THE ADVANTAGE
PROTECTED MEMBRANE ROOFING ASSEMBLY

HIGH DENSITY EXTRUDED POLYSTYRENE RIGID INSULATION

FOAMULAR® 350

INNOVATIONS FOR LIVING™
REDUCED LIFE CYCLE COSTS.
EASE OF INSTALLATION.
DESIGN FLEXIBILITY.

The Protected Membrane Roof (PMR) Assembly places the membrane under the insulation. In this protected environment the roof membrane is shielded from physical damage, extremes in temperature and temperature cycling, high vapour pressure, and the detrimental effects of the environment which often leads to premature failure and high maintenance.

The advantage of long term, durable and low cost roof performance comes from the unique properties of Owens Corning FOAMULAR® 350 Type 4 High Density Extruded Polystyrene Rigid Insulation. FOAMULAR® 350's high moisture resistance, high compressive strength and reliable thermal value is the only type of insulation suitable for use in protected membrane roofs.

A protected membrane roof will enhance the performance of single ply membranes, modified bitumen, and BUR membranes.

The Owens Corning advantage, with FOAMULAR® 350 Insulation, shields both the membrane and flashings from physical damage, temperature extremes and high moisture pressure. This roofing/flashings integrated approach provides for improved long term performance with substantially reduced maintenance when compared to traditional roofing practices.

With over twenty years of proven performance in Canada, the protected membrane roof – with Extruded Polystyrene Insulation – can be considered the ideal choice of roofing assembly for new construction, reroofing and retrofit (thermal upgrading) projects.

As owners and property managers become more concerned about the management of the Life Cycle costs of their facilities it is essential that designers respond to their client’s needs. The FOAMULAR® 350 PMR Assembly provides an answer to the protection of the facility and its contents as well as minimizing the Life Cycle costs associated with one of the most important, but often neglected building envelope component... the roof.

Life Cycle costs are composed of several elements: Initial building costs, normal maintenance and scheduled repairs, emergency repairs, system additions/upgrades/replacements.

The FOAMULAR® 350 PMR Assembly eliminates the need for a separate air and vapour barrier. This simplifies design and construction, reduces cost, speeds construction, and clarifies trade responsibility.

**DESIGN AND MAINTENANCE ADVANTAGES.**

Protection of the membrane and membrane flashings with a contiguous layer of FOAMULAR® 350 Insulation reduces energy requirements by eliminating thermal bridges. Greater design flexibility and building use is achieved.

This:
- Eliminates special provision for normal roof traffic.
- Can reduce the requirement to provide roof dividers.
- Eliminates the need to provide insulation stops.
- Maximizes use of the roof. Given the proper design, the roof may be used to accommodate mechanical equipment, landscaping, patios, or recreational facilities.
- Makes it easier to achieve total continuity of design with respect to thermal, air and moisture barriers.
- Maximizes potential use of building for occupants.
INSTALLATION
• Initial installation is a cost effective step towards lower overall maintenance costs and attaining of optimal life expectancy of the system.
• Reduced susceptibility to “post installation” roof traffic damage and vandalism.
• Moisture driven from the interior of the facility cannot affect the insulation.

MAINTENANCE
• Normal inspection and maintenance of a well installed membrane is minimized.
• Need to resaturate BUR systems is eliminated because there is no attack by ultraviolet rays.

EMERGENCY REPAIRS
• Reduced emergency repairs, because in the unlikely event of a roof leak, the leak is localized and cannot be trapped in the system by a separate vapour retarder.
• Reduced material costs for membrane repairs (if required) since ballast, water permeable fabric, and insulation can be reused.

THERMAL UPGRADE
• Planned thermal upgrades to the insulation are cost efficient and require minimal disruption to operation of the facility... the integrity of the waterproofing membrane need never be disturbed.
DESCRIPTION

FOAMULAR® 350 Roof Insulation is a pink, closed cell, Type 4* extruded polystyrene having a minimum 240 kPa (35 psi) compressive strength. It is produced using a unique method - Hydrovac® - a patented vacuum hydrostatic process that provides uniform thickness, consistent shiplap board edges, and a choice of popular thickness. FOAMULAR® 350 is available in a shiplapped format for optimum thermal performance. It can be supplied with channel vents for optimal drainage applications.

APPLICATIONS

Type 4* extruded polystyrene insulation, such as FOAMULAR® 350, is the only type of roofing insulation suitable for use in Protected Membrane Roofs. FOAMULAR® 350 is ideal for application in:
• New Roofing Assemblies
• Re-roofing Systems
• Retrofit Roofing (thermal upgrade)
• FOAMULAR® 350 may be used in conjunction with all popular membranes including single-ply, modified, and built-up PMR assemblies.

DIMENSIONS

FOAMULAR® 350 is provided in: 24’ x 48” (600mm x 1200mm)
Thickneses: 1.5’, 2’, 2.5’, 3’ and 4’ (38mm, 50mm, 63mm, 75mm, and 100mm)

ADVANTAGES

• Reliable Aged R-Value for consistent energy savings.
• Lightweight and easy to handle during application.
• High compressive strength provides excellent resistance to damage from normal roof traffic, even in areas under wood decks, pavers, and planters.
• High resistance to moisture absorption means the insulation will not degrade or disintegrate in wet conditions even after repeated freeze thaw cycles... as a result there is no significant loss of thermal performance or physical integrity of a properly constructed assembly.
• Unique manufacturing process ensures reliable control and consistency of the products physical properties for optimal efficiency in roof design.

CODES AND COMPLIANCES

IN A PMR CONFIGURATION

ULC S107 (Class A) - Fire from an external source
ULC S126 (Class A) - Fire from an internal source
ULC Fire Resistant Roof / Ceiling Systems R703, R805, R806, R808 and R217
ULC Fire Acceptable Rating - Constructions C35 & C36
FM Class I 90
* CAN ULC S701 Type 4
CAN/S102.2-M83 - Surface burning characteristics
- Greater than 25 and less than 500
CCMC Evaluation report # CCMC no. 11430-L

PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>ASTM METHOD</th>
<th>METRIC</th>
<th>IMPERIAL</th>
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<tbody>
<tr>
<td>Thermal Resistance(1)</td>
<td>C 518 or C 177</td>
<td>0.88 m² °C/W</td>
<td>5.0 ft² hr °F/BTU</td>
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<tr>
<td>Water Vapour Permeance</td>
<td>E 96</td>
<td>35 ng/Pa.s.m²</td>
<td>0.60 perms</td>
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<tr>
<td>Compressive Strength, min.</td>
<td>D 1621</td>
<td>240 kPa</td>
<td>35 psi</td>
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<tr>
<td>Water Absorption, max.</td>
<td>D 2842</td>
<td>0.7%</td>
<td>0.7%</td>
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<tr>
<td>Linear Coefficient of Thermal Expansion</td>
<td>D 696</td>
<td>4.9 x 10⁻⁵ mm/mm/°C</td>
<td>2.7 x 10⁻⁵ in/in/°F</td>
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<tr>
<td>Flexural Strength, typical</td>
<td>C 203</td>
<td>415 kPa</td>
<td>60 psi</td>
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<tr>
<td>Dimensional Stability, max (% linear change)</td>
<td>D 2126</td>
<td>1.5</td>
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<tr>
<td>Water Capillarity</td>
<td>-</td>
<td>None</td>
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<tr>
<td>Water Affinity</td>
<td>-</td>
<td>Hydrophobic</td>
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<tr>
<td>Maximum Operating Temperature</td>
<td>-</td>
<td>74° C</td>
<td>165° F</td>
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<tr>
<td>Limiting Oxygen Index (min 24)</td>
<td>ASTM D 2863</td>
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(1) Per inch (25 mm) of thickness
SPECIFICATION FOR A LIGHTWEIGHT PMR ASSEMBLY

1. GENERAL MATERIAL HANDLING

- Cover FOAMULAR® 350 insulation on the job site with a light coloured tarp. Discoloured surfaces should be brushed clean prior to installation.
- FOAMULAR® 350 insulation is a combustible material and may constitute a fire hazard. Do not expose it to a direct flame or other ignition source during shipping, storage, or application.
- Keep other roofing materials dry prior to and during application.

2. MATERIAL SELECTION

SPEC NOTE: Specify only those materials needed for the type of deck that is being roofed.

- Thermal barrier to deck securement
  a. Roofgrip fasteners with flat plates or
  b. Asphalt type _____, to CSA A123.4M.
- Thermal Barrier such as Supra Deck F or approved equal, _____ mm (_____ in.).
- Ballast: crushed or round stone, free of fines or less than 19mm (3/4") or greater than 38mm (1-1/2"). Most stones should range from 19-38mm (3/4" to 1-1/2").
- Insulation - FOAMULAR® 350 roof insulation RSI ____(R ____), to CAN/CGSB-51.20-M87 Type 4*, supplied by Celfort. Applied in (one) (two) layers or RSI _____ (R ____) .
- Membrane - 4 plies of BUR #15 perforated asphalt felt
  or 4 plies of Type 4 glass felt
  or approved modified bituminous system
  or single ply membrane to the manufacturer’s specification
  or liquid membrane to the manufacturer’s specification.
- Fabric - Fabrene® V.I.E. in 3660mm (144") wide sheets as supplied by Celfort.
- Construct flashing to the manufacturer’s or to CRCA’s specifications.

3. APPLICATION

- Ensure that the temperature and general site conditions are acceptable for proper application of the system.
- Deck Treatment - All roof decks should have positive drainage to avoid ponding. CRCA recommendation is 1:50. For FM or ULC fire rated systems, the steel deck must be covered with a securely fastened thermal barrier.
- Deck and structure must be designed to take the ballast load and limit deck deflection to Building Code requirements.
- Curbs and cants shall be installed where flashings are required. Deck shall be securely anchored and be smooth, free of dust and dirt, snow, ice, debris, or standing water. Ensure that a concrete deck is properly cured.

MEMBRANE INSTALLATION

- Organic BUR - apply the BUR membrane as per CRCA or provincial trade association specifications as required. A slip sheet may be required to ensure that the insulation is not bonded to the membrane.
- Other membranes - apply the [Modified Bituminous] [liquid membrane] [single ply sheets] to the manufacturer’s specification.

SPEC NOTE: Some liquid membranes remain tacky and require the use of a slip sheet over the top of them.

- Insulation - over the top of the membrane loose lay the FOAMULAR® 350 insulation, butting the panels tightly together. Stagger the edges from row to row so that the short edges are not in line. Bevel the edges to conform with the shape of the cant. Cut insulation to fit snugly around all openings. When applying multiple layers, each layer should have the joints offset from the lower layer.
- Water permeable fabric - lay the Fabrene’ V.I.E. sheet loose over the top of the insulation, lapping sides and ends by 305mm (12”). Slit the fabric to fit tightly around roof projections. Cut out roof drains and openings. Turn the fabric up at the cant and leave loose in back of the counterflashing. Do not use fabric pieces that are less than 2.4m x 2.4m (8’ x 8’) in size.
- Flashings - construct all flashings to conform to CRCA specifications for a PMR assembly or to the membrane manufacturer's specifications. Protect drains and gutters from the entry of ballast.
PMR ASSEMBLY

The PMR Assembly permits the owner of the facility to upgrade the thermal performance of his roofing system at low cost and with a minimum of effort provided the existing roofing system is in good or maintainable condition. In order to optimize the benefits of this type of system, it is essential that the owner undertake the following:

1. INVESTIGATIVE REVIEW
   - The facility and roof structure must be examined by a certified engineer in order to determine the appropriateness for the new design criteria (in particular, the additional system weight).
   - The roofing system must be checked by a qualified roofing expert to determine the present status of the roof and what repairs should be undertaken prior to the application of the new system.
   - The investigation should include cut tests to establish the condition of the deck, vapour retarder, insulation, gypsum or membrane... in general, any component of the old system which may have suffered from the adverse effects of moisture in the system, roof traffic, or other external forces.
   - Establish a plan to account for the raising of all flashings and changes to parapet details (ensure that the top level of the insulation will not approach the bottom of penthouse doors etc.).
   - Develop plans to ensure proper drainage of any ponded areas on the roof.
   - Have a qualified person calculate the dewpoint to calculate the correct insulation thickness required.

2. REPAIR/REPLACEMENT STRATEGIES
   - Establish the extent of repairs necessary to restore the roof to a level appropriate to its expected life cycle.

   NOTE: Excessive moisture in the old roofing components such as the insulation or gypsum may lower the structural strength of the system and affect the system’s ability to meet the original design criteria.

   - Prepare repair specifications and undertake repairs or, if the repairs required are excessive, replace the entire system with a new PMR assembly (see Page 2).

3. INSTALLATION OF THE RETROFIT SYSTEM

   The following options are available for these types of existing roof systems.

   EXISTING PMR ASSEMBLY
   - Remove and retain the ballast.
   - Install the FOAMULAR® 350 on top of the existing insulation, offsetting the edges of the two layers.
   - Complete the installation as per the Specification for Light Weight PMR.
   - Optional: Specify Channel Vent FOAMULAR® 350 for optimal drainage of the roof system.
   - Reapply the ballast and add additional ballast as required to eliminate negative flotation of the insulation.

   Existing Bur System
   - Scrape off all loose gravel.
   - Effect all repairs as required.
   - Complete the installation as per the specification for Light Weight PMR.
   Optional: Specify Channel Vent FOAMULAR® 350 for optimal drainage of the roof system.

   Existing Single Ply in Loose-Laid and Ballasted Systems
   - Remove and retain all ballast.
   - Check all seams for integrity and continuity.
   - Make all necessary repairs.
   - Complete the installation as per the specification for Light Weight PMR.
   Optional: Specify Channel Vent FOAMULAR® 350 for optimal drainage of the roof system.

   All roof drains should have perforated screens attached in order to keep ballast out of the drain system.
ROOFING DESIGN DETAILS
AS USED IN TRAFFIC AREAS

PLANTERS AND INTERLOCKING PAVERS
A water permeable, filter fabric is laid directly over the insulation and covered with a layer of aggregate. The planter boxes are laid in the bed of aggregate. Planters must be adequately drained to avoid the extra weight of trapped water. All paving stones must be firmly butted together to prevent passage of UV rays.

CONCRETE PEDESTRIAN TRAFFIC DECK
A water permeable slip sheet must be laid over the insulation before laying the gravel drainage layer. The concrete must be reinforced and expansion and contraction joints provided where required.

WOOD DECKS
Wood sleepers are laid directly on the insulation and the wood deck is constructed on the sleepers. Gravel is distributed as per specification around the wood sleepers.

PAVING SLABS
To provide adequate drainage, the paving slabs must be set on a bed of sand, pea gravel, or leveling pads in order to keep them above the level of the insulation. A water permeable filter sheet should be used under the sand or pea gravel to keep the insulation joints clear.

PROTECTED PARAPET
A layer of insulation and a layer of overlay board, such as Supra Deck F, is applied to the roof side of the parapet as a protective cover for the membrane. This ensures superior thermal and physical protection for the membrane in an area that can account for approximately 70% of roof failures.

ROOF DRAINS
All roof drains should have perforated screens attached in order to keep ballast out of the drain system.
QUARTERLY TIPS

TECHNICAL SERVICES

Technical suggestions on the use of FOAMULAR® 350 Insulation for use in new construction, reroofing or thermal upgrading is available by contacting a local Owens Corning representative or by calling 1-800-387-0303.

Technical advice is available on other Owens Corning Roof, Wall and High Density insulation products. Owens Corning “Smart Solutions” – technical tips on improving standards for the design, construction and maintenance of roofing systems – is available without cost from your local Owens Corning representative.

SMART SOLUTIONS

In an ongoing effort to develop new solutions to roofing concerns Owens Corning has undertaken the “Smart Solutions” Program. Our technical service group will work with outsourced building science consultants to present their ideas on a regular basis through our technical publication “Smart Solutions.”

FOAMULAR® 350 WITH PRE-ENGINEERED DRAINAGE CHANNELS

FOAMULAR® 350 with pre-engineered drainage channels can be used to increase moisture removal from the membrane surface. This is particularly important on retrofit roofs where dust and grit from the original membrane could clog up the normal drainage paths between insulation boards. Some adjustment in thickness of insulation specified may be required to meet energy considerations of the system.

FOAMULAR® 350 is manufactured by Owens Corning to provide optimum insulating performance in your roofing assemblies. In an attempt to provide you with suggestions for optimizing design criteria, we have incorporated some drawings and recommendations from design authorities such as CRCA and provincial associations. However, drawings and recommendations contained herein, do not in anyway replace the expertise and the responsibilities of engineers and architects. Owens Corning does not practice either architectural or applications engineering and assumes no liability for design or construction by others, nor for improper handling, storage, or application of our products.

Codes & Standards Compliance:
- Meets Montreal Protocol 2010, CFC, HCFC Free
- Zero Ozone Depletion Potential
- 70% Less Global Warming Potential*

*The insulation is manufactured with a blowing agent with 70% less global warming potential as compared to Owens Corning previous blowing agents. THE PINK PANTHER™ & ©1964–2010 Metro-Goldwyn-Mayer Studios Inc. All Rights Reserved. The colour PINK is a registered trademark of Owens Corning © 2010 Owens Corning.