

# PERFORMANCE CHARACTERISTICS OF INDUSTRIAL INSULATION



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## 12B. SELECTING ACCESSORY PRODUCTS TO COMPLEMENT THE TOTAL INSULATION SYSTEM

### Adhesives and Sealants

#### ■ PREFACE

In the last newsletter we saw the importance of system compatibility for coatings, which provide an insulation's exterior protection, and for fabrics, which reinforce this outer protective layer. In the current discussion, we are concerned with those accessories which adhere an insulation to a surface—the adhesive, and those which help to prevent water vapor entry at joints—the sealant.

#### ■ ADHESIVES

Adhesives are used to join FOAMGLAS® cellular glass insulation to vessels, tanks, chambers—or virtually any industrial surface for which the insulation is appropriate. There are also fabricating adhesives used to join FOAMGLAS® insulation to itself during fabrication; these will be discussed later.

Just as the adhesive must be compatible with the insulation, it also must be appropriate for the surface to which the insulation is applied. On porous masonry, concrete and gypsum board surfaces, for example, solvent-based adhesives might be used; while on metals and other nonporous material surfaces, a low-solvent, hot-melt or self-curing adhesive is required. FOAMGLAS® insulation is a non-porous material. With adhesives, the "total system" approach is doubly critical: compatibility must be attained not only between insulation and accessory

product, but between accessory product and substrate, as well.

There are other factors to be considered when choosing adhesives, including temperature at the adhesive site, chemical resistance, odor (significant in food processing areas), and good consistency. Also, flexibility over the temperature range of use should be a high priority. It is critical that testing and experience guide your selection.

#### Types

Adhesives broadly fall into two categories: one- or two-part materials (the latter requiring mixing before use). Most come in either format, with one-part adhesives usually requiring air to cure.

Generally, temperature and corrosion resistance will be the two strongest criteria in choosing an adhesive type. Silicones provide excellent heat resistance: up to 500°F for extended periods and up to 650°F intermittently. Asphalt-based adhesives are recommended where corrosion resistance is a high priority, including contact with acids, alkalis and many chemicals. Other adhesive types include urethanes, butyls, polysulfides, epoxies, neoprenes and styrenes/polyesters.

#### Installation

Installation using a one-part adhesive is generally faster, as no material preparation is required; and most of these products are applied by caulking gun.

When using two-part adhesives, mechanical mixing is required prior to use. Generally, adhesives of this type are applied with a notched trowel to the substrate, insulation or both. In overhead applications—such as tank systems or duct work—where temporary tape, strap or band support is not used, a catalyst is available to accelerate bonding.

#### Recommendations

Pittsburgh Corning has extensively tested the wide range of adhesives and sealants available for installing FOAMGLAS® insulation in numerous applications. The following materials have been developed specifically for use with FOAMGLAS® insulation and have proven performance characteristics.

#### PC® HI-TEMP/RTV Silicone Adhesive

This one-part, silicone rubber, acetoxycure adhesive was formulated for use at high temperatures. PC® HI-TEMP/RTV silicone adhesive, which can also be used as a sealant, withstands operating temperatures up to 500°F and intermittent environments to 650°F. It is well suited for adhering or sealing FOAMGLAS® insulation to itself or to hot surfaces and cures to an elastomeric solid in 24 hours (at 77°F and 50% RH). A significant, cost-effective characteristic of PC® HI-TEMP/RTV silicone adhesive is its service life expectancy of over 33 years.

### PITTSBURGH CORNING ADHESIVE & SEALANT DESCRIPTIONS

ACCESSORY	TYPE	ADVANTAGES
PC® HI-TEMP/RTV	One-part silicone adhesive and sealant	Has long service life, withstands temperatures up to 650°F. It cures to an elastomeric solid at room temp.
PC® 88 Adhesive	Two-part adhesive and sealant	Ideal for adhering to metals and plastics, but works well on most surfaces. Flexible, high solids content, can act as vapor retarder.
PITTSEAL® 444N	Single component nonhardening butyl composition	Vapor barrier with high solids content remains highly flexible throughout service.



PC® HI-TEMP/RTV silicone adhesive is supplied in cartridges for application by caulking gun.

Typical applications for PC® HI-TEMP/RTV silicone adhesive include steam distribution systems; cyclic temperature equipment, reactor vessels and chambers; hot-asphalt containment barges; and hot tank roofs.

PC® HI-TEMP/RTV silicone adhesive is not recommended for underwater use nor for applications on concrete or mortar.

### PC® 88 Adhesive

PC® 88 Adhesive is a two-part, asphalt-based bonding material generally recommended for low to moderate temperature applications (-70°F to +180°F).

PC® 88 Adhesive is ideally suited for adhering FOAMGLAS® insulation to metals and some plastics, although it performs well on most surfaces. PC® 88 Adhesive is not recommended for use in contact with asphalt, coal tar, plasticized vinyls, fluorinated compounds, silicone coatings (except silicone alkyls) and some urethane coatings. Also, PC® 88 Adhesive will not bond to itself after curing more than eight hours (however, solvent treatment and mechanical abrasion can overcome this). Full cure is attained in 24 hours (at 77°F and 50%RH), and flexibility is maintained over a wide temperature range. To accelerate bonding, PC® 88 Adhesive can be used with HOLD CATALYST, an organometallic compound in mineral spirits. PC® 88 Adhesive displays very low shrinkage, because of a high-solids composition (90%), as well as good weatherability and resistance to water. PC® 88 Adhesive has a low permeability (0.005 perm in.) and can also be used as a sealant restricting the passage of water vapor into the insulation system.

PC® 88 Adhesive exhibits excellent chemical resistance and can be used in corrosive environments as a coating and is resistant to many acids, bases, salts and solvents.

When PC® 88 Adhesive is used in food areas there is a potential for odor problems during mixing, application and cure. Care must be taken to properly mix the components and ventilate the application area during use. Also, when used as a coating, it displays poor UV resistance and should be protected with a jacketing. When used as an adhesive, PC® 88 Adhesive also can contribute to fire protection by holding noncombustible FOAMGLAS® insulation in place.

### Other Adhesives

There are also several other adhesives that can be satisfactory for installing FOAMGLAS® insulation, depending on particular system operating conditions.

Some possible options include (1) **two-component urethanes, butyls, silicones and polysulfides** (exhibiting relatively long cure and mixing times, moderate-to-high cost, comparatively high permeability, and excellent high- and low-temperature properties); and

(2) **silica-based mortars** (with properties similar to calcium sulfate and demonstrating resistance to acid, but not alkali).

### Fabricating Adhesives

Virtually all industrial applications will require the fabrication of pieces of FOAMGLAS® insulation for covering valves, fittings and other components. Because thermal stresses are more equalized and drying stresses are lower between like materials, many adhesives that would otherwise be unsatisfactory for installation are appropriate as fabricating adhesives. Critical to the selection of these materials are service temperature, permeability, thermal conductivity, and fire and chemical resistance.

PC® 88 Adhesive with HOLD CATALYST can be used as a fabricating adhesive. Others include (1) **hot-melts and asphaltics**, which exhibit rapid set, low shrinkage, good chemical resistance and low permeability—but, they also possess organic solvent sensitivity, no fire resistance and cold-flow behavior that can lead to slippage well below the softening point; (2) **calcium sulfate hydrate cements**, such as Hydrocal® gypsum cement, which display good high- and low-temperature performance, resistance to most organic solvents, and non-flammability—but also high permeability and poor acid resistance; and (3) **epoxies and styrenes/polyesters** offering good chemical resistance, low permeability and a rigid system. When any materials other than these preferred adhesives are to be considered for fabricating, sufficient testing should be done to assure that they are appropriate for the specific job and are complementary to the FOAMGLAS® insulation system.

### SEALANTS

Unlike coatings, mastics and adhesives, sealants are an insulation system accessory product that is applied only locally at the job site. Utilized at joints, metal jacketing laps and around protrusions, sealants are used to prevent water vapor entry on low- and intermediate-temperature and cyclic systems. Their function is not to mask poor-fitting insulation.

Butyl sealants are appropriate for use with FOAMGLAS® insulation because of their durability and low-temperature flexibility. Sealants must remain flexible and resealable, be compatible with coatings and resist mildew.

Testing was performed by Pittsburgh Corning comparing two competitive sealants and butyl-based PITTSEAL® 444N sealant in a FOAMGLAS® insulation joint at 180°F. After two weeks, the competitive products were either hard and cracked or shrunken and without tack. PITTSEAL® 444N sealant, however, remained soft and sticky. But even with some other butyl sealants, shrinkage of up to 50% can occur, and hardening may develop when it becomes fully dried.

Please be aware that published service temperatures for many sealants may not be accurate when used with FOAMGLAS® insulation.

### PITTSEAL® 444N Sealant

PITTSEAL® 444N sealant is a single-component, nonhardening butyl composition for sealing joints in FOAMGLAS® insulation systems, sealing laps in metal jacketing, and for sealing around protrusions. PITTSEAL® 444N sealant is specially formulated to meet stainless steel service requirements for MIL I-24244 and NRC Regulatory Guide 1.36. When applied at the minimum film thickness of 1/8", 1 gal. of product covers 13 ft<sup>2</sup>. PITTSEAL® 444N is compatible with a wide range of coatings, but shouldn't be used in applications where solvent odor could affect food test or flavor, nor in areas exposed to UV light without protective jacketing.

### Application

With all surfaces dry and free of dust, scale, oil, grease and frost, the sealant should be applied to both surfaces of the joint or block using a trowel, knife or caulking gun. The two surfaces should be firmly pressed together. If a coating is to be applied, any squeezed-out sealant should be cut flush with the surface. When sealing laps of metal jacketing, a minimum 1/16" thickness should be maintained.

### ADDITIONAL INFORMATION

As with coatings and fabrics, the above-mentioned adhesives and sealants have all been tested and proven to perform well in a FOAMGLAS® insulation system. There may be other products on the market that, depending on your specific requirement, can also meet your needs. Please contact your Pittsburgh Corning representative for more information.

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