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REFRASIL®

Refractory silica in textile form

INSULATION

PRODUCT DATA
BULLETIN

ALL PRODUCTS

REFRASIL textiles insulate against extreme high temperatures

Description

REFRASIL textiles for industrial insulation are continuous filament, amorphous silica products with the thermal performance of a refractory material. They are produced by the chemical leaching of glass fibers, resulting in almost pure silica (SiO_2) in the 8 to 10 micron size range.

Standard REFRASIL textiles are caramel in color, while pre-shrunk forms of cloth, bulk fiber, batt, yarn and cordage are white in color. Chromia-treated "Irish" REFRASIL material is greenish in color.

Performance capabilities

Temperature. REFRASIL textiles will not melt or vaporize until temperatures exceed 3100°F (1704°C). REFRASIL textiles will insulate continuously and retain their strength and flexibility to temperatures of 1800°F (982°C). Beyond 1800°F (982°C) some embrittlement and shrinkage occurs, but REFRASIL textiles will continue to provide thermal protection to 3100°F (1704°C).

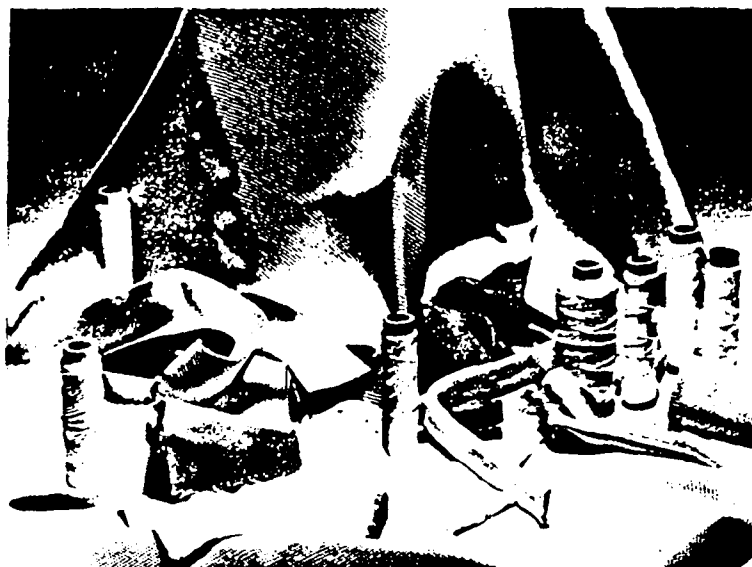
Chemical resistivity. The chemical properties of REFRASIL are similar to those of vitreous silica. REFRASIL is chemically compatible with many materials, including the following: air, oxygen, nitrogen, argon, ammonia, carbon monoxide, chlorine, hydrogen chloride, and sulfur dioxide. It is also stable in a vacuum, in contact with water, various hydrocarbons, ammonium hydroxide, and hydrochloric, nitric, and sulfuric acids.

Most elements do not react with REFRASIL textiles. Some molten metals such as magnesium, sodium and silicon are exceptions, and attack REFRASIL textiles rapidly. Fluorine, hydrogen (above 2100°F) and carbon (above 1900°F) also react with REFRASIL textiles.

In general, phosphates, phosphoric acid and basic oxides and hydroxides (such as sodium, potassium and calcium hydroxides) react with REFRASIL textiles, especially at elevated temperatures. Hydrofluoric acid and various fluorides are also incompatible with REFRASIL textiles.

Dielectric properties. REFRASIL textiles are also outstanding high temperature electrical insulators. As an example of their excellent electrical resistivity, the dielectric constant of REFRASIL C100-48 cloth measured at 220°F (104°C) and 60 cycles per second is 1.43. This increases to 1.53 at 500°F (260°C).

Alternative for asbestos. REFRASIL textiles are a superior alternative for asbestos. They protect at



higher temperatures, exhibit minimal dusting and fly-off of fiber particles, are very low in chlorides, and there are no known health hazards associated with its use.

Associated benefits

REFRASIL textiles have excellent resistance to thermal shock and minimum shrinkage in service. They protect against contamination, marking and damage to parts and products during high temperature processing. REFRASIL textiles resist oxidation, most corrosive solutions and chemicals. In addition they have a high capacity to absorb moisture but do not degrade in the presence of water.

Applications

REFRASIL textiles have proven their ability to shield and protect hydraulic lines, motor leads, hoses, pipes and machinery from extreme radiant heat and molten metal splash. REFRASIL textiles have also been used successfully as insulating blankets in heat-treating and high-temperature processing operations as refractory lining, aluminum pot line hood skirts, flexible expansion joints, furnace curtains, flue sleeves, and numerous other electrical and thermal insulation applications. As a weld protection cloth, REFRASIL guards equipment and finishes from damage from sparks and weld deposits, thus improving total welding performance.

These are just a few. New applications for REFRASIL textiles are continually being discovered. REFRASIL insulation can cut maintenance time and costs, reduce energy consumption and protect parts, materials and machinery from potential damage caused by extreme heat.

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REFRASIL textiles are available as . . .

Cloth



REFRASIL cloth protects equipment and finishes from sparks, weld deposits, and slag spatter during welding and torch cutting operations.

Product Description	Product Code	Nominal Thickness (in.)	Nominal Width (in.)
Standard Cloth	UC100-28	.015	36
	UC100-48	.026	36
	UC100-96	.054	36
Treated Cloth	2220-28	.017	36
	2220-48	.028	36
	2220-96	.056	36
Adhesive Cloth	Adhesive 48	.026	36
	Adhesive 96	.050	36
Pre-Shrunk Cloth	C100-48	.026	33
	C100-96	.050	33
Irish Cloth	C1554-48	.026	33
	C1554-96	.050	33
Treated Irish Cloth	2221-48	.026	33
	2221-96	.050	33

The standard UC 100 cloth is the most popular form of REFRASIL textiles.

2220 REFRASIL cloth is a treated form of the UC 100 cloth. This treatment provides a tough, sacrificial coating that improves the abrasion resistance, durability and handling characteristics of the material. It facilitates fabrication by conventional methods of stitching, sewing, and grommeting.

Adhesive cloth is simply standard cloth with an adhesive backing to aid installation.

Standard cloth is also available as "pre-shrunk" cloth. Pre-shrunk cloth is weaker in strength and lower in abrasion resistance than standard cloth and should only be used where shrinkage cannot be tolerated. It is white in color versus the caramel color of standard.

"Irish" REFRASIL cloth



Use of "Irish" REFRASIL cloth as furnace curtains on this steel strip finishing line resulted in 16% energy cost savings.

"Irish" REFRASIL insulation cloth was developed to extend the temperature stability and flexible characteristics of REFRASIL textiles to higher performance temperatures than standard REFRASIL products. It is treated with chromia (1 to $3\% \text{CR}_2\text{O}_3$) from which it derives its greenish color and name.

When temperature cycles exceed 1850°F (1010°C) and continuous flexibility is a requirement, "Irish" REFRASIL insulation exhibits the necessary performance characteristics. It will operate continuously at temperatures to 2300°F (1260°C) with little or no change in properties. In addition, "Irish" REFRASIL insulation has exhibited up to 10% lower thermal conductivity than other forms of REFRASIL insulation.

Cloth is the standard form for "Irish" REFRASIL insulation. It is also available in a treated form for ease of handling and physical integrity during fabrication.

Standard roll size

Standard roll size for all REFRASIL cloth is 50 lineal yards minimum, plus 10% maximum length. No roll shall contain more than two pieces of fabric and no piece within the roll shall be less than 10 lineal yards.

The information and data in this product data bulletin are accurate to the best of our knowledge and belief, but are intended for general information only. Applications suggested for the materials are described only to help the reader make his own evaluation and decision, and are neither guarantees nor to be construed as express or implied warranties of suitability for these or other applications, or recommendation to use the product in the infringement of any patent.

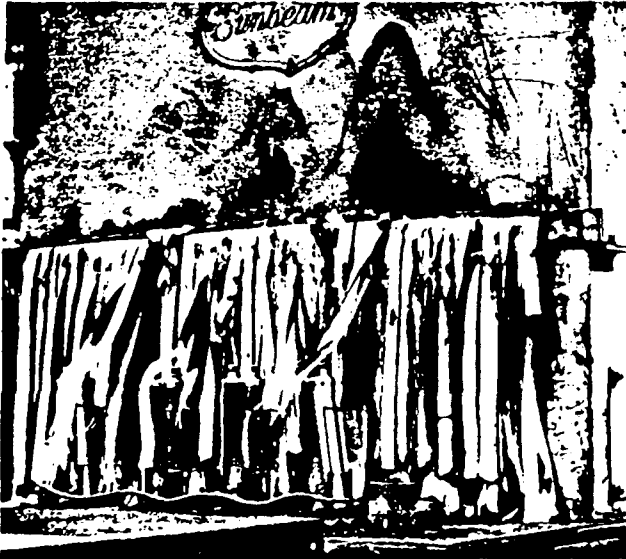
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8005 1682

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Woven tape



REFRASIL woven tape curtains at both ends of this brazing furnace reduced natural gas requirements for the unit by one-third.

Product Description	Product Code	Nominal Thickness (in.)	Nominal Width (in.)
Standard Tape	UT100-1	.015	1
	UT100-1½	.015	1½
Pre-Shrunk Tape	TF100-1	.015	1
	TF100-1½	.015	1½

REFRASIL woven tape is available in standard or pre-shrunk forms. Pre-shrunk should only be used where shrinkage due to continuous high temperature environment cannot be tolerated. REFRASIL woven tapes have selvaged edges to prevent raveling.

Standard roll size

Standard tape roll size is 285 lineal feet, plus or minus 10%. Pre-shrunk tape roll size is 265 lineal feet, plus or minus 10%. All rolls are one continuous length, no splices.

Slit tape



REFRASIL slit tape protects motor leads, electrical cables, hoses, and a variety of other items subjected to the extreme radiant heat environment found in steel melt shop.

Product Description	Product Code	Nominal Thickness (in.)	Nominal Width (in.)
Standard Tape (w/adhesive)	UT-48-2	.026	2
	UT-48-4	.026	4
	UT-96-2	.050	2
	UT-96-4	.050	4
Treated Tape (no adhesive)	2220-48-3	.028	3
	2220-48-6	.028	6
	2220-96-3	.052	3
	2220-96-6	.052	6
Irish Tape (no adhesive)	2221-48-2	.028	2
	2221-48-4	.028	4
	2221-96-2	.052	2
	2221-96-4	.052	4

REFRASIL slit tapes are available in the same forms as REFRASIL cloth: standard, with pressure sensitive adhesive backing, treated with no adhesive, and treated "Irish" with no adhesive.

Special widths are available as custom slit tape from standard 50 lineal yard stock rolls of cloth products.

Standard roll size

Standard slit tape roll size is 100 lineal feet, plus or minus 10% length tolerance. No roll shall contain more than three pieces with single pieces not less than 20 lineal feet.

Sleeving



REFRASIL sleeving, covered by a protective metal-braided sheathing, provides thermal protection for this hydraulic hose system in areas subject to radiant heat and molten metal splash.

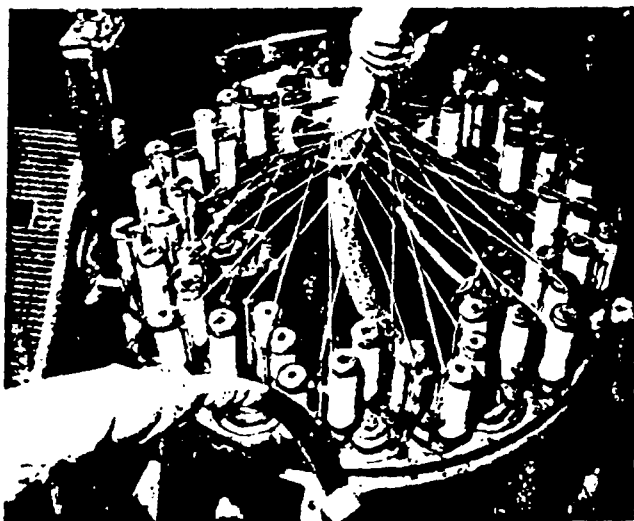
Product Description	Product Code	Nominal I.D. (in.)	Maximum I.D. (in.)
Standard Nominal Wall Thickness-.032 in.	UB-¾	¾	.95
	UB-1	1	1.30
	UB-1½	1½	2.50
	UB-2	2	3.20
	UB-2½	2½	3.30
Heavy Wall Nominal Wall Thickness-.065 in.	HWS-¾	¾	.40
	HWS-1	1	.60
	HWS-1½	1½	.80
	HWS-2	2	1.10
	HWS-2½	2½	1.60

REFRASIL sleeving is available as standard or heavy wall. The looser weave of standard sleeving can accommodate a larger variety of diameters. Heavy wall sleeving has a very tight weave for maximum thermal protection. A special coating is available for improved installation, lubrication, and slightly increased abrasion resistance. For most applications, a protective, abrasion-resistant sheathing completely covering the REFRASIL sleeving insulation is recommended.

Standard roll size

Standard roll size for both standard and heavy wall sleeving is 50 lineal feet, plus or minus 10% length tolerance. Rolls are one continuous length, no splices.

Yarn & Cordage



REFRASIL cordage and yarn are braided onto or around thermocouple wires, instrument heating elements, electrical cables, and hoses for superior thermal protection.

Product Description	Product Code	Nominal Diameter (in.)	Nominal Yield (Yds/Lb)
Yarn	FYT 100-Z	.020	3280
Cordage	C100-3	.040	700
	C100-4	.053	330

All REFRASIL yarn and cordage is pre-shrunk and comes specially coated for improved handling and abrasion resistance.

Standard package size

Yarn is wound on 4½" braider tubes, weight is approximately 1/4 pound per tube. Cordage is available on either standard 4½" braider tubes or 3" x 10" cores. Weight is approximately 1/2 pound for braider tubes, and 3 pounds for cores.

Bulk fiber

Product Description	Product Code	Nominal Length (in.)	Nominal Fiber Dia. (in.)
Standard Fiber	F100-A25	.25	.0004

Bulk fiber—chopped REFRASIL yarn in 1/4-inch lengths—is available in standard chopped fibers. Used as bulk packing, thermal insulation, filter media, catalyst carriers and selective absorbents, bulk fibers are pre-shrunk.

Standard package size

Bulk fibers are packaged in polyethylene bags, 50 pounds per bag, two bags per 100-pound fiberboard drum.

Batt



"Irish" tape contains insulating batt to protect cooling water pipes from temperatures up to 2200° F in skid-type steel re-heat furnaces.

Product Description	Product Code	Nominal Thickness (in.)	Nominal Density (Lbs/Ft³)
Standard Batt	B100-1	.50	3.0

Standard batt is comprised of loose felted, self-bonded, random interlocking fibers and contains no binders to reduce physical integrity in high temperature environments.

Standard package size

Batt is packaged 3 blankets of 48 square feet each to a box of 144 square feet. Each blanket is nominal 40" x 14½" dimensions.

Investigate REFRASIL insulation

REFRASIL textiles are cutting maintenance time and costs in more and more high temperature applications. For more information, write or call:



Materials Division of HITCO
a subsidiary of Armco Inc.
1600 West 135th Street
Gardena, California 90249
Phone: (213) 321-8080

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Description

REFRASIL textiles for industrial insulation are continuous filament, amorphous silica products with the thermal performance of a refractory material. They are produced by the chemical leaching of glass fibers, resulting in almost pure silica (SiO_2) in the 8 to 10 micron size range.

Standard REFRASIL textiles are tan in color, while pre-shrunk forms of cloth, bulk fiber, batt, yarn and cordage are white in color. Chromia-treated "Irish" REFRASIL material is greenish in color.

Performance capabilities

Temperature. REFRASIL textiles will not melt or vaporize until temperatures exceed 3100 F (1704 C). REFRASIL textiles will insulate continuously and retain their strength and flexibility to temperatures of 1800 F (982 C). Beyond 1800 F (982 C) some embrittlement and shrinkage occurs, but REFRASIL textiles will continue to provide thermal protection to 3100 F (1704 C).

Chemical resistivity. The chemical properties of REFRASIL are similar to those of vitreous silica. REFRASIL is chemically compatible with many materials, including the following: air, oxygen, nitrogen, argon, ammonia, carbon monoxide, chlorine, hydrogen chloride, and sulfur dioxide. It is also stable in a vacuum, in contact with water, various hydrocarbons, ammonium hydroxide, and hydrochloric, nitric, and sulfuric acids.

Most elements do not react with REFRASIL textiles. Some molten metals such as magnesium, sodium and silicon are exceptions, and attack REFRASIL textiles rapidly. Fluorine, hydrogen (above 2100 F) and carbon (above 1900 F) also react with REFRASIL textiles.

In general, phosphates, phosphoric acid and basic oxides and hydroxides (such as sodium, potassium and calcium hydroxides) react with REFRASIL textiles, especially at elevated temperatures. Hydrofluoric acid and various fluorides are also incompatible with REFRASIL textiles.

Dielectric properties. REFRASIL textiles are also outstanding high temperature electrical insulators. As an example of their excellent electrical resistivity, the dielectric constant of REFRASIL C100-48 cloth measured at 220 F (104 C) and 60 cycles per second is 1.43. This increases to 1.53 at 500 F (260 C).

Alternative for asbestos. REFRASIL textiles are a superior alternative for asbestos. They protect at higher temperatures, exhibit minimal



dusting and fly-off of fiber particles, are very low in chlorides, and there are no known health hazards associated with its use.

Associated benefits

REFRASIL textiles have excellent resistance to thermal shock and minimum shrinkage in service. They protect against contamination, marking and damage to parts and products during high temperature processing. REFRASIL textiles resist oxidation, most corrosive solutions and chemicals. In addition they have a high capacity to absorb moisture but do not degrade in the presence of water.

Applications

REFRASIL textiles have proven their ability to shield and protect hydraulic lines, motor leads, hoses, pipes and machinery from extreme radiant heat and molten metal splash. REFRASIL textiles have also been used successfully as insulating blankets in heat-treating and high-temperature processing operations as refractory lining, aluminum pot line hood skirts, flexible expansion joints, furnace curtains, flue sleeves, and numerous other electrical and thermal insulation applications. As a weld protection cloth, REFRASIL guards equipment and finishes from damage from sparks and weld deposits, thus improving total welding performance.

These are just a few. New applications for REFRASIL textiles are continually being discovered. REFRASIL insulation can cut maintenance time and costs, reduce energy consumption and protect parts, materials and machinery from potential damage caused by extreme heat.

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REFRASIL textiles are available as...

Cloth



REFRASIL cloth protects equipment and finishes from sparks, weld deposits, and slag spatter during welding and torch cutting operations.

Product Description	Product Code	Color	Nominal Thickness (in.)	Nominal Width (in.)
Standard Cloth	UC100-28	Tan	.015	36
	UC100-48		.026	36
	UC100-96		.054	37
Treated Cloth	AR100-48	Orange	.033	36
	AR100-96		.060	37
Adhesive Cloth	Adhesive 48	Tan	.026	36
	Adhesive 96		.050	36
Pre-Shrunk Cloth	C100-48	White	.026	33
	C100-96		.050	33
Irish Cloth	C1554-48	Green	.026	33
	C1554-96		.050	33
Treated Irish Cloth	2221-48	Green	.026	33
	2221-96		.050	33

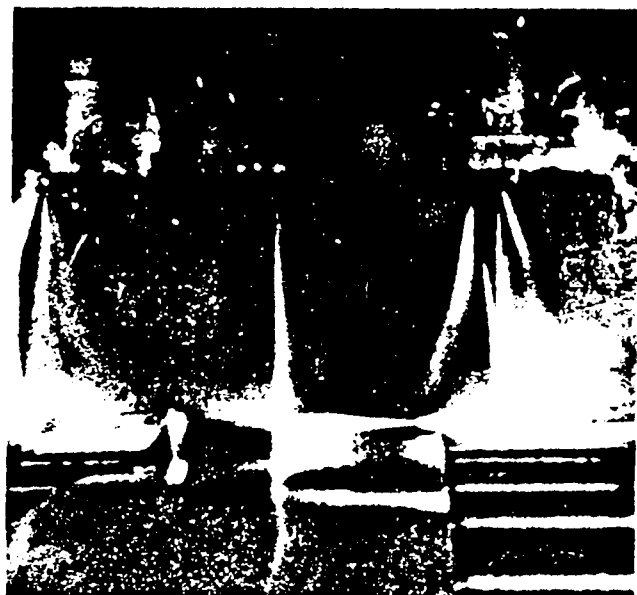
The standard UC100 cloth is the most popular form of REFRASIL textiles. It is tan or gold in color.

AR100 REFRASIL cloth is a treated form of the UC100 cloth. This treatment provides a tough, sacrificial coating that improves the abrasion resistance, durability and handling characteristics of the material. It facilitates fabrication by conventional methods of stitching, sewing, and grommeling. It is orange in color.

Adhesive cloth is simply standard cloth with an adhesive backing to aid installation.

Standard cloth is also available as "pre-shrunk" cloth. Pre-shrunk cloth is weaker in strength and lower in abrasion resistance than standard cloth and should only be used where shrinkage cannot be tolerated. It is white in color versus the tan color of standard.

"Irish" REFRASIL cloth



Use of "Irish" REFRASIL cloth as furnace curtains on this steel strip finishing line resulted in 16% energy cost savings.

"Irish" REFRASIL insulation cloth was developed to extend the temperature stability and flexible characteristics of REFRASIL textiles to higher performance temperatures than standard REFRASIL products. It is treated with chromia (1 to 3% Cr_2O_3) from which it derives its greenish color and name.

When temperature cycles exceed 1850 F (1010 C) and continuous flexibility is a requirement, "Irish" REFRASIL insulation exhibits the necessary performance characteristics. It will operate continuously at 2300 F (1260 C) with little or no change in properties. In addition, "Irish" REFRASIL insulation has exhibited up to 10% lower thermal conductivity than other forms of REFRASIL insulation.

Cloth is the standard form for "Irish" REFRASIL insulation. It is also available in a treated form for ease of handling and physical integrity during fabrication.

Standard roll size

Standard roll size for all REFRASIL cloth is 50 lineal yards minimum, plus 10% maximum length. No roll shall contain more than two pieces of fabric and no piece within the roll shall be less than 10 lineal yards.

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Woven tape



REFRASIL woven tape curtains at both ends of this brazing furnace reduced natural gas requirements for the unit by one-third.

Product Description	Product Code	Nominal Thickness (in.)	Nominal Width (in.)
Standard Tape	UT100-1	.015	1
	UT100-1½	.015	1½
Pre-Shrunk Tape	TF100-1	.015	1
	TF100-1½	.015	1½

REFRASIL woven tape is available in standard or pre-shrunk forms. Pre-shrunk should only be used where shrinkage due to continuous high temperature environment cannot be tolerated. REFRASIL woven tapes have selvaged edges to prevent raveling.

Standard roll size

Standard tape roll size is 285 lineal feet, plus or minus 10%. Pre-shrunk tape roll size is 265 lineal feet, plus or minus 10%. All rolls are one continuous length, no splices.

Slit tape



REFRASIL slit tape protects motor leads, electrical cables, hoses, and a variety of other items subjected to the extreme radiant heat environment found in steel melt shop.

Product Description	Product Code	Nominal Thickness (in.)	Nominal Width (in.)
Standard Tape (w/adhesive)	UT48-2	.026	2
	UT48-4	.026	4
	UT96-2	.050	2
	UT96-4	.050	4
Treated Tape (no adhesive)	AR48-2	.033	2
	AR48-4	.033	4
	AR96-2	.060	2
	AR96-4	.060	4
Irish Tape (no adhesive)	2221-48-2	.028	2
	2221-48-4	.028	4
	2221-96-2	.052	2
	2221-96-4	.052	4

REFRASIL slit tapes are available in the same forms as REFRASIL cloth: standard, with pressure sensitive adhesive backing, treated with no adhesive, and treated "Irish" with no adhesive.

Special widths are available as custom slit tape from standard 50 lineal yard stock rolls of cloth products.

Standard roll size

Standard slit tape roll size is 100 lineal feet, plus or minus 10% length tolerance. No roll shall contain more than three pieces with single pieces not less than 20 lineal feet.

Sleeving



REFRASIL sleeving, covered by a protective metal-braided sheathing, provides thermal protection for this hydraulic hose system in areas subject to radiant heat and molten metal splash.

Product Description	Product Code	Nominal I.D. (in.)
Standard Nominal Wall Thickness—.032 in.	UB-¾	¾
	UB-1	1
	UB-1½	1½
	UB-2	2
	UB-2½	2½
Heavy Wall Nominal Wall Thickness—.065 in.	HWS-¾	¾
	HWS-1	1
	HWS-1½	1½
	HWS-2	2
	HWS-2½	2½

REFRASIL sleeving is available as standard or heavy wall. The looser weave of standard sleeving can accommodate a larger variety of diameters. Heavy wall sleeving has a very tight weave for maximum thermal protection. A special coating is available for improved installation, lubrication, and slightly increased abrasion resistance. For most applications, a protective, abrasion-resistant sheathing completely covering the REFRASIL sleeving insulation is recommended.

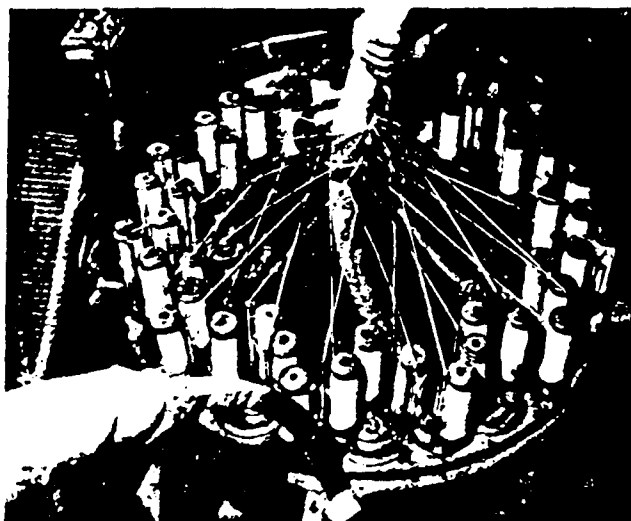
Standard roll size

Standard roll size for both standard and heavy wall sleeving is 50 lineal feet, plus or minus 10% length tolerance. Rolls are one continuous length, no splices.

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Yarn & Cordage



REFRASIL cordage and yarn are braided onto or around thermocouple wires, instrument heating elements, electrical cables, and hoses for superior thermal protection.

Product Description	Product Code	Nominal Diameter (in.)	Nominal Yield (Yds/Lb)
Yarn	FYT 100-Z	.020	3280
Cordage	C100-3	.040	700
	C100-4	.053	330

All REFRASIL yarn and cordage is pre-shrunk and comes specially coated for improved handling and abrasion resistance.

Standard package size

Yarn is wound on 4½" braider spools; weight is approximately ¼ pound per spool. Cordage is available on standard 4½" spools. Weight is approximately ½ pound per spool.

Bulk fiber

Product Description	Product Code	Nominal Length (in.)	Nominal Fiber Dia. (in.)
Standard Fiber	F100-A25	.25	.0004

Bulk fiber—chopped REFRASIL yarn in ¼-inch lengths. Used as bulk packing, thermal insulation, filter media, catalyst carriers and selective absorbents, bulk fibers are pre-shrunk.

Standard package size

Bulk fibers are packaged in polyethylene bags, 25 pounds per bag, one bag per carton.

Batt



"Irish" tape contains insulating batt to protect cooling water pipes from temperatures up to 2200 F in skid-type steel re-heat furnaces.

Product Description	Product Code	Nominal Thickness (in.)	Nominal Density (Lbs/Ft³)
Standard Batt	B100-1	.50	3.0

Standard batt is comprised of loose felted, self-bonded, random interlocking fibers and contains no binders to reduce physical integrity in high temperature environments.

Standard package size

Batt is packaged 2 blankets of 48 square feet each to a box of 96 square feet. Each blanket is nominal 40" x 14½' dimensions.

Rope Gasket

REFRASIL rope gasket is produced in three sizes—¼", ⅜", and ½" diameters. This new product is braided from texturized yarns, pre-shrunk, and specially coated for improved abrasion resistance.

Product Code	Nominal Diameter (in.)	Density (lbs/cu ft)	Yield (ft/lb)	Breaking Strength Ambient Temp. (lb)	Shrinkage at 1600 F (%)
RG-¼	0.24	46	64	35	0.8
RG-⅜	0.32	42	45	60	0.9
RG-½	0.44	37	26	170	1.2

Standard package size

Rope gasket is packaged as 100-lineal-foot spools, two spools to a carton.

Investigate REFRASIL insulation

REFRASIL textiles are cutting maintenance time and costs in more and more high temperature applications. For more information, write or call:

F. B. Wright Company
9999 Mercier Ave.
Dearborn, Michigan 48121
(813) 843-8250

ARMCO HITCO Materials Division