

Insulfrax® Thermal Insulation

Introduction

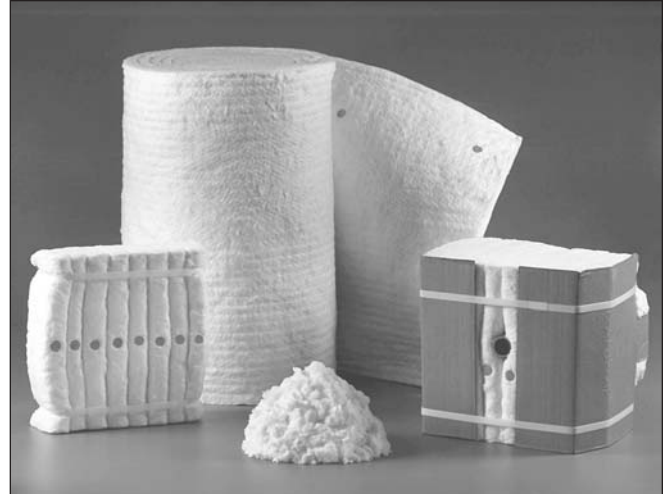
Unifrax Corporation's Insulfrax® Thermal Insulation product family was developed from a calcium, magnesium, silicate chemistry to provide thermal insulation at recommended operating temperatures up to 1832°F (1000°C). Insulfrax products also meet European regulatory requirements (Directive 97/69/EC). The Insulfrax fiber chemistry has been combined with the Unifrax Corporation's proprietary fiber spinning technology to create a specialty high-temperature fiber with superior thermal and mechanical properties. The Insulfrax product family consists of a range of products including fiber, needled blanket, Anchor-Loc® modules, bonded modules, paper, and Marine Blanket.

Insulfrax products are used in a wide range of applications including refractory linings, thermal insulation, fire protection and metals transfer.

General Characteristics

The Insulfrax product line offers users a number of important advantages:

1. The calcium, magnesium, silicate chemistry provides superior wetting resistance to molten aluminum alloys. Testing with corrosive aluminum alloys at elevated temperatures has proven that Insulfrax fibers are superior to traditional alumina/silica refractory ceramic fibers.
2. Tensile strength of all Insulfrax products is enhanced by the Unifrax Corporation's proprietary spinning technology used to fiberize this product.
3. Insulfrax products exhibit physical properties similar to Fiberfrax® refractory ceramic fibers. Products feature lightweight, flexible, and excellent acoustical properties.
4. Insulfrax blankets, modules and fibers exhibit excellent thermal stability at temperatures up to 1000°C (1832°F) after exposure to water immersion or high humidity.



Product Forms

Insulfrax products are available in several product forms to solve a wide range of thermal insulation and heat processing problems.

- Insulfrax Fiber 3010/3011, a loose fiber material for vacuum cast shapes, expansion joints and refractory fill applications. These fibers are available in both chopped (3011) and unchopped (3010) grades.
- Insulfrax 1800 Blanket available in thicknesses from ½" to 2" and densities ranging from 4 to 8 PCF.
- Bonded 1800 Modules offered in several densities and a wide range of thicknesses.
- Anchor-Loc 1800 Modules available in a range of thicknesses and two standard densities. The Anchor-Loc 1800 Module can be installed with a choice of four different attachment options.
- Insulfrax Marine Blanket – U.S. Coast Guard approved for fire-rated assemblies on marine structures and vessels. Refer to product information sheet C-1438 for additional information.
- Insulfrax Paper, a flexible, thin, lightweight, nonwoven material which is ideal for heat shields, high-temperature gasketing, and refractory backup applications. Refer to product information sheet C-3003 for additional information.

Refer to the product Material Safety Data Sheet (MSDS) for recommended work practices and other product safety information.

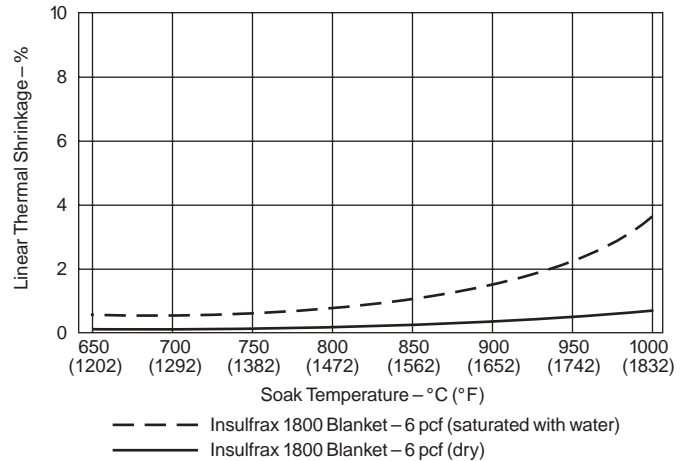
Typical Product Parameters

Chemical Analysis (%)		
SiO ₂	61 to 67	
CaO	27 to 33	
MgO	2 to 7	
Other	<1	
Average Fiber Diameter (microns)	3 to 5	
Fiber Index (%) ¹	55 to 60	

¹ Fiber Index is measured using the conical elutriation method.

Thermal Shrinkage

Insulfrax 1800 Blanket Thermal Shrinkage Data*



*Shrinkage Test Performed at Soak Temperatures for 24 Hours.

Typical Product Properties

Insulfrax Product Form	Color	Temperature Grade	Recommended Operating Temperature ⁽²⁾	Melting Point	Specific Heat	Specific Gravity	Average Tensile Strength
Insulfrax Fiber	White	1000°C 1832°F	1000°C 1832°F	1260°C 2300°F	1000j/kgk (1000°C)	2.67 (g/cm ³)	—
Insulfrax 1800 Blanket	White	1000°C 1832°F	1000°C 1832°F	1260°C 2300°F	1000j/kgk (1000°C)	2.67 (g/cm ³)	4.0 psi/4 PCF 5.0 psi/6 PCF 7.0 psi/8 PCF

Health and Safety Information

Insulfrax Thermal Insulation from Unifrax, according to Directive 97/69/EC, possesses a fiber chemistry within the regulatory definition of a “man-made vitreous (silicate) fiber with random orientation with alkaline oxide and alkaline earth oxide content greater than 18% by weight.” Insulfrax fibers have been tested pursuant to EU protocol ECB/TM/26, Revision 7, Nota Q, Directive 97/69/EC, with results that are below regulatory thresholds. As a result, Insulfrax Thermal Insulation does not require additional labeling or further testing. Refer to the product Material Safety Data Sheet (MSDS) for recommended work practices and other product safety information.

For additional information about product performance or to identify the recommended product for your application, please contact the Unifrax Application Engineering Group at 716-278-3888.

Data are average results of tests conducted under standard procedures and are subject to variation. Results should not be used for specification purposes.

⁽²⁾The recommended operating temperature of Fiberfrax and Insulfrax products is determined by irreversible linear change criteria, not melting point.

Insulfrax Fiber

Insulfrax Fiber is a man-made vitreous fiber based on a calcium, magnesium, silicate composition. A high fiber index (low percentage of unfiberized particles) provides the excellent thermal performance associated with traditional fibrous insulating materials. Insulfrax Fiber is available in both chopped (3011) and unchopped (3010) grades. This fiber is the feedstock used to manufacture the Insulfrax product line, and it is ideally suited for conversion to boards, coatings and vacuum cast shapes.

Insulfrax Fiber was developed for the temperature range extending from cryogenic levels through 1000°C (1832°F). The wide operating temperature range combined with superior wetting resistance to molten aluminum alloys makes this product ideal for conversion to vacuum cast shapes for metal transfer in the aluminum industry.

A partial list of typical applications for Insulfrax Fiber is provided below:

- Expansion joint packing – refractory construction
- Fire protection of penetration seals
- Conversion to vacuum cast tap out cones, precast molten metal distribution shapes, fireplace logs
- Tube seal packing
- Burner block gaskets
- Manufacture of cements, moldables and coatings



Insulfrax 1800 Blanket

Insulfrax 1800 Blanket is a flexible, strong, lightweight, needled blanket produced from Insulfrax Fiber. Mechanical needling of the spun Insulfrax fibers eliminates the need for binders in the product's manufacture and results in a product with high tensile strength. Since Insulfrax 1800 Blanket is completely inorganic, the product exhibits no smoke generation or outgassing in service.

Insulfrax 1800 Blanket combines low thermal conductivity with excellent resistance to thermal shock. Note that high humidity and wetting with water prior to service has little effect on Insulfrax 1800 Blanket.

A series of green dots on the surface of the blanket make identification, tracking, and inspection of Insulfrax simple on the job site or in the fabrication shop.



Insulfrax 1800 Blanket is classified by Underwriters Laboratories (UL), per UL 723 (ASTM E-84). Flame Spread Rating = 0, Smoke Developed Rating = 0. High tensile strength and excellent thermal properties combine to make Insulfrax 1800 Blanket the product of choice for a wide range of applications in a number of industries:

Primary Metals

- Expansion joint seals
- Aluminum homogenizing furnace linings
- Aluminum transfer ladle covers
- Backup insulation for dense refractory linings
- Backup insulation for refractory ceramic fiber or Isofrax® linings
- Maintenance blanket
- Heat shields

Metals Processing

- Annealing furnace linings
- Stress relieving blankets
- Seals and gaskets
- Investment casting mold wrap
- Heat treating furnace linings

Petrochemical/Power

- Crude heater linings
- Convection box, stack linings
- Cogeneration duct linings
- Reusable insulating pads
- External boiler and duct insulation
- Field steam generator linings

Ceramic and Glass

- Glass tank crown insulation
- Glass lehr linings
- Expansion joints
- Carbon baking furnace cover linings

Fire Protection

- Tank car insulation
- Chimney flue insulation
- Cable tray insulation
- Pressure and cryogenic vessel insulation

Anchor-Loc 1800 Modules

Insulfrax 1800 Blanket is combined with the Anchor-Loc module hardware to extend the benefits of this unique fiber chemistry to heat processing vessels operating under 1000°C (1832°F).

Anchor-Loc 1800 modules are fabricated from eight folds of one-inch thick Insulfrax 1800 Blanket to achieve precompression of the block during manufacture. The folded blanket layers are secured to the metallic module anchor with several alloy support tubes. Flanges on the tube ends effectively lock the position of the tubes relative to the anchor at the time of installation.

The Anchor-Loc 1800 block is manufactured in several densities and a range of sizes. A choice of attachment systems is provided to meet a wide range of application needs.



Anchor-Loc 1800 modules combine the benefits of the Insulfrax fiber chemistry with the proven installation advantages of modular fiber blocks for operating temperatures up to 1000°C (1832°F). When compared with traditional hard refractory materials, the Anchor-Loc 1800 blocks provide the advantages listed below:

- Fast temperature cycling
- Lower heat storage
- Decreased fuel cost
- Increased furnace productivity
- Lower installed cost
- Fast and easy lining repairs

A partial list of applications for Anchor-Loc 1800 modules is provided below:

- Annealing furnace linings
- Slow cool covers for slabs and ingots
- Process heater linings
- Aluminum homogenizing furnace linings
- Aluminum ladle covers
- Personnel heat shields
- Heat treating furnace linings
- Flue stack and duct linings
- Field steam generator linings

Note that Anchor-Loc 1800 modules exhibit excellent thermal stability after exposure to moisture or high humidity.

Hilti® is a trademark of Hilti Tool Corporation.

Weld-Loc® 1800 Modules

A special weld assembly is installed in each Weld-Loc 1800 module. This stud assembly permits fusion of the stud base to the furnace casing and allows a threaded fastener to be torqued on the stud, drawing the module to the plate. Advantages offered by the Weld-Loc module include:

- High installation speed
- Ease and simplicity of installation
- Permits random placement of modules on the casing
- Multiple welds per module are possible
- System provides a positive torque test of the welds

Power-Loc® 1800 Modules

A hardened steel pin mechanically secures each Power-Loc 1800 module to the steel casing plate. The anchor pin is installed with a special Hilti® powder actuated fastening tool and powder booster. Advantages which are offered by the Power-Loc 1800 module include:

- High installation speed
- Casing preparation is eliminated
- Permits random placement of modules on the casing
- Ease and simplicity of installation
- Positive mechanical/attachment of modules to the casing plate
- Setup time is reduced

Thread Loc® 1800 Modules

Provided with an all-thread weld stud and flanged nut, the Thread Loc 1800 module is designed for installation on a pre-positioned stud pattern. The Thread Loc attachment system has several advantages:

- Compatibility with mastic coatings, back-up insulation, and foil vapor barriers
- Module design compensates for variations in stud placement
- Access to the welded fastener for full testing before the module is installed

Screw Loc® 1800 Module

A self-tapping screw supplied with each Screw Loc 1800 module easily penetrates mild steel up to 1/8" in thickness. The Screw Loc attachment system provides the following installation advantages:

- Multiple, random anchor placement
- Ease of removal and replacement
- Furnace casing preparation is eliminated
- Low cost installation equipment is readily available

Available Anchor-Loc Modules

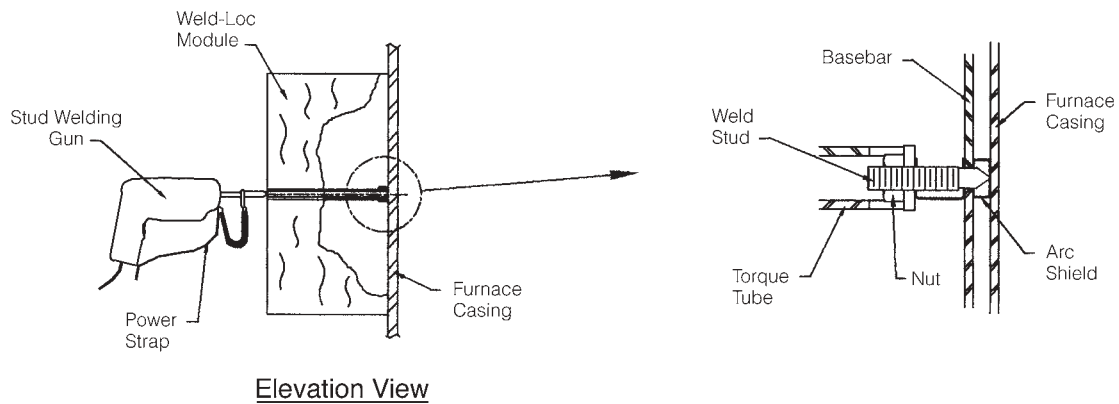
305 mm x 610 mm (12" x 24"), 305 mm x 305 mm (12" x 12"), 305 mm x 152.5 mm (12" x 6")

Module Type	Temperature Grade	Recommended Operating Temperature Limit	Construction	Module Density
Anchor-Loc 1800	1000°C (1832°F)	1000°C (1832°F)	Folded Insulfrax 1800 Blanket	128 kg/m ³ (8 lb/ft ³) 160 kg/m ³ (10 lb/ft ³)

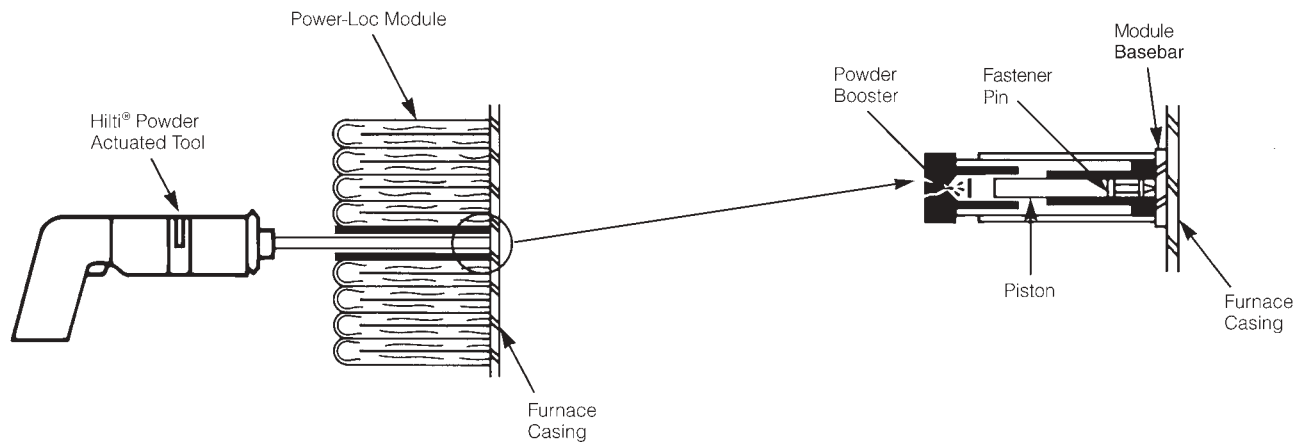
The recommended operating temperature of Fiberfrax and Insulfrax products is determined by irreversible linear change criteria, not melting point.

Available Attachment Option

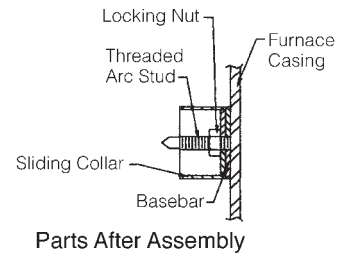
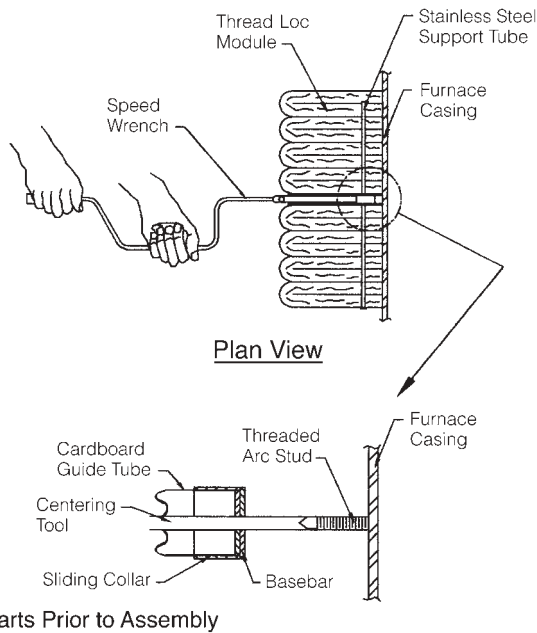
A. Weld-Loc® 1800 Module



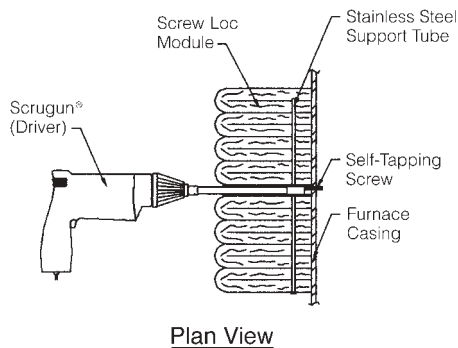
B. Power-Loc® 1800 Module



C. Thread Loc® 1800 Module



D. Screw Loc® 1800 Module



Anchor-Loc 1800 Modules

Anchor-Loc 1800 Modules – 128 kg/m³ (8 lbs/ft³)

Hot Face °C (°F)	Insulation Thickness – mm (in)	Cold Face Temperature °C (°F)			
		102 (4)	152 (6)	203 (8)	254 (10)
600 (1112)		78 (172)	65 (147)	56 (133)	51 (125)
800 (1472)		109 (228)	87 (190)	75 (168)	67 (154)
1000 (1832)		148 (300)	118 (246)	101 (214)	89 (194)

Anchor-Loc 1800 Modules – 160 kg/m³ (10 lbs/ft³)

Hot Face °C (°F)	Insulation Thickness – mm (in)	Cold Face Temperature °C (°F)			
		102 (4)	152 (6)	203 (8)	254 (10)
600 (1112)		76 (170)	63 (145)	55 (132)	50 (123)
800 (1472)		105 (221)	84 (184)	73 (164)	65 (150)
1000 (1832)		141 (287)	112 (236)	96 (206)	85 (186)

See note on bottom of back page.



Insulfrax Bonded 1800 Modules

Insulfrax Bonded 1800 modules provide the benefits of Insulfrax fiber in new construction or the upgrade of existing refractory for a wide range of heat processing equipment. The Bonded 1800 modules can be installed as a hot face veneer over existing refractory, or with the Unifrax Corporation's Hefty Lock™ hardware as a full thickness lining.

Manufacture of Bonded 1800 modules is based on Insulfrax 1800 Blanket, a high-strength spun fiber blanket. This blanket is folded, then tightly compressed and banded to form the Bonded 1800 block. These bonded modules are offered in two standard densities and a range of thicknesses to provide peak performance in applications operating up to 1832°F.



Bonded 1800 Module Installation Over Refractory

Insulfrax Bonded 1800 modules are typically mortared into place over hard refractory using .908 kg to 1.36 kg (2 to 3 pounds) of Fiberstick™ mortar per module. This lining over refractory installation technique (veneer) with Bonded 1800 modules offers the benefits of Insulfrax fiber in addition to the performance advantages listed below:

- Reduced heat loss
- Faster furnace cycling
- Increased resistance to thermal shock
- Improved sound absorption
- Low installed cost
- Reduced heat storage
- Reduced fuel costs

Typical applications for Insulfrax Bonded 1800 modules include heat treating furnaces, aluminum processing furnaces and process heaters operating under 1800°F.

For additional information about the installation of bonded module veneers, refer to the Fiberwall™ Installation Manual (Form C-729).

Bonded 1800 Module Installation With the Hefty Lock System

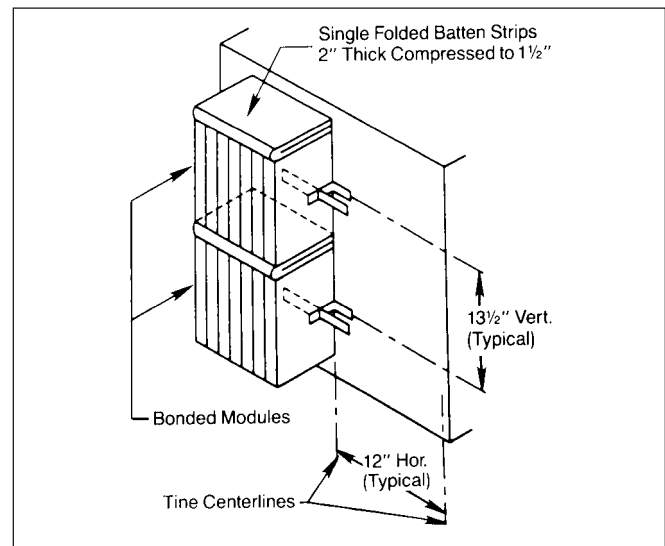
The Unifrax Corporation's Hefty Lock alloy steel hardware is combined with Insulfrax Bonded 1800 modules for full thickness lining installations at temperatures up to 1000°C (1832°F).

The Hefty Lock hardware system consists of an alloy base bar which is fastened to the casing and an alloy tine which passes through the Bonded 1800 module and locks it to the base bar.

The Hefty Lock module/Bonded 1800 system combines the performance benefits of Bonded 1800 modules with the design and installation advantages listed below:

- Field fabrication of special block shapes is simplified.
- Backup lining, furnace casing coatings and backup layered linings are compatible with the Hefty Lock Bonded 1800 system.
- Prepositioning of Hefty Lock base bars insures tight module compression, eliminating casing hot spots.

Complete details of Hefty Lock module installation procedures are available in the Fiberwall Installation Manual, Form C-729.



The Hefty Lock/Bonded 1800 module system is used in a wide range of applications in the temperature range up to 1000°C (1832°F). Typical applications include:

- Annealing furnaces
- Aluminum homogenizing furnaces and soaking pits
- Process heaters
- Stacks, ducts and flue linings
- Heat treating furnace linings
- Fume incinerators
- Field steam generators

Heat Flow Analysis

Insulfrax Bonded 1800 Modules Module Over Refractory Veneer

Bonded 1800/Fireclay Brick		Folded Modules 112 kg/m ³ (7 lb/ft ³)			
		Cold Face Temperature °C (°F)			
Hot Face °C (°F)	Insulation Thickness – mm (in) Refractory Thickness – mm (in)	0 (0) 228 (9)	51 (2) 228 (9)	76 (3) 228 (9)	102 (4) 228 (9)
600 (1112)		140 (287)	87 (191)	76 (170)	68 (156)
800 (1472)		184 (366)	123 (257)	108 (228)	96 (206)
1000 (1832)		227 (445)	165 (333)	146 (298)	131 (270)

Bonded 1800/Fireclay Brick		Folded Modules 149 kg/m ³ (9.3 lb/ft ³)			
		Cold Face Temperature °C (°F)			
Hot Face °C (°F)	Insulation Thickness – mm (in) Refractory Thickness – mm (in)	0 (0) 228 (9)	51 (2) 228 (9)	76 (3) 228 (9)	102 (4) 228 (9)
600 (1112)		140 (287)	86 (188)	74 (167)	66 (153)
800 (1472)		184 (366)	119 (249)	103 (219)	92 (199)
1000 (1832)		227 (445)	158 (320)	138 (283)	123 (256)

Bonded 1800/Hefty Lock™ Full Thickness Lining

Fiberwall Bonded 1800		Folded Modules 112 kg/m ³ (7 lb/ft ³)			
		Cold Face Temperature °C (°F)			
Hot Face °C (°F)	Insulation Thickness – mm (in)	102 (4)	152 (6)	203 (8)	254 (10)
600 (1112)		79 (175)	65 (150)	57 (136)	52 (126)
800 (1472)		112 (235)	90 (195)	77 (172)	69 (157)
1000 (1832)		155 (312)	124 (256)	106 (223)	93 (201)

Fiberwall Bonded 1800		Folded Modules 149 kg/m ³ (9.3 lb/ft ³)			
		Cold Face Temperature °C (°F)			
Hot Face °C (°F)	Insulation Thickness – mm (in)	102 (4)	152 (6)	203 (8)	254 (10)
600 (1112)		77 (171)	63 (147)	56 (133)	51 (124)
800 (1472)		106 (225)	82 (187)	74 (166)	66 (152)
1000 (1832)		145 (294)	116 (241)	98 (210)	87 (190)

All heat flow calculations are based on a surface emissivity factor of .90, an ambient temperature of 27°C (80°F) and zero wind velocity, unless otherwise stated. All thermal conductivity values for Insulfrax materials have been measured in accordance with ASTM Test Procedure C-177. When comparing similar data, it is advisable to check the validity of all thermal conductivity values and ensure the resulting heat flow calculations are based on the same condition factors. Variations in any of these factors will result in significant differences in the calculated data.

