PLAINTIFF'S
EXHIBIT
DUP-631

MATERIALS

MATERIAL SPECIFICATION
SERIES 100
PREFORMED BLOCK AND PIPE

THERMAL INSULATION
STANDARD ENGINEERING SPECIFICATION

ISSUED OCT 1954 | SN 100 M

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Code	102* ◊	102.1*
Material	Calcium silicate	Calcium silicate-inhibited
Material Description	Reacted hydrous calcium silicate reinforced with mineral fibers	Reacted hydrous calcium silicate with inhibitor for chloride stress corrosion cracking and reinforced with mineral fibers
Temperature Range	1200°F max	1200°F max
K Factor	500°F – 0.60 max	500°F – 0.60 max
Density	14 lb per cu ft max	14 lb per cu ft max
Compressive Strength	60 lb per sq in. min at 5% deformation	60 lb per sq in. min at 5% deformation
Manufacturing Process	Pan molded, precision molded, or filter press molded	Precision molded
Resistance to Breakage in Handling	Block must average 2" or greater in drop test per ASTM C 487.	
Dimensions	See SN3D	See SN3D
Other Qualifications		Stressed Type 304 stainless steel U-bend specimens at 100°C, when in contact with this insulating material in the Du Pont wick test with 1500 ppm chloride as NaCl in the test water, shall show no cracking at the end of 144 hours exposure

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

* Bands are supplied at extra cost. Order must state "without bands" if not required. For 11" IPS and larger there is an additional charge for 2-oz canvas cover. Material should be specified "without 2-oz canvas" to avoid extra charge. ◊ Codes 184 and 186 are acceptable alternates unless noted on the Project Specifications. † Expanded Perlite insulation. Molded two-piece fitting covers are available in screwed, welded, and sweat types.	*Calsilite* The Ruberoid Co	*Thermasil* ** Baldwin-Ehret-Hill, Inc
	Kaylo Owens-Corning Corp	
	Thermobestos Johns-Manville Sales Corp	
	Caltemp Fiberboard Paper Products Corp	
	Careytemp † Philip Carey Mfg Co	
	Thermasil ** Baldwin-Ehret-Hill, Inc	

** Thermasil is a grey material with longitudinal extrusion marks on block and pipe covering. The ends and no more than one edge of block and the edges and ends of pipe covering will show cutting marks. This material is acceptable in Baldwin-Ehret-Hill printed cartons, not in cartons over labeled with a Baldwin-Ehret-Hill sticker. Armstrong "L-K" cartons with a "B" in the lower left-hand corner of the label will contain acceptable materials.

Vendors and merchandise designations are given to describe materials and may not include all acceptable products. Substitutions are to be made only on approval of the authority initiating the use of this specification.

SUBCOMMITTEE NO. 88

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MATERIAL SPECIFICATION - SERIES 100

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Code	104	106	
Material	Inorganic silicates	Asbestos fiber and sodium silicate	
Material Description	Inorganic silicas and asbestos fibers	Compressed fluffy amesite asbestos fiber sprayed with sodium silicate to form a mat containing a minimum of 20% sodium silicate by weight. Asbestos mat is then sprinkled with diatomaceous earth to provide an integral refractory coating	
Temperature Range	100°F to 1800°F	1200°F max	
K Factor	Block - 500°F - 0.58 max	400°F - 0.54 max 600°F - 0.65 max	
Density	Block - 14 lb per cu ft	20 lb per cu ft max	
Compressive Strength	65 lb per sq in. min at 5% deformation	27 lb per sq in. at 10% ♦ deformation - dry	
Manufacturing Process		Formed and comp on mandrel. Pipe mech cut on die	
Resistance to Breakage in Handling	Block must average 3" or greater in drop test per ASTM C 487, tentative method of test for resistance to dropping of preformed block thermal insulation.		
Other Qualifications	Good mechanical strength. Shrinkage less than 2% at 1600°F	Formed on a mandrel to a predetermined weight. Pressed to obtain the desired density, and baked. Stressed Type 304 stainless steel U-bend specimens at 100°C, when in contact with this insulating material in the Du Pont wick test with 1500 ppm chloride as NaCl in the test water, shall show no cracking at the end of 144 hours exposure	
The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.			
* Minimum thickness available 1½", also available in pipe covering on special order ♦ Pipe covering only	*Kaylo 20** Owens-Corning Corp	*Unibestos* Pittsburgh Corning Corp	

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MATERIAL SPECIFICATION - SERIES 100

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Code	110	111	111.1
Material	Vegetable cork	Cellular glass	Cellular glass
Material Description	Vegetable cork, granulated and compressed into cork-board or molded forms, from material of vegetable origin for low and medium temperature insulation.	Cellular glass foamed and fused into unicellular form.	Cellular glass foamed and fused into unicellular form. Factory-applied jacket having white kraft paper outer jacket (60 lb per 3000 sq ft) backed by 0.00035" aluminum foil with fire-resistant adhesive.
Filler			
Binder	Natural resin in cork		
Temperature Range	-200°F to 100°F	-200°F to 100°F (+300°F for dual temp)	+35°F to +300°F
K Factor	100°F - 0.29 max	100°F - 0.43 max	100°F - 0.43 max
Density	9 - 11 lb per cu ft	10 - 11 lb per cu ft	9 lb per cu ft
Compressive Strength	15 lb per sq in. min	30 lb per sq in. min at 5 percent deformation	30 lb per sq in. min at 5 percent deformation
Manufacturing Process	Machine cuts or molded. Baked at moderate temp		
Resistance to Breakage in Handling	Good		
Dimensions			
Other Qualifications	Pipe covering shall be coated on the outside with heavy mastic		

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

Cork Armstrong C&S Corp	*Foamglas* Pittsburgh Corning Corp	*Foamglas Stay-Dry* Pittsburgh Corning Corp
Cork Mundet Cork Co		

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MATERIAL SPECIFICATION – SERIES 100

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Code	111.2	111.3	112
Material	Cellular glass	Cellular glass	Glass fiber
Material Description	Cellular glass foamed and fused into unicellular form. Factory applied jacket having 0.00035" aluminum foil outer jacket backed by kraft paper (60 lb per 3000 sq ft)	Cellular glass foamed and fused into unicellular form. Plain – without jacket.	See Codes 112.01 through 112.81.
Filler			
Binder			
Temperature Range	+35°F to +300°F	+35°F to +300°F	
K Factor			
Density	9 lb per cu ft	9 lb per cu ft	
Compressive Strength	30 lb per sq in. min at 5 percent deformation	30 lb per sq in. min at 5 percent deformation	
Manufacturing Process			
Resistance to Breakage in Handling			
Dimensions			
Other Qualifications			

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

Foamglas Stay-Dry Pittsburgh Corning Corp	*Foamglas Stay-Dry* Pittsburgh Corning Corp	

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Code	112.01	112.02	
Material	Glass fiber	See Code 112.01	
Material Description	Textile-type fine glass fiber pipe and fitting insulation, plain, with medium-temperature binder		
Filler			
Binder	Phenol-formaldehyde or Di-Cy		
Temperature Range	80°F to 350°F		
K Factor	100°F – 0.25		
Density	3" and 6"" lb per cu ft		
Compressive Strength	Compressive strength and resilience are very low. Inserts are required where pipe is supported by the insulation. Has poor resistance to abuse.		
Resistance to Breakage in Handling	Very good		
Other Qualifications	Specify whether for iron pipe or copper tubing		

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

* Fittings only as follows: For 125-lb cast iron screwed ells and tees Size / Thickness 1/2 thru 6 / 1/2, 1, 1 1/2 8 / 1 only For butt-welding long-radius 90° and 45° ells Size / Thickness 2 thru 6 / 1/2, 1 2 thru 12 / 1 1/2, 2 Available factory finished with Code 731 "Hypalon" mastic on request	*Ultrafine Snap-on Gustin-Bacon Mfg Co		
	*Mono-Kover Baldwin-Ehret-Hill, Inc		
	*Thermoglas Philip Carey Mfg Co		
	**Fiberglas Owens-Corning Corp		
	**Armaglas PF Pipe Insu Armstrong C&S Corp		
	*Micro-Lok Johns-Manville Sales Corp		
	*Insul-Sure Insul-Caustic Corp Maspeth 78, NY		
	*PPG Glass Fiber Pitts Plate Glass Co		
	*Superfine The Ruberoid Co		

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DU 041411

MATERIAL SPECIFICATION - SERIES 100

Code	112.11	112.12	
Material	Glass fiber	See 112.11	
Material Description	Textile type fine glass fiber bonded pipe insulation with 45-lb factory-applied roofing felt finish. Code 701 asbestos felt must be used.		
Filler			
Binder	Phenol-formaldehyde or Di-Cy		
Temperature Range	80°F to 350°F		
K Factor	100°F - 0.25		
Density	3" and 6"" lb per cu ft		
Compressive Strength	Compressive strength and resilience are very low. Inserts are required where pipe is supported by the insulation. Has poor resistance to abuse.		
Resistance to Breakage in Handling	Very good		
Dimensions			
Other Qualifications	Specify whether for iron pipe or copper tubing.		

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

* Order must specify finish noted under Material Description.	*Ultrafine Snap-on Gustin-Bacon Mfg Co		
	*Vono-Kover Baldwin-Ehret-Hill, Inc		
	*Thermoglas Philip Carey Mfg Co		
	**Fiberglas Owens-Corning Corp		
	**Armaglas PF Pipe Insu Armstrong C&S Corp		
	Micro-Lok Johns-Manville Sales Corp		
	*PPG Glass Fiber Pitts Plate Glass Co		
	*Superfine The Ruberoid Co		

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DU 041412

Code	112.16	112.17	
Material	Glass fiber	Glass fiber	
Material Description	Textile type fine glass fiber bonded pipe insulation with 4-oz factory-applied canvas finish.	Textile type fine glass fiber bonded pipe insulation with 8-oz factory-applied canvas finish.	
Filler			
Binder	Phenol-formaldehyde or Di-Cy	Phenol-formaldehyde or Di-Cy	
Temperature Range	80°F to 300°F	80°F to 300°F	
K Factor	100°F - 0.25	100°F - 0.25	
Density	3" and 6" lb per cu ft	3" and 6" lb per cu ft	
Compressive Strength	Compressive strength and resilience are very low. Inserts are required where pipe is supported by the insulation. Has poor resistance to abuse.	Compressive strength and resilience are very low. Inserts are required where pipe is supported by the insulation. Has poor resistance to abuse.	
Resistance to Breakage in Handling	Very good	Very good	
Dimensions			
Other Qualifications	Specify whether for iron pipe or copper tubing	Specify whether for iron pipe or copper tubing	
The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.			
	*Ultrafine Snap-on Gustin-Bacon Mfg Co	*Ultrafine Snap-on Gustin-Bacon Mfg Co	
	*Mono-Kover Baldwin-Ehret-Hill, Inc	*Mono-Kover Baldwin-Ehret-Hill, Inc	
	*Thermoglas Philip Carey Mfg Co	*Thermoglas Philip Carey Mfg Co	
	**Fiberglas Owens-Corning Corp	**Fiberglas Owens-Corning Corp	
	**Armaglas PF Pipe Insu Armstrong C&S Corp	**Armaglas PF Pipe Insu Armstrong C&S Corp	
	*Micro-Lok Johns-Manville Sales Corp	*Micro-Lok Johns-Manville Sales Corp	
	*PPG Glass Fiber Pitts Plate Glass Co	*PPG Glass Fiber Pitts Plate Glass Co	
	* Superfine The Ruberoid Co	* Superfine The Ruberoid Co	

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MATERIAL SPECIFICATION - SERIES 100

OCTOBER 1954

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Code	112.22	
Material	Glass fiber	
Material Description	Preformed pipe covering composed of glass fibers bonded together by inert thermosetting resin with factory-applied 35-lb minimum per 3000 sq ft white bleached kraft paper, laminated to 0.0007" aluminum foil by fire-retardent adhesive (moisture vapor transmission rate shall not exceed 0.015 perms - wet cup test) and reinforced by glass threads in both directions, maximum spacing 1/4". Finish includes lap 2", ± 1/4", long and butt strips 4", ± 1/4", wide. Paper to be creped or embossed sufficiently to conceal wrinkles without requiring excessive lap adhesive to make a tight seal. Type A - one-piece Type B - two-piece	
Filler		
Binder	Phenol-formaldehyde or Di-Cy	
Temperature Range	40°F to 250°F	
K Factor	100°F - 0.25, 250°F - 0.33	
Density	Type A - 3 lb per cu ft min Type B - 6 lb per cu ft min	
Compressive Strength*	Compressive strength and resilience are very low. Inserts are required where pipe is supported by insulation. Type B has more resistance to abuse than Type A.	
Resistance to Breakage in Handling	Very good	
Dimensions	3-ft sections Type A - 1/2", 3/4", 1", 1 1/2", 2", 2 1/2", and 3" thick Type B - 1/2", 1", 1 1/2", 2", and 2 1/2" thick	
Other Qualifications	Specify whether for iron pipe or copper tubing. Weather protection is required for outside service.	

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

Ultrafine Snap-on (Type A) Gustin-Bacon Mfg Co	
Mono-Kover (Type A) Baldwin-Ehret-Hill, Inc	
Fiberglas (Type A and Type B) Owens-Corning Corp	
Armaglas PF Pipe Insulation (Type A and Type B) Armstrong C&S Corp	
Micro-Lok (Type A) Johns-Manville Sales Corp	
PPG Glass Fiber (Type A) Pittsburgh Plate Glass Co	
Superflex (Type A) The Ruberoid Co.	
Thermoglas (Type A) Philip Carey Mfg Co	

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DUP 0961217

DU 041414

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Code	112.61		
Material	Glass fiber		
Material Description	Plain semi-rigid board, formed from fibrous glass or mineral fibers.		
Filler			
Binder	Phenol-formaldehyde		
Temperature Range	40°F to 350°F		
K Factor	100°F – 0.25 to 0.30		
Density	6 and 9 lb per cu ft		
Compressive Strength	Compressive strength and resilience are very low. Inserts are required where pipe is supported by the insulation. Has poor resistance to abuse.		
Resistance to Breakage in Handling	Very good		
Dimensions	Std 24" x 48" Thickness PF615 (6-lb density) 1/2" through 3". PF617 (9-lb density), 1/2" through 2 1/4".		

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

CONFIDENTIAL	*Fiberglas PF615 or 617 Insulation* Owens-Corning Corp		
	Armaglas PF Insulation Armstrong C&S Corp		
	Spintex No. 414 or 415 Johns-Manville Sales Corp		
	E-Z Ply Duct Insulation Baldwin-Ehret-Hill, Inc		

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MATERIAL SPECIFICATION - SERIES 100

Code	112.71		112.81
Material	Glass fiber		Glass fiber
Material Description	Bonded board insulation formed from fibrous glass or mineral fibers, with asphalt and kraft paper vapor-barrier finish.		Bonded acoustical board formed from fibrous glass or mineral fibers with a thin neoprene compound on one surface.
Filler			
Binder	Phenol-formaldehyde		Phenol-formaldehyde
Temperature Range	40°F to 150°F		40°F to 150°F
K Factor	100°F - 0.26		100°F - 0.26
Density	3 and 6 lb per cu ft		6 lb per cu ft
Compressive Strength			
Manufacturing Process	Machine molded		Machine molded
Resistance to Breakage Handling	Very good		Very good
Dimensions	24" x 48" boards 3/4" to 2" thickness		24" x 48" boards 3/8" to 2" thickness
Other Qualifications	Higher density material is more resistant to abuse		Neoprene coating on side of board exposed to air flow

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

* 3-lb density. High-density outer layers.	*Fiberglas Vapor Seal Duct Insu* Owens-Corning Corp		*Fiberglas Coated Duct Insu* Owens-Corning Corp
	Armaglas Vapor Seal Duct Insu Armstrong C&S Corp		*Armaglas Coated Duct Insu* Armstrong C&S Corp
	Spintex No. 414VS Johns-Manville Sales Corp		*Coated Duct Insulation* Baldwin-Ehret-Hill, Inc
	E-Z Ply Duct Insu Baldwin-Ehret-Hill, Inc		
	*Fiberglass Board** Gustin-Bacon Mfg Co		

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DU 041416

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MATERIAL SPECIFICATION - SERIES 100

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Code		114	
Material		Mineral wool (Block only)	
Material Description		Mineral slag wool	
Filler			
Binder		High temp binder	
Temperature Range		500°F to 1700°F	
K Factor		500°F - 0.45 max	
Density		19.2 lb per cu ft	
Compressive Strength		12 lb per sq in.	
Manufacturing Process		Machine molded	
Resistance to Breakage in Handling		Good	
Dimensions			
Other Qualifications			

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

	PV Superstemp Eagle-Picher	
	Mono-Block Baldwin-Ehret-Hill, Inc	
	Armastemp Armstrong C&S Corp	
	M W Block M. H. Detrick Co	

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116

Code	118
Material	Urethane Foam, Rigid
Material Description	Preformed rigid urethane foam block, pipe, and fitting insulation manufactured with polyester or polyether resins with fluorocarbon blowing agent
Temperature Range	-270°F to +150°F
K Factor	0.17 max at 75°F
Density	1.7 to 2.5 lb per cu ft
Compressive Strength	Min 30 psi at 6.6% deformation, measured parallel to the direction in which the foam rose during manufacture or min 24 psi at 6.6% deformation in all directions
Manufacturing Process	Molded or cut from molded billet
Resistance to Breakage in Handling	Excellent
Dimensional Tolerances	Inside Diameter (In.)

Pipe Size of Insulation ID (In.)	Minimum Diameter (In.)	Maximum Diameter (In.)
1/2 – 6	IPS OD	IPS OD + 1/16
7 – 12	IPS OD	IPS OD + 1/8
14 and up	IPS OD + 1/16	IPS OD + 3/16

Outside Diameter (In.)

Pipe Size of Insulation OD (In.)	Minimum Diameter (In.)	Maximum Diameter (In.)
1/2 – 6	IPS OD – 1/8	IPS OD – 1/16
7 – 12	IPS OD – 1/8	IPS OD
14 and up	IPS OD – 1/16	IPS OD + 1/16

All other dimensions to be ± 1/16" including straightness and squareness

Other Qualifications	Uniform cell structure with max 10% open cells. No voids having any dimensions exceeding 1/4". Heat aging test: Block 1" square by 7" long, cut from near outer surface, on rests 6" apart with 70 gm weight having 1" square base in middle of span shall not distort block more than 1/16" in 1 hour at 225°F. Flame-spread rating per ASTM E 162 shall not exceed 60 when coated with PVA mastic 3/32" dry thickness reinforced by 10 x 10 mesh glass cloth, 10 lb per 100 sq yd. Water absorption max 4% by volume into a 2" x 2" x 1" skin-free piece immersed in water just under the surface for 5 days and then wiped with a wet cloth and weighed, with no delay between steps.

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

♦ Available only as two-piece sectional fittings for 90-degree elbows and tees.	*U–200* Unarco Industries
	Zerocel NB 200 National Gypsum
	Thermo FR Dow Chemical Co
	Foamthane FR ♦ Pittsburgh-Corning

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MATERIAL SPECIFICATION - SERIES 100

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Code	120		
Material	Polystyrene		
Material Description	Preformed rigid cellular polystyrene block, pipe, and fitting insulation		
Filler			
Binder			
Temperature Range	- 100°F to + 160°F		
K Factor	0.29 max at 75°F		
Density	1.7 to 2.3		
Compressive Strength	Min 20 lb per sq in. at 10% deformation		
Manufacturing Process	Cut from molded logs		
Resistance to Breakage in Handling	Excellent		
Dimensions	+ 1/16" - 0" on insulation ID, all other dimensions to be ± 1/16" including straightness and squareness		
Other Qualifications	Uniform cell structure with max 10% open cells. No voids having any dimensions exceeding 1/4". No distortion or volume change, or loss or compressive strength after exposure at 160°F and 80% relative humidity for 15 days. Water absorption max 0.03% by volume after being subjected to 90°F, 90% relative humidity for 15 days and max 4% by volume into a 2" x 2" x 1" skin-free piece immersed in water just under the surface for 5 days, then wiped with a wet cloth and weighed, with no delay between steps		

The following materials have proven satisfactory in field tests and proof has been furnished by the manufacturers that their product meets the above specifications.

* Available as two-piece sectional fittings for 90-degree elbows and tees	*Styrofoam Blue* * MMM Co, Houston Texas		
	Styrofoam Blue * Unicell Products, Inc		
	Styrofoam Blue * Styro Fabricators, Inc		

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