydroSeal PMMA flashing

PMR Assembly Components

Monolithic Membrane 6125®

Hydrotech's Monolithic Membrane 6125® (MM6125) is a seamless, rubberized asphalt membrane that can be applied to structural concrete decks, plywood or gypsum board over metal decks. It consists of one coat of membrane at 90 mils (2.3 mm) into which Hydrotech's Flex-Flash F (a spunbonded polyester fabric) is embedded. A second coat of membrane is then installed at 125 mils (3.2 mm). The total membrane thickness is 215 mils (6.0 mm).

Weight: 1.4 lbs./SF installed (7.3 kg./sq.m)

Size: 40 lbs. solid cakes

Thickness: 215 mils (total installed thickness)

Recycled Content: Up to 40% post-consumer by weight

Surface Conditioner

An asphaltic surface conditioner used to enhance the bond of MM6125 to concrete. Conforms to ASTM D41-85. Surface Conditioner is available in both 5 gallon pails and 55 gallon drums.

Weight: 5 Gal. Pail is 40 lbs (18.1 kg)/each
55 Gal. Drum is 440 lbs (199.6 kg)/each

Flex-Flash F

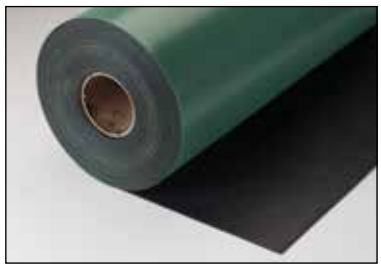
Flex-Flash F is a spunbonded polyester fabric used as a reinforcement material with MM6125. It is used to reinforce the membrane over cracks, construction joints and changes-in-plane. It is also used embedded into and top coated over with MM6125 over the roof substrate, creating a fabric reinforced membrane assembly. Flex-Flash F is not intended to be used at drains, expansion joints or as an exposed flashing.

Weight: 1.35 oz/sq yd (45.77 g/sq m)

Size: 6" x 600' (15.2 cm x 183 m)
12" x 600' (30.5 cm x 183 m)
39" x 600' (99.1cm x 183 m)

Thickness: 0.01" (.254 mm)

Flex-Flash UN



Flex-Flash UN is a thermoset material made of uncured neoprene rubber. It is typically used as a heavy-duty reinforcing and exposed flashing membrane in conjunction with MM6125. Flex-Flash UN is perfect for forming around penetrations and corners as well as detailing expansion joints and drains.

Weight: 0.52 lbs/SF (2.54 kg/sq m)

Size: Available in rolls 6" (15.2 cm), 12" (30.5 cm), 18" (45.7 cm), 24" (61.0 cm), 36" (91.4 cm) and 48" (121.9 cm) wide x 100' long (30.5 m)

Thickness: 0.060" (1.5 mm)+/- 10%

Flex-Flash MB

Flex-Flash MB is a high-quality polymer modified bitumen flashing sheet, reinforced with a polyester scrim and a glass fiber mat. The product is available either with or without a white/gray UV resistant granular top surface and lightly sanded underside. Flex-Flash MB is typically used as an exposed torch-applied flashing membrane with MM6125.

Weight: Granule surfaced 100 lbs (45.36 kg)/roll
Smooth surfaced 89 lbs (40.4 kg)/roll

Size: 39.4" (1.0 m) wide x 33'-4" (10.2 m) long

Thickness: Granule surfaced 0.180" (4.5 mm)
Smooth surfaced 0.160" (4.0 mm)

Bonding Adhesive, Splice Tape & Primer

Bonding Adhesive is a synthetic rubber-based adhesive, specifically designed to bond Flex-Flash UN to an acceptable substrate (i.e. wood, metal, concrete). Splice Tape is a black, pressure sensitive, fully cured, double-sided, butyl tape, designed to be used to bond the laps of Flex-Flash UN uncured neoprene flashing together. Splice Tape Primer, which is solvent-based and VOC compliant, is used to prepare the mating surfaces of Flex-Flash UN and Splice Tape.

Size/Weight:

Bonding Adhesive: 5 gallon pail 50 lbs (22.7 kg)/each

Splice Tape: 4" (1.0 m) wide x 100' (3.5 m) long rolls0.035" (0.8 mm) thick; 14 lb (6.4 kg)/roll

Splice Tape Primer: 1 gallon (0.25 l) cans; 9 lb (4 kg) per can)

Hydroflex® 10

Hydroflex® 10 is a modified asphalt separation/protection sheet with a synthetic fiber reinforcement that is embedded into MM6125 to provide protection from light foot traffic. It is not designed to provide protection in high traffic areas or where extreme physical abuse is anticipated.

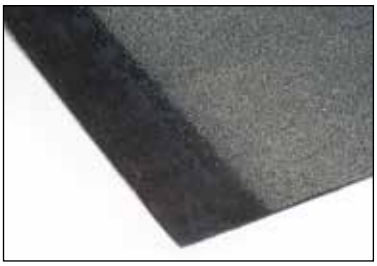
Weight: 0.31 lbs/SF (1.51 kg/sq. m)
Size: 39.37" x 98.5' (1 m x 30 m)
Thickness: 0.043" (1.1 mm)

Hydroflex® 30

Hydroflex® 30 is a modified asphalt separation/protection sheet, with a synthetic fiber reinforcement, that is embedded into MM6125 to provide protection from typical construction traffic. In high traffic areas where vehicular traffic is anticipated, or extreme physical abuse is expected, additional protection may also be required. (Available as either an APP or SBS asphalt sheet).

Weight: 0.46 lbs/SF (2.25 kg/sq m)
Size: 39.37" x 98.5' (1 m x 30 m)
Thickness: 0.090" (2.2 mm)

Hydroflex® RB II



A heavy duty, granular-surfaced, modified asphalt sheet with a factory applied root inhibitor. Used in intensive vegetated roof applications or whenever aggressive root growth is anticipated. It is also used in sloped applications as the granular surfacing provides additional slip resistance.

Weight: 0.91 lbs./SF (4.4 kg/sq.m)
Size: 39.4" x 33.4' rolls
(1 m x 10.2 m)
Effective coverage: 97 SF per roll
Thickness: 0.160" (160 mils, 4.0 mm)

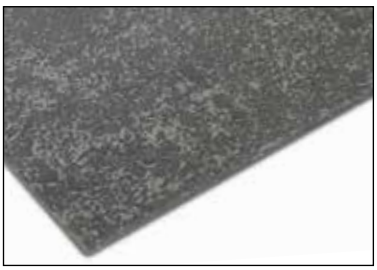
Hydrocap 90FR and 160FR

Hydrocap 90FR and 160FR are specially formulated, heavy duty, rubberized asphalt protection/cap sheets with fiberglass reinforcement and with a fire rated, non-combustible ceramic granular surface. Hydroflex 90FR is specifically designed to be embedded into MM6125 to act as a protection course for the membrane. Hydroflex 160FR is specifically designed to be embedded into MM6125 to act as both protection for the membrane and the finished surface of the roof.

Hydrocap 90FR
Weight: 90 lbs/roll (41 kg/roll)
Size: 39.76" x 33.5' (1 m x 10.2 m)
Thickness: 0.090"" (2.2 mm)

Hydrocap 160FR
Weight: 110 lbs/roll (50 kg/roll)
Size: 39.625" x 33.33' (1 m x 10.1 m)
Thickness: 0.133" (3.3 mm)

Permaboard



Permaboard is a superior quality, semi-rigid waterproofing/ roofing protection board composed of a rubberized asphalt core reinforced with a non-woven fiberglass mat and sandwiched between two protective polypropylene layers. Permaboard is designed to be embedded into MM6125 as a protection board when heavy construction traffic is anticipated. The board should be overlapped a minimum of 1" to insure complete coverage of the membrane is achieved.

Weight: 15 lbs. (6.8 kg)/ 1/8" sheet
22.5 lbs (10.2 kg)/ 3/16" sheet
Size: 39.5" x 6.67' (1 m x 2 m)
Thickness: 1/8" thick or 3/16" thickness (3.0 mm or 4.5 mm)
Note: Available only on the West Coast

DuPont Styrofoam™

Styrofoam™ an extruded polystyrene (XPS) insulation provides a design R-Value of 5 per inch of thickness. Styrofoam™ provides thermal insulation to the building, protection to the membrane, and is ideally suited to wet environments due to its high moisture absorption resistance.

Weight: 0.17 lbs./SF per inch of thickness (0.83 kg./sq.m)
Size: 2' x 8' (0.6 m x 2.4 m)
Thickness: 1" to 4" thickness available
Compressive Strength: 40, 60, or 100 psi (275.8, 413.7, 689.5 kPa)
R-Value: 5 per inch of thickness
Recycled Content: 20% post-industrial and pre-consumer by weight

PMR Assembly Components

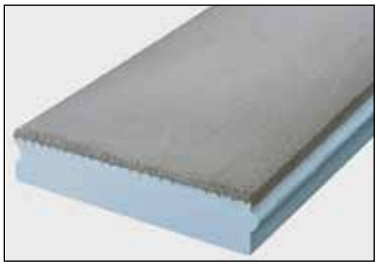
Stone Filter Fabric

Stone Filter Fabric is a white, UV stabilized, needle-punched, non-woven polypropylene fabric designed to be used in all Protected Membrane Roof (PMR) Assemblies as a separation sheet between the stone/gravel ballast and DuPont Styrofoam insulation. Stone Filter Fabric serves three main functions. It protects the insulation board from exposure to the sun, prevents stone/gravel ballast from falling in between the joints of the insulation boards and rafts them together.

Weight: 3.0 oz/sq yd or 101 lbs./roll (101 g/sq m or 45.8 kg/roll)

Size: 13.5' (4.1 m) wide x 360' (109.7 m) long

Hydroguard® (Standard or Heavy)



Hydroguard® consists of Styrofoam™ insulation board topped with a 3/8" or 15/16" latex modified concrete surface. It measures 2' x 4', with tongue and groove edges along the long sides of the panels. Hydroguard is a lightweight self-ballasted insulation panel for use in a Protected Membrane Roof (PMR) Assembly.

Weight: 3/8" (9.55 mm) concrete surface, 4.5 lbs./SF

15/16" (23.8 mm) concrete surface, 11 lbs./SF

Size: 24" (.61 m) x 48" (1.2 m) panels

Thickness: Insulation only - 2" (50.8 mm) or 3" (76.2 mm)

Hydrodrain® 300, 302 & 1000

(Ideal for horizontal applications)

Hydrodrain® 300 is a composite drainage product with a three-dimensional, crush-proof drainage core to which is bonded a white non-woven needle punched filter fabric. Hydrodrain 302 and 1000 utilize the same core but have different filter fabric combinations.
For more information on these products please contact Hydrotech.

Hydrodrain 300

Weight: 0.24 lbs./SF (1.17 kg/sq m)

Size: 48" x 75' rolls (1.2 m x 22.9 m)

Thickness: 0.22" (5.6 mm)

Recycled Content: 100% post-industrial by weight

Hydrodrain® 400, 420, 700 & 990

(Ideal for vertical applications)

Hydrodrain® 400 is a composite drainage product with a three-dimensional dimple core to which is bonded a black needle punched filter fabric. Hydrodrain 420, 700 and 990 utilize the same core design but differ from Hydrodrain 400 in several ways.
For more information on these products please contact Hydrotech.

Hydrodrain 400

Weight: 45-50 lbs./SF (220-244 kg/sq.m)

Size: 48" x 50' rolls (1.2 m x 15.2 m)

Thickness: 0.40" (10.1 mm)

Recycled Content: 100% post-industrial by weight

Securock®

USG's Securock® Gypsum-Fiber Roof Board, marketed by Hydrotech, is a rigid, square-edged, roof substrate board composed of recaptured gypsum and cellulose fiber. Securock is an acceptable substrate over metal deck, for the application of Hydrotech's MM6125 in a fabric reinforced application. Securock (5/8") must be secured to minimum 22-gauge structural metal decking with appropriate plates and fasteners. Securock (1/2") may be used only when securing through a rigid insulation to the metal decking.

Weight: 3.20 lbs./SF for 5/8" (15.62 kg/sq.m) 2.76 lbs./SF for 1/2" (13.5 kg/sq.m)

Size: 4' x 8' panels (1.2 m x 2.43 m)

Thickness: 5/8" or 1/2" available (15.8 mm or 12.7 mm)

Recycled Content: 97% pre-consumer recycled content

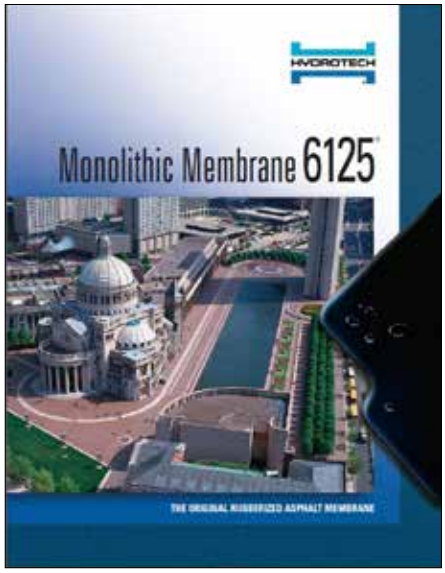
Other Products

The following assemblies are comprised of a number of products and accessories too numerous to be included within this document. Please visit Hydrotech's website for more specific information regarding Hydrotech's:

- **HydroSeal Flashing and Membrane**
- **Ultimate Assembly**
- **Wood Tile Assembly**
- **Garden Roof Assembly**

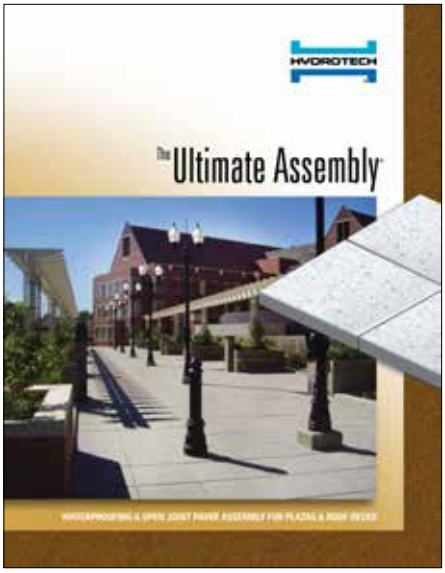
Additional Resources

Hydrotech has a wide array of additional Protected Membrane Roof (PMR) Assembly resources available for you.



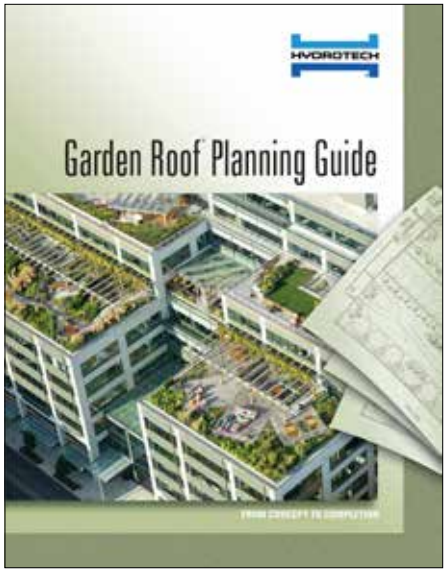
Monolithic Membrane 6125®

This brochure outlines the capabilities of Hydrotech's flagship product, MM6125, and its value in the most important aspect of any roofing and waterproofing project: **keeping the structure watertight.**



The Ultimate Assembly®

Often projects involve hardscape elements and the Ultimate Assembly brochure outlines the assemblies that are appropriate for creating a wide array of paved pedestrian friendly surfaces on roof tops and plazas.



Garden Roof® Assembly

With more than 20 years of experience in vegetated roofs, Hydrotech's Garden Roof Planning Guide is indispensable to designers, architects and engineers who need design or technical guidance for their next vegetated roof project.

Website - www.hydrotechusa.com

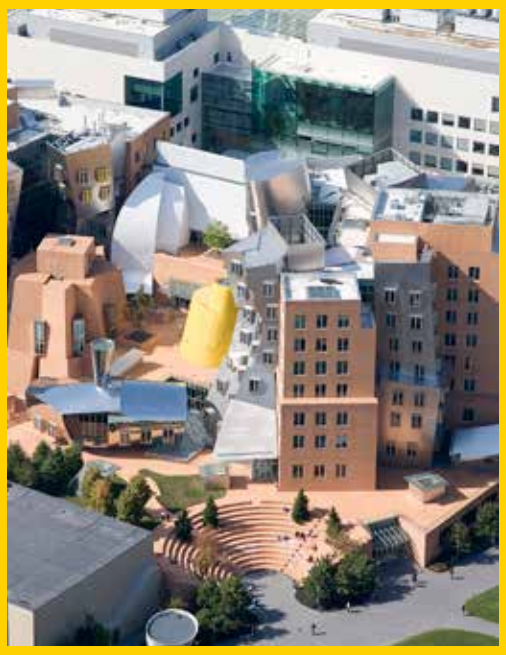
Hydrotech's website has been optimized for viewing from whichever device a user prefers. Whether browsing from a desktop, tablet or smartphone, the following resources are available...

- Brochures
- Specifications
- Details
- Installation Guidelines
- Project Spotlights
- Project Photography
- Plant Lists
- Product Data Sheets
- Material Safety Data Sheets
- Ask an Expert

People Make the Difference

Hydrotech's most valuable resource is the knowledge and experience we have gained from each and every roof in which we have been involved. We encourage you to talk to your local sales representatives or directly with our Technical or Garden Roof Department personnel. We are available to assist you with your next project, whether you need design input, details reviewed, or help with your specifications.

Please **contact us at 800-877-6125** or visit our website at **www.hydrotechusa.com.**



Stata Center, Massachusetts Institute of Technology - Cambridge, MA

Walt Disney Concert Hall - Los Angeles, CA

In 1980, American Hydrotech, Inc. purchased the Construction Products Division of Uniroyal Ltd. in Canada, giving the company exclusive worldwide ownership for the manufacture and distribution of Monolithic Membrane 6125®.

One early strength of American Hydrotech, Inc., that continues today, is its established relationships with the architectural community. The highly respected architectural firm Skidmore, Owings and Merrill first used MM6125® in the late 1960's for the Finance and Management Center at the Illinois Institute of Technology in Chicago.

We have best-in-class brands that provide exceptional performance and owner value: Monolithic Membrane 6125®, our premium (flagship) waterproofing product has been successfully installed on the world's most prestigious structures in over 62 countries for more than 50 years.

In 2021, Sika Corporation acquired American Hydrotech for its position as the market leader in the development and production of premium waterproofing and roofing products and assemblies. With more than 100 years of experience, Sika is a worldwide innovation and sustainability leader in the development and production of systems and products for commercial and residential construction, as well as the marine, automotive, and renewable energy manufacturing industries. Sika has offices in over 103 countries with over 400 manufacturing facilities and more than 33,000 employees worldwide. With annual sales of 12 billion dollars in 2023, our commitment to quality, innovation, and the environment as well as putting our customer's needs first, encompasses why Sika is the global leader in our industries. Sika, beyond the expected.

WE ARE SIKA

With more than 100 years of experience, Sika is a worldwide innovation and sustainability leader in the development and production of systems and products for commercial and residential construction, as well as the transportation, marine, automotive, and renewable energy manufacturing industries.

Sika has subsidiaries in 102 countries around the world and, in over 400 factories, produces innovative technologies for customers worldwide. In doing so, it plays a crucial role in the transformation of the construction and transportation sector toward greater environmental compatibility. With more than 34,000 employees, the company generated sales of CHF 11.76 billion in 2024.

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