FOAMGLAS® INSULATION SPECIFICATION

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SPECIFICATION GUIDELINES FOR FOAMGLAS® INSULATION

1. SCOPE

1.1 These specification guidelines are general in nature and intended to be used as a tool in the design process, not as the ultimate design.

1.2 These specification guidelines offer application suggestions for the use of FOAMGLAS® insulation and accessory systems for temperature ranges from -450°F to +900°F (-268°C to 482°C). Other application options not listed in these guidelines may be appropriate. Contact Pittsburgh Corning Corporation for recommendations.

1.3 The product data sheets referenced in the text are listed at the end of the specification. Product data sheets for Pittsburgh Corning Corporation products may be accessed on line at: http://www.foamglasinsulation.com/datasheets.asp

1.4 Metric conversions have been rounded to nearest inch-pound equivalent.

2. GENERAL

2.1 This specification is subject to revision without notice. Contact Pittsburgh Corning Corporation for current revision data before using. This specification is offered as a guide for the purpose described herein and should be employed at the discretion of the user. No warranty of procedures, either expressed or implied is intended.

2.2 All surfaces to be insulated shall be cleaned of all scale, rust, oil, and foreign matter and shall be dry and free of frost prior to and during application of insulation.

2.3 Cleaning, such as sandblasting and priming of surfaces to be insulated, while recommended, is not part of this specification. If priming is specified, the primer must be thoroughly dry prior to the application of any insulation materials. The primer should also be compatible with any accessory materials recommended in this guide specification with which it may come in contact.

2.4 All un-insulated protrusions, such as stairs and railings, shall be cleaned, primed and painted prior to the application of any insulation materials.

2.5 It is recommended that all testing of piping, vessels, equipment, and tanks be completed prior to the application of any insulation materials.

2.6 All insulation and accessory materials shall be stored in an area that is dry and protected from the weather before and during insulation application.

2.7 Bore Coatings as described in 3.13.1 are typically specified if one or more of the following conditions exist:

2.7.1 The surface being insulated cycles, or swings through a given temperature range, more than once a week.

2.7.2 The surface being insulated experiences high vibration. Generally, this is associated with visible movement.

2.7.3 The FOAMGLAS® insulation is carrying the load of the pipe such as at a pipe hanger or support.

2.8 Insulation thickness should be based on one or more of the following criteria. It is the specifying engineer's responsibility to determine which criteria is most important.

2.8.1 In cold service, limiting heat gain to a predetermined acceptable value may be based on process control, energy conservation, or limiting product boil-off (this value is frequently in the range of 8 - 12 Btu/hr ft^2 or 22 to 32 kcal/hr m^2).

2.8.2 In some cold service applications it is desirable to limit or control condensation on the surface of the insulation.

2.8.3 Insulation thickness can be selected to provide freeze protection for a predetermined time period under extreme ambient conditions, or, in conjunction with heat tracing systems, to maintain a design temperature value.

2.8.4 In addition, insulation thickness for a hot process may also be designed to provide a minimum heat loss for process control.

2.8.5 For hot service, insulation thickness will most frequently be designed to provide personnel protection [usually, surface temperatures below 140°F (60°C)].

2.8.6 FOAMGLAS® insulation thickness can be designed to provide fire protection for piping and equipment for specified amounts of time under given fire conditions. Credit may be taken for the insulation in sizing pressure relief valves, protecting the steel from over stressing, or protecting the contents of the vessel from overheating.

Note: Contact Pittsburgh Corning Corporation's Energy Analysis Group for assistance in selecting an insulation thickness based on one or more of the above criteria.

2.9 All un-insulated penetrations through the insulation system shall be insulated along their length to a minimum distance of four times the insulation thickness. To prevent moisture migration behind the insulation, these penetrations should be sealed with a sealant as recommended in Section 3.2 or Section 3.9, and flashed to shed water. The selection of an appropriate sealant will depend on the temperature of the metal at the insulation termination. Flanged connections, valves, or other obstructions on the penetration should be designed to accommodate this insulation.

3. MATERIALS

3.1 Insulation - shall be FOAMGLAS® cellular glass insulation manufactured in accordance with ASTM C 552, "Standard Specification for Cellular Glass Thermal Insulation," by Pittsburgh Corning Corporation, whose quality system for manufacturing, inspecting, and testing of FOAMGLAS® insulation is certified to meet the requirements of ISO 9001:2000.

3.1.1 For pipes, FOAMGLAS® insulation shall be fabricated in half sections wherever possible. For large diameter piping where half sections are not practical, curved sidewall segments are preferred. See Table 1 for fabrication guidelines.

3.1.2 For large diameter piping, vessels, kettles, and other large radius curved surfaces; insulation should be fabricated in curved sidewall segments or dished head segments wherever possible. See Table 1 for fabrication guidelines.

3.1.3 For above ambient surfaces, the insulation may also consist of rectangular lags or segments, each having a trapezoidal cross section, adhered to a flexible facing, which allows the assembly to be formed into a cylindrical shape.

3.1.4 Dished head segments shall be used on all vessel heads that are 14" (356 mm) O.D. or larger. Heads smaller than 14" (356 mm) O.D. may be insulated with either dished head segments, or, by extending the insulation for the body of the vessel out over the end of the vessel and cutting round sections of FOAMGLAS® insulation out of flat block. These round sections are plugs that can be used to fill the opening formed by the extended insulation.

3.2 Joint Sealant:

3.2.1 PITTSEAL® 444N Sealant as supplied by Pittsburgh Corning Corporation or,

3.2.2 PITTSEAL® 727 sealant as supplied by Pittsburgh Corning Corporation.

3.3 Vapor Retarder Mastic - PITTCOTE® 300 Finish, an asphalt cutback mastic, as supplied by Pittsburgh Corning Corporation.

3.4 Protection Wrap - PITTWRAP® CW30 Jacketing, a self sealing, non-metallic, bituminous sheet, as supplied by Pittsburgh Corning.

3.5 Weather Barrier Mastic - PITTCOTE® 404 Coating, an acrylic latex mastic, as supplied by Pittsburgh Corning Corporation.

3.6 Reinforcing Fabric - PC® Fabric 79, a polyester fabric mesh, as supplied by Pittsburgh Corning Corporation.

3.7 Insulation Adhesive - PC® 88 Adhesive, a two-component urethane modified asphalt adhesive, as supplied by Pittsburgh Corning Corporation.

3.8 Fabrication Adhesive - See Table 2 for fabrication adhesive recommendations. May be either:

3.8.1 Hydrocal® B-11 Powder, gypsum cement, as manufactured by U.S. Gypsum, Inc.

3.8.2 PC® 136, a cementitious product used for compliance with NRC 1.36.

3.8.3 Hot asphalt, ASTM D 312, Type III

3.8.4 StrataFab® Adhesive for use with the FOAMGLAS® Insulation StrataFab® System only, as supplied by Pittsburgh Corning Corporation. Complies with NRC 1.36.

3.9 High Temperature Insulation Adhesive/Sealant - may be either PC® HI-TEMP/RTV or PC® RTV 450 Silicone Adhesive. Check product data sheets for temperature limits.

3.10 Metal Jacket - options are:

3.10.1 0.016" (0.4 mm) smooth aluminum jacket for insulation O.D.'s of 24" (610 mm) or less. For larger O.D.'s use 0.020" (0.5 mm) embossed aluminum jacket, or:

3.10.2 0.016" (0.4 mm) smooth stainless steel jacket for caustic service or where the FOAMGLAS® insulation is being used for fire protection applications. Depending on conditions, galvanized steel jacketing may be an acceptable alternative. Contact jacketing manufacturer for recommendations.

3.11 Metal Bands - options are:

3.11.1 0.5" x 0.020" (13 x 0.5 mm) aluminum bands with matching seals for piping, vessels, or equipment with O.D.'s of 48" (1219 mm) or less. For larger O.D.'s, use 0.75" x 0.020" (19 x 0.5 mm) aluminum bands, or:

3.11.2 0.5" x 0.015" (13 x 0.38 mm) stainless steel bands with matching seals for caustic service or where the FOAMGLAS® insulation is being used for fire protection applications.

3.12 Tape - shall be 1" (25 mm) wide, high tensile strength, fiber reinforced, strapping tape. Scotch Brand Filament Tape or approved equal. Tape is appropriate for providing temporary insulation securement for piping with insulation O.D.'s 18" (457 mm) or smaller as long as it is covered with metal jacket afterwards. Tape is not acceptable as primary means of securement if the insulation system is being designed to provide fire protection.

3.13 Bore Coating - options are:

3.13.1 Hydrocal® B-11 gypsum cement as manufactured by U.S. Gypsum, Inc., for service temperatures above 150°F (66°C) and below -290°F (-179°C). Not acceptable for stainless steel service where stress corrosion cracking is of concern. Acceptable for use in cryogenic systems where organic content is limited or prohibited.

3.13.2 PC® 136 is a reactive cementitious product manufactured by Anti Hydro International, for service temperatures of -100°F (-73°C) to 900°F (482°C). PC® 136 complies with the requirements of NRC 1.36.

3.13.3 Anti-Abrasive 2A Coating as supplied by Pittsburgh Corning Corporation, for service temperatures from -320°F (-196°C) to 250°F (121°C). Anti-Abrasive 2A Coating is also approved for stainless steel service.

3.14 Cushioning Blanket - shall be a 9 to 11 lb/ft^3 (144 to 176 kg/m^3), type E, glass fiber mat insulation, J.P.S. "Insulbatte," Alpha Associates, "Alphamat D," BGF Industries "BGF Mat," Claremont Co. Inc. "Claremat 1200," or approved equal

4. APPLICATION -450°F (-268°C) to -290°F (-179°C)

4.1 All insulation shall be fabricated with Hydrocal® B-11 gypsum cement, so that fabrication through-joints are minimized. Fabrication shall be such that insulation joints are also minimized by using half sections wherever possible and curved sidewall segments when half sections are not feasible.

4.2 It is necessary to install the insulation in multiple layers. The critical factor in determining the number and thickness of each layer is the interface temperature of the outer layer of insulation. This interface temperature must be within the service temperature range of the joint sealant.

4.3 In multi-layer applications, the first layer or layers of insulation shall be installed dry (using no joint sealants) with butt joints offset 12" (305 mm) laterally, and lap joints offset circumferentially between layers. The outer or final layer shall be installed with all joints tightly butted and sealed with a full bed of joint sealant as found in Section 3.2.1. If the presence of organic materials is not acceptable (as in liquid oxygen systems) the outer layer sealant shall be as found in Section 3.9. Any broken or poorly fitting insulation shall be replaced or re-cut to fit.

4.4 The inner layers in multi-layer applications may be applied with tape as specified in Section 3.12, wrapping the tape 1-1/2 times around the insulation such that the tape secures to itself. This procedure is acceptable as long as the O.D. of the insulation section being taped in place does not exceed 18"(457 mm).

4.4.1 For insulation with larger O.D.'s than 18" (457 mm), metal bands as specified in Section 3.11 shall be used.

4.4.2 Regardless of the O.D., the outermost layer of insulation shall be installed with metal bands in order to make certain that the sealed joints are drawn tight.

4.5 In asphalt bonded fabrication, with all joints of the outermost layer of FOAMGLAS® insulation completely sealed and drawn tight, the system is vapor sealed and no additional vapor barrier is required. As an engineer specified option, the insulation can be finished using one of the following three listed methods. Primarily these methods serve to protect the outer surface of the insulation material from physical or environmental damage.

Note: In Hydrocal® B-11 bonded fabrication, the joint zone is permeable to water vapor below ambient. The insulation should be finished using method 4.5.2 or 4.5.3.

4.5.1 Weather barrier mastic finish - Apply weather barrier mastic as found in Section 3.5, in two coats at a coverage rate of 3-4 gal./100 ft^2 (1.2 to 1.6 liters/m^2) for each coat. The

fabric found in Section 3.6 above reinforces the first layer of mastic. See Pittsburgh Corning Corporation data sheet for more detailed information.

4.5.2 Metal jacket finish with vapor retarder mastic - Prior to applying the metal jacket, cover the entire insulation surface with a tack coat of mastic as found in Section 3.3, at a coverage rate of approximately 2-3 gal./100 ft^2 (0.8 to 1.2 liters/m^2). The fabric found in Section 3.6 above reinforces the first layer of mastic. Apply a second coat at a rate of 4 to 5 gal./100 ft^2 (1.6 to 2 liters/m^2). As an alternative, spray application can be made. See Pittsburgh Corning Corporation data sheet for more detailed information. When the second coat has dried, cover the insulated surface with metal jacket. Apply metal jacket with all laps positioned to shed water and sealed with a manufacturer's recommended lap sealant. Firmly secure metal jacket in place with bands in accordance with manufacturer's recommendations. Do not use screws.

4.5.3 Metal jacket finish with combination protection wrap and vapor retarder mastic - Apply as described in 4.5.2, using protection wrap only on straight piping, and mastic only on components such as valves and fittings and elbows. Note the procedure for sealing the transition surface between jacketing and mastic by using a "reverse butt strip" as detailed in the product data sheet for PITTWRAP® CW 30 Jacketing.

5. APPLICATION -289°F (-178°C) to -61°F (-52°C)

5.1 All insulation shall be applied in a double layer application. Insulation shall be fabricated in half sections or curved sidewall segments with a minimum number of fabrication through-joints. For vessel head fabrication see Section 3.1.3.

5.2 The first layer shall be installed dry (using no joint sealant) and may be either taped in place or banded in place in accordance with the limitations specified in Section 4.4 for securement.

5.3 The second layer shall be installed with all joints offset from the layer below, tightly butted and sealed with a full bed of joint sealant as found in Section 3.2.1. The second layer shall be secured using metal bands to ensure that the sealed joints are drawn up tight.

5.4 See Section 4.5 for suggested finishes in this application temperature range.

6. APPLICATION -60°F (-51°C) to 35°F (2°C)

6.1 Insulation may be applied in a single layer application. Insulation shall be fabricated in half sections or curved sidewall segments with a minimum number of fabrication through-joints.

6.2 For surfaces with diameters up to approximately 3.0' (0.9 m) O.D., the insulation shall be applied with all joints tightly butted and sealed with joint sealant as found in Section 3.2. Poorly fitting or broken insulation shall be replaced or re-cut to form a completely vapor sealed insulation system. This insulation shall be banded in place as described above.

6.3 For piping, vessels, equipment, and tanks with diameters larger than 3.0' (0.9 m), the Pittsburgh Corning Corporation PC® 88 Adhered Insulation System is the preferred method of application. Banding is also an option. Contact Pittsburgh Corning Corporation for more details on this system.

6.4 See Section 4.5 for suggested finishes in this application temperature range.

7. APPLICATION 36°F (2°C) to 180°F (82°C)

7.1 Insulation may be applied in a single layer application. Insulation should be fabricated in half sections or curved sidewall segments wherever possible. Beveled lags or flat block insulation may be acceptable for large diameter surfaces as shown in Table 1.

7.2 The use of joint sealant is recommended on all systems that operate below ambient temperature for any length of time, and is required on systems that operate at or below 36°F. In cases where the below ambient system is operating at a temperature higher than 36°F, and the outdoor relative humidity is not routinely expected to exceed 50%, the use of a joint sealant is at the discretion of the design engineer. PITTSEAL® 727 is the preferred sealant in this temperature range.

7.3 For piping and small diameter equipment, the insulation may be either taped or banded in place. See Sections 3.11 and 3.12 for guidelines in reference to securement.

7.4 For piping, vessels, equipment, and tanks with diameters larger than 3.0' (0.9 m), the insulation may be secured by using bands, pins, or adhesive. Contact Pittsburgh Corning Corporation for more details on these various systems.

7.5 See Section 4.5 for suggested finishes in this application temperature range.

7.6 The Advantage® System is an alternative fabrication method suitable for use in this temperature range. Contact Pittsburgh Corning Corporation for recommendations in use on below ambient applications such as chilled water.

8. APPLICATION 181°F (83°C) to 400°F (204°C)

8.1 Insulation may be applied in a single layer application. Insulation should be fabricated in half sections or curved sidewall segments wherever possible. Beveled lags or flat block insulation may be acceptable for large diameter surfaces as shown in Table 1.

8.2 For piping and small diameter equipment, the insulation may be either taped or banded in place. See Sections 3.11 and 3.12 for guidelines in reference to securement.

8.3 For piping, vessels, equipment, and tanks with diameters larger than 3.0' (0.9 m), the insulation may be secured using either bands, or pins. Contact Pittsburgh Corning Corporation for more details on these various systems.

8.4 Finish for this temperature range is usually metal jacket as found in Section 3.10, however, mastic finish as found in Section 3.5 is also used. Mastic finish may be applied in accordance with Section 4.5.1, and the metal finish may be applied according to Section 4.5.2 without the use of lap sealant. For this temperature range, check insulation surface temperature for ability to use a mastic finish or protection wrap product on exterior insulation surfaces.

8.5 As an alternative for this temperature range, see Pittsburgh Corning Corporation's FOAMGLAS® Insulation StrataFab® System and Advantage® System specification guidelines.

9. APPLICATION 401°F (205°C) to 900°F (482°C)

9.1 Insulation should be fabricated in half sections or curved sidewall segments wherever possible. Beveled lags or flat block insulation may be acceptable for large diameter surfaces as shown in Table 1.

9.2 Pittsburgh Corning Corporation's primary recommendation for this temperature range is the FOAMGLAS® Insulation StrataFab® System. Contact Pittsburgh Corning Corporation for more information about the StrataFab® System.

9.3 As an alternative to the StrataFab® System, FOAMGLAS® insulation may be used in this temperature range in the following configurations:

9.3.1 Applied in a double layer application. The first layer may be either taped or banded according to the recommendations above. The second layer should be banded in place.

9.3.2 Applied in a single layer with an external reinforcement of gypsum cement as found in Section 3.8.1 and a 10x10 fiberglass scrim reinforcing fabric. This external reinforcement system is applied in the fabrication shop, not in the field.

9.3.2 Applied in the Advantage® System. Contact Pittsburgh Corning Corporation for details.

9.3.3 Applied in a composite system using either a high density fibrous glass blanket or a mineral wool inner layer and FOAMGLAS® insulation outer layer. Not for use on systems containing combustible fluids.

Note: Pittsburgh Corning Corporation recommends that composite systems only be used on lines operating at 450°F (232°C) or higher. In addition, the system should be designed so that the FOAMGLAS® insulation/mineral wool interface is a minimum temperature of 250°F (121°C). Contact Pittsburgh Corning Corporation for further details.

9.4 For piping and small diameter equipment, the insulation should be banded in place. See Section 3.11 for guidelines in reference to securement.

9.5 For piping, vessels, equipment, and tanks with diameters larger than 3.0' (0.9 m), the insulation may be secured using bands. Contact Pittsburgh Corning Corporation for more details on these systems.

9.6 See Section 8.4 for information regarding appropriate finish for this temperature range.

10. INSPECTION

Inspect all insulation and accessory materials to be certain they are applied in conformance with the specification recommendations. Joints should be tight, sealing and flashing should be thorough and watertight, and finishes should be uniform and free of defects.

11. QUALITY ASSURANCE

The insulation manufacturer's quality system, including its implementation, shall meet the requirements of ISO 9001:2000.

12. CERTIFICATES

The manufacturer will furnish evidence of compliance with the quality system requirements of ISO 9001:2000.

Product Data Sheets

1. PITTSEAL® 444N Sealant: FI-164
2. PITTCOTE ® 300 Finish: FI-120
3. PITTCOTE ® 404 Coating: FI-138
4. PC® Fabric 79: FI-159
5. PC® 88 Adhesive: FI-125
6. Hydrocal® B-11 Powder: FI-169
7. Anti Abrasive 2A Coating: FI-144
8. PITTWRAP® CW 30 Jacketing: FI-235
9. PC® HI-TEMP/RTV Silicone Adhesive: FI-232
10. PC® RTV 450 Silicone Adhesive: FI-244
11. PC®136 Adhesive: FI-252
12. PITTSEAL® 727 sealant: FI-255

TABLE 1
RECOMMENDED FABRICATION CONSIDERATION

DIAMETER in./ft (mm/m)	HALF-SECTIONS (min. thickness) in (mm)	CURVED SIDEWALL SEGMENTS	BEVELED LAGS	FLAT BLOCKS (max. size)
< 6" O.D. (152 mm)	1" (25 mm)			
6" to 12" (152 to 305 mm)	1 - 1 1/2" (25 to 38 mm)			
12" to 20" (305 to 508 mm)	2" (51 mm)			
20" to 24" (508 to 610 mm)	2 - 2 1/2" (51 to 64 mm)	X		
24" to 6' (610 mm to 1.8 m)		X		
6' to 13' (1.8 m to 4 m)		X	X	6" (152 mm)
14' to 23' (4.3 to 7 m)		X	X	9" (229 mm)
24' to 53' (7.3 to 16 m)				12" (305 mm)
54' to 150' (16.2 to 45 m)				18" (457 mm)
over 150' (over 45 m)				18" (457 mm)

TABLE 2
FABRICATION ADHESIVE GUIDELINES

OPERATING TEMPERATURE °F (°C)	HOT ASPHALT	HYDROCAL ® B-11, PC® 136	StrataFab ® System	Advantage® System
-450 to -290 (-268 to -179)		X [1]		
-289 to -101 (-178 to -74)	X	X		
-100 to 250 (-73 to 121)	X	X , PC® 136		X[4]
250 to 400 (121 to 204)	X [2]	X , PC® 136	X	X
401 to 500 (205 to 260)		X, PC® 136	X	X
501 to 900 (261 to 482)		X, PC® 136	X [3]	X

Notes: Table 1 and 2

1. Hydrocal® B-11 is an inorganic gypsum based cement product. For applications where the process temperature may result in the presence of liquid oxygen, inorganic materials are always preferred. PC® 136 is recommended on stainless steel for compliance with NRC 1.36.

2. In this temperature range, only use asphalt if it is above ground and outdoors because of potential odor and melting concerns.

3. If the StrataFab® System is being used in a tunnel, vault or other confined air space, ventilation is recommended. Bonding adhesive may smoke in contact with hot surfaces above 125°F (52 °C). See MSDS for safe handling and use.

4. The Advantage® System is typically specified for above ambient processes. For below ambient applications, contact Pittsburgh Corning Corporation for recommendations.