Energy-Saving, Moisture-Resistant XPS Insulation
For Cold Storage Applications
ASTM C 578 Type IV, 30 psi minimum

Description
FOAMULAR® LT30 extruded polystyrene insulation is suitable for virtually all cold storage insulating needs, including floors, walls and roofs. Durable FOAMULAR® XPS insulation also performs well under cold storage concrete floor slabs. FOAMULAR® XPS insulation’s resistance to water absorption and water vapor transmission allows it to maintain low thermal conductivity in the presence of the severe water vapor characteristics of cold storage applications.

FOAMULAR® LT30 extruded polystyrene insulation is a closed-cell insulation made using Owens Corning’s exclusive HYDROVAC® manufacturing process. FOAMULAR® LT30 extruded polystyrene insulation is manufactured to comply with ASTM C 578. See Typical Physical Properties table.

Owens Corning offers a variety of FOAMULAR® insulation products for use in cold storage applications depending on the specific needs of the design and engineering process.

LT30 insulations with minimum compressive strengths of 30 psi are suitable for insulating cold storage facilities.

Key Features
- Excellent long-term stable insulating performance at R-5.1 per inch
- Exceptional moisture resistance, long-term durability
- Limited lifetime warranty—maintains 90% of R-value and covers all ASTM C 578 properties
- GREENGUARD Gold Certified
- The only XPS foam with certified recycled content—certified by SCS Global Services to contain a minimum 20% recycled content
- Will not corrode, rot or support mold growth
- Zero ozone depletion potential with 70% less global warming potential than our previous formula
- Reusable
- Lightweight, durable rigid foam panels are easy to handle and install
- Easy to saw, cut or score

Excellent Resistance to Freeze/Thaw Cycling
FOAMULAR® LT30 extruded polystyrene insulation has been tested for its ability to retain critical structural properties in a severe freeze/thaw environment.

Determined Thickness
Thickness of insulation, which determines heat flow rate, can be determined using the FOAMULAR® Insulation Thickness graph and the temperatures found in the Summer Design Temperatures for Selected U.S. Cities. Refer to Owens Corning Cold Storage Technical Guide, Pub. No. 43746-A.

Design of Concrete Slabs on Grade Supported by FOAMULAR® Insulation
Insulated concrete slabs are common in cold storage facilities. These slabs and the layers below must be capable of supporting the live and dead loads imposed by vehicles, stationary and/or moving equipment, loaded storage racks and pedestrian traffic. FOAMULAR® extruded polystyrene insulation provides support beneath insulated concrete floor slabs. The slab and supporting layers must be designed with consideration given to the rigidity of each layer. Proper design avoids excessive deflection which can result in cracking. Note: It is recommended that final concrete slab design be specified by a professional architect or engineer.
Allowable Stress on FOAMULAR® Insulation Layers

A concrete slab must be capable of distributing loads over an area of sufficient size so that pressure on underlying layers do not exceed allowable limits. When FOAMULAR® extruded polystyrene insulation is used below the slab, allowable stress limits are defined based upon a percentage of FOAMULAR® insulation’s minimum compressive strength, see Technical Guide, Pub. No. 43746-A.

Determining Stress

To determine the stress that FOAMULAR® insulation will experience, you will need to know the deflection of the concrete slab (see Concrete Slab Design Formulas) as well as the foundation modulus.

Foundation modulus is a measure of how much a substrate deflects under a given load, expressed as inches deflection per inch of thickness or “pci.” The foundation modulus for various thicknesses of FOAMULAR® insulation can be found in Table 3.

Cold Storage Design Notes

• Cold storage facility temperatures should be lowered gradually to the operating temperature range to minimize the possibility of damage to the structure. Doors should remain partially open during temperature reduction to relieve internal pressure. Complete any necessary joint caulking after temperature reduction to allow for surface contraction.

• Cold storage facilities designed to operate below freezing should have an installed heat source below the facility floor to protect from frost heave. Heating capacity must be designed based on the heat flow rate of the floor slab assembly, the operating temperature inside the facility and the efficiency of the heating source.

• Cold storage building envelope assemblies should be evaluated for effectiveness and location of vapor retarders to avoid condensation and subsequent deterioration of insulation performance.

• Install multiple layers of FOAMULAR® insulation with joints staggered and edges tightly butted.

• Select primers, sealers, caulking and adhesives with care. Coal tar pitch sealants should not be used with FOAMULAR® insulation.

• Avoid penetrating the FOAMULAR® insulation envelope around the facility with steel beams, large pipes, or conduits. Where penetration is necessary, insulate the intruding object as fully as possible to avoid creating excessive thermal shorts through the FOAMULAR® insulation envelope.

Typical Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Resistance¹, R-Value minimum,</td>
<td>ASTM C 518</td>
<td></td>
</tr>
<tr>
<td>°F•ft²•hr•Btu @ 40°F (4.4°C) mean temperature</td>
<td></td>
<td>5.4</td>
</tr>
<tr>
<td>Compressive Strength², minimum psi</td>
<td>ASTM D 1621</td>
<td>30</td>
</tr>
<tr>
<td>Flexural Strength³, minimum psi</td>
<td>ASTM C 203</td>
<td>50</td>
</tr>
<tr>
<td>Water Vapor Permeance⁴, maximum % by volume</td>
<td>ASTM C 272</td>
<td>0.10</td>
</tr>
<tr>
<td>Water Absorption⁵, maximum % by volume</td>
<td>ASTM E 96</td>
<td>1.1</td>
</tr>
<tr>
<td>Dimensional Stability, maximum % linear change</td>
<td>ASTM D 2126</td>
<td>2.0</td>
</tr>
<tr>
<td>Flame Spread⁶,</td>
<td>ASTM E 84</td>
<td>5</td>
</tr>
<tr>
<td>Smoke Developed⁷,</td>
<td>ASTM E 84</td>
<td>45-175</td>
</tr>
<tr>
<td>Oxygen Index⁸,</td>
<td>ASTM D 2863</td>
<td>24</td>
</tr>
</tbody>
</table>

1. Properties shown are representative values for 1” thick material, unless otherwise specified.
2. Modified as required to meet ASTM C 578
3. R means the resistance to heat flow; the higher the value, the greater the insulation power. This insulation must be installed properly to get the marked R-value. Follow the manufacturer’s instructions carefully. If a manufacturer’s fact sheet is not provided with the material shipment, request this and review it carefully. R-values vary depending on many factors including the mean temperature at which the test is conducted, and the age of the sample at the time of testing. Because rigid foam plastic insulation products are not all aged in accordance with the same standards, it is useful to publish comparison R-value data. The R-value for FOAMULAR® XPS insulation is provided from testing at two mean temperatures, 40°F and 75°F, and from two aging (conditioning) techniques, 180 day real-time aged (as mandated by ASTM C 578) and a method of accelerated aging sometimes called “Long Term Thermal Resistance” (LTTR) per CAN/ULC S770-03. The R-value at 180 day real-time age and 75°F mean temperature is commonly used to compare products and is the value printed on the product.
4. Values at yield or 10% deflection, whichever occurs first.
5. Value at yield or 5%, whichever occurs first.
6. Data ranges from 0.00 to value shown due to the level of precision of the test method.
7. Water vapor permeance decreases as thickness increases.
8. These laboratory tests are not intended to describe the hazards presented by this material under actual fire conditions.
10. ASTM E 84 is thickness-dependent, therefore a range of values is given.
**FOAMULAR® LT30**
Extruded Polystyrene (XPS) Rigid Foam Insulation

**Product and Packaging Data**
FOAMULAR® LT40 Extruded Polystyrene Insulation

<table>
<thead>
<tr>
<th>Material</th>
<th>Packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extruded polystyrene closed-cell foam, ASTM C 578 Type IV, 25 psi minimum</td>
<td>Shipped in units covered with poly-wrap. Common unit sizes are 4’x4’x8’ or 4’x8’x8’.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thickness (in)</th>
<th>Product Dimensions (typical) Thickness (in) x Width (in) x Length (in)</th>
<th>Pallet (Unit) Dimensions (ft)</th>
<th>Square feet per Pallet</th>
<th>Board feet per Pallet</th>
<th>Bundles per Pallet</th>
<th>Pieces per Bundle</th>
<th>Pieces per Pallet</th>
<th>Edges</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2 x 48 x 96</td>
<td>4 x 8 x 8</td>
<td>1,536</td>
<td>3,072</td>
<td>8</td>
<td>6</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3 x 48 x 96</td>
<td>4 x 8 x 8</td>
<td>1,024</td>
<td>3,072</td>
<td>8</td>
<td>4</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

1. Available lengths and edge configurations vary by thickness. See www.foamular.com for current offerings. Other sizes may be available upon request. Consult your local Owens Corning representative for availability.

**Technical Information**

- **FOAMULAR®** extruded polystyrene insulation is suitable for cold storage building roofs but should be covered with roof membrane and/or ballast on the same day of installation. This will prevent potential damage from heat build-up by excessive exposure to direct sunlight.

- **FOAMULAR®** insulation is not recommended for use where sustained temperatures exceed 165°F. Do not use in contact with chimneys, heater vents, steam pipes or surfaces with temperatures over 150°F.

**Standards, Codes Compliance**
- Meets ASTM C 578 Type X
- Meets California Quality Standards; HUD UM #71A
- Compliance verification by RADCO (AA-650)
- See UL ER8811-01 at UL.com
- UL Classified. A copy of UL Classification Certificate U-197 is available at www.foamular.com

**FOAMULAR® XPS Insulation**

- FOAMULAR® XPS Insulation is a non-structural material and must be installed on framing which is independently braced and structurally adequate to meet required construction and service loading conditions.

- FOAMULAR® insulation can be exposed to the exterior during normal construction cycles. During that time some fading of color may begin due to UV exposure, and, if exposed for extended periods of time, some degradation or “dusting” of the polystyrene surface may begin. It is best if the product is covered within 60 days to minimize degradation. Once covered, the deterioration stops, and damage is limited to the thin top surface layers of cells. Cells below are generally unharmed and still useful insulation.

**Technical Information**

This product is combustible. A protective barrier or thermal barrier is required as specified in the appropriate building code. For additional information, consult MSDS or contact Owens Corning World Headquarters at 1-800-GET-PINK®.

All construction should be evaluated for the necessity to provide vapor retarders. See current ASHRAE Handbook of Fundamentals.
Certifications and Sustainable Features of FOAMULAR® XPS Insulation

- **FOAMULAR® XPS insulation** is reusable.
- **FOAMULAR® XPS insulation** is made with a zero ozone depletion formula.
- Certified by SCS Global Services to contain a minimum of 20% recycled content.
- Certified to meet indoor air quality standards under the stringent GREENGUARD Indoor Air Quality Certification Program, and the GREENGUARD Gold Certification.
- Qualified as an ENERGY STAR® product, under the U.S. Environmental Protection Agency and the U.S. Department of Energy.
- Approved under the Home Innovation Research Labs NGBS Green Certification Program.
- Utilizing FOAMULAR® XPS insulation can help builders achieve green building certifications including the Environmental Protection Agency’s ENERGY STAR®, the Home Innovation Research Labs NGBS Green Certification, and the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED®) certification.
- **FOAMULAR® XPS insulation** qualifies for The Buy American provision of the American Recovery and Reinvestment Act (ARRA).

Discussion of Design Examples

Example 1—The conditions listed result in a stress of 3.42 psi on the insulation layer. The stress is acceptable when related to the live or dead load recommendations for the chosen insulation. The actual stress in the concrete slab is also below that which is allowed.

Example 2—Changing the insulation layer from Example 1 results in reduced stress on the insulation layer. However, the increased insulation layers are prone to more deflection and are less capable of supporting the load. Therefore, deflection in the concrete slab increases, which results in a concrete stress that is too high.

Example 3—Increasing the thickness of the concrete slab in Example 2 reduces the concrete stress under the point load to an acceptable level. Other variable changes that reduce concrete slab tensile stress to acceptable levels include reducing load, increasing area of load contact, using a stronger concrete, adding steel reinforcements or increasing the insulation foundation modulus.

Example 4—Changing to an insulation with a substantially greater foundation modulus and compressive strength results in a reduction in concrete tensile stress. Note that the foundation modulus in the example increased by 75% over that used in Example 2 to cause only a 7% reduction in concrete slab tensile stress. Variation of insulation foundation modulus within a small range has little impact on the final concrete slab design.

Example 5—Excessive stress levels in the concrete slab can also be corrected by increasing the area of load contact. Note the decrease in concrete slab tensile stress from Example 2, which results from distributing the load over a larger area.

Example 6—All of the previous examples focus on reducing the tensile stress in the concrete slab to an acceptable level. This example shows the effect of increasing the load to a level which places maximum allowable compressive strength on the insulation. Note the excessive tensile stress which results on the concrete slab.
### FOAMULAR® LT30 Insulation Recommended Stress Limits

<table>
<thead>
<tr>
<th>Recommended</th>
<th>PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum compressive strength</td>
<td>30.0</td>
</tr>
<tr>
<td>Live Load (&lt;20 of minimum)</td>
<td>6.0</td>
</tr>
<tr>
<td>Dead Load (&lt;33 of minimum)</td>
<td>10.0</td>
</tr>
</tbody>
</table>

### FOAMULAR® LT30 Foundation Modulus “K” (psi)

<table>
<thead>
<tr>
<th>Insulation</th>
<th>Thickness</th>
<th>2”</th>
<th>3”</th>
<th>4”</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT40</td>
<td>700</td>
<td>570</td>
<td>515</td>
<td></td>
</tr>
</tbody>
</table>

Note: For multiple layer insulation systems, assuming layers are identical, the foundation modulus for the system (KT) equals the foundation modulus for one (1) of the layers (K1) divided by the total number of layers (L). KT=K1/L. For insulation systems which utilize a variety of thicknesses, the system foundation modulus (KT) is determined by adding the reciprocal of the foundation modulus for the individual layers (1/K1). The total is the reciprocal value for the foundation modulus of the entire insulation system.

### Concrete Slab Design Formulas

**• Stress Under Point Load in Field of Slab**

\[
\sigma_b = 0.316 \frac{P}{h^2} \left[ \log h^3 - 4 \log \left( \sqrt{1.6a^2 + h^2} - 0.675h \right) - \log k + 6.48 \right]
\]

**• Deflection**

\[
D = \frac{P}{8} \sqrt{\frac{K}{\frac{Eh^3}{12 \left(1 - \mu^2\right)}}}
\]

**Nomenclature**

- \(a\) : Radius of load contact area (in)
- \(D\) : Deflection (in)
- \(E\) : Modulus of Elasticity, concrete (psi) \(E = 57,000 \sqrt{F_c}\)
- \(f_b\) : Tensile stress, bottom of slab (psi)
- \(F_c\) : Concrete compressive strength min (psi)
- \(f_t\) : Tensile stress, top of slab (psi)
- \(F_t\) : Concrete tensile strength, allowed (psi) \(F_t = 4.6 \sqrt{F_c}\)
- \(h\) : Slab thickness (in)
- \(K\) : Insulation foundation modulus (pci)
- \(L\) : Radius of relative stiffness (in)
- \(P\) : Load (lb)
- \(\mu\) : Poisson’s Ratio, .20 for concrete

### Estimating Stress in FOAMULAR® Insulation Layer

The stress that FOAMULAR® insulation will experience under a concrete slab can be estimated by multiplying the insulation’s foundation modulus (K) by the deflection of the concrete slab (D).

\[
F (\text{Stress}) = K \times D
\]

Deflection of the concrete slab can be determined by using the Concrete Slab Design Formulas to the left.
Environmental and Sustainability
Owens Corning is a worldwide leader in building material systems, insulation and composite solutions, delivering a broad range of high-quality products and services. Owens Corning is committed to driving sustainability by delivering solutions, transforming markets and enhancing lives. More information can be found at www.sustainability.owenscorning.com.

Warranty
FOAMULAR® XPS insulation limited lifetime warranty maintains 90% of its R-value for the lifetime of the building and covers all ASTM C 578 properties. See actual warranty for complete details, limitations and requirements at www.foamular.com or www.owenscorningcommercial.com.

Notes
1. R means the resistance to heat flow; the higher the R-value, the greater the insulating power.
2. See actual warranty for complete details, limitations and requirements.

All products described here may not be available in all geographic markets. Consult your local sales office representative for more information.

For more information on the Owens Corning family of building products, contact your Owens Corning dealer, call 1-800-GET-PINK®, or access our web sites: www.foamular.com and www.owenscorning.com. More Information
For more information on FOAMULAR® insulation, please contact your Owens Corning representative to request the following publications:

THERMAPINK® Extruded Polystyrene Insulation Product Data Sheet Pub. No. 23546

DURAPINK® Extruded Polystyrene Roofing Recovery Board Product Data Sheet Pub. No. 23550

DURAPINK® PLUS Extruded Polystyrene Roofing Recovery Board Product Data Sheet Pub. No. 23551