

Interoffice Memorandum

TO (Name and Location) Mr. J. C. Susil	DATE August 15, 1979
FROM (Name and Location) V. L. Deck	REFERENCE NO. ED79-487-VLD

cc: M. A. John
C. F. Hall
G. L. Cade
~~W. P. Slagle~~
E. D. Reed
C. C. Weikal
L. H. Simmons

W. P. Slagle
E. V. Kunkel - OCCC
R. S. O'Neal - Bay City
R. W. Schwansch - Clear Lake
L. T. Johnston - Pampa
T. L. Arnold



SUBJECT: EXPANDED PERLITE INSULATION

Plant Engineering recommends the testing of expanded perlite insulation on particular installations to be selected by Mr. J. W. Beasley. After factors such as ease of installation, maintainability, actual cost, and service performance are evaluated, this insulation may prove to be a favorable addition to the Chemcel insulation standards.

DISCUSSION

Expanded perlite is a naturally occurring alkaline alumina silicate rock which has been expanded at a high temperature to form a structure of minute air cells surrounded by a substance which converts into a glassy material by heat and fusion. The substance is held together by inorganic and organic binders and reinforcing fibers. We would like to submit for consideration, on an experimental basis, the use of Goodtemp 1500 insulation. This is an expanded perlite insulation with phenolic and starch binders and nylon reinforcing fibers.

Present Celanese insulation standards do not include expanded perlite because of the bad reputation it originally incurred. When asbestos was outlawed, an alternative to good insulation with a low K value (thermal conductivity) was needed. Expanded perlite and calcium silicate were two alternatives to this dilemma. Expanded perlite was rejected for several reasons. Breakage was the most common problem which occurred because of nonuniformity of components and the uneven distribution of nylon fibers which appeared as clumps. The small plant that manufactured it made no attempt to upgrade their product. The low flash point and misapplication of the material also contributed to the omission from the Celanese insulation standards.

Goodtemp 1500 exhibits several characteristics that distinguish it from calcium silicate (Kaylo). It has a temperature range from 200° F to

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1500° F , which is a wider range than calcium silicate's temperature range, 450° F. to 1200° F. It is especially suited for high temperature service. (Ref: Attachment 1).

The compressive strength of this material allows it to withstand 90 psi of pressure with only 5% deformation. Unlike calcium silicate, when a crack appears, Goodtemp 1500 does not flake and crumble. Instead, a "hinge" is formed with its nylon reinforcing fibers from which it retains its strength.

Non-wettable properties also give it advantages in strength and protection against chloride attack. The presence of tensile stresses along with a corrosive medium can result in stress corrosion cracking. In this case, the corrosive medium is a concentration of chloride ions that have built up on the metal's surface and hydrolyzed to form HCl, which is detrimental to austenitic stainless steel. Literature distributed about Goodtemp 1500 maintains that it contains less than 100 ppm chloride but lab results from CCTC show 147 ppm chloride. In the near future, Goodtemp will be manufacturing a product with zero ppm chlorides. The product will contain an inhibitor, such as sodium silicate, to prevent chloride attack.

There is conflicting information between the calcium silicate and expanded perlite manufacturer about the K value of Goodtemp 1500 versus Kaylo. Goodtemp has reported that in the lower temperature range, Goodtemp 1500 shows a slightly higher K value than calcium silicate. However, in high temperature service, the thermal conductivity drops below that of Kaylo. Data from an independent source would have to be obtained if more accurate numbers are desired. (Ref: Attachment 2).

Cost savings result from availability of the material, easy storage, minimized breakage and easy installation. In actual costs, according to Jack Burney, distributor from Gilman Insulation Company, Goodtemp 1500 is approximately 15-20% lower than Kaylo. Fiberglass prices are the highest of the three types. Gilman Insulation Company distributes Kaylo, fiberglass and Goodtemp 1500. Because Goodtemp 1500 is manufactured in Nuevo Laredo, Mexico, shipping costs would be lower. It could be stored outdoors because of its water resistance properties. Its durability results in less breakage in shipping and handling. Installation is easy because of its light weight, 11 lbs/cu ft., and handles easier and fabricates well because of its rigidity.

One disadvantage of Goodtemp 1500 is the color changes that occur when the organic binder used during manufacturing oxidizes. At 400° F the starch and phenolic binders begin to leave, and the insulation smokes slightly. The color has changed from light to dark pink. At approximately 500° F and above, a hardening occurs and the insulation becomes a firebrick substance. The nylon fibers begin to leave at 900° F and the insulation becomes

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grayish white at 1200° F. After the organic binder dissipates, the inorganic binder continues to bond the insulation together with negligible loss in insulation values. (Ref: Attachment 3).

Goodtemp 1500 may be used in various applications. Its moisture resistance is particularly advantageous for installation in high humidity areas. Its broad temperature range makes it an excellent replacement for Kaylo and Fiberglass. It has an upper temperature limit which enables it to be used for high temperature service. The insulation is available in thicknesses 1" through 4", single layer, and could possibly be used as a replacement for Kaylo and Fiberglass combinations. Double layering is also available.

In an attempt to obtain further information, several companies were contacted. These companies are presently installing Goodtemp 1500 or investigating it for future use.

Mr. Ron Herwood, an Engineer with DuPont at Ingleside, was first contacted. DuPont is presently installing Goodtemp 1500 on a 6" C/S pipeline which previously was insulated with calcium silicate. Mr. Herwood highly recommended Goodtemp 1500. The main reason was because of good fabrication properties. It was not dusty, it cut well, and therefore had decreased waste. It was tough, handled well, and very moisture resistant. Labor costs were lowered because of faster installation time and easier handling. When the new chloride-free version of Goodtemp 1500 is put on the market, it will be considered as an insulation possibility for stainless steel.

Mr. Ernie Powell, Head of the Technical Center on Insulation with Union Carbide, South Charleston, West Virginia, performed a fire test on a 3" pipe insulated with Goodtemp 1500. Thermocouples were installed and then the pipe was engulfed in flame. To pass the test, the pipe must stay below 1000° F for one hour's time and remain intact when hit with a steady stream of water, i.e., fire hose. Goodtemp kept the pipe at temperatures between 350°-400° F. After water stream was encountered, the insulation cracked but stayed on the pipe. Union Carbide uses Goodtemp 1500 on stainless steel but the pipe is coated first.

A Union Carbide Plant, located in Corpus Christi, is presently using and installing expanded perlite. Because of weathering and asbestos, they switched from calcium silicate to Goodtemp 1500. Other advantages included less breakage, high temperature service, and double layering was easier to handle.

Fluor Engineers and Constructors, Inc., are considering the use of Goodtemp 1500 for insulating a plant in Venezuela. Mr. Gary L. Carson, Staff Supervisor of the Insulation and Coatings Group, was contacted in regard to Fluor's application of the expanded perlite insulation. The attached

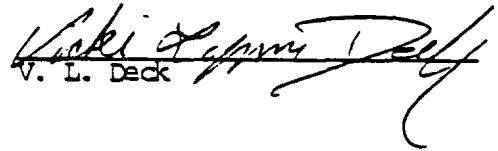
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August 15, 1979

letter from Fluor states that quality control of the insulation products was commendable as proven by a plant visit. (See Attachment 4).

CONCLUSION

The purpose of this report was to justify the testing of expanded perlite insulation. We believe that enough benefits are evident to follow up and install this insulation on hand-picked small-to-medium jobs. Actual usage is the proper way to realistically evaluate this insulation. Jim Beasley will be responsible for selecting the proper installation(s) for testing.


V. L. Deck

VLD:ds

Reference Attachments

- Attachment 1 - Comparison of Goodtemp 1500, Fiberglass and Kaylo
- Attachment 2 - "Confidential" Letter
- Attachment 3 - Goodtemp - Effects of Heat on Pipe Insulation
- Attachment 4 - Letter from Fluor Engineers and Constructors, Inc.
- Attachment 5 - Goodtemp 1500 - Asbestos Free Insulation
- Cost Sheets 1 through 5

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COMPARISON OF GOODTEMP 1500, FIBERGLASS AND KAYLO

	Temperature Range (°F)	Availability (Distributor)	Cost	Required Thickness 700°F/450°F.	K Value	Compressive Strength (psi)	Chloride (ppm)
GOODTEMP 1500 (Expanded Perlite)	200° - 1500°	Next day service - plant in N. Laredo. Gilman Insulation Co., Inc.	See Cost Sheet No. 1 and 2 Attached	Full Year Operation 3" Process 2-1/2" Steam Generation 3"	300° F - .52 500° F - .655 700° F - .805	90 @ 5% 147	
FIBERGLASS	90° - 450°	Gilman Insulation Co., Inc.	See Cost Sheet No. 4 and 5 Attached	450° Requires 2-1/2"	N/A	.02 to 3.5 @ 10% N/A	
KAYLO (Calcium Silicate)	450° - 1200°	Gilman Insulation Co., Inc.	See Cost Sheet No. 3 Attached	700° 3" + 1-1/2"*** 450° 3"	300° - .515 500° - .65 700° - .83	100 to 250 @ 5% 0**	

* First number = Calcium Silicate Thickness, 1st Layer (To be applied as two, 1-1/2" layers)
Second number = Fiberglass Thickness, 2nd Layer

** Probably not representative, further testing being done at OOCIC

Miscellaneous Information. Goodtemp 1500 and Kaylo were both submerged in water for six days. Goodtemp 1500 absorbed little water (mass/water = .17 or 17%) while Kaylo sunk (mass/water = 3.59 or 359%).



GOODTEMP CORPORATION
2371 SMOKEHOUSE PATH,
LAWRENCEVILLE, GA. 30245
(404) 972-1623

ATTACHMENT 2.

C O N F I D E N T I A L

A recent technical bulletin presented a case for calcium silicate over perlite insulation based on thermal conductivity.

Thermal conductivity expressed as "K" can be used to prove almost any case. Independent tests will prove printed literature in error, over or under-stated, based on samples and the number of samples tested.

We requested a Distributor to random-select test material of this manufacture and send it directly to Dynatech R/D Company. Our plant sent samples of GOODTEMP Insulation.

The resulting "K" values were measured:

	<u>calcium silicate</u>	<u>GOODTEMP</u>
300°	.515	.52
500°	.65	.655
700°	.83	.805

You be the judge!

NOTE: Michael R. Harrison, Manager of Engineering and Technical Services for Insulation Systems Department of Johns-Manville's Industrial Products Division reports the following K values:

	<u>calcium silicate</u>	<u>expanded perlite</u>
75°	.37	
200°	.41	.46
500°	.53	.63

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Goodtemp

**EFFECTS OF HEAT
ON PIPE INSULATION**



ATTACHMENT 3

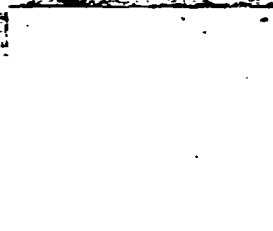
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Goodtemp

EFFECTS OF HEAT ON PIPE INSULATION



If we heat the insulation to 300° F, it will match the color of the uniforms, precisely.



AS PRESSED



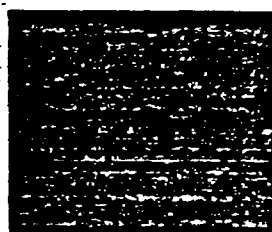
200°



300°



700°



800°



900°

Goodtemp 1500 is a temperature and weather resistant asbestos-free insulation. Manufactured in an easy to identify pink, Goodtemp 1500 is composed of perlite and compatible organic and inorganic binders.

Perlite, a naturally occurring alkaline alumina silicate rock, millions of years old, is of volcanic origin. The organic portion of the binder is unnecessary for the performance of the insulation — it is used as a forming aid and to add greater strength during shipment, handling and installation. When exposed to temperatures above 400 degrees F, the organic binder will oxidize and

smoke (no further smoking occurs once binder has dissipated). The inorganic portion of the binder, however, is unreduced by the high temperatures in its performance. It continues to bond the perlite grains together for the life of the product.

300100

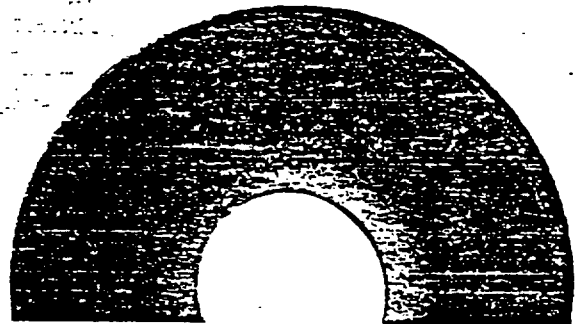
The chart below graphically displays the Goodtemp 1500.

BELOW 300 degrees F	No effect.
400 degrees F	Initial organic binder oxidation.
500-900 degrees F	Reduction of all organic binder to carbon.
1000 degrees F	Removal of last traces of carbon.
1100-1500 degrees F	All carbon residue completely removed. Perlite bonded together ceramically by inorganic binder component.

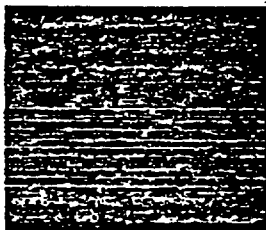


No problem, sir . . . the binder always smokes slightly, at 400° F.

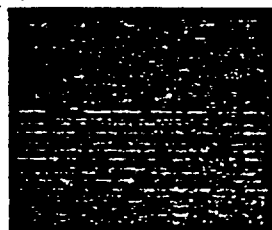
The sample in the upper right hand corner shows a cross section of insulation placed on a pipe operated at 1200 degrees F for one week. Note the color band changes, indicating the temperature at that point in the insulation sample. Also note that the outer layer of insulation still contains its organic binder component providing an extra measure of protection to the insulation.



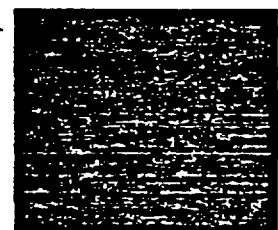
GOODTEMP 1500 REMOVED FROM A 1200° PIPE



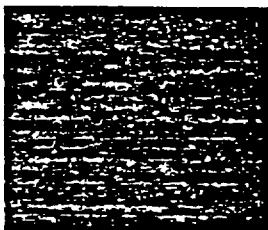
400°



500°



600°



1000°



1100°

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1200°

ATTACHMENT 4.

FLUOR ENGINEERS AND CONSTRUCTORS, INC.

SOUTHERN CALIFORNIA DIVISION
3333 MICHELSON DRIVE, IRVINE
P.O. BOX 11977
SANTA ANA, CA 92711
TELEPHONE (714) 975 2000
TELEX 69-2486

November 14, 1978

Mr. Edgar Gerber, President
Goodtemp Insulation Corporation
121 S. W. Eighth Street
Miami, Florida 33130

Dear Edgar:

I am writing to extend my thanks for your personal assistance and attention during our recent visit to your manufacturing facility in Nuevo Laredo, Mexico.

I, and our Exxon Client, found the visit enlightening and very interesting from a technical viewpoint. Of particular note was ~~the level of QA/QC attention paid to the manufacturing process.~~ We feel confident that you produce a quality product that would arrive at any jobsite exactly as offered by your technical literature.

Please extend my thanks also to your excellent plant staff when next you visit Nuevo Laredo.

Very sincerely yours,



Gary L. Carlson
Staff Supervisor
Insulation and Coatings Group

GLC:al

cc: Mr. R. C. Kiefer,
Metalclad Insulation Corporation

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Goodtemp 1500

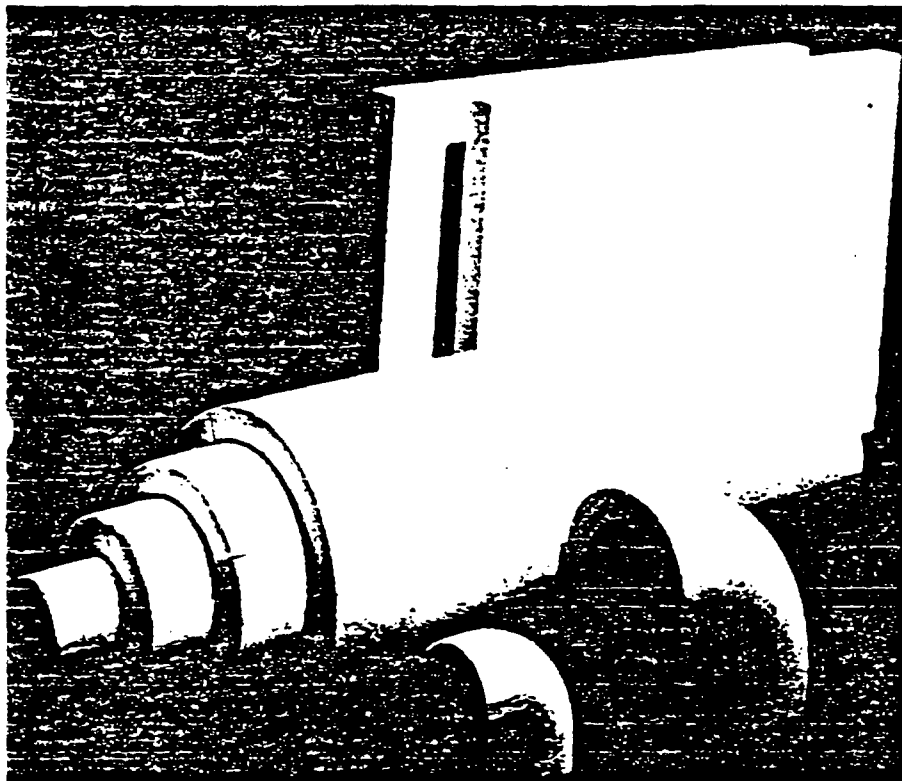
asbestos free
insulation by

Goodtemp

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Goodtemp

ATTACHMENT 5. Page 1.



Unique characteristics, and outstanding quality make GOODTEMP 1500™ exceptionally economical. Abundant industrial applications have resulted from this exclusive manufacturing process of bonding millions of vitrified air cells, reinforced with inorganic fibers.

Major Advantages

Moisture Resistant	low absorption, corrosion guard
Fire Resistant	does not act as wick, protects against actual fire damage
Low Shrinkage	less than 2% linear to 1500°F (815°C)
Corrosion Protection	acid resistant; contains little chloride, no lime
Versatile Applications	up to 1500°F (815°C) temperatures, low thermal conductivity, promotes standardization
No Asbestos	no health hazards, meets OSHA requirements
High Strength and Flexibility ..	easier installation, improved appearance, longer life
Only Metric Producer	all one meter lengths
Cost and Time Savings	full rating without double layers, pre-made fitting covers available
Unique Packaging	visible inspection, job site storage

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mp 1500

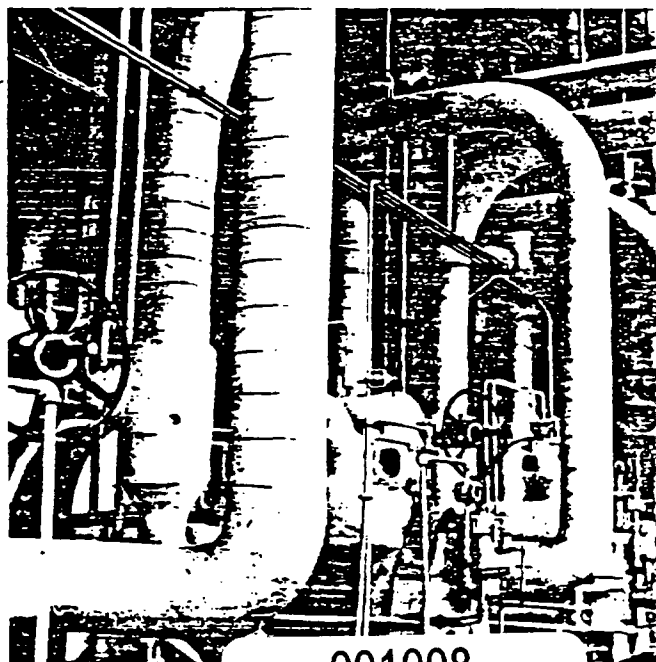
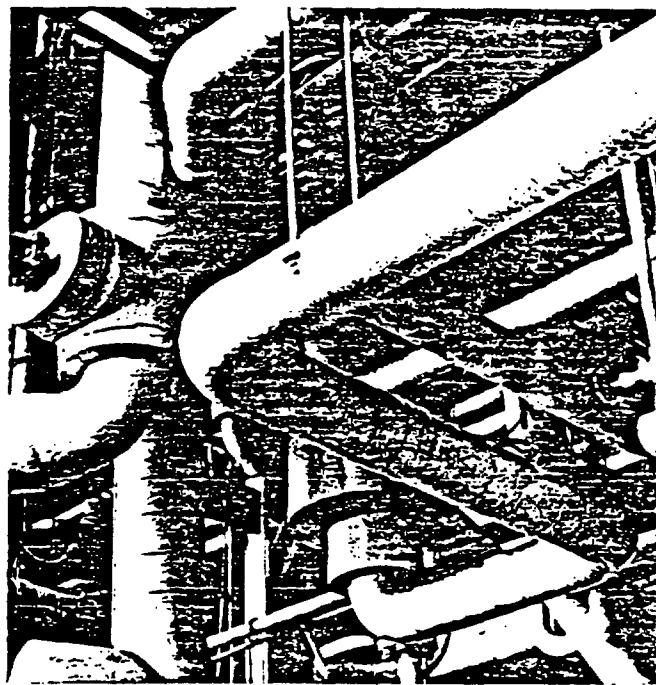
ATTACHMENT 5. Page 2.

Applications

GOODTEMP 1500® is recommended for insulating piping, vessels, and equipment in continuous and cyclic operation. It is especially suited to new high temperature applications (to 1500°F, 815°C) in process piping, refractory use, and in chemical plants and refineries. Its moisture resistance is particularly advantageous for installations in high humidity areas. The lack of asbestos makes GOODTEMP 1500® compatible with use in operations faced with limitations imposed by the Occupational Safety & Health Association.

Manufacturing

GOODTEMP 1500® is made with expanded perlite which involves a specifically developed vitrified air cell bonding process. Inorganic fibers reinforce and contribute to lower shrinkage.



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Goodtemp

ATTACHMENT 5. Page 3.

• Corrosion Prevention

GOODTEMP 1500® does not contain lime, thus it will not cause corrosion of aluminum. It contains less than 100 ppm chloride (lowest in its class), thus it will not contribute to stress corrosion of austenitic stainless steel.

• Fire Protection

The expanded perlite process allows the lowest absorption rate of any high temperature insulation. This is important in eliminating fire hazards. GOODTEMP 1500® resists auto-ignition by absorbing only limited amounts of flammable liquids. It does not appreciably lower the flash point of leaking materials. Should the misfortune of fire occur, GOODTEMP 1500® will, in many instances, require neither piping nor insulation replacement.



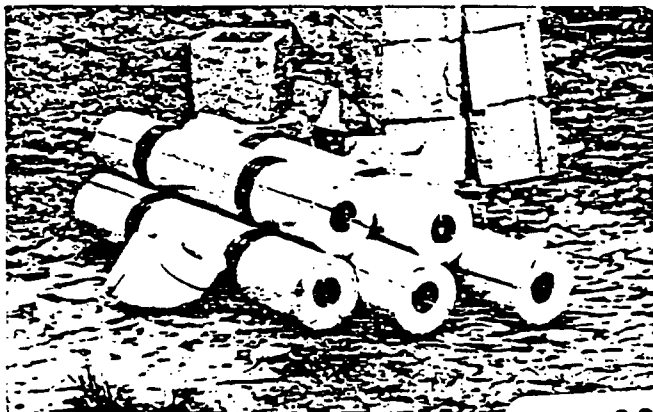
Even direct exposure to flame does not harm Goodtemp 1500® (It can withstand temperatures up to 1500°F (815°C).) In the event of a fire, substantial amounts of money can be saved by this kind of protection.

Cost Savings/Quality

The expanded perlite process results in a more attractive, stronger and lighter insulation. GOODTEMP 1500® resists crumbling and breaking, and its high impact strength makes it less subject to damage. All this results in cost savings due to easier installation and extended life. To further simplify installation.

The low conductivity and broad temperature range of GOODTEMP 1500® allows use of a single layer of insulation to provide full rated value without the extra cost of double layers as pipe and block insulation is available in thicknesses of 4" and 6," respectively.

Tremendous savings can be realized in the fact that GOODTEMP 1500® is versatile enough that all system insulation can be standardized.



Normally, a rainstorm, during construction, requires the covering of exposed insulation. Moisture resistant Goodtemp 1500® avoids this wasted effort. A low absorption rate and a sturdy composition make it impermeable to the harshest of weather conditions.

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mp 1500

ATTACHMENT 5. Page 4.

Physical Properties

Temperature limits	Maximum 1500°F (815°C) Continuous 1500°F (815°C) Cyclic 1500°F (815°C)
Density (dry)	11 lbs./cu. ft. (160 kg/m ³ -208)
Compressive strength	5% deformation 90psi (6.12 kg/cm ²)
Linear shrinkage	
1200°F (648°C) for 24 hours	.70%
1500°F (815°C) for 24 hours	1.60%
Water absorption	
By volume @ 90% relative humidity 4 weeks	1.30%
By volume, immersed 24 hours	2.7%
Acid resistance (after 24 hours immersion)	
25% Sulfuric or hydrochloric acid	No effect
Thermal conductivity expressed as BTU/hr./ft. ² /°F/in. (Kcal/m ² /hr./°C/cm)	
300°F (149°C) mean	.44 (.046)
500°F (260°C) mean	.55 (.058)
700°F (371°C) mean	.67 (.069)

Complies with: A.S.T.M. C-610-67
MIL 24244

Standard Sizes

It should be noted that Goodtemp is the only insulation producer simplifying metric conversion through the use of standard one meter lengths.

PIPE INSULATION

Iron pipe	1/2 in. through 24 in. IPS, half sections
Thickness	1 in. through 4 in. single layer; double layer available
Standard length	1 meter (39.37 in.)

BLOCK INSULATION

Standard width	6 in. and 12 in.
Standard length	39.37 in. (1.00 m)
Standard thickness	1 in. through 6 in. in 1/2 in. increments
Scored block	6 in. and 12 in. widths

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Recommended Specifications and Application Procedures

These specifications are general. Application procedures and material approval are the design engineers responsibility.

Goodtemp 1500 Pipe Insulation

Pipe insulation shall be applied over a clean, dry surface. Sectional insulation under 12" in diameter shall be installed with joints closely butted and secured by wire on 20" centers or 1/2" straps.

Insulation on pipes over 12" in diameter and all outdoor insulation shall be wired in place on 9" centers with 16 gauge soft annealed iron wire. Where double layer insulation is applied, joints shall be staggered and each layer must be secured with wire.

Elbows shall be insulated with Premolded Elbows wired in place. Fittings, flanges and valves shall be insulated with covers fabricated from GOODTEMP 1500[®] Pipe insulating cement.

Finish depends on cost. Available are fabric, membrane coated, printed, or other types of jacketing such as aluminum, sheet metal, plastic coating, etc. - all of which may be installed as recommended by the manufacturer.

All indoor fittings, flanges and valves shall be pointed to a smooth surface.

Goodtemp 1500 Block Insulation and Segments

Surfaces over 24" diameter up to and including 60" diameter shall be insulated with GOODTEMP Scored Block and attached to equipment using GOODHESIVE Cement on 12" centers. All voids and joints shall be pointed-up with insulating cement. Then apply wire mesh over the insulated surface. Finally, apply 3/8" to 1/2" coat of insulating cement over the wire mesh and finish to match specified jacketing.

Surfaces over 60" diameter shall be insulated with Goodtemp flat block securely fastened with 16 gauge black annealed wire or 1/2" x .020 galvanized bands and seals on 12" to 18" centers using staggered joint construction. Point all voids and joints with insulating cement. Then apply wire mesh over the insulated surface. Over the mesh, apply a 3/8" to 1/2" coat of insulating cement. It may be weather proofed or finished with metal, installed as recommended by manufacturer.

It is recommended for large vessels, such as towers, tanks, stills, etc., that angle iron supports be installed on 12-ft. centers. On large vessels, vertical angle iron members should be installed to hold a 30-ft. maximum length of the securing wire or band. Horizontal vessels over 6 feet in diameter should have two steel angles welded to the vessel shell approximately 30 degrees below the horizontal center line. The depth of these supports should be held to 1/2" less than the insulation thickness.

Recommended thicknesses:

TEMPERATURE OF SURFACE, F (°C)													
100 (38)	200 (93)	300 (149)	400 (204)	500 (260)	600 (316)	700 (371)	800 (427)	900 (482)	1000 (538)	1100 (593)	1200 (649)	1300 (704)	1400 (760)
NOMINAL THICKNESS, INCHES													
Utility-Steam Generation													
2	2	2	2	2 1/2	2 1/2	3	3	3 1/2	3 1/2	4	5	5	6
Process													
2	2	2	2	2	2	2 1/2	2 1/2	3	3	3 1/2	4	4 1/2	5
Commercial-Full Year Operation													
2	2	3	3	3									

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Goodtemp Insulation Dimensions

GOODTEMP 1500[®] PIPE INSULATION

ALL SECTIONS ARE 1 METER LONG, DIAMETER IN INCHES

PIPE SIZE	INSULATION I.D.'S	1" THICK O.D.	1½" THICK O.D.	2" THICK O.D.	2½" THICK O.D.	3" THICK O.D.	3½" THICK O.D.	4" THICK O.D.
½	.910	2.875	4.000	5.000	6.625	7.625	8.625	9.625
¾	1.110	2.875	4.000	5.000	6.625	7.625	8.625	9.625
1	1.375	3.500	4.500	5.563	6.625	7.625	8.625	9.625
1¼	1.705	3.500	5.000	5.563	6.625	7.625	8.625	9.625
1½	1.960	4.000	5.000	6.625	7.625	8.625	9.625	10.750
2	2.435	4.500	5.563	6.625	7.625	8.625	9.625	10.750
2½	2.935	5.000	6.625	7.625	8.625	9.625	10.750	11.750
3	3.560	5.563	6.625	7.625	8.625	9.625	10.750	11.750
3½	4.060	6.625	7.625	8.625	9.625	10.750	11.750	12.750
4	4.560	6.625	7.625	8.625	9.625	10.750	11.750	12.750
4½	5.060	7.625	8.625	9.625	10.750	11.750	12.750	14.000
5	5.623	7.625	8.625	9.625	10.750	11.750	12.750	14.000
6	6.685	8.625	9.625	10.750	11.750	12.750	14.000	15.000
7	7.695		10.750	11.750	12.750	14.000	15.000	16.000
8	8.695		11.750	12.750	14.000	15.000	16.000	17.000
9	9.705		12.750	14.000	15.000	16.000	17.000	18.000
10	10.840		14.000	15.000	16.000	17.000	18.000	19.000
11	11.850		15.000	16.000	17.000	18.000	19.000	20.000
12	12.860		16.000	17.000	18.000	19.000	20.000	21.000
14	14.120		17.000	18.000	19.000	20.000	21.000	22.000
15	15.120		18.000	19.000	20.000	21.000	22.000	23.000
16	16.150		19.000	20.000	21.000	22.000	23.000	24.000
17	17.130			21.000	22.000	23.000	24.000	25.000
18	18.140			22.000	23.000	24.000	25.000	26.000
19	19.140			23.000	24.000	25.000	26.000	27.000
20	20.150			24.000	25.000	26.000	27.000	28.000
21	21.150			25.000	26.000	27.000	28.000	29.000
22	22.160			26.000	27.000	28.000	29.000	30.000
23	23.160			27.000	28.000	29.000	30.000	31.000
24	24.160			28.000	29.000	30.000	31.000	32.000

GOODTEMP 1500[®] BLOCK INSULATION

1" 1½" 2" 2½" 3" 3½" 4" 5" 6"

All block sections are 1 meter long, widths are 6 in. and 12 in.

GOODHESIVE CEMENT. A remarkable cement used in fabrication of fittings. It is water soluble, tools are easily washed with water. GOODHESIVE has no flammable solvents. Request a technical description from your GOODTEMP distributor.

NOTE

Goodtemp warrants only that the Goodtemp products sold will be free from defects in material and workmanship for one year. Goodtemp's liability shall be limited to the furnishing of replacement products found to be defective in material and workmanship. Goodtemp shall not be liable for anticipated profits or for special, indirect or consequential damages.

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GILMAN INSULATION CO., INC.

"Serving and Growing With Industry of South Texas"

INDUSTRIAL INSULATION & REFRACTORIES

P. O. Box 4074 • Corpus Christi, Texas 78408 •

Telephone 884-4906

Cost Sheet No. 1

August 15, 1979

GOODTEMP PIPE COVERING PER LINEAL FOOT

I.P.S.	1"	1-1/2"	2"	2-1/2"	3"
1/2	.72	.84	1.33	1.71	2.12
3/4	.74	.86	1.42	1.85	2.22
1	.76	.91	1.49	1.94	2.36
1-1/4	.79	.95	1.55	2.03	2.46
1-1/2	.81	1.01	1.64	2.11	2.57
2	.91	1.05	1.73	2.15	2.66
2-1/2	1.03	1.20	1.86	2.41	2.79
3	1.12	1.32	1.98	2.46	2.92
3-1/2	1.29	1.50	2.26	2.52	3.19
4	1.31	1.66	2.40	2.84	3.85
4-1/2	1.33	1.76	2.53	3.12	4.06
5	1.42	1.82	2.65	3.80	4.42
6	1.51	1.99	2.92	3.85	4.88
7		2.23	3.40	4.69	5.17
8		2.68	3.77	4.88	5.57
9		3.08	4.24	5.12	6.56
10		3.35	4.56	5.96	6.89
11		3.56	4.94	6.57	7.13
12		3.99	5.21	6.73	7.52
14		4.36	5.79	6.82	8.01
15		4.73	6.05	7.33	9.00
16		5.04	6.33	7.68	9.97
17			6.67	8.44	11.04
18			7.10	9.01	11.55
19			7.38	9.62	11.83
20			7.77	9.98	11.91
24			8.87	11.27	13.31

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Cost Sheet No. 2
August 15, 1979

GOODTEMP BLOCK PER SQUARE FOOT

<u>I. I. C.</u>	<u>1"</u>	<u>1-1/2"</u>	<u>2"</u>	<u>2-1/2"</u>	<u>3"</u>
FLAT	.52	.77	1.04	1.29	1.46
SCORED	.55	.81	1.09	1.36	1.53

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Cost Sheet No. 3

August 15, 1979

KAYLO-10 OR PABCO SUPER CALTEMP PIPE COVERING PER LINEAL FOOT

(IPS)	1"	1-1/2"	2"	2-1/2"	3"
1/2	.90	1.07	1.72	2.03	2.50
3/4	.92	1.11	1.78	2.13	2.78
1	.93	1.18	1.89	2.23	2.89
1-1/4	.94	1.28	2.03	2.32	3.00
1-1/2	.95	1.35	2.13	2.43	3.20
2	1.17	1.48	2.23	2.54	3.34
2-1/2	1.23	1.62	2.39	2.73	3.54
3	1.31	1.70	2.56	3.04	3.84
3-1/2	1.48	1.88	2.83	3.43	4.26
4	1.51	1.98	3.04	3.73	5.03
4-1/2	1.57	2.07	3.26	4.04	5.37
5	1.64	2.21	3.47	4.80	5.71
6	1.77	2.28	3.89	5.15	6.17
7		2.75	4.23	5.49	6.66
8		3.09	4.65	5.94	7.33
9		3.71	5.32	6.72	8.24
10		4.12	5.82	7.25	8.83
11		4.67	6.17	7.75	9.35
12		4.84	6.48	8.11	9.80
14		5.49	7.14	9.04	10.98
15		5.94	7.49	9.52	11.53
16		6.17	7.86	9.98	12.13
17		6.52	8.20	10.47	12.72
18		6.78	8.56	10.94	13.31
19		7.06	9.04	11.42	13.80
20			9.80	12.24	14.27

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Cost Sheet No. 4

August 15, 1979

FIBERGLASS HEAVY DENSITY NO WRAP PIPE COVERING PER LINEAL FOOT

(IPS)	1"	1-1/2"	2"	2-1/2"
1/2	.46	.99	1.56	1.94
3/4	.53	1.03	1.64	2.00
1	.56	1.07	1.73	2.10
1-1/4	.61	1.17	1.85	2.16
1-1/2	.68	1.24	1.94	2.34
2	.73	1.35	2.04	2.50
2-1/2	.83	1.48	2.18	2.68
3	.92	1.54	2.34	2.90
3-1/2	1.03	1.66	2.53	3.05
4	1.21	1.76	2.72	3.25
4-1/2	1.29	1.85	2.90	3.65
5	1.39	1.98	3.09	3.72
6	1.48	2.04	3.15	4.16
7	1.85	2.34	3.61	4.69
8	2.15	2.64	3.90	4.99
9	2.34	2.93	4.29	5.47
10	2.54	3.23	4.69	5.97
11	2.73	3.42	4.99	6.25
12	2.93	3.61	5.27	6.64
14	3.49	4.31	6.15	7.80
15	3.79	4.61	6.47	8.20
16	4.11	4.82	6.76	8.61
17	4.31	5.14	7.08	9.02
18	4.51	5.33	7.38	9.43
19	4.82	5.64	7.80	9.83
20	5.03	5.84	8.20	10.25

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Cost Sheet No. 5

August 15, 1979

FIBERGLASS 703 BOARD PER S/F

	1"	1-1/2"	2"	2-1/2"	3"
PLAIN	.20	.29	.38	.48	.57
FRK FACED	.34	.44	.54	N/A	N/A

FOAMGLASS FLAT BLOCK PER S/F

	1-1/2"	2"	2-1/2"	3"
	.70	.92	1.16	1.38

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