

IN THE UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
HOUSTON DIVISION

IN RE: ASBESTOS RELATED LITIGATION	§ §	MASTER ASBESTOS DOCKET NO. 100

DEFENDANT OWENS-CORNING FIBERGLAS CORPORATION'S RESPONSES TO PLAINTIFFS' MASTER SET OF INTERROGATORIES

1. As to the person answering these interrogatories, state:

a. Name;
b. Title or position with defendant;
c. Business address;
d. Residence address;
e. Length of time employed by defendant.

A-1(a-e) Answers to these interrogatories were prepared based upon a search of presently existing corporate files and records regularly maintained in the ordinary course of business of Owens-Corning Fiberglas Corporation and also information obtained during interviews with various employees of the company. No single officer, employee or agent of the company has the direct knowledge or the proper documents necessary to supply each and every answer required. All answers are derived from a number of sources, persons and documents. The person signing the answers to these interrogatories does so solely to satisfy whatever requirement may exist under the applicable Federal Rules of Civil Procedure. The person signing the answers does not, however, have direct knowledge regarding any specific answer but is informed that the files, documents and interviews referred to above do support the responses based upon information available as of the date of signature.

If information is later obtained which changes, modifies or enlarges any of the answers here presented, such information will be conveyed to the parties submitting these interrogatories. These interrogatories are signed by Daniel M. Phillips, Director - Litigation, Owens-Corning Fiberglas Corporation, Fiberglas Tower, Toledo, Ohio 43659. The telephone number of the corporation is A/C 419/248-8000.

2. State the following concerning this defendant:

a. Full and correct name;
b. Principal place of business;
c. State of incorporation;
d. Date of incorporation, and name of corporation;

e. Is this defendant authorized to transact business in the State of Texas? If so, state the date such authority was first issued and last renewed;

f. Does this defendant have an agent, representative or place of business in Texas? If so, state the name and address of such agent, representative or place of business;

g. Does this defendant have an agent for service in the State of Texas? If so, state the name and address of the registered agent.

A-2(a) Owens-Corning Fiberglas Corporation.
A-2(b) Fiberglas Tower, Toledo, Ohio
A-2(c) Delaware
A-2(d) 1938. See response to #2(a).
A-2(e) Yes. This defendant has had authority to do business in the State of Texas since 1959.
A-2(f) Yes. This defendant has branch offices in Texas, located in Dallas, Houston and Lubbock. This defendant has manufacturing facilities in Texas, located in Amarillo, Conroe, Waxahachie, Houston, Lubbock and Irving.
A-2(g) Yes. CT Corporation, Republic National Bank Building, Dallas, TX 75201.

3. Has this defendant been sued under its correct name: If not, state the correct legal name of the defendant and provide the information requested in #2 above concerning the defendant as correctly named.

A-3 Yes, Owens-Corning Fiberglas Corporation.

4. As to any product containing asbestos in any form, has this defendant:

a. Ever designed such a product?
b. Manufactured such a product?
c. Processed such a product?
d. Sold such a product?
e. Distributed such a product?
f. Patented such a product?
g. Relabeled such a product which was manufactured, sold, or distributed by another company?

A-4(a) No.
A-4(b) Yes.
A-4(c) No.
A-4(d) Yes.
A-4(e) Yes.
A-4(f) The original Kaylo product was patented by Owens-Illinois. This defendant acquired certain of these patents when it acquired the Berlin Plant from Owens-Illinois in May, 1958. In addition, this defendant developed other patents relating to Kaylo thereafter. Unknown, as to other products.

The Fyrcor product (originally called Unarcoboard) was patented by Unarco Industries.

No patents were obtained on Type II mastic.

A-4(g) Yes.

5. If your answer to #4(d) and 4(e) is "Yes", then give the trade name of the product, the year the defendant first sold or distributed such product, and the year the defendant last sold or distributed such product.

A-5 See attached Exhibit "A".

6. In what year did the defendant first begin selling or distributing insulation products containing asbestos?

A-6 See response to #5.

7. In what year did the defendant last sell the insulation product which contained asbestos?

A-7 See response to #5.

8. For each asbestos containing insulation product manufactured or sold by you, please give the asbestos content by weight and by volume.

A-8 See response to #5.

9. Has this defendant ever acquired another corporation, company, or business which manufactured, sold, processed, distributed or contracted to apply insulation products containing asbestos?

A-9 This defendant did purchase certain assets of the Kaylo Division, Berlin, New Jersey Plant from Owens-Illinois in May, 1958, and the Chembest Division, Bloomington, Illinois plant from Unarco in April, 1970, but this defendant did not purchase or acquire either corporation. Neither Owens-Illinois nor Unarco were predecessor corporations of this defendant.

10. If the answer to Interrogatory #9 is "Yes", then state the following concerning such predecessor:

a. Full and correct name;
b. The principal place of business;
c. State of Incorporation;
d. Date of acquisition by defendant;
e. Was this business authorized to transact business in the State of Texas?

f. Attach copies of all papers pertaining to the acquisition.

A-10(a-e) See response to #9.
A-10(f) See attached Exhibits "B" and "C".

11. If your answer to #9 is "Yes," then give the trade name of the product, the year such predecessor first sold or distributed such product, and the year such predecessor last sold or distributed such product.

A-11 See response to #9.

Kaylo was the name of such product when it was manufactured by Owens-Illinois Glass Co. This defendant does now know when Owens-Illinois first sold or distributed Kaylo. This defendant believes that Owens-Illinois ceased distributing or selling Kaylo at the time this defendant acquired the Berlin facility.

Unarcoboard was the name of the product manufactured by Unarco when the Bloomington, Illinois plant (Chembest Division) was purchased by this defendant. This defendant does not know when Unarco first sold or distributed Unarcoboard. This defendant believes that Unarco ceased distributing or selling Unarcoboard at the time this defendant acquired the Bloomington facility.

12. In what year did the predecessor or acquired business begin selling or distributing insulation products containing asbestos?

A-12 See response to #11.

13. In what year did the predecessor or acquired business last sell insulation products containing asbestos?

A-13 See response to #11.

14. As to the named defendant or any predecessor or acquired business, state the various types of products, such as blocks, pipe covering, cements, tape, spray-on insulation, mastics, and cloth, and in connection with each type of such product, state how the same was packaged (i.e., bags, boxes, sacks, etc.) for sale.

A-14 See response to #5.

15. Have you, since 1950, had designated distributors of your products in the State of Texas?

A-15 Objection, overly broad and burdensome, irrelevant and not calculated to lead to the discovery of admissible evidence without waiving its objection this defendant states that based upon present information, it may have employed licensed or franchised distributors for the distribution of its Kaylo product. This defendant, however, does not know the names of these distributors. At this time, this defendant does not know whether distributors or suppliers were used with respect to the other asbestos-containing products listed on Exhibit "A".

16. If your answer to Interrogatory #15 is "Yes," then state the name of all companies, their addresses, and give the years that each was a designated distributor.

A-16 See response to #15.

17. If you did not have designated distributors in the State of Texas, then state by what method sales were promoted, encouraged or consummated, and give the name and address of all sales offices located in the State of Texas.

A-17 See response to #15. This defendant distributed its product through its Supply Centers. See response to #2(f) for offices located in Texas.

18. Describe the purpose or purposes for which each of the products were designed, said type of products being as follows:

a. Pipe covering;
b. Blocks;
c. Asbestos cloth;
d. Mastics;
e. Spray-on insulation;
f. Rope or tape;
g. Asbestos sheeting or millboard.

A-18 This defendant was not involved in the design of said products, however; see response to #5 for those products this defendant manufactured and sold.

19. Did each of your insulation products or materials generally reach, or were packaged to reach, the consumer, insulation helper, insulation mechanic, or ultimate user, without substantial change in the condition in which it was sold?

A-19 Yes.

20. Do you admit that asbestos insulation applicators, helpers or mechanics, were foreseeable users of defendant's asbestos-contained insulation products?

A-20 Yes.

21. Based upon the material contents of your products, the method of manufacturing, and the method of application for the purpose of insulation, can your products be generally applied by an insulator without creating dust?

A-21 This defendant assumes that this position relates to asbestos-containing insulation products. This defendant no longer manufactures asbestos-containing insulation products.

22. Please describe in detail each test that you performed on your asbestos containing insulation products to determine whether person applying the products would be exposed to bodily injury or disease as a result of applying those products. In connection with this interrogatory, include in your answer the date the test was made, the circumstances under which the test was made, the results of the test, and the name and address of the person or persons who have custody of the documentary evidence supporting the tests.

A-22 Dust studies were performed at a power plant in Montour, Pennsylvania on January 15, 1973 and Peachbottom, Pennsylvania on January 16 and 17, 1973, and San Diego, California on June 26 and 27, 1973. These studies were done by G. E. Devitt, Chief Industrial Hygienist, Owens-Corning Fiberglas Corporation, Fiberglas Tower, Toledo, Ohio 43659. Results of the studies were communicated to defendant's Contracting Division. The defendant ceased the manufacture of asbestos-containing insulation in November 1972 and the sale of such product in early 1973.

See attached Exhibit "D".

23. Did your company, or any predecessor, ever at any time give insulation contractors, insulation helpers, or insulation mechanics who would be using or applying your products instructions concerning safety precautions to use in applying such products? If so, describe such instructions, to whom they were given, the dates they were given, and the manner of giving such instructions.

A-23 This defendant placed written warnings on shipping containers of Kaylo products in 1966, on Unarcoboard (Fyrcor) in April, 1970, and on SC-30 and SC-40 cements in 1964. Those warnings were directed to all users of those products. See Exhibits "E", "F", "G", "H" and "I".

Additionally, this defendant on its own and through the National Insulation Manufacturers Association prepared and disseminated to contractors, distributors and insulators information regarding the health hazards associated with

asbestos-containing insulation. In 1968 NIMA published a pamphlet entitled "Recommended Health Safety Practices for Handling and Applying Thermal Insulation Products Containing Asbestos." That pamphlet was distributed at meetings of the Insulation Distributor Contractors National Association. Additionally, this defendant distributed that pamphlet to its Branch Managers and Supply and Contracting Managers with instructions to review the matter with their salesmen.

This defendant also participated through the education and legislative committee of NIMA, at regional meetings of the IDCNA in presenting to the distributors and contractors programs on health and safety. At those meetings, contractors and distributors: 1) were advised of the current status of health and safety activities pertinent to their business, 2) were given copies of the NIMA publications on health and safety practices and medical research literature, 3) discussed the contents of those publications, 4) discussed the merits of the proposed pre-employment and periodic physical examination programs on a cooperative employer-employee basis, 5) were urged to establish regional health and safety committees, and 6) were given an opportunity to ask questions of the experts. This defendant believes that Mr. Hutchinson, President of the National Asbestos Workers Union was present at, at least one of these meetings.

These NIMA programs were presented to contractors and distributors with the intention that this information would be passed on by the contractors and distributors to their employees.

24. Did your company, or your predecessor, ever require your employees at the mines, mills, factories, or plants to wear respirators? If your answer is "Yes", then state the first year that respirators were required.

A-24 This defendant was never involved in the mining or milling of asbestos, however, respirators were always available for use by defendant's plant employees. In 1971, plant rules made the use of respirators in designated areas and jobs a mandatory requirement.

25. Prior to your company, or its predecessor, requiring your employees at mines, mills, factories, or plants to wear respirators, did you require of such employee a physical examination to determine whether the wearing of a respirator would endanger such employee's health?

A-25 Unknown.

26. Was your company aware that in 1971-1972, in Washington, D.C., an advisory committee on the asbestos standard was set up by the United States Secretary of Labor James Hodgson, which committee recommended to the Secretary of Labor that before respirators could be issued to workers for any reason, each worker must have a complete physical examination to determine whether such worker could wear a respirator without endangering his health?

A-26 Yes.

27. Did your company, or your predecessor, ever place any warning signs on the containers in which asbestos insulation products were packaged?

A-27 Yes, this defendant placed warnings on its containers.

28. If you have answered Interrogatory #27 in the affirmative, please state:

a. On what date did your company, or your predecessor, issue an order directing a warning be placed on your insulation products, or containers?

b. On what date was such warning actually first placed on your insulation products or containers?

c. State the exact size of the warning printed on your asbestos insulation products or containers.

d. Did your company, or its predecessor, place such warning on your asbestos insulation products or containers?

e. Please attach to your answers to these interrogatories true and correct copies of any photographs you may have showing the placement of such warning on the boxes containing your products.

A-28(a) November, 1966
A-28(b) December, 1966
A-28(c) See Exhibit "J" attached.
A-28(d) Answering for this defendant, yes.
A-28(e) See response to Interrogatory #23.

29. Did your company, or its predecessor, ever place any warning on any of its asbestos insulation pipe covering, blocks, cloth, or millboard?

A-29 Warning labels were not printed on the product; they were printed on this defendant's containers and bags in which the product was shipped.

30. If your answer to Interrogatory #29 is "Yes," then state the date and the type of product on which said warning was stamped or printed.

A-30 See response to #29.

31. Did your company ever stamp the name of its company, its initials, or any identifying logo on any of its asbestos pipe covering, blocks, cloth, or millboard?

A-31 See response to #29.

32. Did the warning inquired about in Interrogatories Nos. 27 and 29, or similar warning, ever appear in any of your sales literature? If so, attach copies of such sales literature, showing the date such literature was printed.

A-32 This defendant did not advertise in the usual way via TV or magazines, etc. However, Product Data and Specification Material was prepared and distributed to purchasers of defendant's asbestos-containing insulation. This material was not the result of any one author, but many people contributed. This defendant did not use an "ad agency" for this material.

33. On what date was the sales literature inquired about in Interrogatory #32 first provided to distributors or sellers of your company's products, or your predecessor's products?

A-33 N/A

34. Has your company, or your predecessor, ever devised a high temperature heat insulation which does not contain asbestos? If so, state the date that such insulation was first placed on the market.

A-34 Yes. This defendant began production of asbestos-free Kaylo in November, 1972.

35. If your company, or your predecessor, ever devised a high temperature heat insulation which does not contain asbestos, state what prompted your company to devise such high temperature heat insulation not containing asbestos.

A-35 The production of Kaylo and Fyrcor products ceased because this defendant wanted to use its own product, fibrous glass, as an ingredient in industrial insulation and because of more definitive medical literature relative to asbestos and health.

36. Has such high temperature heat insulation not containing asbestos performed satisfactorily; that is, is such insulation suitable for the purpose for which it is to be used?

A-36 This defendant's non-asbestos containing insulation performs satisfactorily, except that it does not protect heated surfaces for as high a temperature control as did asbestos-containing insulation.

37. Give the trade names of your high temperature heat insulation products which do not contain asbestos, and state fully what such insulation contains.

A-37 Kaylo AF is the name of defendant's asbestos-free insulation and the ingredients are as follows:

AR Glass fibers
Wood pulp
Lime
Portland Cement
Diatomaceous earth
Tripoli
Clay
Kaylo dust

38. Does your company have, or has it ever had, a division or subsidiary company engaged in the contracting business? If so, give the name of such division or subsidiary company, the full address of the home office of such division or subsidiary company, and the dates such division or subsidiary company was engaged in the contracting business.

A-38 Yes. January 27, 1950 - Board of Directors authorized the formation of Fiberglas Engineering & Supply Company of Northern California.

January 25, 1951 - Board of Directors authorized the formation of "Fiberglas Engineering & Supply Company of Oregon" or some similar name to operate in the states of Oregon and Idaho. (Was incorporated as Fiberglas Engineering & Supply Company of Northwest.)

July, 1951 - The Fiberglas Contracting & Supply Company of Ohio Valley was formed in the state of Ohio.

June 27, 1952 - Fiberglas Engineering & Supply Company of Northern California purchased the assets of Marine Engineering & Supply and the name was changed to "Fiberglas Engineering & Supply Company."

June 27, 1952 - Purchase of the Detroit Insulation Company and the name apparently changed to "Detroit Fiberglas Insulation Company."

November 18, 1953 - The Detroit Fiberglas Insulation Company was merged into Fiberglas Contracting & Supply Company of Ohio Valley.

January 24, 1954 - Fiberglas Engineering & Supply Company of the Northwest was merged into Fiberglas Engineering & Supply Company.

November 27, 1954 - The Board of Directors liquidated the subsidiaries, Fiberglas Engineering & Supply Company and Fiberglas Contracting & Supply Company, and the wholly-owned subsidiaries were dissolved.

Also this defendant has had contracting units in various states under the name of Owens-Corning Fiberglas Corporation.

39. Please state whether or not any division of your company or subsidiary company engaged in the contract business of applying insulation products had any claims for lung diseases or death from lung disease attributable to asbestosis, mesothelioma or lung cancer. If the answer is "Yes," give the names of such employees and attach copies of such claims.

A-39 To date, this defendant has been served lawsuits involving in excess of 35,000 plaintiffs and to supply the information requested would be unduly burdensome. Defendant has, however, received copies of workers compensation claims from plaintiff's attorney in South Carolina. These documents number in excess of 5,000 pages of information and defendant will provide copies of these documents for reimbursement of the cost of producing same.

40. Has your company or its predecessor ever conducted or caused to be conducted any studies designed to minimize or eliminate the inhalation of asbestos dust and fibers by those exposed to the use of your company's insulation products? If so, give the following:

a. Name of the person or firm conducting such studies;

b. The date the studies began and the date completed;

c. Any publication or dissemination of the results of the studies;

d. The nature of any action to eliminate or minimize the inhalation of asbestos dust or fibers.

A-40(a-d) Studies/Surveys were conducted by Aetna, Bradley, and Clayton; however, they were conducted for all dusts, not just asbestos dust and fibers. See Exhibits "K", "L" and "M" attached.

41. State the year that this defendant, or any predecessor, was first advised of either threshold limit values or total dust by the American Conference of Governmental Industrial Hygienists, and state the name of the

employee-official of the company receiving such advise and attach copies of the instrument communicating such advice.

A-41 This defendant cannot represent that it is aware of all State, Federal, local and private standards regarding TLVs.

In 1938, the U.S. Public Health Service tentatively recommended a TLV for asbestos dust exposure of 5 MPPCF.

From 1946-1970, the ACGIH adopted a TLV of 5 MPPCF.

In 1963 this defendant was informed by Robert Peele, an Industrial Hygienist for Union Carbide, that the maximum allowable asbestos dust in the air was five (5) million particles per cubic foot of air. The Company was also informed that based upon dust samplings conducted by Mr. Peele during the fabrication of Kaylo that the dust amounts taken were below the applicable TLV.

In 1971, OSHA adopted an emergency standard for exposure of asbestos dust of 5 fibers/cc greater than 5 micrometers in length based on an 8 hour time weighted average.

In 1972, OSHA adopted the above as a permanent standard.

In 1974, the ACGIH adopted a TLV of 5 fibers/cc greater than 5 micrometers in length.

In 1976, OSHA adopted a standard of 2 fibers/cc greater than 5 micrometers in length based on an 8 hour time weighted average.

42. Was such threshold limit values or maximum allowable concentrations inquired about in Interragatory #41 TOTAL dust and not just asbestos dust?

A-42 See answer to #41.

43. State whether or not the American Conference of Governmental Industrial Hygienists is or is not an agency or department of the United States Government.

A-43 The ACGIH is not an agency or department of the United States Government.

44. Has your company or its predecessor ever advised any contractor to whom you sell your products containing asbestos of threshold limit values for exposure to asbestos dust recommended by the American Conference of Governmental Industrial Hygienists? If so, state the date or dates that you

so advised such contractors, the manner in which you advised such contractor, and the name of the contractor.

A-44 Based on present information no.

45. Before releasing the products previously listed in these interrogatories to the public, were any tests conducted on them to determine potential health hazards involved in the use of materials contained in those products?

A-45 Kaylo pipe, block and core insulation was manufactured and sold by Owens-Illinois Glass Company prior to the time this defendant became either a distributor or manufacturer and, therefore, no tests were conducted by this defendant. However, Owens-Illinois did conduct studies. Those studies were conducted at the Trudeau Foundation, Saranac Lake, New York.

46. If the answer to Interrogatory #45 is affirmative, state:

a. The names of the products tested and date.

b. The name, address and job title of each person who conducted those tests.

c. The results of those tests and date.

A-46(a-c) See response to Interrogatory #45.

47. Do any documents, including written memoranda, specifications, recommendations, blueprints, or other written materials of any kind or character relating to the testing of the named products now exist?

A-47 This defendant performed numerous tests relating to breakage, shrinkage, density, corrosion, and thermal conductivity which are too voluminous to list.

Other documents exist which relate to Animal Experimentation Studies conducted for Owens-Illinois by Saranac Laboratories. The originals of these documents are in the possession of the law firm of the defunct Saranac Laboratory; however, this defendant has copies of those documents which were obtained at a deposition in Saranac Lake, New York, in May, 1979.

48. If the answer to Interrogatory #47 is affirmative:

a. List each document and date.

b. State the name, address, and job title of each person who currently has possession of each document and where it is presently located.

A-48(a-b) See response to Interrogatory #47.

49. Did the defendant or its predecessor, or any of its subsidiary companies make any design changes as a result of those tests?

A-49 This defendant was not involved in the design of said products. See response to Interrogatory #48.

50. If the answer to Interrogatory #49 is affirmative, state:

a. The trade names of the products changed.

b. The nature of the changes made.

c. The name, address, and job title of each person responsible for having made a change.

A-50(a-c) See response to Interrogatory #49.

51. Please state the amount of asbestos fibers that are required to be in the body to produce the following diseases:

a. Plural asbestosis.

b. Parenchymal asbestosis.

c. Lung cancer.

d. Mesothelioma.

A-51 Objection, question calls for a medical conclusion of which this defendant is not qualified to provide.

52. Please state in detail the evidence you intend to offer at the time of trial to show, or prove, that the plaintiff in this case was actually aware of the following dangers from exposure to asbestos.

a. Plural asbestosis.

b. Parenchymal asbestosis.

c. Lung cancer.

d. Mesothelioma.

A-52 The response to this question requires a "general" identification of evidence to be used in "a" particular case. It would be speculation on the part of the defendant to provide information in this type of request.

This defendant will provide the requested information as specific cases are identified and set for trial in accordance with the Federal Rules of Civil Procedure.

53. Has defendant, or its predecessor, or any of its subsidiary companies at any time been members of any "trade organization" or "association" comprised of other manufacturers, miners, marketers, and/or sellers of asbestos products?

A-53 Yes.

54. If the answer to Interrogatory #53 is affirmative, state:

a. The name and address of each of those associations or organizations.

b. The dates during which defendant or its predecessor or any of its subsidiary companies were members.

c. The names of any publications published by or written by any of the named associations or organizations.

A-54(a-b) This defendant has been a member of the following organizations for the years stated:

National Insulation Manufacturers Association, Inc. (1958 to present), 441 Lexington Ave., New York, New York 10017;

Thermal Insulation Manufacturers Association (1958 to present), 7 Kirby Plaza, Mt. Kisco, New York 10549;

National Mineral Wool Association (1969 to present), 382 Springfield Ave., Summitt, New Jersey 07901;

Industrial Hygiene Foundation of America and its successor, Industrial Health Foundation (1942-1950 and 1953 to present), 5232 Center Ave., Pittsburgh, Pennsylvania 15232;

National Insulation Contractors Association (1967 to present), 1025 Vermont Ave., N.W. Suite 410, Washington, D.C. 20005;

American Society for Testing & Materials (Unknown), 1916 Race Street, Philadelphia, Pennsylvania 19103.

A-54(c) Industrial Hygiene Digest, and "Recommended Health Safety Practices" pamphlet prepared by NIMA.

55. Have any written materials of any kind or character been prepared by defendant or its predecessor or any of its subsidiary companies or their agents indicating how asbestos products should be used and maintained? Please attach to your answers to these interrogatories true and correct copies of such literature.

A-55 See Exhibits "N", "O", "P" and "Q" attached. This material was distributed to purchasers of defendant's asbestos-containing products. Whether or not it was supplied to users is not known by this defendant.

In addition, a pamphlet entitled "Recommended Health Safety Practices for Handling and Applying Thermal Insulation Products Containing Asbestos" was published in 1968 by the National Insulation Manufacturers Association. Additionally, this defendant distributed that pamphlet to its branch managers, S&C supervisors, HBP supervisors, and S&C managers, with instructions to review the matter with their salesmen.

This defendant also participated through the education and legislative committee of NIMA, at regional meetings of the IDCNA in presenting to the distributors and contractors programs on health and safety. At those meetings, contractors and distributors: 1) were advised of the current status of health and safety activities pertinent to their business, 2) were given copies of the NIMA publications on health and safety practices and medical research literature, 3) discussed the contents of those publications, 4) discussed the merits of the proposed pre-employment and periodic physical examination programs on a cooperative employer-employee basis, 5) were urged to establish regional health and safety committees, and 6) were given an opportunity to ask questions of the experts.

Also, this defendant placed written warnings on shipping containers of Kaylo in 1966, on Unarcoboard (Fyrcor) in April, 1970 and on SC-30 and SC-40 cements in 1964. Those warnings were directed to all users of those products.

56. Does defendant have insurance policies that might cover the claims made by plaintiff in this case?

A-56 This defendant has not obtained specific coverage to protect it from claims relating to exposure to asbestos products. This defendant has obtained general liability and workmen's compensation insurance. That coverage was provided by the Aetna except for various states in which this defendant

participated in the state workmen's compensation fund or was self-insured. See attached Exhibit "R".

57. If the answer to Interrogatory #56 is affirmative, list the name of each insurance carrier, the amount of coverage, and the effective dates of each policy.

A-57 See response to Interrogatory #56.

58. Describe in detail the type of packages in which defendant or its predecessor, or any of its subsidiary companies, sold asbestos material, listing the dates each type of package was used, a physical description of each type of package, and a description of any printed material or trademarks that appeared on it. Please attach to your answers to these interrogatories true and correct copies of photographs of the packages in which your products were packed.

A-58 See attached Exhibits "S", "T", "U" and "V".

59. Does defendant admit that it or its predecessor or any of its subsidiaries sold asbestos insulation material in the State of Texas at any time?

A-59 Yes.

60. If your answer to #59 is affirmative, list the dates during which the product was sold.

A-60 From 1953 through early 1973. See also Exhibit "A" for products sold from 1938-1952. Their asbestos content, however, is unknown.

61. State the name of each and every witness, including experts, whom you intend to call to testify during the trial of this cause and indicate as to what they are expected to testify. If any of your expert witnesses whom you expect to testify at trial of this cause have furnished you with any sort of written reports, memoranda or any other written information, please identify such writings by attaching a true copy to your answers hereto.

A-61 The response to this question requires a "general" identification of witnesses to be used in "a" particular case. It would be speculation on the part of the defendant to provide information in this type of request.

This defendant will provide the requested information as specific cases are identified and set for trial in accordance with the Federal Rules of Civil Procedure.

62. Name by date and source as to when your company, or its predecessor, first suspected there was a health hazard to human beings from exposure to, or breathing of, asbestos dust, fibers, or particles.

A-62 This defendant is now aware of medical literature associating various health problems with the inhalation of asbestos fibers. There was no specific date as to when this defendant became aware of the relationship of exposure to asbestos fibers and dust to various health hazards. Likewise, there was no specific date as to when this defendant became aware of the relationship of exposure to Kaylo dust to various health hazards. The knowledge of that relationship was developed over a considerable period of time.

In the early 1940's some employees of this defendant became aware of potential health hazards associated with the inhalation of asbestos fibers in the asbestos and textile manufacturing industry.

In 1953, this defendant began to distribute a hydrous calcium silicate reinforced with asbestos, called Kaylo, which was manufactured by Owens-Illinois. This defendant began to manufacture the product in 1958, when it purchased the Berlin, New Jersey plant from Owens-Illinois.

In 1956, prior to the acquisition of the Kaylo manufacturing plant from Owens-Illinois, this defendant inquired into the information that Owens-Illinois had regarding the health aspects of the Owens-Illinois Kaylo product. This defendant was informed that a study at Lake Saranac, published in 1955, showed that animals, if exposed for a prolonged period of time in high concentrations of Kaylo dust, could develop a mild asbestosis reaction. However, this defendant was informed at the same time that experience in the manufacturing plant, including x-ray results, revealed no lung changes of any kind that could be contributed to the occupational exposure to Kaylo.

Other documents, presumably received from Owens-Illinois around the time of the acquisition, informed this defendant that Owens-Illinois had concluded, based on this experience in the factories and in the field and its consideration of the Saranac report, that the actual hazard to the health of those handling Kaylo was considered to be small.

It was not until 1964 that this defendant was made aware of new developments concerning the potential hazards of asbestos insulating materials. It was at this time that Dr. Selikoff had published several articles on the hazards associated with asbestos-containing insulation material. These articles, as

they related to prolonged use and exposure to asbestos insulating materials and potential lung disease, were questioned by certain employees of this defendant with regard to their application to the product Kaylo. It was felt that Kaylo, a calcium silicate, could not have been involved to any appreciable extent in the studies because the studies involved men who had entered the insulation trade before 1943 and Kaylo had not yet been marketed in 1943. In addition, the fact that the asbestos in Kaylo was altered physically and chemically during the autoclaving process raised the issue as to whether or not the alteration changed the cancer inducing tendencies of the original asbestos.

As of the mid '60s no Worker's Compensation cases had been filed by employees of the Berlin plant, the Kaylo manufacturing plant. In October of 1966 certain employees of this defendant were advised that a Worker's Compensation case had been filed by an insulation worker in Massachusetts alleging lung damage due to the handling of Kaylo.

Shortly thereafter, notwithstanding the fact that there was still doubt among certain employees as to whether Kaylo could cause lung disease, a decision was made to place warnings on the Kaylo cartons and said decision was implemented in December 1966.

It was not until 1969 that the first case of lung disease at the Berlin plant was diagnosed.

63. Please list and identify in detail each and every document, report, research study, survey, article or journal, both medical and technical, which this defendant will use, or anticipates using, at the time of trial.

A-63 The response to this question requires a "general" identification of evidence to be used in "a" particular case. It would be speculation on the part of the defendant to provide information in this type of request.

This defendant will provide the requested information as specific cases are identified and set for trial in accordance with the Federal Rules of Civil Procedure.

0558n

FULBRIGHT & JAWORSKI

By: _____
Samuel E. Stubbs
MBank Building
Houston, Texas 77002
(713) 651-5151

Attorney for Defendant
Owens-Corning Fiberglas Corp.

CERTIFICATE OF SERVICE

I hereby certify that a true copy of the above and foregoing instrument was served upon plaintiffs' attorneys by certified mail, return receipt requested, and defendants' attorneys by regular mail this 26th day of December, 1985.

_____
Samuel E. Stubbs

PRODUCT CHART

Brand Name of Product	First Year Produced Or Sold	Last Year Produced, Supplied Or Sold Or Year Asbestos Removed	Purpose For Which Product Intended	Asbestos Content (%)	Year Warning Label Placed On Product	Form Of Product (Solid, Granule, etc.) How Pkgd.	Product Cut, Sawed, etc., on Job Site (Yes/No)	Product Mixed etc., on Job Site (Yes/No)	Physical Composition and Type of Asbestos In Product	Additional Comments
Kaylo Core block and pipe Kaylo 10-for temp. up to 1200F. Kaylo 20-for temp. up to 1650F. Kaylo Clad-pipe insulation with metal jacket.	1958 (Produced) 1963 (Sold)	Nov. 1972 (Mfg'd.) Early 1973 (Sold)	Pipe Insulation High temperature Industrial Insulation	Approx. 15% by weight	Dec. 1966 and Nov. 1970	Solid Cartons	Yes, as necessary	No	Amosite and/or Chrysotile Asbestos, Calcium Silicate, organic and inorganic binders and diatomaceous Earth. Asbestos 15% by weight	This product was manufactured in various sizes and lengths. Product Color-Pink/Gray/White
Undercoboard (Name was changed to Fyrcor in 1971)	1970 (Produced)	1972	Core Insulation for Fireproof Doors High temperature Industrial Insulation	Approx. 15% by weight	Mid-1971	Solid Palletized w/corr. ext. & steel bands	Presumed to be cut, sawed, or routed	No	Same as Kaylo only Amosite Asbestos used.	Color was a grayish white. Also a small amount was mfg'd with a blue and white mottled appearance
Hy-lo (Kaylo re-branded for Eagle-Picher)	1958/60 (Produced) Exact date Unknown at Present	1972	Same as Kaylo	Same as Kaylo	Same as Kaylo	Same as Kaylo	Same as Kaylo	Same as Kaylo	Same as Kaylo	Same as Kaylo
Armstrong UX Insulation (Kaylo re-branded for Armstrong Cork)	Unknown at present (Produced)	Believed to be 1962	Same as Kaylo	Same as Kaylo	Same as Kaylo	Same as Kaylo	Same as Kaylo	Same as Kaylo	Same as Kaylo	Same as Kaylo
Kaylo (Re-branded for OCF by Fibreboard Co. Pabco Div.)	1960 (sold only)	Late 60's or early '70s	Pipe Insulation (High Temperature Insulation)	Unknown	Jan. 1967	Solid Cartons	Unknown	No	Unknown	
Actual Name unknown but believed to be Kaylo (Re-branded for OCF by Johns-Manville)	1958 (sold only)	1960	Pipe Insulation (High Temperature Insulation)	Unknown	Unknown whether a warning label was on product at this time	Solid Cartons	Unknown	No	Unknown	
SC-30 (OC-110) SC-40 (OC-660) Cements re-branded for OCF by Eagle-Picher	1958	1966	Pipe Insulation	See Physical Composition Column	1964	Granule (bulk) Bags	No	Yes	SC-30 varies from 2.5 to 5% Chrysotile SC-40 varies from 3 to 5% Chrysotile	
Fiberglas Insulating Cement	Possibly 1951	Possibly 1951	A Monolithic Insulation for any surface	Unknown	No Warning Label believed to have been placed on product	Granule Bag	No	Yes	Insulated Insulation, dry mixed with refractory type materials	Believed to contain asbestos from April 1951 to October 1951
Fiberglas Finishing Cement	1960	1969	Provide a finished surface to insulated pipe or tanks	Unknown	No Warning label believed to have been placed on product	Granule Bag	No	Yes	Light Density Fibrous Material combined with asbestos fibers and suitable binders	Less than $50,000 sold during period
OC Mastic (Purchased-Supplier unknown)	1960	1962	Protective finish over the insulation on pipe lines, boilers, ducts, breechings, convertors, digesters and other equipment exposed to moisture or weathering	Unknown	No warning label believed to have been placed on product	Ready mixed plastic form of trowling consistency. Metal Container	No	No	Asphalt emulsion to which long asbestos fibers have been added	Less than $50,000 sold during period

EXHIBIT A

Brand Name of Product	First Year Produced Supplied Or Sold	Last Year Produced, Supplied Or Sold Or Year Asbestos Removed	Purpose For Which Product Intended	Asbestos Content (%)	Year Warning Label Placed On Product	Form Of Product (Solid, Granule, etc.) How Pkgd.	Product Cut, Sawed, etc., on Job Site (Yes/No)	Product Mixed etc., on Job Site (Yes/No)	Physical Composition and Type of Asbestos In Product	Additional Comments
OCF Type II Mastic (Supplier Unknown)	July 1964	April 1978	Sealer for duct joints	Less than 5% by weight	Unknown	Wet pasty Substance Metal Container	No	No	Chrysotile Asphaltic Emulsion	
Asbestos Paper Facing used as special order facing on sewn blanket	1938	1961	Thermal insulation	Asbestos content of paper unknown	No warning label believed to have been placed on product	Solid Presently Unknown	Unknown	No	Unknown	Asbestos paper was sold as special order facing (1 of 7) applied to sewn glass fiber blankets used in insulation applications. Less than $27,000 of blankets sold. Asbestos paper not produced by OCF.
Asbestos tie yarn used for special orders for metal mesh blankets	1938	Possibly 1952	Asbestos Tie cords, were installed at the OCF Plant. Used to hold metal mesh to fiberglas blanket core; were offered as an option.	Asbestos content of yarn unknown	No warning label believed to have been placed on product	Solid banded, telescope type, plain cartons	Unknown	No	Flexible insulating blanket, all glass wool with metal facing on one or both sides	Had to be special ordered. Asbestos tie cords not produced by OCF

OWENS-ILLINOIS

GENERAL OFFICES (O) TOLEDO 1, OHIO

May 9, 1958

Owens-Corning Fiberglas Corporation
P. O. Box 911
Toledo 1, Ohio

Gentlemen:

We have this day sold to you certain of the properties of our Kaylo Division as of the close of business April 30, 1958. This letter summarizes the procedure that will be followed with regard to the employees of the Kaylo Division.

You agree to assume any obligations which we may have with regard to payment of vacation pay to any hourly employees of the Kaylo Division who become your employees, and we will reimburse you in an amount equal to the amount properly accrued, as of May 1, 1958, on our books in accordance with our regular accounting practice for vacation pay for such employees.

With reference to such of our personnel as become your employees, you and we will cooperate in an effort to secure the transfer to the trust under your retirement plan, for the benefit of such employees, in accordance with the provisions of our retirement plans and to the extent permissible thereunder, of the funds held for the benefit of such employees in the trusts under our plans, without affecting, however, the present qualification under the provisions of the Internal Revenue Code of 1954 of all such retirement plans and the tax exempt status of the trusts thereunder and without providing any benefits under your retirement plan other than such as are available to your

exhibit B

present employees similarly situated, and provided, however, that there shall be no transfer of funds hereunder as to any of such personnel who shall not qualify under your retirement plan.

The agreements made above shall extend to and be binding upon each of us and our respective successors and assigns, but no third person, except for such successors and assigns, shall have or acquire any right to enforce these agreements against either of us.

If this proposal meets with your approval, please note your acceptance on the form provided at the end hereof and on the duplicate original enclosed herewith, and return the duplicate original to us.

Yours very truly,

OWENS-ILLINOIS GLASS COMPANY

By C R Meyrowitz

Accepted: May 9, 1958

OWENS-CORNING FIBERGLAS CORPORATION

By H Rudinski

H. R. WINKLE
Financial Vice-President

May 9, 1953

Owens-Illinois Glass Company
Toledo, Ohio

Gentlemen:

In connection with the sale by you to us today, as of the close of business on April 30, 1953, of certain of the assets and properties of your Keylo Division and in consideration of your possession, use and disposition of such assets and your operation of such properties for our account for the period from the close of business on April 30, 1953, to the consummation of such sale, we hereby agree to indemnify you against, and save you harmless from, any and all federal, state or local taxes, including taxes on income, and including any and all penalties and interest on any such taxes, which may be levied or assessed against you by reason of your possession, use or disposition of such assets or your operation of such properties during such period.

Yours very truly,

OWENS-CORNING FIBERGLAS CORPORATION

By H R Winkle
H. R. Winkle
Financial Vice President

HRW:/emf

(4)

May 9, 1958

The Toledo Trust Company
245 Summit Street
Toledo, Ohio

Attention: Mr. Howard Aumend

Re: Owens-Illinois Service Retirement Trust
Owens-Illinois Contributory Retirement Trust

Gentlemen:

Owens-Illinois Glass Company has today sold to Owens-Corning Fiberglas Corporation certain of the properties of the Kaylo Division of Owens-Illinois; both parties contemplate that the employment of substantially all of the personnel of that Division, including those who are participants under the Owens-Illinois Service Retirement Plan and Owens-Illinois Contributory Retirement Plan, will be transferred from Owens-Illinois to Owens-Corning.

In connection with such transfer of employment, Owens-Illinois and Owens-Corning have agreed as follows:

> With reference to such of our personnel as become your employees, you and we will cooperate in an effort to secure the transfer to the trust under your retirement plan, for the benefit of such employees, in accordance with the provisions of our retirement plans and to the extent permissible thereunder, of the funds held for the benefit of such employees in the trusts under our plans, without affecting, however, the present qualification under the provisions of the Internal Revenue Code of 1954 of all such retirement plans and the tax exempt status of the trusts thereunder and without providing any benefits under your retirement plan other than such as are available to your present employees similarly situated, and provided, however, that there shall be no transfer of funds hereunder as to any of such personnel who shall not qualify under your retirement plan.

We now notify you that we intend to carry out such agreement in accordance with the provisions of Article III, Section 7, of the Owens-Illinois Service Retirement Trust Agreement and Article III, Section 8, of the Owens-Illinois Contributory Retirement Trust Agreement.

Yours very truly,

OWENS-ILLINOIS GLASS COMPANY

By _____

OWENS-CORNING FIBERGLAS CORPORATION

By _____

AGREEMENT made this 9th day of May, 1958, with an effective date as of the close of business on April 30, 1958, between OWENS-ILLINOIS GLASS COMPANY, an Ohio corporation, hereinafter called "O-I," and OWENS-CORNING FIBERGLAS CORPORATION, a Delaware corporation, hereinafter called "OCF."

In consideration of the mutual promises herein contained, the parties agree as follows:

1. O-I hereby sells to OCF certain of the properties, hereinafter more particularly described, of the Kaylo Division of O-I on the following terms and conditions.

2. The term "Products" wherever it appears in this Agreement means hydrous calcium silicate products of the type heretofore manufactured by O-I at Berlin, New Jersey, and commonly referred to as "Kaylo." OCF hereby purchases the inventories of raw materials for the production of Products, Products in process of manufacture, finished Products in warehouse, and the manufacturing supplies and repair parts at the Kaylo plant at Berlin, New Jersey, all as of the close of business on April 30, 1958, for an aggregate consideration of $633,661.11, which OCF agrees to pay in Toledo funds upon the execution of this Agreement.

3. OCF hereby purchases all trademarks relating exclusively to Kaylo owned by O-I, including trademarks set forth on the attached Schedule A, for an aggregate consideration of $17,500.00, which OCF agrees to pay in Toledo funds upon the execution hereof.

4. OCF hereby purchases as of the close of business on April 30, 1958, the land, buildings, machinery and equipment, including

facilities under construction, office furniture, fixtures and equipment and automotive-equipment, all located at Berlin, New Jersey; equipment at other locations used solely for testing Products or research in connection therewith, for an aggregate consideration of $3,600,000.00, which OCF agrees to pay in Toledo funds upon the execution hereof.

5. OCF hereby purchases all inventions, patents and patent applications, both domestic and foreign, owned by O-I at the close of business on April 30, 1958, defining Products, or processes or apparatus for the manufacture thereof, including but not limited to the patents and applications listed on the attached Schedule B, for an aggregate consideration of $2,650,000.00, which OCF agrees to pay in Toledo funds upon the execution hereof.

6. O-I hereby assigns to OCF all of the executory contracts as of May 1, 1958, of the Kaylo Division, including those for the purchase or sale of goods, materials, equipment, supplies and capital assets, agreements with labor unions, consultant agreements and all other contracts having to do with the conduct of its business (excepting, however, accounts receivable arising from goods supplied, services rendered or other transactions prior to May 1, 1958) and OCF agrees to perform and discharge all executory obligations under such contracts (excepting, however, any obligation for goods supplied or services rendered prior to that date, these obligations remaining the responsibility of O-I and excepting the obligation, if any, of O-I to pay compensation to any salaried employee of its Kaylo Division by reason of the termination of his employment by O-I), and will save O-I harmless from any and all claims of any third person or persons for any breach, after assignment

thereof, of any agreement so assigned. O-I will save OCF harmless from any and all claims for any breach, prior to assignment thereof, of any agreement so assigned, and for the breach of all warranties and agreements relating to goods delivered prior to May 1, 1958.

7. O-I will permit OCF to have such access as OCF may desire to the books, records, contracts, orders, files and properties of the Kaylo Division, and as promptly as practicable O-I will deliver to OCF all books, records, contracts, orders and files of the Kaylo Division, except such as O-I desires to retain, and as to these, O-I will make and deliver to OCF copies of any OCF desires.

8. O-I will turn over to OCF as promptly as practicable the files and records relating to all domestic and foreign patents, applications and inventions transferred to OCF. O-I will cooperate in making available other pertinent files and records, and O-I will cooperate in assisting OCF to prosecute pending applications and to file and prosecute additional applications on inventions transferred as OCF may elect.

9. O-I will deliver to OCF as promptly as practicable all deeds, bills of sale, assignments, and any other documents that are necessary or advisable to carry out the purposes of this Agreement. All titles to be conveyed by O-I hereunder shall be free, clear and unencumbered, except for the lien of taxes and assessments not due and payable on May 1, 1958, and except for defects in title to real estate which do not and will not substantially interfere with the use of real estate for the purpose for which it is presently used, and transfers thereof shall be made by deeds and bills of sale of general warranty, accompanied by appropriate abstract, report of title or title insurance policy showing

real estate titles to be good and merchantable in O-I, free, clear and unencumbered except as aforesaid. O-I makes no representation or warranty whatsoever, except as to title, as to personal property sold to OCF, nor as to the validity or scope of any patent or patent application, nor as to the rights OCF will acquire under any trademark or trade name. All documents contemplated hereby and all necessary corporate action shall be subject to the reasonable approval of respective counsel. O-I and OCF will each pay its own expenses in connection with the transaction herein contemplated.

10. The possession, use and disposition by O-I of the assets sold to OCF from the close of business on April 30, 1958, until the consummation of the sale herein contemplated shall be at the risk, and for the account, of OCF; O-I will account to OCF for any excess of its receipts therefrom over its disbursements in connection therewith or OCF will reimburse O-I for any excess of such disbursements over such receipts, as the case may be, as promptly as the balance can be determined.

11. Any controversy or dispute arising out of this Agreement shall be settled by arbitration conducted in accordance with the rules, in effect at the time the controversy or dispute arises, of the American Arbitration Association.

12. This Agreement shall be governed and construed in accordance with the laws of the State of Ohio applicable to contracts made and to be performed in the State of Ohio.

13. The several rights and obligations hereunder shall extend to and be binding on O-I, OCF and their respective successors and

assigns, but no third person, except for such successors and assigns, shall have or acquire any right hereunder.

IN WITNESS WHEREOF, the parties have executed this Agreement and affixed their corporate seals by their duly authorized officers on the day and year first above written.

OWENS-ILLINOIS GLASS COMPANY

By C R Megargee
President

ATTEST

Secretary

OWENS-CORNING FIBERGLAS CORPORATION

By H Rudinske
Financial Vice President

ATTEST

Secretary

O-I 1

AGREEMENT made this 9th day of May, 1958, with an effective date as of the close of business on April 30, 1958, between OWENS-ILLINOIS GLASS COMPANY, an Ohio corporation, hereinafter called "O-I," and OWENS-CORNING FIBERGLAS CORPORATION, a Delaware corporation, hereinafter called "OCF."

In consideration of the mutual promises herein contained, the parties agree as follows:

1. O-I hereby sells to OCF certain of the properties, hereinafter more particularly described, of the Kaylo Division of O-I on the following terms and conditions.

2. The term "Products" wherever it appears in this Agreement means hydrous calcium silicate products of the type heretofore manufactured by O-I at Berlin, New Jersey, and commonly referred to as "Kaylo." OCF hereby purchases the inventories of raw materials for the production of Products, Products in process of manufacture, finished Products in warehouse, and the manufacturing supplies and repair parts at the Kaylo plant at Berlin, New Jersey, all as of the close of business on April 30, 1958, for an aggregate consideration of $633,661.41, which OCF agrees to pay in Toledo funds upon the execution of this Agreement.

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4. OCF hereby purchases as of the close of business on April 30, 1958, the land, buildings, machinery and equipment, including

facilities under construction, office furniture, fixtures and equipment and automotive equipment, all located at Berlin, New Jersey; equipment at other locations used solely for testing Products or research in connection therewith, for an aggregate consideration of $3,600,000.00, which OCF agrees to pay in Toledo funds upon the execution hereof.

5. OCF hereby purchases all inventions, patents and patent applications, both domestic and foreign, owned by O-I at the close of business on April 30, 1958, defining Products, or processes or apparatus for the manufacture thereof, including but not limited to the patents and applications listed on the attached Schedule B, for an aggregate consideration of $2,550,000.00, which OCF agrees to pay in Toledo funds upon the execution hereof.

6. O-I hereby assigns to OCF all of the executory contracts as of May 1, 1958, of the Kaylo Division, including those for the purchase or sale of goods, materials, equipment, supplies and capital assets, agreements with labor unions, consultant agreements and all other contracts having to do with the conduct of its business (excepting, however, accounts receivable arising from goods supplied, services rendered or other transactions prior to May 1, 1958) and OCF agrees to perform and discharge all executory obligations under such contracts (excepting, however, any obligation for goods supplied or services rendered prior to that date, these obligations remaining the responsibility of O-I and excepting the obligation, if any, of O-I to pay compensation to any salaried employee of its Kaylo Division by reason of the termination of his employment by O-I), and will save O-I harmless from any and all claims of any third person or persons for any breach, after assignment

thereof, of any agreement so assigned. O-I will save CCF harmless from any and all claims for any breach, prior to assignment thereof, of any agreement so assigned, and for the breach of all warranties and agreements relating to goods delivered prior to May 1, 1958.

7. O-I will permit CCF to have such access as CCF may desire to the books, records, contracts, orders, files and properties of the Kaylo Division, and as promptly as practicable O-I will deliver to CCF all books, records, contracts, orders and files of the Kaylo Division, except such as O-I desires to retain, and as to these, O-I will make and deliver to CCF copies of any CCF desires.

8. O-I will turn over to CCF as promptly as practicable the files and records relating to all domestic and foreign patents, applications and inventions transferred to CCF. O-I will cooperate in making available other pertinent files and records, and O-I will cooperate in assisting CCF to prosecute pending applications and to file and prosecute additional applications on inventions transferred as CCF may elect.

9. O-I will deliver to CCF as promptly as practicable all deeds, bills of sale, assignments, and any other documents that are necessary or advisable to carry out the purposes of this Agreement. All titles to be conveyed by O-I hereunder shall be free, clear and unencumbered, except for the lien of taxes and assessments not due and payable on May 1, 1958, and except for defects in title to real estate which do not and will not substantially interfere with the use of real estate for the purpose for which it is presently used, and transfers thereof shall be made by deeds and bills of sale of general warranty, accompanied by appropriate abstract, report of title or title insurance policy showing

real estate titles to be good and merchantable in O-I, free, clear and unencumbered except as aforesaid. O-I makes no representation or warranty whatsoever, except as to title, as to personal property sold to OCF, nor as to the validity or scope of any patent or patent application, nor as to the rights OCF will acquire under any trademark or trade name. All documents contemplated hereby and all necessary corporate action shall be subject to the reasonable approval of respective counsel. O-I and OCF will each pay its own expenses in connection with the transaction herein contemplated.

10. The possession, use and disposition by O-I of the assets sold to OCF from the close of business on April 30, 1958, until the consummation of the sale herein contemplated shall be at the risk, and for the account, of OCF; O-I will account to OCF for any excess of its receipts therefrom over its disbursements in connection therewith or OCF will reimburse O-I for any excess of such disbursements over such receipts, as the case may be, as promptly as the balance can be determined.

11. Any controversy or dispute arising out of this Agreement shall be settled by arbitration conducted in accordance with the rules, in effect at the time the controversy or dispute arises, of the American Arbitration Association.

12. This Agreement shall be governed and construed in accordance with the laws of the State of Ohio applicable to contracts made and to be performed in the State of Ohio.

13. The several rights and obligations hereunder shall extend to and be binding on O-I, OCF and their respective successors and

assigns, but no third person, except for such successors and assigns, shall have or acquire any right hereunder.

IN WITNESS WHEREOF, the parties have executed this Agreement and affixed their corporate seals by their duly authorized officers on the day and year first above written.

OWENS-ILLINOIS GLASS COMPANY

By _____
President

ATTEST

_____
Secretary

OWENS-CORNING FIBERGLAS CORPORATION

By _____
Financial Vice President

ATTEST

_____
Secretary

[redacted]

[redacted]

[redacted]	United States Registration No.	Date
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted]	Foreign Registration No.	Date
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

1. [redacted]

[redacted]	[redacted]	[redacted]
2,425,610	Finley	8-12-47
2,439,724	Finley	4-13-48
RE.23,288	Thaler	5-6-50
2,534,203	Barbalo	12-19-50
2,540,354	Selden	2-6-51
2,547,147	Zalewski	4-3-51
2,570,835	Mosby, et al	10-9-51
2,574,667	Glenn	11-13-51
2,665,336	Zalewski	1-12-54
2,708,008	Zalewski	5-25-55
2,787,345	Scobier, et al	4-2-57
2,788,214	Zacharek	4-9-57

2. [redacted]

[redacted]	[redacted]	[redacted]
679,092	Zalewski	8-19-57
691,543	Disley	10-22-57
697,655	Scobier	3-30-55
701,705	Taylor	4-19-55
704,315	Tendall	4-27-55
715,547	Scobier	6-14-55
718,960	Glenn	6-28-55
722,014	Pio	7-14-55
723,747	Glenn	7-22-55
726,859	Zalewski	8-8-55
728,747	Bowers	8-15-55
738,939	Tendall	10-6-55
753,704	Bowers	12-19-55
760,403	Simpson	1-20-56
771,755	Taylor	11-7-56
784,058	Taylor	11-29-56
802,012	Zalewski	1-2-57
803,855	Scobier	3-1-57
795,772	Taylor	10-29-57
808,124	Dezzy	1-11-57
772,061	Barbalo	10-11-57
802,809	Glenn	10-29-57

3. Foreign Patents and Applications:

	Serial No.	Filing Date	Patent No.	Issue Date
(a) Australia:			153,619	7-3-53
(b) Belgium:			485,559	11-13-48
			522,357	6-25-53
			533,913	6-17-54
			533,857	5-15-54
			533,591	5-2-54
			550,858	12-28-55
			479,512	1-14-48
(c) Canada:			502,677	5-18-54
			530,331	4-30-57
	669,395	7-12-54		
	669,396	7-12-54		
			540,333	4-30-57
			538,288	1-12-54
			538,578	12-8-56
(d) France:			974,338	10-25-50
			1,082,333	7-15-54
			1,113,408	9-25-55
			1,113,358	11-15-55
			1,111,210	8-31-55
			1,035,307	2-4-53
			559,751	1-7-50
(e) Germany:			857,835	8-12-53
	3034 IVa/12i	6-10-53		
			1,005,435	9-7-57
			1,018,357	11-12-57
	3/20 IVa/12i	8-24-55		
(f) Great Britain:			658,427	10-3-51
			748,149	5-23-55
			759,038	8-30-56
			775,558	5-15-57
			767,761	8-20-56
			772,257	10-10-56
			815,888	11-25-59
(g) Holland:			85,222	8-16-57
	150,555	9-4-53		
			82,239	6-15-56
	150,853	8-24-53		

	Serial No.	Filing Date	Patent No.	Issue D
(3) Italy:			531,556	6-21-5
			543,529	8-30-5
			533,115	8-24-5
(4) Sweden:	6197/53	6-30-53		
	7621/54	8-28-54		
	7715/54	8-27-54		
			150,328	7-12-5

#33

A G R E E M E N T

This Agreement made this 1st day of April, 1970, by and between OWENS-CORNING FIBERGLAS CORPORATION, a Delaware corporation ("Buyer"), and UNARCO INDUSTRIES, INC., an Illinois corporation ("Seller"):

W I T N E S S E T H:

Seller operates its Chembest Division in Bloomington, Illinois which Division manufactures and sells a variety of products including urethane foam, Unarcoboard, and asbestos products, and Buyer desires to purchase and Seller desires to sell all of the tangible and intangible properties and assets employed in Seller's Chembest Division except as herein expressly provided and except for those of such properties and assets employed solely in the manufacture and sale of asbestos products (the portion of the Chembest Division which manufactures and sells asbestos products is herein sometimes called the "Asbestos Department" and the remainder of the operations of the Chembest Division is herein sometimes called the "OCF-Chembest Division").

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein contained, the parties hereto mutually covenant and agree as follows:

1. (a) The Schedules, numbered 1 through 8, hereinafter described have been signed for identification purposes by those signing this Agreement and each of such Schedules is hereby included herein by reference and made a part hereof except for Schedules 4 and 5 which will be prepared after the date hereof and will be signed for identification purposes by those signing this Agreement at the time they are prepared in definitive form.

(c) On the terms and subject to the conditions herein expressed Seller hereby sells, conveys, transfers, assigns, sets over and delivers to Buyer and Buyer hereby purchases and accepts delivery of the following assets:

(i) All of the tangible assets and properties, including all operating equipment, fixtures, office equipment, and properties used in or relating to the operation of the OCF-Chemtest Division ("Equipment") including all those described in Schedule 1 entitled "Equipment."

(ii) All of the intangible assets and properties, including, if any, all copyrights, trademarks (except the trademark "Unarcoboard"), trade names, licenses, contracts, patents, patent applications, inventions, discoveries and improvements, shop rights, processes and formulae, trade secrets, proprietary and technical information and know-how, used in or relating to the operation of the OCF-Chemtest Division (including all those described in Schedule 2 entitled "Intangibles").

(iii) The leasehold estate created by the lease ("Lease") described in Schedule 3 entitled "Lease of plant site of Chemtest Division in Bloomington, Illinois" and all buildings and other improvements located on the real estate ("Real Estate") which is subject to the Lease described in Schedule 1 or Schedule 3,

(iv) All business, manufacturing, sales and other records directly relating to the OCF-Chembest Division including all books and records listed in Schedule 2.

(v) All of the inventories of raw materials, work in process and finished goods of Seller as of the date hereof for use in or used in or produced in the operations of the OCF-Chembest Division ("Inventories").

(vi) Any and all other assets and business utilized in connection with the operation of the business of the OCF-Chembest Division.

(c) On the terms and subject to the conditions herein expressed Seller will, at the time of delivery of Schedule 4 entitled "Accounts and prepaid items of the OCF-Chembest Division" to Buyer as provided in paragraph 5(a) hereof, sell, convey, transfer, assign, set over and deliver to Buyer the accounts receivable of the OCF-Chembest Division as of the date hereof (the "Accounts") and the prepaid items of the OCF-Chembest Division as of the date hereof, which will be described in Schedule 4 and Seller will, at that time, execute and deliver to Buyer such instruments as may be required to effect such sale, conveyance, transfer, assignment and delivery to Buyer;

(d) All of the assets being and to be sold to Buyer pursuant to paragraphs 1(b) and 1(c) above are herein sometimes collectively called the "Acquired Assets."

(e) It is understood and agreed that the Acquired Assets shall not include cash on hand and in banks and any assets of Seller used exclusively in the operations of the Asbestos Department or the Federal Stainless Sink Division of UNARCO ("Sink Division").

2. Based upon the representations and warranties of the Seller contained herein and on the terms and subject to the conditions herein expressed and in full consideration for the sale, conveyance, transfer, [illegible] and delivery to Buyer of the Acquired Assets and of any other [illegible] Seller pursuant to the terms hereof:

(a) Buyer has delivered to Seller, and Seller acknowledges receipt of, a deposit to Seller's account of $933,000 in such bank as may be designated by Seller.

(b) Buyer shall deposit to Seller's bank account with five (5) days after the date of the delivery of Schedule A and assignment of the Accounts to Buyer as provided in paragraph 5(a) an aggregate amount equal to the lesser of (i) $162,000 or (ii) the aggregate face amount of the Accounts plus the amount of the prepaid items as set forth on Schedule A, said deposit to be made in such bank as may be designated by Seller.

(c) Buyer shall deliver to Seller, within thirty (30) days after the Removal Date (as defined in paragraph 5(c) hereof), its certified or a cashier's check or checks in the aggregate amount of $250,000, which amount shall be adjusted, if necessary, as required by paragraph 4 hereof. If the reduction in the purchase price is in excess of $250,000 Seller shall,

no later than May 31, 1970, deliver to Buyer its certified or cashier's check or checks in the amount of such excess.

3. (a) Seller hereby assigns to Buyer, and Buyer hereby assumes and agrees to perform all of the obligations arising on and after the date hereof under the presently outstanding leases, contracts and commitments of Seller relating to the operations of the OCF-Chembest Division described in Schedules 2 and 3 and in Schedule 6 entitled "Commitments of OCF-Chembest Division," and Buyer will indemnify and hold harmless Seller against any [illegible] liabilities, claims, damages and expenses (including reasonable attorneys' fees) incurred or suffered by Seller resulting from Buyer's failure to perform any of such obligations in accordance with the terms of such leases, contracts and commitments. In each case where any of such contractual rights of Seller are not assignable by Seller to Buyer without the consent of the other contracting party Seller has obtained the written consent of such other contracting party to the assignment of such rights to Buyer and Seller has herewith delivered such consents to Buyer.

(b) Anything in the Agreement to the contrary notwithstanding, Buyer does not hereby and shall not assume any liability or obligation of any kind or nature of the Seller except as expressly provided in paragraph 3(a). All payments made either before or after the date hereof which relate to the operations of the OCF-Chembest Division by Seller up to the date hereof and by Buyer after the date hereof shall be prorated between Buyer and Seller.

4. The regular employees of the OCF-Chembest Division will take the inventory of the OCF-Chembest Division as of the close of business on the day before the date hereof and they will prepare and deliver to Buyer and Seller as promptly as possible after the date hereof a schedule of the inventory (Schedule 5 entitled "Inventory of the OCF-Chembest Division"). Schedule 5 shall set forth in reasonable detail the quantities of each class of inventory and the values thereof at the lower of cost or market (including costs of labor actually expended and costs of overhead) determined [illegible] with accounting principles applied on a basis consistent with [illegible] in the preparation of audited financial reports of Seller. Such accounting principles shall be applied only if they are generally accepted accounting principles. Both Buyer and Seller shall have the right to have representatives present at the taking of such inventory and Arthur Andersen & Co. shall be requested to be present at the taking of such inventory. Arthur Andersen & Co., together with such representative of Buyer and Seller, shall have access to all requisite accounting and other records and physical facilities requested by them in connection with the taking of the inventory and review of Schedule 5. In the event Buyer and Seller shall disagree with respect to any matter set forth on Schedule 5 they shall within thirty (30) days after the delivery of such Schedule 5 to them as hereinabove provided notify Arthur Andersen & Co. of the details of such disagreement, and the determination by Arthur Andersen & Co. of all such matters in dispute shall be final and binding on both Buyer and Seller and such changes as may be required because of such final determination shall be made to Schedule 5.

Buyer and Seller shall each pay one-half the fees and expenses of Arthur Anderson & Co. incurred under this paragraph 4. In the event the aggregate value (as so determined) of the Inventory shall be less than $[illegible]49,000, the payment to be made by Buyer to Seller pursuant to paragraph 2(b) hereof shall be reduced by an amount equal to the excess of $[illegible]49,000 over such aggregate value of the Inventory.

5. (a) Seller will deliver to Buyer within 5 days after the date hereof Schedule 4, together with the instruments of assignment referred to in paragraph 1(c) above, and Seller hereby warrants and represents to and [illegible] Buyer, its successors and assigns, that all of the Accounts [illegible]e in the ordinary course of business of the OCF-Chemtest Division and that Schedule 4 will correctly identify each Account by the name of the Account debtor, will set forth the date each Account arose, and will list accurately the amount due Seller as of the date hereof on each such Account. Seller guarantees that the amount due on each of the Accounts as listed on Schedule 4 will be fully paid to Buyer on or before March 31, 1971. Buyer may, on April 1, 1971, or on such earlier date or dates as Seller may allow, reassign and deliver to Seller all or any portion of the Accounts then remaining unpaid and Seller shall on the date of such reassignment pay to Buyer by its certified or a cashier's check or checks the aggregate amount then remaining unpaid on the Accounts so reassigned to Seller.

In the event any amount is received by Seller after the date hereof from any of the debtors on any of the Accounts, Seller shall promptly pay over to Buyer such amount so received until the total amount due on such Account is fully paid.

(b) Seller warrants and represents to and covenants with Buyer that it has not produced since March 31, 1970, and will not produce after the date hereof asbestos products on the Real Estate, that it has removed all asbestos, asbestos products and asbestos residue from the Real Estate and Seller has deactivated and prepared all of the tangible personal properties used in the operations of the Asbestos Department, and not included in the Acquired Assets, for removal from said Real Estate. Seller agrees to remove all of such tangible personal properties from the Real Estate promptly as possible, but in no event later than May 31, 1970.

(c) Seller agrees that the operations of the Sink Division on the Real Estate will be confined to the area of such Real Estate now occupied by the Sink Division as shown on Schedule 8 entitled "Plant Diagram," that the operations of the Sink Division on the Real Estate will be stopped as soon as practical after the date hereof and that all of the properties and assets used in such operations, and not included in the Acquired Assets, will be removed from the Real Estate as promptly as possible thereafter, but not later than March 31, 1971. The date on which all of such properties and assets are so removed and the space now occupied by the operations of the Sink Division is available and in condition for the exclusive occupancy and use by Buyer is herein sometimes called the "removal date." Seller agrees that from and after the date hereof all inventories and other assets for use in or used in the operations of the Sink Division will be confined to the area now occupied by the Sink Division referred to above.

6. The Seller warrants and represents to and covenants with Buyer, its successors and assigns that:

(a) Seller is a corporation duly organized, validly existing and in good standing under the laws of the State of Illinois, and has the right, power and all required licenses to own and operate the properties used in and to carry on the business of the OCP-Chemtest Division.

(b) Seller has good and marketable title to all of the Acquired Assets subject to no mortgages, pledges, liens, encumbrances or charges of any kind and has the right and power to transfer such Acquired Assets to Buyer pursuant hereto subject to no mortgages, pledges, liens, encumbrances or other charges of any kind, except such as may have been created by Buyer.

(c) There is no litigation at law or in equity, and no proceeding before any commission or other administrative or regulatory authority, pending, or to the knowledge of Seller threatened, against or affecting the Acquired Assets or the business or property of the OCP-Chemtest Division or its right to carry on the business of the OCP-Chemtest Division as conducted on the date hereof or its right to consummate this Agreement.

(d) Since December 31, 1967 Seller has operated the OCP-Chemtest Division in the ordinary and usual course, no material adverse change has occurred in the business of the OCP-Chemtest Division and Seller has used its best efforts to preserve the good will and that of the suppliers and customers of the OCP-Chemtest Division and others having business relationships with it.

Seller will be responsible for the payment of all salaries and wages, providing all employee benefits, making appropriate deductions and payments with regard to all Federal and State income tax withholding requirements and other similar items with respect to all employees of the Chembest Division and the Sink Division up to the date hereof and with respect to all employees of the Sink Division and of the Chembest Division employed in the Asbestos Department after the date hereof, it being agreed by Buyer and Seller that Seller's responsibility shall cease as of the date hereof only for those employees listed on Schedule 7 entitled "Employees of the [illegible] Division."

(e) Seller has used its best efforts to keep available to Buyer, and Seller will cooperate with Buyer after the date hereof to retain for Buyer the services of the present employees of Seller employed in the OCF-Chembest Division and listed on Schedule 7.

(f) Seller is not in any default under or in any breach of the terms or conditions of any contract, agreement, commitment or arrangement to which it is a party which is disclosed on Schedules 2, 3 or 6 or which affects the Acquired Assets whether or not disclosed on said Schedules.

(g) The Equipment listed on Schedule 1 is a true and accurate description of all the physical personal properties and assets used in the operations of the OCF-Chembest Division, except for the Inventories, and there is no material asset or property used or required by Seller in the conduct of the business of the OCF-Chembest Division which is not either owned by

it and listed on one of the Schedules or leased to it under one of the leases listed on one of the Schedules, and all of such assets and properties are in good and normal operating condition and repair, normal wear and tear excepted and except for the high pressure boiler in the heating system listed under Item 26 on the List of Leasehold Improvements on Schedule 1.

(h) The execution and delivery of this Agreement and the consummation of the transactions contemplated hereby do not conflict with or result in a breach of any of the terms, provisions or conditions of the Articles of Incorporation or By-Laws of Seller or any statute, regulation or rule or administrative order or process, or any agreement or instrument to which Seller is a party or by which it is bound or constitute a default thereunder. The business of the OCF-Chembest Division is not conducted in violation of any law, ordinance or regulation of any governmental entity.

(i) Seller will pay all costs and expenses (including, without limitation, its attorneys' and accounting fees, Federal documentary stamps, and transfer, use and sales taxes) incurred in connection with this Agreement and the transactions contemplated herein including, without limitation, the transfer of the Acquired Assets to Buyer.

(j) To the knowledge of Seller none of the buildings, structures and improvements located on the Real Estate encroach on adjoining real estate, and all such buildings, structures and improvements are located and constructed in conformity with all "setback" lines, easements or other restrictions or rights of record or that have been established by an applicable

zoning or building ordinance, and there are no encroachments upon the Real Estate by buildings, structures or improvements located upon adjoining real estate or any easements, restrictions or rights of record which interfere with the use of the Real Estate.

(k) The improvements located on the Real Estate are not the subject of any official complaint or notice of violation of any applicable zoning ordinance or building code and no such violation is known to exist and there is no zoning ordinance or building code or use or occupancy [illegible] or condemnation proceedings pending or to the knowledge of [illegible] threatened, which would preclude or impair the use of such Real [illegible] the improvements thereon by Seller or Buyer, as the case may be, for the purpose for which they are presently used.

(l) Seller has taken all requisite corporate action to [illegible] and approve this Agreement and the transfer of the Acquired Assets to Buyer as contemplated in this Agreement, and Seller has full power, right and authority to make this Agreement and to transfer the Acquired Assets as provided herein.

(m) Seller is the only party in possession, or with a right to possession, of the Real Estate and Equipment, and the contracts and agreements being assigned to Buyer pursuant hereto are in full force and effect and binding on the parties thereto and Seller has complied with all obligations imposed upon it thereunder. The lease is in full force and effect and Seller has obtained a decree of the Court of McLean County, Illinois permitting transfer of the lease and all the rights thereunder to Buyer.

(n) A true and complete schedule setting forth all copyrights, trademarks, trade names, licenses, contracts, patents, and patent applications, and setting forth the identification and location of all books and records containing all inventions, discoveries and improvements, shop rights, processes and formulae, trade secrets, proprietary and technical information and know-how used in or relating to the operation of the OCF-Chembest Division is contained in Schedule 2. No licenses, sublicenses, covenants or agreements have been granted or entered into by Seller in respect of any copyrights, trademarks, trade names, licenses, contracts, patents, patent applications, inventions, discoveries or improvements, shop rights, processes or formulae, trade secrets, proprietary or technical information or know-how used in or relating to the operation of the OCF-Chembest Division; Seller has the right to use without payment of any separate royalty, fee or charge therefor all thereof; and they are all free and clear of all liens and encumbrances of every nature and are not currently being challenged in any way and are not involved in any pending or threatened or interference proceedings. The operations of the OCF-Chembest Division, the manufacture, use and sale by it of its products, the use by it of its machinery, equipment and processes, the use of its products by its customers for the purpose for which sold, and the use of the patents, trademarks, trade names, brand names, inventions, applications, licenses and advertising, technical or other literature of the OCF-Chembest Division do not involve infringement or claimed infringement of any proprietary right, patent, trademark, trade name or copyright of others.

(o) Upon request of Buyer at any time or times following the date hereof Seller will forthwith execute and deliver such further instruments of assignment, transfer, conveyance, endorsement, direction or authorization

as Buyer or its counsel may reasonably request in order to perfect the title of Buyer, its successors and assigns, in and to the Acquired Assets provided to be transferred by Seller to Buyer hereunder.

7. Buyer has been furnished with an opinion satisfactory to it and its counsel of Sonnenschein, Levinson, Carlin, Nath & Rosenthal, dated the date of this Agreement, and addressed to the Buyer, to the effect that:

(a) Seller is a corporation duly organized and validly existing and in good standing under the laws of the State of Illinois;

(b) the execution and delivery of this Agreement has been duly authorized and this Agreement has been duly executed and delivered by Seller and is binding upon Seller in accordance with its terms.

(c) the Seller has power to sell, convey, transfer and deliver the Acquired Assets and to do so does not require any action by the Seller's stockholders and does not violate the provisions of the Seller's Certificate of Incorporation or by-laws, or the provisions of any note of which the Seller is the maker, or of any indenture, agreement or other instrument to which the Seller is a party;

(d) The Lease is in full force and effect and may be assigned to Buyer and when assigned to Buyer will vest in Buyer all rights vested in Seller prior to transfer to Buyer; and

(e) the instruments executed and delivered to transfer the assets and properties transferred pursuant to this Agreement are valid in

in accordance with their terms and effectively vest title to the Acquired Assets in Buyer free and clear of any liabilities, obligations, liens and encumbrances.

8. (a) Seller agrees to indemnify and hold harmless Buyer against any and all losses, liabilities, claims, damages and expenses (including reasonable attorneys' fees) incurred or suffered by Buyer in respect of the liabilities and obligations of the Seller not assumed by Buyer pursuant to this Agreement, and in respect of the failure of the Seller to perform the duties and undertaken by it pursuant to this Agreement.

(b) Without limiting the generality of the foregoing, Seller agrees to indemnify and hold harmless the Buyer from and against any and all losses, liabilities, claims, damages and expenses (including reasonable attorneys' fees) incurred or suffered by Buyer resulting from (i) any inaccuracy in or breach of any of the representations, warranties or covenants made by Seller herein, (ii) any operations of the Chembest Division on or prior to the date hereof and any operations of the Sink Division prior to or on or after the date hereof, (iii) any activities of Seller in connection with the removal of the properties and assets of the Asbestos Department and the Sink Division from the Real Estate contemplated by the terms hereof and (iv) any action brought against the Buyer to the extent that it is based on a claim that any of the Acquired Assets infringes a United States Copyright, patent or trademark.

(c) Upon obtaining knowledge thereof, Buyer shall promptly notify Seller, in writing, of any claim or demand which Buyer may determine

could give rise to a right of indemnification in Buyer under this Agreement, if such a claim or demand relates to a claim or demand asserted by a third party against Buyer then Seller shall have the right to employ counsel to defend any such claim or demand asserted against Buyer and Buyer shall have the right to cooperate and participate in the defense of any said claim and shall make available to Seller or its representatives all records and other materials required by it for its use in contesting any such liability.

9. Without limiting any other provision hereof, Seller shall be responsible for:

(a) The return or replacement, for any reason, of products sold by the Chemlest Division prior to the date hereof;

(b) Any liability to third persons, firms or corporations arising out of the sale of any products manufactured by the Chemlest Division prior to the date hereof; and

(c) Seller agrees to indemnify, save and hold Buyer harmless against any and all Workmen's Compensation claims arising out of injury occurring prior to April 1, 1970, even though such claims may be asserted on or after April 1, 1970, and Seller agrees to indemnify, save and hold Buyer harmless against all claims arising out of the contracting of asbestosis, emphysema, or other respiratory ailments prior to April 1, 1970 where the contracting of such asbestosis, emphysema or other respiratory ailments resulted from exposure to Seller's materials or products prior to April 1, 1970, even though such claims may be asserted on or after April 1, 1970, provided,

however, that this indemnity shall not apply to claims based upon the contracting of asbestosis, emphysema or other respiratory ailments in those cases where the claimant was also exposed, prior to April 1, 1970, to products and materials of the Buyer, and this indemnity shall not apply to any claims which are the subject of litigation pending or threatened against both Buyer and Seller on April 1, 1970. With respect to all litigation based upon the claimed contracting of asbestosis, emphysema or other respiratory ailments in which the Seller alone or both the Buyer and Seller are parties, Buyer agrees to make available to Seller all files, documents, and other materials [illegible] acquired from Seller which Seller requests for use in preparation [illegible] the defense of such litigation, and Buyer agrees to make reasonably available to Seller all employees who were formerly Seller's employees for consultation and the giving of evidence in such litigation. In the event that Buyer and Seller should elect to prosecute or defend crossclaims against each other in such litigation, the cooperation with Seller of Buyer's aforementioned employees (who had previously been Seller's employees) shall not be deemed disloyalty to Buyer nor work to the prejudice of such employees in their employment with Buyer.

10. Buyer warrants and represents to and covenants with Seller, its successors and assigns that:

(a) Buyer is a corporation duly organized, validly existing and in good standing under the laws of the State of Delaware and duly qualified to do business and in good standing as a foreign corporation under the laws of the State of Illinois.

(d) Buyer has taken all requisite corporate action to authorize and approve this Agreement.

(e) Buyer will pay all costs and expenses (including, without limitation, its attorneys' and accounting fees) incurred by it in connection with this Agreement and the transactions contemplated herein, except for those expenses payable by Seller as provided in paragraph 6(i).

11. Seller has been furnished with an opinion satisfactory to it [illegible] its counsel of Allen S. Person, Special Counsel for Buyer, dated the [illegible] Agreement, and addressed to the Seller, to the effect that:

(a) Buyer is a corporation duly organized, validly existing and in good standing under the laws of the State of Delaware, and duly qualified to do business and in good standing as a foreign corporation under the laws of the State of Illinois;

(b) Buyer has taken all requisite corporate action to authorize and approve this Agreement.

12. The representations and warranties of the Seller and the Buyer shall survive the closing of this transaction and shall survive the sale, conveyance, transfer and delivery of the assets and properties hereunder.

13. Within a period of five (5) years from the date hereof, Buyer will not destroy or otherwise dispose of any of the books and records of Seller acquired by buyer hereunder unless otherwise consented to in writing by Seller without first offering to surrender such books and records or any portion thereof which Buyer may intend to destroy or dispose of to Seller and Buyer

shall allow Seller and its representatives, attorneys and accountants access to such books and records upon reasonable notice and during Buyer's normal business hours for examination and/or copying.

15. Seller agrees with Buyer that it will not participate directly or indirectly in any business (either financially or as an employee, officer, partner, independent contractor or owner, or in any other capacity calling for the rendition of personal services or acts of management, operation or control) which is in any respect competitive with the business conducted by the OCF- [illegible] at the date hereof, within the geographical area in which [illegible] business is now conducted, (excluding Johnson County, Illinois) for a period of three (3) years after the date hereof.

A breach of the covenant and agreement set forth in this paragraph will result in irreparable and continuing damage to Buyer for which Buyer will have no adequate remedy at law, and in the event of any breach of such covenant and agreement, Buyer and its successors and assigns will be entitled to injunctive relief and such other and further relief as may be proper in the premises.

16. Each party hereto represents and warrants to the other party hereto that this Agreement was not induced or procured through any person, firm or corporation acting as broker or finder for such party.

17. This Agreement may be executed in two or more counterparts each of which shall be deemed an original but all of which together shall constitute one and the same Agreement.

17. This Agreement contains the entire agreement between the parties.

18. All the terms of this Agreement shall be binding upon and inure to the benefit of and be enforceable by the successors of the parties hereto.

19. Unless otherwise notified in writing to the contrary, any notice required or permitted by the terms hereof shall be effectively given for all purposes upon deposit in the United States mail, postage prepaid, if directed to Seller, properly addressed to it at 332 S. Michigan Ave., Chicago, Illinois, Attention: Edward E. Hokin, with copies thereof addressed and mailed to Sonnenschein, Levinson, Carlin, Nath & Rosenthal, 69 West Washington Blvd., Chicago, Illinois, Attention: Robert Crank; and if directed to Buyer properly addressed to it at Fiberglas Tower, P.O. Box 901, Toledo, Ohio 43601, Attention: James J. Young, or to such other address or addresses as the parties hereto may from time to time designate in writing.

20. This Agreement is being delivered in Chicago, Illinois, and shall be construed according to the laws of that state.

IN WITNESS WHEREOF, the parties hereto have duly executed this Agreement on the day and year first above written.

OWENS-CORNING FIBERGLAS CORPORATION

(SEAL)
ATTEST:

By_____

UNARCO INDUSTRIES, INC.

(SEAL)
ATTEST:

By_____

GEORGE D. CLAYTON & ASSOCIATES, INC.
INDUSTRIAL HYGIENE FIELD SAMPLING RECORD

Plant -- Manteno, Ill (Power Plant) Date 1-15-71

Process Insulation By [illegible]

Material(s) Asbestos Sampling Method

Remarks (Ventilation, etc.)

Sample No.	Rotameter Reading	Description of Sample	Start	Stop	COUNT
1	#9 - 9.0	Insulator - Harry Kennedy	12:46	13:56	12.2
2	#28 - 10.0	" - - Al Sabin	13:45	13:55	5.0
3	#11 - 9.0	" - " Jack Washburn (saw)	12:38	14:00	0.3
4	#7 - 9.0	" - " Bruce Kerr	12:50	14:01	0.49
5	#9 - 9.0	Asst. on #1	13:56	15:00	1.0
6	#25 - 10.0	Asst " #2	13:57	15:00	1.6
7	#11 - 9.0	" " " #3 (sawing)	14:00	15:01	0.4
8	#7 - 9.0	" " #4	14:01	15:01	1.2
		Comment by Lab of			
		Heavy Dust Count			
		-1-			

EXHIBIT D

GEORGE D. CLAYTON & ASSOCIATES, INC.
INDUSTRIAL HYGIENE FIELD SAMPLING RECORD

Plant Track Bottom Fire Date 1-16-92

Process Insulation By [illegible]

Material(s) Fiberglass Sampling Method

Remarks (Ventilation, etc.)

Sample No.	Rotameter Reading	Description of Sample	Start	Stop	COD
#9	#7 - 9.0	Insulation - Bell Rubber	12:47	14:02	0.:
10	#9 - 9.0	" (wrong) - Richard Lehr	12:50	14:05	1.'
11	#28 - 10.0	" " - Steve Turner	12:57	13:21	4.'
12	#11 - 9.0	" - Larry Putzier	12:58	13:22	4..
13	#7 - 9.0	same as #9	14:05	14:30	7..
14	#9 - 9.0	" " #10	14:05	14:30	2.
15	#28 - 10.0	" " #11	13:23	13:53	9.(
16	#11 - 9.0	" " #12	13:24	13:54	2.-

GEORGE D. CLAYTON & ASSOCIATES, INC.
INDUSTRIAL HYGIENE FIELD SAMPLING RECORD

Plant Quad Cities, Pa. Date 1-12-77

Process Fabrication By [illegible]

Material(s) Asbestos Sampling Method

Remarks (Ventilation, etc.)

Sample No.	Rotometer Reading	Description of Semple	Start	Stop	C
17	#7 - 9.0	Fabricate of Kraft - Feed end	0843	0903	2
18	#9 - 9.0	" " - Back end	0844	0904	2
19	#11 - 9.0	Board scrap - Lower floor	0845	0905	3
20	#7 - 9.0	same as #17	0904	0924	2
21	#9 - 9.0	" " #18 (Back)	0905	0925	2
22	#11 - 90	" " #19 Lower floor	0906	0921	3

GEORGE D. CLAYTON & ASSOCIATES

Owens-Corning Fiberglas INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant San Diego, California Material Glass and Asbestos Fibers

1971 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight	Sample Volume Liters	Concentration Glass Fiber/ml	Concentration Asbestos Fiber/ml
[illegible]	1	Pad Shack	13:15	14:45		194	0.02	0.01
[illegible]	2	Romano	13:25	14:40		154	0.07	0.03
[illegible]	3	Dunsworth	13:27	14:37		161	<0.003	<0.003
[illegible]	4	Anderson	13:31	14:31		135	0.12	0.03
[illegible]	5	Williamson (helper)	09:10	11:00		231	0.07	0.04
[illegible]	6	Thomas	09:16	11:01		226	0.06	0.03
[illegible]	7	Hernandez	09:14	11:04		248	0.07	0.02

GEORGE D. CLAYTON & ASSOCIATES
MICROSCOPIC SIZING DATA FOR GLASS FIBER DUST

Date 6-26-73
Plant CCF San Diego
Process

Sample No. 1
Objective Prico 40X
Eyepiece Jerielon 10X
Total Magnification 400X

SIZE DISTRIBUTION OF FIBERS:*

Diameter Range, μm	Mean Diam., μm	No. of Fibers	Size Distribution by Count	
			% of Total	Cumulative %
0.8-1.1	0.95	-	-	-
1.1-1.6	1.35	-	-	-
1.6-2.2	1.90	18	36.0	36.0
2.2-3.1	2.65	10	20.0	56.0
3.1-4.4	3.75	12	24.0	80.0
4.4-6.2	5.3	6	12.0	92.0
6.2-8.8	7.5	1	2.0	94.0
8.8-12.5	10.6	3	6.0	100.0
12.5-17.7	15.1	-		
17.7-25.0	21.3	-		
25.0-35.2	30.1	-		
TOTAL		50		

Ratio, fibers:total particles = 1 : 501

Fibrous Content, Percent 0.2

* Any particle which has an aspect ratio of 3 or greater is considered a fiber.

GEORGE D. CLAYTON & ASSOCIATES
MICROSCOPIC SIZING DATA FOR GLASS FIBER DUST

Date 6-26-73
Plant OCF San Diego
Process

Sample No. [illegible]
Objective Phase [illegible]
Eyepiece Periplan [illegible]
Total Magnification [illegible]

SIZE DISTRIBUTION OF FIBERS:*

Diameter Range, um	Mean Diam., um	No. of Fibers	Size Distribution by Count	
			% of Total	Cumulative %
0.8-1.1	0.95	-	-	-
1.1-1.6	1.35	-	-	-
1.6-2.2	1.90	14	28.0	28.0
2.2-3.1	2.65	19	38.0	66.0
3.1-4.4	3.75	11	32.0	88.0
4.4-6.2	5.3	5	10.0	98.0
6.2-8.8	7.5	1	2.0	100.0
8.8-12.5	10.6	-		
12.5-17.7	15.1	-		
17.7-25.0	21.3	-		
25.0-35.2	30.1	-		
TOTAL		50		

Ratio, fibers:total particles = <1 : 509

Fibrous Content, Percent <0.2

* Any particle which has an aspect ratio of 3 or greater is considered a fiber.

GEORGE D. CLAYTON & ASSOCIATES
MICROSCOPIC SIZING DATA FOR GLASS FIBER DUST

Date 6-26-73
Plant OCF San Diego
Process

Sample No. #3
Objective Phase 40X
Eyepiece Periplan 10X
Total Magnification 400X

SIZE DISTRIBUTION OF FIBERS:*

Diameter Range, um	Mean Diam., um	No. of Fibers	Size Distribution by Count % of Total	Cumulative %
0.8-1.1	0.95	Insufficient amount of fibers and Particles.		
1.1-1.6	1.35			
1.6-2.2	1.90			
2.2-3.1	2.65			
3.1-4.4	3.75			
4.4-6.2	5.3			
6.2-8.8	7.5			
8.8-12.5	10.6			
12.5-17.7	15.1			
17.7-25.0	21.3			
25.0-35.2	30.1			
TOTAL				

Ratio, fibers:total particles = _____ : _____

Fibrous Content, Percent _____

* Any particle which has an aspect ratio of 3 or greater is considered a fiber.

GEORGE D. CLAYTON & ASSOCIATES
MICROSCOPIC SIZING DATA FOR GLASS FIBER DUST

Date 6-26-73
Plant OCF San Diego
Process

Sample No. 24
Objective Phase 40
Eyepiece Periplan 10
Total Magnification 400

SIZE DISTRIBUTION OF FIBERS:*

Diameter Range, μm	Mean Diam., μm	No. of Fibers.	Size Distribution by Count	
			% of Total	Cumulative %
0.8-1.1	0.95	-	-	-
1.1-1.6	1.35	-	-	-
1.6-2.2	1.90	15	30.0	30.0
2.2-3.1	2.65	13	26.0	56.0
3.1-4.4	3.75	16	32.0	88.0
4.4-6.2	5.3	5	10.0	98.0
6.2-8.8	7.5	-	-	98.0
8.8-12.5	10.6	1	2.0	100.0
12.5-17.7	15.1	-		
17.7-25.0	21.3	-		
25.0-35.2	30.1	-		
TOTAL		50		

Ratio, fibers:total particles = 1 : 509

Fibrous Content, Percent 0.2

* Any particle which has an aspect ratio of 3 or greater is considered a fiber.

MICROSCOPIC [illegible] GLASS FIBER TEST

Date 6-7-73
Plant DCF San Diego
Process

Sample No. [illegible]
Objective Phase [illegible]
Operator Perkins
Total Magnification [illegible]X

SIZE DISTRIBUTION OF FIBERS:*

Diameter Range, μm	Mean Diam., μm	No. of Fibers	Size Distribution by Count	
			% of Total	Cumulative %
0.8-1.1	0.95	-	-	-
1.1-1.6	1.35	-	-	-
1.6-2.2	1.90	14	21.2	21.2
2.2-3.1	2.65	26	39.4	60.6
3.1-4.4	3.75	13	19.7	80.3
4.4-6.2	5.3	8	21.1	92.4
6.2-8.8	7.5	3	4.6	97.0
8.8-12.5	10.6	2	3.0	100.0
12.5-17.7	15.1	-		
17.7-25.0	21.3	-		
25.0-35.2	30.1	-		
TOTAL		66		

Ratio, fibers:total particles = 1 : 519

Fibrous Content, Percent 0.2

* Any particle which has an aspect ratio of 3 or greater is considered a fiber.

GEORGE C. CLAYTON & ASSOCIATES

MICROSCOPIC SIZING DATA FOR GLASS FIBER DUST

Date 6-27-73
Plant OCF San Diego
Process

Sample No. [illegible]
Objective Planco [illegible]
Eyepiece Filar [illegible]
Total Magnification [illegible]

SIZE DISTRIBUTION OF FIBERS:*

Diameter Range,um	Mean Diam.,um	No. of Fibers	Size Distribution by Count	
			% of Total	Cumulative %
0.8-1.1	0.95	-	-	-
1.1-1.6	1.35	-	-	-
1.6-2.2	1.90	11	21.6	21.6
2.2-3.1	2.65	17	33.3	54.9
3.1-4.4	3.75	12	23.5	78.4
4.4-6.2	5.3	10	19.6	98.0
6.2-8.8	7.5	1	2.0	100.0
8.8-12.5	10.6	-		
12.5-17.7	15.1	-		
17.7-25.0	21.3	-		
25.0-35.2	30.1	-		
TOTAL		51		

Ratio, fibers·total particles = <1 : 521

Fibrous Content, Percent <0.2

* Any particle which has an aspect ratio of 3 or greater is considered a fiber.

GEORGE D. CLAYTON & ASSOCIATES
MICROSCOPIC SIZING DATA FOR GLASS FIBER DUST

Date 6-27-73
Plant OCF San Diego
Process

Sample No
Objective Phase 40X
Eyepiece Periplan 10X
Total Magnification 400X

SIZE DISTRIBUTION OF FIBERS:*

Diameter Range, μm	Mean Diam., μm	No. of Fibers	Size Distribution by Count	
			% of Total	Cumulative %
0.8-1.1	0.95	-	-	-
1.1-1.6	1.35	-	-	-
1.6-2.2	1.90	11	21.2	21.2
2.2-3.1	2.65	14	26.9	48.1
3.1-4.4	3.75	7	13.5	61.6
4.4-6.2	5.3	19	36.5	98.1
6.2-8.8	7.5	-	-	98.1
8.8-12.5	10.6	1	1.9	100.0
12.5-17.7	15.1	-		
17.7-25.0	21.3	-		
25.0-35.2	30.1	-		
TOTAL		52		

Ratio, fibers:total particles = <1 : 511

Fibrous Content, Percent <0.2

* Any particle which has an aspect ratio of 3 or greater is considered a fiber.

WARNING

This product contains asbestos fibers. Inhalation of asbestos fibers in excessive quantities over long periods of time may be harmful. Avoid breathing the dust. If adequate ventilation control is not possible, wear respirators of a type approved by the U.S. Bureau of Mines for pneumoconiosis producing dusts.

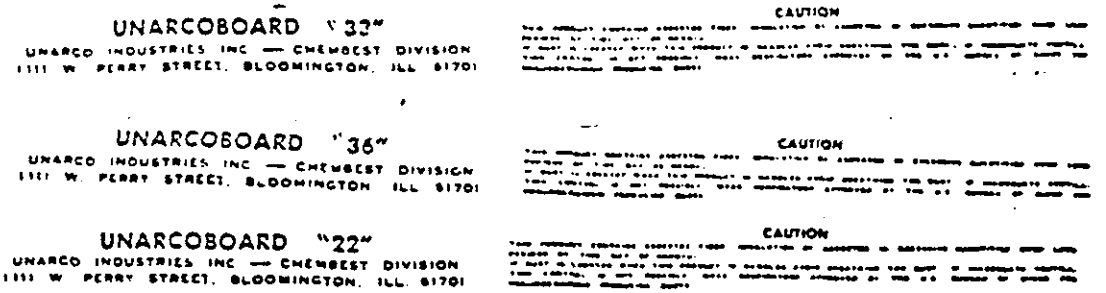
L.I. 610

Size: 4" x 3"
Color: Red to match Sleight & Hellmuth #8198 "Dixie Red"
PAS.5.1.102

5/17/71

(This warning was printed on the containers used to ship Fyrcor products.)

EXHIBIT E



OWENS-CORNING FIBERGLAS CORPORATION CONTINUED TO USE THESE UNARCO WARNINGS ON UNARCOBOARD/FYRCOR FROM THE DATE OF ACQUISITION OF THE CHEMBEST DIVISION OF UNARCO INDUSTRIES, INC., APRIL 15, 1970 TO APPROXIMATELY MAY 17, 1971.

The above 3 "Cautions" (warnings) are identical. We've reproduced the "Caution" wording below for easier reading.

CAUTION

THIS PRODUCT CONTAINS ASBESTOS FIBER. INHALATION OF ASBESTOS IN EXCESSIVE QUANTITIES OVER LONG PERIODS OF TIME MAY BE HARMFUL
IF DUST IS CREATED WHEN THIS PRODUCT IS HANDLED AVOID BREATHING THE DUST. IF INADEQUATE VENTILATION CONTROL IS NOT POSSIBLE, WEAR RESPIRATORS APPROVED BY THE U.S. BUREAU OF MINES FOR PNEUMOCONIOSIS PRODUCING DUSTS.

EXHIBIT F

KAYLO®
INSULATION
featuring FIBERGLAS

A-208
(8½" x 4¼")

A-32 THIS SIDE UP

A-27 HANDLE WITH CARE

A-209
(5¼" x 2⅝")

FOR
TEMPERATURES
TO 1200° F.



A-68

THIS PRODUCT CONTAINS
ASBESTOS FIBER

IF DUST IS CREATED WHEN THIS PRODUCT IS HANDLED, AVOID BREATHING THE DUST.

IF ADEQUATE VENTILATION CONTROL IS NOT POSSIBLE, WEAR RESPIRATOR APPROVED BY U.S. BUREAU OF MINES.

A-210
(3" x 2½")

Art elements shall be printed to match Glass Container Manufacturers Institute (GCMI) red Ink #75

OWENS-CORNING FIBERGLAS

SPECIFICATION

HISTORY COPY

DATE: November 4, 1970

ISSUED BY:
CONSTRUCTION MATERIALS PROCESS AND QUALITY CONTROL DEPARTMENT (Toledo)

SUBJECT: Specification Revision

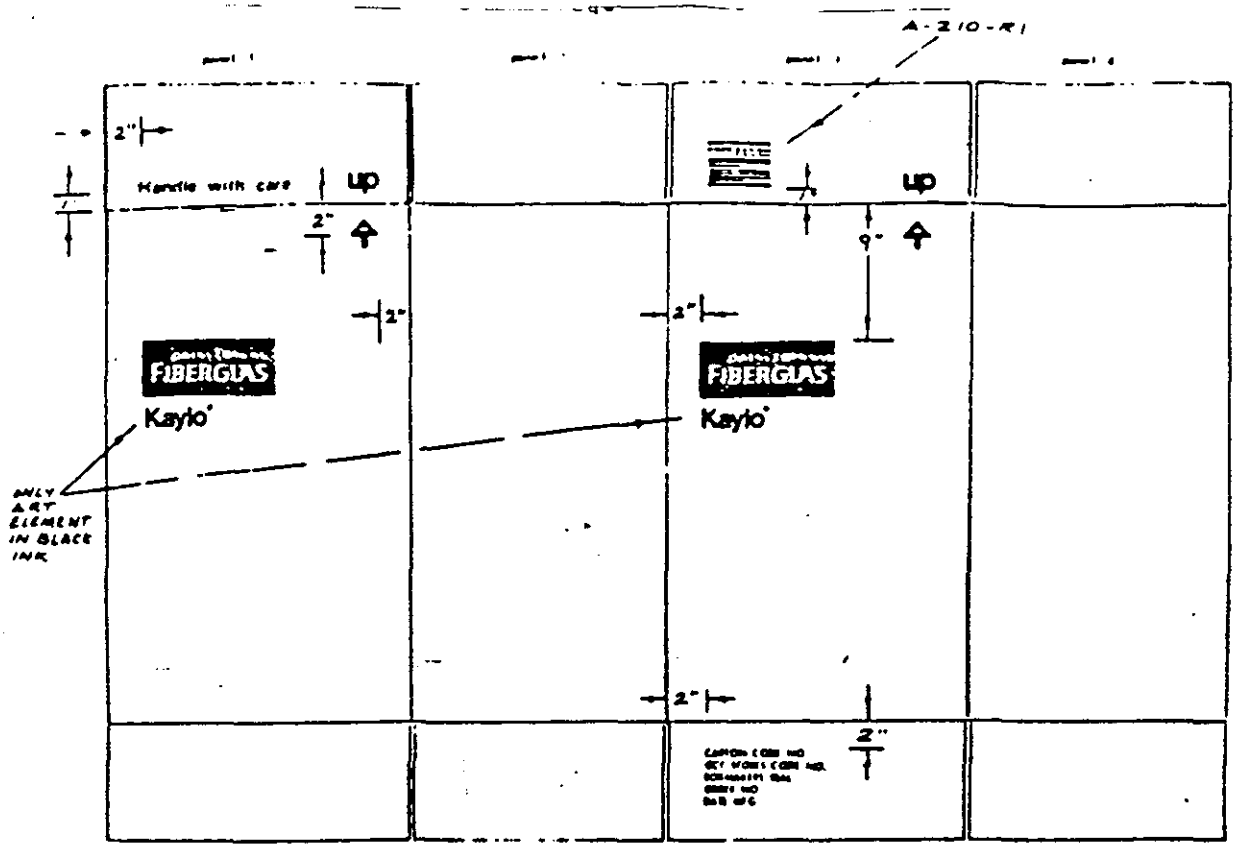
REF. Purchase Acceptance Standard - PAS.2.1.43 - Regular Slotted Printed Cartons and Accessory Materials for Shipping Kaylo Beveled La Kaylo Block

The attached subject PAS has been revised as follows:

1. Revised carton artwork.

Please cancel the 1/20/67 issue of this specification and replace with the attached.

EXHIBIT H



Kaylo

A-277 (5 5/16" LONG)

Handle with care

A-260 (7 1/4" LONG)

CAUTION—PRODUCT CONTAINS ASBESTOS FIBER

INHALATION OF DUST IN EXCESSIVE QUANTITIES OVER LONG PERIODS OF TIME MAY BE HARMFUL.

AVOID BREATHING DUST.

IF ADEQUATE VENTILATION IS NOT POSSIBLE, WEAR RESPIRATORS APPROVED BY THE U. S. BUREAU OF MINES FOR PNEUMOCONIOSIS PRODUCING DUST.

A-210-R1 (4" x 2 5/8")

OWENS/CORNING FIBERGLAS TRADEMARK

A-230 (8" LONG)

up

A-267 (2 1/2" x 5 1/16" TALL)

In order to eliminate possible deviations from corporate identity, printing dies should be ordered from The Pannier Corporation, 207 Sandusky Street, Pittsburgh, Pennsylvania 15212. Specify art element number and the length (example: A-230, 13" long).
If the printing dies are to be ordered elsewhere, a glossy print of the original art may be obtained from Pannier.

For A-230 logotype 10" long and over, the TRADEMARK shall measure 2⅛" long. For A-230 logotype 8" long and under, the measurement shall be equal to the distance from the left edge of the letter "L" to the right edge of the letter "S" in FIBERGLAS (see above print of logo) and shall be readable when printed. These dimensions pertain to carton printing only.

Art elements printed to match Black ink and PMS #2008 Red ink.

CAUTION: This product contains asbestos fiber. Inhalation of asbestos in excessive quantities over long periods of time may be harmful. If dust is created when this product is handled, avoid breathing the dust. If adequate ventilation control is not possible, wear respirators approved by the U. S. Bureau of Mines for pneumoconiosis producing dust.

(This warning was printed on the bags of cement manufactured by Eagle-Picher and re-branded for Owens-Corning Fiberglas.)

EXHIBIT I

TO:

1905

HISTORY COPY

OWENS-CORNING FIBERGLAS SPECIFICATION

DATE: 1/19/67

ISSUED BY:
GENERAL PRODUCTS PROCESS AND QUALITY CONTROL DEPARTMENT (Toledo)

SUBJECT: Specification Revision

REF. Purchase Acceptance Standard - PAS. 2.1.13 - Regular Slotted Printed Cartons and Accessory Materials for Shipping Kaylo Pipe Insulation

The attached subject PAS has been revised as follows:

1. Addition of artwork element A-210 to printing instructions.

Please cancel the 7/28/66 issue of this specification and replace with the attached

EXHIBIT J

FIBERGLAS PURCHASE ACCEPTANCE STANDARDS

No. PAS.2.1.1

Date 1/19/67

Supersedes 7/28/

MATERIAL - Regular Slotted Printed Cartons and Accessory Materials for Shipping Kaylo Pipe Insulation

SCOPE

This specification covers the necessary data for ordering and checking regular slotted corrugated printed cartons and corrugated inner packing accessories used for packaging and shipping Kaylo Pipe Insulation.

No change shall be made in the quality of successive shipments of materials furnished under this specification without first obtaining a written approval from the Owens-Corning Fiberglas Corporation.

A. MANUFACTURE

1. The cartons shall be of the regular slotted type and manufactured of single wall corrugated fiberboard, having a minimum Mullen test of 200#. The fluting shall be "A" type. The inner and outer liners shall be .016", 42# Kraft. The corrugated medium shall be either .009", 26# dry finish or semi-chemical Kraft. The boxmaker's joint shall be closed with not less than 2" wide "Fiberglas" reinforced tape. The carton code number and boxmaker's certificate shall appear on the cartons in addition to the printing specified in Section D and attached layouts.

2. The "U" and "W" series accessory pads shall be of the regular trimmed-scored and unslotted type and manufactured of non-test double wall corrugated fiberboard. The fluting shall be "B" and "C" type. The inner, outer, and center liners shall be at least 26 pound Kraft.

B. PHYSICAL PROPERTIES

1. The cartons shall be cut so that the corners are absolutely square with no ragged edges. The tape on the boxmaker's joint must adhere securely and be properly centered to the sides of the carton. The corrugation must be as specified and the flutes must be firm so that they do not stretch or flatten out. The corrugation shall run the short way with the direction of flutes perpendicular to the score line of the box opening. All scoring must be carefully made so that it does not come through the entire thickness of the board. All outside flaps on the top and bottom shall come together when the cartons are set up for sealing.

2. The accessory pads shall be cut so that the corners are square with no ragged edges. The corrugations shall be as specified and flutes shall be firm so that they do not stretch or flatten out. The corrugation shall run the following direction: "U" and "W" series run short way.

TABLE I

DIMENSIONAL LIMITATIONS BY CARTON CODE

Carton Code	Inside Dimensions (Inches)		
	Length	Width	Depth
Kaylo Pipe Insulation Cartons: Carton Reference			
C-1515-36 -J	15-1/16	15-1/16	36
C-1616-36 -D	16-1/8	16-1/8	36
C-1717-36 -A	17-5/8	17-5/8	36
C-2020-36 -B	20-1/8	20-1/8	36
C-2110-36 -K	21-5/8	10-7/8	36
C-2311-36 -F	23-1/2	11-3/4	36
C-2316-36 -I	23-1/8	16-1/8	36
C-2318-36 -E	23	18-1/2	36
C-2513-36 -G	25-5/8	12-13/16	36
C-2520-36 -C	25-5/8	20	36
C-2814-36 -H	28-1/8	14-1/16	36
C-1818-36 -M	18-1/4	18-1/4	36
C-1919-36 -N	19-1/4	19-1/4	36
C-2121-36 -O	21-1/4	21-1/4	36
C-2222-36 -P	22-1/4	22-1/4	36
C-2323-36 -Q	23-1/4	23-1/4	36
C-2424-36 -R	24-1/4	24-1/4	36
C-2525-36 -S	25-1/4	25-1/4	36
C-2626-36 -T	26-1/4	26-1/4	36
C-2727-36 -U	27-1/4	27-1/4	36
C-2828-36 -V	28-1/4	28-1/4	36
C-2929-36 -W	29-1/4	29-1/4	36
C-3030-36 -X	30-1/4	30-1/4	36
C-1811-36 -Y	18	11	36-1/4

Tolerances: Inside Dimensions

Length - ± 1/8", -0"
Width - ± 1/8", -0"
Depth - ± 1/8", -0"

INNER PACKAGING ACCESSORY CODE

Tolerance on accessory pad dimension ± 1/16".

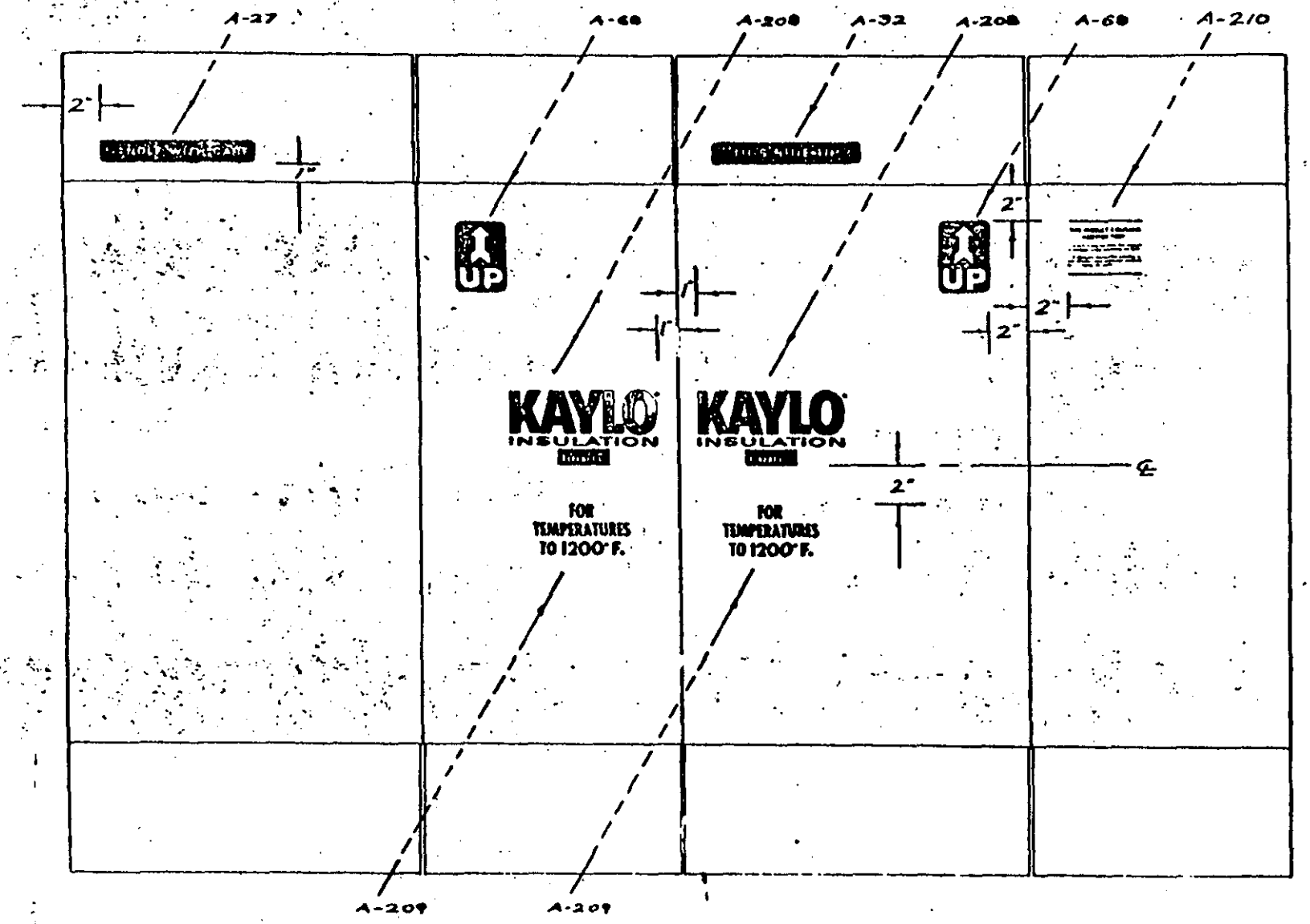
Accessory Number	Blank Size	Accessory Pad Dimensions (Inches) 35-1/2" Long Score Locations
U1	19 x 35-1/2	6 x 7 x 6
U2	21 x 35-1/2	7 x 7 x 7
U3	23 x 35-1/2	7 x 9 x 7
U4	26 x 35-1/2	8 x 10 x 8
W1	24-1/2 x 35-1/2	3-3/4 x 8-1/2 x 8-1/2 x 3-3/4
W2	28 x 35-1/2	4-1/2 x 9-1/2 x 9-1/2 x 4-1/2
W3	31 x 35-1/2	5-1/2 x 10 x 10 x 5-1/2
W4	34 x 35-1/2	6-1/2 x 10-1/2 x 10-1/2 x 6-1/2
W5	16 x 35-1/2	2 x 6 x 6 x 2
W6	20-1/2 x 35-1/2	2-1/2 x 7-3/4 x 7-3/4 x 2-1/2
W7	21 x 35-1/2	3-1/2 x 7 x 7 x 3-1/2

TABLE II

PRINTING INSTRUCTIONS

Carton Code	Signature Elements				Warning Notice							
	No.	Size	No.	Size	No.	Size	No.	Size	No.	Size	No.	Size
C-1515-36-J	A-208	8-1/2	A-209	5-1/4	A-68	3 x 4	A-27	10	A-32	10	A-210	3
C-1616-36-D												
C-1717-36-A												
C-2020-36-B												
C-2110-36-K												
C-2311-36-F												
C-2316-36-I												
C-2318-36-E												
C-2513-36-G												
C-2520-36-C												
C-2814-36-H												
C-1818-36-M												
C-1919-36-N												
C-2121-36-O												
C-2222-36-P												
C-2323-36-Q												
C-2424-36-R												
C-2525-36-S												
C-2626-36-T												
C-2727-36-U												
C-2828-36-V												
C-2929-36-W												
C-3030-36-X												
C-1811-36-Y												

REGULAR SLOTTED CARTON



Art elements shall be printed to match Glass Container Manufacturers [illegible]

SPECIAL HAZARDS SURVEY

Prepared for: OWENS-CORNING FIBERGLAS CORP.
BERLIN, NEW JERSEY

April 27, 1967

SUBJECT

INDUSTRIAL HYGIENE SURVEY

P.S. PERSONAL SERVICE
FROM THE OFFICE OF

PICTON-CAVANAUGH, INC.

Prepared by:

B. R. ROY
INDUSTRIAL HYGIENIST

Survey date:

APRIL 27, 1967

RECEIVED
FEB 1 1971
OWENS-CORNING
FIBERGLAS CORP.
MEDICAL SERVICES

Ætna
LIFE & CASUALTY

An Engineering Service of:
ÆTNA CASUALTY AND SURETY COMPANY
Ætna Life Insurance Company
Standard Fire Insurance Company
Hartford, Connecticut 06115

This report is prepared to assist the named insured in a loss control program. It is confidential and is not to be used for any other purpose. It does not purport to include every loss potential, code violation or exception to good practice but relates only to those hazards specifically examined and described herein.

EXHIBIT K

OWENS-CORNING FIBERGLAS CORPORATION
BERLIN, NEW JERSEY

April 27, 1967

PURPOSE:
This Industrial Hygiene Survey was made in order to measure, study and evaluate the occupational disease exposures associated with your various manufacturing operations.

CONCLUSION:
The Diphenyl vapors measured in your Dowtherm Control Room were not found to be dangerous although they were slightly above the advocated threshold limit value. The dust concentrations in your Flat Ware Department did exceed the advocated Threshold Limit Value for asbestos. Other areas where the Threshold Limit Value for asbestos was found to be exceeded was in the Molded pipe stripping area and also in the batch house.

CONTACTS:
This survey was conducted in company with our Haddonfield, New Jersey Engineering Manager Mr. W. McKinney and our Home Office Technical Service Representative, Mr. W. Stallings. We contacted your Safety Direct, Mr. A. Courter. Also contacted were the various supervisors of the departments surveyed.

PROCEDURE:
The Diphenyl vapors (Dowtherm A) were absorbed in silica gel at the sampling rate of two liters per minute. In our Hartford Home Office Research Laboratory the vapors were then extracted with isoproply alcohol and determined by means of a DU Spectrophotometer at the 251 millimicron wave length.

The dust samples were collected with midget impingers utilizing isopropyl alcohol as the collecting medium. Dust counts were made on a light field as outlined in the United States Public Health Service Method for Dust Counting.

FINDINGS:
The analytical results of the air samples taken during our survey have been listed in the attached Appendices A and B. The Dowtherm A (Diphenyl) vapors expressed in terms of milligrams per liter of air by volume have been listed in Appendix A.

The dust counts for the flat ware finishing line and other areas where the asbestos finishing operations were conducted have been tabulated in Appendix B.

CRITERIA:
In the study of occupational health hazards, the Industrial Hygienist makes use of certain guides or bench marks in his evaluation of the exposures. These are referred to as TLV's or Threshold Limit Values. These values are time weighted concentrations below which it is believed that the average employee can be exposed daily without experiencing adverse physiological reactions. They are values that have been derived from animal experimentation and/or industrial experience. They are modified on a yearly basis according to additional industrial experience and toxicological studies.

During previous surveys we did not a specific TLV for Dowtherm A although we did find out that it was a trade name chemical for a mixture of 26.5% Diphenyl and 73.5% Diphenyl Oxide. The former was listed as being moderately to highly toxic by inhalation, while the latter is only believed to be a slight irritant. Consequently, our analysis was made on the basis of the former, namely Diphenyl. In our previous analysis we had quoted Fairhall from his book Industrial Toxicology, namely that prolonged exposure to Diphenyl could only be speculated upon but concentrations of 0.005 mg/liter should be considered dangerous. Since then the American Conference of Governmental Industrial Hygienists in its tentative values for 1966 has listed Diphenyl with a concentration of 1 mg/m3 which is equivalent to 0.001 mg/liter.

The Threshold Limit Value for asbestos dust has remained the same as that listed in previous years, namely 5 million particles per cubic foot of air, which is based on impinger samples counted by light field technique.

DISCUSSION:
As can be depicted from Appendix A, several of the results of the air samples taken during this visit were found to exceed the advocated TLV of 0.001 mg/liter of air. They were not found to be excessively high but nonetheless were in excess of what should be considered permissible for an eight-hour daily exposure. In reviewing this data, it can be seen that a sample taken outside between the pumps Nos. 6 and 8 was nine times that of the advocated value. However, there are no employees present in this area and certainly this would not represent an employee exposure. In addition, we would like to point out that this sample was taken on a day when the relative humidity was extremely high and that Dowtherm vapors appeared to concentrate in the pump area.

The concentrations measured inside at what could be considered regular operator stations were not found to be excessive if one considers that

these values must be integrated for the time periods spent at each location during the day. Again it should be pointed out that the environmental conditions under which these tests were made were for all practical purposes extremely adverse and should not be construed as representative for eight-hour daily exposures.

In Appendix B are listed the various dust counts made in several areas of your plant. As can be seen, there were a few locations where the advocated TLV for asbestos has been exceeded. We would like to point out that in the Flat Ware Department that a significant improvement has been noted from previous studies and that the concentrations measured were not alarmingly high. Nonetheless, it would be a continued recommendation that employees be monitored medically and that continued efforts be made to maintain the exhaust ventilation at peak efficiency.

The pouring line molded type stripping operation was also found to be slightly in excess of the advocated limit.

Although the operator's breathing zone dust sample taken near the stripping operation in the Molded Pipe Pouring Line Department was found to exceed the advocated TLV of 5.0 mppcf, we do not feel that the operator exposure here is that excessive since he is also exposed to dust concentrations measured in the surrounding areas. The latter were not found to be excessive and consequently we feel that by integrating these various exposures that the operator in question is not exposed to concentrations in excess of the advocated value quoted in the criteria of this report.

The same reasoning can be applied for the operator exposures in the batch house since the higher concentrations are very intermittent and only for short durations. The background counts in the batch house would allow for some leeway and, consequently, we feel that there is no need for additional ventilation at this time.

ACKNOWLEDGMENT:

Mr. Stallings and I wish to express our gratitude for the courtesy extended to us during this visit. We are also indebted to Mr. Courter for assisting us during the initial phases of air sampling.

B. R. Roy

B. R. Roy, Industrial Hygienist
Certificate No. 590

sh

APPENDIX A

OWENS CORNING FIBERGLAS CORPORATION
BERLIN, NEW JERSEY

April 27, 1967

No.	Location	Time	Results
1.	Average Breathing Height-between cylinders 14 and 15 - adjacent to Schedule Board.	10:30 A. M.	0.0014 mg/l
2.	Average Breathing Height - Desk Area in front of No. 9 cylinder.	10:35 A. M.	0.0011 mg/l
3.	Average Breathing Height - On platform between Nos. 13 & 14 cylinder.	10:50 A. M.	0.0005 mg/l
4.	Average Breathing Height - On platform above No. 6 cylinder.	11:00 A. M.	0.002 mg/l
5.	Average Breathing Height - Feed End of No. 6 cylinder.	11:20 A. M.	0.0001 mg/l
6.	Average Breathing Height - Outside Southern Room between pumps Nos. 6 & 8 No. 7 pump was dismantled.	11:25 A. M.	0.009 mg/l

NOTE: mg/liter denotes milligrams of Diphenyl per liter of air by volume.

B.R.Roy

B. R. Roy, Industrial Hygienist
Certificate No. 590

APPENDIX B

OWENS CORNING FIBERGLAS CORP.
BERLIN, NEW JERSEY

April 27, 1967

No.	Depart	Location	Time	Results
7.	Flat Ware	Feeding Operator's Breathing Zone.	1:05 P. M.	5.2 mppcf
8.	Flat Ware	Average Breathing Level Between Fly Cutter and 1st Sander.	1:05 P. M.	2.4 mppcf
9.	Flat Ware	Average Breathing Level Between 1st and 2nd Sanders.	1:07 P. M.	4.5 mppcf
10.	Flat Ware	Average Breathing Level West Side of Line-Near End Trimmer and Turner.	1:25 P. M.	3.2 mppcf
11.	Flat Ware	Packer's Breathing Zone.	1:25 P. M.	6.6 mppcf
12.	Flat Ware	Average Breathing Height Box Preparation Area East Side of Packaging.	1:27 P. M.	2.5 mppcf
13.	Molded Pipe	Packer's Breathing Zone.	1:50 P. M.	0.2 mppcf
14.	Molded Pipe	Operator's Breathing Zone. B-Trim Saw	1:50 P. M.	3.5 mppcf
15.	Flat Ware Pouring Line	Stripper Breathing Zone.	2:10 P. M.	2.1 mppcf
16.	Flat Ware Pouring Line	General Background Cylinder Loading Area 4th Col. from No. 12 Cylinder.	2:10 P. M.	1.3 mppcf
17.	Molded Pipe Pouring Line	Operator's Breathing Zone Stripping Operation.	2:15 P. M.	5.4 mppcf
18.	Semi Molded Billet Machine	Packer's Breathing Zone	2:30 P. M.	3.4 mppcf

APPENDIX B CONT'D

No.	Depart	Location	Time	Results
19.	Semi Molded Billet Machine	Feed Operator's Breathing Zone.	2:30 P. M.	1.65 mppcf
20.	Batch House	Batcher's Breathing Zone.	2:50 P. M.	7.5 mppcf
21.	Batch House	Average Breathing Height Center of Batch House.	2:45 P. M.	3.7 mppcf

NOTE: mppcf - denotes million particles per cubic foot of air.

B. R. Ray

B. R. Ray Industrial Hygienist
Certificate No. 590

SPECIAL HAZARDS SURVEY

Prepared for OWENS-CORNING FIBERGLAS
BERLIN, N. J.

7 May 11, 1961

SUBJECT

OCCUPATIONAL DUST HAZARDS



ANOTHER SERVICE FROM THE OFFICE OF

VICTOR & CAVANAUGH

RECEIVED
FEB 1
INS
TECHNICAL

Prepared by
B. R. P Y
RESEARCH DIVISION

Safety Engineering Department
ÆTNA CASUALTY AND SURETY COMPANY
Affiliated with Ætna Life Insurance Company • Standard Fire Insurance Co.
Hartford 15, Connecticut

OWENS CORNING FIBERGLAS
BERLIN, N. J.

May 11, 1961

PURPOSE:

This visit was made at the request of our Philadelphia Engineering [illegible] to evaluate the employee asbestosis exposure associated with your batt[illegible] and routing operations.

CONTACTS:

In company with our Philadelphia Engineering Superintendent, Mr. D. K. Sv[illegible] I contacted your Plant Manager, Mr. O. W. Pfeifer.

PROCEDURE:

Air was sampled at the rate of 0.1 cubic feet per minute utilizing midget impingers with isopropyl alcohol as collecting media. The samples were taken in the general area of the units and operations surveyed as well as in the employees breathing zones at specified locations. Dust counts were made on a light field as prescribed by the United States Public Health Service method for dust counting.

FINDINGS:

Our findings, as well as pertinent remarks can be studied and interpreted from the attached Appendix A.

CRITERIA:

The threshold limit adopted at the 22nd Annual Meeting of Governmental Industrial Hygienists for mineral dusts containing asbestos is 5 million particles per cubic foot of air.

DISCUSSION:

With reference to the above, it can be seen that in only two of the operations studied has the threshold limit been exceeded. It should be pointed out, however, that although the threshold limit value has been exceeded in both operations that the limit in one instance was only slightly exceeded and in the other operation, the exposure was intermittent.

It was not possible for us to make a dust study at the feed end of the flat ware finishing line since the line was not operating after the lunch hour. The counts at the other locations on the line, viz. the turnover, and the two packaging stations were close to or exceeding (See sample No. 3 in Appendix A) the threshold

limit. We would like to point out, however, that at all these stations, there was a considerable improvement from that noted on our Mr. Robinson's 1959 survey. In addition, we were assured that the employee exposed to the highest concentrations normally wears a respirator. We would recommend, however, that the exhaust systems on this line be properly maintained and kept operating at peak efficiency.

The dust levels noted near your trim saws were well below the prescribed threshold limit. Samples were taken at operator's breathing level near trim saws A and B. Both of these were working on 3x1 pieces. The noted concentrations at both levels were approximately the same. The Trim Saw on the larger 12x2½ pieces was not running during our survey.

The general area dust concentrations in the Batch House was well within the prescribed limits. The counts noted at operator's breathing level during the mixing operation was slightly higher. Since dusts of a nuisance category such as lime, limestone and other ingredients would also score in our counts and since this is an intermittent operation, 12 minutes per batch for approximately 8 to 10 batches per day, it is our believe that the exposure here is not serious.

CONCLUSION:

The dust counts made from the air samples taken at the various locations in your asbestos operations were found to be within the prescribed threshold limits. There are no recommendations being submitted at this time.

The writer wishes to express his appreciation for the courtesy extended to us during his visit.

B. Roy

B. Roy, Research Division

fsf

APPENDI

NO.	UNIT	LOCATION	REMARKS	EMPLOYEES EXPOSED	RESULTS (1)
1.	Billet Finishing Machine	Feed Station Operator's breathing zone.	Packaging & wrapping are wet operations.	2 or 4	2.6
2.	Flat Ware Finishing Line	Packaging Employee's breathing zone (Far end)	Employee does not wear respirator	1	4.3
3.	" "	Packaging Employee's breathing zone (nearest exhaust)	Employee wears respirator intermittently.	1	8.4
4.	" "	Turn-Over Station Operator's breathing zone.	-	1	3.2
5.	Trim Saw A	Operator's breathing level	-	1	1.6
6.	Trim Saw B	" "	-	1	1.5
7.	Batch House	General Area	-	2	0.8
8.	" "	Operator's breathing zone during mixing operation	Intermittent exposure (12 minutes per batch)	1	11.2

(1) Results expressed in million particles 10 microns or less in size per cubic foot of air.

B. Roy, Industrial Hygiene Div.

B. R. Roy

OWENS CORNING FIBERGLAS CORPORATION
BERLIN, NEW JERSEY

OCTOBER 7, 1963

PURPOSE:
A dust and fume survey was made in your plant to evaluate the occupational health exposures associated with the emanation of such.

CONTACT:
This survey was conducted in company with our Messrs. Steyton and Doane, Philadelphia Engineering Manager and Assistant respectively.

CONCLUSION:
The Diphenyl vapors measured in your STD Department were found to be below that to considered to be dangerous concentrations. The dust counts made in your Flat Ware Finish Department, however, exceeded the advocated threshold limit for asbestos quite substantially. A recommendation to improve the exhaust ventilation in the packaging area is being made accordingly.

PROCEDURE:
The Dipheryl Vapors (Dowtherm A) were absorbed in silica gel at the sampling rate of two liters per minute. In our Hartford Home Office Research Laboratory the vapors were then extracted with isopropyl alcohol and determined with a DU Spectrophotometer at the 251 millimicrons wave length.

The dust samples were collected with midget impingers utilizing distilled water and acidified distilled water as the collecting media. Dust counts were made on a light field as outlined in the U. S. Public Health Service Method for dust counting.

FINDINGS:
The analytical results of the air samples taken during our survey have been listed in Appendix A. Relative to the denominations used to express our results we would like to point out the MPPCF denotes million particles per cubic foot of air while mg/L represents milligrams per liter of air.

The Dowtherm A sample was returned to our laboratory and identified, from the trade name index, as a eutectic mixture of 26.5% diphenyl and 73.5% diphenyl oxide. The former is listed as being moderate to highly toxic by inhalation while the latter is only believed to be a slight irritant. Our analytical results are on the basis of the former, namely Diphenyl.

CRITERIA:
To assist you in the interpretation of these results may we point out that the Threshold Limit Value for Asbestos dust as adopted at the 25th Annual Meeting of the American Conference of Governmental Industrial Hygienists is 5 million particles per cubic foot of air. There are no such average concentrations listed for Diphenyl. Fairhall in his book Industrial Toxicology" feels that prolonged human exposure to Diphenyl can only be speculated upon. However, concentrations of 005 mg/ liter should be considered dangerous.

DISCUSSION:
As can be seen by comparing the analytical results listed in Appendix A and the Threshold Limit Values for the contaminates in question that some of the exposures measured were significantly high. These, of course, should not be compared per se without discussing the time exposures involved nor the conditions under which our samples were taken. In the following discussion, by departments, we have listed our evaluation of the exposures studied.

A - Batch House:

The preparation of the asbestos slurry takes but 6 minutes per batch for a possible total exposure of 60 to 72 minutes per day. The Hydra pulper exposure is of the same duration. In addition, to these short durations we would like to emphasize that the dust concentration measured were for limestone, chromite, clay, asbestos, lime, and silica. In appendix A Nos. 2 and 3 we have listed the differentiation between the total concentrations. In this case a total dust count of 6.7 MPPCF of air was made of which only 1.2 MPPCF was for free silica.

Air velocity readings with an Alnor Velometer were taken near the hydra pulper. This unit was found to be effectively exhausted. General Room dilution, through the extension of the department to include the ceiling fan was also found to be adequate.

The practice of sweeping floors with push broom, however, should be discontinued in favor of an industrial type vacuum cleaner.

B - Flat Ware Finish:

The exposures studied in this department were found to be in excess of 5 hours per day thus for all practical purposes these could be considered continuous exposures. Consequently the threshold limit value of 5 million particles per cubic foot of air should not be exceeded. As can easily be seen, there is a definite need to improve ventilation for this line. The dust levels measured at the packing stations in particular can be considered alarming.

For this station we measured capture velocities ranging from 0 to 125 linear feet per minute at the opening of the hood. At the point of dust generation these velocities were negative. We are thus recommending that a study be made to bring these capture velocities back to standards.

C - Trimming:

The dust concentrations measured in this department, at operator's breathing level while operating the trim saws, fell within the limits listed in the criteria above.

D - SID:

Although the diphenyl concentrations measured in this department were not considered dangerous, it is our feeling that these may vary during the colder winter months when the windows and doors in this department are kept closed. It may be advisable to check these vapors under these different conditions.

RECOMMENDATIONS:

A. It is recommended that a study be made to increase the air capture velocity rates on the exhaust system at the packing station of the Flat Wire Finish Department.

B. R. Roy

B. R. Roy
Industrial Hygienist

brr/l

APPENDIX A

No.	Department	Location	Operation	Results
1.	Batch house	Employee breathing zone	Batching of Asbestos Flurry	10.6 MPPCF
2.	" "	" "	Hydra Pulper	6.7 MPPCF
3.	" "	" "	" "	1.2 MPPCF
4.	" "	General Background	Batching Sweeping, etc.	2.0 MPPCF
5.	Flat Ware Finish	Employee breathing Zone	Feeding	15.5 MPPCF
6.	" " "	" "	Turn Around Station	11.65 MPPCF
7.	" " "	" "	Packing	19 MPPCF
8.	Trimming	Employee's breathing Zone.	Trim Saw	4.75 MPPCF
9.	SID	Desk Area		0.0005 mc/liter
10.	"	Near Telephone Booth		0.001 mc/liter

B. R. Roy

B. R. Roy
Industrial Hygienist

brr/l

SPECIAL HAZARDS SURVEY

Prepared for: [illegible]
PERSEUS CORPORATION
[illegible], NEW JERSEY

SUBJECT

INDUSTRIAL HYGIENE STUDY

ANOTHER SERVICE RENDERED BY THE

PHOTOGRAPHIC DEPARTMENT

Prepared by:

R. R. [illegible]
TECHNICAL SERVICE

Engineering Department
ÆTNA CASUALTY AND SURETY

Affiliated with Aetna Life Insurance Company
Hartford, Connecticut 06115

OWENS-CORNING FIBERGLAS CORPORATION
BERLIN, NEW JERSEY

December 8, 1965

PURPOSE:
This Industrial Hygiene Survey was made at the joint request of your Production Manager, Mr. R. Grimmie, and our Philadelphia Engineering Representative, Mr. W. McKinney. Its purpose was to study, measure and evaluate the occupational disease exposures associated with your manufacturing operations.

CONCLUSION:
The Diphenyl vapors measured in your Dowtherm Control Room were not found to be dangerous. The dust concentration in your Flat Ware Department did not exceed the advocated Threshold Limit Value for asbestos but the employee exposures were found to be moderate. A recommendation to improve the housekeeping in this area is being made accordingly.

CONTACTS:
This survey was conducted in company with your Production Manager, Mr. R. Grimmie, and our Philadelphia Engineering Representative, Mr. W. McKinney. Also, contacted during this visit was your Plant Manager, Mr. M Hardwick.

PROCEDURE:
The Diphenyl vapors (Dowtherm A) were absorbed in silica gel at the sampling rate of two liters per minute. In our Hartford Home Office research laboratories the vapors were then extracted with isopropyl alcohol and determined with a DU Spectrophotometer at the 251 millimicron wave length.

The dust samples were collected with midget impingers utilizing distilled water as the collecting medium. Dust counts were made on a light field as outlined in the United States Health Service Method for Dust Counting.

FINDINGS:
The analytical results of the air samples taken during our survey have been listed in the attached Appendices A and B. The Dowtherm A fumes, expressed in part of Diphenyl per liter of air by volume have been listed in Appendix A. The dust counts for the Flat Ware Finishing line and the Billet Finishing Department have been tabulated in Appendix B.

CRITERIA:

In the study of occupational health hazards, the Industrial Hygienist makes use of certain guides or bench marks in his evaluation of the exposures. These are referred to as TLV's or Threshold Limit Values. These values are reviewed on a yearly basis and modified according to industrial experience and additional toxicological studies. For asbestos dust, the TLV for 1965 is listed as 5,000,000 particles per cubic foot of air by volume.

Although there are no TLV's listed for Dowtherm A, we would like to point out that this is a trade name chemical for a eutectic mixture of 26.5% Diphenyl and 73.5% Diphenyl Oxide. The former is listed as being moderately to highly toxic by inhalation, while the latter is only believed to be a slight irritant. Our analysis and results are on the basis of the former, namely, Diphenyl. Fairhall in his book (Industrial Toxicology) feels that prolonged human exposure to Diphenyl can only be speculated upon. However, concentrations of 0.005 mg/liter should be considered dangerous.

DISCUSSION:

As can be depicted from Appendix A, the Dowtherm A vapors in the SID Department were not found to be dangerous. Nonetheless, these could change with varying atmospheric conditions. On that basis, we would recommend that another air sampling survey be made during the summer months when the relative humidity and the ambient temperatures will be higher. In the interim, we would suggest that a study be made to ascertain the feasibility of providing make-up air other than through window and door infiltration, particularly those adjacent to Dowtherm A outside pumps.

The dust concentration measured in the Flat Wire Finishing Department were found to be significantly lower than those noted in previous years. This reduction certainly could be attributed to the newly installed exhaust system (lateral exhaust ventilation) on the Feeding end of the line. Air capture velocity rates of more than 3,000 Linear feet per minute were measured at the lateral exhaust intake while average velocities of 75 linear feet per minute were recorded at the farthest point on the conveyer belt. This, in our opinion, certainly is commendable and could account for the 70% reduction in the dust concentrations to which the Feeding operators have been exposed to in previous years.

It should be pointed out that although Air Sample No. 6 was found to be in excess of the advocated TLV of 5,000,000 particles per cubic foot of air, that the employees are generally rotated on this line and thus are not at this point exposed to average concentration in excess of the TLV.

In addition to the new exhaust system at the feed end of the line, it is our understanding that the canopy hood over the packaging stations will be modified and thus, exhaust the dust away rather than through

the packagers' breathing zones. With this change, there should be another reduction in the amount of airborne asbestos dust in this department.

The housekeeping was found to be better than in previous years, but there is still room for improvement. We would recommend that the overhead ledges and machine surfaces be vacuumed on a more frequent basis. This was discussed with your Mr. Grimmis.

RECOMMENDATIONS:

A. To prevent the entering and build-up of Diphenyl vapors in your Dowtherm Control Room, it is recommended that a study be made to determine whether the make-up air in the department can be provided by other means than through door and window infiltration.

B. To further reduce the asbestos airborne dust in your Flat Ware Finishing Department, we are recommending that overhead ledges and machine surfaces be vacuumed on a more frequent basis.

B. R. Ray

B. R. Ray
Industrial Hygienist

brr/l

APPENDIX A

OWENS-CORNING FIBERGLAS CORPORATION
BERLIN, NEW JERSEY

December 8, 1965

No.	Location	Time	Results
1.	Average Breathing Height near Control Panel - Northern Control Room	10:15 AM	0.001 mg/liter
2.	Average Breathing Height - Deck Area Northern Control Room	10:30 AM	0.0009 mg/liter
3.	Average Breathing Height - Top of Stairway Autoclave Platform - Northern Room	10:45 AM	0.0003 mg/liter
4.	Average Breathing Height - Outside Northern Room near pumps	11:00 AM	0.00043 mg/liter

NOTE: Mg/liter denotes milligrams of Diphenyl per liters of air by volume.

B. R. Roy

B. R. Roy
Industrial Hygienist

brr/l

APPENDIX B

OWENS-CORNING FIBERGLAS CORPORATION
BERLIN, NEW JERSEY

December 8, 1965

No.	Location	Time	Results	Remarks
5.	Operator Breathing Zone - Feeding End Flat Ware Line (Kaylo Heat Insulation)	11:20 AM	3.8 mppcf	4½" x 18" x 36"
6.	Same as No. 5	11:35 AM	6.7 mppcf	21/32" x 18" x 36"
7.	Average Breathing Height - Between Bottom and Top Sanders - Flat Ware Line	11:50 AM	3.0 mppcf	" " "
8.	Average Breathing Height - Rear Side Trimmer - Flat Ware Line	1:30 PM	0.97 mppcf	" " "
9.	Employee's Breathing Zone Packaging - Flat Ware Line	1:20 PM	3.3 mppcf	" " "
10.	General Background - Stenciling and Stapling Area	1:50 PM	1.0 mppcf	" " "
11.	Operator's Breathing Zone - Billet Finishing Machine	2:15 PM	1.6 mppcf	3½" OD
12.	Employee's Breathing Zone - Billet Packaging	2:25 PM	3.0 mppcf	3½" OD

NOTE: mppcf denotes million particles 10 microns or less in size per cubic foot of air.

B. R. Roy

B. R. Roy
Industrial Hygienist

brr/1

William R. Bradley and Associates
ENVIRONMENTAL HEALTH CONSULTANTS
18 GREEN STREET • NEWARK, N. J. 07102
201 622 4246

October 23, 1968

Mr. S. H. Thomas
Director of Environmental Control
Owens Corning Fiberglas Corporation
P. O. Box 901
Toledo, Ohio 43601

Re: Environmental Health Investigation
Owens Corning Fiberglas Corporation
Berlin, N. J. Plant

Studies on employee work environment were conducted at the Berlin, New Jersey Plant of Owens Corning Fiberglas Corporation September 23 through November 27, 1968. This plant processes installation [illegible] for pipes in various sizes and thicknesses using asbestos, silica, diatomite and cement as main ingredients. The operation is known as the Kaylo process. Samples of work-room air were collected to determine the concentration of asbestos dust and measurements were made of noise intensity at various points [illegible].

EXHIBIT L

Dust exposure exists for [illegible] cars of diatomite shipped in paper bags. The supplier should be urged to use a multi-wall paper bag of heavier strength and one with a dust proof seal. More care should be taken in the loading of box cars to prevent broken bags.

There is a potential dust exposure at the second floor batch mix area during bag dumping. It is recommended that the hopper where bags are dumped be enclosed on three sides and mechanically exhausted to the bag collectors. The handling of empty bags is a source of dust. It is suggested that empty bags be placed in a mechanically exhausted bin.

Dust counts in the area of the flatware line where the product is boxed or stacked on pallets are higher than [illegible] table. It is suggested that cartons to be loaded, travel on a roller conveyor that passes through a mechanically exhausted booth enclosure.

The design of dust collection hoods on the integrated [illegible] sawing stations should be improved in order to provide more complete enclosure. Dust counts are excessive at [illegible] stations, and it is recommended that employees wear

respiratory protection until dust control has been installed.

Dust control at the two band sawing stations for pipe needs improvement. Operators are exposed to high dust concentrations. The two band saw stations should have a separate dust collecting system rather than being 'tied in" to one of the existing systems. Hood design for dust control should be improved.

Work environment around the entrance to the Sid Cylinder is bound to be quite warm and to have high humidity due to escaping steam. Engineering studies should be made to enclose an exhaust steam to the outdoors.

An air sample in the bowtherm motor room shows that there is no exposure to bowtherm.

Measurements for noise throughout the plant show a nuisance level of noise being created by the release of compressed air without the benefit of mufflers. A high noise level exists in front of the Sid Cylinder due to escaping steam. This noise should be made a background

noise level of nearby areas of the plant. Noise on the flatware sanding line is borderline and employees here should be monitored periodically with audiometric testing.

Undesirable noise levels exist on the integrated line sawing equipment. Enclosure of the sound source with acccustical paneling is desirable.

The Rotoblast equipment in the Mold Shop is noisy, but the main shop sound pressures exist in the lower octave band frequencies. The problem is mainly one of nuisance sound intensity.

William R. Bradley

Sample No.	Location	Millions of Particles Per Cubic Foot of Air
1	Breathing zone level of workmen in box car while unloading paper bags of diatomite (Eagle Pitcher "Celatom").	18.0
2	Batch mix floor while charging asbestos 78, X3, S33, scrap, lime, iron chromite into west asbestos tank.	6.0
3	Batch mix floor while charging into south hydropulper. Charging lime and diatomite by hand, cement and silica being charged by screw conveyor.	5.0
4	No. 2 line stripping area.	3.1
5	No. 2 line pouring end.	2.2
6	No. 1 line pouring end.	2.3
7	No. 1 line stripping end.	3.5
8	Discharge area of pre-hardener during fork lift truck unloading.	3.6
9	In front of No. 9 Sid Condenser.	2.6
10	Operator's desk at rear of No. 7 Sid Condenser.	1.9
11	Flatware sanding at hood operator's station. (K-17)	4.2
12	Flatware line at top hood station. (K-17)	5.2

DUST SAMPLES (Continued)

Sample No.	Location	Millions of Particles Per Cubic Foot of Air
13	Boxing flatware and packing on skids. (K-17)	6.0
14	Feeder's station on billet line.	3.3
15	Packer's station on billet line.	3.1
16	Integrated line sawing station on pipe halves. "D" Saw	12.9
17	Flatware finishing line, packing station. K-10 product sizes 2 x 6 x 36 and 2 x 12 x 36.	7.7
18	Flatware finishing line, packing station. K-10 product size 3 x 6 x 36.	6.8
19	Shipping area at end of flatware line. K-10 product size 3 x 6 x 36. Carton closing and sealing.	1.4
20	Integrated line, sawing K-10 product size 12 x 3 x 36 and 12 x 1.5 x 36. "D" Saw	11.8
21	Integrated line wrapping and packing station.	.9
22	Integrated line carton sealing area.	2.2
23	Special assembly laminating jigs. Pipe area.	2.3
24	Band sawing, pipe area 3/4 x 2 1/2.	8.7

DUST SAMPLES (Continued)

Sample No.	Location	Millions of Particles Per Cubic Foot of Air
25	Center of warehouse.	1.3
26	Outdoors 20 feet west of No. 3 and No. 4 bag collectors.	3.0
27	Mold shop at discharge end of Rotoblast.	3.5
28	Mold shop entrance to Rotoblast unit.	2.9
29	Mold shop repair area, disc sanding and arc welding.	2.4
30	Maintenance Shop, center of area.	1.6
31	Dowtherm boiler room.	0.9
32	Box car loading 2 x 6 x 16 pipe covering.	2.3
33	Entrance to No. 2-8 drier. Fork lift truck unloading in drier. flatware and pipe.	3.0
34	Outdoor sample collected in Salary staff parking lot.	1.1
35.	"A" Saw.	

NOISE MEASUREMENTS

Sample No.	Overall Level	A Scale	31	63	125	250	500	1000	2000	4000	8000
1	90	86	81	80	80	81	78	77	78	76	72
2	91	89	80	82	82	82	80	80	80	86	70
3	95	89	85	84	86	90	91	82	79	73	73
4	92	83	83	84	82	87	81	78	74	72	76
5	93	90	85	81	83	81	89	77	75	74	76
6	90	85	82	82	86	82	80	78	75	74	76
7	100	99	82	82	82	94	84	90	88	88	97
8	96	92	84	84	84	82	81	82	86	85	92
9	101	100	83	82	83	83	82	86	92	98	96
10	93	91	80	80	79	77	78	80	84	84	89
11	97	94	80	81	80	[illegible]	84	84	88	88	87
12	95	93	80	86	82	86	85	85	91	87	82
13	91	86	81	80	77	87	77	78	80	76	78
14	89	87	80	86	79	78	78	76	76	74	82
15	88	85	78	81	77	77	74	73	73	72	85
16	99	95	86	86	85	85	87	87	89	96	89
17	91	89	80	82	78	82	80	87	84	77	75
18	91	89	80	82	78	82	80	87	84	77	75

(Continued)

Sample No.	Overall Level	A Scale	31	63	125	250	500	1000	2000	4000	8000
19	93	92	81	83	80	82	92	86	90	82	82
20	86	94	81	84	84	87	86	87	87	89	93
21	84	75	76	76	74	91	78	84	72	70	70
22	82	78	74	73	70	79	74	70	70	68	68
23	82	76	73	71	69	68	66	76	68	66	68
24	90	88	75	74	70	68	71	82	76	74	87
25	98	90	84	95	89	89	90	86	86	87	79
26	98	91	79	91	92	90	88	87	88	84	80
27	95	85	79	82	84	93	83	80	76	76	70
28	84	75	72	81	76	70	72	70	66	68	70
29	94	89	86	90	84	86	82	81	81	81	82
30	92	84	86	90	82	83	74	74	74	75	77

LOCATION OF NOISE MEASUREMENTS

Sample No.	Location
1	Batch mix floor while charging asbestos 7B, K3, S33, scrap, lime, iron chromite into west asbestos tank.
2	Batch mix floor while charging into south hydropulper. Charging lime and diatomite by hand, cement and silica being charged by screw conveyor.
3	No. 2 line stripping area.
4	No. 2 line pouring end.
5	No. 1 line pouring end.
6	No. 1 line stripping end.
7	No. 1 line stripping end, use of compressed air.
8	Discharge area of pre-hardener during fork lift truck unloading.
9	In front of No. 9 Sid Condenser.
10	Operator's desk at rear of No. 9 Sid Condenser.
11	Flatware sanding at feed operator's station. (K-17)
12	Flatware line at top sander station. (K-17)
13	Boxing flatware and packing on skids. (K-17)

LOCATION OF SAMPLES (continued)

Sample No.	Location
14	Feeder's station on billet line.
15	Packer's station on billet line.
16	Integrated line sawing station on pipe halves.
17	Flatware finishing line, packing station. X-10 product sizes 2 x 6 x 36 and 2 x 12 x 36.
18	Flatware finishing line, packing station. X-10 product size 3 x 6 x 36.
19	Shipping area at end of flatware line. X-10 product size 3 x 6 x 36. Carton closing and gluing.
20	Integrated line, sawing X-10 product size 12 [illegible] and 10 x 1.5 x 36.
21	Integrated line wrapping and packing station.
22	Integrated line station sealing area.
23	Special assembly laminating jigs. Pipe area.
24	Band sawing, pipe area 3/8 x 1 1/2.
25	Mold room at discharge end of Rotoplast.
26	Mold room entrance to Rotoplast unit.

LOCATION OF MOLD [illegible]

Sample No.	Location
27	Mold shop repair area, disc sanding and arc welding.
28	Maintenance Shop, center of area.
29	Dowtherm boiler room.
30	Box car loading 2 x 6 x 36 pipe covering.

TEMPERATURE AND HUMIDITY DATA

Test No.	Location	Temperature Degrees Fahrenheit	% Relative Humidity
1	No. 2 line stripping area.	79	60
2	No. 2 line pouring end.	80	60
3	No. 1 line pouring end.	81	59
4	No. 1 line stripping end.	85	58
5	Batch mix floor while charging into south hydropulper. Charging lime and diatomite by hand, cement and silica being charged by screw conveyor.	85	42
6	Discharge area of pre-hardener during fork lift truck unloading.	90	52
7	In front of No. 1 Slid Condenser.	87	50
8	Operator's desk at end of No. 1 Slid Condenser.	86	44

William R [illegible]
[illegible]

June 27, 1969

Mr. S. H. Thomas
Director of Environmental Control
Owens Corning Fiberglas Corporation
P.O. Box 901
Toledo, Ohio 43601

Re: Environmental Health Study
Berlin, New Jersey Plant

Environmental Health Studies on work environment were conducted June 17 and 18, 1969 at the Berlin, New Jersey plant of Owens-Corning Fiberglas Corporation. The current study was a follow up investigation of a study made in September 1968 to determine whether improvements have been made in lessening employee exposure to the inhalation of dusts including asbestos fibers. The plant processes insulation for flat surfaces and for pipes in various sizes and thicknesses using asbestos, silica, diatomite and a cement as main ingredients.

Measurements were made of in-plant noise intensity at several locations, which include overall noise pressure energy measurements as well as octave band frequencies. Noise measurements were made at those locations where previous measurements indicated noise exposures of employees exceeded "A" scale intensities above 90 decibels.

The dust samples collected by the impingement technique using triple distilled water were counted under 100 x light field microscopy. The membrane filter samples were evaluated in accordance with the method for the enumeration of asbestos dust on membrane filters as proved by Edwards & Lynch of the U.S. Public Health Service. It is recognised that membrane filter technique is only an indication of the presence of asbestos fibers in air developed for the asbestos fabric industry. It is further recognised with the impinger technique that an estimation of the presence or absence of Asbestos fibers of respirable size given answers that are relatable to the toxicology and to the instances of asbestosis in industry.

Most of the batches prepared for production of insultation products in the Berlin Plant contained between 13 and 20% asbestos or diatomaceous earth and represent an even smaller percentage of raw product by weight involving respirable size asbestos in the form of fibers.

Summary

Generally speaking airborne dust in the work environment has lessened in concentration. The exhaust hood at the flatware finishing line loading station should be extended in accordance with prior design.

- 4 -

Hood enclosures about the mixer mix dumping stations that are mechanically exhausted also should be installed. Improvements in exhaust ventilation hood enclosure should be made at the finishing line station. The "B" saw and the "C" saw should be provided with mechanically exhausted hood enclosures on the integrated line similar to those installed on the "A" saw. Where dust exposures exceed five million particles per cubic foot of air, control of the work environment is recommended. In cases where the dust count is less than five million particles the quantity of asbestos fibers in the breathing zone is of such a limited quantity that occupational illness from asbestosis is unlikely. Where dust control by hood enclosure of the process with mechanically exhausted ventilation does not reduce operator exposure to dust concentrations less than five million particles per cubic foot of air, then respiratory protection in the form of approved type masks should be worn. These masks are classified as toxic dust respirators, approved by the U.S. Bureau of Mines in Schedule 21. These respirators are similar to MSA Dustfoe type number 25, or similar respirators issued by Willson Company, or American Optical Company.

There are a few locations in the plant where noise measurements exceed 90 decibels on the "A" scale. Consideration should be given to noise reduction by control of the noise source. If this is not feasible then the wearing of ear muffs on the part of employees is recommended. A new noise source was evaluated in the plant. This involves disc grinding on metal forms in the Mold Shop.

William R. Bradley

IMPINGER DUST SAMPLES

Sample No.	Location	Millions of Particles Per Cubic Foot of Air
1	Number 2 line stripping	1.9
2	Flatware line, Feed Operator's Station K-10, 3 x 18 x 36	3.9
3	Flatware line, Top-Sander Station K-20, 1¼ x 18 x 36	2.9
4	Batch mix floor while charging Asbestos tanks	4.2
5	Batch mix floor, south hydropulper	4.0
6	Flatware finishing line Packing station K-10 1¼ x 18 x 36	5.1
7	Flatware finishing line packing station K-10 product 1¼ x 18 x 36	5.0
8	Integrated line - "D" saw K-10 product, 2 x 1 x 36	12.9
9	"A" saw 16 x 1¼ x 36 Trisect, product K-10	2.7
10	Number 3 line pouring	1.6
11	Number 3 line stripping	1.7
12	Number 2 line pouring	1.8
13	Number 1 line pouring	1.7

ENGINEER DUST SAMPLES (cont'd)

Sample No.	Location	Millions of Particles per Cubic Foot of Air
14	Batch mix floor, loading East-West tanks	3.0
15	Batch mix floor, South Hydropulper	3.7
16	Band saw, no. 1204 no. 1547	3.0
17	"A" saw - feed end 18 x 2 x 36; Tri cut K-10 product	2.2
18	"B" saw operator's station K-10 product 10 x 2 x 36	12.6
19	Flatware finishing product stacking $1\frac{11}{16}$ x 18 x 36: Core product	4.9
20	Flatware finishing stacking station	4.3
21	Billet line feeder station	2.3
22	Billet line packing station	2.1
23	Flatware line top sanding area	2.7
24	Flatware line feed operator area	4.1
25	Integrated line end wrap deck	1.7
26	Mold Shop, metal shot blast area	2.3
27	Outdoors 20' west of no. 3 and no. 4 bag collectors	1.6

MEMBRANE FILTER SAMPLES

Sample No.	Location	Asbestos Fibers/cc. Total Fibers	Fibers greater than 10 microns
1	Batch mix floor while charging Asbestos tank	.05	.04
2	Batch mix floor while charging hydropulper	.04	.03
3	Flatware line feed operator's station	.02	.01
4	Flatware line top sanding	.01	.008
5	Boxing flatware and packing on skids	.02	.015
6	Flatware line packing station	.02	.015
7	Flatware line packing station	.02	.015
8	Integrated line "B" saw	.11	.05
9	Band saw operation	.01	.008
10	"A" saw	.02	.016

NOISE MEASUREMENTS

Sample No.	Overall Level	'A' Scale	31	63	125	250	500	1000	2000	4000	8000	16000
1	100	99	86	84	90	83	83	85	93	97	92	80
2	104	103	84	81	85	85	85	87	91	94	101	93
3	97	96	82	82	84	85	83	85	87	88	94	83
4	94	89	82	82	90	84	83	80	79	80	91	70
5	97	94	80	82	84	80	83	83	86	94	90	82
6	96	93	76	80	78	84	83	83	88	93	83	77
7	93	90	84	80	82	82	79	80	86	90	71	68
8	93	91	81	84	84	83	82	83	90	83	86	76
9	89	87	78	80	77	76	76	77	82	86	76	68
10	94	92	80	81	81	87	86	86	86	90	76	66
11	112	110	74	80	78	92	92	96	92	94	108	90

LOCATION OF [illegible] SAMPLES

Sample No.	Location
1	Operator's desk at rear of No. 9 Sid Condenser
2	In front of No. 9 Sid Condenser
3	Discharge area of pre-hardener during fork lift truck unloading
4	Line 1, stripping end
5	Integrated line, 3 saw
6	Integrated line, 3 saw
7	Flatware finishing line operator's zone station
8	Flatware finishing line top sander area
9	Shipping area end of flatware line
10	Mold Shop - metal shot blast area
11	Mold Shop - disc grinding on metal forms

#6

INDUSTRIAL HYGIENE AND VENTILATION SURVEY

OWENS-CORNING FIBERGLAS CORPORATION
BERLIN, NEW JERSEY

June 8-12, 1970

EXHIBIT M

Subsidiary of Sifkin Smelting and Refining Company, Inc
25711 Southfield Road, Southfield, Michigan 48075 • Telephone: 313-352-3120

JUL 27 1970

July 24, 1970

Dr. Jon L. Konsen
Medical Director
Owens-Corning Fiberglas Corporation
Toledo, Ohio 43601

Dear Dr. Konsen:

Presented herewith are two copies of our report covering the asbestos survey and ventilation study at the Berlin, New Jersey Plant. In accordance with your request, our recommendations resulting from this study are being forwarded with the report as a separate item.

This report contains the same basic information that was presented and discussed at our meeting at the Berlin Plant on July 10, and the recommendations have been changed very little as a result of that meeting.

If there are any questions concerning this study or the report, do not hesitate to contact us.

Very truly yours,

George D. Clayton
President

GDC:bh

INDUSTRIAL HYGIENE AND VENTILATION SURVEY
OWENS-CORNING FIBERGLAS CORPORATION
BERLIN, NEW JERSEY

PROBLEM

An extensive asbestos sampling survey was conducted at the Berlin, New Jersey Plant of Owens-Corning Fiberglas Corporation to identify areas where men are being over-exposed to asbestos fibers, and to measure the intensity of asbestos inhalation to men in various job classifications. At the time of the survey an evaluation was made of the Flatware Finishing Line ventilation to assess its performance in controlling sources of asbestos in the work-room. This survey was conducted by Messrs. John E. Mutchler and Henry J. Muranko of George D. Clayton & Associates, Inc. during the week of June 8, 1970.

INTRODUCTION

The Berlin, New Jersey Plant of Owens-Corning Fiberglas Corporation produces an asbestos containing insulation material, Kaylo. The basic process consists of wet formulation, pouring, drying, slicing and peeling, using various formulations and several different sizes and shapes of dried insulation material. Both chrysotile and amosite asbestos are used in the basic formulation, together with lime, silica, cement, diatomaceous earth, iron chromite, clay and reprocessed Kaylo dust.

Worker exposures were measured in the following plant areas:

Raw Material Handling
Batch Floor Operations
No. 1 Pouring Line
No. 2 Pouring Line
Miscellaneous Service Jobs
Semi-Molded Billet Finishing
Integrated Finishing Line
New Flatware Finishing Line
Band Saw Operations
Dowtherm Control Room

ASBESTOS INHALATION

Until recently the standard method of sampling asbestos in the workroom was based on the number of particles per unit volume (millions of particles per cubic foot) determined by standard impinger sampling and 100X lightfield microscopy. For several years the Threshold Limit Value (ACGIH) was set at 5 mppcf. In 1969 the Threshold Limits Committee changed the TLV to a tentative value of 12 asbestos fibers per ml for fibers greater than 5μ in length, as determined by phase contrast microscopy at 430X. In 1970 the Committee reduced the TLV to a tentative value of 5 fibers per ml on the same basis. The British Occupational Hygiene Society has adopted a standard for chrysotile of 2 fibers per ml for 50 years of exposure, 4 fibers per ml for 25 years of exposure, or 10 fibers per ml for 10 years of exposure. These standards are, in the opinion of the experts, the best that can be drawn from existing data. These data are not ideal and, of course, the standards are subject to review in the light of new evidence and improved methods of measurement.

Good industrial hygiene practice suggests controlling exposures below the maximum allowable level, rather than maintenance at the maximum. In this connection, it is appropriate to design current engineering controls for an expected air-borne concentration of 2 fibers per ml in view of the trend downward in the acceptable exposure level and in accordance with good engineering practice.

SAMPLING PROCEDURES

In line with the latest sampling developments, those specified by the Threshold Limit Value, air samples were collected on pre-weighed cellulose ester membrane filters by the use of Mine Safety Appliances personal samplers. Three types of samples were taken: breathing zone, general area, and equipment locations. Sampling rates were 1.8-2.0 liters per minute and sampling periods varied between 5 and 150 minutes, depending upon the expected dust loading. At the conclusion of a sampling period the filter heads were removed and carried to a laboratory area where the filters were carefully transferred to sealed containers for transport back to the laboratories of Clayton & Associates.

FIBER COUNTING PROCEDURE

The method of counting asbestos fibers was that used by the U.S. Public Health Service for the enumeration of asbestos dust on membrane filters. The description of this method by G. H. Edwards and J. R. Lynch appeared in Ann. Occup. Hyg., 11, 1-6 (1968).

After weighing, sections of the sample are mounted on standard microscope slides using a high viscosity solution of membrane filter material in a 1:1 mixture of diethyl oxalate and dimethyl phthalate to render the filter transparent. Since the mount is stable for 30 days, 35 mm color slides are taken as permanent records of representative areas of each filter.

The asbestos fibers which lie on the surface of the filter are counted with phase contrast microscopy (as specified by the tentative Threshold Limit Value) using 10 x eyepiece and a 40 x phase contrast objective.

In mounting the sample, the transition of the dust-supporting substrate from translucent solid membrane filter cellulose ester material to a transparent, optically homogeneous gel is very gentle. Clearing of the filter is slow, requiring about 15 minutes, and at no time does a meniscus sweep across the dust deposit. The filter slowly softens from below causing no redistribution of the fibers.

Ten fields selected at random on the sample are counted and total fibers, fibers from 0 to 5μ, fibers greater than 5μ, and fibers greater than 10μ are recorded. Any particle having an aspect ratio of 3 or greater is considered to be a fiber.

RESULTS OF SAMPLING SURVEY

Table 1 records the results from the 95 samples taken during the survey, and lists the concentrations in terms of total dust, milligrams per cubic meter, and asbestos fiber concentration, fibers per milliliter. Three fiber length categories are included: "greater than 5 microns," "greater than 10 microns" and "total."

Table 2 tabulates the exposure by job classifications for each job studied. The exposures are categorized by intensity with numbers 1, 2 and 3, for both asbestos concentration

(fibers >5μ) and total dust concentration. The exposure intensity was obtained by averaging all breathing zone samples taken for a given job classification and comparing that average with the tentative Threshold Limit Values (ACGIH) for 1970 as follows:

Exposure Category	Average Concentration	
	Asbestos Fibers/ml (>5μ)	Total Dust Mg/M^3
1	≤4.99	≤9.99
2	5.00-9.99	10.00-19.99
3	≥10.00	≥20.00

Although the numbers do not necessarily reflect time-weighted average exposures, they do offer a useful index of relative exposures for all job classifications.

NEW FLATWARE FINISHING LINE VENTILATION

DESCRIPTION

The new dust collection and local exhaust system at the flatware finishing line consists of a rather complex multi-branched series of exhaust ducts leading from the new finishing line conveyor operations upward to a central exhaust duct that exits through the roof and northward to a baghouse collector located near the main plant building. The new flatware line runs continuously during the day shift with the exception of three "break" periods at 10:00 A.M., 12:00 noon and 2:00 P.M. At these times, the system is shut down, the baghouse is shaken, and the "baghouse checker" inspects the inside of the baghouse for excessive dust accumulation.

This control concept and the present mode of operation results in a decreased air flow and increased static pressure (loss of suction) within the dust collection network as the fabric filters accumulate dust.

AIR FLOW VARIATION IN ROOF DUCT

On June 11 the static pressure and air flow rates were monitored in the 30" roof duct leading from the new flatware finishing line to the baghouse collector. A velometer, standard pitot tube, inclined gauge manometer and glass-stemmed thermometer were used for the measurements, conducted at a point about halfway between the roof exit and the collector. The results of these measurements are shown below:

Time		Static Pressure -"W.C.	Duct Temp. °F	Avg. Velocity fpm	Flow Rate cfm
0925		-6.6			
0936		-6.6	80		
0943		-6.6	80		
0953		-6.5	80	3,870	19,002
1002	Shutdown				
1013	Startup	-8.4	79	4,074	20,003
1017		-8.2	80		
1022		-8.0	80		
1400		-6.0	86	3,762	18,471
1403	Shutdown		86		
1435	Startup	-8.8	86	4,128	20,268

As a result of these measurements, it may be seen that the air flow into the dust collector varies about 5-10% depending upon the degree of dust accumulation within the baghouse.

AIR FLOW VARIATION AT THE FINISHING LINE

On June 11 the static pressures were measured in six selected legs and the center line velocities were measured in four selected legs of the finishing line exhaust system prior to and following the noon break, during which the bag filters were cleaned. The results of those measurements are listed below in Table 3.

These measurements show that the variation in air flow rates is much greater at the finishing line than in the main duct leading to the baghouse collector. In some cases the duct velocity can drop below the accepted minimum dust carrying velocity of 3,500 fpm as a result of normal operations, prior to cleaning the dust filters.

OBSERVATIONS ON DUST CONTROL AT THE NEW FLATWARE LINE

1. At the flycutter operation the motor shaft protrudes through the housing with a 3/4" gap around the motor shaft. This results in a considerable amount of dust emitted through the opening by the centrifugal action of the rotating shaft.

2. At the flycutter exit position, a series of rubber deflecting baffles have been installed improperly, resulting in a 1/2" gap between the top of the flycutter housing and the top of the baffles which should serve to prevent dust particles being thrown outward by the rotating flycutter. As a result, a large amount of dust is being emitted to the workroom through this unnecessary opening.

3. At several conveyor line junctions, including that between the sanders, the underside exhaust hoods are improperly placed at the point where the conveyors reverse direction. As a result, dust which could be captured is carried along the conveyor and dumped onto the floor.

4. At several conveyor junctions, including the flycutter-sander and side and end trim positions, there is no underside exhaust for dust being carried along the conveyor, resulting in significant quantities of dust being dropped on the floor when the conveyor belt reverses direction.

5. At the slitter saw position, there is an unnecessarily large gap around the shaft which allows excess dust to be thrown outward by the saw's rotating action.

6. Following the slitter saw position a rotating brush has been installed to clean the moving flatware before it is packed. The brush is not positioned properly and the flatware product moves to the final conveyor section with considerable dust on its upper surface. As a consequence, when the flatware products are pushed into the boxes by the packers, copious amounts of dust are entrained into the breathing zone of these men.

7. There is presently no exhaust ventilation at or near the packers on the new flatware line, although there is a clear need for such local exhaust ventilation.

8. At the feeder position a canopy hood with a face area of 16 square feet hangs above the conveyor approximately 14" above the conveyor belt. This hood is exhausted to a different collector than the other local exhaust hoods in the flatware ventilation network. The face velocities at this

hood were measured twice; first with the nearby portable fan running and second, with the fan off. In the first case, the face velocity averaged 83 fpm with a total flow rate of 1,330 cfm. In the second case, the face velocity averaged 150 fpm with a total flow of 2,400 cfm. Both of these conditions represent unacceptable control for the dust entrained in the breathing zone of the feeder during his normal work operations. The canopy hood is a second choice of control for this application, but if used, a flow rate of 4,200 cfm would be required.

SAMPLING AT FLATWARE FINISHING LINE EQUIPMENT

Six samples were taken near the flycutter, sanders and slitter saw on the flatware line conveyor, to assess the significance of these unit operations as sources of dust in the workroom. The results are as follows:

	No. of Samples	Total Dust mg/M^3	Asbestos Fibers/ml <5μ
Flycutter Inlet	1	32.77	4.80
Flycutter Exit	2	23.47	1.15
Between Sanders	2	21.28	1.11
Slitter-saw	1	11.67	5.55

It may be concluded that efforts to lower the dust concentrations near the Flatware Line are not aided by the present state of operation for the above items.

This report prepared by: John E. Mutchler

John E. Mutchler
Chief, Engineering Services

TABLE 1
GEORGE D. CLAYTON & ASSOCIATES, INC.
FIBER SAMPLING SUMMARY

Fibrous Material Asbestos — Plant Berlin

1970 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration mg/M³	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
5-8/11	1570	Batch Floor Control Panel	1458	1514	27.47	19,512	1.41	too heavy to count		
-6	1571	Lunch Room	1603	1703	0.06	108	0.55	0.43	0.25	0.5
-8	1572	Line Service Man, Flatware	1608	1654	0.42	92	4.57	0.86	0.48	0.9
-8	1573	Plant Sweeper	1555	1631	0.33	68	4.85	0.80	0.33	0.8
-8	1574	#1 Line Service Man	1625	1706	0.61	82	7.44	1.59	0.54	2.0
-8	1575	#2 Line Service Man	1629	1708	0.58	78	7.43	3.10	1.47	3.7
-8	1576	Cylinder Service Man	1635	1712	0.50	74	6.76	1.17	0.50	1.4
-9	1577	#2 Line Pour Service Man	0855	0923	0.49	56	8.75	2.54	1.40	3.0
-9	1578	#2 Line Stripper A	0855	0914	0.92	38	24.21	14.19	7.95	15.3
-9	1584	#2 Line Stripper B	0855	0913	1.41	36	39.17	11.56	6.86	13.2
-9	1581	#2 Line Oiler	0855	0912	1.66	34	48.82	9.42	4.55	11.0
-9	1582	#2 Line Desk	0856	0925	0.86	58	14.82	3.16	1.64	3.7
-9	1583	#2 Line Strip Service Man	0855	0915	1.26	40	31.50	10.04	4.90	11.6
-9	1580	#2 Line Pourer	0855	0920	0.71	50	14.20	1.54	0.84	1.5
9	1585	#2 Line Screeder	0855	0917	0.85	44	19.32	0.74	0.38	0.9

GEORGE D. CLAYTON & ASSOCIATES, INC.
FIBER SAMPLING SUMMARY

Fibrous Material Asbestos — Plant Berlin

Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration mg/M³	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
-9	1587	Raw MaterialTrucker (diatomite	0921	0952	1.07	62	17.25	0.24	0.11	0.2
-9	1588	Dowtherm Control Room Desk	0930	1115	0.71	210	3.38	0.05	0.03	0.0
-9	1590	Baghouse Cleaner	0950	1015	0.48	45	10.67	6.87	2.87	8.5
-9	1591	Mixer's Desk, Batch Floor	0959	1025	0.58	52	11.15	1.36	0.49	1.8
-9	1592	#1 Line Stripper	1020	1046	1.78	52	34.23	15.10	9.51	16.2
-9	1593	Lab Bench (near batch floor)	1005	1235	0.48	292.5	1.64	0.12	0.05	0.1
-9	1594	#1 Line Strip Service Man	1020	1054	0.63	68	9.26	3.00	1.45	3.6
-9	1595	#1 Line Pourer	1020	1055	0.56	63	8.89	2.18	0.89	2.5
-9	1596	Storage Area Across from #1 Line	1027	1059	0.73	64	11.40	1.87	0.98	2.1
-9	1597	#1 Line Desk	1022	1058	0.60	72	8.33	1.68	0.44	2.1
-9	1598	#1 Line Pour Service Man	1020	1057	0.76	74	10.27	1.94	0.86	2.2
-9	1599	#1 Line Oiler	1036	1100	0.70	48	14.58	3.97	1.97	4.6
9	1600	Trimmer Saw Position, Integrated Line	1050	1140	0.67	100	6.70	1.90	1.00	2.1
9	1602	Raw Material Trucker(amosite)	1114	1144	0.51	60	8.50	2.42	1.09	2.8
9	1603	C-Saw off-bearer, Integrated Line	1124	1138	0.53	28	18.93	11.09	6.33	13.1

GEORGE D. CLAYTON & ASSOCIATES, INC.
FIBER SAMPLING SUMMARY

Fibrous Material Asbestos — Plant Berlin

Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration mg/M³	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
-9	1604	C-Saw Feeder, Integrated Line	1123	1241	0.63	35.1	17.95	9.25	0.83	10.08
-9	1605	Packing Service Man - New Flatware Line	1257	1339	0.50	84	5.95	1.22	0.16	1.38
-9	1606	Wrapper/Packer, Integrated Line	1429	1453	0.56	21.6	25.93	10.07	1.04	11.11
-9	1607	Desk near Flatware Packers	1432	1500	0.42	50.4	8.33	1.85	0.94	2.21
-9	1608	Crew Leader, New Flatware Line	1307	1335	0.59	56	10.54	8.21	1.45	9.66
-9	1609	Feeder, New Flatware Line	1301	1327	1.01	52	19.42	6.53	0.74	7.26
-9	1610	Wrapper/Packer - New Flatware Line	1310	1336	0.48	49.4	9.72	1.08	0.13	1.16
-9	1611	Band Saw Operator (Cutting Legs)	1316	1329	0.60	26	13.04	10.66	5.90	11.86
-9	1612	Packing Service Man, Integrated Line	1447	1456	1.12	55.1	20.33	1.12	0.14	1.25
-9	1613	Wrapper/Packer- Integrated Line	1430	1453	0.62	46	13.48	11.94	1.52	13.46
-9	1614	Flycutter Exit Position - New Flatware Line	1436	1501	0.33	47.5	6.94	1.33	0.73	1.48
-9	1615	Carton Man, Integrated Line	1426	1458	0.49	64	7.65	2.06	1.32	2.40
-9	1617	Between Top and Bottom Sanders - New Flatware Line	1439	1502	0.33	43.7	7.56	1.05	0.52	1.17
9	1618	Crew Leader's Desk, Flatware Line	1441	1503	0.37	44	8.41	0.70	0.14	0.84
9	1619	North General Area, Batch Floor	1541	1602	0.40	42	9.52	0.64	0.32	0.84

GEORGE D. CLAYTON & ASSOCIATES, INC.
FIBER SAMPLING SUMMARY

Fibrous Material Asbestos — Plant Berlin

Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration mg/M³	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
6-9	1620	Batch mixer (Dumping Diatomite)	1630	1648	0.60	36.4	17.58	0.99	0.32	1.23
6-9	1621	Slitter position New Flatware line	1447	1503	0.42	36	11.67	5.55	2.50	6.70
6-10	1622	Router-cutter position- Billet line	0954	1006	0.45	24	18.75	8.96	3.89	10.40
6-9	1623	Ass't. Batch Mixer (Dumping Amosite)	1633	1646	0.45	26	17.31	6.67	3.20	7.70
6-10	1624	Ass't. Batch Mixer (Dumping Amosite)	0841	0852	0.26	18	14.44	4.45	2.13	5.12
-10	1625	Batch Mixer	0841	0856	<0.05	30	<1.67	0.17	0.04	0.32
-10	1626	Wrapper/Packer - Billet Line	0922	0950	<0.05	56	<0.89	24.90	2.28	27.20
-10	1627	Carton man - Billet Line	0920	0951	0.15	62	2.42	0.78	0.40	0.90
-10	1628	Wrapper/Packer - Billet Line	0924	0951	0.20	51.3	3.90	1.19	0.58	1.38
-10	1630	Desk at Billet Line	0953	1008	0.28	30	9.33	0.79	0.45	0.98
6-10	1631	Ass't. Batch Mixer (Dumping Amosite)	0854	0904	0.48	20	24.00	36.90	58.30	95.00
-9	1632	Mixer's Desk-Batch Floor	0858	0909	0.77	22	35.00	0.49	0.14	0.64
6-10	1633	General area in front of SID Cylinders	1014	1025	1.23	22	55.91	11.61	5.03	15.27
-10	1634	End trimming position - Billet Line	0928	0955	0.70	54	12.96	0.37	0.20	0.50
6-10	1635	Dryer Service Man	0936	1003	1.17	54	21.67	23.78	11.91	28.52

GEORGE D. CLAYTON & ASSOCIATES, INC.
FIBER SAMPLING SUMMARY

Fibrous Material Asbestos — Plant Berlin

Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration mg/M³	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
10	1636	Baghouse Cleaner	0950	1010	0.54	38	14.21	1.55	0.62	1.62
10	1637	Line Service Man - Semi-Molded Billets	0926	0954	0.68	56	12.14	1.80	1.08	2.27
10	1638	Plant Sweeper	0915	0942	0.73	54	13.51	2.26	1.13	2.63
10	1639	Feeder, Semi-Molded Billets	0921	0951	0.68	51.3	13.25	1.86	1.31	1.99
10	1640	Dischare end of "Rotoblast"	1407	1431	0.56	21.6	25.92	1.91	0.98	2.26
10	1641	Feed end of "Rotoblast"	1406	1433	0.49	45	10.88	0.57	0.38	0.60
11	1642	#2 Line Strip Service Man	0816	0829	0.66	26	38.46	1.15	0.76	1.33
11	1643	#1 Line Desk	0834	0859	0.65	50	13.00	1.98	0.88	2.30
10	1644	General Area W Center of Finishing Room	1142	1223	0.54	82	6.58	0.69	0.41	0.77
10	1645	Feeder, New Flatware Line	1125	1134	0.65	18	36.11	19.61	12.16	21.90
10	1646	Packer A, New Flatware Line	1140	1146	0.61	12	50.83	22.68	11.36	25.65
10	1648	Packer B, New Flatware Line	1137	1145	0.24	16	15.00	26.52	15.32	30.40
10	1649	Crew Leader's Desk, New Flatware Line	1127	1150	0.78	43.7	17.84	1.61	0.77	2.05
10	1650	Band Saw Operator	1123	1132	0.43	18	23.88	2.92	1.51	3.22
10	1651	B-Sawyer, Integrated Line	1108	1117	0.77	18	42.77	10.63	6.58	11.91

GEORGE D. CLAYTON & ASSOCIATES, INC.
FIBER SAMPLING SUMMARY

Fibrous Material Asbestos — Plant Berlin

Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration mg/M³	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
-11	1652	#1 Line Stripper (hand held)	0905	0930	0.48	10	48.00	3.26	0.64	3.90
-11	1653	#2 Line Oiler	0816	0828	0.57	24	23.75	3.14	1.70	3.44
-11	1655	#2 Line Desk	0817	0830	0.55	26	21.15	1.77	0.76	2.26
-11	1656	#1 Line Stripper	0858	0905	0.64	14	45.71	18.66	11.2	21.12
-11	1657	Packer, New Flatware Line	1131	1137	<0.05	12	<4.17	6.66	4.21	7.36
10	1659	Desk in NW Laminating Area	1325	1355	0.56	60	9.33	1.33	0.57	1.75
-11	1660	#2 Line Stripper B	0816	0825	0.63	18	35.00	7.47	4.76	8.32
-11	1661	#1 Line Oiler	0858	0908	0.49	20	24.50	0.99	0.29	1.41
-11	1662	#1 Line Strip Service Man	0858	0907	0.72	18	40.00	2.38	1.06	3.02
-11	1663	#2 Line Stripper A	0816	0826	0.60	20	30.00	9.41	5.15	11.32
-11	1665	Inlet to Flycutter, New Flatware Line	1056	1105	0.59	18	32.77	4.80	2.13	6.29
-11	1666	Mixer's Desk, Batch Floor	1325	1342	0.67	35.7	18.76	4.34	1.80	5.21
-11	1667	Feeder, New Flatware Line	1502	1507	0.63	10	63.00	7.04	4.03	8.06
-11	1668	Inlet to Top Sander, New Flatware Line	1055	1104	0.63	18	35.00	1.17	0.78	1.24
11	1669	Flycutter Exit, Flatware Line	1055	1104	0.72	18	40.00	0.96	0.50	1.35

GEORGE D. CLAYTON & ASSOCIATES, INC.
FIBER SAMPLING SUMMARY

Fibrous Material Asbestos Plant Berlin

Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration mg/M³	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
6-9	1670	Line Service Man-New Flatware	1249	1330	1.06	80	13.25	4.01	2.44	4.7
6-9	1671	Packer A-New Flatware Line	1305	1333	2.00	56	35.71	26.69	17.52	29.2
6-9	1672	Packer B-New Flatware Line	1304	1333	5.61	55.1	101.8	Too heavy to count		
6-9	1673	Wrapper/Packer, Flatware Line	1308	1335	0.90	48.6	18.51	10.42	5.28	12.1
6-9	1674	Area between band saws	1328	1342	0.72	28	25.71	2.97	1.60	3.2

TABLE 2
EXPOSURE BY JOB CLASSIFICATIONS
BERLIN, NEW JERSEY PLANT
OWENS-CORNING FIBERGLAS CORPORATION

June, 1970

	Asbestos >5μ	Total Dust
Raw Material Handling		
Raw Material Trucker	1*	2*
Raw Material Unloader	NS	NS
Batch Floor Operations		
Batch Mixer	1	2
Assistant Batch Mixer	3	2
No. 1 Pouring Line (Flatware)		
Strip Service Man	1	3
Stripper	3	3
Mold Oiler	1	2
Line Service Man	1	1
Pourer	1	1
Pour Service Man (Screeder)	1	2
No. 2 Pouring Line		
Strip Service Man	2	3
Strippers	3	3
Mold Oilers	3	3
Line Service Man	1	1
Pourer	1	2
Pour Service Man	1	1
Screeder	1	2
Miscellaneous Service Jobs		
Baghouse Checker	1	2
SID Cylinder Service Man	1	1
Plant Sweeper	1	1
Dryer Service Man	3	3
Semi-Molded Billet Finishing		
Feeder	1	2
Wrapper-Packers	3	1
Carton Man	1	1
Line Service Man	1	2

* 1: $\bar{c} <$ TLV
2: TLV $< \bar{c} <$ 2 TLV
3: $\bar{c} >$ 2 TLV
NS: Not Sampled

EXPOSURE BY JOB CLASSIFICATIONS
(Continued)

	Asbestos >5u	Total Dust
Integrated Line		
B-Saw Operator	3	3
C-Saw Operator	2	2
C-Saw Off-Bearer	3	2
Wrapper-Packers	3	3
Packing Service Man	1	3
Carton Man	1	1
New Flatware Finishing Line		
Feeder	3	3
Carton Man (Wrapper-Packer)	2	2
Packers	3	3
Crew Leader	2	2
Line Service Man	1	1
Packing Service Man	1	1
Band Saw Operations		
Band Saw Operators	2	3
Downdraft Control Room		
Control Room Operator	1	1

AIR FLOW VARIATION AT THE NEW FINISHING LINE

TABLE 3

Exhaust Leg	Time	Static Pressure, "W.C.	Center-line Velocity, fpm
Top Sander, West Lateral Exhaust	1050	-5.1	
	1115	-4.3	
	1140	-3.9	
	1155	-3.7	
	1225	-4.8	
North Floor Pick-up	1110(closed)	-5.0	
	1150(closed)	-4.7	
	1200(open)		2,832
	1220(open)		3,756
	1225(closed)	-5.3	
Flycutter Underside Exhaust, West Side	1110	-4.2	
	1150	-4.7	
	1200		Completely plugged, plus large hole in flexible duct.
	1220	-5.2	
Bottom Sander, Main Vertical	1105	-4.5	
	1145	-3.9	
	1200		3,730
	1220	-5.2	4,008
Bottom Sander, North Leg of Underside Exhaust	1105	-4.3	
	1145	-3.4	
	1200	-3.3	2,658
	1220	-4.6	4,008
Bottom Sander, South Leg of Underside Exhaust	1105	-5.4	
	1145	-4.3	
	1200	-4.1	4,200
	1220	-5.7	4,296

RECOMMENDATIONS
OWENS-CORNING FIBERGLAS CORPORATION
BERLIN, NEW JERSEY

1. A significant contribution to the over-all dust problem at the Berlin plant results from traffic, both pedestrian and lift-truck, in areas where large amounts of settled dust have accumulated, especially on the batch floor, near the pouring lines and the finishing lines. A greater amount of attention must be devoted to removing these accumulations of dust on a frequent basis, both with the mechanized sweeper and with local house-cleaning efforts, including wet methods or other dust suppression measures. A permanent, central vacuum cleaning system could undoubtedly be used to effect a cleaner, less dusty over-all condition.

2. A thorough study should be made of ways and methods of optimizing the production lay-out in terms of material flow patterns and automation of certain operations which presently generate significant quantities of dust, including the batch floor operations.

3. The assistant Batch Mixer's dumping station must be re-designed to incorporate adequate local ventilation.

4. The Strippers, Oilers and Strip Service Men on the pouring lines are receiving excessive exposure to asbestos and total dust, and steps must be taken immediately to reduce these exposures to an acceptable level. The extent to which ventilation should be used for control should be carefully studied as well as other techniques.

5. The Dryer Service Man should have his exposure documented, and if it is as high as presently estimated, he should be equipped with an enclosed, filtered air cabin for his lift-truck.

6. All Wrapper-Packers and Packers on the finishing lines (Carton Men on New Flatware Line) must be protected through local exhaust ventilation at their job stations.

7. The Integrated Finishing Line, when moved to its new location, must be equipped with adequate local ventilation to protect the Saw Operators and the Packing Service Man.

8. The dust control system at the band saws near the new Flatware Finishing Line must be thoroughly cleaned, repaired and maintained to provide suitable control of air-borne dust for the saw operators.

9. The problems outlined in the section "New Flatware Finishing Line Ventilation" should be corrected as soon as possible, since each of the enumerated problems is a rather easily corrected, but significant contributor to the dust contamination around the Flatware Finishing Line.

10. The canopy hood at the Feeder's work position on the Flatware Finishing Line should be removed and replaced with a properly designed slotted, lateral exhaust hood which will remove dust from the man's breathing zone.

The dust control system for the new Flatware Finishing Line, even though it is new, has design problems which will render its performance marginal even under the best conditions, and in our opinion will undoubtedly prove to be unacceptable after a period of normal use; it should therefore be re-designed.

TABLE 1-1

GEORGE D. CLAYTON & ASSOCIATES

INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey — Material Total Dust, Asbestos, Silica

1971 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight (mg)	Sample Volume Liters	Concentration Total Dust (mg/M^3)	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
8/16	9214AA	Batch Floor, northwest side of batch floor opposite dumping operation (on passage way)	1327	1650	<0.10	516	<0.19	0.10	0.06	0.
8/16	9202AA	Batch Floor, north side between two dumping hoppers	1300	1645	2.39	3632	0.66			(%Si 9.
8/16	9200AA	Batch Floor, south side between two dumping hoppers	1310	1647	0.19	1751	0.11			
8/17	9208AA	Batch Floor, north side opposite dumping operation	0803	1320	3.55	5117	0.69			(%Si 11.
8/17	9364AA	Batch Floor, south side opposite dumping operation	0905	1318	0.97	2526	0.38			
8/17	9222AA	Batch Floor, west side	1317	1710	31.00	592	52.4			(%Si 5.
8/17	9221AA	Batch Floor, south side between two dumping hoppers	1318	1714	44.62	1905	23.4			(%Si 25.
8/17	9224AA	Batch Floor, north side between two dumping hoppers	1320	1717	3.66	3826	0.96			(%Si 9.
		Threshold Limit Value (Asbestos)						5.0		
		Threshold Limit Value (Total Dust)					2.0			
		30 mg/M3 / % quartz + 3								

TABLE 2-1
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey — Material Total Dust, Asbestos

1971 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight (mg)	Sample Volume Liters	Concentration Total Dust (mg/M³)	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
		Finishing Area								
8/17	9227AA	At the southwest end of the integrated line	1105	1643	0.08	788	0.10	0.26	0.21	0.2
8/17	2205ZA	At the southwest end of the integrated line	1120	1645	0.38	647	0.59			
8/17	9225AA	At southwest end of SNB line	1056	1640	<0.10	853	<0.12	0.40	0.25	0.4
8/18	9343AA	10' East of F-1 Boxing Oper.	0953	1246	0.11	413	0.27	0.07	0.05	0.0
8/18	2362AA	10' East of F-1 boxing Oper.	1246	1625	<0.10	519	<0.19			
8/18	9344AA	on F-1 horizontal slit saw	0959	1241	<0.10	352	<0.28	0.76	0.52	0.7
8/18	9369AA	on F-1 horizontal slit saw	1243	1632	0.18	497	0.36			
8/18	9345AA	head level, on front of F-1 box filler (fan blowing from behind)	1005	1244	0.30	324	0.93	0.36	0.27	0.3
8/18	9361AA	head level, on front of F-1 box filler (fan blowing from behind)	1245	1629	<0.10	424	<0.24			
8/18	9353AA	at north end of F-3 line, feed area	1025	1250	0.25	325	0.77	0.20	0.13	0.2
8/18	9370AA	at north end of F-3 line, feed area	1251	1638	0.25	508	0.49			
8/18	9365AA	At F-3 Line Box Fill Station	1256	1640	0.40	563	0.71			

TABLE B-2-2
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey — Material Total Dust, Asbestos

1971 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight (mg)	Sample Volume Liters	Concentration Total Dust (mg/M^3)	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
		Finishing Area								
8/18	9355AA	Center, Special Materials Fabrication Area	1038	1258	0.13	344	0.38	0.21	0.15	0.2
8/18	9360AA	Center, Special Materials Fabrication Area	1259	1644	0.70	523	1.3			
8/18	9356AA	Special Materials Laminating Area - glue only this date.	1047	1300	0.04	317	0.13			
8/18	9366AA	Special Materials Laminating Area - glue only this date.	1301	1646	<0.10	526	<0.19			
8/18	9357AA	Automatic boxing, south of F-4	1055	1625	0.31	746	0.42			
8/18	9358AA	50' from north and east walls of Finishing Area, near SID area.	1104	1235	<0.10	196	<0.51			
8/18	9368AA	50' from north and east walls of Finishing Area, near SID area.	1237	1649	<0.10	522	<0.19			
8/18	9359AA	At head level on F-1 feed hood	1020	1238	0.03	351	0.09	0.44	0.35	0.4
8/18	9367AA	At head level on F-1 feed hood	1240	1634	0.32	594	0.54			
		Threshold Limit Value						5.0		

TABLE B-3-1
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey — Material Total Dust, Asbestos

1971 Date	Sample No.	Description	Sampling Period		Sample Weight	Sample Volume	Concentration			
			Start	Stop	(mg)	Liters	Total Dust (mg/M^3)	Fibers/ml >5μ	Fibers/ml >10μ	Fibers/ml Total
		LIFT TRUCKS								
8/19	9349AA	TK#43 - Finishing Area	0830	1050	0.28	344	0.81	0.14	0.09	0.16
8/19	8396A	TK#45 - Finishing Area	0836	1555	0.04	384	0.10			
8/19	8398A	TK#43 - Finishing Area	1050	1537	0.35	761	0.46			
8/19	8400A	TK#45 - Finishing Area	1055	1545	0.32	800	0.40			
8/19	8404A	TK#50 - Loading Area	0900	1200	0.35	394	0.89			
8/19	9319AA	TK#50 - Loading Area	1201	1530	0.50	451	1.1	0.62	0.36	0.7
8/19	9348AA	TK#56 - Pouring Lines	0917	1250	0.23	541	0.43	0.44	0.26	0.4
8/19	8403A	TK#44 - Pouring Lines	0925	1100	<0.10	243	<0.41			
8/19	9314AA	TK#56 - Pouring Lines	1250	1400	0.04	169	0.24	0.19	0.12	0.2
8/19	8402A	TK#44 - Pouring Lines	1100	1545	0.08	730	0.11			

TABLE B-2
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey — Material Total Dust, Asbestos

1971 Date	Sample No.	Description	Sampling Period		Sample Weight	Sample Volume	Concentration			
			Start	Stop	(mg)	Liters	Total Dust (mg/M^3)	Fibers/ml >5μ	Fibers/ml >10μ	Fibers/ml Total
		LIFT TRUCKS								
8/19	9350AA	TK#41 - Warehouse	0930	1255	<0.10	463	<0.22	0.09	0.06	0.10
8/19	9318AA	TK#41 - Warehouse	1256	1541	<0.10	373	<0.27	0.20	0.12	0.24
		Threshold Limit Value						5.0		

TABLE B-4-1
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey — Material Total Dust

1971 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight (mg)	Sample Volume Liters	Concentration Total Dust (mg/M³)	Concentration Fibers/ml >5μ	Concentration Fibers/ml >10μ	Concentration Fibers/ml Total
		Maintenance Group								
8/19	9346AA	Electric Welder's Breathing Zone (iron) in shop (no exhaust ventilation)	0901	1138	1.33	341	3.9			
8/19	9316AA	Welder's breathing zone in shop - burning with acetylene	1233	1609	0.68	464	1.5			
8/19	9347AA	Welder's breathing zone (iron) working on SID front in A.M., as machinist on SID #9 in P.M	1050	1611	1.55	748	2.1			
8/19	8382A	northeast corner of maintenance shop, lathe work	0910	1515	4.86	5045	0.83			
8/19	9322AA	northeast corner of maintenance shop, lathe work	1516	1632	0.32	1104	0.29			
8/19	8383A	East center of main shop, pipe fitting	0913	1518	0.43	3408	0.12			
8/19	9324AA	East center of main shop, pipe fitting	1520	1638	0.08	693	0.12			
		Threshold Limit Value					10.0			

TABLE B-5-1
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey — Material Total Dust, Asbestos

1971 Date	Sample No.	Description	Sampling Period		Sample Weight	Sample Volume	Concentration			
			Start	Stop	(mg)	Liters	Total Dust (mg/M^3)	Fibers/ml >5μ	Fibers/ml >10μ	Fibers/ml Total
		Mold Shop								
8/19	8182A	East end of automatic shot blast hood, feed operator working	0927	1246	8.59	3,32	2.7			
8/19	8397A	West end of blast hood, loading platform	1253	1619	3.53	3872	0.91			
8/19	8395A	On foreman's desk, center of shop	0931	1354	1.28	660	1.9			
8/19	9321AA	On Foreman's desk, center of shop	1355	1416	0.17	47	3.6	4.2	3.7	4.3
8/19	9323AA	Breathing zone of welder (electric on iron)	1243	1614	0.92	454	2.0			
8/19	9320AA	At west end of blast hood, loading platform	1358	1619	0.27	337	0.80	0.79	0.66	0.8
		Threshold Limit Value						5.0		

TABLE B-6-1
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey — Material Total Dust, Asbestos

1971 Date	Sample No.	Description	Sampling Period		Sample Weight	Sample Volume	Concentration			
			Start	Stop	(mg)	Liters	Total Dust (mg/M^3)	Fibers/ml >5μ	Fibers/ml >10μ	Fibers/ml Tota
8/16	9195AA	Pouring Line #2 - on the west side, north end	1350	1701	<0.10	426	<0.23	0.30	0.18	0.3
8/16	9197AA	Pouring Line #2 - on the east side, north end	1415	1700	.0.23	299	0.77			
8/16	9196AA	Pouring Line #1 - on the east side behind molder gun operator.	1450	1704	1.11	2163	0.51			
8/16	9201AA	Pouring Line #1 - on the east side behind molder gun operator.	1500	1707	<0.10	854	<0.12			
8/17	9226AA	Pouring Line #2 - east side, north end	0821	1310	0.54	549	0.98			
8/17	9198AA	Pouring Line #2 - west side, center	0822	1708	1.02	1173	0.87			
8/17	9199AA	Pouring Line #2 - east side behind the molder gun operator	0830	1306	0.22	624	0.35			
8/17	9415AA	Pouring Line #1 - east side behind the molder gun operator	0832	1303	3.04	4375	0.69			
8/17	9212AA	Pouring Line #1 - south side on east end	0833	1653	2.05	3363	0.61			
8/17	9223AA	Pouring Line #2 - east side behind molder gun operator	1307	1705	<0.10	538	<0.19			
8/17	9210AA	Pouring Line #2 - east side behind molder gun operator	1310	1706	1.01	448	2.3			
		Threshold Limit Value						5.0		

TABLE B-7-1
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey Material Total Dust, Asbestos

1971 Date	Sample No.	Description	Sampling Period		Sample Weight	Sample Volume	Concentration			
			Start	Stop	(mg)	Liters	Total Dust (mg/M^3)	Fibers/ml >5μ	Fibers/ml >10μ	Fibers/ml Total
8/16	9209AA	Filter Press Area, on post opposite center line, facing west	1335	1650	<0.10	454	<0.22	0.37	0.24	0.4
8/16	9213AA	Ceiling above where finished pieces are loaded on the east end.	1345	1658	0.02	409	0.05			

TABLE B-7-2
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey — Material Total Dust, Asbestos

1971 Date	Sample No.	Description	Sampling Period		Sample Weight	Sample Volume	Concentration			
			Start	Stop	(mg)	Liters	Total Dust (mg/M^3)	Fibers/ml >5μ	Fibers/ml >10μ	Fibers/ml Total
8/17	9206AA	Filter Press Area, on post opposite center line, facing west	0815	1315	0.39	585	0.67			
8/17	9211AA	Ceiling above where finished pieces are loaded on the east end	0819	1633	0.14	1000	0.14			
8/17	9363AA	Filter Press Area, on post opposite center line, facing west	1315	1635	<0.10	449	<0.22			
		Threshold Limit Value						5.0		

TABLE B-8-1
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey Material Silica

1971 Date	Sample No.	Description	Sampling Period		Sample Weight	Sample Volume	Concentration		
			Start	Stop			SiO_2 %		
8/19	16446	Random picked piece of finished Kaylo insulating material					<1.0		

TABLE C-1-1
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey — Material Carbon Monoxide

1971 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight	Sample Volume	Concentration ppm	Concentration	Concentration
		Lift Trucks							
8/19	CO-1	On lift truck #60, Press-SID hood area	14:30				60		
8/19	CO-2	Opposite pre-hardening ovens no truck in area	13:50				25		
8/19	CO-3	SID loading area, opposite #6 SID, center of room	13:56				50		
8/19	CO-4	Near ovens, one truck idling	13:58				40		
8/19	CO-5	General area, walking	13:55				40		
8/19	CO-6	Warehouse opposite stall 34-10 and line	14:00				<10		
8/19	CO-7	On truck #32 at pouring line	14:13				40		
8/19	CO-8	On truck #14 at finishing oven	14:30				30		
8/19	CO-9	On truck #39 on warehouse	14:37				25		
8/19	CO-10	On truck #58, SID hood area	14:45				50		
8/19	CO-11	On batch floor near operator's desk	14:50				<10		
		Threshold Limit Value					50		

TABLE C-2-1
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OWENS-CORNING FIBERGLAS Berlin, New Jersey — Material Carbon Monoxide

1971 Date	Sample No.	Maintenance and Mold Shops Description	Sampling Period Start	Stop	Sample Weight	Sample Volume	Concentration CO ppm		
8-19	1	Maintenance shop, lift truck	13:16				< 10		
8-19	2	Maintenance shop, lift truck	13:20				< 10		
8-19	3	Maintenance shop, lift truck	13:22				< 10		
8-19	4	Center, maintenance shop	13:23				< 10		
8-19	5	West end of maintenance shop	13:25				10		
8-19	6	West end of mold shop	13:30				50		
		(lift truck in area)							
8-19	7	West end of mold shop	13:32				10		
		(lift truck in area)							
8-19	8	West end of mold shop	13:34				< 10		
		(lift truck in area)							
8-19	9	East of center of mold shop	13:36				< 10		
		Threshold Limit Value					50		
		Note: Garage doors open at both ends of both shops.							

TABLE C-3-1
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey

Material Oil Mist, Dowtherm A

1971 Date	Sample No.	Description	Sampling Period		Sample Weight	Sample Volume	Concentration		
			Start	Stop		Liters	Oil Mist mg/M^3	Dowtherm A mg/M^3	
8/17	ISO-1	SID Control area, opposite SID #6 on cat walk	0957	1458		692	15.9	3.0	
8/17	ISO-2	SID Control Area, opposite SID #6 on cat walk	0958	1459		692	47.9	6.9	
8/17	ISO-3	SID Control Area, opposite SID #15 on cat walk	1004	1501		603	8.2	1.3	
8/17	ISO-4	SID Control Area, opposite SID #15 on cat walk	1005	1502		582	20.5	2.4	
8/17	ISO-5	On Control Operator's Desk, Opposite SID #9	1010	1505		696	26.1	2.2	
8/17	ISO-6	SID Control Area, opposite SID #10 on cat walk	1015	1430		556	54.0	7.2	

TABLE C-3-2
GEORGE D. CLAYTON & ASSOCIATES
INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant OCF - Berlin, New Jersey Material Oil Mist

1971 Date	Sample No.	Description	Sampling Period		Sample Weight	Sample Volume	Concentration		
			Start	Stop		Liters	Oil Mist mg/M^3		
8/19	ISO-10	SID Loading Area, lift TK-40	0850	1205		448	42.8		
8/19	ISO-11	SID Loading Area, lift TK-50	0900	1200		382	95.2		
8/19	ISO-12	Pouring line #2	1000	1455		381	104		
8/19	ISO-13	Pouring line #2	1001	1456		620	24.6		
8/19	ISO-14	Pouring line #2	1245	1630		418	19.8		
		Threshold Limit Value					5.0		

GEORGE D. CLAYT & ASSOCIATES

HEAT STRESS SURVEY SUMMARY

PLANT OCF - Berlin, New Jersey DATE August 16, 1971

Sample No.	Time	Location	WGT °F	Equivalent WBGT °F	ACGIH Proposed Max. Values	
					Work Load	Work-Rest Regimen
HS-1	15:55	Batch Floor, 2nd Level, West Side (Fan On)	71.5	78.0	Moderate	Continuous Work
HS-2	16:07	Batch Floor, 3rd Level, west side opposite stairs to tank top cat walk	74	81.0	Moderate	75% Work 25% Rest
HS-3	16:15	SID Control Area, north end opposite control panel and SID #9	78	84.8	Light	Continuous Work
HS-4	16:24	SID Control Area at operator's desk	76	82.7	Light	Continuous Work
HS-5	16:30	SID Control Area, south end, opposite SID #15	77.5	84.2	Moderate	50% Work 50% Rest
HS-6	16:36	On cat walk above SID #15	84.5	91.5	Light	25% Work 75% Rest
HS-7	16:43	On cat walk above SID #6	88.5	95.7	Light	<25% Work >75% Rest

INDUSTRIAL HYGIENE SURVEY
OWENS-CORNING FIBERGLAS CORPORATION

Berlin, New Jersey

August, 1971

Division of Marlennan Management Systems, Inc.
25711 Southfield Road, Southfield, Michigan 48075 • Telephone: 313-352-3120

October 22, 1971

Mr. Gerald E. Devitt
Industrial Hygienist
OWENS-CORNING FIBERGLAS CORPORATION
P.O. Box 901
Toledo, Ohio 43659

Dear Jerry:

Presented herewith is the report of the industrial hygiene survey at the Berlin, New Jersey Plant.

The dust survey conducted in the plant revealed no excessive airborne concentrations of asbestos or other fibrous materials. Oil mist concentrations in the SID and Number 2 Pouring Line areas, however, were quite high. All other contaminants and stresses measured are discussed in the body of the report.

Very truly yours,

George D. Clayton
President

GDC:bj
Enclosure.

cc: S. H. Thomas

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INDUSTRIAL HYGIENE SURVEY
OWENS-CORNING FIBERGLAS CORPORATION
BERLIN, NEW JERSEY

INTRODUCTION

During the week of August 16-20, 1971, an industrial hygiene survey was conducted at the Owens-Corning Fiberglas plant in Berlin, New Jersey. The participants in this survey were Messrs. Jack A. Barton and Frederick M. Toca of George D. Clayton and Associates. The purpose of this survey was to evaluate environmental stresses throughout the plant, particularly those arising from exposure to noise, dusts, fumes, gases, vapors and heat.

The following discussion is limited to those operations where environmental stresses in excess of acceptable levels were measured. Summary data sheets follow for all measurements taken in the survey.

SUMMARY AND RECOMMENDATIONS

NOISE

Representative sound pressure level measurements were made throughout the plant. Octave band analyses were made at locations where the sound pressure level was in excess of 85 dBA. Impact noise measurements were made in the Mold Shop and at the pouring lines.

Boiler Room

Noise levels at two locations in the Boiler Room representing about half of the room work area and near each of the two boilers exceeded the Walsh-Healy 8-hour exposure standard (90 dBA). No personnel routinely stay in this area a significant amount of time. Hearing protectors should, however, be worn by maintenance or other personnel who may be scheduled to work near the boilers longer than 4 to 5 hours during any day.

Mold Shop

A noise level of 102 dBA was recorded at the mold repair station where a man does a considerable amount of abrasive grinding of welded seams on molds. The total time spent

while grinding usually exceeds 1-1/2 hours per day. Hearing protectors should be worn by personnel stationed at work locations within approximately 10 feet of the mold repair station.

SID Control Area

A noise hazard exists in the SID area. Noise from high pressure steam leaks was found to be a common occurence. The general background noise is that of steam flowing through piping. Operations personnel stationed in the SID Control Area should be provided with a protective enclosure to accommodate a desk in a small office area that will effectively reduce the noise exposure at their desk to less than 85 dBA. All personnel who are required to work in the immediate area of the SID's should be required to wear hearing protectors.

DUST SURVEY

A dust survey was conducted throughout the plant. This survey included samples for total dust, welding fume and asbestos. Two samples collected in the batch floor were analyzed for percentage of free silica. Selected samples were analyzed for asbestos fibers using the technique described by Edwards and Lynch in the "Annals of Occupational Hygiene," Volume 11, pp. 1-6 (1968).

It is worthy of mention that in no samples analysed were asbestos concentrations found to be in excess of the threshold limit value.

Batch Floor

Two samples collected at the west side and at the south side of the batch floor between two dumping hoppers indicate that dust concentrations may at times exceed the threshold limit value by a considerable margin (52.4 mg/M^3 and 23.4 mg/M^3 respectively). Dust filter masks approved by the Bureau of Mines should be worn by operations personnel when dumping material into the hoppers.

Gas and Vapor Survey

The survey for gaseous contaminants was conducted in selected areas of the plant. The contaminants to be sampled were determined by the nature of the operation in the area being surveyed and included carbon monoxide, Dowtherm A and oil mist.

Table A-1-1

GEORGE D. CLAYTON & ASSOCIATES
NOISE SURVEY DATA SHEET

Plant OCF-Berlin, New Jersey Date August 17, 1971 Study by F.M.T.

Area or Department Batch Floor Instrument B&K

Operating Conditions _____ Remarks _____

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB) re 0.0002 Microbar									
						Octave-Band Frequency (Hertz)									
			A		Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
1	14:15	South side of room	80												
2	14:20	East center of room	82												
3	14:25	North side of room (Fan on)	85												
4	14:30	North side of room	83												
5	14:35	North side with mixer on	86			87	88.5	87	86	83	80	75.5	71		
		with bulk separator on	94												

Carbon Monoxide

Carbon monoxide concentrations in areas frequented by lift trucks did not present a potential health hazard at the time of the survey. A potential health hazard may exist, however, during the winter months when dilution ventilation may be at a minimum as some doorways and openings will be closed. An industrial hygiene survey to determine carbon monoxide exposures should be conducted during winter months.

Oil Mist

Oil mist concentrations found in the SID Control Area, SID loading area and #2 Pouring Line area were consistently above the threshold limit value (5 mg/M^3). Concentrations in the range of 8.2 mg/M^3 to 104 mg/M^3 were found. The 5 mg/M^3 limit is recommended as an index of good industrial practice. Better control of the oil-steam leakage from the SID cylinders and prehardeners is required, together with better procedural controls on the excess oil applied to the pens at the pouring lines.

Heat Stress

The heat stress survey was conducted using the wet globe thermometer technique developed by J. H. Botsford. Wet globe thermometer (WGT) readings were correlated with wet bulb globe temperature (WBGT) values by use of the formula (WGT = 0.958 WBGT - 3.2) developed by Brief and Confer. WBGT values were then compared with limits for occupational heat exposures proposed by the American Conference of Governmental Industrial Hygienists.

Batch Floor

The potential for excessive heat stress exists at the third floor level of the Batch Floor for moderate and heavier work. A work-rest regimen of 75% work and 25% rest is recommended for moderate work loads.

SID Area

The potential for excessive heat stress exists in the general areas near the SID's for light and heavier work loads. A work-rest regimen of 25% work and 75% rest is recommended for light work loads in the area above the SID's. A work-rest regimen of 50% work and 50% rest is recommended for moderate work loads in the area along the south end of the SID's.

This report prepared by: Jack A. Barton

J. A. Barton,
Industrial Hygienist

GEORGE D. CLAY N & ASSOCIATES
NOISE VEY DATA SHEET

OWENS-CORNING FIBERGLAS

Plant Berlin, New Jersey Date 8-18-71 Study by JAB

Area or Department Boiler Room Instrument B & K 2204/1613

Operating Conditions Normal Remarks

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB) re 0.0002 Microbar									
						Octave-Band Frequency (Hertz)									
			A		Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
1	07:35	East end of boiler room	89		98	93	90	86	87	84	81	81	82	80	68
2	07:40	25' South of north door, 10' West	95		101										
		of Wicks boiler													
3	07:42	West end of boiler room at work	86		95										
		bench													
4	07:46	West end of B. & W. boiler	93		97	90	85	86	87	90	88	86	84	84	72

GEORGE D. CLA[illegible]N & ASSOCIATES
NOISE [illegible]VEY DATA SHEET

OWENS-CORNING FIBERGLAS

Plant Berlin, New Jersey Date 8-18-71 Study by JAB

Area or Department Dowtherm Storage & Transfer Area Instrument B & K 2204/1613

Operating Conditions Normal Remarks

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB)-re 0.0002 Microbar Octave-Band Frequency (Hertz)									
			A		Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
1	15:45	Outside east, 15' from north end, center	84		92										
2	15:48	Outside east, 15' from south end, center	87		92	84	83	81	82	86	84	78	76	74	72

TABLE A-4-1

GEORGE D. CLAYTON & ASSOCIATES

NOISE SURVEY DATA SHEET

OWENS-CORNING FIBERGLAS

Plant Berlin, New Jersey Date 8-18-71 Study by JAB

Area or Department Finishing Area Instrument B & K 2204/1613

Operating Conditions F-2 & F-4 Down, Otherwise Normal Remarks

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB) re 0.0002 Microbar Octave-Band Frequency (Hertz)									
			A		Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
1	13:15	Finishing area office	60		78										
2	13:18	Integrated line-box filling	80		85										
3	13:20	North East corner, finishing area	77		84										
4	13:22	At F-1 feed hood station	82		86										
5	13:25	10' West of F-1 feed hood station	77		86										
6	13:28	At F-1 side trimmer	91		92	75	78	77	84	86	83	84	85	80	72
7	13:30	At F-1 length slitter	86		88										
8	13:33	At F-1 box filling station	84		95	80	78	84	80	80	75	76	76	73	60
9	13:35	South East corner, finishing area	80		86										
10	13:38	South West corner, box sealing machine	77		83										
11	13:40	Center, finishing area	74		81										
12	13:42	At F-3 loading station	74		83										
13	13:45	At F-3 box filling station	80		86										
14	13:47	Between F-3& F-4 box making station	78		84										

TABLE A-4-2

GEORGE D. CLAY[illegible] & ASSOCIATES

NOISE SU[illegible]Y DATA SHEET

OWENS-CORNING FIBERGLAS

Plant Berlin, New Jersey Date 8-18-71 Study by JAB

Area or Department Finishing Area Instrument B & K 2204/1613

Operating Conditions _____ Remarks _____

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB)-re 0.0002 Microbar Octave-Band Frequency (Hertz)									
			A		Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
15	13:49	South East corner, special	75		82										
		materials assembly													
16	13:50	South West corner, special	76		83										
		materials assembly													
17	13:52	North of special materials	74		82										
		assembly													
18	13:54	Inside Quality Control Laboratory	59		79										
		(no activity)													

NOISE SURVEY DATA SHEET

OWENS-CORNING FIBERGLAS

Plant Berlin, New Jersey Date 8-19-71 Study by JAB

Area or Department Maintenance Shop Instrument B & K 2204/1613

Operating Conditions _____ Remarks _____

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB) re 0.0002 Microbar Octave-Band Frequency (Hertz)									
			A		Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
1	14:20	At lathe operator, west end of shop, no activity	72		78										
2	14:21	Center of shop, no activity	71		80										
3	14:24	East end of shop, lift truck maintenance	70		78										
4	14:25	Center carpenter shop, no activity	72		83										
5	14:27	Center welding shop, no activity	70		78										

NOISE S VEY DATA SHEET

Plant OWENS-CORNING FIBERGLAS Berlin, New Jersey Date 8-19-71 Study by JAB

Area or Department Mold Shop Instrument B & K 2204/1613

Operating Conditions Normal Remarks

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB) -re 0.0002 Microbar Octave-Band Frequency (Hertz)									
			A	Imp	Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
1	14:31	Center, blast hood operating	84		92										
2	14:33	At mold repair station, grinding, etc	102												
3	14:35	Center of shop at mold unloading	93												
		station (grinding 30' away)													
4	14:37	At mold unloading station, west	87		95	78	90	88	86	83	73	78	74	74	62
		end of hood													
5	14:40	At hood loading station	86		95										
6	14:45	Maximum impact, at mold repair		114											
		bench													

NOISE SURVEY DATA SHEET

OWENS-CORNING FIBERGLAS

Plant Berlin, New Jersey Date 8-18-71 Study by JAB

Area or Department Pouring Lines Instrument B & K 2204/1613

Operating Conditions Normal Remarks

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB) -re 0.0002 Microbar Octave-Band Frequency (Hertz)									
			A	IMP	Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
1	14:10	Center, #1 flatware pouring line	84		92										
2	14:14	Center, #2 flatware pouring line	82		97										
		(fan on)													
3	14:15	Outside, waste loading dock	82		86										
		(noise from dust collector)													
4	14:20	#2 pouring line-mold stripping	85		93	83	85	83	81	84	83	74	71	66	55
		station													
5	14:28	Peak impact level, #2 pouring line-		129											
		mold stripping station													
6	14:30	At semi-billet line boxing station	81		86										
7	14:34	At semi-billet line loading station	89		91	72	83	83	81	80	80	81	84	84	71
8	14:37	At #2 press mold station	82		89										
9	14:39	At #1 press mold station	84		90										
10	14:43	Center of building, 20' north of north pre-hardener	84		91										

GEORGE D. CLAY[illegible] & ASSOCIATES

NOISE SURVEY DATA SHEET

OWENS-CORNING FIBERGLAS

Plant Berlin, New Jersey Date 8-18-71 Study by JAB

Area or Department Pouring Lines Instrument B & K 2204/1613

Operating Conditions Normal Remarks

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB) re 0.0002 Microbar Octave-Band Frequency (Hertz)									
			A		Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
11	14:45	Center of building, 15' east of center pre-hardener	90		94	83	83	91	84	83	81	82	84	84	74
12	14:48	30' East of north east corner of finishing area	92		97	80	81	88	95	87	85	83	83	80	78
13	14:55	Integrated pipe finishing area, leg saw station	92		93	84	85	86	80	80	82	84	86	82	71

GEORGE D. CLAYT & ASSOCIATES
NOISE SU Y DATA SHEET

OWENS-CORNING FIBERGLAS

Plant Berlin, New Jersey Date 8-18-71 Study by JAB

Area or Department SID Control Area Instrument B & K 2204/1613

Operating Conditions SID #'s. 1,5,6,8,9,12,13,14 Down Remarks

Test No.	Time	Location of Microphone	Weighting Network		Sound Pressure Level (dB) re 0.0002 Microbar Octave-Band Frequency (Hertz)									
			A	Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
1	15:08	Center of building, 30' east of	84	90										
		drying ovens												
2	15:10	South east corner of building, 50'	82	87										
		south of SID control area												
3	15:12	#16 SID, 20' north of south end of	95	96	82	77	81	81	83	85	88	90	89	77
		control area												
4	15:15	Between #15 and #16 SID	93	95										
5	15:18	15' west of #16 SID	97	97										
6	15:20	15' west of #12 SID (steam leak)	104	104	84	81	84	88	93	94	97	100	102	93
7	15:24	Inside control area, opposite	84	86										
		#15 SID												
8	15:26	East end of #12 SID	94	95										
9	15:29	Operator's desk, east end of #9 SID	92	95	85	80	86	80	82	82	84	86	89	79
10	15:33	East of #5 SID, center	91	94										

GEORGE D. CLAYTON & ASSOCIATES
NOISE SURVEY DATA SHEET

OWENS-CORNING FIBERGLAS
Plant Berlin, New Jersey Date 8-18-71 Study by JAB

Area or Department SID Control Area Instrument B & K 2204/1613

Operating Conditions SID #'s. 1, 5, 6, 8, 9, 12, 13 Down Remarks

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB) re 0.0002 Microbar Octave-Band Frequency (Hertz)									
			A		Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
11	15:36	15' west of #9 SID	104		104										
12	15:40	15' west of #5 SID	94		96										
13	15:43	15' west of #1 SID	85		91	83	83	80	82	82	79	75	76	76	67

INDUSTRIAL HYGIENE SURVEY

OWENS-CORNING FIBERGLAS CORPORATION
Berlin, New Jersey

September 14, 1972

George D. Clayton & Associates Division of Marlenman Management Systems, Inc.
25711 Southfield Road, Southfield, Michigan 48075 • Telephone: 313-352-3120

November 1, 1972

Mr. Gerald E. Devitt
Chief, Industrial Hygienist
OWENS-CORNING FIBERGLAS CORPORATION
Fiberglas Towers
Toledo, Ohio 43659

Dear Mr. Devitt:

Presented herewith are three copies of a report summarizing the results of the industrial hygiene survey conducted at your plant in Berlin, New Jersey on September 14, 1972 by Mr. Paul Carlson and the undersigned.

The following comments are based on observations and measurements made by field team during the survey and represent their overall impressions of the plant. Particular areas in which a need exists for either implementation of corrective measures or further investigation have been noted.

1. Comparison of noise measurements with current Occupational Safety and Health standards indicate that a potential exists for overexposure of workers to noise near the SID cylinders (see Table IV). A comprehensive hearing conservation program should be implemented.

2. Total dust concentrations ranged from 2.2 to 64.4 mg/M^3 in those areas of the plant studied. The Occupational Safety and Health standard of 15 mg/M^3 for total nuisance dust concentrations was exceeded at most work stations (see Table I).

3. The concentrations of airborne fibrous material greater than 5 micrometers in length were found to be less than 3 fibers per milliliter. One of the five samples evaluated for fiber concentration indicated a level in excess of the 2 fibers/ml standard intended for use by 1976.

4. The exposures of batch floor operators to siliceous dust were found to be within acceptable limits based on the determination of free silica content of the dust (see Table II).

5. A single short-term sample collected during a welding operation indicated concentrations of iron oxide of 16.2 mg/M^3 and total dust of 40.0 mg/M^3. Although these results may not be representative of the workers' 8-hour time-weighted average exposure, they do indicate a need for control of dusts and fumes generated by welding.

6. Comparison of heat stress measurements made at the SID cylinder area with the current proposed ACGIH threshold limit value (WBGT index) indicates that a 25% work - 75% rest regiment is appropriate for the light work loads which characterize this area.

7. The exhaust fan on the number 4 pre-hardner ventilation hood was not working allowing hot gases and mist to escape into the adjacent work area. It was understood that the lubricant used for the shaft periodically dries out or degrades causing the shaft to "freeze." A lubricant which is compatible with the gases and mists evolved by this operation should be used.

Very truly yours,

Russel L. Witzke
Industrial Hygienist

RLW/c

TABLE 1

GEORGE D. CLAYTON & ASSOCIATES

OWENS-CORNING FIBERGLAS INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant Berlin, New Jersey Material Total Dust

1972 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration Total Dust mg/M^3		
		BATCH FLOOR							
9-14	30175A	Hydro-Pulper Operator	10:25	11:48	2.5	206	12.1		
9-14	30166A	Asbestos Tanks Operator	10:27	11:48	3.0	205	14.6		
9-14	30163A	Batch Mix - Operator for Filter Presses	10:30	12:02	2.9	174	16.7		
		FILTER PRESSES							
9-14	30176A	Filter Press No.2 Operator	13:14	15:10	3.3	282	11.7		
9-14	30167A	Filter Press No.3 Operator	10:34	11:50	2.5	197	12.7		
9-14	30180A	Stripper for Filter Presses	13:18	15:12	8.9	287	31.0		
		Pour Line No.1							
9-14	26362AA	Stripper	13:18	14:08	2.1	121	7.4		
		Pour Line No. 2							
9-14	30161A	HiLow Driver Line Service	10:40	11:52	4.0	174	23.0		
9-14	30165A	Stripper	10:38	11:53	10.8	180	60.0		
9-14	30172A	Feeder	10:42	11:52	11.2	174	64.4		
9-14	30179A	Unloader	13:21	15:13	2.7	272	9.9		
		Acceptable limit for 8-hour time-weighted average exposure (OSHA)					15		

TABLE 10

GEORGE D. CLAYTON & ASSOCIATES

OWENS-CORNING FIBERGLAS INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant Berlin, New Jersey Material Total Dust

1972 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration Total Dust mg/M3		
9-14	30174A	Pole 6' off Floor General area Pour Line #2	10:44	11:54	2.4	170	14.1		
		Finish Line #2 - MPC							
9-14	30160A	MPC - B Saw Feeder	13:24	15:17	2.9	274	10.6		
9-14	30148A	MPC - Packer	10:45	11:56	0.4	182	2.2		
		Flatware Finish Line #1							
9-14	30170A	Feeder	10:28	11:50	3.9	184	21.2		
9-14	30173A	Packer	10:29	11:51	3.4	208	16.3		
9-14	30168A	Packer	10:29	11:51	3.3	198	16.7		
		Finish Line #3							
9-14	30169A	Line Feeder	10:34	11:53	3.1	138	22.5		
9-14	30164A	Packer	10:37	11:55	3.2	152	21.1		
9-14	30146A	Packer	10:39	11:55	5.2	168	31.0		
		Acceptable limit for 8-hour time-weighted average exposure (OSHA)					15		

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TABLE

GEORGE D. CLAYTON & ASSOCIATES

OWENS-CORNING FIBERGLAS INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant Berlin, New Jersey — Material Total Dust / Iron Oxide

1972 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration Total Dust MG/M^3	Concentration Iron Oxide MG/M^3	
		Finish Line #4							
9-14	30171A	Packer	10:43	11:55	2.9	180	16.1	—	
		Between SID #8 & Pre-Hardner							
9-14	30182A	General Area	13:47	15:50	7.6	1830	4.2	—	
9-14	26369AA	Maintenance Shop - Welder	13:29	13:35	0.4	10	40	16.2	
		Acceptable limit for 8-hour time-weighted average exposure (OSHA)					15	10	

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TABLE I

GEORGE D. CLAYTON & ASSOCIATES

OWENS-CORNING FIBERGLAS INDUSTRIAL HYGIENE SAMPLING SUMMARY

Plant Berlin, New Jersey — Material Fiber Sizing* Silica

1972 Date	Sample No.	Description	Sampling Period Start	Sampling Period Stop	Sample Weight mg	Sample Volume liters	Concentration Total* Fibers per ml	Concentration Fibers >5 μm per ml	Concentration SiO_2 %
9-14	26367AA	Batch Floor-Operator's Desk	13:12	13:50	—	71	0.45	0.45	—
9-14	26365AA	Pour Line #2, Stripping	13:15	14:05	—	108	2.6	2.2	—
9-14	26362AA	Pour Line #1, Stripping	13:18	14:08	—	121	3.0	1.6	—
9-14	26360AA	Flatware Finish Line #1	13:22	14:06	—	66	0.85	0.72	—
9-14	26368AA	Finish Line #3, Packing	13:25	14:07	—	96	0.32	0.27	—
						OSHA Limit Value		5	
		* Fibrous material consisted of both glass fiber and asbestos, no attempt was made to distinguish between the various fiber particles.							
		BATCH FLOOR							
9-14	27089NP	Hydro-Pulper	10:52	15:05	2.6	4080	0.6		<1.0
9-14	27083NP	Asbestos Mix Tanks	10:55	15:11	11.2	2580	4.3		<1.0
		Acceptable limit for 8-hour time-weighted average exposure (OSHA)					15		

GDC-19

TABLE I

GEORGE D. CLAYTON & ASSOCIATES
HEAT STRESS SURVEY SUMMARY

Plant: OWENS-CORNING FIBERGLAS, Berlin, New Jersey

Area Surveyed: SID Pre-Hardner

1972 Date	Time	Description	Air Temp. °F	Wet Bulb Temp. °F	Black Globe Temp. °F	Air Velocity (FPM)	WBGT Index	ACGIH Proposed Max. Values: Work Load	ACGIH Proposed Max. Values: Work-Rest Regimen
9-14	15:15	10ft. North of SID #11	99	82	102	70	88	Light	50% work 50% rest
9-14	15:47	Between Pre-Hardners & SID 8 & 9	105	84	108	80	91	Light	25% work* 75% rest
9-14	16:17	Between SID 7 & 8, front side	117	94	125	40	103	Light	25% work* 75% rest

WBGT Index:

WBGT = 0.7WB + 0.2GT + 0.1DB

*Medical surveillance for any new employee until acclimatized to heat stress.

TABLE

GEORGE D. CLAYTON ASSOCIATES, INC.
NOISE SURVEY DATA SHEET

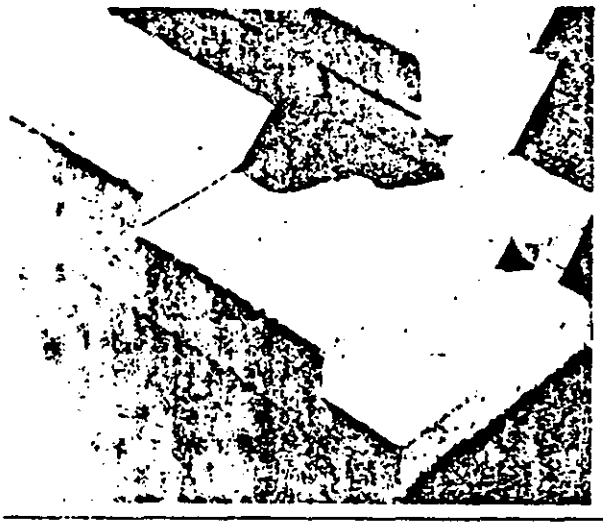
OWENS-CORNING FIBERGLAS
Plant Berlin, New Jersey Date 9-14-72 Study by RW

Area or Department SID & Pre-Hardners Instrument GR 1565A

Operating Conditions _____ Remarks _____

Test No.	Time	Location of Microphone	Weighting Network			Sound Pressure Level (dB) re 0.0002 Microbar — Octave-Band Frequency (Hertz)									
			A	C	Lin.	31.5	63	125	250	500	1000	2000	4000	8000	16000
1	14:58	Deck, Back of SID #9	90	92											
2	14:50	Between SID 12 & 11, Backside	91	93											
3	14:49	Front of SID #2	109	110											
4	14:59	Between SID #12 & Pre-Hardner	95	96											
12	15:20	40ft. West of SID #16	95	95											
13	15:22	Front of SID #16	102	102											
5	14:59	50ft. North of Pre-Hardner	87	93											
6	15:00	Pour Line #2, Stripping	84	92											
7	15:01	Pour Line #2, Pourer	83	94											
8	15:02	Pour Line #1, Pourer	86	92											
9	15:05	Pour Line #1, Stripping	89	92											
10	15:15	Filter Press #1	87	93											
11	15:22	20ft. East of Pour Line #1	88	92											
14	15:23	batch Floor - Mix Tank	82	90											

Kaylo Core Product & Application Data



uses

This product is designed for use as a rigid, insulating and fire-resistant structural core material for doors, panels and partitions. Wood, metal and plastic facing material can readily be laminated to it.

Sizes		Tol.
Length	36"	−0.+⅛"
Width	18"	−0.+⅛"
Thickness	1½" to 3" (increments of 1/16")	−0.+⅛"

description

Fiberglas* Kaylo* Core Material is a rigid structural hydrous calcium silicate insulating material produced in block or slab form. It is white and has a nominal density of 17 pcf, and a temperature range up to 1800F.

benefits

Inorganic material — Kaylo Core will not burn or rot. It is vermin-proof, and resists water and termites and is one of the most efficient structural mineral insulations.

Insulating value — At high mean temperatures its insulating values are equal to materials used only for insulation.

Dimensional stability — Dimensions of Kaylo Core change little with variances in moisture content. Linear shrinkage after heating for one hour in a muffle at 1800F is an average maximum of 0.72%.

Low moisture absorbtion — Kaylo Core absorption characteristics are similar to wood, except there is no warping due to moisture content as with wood. Flexural strength, when wet, is reduced only moderately.

Fire safety — Kaylo Core is completely non-combustible. It has a Flame Spread, Fuel Contributed and Smoke Developed rating of zero, as tested by Underwriters Laboratory Standards for Safety UL-727 which incorporates ASTM-E-84.

Good workability — Kaylo Core is responsive to woodworking tools. It can be sawed with hand or power saw. It can be routed, tongue and grooved, sanded. It can be run through most wood-working equipment, especially if heavy duty cutting edges are used.

*Trademark Registered Owens-Corning Fiberglas Corporation

EXHIBIT N

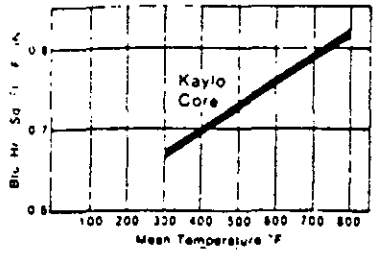
I.T.L. 4590

Performance characteristics

compressive strength:	Above 400 psi at 10% deformation ± 50 psi tolerance
flexural strength:	Above 157 psi, ± 25 psi
moisture content: (factory produced):	reading between 7% — 15% in a moisture detector such as "Delmhorst G-2". maximum 10% by weight
dimensional stability:	2.0% maximum linear shrinkage after heating for 24 hours in muffle at 1800F.
fire hazard classification:	Underwriters Laboratory ASTM-E 84

flame spread	0
fuel contributed	0
smoke developed	0

thermal conductivity:





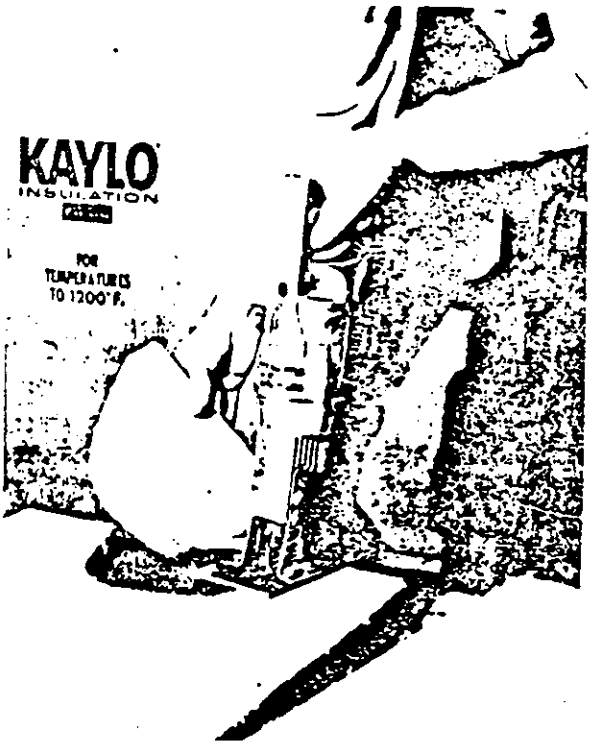
Kaylo Core is readily cut with portable power saw.



It can be processed with woodworking equipment.



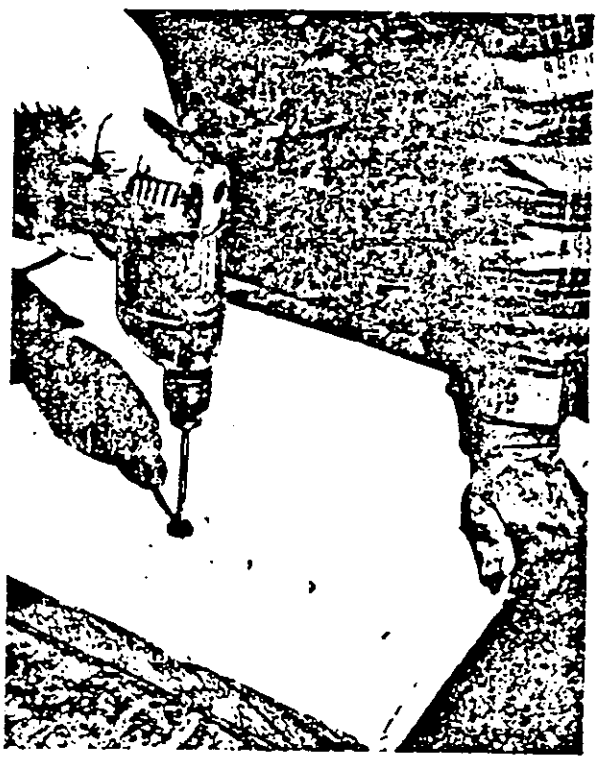
Cutting characteristics are similar to those of wood.



Cut-outs can be made with a sabre saw.



Cement-coated nails resist withdrawal best.



Drills easily with standard portable drill.

Fabrication

Lamination over Kaylo Core — Almost any face material may be bonded to Kaylo Core. Bonding agents can be selected to meet the requirements of the particular facing — also to satisfy the service requirements of the finished product — and still offer some choice in curing procedure.

All core pieces must be brought to close tolerance in thickness. If a bonded core unit is to be produced, the core unit may be sanded mechanically on both sides to bring all of the laminating surface to a plane. With individual pieces of core, they must be made plane to tolerances consistent with the type of face materials used and the specifications for planeness of the finished sandwich.

In laminates for which requirements for fire resistance are to be met, it is generally necessary to use tongue-and-groove construction for combustible or low-melting point faces. The depth need not exceed ¼ inch, but the width of the tongue should be relatively great, ⅜ inch or more. Such construction is intended to minimize transfer of heat through joints by radiation. Where it is important to minimize warping of the panel due to fire, the tongue-and-groove joints mentioned above provide a joining action between core pieces without disrupting the unity of the panel.

Treatment prior to Lamination — Kaylo Core Material is porous and slightly dusty. To obtain better adhesion, a primer is recommended. Several kinds of primer may be used, but they must be compatible with the slight alkalinity of Kaylo Core, and the molecular size of the primer must permit penetration of the solid phase into the pores of the core. Frequently, when solutions of large molecule materials are used as primers, the solvent penetrates the core, leaving the solid phase on the surface with little bond strength. One of the easiest primers to apply is a mixture of phenolic resin diluted with alcohol and water which may be sprayed or applied with a conventional glue spreader.

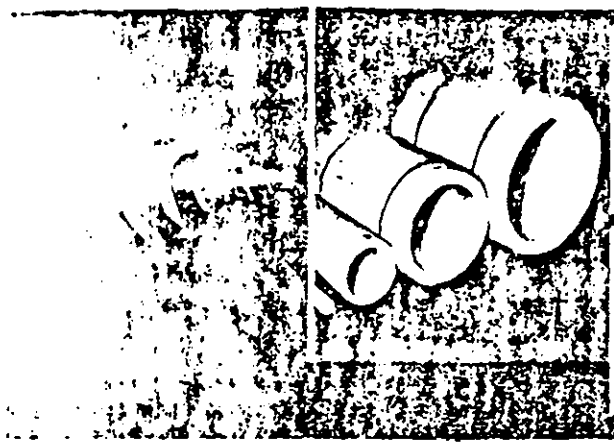
The face materials applied to the core usually require preparation to provide good bond in the laminate. Metals must be degreased and be clean at the time of laminating; wood must be smooth and not contain excess moisture. Plastic and cement products must be smooth and plane when pressed.

Adhesives — Kaylo Core may be bonded using most available adhesives, but like all laminates, it is advisable to choose an adhesive which will take advantage of the strengths of the components. The tensile strength of Kaylo Core Material is well in excess of 100 psi. Users of Kaylo Core will find it advantageous to work with their suppliers of adhesives and to specify the properties required.

OWENS-CORNING FIBERGLAS CORPORATION
Industrial and Commercial Construction Materials Division
Fiberglas Tower, Toledo, Ohio 43601

Pub No 1-IN-4380 Litho in U.S.A. August 1970

Pipe Insulation



Kaylo 10 STS Pipe Insulation

for hot stainless steel piping up to 1200 degree F.

The problem of stress corrosion cracking of stainless steel and subsequent pipe failure has been attributed to a combination of fabrication on pressure stresses, coupled with, or accelerated by, chlorides deposited on the pipe surface by water leaking through the weather proof finishes. Papers* written on this subject also indicate that the problem occurs in certain temperature range.

There is no proof that these soluble chlorides are the only cause of this phenomenon, but laboratory tests over extended periods of time indicate that cracking occurs much more readily when soluble chlorides are present. This is why Owens-Corning Fiberglas has developed Kaylo 10 STS Pipe Insulation using special inhibitors which will help slow down the reaction of the chlorides on stainless steel, reducing the hazard of stress corrosion cracking until the source of the leak or chlorides can be repaired. Please note that Kaylo 10 STS should not be used as a means of preventing stress corrosion cracking. It will not serve as a substitute for proper initial system design and proper maintenance.

*"Another Look At The Stress Corrosion Cracking Of Stainless Steel Under Thermal Insulation." W. G. Ashbaugh. Paper presented at 20th Anniversary Conference, National Association Of Corrosion Engineers, March, 1964, Chicago.

uses

Designed for use on hot Type 304 austenitic stainless steel process piping operating at temperatures up to 1200° F., indoors or out, when protected with a weather proof jacket.

description

Kaylo 10 STS Pipe Insulation is a rigid hydrous calcium silicate high temperature insulation. It contains special inhibitors which help retard the stress corrosion cracking of stainless steel resulting from chloride contamination. The insulation sections are gray in color with a 1" wide black longitudinal stripe on the outer surface.

benefits

lower operating costs—Kaylo 10 STS Pipe Insulation has good thermal efficiency. The low k factor of .40 at 200° F. mean temperature means lower operating cost, better temperature control for process operations.

rugged—Kaylo 10 STS Pipe Insulation is tough and rigid and will resist most mechanical abuse in shipping, handling and in service.

does not contribute to stress corrosion cracking—the Kaylo 10 STS material itself will not contribute to stress corrosion cracking of stainless steel because it contains an inhibitor, and has less than 200 ppm residual soluble chlorides. It will not crack when subjected to the 6 day Dana Stress Corrosion Cracking Test.

unaffected by moisture—Kaylo can be completely saturated in water without appreciable loss of strength and regains its strength and thermal value after drying out. However, long periods of exposure to moisture may reduce the effectiveness of the inhibitors.

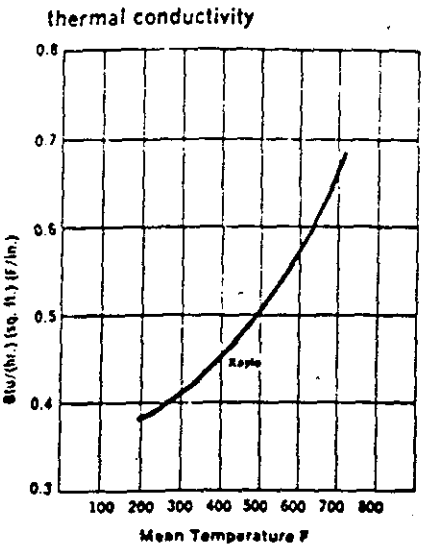
clean, neat installation—Kaylo cuts cleanly leaving a sharp square edge for neater appearance on fittings.

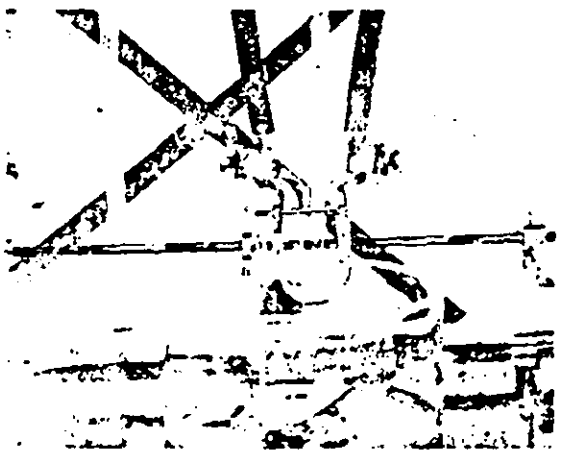
variety of jackets—a variety of factory-applied jackets allows a selection of product for indoor finished appearance or for weatherproofing insulation on outdoor lines. Proper attention should be paid to the selection of accessory materials such as cements, adhesives, etc., to avoid chloride contamination from these sources.

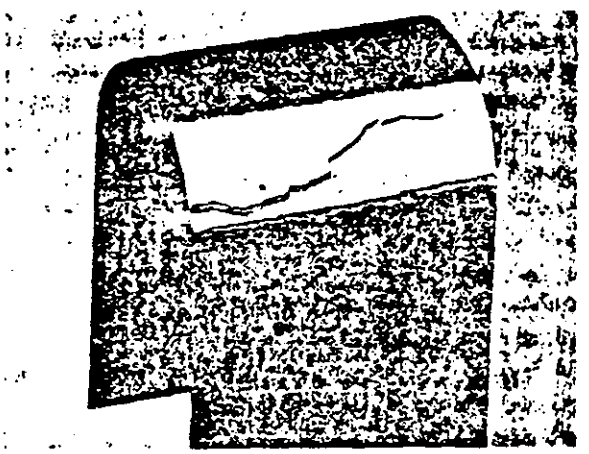
nesting sizes—Kaylo 10 STS Pipe Insulations are manufactured to Simplified Dimensional Standards to permit nesting sizes for double layer applications. Material for double layer application is nested and shipped in matched sections.

performance characteristics

density approximately	11 pcf.
modulus of rupture (ASTM C-446 64)	55 psi.
compressive strength (ASTM C-165) at 5% deformation.	50 psi.
alkalinity	ph 10
corrosion resistance	does not contribute to or accelerate corrosion of steel, aluminum or stainless steel.
specific heat	0.22 btu/lb. F.
stress corrosion	stainless steel will not crack when subjected to 6 day Dana Stress Corrosion Cracking Test.







Five year testing and research led to the development of Kaylo STS insulation for use on stainless steel. Test specimens of type 304 austenitic stainless steel were bent in a U shape and continually stressed by a bolt and nut holding the legs of the U in tension. Test specimens were cradled in a block of insulation partially submersed in deionized water. The steel was heated to 100 C. The insulation acted as a wick and as the water passed through it, picked up soluble chlorides and concentrated them on to the hot steel surface with the cracking phenomenon shown at the right. Many insulation formulations were tested before Kaylo STS was developed. No stress corrosion cracking was evident after 16 months of testing.

sizes

thickness—Kaylo Pipe Insulation is available in single or double layer thicknesses from 1" to 3" depending upon pipe size.

pipe sizes—Kaylo Pipe Insulation sections are smooth, uniform and precision molded to fit iron pipe sizes from ¼" to 30" in diameter.

forms—Kaylo Pipe Insulation is available in sectional or multi-segmental form depending upon pipe size. All insulation is furnished in nominal 3 ft. sections.

specification compliance

HH-I-523c—Insulation Block and Pipe Covering Thermal (Calcium Silicate for Temperatures up to 1200F). Type II, Class A (Grade A).

HH-I-2781D (Int. Amend. 1)—Insulation Pipe Covering, Thermal: Grade I, Class b; Grade II, Class c; Grade III, Class e, Type One.

MIL-I-24244 (Ships)—Insulation Materials, Thermal, with Special Corrosion and Chloride Requirements, Type 1A, 1C.

jackets

Kaylo 10 STS Pipe Insulation is shipped without jacket. Bands are available for use with this product at slight additional charge and will be furnished upon request.

canvas—8 oz. canvas jacket is available for all types, sizes and thicknesses of Kaylo Pipe Insulation at an additional charge. This jacket is factory applied on Sectional Pipe Insulation. On multi-segmental forms, it is furnished but not adhered.

Kaylo Klad—Kaylo is also available with an embossed aluminum jacket .016" thick or .010" thick stainless steel jacket. These jackets provide greater resistance to mechanical damage and present a neat finished appearance to pipe lines. The longitudinal seam has a self-locking joint. Butt sealing strips with integral mastic and protective Kra.t cover are furnished for sealing end joints.

economic thickness* — KAYLO 10 STS pipe insulation

Selection of insulation thicknesses for any specific application should take into consideration the following important criteria: 1. Cost of insulation applied. 2. Cost of heat energy. 3. Cost of capital. 4. Cost of depreciation — plant and insulation. 5. Capital investment in heat production equipment. 6. Temperature differential. 7. Size of the pipe or surface. 8. Conductivity of insulation.

for hot piping, the tabulated thicknesses are optimum thicknesses calculated on an "Economic"* basis for heat conservation under average operating conditions and assures adequate temperature control. Special conditions may warrant the use of other thicknesses.

*From "How to Determine Economic Thickness of Insulation"—National Insulation Manufacturers Association.

table key

ET — economic thickness
ST — surface temperature
HL — heat loss...Btu/hr/lineal foot

power & utility piping to 1200F—(80F ambient still air)

PIPE TEMP.		200			400			600			800			1000			1200		
TEMP. DIFF.		120			320			520			720			920			1120		
IPS	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST
½	1	17	94	1	48	119	1½	71	121	1½	108	143	2	139	145	2½	168	139
¾	1	20	97	1	57	127	1½	81	127	2	109	131	2	157	153	2½	187	145
1	1	21	94	1	60	120	1½	88	126	2	118	130	2½	153	134	3	196	140
1¼	1	27	98	1	76	131	1½	98	126	2	139	138	2½	177	142	3	224	148
1½	1	28	96	1	78	125	1½	111	132	2½	124	118	2½	178	134	3	227	141
2	1	32	97	1½	72	110	1½	126	133	2½	147	125	2½	210	144	3	265	151
2½	1	37	97	1½	73	106	2	113	114	2½	156	122	3	206	130	3½	262	137
3	1	44	98	1½	94	113	2	140	123	2½	189	131	3	244	139	3½	306	146
3½	1	44	94	1½	98	109	2	143	119	3	175	118	3½	232	126	4	298	134
4	1	52	98	1½	113	114	2½	145	115	3	197	123	3½	259	131	4	330	140
4½	1	49	95	1½	111	110	2½	145	111	3	202	120	3½	265	128	4	335	135
5	1	63	99	1½	135	116	2½	167	116	3	229	125	3½	298	134	4	371	142
6	1	77	101	2	128	108	2½	194	118	3	263	128	3½	333	135	4½	396	138
7	1½	62	93	2	143	108	2½	215	119	3	283	127	3½	370	137	4½	434	139
8	1½	60	94	2	157	109	2½	228	118	3½	282	121	4	370	131	4½	472	141
9	1½	75	94	2	164	107	2½	249	118	3½	306	122	4	400	132	5	476	135
10	1½	80	93	2	184	108	3	245	114	3½	336	124	4	439	134	5	519	138
11	1½	87	94	2	198	109	3	264	114	3½	362	124	4	472	135	5	556	139
12	1½	93	93	2	216	110	3	282	115	4	351	119	4½	462	129	5	590	140
14	1½	111	95	2½	206	105	3	314	117	4	386	121	4½	506	131	5½	611	137
16	1½	126	95	2½	232	106	3	353	117	4	431	122	4½	564	133	5½	677	138
18	1½	140	96	2½	257	106	3	391	118	4	475	123	4½	620	134	5½	742	140
20	1½	154	96	2½	282	106	3	428	118	4	518	123	4½	676	134	5½	807	144
24	1½	183	96	2½	332	107	3½	441	113	4½	549	119	5	723	130	6	860	136

process piping to 1200F—(80F ambient still air)

PIPE TEMP.		200			400			600			800			1000			1200		
TEMP. DIFF.		120			320			520			720			920			1120		
IPS	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST
½	1	17	94	1	48	119	1	85	149	1	129	185	1	184	229	1½	211	203
¾	1	20	97	1	57	127	1	101	162	1	153	204	1	217	256	1½	242	221
1	1	21	94	1	60	120	1	106	150	1	161	187	1½	193	180	1½	263	216
1¼	1	27	98	1	76	131	1	133	169	1	203	215	1½	214	180	1½	293	217
1½	1	28	96	1	78	125	1	136	159	1½	169	159	1½	241	192	1½	329	233
2	1	32	97	1	91	127	1	159	162	1½	193	161	1½	275	195	2	321	193
2½	1	37	97	1	104	128	1½	144	125	1½	198	149	2	248	156	2	340	184
3	1	44	98	1	124	132	1½	166	138	1½	253	169	2	306	173	2½	370	180
3½	1	44	94	1	116	121	1½	166	131	1½	254	157	2	313	164	2½	382	172
4	1	52	98	1	146	131	1½	200	141	2	255	149	2	364	178	2½	436	185
4½	1	49	95	1	138	122	1½	196	133	2	256	142	2	365	168	2½	437	174
5	1	63	99	1	177	134	1½	238	144	2	301	153	2	429	183	2½	501	188
6	1	77	101	1½	161	119	1½	284	148	2	346	155	2	493	187	2½	582	195
7	1½	62	93	1½	175	118	1½	309	147	2	386	156	2½	470	166	2½	644	197
8	1½	60	94	1½	194	118	1½	342	148	2	423	157	2½	500	163	3	608	174
9	1½	75	94	1½	212	116	1½	372	148	2	443	153	2½	544	164	3	659	175
10	1½	80	93	1½	226	117	2	321	130	2½	422	141	2½	602	167	3½	661	166
11	1½	87	94	1½	246	118	2	350	131	2½	462	143	2½	660	170	3½	711	167
12	1½	93	93	1½	262	118	2	382	132	2½	494	144	2½	706	171	3½	758	168
14	1½	111	95	1½	311	123	2	434	136	2½	556	148	2½	793	177	3½	839	173
16	1½	126	95	1½	354	123	2	492	137	2½	627	150	2½	894	179	3½	940	175
18	1½	140	96	1½	394	124	2	546	138	2½	694	150	3	855	163	3½	1036	177
20	1½	154	96	1½	434	124	2	600	138	2½	761	151	3	936	164	3½	1133	178
24	1½	183	96	1½	514	124	2	708	139	2½	896	152	3	1098	165	3½	1325	180

*calculated

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OWENS-CORNING FIBERGLAS CORPORATION
Industrial and Commercial Construction Materials Division
717 Fifth Avenue, New York, New York 10022 • General Offices, Toledo, Ohio 43601

Equipment Insulation



Kaylo 10 STS Block Insulation

rigid calcium silicate insulations for all types of stainless steel heated equipment operating at temperatures up to 1200°F.

The problem of stress corrosion cracking of stainless steel and subsequent equipment failure has been attributed to a combination of fabrication or pressure stresses, coupled with, or accelerated by, chlorides carried to the vessel surface by water leaking through the weather proof finishes. Papers written on this subject also indicated that the problem occurs in a certain temperature range.*

There is no proof that these soluble chlorides are the only cause of this phenomenon, but laboratory tests over extended periods of time indicate that cracking occurs much more readily when soluble chlorides are present. This is why Owens-Corning Fiberglas has developed Kaylo 10 STS Block Insulation using special inhibitors which will help slow down the reaction of the chlorides on stainless steel, reducing the hazard of stress corrosion cracking until the source of the leak or chlorides can be repaired. Please note that Kaylo 10 STS Block Insulation should not be used as a means of preventing stress corrosion cracking. *It will not serve as a substitute for proper initial system design and proper maintenance.*

*"Another Look At The Stress Corrosion Cracking Of Stainless Steel Under Thermal Insulation." W. G. Ashbaugh. Paper presented at 20th Anniversary Conference, National Association of Corrosion Engineers, March, 1964, Chicago.

uses

Kaylo 10 STS Block Insulation is for use on hot Type 304 austenitic stainless steel indoor or outdoor equipment operating at temperatures up to 1200°F. Kaylo 10 STS Block Insulation is ideally suited for use on stainless steel vessels and equipment as it helps inhibit stress corrosion cracking.

description

Kaylo 10 STS Block Insulation is a gray rigid hydrous calcium silicate high temperature equipment insulation. It contains special inhibitors which help retard the stress corrosion cracking of stainless steel resulting from chloride contamination. The insulation blocks are marked with a 1" wide black stripe across the 18" width in the center of the block.

benefits

lower operating costs—Kaylo 10 STS Block Insulation has good thermal efficiency. The low k factor of .40, (at 200°F. mean temperature,) means lower operating cost, better temperature control for process operations.

rugged—Kaylo 10 STS Block Insulation is tough and rigid and will resist most mechanical abuse in shipping, handling and in service.

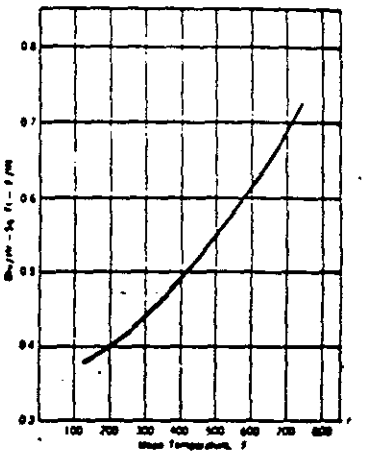
does not contribute to stress corrosion cracking—Kaylo 10 STS material itself will not contribute to stress corrosion cracking of stainless steel because it contains an inhibitor, and has less than 200 ppm residual soluble chlorides. It will not crack when subjected to the 6 day Dana Stress Corrosion Cracking Test.

unaffected by moisture—Kaylo can be completely saturated in water without appreciable loss of strength and regains its strength and thermal value after drying out. However, long periods of exposure to moisture may reduce the effectiveness of the inhibitors.

clean, neat installation—Kaylo cuts cleanly leaving a sharp square edge for a neat appearance.

performance characteristics

density: approximately	11 pcf.
flexural strength: (ASTM C-203)	50 psi.
compressive strength: (ASTM C-165) at 5% deformation	80 psi.
thermal conductivity: 0.40 at 200 F mean temp.	
alkalinity:	ph 10
shrinkage (24 hrs. at 1200 F)	
% Loss in weight	10
% Linear shrinkage (max.)	1.6
weight loss by tumbling	
% Loss in weight after 10 min. (max.)	20
% Loss in weight after 20 min. (max.)	45
specific heat	0.22 btu/lb. F
stress corrosion: (1500 ppm chloride method)	stainless steel will not crack when subjected to 6 day Dana Stress Corrosion Cracking Test



heat transfer data* — Kaylo 10 STS to 1200°F — ambient still temperature 80°F.

Operating Temp.	500°F.		600°F.		700°F.		800°F.		900°F.		1000°F.		1100°F.		1200°F.	
Thickness: Chemical Process	1½		1½		2		2½		3		3½		4		4½	
	HEAT LOSS	SURF TEMP	HEAT LOSS	SURF TEMP	HEAT LOSS	SURF TEMP	HEAT LOSS	SURF TEMP	HEAT LOSS	SURF TEMP	HEAT LOSS	SURF TEMP	HEAT LOSS	SURF TEMP	HEAT LOSS	SURF TEMP
2	83	131	108	146												
2½	68	121	88	134	111	148										
3	57	115	75	125	94	137	115	150								
3½	49	110	65	119	81	130	100	141	120	153						
4	44	107	57	115	72	124	88	134	106	145	126	157				
4½	39	104	51	111	64	119	78	128	95	138	113	149				
5	35	102	46	108	58	115	71	123	86	132	102	142	120	153		
5½	32	100	42	106	53	112	65	119	78	128	93	137	109	147	127	158
6	30	98	39	104	48	110	59	116	72	124	85	132	100	141	117	151

*calculated

sizes

Thickness—1", 1½", 2", 2½", 3", 3½" and 4"
width—3", 6", 12" and 18"
length—18" to 36"
form—block

specification compliance

HH-I-523c Insulation Block and Pipe Covering, Thermal, (Calcium Silicate for temperatures up to 1200°F). Type 1.

MIL-I-2817 E Insulation Block, Thermal. Class 1 & 2.

MIL-I-24244 (ships) Insulating Materials, Thermal, with Special Corrosion and Chloride Requirements, Type 3A, 3B.

ASTM C533-67.

application recommendations

Kaylo 10 STS Block Insulations are held in place by mechanically fastening with bands, welded rods or studs. The insulation may be finished with a trowel coat of insulating cement, canvassed and painted. Outdoor installations require weatherproofing with mastics or metal jacketing. Proper attention should be paid to the selection of accessory materials such as cements, adhesives, etc, to avoid chloride contamination from these sources.

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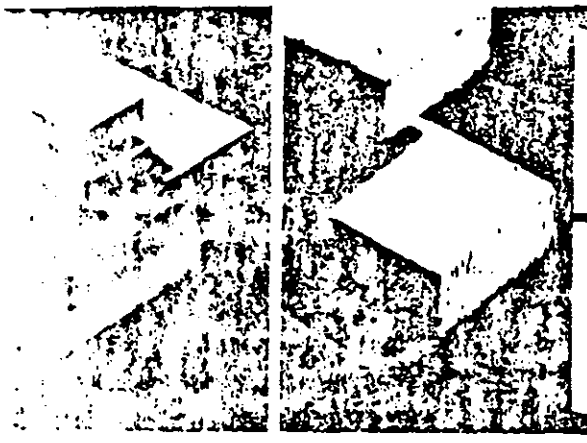
July 1968 — Litho in U.S.

Equipment Insulation



Kaylo & Kaylo 20 Block Insulation

rigid calcium silicate insulations for all types of heated equipment operating at temperatures up to 1800F.

uses

Kaylo® Block is for use on indoor or outdoor equipment operating at temperatures up to 1200F. Kaylo block is especially suited for use on stainless steel vessels and equipment as it helps inhibit stress corrosion cracking. Typical applications are for boilers, breeching, tanks, vessels. Kaylo Block is gray in color.

Kaylo 20 with its high temperature limit of 1800F extends its use to include refractory wall backing for furnaces and ovens and fireproofing of equipment and vessel skirts.

description

Kaylo and Kaylo 20 Block Insulations are rigid hydrous calcium silicate heat insulations reinforced with asbestos fibers. They are strong, efficient and are highly resistant to abrasion and moisture damage. Kaylo 20 has a slightly pink color to distinguish it from Kaylo.

benefits

high thermal efficiency—both Kaylo and Kaylo 20 offer excellent thermal efficiency coupled with high strength. A low k of .40 for Kaylo and .52 for Kaylo 20 at 200F mean temperature proves that Kaylo will provide significant savings in operating costs over the life of the equipment.

resistant to abuse—resists mechanical damage because of hard, tough, reinforced structure.

strong—less breakage in shipment and handling. High temperatures have little effect on strength characteristics.

will not cause stress corrosion cracking—Kaylo will not cause stress corrosion cracking of stainless steel because Kaylo contains less than 200 ppm water soluble chlorides as well as an inhibitor which neutralizes trace quantities of chlorides from the atmosphere or other sources from causing cracking and possible failure of piping and equipment.

resistant to moisture damage—unlike many other insulations, Kaylo is not affected appreciably from moisture damage. It regains thermal efficiency and strength after drying out. Outdoor installations must be weatherproofed, however, for long continuous service.

dimensionally stable—Kaylo does not shrink appreciably in service, even at elevated temperatures. This means less heat leakage at the joints. And Kaylo will not warp or crack in service.

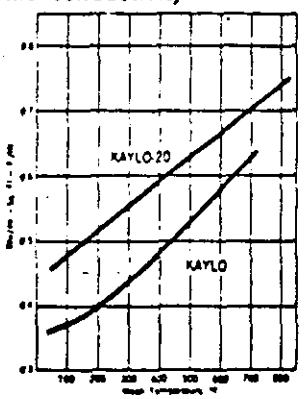
fabricates easily—ordinary insulators tools are all that is required to fabricate Kaylo. It cuts with a clean true edge for tighter fit at the joints. Fittings are neater, faster

Kaylo is a registered trademark (Reg. U.S. Pat. Off.) of Owens-Corning Fiberglas Corp.

performance characteristics

	KAYLO	KAYLO 20
density:	11 pcf approx.	12 pcf. approx.
flexural strength: (ASTM C-203)	over 50 lb/sq. in.	90 lb/sq. in.
compressive strength: (ASTM C-165) at 5% deformation	125 psi	130 psi
resistance to abrasion: (conventional temperature test — loss in weight before heating)	after 10 minutes 10% after 20 minutes 20%	
dimensional stability:	linear shrinkage after heating for 24 hours in muffle at 1200 F.—1.4%	
alkalinity:	ph 10	

thermal conductivity



economic thickness*

Selection of insulation thicknesses for any specific application should take into consideration the following important criteria. 1. Cost of insulation applied. 2. Cost of heat energy. 3. Cost of capital. 4. Cost of depreciation—plant and insulation. 5. Capital investment in heat production equipment. 6. Temperature differential. 7. Size of the pipe or surface. 8. Conductivity of insulation.

for hot piping, the tabulated thicknesses are optimum thicknesses calculated on an "Economic"* basis for heat conservation under average operating conditions and assure adequate temperature control. Other conditions may warrant the use of other thicknesses.

**From "How to Determine Economic Thickness of Insulation"— National Insulation Manufacturers Association.*

economic thickness — Kaylo block to 1200 F — ambient still air 80 F

ET—economic thickness HL—heat loss
ST—surface temperature Btu/hr/lin/foot

THICK	200 F		300 F		400 F		500 F		600 F		700 F		800 F		900 F		1000 F		1100 F		1200 F	
	HEAT LOSS	SURF. TEMP.	HEAT LOSS	SURF. TEMP.	HEAT LOSS	SURF. TEMP.	HEAT LOSS	SURF. TEMP.	HEAT LOSS	SURF. TEMP.	HEAT LOSS	SURF. TEMP.	HEAT LOSS	SURF. TEMP.	HEAT LOSS	SURF. TEMP.	HEAT LOSS	SURF. TEMP.	HEAT LOSS	SURF. TEMP.	HEAT LOSS	SURF. TEMP.
1.000	38	103	72	124	109	147																
1.500	27	96	51	111	78	127	107	145														
2.000	21	93	40	104	60	117	83	130	107	145												
2.500	17	90	33	100	49	110	68	121	87	133	109	146										
3.000	14	89	28	97	42	105	57	115	74	125	92	136	112	148								
3.500	13	88	24	95	36	102	49	110	64	119	80	129	97	139	116	150						
4.000	11	87	21	93	32	99	44	107	56	114	70	123	85	132	102	142	120	153				
4.500	10	86	19	91	28	97	39	104	50	111	63	118	76	127	91	136	107	145	125	156		
5.000	9	85	17	90	26	96	35	101	46	108	57	115	69	122	82	130	97	139	113	149	130	159
5.500	8	85	16	89	23	94	32	100	42	105	52	112	63	118	75	126	88	134	103	143	118	152
6.000	7	85	14	89	22	93	30	98	38	103	48	109	58	115	69	122	81	130	94	138	109	146

*calculated

Kaylo 20 Block to 1800 F — ambient still air 80 F

Operating Temp. F	Power			Process		
	ET	HL	ST	ET	HL	ST
1300	7½	111	136	6	135	148
1400	8	117	139	6½	143	152
1500	8	123	142	7	151	155
1600	8½	129	145	7	158	159
1700	9	135	148	7½	165	163
1800	9½	141	151	7½	172	166

specification compliance

FHA-1-523c Insulation Block, Pipe Covering, Thermal, (Calcium Silicate for temperatures up to 1200°F), Type 1.

MIL-I-2819E Insulation Block, Thermal, Class 1, 2, and 3. ASTM C533-67.

MIL-I-24244 (ships) Insulating Materials, Thermal, with Special Corrosion and Chloride Requirements (Kaylo only), Type CA, 3B.

sizes

thickness—1", 1½", 2", 2½", 3", 3½" and 4"
width—3", 6", 12" and 18"
length—18" to 36"
form—Block

beveled lags

For pipe sizes greater than those for which Kaylo and Kaylo 20 Insulation sizes are available, Kaylo and Kaylo 20 beveled lags may be used to insulate piping. Lags beveled to fit pipes from 18" to 36" in diameter are available in thickness of 1½", 2", 2½", 3". Lags are 36" long and 3" wide.

application recommendations

Kaylo and Kaylo 20 Block Insulations are held in place by mechanically fastening with bands, welded rods or studs. The insulation may be finished with a trowel coat of insulating cement, canvassed and painted. Outdoor installations require weatherproofing with mastics or metal jacketing.

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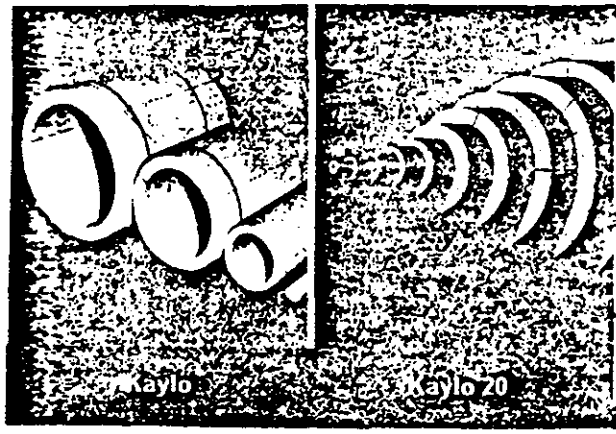
OWENS-CORNING FIBERGLAS

Pipe Insulation



Kaylo & Kaylo 20 Pipe Insulations

rigid hydrous calcium silicate pipe insulations for heated piping up to 1800F.

uses

Standard Kaylo is recommended for use on heated piping operating up to 1200F and Kaylo 20 extends the temperature range to 1800F. These thoroughly field-tested insulations have the physical properties most desirable for efficient, durable work for indoor and outdoor, power and process piping. A variety of jackets are available for surface finish and weatherproofing.

description

Kaylo* & Kaylo 20* pipe insulations are rigid hydrous calcium silicate heat insulations for use on all heated piping up to 1800F — indoors and outdoors. The products are precision molded in sections or segments from a chemically reacted material. A small amount of asbestos fiber is added to improve mechanical strength. Kaylo is gray. Kaylo 20 has a slight pinkish color to distinguish it from Kaylo.

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benefits

lower operating costs — Kaylo Insulations have exceptional thermal efficiency. The low k factor of .40 at 200 mean temperature means lower operating cost, better temperature control for process operations.

rugged — Kaylo Pipe Insulations are strong and rigid to resist mechanical abuse in shipping, handling and in service

versatile — Kaylo's extended temperature range covers a broad number of uses with one material. All heated piping requirements to 1800F and in sizes from ½" to 30" IPS can be met with Kaylo and Kaylo 20.

will not cause stress corrosion cracking — Kaylo will not cause stress corrosion cracking of stainless steel because Kaylo contains an inhibitor, and has less than 200 ppm soluble chlorides.

unaffected by moisture — Kaylo can be completely saturated in water without appreciable loss of strength and regains its strength and thermal value after drying out.

clean, neat installation — Kaylo cuts cleanly leaving a sharp square edge for neater appearance on fittings. Rigid manufacturing tolerances assure uniform, smooth, unbroken joints.

variety of jackets — A variety of factory-applied jackets allows a selection of product for indoor finished appearance or for weatherproofing insulation on outdoor lines.

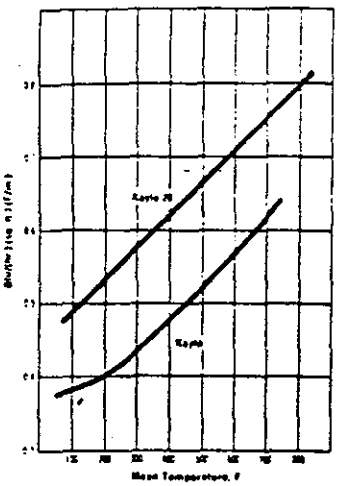
nesting sizes — Kaylo and Kaylo 20 Pipe Insulations are manufactured to Simplified Dimensional Standards to permit nesting sizes for double layer applications.

†Kaylo is a registered trademark (Reg. U.S. Pat. Off.) of Owens-Corning Fiberglas Corp.

performance characteristics

	Kaylo	Kaylo 20
density (approx.)	11 lb. pcf.	12 lb. pcf.
flexural strength (ASTM C-446)	75 lbs./sq. in.	90 lbs./sq. in.
compressive strength (ASTM C-165) at 5% deformation	125 psi	130 psi
resistance to abrasion (Conventional tumbling test-loss in weight before heating)	after 10 minutes, 20%	
	after 20 minutes, 40%	
alkalinity	ph 10	ph 10
corrosion resistance	does not cause or accelerate corrosion of steel, aluminum, or stainless steel	
Specific heat	0.22 btu/lb. F	
dimensional stability linear shrinkage after heating for 24 hours in a muffle		
% length loss	1.6 (at 1200°F)	2.5 (at 1800°F)

thermal conductivity



sizes

thickness — Kaylo Pipe Insulation is available in single or double layer thicknesses from 1" to 3" depending upon pipe size. Kaylo Tube Insulation is available in single layer thicknesses of 1" and 1½".

pipe sizes — Kaylo Pipe Insulation is available to fit nominal pipe sizes from ½" to 39" in diameter. Kaylo Tube Insulation will fit nominal copper tubing sizes from ⅛" to 3" in diameter.

forms — Kaylo Pipe Insulation is available in sectional or multisegmental form depending upon pipe size. All insulation is furnished in 3 ft. sections.

jackets

canvas — Standard canvas & 8 oz. canvas jacket are available for all types, sizes and thicknesses of Kaylo Pipe and Tube Insulation at an additional charge. These jackets are factory applied on Sectional Pipe and Tube Insulation. On Multisegmental forms, they are furnished but not adhered. Bands are available for use with this product at slight additional charge and will be furnished on request.

Kaylo Klad — Kaylo is also available with an embossed aluminum jacket .016" thick or .010" thick stainless steel jacket. These jackets provide greater resistance to mechanical damage and present a neat finished appearance to pipe lines. The longitudinal seam has a self-locking joint. Butt sealing strips with integral mastic and protective asbestos cover are furnished for sealing end joints.

specification compliance

HH-I-523c — Insulation Block and Pipe Covering Thermal (Calcium Silicate for Temperatures up to 1200F). Type II, Class A through F.

MIL-I-2781D (Int. Amend. 1) — Insulation Pipe Covering, Thermal: Grade I, Class b; Grade II, Class d; Grade III, Class e, Type I and II.

MIL-I-24244 (Ships) — Insulation Materials, Thermal, with Special Corrosion and Chloride Requirements, Type 1A, 1C, 1D, 1E.

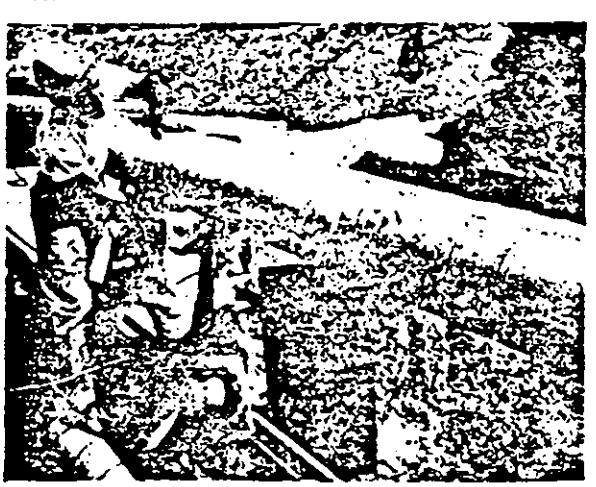
ASTM C533-67.

application recommendations

outdoor lines — Kaylo Pipe Insulations are mechanically fastened by wiring in place using 16 gauge wire on 9" centers and subsequently covered with a weatherproof jacket of metal or 45 lb. roofing felt. See Application Specifications for complete details.

indoor lines — Kaylo for indoor piping work is furnished with a factory-applied canvas jacket and held in place with bands or wire. The jacket has overlapping joint flaps that are smoothly pasted in place. Canvas should be sized to provide a base for painting.

fittings — Fitting are insulated with mitered segments of Kaylo wired in place and finished with a ¼" layer of insulating cement. Flanges and valves are insulated with oversized pipe insulation. They are finished off with canvas pasted in place for indoor lines or reinforced waterproof mastic for outdoor lines.



economic thickness

Selection of insulation thicknesses for any specific application should take into consideration the following important criteria. 1. Cost of insulation applied. 2. Cost of heat energy. 3. Cost of capital. 4. Cost of depreciation—plant and insulation. 5. Capital investment in heat production equipment. 6. Temperature differential. 7. Size of the pipe or surface. 8. Conductivity of insulation.

for hot piping, the tabulated thicknesses are optimum thicknesses calculated on an "Economic"* basis for heat conservation under average operating conditions and assures adequate temperature control. Special conditions may warrant the use of other thicknesses.

**From "How to Determine Economic Thickness of Insulation"—National Insulation Manufacturers Association.*

economic thickness*—kaylo pipe insulation—process piping (80F ambient still air)

PIPE TEMP.	200			400			600			800			1000			1200		
TEMP. DIFF.	120			320			520			720			920			1120		
IPS	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST
½	1	18	95	1	51	122	1	89	152	1	132	187	1	182	228	1½	202	198
¾	1	22	98	1	61	129	1	106	166	1	157	207	1	215	254	1½	232	215
1	1	23	95	1	64	123	1	111	154	1	165	190	1½	191	179	1½	252	211
1¼	1	29	99	1	81	143	1	140	173	1	207	218	1½	213	179	1½	281	211
1½	1	29	97	1	82	128	1	143	163	1½	173	161	1½	239	192	1½	315	227
2	1	34	98	1	96	130	1	167	166	1½	198	163	1½	273	194	2	308	188
2½	1	39	98	1	110	131	1½	136	128	1½	203	151	2	247	155	2	326	179
3	1	47	100	1	131	135	1½	174	141	1½	260	171	2	304	173	2½	355	176
3½	1	44	95	1	123	123	1½	175	133	1½	261	159	2	311	164	2½	366	168
4	1	55	99	1	155	134	1½	209	144	2	262	150	2	361	177	2½	418	181
4½	1	52	96	1	147	125	1½	206	135	2	262	143	2	363	168	2½	419	171
5	1	67	100	1	188	137	1½	250	147	2	308	154	2	426	183	2½	481	184
6	1	81	102	1½	171	121	1½	298	152	2	355	157	2	489	186	2½	558	190
7	1½	66	94	1½	187	120	1½	324	150	2	395	158	2½	467	165	2½	617	192
8	1½	73	95	1½	207	121	1½	359	151	2	434	159	2½	497	162	3	583	170
9	1½	80	95	1½	225	121	1½	391	151	2	454	155	2½	541	164	3	631	171
10	1½	85	94	1½	240	120	2	341	133	2½	433	143	2½	598	167	3½	633	162
11	1½	93	94	1½	262	121	2	368	133	2½	474	145	2½	656	170	3½	682	164
12	1½	99	94	1½	279	120	2	401	135	2½	507	146	2½	701	171	3½	727	165
14	1½	117	96	1½	331	125	2	456	139	2½	570	150	2½	787	177	3½	804	169
16	1½	134	96	1½	377	126	2	517	140	2½	643	151	2½	888	179	3½	901	171
18	1½	149	97	1½	419	126	2	574	141	2½	712	152	3	849	162	3½	993	173
20	1½	164	97	1½	462	127	2	630	141	2½	781	153	3	930	163	3½	1085	174
24	1½	194	97	1½	546	127	2	744	142	2½	919	154	3	1091	165	3½	1270	175

economic thickness—kaylo pipe insulation—power & utility piping (80F ambient still air)

PIPE TEMP.	200			400			600			800			1000			1200		
TEMP. DIFF.	120			320			520			720			920			1120		
IPS	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST
½	1	18	95	1	51	122	1½	74	123	1½	111	145	2	138	144	2½	161	136
¾	1	22	98	1	61	129	1½	85	130	2	112	132	2	156	153	2½	179	143
1	1	23	95	1	64	123	1½	93	128	2	122	131	2½	152	133	3	188	137
1¼	1	29	99	1	81	134	1½	103	128	2	143	140	2½	176	142	3	215	145
1½	1	29	97	1	82	128	1½	116	134	2½	128	119	2½	177	134	3	217	139
2	1	34	98	1½	76	112	1½	133	136	2½	151	126	2½	209	144	3	254	148
2½	1	39	98	1½	78	107	2	119	116	2½	161	123	3	205	129	3½	251	134
3	1	47	100	1½	100	115	2	147	125	2½	194	132	3	243	139	3½	293	143
3½	1	44	95	1½	101	111	2	151	121	3	180	119	3½	231	126	4	286	132
4	1	55	99	1½	121	117	2½	153	117	3	203	124	3½	257	131	4	316	137
4½	1	52	96	1½	118	112	2½	153	113	3	207	121	3½	264	128	4	321	133
5	1	67	100	1½	144	119	2½	176	118	3	235	126	3½	296	134	4	356	139
6	1	81	102	2	137	110	2½	205	120	3	270	129	3½	331	135	4½	356	129
7	1½	66	94	2	152	110	2½	226	121	3	291	128	3½	367	137	4½	416	137
8	1½	73	95	2	167	110	2½	241	120	3½	290	122	4	368	130	4½	452	139
9	1½	80	95	2	175	109	2½	262	121	3½	314	123	4	398	132	5	456	133
10	1½	85	94	2	196	110	3	258	115	3½	346	125	4	437	134	5	497	135
11	1½	93	94	2	212	111	3	278	116	3½	372	126	4	469	135	5	532	136
12	1½	99	94	2	231	112	3	297	116	4	360	120	4½	459	129	5	565	137
14	1½	117	96	2½	219	107	3	331	119	4	397	122	4½	503	131	5½	579	134
16	1½	134	96	2½	248	107	3	372	119	4	443	123	4½	561	132	5½	641	135
18	1½	149	97	2½	274	108	3	411	120	4	488	124	4½	617	133	5½	703	137
20	1½	164	97	2½	301	108	3	450	120	4	533	124	4½	672	134	5½	764	137
24	1½	194	97	2½	354	108	3½	464	115	4½	565	120	5	719	129	6	824	133

table key (ambient still air at 80F) ET—economic thickness HL—heat loss... Btu/hr/lineal foot

*calculated ST—surface temperature

economic thickness—kaylo 20 pipe insulation—power & utility piping

(80°F ambient still air)

Temp. / Pipe Size	1300			1400			1500			1600			1700			1800		
	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST
½	2½	221	152	2½	245	160	3	254	150	3	278	157	3	304	164	3½	313	156
¾	2½	243	156	3	252	148	3	278	155	3	305	162	3½	314	154	3½	342	161
1	2½	269	161	3	277	152	3	306	160	3½	316	152	3½	345	159	3½	375	166
1¼	3	279	149	3	310	157	3	342	165	3½	351	157	3½	384	164	3½	417	172
1½	3	284	153	3½	309	146	3½	362	160	3½	368	160	4	397	160	4	434	168
2	3	337	156	3½	347	150	3½	383	158	3½	421	165	4	432	159	4	469	166
2½	3	374	160	3½	385	154	3½	425	162	3½	466	170	4	476	163	4	518	171
3	3½	388	150	4	402	146	4	444	153	4½	458	150	4½	500	156	4½	545	163
3½	4	390	142	4	434	149	4	479	156	4½	494	152	4½	539	159	5	555	155
4	4	419	144	4	465	151	4½	481	148	4½	528	154	5	545	151	5	593	158
4½	4	446	145	4½	464	143	4½	512	150	5	530	147	5	579	153	5½	598	151
5	4½	445	138	4½	495	145	5	515	143	5	565	149	5½	585	147	5½	637	153
6	4½	502	141	5	523	140	5	578	146	5½	560	144	5½	655	150	6	678	149
7	4½	550	143	5	572	142	5	632	148	5½	655	147	6	679	146	6	738	151
8	5	560	137	5	622	143	5½	647	142	5½	710	149	6	735	148	6½	761	147
9	5	603	138	5½	630	138	5½	696	144	6	722	143	6	789	149	6½	817	149
10	5	653	140	5½	681	139	5½	752	146	6	779	145	6½	809	145	6½	880	150
11	5½	652	134	5½	724	140	6	754	140	6	829	146	6½	859	146	7	890	146
12	5½	693	135	5½	770	141	6	801	141	6½	834	141	6½	911	147	7	943	147
14	5½	742	136	6	776	137	6	857	143	6½	891	143	7	926	143	7	1007	148
16	6	772	132	6	858	138	6½	896	139	7	934	139	7	1020	144	7½	1058	145
18	6	844	133	6½	886	134	6½	978	140	7	1018	140	7½	1059	141	7½	1153	146
20	6	917	134	6½	960	135	6½	1060	141	7	1102	142	7½	1146	142	7½	1247	148
24	6	1060	136	6½	1108	137	7	1157	138	7½	1206	139	7½	1318	144	8	1366	145
30	6½	1195	133	7	1253	134	7½	1312	135	7½	1440	141	8	1497	142	8½	1555	143
36	6½	1620	142	7	1690	144	7½	1790	147	7½	1950	153	8	2050	155	8½	2150	158

ET—economic thickness HL—heat loss . . . Btu/hr/lineal foot ST—surface temperature

OWENS-CORNING FIBERGLAS CORPORATION
Industrial and Commercial Construction Materials Division, 717 Fifth Avenue, New York, New York 10022
General Offices, Toledo, Ohio 43601

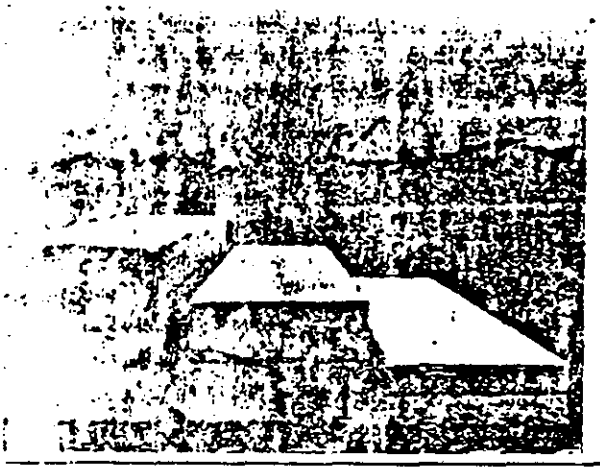
PUB NO 1-IN-4350

July 1968—Litho in USA

MIL-I-24244(Ships) Int Amend. 2, Type 3A & 3B
Mil-I-2819E Classes 1 & 2 Kaylo
20 MIL-I-2819E Class 3 Kaylo
164 009/64/1 Kaylo 10, 164.009/65/1 Kaylo 20
Marine D.12

Kaylo 10 & Kaylo 20 Block Insulation

rigid calcium silicate insulations for all types of heated equipment operating at temperatures up to 1800F.



uses

Kaylo 10* Block is for use on indoor or outdoor equipment operating at temperatures up to 1200F. Kaylo block is ideally suited for use on stainless steel vessels and equipment as it helps inhibit stress corrosion cracking. Typical applications are for boilers, breeching, tanks, vessels. Kaylo 10 Block is white in color.

Kaylo 20* with its high temperature limit of 1800F extends its use to include refractory wall backing for furnaces and boilers and fireproofing of equipment and vessel skirts.

description

Kaylo 10 and Kaylo 20 Block Insulations are rigid hydrous calcium silicate heat insulations reinforced with asbestos fibers. They are strong, efficient and are highly resistant to abrasion and moisture damage. Kaylo 20 has a slightly pink color to distinguish it from Kaylo 10.

benefits

high thermal efficiency—both Kaylo 10 and Kaylo 20 offer excellent thermal efficiency coupled with high strength. A low k of .40 for Kaylo 10 and .52 for Kaylo 20 at 200F mean temperature proves that Kaylo will provide significant savings in operating costs over the life of the equipment.

resistant to abuse—resists mechanical damage because of hard, tough, reinforced structure.

strength—less breakage in shipment and handling. High temperatures have little effect on strength characteristics.

will not cause stress corrosion cracking—Kaylo 10 will not cause stress corrosion cracking of stainless steel because Kaylo 10 contains less than 75 ppm soluble chlorides as well as an inhibitor which prevents trace quantities of chlorides from the atmosphere or other sources from causing cracking and possible failure of piping and equipment.

resistant to moisture damage—unlike many other insulations, Kaylo is not affected appreciably from moisture damage. It regains thermal efficiency and strength after drying out. Outdoor installations must be weatherproofed, however, for long continuous service.

dimensionally stable—Kaylo does not shrink appreciably in service, even at elevated temperatures. This means less heat leakage at the joints. And Kaylo will not warp or crack in service.

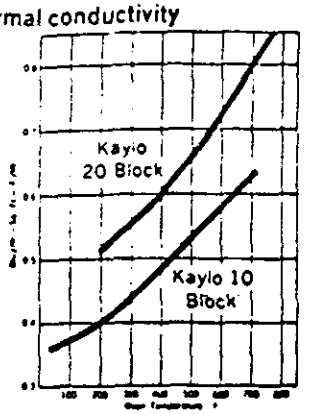
fabricates easily—ordinary insulators tools are all that is required to fabricate Kaylo. It cuts with a clean true edge for tighter fit at the joints. Fittings are neater, faster.

*Trademark Registered Owens-Corning Fiberglas Corporation

Performance characteristics

	KAYLO 10	KAYLO 20
density:	11 pcf approx.	12 pcf approx
flexural strength: (ASTM C-203)	60 psi average	65 lb./sq. in.
compressive strength: (ASTM C-165) at 5% deformation	115 psi	110 psi
resistance to abrasion: (ASTM C-421)	after 10 minutes, 20% max after 20 minutes, 45% max.	
dimensional stability: (ASTM C-356)	linear shrinkage after heating for 24 hours in muffle at 1200F.—1.4% (Kaylo 10) for 24 hours in muffle at 1800F.—2.0% (Kaylo 20)	
hardness: (ASTM C-569	.60	.70

thermal conductivity



economic thickness*

Selection of insulation thicknesses for any specific application should take into consideration the following important criteria. 1. Cost of insulation applied. 2. Cost of heat energy. 3. Cost of capital. 4. Cost of depreciation—plant and insulation. 5. Capital investment in heat production equipment. 6. Temperature differential. 7. Size of the pipe or surface. 8. Conductivity of insulation.

*From "How to Determine Economic Thickness of Insulation"—National Insulation Manufacturers Association.

economic thickness— Kaylo 10 block to 1200 F— ambient still air 80 F

ET—economic thickness HL—heat loss
ST—surface temperature Btu/hr/lin/foot

THICK	200 F HEAT LOSS	200 F SURF. TEMP.	300 F HEAT LOSS	300 F SURF. TEMP.	400 F HEAT LOSS	400 F SURF. TEMP	500 F HEAT LOSS	500 F SURF. TEMP.	600 F HEAT LOSS	600 F SURF. TEMP.	700 F HEAT LOSS	700 F SURF. TEMP.	800 F HEAT LOSS	800 F SURF. TEMP.	900 F HEAT LOSS	900 F SURF. TEMP.	1000 F HEAT LOSS	1000 F SURF. TEMP.	1100 F HEAT LOSS	1100 F SURF. TEMP.	1200 F HEAT LOSS	1200 F SURF. TEMP.
1 000	38	103	72	124	109	147																
1 500	27	96	51	111	78	127	107	145														
2 000	21	93	40	104	60	117	83	130	107	145												
2 500	17	90	33	100	49	110	68	121	87	133	109	146										
3 000	14	89	28	97	42	105	57	115	74	125	92	136	112	148								
3 500	13	88	24	95	36	102	49	110	64	119	80	129	97	139	116	150						
4 000	11	87	21	93	32	99	44	107	56	114	70	123	85	132	102	142	120	153				
4 500	10	86	19	91	28	97	39	104	50	111	63	118	76	127	91	136	107	145	125	156		
5 000	9	85	17	90	26	96	35	101	46	108	57	115	69	122	82	130	97	139	113	149	130	159
5 500	8	85	16	89	23	94	32	100	42	105	52	112	63	118	75	126	88	134	103	143	118	152
6 000	7	85	14	89	22	93	30	98	38	103	48	109	58	115	69	122	81	130	94	138	109	148

*calculated

Kaylo 20 Block to 1800 F— ambient still air 80 F

Operating Temp. F	Power ET	Power HL	Power ST	Process ET	Process HL	Process ST
1300	7½	111	136	6	135	148
1400	8	117	139	6½	143	152
1500	8	123	142	7	151	155
1600	8½	129	145	7	158	159
1700	9	135	148	7½	165	163
1800	9½	141	151	7½	172	166

sizes

thickness—1", 1½", 2", 2½", 3", 3½" and 4"
width—3", 6", 12" and 18"
length—18" to 36"
form—Block

beveled lags

For pipe sizes greater than those for which Kaylo 10 and Kaylo 20 Pipe Insulation sizes are available, Kaylo 10 and Kaylo 20 beveled lags may be used to insulate piping. Lags beveled to fit pipes from 18" to 72" in diameter are available in thickness of 1½," 2", 2½", 3". Lags are 36" long and 3" wide.

application recommendations

Kaylo 10 & 20 Block Insulations are held in place by mechanically fastening with bands, welded rods or studs. The insulation may be finished with a trowel coat of insulating cement, canvassed and painted. Outdoor installations require weatherproofing with mastic or metal jacketing.

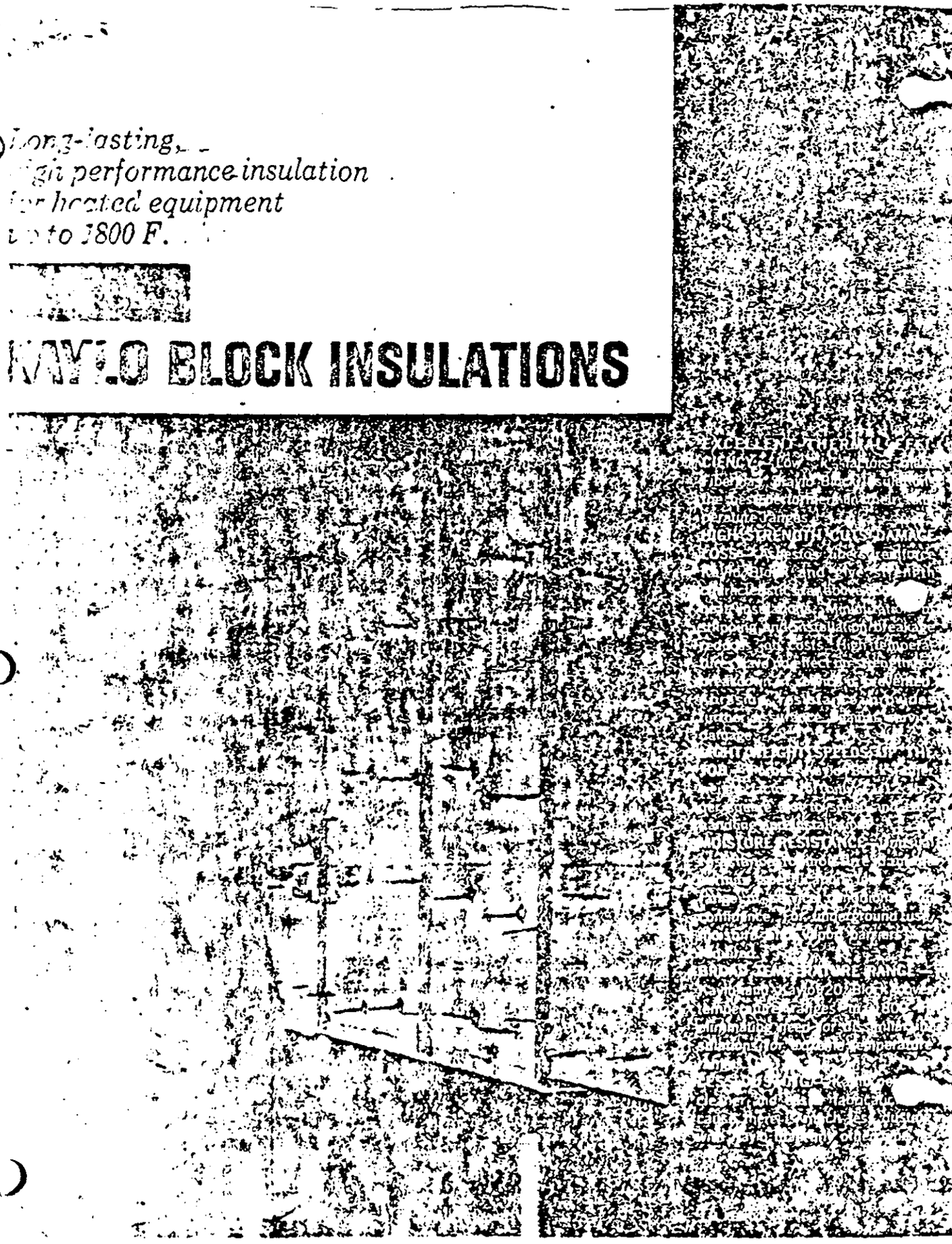
OWENS/CORNING FIBERGLAS

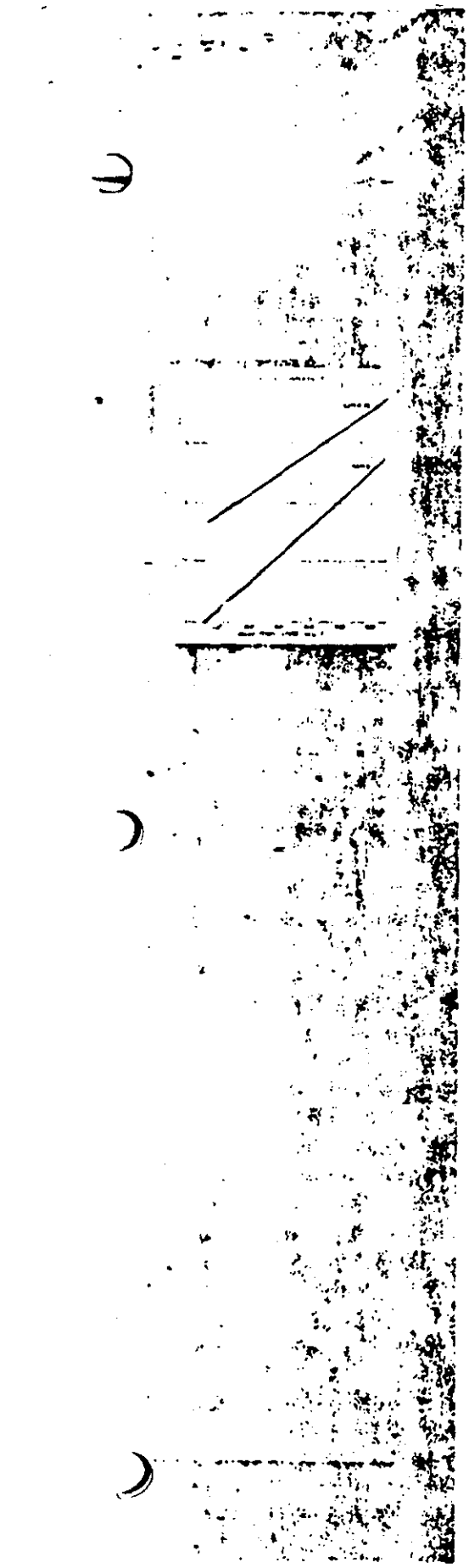
OWENS-CORNING FIBERGLAS CORPORATION
Industrial and Commercial Construction Materials Division
Fiberglas Tower, Toledo, Ohio 43601

Pub. No. 4-IN-4441 Litho in U.S.A. May, 1970

Long-lasting,
high performance insulation
for heated equipment
up to 1800 F.

MYLO BLOCK INSULATIONS





KAYLO BLOCK INSULATIONS

lasting performance for indoor and outdoor equipment

Kaylo Block insulations are calcium silicate reinforced with asbestos fibers. Countless entrapped air pockets in the hydrous calcium silicate block provide effective barrier to heat passage. Kaylo Block, off-white in color, serves up to 1200 F. Kaylo 20 Block, slightly pink in color for identification, extends temperature tolerance to 1800 F. Applied to heated equipment with wire, pins and washers or steel bands to retain heat and reduce surface temperature to safe level of 150 F. Available as flat block in wide range of thickness and sizes or as beveled lag block for use on very large sizes of pipe.

PUB. NO. S-IN-2439

LITHO IN U.S.A. 4/63

engineering data

KAYLO & KAYLO 20 THICKNESS STANDARDS, NESTING SIZES

nom. pipe size	O.D. of pipe	single layer only: nom. 1" actual	nom. 1" O.D.	nom. 1½" actual	nom. 1½" O.D.	single or double layer*: nom. 2" actual	nom. 2" O.D.	nom. 2½" actual	nom. 2½" O.D.	nom. 3" actual	nom. 3" O.D.	multiple layer—recommended combinations: 2" IL / OL	2½" IL / OL	3" IL / OL	3½" IL / OL	4" IL / OL	4½" IL / OL	5" IL / OL	6" IL / OL
										3.06	17.00			10 x1½ / 14 x1½	10 x1½ / 14 x2	10 x2 / 15 x2	10 x2 / 15 x2½	10 x2½ / 16 x2½	10 x3 / 17 x3
								2.55	17.00	3.05	18.00			11 x1½ / 15 x1½	11 x1½ / 15 x2	11 x2 / 16 x2	11 x2 / 16 x2½	11 x2½ / 17 x2½	11 x3† / 18 x3
						2.05	17.00	2.55	18.00	3.05	19.00			12 x1½ / 16 x1½	12 x1½ / 16 x2	12 x2 / 17 x2	12 x2 / 17 x2½	12 x2½ / 18 x2½	12 x3 / 19 x3
14"	14.00			1.42	17.00	1.92	18.00	2.42	19.00	2.92	20.00			14 x1½ / 17 x1½	14 x1½ / 17 x2	14 x2 / 18 x2	14 x2 / 18 x2½	14 x2½ / 19 x2½	14 x3 / 20 x3
15"	15.00			1.42	18.00	1.92	19.00	2.41	20.00	2.92	21.00			15 x1½ / 18 x1½	15 x1½ / 18 x2	15 x2 / 19 x2	15 x2 / 19 x2½	15 x2½ / 20 x2½	15 x3 / 21 x3
16"	16.00			1.41	19.00	1.91	20.00	2.41	21.00	2.91	22.00			16 x1½ / 19 x1½	16 x1½ / 19 x2	16 x2 / 20 x2	16 x2 / 20 x2½	16 x2½ / 21 x2½	16 x3 / 22 x3
17"	17.00			1.41	20.00	1.91	21.00	2.41	22.00	2.91	23.00			17 x1½ / 20 x1½	17 x1½ / 20 x2	17 x2 / 21 x2	17 x2 / 21 x2½	17 x2½ / 22 x2½	17 x3 / 23 x3
18"	18.00			1.41	21.00	1.91	22.00	2.41	23.00	2.91	24.00			18 x1½ / 21 x1½	18 x1½ / 21 x2	18 x2 / 22 x2	18 x2 / 22 x2½	18 x2½ / 23 x2½	18 x3 / 24 x3
19"	19.00			1.41	22.00	1.91	23.00	2.41	24.00	2.91	25.00			19 x1½ / 22 x1½	19 x1½ / 22 x2	19 x2 / 23 x2	19 x2 / 23 x2½	19 x2½ / 24 x2½	19 x3 / 25 x3A
20"	20.00			1.41	23.00	1.91	24.00	2.41	25.00	2.91	26.00			20 x1½ / 23 x1½	20 x1½ / 23 x2	20 x2 / 24 x2	20 x2 / 24 x2½	20 x2½ / 25 x2½A	20 x3 / 26 x3A
21"	21.00			1.41	24.00	1.91	25.00	2.41	26.00	2.91	27.00			21 x1½ / 24 x1½	21 x1½ / 24 x2	21 x2 / 25 x2A	21 x2 / 25 x2A	21 x2½ / 26 x2½A	21 x3 / 27 x3A
22"	22.00			1.41	25.00	1.91	26.00	2.41	27.00	2.91	28.00			22 x1½ / 25 x1½A	22 x1½ / 25 x2 A	22 x2 / 26 x2A	22 x2 / 26 x2½A	22 x2½ / 27 x2½A	22 x3 / 28 x3A
23"	23.00			1.41	26.00	1.91	27.00	2.41	28.00	2.91	29.00			23 x1½ / 26 x1½A	23 x1½ / 26 x2 A	23 x2 / 27 x2A	23 x2 / 27 x2½A	23 x2½ / 28 x2½A	23 x3 / 29 x3A
24"	24.00			1.41	27.00	1.91	28.00	2.41	29.00	2.91	30.00			24 x1½ / 27 x1½A	24 x1½ / 27 x2 A	24 x2 / 28 x2A	24 x2 / 28 x2½A	24 x2½ / 29 x2½A	24 x3 / 30 x3A
25"	25.00			1.46	28.00	1.98	29.00	2.50	30.00	3.02	31.00			25 x1½A / 28 x1½B	25 x1½A / 28 x2 B	25 x2A / 29 x2B	25 x2 A / 29 x2½B	25 x2½A / 30 x2½B	25 x3A / 31 x3B
26"	26.00			1.46	29.00	1.98	30.00	2.50	31.00	3.02	32.00			26 x1½A / 29 x1½B	26 x1½A / 29 x2 B	26 x2A / 30 x2B	26 x2 A / 30 x2½B	26 x2½A / 31 x2½B	26 x3A / 32 x3B
27"	27.00			1.46	30.00	1.98	31.00	2.50	32.00	3.02	33.00			27 x1½A / 30 x1½B	27 x1½A / 30 x2 B	27 x2A / 31 x2B	27 x2 A / 31 x2½B	27 x2½A / 32 x2½B	27 x3A / 33 x3B
28"	28.00			1.46	31.00	1.98	32.00	2.50	33.00	3.02	34.00			28 x1½A / 31 x1½B	28 x1½A / 31 x2 B	28 x2A / 32 x2B	28 x2 A / 32 x2½B	28 x2½A / 33 x2½B	28 x3A / 34 x3B
29"	29.00			1.46	32.00	1.98	33.00	2.50	34.00	3.02	35.00			29 x1½A / 32 x1½B	29 x1½A / 32 x2 B	29 x2A / 33 x2B	29 x2 A / 33 x2½B	29 x2½A / 34 x2½B	29 x3A / 35 x3B
30"	30.00			1.46	33.00	1.98	34.00	2.50	35.00	3.02	36.00			30 x1½B / 33 x1½C	30 x1½B / 33 x2 C	30 x2B / 34 x2C	30 x2 B / 34 x2½C	30 x2½B / 35 x2½C	30 x3B / 36 x3C
31"	31.00			1.46	34.00	1.98	35.00	2.50	36.00	3.02	37.00			31 x1½B / 34 x1½C	31 x1½B / 34 x2 C	31 x2B / 35 x2C	31 x2 B / 35 x2½C	31 x2½B / 36 x2½C	31 x3B / 37 x3C
32"	32.00			1.46	35.00	1.98	36.00	2.50	37.00	3.02	38.00			32 x1½B / 35 x1½C	32 x1½B / 35 x2 C	32 x2B / 36 x2C	32 x2 B / 36 x2½C	32 x2½B / 37 x2½C	32 x3B / 38 x3C
33"	33.00			1.46	36.00	1.98	37.00	2.50	38.00	3.02	39.00			33 x1½B / 36 x1½C	33 x1½B / 36 x2 C	33 x2B / 37 x2C	33 x2 B / 37 x2½C	33 x2½B / 38 x2½C	33 x3B / 39 x3C
34"	34.00			1.46	37.00	1.98	38.00	2.50	39.00	3.02	40.00			34 x1½B / 37 x1½C	34 x1½B / 37 x2 C	34 x2B / 38 x2C	34 x2 B / 38 x2½C	34 x2½B / 39 x2½C	34 x3B / 40 x3C
35"	35.00			1.46	38.00	1.98	39.00	2.50	40.00	3.02	41.00			35 x1½B / 38 x1½C	35 x1½B / 38 x2 C	35 x2B / 39 x2C	35 x2 B / 39 x2½C	35 x2½B / 40 x2½C	35 x3B / 41 x3C
36"	36.00			1.46	39.00	1.98	40.00	2.50	41.00	3.02	42.00			36 x1½B / 39 x1½C	36 x1½B / 39 x2 C	36 x2B / 40 x2C	36 x2 B / 40 x2½C	36 x2½B / 41 x2½C	36 x3B / 42 x3C
37"	37.00			1.46	40.00	1.98	41.00	2.50	42.00	3.02	43.00			37 x1½B / 40 x1½C	37 x1½B / 40 x2 C	37 x2B / 41 x2C	37 x2 B / 41 x2½C	37 x2½B / 42 x2½C	37 x3B / 43 x3C
38"	38.00			1.46	41.00	1.98	42.00	2.50	43.00	3.02	44.00			38 x1½B / 41 x1½C	38 x1½B / 41 x2 C	38 x2B / 42 x2C	38 x2 B / 42 x2½C	38 x2½B / 43 x2½C	38 x3B / 44 x3C
39"	39.00			1.46	42.00	1.98	43.00	2.50	44.00	3.02	45.00			39 x1½B / 42 x1½C	39 x1½B / 42 x2 C	39 x2B / 43 x2C	39 x2 B / 43 x2½C	39 x2½B / 44 x2½C	39 x3B / 45 x3C

QUAD, TRI-SEGMENTAL

16 SEGMENTAL

Insulation for the nominal pipe sizes range of 25"-39" is furnished in three K Segmental curvature sizes. Approximately six to eight segments are required to enclose pipes in this size range. The last segment applied must be cut to fit accurately. Letter designates molded K-Segmental size for proper nesting.

* Note: All single layer tri-seg. and quad-seg. sizes shown are also available in sectional form. K-segmental is not available in a fabricated sectional form.

† Note: Use 3" x 3" K-Segmental for 25" pipe.

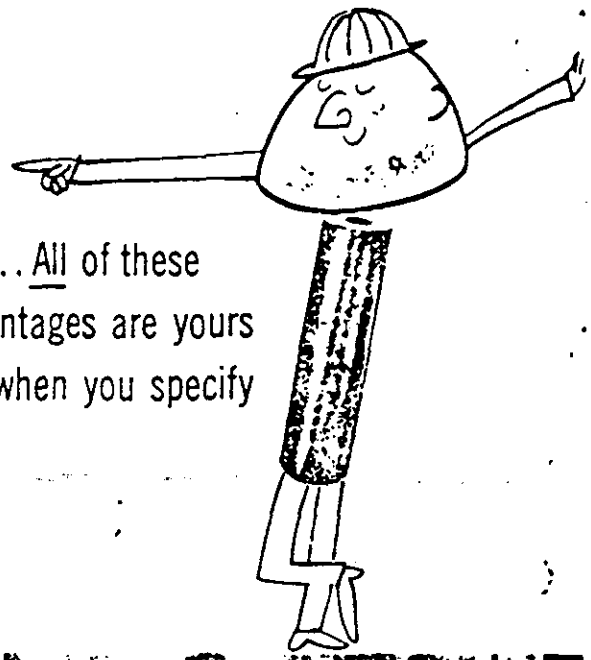
K-Segmental Dimensions:

Letter	In. Dia.	O. Dia.	Approx. Outer Arc
A	26.00"	31.00"	14"
B	31.00"	36.00"	16"
C	36.00"	41.00"	18"

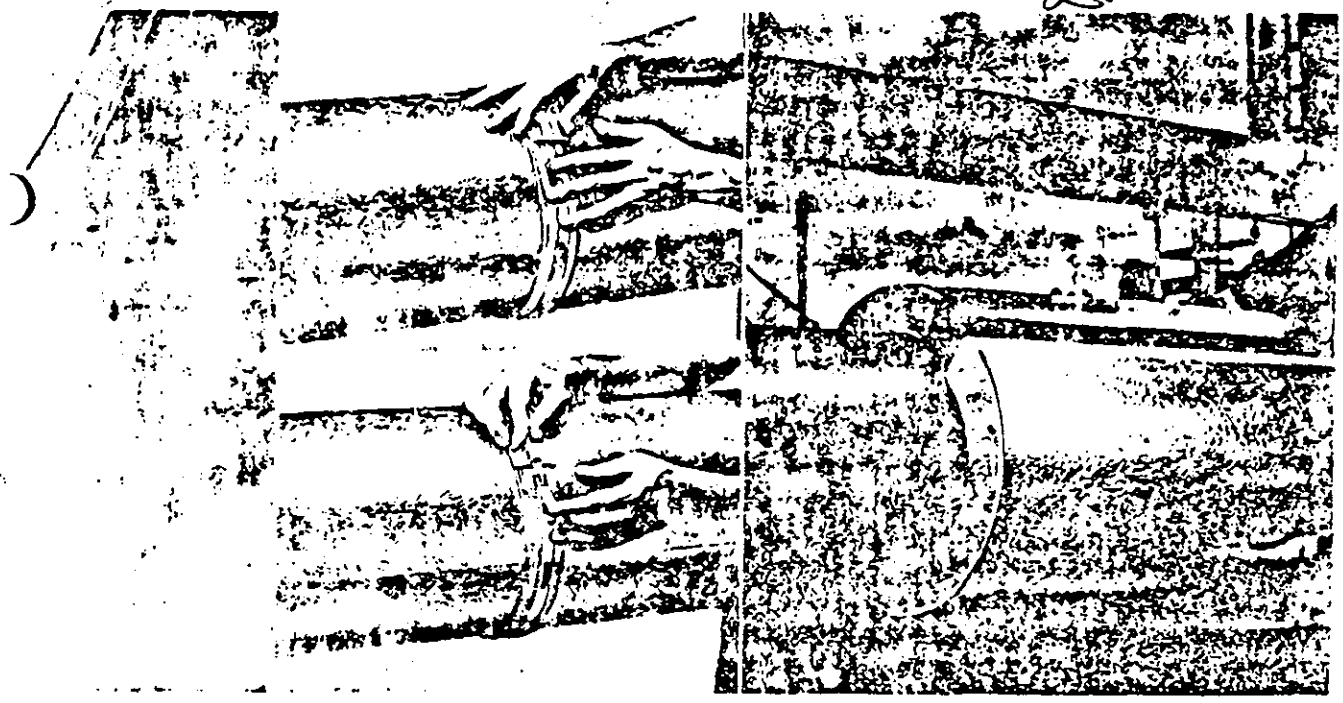
OWENS-CORNING FIBERGLAS CORPORATION
Industrial Materials Division
Fiberglas Tower, Toledo, Ohio 43601

Printed in U.S.A. 3/67 Pub. No. 4-BN-2406

- A "DRESSED-UP" LINE
- "LOCKS OUT" THE WEATHER
- LESS MAINTENANCE
- RESISTANCE TO MECHANICAL DAMAGE
- "NO-GLARE" TEXTURE
- SELF-LOCKING JACKET
- ACCURATELY SIZED
- PERMANENT AND RE-USABLE
- EXCELLENT THERMAL EFFICIENCY
- ECONOMY WITH ONE-STEP APPLICATION



... All of these advantages are yours when you specify



"LOCKS OUT" THE WEATHER

...ractive appearance afforded by Kaylo-Klad, while out-...sis all-important, Kaylo-Klad is "tough" in its thick ...minum jacket. It provides greater resistance to me-...cal damage. The longitudinal seam of jacket snaps to-...with interlocking lips which, when faced downward, assure ...weather tightness and maintenance-free performance.

FAST INSTALLATION

The soft, rippled texture embossed in the aluminum jacket diffuses light and eliminates glare—at the same time "dressing up" a pipe line. Installation of jacket and insulation is a one-step application—an important factor in the all-around practicability of Kaylo-Klad. Longitudinal seam has a self-locking jo... joints are sealed with a band having an integral sealing co... pound which resists direct contact temperatures to 400°F.

OWENS-CORNING FIBERGLAS

engineering data

Engineering Data 10 E 8
April 1970

Kaylo 10 & Kaylo 20 Thickness Standards, Nesting Sizes

Kaylo Pipe Insulations are precision molded to fit nominal iron pipe sizes from ⅛" to 39" in diameter, single or double-layer thicknesses. Single layer thicknesses are 1" and 1½", double layer from 1" to 3" in half-sectional or multisegmental form depending on pipe size.

Single layer sectional covering is available for copper tubing sizes from ⅛" to 3" sizes and in thicknesses from 1" to 1½".

Kaylo in single layer, double layer or multiple layer thicknesses is designed in accordance with the Simplified Dimensional Standards to allow accurate nesting. Double or multiple layer application with staggered joints is recommended to reduce leakage at the joints where operating temperatures exceed 600°F. See Product Data Sheet 5.3 for Economic Thicknesses recommendations.

KEY

IP = Iron Pipe Sizes
CT = Copper Tubing
IL = Inner Layer
OL = Outer Layer
(copper tubing size table)

note:

Insulation for tubing sizes other than standard sizes shown are available only as cut downs from next larger size tube or pipe and will be slightly elliptical in shape.

INSULATION THICKNESS STANDARDS & NESTING SIZES

nom. tube size	O. D. of tube (nom.)	single layer nom. 1" actual	nom. 1" O.D.	nom. 1½" actual	nom. 1½" O.D.
⅜"	½"	1.18	2.88	1.49	3.50
½"	⅝"	1.61	2.88	1.92	3.50
⅝"	¾"	1.85	2.88	1.61	4.00
¾"	⅞"	.99	2.88	1.55	4.00
1"	1⅛"	1.17	3.50	1.42	4.00
1¼"	1⅜"	1.85	3.50	1.55	4.50
1½"	1⅝"	1.17	4.00	1.42	4.50
2"	2⅛"	.91	4.00	1.41	5.00
2½"	2⅝"	.91	4.50	1.45	5.56
3"	3⅛"	.91	5.00	1.73	6.66

pipe size	O.D. of pipe	single layer only: nom. 1" actual	nom. 1" O.D.	nom. 1½" actual	nom. 1½" O.D.	single or double layer: nom. 2" actual	nom. 2" O.D.	nom. 2½" actual	nom. 2½" O.D.	nom. 3" actual	nom. 3" O.D.	multiple layer—recommended combinations: 2" IL / OL	2½" IL / OL	3" IL / OL	3½" IL / OL	4" IL / OL	4½" IL / OL	5" IL / OL	6" IL / OL
⅛"	.405	1.884	2.88	1.65	4.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—
¼"	.540	1.00	2.88	1.56	4.00	2.06	5.00	2.89	6.66	3.39	7.66	⅜x1 / —	½x1 / —	½x½ / —	½x1½ / —	½x2 / —	½x2 / —	½x2½ / —	½x3 / —
⅜"	.675	.90	2.88	1.46	4.00	1.96	5.00	2.79	6.66	3.29	7.66	¾x1 / 2½x1½	¾x1 / 3½x1½	¾x1½ / 3½x1½	¾x2 / 4½x2	¾x2 / 4½x2½	¾x2½ / 6x2½	¾x2½ / 6x2½	¾x3 / 7x3
½"	.840	1.08	3.50	1.38	4.50	2.11	5.56	2.66	6.66	3.16	7.66	1x1 / 2½x1½	1x1 / 3½x1½	1x1½ / 3½x2	1x2 / 4½x2	1x2 / 4½x2½	1x2½ / 6x2½	1x2½ / 6x2½	1x3 / 7x3
¾"	1.050	.90	3.50	1.66	5.00	1.94	5.56	2.48	6.66	2.98	7.66	1¼x1 / 3x1½	1¼x1 / 4½x1½	1¼x1½ / 4½x2	1¼x2 / 5x2	1¼x2 / 5x2½	1¼x2½ / 6x2½	1¼x2½ / 6x2½	1¼x3 / 7x3
1"	1.315	1.03	4.00	1.53	5.00	2.36	6.66	2.86	7.66	3.36	8.66	1½x1 / 3½x1½	1½x1 / 4½x1½	1½x1½ / 4½x2	1½x2 / 5x2	1½x2 / 5x2½	1½x2½ / 6x2½	1½x2½ / 7x2½	1½x3 / 8x3
1¼"	1.660	1.04	4.50	1.57	5.56	2.12	6.66	2.62	7.66	3.12	8.66	2 x1 / 4 x1½	2 x1 / 5 x1½	2 x1½ / 5 x2	2 x1½ / 6 x2	2 x2 / 6 x2½	2 x2 / 7 x2½	2 x2½ / 8 x2½	2 x3 / 8 x3
1½"	1.900	1.04	5.00	1.87	6.66	2.37	7.66	2.87	8.66	3.37	9.66	2½x1 / 4½x1½	2½x1 / 6 x1½	2½x1½ / 6 x2	2½x2 / 7 x2	2½x2 / 7 x2½	2½x2 / 8 x2½	2½x2½ / 9 x2½	2½x3 / 9 x3
2"	2.375	1.00	5.56	1.55	6.66	2.05	7.66	2.55	8.66	3.05	9.66	3 x1 / 5 x1½	3 x1 / 6 x1½	3 x1½ / 6 x2	3 x2 / 7 x2	3 x2 / 7 x2½	3 x2 / 8 x2½	3 x2½ / 9 x2½	3 x3 / 9 x3
2½"	2.875	1.30	6.66	1.80	7.66	2.30	8.66	2.80	9.66	3.36	10.78	3½x1 / 5 x1½	3½x1 / 6 x1½	3½x1½ / 7 x2	3½x2 / 8 x2	3½x2 / 8 x2½	3½x2 / 9 x2½	3½x2½ / 10 x2½	3½x3 / 10 x3
3"	3.500	1.00	6.66	1.55	7.66	2.05	8.66	2.55	9.66	3.11	10.78	4 x1 / 6 x1½	4 x1 / 7 x1½	4 x1½ / 7 x2	4 x2 / 8 x2	4 x2 / 8 x2½	4 x2½ / 9 x2½	4 x2½ / 10 x2½	4 x3 / 10 x3
3½"	4.000	1.30	7.66	1.80	8.66	2.30	9.66	2.86	10.78	3.36	11.78	4½x1 / 7 x1½	4½x1 / 8 x1½	4½x1½ / 8 x2	4½x2 / 9 x2	4½x2 / 9 x2½	4½x2 / 10 x2½	4½x2½ / 11 x2½	4½x3 / 11 x3
4"	4.500	1.05	7.66	1.55	8.66	2.02	9.66	2.58	10.78	3.08	11.78	5 x1 / 7 x1½	5 x1½ / 8 x1½	5 x1½ / 8 x2	5 x2 / 9 x2	5 x2 / 9 x2½	5 x2½ / 10 x2½	5 x2½ / 11 x2½	5 x3 / 11 x3
4½"	5.00	1.30	7.66	1.80	8.66	2.30	9.66	2.86	10.78	3.36	11.78	6 x1 / 8 x1½	6 x1½ / 8 x1½	6 x1½ / 8 x2	6 x2 / 9 x2	6 x2 / 9 x2½	6 x2½ / 10 x2½	6 x2½ / 11 x2½	6 x3 / 11 x3
5"	5.56	1.02	7.66	1.52	8.66	2.02	9.66	2.58	10.78	3.08	11.78	7 x1 / 9 x1½	7 x1½ / 9 x1½	7 x1½ / 9 x2	7 x2 / 10 x2	7 x2 / 10 x2½	7 x2½ / 11 x2½	7 x2½ / 12 x2½	7 x3 / 12 x3
6"	6.63	.95	8.66	1.45	9.66	2.02	10.78	2.52	11.78	3.03	12.81	8 x1 / 10 x1½	8 x1½ / 10 x1½	8 x1½ / 10 x2	8 x2 / 11 x2	8 x2 / 11 x2½	8 x2½ / 12 x2½	8 x2½ / 13 x2½	8 x3 / 13 x3
7"	7.63			1.52	10.78	2.02	11.78	2.53	12.81	3.16	14.06	— / —	— / —	9 x1½ / 11 x2	9 x2 / 12 x2	9 x2 / 12 x2½	9 x2½ / 13 x2½	9 x2½ / 14 x2½	9 x3 / 14 x3
8"	8.63			1.52	11.78	2.03	12.81	2.66	14.06	3.16	15.06	4½x1 / 11 x2	4½x1½ / 11 x2	10 x1½ / 12 x2	10 x2 / 13 x2	10 x2 / 13 x2½	10 x2½ / 14 x2½	10 x2½ / 15 x2½	10 x3 / 15 x3
9"	9.63			1.53	12.81	2.16	14.06	2.66	15.06	3.17	16.09	— / —	— / —	11 x1½ / 13 x2	11 x2 / 14 x2	11 x2 / 14 x2½	11 x2½ / 15 x2½	11 x2½ / 16 x2½	11 x3 / 16 x3
10"	10.75			1.59	14.06	2.09	15.06	2.61	16.09			9 x1½ / 12 x2	9 x1½ / 12 x2	9 x2 / 14 x2	9 x2 / 14 x2½	9 x2½ / 15 x2½	9 x2½ / 16 x2½	9 x3 / 16 x3	
11"	11.75			1.58	15.06	2.09	16.09												
12"	12.75			1.59	16.09														

KAYLO 10 & KAYLO 20 THICKNESS STANDARDS, NESTING SIZES

K SEGMENTAL QUAD. TRI-SEGMENTAL SEG.		single layer only				single or double layer						multiple layer—recommended combinations													
		nom. 1"		nom. 1½"		nom. 2"		nom. 2½"		nom. 3"		2"	2½"	3"		3½"		4"		4½"		5"		6"	
												IL	IL	IL		IL		IL		IL		IL		IL	
		actual	O.D.	actual	O.D.	actual	O.D.	actual	O.D.	actual	O.D.	OL	OL	OL		OL		OL		OL		OL		OL	
										3.06	17.00			10	x1½	10	x1½	10	x2	10	x2	10	x2½	10	x3
														14	x1½	14	x2	15	x2	15	x2½	16	x2½	17	x3
								2.55	17.00	3.05	18.00			11	x1½	11	x1½	11	x2	11	x2	11	x2½	11	x3
														15	x1½	15	x2	16	x2	16	x2½	17	x2½	18	x3
						2.05	17.00	2.55	18.00	3.05	19.00			12	x1½	12	x1½	12	x2	12	x2	12	x2½	12	x3
														16	x1½	16	x2	17	x2	17	x2½	18	x2½	19	x3
14"	14.00			1.42	17.00	1.92	18.00	2.42	19.00	2.92	20.00			14	x1½	14	x1½	14	x2	14	x2	14	x2½	14	x3
														17	x1½	17	x2	18	x2	18	x2½	19	x2½	20	x3
15"	15.00			1.42	18.00	1.92	19.00	2.41	20.00	2.92	21.00			15	x1½	15	x1½	15	x2	15	x2	15	x2½	15	x3
														18	x1½	18	x2	19	x2	19	x2½	20	x2½	21	x3
16"	16.00			1.41	19.00	1.91	20.00	2.41	21.00	2.91	22.00			16	x1½	16	x1½	16	x2	16	x2	16	x2½	16	x3
														19	x1½	19	x2	20	x2	20	x2½	21	x2½	22	x3
17"	17.00			1.41	20.00	1.91	21.00	2.41	22.00	2.91	23.00			17	x1½	17	x1½	17	x2	17	x2	17	x2½	17	x3
														20	x1½	20	x2	21	x2	21	x2½	22	x2½	23	x3
18"	18.00			1.41	21.00	1.91	22.00	2.41	23.00	2.91	24.00			18	x1½	18	x1½	18	x2	18	x2	18	x2½	18	x3
														21	x1½	21	x2	22	x2	22	x2½	23	x2½	24	x3
19"	19.00			1.41	22.00	1.91	23.00	2.41	24.00	2.91	25.00			19	x1½	19	x1½	19	x2	19	x2	19	x2½	19	x3
														22	x1½	22	x2	23	x2	23	x2½	24	x2½	25	x3A
20"	20.00			1.41	23.00	1.91	24.00	2.41	25.00	2.91	26.00			20	x1½	20	x1½	20	x2	20	x2	20	x2½	20	x3
														23	x1½	23	x2	24	x2	24	x2½	25	x2½A	26	x3A
21"	21.00			1.41	24.00	1.91	25.00	2.41	26.00					21	x1½	21	x1½	21	x2	21	x2	21	x2½	21	x3
										2.91	27.00			24	x1½	24	x2	25	x2A	25	x2A	26	x2½A	27	x3A
22"	22.00			1.41	25.00	1.91	26.00							22	x1½	22	x1½	22	x2	22	x2	22	x2½	22	x3
								2.41	27.00	2.91	28.00			25	x1½A	25	x2 A	26	x2A	26	x2½A	27	x2½A	28	x3A
23"	23.00			1.41	26.00									23	x1½	23	x1½	23	x2	23	x2	23	x2½	23	x3
						1.91	27.00	2.41	28.00	2.91	29.00			26	x1½A	26	x2 A	27	x2A	27	x2½A	28	x2½A	29	x3A
24"	24.00			1.41	27.00	1.91	28.00	2.41	29.00	2.91	30.00			24	x1½	24	x1½	24	x2	24	x2	24	x2½	24	x3
														27	x1½A	27	x2 A	28	x2A	28	x2½A	29	x2½A	30	x3A
25"	25.00			1.46	28.00	1.98	29.00	2.50	30.00	3.02	31.00			25	x1½A	25	x1½A	25	x2A	25	x2 A	25	x2½A	25	x3A
														28	x1½B	28	x2 B	29	x2B	29	x2½B	30	x2½B	31	x3B
26"	26.00			1.46	29.00	1.98	30.00	2.50	31.00	3.02	32.00			26	x1½A	26	x1½A	26	x2A	26	x2 A	26	x2½A	26	x3A
														29	x1½B	29	x2 B	30	x2B	30	x2½B	31	x2½B	32	x3B
27"	27.00			1.46	30.00	1.98	31.00	2.50	32.00	3.02	33.00			27	x1½A	27	x1½A	27	x2A	27	x2 A	27	x2½A	27	x3A
														30	x1½B	30	x2 B	31	x2B	31	x2½B	32	x2½B	33	x3B
28"	28.00			1.46	31.00	1.98	32.00	2.50	33.00	3.02	34.00			28	x1½A	28	x1½A	28	x2A	28	x2 A	28	x2½A	28	x3A
														31	x1½B	31	x2 B	32	x2B	32	x2½B	33	x2½B	34	x3B
29"	29.00			1.46	32.00	1.98	33.00	2.50	34.00	3.02	35.00			29	x1½A	29	x1½A	29	x2A	29	x2 A	29	x2½A	29	x3A
														32	x1½B	32	x2 B	33	x2B	33	x2½B	34	x2½B	35	x3B
30"	30.00			1.46	33.00	1.98	34.00	2.50	35.00	3.02	36.00			30	x1½B	30	x1½B	30	x2B	30	x2 B	30	x2½B	30	x3B
														33	x1½C	33	x2 C	34	x2C	34	x2½C	35	x2½C	36	x3C
31"	31.00			1.46	34.00	1.98	35.00	2.50	36.00	3.02	37.00			31	x1½B	31	x1½B	31	x2B	31	x2 B	31	x2½B	31	x3B
														34	x1½C	34	x2 C	35	x2C	35	x2½C	36	x2½C	37	x3C
32"	32.00			1.46	35.00	1.98	36.00	2.50	37.00	3.02	38.00			32	x1½B	32	x1½B	32	x2B	32	x2 B	32	x2½B	32	x3B
														35	x1½C	35	x2 C	36	x2C	36	x2½C	37	x2½C	38	x3C
33"	33.00			1.46	36.00	1.98	37.00	2.50	38.00	3.02	39.00			33	x1½B	33	x1½B	33	x2B	33	x2 B	33	x2½B	33	x3B
														36	x1½C	36	x2 C	37	x2C	37	x2½C	38	x2½C	39	x3C
34"	34.00			1.46	37.00	1.98	38.00	2.50	39.00	3.02	40.00			34	x1½B	34	x1½B	34	x2B	34	x2 B	34	x2½B	34	x3B
														37	x1½C	37	x2 C	38	x2C	38	x2½C	39	x2½C	40	x3C
35"	35.00			1.46	38.00	1.98	39.00	2.50	40.00	3.02	41.00														
36"	36.00			1.46	39.00	1.98	40.00	2.50	41.00	3.02	42.00														
37"	37.00			1.46	40.00	1.98	41.00	2.50	42.00	3.02	43.00														
38"	38.00			1.46	41.00	1.98	42.00	2.50	43.00	3.02	44.00														
39"	39.00			1.46	42.00	1.98	43.00	2.50	44.00	3.02	45.00														

NOTE: Insulation for the nominal pipe size range of 25"-39" is furnished in three K Segmental curvature sizes. Approximately six to eight segments are required to enclose pipes in this size range. The last segment applied must be cut to fit accurately. Letter designated mold from which K Seg. sizes are made. (See K Segmental Dimensions) for proper nesting.

K Segmental pieces from the same curvature range, i.e. letter C, cannot be nested with each other.

*Note: All single layer tri seg. sizes shown are also available in sectional form. K segmental is not available in a fabricated sectional form.

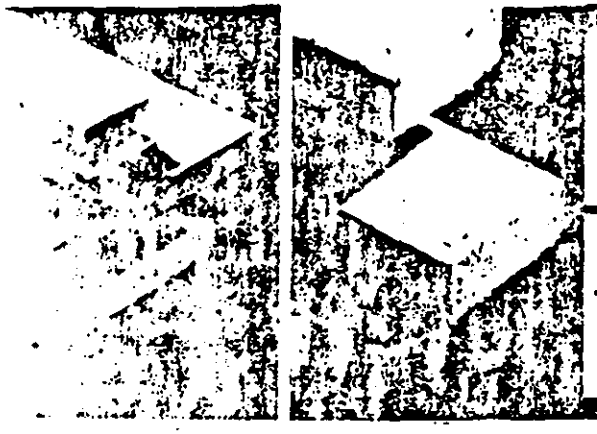
K-Segmental Dimensions:

Letter	In. Dia.	O. Dia	Approx. Outer Arc
A	26.00"	31.00"	14"
B	31.00"	36.00"	16"
C	36.00"	41.00"	18"

OWENS-CORNING FIBERGLAS CORPORATION
Industrial Materials Division
Fiberglas Tower, Toledo, Ohio 43601

Litho in U.S.A. April 1978 Pub. No. 6 IN 3408 A

Equipment Insulation



Kaylo & Kaylo 20 Block Insulation

rigid calcium silicate insulations for all types of heated equipment operating at temperatures up to 1800F.

uses

Kaylo® Block is for use on indoor or outdoor equipment operating at temperatures up to 1200F. Kaylo Block is especially suited for use on stainless steel vessels and equipment as it inhibits stress corrosion cracking. Typical applications are for boilers, breeching, tanks, vessels.

Kaylo 20® with its high temperature limit of 1800F extends its use to include refractory wall backing for furnaces and boilers and fireproofing of equipment and vessel skirts.

description.

Kaylo and Kaylo 20 Block insulations are rigid hydrous calcium silicate heat insulations reinforced with asbestos fibers. They are strong, efficient and are highly resistant to abrasion and moisture damage. Kaylo 20 has a slightly pink color to distinguish it from Kaylo.

benefits

high thermal efficiency—both Kaylo and Kaylo 20 offer excellent thermal efficiency coupled with high strength. A low k of .37 for Kaylo and .43 for Kaylo 20 at 200F mean temperature proves that Kaylo will provide significant savings in operating costs over the life of the equipment.

resistant to abuse—resists mechanical damage because of hard, tough, reinforced structure.

strong—less breakage in shipment and handling. High temperatures have little effect on strength characteristics.

will not cause stress corrosion cracking—Kaylo will not cause stress corrosion cracking of stainless steel because Kaylo contains less than 200 ppm soluble chlorides as well as an inhibitor which prevents trace quantities of chlorides from the atmosphere or other sources from causing cracking and possible failure of piping and equipment.

resistant to moisture damage—unlike many other insulations, Kaylo is not affected appreciably from moisture damage. It regains thermal efficiency and strength after drying out. Outdoor installations must be weatherproofed, however, for long continuous service.

dimensionally stable—Kaylo does not shrink appreciably in service, even at elevated temperatures. This means less heat leakage at the joints. And Keylo will not warp or crack in service.

fabricates easily—ordinary insulators tools are all that is required to fabricate Kaylo. It cuts with a clean true edge for tighter fit at the joints. Fittings are neater, faster.

*T.M. REG. OCF CORP.

physical properties

	Standard Kaylo	Kaylo 20
density:	11 psf approx.	12 psf approx.
flexural strength:	over 50 lb/sq. in. (ASTM C-203)	90 lb/sq. in.

compressive strength: (at 5% deformation) (ASTM C-165) Kaylo 20: before heating, 130 lbs. per square inch.

Standard Kaylo: before heating, 150 lb/sq. in.; 144 lb/sq. in. at 750°F, 123 lb/sq. in. at 1000°F; 117 lb/sq. in. at 1200°F; after boiling for 24 hr., 74 lb/sq. in. (while wet).

resistance to abrasion: (conventional tumbling test—loss in weight after 10 min.)

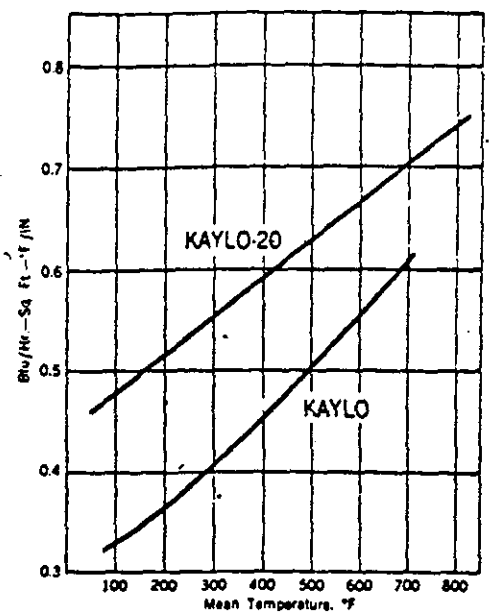
	standard Kaylo	Kaylo 20
before heating	9%	3%
after heating for 24 hr.		
750°F	5%	
1000°F	4%	
1200°F	3%	5%
1800°F		20%

alkalinity: ph 10

dimensional stability: linear shrinkage after heating for 24 hours in muffle

	standard Kaylo	Kaylo 20
750°F	0.8%	
1000°F	0.9%	
1200°F	1.4%	0.7%
1800°		1.6%

thermal conductivity



key

ET—recommended thickness (inches)
HL—heat loss . . . Btu/hr/lineal foot
ST—surface temperature

economic thicknesses

Selection of insulation thicknesses for any specific application should take into consideration the following important criteria. 1. Cost of insulation applied. 2. Cost of heat energy. 3. Cost of capital. 4. Cost of depreciation—plant and insulation. 5. Capital investment in heat production equipment. 6. Temperature differential. 7. Size of the pipe or surface. 8. Conductivity of insulation.

for hot piping, the tabulated thicknesses are optimum thicknesses calculated on an "Economic" * basis for heat conservation under average operating conditions and assure adequate temperature control. Other conditions may warrant the use of other thicknesses.

**From "How to Determine Economic Thickness of Insulation"—National Insulation Manufacturers Association.*

Kaylo Block to 1200F—ambient temperature 80F

Operating Temp.	Commercial ET	Commercial HL	Commercial ST	Power ET	Power HL	Power ST	Process ET	Process HL	Process ST
[illegible]	1	36	103	1	36	103	1	36	103
[illegible]	1½	50	110	1	69	119	1	69	119
400	2½	48	108	1½	74	122	1	106	138
500	3½	47	108	2	82	126	1½	104	136
600	4½	48	108	2½	85	128	1½	133	148
700				3	89	129	2	127	145
800				4	80	124	2½	125	144
[illegible]				4½	86	127	3	124	144
1000				5½	80	125	3½	125	144
[illegible]				6	84	126	4	125	143
[illegible]				6½	90	127	4½	127	143

Kaylo 20 Block to 1800F—ambient temperature 80F

Operating Temp. F	Power ET	Power HL	Power ST	Process ET	Process HL	Process ST
1300	7½	111	136	6	135	148
1400	8	117	139	6½	143	152
1500	8	123	142	7	151	155
1600	8½	129	145	7	158	159
1700	9	135	148	7½	165	163
1800	9½	141	151	7½	172	166

sizes

thicknesses—1", 1½", 2", 2½", 3", 3½" and 4"
[illegible]—3", 6", 12" and 18"
[illegible]—8" to 36"
[illegible]—Block

beveled lags

For pipe sizes greater than those for which Kaylo and Kaylo 20 [illegible] sizes are available, Kaylo and Kaylo 20 beveled lags may be used to insulate piping. Lags beveled to fit pipes from 8" to 36" in diameter are available in thickness [illegible]. 2", 2½", 3". Lags are 36" long and 3" wide.

federal specifications

HH-I-523b Insulation Block, Pipe Covering, and Cement, Thermal, Calcium Silicate. Type I.

MIL-I-2819D Insulation Block, Thermal. Class 1, 2, & 3. ASTM C533-64T: Kaylo—Class 1 & 2; Kaylo 20—Class 1, 2, 3.

application recommendations

Kaylo and Kaylo 20 Block insulations are held in place by mechanically fastening with bands, welded rods or studs. The insulation may be finished with a trowel coat of insulating cement, canvassed and painted. Outdoor installations require weatherproofing with mastics or metal jacketing.

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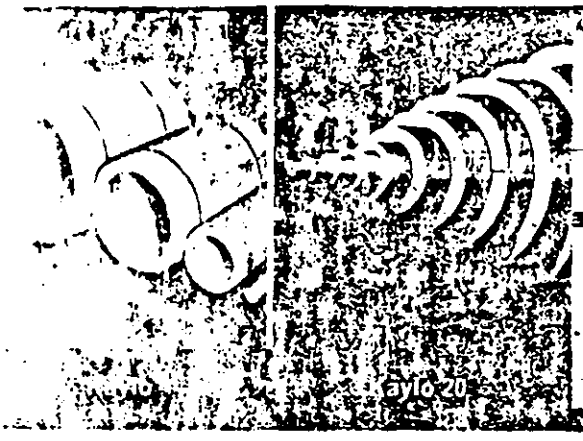
Pipe Insulation



Kaylo & Kaylo 20 Pipe Insulations

rigid hydrous calcium silicate pipe insulations for heated piping up to 1800F.

uses

Standard Kaylo is recommended for use on heated piping operating up to 1200F and Kaylo 20 extends the temperature range to 1800F. These thoroughly field-tested insulations have the physical properties most desirable for efficient, durable work for indoor and outdoor, power and process piping. A variety of jackets are available for surface finish and weatherproofing.

description

Kaylo® & Kaylo 20® pipe insulations are rigid hydrous calcium silicate heat insulations for use on all heated piping up to 1800F — indoors and out. These products are precision molded in sections or segments from a chemical reacted material. A small amount of asbestos fiber is added to improve mechanical strength. Kaylo is white. Kaylo 20 has a slight pinkish color to distinguish it from Kaylo.

benefits

lower operating costs — Kaylo Insulations have exceptional thermal efficiency. The low k factor of .37 at 200 mean temperature means lower operating cost, better temperature control for process operations.

rugged — Kaylo Pipe Insulations are strong and rigid to resist mechanical abuse in shipping, handling and in service.

versatile — Kaylo's extended temperature range covers a broad number of uses with one material. All heated piping requirements to 1800F and in sizes from ½" to 30" IPS can be met with Kaylo and Kaylo 20.

will not cause stress corrosion cracking — Kaylo will not cause stress corrosion cracking of stainless steel because Kaylo contains an inhibitor, and has less than 10 ppm soluble chlorides.

unaffected by moisture — Kaylo can be completely saturated in water without appreciable loss of strength and regains its strength and thermal value after drying out.

clean, neat installation — Kaylo cuts cleanly leaving a sharp square edge for neater appearance on fittings. Rigid manufacturing tolerances assure uniform, smooth, unbroken joints.

variety of jackets — A variety of factory-applied jackets allows a selection of product for indoor finished appearance or for weatherproofing insulation on outdoor lines.

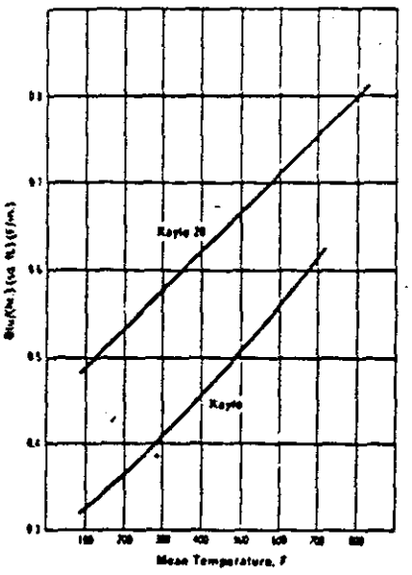
nesting sizes — Kaylo and Kaylo 20 Pipe Insulations are manufactured to Simplified Dimensional Standards to permit nesting sizes for double layer applications.

REG. OCF CORP.

physical properties

	Kaylo	Kaylo 20
density approximately	11 lb. pcf.	12 lb. pcf.
flexural strength (ASTM C-203)	50 lbs./sq. in.	90 lbs./sq. in.
compressive strength (ASTM C-165) at 5% deformation	120 psi	130 psi
resistance to abrasion (Conventional tumbling test-loss in weight after 10 min.) before heating	9%	3%
after heating for 24 hr. at	750° — 5%	1200F — 5%
at	1000° — 4%	1800F — 20%
at	1200° — 3%	
alkalinity	ph 10	ph 10
corrosion resistance	does not cause or accelerate corrosion of steel, aluminum or stainless steel	
dimensional stability linear shrinkage after heating for 24 hrs. in a muffle at	750° — 0.8%	1200° — 0.7%
at	1000° — 0.9%	1800° — 1.6%
at	1200° — 1.4%	
specific heat	0.22 btu/lb.F	0.22 btu/lb.F
thermal diffusivity sq. ft./hr. at 200F mean Temp.	0.012	0.016

thermal conductivity



sizes

thickness — Kaylo Pipe Insulation is available in single or double layer thicknesses from 1" to 3" depending upon pipe size. Kaylo Tube Insulation is available in single layer thicknesses of 1" and 1½".

pipe sizes — Kaylo Pipe Insulation is available to fit nominal pipe sizes from ½" to 39" in diameter. Kaylo Tube Insulation will fit nominal copper tubing sizes from ⅜" to 3" in diameter.

forms — Kaylo Pipe Insulation is available in sectional or multisegmental form depending upon pipe size. All insulation is furnished in 3 ft. sections.

jackets

canvas — Kaylo Sectional Pipe Insulation includes standard canvas jackets, at no additional charge, on thicknesses up to and including 3", depending on pipe size. Standard canvas is available for segmental forms at a slight additional cost. Bands are available for use with this product at slight additional charge and will be furnished on request.

6 oz. and 8 oz. canvas jackets are available for all types, sizes and thicknesses of Kaylo Pipe and Tube Insulation at an additional charge. These jackets are factory applied on Sectional Pipe and Tube Insulation. On Multisegmental forms, they are furnished but not adhered.

Kaylo Klad — Kaylo is also available with an embossed aluminum jacket .016" thick or .010" thick stainless steel jacket. These jackets provide greater resistance to mechanical damage and present a neat finished appearance to pipe lines. The longitudinal seam has a self-locking joint. Butt sealing strip with integral mastic and protective asbestos cover are furnished for sealing end joints. See data sheet—for complete information on Kaylo Klad.

federal specification compliance

HH-I-523b — Insulation Block and Pipe Covering, Thermal (Calcium Silicate for Temperatures up to 1200F) Type II (pipe insulation) Class A thru E.

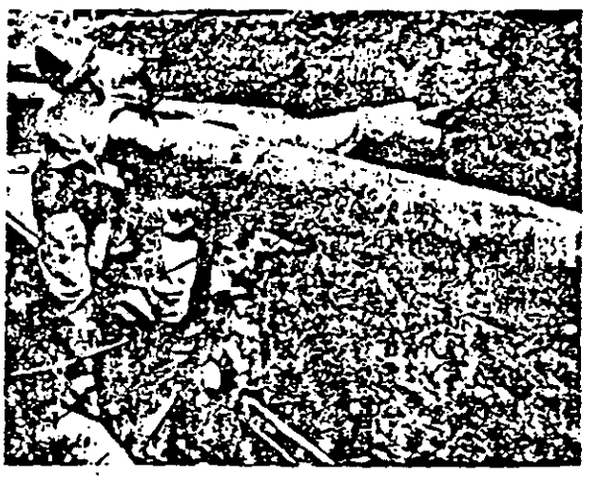
MIL-I-2781D (Int. Amend. 1) — Insulation Pipe Covering, Thermal, Grade I, Class b; Grade II, Class d; Grade III, Class e. Type I & II.

application recommendations

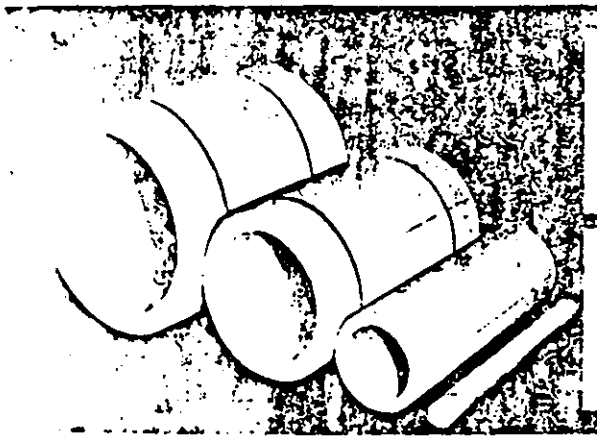
outdoor lines — Kaylo Pipe Insulations are mechanically fastened by wiring in place using 16 gauge wire on 9" centers and subsequently covered with a weatherproof jacket of metal or 45 lb. roofing felt. See Application Specifications for complete details.

indoor lines — Kaylo for indoor piping work is furnished with a factory-applied canvas jacket and held in place with bands or wire. The jacket has overlapping joint flaps that are smoothly pasted in place. Canvas should be sized to provide a base for painting.

fittings — Fitting are insulated with mitered segments of Kaylo wired in place and finished with a ¼" layer of insulating cement. Flanges and valves are insulated with oversized pipe insulation. They are finished off with canvas pasted in place for indoor lines or reinforced waterproof mastic for outdoor lines.



Pipe Insulation



Kaylo Pipe Insulation

for hot water heating, high temperature hot water, steam condensate piping systems and all heated lines to 1200F

uses

Kaylo is particularly suitable for use on high temperature piping systems where high performance and extended temperature range are required. Kaylo is widely used on hot piping where a great degree of physical abuse resistance is required, such as boiler and equipment rooms.

description

Kaylo Pipe Insulation is a rigid white hydrous calcium silicate insulation molded in sections for all types of indoor and outdoor piping that requires an abuse resistant, durable, efficient insulation, for temperatures up to 1200F.

benefits

Rugged—Kaylo Pipe Insulation is a strong and rigid material that resists mechanical damage during shipping, installation and service. It is well suited for riser piping in exposed locations.

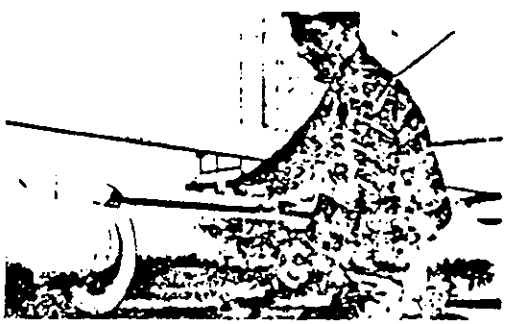
Versatile—Kaylo's extended temperature range offers wider use for all hot piping to 1200F.

will not cause stress corrosion cracking—Kaylo will not cause stress corrosion cracking of stainless steel because Kaylo contains an inhibitor and has less than 200 ppm soluable chlorides.

unaffected by moisture—Kaylo can be completely saturated in water without appreciable loss of strength and regains its strength and thermal value after drying out.



Kaylo Pipe Insulation cuts cleanly with straight square edges. The final result is well insulated piping with a neat finished appearance. Mitered fittings are finished with insulating cement and covered with canvas.



Kaylo Klad Pipe Insulation combines weatherproofing and insulation in one application. Attractive, maintenance-free factory-applied jackets of stainless steel and aluminum are complete with longitudinal locking seams and end joint butt strips.

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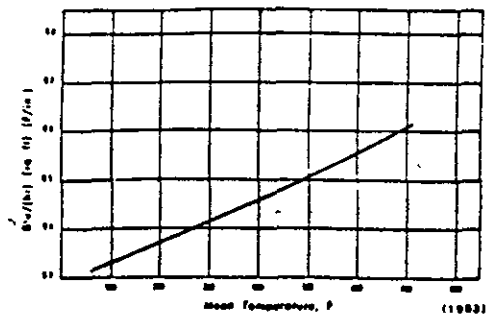
physical properties

density.....approximately 11 lbs. per cu. ft.
flexural strength (ASTM C-203) over 50 lb. per sq. in.
resistance to abrasion
(conventional tumbling test-loss in weight after 10 min.)
before heating.....9%
after heating for 24 hours
at 750 F.....5%
at 1000 F.....4%
at 1200 F.....3%
alkalinity.....ph 10
dimensional stability
linear shrinkage after heating for 24 hours in muffle
at 750 F.....0.8%
at 1000 F.....0.9%
at 1200 F.....1.4%
specific heat.....0.22 Btu/lb.F.

thermal conductivity



specification compliance

HH-I-00523b Insulation Block, Pipe Covering and Cement, Thermal, Calcium silicate (For temperatures up to 1200F) Type II (Pipe covering) Classes A thru E.

MIL-I-2781D Insulation Pipe Covering, Thermal, Grade 1, Class B; Grade 2, Class D; Grade 3, Class E, Type 1 and 2.

economic thickness—ambient air at 80F

Pipe Temp. / Temp. Diff. / IPS	200 / 120 ET	200 / 120 HL	200 / 120 ST	400 / 320 ET	400 / 320 HL	400 / 320 ST	600 / 520 ET	600 / 520 HL	600 / 520 ST
½	1	17	95	1½	40	106	2	63	113
¾	1	19	97	1½	42	110	2	71	117
1	1	20	95	1½	50	109	2½	70	107
1¼	1	24	99	2	52	104	2½	81	111
1½	1	27	98	2	55	105	2½	84	112
2	1	32	98	2	61	104	2½	96	112
2½	1½	26	99	2	64	103	3	94	105
3	1½	33	93	2	79	104	3	111	110
3½	1½	33	91	2½	72	99	3	115	108
4	1½	40	94	2½	83	102	3½	118	106
5	1½	36	93	2½	82	102	3½	120	107
6	1½	43	95	2½	94	105	3½	137	110

Pipe Temp. / Temp. Diff. / IPS	200 / 120 ET	200 / 120 HL	200 / 120 ST	400 / 320 ET	400 / 320 HL	400 / 320 ST	600 / 520 ET	600 / 520 HL	600 / 520 ST
6	2	46	91	3	98	100	4	140	104
7	2	47	92	3	104	103	4	155	107
8	2	55	91	3	115	100	4	169	106
9	2	56	92	3	123	102	4	182	110
10	2	65	91	3½	124	98	4	200	107
11	2	73	92	3½	133	98	4	205	107
12	2	81	92	3½	142	98	4½	210	105
14	2½	72	90	3½	157	99	5	213	103
16	3	70	88	4	159	97	6	207	99
18	3	78	88	5	147	92	6½	212	97
20	3	85	88	5	151	93	6½	229	98
24	3	100	89	5	176	93	6½	266	99

economic thickness

table key
ET—economic thickness (inches)
HL—heat loss (Btu/eff. hr)
ST—surface temperature (F)

importance of specifying economic thickness

Selection of insulation thicknesses for any specific application should take into consideration at least the following criteria. 1. Type of insulation applied. 2. Cost of heat energy. 3. Cost of fuel. 4. Cost of depreciation—plant and insulation. 5. Capital investment in heat production equipment. 6. Temperature difference. 7. Size of the pipe or surface. 8. Conductivity of insulation.

For fuel saving, the tabulated thicknesses are optimum thicknesses calculated on an "Economic" basis for heat conservation under average operating conditions and assure adequate protection control. Special conditions may warrant the use of greater thicknesses.

Based on "How to Determine Economic Thickness of Insulation"—National Insulation Manufacturers Association.
Economic thickness—Heated Piping to 120DF (80F ambient

sizes

block shapes—Kaylo Pipe Insulation is available in single layer thicknesses from 1" to 3" depending upon pipe size. Kaylo Curved Tubing Insulation is available in single layer thicknesses of 1" and 1½".

pipe sizes—Kaylo Pipe Insulation is available to fit nominal pipe sizes from ½" to 39" in diameter, and nominal copper tubing sizes from ⅜" to 3" in diameter. It is manufactured to Dimensional Standards Sizes to permit nesting in multiple-layer applications.

forms—Kaylo Pipe Insulation is available in sectional or multisegmental form depending upon pipe size. All insulation is furnished in 3 ft. sections.

jackets

Jackets are factory-applied on Sectional Pipe and Tube Insulation. On Multisegmental forms they are furnished but not adhered.

canvas—Kaylo Sectional Pipe Insulation includes standard canvas jackets, at no additional charge, on thicknesses up to and including 3" depending on pipe size.

6 oz. and 8 oz. canvas jackets are available for all types, sizes and thicknesses of Kaylo Pipe and Tube Insulation at an additional charge.

smooth and embossed aluminum—Kaylo is also available with smooth or embossed aluminum jacket .016" thick; or stainless steel .010". These weatherproof jackets provide greater resistance to mechanical damage and present a neat finished appearance to outdoor pipe lines. The longitudinal seam has a self-locking joint. Butt sealing strips are furnished with an integral weatherproof mastic for sealing end joints. For additional information refer to Data Sheet on Kaylo Klad Pipe Insulation.

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Pub. No. 1-IN-3067

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economic thickness

selection of insulation thicknesses for any specific application should take into consideration the following important criteria. 1. Cost of insulation applied. 2. Cost of heat energy. 3. Cost of money tied up. 4. Cost of depreciation—plant and insulation. 5. Capital investment in heat production equipment. 6. Temperature differential. 7. Size of the pipe or surface. 8. Conductivity of insulation.

for hot piping, the tabulated thicknesses are optimum thicknesses calculated on an "economic"* basis for heat conservation under average operating conditions and assures adequate temperature control. Special conditions may warrant the use of other thicknesses.

**From "How to Determine Economic Thickness of Insulation"—National Insulation Manufacturers Association.*

economic thickness — kaylo pipe insulation — power & utility piping

(80F ambient air)

PIPE TEMP.		200			400			600			800			1000			1200	
TEMP. DIFF.		120			320			520			720			920			1120	
IPS	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST
¼	1	18	97	1	57	132	1½	81	133	2	106	135	2	150	158	2½	170	146
1	1	19	95	1	59	124	1½	88	131	2	116	134	2½	146	137	3	177	139
1¼	1	25	99	1	76	135	1½	98	131	2	136	143	2½	159	137	3	205	142
1½	1	25	97	1½	63	113	1½	110	137	2½	123	121	2½	171	138	3	206	142
2	1	30	97	1½	71	113	1½	126	139	2½	144	128	2½	202	148	3	238	152
2½	1	36	98	1½	73	113	2	113	118	2½	153	128	3	197	133	3½	258	136
3	1	42	99	1½	93	117	2	140	123	2½	186	135	3	235	144	3½	278	147
3½	1	42	99	1½	94	117	2	143	124	3	173	121	3½	223	129	4	270	135
4	1	50	100	1½	113	118	2½	145	119	3	197	126	3½	248	135	4	300	141
4½	1	62	101	1½	120	118	2½	160	120	3	220	129	3½	260	137	4	322	143
5	1	70	102	1½	155	122	2½	187	122	3	250	131	3½	310	138	4	360	144
6	1	74	102	2	130	111	2½	194	123	3	260	132	3½	319	139	4½	358	137
7	1½	70	97	2	145	112	2½	214	123	3	268	133	3½	332	140	4½	398	139
8	1½	66	94	2	157	112	2½	228	123	3½	274	124	4	355	134	4½	430	142
9	1½	72	94	2	168	112	2½	242	124	3½	302	126	4	384	135	5	440	137
10	1½	78	94	2	184	112	3	245	118	3½	330	128	4	421	138	5	469	138
11	1½	84	94	2	205	114	3	263	118	3½	354	130	4	440	140	5	499	139
12	1½	90	94	2	229	115	3	282	118	4	333	122	4½	442	132	5	532	140
14	1½	108	96	2½	204	108	3	314	121	4	377	124	4½	485	135	5½	542	136
16	1½	124	96	2½	229	108	3	353	122	4	422	126	4½	541	136	5½	601	137
18	1½	137	96	2½	258	109	3	391	122	4	465	126	4½	594	136	5½	659	139
20	1½	151	96	2½	281	110	3	427	123	4	507	127	4½	648	138	5½	695	140
24	1½	179	96	2½	332	110	3½	442	117	4½	538	122	5	694	133	6	777	136

economic thickness — kaylo pipe insulation — process piping

(80F ambient air)

PIPE TEMP.		200			400			600			800			1000			1200	
TEMP. DIFF.		120			320			520			720			920			1120	
IPS	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST
¼	1	19	97	1	57	132	1	100	170	1	147	214	1	205	265	1½	218	221
1	1	20	97	1	60	125	1	105	158	1	156	196	1½	183	186	1½	237	217
1¼	1	26	98	1	76	129	1	132	178	1	196	224	1½	204	186	1½	263	217
1½	1	25	98	1	77	129	1	135	167	1½	164	165	1½	229	199	1½	295	230
2	1	31	98	1	89	132	1	158	171	1½	188	167	1½	262	202	2	288	182
2½	1	37	99	1	101	133	1½	129	130	1½	192	155	2	237	160	2	307	184
3	1	41	99	1	122	137	1½	165	144	1½	245	176	2	293	179	2½	334	183
3½	1	43	100	1	134	124	1½	166	136	1½	280	180	2	299	170	2½	343	174
4	1	51	100	1	144	136	1½	198	147	2	248	155	2	347	184	2½	393	185
4½	1	59	101	1	149	139	1½	201	154	2	258	158	2	361	188	2½	428	172
5	1	68	102	1	170	140	1½	242	158	2	304	159	2	400	190	2½	490	181
6	1	76	103	1½	160	123	1½	281	156	2	339	161	2	474	193	2½	524	195
7	1½	62	94	1½	176	123	1½	311	154	2	388	161	2½	465	167	2½	624	186
8	1½	68	95	1½	193	123	1½	340	155	2	412	163	2½	476	168	3	548	175
9	1½	74	95	1½	208	123	1½	376	155	2	445	163	2½	540	168	3	640	175
10	1½	80	95	1½	219	123	2	324	136	2½	411	147	2½	576	173	3½	596	166
12	1½	86	95	1½	240	124	2	360	138	2½	450	149	2½	626	175	3½	633	168
14	1½	92	95	1½	261	125	2	404	141	2½	482	150	2½	675	177	3½	679	169
16	1½	110	97	1½	307	127	2	432	142	2½	542	154	2½	757	183	3½	746	172
18	1½	125	97	1½	352	128	2	490	144	2½	610	156	2½	852	185	3½	868	174
20	1½	139	97	1½	392	128	2	543	144	2½	674	156	3	818	168	3½	933	177
22	1½	153	97	1½	431	129	2	598	145	2½	743	157	3	893	169	3½	1020	178
24	1½	185	97	1½	511	129	2	707	146	2½	872	158	3	1048	171	3½	1195	180

table key (ambient still air at 80F) ET — economic thickness ST — surface temperature HL — heat loss . . Btu/hr/lineal foot

economic thickness — kaylo pipe insulation — power & utility piping

(80F ambient air)

Temp. Pipe	1300			1400			1500			1600			1700			1800		
	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST	ET	HL	ST
½	2½	221	157	2½	245	160	3	254	150	3	278	157	3	304	164	3½	313	156
¾	2½	243	156	3	252	148	3	278	155	3	305	162	3½	314	154	3½	342	161
1	2½	269	161	3	277	152	3	306	160	3½	316	152	3½	345	159	3½	375	166
1¼	3	279	149	3	310	157	3	342	165	3½	351	157	3½	384	164	3½	417	172
1½	3	284	153	3½	309	146	3½	362	160	3½	368	160	4	397	160	4	434	168
2	3	337	156	3½	347	150	3½	383	158	3½	421	165	4	432	159	4	469	166
2½	3	374	160	3½	385	154	3½	425	162	3½	466	170	4	476	163	4	518	171
3	3½	388	150	4	402	146	4	444	153	4½	458	150	4½	500	156	4½	545	163
3½	4	390	142	4	434	149	4	479	156	4½	494	152	4½	539	159	5	555	155
4	4	419	144	4	465	151	4½	481	148	4½	528	154	5	545	151	5	593	158
4½	4	446	145	4½	464	143	4½	512	150	5	530	147	5	579	153	5½	598	151
5	4½	445	138	4½	495	145	5	515	143	5	565	149	5½	585	147	5½	637	153
6	4½	502	141	5	523	140	5	578	146	5½	560	144	5½	655	150	6	678	149
7	4½	550	143	5	572	142	5	632	148	5½	655	147	6	679	146	6	738	151
8	5	560	137	5	622	143	5½	647	142	5½	710	149	6	735	148	6½	761	147
9	5	603	138	5½	630	138	5½	696	144	6	722	143	6	789	149	6½	817	149
10	5	653	140	5½	681	139	5½	752	146	6	779	145	6½	809	145	6½	880	150
12	5½	652	134	5½	724	140	6	754	140	6	829	146	6½	859	146	7	890	146
14	5½	693	135	5½	770	141	6	801	141	6½	834	141	6½	911	147	7	943	147
16	5½	742	136	6	776	137	6	857	143	6½	891	143	7	926	143	7	1007	148
18	6	772	132	6	858	138	6½	896	139	7	934	139	7	1020	144	7½	1058	145
20	6	844	133	6½	886	134	6½	978	140	7	1018	140	7½	1059	141	7½	1153	146
22	6	917	134	6½	960	135	6½	1060	141	7	1102	142	7½	1146	142	7½	1247	148
24	6	1060	136	6½	1108	137	7	1157	138	7½	1206	139	7½	1318	144	8	1366	145
30	6½	1195	133	7	1253	134	7½	1312	135	7½	1440	141	8	1497	142	8½	1555	143
36	6½	1620	142	7	1690	144	7½	1790	147	7½	1950	153	8	2050	155	8½	2150	158

ET—economic thickness HL—heat loss . . . Btu/hr/lineal foot ST—surface temperature

OWENS-CORNING FIBERGLAS CORPORATION
Industrial and Commercial Construction Materials Division, 717 Fifth Avenue, New York, New York 10022
General Offices, Toledo, Ohio 43601 • Pacific Coast Division, Santa Clara, California 95052

Pub. No. IN-341

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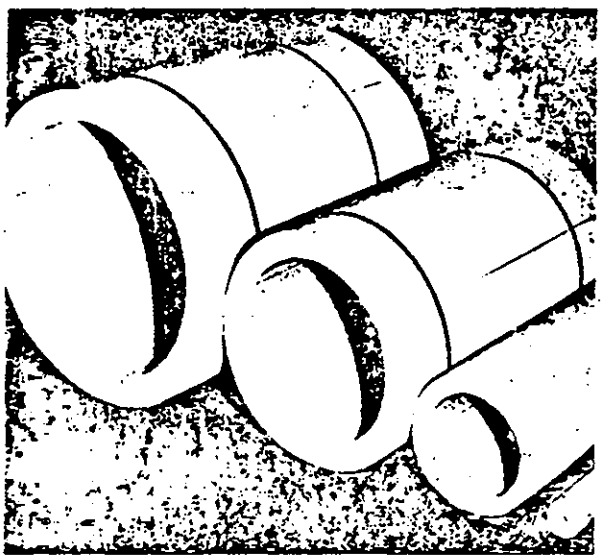
Kaylo and Kaylo-20 Pipe Insulation

KAYLO pipe insulation *for indoor or outdoor piping up to 1200 F operating temperature*



Kaylo pipe insulation applies easily and quickly with standard application methods. Ordinary tools of the trade are sufficient for all cutting, sawing or scoring. It is non-irritating to the skin and non-toxic.



Kaylo Pipe Insulation presents a superior final appearance when applied to a variety of irregularly-shaped high temperature vessels.

Kaylo* pipe insulation, a near white, rigid hydrous calcium silicate heat insulation, manufactured by Owens-Corning Fiberglas Corporation, effectively insulates indoor and outdoor piping to 1200 F. A chemically reacted material, Kaylo pipe insulation contains no added binder. For mechanical effects, a small amount of asbestos fiber is included at the time of manufacture.

This thoroughly tested and field-proven material contains the physical properties most desired for efficient, durable insulation work. It retains an appreciable percentage of its strength even after complete saturation in water, original efficiency returning after drying. The effectiveness, high strength and moisture resistance are unattained by most other insulating materials.

sizes

thickness—Kaylo Pipe Insulation is available in thicknesses from 1" to 3" depending upon pipe size. Kaylo Tube Insulation is available in thicknesses of 1" and 1½".

pipe sizes—Kaylo Pipe Insulation is available to fit pipe from ½" to 39" in diameter. Kaylo Tube Insulation will fit copper tubing from ½" to 3⅛" in diameter.

forms—Kaylo Pipe Insulation is available in sectional or multisegmental form depending upon pipe size. All insulation is furnished in 3 ft. sections.

jackets

canvas—Kaylo Sectional Pipe Insulation includes standard canvas jackets, at no additional charge, on thicknesses up to and including 2½". Standard canvas is available for segmental forms at a slight additional cost. Bands are available for use with this product at slight additional charge and will be furnished on request.

6 oz. and 8 oz. canvas jackets are available for all types, sizes and thicknesses of Kaylo Pipe and Tube Insulation at an additional charge. These jackets are factory applied on Sectional Pipe and Tube Insulation. On Multisegmental forms, they are furnished but not adhered.

Kaylo Klad—Kaylo is also available with a soft rippled embossed aluminum jacket .016" thick or .010 stainless steel jacket. These jackets provide greater resistance to mechanical damage and present a neat finished appearance to pipe lines. The longitudinal seam has a self-locking joint. Joint bands with integral mastic are furnished for sealing end joints.

limitations

Kaylo Pipe Insulation is designed for temperatures up to 1200 F and is not recommended when operating temperatures of piping exceed this limit.

*T. M. Owens-Corning Fiberglas Corp.

physical properties

density ..... approximately 11 lb. per cu. ft

flexural strength .....(ASTM C-203) over 50 lb. per sq. in.

resistance to abrasion

(conventional tumbling test-loss in weight after 10 min.)

before heating 9%

after heating for 24 hours

at 750 F 5%
at 1000 F 4%
at 1200 F 3%

alkalinity: ph 10

dimensional stability

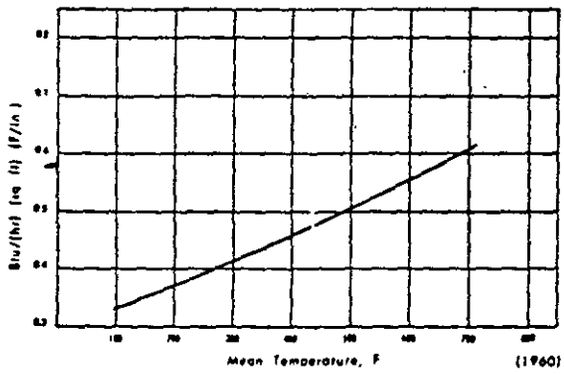
linear shrinkage after heating for 24 hours in muffle

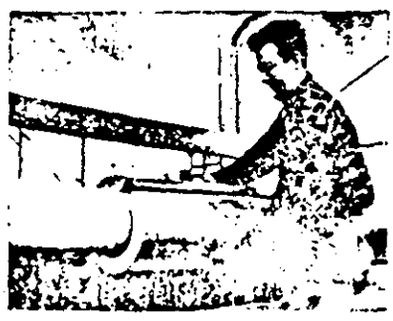
at 750 F 0.8%
at 1000 F 0.9%
at 1200 F 1.4%

specific heat: 0.22 Btu/lb.F.

thermal diffusivity 0.012 sq. ft. per hr. at 200 F. mean temperature.

thermal conductivity





Kaylo Klad
Stainless steel and aluminum clad Kaylo Pipe Insulations apply quickly to piping. A self locking longitudinal seam and end joint strips make application of insulation and weather protection a "one-step" operation. The neat finished appearance "dresses up" the line and provides a virtually maintenance-free weather protection.

specifications

for insulation of piping with Kaylo

applicable specifications

HH-I-523a Insulation Block, Pipe Covering and Cement, Thermal, Calcium Silicate (For Temperatures up to 1200 F) class II (pipe covering).

MIL-I-2781C Insulation Pipe Covering, Thermal, Grade I Class B, Grade II Class D, Grade III Class E.

1. Insulating materials

All heated pipes shall be insulated with Kaylo Pipe Insulation as manufactured by Owens-Corning Fiberglas Corporation, to the thickness noted on drawings or as shown in the table.

2. Application

All Pipe Insulation shall be applied over clean, dry surfaces, butting adjoining sections firmly together and adhered canvas, when furnished, smoothly over joints. Longitudinal and circumferential joints need not be pointed with finishing cement to conserve heat.

Insulation on pipes over 12" diameter and all outdoor piping shall be wired in place with 16 gauge soft annealed wire on no greater than 9" centers. Where double layer insulation is applied, the first layer shall be wired in place without jacket; the second layer shall be applied with all joints staggered.

All flanges, valves and fittings shall be insulated with Fiberglas molded fitting insulation or fabricated mitered segments of pipe insulation equal in thickness to the insulation on the adjoining pipe. Fittings on pipe sizes 3" and smaller may be insulated with O-C 110 Insulating Cement of equal thickness.

3. Surface finish

Indoor piping under 12" diameter not subject to abrasion or mechanical abuse requires no finish in addition to the factory-furnished canvas. Piping over 12" diameter shall be finished with 6-ounce canvas pasted in place.

Piping located outdoors shall be finished with 45-lb. roofing felt jacket with all joints lapped not less than 2". Jackets shall be wired with 16 ga. copper wire on not greater than 9" centers or banded on 12" centers with ½" galvanized bands. Other suitable weatherproof jackets such as metal, asphalt or plastic coating may be applied according to the jacket manufacturers' specifications.

Insulation on flanges, valves and fittings shall be covered with a ¼" coat of O-C 110 Insulation Cement. Insulation located indoors shall be further finished with 6 oz. canvas neatly pasted in place.

All insulation on flanges, valves and fittings located outdoors shall be covered with asphalt weatherproof mastic reinforced with an open mesh glass fabric. Mastic shall be applied in sufficient thickness to give a ⅛" dry coat and shall be troweled neatly over the fitting with the jacket on the adjacent pipe insulation lapped at least 2" over the mastic.

The foregoing is necessarily general in nature. Application procedure and material approval is at the discretion and responsibility of the design engineer to meet specific job requirements.

design data for Kaylo Insulations

This table presents reference data for information on the actual thicknesses according to the simplified Dimensional Standard system.

The following data are presented to aid in the design of Kaylo Pipe Insulation modified to meet specific needs. Recommendations are generalized and should be modified to meet local conditions and job requirements.

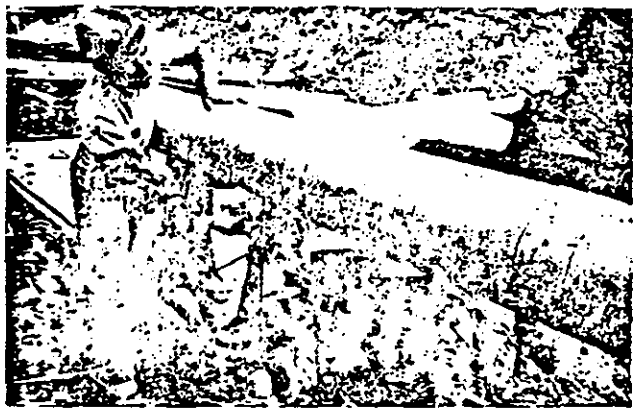
importance of calculating economic thickness

Selection of insulation thicknesses for any specific application should take into consideration at least the following criteria.

1. Cost of insulation applied
2. Cost of heat energy
3. Cost of capital
4. Depreciation period—plant and insulation
5. Capital investment in heat production equipment
6. Temperature differential
7. Size of the pipe or surface
8. Conductivity of insulation

To assist the engineer, Owens-Corning Fiberglas has taken the figures provided by the National Insulation Manufacturers Association in their manual, "How to Determine Economic Thickness of Insulation" and, by pre-calculating many of the equations on a computer, has created a quick, simple system for resolving economic thickness. To obtain your copy of this Dividend Engineering "Economic Thickness Manual," contact your local Fiberglas branch office. Your local Fiberglas representative will be glad to explain this quick, practical method for computing economical thickness under all normal operating conditions.

applications—Kaylo and Kaylo-Klad



Off-site yard steam insulated with Kaylo Pipe Insulation for efficiency and controlled temperatures at distant points.



New Kaylo Trace Line pipe insulation and Kaylo Klad Trace Line Pipe Insulation (jacketed with .016 embossed aluminum or .010 stainless steel) provide great economy in the insulation of trace lines.

These pre-molded trace line insulations are designed for insulating piping 2" IPS x 1" thick up to 8" IPS x 2" thick together with a 1" trace line.

Advantages of this Kaylo molded insulation include higher strength, more rigid construction and, in the case of Kaylo Klad, single application of both insulation and weather proofing. Application and maintenance costs are both reduced. Where a trace line is greater than one inch, an extended leg insulation can be fabricated to special order; contact your local OCF Branch Office.







Kaylo-Klad aluminum jacket "kicks out" the weather. The longitudinal seam joint and end joint band, with integral mastic, provide positive weather protection.

recommended thicknesses—Kaylo†

(ambient still air at 80 F)

pipe temp.	250 F				450 F				650 F			
temp. dif.	-200 F				400 F				600 F			
pipe size	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST
½	1	28.6	79.0	100	1½	52.5	85.7	107	2	77.0	90.6	110
¾	1	34.2	79.5	104	1½	60.0	87.6	110	2½	74.4	92.7	103
1	1	35.9	82.6	101	1½	65.3	89.0	109	2½	85.9	93.1	106
1¼	1	45.8	82.0	108	1½	73.2	90.1	110	2½	98.3	93.7	109
1½	1	46.3	84.0	104	2	65.8	92.2	103	3	89.0	95.0	102
2	1	53.5	84.9	105	2	80.3	92.8	107	3	108	95.1	108
2½	1	61.5	85.5	106	2	83.7	93.3	105	3	115	96.1	107
3	1	72.7	85.7	108	2½	90.9	93.9	104	3½	124	96.1	107
4	1	86.4	86.5	108	2½	107	94.4	105	3½	146	96.4	108
5	1	106	86.5	110	2½	126	94.6	107	3½	164	96.7	110
6	1½	94.2	90.0	103	2½	143	94.8	109	4	170	97.1	107
7	1½	102	90.3	103	2½	162	94.8	109	4	190	97.2	108
8	1½	114	90.4	104	2½	174	95.0	110	4	210	97.2	109
9	1½	125	90.4	104	2½	188	95.2	110	4	222	97.4	110
10	1½	133	90.8	104	3	179	95.9	106	4½	226	97.6	108
12	1½	153	91.0	104	3	210	95.9	107	4½	250	97.7	109
14	1½	178	90.4	106	3	235	95.8	108	4½	275	97.7	109
16	1½	201	90.4	107	3	255	95.9	109	5	286	97.9	108
18	1½	223	90.5	108	3	285	96.0	110	5	320	97.9	109
20	1½	246	90.5	108	3½	272	96.5	106	5	353	97.9	110
24	1½	291	90.5	108	3½	319	96.6	107	5½	364	98.2	108

C

†True economic thickness can now be calculated quickly and easily by following the system provided in the new Fiberglas Dividend Engineering "Economic Thickness Manual". This is available from your local Fiberglas branch office.

KEY

RT = Recommended Thickness.

HL = Heat Loss Btu/Lin. ft./hr.

E = Insulation Efficiency.

ST = Surface Temperature.*

C = Commercial and Industrial

U = Power and Utility

P = Process Industries

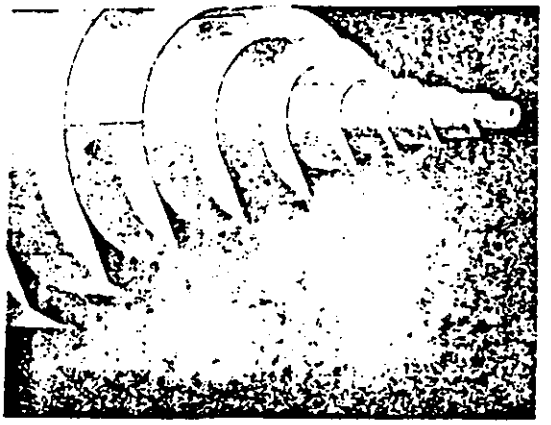
pipe temp	280 F				480 F				680 F				880 F				1080 F				1200 F			
temp. dif.	200 F				400 F				600 F				800 F				1000 F				1120 F			
pipe size	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST
½	1	28.6	79.0	100	1	63.0	84.0	120	1½	86.0	89.5	119	2	112	92.4	124	2½	128	94.8	118	3	145	95.3	120
¾	1	34.2	79.5	104	1	75.2	84.4	128	1½	98.3	90.3	126	2	125	93.2	128	2½	144	95.3	122	3	162	95.8	127
1	1	35.9	82.6	101	1	79.2	86.7	123	1½	107	91.4	125	2	136	94.0	127	3	151	96	130	3	184	96.2	133
1¼	1	45.8	82.0	108	1½	73.2	90.1	110	1½	120	92.3	127	2½	143	95	123	3	175	96.3	125	3½	200	97.1	128
1½	1	46.3	84.0	104	1½	182.1	90.2	114	2	108	93.9	113	2½	146	95.5	119	3	177	96.8	122	3½	199	97.6	127
2	1	53.5	84.9	105	1½	93.5	91.0	114	2	132	94.	121	2½	170	95.8	126	3	208	96.9	130	4	215	97.5	126
2½	1	61.5	85.5	106	1½	96.1	92.3	111	2	137	94.8	117	2½	181	96.3	124	3	206	97.5	129	4	231	97.8	125
3	1	72.7	85.7	108	1½	126	91.5	120	2	164	94.9	128	3	197	96.6	124	3½	236	97.6	126	4	267	97.9	130
4	1	86.4	86.5	108	1½	154	91.9	123	2	202	95.0	128	3	222	97	124	3½	274	97.8	130	4½	286	98.2	127
5	1	106	86.5	110	1½	177	92.4	123	2½	208	95.9	122	3	266	97.1	128	4	292	98.1	125	4½	326	98.3	130
6	1	137	85.1	116	1½	207	92.4	126	2½	239	95.9	125	3½	268	97.5	122	4	332	98.5	129	5	344	98.5	128
7	1½	102	90.3	102	1½	224	92.8	125	2½	270	96	127	3½	297	97.6	125	4½	333	98.5	124	5	377	98.6	129
8	1½	114	90.4	103	1½	249	92.9	127	2½	287	95.2	127	3½	326	97.7	126	4½	366	98.5	125	5½	389	98.7	126
9	1½	125	90.4	108	1½	273	93.0	128	2½	313	96.3	128	3½	353	97.7	127	4½	400	98.5	128	5½	436	98.9	128
10	1½	133	90.8	103	1½	292	93.2	127	2½	348	96.3	129	3½	392	97.7	129	4½	440	98.5	130	6	452	98.9	127
12	1½	153	91.0	108	1½	338	93.7	128	2½	395	96.4	130	4	410	98	125	5	460	98.8	127	6	510	99.0	129
14	1½	178	90.4	106	2	325	94.1	123	3	385	96.8	125	4	447	98	128	5	500	98.7	129	6	556	99.0	131
16	1½	201	90.4	107	2	375	94.0	124	3	428	96.9	126	4	495	98.1	128	5	563	98.7	130	6	621	99.0	132
18	1½	223	90.5	108	2	410	94.2	125	3	480	96.9	127	4	540	98.1	129	5½	545	98.8	127	6	679	99.0	134
20	1½	246	90.5	108	2	460	98.4	126	3	535	96.9	128	4	594	98.1	130	5½	605	98.9	128	6	733	99.1	136
24	1½	291	90.5	108	2	525	94.3	126	3	610	97	128	4½	618	98.4	126	5½	685	98.9	129	6	841	99.1	137
½	1	28.6	79.0	100	1	63.0	84.0	120	1	108	86.8	147	1½	124	91.6	136	2	146	94.1	134	2	179	94.2	149
¾	1	34.2	79.5	104	1	75.2	84.4	128	1½	98.3	90.3	126	1½	145	92.1	145	2	166	94.6	141	2½	175	95.5	134
1	1	35.9	82.6	101	1	79.2	86.7	123	1½	107	91.4	125	2	136	94.0	127	2½	174	95.4	134	2½	198	95.9	141
1¼	1	45.8	82.0	108	1	102	86.3	134	1½	120	92.3	127	2	160	94.4	135	2½	188	96.1	135	3	211	96.5	137
1½	1	46.3	84.0	104	1	102	87.8	129	1½	135	92.4	132	2	156	95.2	126	2½	207	96.2	142	3	212	96.9	134
2	1	53.5	84.9	105	1	118	88.6	131	1½	154	93.0	134	2	189	95.3	135	2½	223	96.7	138	3	250	97.1	140
2½	1	61.5	85.5	106	1	135	89.1	134	1½	158	94.0	127	2	200	96.4	132	2½	237	97.1	134	3	266	97.4	139
3	1	72.7	85.7	108	1	160	89.3	137	1½	202	93.7	140	2	250	95.7	145	2½	292	97.0	147	3	316	97.5	147
4	1	86.4	86.5	108	1	191	89.9	138	1½	249	92.7	147	2	293	96.1	148	3	299	97.6	137	3½	335	97.9	140
5	1	106	86.5	110	1	240	89.6	144	1½	297	94.0	149	2½	294	96.8	137	3	347	97.8	140	3½	386	98.0	145
6	1	137	85.1	116	1½	207	92.4	126	2	270	95.4	133	2½	337	96.9	139	3	403	98	147	3½	430	98.2	147
7	1½	102	90.3	102	1½	224	92.8	125	2	307	95.5	134	2½	375	97.0	141	3½	386	98.3	135	3½	471	98.7	148
8	1½	114	90.4	103	1½	249	92.9	127	2	333	95.6	135	2½	399	97.2	140	3½	422	98.2	137	4	474	98.4	142
9	1½	125	90.4	104	1½	273	93.0	128	2	369	95.9	134	2½	435	97.2	142	3½	458	98.3	138	4	513	98.5	143
10	1½	133	90.8	103	1½	292	93.2	127	2	391	95.8	137	2½	442	97.2	146	3½	504	98.3	140	4	563	98.5	146
12	1½	153	91.0	104	1½	338	93.7	128	2	451	95.9	138	2½	563	97.3	148	3½	576	98.3	143	4	642	98.5	148
14	1½	178	90.4	106	1½	391	93.0	132	2	515	95.7	143	3	541	97.8	140	3½	642	98.3	147	4½	647	99.7	144
16	1½	201	90.4	107	1½	441	93.0	133	2	579	95.8	144	3	606	97.6	141	4	642	98.5	140	4½	719	98.7	145
18	1½	223	90.5	108	1½	492	93.1	134	2	643	95.9	147	3	671	97.7	142	4	717	98.4	142	5	798	98.9	147
20	1½	246	90.5	108	1½	542	93.1	134	2½	588	96.5	135	3	736	97.7	144	4	777	98.4	144	5	840	99.1	143
24	1½	291	90.5	108	1½	642	93.1	135	2	769	97.3	136	3	870	97.7	147	4	903	98.5	144	5	972	98.7	147

U

P

*Surface temperatures for Kaylo Klad will be higher due to the emissivity of the aluminum jacket. This will vary with ambient temperature, thickness of insulation used. However, the thermal efficiency of the application will be improved a great deal over the aluminum jacket.

KAYLO-20 pipe insulation *for indoor and outdoor piping up to 1800 F operating temperature*



Kaylo®-20 Insulation, colored pink for identification, a high-temperature calcium silicate heat insulation manufactured by Owens-Corning Fiberglas extends the range of Kaylo Heat Insulation to include temperatures up to 1800 F with all the properties of moisture resistance and high strength of standard Kaylo material. It also may be used with outer layers of Fiberglas Pipe Insulation to provide ultimate balance of cost and efficiency.

Kaylo-20 Insulation is highly dimensionally stable at the temperatures for which it is designed. Resistance of this insulation to high temperatures makes it extremely useful for protecting fluids in the pipe in case of fire.

sizes

thickness—Kaylo-20 Pipe Insulation is available in thicknesses from 1" to 3" depending upon pipe size. Kaylo-20 Tube Insulation is available in thicknesses of 1" and 1½".

pipe sizes—Kaylo-20 Pipe Insulation is available to fit pipe from ½" to 39" in diameter. Kaylo-20 Tube Insulation in copper tubing sizes will fit tubing from ½" to 3⅛".

forms—Kaylo-20 Pipe Insulation is available in sectional or multi-segmental form depending upon pipe size. All insulation is furnished in 3' sections.

jackets

canvas—Standard canvas jackets are provided at no additional charge with Kaylo-20 Sectional Pipe and Tube Insulation on thicknesses up to and including 2½". Standard canvas is available for segmental forms at a slight additional cost. Bands are available for use with this product at a small additional charge and will be shipped only on request.

6 oz. and 8 oz. canvas jackets are available on all types, sizes and thicknesses of Kaylo-20 Pipe Insulation at additional charge. These jackets are factory applied on sectional pipe and tube insulation. On multi-segmental insulation, they are furnished but not adhered.

Kaylo Klad locks out the weather, protects the insulation and provides a maintenance free line and attractive finished appearance. Factory applied jackets of .016 embossed aluminum and .010 stainless steel have longitudinal interlocking seams and joint bands with integral mastic permitting application of insulation and weather proofing at the same time and reducing application costs.

limitations

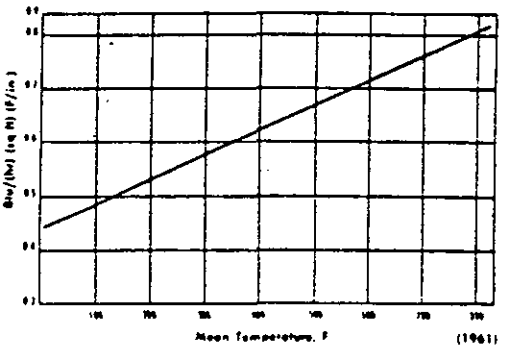
Kaylo 20 material is designed for temperatures up to 1800 F. It should not be used when operating temperatures of piping exceed this limit.

®T. M. Owens Corning Fiberglas Corp.

physical properties

density:
approximately 12 lbs. per cu. ft.
flexural strength: (ASTM C-203)
90 lbs. per sq. in.
compressive strength: (ASTM C-165)
130 lbs. per sq. in. at 5% deformation
dimensional stability:
linear shrinkage after heating for 24 hours in muffle
at 1200 F.....0.7%
at 1800 F.....1.6%
resistance to abrasion:
(conventional tumbling test—loss in weight after 10 min.)
before heating 3%
after heating for 24 hours
at 1200 F 5%
at 1800 F 20%
alkalinity: ph 10
working temperature: up to 1800 F
physical properties
specific heat: 0.22 Btu/1 lbs. F.
thermal diffusivity: 0.016 sq. ft. per hr. at 200 F mean temperature.

thermal conductivity



recommended thicknesses†

These are average figures and may be adjusted to meet special conditions encountered on specific jobs. Kaylo heat loss data is available for use where plant operating economics and other conditions demand greater insulation thicknesses. Design surface temperatures are approx. 150 F.

nom. pipe size	Temperature Difference F							
	1100	1200	1300	1400	1500	1600	1700	1800
½	2½	2½	3	3	3½	3½	4	4
¾	2½	2½	3	3	3½	3½	4	4
1	2½	3	3	3	3½	3½	4	4½
1¼	2½	3	3	3½	3½	4	4½	4½
1½	3	3	3½	3½	3½	4	4½	5
2	3	3	3½	3½	4	4	4½	5
2½	3	3½	3½	4	4	4½	5	5½
3	3½	3½	3½	4	4	4½	5	5½
3½	3½	3½	4	4	4½	5	5½	6
4	3½	3½	4	4	4½	5	5½	6
6	4	4	4½	4½	5	5½	6	6½
8	4	4	4½	4½	5	5½	6	6½
10	4	4½	4½	5	5½	6	6½	7
12	4½	4½	5	5	5½	6	6½	7
14	4½	5	5	5½	6	6½	7	7½
16	4½	5	5½	6	6½	7	7½	8
18	5	5	5½	6	6½	7	7½	8
20	5	5½	5	6½	7	7½	8	8½
24-72	5	5½	6	6½	7	7½	8	8½

† For true economic thickness, request O-C "Economic Thickness Manual"

insulation thickness standards— Kaylo and Kaylo-20

CT

nom. tube size	O. D. of tube (nom.)	single layer nom. 1" actual	nom. 1" O.D.	nom. 1½" actual	nom. 1½" O.D.
⅜"	½"	1.18	2.88	1.49	3.50
½"	⅝"	1.11	2.88	1.42	3.50
⅝"	¾"	1.05	2.88	1.61	4.00
¾"	⅞"	.99	2.88	1.55	4.00
1"	1⅛"	1.17	3.50	1.42	4.00
1¼"	1⅜"	1.05	3.50	1.55	4.50
1½"	1⅝"	1.17	4.00	1.42	4.50
2"	2⅛"	.91	4.00	1.61	5.00
2½"	2⅝"	.81	4.50	1.45	5.56
3"	3⅛"	.91	5.00	1.73	6.66

Federal Specification Compliance

HH-I-523a Insulation Block Pipe Covering and Cement, Thermal, Calcium Silicate (For Temperatures up to 1200 F) class 11 (pipe covering).

MIL-I-2781C Insulation Pipe Covering, Thermal, Grade I Class B, Grade II Class D, Grade III Class E.

For Applicable Specifications refer to Page 2.

note:

Insulations for tubing sizes other than standard sizes shown are available only as cut-downs from next larger size tube or pipe and will be slightly elliptical in shape.

KEY

IP = iron pipe sizes

CT = copper tubing

IL = Inner Layer

OL = Outer Layer

nom. pipe size	O.D. of pipe	single layer only: nom. 1" actual	nom. 1" O.D.	nom. 1½" actual	nom. 1½" O.D.	single or double layer: nom. 2" actual	nom. 2" O.D.	nom. 2½" actual	nom. 2½" O.D.	nom. 3" actual	nom. 3" O.D.	multiple layer—recommended combinations: 2" IL/OL	2½" IL/OL	3" IL/OL	3½" IL/OL	4" IL/OL	4½" IL/OL	5" IL/OL	6" IL/OL
⅛"	.84	1.00	2.88	1.58	4.00	2.06	5.00	2.89	6.66	3.28	7.66	⅛x1	⅛x1	⅛x1 ⅛	⅛x1½	⅛x2	⅛x2	⅛x2½	⅛x3
¼"	1.05	.90	2.88	1.48	4.00	1.96	5.00	2.79	6.66	3.28	7.66	2½x1	2½x1½	3½x1½	3½x2	4½x2	4½x2½	6 x2½	7 x3
⅜"	1.05	.90	2.88	1.48	4.00	1.96	5.00	2.79	6.66	3.28	7.66	⅜x1	⅜x1½	⅜x1½	⅜x2	⅜x2	⅜x2½	⅜x2½	⅜x3
½"	1.32	1.08	3.50	1.58	4.30	2.11	5.88	2.88	6.66	3.28	7.66	3½x1	3½x1½	3½x1½	3½x2	4½x2	4½x2½	6 x2½	7 x3
¾"	1.66	.90	3.50	1.88	5.00	1.94	5.38	2.48	6.66	2.98	7.66	½ x1	½ x1½	½ x1½	½ x2	½ x2	½ x2	½ x2½	½ x3
1"	1.90	1.03	4.00	1.53	5.00	2.36	6.56	2.98	7.66	3.38	8.66	1 x1	1 x1½	1 x1½	1 x2	1 x2	1 x2	1 x2½	1 x3
1¼"	2.38	1.04	4.50	1.57	5.56	2.12	6.66	2.62	7.66	3.12	8.66	1¼x1	1¼x1½	1¼x1½	1¼x2	1¼x2	1¼x2	1¼x2½	1¼x3
1½"	2.38	1.04	5.00	1.87	6.66	2.37	7.66	2.87	8.66	3.37	9.66	1½x1	1½x1½	1½x1½	1½x2	1½x2	1½x2	1½x2½	1½x3
2"	2.38	1.04	5.00	1.87	6.66	2.37	7.66	2.87	8.66	3.37	9.66	2 x1	2 x1½	2 x1½	2 x2	2 x2	2 x2	2 x2½	2 x3
2½"	2.88	1.04	5.00	1.87	6.66	2.37	7.66	2.87	8.66	3.37	9.66	2½x1	2½x1½	2½x1½	2½x2	2½x2	2½x2	2½x2½	2½x3
3"	3.50	1.00	5.50	1.35	6.66	2.05	7.66	2.55	8.66	3.05	9.66	3 x1	3 x1½	3 x1½	3 x2	3 x2	3 x2	3 x2½	3 x3
3½"	4.08	1.30	9.66	1.80	7.66	2.30	8.66	2.80	9.66	3.30	10.78	3½x1	3½x1½	3½x1½	3½x2	3½x2	3½x2	3½x2½	3½x3
4"	4.50	1.05	6.66	1.55	7.66	2.05	8.66	2.55	9.66	3.11	10.78	4 x1	4 x1½	4 x1½	4 x2	4 x2	4 x2	4 x2½	4 x3
4½"	5.00	1.30	7.66	1.80	8.66	2.30	9.66	2.86	10.78	3.36	11.78	4½x1	4½x1½	4½x1½	4½x2	4½x2	4½x2	4½x2½	4½x3
5"	5.56	1.02	7.66	1.52	8.66	2.02	9.66	2.52	10.78	3.02	11.78	5 x1	5 x1½	5 x1½	5 x2	5 x2	5 x2	5 x2½	5 x3
6"	6.63	.95	8.66	1.45	9.66	2.02	10.78	2.52	11.78	3.03	12.81	6 x1½	6 x1½	6 x1½	6 x2	6 x2	6 x2	6 x2½	6 x3
7"	7.83			1.32	10.78	2.02	10.78	2.53	12.81	3.16	14.06	7 x1½	7 x1½	7 x1½	7 x2	7 x2	7 x2	7 x2½	7 x3
8"	8.63			1.32	11.78	2.03	12.81	2.66	14.06	3.18	15.06	8 x1½	8 x1½	8 x1½	8 x2	8 x2	8 x2	8 x2½	8 x3
9"	9.63			1.53	12.81	2.16	14.06	2.68	15.06	3.17	16.09	9 x1½	9 x1½	9 x1½	9 x2	9 x2	9 x2	9 x2½	9 x3
10"	10.75			1.59	14.06	2.09	15.06	2.61	16.09	3.06	17.00	10 x1½	10 x1½	10 x1½	10 x2	10 x2	10 x2	10 x2½	10 x3
11"	11.75			1.58	15.06	2.09	16.09	2.55	17.00	3.05	18.00	11 x1½	11 x1½	11 x1½	11 x2	11 x2	11 x2	11 x2½	11 x3
12"	12.75			1.59	16.09	2.05	17.00	2.55	18.00	3.05	19.00	12 x1½	12 x1½	12 x1½	12 x2	12 x2	12 x2	12 x2½	12 x3
14"	14.00			1.42	17.00	1.92	18.00	2.42	19.00	2.92	20.00	14 x1½	14 x1½	14 x1½	14 x2	14 x2	14 x2	14 x2½	14 x3
15"	15.00			1.42	18.00	1.92	19.00	2.41	20.00	2.92	21.00	15 x1½	15 x1½	15 x1½	15 x2	15 x2	15 x2	15 x2½	15 x3
16"	16.00			1.41	19.00	1.91	20.00	2.41	21.00	2.91	22.00	16 x1½	16 x1½	16 x1½	16 x2	16 x2	16 x2	16 x2½	16 x3
17"	17.00			1.41	20.00	1.91	21.00	2.41	22.00	2.91	23.00	17 x1½	17 x1½	17 x1½	17 x2	17 x2	17 x2	17 x2½	17 x3
18"	18.00			1.41	21.00	1.91	22.00	2.41	23.00	2.91	24.00	18 x1½	18 x1½	18 x1½	18 x2	18 x2	18 x2	18 x2½	18 x3
19"	19.00			1.41	22.00	1.91	23.00	2.41	24.00	2.91	25.00	19 x1½	19 x1½	19 x1½	19 x2	19 x2	19 x2	19 x2½	19 x3
20"	20.00			1.41	23.00	1.91	24.00	2.41	25.00	2.91	26.00	20 x1½	20 x1½	20 x1½	20 x2	20 x2	20 x2	20 x2½	20 x3
21"	21.00			1.41	24.00	1.91	25.00	2.41	26.00	2.91	27.00	21 x1½	21 x1½	21 x1½	21 x2	21 x2	21 x2	21 x2½	21 x3
22"	22.00			1.41	25.00	1.91	26.00	2.41	27.00	2.91	28.00	22 x1½	22 x1½	22 x1½	22 x2	22 x2	22 x2	22 x2½	22 x3
23"	23.00			1.41	26.00	1.91	27.00	2.41	28.00	2.91	29.00	23 x1½	23 x1½	23 x1½	23 x2	23 x2	23 x2	23 x2½	23 x3
24"	24.00			1.41	27.00	1.91	28.00	2.41	29.00	2.91	30.00	24 x1½	24 x1½	24 x1½	24 x2	24 x2	24 x2	24 x2½	24 x3
25"	25.00			1.46	28.00	1.98	29.00	2.50	30.00	3.02	31.00	25 x1½	25 x1½	25 x1½	25 x2	25 x2	25 x2	25 x2½	25 x3
26"	26.00			1.46	29.00	1.98	30.00	2.50	31.00	3.02	32.00	26 x1½	26 x1½	26 x1½	26 x2	26 x2	26 x2	26 x2½	26 x3
27"	27.00			1.46	30.00	1.98	31.00	2.50	32.00	3.02	33.00	27 x1½	27 x1½	27 x1½	27 x2	27 x2	27 x2	27 x2½	27 x3
28"	28.00			1.46	31.00	1.98	32.00	2.50	33.00	3.02	34.00	28 x1½	28 x1½	28 x1½	28 x2	28 x2	28 x2	28 x2½	28 x3
29"	29.00			1.46	32.00	1.98	33.00	2.50	34.00	3.02	35.00	29 x1½	29 x1½	29 x1½	29 x2	29 x2	29 x2	29 x2½	29 x3
30"	30.00			1.46	33.00	1.98	34.00	2.50	35.00	3.02	36.00	30 x1½	30 x1½	30 x1½	30 x2	30 x2	30 x2	30 x2½	30 x3
31"	31.00			1.46	34.00	1.98	35.00	2.50	36.00	3.02	37.00	31 x1½	31 x1½	31 x1½	31 x2	31 x2	31 x2	31 x2½	31 x3
32"	32.00			1.46	35.00	1.98	36.00	2.50	37.00	3.02	38.00	32 x1½	32 x1½	32 x1½	32 x2	32 x2	32 x2	32 x2½	32 x3
33"	33.00			1.46	36.00	1.98	37.00	2.50	38.00	3.02	39.00	33 x1½	33 x1½	33 x1½	33 x2	33 x2	33 x2	33 x2½	33 x3
34"	34.00			1.46	37.00	1.98	38.00	2.50	39.00	3.02	40.00	34 x1½	34 x1½	34 x1½	34 x2	34 x2	34 x2	34 x2½	34 x3
35"	35.00			1.46	38.00	1.98	39.00	2.50	40.00	3.02	41.00								
36"	36.00			1.46	39.00	1.98	40.00	2.50	41.00	3.02	42.00								
37"	37.00			1.46	40.00	1.98	41.00	2.50	42.00	3.02	43.00								
38"	38.00			1.46	41.00	1.98	42.00	2.50	43.00	3.02	44.00								
39"	39.00			1.46	42.00	1.98	43.00	2.50	44.00	3.02	45.00								

IP

Sectional

Tri-Segmental

Quad. Seg.

K-Segmental

Insulation for the nominal pipe sizes range of 25" to 39" is furnished in three K Segment curvature sizes. Actual number of segments required to encircle pipe in this size range. The last segment may be cut to fit accurately. Letter designates required K Segmental size for proper seating.

K-Segmental Dimensions:

Letter	In. Dia.	O. Dia.	Approx. Outer Arc
A	26 7	31 .07"	14°
B	30	35 .07"	16°
C	34	41 .07"	18°

Where to buy

Available from authorized distributors located in principal cities. Consult the yellow pages of your classified directory for their location or call your nearest Fiberglas Branch Office listed below.

Albany, New York	438-6021
Albuquerque, New Mexico	243-4583
Anchorage, Alaska	BR 5-8344
Atlanta, Georgia	799-6821
Baltimore, Maryland	SA 7-0234
Billings, Montana	252-8496
Birmingham, Alabama	TR 1-2723
Boise, Idaho	2-3102
Boston, Massachusetts	CE 5-7540
Buffalo, New York	TL 3-4123
Charleston, West Virginia	DI 3-7094
Charlotte, North Carolina	ED 4-6864
Chicago, Illinois	583-0100
Cincinnati, Ohio	AV 1-1173
Cleveland, Ohio	MA 1-6451
Columbus, Ohio	HU 6-9418
Dallas, Texas	RI 1-3982
Dayton, Ohio	AX 3-3155
Denver, Colorado	AC 2-3126
Des Moines, Iowa	AT 8-4273
Detroit, Michigan	LI 7-8000
Evansville, Indiana	HA 5-5124
Flint, Michigan	NI 9-2931
Fort Wayne, Indiana	EA 4635
Fresno, California	AD 3-7227
Grand Rapids, Michigan	CH 3-3697
Greensboro, North Carolina	CY 9-6116
Greenville, South Carolina	CE 9-4279
Hartford, Connecticut	CH 7-1301
Honolulu, Hawaii	99-5689
Houston, Texas	JA 6-1851
Indianapolis, Indiana	CL 5-4147
Jacksonville, Florida	355-0615
Kansas City, Missouri	PL 3-7725
Los Angeles, California	RA 3-9781
Louisville, Kentucky	ME 7-2588
Lubbock, Texas	SH 4-0269
Memphis, Tennessee	FA 7-6116
Miami, Florida	OX 6-3451
Milwaukee, Wisconsin	DI 4-3811
Minneapolis, Minnesota	FR 7-1730
Mobile, Alabama	HE 2-4411
Nashville, Tennessee	AL 4-9210
Newark, New Jersey	484-2800
New Orleans, Louisiana	523-2821
New York, New York	PL 9-3810
Oakland, California	TE 6-1800
Oklahoma City, Oklahoma	JA 8-4468
Omaha, Nebraska	346-2989
Peoria, Illinois	674-3232
Philadelphia, Pennsylvania	LO 4-3133
Phoenix, Arizona	AL 8-4541
Pittsburgh, Pennsylvania	AT 1-7191
Portland, Oregon	CA 6-3505
Providence, Rhode Island	PA 5-0100
Reno, Nevada	322-6941
Richmond, Virginia	EL 5-5703
Rochester, New York	BR 1-1888
Rock Island, Illinois	788-1190
Sacramento, California	WA 2-5467
St. Louis, Missouri	PA 5-1061
Salt Lake City, Utah	EL 9-5247
San Antonio, Texas	TA 4-6171
San Bernardino, California	TU 5-3496
San Diego, California	CY 7-3751
San Francisco, California	UN 1-4721
San Jose, California	CY 7-9520
Santa Ana, California	KI 7-7781
Seattle, Washington	MA 2-4335
Spokane, Washington	KE 5-3575
Stockton, California	HO 6-0137
Syracuse, New York	476-7456
Tampa, Florida	253-0183
Toledo, Ohio	248-6741
Tucson, Arizona	MA 3-5429
Van Nuys, California	ST 1-3145
Washington, D. C.	NA 8-0724

O-C FIBERGLAS INTERNATIONAL DIV.

GENERAL OFFICE:

New York 22, New York, 717 Fifth Avenue, Plaza 9-3810

BRANCH OFFICES:

San Francisco 7, Calif., 1200 17th Street, Underhill 3-2380

San Juan, P. R., First Federal Savings, Condominium, Santurce, Puerto Rico, 723-8444

OWENS-CORNING FIBERGLAS CORPORATION

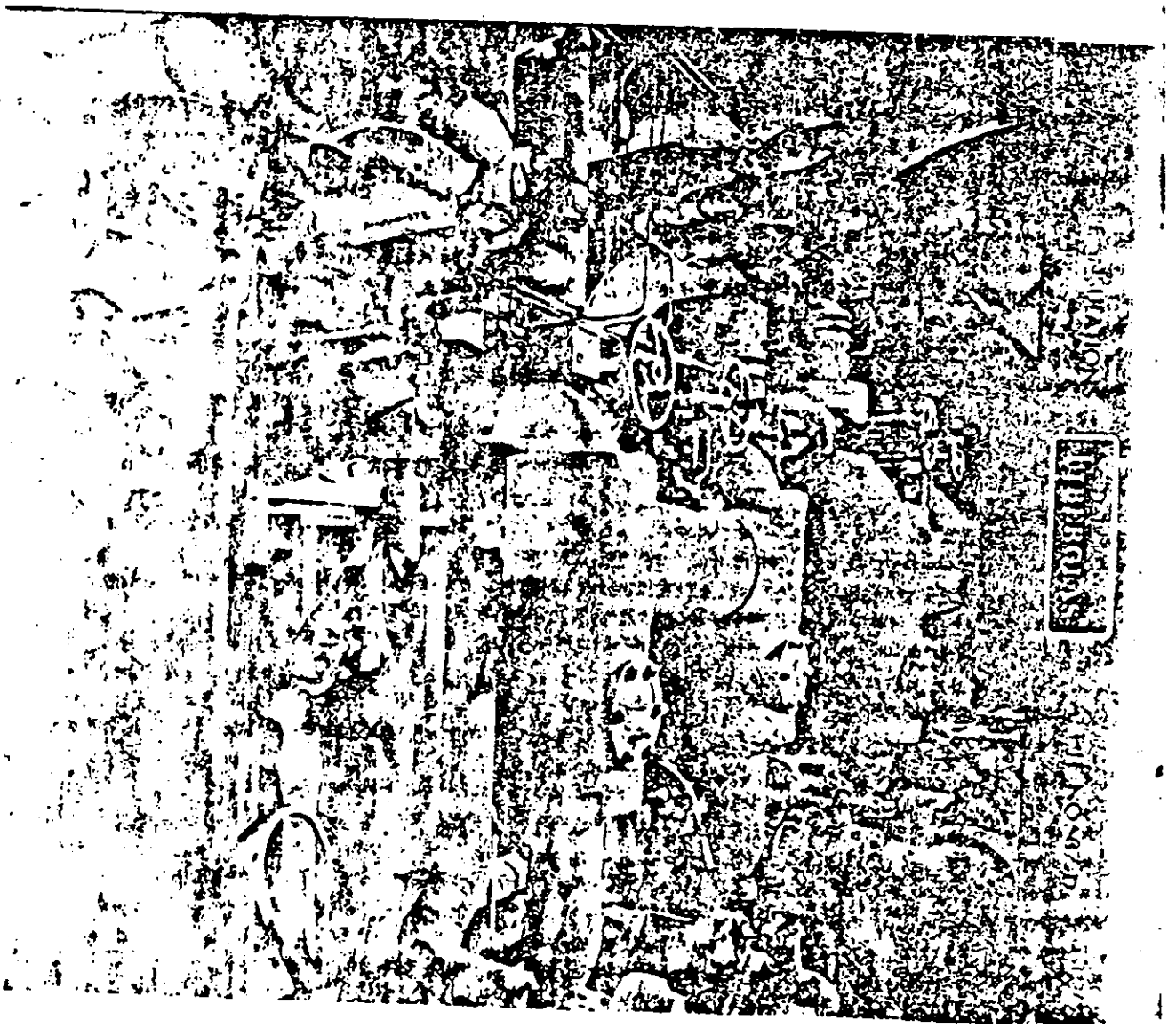
Industrial and Commercial Construction Materials Division, 717 Fifth Avenue, New York 22, N. Y.

General Offices, Toledo 1, Ohio. Pacific Coast Division, Santa Clara, Calif.

Pipe Insulations

a complete line of pipe and tubing insulations for temperatures from minus 120 F to 1800 F

October, 1961



heavy density sectional pipe insulation

...hot and cold lines from minus 120 F to 450 F



DESCRIPTION

Fiberglas Sectional Pipe Insulation is a precision molded pipe covering composed of Fiberglas wool bonded and formed in two half cylinders at a density of 7½ lbs./cu. ft. It is available in three standard sections to fit all types of pipe and tubing from ¼" IPS to 33" operating at temperatures from minus 120 F up to 450 F. A variety of jackets for appearance, vapor barrier, fire proofing or waterproofing permit selection of this all-purpose insulation for a specific end use indoors or out, cold or hot line applications. Thicknesses follow Simplified Dimensional Standards to permit nesting for double layer applications.

ADVANTAGES

This inorganic pipe insulation offers superior thermal efficiency.

Priced competitively with other insulation yet gives greater thermal performance for long term heat savings or where precise temperature control is required.

Fiberglas Sectional Pipe Insulation is easy to cut to fit. It is firm and resists compression. Only a saw or knife is required to fabricate. It will not rot, crack or shrink, withstands thermal shock, will not corrode pipe or rot and is not permanently affected by moisture. Factory applied jackets facilitate application.

Close manufacturing tolerances assure uniform thickness and close fitting to the pipe. The insulation nests neatly at the joints to give, in effect, a continuous unbroken covering of efficient insulation.

JACKETS & USES

Fiberglas Sectional Pipe Insulation is available with a variety of jackets for appearance, painting base, vapor barrier, fire retardant and weather protection. The selection of a particular end use determines the jacket to use.

FRJ (Fire Retardant Jacket)—Minus 150 F to 200 F—This Fiberglas jacketing has attempted to reduce the number of jackets required and offers a new vapor barrier jacket that is fire retardant, and presents a finished appearance. It is composed of one layer of kraft paper and a layer of aluminum foil laminated together with a self-extinguishing adhesive and reinforced with Fiberglas yarn. The exterior surface is coated white eliminating the need for painting. This versatile factory-applied jacketing material makes Fiberglas FRJ Sectional Pipe Insulation the ideal material for commercial and industrial low and dual-temperature piping operating up to 450 F.

CANVAS

Fiberglas Sectional Pipe Insulation is available with a standard weight or 6 or 8 oz. canvas jacket to serve as a base for field painting. Aluminum bands are furnished at additional cost.

ROOFING FELT—for outdoor lines

Where Fiberglas Sectional Pipe Insulation requires protection from the weather, it is available with 3 factory applied weights of roofing felt—35, 45 and 55 lb., a 4" wide end joint sealing strip is provided. Aluminum bands are available at slight extra cost.

SIZES

Iron pipe (IPS)—¼" to 33"

Copper tubing (CT)—⅛" O.D. to 6⅛" O.D.

Insulation thicknesses—1", 1½", 2"*, 2½"* in single layer depending on pipe size. See table on page 6. Made to simplified dimensional standards for nesting in multiple layer applications.

Section length—3'

*Iron pipe size only.

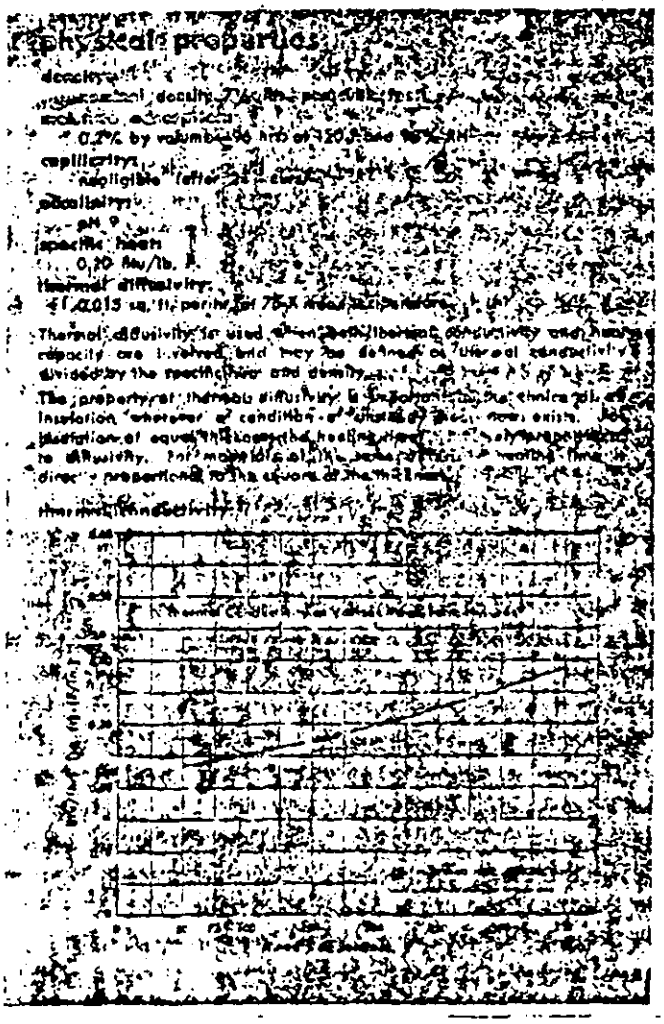
LIMITATIONS

Temperature limit—Should not be used on pipes operating above 450 F.

Low temperature usage—Must have vapor barrier jacket to prevent condensation when used on low temperature lines.

Tolerances—All values given are subject to normal manufacturing and testing tolerances.

Protection—Should be protected from mechanical damage in locations where severe abuse is likely. Canvas and vapor barrier jackets require weatherproofing when located outdoors.



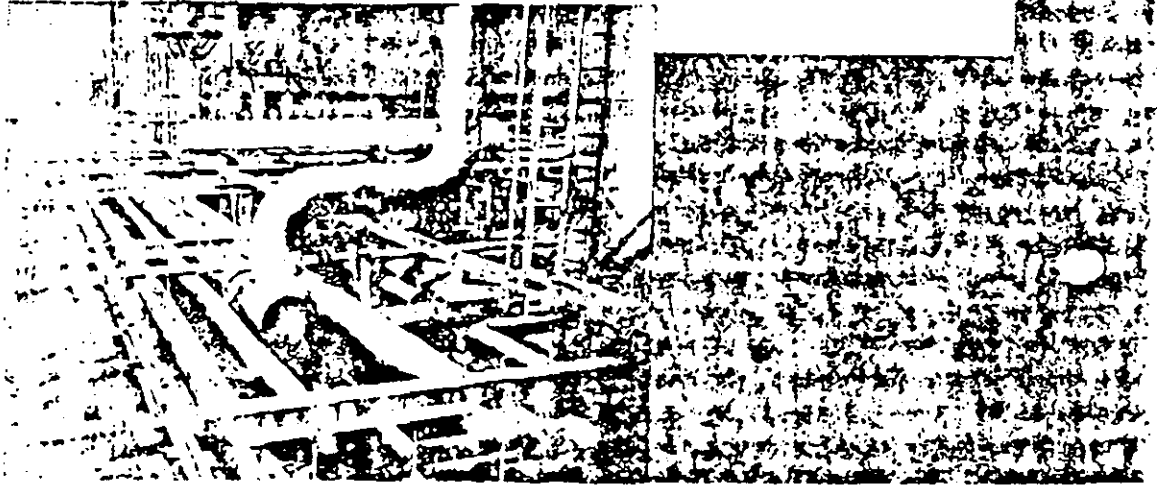
FIBERGLAS PIPE INSULATIONS

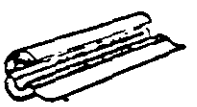
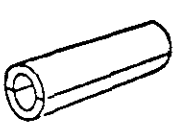


Fiberglas Pipe Insulation indoors for a neat, attractive appearance.

Applied either indoors or outdoors, Fiberglas Pipe Insulations assure superior performance and durability in all temperature ranges. Each of the eight product types offered in the Selector Guide opposite is the result of special engineering research and design to meet each particular use requirement. Manufactured to exacting standards, these fine Fiberglas products have proven their merit through years of industrial experience.

Fiberglas Pipe Insulation outdoors in large refinery.



requirements	service* temperature	product	available thickness	standard sizes	page
[illegible]	up to 450 F	 canvas and metal jacketed pipe insulation	nominal 1", 1½", 2", 2½" in single layer; any thickness possible with multiple layer	iron pipe sizes— ¼" to 33" copper tubing sizes—½"-6⅛" o.d. in 3' sections	4
[illegible] re, ke	—120 F to 450 F	 vapor barrier fire retardant jacket (FRJ) or Dual Temp.	nominal 1", 1½", 2", 2½" in single layer; any thickness possible with multiple layers	iron pipe sizes— ¼" to 33" copper tubing sizes—½" to 6⅛" o.d. in 3' sections	4
[illegible]	—30 F to 400 F	 multi-purpose one-piece pipe insulation	nominal ½", ¾" 1", 1½", 2" in single layer; any thickness possible with multiple layers	iron pipe sizes— ½" to 33" copper tubing sizes—1" to 6⅛" o.d. in 3' sections—6' sections over 6" IPS	10
[illegible]	up to 1200 F (standard Kaylo) / 1200 F to 1300 F (Kaylo 20)	 Kaylo, Kaylo-20 and Kaylo Klad pipe insulation	nominal 1", 1½", 2", 2½", 3" in single layer; any thickness possible with multiple layers	iron pipe sizes— ½" to 39" copper tubing sizes—½" to 3⅛" o.d. in 3' sections	12

[illegible] are for the jacket and insulation for require-

esign data for Kaylo Insulations

[illegible] presents reference data for information on the [illegible] thicknesses according to the simplified Dimensional [illegible] system.

[illegible] data are presented to aid in the design of [illegible] insulation modified to meet specific needs. Recommendations are generalized and should be modified to [illegible] local conditions and job requirements.

Importance of calculating economic thickness

[illegible] of insulation thicknesses for any specific application [illegible] should take into consideration at least the following [illegible]:

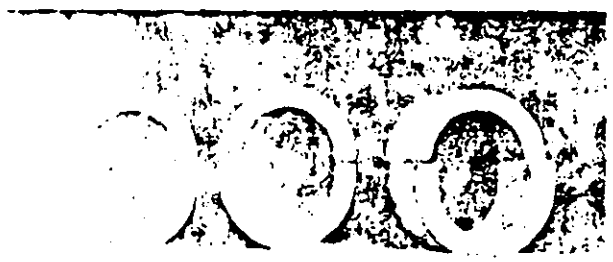
1. Cost of insulation applied
2. Cost of heat energy
3. Cost of capital
4. Depreciation period—plant and insulation
5. Capital investment in heat production equipment
6. Temperature differential
7. Size of the pipe or surface
8. Conductivity of insulation

To assist the engineer, Owens-Corning Fiberglas has taken the figures provided by the National Insulation Manufacturers Association in their manual, "How to Determine Economic Thickness of Insulation" and, by pre-calculating many of the equations on a computer, has created a quick, simple system for resolving economic thickness. To obtain your copy of this Dividend Engineering "Economic Thickness Manual," contact your local Fiberglas branch office. Your local Fiberglas representative will be glad to explain this quick, practical method for computing economical thickness under all normal operating conditions.

Applications—Kaylo and Kaylo-Klad



Off-site yard steam insulated with Kaylo Pipe Insulation for efficiency and controlled temperatures at distant points.



New Kaylo Trace Line pipe insulation and Kaylo Klad Trace Line Pipe Insulation jacketed with .016 embossed aluminum or .010 stainless steel provide great economy in the insulation of trace lines.

These pre-molded trace line insulations are designed for insulating piping 2" IPS x 1" thick up to 8" IPS x 2" thick together with a 1" trace line.

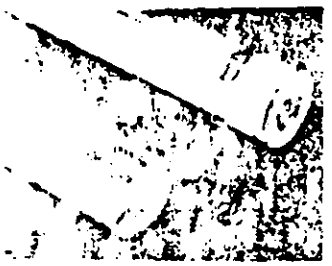
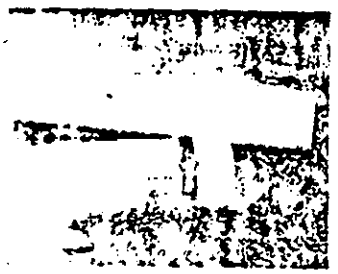
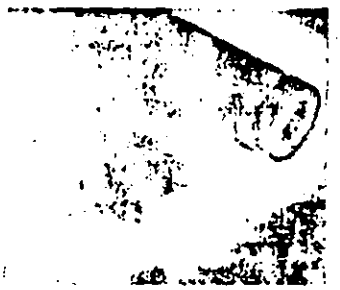
Advantages of this Kaylo molded insulation include higher strength, more rigid construction and, in the case of Kaylo Klad, single application of both insulation and weather proofing. Application and maintenance costs are both reduced. Where a trace line is greater than one inch, an extended leg insulation can be fabricated to special order; contact your local OCF Branch Office.







▲ Kaylo-Klad aluminum jacket "locks out" the weather. The longitudinal seam joint and end joint band, with integral mastic, provide positive weather protection.

Multi-Purpose Use with Appropriate Jacket	use	jacket description	application details
Heated lines to 450 F 	This universally accepted efficient pipe insulation is recommended for heated lines operating at temperatures up to 450 F where a jacket is required for surface finish or as a base for painting.	**Canvas** Available on pipe sizes up to 12" in standard, 6 or 8 oz. weight, factory applied, complete with longitudinal and end joint laps. Aluminum bands furnished at slight additional cost. Additional weatherproofing is required for piping located outdoors.	Insulation is applied to piping and canvas pasted smoothly over laps. Bands may be used for additional mechanical fastening or for appearance. Insulation for piping over 12" is wired in place and subsequently covered with field applied canvas. Fittings are insulated with fibrous glass molded fitting covers, or OC-110 Insulating Cement. Application details and fitting weatherproofing are outlined on Page 8.
Cold & Dual-Temperature or Fire Safety for Lines from Minus 120 F to 450 F 	This all purpose fire retardant vapor barrier jacket factory-applied to Fiberglas covers a broad range of pipe insulation requirements from sub-zero process brine, refrigerant, chilled and ice water to dual-temperature lines and also provides fire safety for all lines operating in temperature range from minus 120 F. to 450 F. Nesting sizes permit multiple layer application and broken joint construction. Asphalt laminated foil-Kraft-foil dual temperature jacket is still available for lines not exceeding 250 F.	**Fire Retardant Vapor Barrier Jacket** Fire retardant vapor barrier jacket is composed of one layer of kraft paper and a layer of aluminum foil laminated together with a fire self extinguishing adhesive and reinforced with tough Fiberglas yarn. The exterior surface is coated white to present a neat appearance requiring no further surface finish for cold or heated lines. Vapor barrier perm rating is a low 0.01 perms — grains per hour per square foot per inch of mercury. Longitudinal joint sealing flap provided. End joint sealing tapes are supplied. Bands are available at slight additional cost.	Cold and dual-temperature piping and fittings require careful application of vapor barrier jacketed pipe insulation and sealing of fittings. For application details and specifications see Pages 8 and 9. Thickness recommendations to prevent condensation and low temperature control for cold piping are shown on Pages 6 and 7. Additional weatherproofing is required for piping located outdoors—details on Page 8.
Outdoor Lines to 450 F 	Fiberglas Pipe Insulation with factory-applied weather-resistant roofing jacket is recommended for outdoor lines operating at temperatures up to 450 F. Weatherproofing and insulation are applied in one step.	**Roofing Felt Jacket** Available with factory-applied 35, 45, or 55 lb. roofing felt jackets. Longitudinal joint flap provided. End joint sealing tapes supplied.	Insulation with integral weather-resistant jacket is wired in place. Side laps are turned down to shed water. End joints are sealed with end joint tape provided and securely wired in place. Further application details and weatherproofing of fittings are described on Pages 8 and 9.
	Fiberglas Metal Jacket Pipe Insulation with factory applied embossed aluminum or stainless steel jacketing is recommended for outdoor lines operating at temperatures up to 450 F. Weatherproofing and insulation are applied in one step.	**Metal Jacket** Fiberglas Metal Jacket pipe insulation with .016 embossed aluminum or .010 stainless steel factory-applied jackets have longitudinal seam joints and end joint bands with integral mastic. Fiberglas Metal Jacket is also available with .010 embossed aluminum facing, factory applied, without seam joints but with a three-inch overlap at longitudinal seam and 3" overlap on one end joint.	Metal Jacket with seam joint is applied by inserting flat edge into sealing joint in a four o'clock position on pipe to shed water. End joint strips with integral mastic are then attached at end joints and banded. Metal Jacket with .010 embossed aluminum is installed with 3" overlap at seams and joints. Bands or wires are attached securely in place at 18" intervals, two per 36" section. See page 8.

...mmended thickness Fiberglas heavy density sectional pipe insulation

...d piping to 450 F

Ambient 80 F

Pipe Size	For Commercial & Industrial Applications 110 F surface temp. — to 25 psig. to 767 F 187 F				to 100 psig. to 338 F 258 F				to 235 psig. to 400 F 320 F				For Power & Utility Uses 130 F surface temp. — to 25 psig. to 267 F 187 F				to 100 psig. to 338 F 258 F			
	RT°	ML	E	ST	RT°	ML	E	ST	RT°	ML	E	ST	RT°	ML	E	ST	RT°	ML	E	ST
...4"	24	80.5	103	1°	30	84.7	104	1½"	33	88.0	100	½"	30	75.6	116	¾"	36	81.6	113	¾"
...4"	28	81.1	105	1°	37	86.8	111	1½"	38	88.7	102	½"	35	77.0	117	¾"	42	82.6	114	¾"
...4"	32	82.0	106	1°	38	86.8	107	1½"	42	89.5	103	½"	40	77.8	119	¾"	48	83.5	116	¾"
...4"	38	83.0	107	1°	48	86.9	112	1½"	46	91.0	102	½"	47	78.5	120	¾"	57	84.6	118	1"
...4"	42	84.0	108	1°	49	88.3	107	1½"	53	91.0	105	½"	57	79.0	121	¾"	63	85.0	119	1"
...4"	49	86.8	107	1°	57	88.8	112	1½"	58	91.5	107	½"	63	80.3	122	¾"	74	85.5	120	1"
...4"	57	85.1	107	1°	67	89.0	111	1½"	76	91.0	112	½"	74	80.5	123	¾"	85	86.1	121	1"
...4"	67	85.3	107	1°	80	89.2	111	1½"	79	93.0	107	½"	92	80.6	124	¾"	99	86.5	122	1"
...4"	75	87.1	111	1°	96	89.8	112	1½"	96	88.5	109	½"	109	81.4	125	¾"	127	86.8	123	1"
5"	83	88.8	104	1½"	87	92.5	104	2"	105	87.9	103	½"	131	81.6	125	¾"	148	87.0	124	1"
5"	94	88.9	104	1½"	101	92.6	105	2"	106	94.5	103	½"	154	81.7	125	1"	137	89.9	115	1"
5"	102	89.1	00	1½"	110	92.8	104	2"	117	94.5	103	½"	175	81.7	125	1"	155	89.9	116	1"
...6"	110	89.5	05	1½"	112	92.9	105	2"	123	94.4	105	½"	195	81.8	125	1"	164	90.6	115	1"
...6"	127	89.5	05	1½"	136	93.0	105	2"	138	94.6	103	½"	208	81.8	125	1"	182	90.5	115	1"
...6"	141	89.0	06	1½"	143	93.2	104	2"	160	94.6	103	½"	240	81.8	126	1"	208	90.4	116	1"
...6"	160	90.0	04	1½"	160	93.5	105	2"	170	94.8	104	½"	246	81.8	126	1"	208	90.9	115	1"
...6"	173	90.0	106	1½"	165	93.4	104	2"	178	94.8	105	½"	282	81.8	127	1"	220	91.2	113	1"
1½"	138	91.7	100	2"	148	93.9	99	2½"	160	95.8	99	1"	182	89.0	106	1"	274	89.8	117	1½"
1½"	141	92.0	98	2"	170	94.1	100	2½"	188	95.6	101	1"	200	89.5	106	1"	296	90.6	118	1½"
1½"	166	92.3	98	2"	190	94.3	101	2½"	205	95.5	102	1"	232	89.2	107	1"	342	90.2	119	1½"
...8"	18	92.4	98	2"	207	94.4	100	2½"	217	95.8	102	1"	254	89.2	107	1"	374	90.2	118	1½"
...8"	211	92.5	98	2"	240	94.5	101	2½"	266	95.8	102	1"	310	89.2	108	1"	484	90.2	122	1½"
...8"	250	92.5	99	2"	310	94.5	101	2½"	325	96.0	102	1½"	268	92.5	99	1½"	390	93.0	107	1½"
...8"	283	92.5	99	2"	329	94.5	101	2½"	344	96.6	102	1½"	285	92.5	99	1½"	440	93.0	107	1½"

...d and dual—Temperature piping—minus 120 F. to 200 F.

Ambient 90 F

Surface Temp.	90% relative humidity: 40 F chilled water		35 F ice water		0 F brine		−30 F special brine		−60 F refrigerants		−120 F special process		85% relative humidity: 35 F ice water		0 F brine		−30 F special brine		−60 F refrigerants	
...ion	RT°	HG	RT°	HG	RT	HG	RT	HG	RT	HG	RT	HG	RT	HG	RT	HG	RT	HG	RT	HG
...es	½	3.8	1½	5	2½	6	3	7	3½	7	4	10	1	6	1½	7	2	8	2½	9
	¾	4.1	1½	5	2½	6	3	7	3½	8	4½	10	1	7	1½	8	2	9	2½	10
	1	4.7	1½	6	2½	6	3	8	3½	9	4½	11	1	7	1½	8	2	10	2½	10
	1¼	5.3	2	6	2½	7	3	9	3½	11	4½	12	1	9	1½	9	2	11	2½	12
	1½	6.0	2	7	3	8	3½	8	3½	10	5	12	1	9	2	9	2½	11	3	12
	2	5.8	2	7	3	8	3½	10	4	11	5	13	1½	8	2	10	2½	12	3	14
		7.2	2	8	3	10	3½	11	4	12	5½	14	1½	11	2	13	2½	14	3	15
		7.5	3	9	3	10	4	11	4½	13	5½	15	1½	11	2	13	2½	15	3	16
		9.1	2	10	3	12	4	13	4½	15	6	18	1½	13	2	15	2½	17	3	19
		10.6	2½	11	3½	13	4	15	4½	17	6	19	1½	16	2½	16	2½	20	3½	20
		12.4	2½	12	3½	14	4½	16	5	18	6½	21	1½	18	2½	18	3	21	3½	22
		13.8	2½	4	3½	15	4½	17	5	19	6½	22	1½	20	2½	20	3	22	3½	24
		15	2½	15	3½	17	4½	18	5	21	6½	24	1½	21	2½	21	3	24	3½	27
		16	2½	16	4	17	4½	20	5½	22	7	25	1½	24	2½	23	3	27	3½	30
		17	2½	17	4	18	4½	22	5½	24	7	27	1½	26	2½	25	3	29	3½	32
	⅛	18	2½	19	4	20	4½	23	5½	25	7	28	1½	29	2½	28	3	31	3½	34
			2½	21	4	21	5	24	5½	26	7	30	2	25	2½	30	3	34	3½	36
			2½	23	4	23	5	28	6	27	7½	31	2	28	2½	33	3	38	4	37
			2½	25	4	25	5	28	6	29	8	32	2	32	2½	37	3	41	4	40
		24	2½	27	4	29	5	31	6	32	8	34	2	35	2½	41	3	46	4	45
		26	2½	31	4	31	5	31	6	35	8	38	2	38	2½	45	3½	45	4	49
		30	3	32	4½	33	5½	37	6	41	8	44	2	44	2½	54	3½	52	4	58
			3	37	4½	40	5½	43	6½	48	8	53	2	56	2½	64	3½	64	4	68
		4	3	45	4½	47	5½	51	6½	54	8	60	2	61	2½	72	3½	73	4	79
	½	3.5	1½	3.8																
	¾	3.5	½	3.5																
	1	3.5	1½	3.8																
	1¼	3.5	1½	4.2																
	1½	4.2	1½	4.9																
	2	4.9	½	5.4																
	2½	5.6	1½	6.1																
	3	4.0	2	5.8																
	3½	6.1	2	6.8																
	4	5.4	2	7.6																
	5	7.4	2	8.5																
	6	7.9	2½	8.6																
	8	9.2	2½	9.6																
	10	12.7	3½	11.3																



For Power Industries
160 F surface temp.

to 25 psig.						to 100 psig.						to 235 psig.			
to 400 F						to 338 F						to 400 F			
330 F				187 F				258 F				320 F			
H	F	ST	RT*	HL	E	ST	RT*	HL	E	ST	RT*	HL	E	ST
		120	½"	30	75.6	116	½"	48	78.0	122	½"	55	80.0	138
		122	½"	35	77.0	117	½"	56	79.1	128	½"	63	81.2	140
		124	½"	40	77.8	119	½"	57	79.9	131	½"	75	81.4	143
		123	½"	47	78.5	120	½"	68	81.0	132	½"	88	82.9	145
		118	½"	57	79.0	121	½"	79	81.1	133	½"	99	83.2	145
		119	½"	73	80.3	122	½"	92	81.9	135	½"	118	83.5	145
		119	½"	74	80.5	123	½"	107	82.2	136	½"	138	83.9	149
			½"	92	80.6	124	½"	129	82.5	137	½"	165	84.3	151
		122	½"	100	81.6	125	½"	159	82.9	138	½"	204	84.4	152
		124	½"	135	81.7	125	½"	194	83.0	139	½"	250	84.5	154
		122	½"	136	81.7	125	½"	233	83.1	140	½"	291	84.5	155
		124	½"	175	81.8	125	½"	236	83.1	141	½"	330	84.5	156
		123	½"	190	81.8	125	½"	285	83.2	141	½"	368	84.5	157
		125	½"	204	81.8	125	½"	312	83.3	142	½"	406	84.8	158
		126	½"	244	81.8	126	½"	340	83.3	143	½"	452	84.8	159
		124	½"	246	81.8	126	½"	370	83.4	144	½"	491	84.9	159
		124	½"	283	81.8	127	½"	410	83.4	145	½"	530	84.9	160
		126	1"	182	89.0	106	1"	274	89.8	117	1"	364	90.6	129
		124	1"	200	89.5	105	1"	296	90.4	118	1"	388	91.0	129
		125	1"	232	89.9	107	1"	342	90.2	119	1"	448	90.8	130
		115	1"	254	89.2	107	1"	374	90.2	118	1"	490	90.8	131
		116	1"	310	89.2	108	1"	464	90.2	122	1"	540	90.8	132
		116	1½"	264	92.5	99	1½"	390	93.0	107	1½"	520	93.5	116
		117	1½"	283	92.5	99	1½"	440	93.0	107	1½"	570	93.5	117

* Minimum thickness available above 12" IPS is 1", above 24" IPS is 1½"

80% relative humidity

32° F	40 F		35 F		0 F		−30 F		−60 F		−120 F	
	chilled water		ice water		brine		special brine		refrigerants		special process	
ac	RT	HG	RT	HG	RT	HG	RT	HG	RT	HG	RT	HG
	½	6.4	¾	6	1"	8	1½	9	1½	11	2	13
	½	7.1	¾	7	1½	8	1½	10	2	10	2½	13
	½	7.1	¾	8	1½	8	1½	11	2	11	2½	14
	½	8.4	1	9	1½	9	1½	12	2	14	2½	16
	½	9.4	1	9	1½	10	2	12	2	15	2½	18
	½	10	1	10	1½	12	2	13	2	16	2½	19
	½	12.6	1	12	1½	13	2	16	2½	17	3	20
	½	13	1	14	1½	14	2	17	2½	18	3	21
	1	14	1	16	1½	18	2	20	2½	21	3	25
	1	16	1	20	1½	23	2	24	2½	25	3	29
		21	1	24	2	21	2	27	2½	28	3	33
		24	1	28	2	23	2	30	2½	31	3	36
	1	25	1	29	2	26	2	33	2½	34	3½	36
	1	27	1½	24	2	27	2	35	2½	37	3½	40
	1	32	1½	26	2	30	2	39	2½	41	3½	43
	1	32	1½	29	2	31	2	41	3	38	3½	45
		34	1½	32	2	36	2½	39	3	41	3½	48
		41	1½	35	2	41	2½	44	3	46	3½	53
		46	1½	39	2	45	2½	49	3	50	3½	58
		57	2	43	2	50	2½	54	3	56	3½	66
		57	1½	48	2	55	2½	60	3	62	4	65
	1	70	1½	55	2	64	2½	70	3	73	4	77
	1	82	1½	70	2	77	2½	83	3	88	4	92
	1	91	1½	77	2	88	2½	92	3	98	4	104
		4.0	¾	4.3								
		4.7	¾	4.9								
		4.8	¾	5.3								
		5.2	¾	5.8								
		6.3	¾	6.9								
		7.2	¾	7.8								
		8.0	1"	8.8								
		9.8	1"	8.0								
		11.5	1"	11.7								
		12.0	1"	10.6								
		2.8	1"	14.0								
		3.2	1"	10.9								
		3.4	1"	15.2								
	1	16.1	1	17.6								

* Minimum thickness available above 12" IPS is 1", above 24" IPS is 1½"

table key

RT—recommended thickness
HL—heat loss . . . Btu/hr/lineal foot
E—efficiency . . . % of bare pipe heat loss stopped
ST—surface temperature . . . insulation surface F.

importance of calculating economic thickness

Selection of insulation thicknesses for any specific application should take into consideration at least the following criteria.

1. Cost of insulation applied
2. Cost of heat energy
3. Cost of capital
4. Cost of depreciation—plant and insulation
5. Capital investment in heat production equipment
6. Temperature differential
7. Size of the pipe or surface
8. Conductivity of insulation

True economic thickness can now be calculated quickly and easily by following the instructions in the Fiberglas DIVIDEND ENGINEERING "Economic Thickness Manual" available from your local Fiberglas branch office.

thicknesses for specific end use

The thicknesses shown here are generalized in recommendations broken down by end use. On all but the smallest projects, it will pay to use the Dividend Engineering "Economic Thickness Manual" to calculate actual economic thickness.

In general, surface temperatures for the 3 sets of recommendations for heated piping were kept below values of 110 F for commercial, 130 F for power & utility and 160 F for process. Surface temperature, however, should not be the only criterion for selection of thickness as outlined above.

For cold piping, proper thickness is required for efficient operation and to prevent condensation on the insulation surface. Specifically:

1. Designed thickness should be specified to result in a surface temperature above the Dew-Point temperature of the surrounding air. Generally this is equal to or greater than the "economical thickness" despite the relatively higher cost of cold Btu's.

2. Insulation thickness should be based on ambient air conditions and corresponding permissible temperature differences.

Ambient Air Condition	Permissible temp. drop (between ambient air and insulation surface)
90 F at 90% R.H.	3 F
90 F at 85% R.H.	6 F
90 F at 80% R.H.	7 F

3. Piping operating down to freezing temperatures or at fluctuating hot and cold temperatures should be insulated for maximum performance during the coolest part of the cold cycle.

specifications

[illegible] pipe insulation

for hot and cold lines 450 F to minus 120 F

[illegible] lines to 450 F—

[illegible] specifications

[illegible]-52 Insulation Pipe Covering, Thermal, and Insulator Blanket, [illegible] Thermal, Pipe Covering Type I, Class A and B

[illegible]-562 Insulation, Thermal, Mineral Wool, Block or Board and [illegible] Insulation (Molded Type) Type II, Class 2 and 3

[illegible] Specification 281-51T

1. **Insulating materials**—All heated pipes shall be insulated [illegible] thickness noted on drawings or as shown on pages 6 and 7 with Fiberglas Pipe Insulation as manufactured by Owens-Corning Fiberglas Corporation.

2. **Application**—All Pipe Insulation shall be applied over clean, dry surfaces, butting adjoining sections firmly together and [illegible] canvas, when furnished, smoothly over joints. Longitudinal and circumferential joints need not be pointed with finishing cement.

Insulation on pipes over 12" diameter shall be wired or banded in place on no greater than 12" centers. Where double layer insulation is applied, the first layer shall be wired in place without jacket; the second layer shall be applied with all joints staggered.

All flanges, valves and fittings shall be insulated with Fiberglas molded fitting insulation or fabricated mitered segments of pipe insulation equal in thickness to the insulation on the adjoining pipe. Fittings on pipe sizes 3" and smaller may be insulated with O-C 110 Insulating Cement of equal thickness.

3. **Surface finish**—Indoor piping not subject to abrasion or mechanical abuse, requires no additional finish other than the factory furnished canvas. Band may be used if specified.

Piping located outdoors shall be finished with approved weather resistant corrugated aluminum jacketing with all lon-

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[illegible]ed water and duct-temp piping 35 F to 200 F

[illegible] specification

[illegible]-562 Insulation, Thermal, Mineral Wool, Block or Board and Pipe Insulation (Molded type) Type II, Class 2 and 3

1. **Insulating materials**—All cold pipes shall be insulated [illegible] thickness noted on drawings or as listed in the table on pages 6 and 7 with Fiberglas White FRJ Jacketed Pipe Insulation as manufactured by Owens-Corning Fiberglas Corporation.

2. **Application**—Fiberglas White FRJ Pipe Insulation shall be applied over clean dry surfaces with the pipe at approximately room temperature. Adjoining sections shall be butted firmly together and the longitudinal seam of the vapor barrier jacket shall be sealed with a white fire-resistant vapor barrier lap adhesive (Foster 81-99 or equal). End joints shall be sealed with the lap adhesive. If multiple layer construction is used joints need not be staggered.

Ends of pipe insulation shall be sealed off with fire-resistant mastic (such as Foster 60-30 N or equal) at all flanges, valves and fittings and at intervals of not more than 21 feet on continuous runs of pipe.

All flanges, valves and fittings shall be insulated with molded or fabricated insulation of a thickness equal to that of the insulation of the adjoining pipe, securely fastened in place.

When in direct contact with the pipe, clamp hangers shall be insulated separately in the same manner as fittings. The insulation shall be applied upward along the vertical hanger rod to a point not less than 6" or 4 times the pipe insulation thickness and sealed off.

[illegible] water and special process 34 F. to minus 120 F.

[illegible] specification

[illegible]-562 Insulation, Thermal, Mineral Wool, Block or Board and Pipe Insulation (Molded type) Type II, Class 2 and 3

1. **Insulating materials**—All cold pipes shall be insulated [illegible] thickness noted on drawings or in accordance with the manufacturer's thickness recommendations with Fiberglas [illegible] Insulation as manufactured by Owens-Corning Fiberglas Corporation.

2. **Application**—Fiberglas FRJ Pipe Insulation shall be applied over clean dry surfaces with the pipe at approximately [illegible] temperature. For complete application, rust proofing is recommended. Adjoining sections shall be butted firmly together and the longitudinal seam of the vapor barrier jacket shall be sealed with Foster 60-30 N adhesive, or equal. Staples are not recommended for holding the laps shut. End joints shall be sealed with 4-inch factory-furnished vapor barrier strips supplied with Foster 60-30 N, or equal. In multiple layer construction all joints shall be staggered.

[illegible] of pipe insulation shall be sealed off with Foster 60-30 N, or equal and at intervals of not more than 21 feet on continuous runs of pipe.

All flanges, valves and fittings shall be insulated with molded or fabricated insulation of a thickness equal to that of insulation on the adjoining pipe, securely fastened in place.

When in direct contact with the pipe, clamp hangers shall be insulated separately in the same manner as fittings. The insulation shall be applied upward along the vertical hanger rod to a point not less than 4 times the pipe insulation thickness from the adjacent pipe finish and sealed off. Insulation on hangers shall be a minimum of ½ pipe insulation thickness.

3. **Surface Finish**—Piping located indoors needs no further painting. If painting is specified, a fire-resistive heavy bodied PVA coating (color as selected) shall be used.

Piping located outdoors shall be finished with embossed .016" aluminum jacket or a layer of 45-lb. roofing felt lapped three inches at all joints with the lap joint in a 4 o'clock position to

The following specifications are necessarily general in nature. Application procedure and material approval is at the discretion and responsibility of the design engineer to meet specific job requirements.

...tional joints lapped not less than 3" and sealed on 12" centers. All circumferential joints may be lapped not less than 3" or be covered with not less than 4" wide strips of the same material securely fastened with bands.

Fabricated insulations on flanges, located indoors, other than molded fitting insulation, shall be covered with ¼" coat of O-C Insulating Cement. Insulation located indoors shall be further finished with canvas neatly adhered and sized with Foster Lagfas or Arabol 60-...

All insulation on flanges, valves and fittings located outdoors shall be covered with Foster 30-36 Mastic or equal, reinforced with an open mesh glass fabric. Mastic shall be applied in two coats of sufficient thickness to give a 3/16" dry film and shall be troweled neatly over the jacket and lapped over the jacket on the adjacent pipe.

---

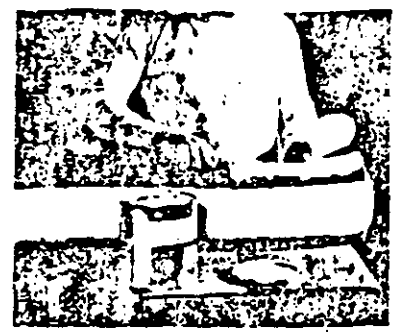
2. Insulation on flanges, valves and fittings ...where shall be vapor sealed with a positive vapor barrier such as or equal to 0.002" aluminum foil lapped onto the adjoining insulation. Further finish the fitting with a brush coat of Foster 30-36 followed by an application of 8-oz. canvas and a second coat of sealer.

Piping located outdoors shall be finished with embossed .016" aluminum jacket or a layer of 45-lb. roofing felt lapped three inches at joints with the lap joint in a 4 o'clock position to shed water. The cover shall be held in place by soft aluminum bands on 12" centers or loops of 16 gauge galvanized soft annealed wire spaced on not more than 8-inch centers. Nothing shall be allowed to pierce jacket at any point.

Outdoor fittings shall receive a final coat of Foster's Sealfas 30-36 or equal, weatherproof aluminum paint or a trowel coat of asphalt ... reinforced with glass fabric.

...water. The cover shall be held in place by soft aluminum bands on 12" centers or ... of 16-gauge galvanized soft annealed ... spaced no more than 8-inch centers. Nothing shall be allowed to pierce jacket at ... point.

...tion on flanges, valves and fittings ... vapor sealed with 0.002" aluminum ... pleated or crinkled in place lapping ad... jacket at least one inch. Foil shall be ... with an ⅛ inch layer of a vapor seal ... troweled neatly over the fitting with ... jacket on the adjacent pipe insulation ... at least 2" over the mastic. Outdoor ... these elements shall include a second ... coat of a suitable weather-resist... such as Foster 60-30 N, reinforced ... light exterior wrapping of open mesh ... fabric troweled well into mastic.



Fiberglas Sectional Pipe Insulation with Fire Retardant vapor barrier Jacket is sealed in place with a white vapor barrier lap adhesive. The adhesive is brushed or troweled on the laps of the jacket and on the factory-furnished end joint sealer strips.



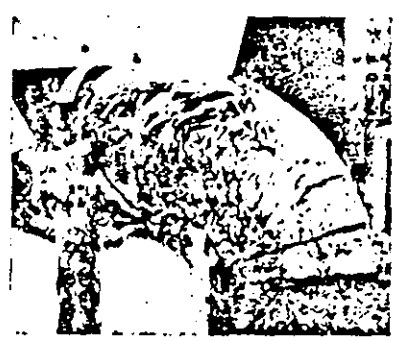
Bands are supplied for placing over the edges of the end joint sealer strips and at the center of each section for holding laps until the adhesive sets.



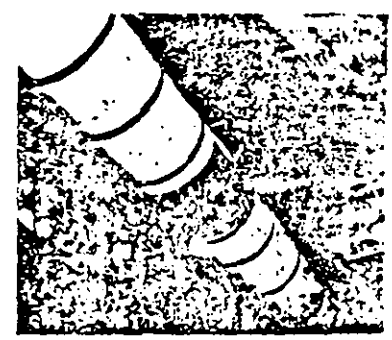
Fittings are insulated with mitered segments of insulation and vapor sealed with foil and a brush coat of vapor barrier sealer, reinforced with 8-oz. canvas and finished with a second coat of sealer. Pre-molded fitting insulation may also be used.



Multiple layer applications and staggered joint construction are recommended to build-up thicknesses on low temperature lines. (See pages 12 and 13 for nesting sizes.) The final layer vapor jacket flaps must be carefully sealed with vapor barrier adhesive. For outdoor applications additional weatherproofing is required.



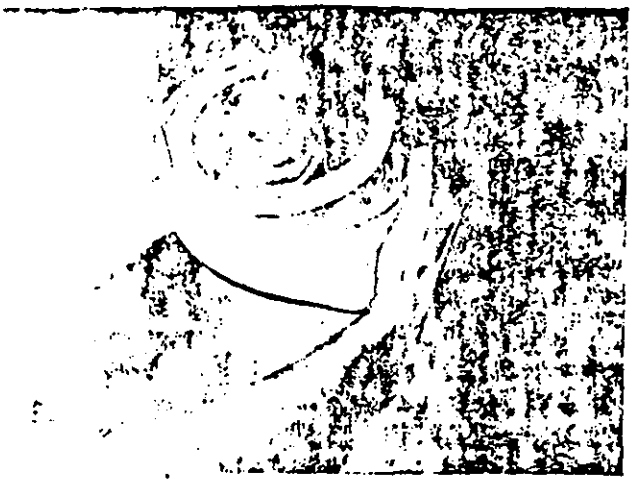
A foil barrier on fittings assures a continuous unbroken vapor barrier. The .002" aluminum foil is crinkled into place and subsequently covered with vapor barrier mastic and glass fabric reinforcement. Insulation at all fittings and hangers require sealing off to the pipe and straight runs every 21 feet.



At the saddle or trapeze hangers a metal shield is required to support the insulated piping. Shield is to be 12 ga. and three times the diameter of the pipe, in length, with a minimum of 12".

one-piece pipe insulations

multi-purpose insulation for piping & copper tubing from –30 F to 400 F



Fiberglas One-Piece Pipe Insulation is available in 180 different thickness-size-length-jacket combinations — for almost all large and small piping and copper tubing sizes.

description

Fiberglas One-Piece Pipe Insulation is a resilient, lightweight pipe insulation molded from fine glass fibers. It is made in one-piece cylinders—in sizes up to 33" IPS—with a single longitudinal seam that is opened to apply to the pipe and closes after it is in place. This unique feature offers faster application and better handling characteristics. This multipurpose one-inventory pipe covering is designed for use on pipe and copper tubing lines from—30 to 400 F. It possesses exceptionally high thermal efficiency — in a range of wall thicknesses from ½" to 2" — making possible the use of lesser thicknesses than other pipe coverings to get greater heat-saving economies. Fiberglas One-Piece Pipe Insulation is not affected by moisture, will not corrode metals, will not shrink, and will accommodate line expansion and contraction without cracking.

jackets

Fiberglas One-piece Pipe Insulation is available with a choice of factory applied jackets for appearance and/or functional purposes.

Flame Retardant Jacket (FRJ)—A laminate of aluminum foil and special embossed kraft paper with a flame retardant vapor barrier adhesive, reinforced with glass fibers for high tensile strength. This jacket is available in both white and aluminum exterior finishes. A special embossed kraft exterior surface gives a satisfactory finished appearance and to maintain the flame retardant characteristics, it is recommended that no further finish be applied.

Asphalt Kraft Jacket—A heavy, white kraft paper is laminated to an asphalt vapor barrier facing of aluminum foil. This white asphalt kraft jacket enables Fiberglas Low Pressure Pipe Insulation to insulate tubing and piping from 50 F to 250 F, but may not be used outside of this temperature range on thicknesses of insulation greater than ¾".

Canvas—The standard weight canvas jacket suits heated lines to 400 F. A heavier jacket, 6 or 8 oz. canvas is available on request at a slight additional cost.

Foil Reinforced Kraft Jacket—A 3-ply laminate consisting of aluminum foil sandwiched between two layers of special kraft paper. The slightly crinkled exterior presents an attractive appearance and doesn't require additional painting under normal conditions.

physical properties

density: 4 lbs. per cu. ft. (approx.)

moisture absorption: 0.2% by volume 96 hrs. at 120 F and 95% RH

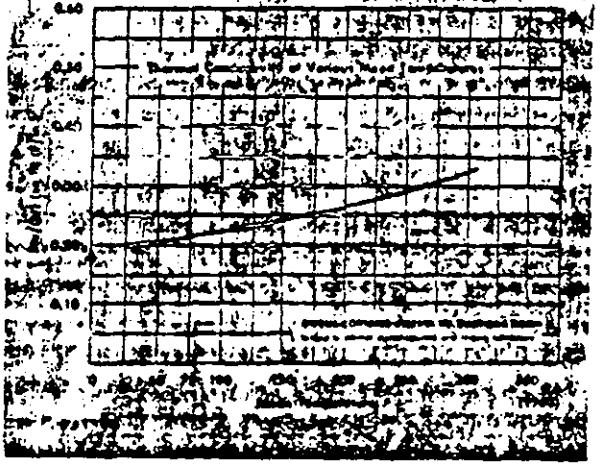
specific heat: 0.20 Btu/lb F

shrinkage: None

diffusivity:

thermal diffusivity: .024 sq. ft. per hr. at 75 F mean temperature. It may be defined as thermal conductivity divided by the specific heat and density. Wherever a condition of unsteady heat flow exists, the property of thermal diffusivity is important. In the choice of a pipe insulation with insulations of equal thickness, heating time is inversely proportional to their diffusivity, with materials of the same diffusivity, heating time is directly proportional to the square of the thickness.

thermal conductivity: Fiberglas insulation's unusually low thermal conductivity (k) values (shown on the chart below) make this the ideal one-piece pipe insulation for all applications in its temperature range.



advantages

one piece means quick, easy, economical application — even in large sizes — with savings up to 50%. Unjacketed 6' long sections available for larger sizes.

light weight — down to 1/10 that of other insulations — means less material to handle and apply.

easy fabrication — only a knife needed for the most intricate shapes; reduces clean-up time.

no shrinkage — fibers at joints mesh tightly, eliminating post-application pointing.

resilient dimensional stability resists mechanical damage before, during and after application. Does not break.

choice of jackets for function and/or appearance.

multipurpose, single-inventory product cuts stock to a minimum.

economy due to superior thermal efficiency, with equal or better performance than other insulations.

permanent, inorganic, fire-safe glass fiber construction will never rot or assist corrosion. Dries out quickly when wet; lasts indefinitely.

®T. M. Owens-Corning Fiberglas Corp.



specifications

applicable specifications

a. Hot Water, Cold Water and Low Pressure Steam Lines: 50 to 250 F

b. ASTM C-552 Insulation Pipe Covering, Thermal, and Insulation Blocks, Thermal, Pipe Covering Type I, Class A and B

c. Heated Lines: up to 400 F

d. ASTM C-547 Insulation, Thermal, Mineral Wool, Block or Board and Pipe Insulation (Molded Type) Type II, Classes 2 and 3 and Federal Specification 281-517

e. Cold and Dual Temperature Piping: 35 to 200 F

f. Low Temperature Lines: 34 to −30 F

recommended thicknesses

	Iron pipe	RT—recommended thickness
RT	copper tubing	HL—heat loss Btu/lin. ft./hr.
		HG—heat gain Btu./lin. ft./hr.

1. Insulating Materials

All piping shall be insulated with One-Piece Fiberglas Pipe Insulation as manufactured by Owens-Corning Fiberglas Corporation to the thickness as noted on drawings.

2. Application

a. Hot Water, Cold Water and Low Pressure Steam Lines: 50 to 250 F (*See page 8.*)

b. Heated Lines: up to 400 F (*See page 8.*)

c. Cold and Dual Temperature Piping: 35 to 200 F. (*See page 8.*)

d. Low Temperature Lines: 34 to −30 F (*See page 8.*)

True economic thickness can now be calculated quickly and easily by following the system provided in the new Fiberglas Dividend Engineering "Economic Thickness Manual." This is available from your local Fiberglas branch office.

hot water, hot water and low pressure steam lines

recommended for greater heat savings

pipe size	ambient air at 80 F						ambient air at 90 F		ambient air at 80 F									
steam temp.	150 F		200 F		250 F		30 F*		300 F		250 F		300 F		350 F		400 F	
fluid temp.	70 F		170 F		170 F		40 F		120 F		170 F		220 F		270 F		320 F	
	RT	HL	RT	HL	RT	HL	RT	HG	RT	HL	RT	HL	RT	HL	RT	HL	RT	HL
1	1½	8	1½	14	1½	21	1½	4	1½	14	1	18	1	25	1½	27	2	29
1¼	1½	10	1½	18	1½	27	1½	5	1½	17	1	22	1	30	1½	31	2	34
1½	1½	13	1½	24	1½	36	1½	6	1½	23	1	23	1	31	1½	34	2	37
2	1½	14	1½	25	1½	38	1½	7	1½	25	1	29	1½	29	1½	37	2	43
2½	1½	18	1½	32	1½	48	1½	8	¾	24	1	30	1½	32	1½	42	2	48
3	1½	19	1½	34	1½	53	1½	10	¾	28	1	35	1½	38	1½	49	2	51
3½	1½	23	1½	41	1½	62	1½	12	¾	32	1	40	1½	47	2	50	2½	62
4	1½	29	1½	52	1½	79	1½	15	¾	40	1	47	1½	50	2	54	2½	59
5	1½	33	1½	59	1½	89	1½	17	¾	43	1	45	1½	61	2	64	2½	60
6	1½	35	1½	63	1½	95	1½	18	¾	39	1	57	1½	60	2	64	2½	67
8	1½	28	1½	52	1½	78	1½	13	¾	52	1	54	1½	74	2	76	2½	69
10	1½	43	1½	77	1½	117	1½	28	¾	58	1	70	1½	72	2	76	2½	79
12	1½	53	1½	97	1½	143	1½	32	¾	60	1½	61	1½	85	2	86	2½	88
14	1½	61	1½	109	1½	164	1½	35	1	64	1½	67	1½	92	2	97	2½	101
16	1½	67	1½	120	1½	181	1½	38	1	69	1½	75	1½	102	2	106	2½	107
18	1½	73	1½	132	1½	197	1½	46	1	76	1½	82	1½	112	2	111	2½	117
20	1½	88	1½	158	1½	237	1½	66	1	88	1½	89	1½	121	2	126		
24	1½	86	1½	157	1½	275	1½	48	1	87	1½	96	1½	131	2	136		
30	1½	85	1½	164	1½	251			1	96	1½	105	1½	142				

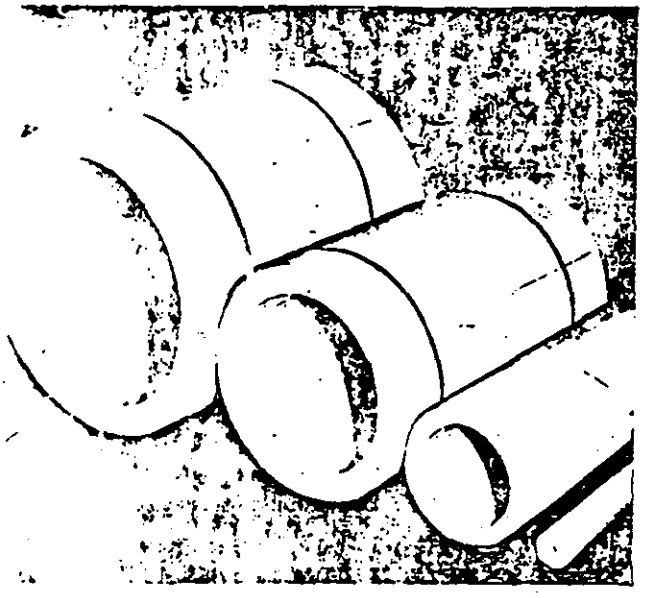
cold and dual-temperature lines (90 F at 80% R.H.)

pipe surface temperature	50 F or above		49 F to 35 F		34 F to 0 F		0 F to −30 F	
pipe size	RT	HG	RT	HG	RT	HG	RT	HG
½	1½	4	¾	5	1	8	1½	8
¾	1½	5	¾	6	1	9	1½	10
1	1½	6	¾	7	1½	8	1½	11
1¼	1½	7	¾	8	1½	9	1½	12
1½	1½	8	¾	9	1½	10	1½	13
2	1½	10	¾	11	1½	12	1½	15
2½	1½	12	¾	13	1½	15	2	15
3	¾	11	¾	13	1½	16	2	17
3½	¾	13	1	12	1½	18	2	19
4	¾	13	1	14	1½	18	2	20
5	¾	14	1	15	1½	22	2	23
6	¾	15	1	19	1½	23	2	23
8	¾	17	1	22	1½	25	2	26
10	1	18	1	25	1½	28	2	29
12	1	20	1	27	1½	31	2	32
14	1	22	1	29	1½	34	2	35
16	1	25	1	32	1½	36	2	38
18	1	25	1	34	1½	39	2	41
20	1	26	1	35	1½	43	2	44

pipe size	ambient air at 80 F						ambient air at 90 F	
steam temp.	150 F		200 F		250 F		30 F*	
fluid temp.	70 F		170 F		170 F		40 F	
	RT	HL	RT	HL	RT	HL	RT	HG
1	½	8	½	14	½	22	½	86
1¼	½	10	½	19	½	28	½	85
1½	½	14	½	25	½	37	½	83
2	½	14	½	26	½	38	½	84
2½	½	16	½	29	½	43	½	84
3	½	19	½	34	½	50	½	84
3½	½	21	½	39	½	58	½	84
4	½	24	½	44	½	66	½	84
5	½	28	½	49	½	99	½	84
6	½	31	½	55	½	84	½	84
8	½	37	½	66	½	99	½	84

*Nearest Fiberglas Branch Office for heat loss values above 12"

KAYLO pipe insulation



Kaylo pipe insulation applies easily and quickly with standard application methods. Ordinary tools of the trade are sufficient for all cutting, sawing or scoring. It is non-irritating to the skin and non-toxic.



Kaylo Pipe Insulation presents a superior final appearance when applied to a variety of irregularly-shaped high temperature vessels.

note:
high temperature insulation for indoor or outdoor piping up to 1200 F operating temperature

(for temperatures ranging from 1200 F to 1800 F, see Kaylo-20)

Kaylo* pipe insulation, a near white, rigid hydrous calcium silicate heat insulation, manufactured by Owens-Corning Fiberglas Corporation, effectively insulates indoor and outdoor piping to 1200 F. A chemically reacted material, Kaylo pipe insulation contains no added binder. For mechanical effects, a small amount of asbestos fiber is included at the time of manufacture.

This thoroughly tested and field-proven material contains the physical properties most desired for efficient, durable insulation work. It retains an appreciable percentage of its strength even after complete saturation in water, original efficiency returning after drying. The effectiveness, high strength and moisture resistance are unattained by most other insulating materials.

sizes

thickness—Kaylo Pipe Insulation is available in thicknesses from 1" to 3" depending upon pipe size. Kaylo Tube Insulation is available in thicknesses of 1" and 1½".

pipe sizes—Kaylo Pipe Insulation is available to fit pipe from ½" to 39" in diameter. Kaylo Tube Insulation will fit copper tubing from ½" to 3⅛" in diameter.

forms—Kaylo Pipe Insulation is available in sectional or multisegmental form depending upon pipe size. All insulation is furnished in 3 ft. sections.

jackets

canvas—Kaylo Sectional Pipe Insulation includes standard canvas jackets, at no additional charge, on thicknesses up to and including 2¼". Standard canvas is available for segmental forms at a slight additional cost. Bands are available for use with this product at slight additional charge and will be furnished on request.

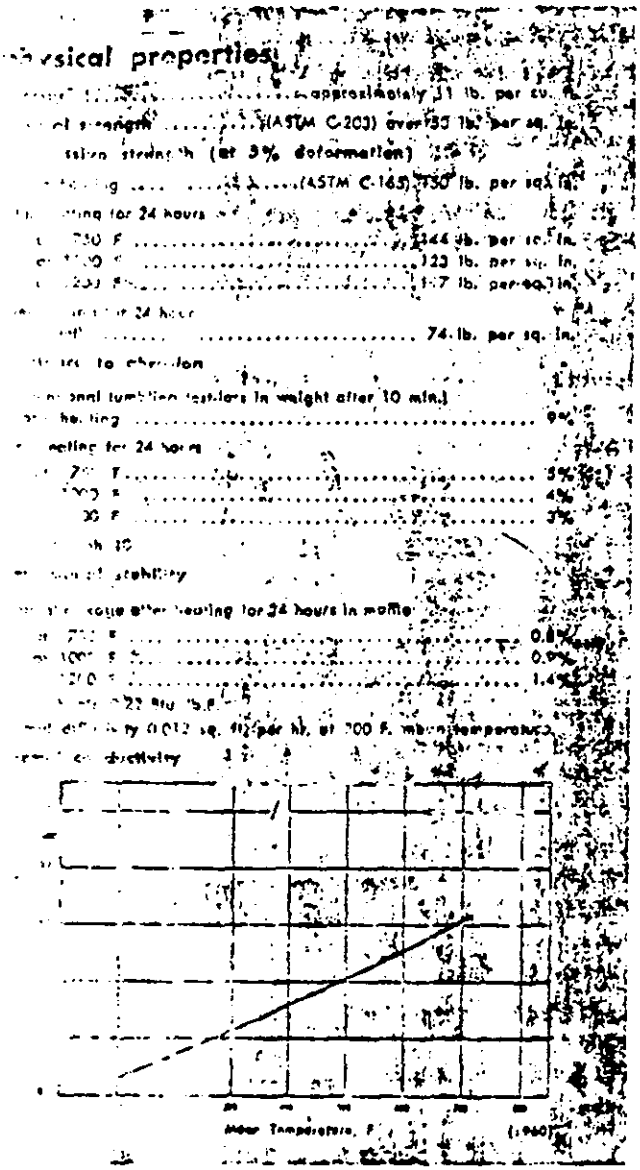
6 oz. and 8 oz. canvas jackets are available for all types, sizes and thicknesses of Kaylo Pipe and Tube Insulation at an additional charge. These jackets are factory applied on Sectional Pipe and Tube Insulation. On Multisegmental forms, they are furnished but not adhered.

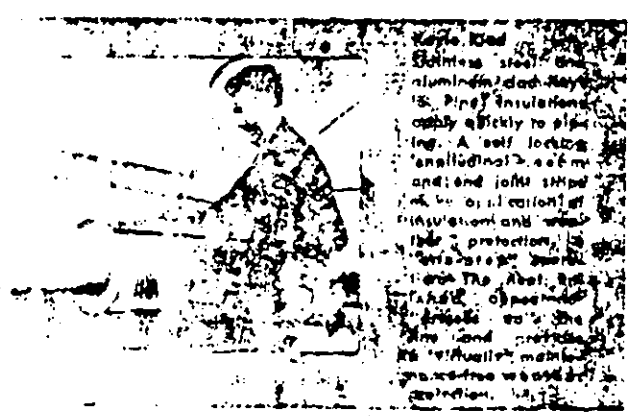
Kaylo Kled—Kaylo is also available with a soft rippled embossed aluminum jacket .016" thick or .010 stainless steel jacket. These jackets provide greater resistance to mechanical damage and present a neat finished appearance to pipe lines. The longitudinal seam has a self-locking joint. Joint bands with integral mastic are furnished for sealing end joints.

limitations

Kaylo Pipe Insulation is designed for temperatures up to 1200 F and is not recommended when operating temperatures of piping exceed this limit.

*T. M. Owens-Corning Fiberglas Corp.





specifications

for insulation of piping with Kaylo

applicable specifications

HH-I-523a Insulation Block, Pipe Covering and Cement, Thermal, Calcium Silicate (For Temperatures up to 1200 F) class II (pipe covering).

MIL-I-2781C Insulation Pipe Covering, Thermal, Grade I Class B, Grade II Class D, Grade III Class E.

1. Insulating materials

All heated pipes shall be insulated with Kaylo Pipe Insulation as manufactured by Owens-Corning Fiberglas Corporation, to the thickness noted on drawings or as shown in the table.

2. Application

All Pipe Insulation shall be applied over clean, dry surfaces, butting adjoining sections firmly together and adhered canvas, when furnished, smoothly over joints. Longitudinal and circumferential joints need not be pointed with finishing cement to conserve heat.

Insulation on pipes over 12" diameter and all outdoor piping shall be wired in place with 16 gauge soft annealed wire on no greater than 9" centers. Where double layer insulation is applied, the first layer shall be wired in place without jacket; the second layer shall be applied with all joints staggered.

All flanges, valves and fittings shall be insulated with Fiberglas molded fitting insulation or fabricated mitered segments of pipe insulation equal in thickness to the insulation on the adjoining pipe. Fittings on pipe sizes 3" and smaller may be insulated with O-C 110 Insulating Cement of equal thickness.

3. Surface finish

Indoor piping under 12" diameter not subject to abrasion or mechanical abuse requires no finish in addition to the factory-furnished canvas. Piping over 12" diameter shall be finished with 6-ounce canvas pasted in place.

Piping located outdoors shall be finished with 45-lb. roofing felt jacket with all joints lapped not less than 2". Jackets shall be wired with 16 ga. copper wire on not greater than 9" centers or banded on 12" centers with ½" galvanized bands. Other suitable weatherproof jackets such as metal, asphalt or plastic coating may be applied according to the jacket manufacturers' specifications.

Insulation on flanges, valves and fittings shall be covered with a ¼" coat of O-C 110 Insulation Cement. Insulation located indoors shall be further finished with 6 oz. canvas neatly pasted in place.

All insulation on flanges, valves and fittings located outdoors shall be covered with asphalt weatherproof mastic reinforced with an open mesh glass fabric. Mastic shall be applied in sufficient thickness to give a ⅛" dry coat and shall be troweled neatly over the fitting with the jacket on the adjacent pipe insulation lapped at least 2" over the mastic.

The foregoing is necessarily general in nature. Application procedure and material approval is at the discretion and responsibility of the design engineer to meet specific job requirements.

...sic data for Kaylo Insulations

...ble presents reference data for information on the ... thicknesses according to the simplified Dimensional ... system.

The following data are presented to aid in the design of ... insulation modified to meet specific needs. Recommendations are generalized and should be modified to ... conditions and job requirements.

Importance of calculating economic thickness

... of insulation thicknesses for any specific applica... should take into consideration at least the following ...

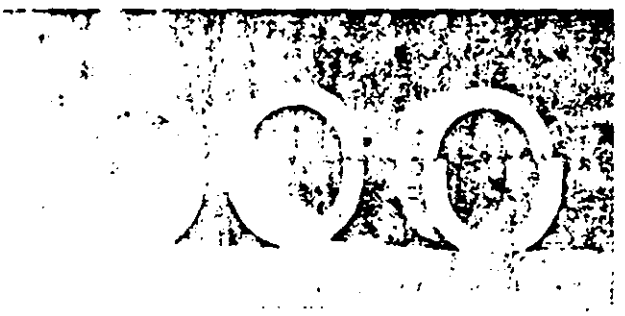
1. Cost of insulation applied
2. Cost of heat energy
3. Cost of capital
4. Depreciation period—plant and insulation
5. Capital investment in heat production equipment
6. Temperature differential
7. Size of the pipe or surface
8. Conductivity of insulation

To assist the engineer, Owens-Corning Fiberglas has taken the figures provided by the National Insulation Manufacturers Association in their manual, "How to Determine Economic Thickness of Insulation" and, by pre-calculating many of the equations on a computer, has created a quick, simple system for resolving economic thickness. To obtain your copy of this Dividend Engineering "Economic Thickness Manual," contact your local Fiberglas branch office. Your local Fiberglas representative will be glad to explain this quick, practical method for computing economical thickness under all normal operating conditions.

...plications—Kaylo and Kaylo-Klad



...cycle yard steam insulated with Kaylo Pipe Insulation for efficiency and controlled temperatures at distant points.



New Kaylo Trace Line pipe insulation and Kaylo Klad Trace Line Pipe Insulation (jacketed with .016 embossed aluminum or .010 stainless steel) provide great economy in the insulation of trace lines.

These pre-molded trace line insulations are designed for insulating piping 2" IPS x 1" thick up to 8" IPS x 2" thick together with a 1" trace line.

Advantages of this Kaylo molded insulation include higher strength, more rigid construction and, in the case of Kaylo Klad, single application of both insulation and weather proofing. Application and maintenance costs are both reduced. Where a trace line is greater than one inch, an extended leg insulation can be fabricated on special order; contact your local OCF Branch Office.







▲ Kaylo-Klad aluminum jacket "locks out" the weather. The longitudinal seam joint and end joint band, with integral mastic, provide positive weather protection.



recommended thicknesses—Kaylo†

(ambient still air at 80 F)

pipe temp.	250 F				400 F				600 F			
temp. diff.	200 F				400 F				600 F			
pipe size	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST
½	1	28.6	72.0	110	1½	52.5	86.7	107	2	77.0	90.6	110
¾	1	34.2	79.5	104	1½	63.0	87.6	110	2½	94.4	92.7	103
1	1	35.9	82.6	101	1½	65.3	89.0	109	2½	85.9	93.1	106
1¼	1	45.8	82.0	108	1½	73.2	90.1	110	2½	98.3	93.7	109
1½	1	46.3	84.0	104	2	65.8	92.2	103	3	89.0	95.0	107
2	1	53.5	84.9	105	2	80.3	92.8	107	3	108	95.1	108
2½	1	61.5	85.5	106	2	81.7	93.3	105	3	113	96.1	107
3	1	72.7	85.7	108	2½	90.8	93.9	104	3½	124	96.1	107
4	1	86.4	86.5	108	2½	107	94.4	105	3½	146	96.4	108
5	1	106	86.5	110	2½	126	94.6	107	3½	164	96.7	110
6	1½	94.2	90.0	103	2½	113	94.8	109	4	170	97.1	107
8	1½	112	90.3	103	2½	162	94.8	109	4	190	97.2	108
8	1½	114	90.4	104	2½	174	95.0	110	4	210	97.2	109
10	1½	125	90.4	105	2½	188	95.2	110	4	222	97.4	110
10	1½	133	90.8	104	3	179	95.9	106	4½	226	97.6	108
10	1½	133	91.0	104	3	210	95.9	107	4½	250	97.7	109
12	1½	178	90.4	106	3	235	95.8	108	4½	275	97.7	109
12	1½	201	90.4	107	3	255	95.9	109	5	296	97.9	108
12	1½	223	90.5	108	3	285	96.0	110	5	320	97.9	109
12	1½	246	90.5	108	3½	272	96.5	106	5	353	97.9	110
12	1½	291	90.3	108	3½	319	96.6	107	5½	364	98.2	108

†True economic thickness can now be calculated quickly and easily by following the system provided in the new Fiberglas Dividend Engineering "Economic Thickness Manual". This is available from your local Fiberglas branch office.

KEY

RT— Recommended Thickness.

HL— Heat Loss Btu/Lin. ft./hr.

E— Insulation Efficiency.

ST— Surface Temperature.*

C— Commercial and Industrial

U— Power and Utility

P— Process Industries

pipe temp.	250 F				400 F				600 F				800 F				1000 F				1200 F			
temp. diff.	200 F				400 F				600 F				800 F				1000 F				1120 F			
pipe size	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST
½	1	28.6	79.0	100	1	63.0	84.0	120	1½	86.0	89.5	119	2	112	92.4	124	2½	148	94.8	118	3	145	95.3	120
¾	1	34.2	79.5	104	1	75.2	84.4	128	1½	98.3	90.3	126	2	125	93.2	128	2½	144	95.5	122	3	162	93.8	127
1	1	35.9	82.6	101	1	79.2	86.7	123	1½	107	91.4	125	2	136	94.0	127	3	151	96	120	3	184	96.2	133
1¼	1	45.8	82.0	108	1½	73.2	90.1	110	1½	120	92.3	127	2½	143	95	123	3	175	96.3	125	3½	200	97.1	128
1½	1	46.3	84.0	104	1½	82.1	90.2	114	2	108	93.9	113	2½	146	95.5	119	3	177	96.8	122	3½	199	97.6	127
2	1	53.5	84.9	105	1½	93.5	91.0	114	2	132	94.	121	2½	170	95.8	126	3	208	96.9	130	4	215	97.5	126
2½	1	61.5	85.5	106	1½	96.1	92.3	111	2	137	94.8	117	2½	181	96.3	124	3	206	97.5	129	4	231	97.8	125
3	1	72.7	85.7	108	1½	126	91.5	120	2	164	94.9	128	3	197	96.6	124	3½	236	97.8	126	4	267	97.9	130
4	1	86.4	86.5	108	1½	154	91.9	123	2	202	95.0	128	3	222	97	124	3½	274	97.8	130	4½	286	98.2	127
5	1	106	86.5	110	1½	177	92.4	123	2½	206	95.9	122	3	266	97.1	128	4	292	98.1	125	4½	326	98.3	130
6	1	137	85.1	116	1½	207	92.4	126	2½	239	95.9	125	3½	268	97.5	122	4	332	98.5	129	5	344	98.5	128
6	1½	102	90.3	102	1½	224	92.8	125	2½	270	96	127	3½	297	97.6	125	4½	333	98.5	124	5	377	98.6	129
6	1½	114	90.4	103	1½	269	92.9	127	2½	287	95.2	127	3½	326	97.7	126	4½	366	98.5	125	5½	389	98.7	126
6	1½	125	90.4	108	1½	273	93.0	128	2½	313	96.3	128	3½	353	97.7	127	4½	400	98.5	128	5½	436	98.9	128
6	1½	133	90.8	104	1½	292	93.2	127	2½	348	96.5	129	3½	392	97.7	129	4½	440	98.5	130	6	452	98.9	127
6	1½	133	91.0	104	1½	338	93.7	128	2½	395	96.4	130	4	410	98	125	5	460	98.8	127	6	510	99.0	129
8	1½	178	90.4	106	2	325	94.1	123	3	385	96.8	125	4	447	98	128	5	500	98.7	129	6	556	99.0	131
8	1½	201	90.4	107	2	375	94.0	124	3	428	96.9	126	4	495	98.1	128	5	563	98.7	130	6	621	99.0	132
8	1½	223	90.5	108	2	410	94.2	125	3	480	96.9	127	4	540	98.1	129	5½	545	98.8	127	6	679	99.0	134
8	1½	246	90.5	108	2	460	94.4	126	3	535	96.9	128	4	594	98.1	130	5½	605	98.9	128	6	733	99.1	136
8	1½	291	90.3	107	2	525	94.3	126	3	610	97	128	4½	618	98.4	126	5½	685	98.9	129	6	841	99.1	137
10	1	28.6	79.0	100	1	63.0	84.0	120	1	106	86.8	147	1½	124	91.6	136	2	146	94.1	134	2	179	94.2	149
10	1	34.2	79.5	104	1	75.2	84.4	128	1½	98.3	90.3	126	1½	145	92.1	145	2	166	94.6	141	2½	175	95.5	134
10	1	35.9	82.6	101	1	79.2	86.7	123	1½	107	91.4	125	2	136	94.0	127	2½	174	95.4	136	2½	198	95.9	141
10	1	45.8	82.0	108	1	102	86.3	134	1½	120	92.3	127	2	160	94.4	135	2½	188	96.1	135	3	211	96.5	137
10	1	46.3	84.0	104	1	104	87.8	129	1½	135	92.4	132	2	156	95.2	126	2½	207	96.2	142	3	212	96.9	134
10	1	53.5	84.9	105	1	118	88.6	131	1½	154	93.0	134	2	189	95.3	133	2½	223	96.7	138	3	250	97.1	140
10	1	61.5	85.5	106	1	135	89.1	134	1½	158	94.0	127	2	200	96.4	132	2½	237	97.1	134	3	266	97.4	139
10	1	72.7	85.7	108	1	160	89.3	137	1½	202	93.7	140	2	250	95.7	145	2½	292	97.0	147	3	316	97.5	147
10	1	86.4	86.5	108	1	191	89.9	138	1½	249	92.7	147	2	293	96.1	148	3	299	97.6	137	3½	335	97.9	140
10	1	106	86.5	110	1	240	89.6	144	1½	297	94.0	149	2½	294	96.8	137	3	347	97.8	140	3½	386	98.0	145
10	1	137	85.1	116	1½	207	92.4	126	2	270	95.4	133	2½	337	96.9	139	3	403	98	147	3½	430	98.2	147
10	1½	102	90.3	102	1½	224	92.8	125	2	302	95.5	134	2½	375	97.0	141	3½	386	98.3	135	3½	471	98.2	148
10	1½	114	90.4	103	1½	269	92.9	127	2	333	95.6	135	2½	399	97.2	140	3½	422	98.2	137	4	474	98.4	142
10	1½	125	90.4	104	1½	273	93.0	128	2	349	95.9	134	2½	435	97.2	142	3½	458	98.3	138	4	513	98.5	143
10	1½	133	90.8	103	1½	292	93.2	127	2	391	95.8	137	2½	442	97.2	146	3½	504	98.3	140	4	563	98.5	146
10	1½	133	91.0	104	1½	338	93.7	128	2	431	95.9	138	2½	563	97.3	148	3½	576	98.3	143	4	642	98.5	148
12	1½	178	90.4	106	1½	391	93.0	132	2	515	95.7	143	3	561	97.6	140	3½	642	98.3	147	4½	647	98.7	144
12	1½	201	90.4	107	1½	441	93.0	133	2	579	95.8	144	3	606	97.6	141	4	642	98.3	140	4½	719	98.7	145
12	1½	223	90.5	108	1½	492	93.0	134	2	640	95.9	147	3	671	97.7	142	4	707	98.6	142	5	728	98.8	140
12	1½	246	90.5	108	1½	541	93.1	134	2½	583	96.5	135	3	735	97.7	144	4	777	98.6	142	5	840	98.9	143
12	1½	291	90.3	108	1½	647	93.1	135	2½	690	97.0	136	3	870	97.7	147	4	903	98.6	144	5	922	98.9	143

*Surface temperatures for Kaylo-Clad will be higher due to the emissivity of the aluminum jacket. This will vary with ambient temperature thickness of insulation used. However, the thermal efficiency of the application will be improved slightly by the aluminum jacket.

Where to buy

Fiberglas Industrial Insulations

For additional information, contact your nearest Fiberglas Branch Office listed below. Authorized Distributors maintain stocks in principal cities. Consult the yellow pages for their locations.

Albuquerque, New Mexico		243-4583
Anchorage, Alaska	BR	5-8344
Atlanta, Georgia		799-6821
Baltimore, Maryland	SA	7-0234
Birmingham, Alabama	TR	1-2723
Boise, Idaho		2-3102
Boston, Massachusetts	CE	5-7540
Buffalo, New York	TL	3-4123
Charleston, West Virginia	DI	3-7094
Charlotte, North Carolina	ED	4-6864
Chicago, Illinois	RA	6-0102
Cincinnati, Ohio	AV	1-1173
Cleveland, Ohio	MA	1-6451
Columbus, Ohio	HU	6-9418
Dallas, Texas	RI	1-3982
Dayton, Ohio	AX	3-3155
Denver, Colorado	AC	2-3126
Des Moines, Iowa	AT	8-4273
Detroit, Michigan	LI	7-8000
Evansville, Indiana	HA	5-5124
Fort Wayne, Indiana	EA	4635
Fresno, California	AD	3-7227
Grand Rapids, Michigan	CH	3-3697
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Hartford, Connecticut	CH	7-1301
Honolulu, Hawaii		99-5689
Houston, Texas	JA	6-1851
Indianapolis, Indiana	CL	5-4147
Jacksonville, Florida	EL	5-4188
Kansas City, Missouri	PL	3-7725
Los Angeles, California	RA	3-9781
Louisville, Kentucky	ME	7-2588
Memphis, Tennessee	FA	7-6116
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Milwaukee, Wisconsin	DI	4-3811
Minneapolis, Minnesota	FR	7-1730
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Nashville, Tennessee	AL	4-9210
New Orleans, Louisiana		523-2821
New York, New York	PL	9-3810
Oklahoma City, Oklahoma	JA	8-4468
Omaha, Nebraska		553-3291
Peoria, Illinois	PE	4-3232
Philadelphia, Pennsylvania	LO	4-3133
Phoenix, Arizona	AL	8-4541
Pittsburgh, Pennsylvania	AT	1-7191
Portland, Oregon	CA	6-3505
Richmond, Virginia	EL	5-5703
Rochester, New York	BR	1-1888
Rock Island, Illinois		788-1190
North Sacramento, California	WA	2-5467
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Spokane, Washington	KE	5-3575
Syracuse, New York	GR	4-4646
Tampa, Florida		253-0183
Toledo, Ohio		248-6741
Washington, D. C.	NA	8-0724

INTERNATIONAL S.A., GENERAL OFFICE:
Panama, Republic de Panama,
Apartado 6718, Phone: 5-1650

INTERNATIONAL S.A., BRANCH OFFICES:
New York 22, New York, 717 Fifth Ave., PL 9-3810
San Francisco 7, Calif., 1200 17th St. UN 1-4721
San Juan, P. R., First Fed. Savings Cond. Santurce, Puerto Rico, 723-8444

OWENS-CORNING FIBERGLAS CORPORATION

Industrial and Commercial Construction Materials Division, 717 Fifth Avenue, New York 22, N. Y.

General Offices, Toledo 1, Ohio Pacific Coast Division, Santa Clara, Calif.

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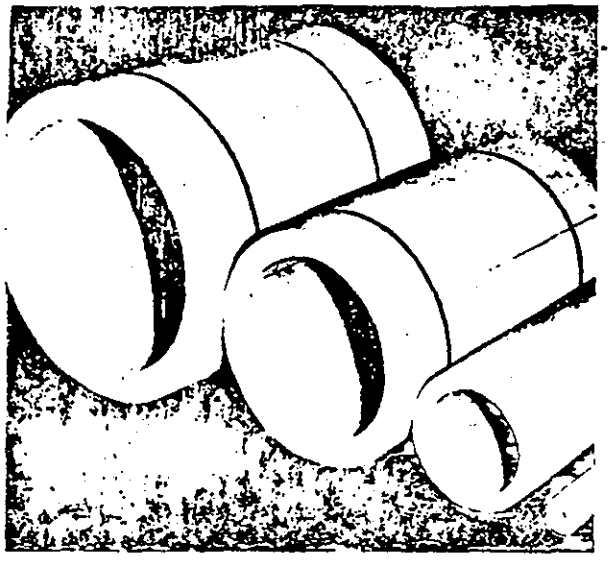
Kaylo and Kaylo-20 Pipe Insulation

KAYLO pipe insulation *for indoor or outdoor piping up to 1200 F operating temperature*



Kaylo pipe insulation applies easily and quickly with standard application methods. Ordinary tools of the trade are sufficient for all cutting, sawing or scoring. It is non-irritating to the skin.



Kaylo Pipe Insulation presents a superior final appearance when applied to a variety of irregularly-shaped high temperature vessels.

Kaylo® pipe insulation, a near white, rigid hydrous calcium silicate heat insulation, manufactured by Owens-Corning Fiberglas Corporation, effectively insulates indoor and outdoor piping to 1200 F. A chemically reacted material, Kaylo pipe insulation contains no added binder. For mechanical effects, a small amount of asbestos fiber is included at the time of manufacture.

This thoroughly tested and field-proven material contains the physical properties most desired for efficient, durable insulation work. It retains an appreciable percentage of its strength even after complete saturation in water, original efficiency returning after drying. The effectiveness, high strength and moisture resistance are unattained by most other insulating materials.

sizes

thickness—Kaylo Pipe Insulation is available in thicknesses from 1" to 3" depending upon pipe size. Kaylo Tube Insulation is available in thicknesses of 1" and 1½".

pipe sizes—Kaylo Pipe Insulation is available to fit pipe from ½" to 39" in diameter. Kaylo Tube Insulation will fit copper tubing from ½" to 3⅛" in diameter.

forms—Kaylo Pipe Insulation is available in sectional or multisegmental form depending upon pipe size. All insulation is furnished in 3 ft. sections.

jackets

canvas—Kaylo Sectional Pipe Insulation includes standard canvas jackets, at no additional charge, on thicknesses up to and including 2½". Standard canvas is available for segmental forms at a slight additional cost. Bands are available for use with this product at slight additional charge and will be furnished on request.

6 oz. and 8 oz. canvas jackets are available for all types, sizes and thicknesses of Kaylo Pipe and Tube Insulation at an additional charge. These jackets are factory applied on Sectional Pipe and Tube Insulation. On Multisegmental forms, they are furnished but not adhered.

Kaylo Klad—Kaylo is also available with a soft rippled embossed aluminum jacket .016" thick or .010 stainless steel jacket. These jackets provide greater resistance to mechanical damage and present a neat finished appearance to pipe lines. The longitudinal seam has a self-locking joint. Joint bands with integral mastic are furnished for sealing end joints.

limitations

Kaylo Pipe Insulation is designed for temperatures up to 1200 F and is not recommended when operating temperatures of piping exceed this limit.

® Reg U.S. Pat. Off. Owens-Corning Fiberglas Corporation

physical properties

density ..... approximately 11 lb. per cu. ft

flexural strength ..... (ASTM C-203) over 50 lb. per sq. in.

resistance to abrasion

(conventional tumbling test-loss in weight after 10 min.)
before heating 9%

after heating for 24 hours
at 750 F 5%
at 1000 F 4%
at 1200 F 3%

alkalinity: ph 10

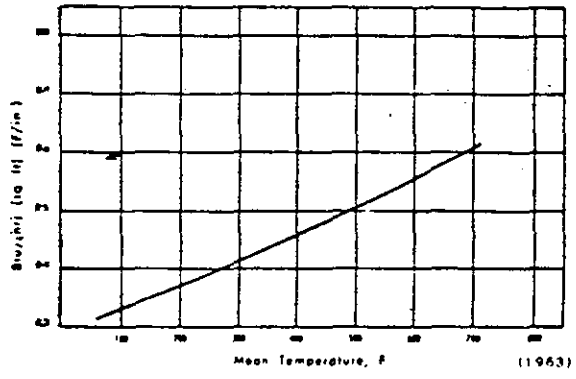
dimensional stability

linear shrinkage after heating for 24 hours in muffle
at 750 F 0.8%
at 1000 F 0.9%
at 1200 F 1.4%

specific heat: 0.22 Btu/lb.F.

thermal diffusivity 0.012 sq. ft. per hr. at 200 F mean temperature.

thermal conductivity



contains stress corrosion inhibitor

Ordinary construction grades austenitic of stainless steels are quite vulnerable to rapid deterioration by stress-corrosion cracking. This attack is caused by trace quantities of chlorides which are present in most industrial waters, industrial atmospheres and in all insulations.

Kaylo and Fiberglas have one of the lowest chloride contents of all commercially available insulations.

Now as an added feature, Kaylo is being formulated with a stress corrosion inhibitor to protect expensive stainless steel piping and equipment from stress corrosion failure from the outside. This inhibitor has been field proven by years of experience in a variety of critical stainless steel applications. Kaylo, with the inhibitor added, has passed a very extensive series of laboratory stress corrosion tests based on the DuPont test procedures.

The low chloride content of Kaylo plus the added inhibitors make Kaylo the logical choice for [illegible] stainless steel piping applications.

specifications

for insulation of piping with Kaylo

applicable specifications

HH-I-523a Insulation Block, Pipe Covering and Cement, Thermal, Calcium Silicate (For Temperatures up to 1200 F) class II (pipe covering).

MIL-I-2781D Insulation Pipe Covering, Thermal

1. Insulating materials

All heated pipes shall be insulated with Kaylo Pipe Insulation as manufactured by Owens-Corning Fiberglas Corporation, to the thickness noted on drawings or as shown in the table.

2. Application

All Pipe Insulation shall be applied over clean, dry surfaces, butting adjoining sections firmly together and adhered canvas, when furnished, smoothly over joints. Longitudinal and circumferential joints need not be pointed with finishing cement to conserve heat.

Insulation on pipes over 12" diameter and all outdoor piping shall be wired in place with 16 gauge soft annealed wire on no greater than 9" centers. Where double layer insulation is applied, the first layer shall be wired in place without jacket; the second layer shall be applied with all joints staggered.

All flanges, valves and fittings shall be insulated with Fiberglas molded fitting insulation or fabricated mitered segments of pipe insulation equal in thickness to the insulation on the adjoining pipe. Fittings on pipe sizes 3" and smaller may be insulated with O-C 110 Insulating Cement of equal thickness.

3. Surface finish

Indoor piping under 12" diameter not subject to abrasion or mechanical abuse requires no finish in addition to the factory-furnished canvas. Piping over 12" diameter shall be finished with 6-ounce canvas pasted in place.

Piping located outdoors shall be finished with 45-lb. roofing felt jacket with all joints lapped not less than 2". Jackets shall be wired with 16 ga. copper wire on not greater than 9" centers or banded on 12" centers with ½" galvanized bands. Other suitable weatherproof jackets such as metal, asphalt or plastic coating may be applied according to the jacket manufacturers' specifications.

Insulation on flanges, valves and fittings shall be covered with a ¼" coat of O-C 110 Insulation Cement. Insulation located indoors shall be further finished with 6 oz. canvas neatly pasted in place.

All insulation on flanges, valves and fittings located outdoors shall be covered with asphalt weatherproof mastic reinforced with an open mesh glass fabric. Mastic shall be applied in sufficient thickness to give a ⅛" dry coat and shall be troweled neatly over the fitting with the jacket on the adjacent pipe insulation lapped at least 2" over the mastic.

The foregoing is necessarily general in nature. Application procedure and material approval is at the discretion and responsibility of the designer, contractor and/or jobsite personnel.

design data for Kaylo Insulations

This table presents reference data for information on the actual thicknesses according to the simplified Dimensional Standard system.

The following data are presented to aid in the design of Kaylo Pipe Insulation modified to meet specific needs. Recommendations are generalized and should be modified to meet local conditions and job requirements.

importance of calculating economic thickness

Selection of insulation thicknesses for any specific application should take into consideration at least the following criteria.

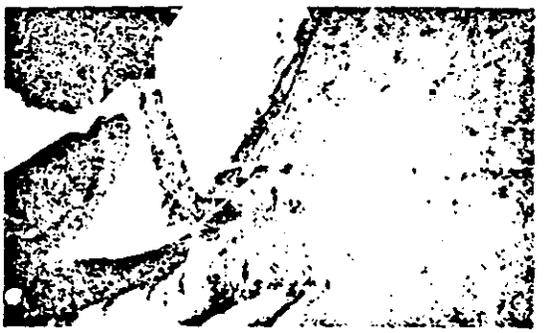
1. Cost of insulation applied
2. Cost of heat energy
3. Cost of capital
4. Depreciation period—plant and insulation
5. Capital investment in heat production equipment
6. Temperature differential
7. Size of the pipe or surface
8. Conductivity of insulation

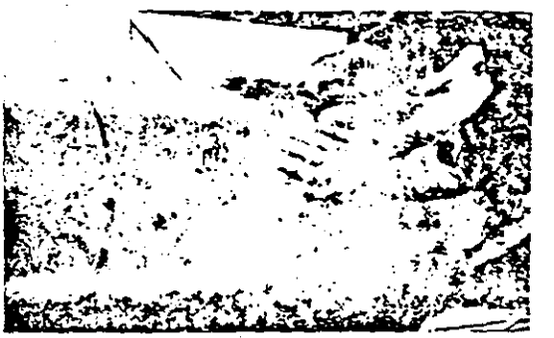
To assist the engineer, Owens-Corning Fiberglas has taken the figures provided by the National Insulation Manufacturers Association in their manual, "How to Determine Economic Thickness of Insulation" and, by pre-calculating many of the equations on a computer, has created a quick, simple system for resolving economic thickness. To obtain your copy of this Dividend Engineering "Economic Thickness Manual," contact your local Fiberglas branch office. Your local Fiberglas representative will be glad to explain this quick, practical method for computing economical thickness under all normal operating conditions.

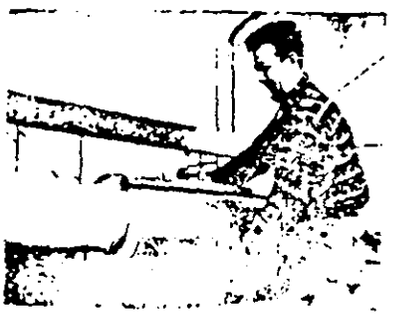
applications—Kaylo and Kaylo-Klad



Off-site yard steam insulated with Kaylo Pipe Insulation for efficiency and controlled temperatures at distant points.







Kaylo Klad
Stainless steel and aluminum clad Kaylo Pipe Insulations apply quickly to piping. A self locking longitudinal seam and end joint strips make application of insulation and weather protection a "one-step" operation. The neat finished appearance "dresses up" the line and provides a virtually maintenance-free weather protection.



Kaylo-Klad aluminum jacket "locks out" the weather. The long lasting seam joint and end joint band, with integral moisture gasket provide positive weather protection.

recommended thicknesses—Kaylo†

(ambient still air at 80 F)

pipe temp.		280 F				480 F				680 F			
temp. diff.		200 F				400 F				600 F			
	pipe size	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST
C	½	1	28.6	79.0	100	1½	52.5	86.7	107	2	77.0	90.6	110
	¾	1	34.2	79.5	104	1½	60.0	87.6	110	2½	74.4	92.7	103
	1	1	35.9	82.6	101	1½	65.3	89.0	109	2½	85.9	93.1	106
	1¼	1	45.8	82.0	108	1½	73.2	90.1	110	2½	98.3	93.7	109
	1½	1	46.3	84.0	104	2	65.8	92.2	103	3	89.0	95.0	102
	2	1	53.5	84.9	105	2	80.3	92.8	107	3	108	95.1	108
	2½	1	61.5	85.5	106	2	83.7	93.3	105	3	115	96.1	107
	3	1	72.7	85.7	108	2½	90.8	93.9	104	3½	124	96.1	107
	4	1	86.4	86.5	108	2½	107	94.4	105	3½	146	96.4	108
	5	1	106	86.5	110	2½	126	94.6	107	3½	164	96.7	110
	6	1½	94.2	90.0	103	2½	143	94.8	109	4	170	97.1	107
	7	1½	102	90.3	103	2½	162	94.8	109	4	190	97.2	108
	8	1½	114	90.4	104	2½	174	95.0	110	4	210	97.2	109
	9	1½	125	90.4	104	2½	188	95.2	110	4	222	97.4	110
	10	1½	133	90.8	104	3	179	95.9	106	4½	226	97.6	108
	12	1½	153	91.0	104	3	210	95.9	107	4½	250	97.7	109
	14	1½	178	90.4	106	3	235	95.8	108	4½	275	97.7	109
	16	1½	201	90.4	107	3	255	95.9	109	5	286	97.9	108
	18	1½	223	90.5	108	3	285	96.0	110	5	320	97.9	109
	20	1½	246	90.5	108	3½	272	96.5	106	5	353	97.9	110
	24	1½	291	90.5	108	3½	319	96.6	107	5½	364	98.2	108

†True economic thickness can now be calculated quickly and easily by following the system provided in the new Fiberglas Dividend Engineering "Economic Thickness Manual". This is available from your local Fiberglas branch office.

KEY

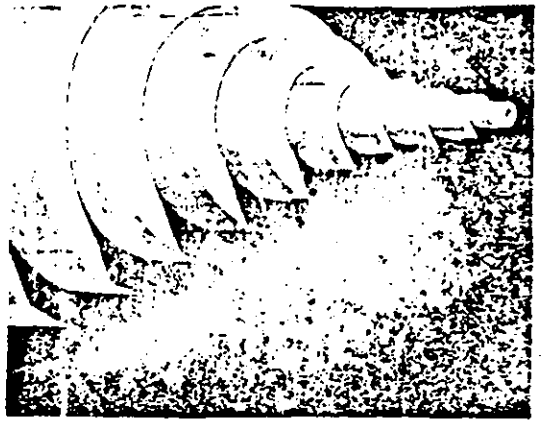
RT = Recommended Thickness.
HL = Heat Loss Btu/sq. ft./hr.
E = Insulation Efficiency.
ST = Surface Temperature.*

C = Commercial and Industrial
U = Power and Utility
P = Process Industries

pipe temp		280 F				480 F				680 F				880 F				1080 F				1200 F			
temp. diff.		200 F				400 F				600 F				800 F				1000 F				1120 F			
	pipe size	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST
U	½	1	28.6	79.0	100	1	63.0	84.0	120	1½	86.0	89.5	119	2	112	92.4	124	2½	128	94.8	118	3	145	95.3	120
	¾	1	34.2	79.5	104	1	75.2	84.4	128	1½	98.3	90.3	126	2	125	93.2	128	2½	144	95.3	122	3	162	95.8	127
	1	1	35.9	82.6	101	1	79.2	86.7	123	1½	107	91.4	125	2	136	94.0	127	3	151	96	120	3	184	96.2	133
	1¼	1	45.8	82.0	108	1½	73.2	90.1	110	1½	120	92.3	127	2½	143	95	123	3	175	96.3	125	3½	200	97.1	128
	1½	1	46.3	84.0	104	1½	82.1	90.2	114	2	108	93.9	113	2½	146	95.5	119	3	177	96.8	122	3½	199	97.6	127
	2	1	53.5	84.9	105	1½	93.5	91.0	114	2	132	94.	121	2½	170	95.8	126	3	208	96.9	130	4	215	97.5	126
	2½	1	61.5	85.5	106	1½	96.1	92.3	111	2	137	94.8	117	2½	181	96.3	124	3	206	97.5	129	4	231	97.8	125
	3	1	72.7	85.7	108	1½	126	91.5	120	2	164	94.9	128	3	197	96.6	124	3½	236	97.6	126	4	267	97.9	130
	4	1	86.4	86.5	108	1½	154	91.9	123	2	202	95.0	128	3	222	97	124	3½	274	97.8	130	4½	286	98.2	127
	5	1	106	86.5	110	1½	177	92.4	123	2½	206	95.9	122	3	266	97.1	128	4	292	98.1	125	4½	326	98.3	130
	6	1	137	85.1	116	1½	207	92.4	126	2½	239	95.9	125	3½	268	97.5	122	4	332	98.5	129	5	344	98.5	128
	7	1½	102	90.3	102	1½	224	92.8	125	2½	270	96	127	3½	297	97.6	125	4½	333	98.5	124	5	377	98.6	129
	8	1½	114	90.4	103	1½	249	92.9	127	2½	287	95.2	127	3½	326	97.7	126	4½	366	98.5	125	5½	389	98.7	126
	9	1½	125	90.4	108	1½	273	93.0	128	2½	313	96.3	128	3½	353	97.7	127	4½	400	98.5	128	5½	436	98.9	128
	10	1½	133	90.8	103	1½	292	93.2	127	2½	348	96.3	129	3½	392	97.7	129	4½	440	98.5	130	6	452	98.9	127
	12	1½	153	91.0	108	1½	338	93.7	128	2½	395	96.4	130	4	410	98	125	5	460	98.8	127	6	510	99.0	129
	14	1½	178	90.4	105	2	325	94.1	123	3	385	96.8	125	4	447	98	128	5	500	98.7	129	6	556	99.0	131
	16	1½	201	90.4	107	2	375	94.0	124	3	428	96.9	126	4	495	98.1	128	5	563	98.7	130	6	621	99.0	132
	18	1½	223	90.5	108	2	410	94.2	125	3	480	96.9	127	4	540	98.1	129	5½	565	98.8	127	6	679	99.0	134
	20	1½	246	90.5	108	2	460	98.4	126	3	535	96.9	128	4	594	98.1	130	5½	605	98.9	128	6	733	99.1	136
	24	1½	291	90.5	108	2	525	94.3	126	3	610	97	128	4½	618	98.4	126	5½	685	98.9	129	6	841	99.1	137
P	½	1	28.6	79.0	100	1	63.0	84.0	120	1	108	86.8	147	1½	124	91.6	136	2	146	94	134	2	179	94.2	149
	¾	1	34.2	79.5	104	1	75.2	84.4	128	1½	98.3	90.3	126	1½	145	92.1	145	2	165	94.6	141	2½	175	95.5	134
	1	1	35.9	82.6	101	1	79.2	86.7	123	1½	107	91.4	125	2	136	94.0	127	2½	174	95.4	134	2½	198	95.9	141
	1¼	1	45.8	82.0	108	1	102	86.3	134	1½	120	92.3	127	2	160	94.4	135	2½	188	96.1	135	3	211	96.5	137
	1½	1	46.3	84.0	104	1	102	87.8	129	1½	135	92.4	132	2	156	95.2	126	2½	207	96.2	142	3	212	96.9	134
	2	1	53.5	84.9	105	1	118	88.6	131	1½	154	93.1	134	2	189	95.3	135	2½	223	96.7	138	3	250	97.1	140
	2½	1	61.5	85.5	106	1	135	89.1	134	1½	158	93	127	2	200	96.4	132	2½	237	97.1	134	3	266	97.4	139
	3	1	72.7	85.7	108	1	160	89.3	137	1½	187	93.2	140	2	230	95.7	145	2½	292	97.0	147	3	316	97.5	147
	4	1	86.4	86.5	108	1	191	89.9	138	1½	229	93.7	147	2	293	96.1	148	3	299	97.6	137	3½	335	97.9	140
	5	1	106	86.5	110	1	240	89.6	144	1½	297	94.0	149	2½	294	96.8	137	3	347	97.8	140	3½	386	98.0	145
	6	1	137	85.1	116	1½	207	92.4	126	2	270	95.4	133	2½	337	96.9	139	3	403	98	147	3½	439	98.2	147
	7	1½	102	90.3	102	1½	224	92.8	125	2	332	95.5	134	2½	375	97.0	141	3½	386	98.3	135	3½	471	98.2	148
	8	1½	114	90.4	103	1½	249	92.9	127	2	313	95.6	133	2½	389	97.2	140	3½	422	98.2	137	4	474	98.4	142
	9	1½	125	90.4	104	1½	273	93.0	128	2	342	95.7	134	2½	435	97.2	142	3½	458	98.3	138	4	513	98.5	143
	10	1½	133	90.8	103	1½	292	93.2	127	2	391	95.8	137	2½	442	97.2	146	3½	504	98.3	140	4	563	98.5	146
	12	1½	153	91.0	104	1½	338	93.7	128	2	451	96.2	138	2½	563	97.3	148	3½	576	98.3	143	4	662	98.5	148
	14	1½	178	90.4	106	1½	391	93.8	132	2	515	96.7	143	3	541	97.6	140	3½	642	98.3	147	4½	647	98.7	144
	16	1½	201	90.4	107	1½	441	93.9	133	2	574	96.8	144	3	606	97.6	141	4	642	98.5	140	4½	719	98.7	145
	18	1½	223	90.5	108	1½	492	93.9	133	2	634	97.0	147	3	671	97.7	142	4	727	98.6	142	5	726	98.8	147
	20	1½	246	90.5	108	1½	541	93.9	133	2	691	97.1	151	3	736	97.7	144	4	792	98.6	144	5	864	98.9	147
	24	1½	291	90.5	108	1½	638	93.9	133	2	806	97.2	155	3	871	97.7	147	4	931	98.6	144	5	1044	98.9	147

*Surface temperature is based on [illegible] the thermal efficiency of the application will be maximized by the [illegible]

KAYLO-20 pipe insulation *for indoor and outdoor piping up to 1800 F operating temperature*



Kaylo-20® Insulation, colored pink for identification, a high-temperature calcium silicate heat insulation manufactured by Owens-Corning Fiberglas extends the range of Kaylo Heat Insulation to include temperatures up to 1800 F with all the properties of moisture resistance and high strength of standard Kaylo material. It also may be used with outer layers of Fiberglas Pipe Insulation to provide ultimate balance of cost and efficiency.

Kaylo-20 Insulation is highly dimensionally stable at the temperatures for which it is designed. Resistance of this insulation to high temperatures makes it extremely useful for protecting fluids in the pipe in case of fire.

sizes

thickness—Kaylo-20 Pipe Insulation is available in thicknesses from 1" to 3" depending upon pipe size. Kaylo-20 Tube Insulation is available in thicknesses of 1" and 1½".

pipe sizes—Kaylo-20 Pipe Insulation is available to fit pipe from ½" to 39" in diameter. Kaylo-20 Tube Insulation in copper tubing sizes will fit tubing from ⅜" to 3⅛".

forms—Kaylo-20 Pipe Insulation is available in sectional or multi-segmental form depending upon pipe size. All insulation is furnished in 3' sections.

jackets

canvas—Standard canvas jackets are provided at no additional charge with Kaylo-20 Sectional Pipe and Tube Insulation on thicknesses up to and including 2½". Standard canvas is available for segmental forms at a slight additional cost. Bands are available for use with this product at a small additional charge and will be shipped only on request.

6 oz. and 8 oz. canvas jackets are available on all types, sizes and thicknesses of Kaylo-20 Pipe Insulation at additional charge. These jackets are factory applied on sectional pipe and tube insulation. On multi-segmental insulation, they are furnished but not adhered.

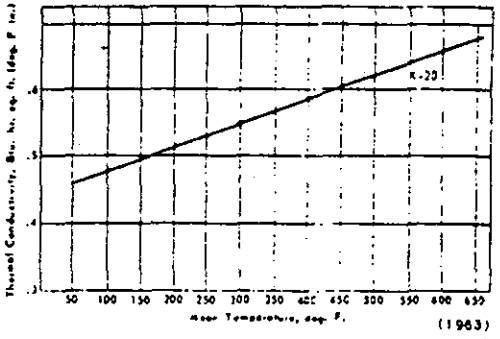
Kaylo Klad locks out the weather, protects the insulation and provides a maintenance free line and attractive finished appearance. Factory applied jackets of .016 embossed aluminum and .010 stainless steel have longitudinal interlocking seams and joint bands with integral mastic permitting application of insulation and weather proofing at the same time and reducing application costs.

limitations

physical properties

density:
approximately 12 lbs. per cu. ft.
flexural strength: (ASTM C-203)
90 lbs. per sq. in.
compressive strength: (ASTM C-165)
130 lbs. per sq. in. at 5% deformation
dimensional stability:
linear shrinkage after heating for 24 hours in muffle
at 1200 F.....0.7%
at 1800 F.....1.6%
resistance to abrasion:
(conventional tumbling test—loss in weight after 10 min.)
before heating 3%
after heating for 24 hours
at 1200 F 5%
at 1800 F 20%
alkalinity: ph 10
working temperature: up to 1800 F
physical properties
specific heat: 0.22 Btu/1 lbs. F.
thermal diffusivity: 0.016 sq. ft. per hr. at 200 F mean temperature.

thermal conductivity



(1963)

recommended thicknesses

These are average figures and may be adjusted to meet special conditions encountered on specific jobs. Kaylo heat loss data is available for use where plant operating economics and other conditions demand greater insulation thicknesses. Design surface temperatures are approx. 150 F.

nom. pipe size	Temperature Difference F							
	1100	1200	1300	1400	1500	1600	1700	1800
½	2½	2½	3	3	3½	3½	4	4
¾	2½	2½	3	3	3½	3½	4	4
1	2½	3	3	3	3½	3½	4	4½
1¼	2½	3	3	3½	3½	4	4½	4½
1½	3	3	3½	3½	3½	4	4½	5
2	3	3	3½	3½	4	4	4½	5
2½	3	3½	3½	4	4	4½	5	5½
3	3½	3½	3½	4	4	4½	5	5½
3½	3½	3½	4	4	4½	5	5½	6
4	3½	3½	4	4	4½	5	5½	6
6	4	4	4½	4½	5	5½	6	6½
8	4	4	4½	4½	5	5½	6	6½
10	4	4½	4½	5	5½	6	6½	7
12	4½	4½	5	5	5½	6	6½	7
14	4½	5	5	5½	6	6½	7	7½
16	4½	5	5½	6	6½	7	7½	8
18	5	5	5½	6	6½	7	7½	8
20	5	5½	5½	6½	7	7½	8	8½
24-72	5	5½	6	6½	7	7½	8	8½

insulation thickness standards— Kaylo and Kaylo-20

CT

nom. tube size	O. D. of tube (nom.)	single layer — nom. 1" actual	nom. 1" O.D.	nom. 1½" actual	nom. 1½" O.D.
⅜"	½"	1.18	2.88	1.49	3.50
½"	⅝"	1.11	2.88	1.42	3.50
¾"	⅞"	1.05	2.88	1.61	4.00
⅞"	1⅛"	.99	2.88	1.55	4.00
1"	1⅜"	1.17	3.50	1.42	4.00
1¼"	1⅝"	1.05	3.50	1.55	4.50
1½"	1⅞"	1.17	4.00	1.42	4.50
2"	2⅛"	.91	4.00	1.41	5.00
2½"	2⅝"	.91	4.50	1.45	5.56
3"	3⅛"	.91	5.00	1.73	6.66

Federal Specification Compliance

HH-I-523a Insulation Block Pipe Covering and Cement, Thermal, Calcium Silicate (For Temperatures up to 1200 F) class 11 (pipe covering).

MIL-I-2781D Insulation Pipe Covering, Thermal, Grade I Class B, Grade II Class D, Grade III Class E.

For Applicable Specifications refer to Page 23.

note:

Insulations for tubing sizes other than standard sizes shown are available only as cut-downs from next larger size tube or pipe and will be slightly elliptical in shape.

KEY

IP = iron pipe sizes

CT = copper tubing

IL = Inner Layer

OL = Outer Layer

IP

nom. pipe size	O.D. of pipe	single layer only — nom. 1" actual	nom. 1" O.D.	nom. 1½" actual	nom. 1½" O.D.	single or double layer — nom. 2" actual	nom. 2" O.D.	nom. 2½" actual	nom. 2½" O.D.	nom. 3" actual	nom. 3" O.D.	multiple layer—recommended combinations 2" IL / OL	2½" IL / OL	3" IL / OL	3½" IL / OL	4" IL / OL	4½" IL / OL	5" IL / OL	6" IL / OL
⅛"	.84	1.00	2.88	1.36	4.00	2.06	5.00	2.89	6.66	3.39	7.66								
¼"	1.05	.90	2.88	1.48	4.00	1.96	5.00	2.79	6.66	3.29	7.66								
⅜"	1.32	1.08	3.50	1.58	4.50	2.11	5.56	2.66	6.66	3.16	7.66								
½"	1.66	.90	3.50	1.86	5.00	1.96	5.56	2.48	6.66	2.98	7.66								
¾"	1.90	1.03	4.00	1.53	5.00	2.36	6.66	2.86	7.66	3.38	8.66								
1"	2.38	1.04	4.50	1.57	5.56	2.12	6.66	2.62	7.66	3.12	8.66								
1¼"	2.88	1.04	5.00	1.87	6.66	2.37	7.66	2.87	8.66	3.37	9.66								
1½"	3.50	1.00	5.56	1.55	6.66	2.05	7.66	2.55	8.66	3.05	9.66								
2"	4.00	1.30	6.66	1.80	7.66	2.30	8.66	2.80	9.66	3.36	10.78								
2½"	4.50	1.05	6.66	1.55	7.66	2.05	8.66	2.55	9.66	3.11	10.78								
3"	5.00	1.30	7.66	1.80	8.66	2.30	9.66	2.86	10.78	3.36	11.78								
3½"	5.56	1.02	7.66	1.52	8.66	2.02	9.66	2.58	10.78	3.08	11.78								
4"	6.63	.95	8.66	1.45	9.66	2.02	10.78	2.52	11.78	3.03	12.81								
5"	7.63			1.52	10.78	2.02	11.78	2.83	12.81	3.16	14.06								
6"	8.63			1.52	11.78	2.03	12.81	2.66	14.06	3.16	15.06								
8"	9.63			1.53	12.81	2.16	14.06	2.86	15.06	3.17	16.09								
10"	10.75			1.59	14.06	2.09	15.06	2.81	16.09	3.06	17.00								
12"	12.75			1.59	16.09	2.09	16.09	2.55	17.00	3.05	18.00								
14"	14.00			1.42	17.00	2.05	17.00	2.55	18.00	3.05	19.00								
15"	15.00			1.42	18.00	1.92	18.00	2.42	19.00	2.92	20.00								
16"	16.00			1.42	19.00	1.92	19.00	2.41	20.00	2.92	21.00								
17"	17.00			1.41	20.00	1.91	20.00	2.41	21.00	2.91	22.00								
18"	18.00			1.41	21.00	1.91	21.00	2.41	22.00	2.91	23.00								
19"	19.00			1.41	22.00	1.91	22.00	2.41	23.00	2.91	24.00								
20"	20.00			1.41	23.00	1.91	23.00	2.41	24.00	2.91	25.00								
21"	21.00			1.41	24.00	1.91	24.00	2.41	25.00	2.91	26.00								
22"	22.00			1.41	25.00	1.91	25.00	2.41	26.00	2.91	27.00								
23"	23.00			1.41	25.00	1.91	26.00	2.41	27.00	2.91	28.00								
24"	24.00			1.41	27.00	1.91	27.00	2.41	28.00	2.91	29.00								
25"	25.00			1.46	28.00	1.98	28.00	2.50	29.00	3.02	30.00								
26"	26.00			1.46	29.00	1.98	29.00	2.50	30.00	3.02	31.00								
27"	27.00			1.46	30.00	1.98	30.00	2.50	31.00	3.02	32.00								
28"	28.00			1.46	31.00	1.98	31.00	2.50	32.00	3.02	33.00								
29"	29.00			1.46	32.00	1.98	32.00	2.50	33.00	3.02	34.00								
30"	30.00			1.46	33.00	1.98	33.00	2.50	34.00	3.02	35.00								
31"	31.00			1.46	34.00	1.98	34.00	2.50	35.00	3.02	36.00								
32"	32.00			1.46	35.00	1.98	35.00	2.50	36.00	3.02	37.00								
33"	33.00			1.46	36.00	1.98	36.00	2.50	37.00	3.02	38.00								
34"	34.00			1.46	37.00	1.98	37.00	2.50	38.00	3.02	39.00								
35"	35.00			1.46	38.00	1.98	38.00	2.50	39.00	3.02	40.00								
36"	36.00			1.46	39.00	1.98	39.00	2.50	40.00	3.02	41.00								
37"	37.00			1.46	40.00	1.98	40.00	2.50	41.00	3.02	42.00								
38"	38.00			1.46	41.00	1.98	41.00	2.50	42.00	3.02	43.00								
39"	39.00			1.46	42.00	1.98	42.00	2.50	43.00	3.02	44.00								

Sectional

Tri-Segmental

Quad. Seg.

K-Segmental

Insulation for the nominal pipe size range of 25 39" is furnished in three K Segmental configurations. Adjacent sizes in each segmental grouping are to provide a wide size range. The last segment size of each is to fit circularly. Letter designates molded K Segmental size for proper nesting.

K-Segmental Dimensions:

Letter	In. Dia.	O. Dia.	Approx. Outer Arc
A			
B			

Blank Page

Where to buy

Available from authorized distributors located in principal cities. Consult the yellow pages of your classified directory for their location or call your nearest Fiberglas Branch Office listed below.

Albany, New York	438-6021
Albuquerque, New Mexico	243-4583
Anchorage, Alaska	275-8344
Atlanta, Georgia	355-6821
Baltimore, Md. (Washington)	587-0930
Billings, Montana	252-8496
Birmingham, Alabama	252-4184
Boise, Idaho	342-9311
Boston, Massachusetts	235-7540
Buffalo, New York	853-4123
Charleston, West Virginia	343-7094
Charlotte, North Carolina	334-6864
Chicago, Illinois	583-0100
Cincinnati, Ohio	281-1173
Cleveland, Ohio	621-6451
Columbia, South Carolina	252-1348
Columbus, Ohio	486-9418
Dallas, Texas	741-3982
Dayton, Ohio	293-3155
Denver, Colorado	244-2991
Des Moines, Iowa	288-4273
Detroit, Michigan	547-8000
Evansville, Indiana	425-5124
Flint, Michigan	787-2595
Fort Wayne, Indiana	743-4635
Fresno, California	233-7227
Grand Rapids, Michigan	243-3697
Greensboro, North Carolina	299-3911
Greenville, South Carolina	239-4279
Harrisburg, Pennsylvania	761-0430
Hartford, Connecticut	247-1301
Honolulu, Hawaii	58-7586
Houston, Texas	686-8426
Indianapolis, Indiana	255-4147
Jacksonville, Florida	387-2543
Kansas City, Missouri	753-7725
Los Angeles, California	723-9781
Louisville, Kentucky	634-8384
Lubbock, Texas	744-0269
Memphis, Tennessee	327-6116
Miami, Florida	696-3451
Milwaukee, Wisconsin	344-3811
Minneapolis, Minnesota	377-1730
Mobile, Alabama	471-5963
Nashville, Tennessee	254-9210
Newark, New Jersey	484-2800
New Orleans, Louisiana	486-5468
New York, New York	759-3810
Norfolk, Virginia	853-9162
Oakland, California	836-0262
Oklahoma City, Oklahoma	528-4468
Omaha, Nebraska	346-2989
Peoria, Illinois	674-3232
Philadelphia, Pennsylvania	688-8650
Phoenix, Arizona	258-4541
Pittsburgh, Pennsylvania	563-7766
Portland, Oregon	226-3505
Providence, Rhode Island	725-0100
Reno, Nevada	322-6941
Richmond, Virginia	355-5703
Rochester, New York	271-1888
Rock Island, Illinois	788-1190
Sacramento, California	927-1341
St. Louis, Missouri	725-1061
Salt Lake City, Utah	359-5247
San Antonio, Texas	824-6171
San Bernardino, California	885-3496
San Diego, California	297-3751
San Francisco, California	861-4721
San Jose, California	297-9520
Santa Ana, California	547-7781
Seattle, Washington	622-4335
Spokane, Washington	535-3575
Syracuse, New York	476-7456
Tampa, Florida	253-0183
Toledo, Ohio	248-6741
Tucson, Arizona	623-5429
Van Nuys, California	781-3145
Washington, D. C.	296-3296
Wichita, Kansas	265-2522

O-C FIBERGLAS INTERNATIONAL DIV.

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OWENS-CORNING FIBERGLAS CORPORATION

Industrial and Commercial Construction Materials Division, 717 Fifth Avenue, New York 22, N. Y.

General Offices, Toledo 1, Ohio. Pacific Coast Division, Santa Clara, Calif.

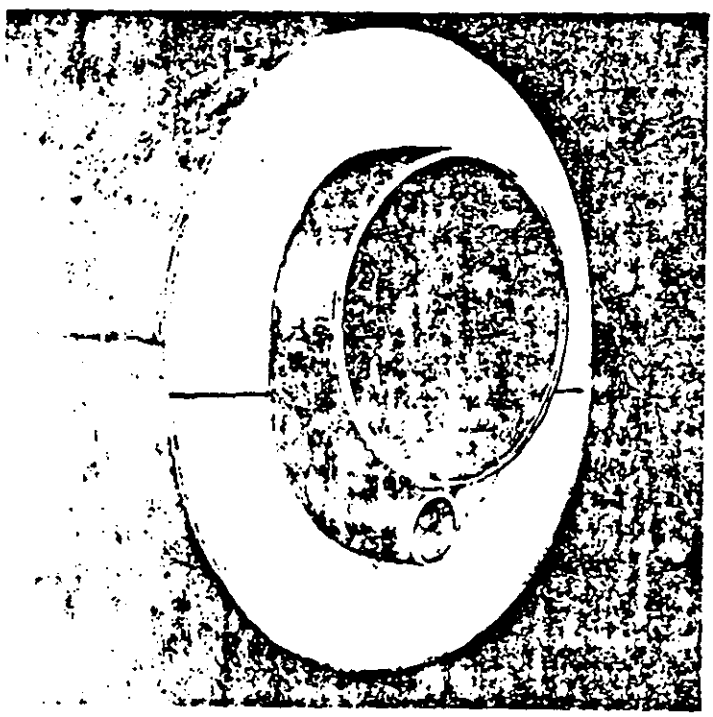
Kaylo and Kaylo-20 Trace Pipe Insulation

You can now reduce your labor and material costs in insulating trace lines, operating at temperatures up to 1800 F and at the same time assure a neater finished appearance by specifying Kaylo® Trace Insulation.

Kaylo Trace Pipe Insulation is available with a plain canvas, embossed aluminum or stainless steel jacket.

The embossed aluminum and stainless steel jackets offer a tough, smooth protective finish for exterior applications. The weather-resistant jacketing material, factory adhered, holds the sectional pieces together and speeds application. The metal jacketing also allows the "one step" method of application, since weatherproofing and insulation are applied together. The longitudinal seam on both metal jackets is designed to "lock out" the weather while the butt strip, with integral mastic, provides positive weather protection at each end joint.

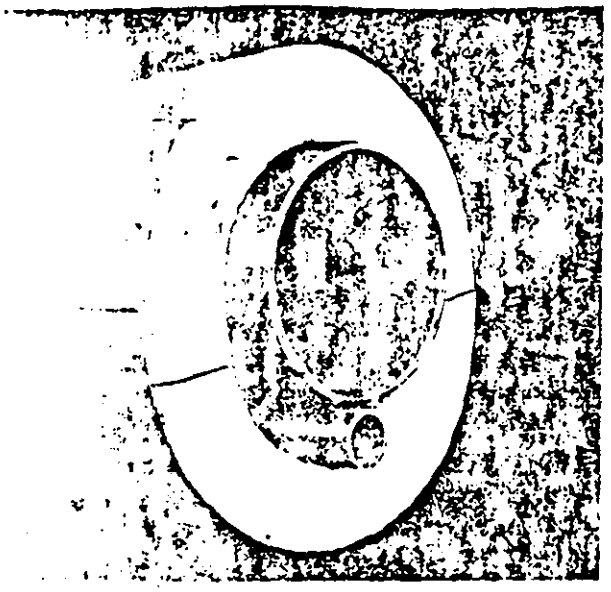
The canvas jacketing will accept any type of finishing paint or for outdoor use may be separately covered with roofing felt or metal jacket according to standard Kaylo specification.



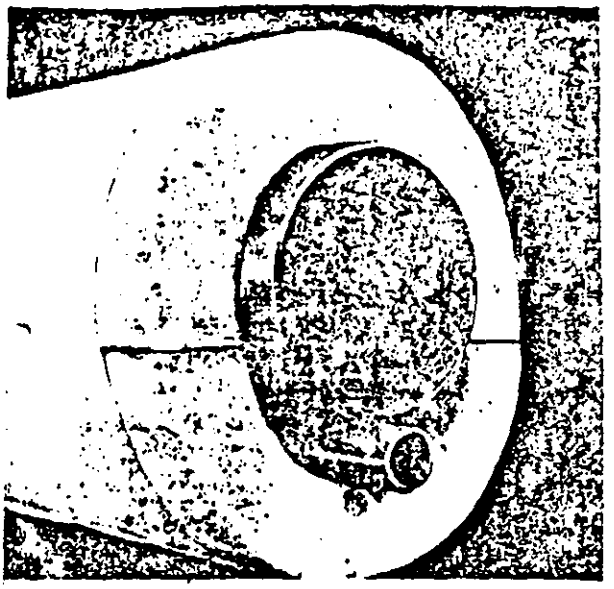
Embossed Aluminum Kaylo Klad Trace Pipe Insulation is available with a softly rippled embossed aluminum jacket 0.016" thick. This jacket provides greater resistance to mechanical damage and is recommended for use in atmospheres having an acid content.

The Fiberglas product described herein is offered for sale under our standard warranty but is subject to modification without notice. Properties and uses other than those given have not been established by tests or experience.

® Trademark of Owens-Corning Fiberglas Corporation



Kaylo Klad Trace Pipe Insulation (Type 302, Stainless Steel) is available with a smooth stainless steel jacket .010" thick. This jacket presents a neat finished appearance to pipe lines and is recommended for use in atmospheres having a high alkaline content. Consult OCF for specialized applications.



Kaylo Trace Pipe Insulation includes standard canvas jackets, at no additional charge on all thicknesses. 6-oz. and 8-oz. canvas jackets are available for all types, sizes and thicknesses of Kaylo Trace Pipe Insulation at an additional charge. Bands are supplied at cost.

SIZES

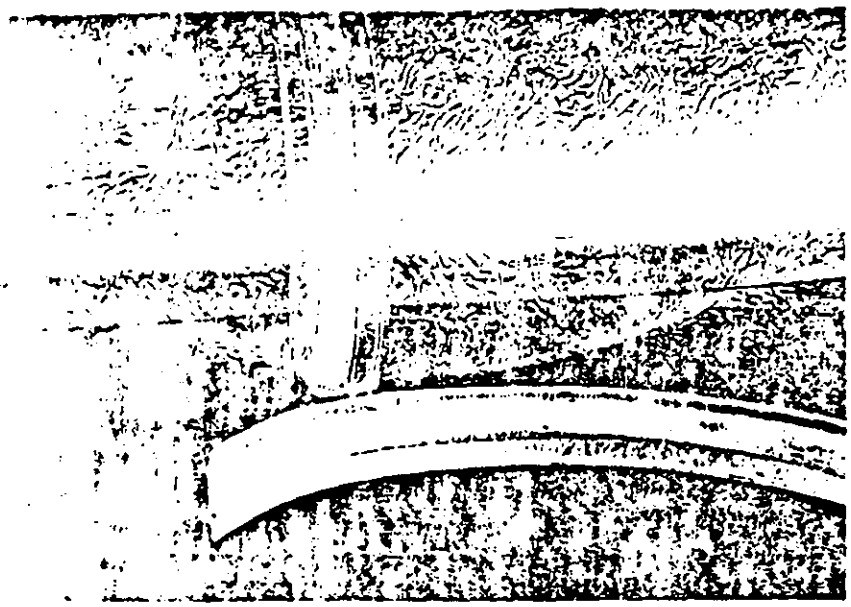
Thicknesses: - Kaylo Trace and Kaylo Klad Trace Pipe Insulation is available in thicknesses 1", 1-1/2" and 2".

Pipe Sizes: - Kaylo Trace and Kaylo Klad Trace Pipe Insulation is available to fit pipe sizes from 2" to 8" I.P.S.

Trace Line Sizes: - Kaylo Trace and Kaylo Klad Trace Pipe Insulation is supplied in standard sizes to accommodate 1" O.D. trace line piping or 5/8" trace line piping supported by "W" clips. Through fabricating methods, Kaylo Trace and Kaylo Klad Trace Pipe Insulation can be supplied to insulate piping having trace lines from 1/2" to 1" O.D. in any increments. Sizes above 1" O.D. can be accommodated by special fabricating methods.

LIMITATIONS

Kaylo Trace and Kaylo Klad Trace Pipe Insulation is designed for temperatures up to and not exceeding 1200 F. For the higher temperature ranges (1200 F - 1800 F) specify Kaylo-20 Trace and Kaylo-20 Klad Trace Pipe Insulation

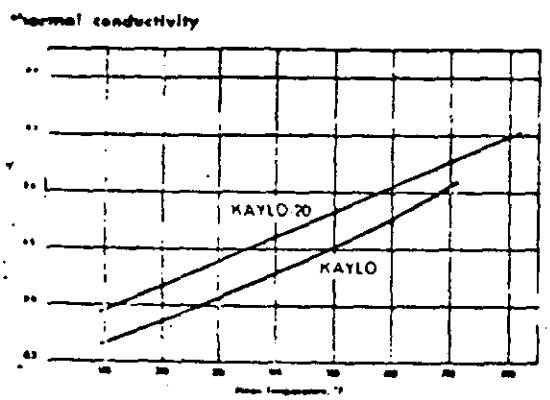


Both the aluminum and stainless steel jackets are constructed with a longitudinal seam which has a self-locking joint that "LOCKS OUT THE WEATHER".
Butt strips are furnished with integral mastic for sealing circumferential joints.

PHYSICAL PROPERTIES

	Kaylo (1200 F)	Kaylo-20 (1800 F)
Density	11 pcf	12 pcf
Flexural Strength (ASTM C-203)	over 50 psi	90 psi
Compressive Strength (at 5% deformation) Before Heating	150 psi	130 psi
Dimensional Stability (linear shrinkage after heating for 24 hrs. in muffle)	at 750 F 0.8% at 1000 F 0.9% at 1200 F 1.4%	at 1200 F 5% at 1800 F 20%

THERMAL CONDUCTIVITY



SURFACE TEMPERATURES

Surface temperatures are increased with the use of metal jacketing. For example, when embossed aluminum is used as a jacketing, the surface temperature will increase approximately 18 degrees at a mean temperature of 200 F. When stainless steel jacketing is used, the surface temperature will increase approximately 4 degrees at a mean temperature of 200 F.

APPLICATION SPECIFICATION

For insulation of piping with Kaylo Trace.

Applicable Specifications

HH-I-523a Insulation Bock, Pipe Covering and cement, thermal calcium silicate (for temperatures up to 1200 F) Class II (pipe covering).

MIL-I-2781C insulation pipe covering, thermal, Grade I, Class B, Grade II, Class D, Grade III, Class E.

1. Insulating Materials

All heated pipes up to 1200 F with trace lines shall be insulated with standard Kaylo Trace Pipe Insulation. All heated pipes up to 1800 F with trace lines shall be insulated with Kaylo-20 Trace Pipe Insulation as manufactured by O-CF. The insulation thickness for 1200 F and 1800 F Trace Pipe Insulation shall be as specified on drawings or as shown in recommended thickness tables originated by O-CF.

2. Application

All Kaylo Trace Pipe Insulation shall be applied over clean, dry surfaces, butting adjoining sections firmly together. Where double layer insulation is applied, the first layer shall bewired in place without a jacket while the second layer shall be applied with all joints staggered. All flanges, valves and fittings shall be insulated with fabricated mitered segments of pipe insulation equal in thickness to the insulation on the adjoining pipe. Fittings on pipe sizes of 3" and smaller may be insulated with O-CF 110 Insulating Cement of equal thickness.

When Kaylo Klad (aluminum or stainless steel) Trace Pipe Insulation is used, the insulation shall be applied in such a way as to prevent overhead (rain, etc.) from reaching the insulation through the longitudinal self locking seam.

3. Surface Finish

Indoor pipe not subject to abrasion or mechanical abuse requires no finish in addition to the factory furnished canvas.

Piping located outdoors shall be insulated with Kaylo Klad Trace Pipe Insulation with either an embossed aluminum or stainless steel jacket factory applied.

All circumferential end joints shall be sealed with "butt strips" that are factory supplied. The butt strip shall be positioned so that the weatherproof sealing mastic is centrally located across the joints.

The aluminum butt strip shall be secured to the embossed aluminum insulation with 1/2" wide .020 aluminum bands, hand tightened. The stainless steel butt strip shall be secured to the stainless steel jacketing with 1/2" wide .015 stainless steel bands, machine tightened. (NOTE: Care shall be taken when tightening either type of band to prevent excessive compression of the jacket.)

Insulation on flanges, valves and fittings, located indoors where canvas covered Kaylo Trace Pipe Insulation has been used, shall be covered with a 1/2" coat of O-C 110 Insulating Cement.

Insulation on flanges, valves and fittings, located outdoors where Kaylo Klad Trace Pipe Insulation has been used, shall be covered with fabricated segmented flat sheets of either aluminum or stainless steel overlapped, caulked with a weatherproof mastic and secured with stainless steel sheet metal screws.

The foregoing is necessarily general in nature. Application procedure and material approval is at the discretion and responsibility of the design engineer to meet specific job requirements.



Kaylo Klad Trace Pipe Insulation is equipped with a self-locking longitudinal seam. The flat edge is inserted up into the seam joint so that the finished joint will shed water. The butt joint strips containing an integral mastic are then applied at the butt joints and are banded in position assuring a weather-resistant jacket the length of the line.

TRACE PIPE REFERENCE TABLE

The following tables may be used as a guide to determine trace pipe size, trace pipe steam pressure, and insulation thickness required to maintain an approximate process line temperature.

EXAMPLE:

Assumed Conditions

2" IPS water or process line
Temperature minimum - 100 F
Ambient temperature - 0 F
Wind velocity - 0 ft./sec.
15 psi steam pressure

The 15 PSI Table below shows you can use either a 5/8" O.D. tracer at 15 psi steam pressure and 1" thick insulation or 3/8" O.D. tracer at 15 psi steam pressure with 2" thick insulation. Steam traps should be installed at the lengths indicated beneath the given temperature.

Tables should be used only as a guide.

STEAM TRACING DATA IPS SIZES

STEAM PRESSURE 15 PSIG AMBIENT TEMP. 0 °F

Tube OD	Process Line Size, IPS	3/8	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	6	8
	Actual OD	0.675	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	8.625
3/8	Temp. °F	112	103	112	110	103	93	84	85	76	65	--	--
	Length Ft.	72	70	19	74	70	65	64	64	63	61	--	--
	Temp. °F	133	133	142	133	127	123	117	118	104	92	--	--
	Length Ft.	207	207	222	207	198	196	186	192	180	171	--	--
3/8	Temp. °F	123	115	125	123	114	112	98	96	86	76	66	57
	Length Ft.	76	75	81	17	74	74	67	67	66	64	61	59
5/8	Temp. °F	147	147	154	145	144	141	128	127	119	108	94	83
	Length Ft.	224	224	236	224	221	217	203	202	192	182	169	163
3/8	Temp. °F	131	123	132	132	123	118	107	106	97	86	73	67
	Length Ft.	83	78	83	82	78	77	72	72	69	64	63	61
5/8	Temp. °F	155	155	163	155	151	149	137	137	128	118	104	95
	Length Ft.	235	235	253	237	232	228	214	212	202	191	179	172

NOTE: Max. length between steam traps based on 10% pressure drop.

Key'e Klad Trace Pipe Insulation accommodates a 1" O.D. trace line or 5/8" trace line supported by "W" clips.

STEAM TRACING DATA IPS SIZES

STEAM PRESSURE 50 PSIG AMBIENT TEMP. 0 °F

Insulation Thickness	Tracer Size OD	Process Line Size, IPS	3/8	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	6	8
		Actual OD	0.675	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	8.625
1	3/8	Temp. °F	133	121	136	133	121	113	102	104	91	77	--	--
		Length Ft.	125	120	125	125	120	115	110	110	105	105	--	--
	5/8	Temp. °F	160	160	170	160	150	145	138	140	125	112	--	--
		Length Ft.	355	355	375	355	335	330	320	325	305	290	--	--
1-1/2	3/8	Temp. °F	146	136	152	145	136	133	117	116	102	90	75	68
		Length Ft.	130	125	135	130	125	125	115	115	110	105	100	100
		Temp. °F	174	174	183	172	171	168	152	153	140	126	111	98
		Length Ft.	380	380	398	380	375	368	345	340	325	305	290	275
2	3/8	Temp. °F	158	145	159	159	147	142	125	125	113	102	89	80
		Length Ft.	140	130	140	140	130	130	120	120	115	110	105	105
	5/8	Temp. °F	192	182	196	182	180	175	164	163	152	138	123	113
		Length Ft.	400	400	430	400	390	385	360	360	340	325	300	290

NOTE: Max. length between steam traps based on 10% pressure drop.

Where to buy

Available from authorized distributors located in principal cities. Consult the yellow pages of your classified directory for their location or call your nearest Fiberglas Branch Office listed below.

Albuquerque, New Mexico		243-4583
Anchorage, Alaska	BR	5-8344
Atlanta, Georgia		799-6821
Baltimore, Maryland	SA	7-0234
Birmingham, Alabama	TR	1-2723
Boise, Idaho		2-3102
Boston, Massachusetts	CE	5-7540
Buffalo, New York	TL	3-4123
Charleston, West Virginia	DI	3-7094
Charlotte, North Carolina	ED	4-6864
Chicago, Illinois	RA	6-0102
Cincinnati, Ohio	AV	1-1173
Cleveland, Ohio	MA	1-6451
Columbus, Ohio	HU	6-9418
Dallas, Texas	RI	1-3982
Dayton, Ohio	AX	3-3155
Denver, Colorado	AC	2-3126
Des Moines, Iowa	AT	8-4273
Detroit, Michigan	LI	7-8000
Evansville, Indiana	HA	5-5124
Fort Wayne, Indiana	EA	4635
Fresno, California	AD	3-7227
Grand Rapids, Michigan	CH	3-3697
Greenville, South Carolina	CE	9-4279
Hartford, Connecticut	CH	7-1301
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Houston, Texas	JA	6-1851
Indianapolis, Indiana	CL	5-4147
Jacksonville, Florida	EL	5-4188
Kansas City, Missouri	PL	3-7725
Los Angeles, California	RA	3-9781
Louisville, Kentucky	ME	7-2588
Memphis, Tennessee	FA	7-6116
Miami, Florida	OX	6-3431
Milwaukee, Wisconsin	DI	4-3811
Minneapolis, Minnesota	FR	7-1730
Mobile, Alabama	HE	2-4411
Nashville, Tennessee	AL	4-9210
New Orleans, Louisiana		523-2821
New York, New York	PL	9-3810
Oklahoma City, Oklahoma	JA	8-4468
Omaha, Nebraska		553-3291
Peoria, Illinois	PE	4-3232
Philadelphia, Pennsylvania	LO	4-3133
Phoenix, Arizona	AL	8-4541
Pittsburgh, Pennsylvania	AT	1-7191
Portland, Oregon	CA	6-3505
Richmond, Virginia	EL	5-5703
Rochester, New York	BR	1-1888
Rock Island, Illinois		788-1190
North Sacramento, California	WA	2-5467
St. Louis, Missouri	MA	1-6822
Salt Lake City, Utah	EL	9-5247
San Antonio, Texas	CA	4-7673
San Bernardino, California	TU	8-3496
San Diego, California	CY	7-3751
San Francisco, California	UN	1-4721
San Jose, California	CY	7-9520
Seattle, Washington	MA	2-4335
Spokane, Washington	KE	5-3575
Syracuse, New York	GR	4-4646
Tampa, Florida		253-0183
Toledo, Ohio		248-6741
Washington, D. C.	NA	8-0724

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Apartado 6718, Phone: 5-1650

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Santurce, Puerto Rico, 723-8444

OWENS-CORNING FIBERGLAS CORPORATION

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PUB. NO. 1-14-2025

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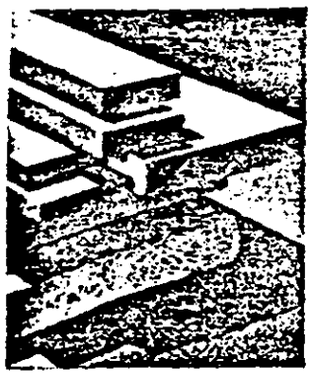
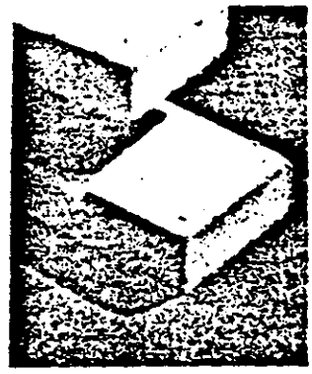
FIBERGLAS

Kaylo & Kaylo 20 Block Insulation





for high temperature insulation of heated equipment up to 1800° F

Kaylo* and Kaylo 20 Block Insulations are rigid hydrous calcium silicate heat insulations reinforced with asbestos fibers. They are manufactured by Owens-Corning Fiberglas Corporation. Kaylo is used to insulate indoor and outdoor heated equipment up to 1200°F, Kaylo 20 up to 1800°F. Kaylo 20 has a slightly pink color to distinguish it from regular Kaylo.

Both of these widely used heat insulations offer excellent thermal efficiency, high strength, and unusual resistance to moisture damage. They combine the most desirable physical characteristics of heat insulations. This is why they are selected over most other materials on the market.

Low K factors place Kaylo Block Insulations among the most efficient insulations in their temperature ranges. Standard Kaylo covers a broad temperature range to 1200°F. This eliminates the need for using two dissimilar insulations for temperatures from 600 to 1200°F. Kaylo 20 may be used as a single layer insulation for flat surfaces up to 700°F. and in double layers from this temperature to 1800°F, or, may be used as a first layer with standard Kaylo or Fiberglas Block.

Kaylo Insulations exhibit lightweight, superior flexural strength and resistance to abrasion to a degree far above normal requirements for heat insulation. High strength minimizes breakage in shipping and installation, and high temperatures have no effect on strength characteristics. Kaylo 20 high temperature limit extends its use to include refractory wall backing for furnaces and boilers and fireproofing of equipment and vessel skirts.

sizes

thickness—1", 1½", 2", 2½", 3", 3½" and 4"

width—3", 6", 12" and 18"

length—18" to 36"

form—Block (curved block available on special order)

limitations

Kaylo block insulations should not be used above their maximum temperature range—Kaylo up to 1200°F—Kaylo 20 to 1800°F. Outdoor installations require a weatherproof finish. If used underground, special moisture and vapor barriers are required.

*T. M. Owens-Corning Fiberglas Corp.

physical properties

	Standard Kaylo	Kaylo 20
density:	11 pcf approx.	12 pcf approx.
flexural strength:	over 50 lb/sq. in. (ASTM C-203)	90 lb/sq. in.

compressive strength: (at 5% deformation) (ASTM C-165)
Kaylo 20: before heating, 130 lbs. per square inch.
Standard Kaylo: before heating, 150 lb./sq. in.; 144 lb./sq. in. at 759°F. 123 lb./sq. in. at 1000°F; 117 lb./sq. in. at 1200°F; after boiling for 24 hr., 74 lb./sq. in. (while wet).

resistance to abrasion: (conventional tumbling test—loss in weight after 10 min.)

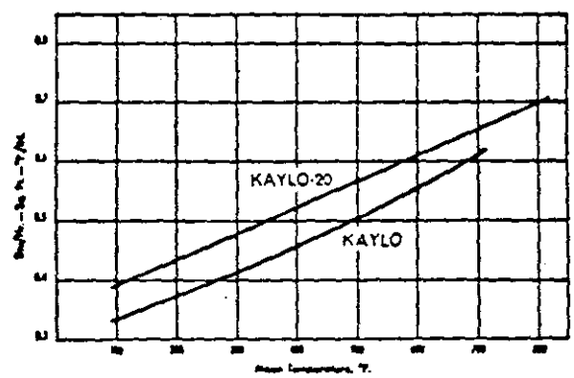
	Standard Kaylo	Kaylo 20
before heating	9%	3%
after heating for 24 hr.		
750°F	5%	
1000°F	4%	
1200°F	3%	5%
1800°F		20%

alkalinity: ph 10

dimensional stability: linear shrinkage after heating for 24 hours in muffle

	Standard Kaylo	Kaylo 20
750°F	0.8%	
1000°F	0.9%	
1200°F	1.4%	0.7%
1800°		1.6%

thermal conductivity



beveled lags

For pipe sizes greater than those for which Kaylo and Kaylo 20 Insulation sizes are available, Kaylo and Kaylo 20 beveled lags may be used to insulate piping. Lags beveled to fit pipes from 18" to 36" in diameter are available in thicknesses of 1½", 2", 2½", 3". Lags are 36" long.

KEY

RT—recommended thickness
E—efficiency
HL—heat loss
ST—surface temperature

KAYLO

ambient temperature 80 F

Equip. Temp. F	(110 F max St.) COMMERCIAL				— 80 F (130 F max St.) POWER				(150 F max St.) PROCESS			
	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST
200	1	36	86.8	103	1	36	86.8	103	1	36	86.8	103
300	1½	50	92.0	110	1	69	88.9	119	1	69	88.9	119
400	2½	48	95.7	108	1½	74	93.3	122	1	106	90.4	138
500	2½	47	97.3	108	2	82	95.3	126	1½	104	94.1	136
600	4½	48	98.2	108	2½	85	96.7	128	1½	133	94.9	148
700					3	89	97.6	129	2	127	96.5	145
800					4	80	98.4	124	2½	125	97.5	144
900	not applicable				4½	86	98.7	127	3	124	98.1	144
1000					5½	80	99.1	125	3½	125	98.6	144
1100					6	84	99.2	126	4	125	98.9	143
1200					6½	90	99.4	127	4½	127	99.1	143

KAYLO 20

temp. diff.: hot surface to air deg. F.

temp. diff.	1100	1200	1300	1400	1500	1600	1700	1800
thickness	5=	5½	6	6½	7	7½	8	8½

For temperatures to 1200 F, use standard Kaylo block at recommended thickness. Design surface temperatures are approximately 150 F.

or true economic thickness, request a DIVIDEND ENGINEERING Evaluation Manual om your local Fiberglas branch office

applicable specifications

HH-I-523a Insulation Block, Pipe Covering, and Cement, Thermal, Calcium Silicate, Class 1.

MIL-I-2819 Insulation, Thermal Block, Class A and B.

1: Insulating material

All high temperature equipment shall be insulated with ..... thick Kaylo Block (or Kaylo 20) Insulation as manufactured by Owens-Corning Fiberglas Corporation.

2: Application methods

FOR CURVED SURFACES OVER 39" O.D.—Hold in place with ½" galvanized steel bands on work up to 48" diameter and ¾" bands on work over 48" diameter. Bands to be spaced on 12-18 inch centers. Point-up with O-C 660 Insulating Cement and then apply hexagonal wire mesh or metal lath, wiring to bands and laced edges. Note: The maximum temperature for the bands should be established by the metal band manufacturer due to the expansion of the equipment when heated.

FOR FLAT SURFACES—Hold in place with 16 gauge annealed wire attached to welded rods or studs. Point up with O-C 660 Insulating Cement and then apply hexagonal wire mesh or metal lath over entire surface. Securely fasten down and lace the edges.

FOR IRREGULAR SURFACES—Apply a filler coat of O-C 660 cement to cover the high points of all irregularities. Trowel to a level surface before applying blocks. Then follow recommended specifications, above, for flat surfaces.

FOR DOUBLE LAYERS—Apply the outer layer so that joints are staggered from inner layer.

3: Finishing methods

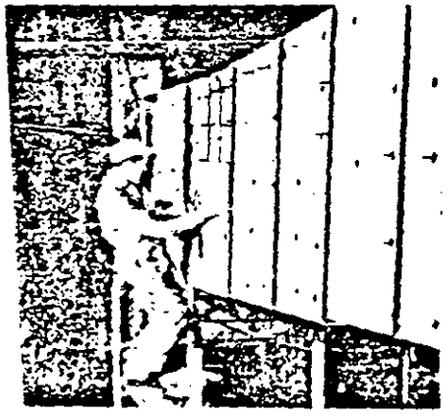
MINIMUM INDOOR FINISH—(base for further finishes.) Apply ½" coat of O-C 110 Insulating Cement.

GOOD INDOOR FINISH—To minimum finish, adhere and size 6 or 8 oz. canvas to cement surface with Foster Lagfas or equal.

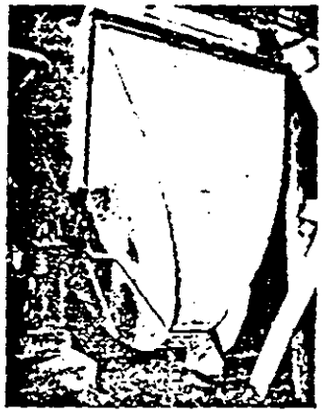
WEATHER-RESISTANT FINISH FOR OUTDOOR WORK—Over minimum finish trowel two coats ⅛" thick of a suitable asphalt emulsion or vinyl base weather-resistant mastic reinforced with Fiberglas fabric between coats.

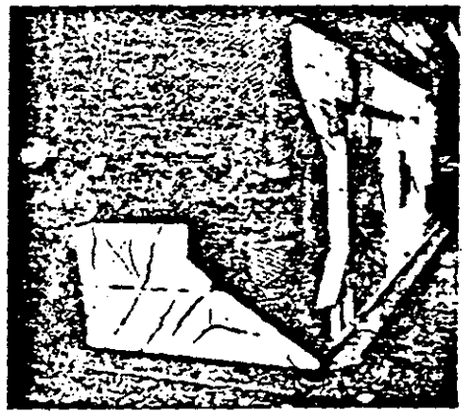
The foregoing is necessarily general in nature. Application procedure and material approval is at the discretion and responsibility of the design engineer to meet specific job requirements.

application details



Kaylo insulation installed on a recirculating gas duct and fan. Application of 2 layers were made, impaled over No. 9 gauge pins and secured with metal washers.





Boiler side wall showing 2 layers of Kaylo block wired in place over diamond mesh.

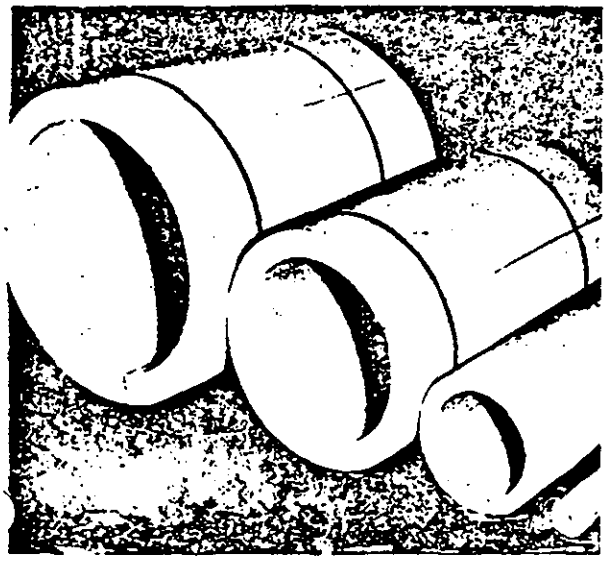
OWENS-CORNING FIBERGLAS CORPORATION
Industrial Construction Material Division, 717 Fifth Avenue, New York 22, N. Y.
General Offices, Toledo 1, Ohio. Pacific Coast Division, Santa Clara, Calif.

O. 1-IN-2264

LITHO IN U.S.A., JULY 1962

Kaylo and Kaylo-20 Pipe Insulation

KAYLO pipe insulation *for indoor or outdoor piping up to 1200 F operating temperature*



Kaylo pipe insulation applies easily and quickly with standard application methods. Ordinary tools of the trade are sufficient for all cutting, sawing or scoring. It is non-irritating to the skin and non-toxic.



Kaylo Pipe Insulation presents a superior final appearance when applied to a variety of irregularly-shaped high temperature vessels.

Kaylo* pipe insulation, a near white, rigid hydrous calcium silicate heat insulation, manufactured by Owens-Corning Fiberglas Corporation, effectively insulates indoor and outdoor piping to 1200 F. A chemically reacted material, Kaylo pipe insulation contains no added binder. For mechanical effects, a small amount of asbestos fiber is included at the time of manufacture.

This thoroughly tested and field-proven material contains the physical properties most desired for efficient, durable insulation work. It retains an appreciable percentage of its strength even after complete saturation in water, original efficiency returning after drying. The effectiveness, high strength and moisture resistance are unattained by most other insulating materials.

sizes

thickness—Kaylo Pipe Insulation is available in thicknesses from 1" to 3" depending upon pipe size. Kaylo Tube Insulation is available in thicknesses of 1" and 1½".

pipe sizes—Kaylo Pipe Insulation is available to fit pipe from ½" to 39" in diameter. Kaylo Tube Insulation will fit copper tubing from ½" to 3⅛" in diameter.

forms—Kaylo Pipe Insulation is available in sectional or multisegmental form depending upon pipe size. All insulation is furnished in 3 ft. sections.

jackets

canvas—Kaylo Sectional Pipe Insulation includes standard canvas jackets, at no additional charge, on thicknesses up to and including 2½". Standard canvas is available for segmental forms at a slight additional cost. Bands are available for use with this product at slight additional charge and will be furnished on request.

6 oz. and 8 oz. canvas jackets are available for all types, sizes and thicknesses of Kaylo Pipe and Tube Insulation at an additional charge. These jackets are factory applied on Sectional Pipe and Tube Insulation. On Multisegmental forms, they are furnished but not adhered.

Kaylo Klad—Kaylo is also available with a soft rippled embossed aluminum jacket .016" thick or .010 stainless steel jacket. These jackets provide greater resistance to mechanical damage and present a neat finished appearance to pipe lines. The longitudinal seam has a self-locking joint. Joint bands with integral mastic are furnished for sealing end joints.

limitations

Kaylo Pipe Insulation is designed for temperatures up to 1200 F and is not recommended when operating temperatures of piping exceed this limit.

*T. M. Owens-Corning Fiberglas Corp.

KAYLO AND KAYLO-20 PIPE INSULATION FIBERGLAS

physical properties

density ..... approximately 11 lb. per cu. ft.

flexural strength ..... (ASTM C-203) over 50 lb. per sq. in.

compressive strength (at 5% deformation)

before heating ..... (ASTM C-165) 150 lb. per sq. in.

after heating for 24 hours

at 750 F ..... 144 lb. per sq. in.
at 1000 F ..... 123 lb. per sq. in.
at 1200 F ..... 117 lb. per sq. in.

after boiling for 24 hours
(while wet) ..... 74 lb. per sq. in.

resistance to abrasion

(conventional tumbling test-loss in weight after 10 min.)
before heating 9%

after heating for 24 hours

at 750 F 5%
at 1000 F 4%
at 1200 F 3%

alkalinity: ph 10

dimensional stability

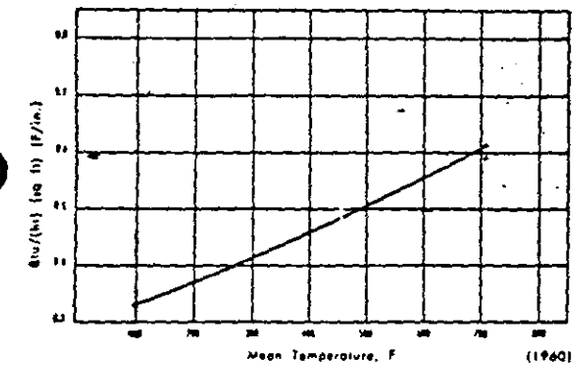
linear shrinkage after heating for 24 hours in muffle

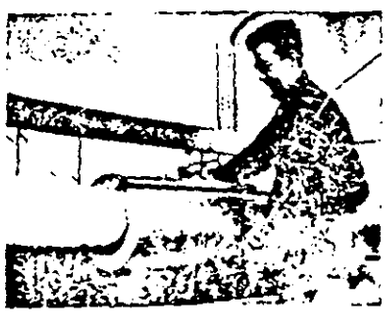
at 750 F 0.8%
at 1000 F 0.9%
at 1200 F 1.4%

specific heat: 0.22 Btu/lb.F.

thermal diffusivity 0.012 sq. ft. per hr. at 200 F. mean temperature.

thermal conductivity





Kaylo Klad. Stainless steel and aluminum clad Kaylo Pipe Insulations apply quickly to piping. A self locking longitudinal seam and end joint strips make application of insulation and weather protection a "one-step" operation. The neat finished appearance "dresses up" the line and provides a virtually maintenance-free weather protection.

specifications

for insulation of piping with Kaylo

applicable specifications

HH-I-523a Insulation Block, Pipe Covering and Cement, Thermal, Calcium Silicate (For Temperatures up to 1200 F) class II (pipe covering).

MIL-I-2781C Insulation Pipe Covering, Thermal, Grade I Class B, Grade II Class D, Grade III Class E.

1. Insulating materials

All heated pipes shall be insulated with Kaylo Pipe Insulation as manufactured by Owens-Corning Fiberglas Corporation, to the thickness noted on drawings or as shown in the table.

2. Application

All Pipe Insulation shall be applied over clean, dry surfaces, butting adjoining sections firmly together and adhered canvas, when furnished, smoothly over joints. Longitudinal and circumferential joints need not be pointed with finishing cement to conserve heat.

Insulation on pipes over 12" diameter and all outdoor piping shall be wired in place with 16 gauge soft annealed wire on no greater than 9" centers. Where double layer insulation is applied, the first layer shall be wired in place without jacket; the second layer shall be applied with all joints staggered.

All flanges, valves and fittings shall be insulated with Fiberglas molded fitting insulation or fabricated mitered segments of pipe insulation equal in thickness to the insulation on the adjoining pipe. Fittings on pipe sizes 3" and smaller may be insulated with O-C 110 Insulating Cement of equal thickness.

3. Surface finish

Indoor piping under 12" diameter not subject to abrasion or mechanical abuse requires no finish in addition to the factory-furnished canvas. Piping over 12" diameter shall be finished with 6-ounce canvas pasted in place.

Piping located outdoors shall be finished with 45-lb. roofing felt jacket with all joints lapped not less than 2". Jackets shall be wired with 16 ga. copper wire on not greater than 9" centers or banded on 12" centers with ½" galvanized bands. Other suitable weatherproof jackets such as metal, asphalt or plastic coating may be applied according to the jacket manufacturers' specifications.

Insulation on flanges, valves and fittings shall be covered with a ¼" coat of O-C 110 Insulation Cement. Insulation located indoors shall be further finished with 6 oz. canvas neatly pasted in place.

All insulation on flanges, valves and fittings located outdoors shall be covered with asphalt weatherproof mastic reinforced with an open mesh glass fabric. Mastic shall be applied in sufficient thickness to give a ⅛" dry coat and shall be troweled neatly over the fitting with the jacket on the adjacent pipe insulation lapped at least 2" over the mastic.

The foregoing is necessarily general in nature. Application procedure and material approval is at the discretion and responsibility of the design engineer to meet specific job requirements.

OWENS-CORNING FIBERGLAS

Customer Service Technical Report

KAYLO PIPE INSULATION

Sizes, Forms and Thicknesses
(Supplement to IN1.C5)

No. 2-IN-267
Date Nov 1, 1957
Customer
Reported by Houston Branch
Prepared by Industrial Insulation Division

The table below indicates the range of sizes and forms in which Kaylo Pipe Insulation is available.

nom. pipe size	O.D. of pipe	single layer only: nom. 1" actual	nom. 1" O.D.	nom. 1½" actual	nom. 1½" O.D.	single or double layer: nom. 2" actual	nom. 2" O.D.	nom. 2½" actual	nom. 2½" O.D.	nom. 3" actual	nom. 3" O.D.	nom. 3½" actual	nom. 3½" O.D.	nom. 4" actual	nom. 4" O.D.	nom. 4½" actual	nom. 4½" O.D.	nom. 5" actual	nom. 5" O.D.
⅛"	.84	1.00	2.88	1.56	4.00	2.06	5.00	2.69	6.66	3.39	7.66								
¼"	1.05	.90	2.88	1.46	4.00	1.96	5.00	2.79	6.66	3.29	7.66								
1"	1.32	1.08	3.50	1.38	4.50	2.11	5.56	2.66	6.66	3.16	7.66								
1¼"	1.66	.90	3.50	1.46	5.00	1.94	5.56	2.48	6.66	2.98	7.66								
1½"	1.90	1.03	4.00	1.53	5.00	2.36	6.66	2.86	7.66	3.36	8.86								
2"	2.38	1.04	4.50	1.57	5.56	2.12	6.66	2.62	7.66	3.12	8.66	3.62	9.66	4.18	10.78	4.68	11.78	5.20	12.81
2½"	2.88	1.04	5.00	1.67	6.66	2.37	7.66	2.87	8.66	3.37	9.66	3.93	10.78	4.43	11.78	4.93	12.81	5.57	14.06
3"	3.50	1.00	5.56	1.55	6.66	2.05	7.66	2.55	8.66	3.05	9.66	3.61	10.78	4.11	11.78	4.63	12.81	5.23	14.06
3½"	4.00	1.30	6.66	1.80	7.66	2.30	8.66	2.80	9.66	3.36	10.78	3.86	11.78	4.38	12.81	5.00	14.06	5.60	15.06
4"	4.50	1.05	6.66	1.55	7.66	2.05	8.66	2.55	9.66	3.11	10.78	3.81	11.78	4.13	12.81	4.75	14.06	5.28	15.06
4½"	5.00	1.30	7.66	1.80	8.66	2.30	9.66	2.86	10.78	3.36	11.78	3.88	12.81	4.50	14.06	5.00	15.06	5.51	16.09
5"	5.56	1.02	7.66	1.52	8.66	2.02	9.66	2.58	10.78	3.08	11.78	3.59	12.81	4.22	14.06	4.72	15.06	5.23	16.09
6"	6.63	.95	8.66	1.46	9.66	2.02	10.78	2.52	11.78	3.02	12.81	3.66	14.06	4.16	15.06	4.68	16.09	5.13	17.00
7"	7.63			1.53	10.78	2.02	11.78	2.53	12.81	3.16	14.06	3.66	15.06	4.17	16.09	4.65	17.00	5.13	18.00
8"	8.63			1.32	11.78	2.02	12.81	2.66	14.06	3.16	15.06	3.67	16.09	4.13	17.00	4.63	18.00	5.13	19.00
9"	9.63			1.33	12.81	2.16	14.06	2.66	15.06	3.17	16.09	3.63	17.00	4.13	18.00	4.63	19.00	5.13	20.00
10"	10.73			1.39	14.06	2.09	15.06	2.61	16.09	3.06	17.00	3.56	18.00	4.06	19.00	4.56	20.00	5.06	21.00
11"	11.75			1.38	15.06	2.09	16.09	2.53	17.00	3.03	18.00	3.55	19.00	4.05	20.00	4.54	21.00	4.55	22.00
12"	12.75			1.39	16.09	2.05	17.00	2.53	18.00	3.05	19.00	3.55	20.00	4.05	21.00	4.54	22.00	4.55	23.00
13"	14.00			1.43	17.00	1.92	18.00	2.42	19.00	2.92	20.00	3.42	21.00	3.92	22.00	4.42	23.00	4.92	24.00
14"	15.00			1.42	18.00	1.92	19.00	2.41	20.00	2.92	21.00	3.42	22.00	3.92	23.00	4.41	24.00	4.92	25.00
15"	16.00			1.41	19.00	1.91	20.00	2.41	21.00	2.91	22.00	3.41	23.00	3.91	24.00	4.41	25.00	4.91	26.00
16"	17.00			1.41	20.00	1.91	21.00	2.41	22.00	2.91	23.00	3.41	24.00	3.91	25.00	4.41	26.00	4.91	27.00
17"	18.00			1.41	21.00	1.91	22.00	2.41	23.00	2.91	24.00	3.41	25.00	3.91	26.00	4.41	27.00	4.91	28.00
18"	19.00			1.41	22.00	1.91	23.00	2.41	24.00	2.91	25.00	3.41	26.00	3.91	27.00	4.41	28.00	4.91	29.00
19"	20.00			1.41	23.00	1.91	24.00	2.41	25.00	2.91	26.00	3.41	27.00	3.91	28.00	4.41	29.00	4.91	30.00
20"	21.00			1.41	24.00	1.91	25.00	2.41	.00	2.91	27.00	3.41	28.00	3.89	29.00	4.41	30.00	4.91	31.00
21"	22.00			1.41	25.00	1.91	26.00	2.41	27.00	2.91	28.00	3.39	29.00	3.89	30.00	4.41	31.00	4.91	32.00
22"	23.00			1.41	26.00	1.91	27.00	2.41	28.00	2.91	29.00	3.39	30.00	3.89	31.00	4.41	32.00	4.91	33.00
23"	24.00			1.41	27.00	1.91	28.00	2.41	29.00	2.91	30.00	3.39	31.00	3.89	32.00	4.41	33.00	5.00	34.00
24"	25.00			1.46	28.00	1.96	29.00	2.50	30.00	3.02	31.00	3.44	32.00	3.96	33.00	4.46	34.00	5.00	35.00
25"	26.00			1.46	29.00	1.98	30.00	2.50	31.00	3.02	32.00	3.44	33.00	3.96	34.00	4.48	35.00	5.00	36.00
26"	27.00			1.46	30.00	1.98	31.00	2.50	32.00	3.02	33.00	3.44	34.00	3.96	35.00	4.48	36.00	5.00	37.00
27"	28.00			1.46	31.00	1.98	32.00	2.50	33.00	3.02	34.00	3.44	35.00	3.96	36.00	4.48	37.00	5.00	38.00
28"	29.00			1.46	32.00	1.98	33.00	2.50	34.00	3.02	35.00	3.44	36.00	3.96	37.00	4.48	38.00	5.00	39.00
29"	30.00			1.46	33.00	1.98	34.00	2.50	35.00	3.02	36.00	3.44	37.00	3.96	38.00	4.48	39.00	5.00	40.00
30"	31.00			1.46	34.00	1.98	35.00	2.50	36.00	3.02	37.00	3.44	38.00	3.96	39.00	4.48	40.00	5.00	41.00
31"	32.00			1.46	35.00	1.98	36.00	2.50	37.00	3.02	38.00	3.44	39.00	3.98	40.00	4.48	41.00	5.00	42.00
32"	33.00			1.46	36.00	1.98	37.00	2.50	38.00	3.02	39.00	3.48	40.00	3.98	41.00	4.48	42.00	5.00	43.00
34"	34.00			1.46	37.00	1.98	38.00	2.50	39.00	3.02	40.00	3.48	41.00	3.98	42.00	4.48	43.00	5.00	44.00
35"	35.00			1.46	38.00	1.98	39.00	2.50	40.00	3.02	41.00	3.48	42.00	3.98	43.00	4.48	44.00	5.00	45.00
36"	36.00			1.46	39.00	1.98	40.00	2.50	41.00	3.02	42.00	3.48	43.00	3.98	44.00	4.48	45.00	5.00	46.00
37"	37.00			1.46	40.00	1.98	41.00	2.50	42.00	3.02	43.00	3.48	44.00	3.98	45.00	4.48	46.00	5.00	47.00
38"	38.00			1.46	41.00	1.98	42.00	2.50	43.00	3.02	44.00	3.48	45.00	3.98	46.00	4.48	47.00	5.00	48.00
39"	39.00			1.46	42.00	1.98	43.00	2.50	44.00	3.02	45.00	3.48	46.00	3.98	47.00	4.48	48.00	5.00	49.00

Sectional

Tri-segmental

Quad-segmental

K-segmental

*FIBERGLAS (Reg. U.S. Pat. Off.) _____ and _____ are trademarks of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass.

to 1800° F.



insulation thickness standards—Kaylo and Kaylo-20

IRON PIPE SIZES

	nom. pipe size	O.D. of pipe	single layer only				single or double layer						multiple layer only							
			nom. 1"		nom. 1½"		nom. 2"		nom. 2½"		nom. 3"		nom. 3½"		nom. 4"		nom. 4½"		nom. 5"	
			actual	O.D.	actual	O.D.	actual	O.D.	actual	O.D.	actual	O.D.	actual	O.D.	actual	O.D.	actual	O.D.	actual	O.D.
Segmental	½"	.84	1.00	2.88	1.56	4.00	2.06	5.00	2.89	6.66	3.39	7.66								
	¾"	1.05	.90	2.88	1.46	4.00	1.96	5.00	2.79	6.66	3.29	7.66								
	1"	1.32	1.08	3.50	1.58	4.50	2.11	5.56	2.66	6.66	3.16	7.66								
	1¼"	1.66	.90	3.50	1.66	5.00	1.94	5.56	2.48	6.66	2.98	7.66								
	1½"	1.90	1.03	4.00	1.53	5.00	2.36	6.66	2.86	7.66	3.36	8.86								
	2"	2.38	1.04	4.50	1.57	5.56	2.12	6.66	2.62	7.66	3.12	8.66	3.62	9.66	4.18	10.78	4.68	11.78	5.20	12.81
	2½"	2.88	1.04	5.00	1.87	6.66	2.37	7.66	2.87	8.66	3.37	9.66	3.93	10.78	4.43	11.78	4.95	12.81	5.57	14.06
	3"	3.50	1.00	5.56	1.55	6.66	2.05	7.66	2.55	8.66	3.05	9.66	3.61	10.78	4.11	11.78	4.63	12.81	5.25	14.06
	3½"	4.00	1.30	6.66	1.80	7.66	2.30	8.66	2.80	9.66	3.36	10.78	3.86	11.78	4.38	12.81	5.00	14.06	5.50	15.06
	4"	4.50	1.05	6.66	1.55	7.66	2.05	8.66	2.55	9.66	3.11	10.78	3.61	11.78	4.13	12.81	4.75	14.06	5.25	15.06
	4½"	5.00	1.30	7.66	1.80	8.66	2.30	9.66	2.86	10.78	3.36	11.78	3.88	12.81	4.50	14.06	5.00	15.06	5.51	16.09
	5"	5.56	1.02	7.66	1.52	8.66	2.02	9.66	2.58	10.78	3.08	11.78	3.59	12.81	4.22	14.06	4.72	15.06	5.23	16.09
	6"	6.63	.95	8.66	1.45	9.66	2.02	10.78	2.52	11.78	3.03	12.81	3.66	14.06	4.16	15.06	4.68	16.09	5.13	17.00
	7"	7.63			1.52	10.78	2.02	11.78	2.53	12.81	3.16	14.06	3.66	15.06	4.17	16.09	4.63	17.00	5.13	18.00
	8"	8.63			1.52	11.78	2.03	12.81	2.66	14.06	3.16	15.06	3.67	16.09	4.13	17.00	4.63	18.00	5.13	19.00
Tri-Segmental	9"	9.63			1.53	12.81	2.16	14.06	2.66	15.06	3.17	16.09	3.63	17.00	4.13	18.00	4.63	19.00	5.13	20.00
	10"	10.75			1.59	14.06	2.09	15.06	2.61	16.09	3.06	17.00	3.56	18.00	4.06	19.00	4.56	20.00	5.06	21.00
	11"	11.75			1.58	15.06	2.09	16.09	2.55	17.00	3.05	18.00	3.55	19.00	4.05	20.00	4.56	21.00	4.55	22.00
	12"	12.75			1.59	16.09	2.05	17.00	2.55	18.00	3.05	19.00	3.55	20.00	4.05	21.00	4.56	22.00	4.55	23.00
	14"	14.00			1.42	17.00	1.92	18.00	2.42	19.00	2.92	20.00	3.42	21.00	3.92	22.00	4.42	23.00	4.92	24.00
	15"	15.00			1.42	18.00	1.92	19.00	2.41	20.00	2.92	21.00	3.42	22.00	3.92	23.00	4.41	24.00	4.92	25.00
	16"	16.00			1.41	19.00	1.91	20.00	2.41	21.00	2.91	22.00	3.41	23.00	3.91	24.00	4.41	25.00	4.91	26.00
	17"	17.00			1.41	20.00	1.91	21.00	2.41	22.00	2.91	23.00	3.41	24.00	3.91	25.00	4.41	26.00	4.91	27.00
	18"	18.00			1.41	21.00	1.91	22.00	2.41	23.00	2.91	24.00	3.41	25.00	3.91	26.00	4.41	27.00	4.91	28.00
	19"	19.00			1.41	22.00	1.91	23.00	2.41	24.00	2.91	25.00	3.41	26.00	3.91	27.00	4.41	28.00	4.91	29.00
	20"	20.00			1.41	23.00	1.91	24.00	2.41	25.00	2.91	26.00	3.41	27.00	3.91	28.00	4.41	29.00	4.91	30.00
	21"	21.00			1.41	24.00	1.91	25.00	2.41	26.00	2.91	27.00	3.41	28.00	3.89	29.00	4.41	30.00	4.91	31.00
	22"	22.00			1.41	25.00	1.91	26.00	2.41	27.00	2.91	28.00	3.39	29.00	3.89	30.00	4.41	31.00	4.91	32.00
	23"	23.00			1.41	26.00	1.91	27.00	2.41	28.00	2.91	29.00	3.39	30.00	3.89	31.00	4.41	32.00	4.91	33.00
Segmental	24"	24.00			1.41	27.00	1.91	28.00	2.41	29.00	2.91	30.00	3.39	31.00	3.89	32.00	4.41	33.00	5.00	34.00
	25"	25.00			1.46	28.00	1.98	29.00	2.50	30.00	3.02	31.00	3.44	32.00	3.96	33.00	4.48	34.00	5.00	35.00
	26"	26.00			1.46	29.00	1.98	30.00	2.50	31.00	3.02	32.00	3.44	33.00	3.96	34.00	4.48	35.00	5.00	36.00
	27"	27.00			1.46	30.00	1.98	31.00	2.50	32.00	3.02	33.00	3.44	34.00	3.96	35.00	4.48	36.00	5.00	37.00
	28"	28.00			1.46	31.00	1.98	32.00	2.50	33.00	3.02	34.00	3.44	35.00	3.96	36.00	4.48	37.00	5.00	38.00
	29"	29.00			1.46	32.00	1.98	33.00	2.50	34.00	3.02	35.00	3.44	36.00	3.96	37.00	4.48	38.00	5.00	39.00
K-Segmental	30"	30.00			1.46	33.00	1.98	34.00	2.50	35.00	3.02	36.00	3.44	37.00	3.96	38.00	4.48	39.00	5.00	40.00
	31"	31.00			1.46	34.00	1.98	35.00	2.50	36.00	3.02	37.00	3.44	38.00	3.96	39.00	4.48	40.00	5.00	41.00
	32"	32.00			1.46	35.00	1.98	36.00	2.50	37.00	3.02	38.00	3.44	39.00	3.96	40.00	4.48	41.00	5.00	42.00
	33"	33.00			1.46	36.00	1.98	37.00	2.50	38.00	3.02	39.00	3.48	40.00	3.98	41.00	4.48	42.00	5.00	43.00
	34"	34.00			1.46	37.00	1.98	38.00	2.50	39.00	3.02	40.00	3.48	41.00	3.98	42.00	4.48	43.00	5.00	44.00
	35"	35.00			1.46	38.00	1.98	39.00	2.50	40.00	3.02	41.00	3.48	42.00	3.98	43.00	4.48	44.00	5.00	45.00
	36"	36.00			1.46	39.00	1.98	40.00	2.50	41.00	3.02	42.00	3.48	43.00	3.98	44.00	4.48	45.00	5.00	46.00
	37"	37.00			1.46	40.00	1.98	41.00	2.50	42.00	3.02	43.00	3.48	44.00	3.98	45.00	4.48	46.00	5.00	47.00
	38"	38.00			1.46	41.00	1.98	42.00	2.50	43.00	3.02	44.00	3.48	45.00	3.98	46.00	4.48	47.00	5.00	48.00
	39"	39.00			1.46	42.00	1.98	43.00	2.50	44.00	3.02	45.00	3.48	46.00	3.98	47.00	4.48	48.00	5.00	49.00

Note: Sizes above 3" available in multiple layers.

Insulation for the nominal pipe size range of 25"-39" is furnished to fit a range of 5 pipe sizes. The last segment applied must be cut to fit accurately.

COPPER TUBING

nom. tube size	O. D. of tube (nom.)	single layer			
		nom. 1"		nom. 1½"	
		actual	O.D.	actual	O.D.
⅜"	½"	1.18	2.88	1.49	3.50
½"	⅝"	1.11	2.88	1.62	3.50
⅝"	¾"	1.05	2.88	1.61	4.00
¾"	⅞"	.99	2.88	1.55	4.00
1"	1⅛"	1.17	3.50	1.42	4.00
1¼"	1⅜"	1.05	3.50	1.55	4.50
1½"	1⅝"	1.17	4.00	1.42	4.50
2"	2⅛"	.91	4.00	1.41	5.00
2½"	2⅝"	.91	4.50	1.69	5.56
3"	3⅛"	.91	5.00	1.73	6.66

Owens-Corning Fiberglas Corporation

GENERAL OFFICES AND GENERAL PRODUCTS Toledo, Ohio PACIFIC COAST, Santa Clara, Calif TEXTILE PRODUCTS New York, N.Y.

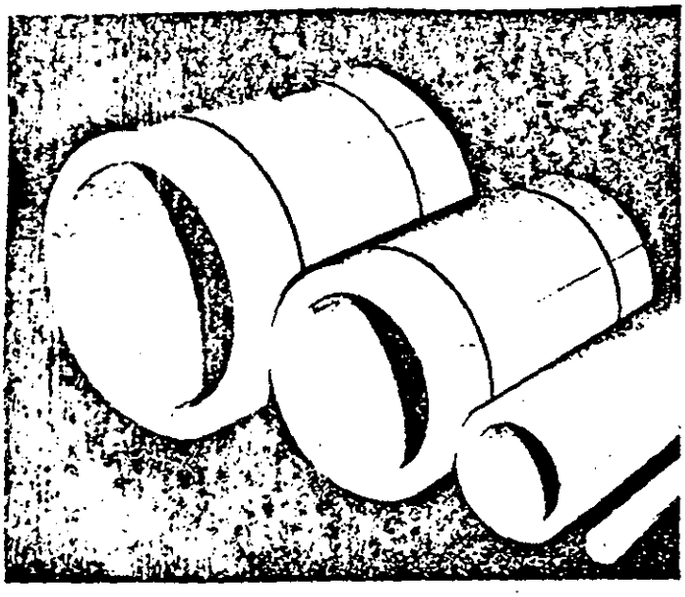
PUB. NO. 1-IN-383

LITHO IN U.S.A. MAY 1958

Kaylo pipe insulation

note:

high temperature insulation for indoor or outdoor piping up to 1200° F. operating temperature



(for temperatures ranging from 1200°F. to 1800°F., see Kaylo-20, page 26)

Kaylo* pipe insulation, a white, rigid hydrous calcium silicate heat insulation, manufactured by Owens-Illinois Glass Company and distributed nationally by Owens-Corning Fiberglas Corporation, effectively insulates indoor and outdoor piping to 1200°F. A chemically reacted material, Kaylo pipe insulation contains no added binder. For mechanical effects, a small amount of asbestos fiber is included at the time of manufacture.

This thoroughly tested and field-proven material contains the physical properties most desired for efficient, durable insulation work. It retains an appreciable percentage of its strength even after complete saturation in water, original efficiency returning after drying. The effectiveness, high strength and moisture resistance are unattained by most other insulating materials.

sizes

thickness—Kaylo Pipe Insulation is available in thicknesses from 1" to 3" depending upon pipe size. Kaylo Tube Insulation is available in thicknesses of 1" and 1½".

pipe sizes—Kaylo Pipe Insulation is available to fit pipe from ½" to 30" in diameter. Kaylo Tube Insulation will fit copper tubing from ½" to 3⅛" in diameter.

forms—Kaylo Pipe Insulation is available in sectional or multisegmental form depending upon pipe size. All insulation is furnished in 3' sections.



Kaylo Pipe Insulation presents a superior final appearance when applied to a variety of irregularly-shaped high temperature vessels.

jackets

canvas—Kaylo Sectional Pipe Insulation includes standard canvas jackets, at no additional charge, on thicknesses up to and including 2½". Standard canvas is available on segmental forms at a slight additional cost. Bands are available for use with this product at slight additional charge and will be furnished on request.

6 oz. and 8 oz. canvas jackets are available for all types, sizes and thicknesses of Kaylo Pipe and Tube Insulation at an additional charge. These jackets are factory applied on Sectional Pipe and Tube Insulation. On Multisegmental forms, they are furnished but not adhered.

limitations

Kaylo Pipe Insulation is designed for temperatures up to 1200°F. and is not recommended when operating temperatures of piping exceed this limit.

*T. M. Owens-Illinois Glass Co.

FIBERGLAS

Kaylo 20 pipe insulation



Specifically designed for indoor and outdoor piping with operating temperatures up to and including 1800° F.

It is colored pink for identification and made of calcium silicate by Owens-Corning Fiberglas. This insulation has moisture resistance and high strength of standard Kaylo* material. Being a high temperature insulation, it is also extremely useful as a fire-proofing material.

It fits all standard pipe to 39" and copper tubing to 3⅛" diameter. All insulation is furnished in 3' lengths. The insulation is available in thicknesses from 1" to 3" depending upon pipe size and for tubing in a thickness of 1" and 1½". Check thickness standard data sheet for exact sizing.

JACKETS

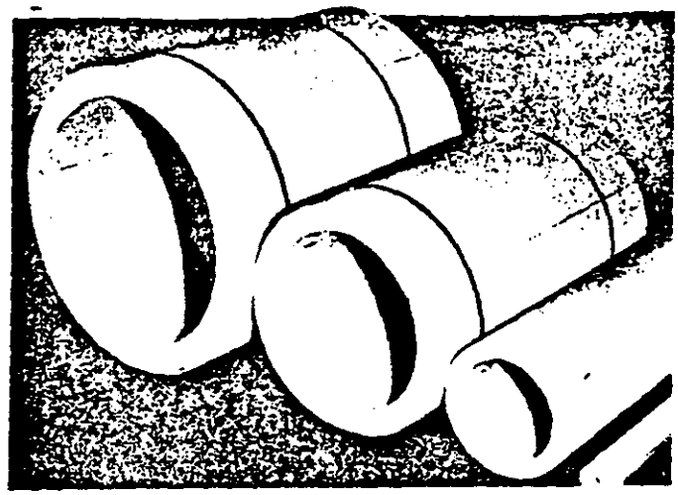
CANVAS—Standard canvas jacketing may be used for hot water or low pressure steam lines. A heavier canvas of 6 oz. or 8 oz. is also available at extra cost.

*Trademark Owens-Corning Fiberglas Corp.

Pub. No. 15-IN-1319 Litho in U.S.A., October, 1959

FIBERGLAS

Kaylo pipe insulation



Designed for indoor or outdoor piping up to 1200° F. It is made of hydrous calcium silicate by Owens-Corning Fiberglas and contains no added binder. A small amount of asbestos fiber is added at time of manufacture for mechanical effects.

This thoroughly tested and field-proven material contains the physical properties most desired for efficient, durable insulation work. Kaylo* is moisture resistant and retains an appreciable amount of strength even after complete saturation in water. Its original efficiency returning after drying.

It is made to fit pipes up to 39" and copper tubing to 3⅛" diameter. All insulation is furnished in 3' sections. This insulation is available in thicknesses from 1" to 3" depending upon pipe size, and for tubing in a thickness of 1" and 1½". Check thickness standard data sheet for exact sizing.

JACKETS

CANVAS—Standard canvas jackets at no additional charge on thickness up to and including 2½". 6 oz. and 8 oz. canvas jackets are available on all types, sizes and thicknesses at additional charge.

*Trademark Owens-Corning Fiberglas Corp.

Pub. No. 15-IN-1318 Litho in U.S.A., October, 1959

Kaylo 20 block insulation



This new calcium silicate block insulation manufactured by OCF extends the use of Kaylo* Equipment Insulation to include temperatures up to 1800° F.

It is slightly pink in color to be distinguished from standard Kaylo. Its characteristics are virtually the same as standard Kaylo except that it has a higher temperature range.

It is suitable for all high temperature applications including refractory wall backing for furnaces and boilers and fireproofing of equipment and vessel skirts.

It is made in thicknesses of 1", 1½", 2", 3", 3½", and 4", and widths of 3", 6", 12" and 18". Two lengths of 18" and 36". Curved block is available on special order.

*Trademark Owens-Corning Fiberglas Corp.

Pub No. 15-IN-1031 Litho in U.S.A., October, 1959

Kaylo block insulation



Kaylo* Block Insulation is an off white, rigid hydrous calcium silicate heat insulation manufactured by Owens-Corning Fiberglas Corp., that effectively insulates indoor and outdoor equipment up to 1200° F.

A chemically reacted material, it contains asbestos fibers for reinforcement. Its insulating effectiveness results from countless tiny entrapped air pockets.

Kaylo's light weight, superior flexural strength and resistance to abrasion, are far above the normal requirements for heat insulation.

It comes in 3", 6", 12" and 18" widths and lengths from 18" to 36". Manufactured thicknesses are 1", 1½", 2", 2½", 3", 3½", and 4".

*Trademark Owens-Corning Fiberglas Corp.

Pub. No. 15 IN-139 Printed in U.S.A. October 1959

design data for Kaylo Insulations

This table presents reference data for information on the actual thicknesses according to the simplified Dimensional Standard system.

The following data are presented to aid in the design of Kaylo Pipe Insulation modified to meet specific needs. Recommendations are generalized and should be modified to meet local conditions and job requirements.

Importance of calculating economic thickness

Selection of insulation thicknesses for any specific application should take into consideration at least the following criteria.

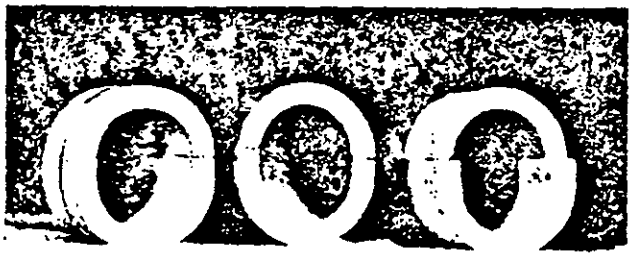
1. Cost of insulation applied
2. Cost of heat energy
3. Cost of capital
4. Depreciation period—plant and insulation
5. Capital investment in heat production equipment
6. Temperature differential
7. Size of the pipe or surface
8. Conductivity of insulation

To assist the engineer, Owens-Corning Fiberglas has taken the figures provided by the National Insulation Manufacturers Association in their manual, "How to Determine Economic Thickness of Insulation" and, by pre-calculating many of the equations on a computer, has created a quick, simple system for resolving economic thickness. To obtain your copy of this Dividend Engineering "Economic Thickness Manual," contact your local Fiberglas branch office. Your local Fiberglas representative will be glad to explain this quick, practical method for computing economical thickness under all normal operating conditions.

applications—Kaylo and Kaylo-Klad



Off-site yard steam insulated with Kaylo Pipe Insulation for efficiency and controlled temperatures at distant points.



New Kaylo Trace Line pipe insulation and Kaylo Klad Trace Line Pipe Insulation (jacketed with .016 embossed aluminum or .010 stainless steel) provide great economy in the insulation of trace lines.

These pre-molded trace line insulations are designed for insulating piping 2" IPS x 1" thick up to 8" IPS x 2" thick together with a 1" trace line.

Advantages of this Kaylo molded insulation include higher strength, more rigid construction and, in the case of Kaylo Klad, single application of both insulation and weather proofing. Application and maintenance costs are both reduced. Where a trace line is greater than one inch, an extended leg insulation can be fabricated to special order; contact your local OCF Branch Office.







Kaylo-Klad aluminum jacket "locks out" the weather. The longitudinal seam joint and end joint band, with integral mastic, provide positive weather protection.

recommended thicknesses—Kaylo†

(ambient still air at 80 F)

pipe temp.	280 F				480 F				680 F			
temp. dif.	200 F				400 F				600 F			
pipe size	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST
½	1	28.6	79.0	100	1½	52.5	86.7	107	2	77.0	90.6	110
¾	1	34.2	79.5	104	1½	60.0	87.6	110	2½	74.4	92.7	103
1	1	35.9	82.6	104	1½	65.3	89.0	109	2½	85.9	93.1	106
1¼	1	45.8	82.0	108	1½	73.2	90.1	110	2½	98.3	93.7	109
1½	1	46.3	84.0	104	2	65.8	92.2	103	3	89.0	95.0	102
2	1	53.5	84.9	105	2	80.3	92.8	107	3	108	95.1	108
2½	1	61.5	85.5	106	2	83.7	93.3	105	3	115	96.1	107
3	1	72.7	85.7	108	2½	90.8	93.9	104	3½	124	96.1	107
4	1	86.4	86.5	108	2½	107	94.4	105	3½	146	96.4	108
5	1	106	86.5	110	2½	126	94.6	107	3½	164	96.7	110
6	1½	94.2	90.0	103	2½	143	94.8	109	4	170	97.1	107
7	1½	102	90.3	103	2½	162	94.8	109	4	190	97.2	108
8	1½	114	90.4	104	2½	174	95.0	110	4	210	97.2	109
9	1½	125	90.4	104	2½	188	95.2	110	4	222	97.4	110
10	1½	133	90.8	104	3	179	95.9	106	4½	226	97.6	108
12	1½	153	91.0	104	3	210	95.9	107	4½	250	97.7	109
14	1½	178	90.4	106	3	235	95.8	108	4½	275	97.7	109
16	1½	201	90.4	107	3	255	95.9	109	5	286	97.9	108
18	1½	223	90.5	108	3	285	96.0	110	5	320	97.9	109
20	1½	246	90.5	108	3½	272	96.5	106	5	353	97.9	110
24	1½	291	90.5	108	3½	319	96.6	107	5½	364	98.2	108

†True economic thickness can now be calculated quickly and easily by following the system provided in the new Fiberglas Dividend Engineering "Economic Thickness Manual". This is available from your local Fiberglas branch office.

KEY

RT = Recommended Thickness.

HL = Heat Loss Btu/Lin. ft./hr.

E = Insulation Efficiency.

ST = Surface Temperature.*

C = Commercial and Industrial

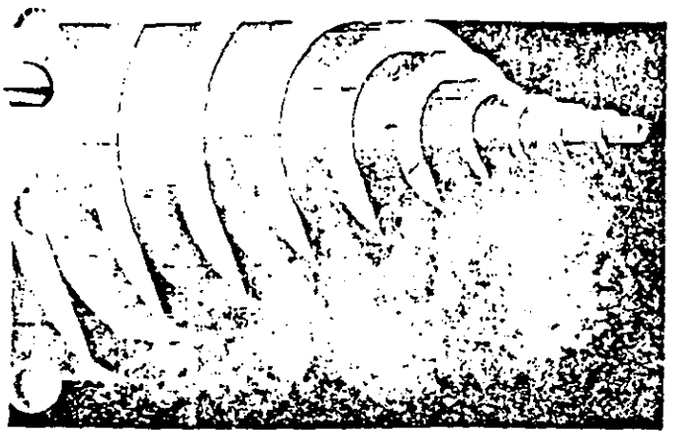
U = Power and Utility

P = Process Industries

pipe temp	280 F				480 F				680 F				880 F				1080 F				1200 F			
temp. dif.	200 F				400 F				600 F				800 F				1000 F				1120 F			
pipe size	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST	RT	HL	E	ST
½	1	28.6	79.0	100	1	63.0	84.0	120	1½	86.0	89.5	119	2	112	92.4	124	2½	128	94.8	118	3	145	95.3	120
¾	1	34.2	79.5	104	1	75.2	84.4	128	1½	98.3	90.3	126	2	125	93.2	128	2½	144	95.3	122	3	162	95.8	127
1	1	35.9	82.6	101	1	79.2	86.7	123	1½	107	91.4	125	2	136	94.0	127	3	151	96	120	3	184	96.2	133
1¼	1	45.8	82.0	108	1½	73.2	90.1	110	1½	120	92.3	127	2½	143	95	123	3	175	96.3	125	3½	200	97.1	128
1½	1	46.3	84.0	104	1½	182.3	90.2	114	2	108	93.9	113	2½	146	95.5	119	3	177	96.8	122	3½	199	97.6	127
2	1	53.5	84.9	105	1½	93.5	91.0	114	2	132	94.	121	2½	170	95.8	126	3	208	96.9	130	4	215	97.5	126
2½	1	61.5	85.5	106	1½	96.1	92.3	111	2	137	94.8	117	2½	181	96.3	124	3	206	97.5	129	4	231	97.8	125
3	1	72.7	85.7	108	1½	126	91.5	120	2	164	94.9	128	3	197	96.6	124	3½	236	97.6	126	4	267	97.9	130
4	1	86.4	86.5	108	1½	154	91.9	123	2	202	95.0	128	3	222	97	126	3½	274	97.8	130	4½	286	98.2	127
5	1	106	86.5	110	1½	177	92.4	123	2½	206	95.9	122	3	266	97.1	128	4	292	98.1	125	4½	326	98.3	130
6	1	137	85.1	116	1½	207	92.4	126	2½	239	95.9	125	3½	268	97.5	122	4	332	98.5	129	5	344	98.5	128
7	1½	102	90.3	102	1½	224	92.8	125	2½	270	96	127	3½	297	97.6	125	4½	333	98.5	124	5	377	98.6	129
8	1½	114	90.4	103	1½	249	92.9	127	2½	287	95.2	127	3½	326	97.7	126	4½	366	98.5	125	5½	389	98.7	126
9	1½	125	90.4	108	1½	273	93.0	128	2½	313	96.3	128	3½	353	97.7	127	4½	400	98.5	128	5½	436	98.9	128
10	1½	133	90.8	103	1½	292	93.2	127	2½	348	96.3	129	3½	392	97.7	129	4½	440	98.5	130	6	452	98.9	127
12	1½	153	91.0	103	1½	338	93.7	128	2½	395	96.4	130	4	410	98	125	5	460	98.8	127	6	510	99.0	129
14	1½	178	90.4	106	2	325	94.1	123	3	385	96.8	125	4	447	98	128	5	500	98.7	129	6	556	99.0	131
16	1½	201	90.4	107	2	375	94.0	124	3	428	96.9	126	4	495	98.1	128	5	563	98.7	130	6	621	99.0	132
18	1½	223	90.5	108	2	410	94.2	125	3	480	96.9	127	4	540	98.1	129	5½	545	98.8	127	6	679	99.0	134
20	1½	246	90.5	108	2	460	98.4	126	3	535	96.9	128	4	594	98.1	130	5½	603	98.9	128	6	733	99.1	136
24	1½	291	90.5	108	2	525	94.3	126	3	610	97	128	4½	618	98.4	126	5½	685	98.9	129	6	841	99.1	137
½	1	28.6	79.0	100	1	63.0	84.0	120	1	108	86.8	147	1½	124	91.6	136	2	146	94.1	134	2	179	94.2	149
¾	1	34.2	79.5	104	1	75.2	84.6	128	1½	98.3	90.3	126	1½	145	92.1	145	2	166	94.6	141	2½	175	95.5	134
1	1	35.9	82.6	101	1	79.2	86.7	123	1½	107	91.4	125	2	136	94.0	127	2½	174	95.4	134	2½	198	95.9	141
1¼	1	45.8	82.0	108	1	102	86.3	134	1½	120	92.3	127	2	160	94.4	135	2½	188	96.1	135	3	211	96.5	137
1½	1	46.3	84.0	104	1	102	87.8	129	1½	135	92.4	132	2	156	95.2	126	2½	207	96.2	142	3	212	96.9	134
2	1	53.5	84.9	105	1	118	88.6	131	1½	154	93.0	134	2	189	95.3	135	2½	223	96.7	138	3	250	97.1	140
2½	1	61.5	85.5	106	1	133	89.3	134	1½	158	94.0	127	2	200	96.4	132	2½	237	97.1	134	3	266	97.4	139
3	1	72.7	85.7	108	1	160	89.3	137	1½	202	93.7	140	2	250	95.7	145	2½	292	97.0	147	3	316	97.5	147
4	1	86.4	86.5	108	1	191	89.9	138	1½	249	93.7	147	2	293	96.1	148	3	299	97.6	137	3½	335	97.9	140
5	1	106	86.5	110	1	240	89.6	144	1½	297	94.0	149	2½	294	96.8	137	3	347	97.8	140	3½	386	98.0	145
6	1	137	85.1	116	1½	207	92.4	126	2	270	95.4	133	2½	337	96.9	139	3	403	98	147	3½	430	98.2	147
7	1½	102	90.3	107	1½	224	92.8	125	2	302	95.5	134	2½	375	97.0	141	3½	386	98.3	135	3½	471	98.2	148
8	1½	114	90.4	103	1½	249	92.9	137	2	333	95.6	135	2½	399	97.2	140	3½	422	98.2	137	4	476	98.4	142
9	1½	125	90.4	104	1½	273	93.0	138	2	369	95.9	134	2½	435	97.2	142	3½	458	98.3	138	4	513	98.5	143
10	1½	133	90.8	103	1½	292	93.2	137	2	391	95.8	137	2½	442	97.2	146	3½	504	98.3	140	4	562	98.5	146
12	1½	153	91.0	104	1½	338	93.7	138	2	451	95.9	138	2½	563	97.3	148	3½	574	98.3	143	4	642	98.5	148
14	1½	178	90.4	106	1½	391	93.0	132	2	515	95.7	143	3	541	97.6	140	3½	642	98.3	147	4½	647	98.7	144
16	1½	201	90.4	107	1½	441	93.0	133	2	579	95.8	144	3	606	97.6	141	4	642	98.5	140	4½	719	98.7	143
18	1½	223	90.5	108	1½	492	93.0	134	2	641	95.9	147	3	671	97.7	142	4	707	98.6	142	5	778	98.8	140
20	1½	246	90.5	108	1½	561	93.1	134	2½	589	96.5	135	3	735	97.7	144	4	777	98.6	142	5	840	98.9	143
24	1½	291	90.5	108	1½	642	93.1	135	2½	692	97.0	136	3	870	97.7	147	4	903	98.5	144	5	922	98.9	143

*Surface temperatures for Kaylo Klad will be higher due to the emissivity of the aluminum jacket. This will vary with ambient temperature, thickness of insulation used. However, the thermal efficiency of the application will be improved slightly by the aluminum jacket.

KAYLO-20 pipe insulation *for indoor and outdoor piping up to 1800 F operating temperature*



Kaylo*-20 Insulation, colored pink for identification, a high-temperature calcium silicate heat insulation manufactured by Owens-Corning Fiberglas extends the range of Kaylo Heat Insulation to include temperatures up to 1800 F with all the properties of moisture resistance and high strength of standard Kaylo material. It also may be used with outer layers of Fiberglas Pipe Insulation to provide ultimate balance of cost and efficiency.

Kaylo-20 Insulation is highly dimensionally stable at the temperatures for which it is designed. Resistance of this insulation to high temperatures makes it extremely useful for protecting fluids in the pipe in case of fire.

sizes

thickness—Kaylo-20 Pipe Insulation is available in thicknesses from 1" to 3" depending upon pipe size. Kaylo-20 Tube Insulation is available in thicknesses of 1" and 1½".

pipe sizes—Kaylo-20 Pipe Insulation is available to fit pipe from ½" to 39" in diameter. Kaylo-20 Tube Insulation in copper tubing sizes will fit tubing from ½" to 3⅛".

forms—Kaylo-20 Pipe Insulation is available in sectional or multi-segmental form depending upon pipe size. All insulation is furnished in 3' sections.

jackets

canvas—Standard canvas jackets are provided at no additional charge with Kaylo-20 Sectional Pipe and Tube Insulation on thicknesses up to and including 2½". Standard canvas is available for segmental forms at a slight additional cost. Bands are available for use with this product at a small additional charge and will be shipped only on request.

6 oz. and 8 oz. canvas jackets are available on all types, sizes and thicknesses of Kaylo-20 Pipe Insulation at additional charge. These jackets are factory applied on sectional pipe and tube insulation. On multi-segmental insulation, they are furnished but not adhered.

Kaylo Klad locks out the weather, protects the insulation and provides a maintenance free line and attractive finished appearance. Factory applied jackets of .016 embossed aluminum and .010 stainless steel have longitudinal interlocking seams and joint bands with integral mastic permitting application of insulation and weather proofing at the same time and reducing application costs.

limitations

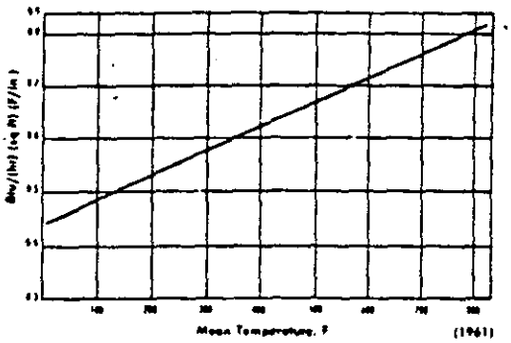
Kaylo-20 material is designed for temperatures up to 1800 F. It should not be used when operating temperatures of piping exceed this limit.

*T. M. Owens-Corning Fiberglas Corp.

physical properties

density:
approximately 12 lbs. per cu. ft.
flexural strength: (ASTM C-203)
90 lbs. per sq. in.
compressive strength: (ASTM C-165)
130 lbs. per sq. in. at 5% deformation
dimensional stability:
linear shrinkage after heating for 24 hours in muffle
at 1200 F. 0.7%
at 1800 F. 1.6%
resistance to abrasion:
(conventional tumbling test—loss in weight after 10 min.)
before heating 3%
after heating for 24 hours
at 1200 F 5%
at 1800 F 20%
alkalinity: ph 10
working temperature: up to 1800 F
physical properties
specific heat: 0.22 Btu/1 lbs. F.
thermal diffusivity: 0.016 sq. ft. per hr. at 200 F mean temperature.

thermal conductivity



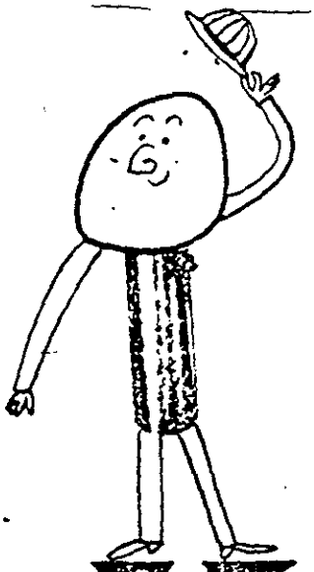
recommended thicknesses†

These are average figures and may be adjusted to meet special conditions encountered on specific jobs. Kaylo heat loss data is available for use where plant operating economics and other conditions demand greater insulation thicknesses. Design surface temperatures are approx. 150 F.

nom. pipe size	Temperature Difference F							
	1100	1200	1300	1400	1500	1600	1700	1800
½	2½	2½	3	3	3½	3½	4	4
¾	2½	2½	3	3	3½	3½	4	4
1	2½	3	3	3	3½	3½	4	4½
1¼	2½	3	3	3½	3½	4	4½	4½
1½	3	3	3½	3½	3½	4	4½	5
2	3	3	3½	3½	4	4	4½	5
2½	3	3½	3½	4	4	4½	5	5½
3	3½	3½	3½	4	4	4½	5	5½
3½	3½	3½	4	4	4½	5	5½	6
4	3½	3½	4	4	4½	5	5½	6
6	4	4	4½	4½	5	5½	6	6½
8	4	4	4½	4½	5	5½	6	6½
10	4	4½	4½	5	5½	6	6½	7
12	4½	4½	5	5	5½	6	6½	7
14	4½	5	5	5½	6	6½	7	7½
16	4½	5	5½	6	6½	7	7½	8
18	5	5	5½	6	6½	7	7½	8
20	5	5½	6	6½	7	7½	8	8½
24-72	5	5½	6	6½	7	7½	8	8½

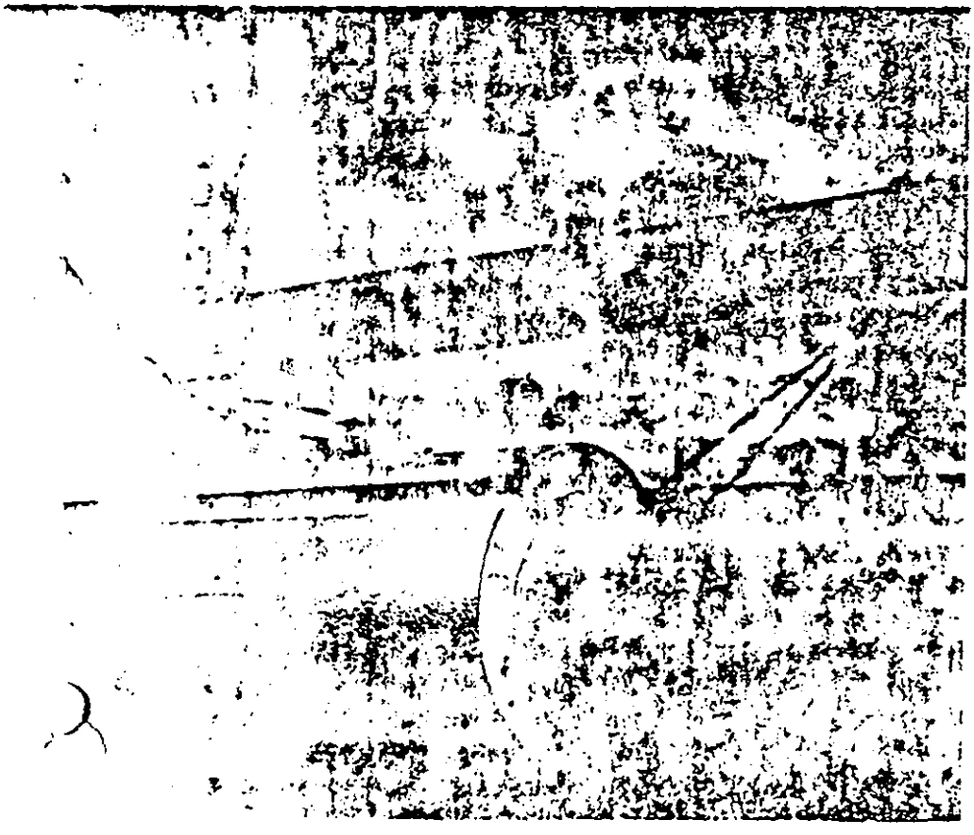
† For true economic thickness, request O-C "Economic Thickness Manual"

Meet the new member
of the FIBERGLAS
Industrial Insulation Family...



FIBERGLAS MYLO-KLAD

PIPE INSULATION



. . . the efficient, high-temperature insulation with a new embossed aluminum jacket

Quick, one-step application gives piping full weather protection while adding a distinctive, "No-Glare" appearance

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SOUTHEASTERN SERVICE CENTER Rhodes Haverty Bldg. (Atlanta 3, Ga.)
BALTIMORE 2, MD. . . . . Commercial Credit Building
BARRINGTON COM. CENTER, Shreve Ave. & Fiberglas Rd.
BIRMINGHAM 3, ALA. . . . . P. O. Box 9187
BOISE, IDAHO. . . . . 510 South 9th Street
BOSTON 16, MASS. . . . . 820 Statler Office Bldg.
BOSTON COM. CENTER. . . . . 820 Statler Office Bldg.
BUFFALO 2, N. Y. . . . . 401 Hodge Building
CHARLESTON, W. VA. . 312 Berman Building, Virginia St.
CHARLOTTE, N. C. . . . . 1106 Johnston Building
CHICAGO 1, ILL. . . . . 3236 Pure Oil Building
CHICAGO COM. CENTER. . . . . 3236 Pure Oil Bldg.
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CINCINNATI COM. CENTER. . . . . 1216 East McMillan St.
CLEVELAND 15, OHIO. . . . . 1024 Hanna Bldg.
CLEVELAND COM. CENTER. . . . . 618 Hanna Building
COLUMBUS 21, OHIO. . . . . 2025 Riverside Dr.
DALLAS 4, TEXAS. . . . . 101 United Bankers Life Bldg.
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DETROIT CONTRACTING CO. 15300 W. Eight Mile Road
DETROIT COM. CENTER. . . . . 15300 W. Eight Mile Road
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HARTFORD, CONN. . . . . 38 Woodland Street
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INTERNATIONAL DIVISION 717 Fifth Ave., N. Y. 22, N. Y.
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GENERAL OFFICES • NATIONAL BANK BUILDING • TOLEDO 1, OHIO
INDUSTRIAL AND COMMERCIAL CONSTRUCTION MATERIALS DIVISION
717 FIFTH AVENUE • NEW YORK 22, NEW YORK

[illegible] Printed in U.S.A.—September 1959

insulation thickness standards— Kaylo and Kaylo-20

CT

nom. tube size	O.D. of tube (nom.)	single layer nom. 1" actual	nom. 1" O.D.	nom. 1½" actual	nom. 1½" O.D.
⅜"	½"	1.18	2.88	1.49	3.50
½"	⅝"	1.11	2.88	1.42	3.50
¾"	⅞"	1.05	2.88	1.61	4.00
1"	1⅛"	.99	2.88	1.55	4.00
1¼"	1⅜"	1.17	3.50	1.42	4.00
1½"	1⅝"	1.05	3.50	1.55	4.50
2"	2⅛"	1.17	4.00	1.42	4.50
2½"	2⅝"	.91	4.00	1.41	5.00
3"	3⅛"	.91	4.50	1.45	5.56
3½"	3⅝"	.91	5.00	1.73	6.66

Federal Specification Compliance

HH-I-523a Insulation Block Pipe Covering and Cement, Thermal, Calcium Silicate (For Temperatures up to 1200 F) class 21 (pipe covering).

MIL-I-2781C Insulation Pipe Covering, Thermal, Grade I Class B, Grade II Class D, Grade III Class E.

For Applicable Specifications refer to Page 2.

note:
Insulations for tubing sizes other than standard sizes shown are available only as cut-downs from next larger size tube or pipe and will be slightly elliptical in shape.

KEY

IP = iron pipe sizes

CT = copper tubing

IL = Inner Layer

OL = Outer Layer

	nom. pipe size	O.D. of pipe	single layer only: nom. 1" actual	nom. 1" O.D.	nom. 1½" actual	nom. 1½" O.D.	single or double layer: nom. 2" actual	nom. 2" O.D.	nom. 2½" actual	nom. 2½" O.D.	nom. 3" actual	nom. 3" O.D.	multiple layer—recommended combinations: 2" IL/OL	2½" IL/OL	3" IL/OL	3½" IL/OL	4" IL/OL	4½" IL/OL	5" IL/OL	6" IL/OL
Sectional	½"	.84	1.00	2.88	1.56	4.00	2.06	5.00	2.89	6.66	3.39	7.66	½x1 / 2½x1	½x1½ / 2½x1½	½x2 / 3½x1½	½x2½ / 3½x2	½x2½ / 4½x2	½x2½ / 4½x2½	½x2½ / 5 x2½	½x3 / 7 x3
	⅝"	1.05	.90	2.88	1.46	4.00	1.96	5.00	2.79	6.66	3.29	7.66	⅝x1 / 2½x1	⅝x1½ / 3½x1½	⅝x2 / 3½x2	⅝x2½ / 4½x2	⅝x2½ / 4½x2½	⅝x2½ / 5 x2½	⅝x2½ / 6 x2½	¾x3 / 7 x3
	1"	1.32	1.08	3.50	1.58	4.50	2.11	5.56	2.66	6.66	3.16	7.66	1 x1 / 3 x1½	1 x1½ / 4 x1½	1 x2 / 4 x2	1 x2½ / 5 x2	1 x2½ / 5 x2½	1 x2½ / 6 x2½	1 x2½ / 7 x2½	1 x3 / 7 x3
	1¼"	1.66	.90	3.50	1.66	5.00	1.94	5.56	2.48	6.66	2.98	7.66	1¼x1 / 3½x1	1¼x1½ / 4½x1½	1¼x2 / 4½x2	1¼x2½ / 5 x2	1¼x2½ / 5 x2½	1¼x2½ / 6 x2½	1¼x2½ / 7 x2½	1¼x3 / 7 x3
	1½"	1.90	1.03	4.00	1.53	5.00	2.36	6.66	2.86	7.66	3.36	8.66	1½x1 / 3½x1½	1½x1½ / 4½x1½	1½x2 / 4½x2	1½x2½ / 5 x2	1½x2½ / 5 x2½	1½x2½ / 6 x2½	1½x2½ / 7 x2½	1½x3 / 8 x3
	2"	2.38	1.04	4.50	1.57	5.56	2.12	6.66	2.82	7.66	3.12	8.66	2 x1 / 4 x1½	2 x1½ / 5 x1½	2 x2 / 6 x2	2 x2½ / 6 x2½	2 x2½ / 7 x2½	2 x2½ / 8 x2½	2 x2½ / 8 x2½	2 x3 / 8 x3
	2½"	2.88	1.04	5.00	1.87	6.66	2.37	7.66	2.87	8.66	3.37	9.66	2½x1 / 4½x1½	2½x1½ / 5 x1½	2½x2 / 6 x2	2½x2½ / 6 x2½	2½x2½ / 7 x2½	2½x2½ / 8 x2½	2½x2½ / 8 x2½	2½x3 / 9 x3
	3"	3.50	1.00	5.56	1.55	6.66	2.05	7.66	2.55	8.66	3.05	9.66	3 x1 / 5 x1½	3 x1½ / 6 x1½	3 x2 / 6 x2	3 x2½ / 7 x2	3 x2½ / 7 x2½	3 x2½ / 8 x2½	3 x2½ / 9 x2½	3 x3 / 9 x3
	3½"	4.00	1.30	6.66	1.80	7.66	2.30	8.66	2.80	9.66	3.30	10.78	3½x1 / 5 x1½	3½x1½ / 6 x1½	3½x2 / 7 x2	3½x2½ / 8 x2	3½x2½ / 8 x2½	3½x2½ / 9 x2½	3½x2½ / 10 x2½	3½x3 / 10 x3
	4"	4.50	1.05	6.66	1.55	7.66	2.05	8.66	2.55	9.66	3.11	10.78	4 x1 / 6 x1½	4 x1½ / 7 x1½	4 x2 / 7 x2	4 x2½ / 8 x2	4 x2½ / 9 x2	4 x2½ / 10 x2½	4 x3 / 10 x3	4 x3 / 11 x3
	4½"	5.00	1.30	7.66	1.80	8.66	2.30	9.66	2.86	10.78	3.36	11.78	4½x1 / 6 x1½	4½x1½ / 7 x1½	4½x2 / 8 x2	4½x2½ / 9 x2	4½x2½ / 9 x2½	4½x2½ / 10 x2½	4½x3 / 11 x3	4½x3 / 12 x3
	5"	5.56	1.02	7.66	1.52	8.66	2.02	9.66	2.52	10.78	3.08	11.78	5 x1 / 7 x1½	5 x1½ / 8 x1½	5 x2 / 9 x2	5 x2½ / 9 x2½	5 x2½ / 10 x2½	5 x2½ / 11 x2½	5 x3 / 12 x3	5 x3 / 13 x3
	6"	6.63	.95	8.66	1.45	9.66	2.02	10.78	2.52	11.76	3.03	12.81	6 x1 / 8 x1½	6 x1½ / 9 x1½	6 x2 / 9 x2	6 x2½ / 10 x2	6 x2½ / 10 x2½	6 x2½ / 11 x2½	6 x3 / 12 x3	6 x3 / 13 x3
	7"	7.63			1.52	10.78	2.02	11.78	2.53	12.81	3.16	14.06			7 x1½ / 10 x1½	7 x2 / 10 x2	7 x2½ / 11 x2	7 x2½ / 12 x2½	7 x3 / 14 x3	7 x3 / 15 x3
	8"	8.63			1.52	11.78	2.03	12.81	2.66	14.06	3.16	15.06			8 x1½ / 11 x1½	8 x2 / 11 x2	8 x2½ / 12 x2	8 x2½ / 13 x2½	8 x3 / 15 x3	8 x3 / 16 x3
Tri-Segmental	9"	9.63			1.53	12.81	2.16	14.06	2.66	15.06	3.17	16.09			9 x1½ / 12 x1½	9 x2 / 12 x2	9 x2½ / 13 x2	9 x2½ / 14 x2½	9 x3 / 16 x3	9 x3 / 17 x3
	10"	10.75			1.59	14.06	2.09	15.06	2.61	16.09	3.06	17.00			10 x1½ / 14 x1½	10 x2 / 14 x2	10 x2½ / 15 x2	10 x2½ / 15 x2½	10 x3 / 17 x3	10 x3 / 18 x3
	11"	11.75			1.58	15.06	2.09	16.09	2.55	17.00	3.05	18.00			11 x1½ / 15 x1½	11 x2 / 15 x2	11 x2½ / 16 x2	11 x2½ / 16 x2½	11 x3 / 18 x3	11 x3 / 19 x3
	12"	12.75			1.55	16.09	2.05	17.00	2.55	18.00	3.05	19.00			12 x1½ / 16 x1½	12 x2 / 16 x2	12 x2½ / 17 x2	12 x2½ / 17 x2½	12 x3 / 19 x3	12 x3 / 20 x3
	14"	14.00			1.42	17.00	1.92	18.00	2.42	19.00	2.92	20.00			14 x1½ / 17 x1½	14 x2 / 17 x2	14 x2½ / 18 x2½	14 x2½ / 19 x2½	14 x3 / 20 x3	14 x3 / 21 x3
	15"	15.00			1.42	18.00	1.92	19.00	2.42	20.00	2.92	21.00			15 x1½ / 18 x1½	15 x2 / 18 x2	15 x2½ / 19 x2½	15 x2½ / 20 x2½	15 x3 / 21 x3	15 x3 / 22 x3
	16"	16.00			1.41	19.00	1.91	20.00	2.41	21.00	2.91	22.00			16 x1½ / 19 x1½	16 x2 / 19 x2	16 x2½ / 20 x2	16 x2½ / 21 x2½	16 x3 / 22 x3	16 x3 / 23 x3
	17"	17.00			1.41	20.00	1.91	21.00	2.41	22.00	2.91	23.00			17 x1½ / 20 x1½	17 x2 / 20 x2	17 x2½ / 21 x2	17 x2½ / 22 x2½	17 x3 / 23 x3	17 x3 / 24 x3
	18"	18.00			1.41	21.00	1.91	22.00	2.41	23.00	2.91	24.00			18 x1½ / 21 x1½	18 x2 / 21 x2	18 x2½ / 22 x2	18 x2½ / 23 x2½	18 x3 / 24 x3	18 x3 / 25 x3
	19"	19.00			1.41	22.00	1.91	23.00	2.41	24.00	2.91	25.00			19 x1½ / 22 x1½	19 x2 / 22 x2	19 x2½ / 23 x2	19 x2½ / 24 x2½	19 x3 / 25 x3	19 x3A / 25 x3A
	20"	20.00			1.41	23.00	1.91	24.00	2.41	25.00	2.91	26.00			20 x1½ / 23 x1½	20 x2 / 23 x2	20 x2½ / 24 x2	20 x2½ / 25 x2½	20 x3 / 26 x3	20 x3A / 26 x3A
	21"	21.00			1.41	24.00	1.91	25.00	2.41	26.00	2.91	27.00			21 x1½ / 24 x1½	21 x2 / 24 x2	21 x2½ / 25 x2A	21 x2½ / 26 x2½A	21 x3 / 27 x3	21 x3A / 27 x3A
	22"	22.00			1.41	25.00	1.91	26.00	2.41	27.00	2.91	28.00			22 x1½ / 25 x1½A	22 x2 / 25 x2A	22 x2½ / 26 x2A	22 x2½ / 27 x2½A	22 x3 / 28 x3	22 x3A / 28 x3A
	23"	23.00			1.41	26.00	1.91	27.00	2.41	28.00	2.91	29.00			23 x1½ / 26 x1½A	23 x2 / 26 x2A	23 x2½ / 27 x2A	23 x2½ / 28 x2½A	23 x3 / 29 x3	23 x3A / 29 x3A
Quad. Seg.	24"	24.00			1.41	27.00	1.91	28.00	2.41	29.00	2.91	30.00			24 x1½ / 27 x1½A	24 x2 / 27 x2A	24 x2½ / 28 x2A	24 x2½ / 29 x2½A	24 x3 / 30 x3	24 x3 / 30 x3
	25"	25.00			1.46	28.00	1.98	29.00	2.50	30.00	3.02	31.00			25 x1½ / 28 x1½B	25 x2 / 28 x2B	25 x2½ / 29 x2A	25 x2½ / 30 x2½B	25 x3 / 31 x3	25 x3 / 31 x3
	26"	26.00			1.46	29.00	1.98	30.00	2.50	31.00	3.02	32.00			26 x1½ / 29 x1½B	26 x2 / 29 x2B	26 x2½ / 30 x2A	26 x2½ / 31 x2½B	26 x3 / 32 x3B	26 x3A / 32 x3B
	27"	27.00			1.46	30.00	1.98	31.00	2.50	32.00	3.02	33.00			27 x1½ / 30 x1½B	27 x2 / 30 x2B	27 x2½ / 31 x2A	27 x2½ / 32 x2½B	27 x3 / 33 x3B	27 x3A / 33 x3B
	28"	28.00			1.46	31.00	1.98	32.00	2.50	33.00	3.02	34.00			28 x1½ / 31 x1½B	28 x2 / 31 x2B	28 x2½ / 32 x2A	28 x2½ / 33 x2½B	28 x3 / 34 x3B	28 x3A / 34 x3B
	29"	29.00			1.46	32.00	1.98	33.00	2.50	34.00	3.02	35.00			29 x1½ / 32 x1½B	29 x2 / 32 x2B	29 x2½ / 33 x2A	29 x2½ / 34 x2½B	29 x3 / 35 x3B	29 x3A / 35 x3B
X-Segmental	30"	30.00			1.46	33.00	1.98	34.00	2.50	35.00	3.02	36.00			30 x1½ / 33 x1½C	30 x2 / 33 x2C	30 x2½ / 34 x2B	30 x2½ / 35 x2½C	30 x3 / 36 x3C	30 x3B / 36 x3C
	31"	31.00			1.46	34.00	1.98	35.00	2.50	36.00	3.02	37.00			31 x1½ / 34 x1½C	31 x2 / 34 x2C	31 x2½ / 35 x2B	31 x2½ / 36 x2½C	31 x3 / 37 x3C	31 x3B / 37 x3C
	32"	32.00			1.46	35.00	1.98	36.00	2.50	37.00	3.02	38.00			32 x1½ / 35 x1½C	32 x2 / 35 x2C	32 x2½ / 36 x2B	32 x2½ / 37 x2½C	32 x3 / 38 x3C	32 x3 / 38 x3C
	33"	33.00			1.46	36.00	1.98	37.00	2.50	38.00	3.02	39.00			33 x1½ / 36 x1½C	33 x2 / 36 x2C	33 x2½ / 37 x2B	33 x2½ / 38 x2½C	33 x3 / 39 x3C	33 x3B / 39 x3C
	34"	34.00			1.46	37.00	1.98	38.00	2.50	39.00	3.02	40.00			34 x1½ / 37 x1½C	34 x2 / 37 x2C	34 x2½ / 38 x2B	34 x2½ / 39 x2½C	34 x3 / 40 x3C	34 x3B / 40 x3C
	35"	35.00			1.46	38.00	1.98	39.00	2.50	40.00	3.02	41.00								
	36"	36.00			1.46	39.00	1.98	40.00	2.50	41.00	3.02	42.00								
	37"	37.00			1.46	40.00	1.98	41.00	2.50	42.00	3.02	43.00								
	38"	38.00			1.46	41.00	1.98	42.00	2.50	43.00	3.02	44.00								
	39"	39.00			1.46	42.00	1.98	43.00	2.50	44.00	3.02	45.00								

X-Segmental Dimensions: Letter | In. Dia. | O Dia. | Approx Outer Arc

A
B
C

RECOMMENDED THICKNESSES OF KAYLO-KLAD

E—Insulation Efficiency ML—Heat Loss Btu/Lin. ft./hr. ST—Surface Temperature

400 F				500 F				600 F				1000 F				1200 F			
200 F				400 F				800 F				1000 F				1200 F			
RT	ML	E	ST	RT	ML	E	ST	RT	ML	E	ST	RT	ML	E	ST	RT	ML	E	ST
1	140	140	170	1½	140	87.5	119	1	133	92.4	124	2½	129	84.8	118	3	148	95.2	136
1	111	111	168	1½	96.3	94.1	126	1	135	93.2	128	2½	144	85.3	122	3	162	95.6	137
1	87	87	165	1	107	91.4	125	1	136	94.9	127	3	151	94	120	3	164	96.2	138
1	71.2	71.2	164	1	119	92.3	122	2½	143	95	122	3	175	96.3	125	3½	192	97.1	139
2	182	91.2	174	2	198	93.9	133	2½	148	95.5	119	3	177	95.6	122	3½	199	97.8	127
2	143	91.6	174	2	132	94	131	2½	170	95.8	126	3	206	96.5	130	4	230	97.3	140
2	113	92.5	173	2	157	94.9	177	2½	181	96.3	124	3	226	97.5	129	4	251	97.8	139
2	176	94	170	2	164	94.9	178	3	197	96.6	124	3½	236	97.6	126	4	267	97.9	138
2	56	91.2	128	2	202	95.8	128	3	222	97	126	3½	274	97.8	130	4½	288	98.2	127
2	177	92.6	128	2½	208	96.9	127	3	166	97.5	128	4	282	98.1	129	4½	329	98.5	140
2	91	93.6	126	2½	223	95.9	125	3½	268	97.5	122	4	332	98.6	129	5	346	98.5	138
2	74	92.8	125	2½	270	96	127	3½	287	97.6	125	4½	333	98.6	127	5	377	98.6	139
2	59	91.9	127	2½	291	96.2	127	3½	376	97.7	128	4½	388	98.5	125	5½	389	98.7	140
2	46.6	91.8	128	2½	313	96.3	128	3½	393	97.7	127	4½	438	98.5	128	5½	438	98.9	138
2	37.7	91.7	127	2½	348	96.2	129	3½	392	97.7	129	4½	448	98.5	130	6	452	98.9	137
2	31.4	91.7	126	2½	386	96.4	130	4	410	98	128	5	448	98.6	127	6	518	99.0	139
3	386	96.8	125	3	386	96.8	125	4	447	98	128	5	501	98.7	128	6	566	98.8	131
3	278	96.9	124	3	478	96.9	127	4½	494	98.5	128	5	563	98.8	130	6	621	98.9	132
3	199	96.9	124	3	499	96.9	124	4½	549	98.5	125	5½	565	98.8	127	6	679	99.0	134
3	135	96.9	128	3	535	96.9	128	4½	597	98.5	130	5½	605	98.9	128	6	732	99.1	136
3	610	97	128	3	610	97	128	4½	61	98.6	126	5½	635	98.9	129	6	841	99.1	137
1	109	96.9	142	1½	109	96.9	142	2½	126	95.6	126	2	146	94.1	124	2	139	94.2	149
1	84.3	96.9	126	1½	84.3	96.9	126	2½	145	95.7	125	2	166	94.6	141	2½	159	95.9	124
1	67	96.9	125	1½	107	96.9	125	2	146	96.9	127	2½	178	95.4	144	2½	193	95.9	141
1	52.8	96.9	127	1½	120	97.1	127	2	169	96.4	125	2½	188	96.1	135	3	213	96.9	137
1½	135	97.4	132	2	135	97.4	132	2	196	95.3	126	2½	207	96.2	142	3	212	96.9	134
1½	104	97.4	134	2	164	97.4	134	2	189	95.3	125	2½	223	96.7	138	3	250	97.1	140
1½	80	97.4	134	2	201	97.4	132	2	221	96.5	132	2½	237	97.1	134	3	268	97.4	139
1½	61	97.4	140	2	246	97.4	140	2	256	96.7	135	2½	257	97.0	147	3	316	97.5	142
2	293	96.1	148	2	293	96.1	148	3	299	97.6	137	3½	335	97.9	140
2	236	96.8	137	2½	236	96.8	137	3	347	97.6	140	3½	396	98.0	145
2	237	96.9	139	2½	237	96.9	139	3	401	98	143	3½	470	98.2	147
2	375	97.0	141	2½	375	97.0	141	3½	386	98.1	135	3½	471	98.1	148
2	333	95.6	135	2½	399	97.2	140	3½	477	98.2	137	4	474	98.4	142
2	269	95.9	138	2½	435	97.3	142	3½	458	98.3	138	4	513	98.5	143
2	210	95.8	137	2½	442	97.3	136	3½	504	98.5	141	4	563	98.5	146
2	161	95.9	138	2½	563	97.3	148	3½	576	98.3	143	4	642	98.5	148
2	555	95.7	143	3	581	97.6	140	3½	642	98.3	143	4½	647	98.7	144
2	519	95.8	144	3	646	97.6	141	4	647	98.5	140	4½	719	98.7	145
2	440	95.9	147	3	6..	97.7	142	4	707	98.5	142	5	728	98.8	140
2	358	95.9	146	3	7..	97.7	141	4	727	98.6	143	5	840	98.9	143
2½	291	96.1	146	3	8..	97.7	147	4	901	98.6	144	5	922	98.9	141

... detailed information ... our complete line of Fiberglas Industrial Insulations.

THERMAL CONDUCTIVITY

PIPE INSULATION

OWENS-CORNING FIBERGLAS CORPORATION

1531

KAYLO-KLAD

:BLE KAYLO IN NEW FACE. Kaylo has long been recognized for its efficient ... insulating high-temperature industrial piping, and now Owens-Corning ... factory-jacketing Kaylo in embossed aluminum. The result—KAYLO-KLAD.



KAYLO-KLAD

is a superior, all-purpose, high-temperature pipe insulation for piping in power, chemical, refining and other processing and industrial uses

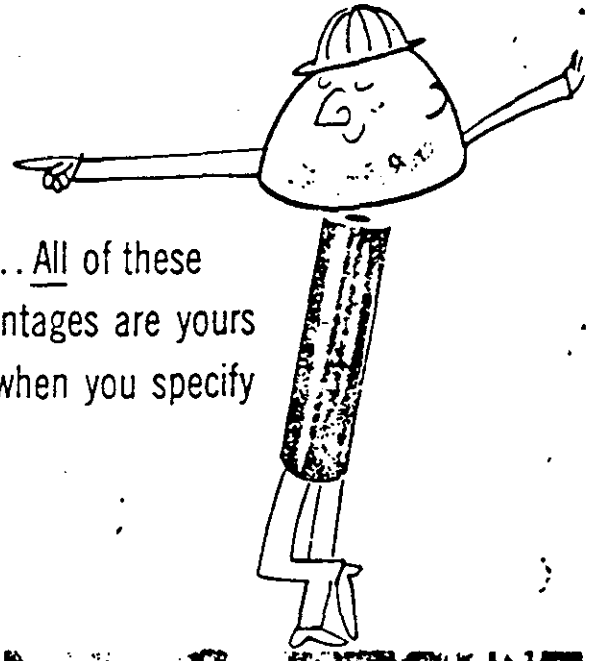
...RICATES WITH SIMPLE TOOLS

A ... hand saw, for instance, is all that is necessary to ... cuts. Where power is unavailable, an ... do. A portable saber saw can be used to ... around pipe supports and hangers.

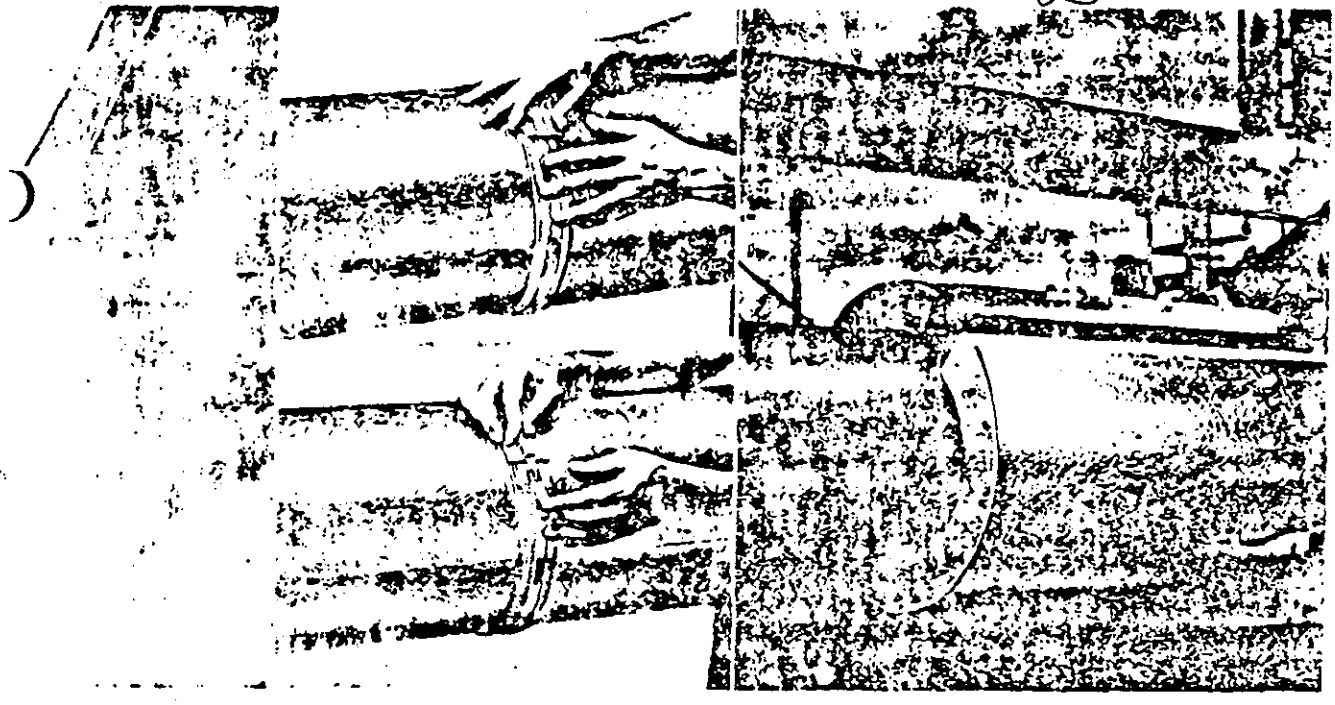
...Kaylo Klad adds up to a long service life and a ... for your industrial pipe insulation, while provid... thermal efficiency for temperatures up to 1200 F.

AND WHAT'S UNDERNEATH THE ALUMINUM JACKET? . . .

- A "DRESSED-UP" LINE
- "LOCKS OUT" THE WEATHER
- LESS MAINTENANCE
- RESISTANCE TO MECHANICAL DAMAGE
- "NO-GLARE" TEXTURE
- SELF-LOCKING JACKET
- ACCURATELY SIZED
- PERMANENT AND RE-USABLE
- EXCELLENT THERMAL EFFICIENCY
- ECONOMY WITH ONE-STEP APPLICATION



... All of these advantages are yours when you specify

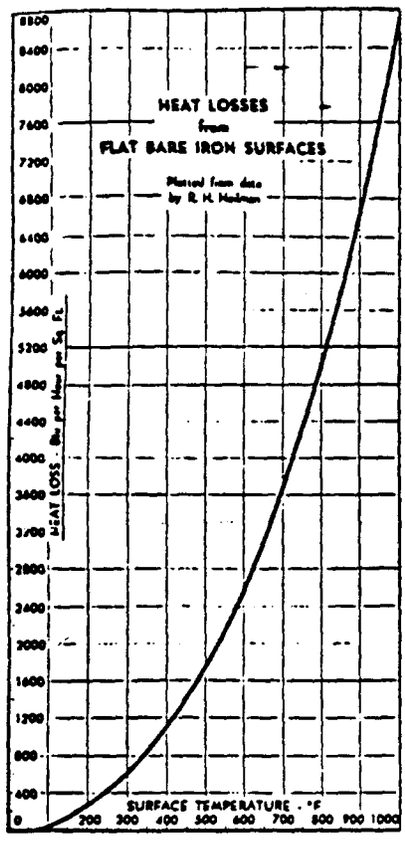


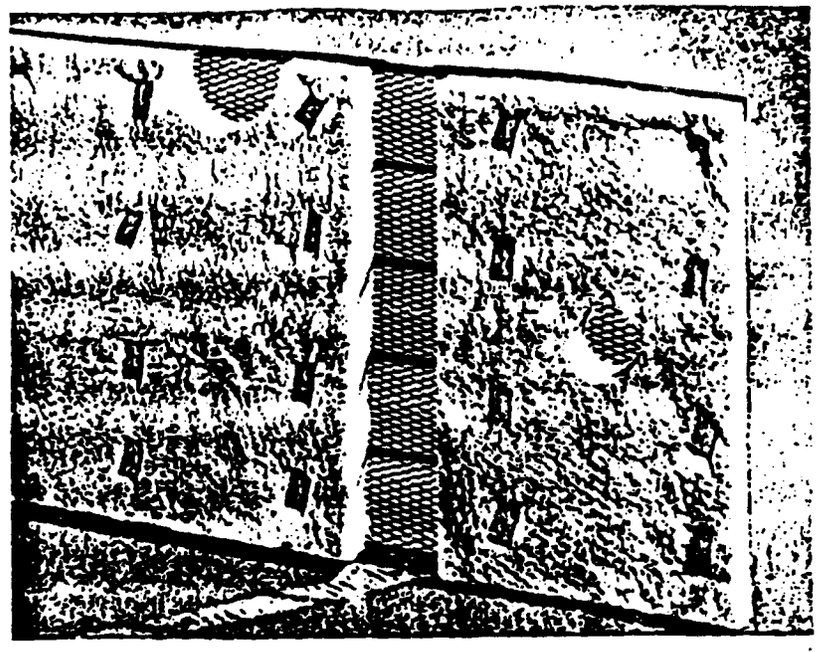
"LOCKS OUT" THE WEATHER

...active appearance afforded by Kaylo-Klad, while out... ...all-important, Kaylo-Klad is "tough" in its thick ...minum jacket. It provides greater resistance to me... ...damage. The longitudinal seam of jacket snaps to... ...with interlocking lips which, when faced downward, assure ...weather tightness and maintenance-free performance.

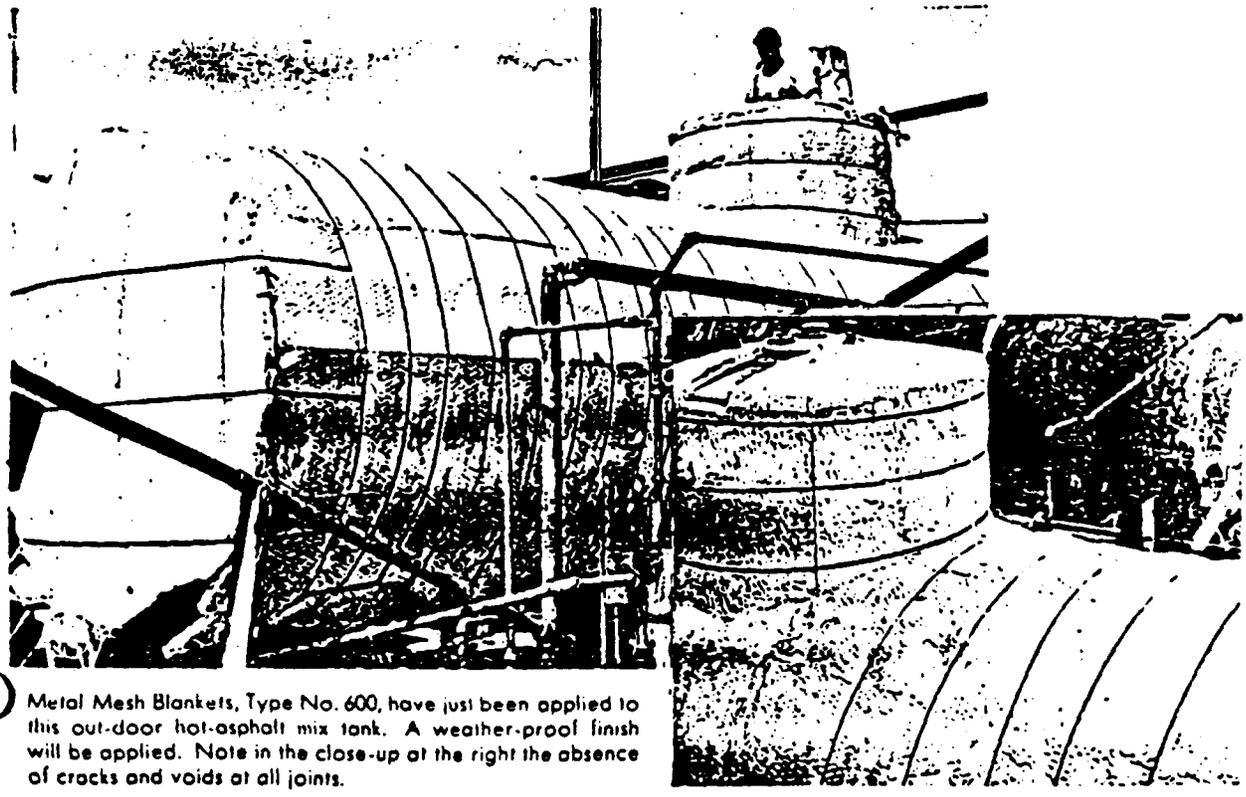
FAST INSTALLATION

The soft, rippled texture embossed in the aluminum jacket diffuses light and eliminates glare—at the same time "dressing up" a pipeline. Installation of jacket and insulation is a one-step application—an important factor in the all-around practicability of Kaylo-Klad. Longitudinal seam has a self-locking jo... joints are sealed with a band having an integral sealing co... pound which resists direct contact temperatures to 400°F.





Fiberglas Metal Mesh Blankets, Type No. 600, can be easily cut to conform to surface irregularities.. When cut with sharp knife the edges are left clean and even. As shown in the sample in the picture above, the sections which have been cut are smooth with no breaks or irregularities.



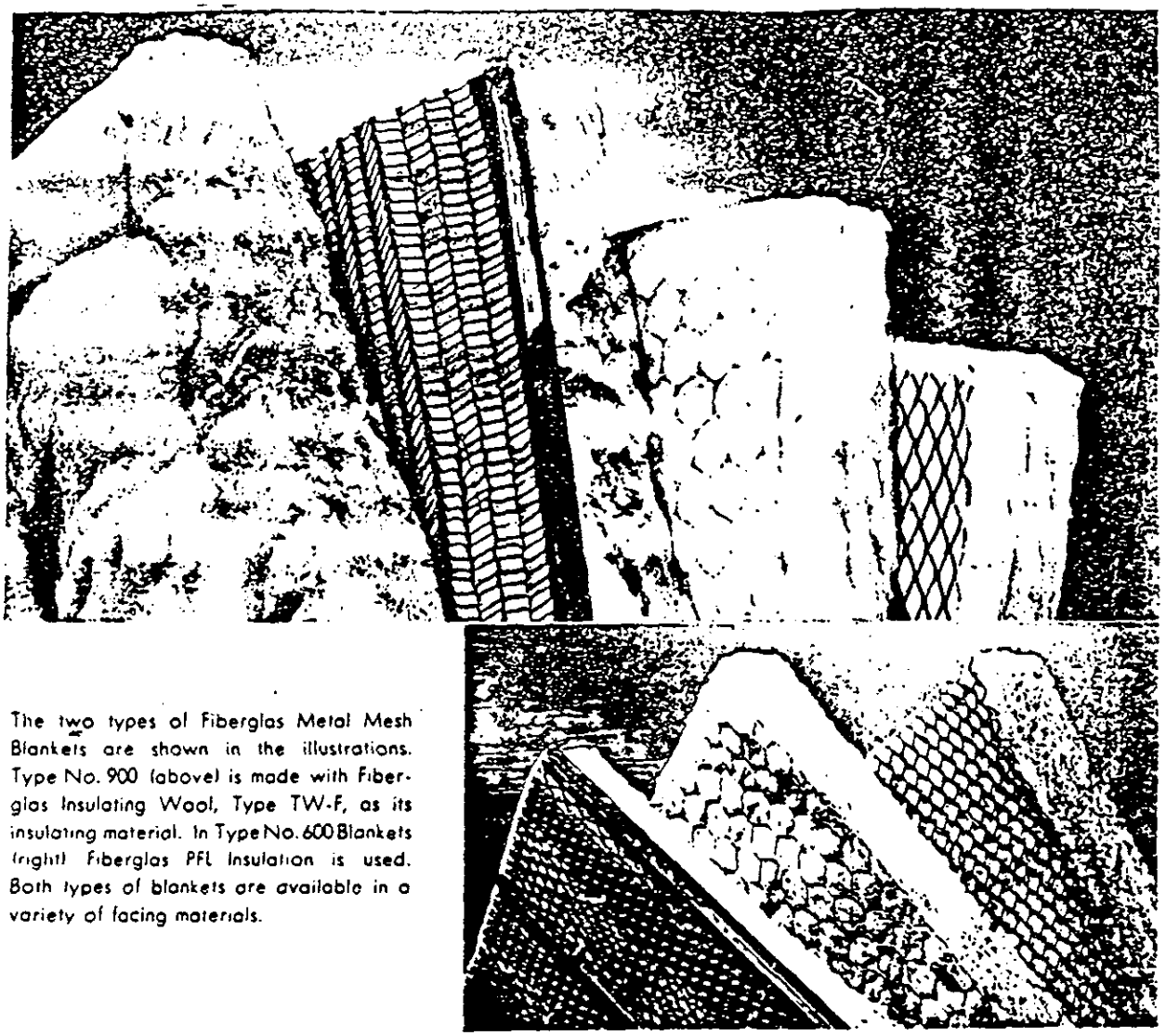
Metal Mesh Blankets, Type No. 600, have just been applied to this out-door hot-asphalt mix tank. A weather-proof finish will be applied. Note in the close-up at the right the absence of cracks and voids at all joints.

FIBERGLAS
STANDARDS
OWENS-CORNING
FIBERGLAS
CORPORATION

For the duration of the war the specifications herein are subject to modifications without further notice to meet priority and allocation requirements or shortages in purchased materials.

#151
D4.4.2
JUNE 1, 1944

FIBERGLAS METAL MESH BLANKETS



The two types of Fiberglas Metal Mesh Blankets are shown in the illustrations. Type No. 900 (above) is made with Fiberglas Insulating Wool, Type TW-F, as its insulating material. In Type No. 600 Blankets (right) Fiberglas PFL Insulation is used. Both types of blankets are available in a variety of facing materials.

FIBERGLAS* Metal Mesh Blankets are flexible insulating blankets of glass wool with metal facing on one or both sides for insulating equipment in temperature ranges from 100° to 1000°F. The metal facings secure the blanket in position and serve as a base for cement finishes.

They combine high insulating value with light weight, strength, durability, extremely low moisture absorption, ease of application and high salvage value.

They are used for the insulation of heated equipment, such as boilers, tanks, railroad tank cars, cylinders, industrial ovens, large ducts and breechings, oil field and refinery equipment.

TYPES

Fiberglas Metal Mesh Blankets are made in two types: Type No. 900 and Type No. 600.

Note: This sheet supersedes G3.5.1, dated February 25, 1943.
2nd Printing, September, 1944

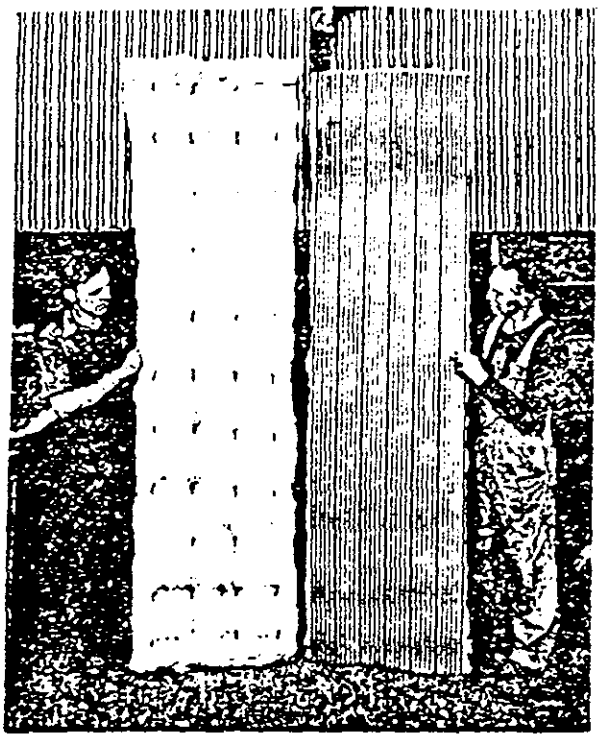
Type No. 900 Blankets are made of Fiberglas Insulating Wool, Type TW-F, which is described in Fiberglas Standards D4.2.1. The wool is secured to facing materials at a density of approximately 6 lbs. per cu. ft. The wool filler may be faced on one or both sides. One side is often left unfaced so that the wool can conform to surface irregularities and projections, such as laps, rivet heads, etc. No. 900 Blankets can be used on hot surfaces at temperatures up to 1000°F.

Type No. 600 Blankets are made of Fiberglas PFL Insulation, which has a density of 4¼ lbs. per cubic foot. It is described in Fiberglas Standards D4.3.1. It can be faced on both sides, but generally there is only one facing because of the semi-rigid character of the PF Insulation. These blankets are recommended for temperatures up to 600°F. Above this temperature, the binder holding the glass fibers

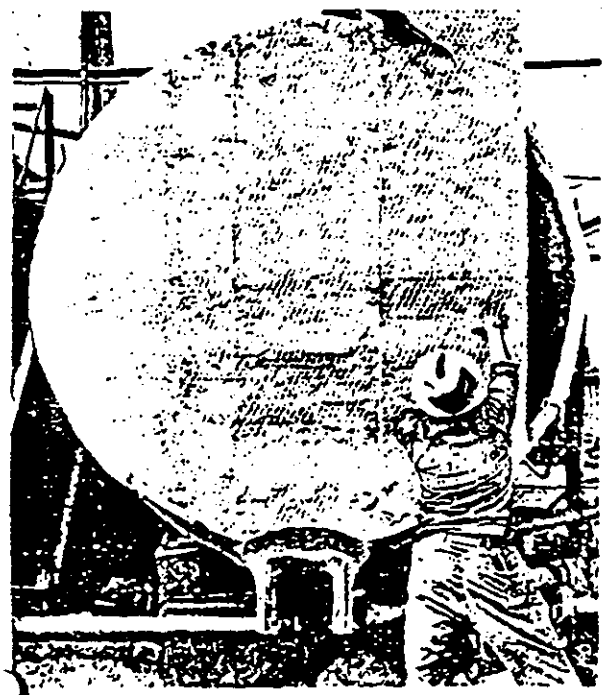
*Fiberglas is the trade name (Reg. U. S. Pat. Off.) of glass manufactured in any fiber or filament form by Owens-Corning Fiberglas Corporation.

Printed in U.S.A.

EXHIBIT O



This picture shows two Type No. 900 Blankets with different facings. At the left is the "O" face, without metal fabric. At right is the "R" face of ribbed metal lath, recommended where maximum rigidity is required. The light weight of these blankets makes them easy for one man to handle.



Type No. 600 Blankets being applied to a tank. The insulating material, which is semi-rigid in character, has the "H" facing, of hexagonal wire mesh.

together volatilizes and the insulation takes on the characteristics of that in the No. 900 Blankets. If No. 600 Blankets are to be used on surfaces having a temperature of 450° F. or greater, it is recommended, though not necessary, that the surfaces be brought up to temperature gradually the first time in order that the binder may volatilize out.

RECOMMENDED THICKNESSES

The recommended thicknesses and types of blankets for various temperature ranges are given in the table below:

FIBERGLAS METAL MESH BLANKETS

Types and Thicknesses Generally Recommended

For Hot Surfaces	Type No. 900	Type No. 600
100° 200° F	1" Thick	1" Thick
201° 300° F	1½" "	1½" "
301° 400° F	2" "	2" "
401° 600° F	2½" "	2½" "
601° 700° F	3" "	
701° 850° F	3½" "	
851° 1000° F	4" "	

FACINGS

There are four standard facings for Fiberglas Metal Mesh Blankets, which, in combination, make up eleven different standard styles. These styles are designated by combinations of letters as shown in the table below. Four basic facings designated O, H, L, and R, are described on the next page.

FIBERGLAS METAL MESH BLANKETS

Styles and Facing Materials

STYLE	ONE SIDE	OPPOSITE SIDE
HH	Hexagonal Wire	Hexagonal Wire
†HO	(Poultry Mesh)	No Metal Facing
HL		Expanded Metal Lath
†LO	Expanded Metal Lath	No Metal Facing
LL		Expanded Metal Lath
†ATRO	⅜" Rib Lath, Rib Turned OUT	No Metal Facing
†RAIO	⅜" Rib Lath, Rib Turned IN	No Metal Facing
ATRH	⅜" Rib Lath, Rib Turned OUT	Hexagonal Wire
RATH	⅜" Rib Lath, Rib Turned IN	Hexagonal Wire
ATRL	⅜" Rib Lath, Rib Turned OUT	Expanded Metal Lath
RATL	⅜" Rib Lath, Rib Turned IN	Expanded Metal Lath

†Featured Construction of Fiberglas Metal Mesh Blankets

"O" Facing. This facing consists of Fiberglas Insulating Wool only, tufted by tie wires to a metal facing on the opposite side. This construction is recommended for use where a resilient surface is required to conform to such irregularities as laps, bolts, and rivet heads, and to retain a smooth finish. It is always used in combination with a metal mesh facing on the opposite side.

"H" Facing. The conventional hexagonal mesh, or chicken wire facing. The wire is a 1" hexagon poultry netting galvanized before weaving. This is the most flexible of the metal facings and is recommended where the blanket must be bent or fitted around irregular surfaces and as a support to prevent any movement of the blanket in a panel. This facing is not intended as a reinforcing base for Fiberglas Insulating Cements, especially on Type TW-F (No. 900 Blankets). Where an "L" or "R" facing cannot be used, the cement should receive supplementary reinforcement of similar wire mesh in the base coat.

"L" Facing. Expanded metal lath weighing 2½ lbs. per square yard with ½" mesh. This is the ideal base for an insulating or finishing cement. It is recommended for use on large flat or curved surfaces.

"R" Facing. Hi-Rib metal lath weighing 4 lbs. per square yard with a ⅜" rib. Recommended for use where maximum rigidity is required in the blanket. These blankets are fabricated with the metal rib turned either to the outside (away from the Fiberglas) or toward the inside. The rib turned out will provide air space between the insulation and the hot surface, an advantage often utilized when insulating steel breeching shells.

Special Facings. The eleven combinations of facings shown in the table on page 2 represent standard styles. Those marked with a dagger are the types or styles most commonly used and recommended. Special types or combinations can be made up on order if approved in advance by the Toledo Office. For example, blankets may be made with screen cloth or stucco lath on one side or both. Also note that blankets made with asbestos paper or any cloth or muslin facing are classified as sewn blankets and are described in Fiberglas Standards D4.4.1.

SIZES

All Fiberglas Metal Mesh Blankets are manufactured in two standard sizes: 2 feet by 8 feet, and 2 feet by 4 feet. Special sizes may be made to order at extra cost.

SURFACE FINISHES

Fiberglas Finishing Cement should be applied only to the "L" surface of expanded metal lath of Fiberglas Metal Mesh Blankets (Types "LO" and "HL", etc.).

INSULATING EFFECTIVENESS

Data on the thermal properties of No. 600 and No. 900 Blankets are given on pages 6 and 7. It will be noted that the tables on these pages give the total surface loss from flat surfaces in still air at 80°F. before the insulation is applied, and also show the heat loss in Btu per square foot per hour from the same surface after the indicated blanket has been applied. The efficiency percentages are the percentages of saving of the total surface loss before insulation. Where conditions vary from those given in the tables, refer to the Selection Charts on pages 6 and 7.

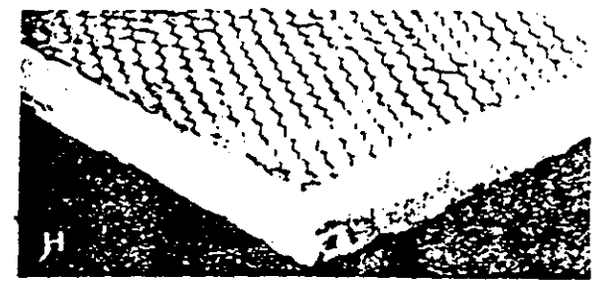
HEAT CAPACITY

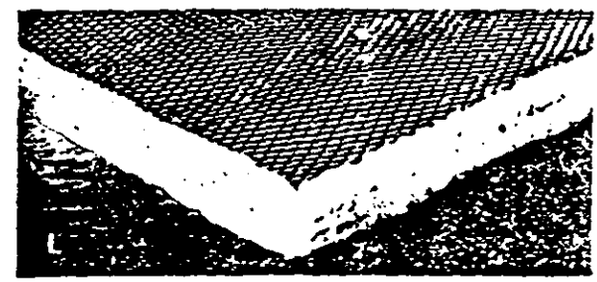
The low heat capacity of Fiberglas Insulating Wool is an advantage in thermal insulation applications where sensitive control and quick response to changing temperature conditions are desired, particularly when the insulated equipment is intermittently operated. Heat capacity is a measure of the amount of heat a material "soaks up" within itself. This storage of heat by materials is responsible for "lag" in heating or cooling an enclosed space; the heat thus accumulated is not only wasted energy but it is often troublesome because it may be emitted long after the desired heating or refrigeration period has ceased.

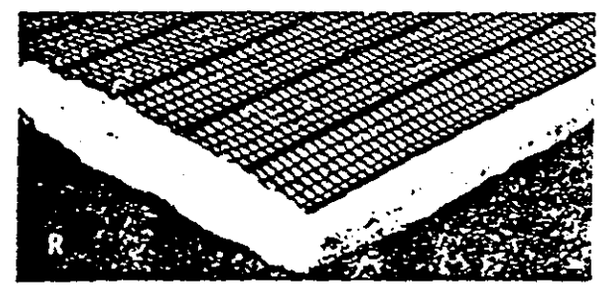
For convenience, heat capacity is given in the table (page 4) in two ways: per board foot (square foot one inch thick) and per cubic foot. The former value permits quick calculation of heat capacity when the thickness and type are known. These values are based on a specific heat of .20 Btu per lb. and do not include the metal facings.

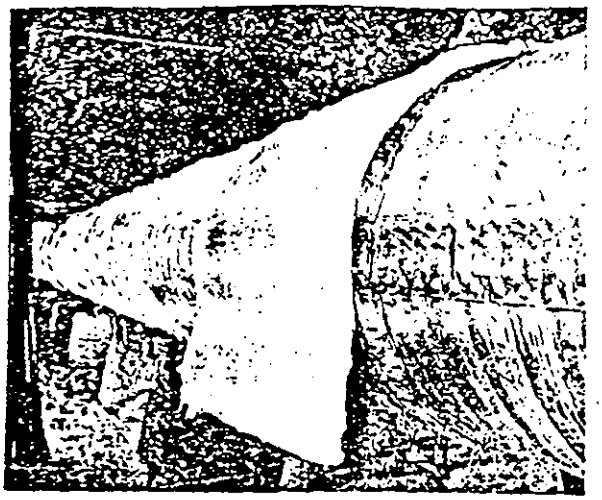
FACING MATERIALS



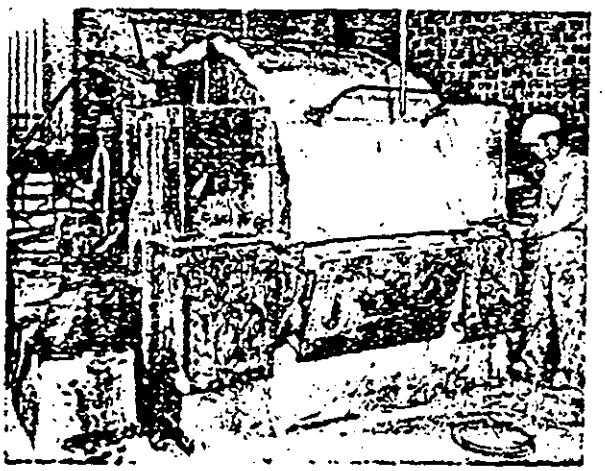




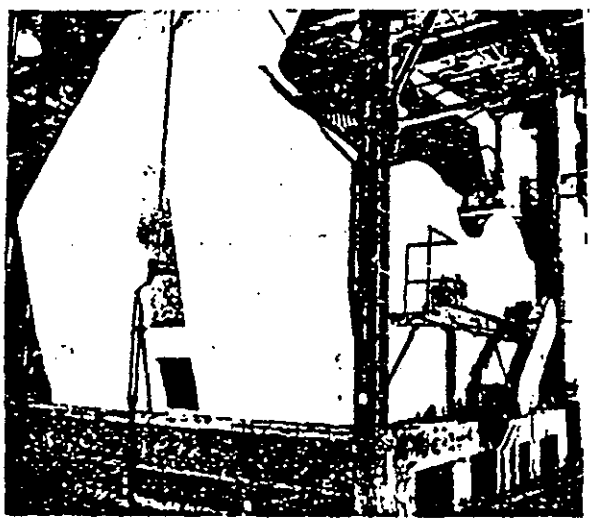




Retort partially covered with Metal Mesh Blankets, Type No. 900. This retort is 140' long and 6' in diameter.



Housing for a hot air blower being insulated with Metal Mesh Blankets, Type No. 900.



Hot air duct insulated with Metal Mesh Blankets, Type No. 900, and covered with Fiberglas Finishing Cement.

HEAT CAPACITY OF FIBERGLAS METAL MESH BLANKETS (Btu per Degree F.)

Blanket Type	Per Sq. Ft., 1" Thick	Per Cu. Ft.
No. 600	.075	.90
No. 900	.10	1.20

PERFORMANCE IN SERVICE

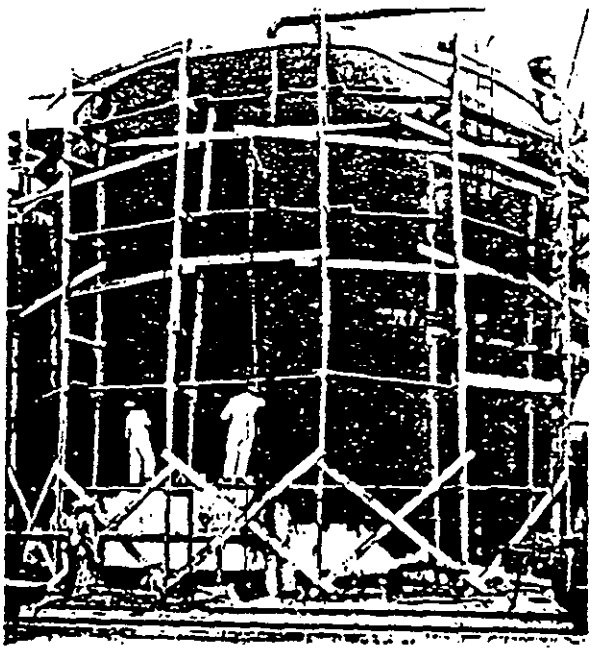
Vibration does not cause Fiberglas Metal Mesh Blankets, properly fastened in place, to settle, sag, or change their original thickness. On the contrary, vibration tends to cause the wool fibers to expand or fluff out and fill any voids in the insulated space.

Non-Corrosive. Severe tests of Fiberglas Insulating Wool, Type TW-F, in contact with both aluminum and steel, during which the test samples were subjected to alternating damp and dry conditions, indicate that these metals are in no wise injured by the presence of the glass fibers. From thousands of installations, there have come no reports to indicate that the binder in No. 600 Blankets has any corrosive effects.

Sanitary. Fiberglas Insulating Wool does not have any odor in itself, nor does it tend to absorb odors. It provides no sustenance for insects, rodents, or other vermin.

LIGHT WEIGHT

The actual net weights per square foot for the various styles of Fiberglas Metal Mesh Blankets are given for Types No. 600 and No. 900 in the tables on page 5. The weights given include the facing material and wire or asbestos cord ties. For shipping weights, see price lists.



Outdoor tank at a large paper mill insulated with Fiberglas Metal Mesh Blankets and Fiberglas Insulating Cement. A coat of O-C Mastic Finish is being applied as a protection against the weather

NET WEIGHTS PER SQUARE FOOT FOR VARIOUS STYLES OF FIBERGLAS METAL MESH BLANKETS

Weights Include Facing Material and Wire Ties

THICKNESS	HEXAGONAL WIRE MESH HO	HEXAGONAL WIRE MESH HH	EXPANDED METAL LATH LO	EXPANDED METAL LATH LL	RIB LATH 3/8" ATRO RATO	HEXAGONAL WIRE MESH 3/8" LATH ATRH RATH	EXP. METAL LATH HL	EXP. METAL LATH 3/8" HI-RIB LATH ATRL RATL	HI-RIB LATH 3/8" Both Sides
TYPE NO. 600 BLANKETS									
1"	.48	.58	.65	.92	.81	.91	.75	1.08	1.25
1½"	.65	.76	.83	1.09	.99	1.09	.93	1.26	1.43
2"	.83	.93	1.00	1.27	1.17	1.26	1.10	1.42	1.60
2½"	1.01	1.11	1.18	1.45	1.35	1.44	1.29	1.61	1.78
3"	1.18	1.28	1.35	1.63	1.53	1.62	1.46	1.78	1.96
3½"	1.36	1.47	1.54	1.81	1.71	1.80	1.64	1.96	2.13
4"	1.54	1.64	1.71	1.98	1.88	1.97	1.81	2.13	2.31
4½"	1.72	1.82	1.89	2.16	2.06	2.15	2.00	2.32	2.49
5"	1.89	1.99	2.06	2.34	2.25	2.34	2.18	2.50	2.67
5½"	2.07	2.17	2.24	2.51	2.41	2.50	2.34	2.66	2.83
6"	2.24	2.35	2.42	2.68	2.58	2.67	2.52	2.85	3.02
TYPE NO. 900 BLANKETS									
1"	.64	.75	.82	1.09	.99	1.09	.92	1.25	1.42
1½"	.91	1.02	1.09	1.36	1.26	1.36	1.19	1.52	1.68
2"	1.17	1.28	1.35	1.62	1.52	1.62	1.45	1.78	1.94
2½"	1.43	1.54	1.61	1.89	1.79	1.89	1.72	2.05	2.21
3"	1.70	1.80	1.87	2.15	2.04	2.14	1.97	2.30	2.46
3½"	1.96	2.07	2.14	2.41	2.31	2.41	2.24	2.57	2.73
4"	2.22	2.33	2.40	2.67	2.57	2.66	2.50	2.83	3.00
4½"	2.48	2.59	2.66	2.93	2.83	2.93	2.77	3.10	3.26
5"	2.75	2.86	2.93	3.20	3.10	3.20	3.04	3.37	3.53
5½"	3.00	3.11	3.18	3.45	3.35	3.45	3.29	3.62	3.79
6"	3.27	3.38	3.45	3.72	3.61	3.71	3.55	3.89	4.05

Note: See Price lists for crated shipping weights.

PACKAGING

All styles of Fiberglas Metal Mesh Blankets are shipped in banded, telescope-type plain cartons, to assure that the material arrives on the job in a clean, undamaged condition. A carton may be easily handled by two men.

PRICES

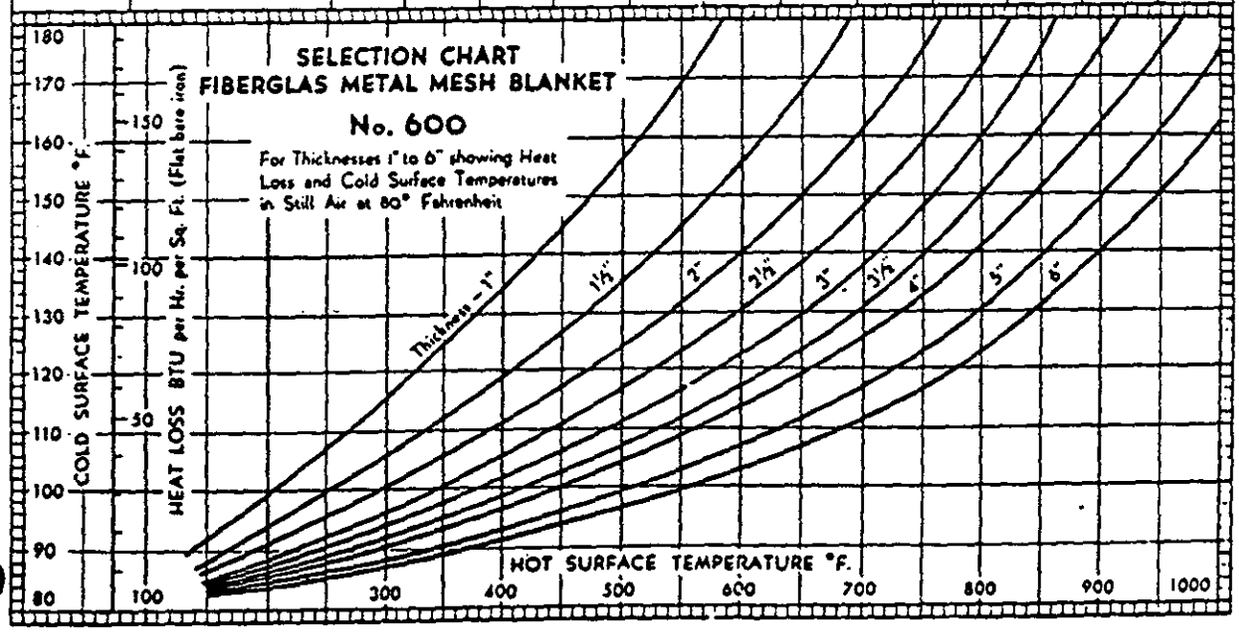
For prices of Fiberglas Metal Mesh Blankets, refer to Fiberglas Standards P4.4.1.

FIBERGLAS METAL MESH BLANKET — No. 600

HEAT LOSSES AND EFFICIENCIES§

Flat Surfaces in Still Air at 80° F.

Temperature of Hot Surface - °F		250	300	350	400	450	500	550	600	700	800	900	1000
Temperature Difference - Hot Surface to Air - °F		170	220	270	320	370	420	470	520	620	720	820	920
Bare Heat Loss - Btu per hour per sq. ft.		430	610	850	1100	1400	1750	2130	2570	3650	5000	6650	8700
Thickness													
1"	Btu Loss	41	56	72	90	111	136	165	196				
	Efficiency %	90.4	90.8	91.5	91.8	92.0	92.2	92.2	92.3				
1½"	Btu Loss	30	40	50	61	77	93	112	133	193			
	Efficiency %	93.0	93.4	94.1	94.4	94.5	94.6	94.7	94.8	94.7			
2"	Btu Loss	23	30	39	48	59	72	83	104	145	213		
	Efficiency %	94.6	95.0	95.4	95.6	95.7	95.8	96.1	96.0	95.9	95.8		
2½"	Btu Loss	18	24	31	38	47	58	70	84	116	170	253	
	Efficiency %	95.9	96.1	96.4	96.5	96.6	96.7	96.7	96.7	96.7	96.6	96.2	
3"	Btu Loss	16	20	26	33	40	49	58	69	98	143	210	310
	Efficiency %	96.3	96.7	96.9	97.0	97.1	97.2	97.3	97.3	97.3	97.2	96.9	96.5
3½"	Btu Loss	13	18	23	29	35	43	51	60	84	120	175	250
	Efficiency %	96.9	97.0	97.3	97.4	97.5	97.5	97.6	97.6	97.6	97.6	97.4	97.2
4"	Btu Loss	11	15	20	25	30	37	44	52	73	104	148	205
	Efficiency %	97.4	97.5	97.6	97.7	97.8	97.9	97.9	97.9	98.0	98.0	97.8	97.7
5"	Btu Loss	9	12	16	20	24	30	36	42	58	83	120	173
	Efficiency %	97.9	98.0	98.1	98.2	98.3	98.3	98.3	98.3	98.4	98.4	98.2	98.1
6"	Btu Loss	8	11	13	16	20	25	30	35	49	70	103	143
	Efficiency %	98.1	98.2	98.5	98.5	98.5	98.5	98.6	98.6	98.7	98.6	98.5	98.4



§Approximate; based on Fiberglas Insulating Wool, Type TW-F.

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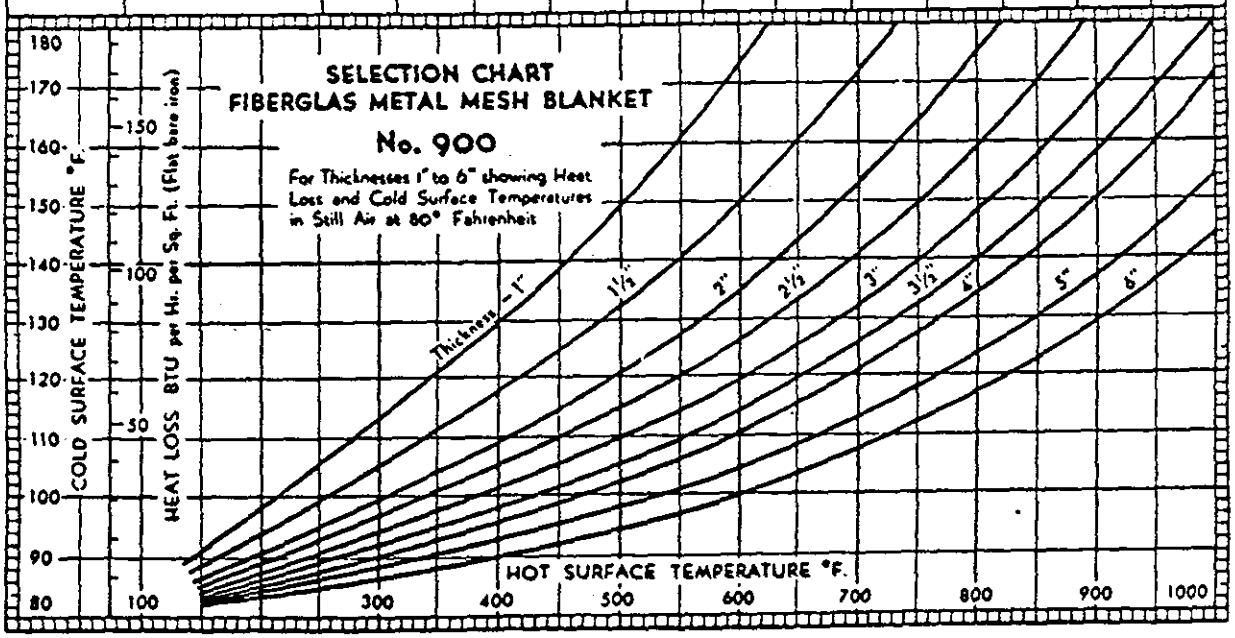
FIBERGLAS METAL MESH BLANKET — No. 900

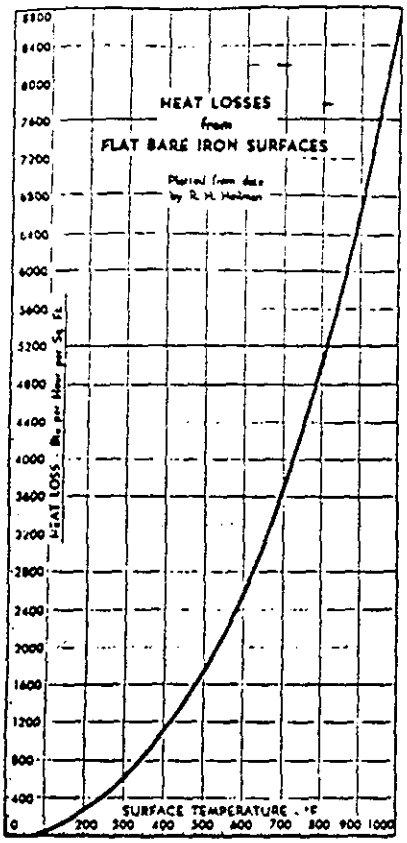
HEAT LOSSES AND EFFICIENCIES§

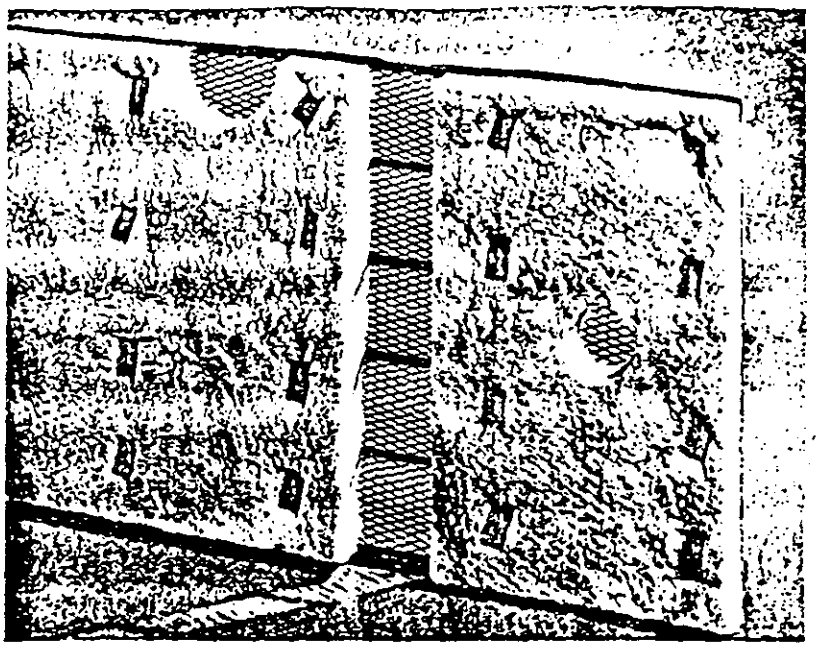
Flat Surfaces in Still Air at 80° F.

Temperature of Hot Surface - °F		250	300	350	400	450	500	550	600	700	800	900	1000
Temperature Difference - Hot Surface to Air - °F		170	220	270	320	370	420	470	520	620	720	820	920
Bare Heat Loss - Btu per hour per sq. ft.		430	610	850	1100	1400	1750	2130	2570	3650	5000	6650	8700
Thickness													
1"	Btu Loss	38	51	65	81	100	120	144	173				
	Efficiency %	91.2	91.6	92.4	92.6	92.9	93.1	93.2	93.3				
1½"	Btu Loss	29	38	48	60	72	86	103	122	169			
	Efficiency %	93.3	93.8	94.3	94.5	94.9	95.1	95.2	95.3	95.4			
2"	Btu Loss	23	29	36	45	54	65	78	92	128	176		
	Efficiency %	94.7	95.2	95.8	95.9	96.1	96.2	96.3	96.4	96.5	96.5		
2½"	Btu Loss	18	24	31	38	45	53	63	75	103	141		
	Efficiency %	95.8	96.1	96.4	96.6	96.8	97.0	97.0	97.1	97.2	97.2		
3"	Btu Loss	16	20	25	31	38	45	53	62	87	119	161	
	Efficiency %	96.3	96.7	97.1	97.2	97.3	97.4	97.5	97.6	97.6	97.6	97.6	
3½"	Btu Loss	13	18	22	27	32	38	45	54	75	102	139	186
	Efficiency %	97.0	97.1	97.4	97.5	97.7	97.8	97.9	97.9	98.0	98.0	97.9	97.9
4"	Btu Loss	11	15	18	23	27	33	39	47	65	90	123	166
	Efficiency %	97.4	97.5	97.9	98.0	98.1	98.1	98.2	98.2	98.2	98.2	98.2	98.1
5"	Btu Loss	9	12	15	19	22	26	31	37	51	71	96	130
	Efficiency %	97.9	98.0	98.2	98.3	98.4	98.5	98.5	98.6	98.6	98.6	98.6	98.5
6"	Btu Loss	7	9	12	15	17	20	25	30	42	58	80	110
	Efficiency %	98.4	98.5	98.6	98.6	98.8	98.9	98.8	98.8	98.8	98.8	98.8	98.7

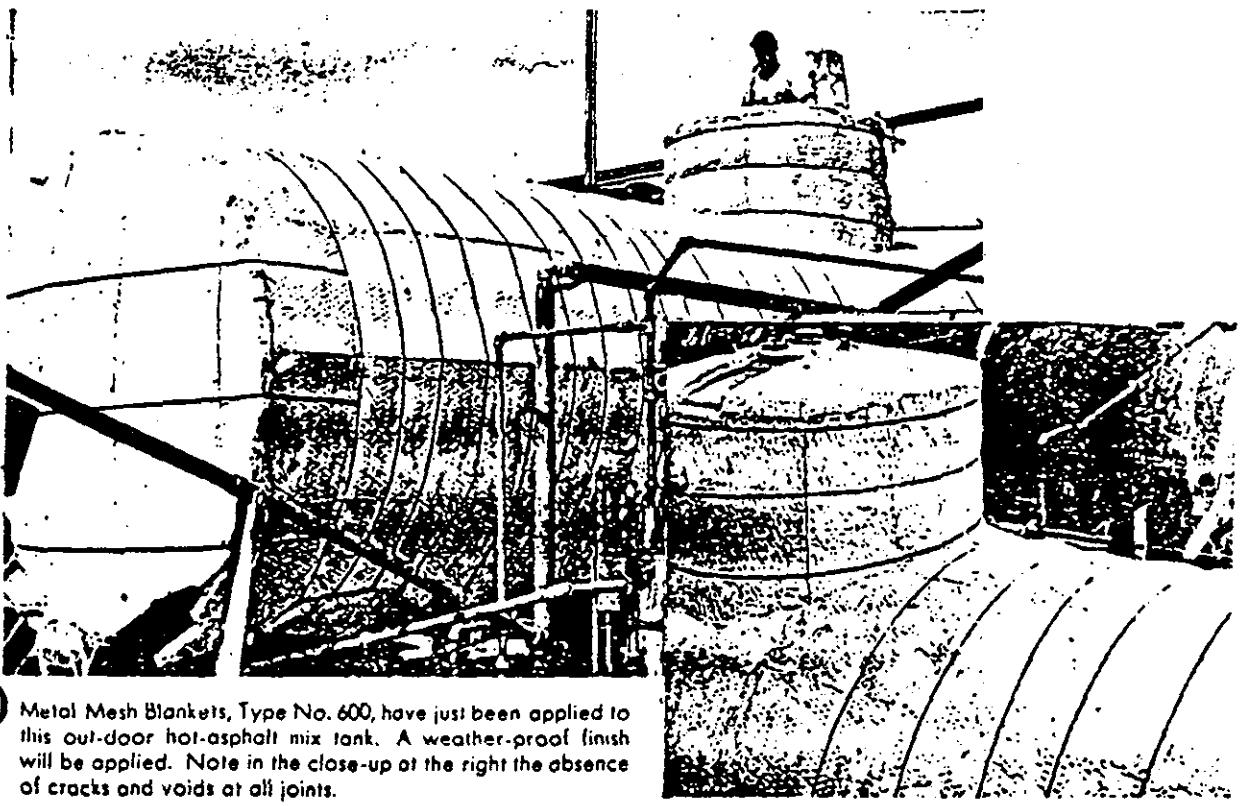


§Approximate; based on Fiberglas Insulating Wool, Type TW-F.





Fiberglas Metal Mesh Blankets, Type No. 600, can be easily cut to conform to surface irregularities.. When cut with sharp knife the edges are left clean and even. As shown in the sample in the picture above, the sections which have been cut are smooth with no breaks or irregularities.



Metal Mesh Blankets, Type No. 600, have just been applied to this out-door hot-asphalt mix tank. A weather-proof finish will be applied. Note in the close-up at the right the absence of cracks and voids at all joints.

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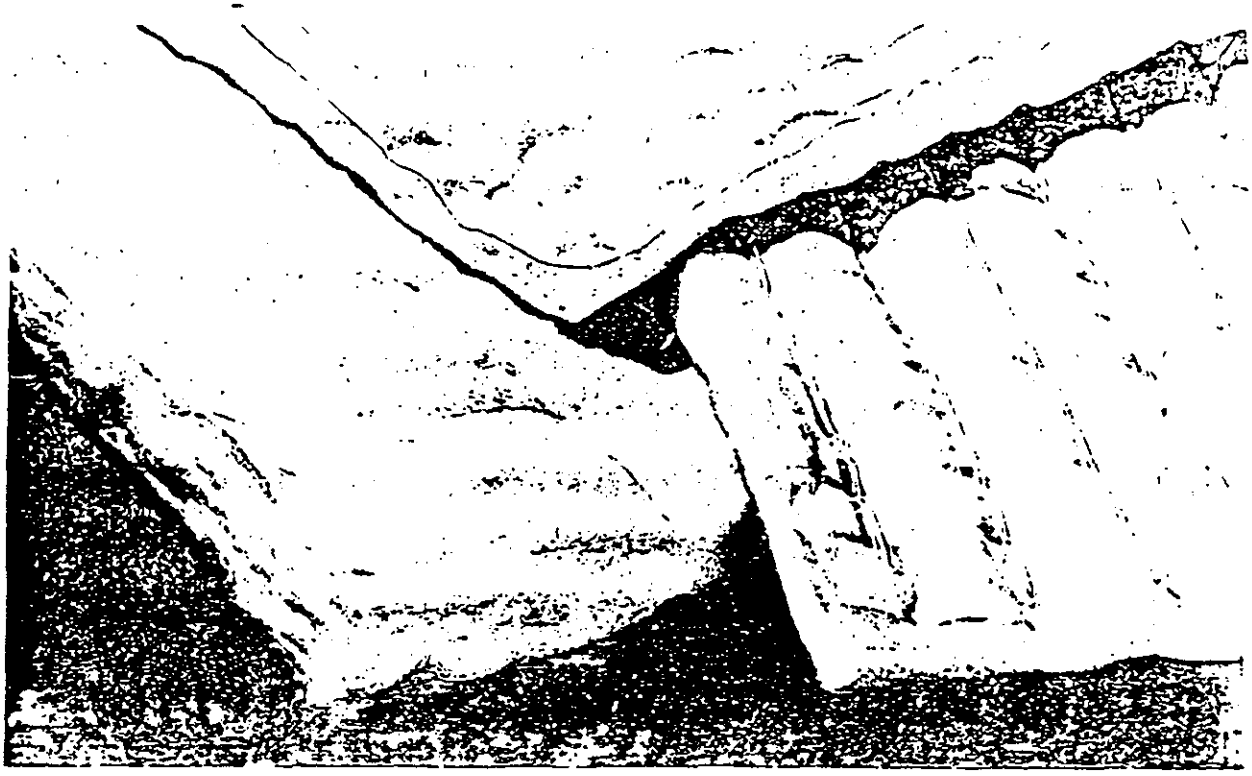
FIBERGLAS STANDARDS
OWENS-CORNING FIBERGLAS CORPORATION

For the duration of the war the specifications herein are subject to modifications without further notice to meet priority and allocation requirements or shortages in purchased materials.

G3.4.1
REVISED MARCH 1, 1944

FIBERGLAS SEWN BLANKETS



FIBERGLAS* Sewn Blankets are fabricated thermal and acoustical insulation materials. They are manufactured from various forms of Fiberglas insulation (a mineral wool made of highly resilient glass fibers) faced on one or both sides with a non-metallic, flexible material such as paper or cloth.

They are available in many forms and are efficient in service, light in weight and easily applied.

AIRCRAFT INDUSTRY

Fiberglas *Aircraft* Blankets are made from Fiberglas Insulating Wool, Type N. This wool, with its almost complete freedom from unfiberized material, results in high thermal insulating efficiency per unit of weight and provides necessary resistance to settling under vibration.

The blankets are available in 1½ lb. and 3 lb. densities, stitched on either 2" or 4" centers and in two basic designs: Design 1 faced on both sides with flameproofed muslin, ends and sides open; Design 3 faced on both sides with Fiberglas Cloth, ends and sides open. The blankets are fire safe. They are used in aircraft to insulate gasoline heater exhausts, heat exchanger ducts, and other high temperature pipes, tubing, ducts, and fittings.

Fiberglas *Aircraft* Galley Equipment Blankets are made of Fiberglas Insulating Wool, Type N, faced on one or both sides with flameproofed muslin. They are used in those parts of galley equipment not exposed to view.

*FIBERGLAS is the trade name (Reg. U. S. Pat. Off.) of glass manufactured in any fiber or filament form by Owens-Corning Fiberglas Corporation.

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ARCTIC APPLICATIONS

Fiberglas Sewn Blankets made of Fiberglas Insulating Wool, Type N, and faced with flameproofed cotton duck, are employed in the arctic regions to insulate tents and huts used as repair shops and as living quarters.

TRANSPORTATION FIELD

Fiberglas Sewn Blankets, faced with flameproofed muslin or Sisalkraft or Kraft paper, are used extensively in refrigerated railway freight cars, railway passenger cars, trucks, trailers and buses.

The facing and the stitching facilitate handling these blankets in large sizes in which they are used in refrigerated freight cars or in applications where the structure requires independent support for the insulation. (Note: In applications where the insulation completely fills the space between the outer and inner surface finishes, such as in trailers and buses, either Fiberglas Insulating Wool, Type TW-F, or Fiberglas PF Insulation may be used for base material.)

NAVAL USES

Fiberglas Sound-Absorbing Blankets, Type N, are made of 3-pound density Fiberglas Insulating Wool, Type N, faced on both sides with flameproofed muslin and stitched on 4" centers with flameproofed cotton thread. They are made to Navy Department Specification 59 B 4 in a standard size of 24" x 48" and in ½", 1", 1½", 2" and 3" thicknesses.

Fiberglas Duct Insulation, Type TW-N, is made of Fiberglas PF Insulation faced on both sides with muslin and stitched

EXHIBIT P

TYPES OF FIBERGLAS SEWN BLANKETS

INSULATIONS	THICKNESSES	DENSITIES (Pounds per Cubic Foot)
Fiberglas Insulating Wool, Type TW-F	Standard: ¾", 1", 1½", 2", 2½", 3", 3½", 4" Special:* ¾" to 3" by ¼" increments	Standard: 3 lbs. Special:* 1½ lbs., 4½ lbs. and 6 lbs.
Fiberglas Insulating Wool, Type N	Standard: 1", 1½", 2" and 3", 3½", 4" ½" (3 lb. density min.)	Standard: 1½ lbs., 3 lbs. Special:* 1½ lbs., 4½ lbs. and 6 lbs.
Fiberglas PF Insulation	Standard: 1", 1½", 2", 3", 4" Special:* ½" to 4" by ¼" increments *Subject to limitations by density.	Standard: 4.25 lbs., 6 lbs. Special: 2.5 lbs., 3.25 lbs. *Subject to thickness limitation.

FACING MATERIALS	SEWING
Muslin, Plain Muslin, Flameproofed Flamsproofed Cotton Duck Fiberglas Cloth	Materials: Cotton thread (for papers and plain cloths). Flameproofed cotton thread (for flameproofed cloths). Fiberglas Thread (for Fiberglas cloths).
	Spacings: Standard, rows 6" on centers. Special, 2" to 8" on centers All chain stitched
Sisalkraft paper Kraft paper (Min. 50-lb.) Reinforced Asbestos paper (special orders only)	Fabrication: Standard, open ends, rectangular shapes. Special, fully enclosed. Blankets may have facings on one or both sides. Double faced blankets may have different facing on each side

DATA FOR DETERMINING WEIGHTS OF FIBERGLAS SEWN BLANKETS

FACING MATERIALS (Lbs. Per Sq. Ft.)		INSULATION (Lbs. Per Sq. Ft.)								
		Density Lbs. Per Cu. Ft.	Thickness							
			½"	⅜"	1"	1½"	2"	2½"	3"	3½"	4"
55 Lb. Sisalkraft	.060	1½	.063	.094	.125	.188	.250	.313	374	.436	.500
Kraft Paper	.026										
14 Lb. Plain Asbestos Paper	.140										
Plain Muslin	.016	2½		.167	.208	.313	.417	.520	.625	.730	.835
Flameproofed Muslin	.017										
Flameproofed Cotton Duck	—	3	.125	.188	.250	.375	.500	.625	.750	.875	1.000
Fiberglas Cloth†	.011										
Cotton Thread §	.004	4½	.185	.282	.375	.565	.750	.937	1.122	1.310	1.500
Flameproofed Cotton Thread §	.006										
Fiberglas Thread §	.008	6	.250	.375	.500	.750	1.000	1.250	1.500	1.750	2.000

Note: The values given are subject to a tolerance of plus and minus 10 per cent.
† Value for ECC-108 Cloth.
§ Value based on stitching on 4" centers.

SOUND ABSORPTION OF FIBERGLAS SEWN BLANKETS*

EXCERPTS FROM TESTS MADE AT RIVERBANK LABORATORIES BY METHODS PRESCRIBED BY ACOUSTICAL MATERIALS ASSN. TO MAR. 1, 1940

Material	Type	Thickness‡	Mounting‡	Coefficients 128	256	512	1024	2048	4096 (4000)	Noise* Reduction Coefficient	Unit Size Tested	Light Reflection Value	Weight Lbs. per Sq. Ft.	Surface	Test No.
FIBERGLAS AIRCRAFT BLANKET (also Decorative Acoustical Blanket.)	Design 3 (Type N Wool) 1.50	1"	2	.26	.40	.70	.93	.88	.82	.75	Strips 22" wide	.73	.18	Fiberglas Cloth	40-12
FIBERGLAS SEWN BLANKETS (Muslin Faced, Styles PM2 or FM2)	TW-F 4D	2"	1	.62	.85	.99	.99	.86	Not tested	.90	Various, 24" x 48" and 24" x 76"		.69	Muslin Facing sewn over plain wool	268

*Noise reduction coefficient is the average of the coefficients at frequencies of 256, 512, 1024 and 2048 cycles, given to the nearest 5 per cent. This average coefficient is recommended for use in comparing materials for noise-quieting purposes as in offices, banks, corridors, etc.
‡ Mounting 1 --Cemented to plaster board.
Mounting 2—Nailed to 1" x 2" wood furring strips, 12" O.C.

on 2" centers with cotton thread. It is made in two classes according to the density of the Fiberglas PF Insulation used: Class A for 4½-lb. density and Class B for 6-lb. density. The purpose of the facing is to provide a base that facilitates cementing the insulation to the duct work and also facilitates the application of a finish of suitable lagging cloth. Fiberglas Duct Insulation, Type TW-N, is made to Navy Department Specification 32 G 5 in the standard sizes of 21" x 48" and 21" x 72" and in thicknesses of ½", ¾" and 1".

Fiberglas Type N Pipe Insulation is made of Fiberglas Insulating Wool, Type N, faced on one side with flameproofed muslin and stitched on 2" centers. The density of the wool is approximately 3 pounds per cubic foot. This product, made to Navy Department Specification 32 G 3, is furnished in the standard width of 2 feet, minimum length 30 feet, and in thicknesses 1", 1¼" and 2". This product may be slit on the job into narrow strips for spiral wrapping, or cut to length and width for straight wrapping.

DOMESTIC BOILER MANUFACTURERS

Fiberglas Sewn Blankets designed to be wrapped completely around a domestic boiler or furnace are fabricated from Fiberglas Insulating Wool, Type TW-F, sewn to a Kraft or reinforced asbestos paper facing. The blankets are made to size within the limits given below. They may be secured in place with metal bands and tie-wires and are easily applied. They provide a highly efficient thermal insulation material.

SOUND-ABSORBING APPLICATIONS

In acoustical applications, Fiberglas Sewn Blankets, fabricated from Fiberglas Thermal and Acoustical Insulations and faced with Fiberglas Cloth or flameproofed muslin, find use in radio studios, motion picture sound studios, and as a fabric ceiling in night clubs and restaurants. The combination of fire-safety and excellent sound-absorbing qualities with unusual decorative and lighting potentialities makes Fiberglas Sewn Blankets a unique material for such applications.

FORMS AND SIZES

Fiberglas Sewn Blankets are made to customers' specifications as to size, thickness, type and density of insulation, stitching and facing materials within the following limits.

Width: Minimum 10", maximum 120".

Length: Minimum 48", maximum limited only by handling and packaging requirements resulting from thickness and size requirements.

Minimum Order: 2000 square feet.

Owens-Corning Fiberglas Corporation, Toledo, Ohio, should be consulted with regard to sizes not obviously or plainly possible either because of wool production limitations or by reason of available widths of facing materials.

PHYSICAL CHARACTERISTICS

Fire-Safety. Fiberglas thermal and acoustical insulations are made of glass to which only a small amount of lubricant or binder is added; hence, they are fire-safe materials. The degree that Fiberglas Sewn Blankets tend to reduce fire hazard depends largely upon the choice of facing materials.

Thermal Conductivity. The thermal conductivity of Fiberglas Insulating Wool, Types TW-F and N, and Fiberglas PF Insulation are shown in the charts at the right. These values are substantially accurate since the effect of various facing materials is practically negligible.

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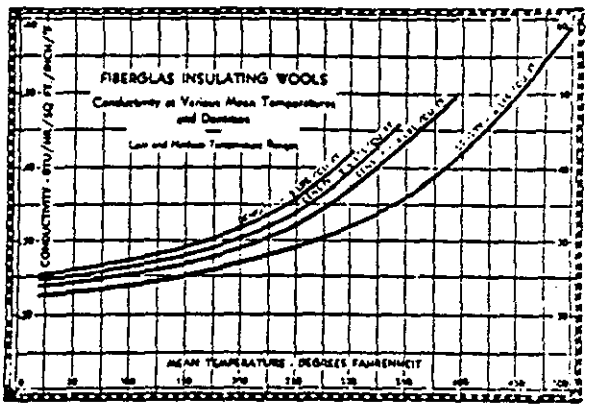
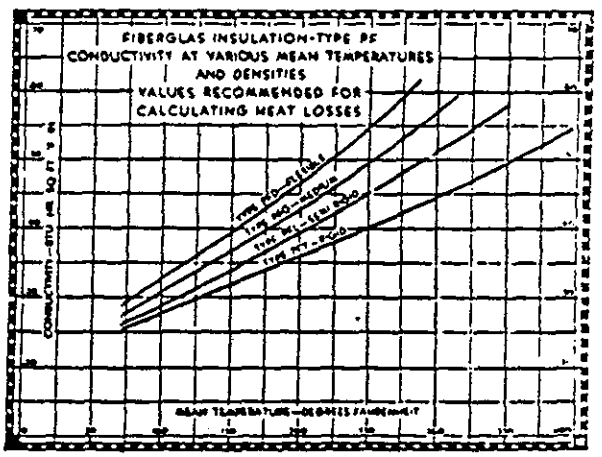
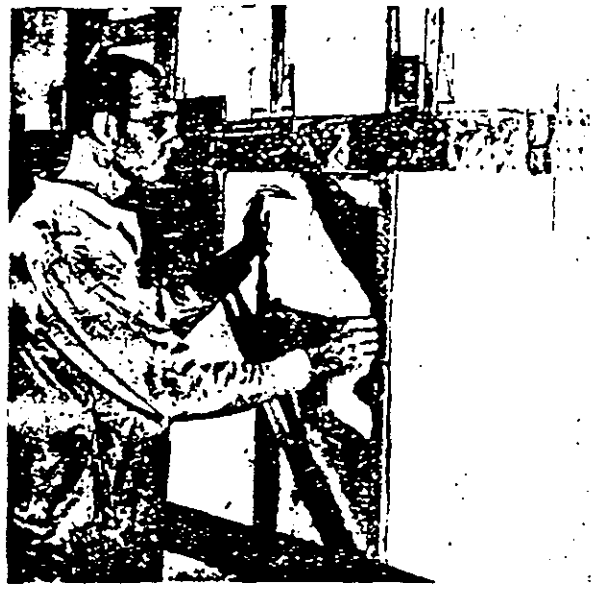
Fiberglas Duct Insulation, Type TW-N, showing Class B at left, which is slightly more rigid than Class A at right. Both classes are of Fiberglas PF insulation faced on both sides with flameproofed muslin.







Fiberglas aircraft cabin insulating blanket being installed on cabin skin of modern transoceanic passenger plane. Light constant weight, resistance to vibration and uniformity of performance make Fiberglas aircraft blankets outstanding for this application.



Fiberglas Sewn Blanket being installed in modern streamline train for heat and sound insulation. Ease of application, light weight, and the ability to withstand grueling vibration without settling make Fiberglas Sewn Blankets particularly applicable in this field.

Temperature Limits. Fiberglas PF Insulation is recommended up to temperatures of 600°F. Fiberglas Insulating Wool, Types TW-F and N, may be used up to 1000°F. Within these ranges, the temperature limits for Fiberglas Sewn Blankets are determined by the temperature limit of the facing material selected.

Vibration does not injure Fiberglas Sewn Blankets. A series of significant tests made on Fiberglas Sewn Blankets show that under service conditions the insulations did not sag, settle or shake down.

Sound Absorption. The sound absorption characteristics of Fiberglas are excellent. Test data are shown on page 2.

Heat Capacity. The heat capacity (the amount of heat that a material stores up in itself) of Fiberglas at a density of 3 pound per cubic foot is .050 Btu per degree F. per square foot 1" thick based on its specific heat of approximately .20 Btu per pound per degree F.

Moisture Adsorption and Vapor Resistance of Fiberglas Sewn Blankets vary with the facing material used. Fiberglas has very low vapor resistance. Tests show that the moisture adsorption of Fiberglas insulation conditioned in a relative humidity of 90% for 96 hours is less than .1% by weight. This combination of characteristics makes Fiberglas a superior insulation in applications where condensation is a common problem.

Weathering properties of Fiberglas Insulating Wool are exceptionally good. This wool, made of chemically stable glass, will withstand repeated wetting and drying.

Non-Corrosive. Severe tests on Fiberglas Insulating Wool in contact with both aluminum and steel, during which the test samples were subjected to alternating damp and dry conditions, indicate that these metals are in no wise injured by the presence of the glass fibers.

Sanitary. Fiberglas Insulating Wool does not have any odor in itself, nor does it tend to absorb odors. It provides no sustenance for insects, rodents or other vermin.

APPLICATION METHODS

Methods of installing Fiberglas Sewn Blankets vary with every application and purpose. In general, blankets used in a horizontal position require no particular support. Under vibration they tend to fluff up or expand so far as the covering will permit and thus retain their designed thickness.

When placed in a vertical position in a panel or vehicle side wall, it is common practice to attach the blanket securely to top and bottom members, making the attachment wherever possible at the stitching points. Fastening in this manner is more important where the panels hang in air spaces without friction against the enclosing walls than when they are enclosed in panels having no extra air space. In the latter case, friction against sides of the insulated enclosure, plus the substantial self-supporting character of the blankets, usually makes further attachment unnecessary.

PACKAGING

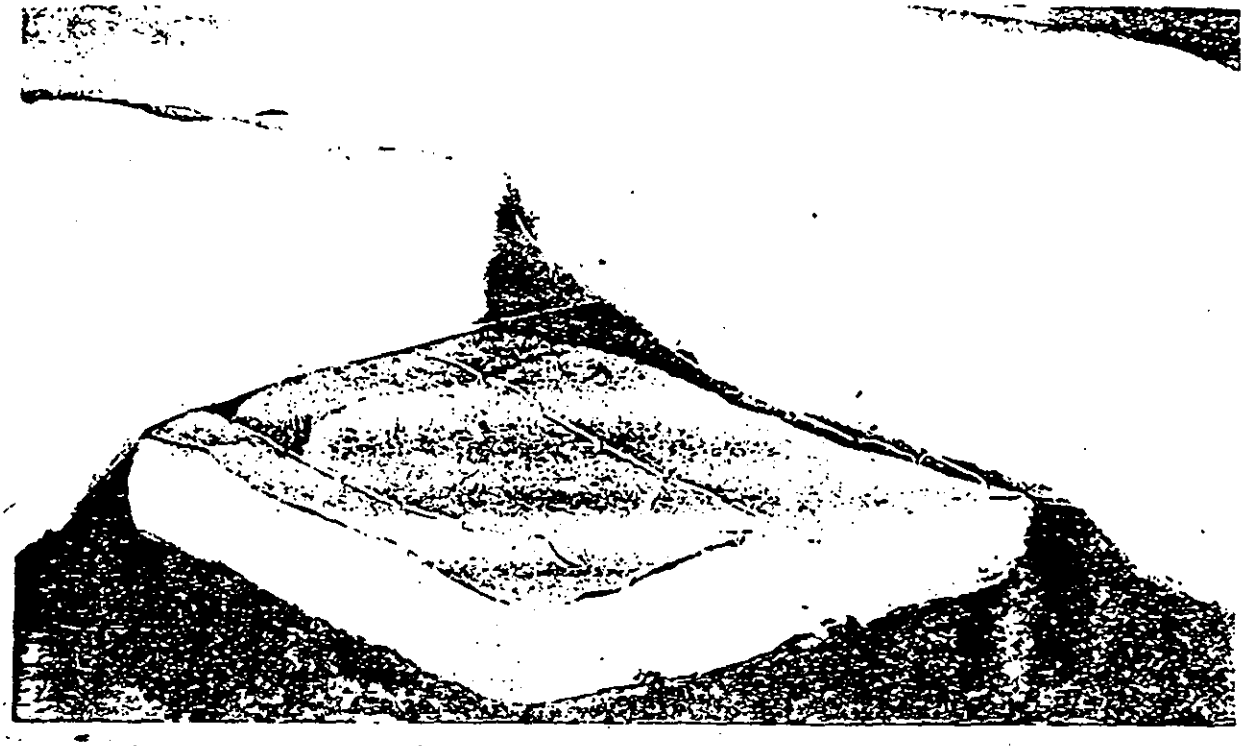
Fiberglas Sewn Blankets are packaged in non-returnable cartons or suitable crates. For minimum quantities and prices, consult the Toledo Office.

FIBERGLAS
STANDARDS
OWENS-CORNING
FIBERGLAS
CORPORATION

For the duration of the war the specifications herein are subject to modifications without further notice to meet priority and allocation requirements or shortages in purchased materials.

D4.4.1
JUNE 1, 1944

FIBERGLAS SEWN BLANKETS



Shown above are Fiberglas Sewn Blankets with three different facings: cotton, Fiberglas and paper.

FIBERGLAS* Sewn Blankets are fabricated thermal and acoustical insulation materials. They are manufactured from various forms of Fiberglas insulation (a mineral wool made of highly resilient glass fibers) faced on one or both sides with a non-metallic, flexible material such as paper or cloth.

They are available in many forms and are efficient in service, light in weight and easily applied.

AIRCRAFT INDUSTRY

Fiberglas Aircraft Blankets are made from Fiberglas Insulating Wool, Type N. This wool, with its almost complete freedom from unfiberized material, results in high thermal insulating efficiency per unit of weight and provides necessary resistance to settling under vibration.

The blankets are available in 1½ lb. and 3 lb. densities, stitched on either 2" or 4" centers, faced on both sides with Fiberglas Cloth, ends and sides open. The blankets are fire safe. They are used in aircraft to insulate gasoline heater exhausts, heat exchanger ducts, and other high temperature pipes, tubing, ducts, and fittings.

Fiberglas Aircraft Galley Equipment Blankets are made of Fiberglas Insulating Wool, Type N, faced on one or both sides with flameproofed muslin. They are used in those parts of galley equipment not exposed to view.

*FIBERGLAS is the trade name (Reg. U. S. Pat. Off.) of glass manufactured in any fiber or filament form by Owens-Corning Fiberglas Corporation.

Note: This sheet supersedes G3.4.1, dated March 1, 1944.

2nd Printing, September, 1944

ARCTIC APPLICATIONS

Fiberglas Sewn Blankets made of Fiberglas Insulating Wool, Type N, and faced with flameproofed cotton duck, are employed in the arctic regions to insulate tents and huts used as repair shops and as living quarters.

TRANSPORTATION FIELD

Fiberglas Sewn Blankets, faced with flameproofed muslin or Sisalkraft or Kraft paper, are used extensively in refrigerated railway freight cars, railway passenger cars, trucks, trailers and buses.

The facing and the stitching facilitate handling these blankets in large sizes in which they are used in refrigerated freight cars or in applications where the structure requires independent support for the insulation. (Note: In applications where the insulation completely fills the space between the outer and inner surface finishes, such as in trailers and buses, either Fiberglas Insulating Wool, Type TW-F, or Fiberglas PF Insulation may be used for base material.)

NAVAL USES

Various types of Fiberglas Sewn Blankets are purchased under Navy Department Specifications to serve specific uses on naval vessels. For complete description of these blankets, see Fiberglas Standards D9.3.1.

(Cont'd on page 3)

EXHIBIT P

TYPES OF FIBERGLAS SEWN BLANKETS

INSULATIONS	THICKNESSES	DENSITIES (Pounds per Cubic Foot)
Fiberglas Insulating Wool, Type TW-F	Standard: ¾", 1", 1½", 2", 2½", 3", 3½", 4" Special:* ¾" to 3" by ¼" increments	Standard: 3 lbs. Special:* 1½ lbs., 4½ lbs. and 6 lbs
Fiberglas Insulating Wool, Type N	Standard: 1", 1½", 2" and 3", 3½", 4" ½" (3 lb. density min.)	Standard: 1½ lbs., 3 lbs. Special: * 1½ lbs., 4½ lbs. and 6 lbs.
Fiberglas PF Insulation	Standard: 1", 1½", 2", 3", 4" Special:* ½" to 4" by ¼" increments *Subject to limitations by density.	Standard: 4.25 lbs., 6 lbs Special: 2.5 lbs., 3.25 lbs. *Subject to thickness limitation.

FACING MATERIALS	SEWING
Muslin, Plain Muslin, Flameproofed Flameproofed Cotton Duck Fiberglas Cloth Sisalkraft paper Kraft paper (Min. 50-lb.) Reinforced Asbestos paper (special orders only)	Materials: Cotton thread (for papers and plain cloths). Flameproofed cotton thread (for flameproofed cloths). Fiberglas Thread (for Fiberglas cloths). Spacings: Standard, rows 6" on centers. Special, 2" to 8" on centers All chain stitched. Fabrication: Standard, open ends, rectangular shapes. Special, fully enclosed. Blankets may have facings on one or both sides. Double faced blankets may have different facing on each side

DATA FOR DETERMINING WEIGHTS OF FIBERGLAS SEWN BLANKETS

FACING MATERIALS (Lbs. Per Sq. Ft.)		INSULATION (Lbs. Per Sq. Ft.)								
		Density Lbs. Per Cu. Ft.	Thickness							
			½"	¾"	1"	1½"	2"	2½"	3"	3½"	4"
55 Lb. Sisalkraft	.060	1½	.063	.094	.125	.188	.250	.313	374	.436	.500
Kraft Paper	.026										
14 Lb. Plain Asbestos Paper	.140										
Plain Muslin	.016	2½		.167	.208	.313	.417	.520	.625	.730	.835
Flameproofed Muslin	.017										
Flameproofed Cotton Duck	—	3	.125	.188	.250	.375	.500	.625	.750	.875	1.000
Fiberglas Cloth†	.011										
Cotton Thread §	.004	4½	.188	.282	.375	.565	.750	.937	1.122	1.310	1.500
Flameproofed Cotton Thread §	.006										
Fiberglas Thread §	.008	6	.250	.375	.500	.750	1.000	1.250	1.500	1.750	2.000

Note: The values given are subject to a tolerance of plus and minus 10 per cent.
† Value for ECC-108 Cloth
§ Value based on stitching on 4" centers.

SOUND ABSORPTION OF FIBERGLAS SEWN BLANKETS*

EXCERPTS FROM TESTS MADE AT RIVERBANK LABORATORIES BY METHODS PRESCRIBED BY ACOUSTICAL MATERIALS ASSN. TO MAR. 1, 1940

Material	Type	Thickness‡	Mounting‡	Coefficients 128	256	512	1024	2048	4096 (4000)	Noise* Reduction Coefficient	Unit Size Tested	Light Reflection Value	Weight Lbs. per Sq. Ft.	Surface	Test No.
FIBERGLAS AIRCRAFT BLANKET (also Decorative Acoustical Blanket)	Design 3 (Type N Wool) 1.50	1"	2	.26	.40	.70	.93	.88	.82	.75	Strips 22" wide	.73	.18	Fiberglas Cloth	40-12
FIBERGLAS SEWN BLANKETS (Muslin Faced, Styles FM2 or FM2)	TW-F 4D	2"	1	.62	.85	.99	.99	.86	Not tested	.90	Various, 24" x 48" and 24" x 76"		.69	Muslin Facing sewn over plain wool	268

*Noise reduction coefficient is the average of the coefficients at frequencies of 256, 512, 1024 and 2048 cycles, given to the nearest 5 per cent. This average coefficient is recommended for use in comparing materials for noise-quieting purposes as in offices, banks, corridors, etc.
‡ Mounting 1—Cemented to plaster board.
Mounting 2—Nailed to 1" x 2" wood furring strips, 12" O.C.

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DOMESTIC BOILER MANUFACTURERS

Fiberglas Sewn Blankets designed to be wrapped completely around a domestic boiler or furnace are fabricated from Fiberglas Insulating Wool, Type TW-F, sewn to a Kraft or reinforced asbestos paper facing. The blankets are made to size within the limits given below under "Forms and Sizes." They may be secured in place with metal bands and tie-wires and are easily applied. They provide a highly efficient thermal insulation material.

SOUND-ABSORBING APPLICATIONS

In acoustical applications, Fiberglas Sewn Blankets, fabricated from Fiberglas Thermal and Acoustical Insulations and faced with Fiberglas Cloth or flameproofed muslin, find use in radio studios, motion picture sound studios, and as a fabric ceiling in night clubs and restaurants. The combination of fire-safety and excellent sound-absorbing qualities with unusual decorative and lighting potentialities makes Fiberglas Sewn Blankets a unique material for such applications.

FORMS AND SIZES

Fiberglas Sewn Blankets are made to customers' specifications as to size, thickness, type and density of insulation, stitching and facing materials within the following limits.

Width: Minimum 10", maximum 120".

Length: Minimum 48", maximum limited only by handling and packaging requirements resulting from thickness and size requirements.

Minimum Order: 2000 square feet.

Owens-Corning Fiberglas Corporation, Toledo, Ohio, should be consulted with regard to sizes not obviously or plainly possible either because of wool production limitations or by reason of available widths of facing materials.

PHYSICAL CHARACTERISTICS

Fire-Safety. Fiberglas thermal and acoustical insulations are made of glass to which only a small amount of lubricant or binder is added; hence, they are fire-safe materials. The degree that Fiberglas Sewn Blankets tend to reduce fire hazard depends largely upon the choice of facing materials.

Thermal Conductivity. The thermal conductivity of Fiberglas Insulating Wool, Types TW-F and N, and Fiberglas PF Insulation are shown in the charts at the right. These values are substantially accurate since the effect of various facing materials is practically negligible.

Temperature Limits. Fiberglas PF Insulation is recommended for temperatures up to 600°F. Fiberglas Insulating Wool, Types TW-F and N, may be used up to 1000°F. Within these ranges, the temperature limits for Fiberglas Sewn Blankets are determined by the temperature limit of the facing material selected.

Vibration does not injure Fiberglas Sewn Blankets. A series of significant tests made on Fiberglas Sewn Blankets show that under service conditions the insulations did not sag, settle or shake down.

Sound Absorption. The sound absorption characteristics of Fiberglas are excellent. Test data are shown on page 2.

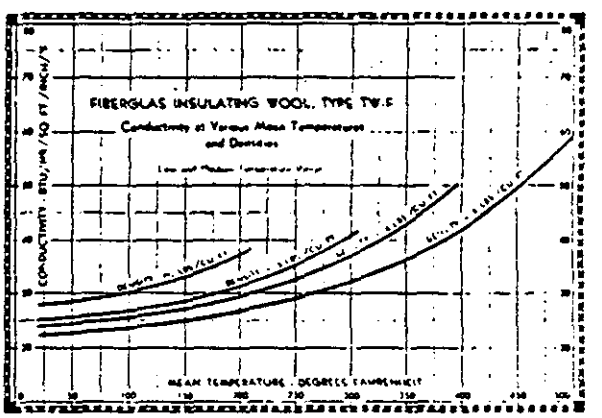
Heat Capacity. The heat capacity (the amount of heat that a material stores up in itself) of Fiberglas at a density of 3 pound per cubic foot is .050 Btu per degree F. per square foot 1" thick based on its specific heat of approximately .20 Btu per pound per degree F.

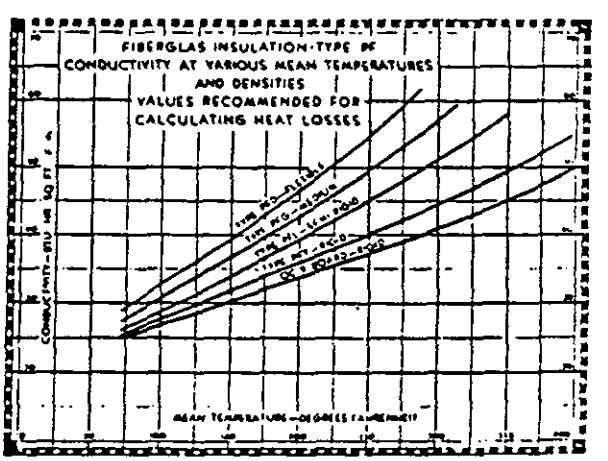
Moisture Adsorption and Vapor Resistance of Fiberglas Sewn Blankets vary with the facing material used. Fiberglas has very low vapor resistance. Tests show that the moisture adsorption of Fiberglas insulation conditioned in a relative humidity of 90% for 96 hours is less than .1% by weight. This combination of characteristics makes Fiberglas a superior insulation in applications where condensation may occasionally be a problem.

Weathering properties of Fiberglas Insulating Wool are exceptionally good. This wool, made of chemically stable glass, will withstand repeated wetting and drying.

Non-Corrosive. Severe tests on Fiberglas Insulating Wool in contact with both aluminum and steel, during which the test samples were subjected to alternating damp and dry conditions, indicate that these metals are in no wise injured by the presence of the glass fibers.

Sanitary. Fiberglas Insulating Wool has no odor in itself, nor does it tend to absorb odors. It provides no sustenance for insects, rodents or other vermin.







Fiberglas aircraft cabin insulating blanket being installed on cabin skin of a transoceanic passenger plane. Light weight, resistance to vibration and fire safety make Fiberglas aircraft blankets outstanding for this application.



Fiberglas Sewn Blankets being installed in a streamline train for heat and sound insulation. Ease of application, light weight, and the ability to withstand vibration make Fiberglas Sewn Blankets particularly applicable in this field.

APPLICATION METHODS

Methods of installing Fiberglas Sewn Blankets vary with every application and purpose. In general, blankets used in a horizontal position require no particular support. Under vibration they tend to fluff up or expand so far as the covering will permit and thus retain their designed thickness.

When placed in a vertical position in a panel or vehicle side wall, it is common practice to attach the blanket securely to top and bottom members, making the attachment wherever possible at the stitching points. Fastening in this manner is more important where the panels hang in air spaces without friction against the enclosing walls than when they are enclosed in panels having no extra air space. In the latter case, friction against sides of the insulated enclosure, plus the substantial self-supporting character of the blankets, usually makes further attachment unnecessary.

PACKAGING

For minimum quantities, prices and packaging, see Fiberglas Standards P4.4.1.

FIBERGLAS STANDARDS
OWENS-CORNING FIBERGLAS CORPORATION

For the duration of the war the specifications herein are subject to modifications without further notice to meet priority and allocation requirements or shortages in purchased materials.

D4.4.1
REVISED
JANUARY 1, 1945

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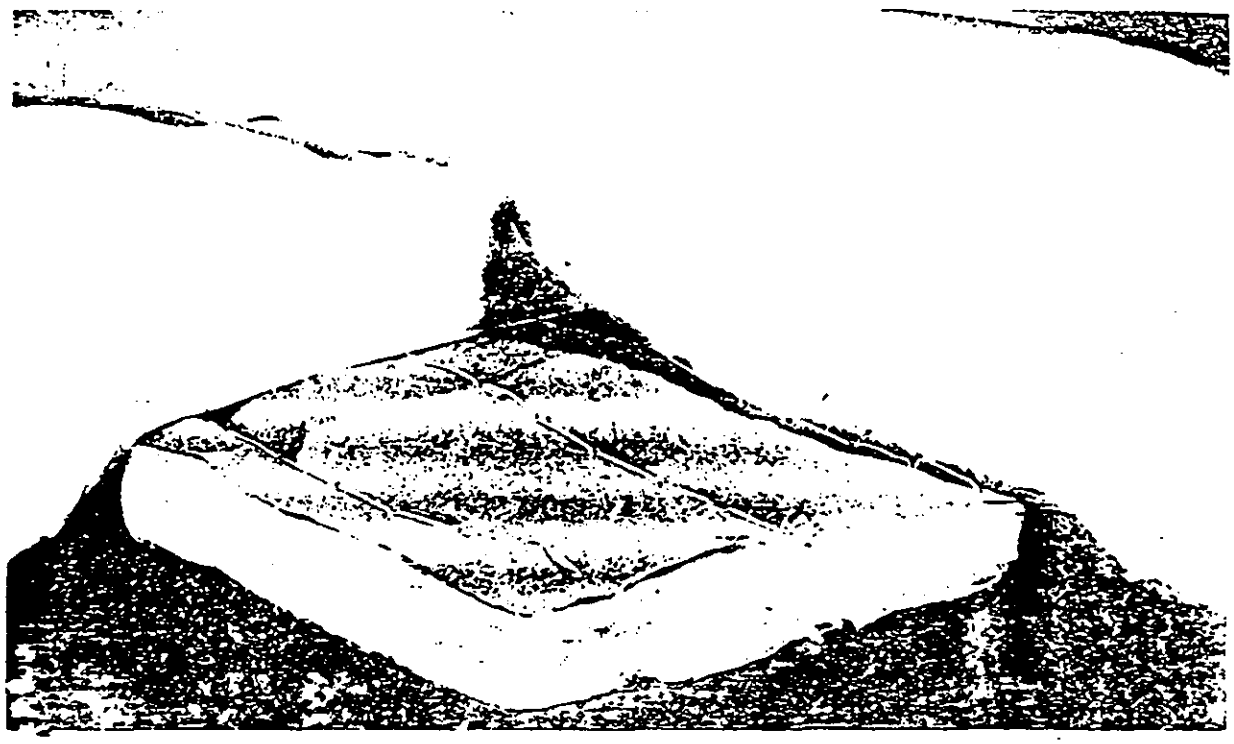
FIBERGLAS SEWN BLANKETS



Shown above are Fiberglas Sewn Blankets with three different facings: muslin, Fiberglas Cloth and paper.

FIBERGLAS* Sewn Blankets are fabricated thermal and acoustical insulation materials. They are manufactured from various forms of Fiberglas insulation (a mineral wool made of highly resilient glass fibers) faced on one or both sides with a non-metallic, flexible material such as paper or cloth.

They are available in many forms and are efficient in service, light in weight and easily applied.

AIRCRAFT INDUSTRY

Fiberglas Aircraft Blankets (for thermal use) are made from Fiberglas Insulating Wool, Type N. This wool, with its almost complete freedom from unfiberized material, results in high thermal insulating efficiency per unit of weight and provides necessary resistance to settling under vibration.

The blankets are available in 1½ lb. and 3 lb. densities, stitched on either 2" or 4" centers, faced on both sides with Fiberglas Cloth, ends and sides open. The blankets are fire safe. They are used in aircraft to insulate gasoline heater exhausts, heat exchanger ducts, and other high temperature pipes, tubing, ducts, and fittings.

*FIBERGLAS is the trade name (Reg. U. S. Pat. Off.) of glass manufactured in any fiber or filament form by Owens-Corning Fiberglas Corporation.

Note: This sheet supersedes D4.4.1, dated June 1, 1944.

ARCTIC APPLICATIONS

Fiberglas Sewn Blankets made of Fiberglas Insulating Wool, Type N, and faced with flameproofed cotton duck, are employed in the arctic regions to insulate tents and huts used as repair shops and as living quarters.

TRANSPORTATION FIELD

Fiberglas Sewn Blankets, faced with flameproofed muslin or Sisalkraft or Kraft paper, are used extensively in refrigerated railway freight cars, railway passenger cars, trucks, trailers and buses.

The facing and the stitching facilitate handling these blankets in large sizes in which they are used in refrigerated freight cars or in applications where the structure requires independent support for the insulation. (Note: In applications where the insulation completely fills the space between the outer and inner surface finishes, such as in trailers and buses, either Fiberglas Insulating Wool, Type TW-F, or Fiberglas PF Insulation may be used for base material.)

NAVAL USES

Various types of Fiberglas Sewn Blankets are purchased under Navy Department Specifications to serve specific uses on naval vessels. For complete description of these blankets, see Fiberglas Standards D9.3.1.

(Cont'd on page 3)

TYPES OF FIBERGLAS SEWN BLANKETS

INSULATIONS	THICKNESSES	DENSITIES (Pounds per Cubic Foot)
Fiberglas Insulating Wool, Type TW-F	Standard: ¾", 1", 1½", 2", 2½", 3", 3½", 4" Special: ¾" to 4" by ¼" increments	Standard: 3 lbs. Special: 1½ lbs. (min. thickness 2"), 4½ lbs., and 6 lbs. (max. thickness 3¾").
Fiberglas Insulating Wool, Type N	Standard: ½", 1", 1½", 2", 3", 3½", and 4". Special: ½" to 4" by ¼" increments.	Standard: 1½ lbs. (min. thickness 1"), 3 lbs Special: 4½ lbs., and 6 lbs. (max. thickness 3¾").
Fiberglas PF Insulation	Consult Toledo Office for available sizes and densities.	

FACING MATERIALS	SEWING
Muslin, Plain Muslin, Flameproofed Flameproofed Cotton Duck Fiberglas Cloth	Materials: Cotton thread (for papers and plain cloths). Flameproofed cotton thread (for flameproofed cloths). Fiberglas Thread (for Fiberglas cloths). Spacings: Standard, rows 6" on centers. Special, 2" (max. blanket width 48") to 8" (min. blanket width 12") on centers. All chain stitched.
Sisalkraft paper Kraft paper (Min. 50-lb.) Reinforced Asbestos paper (special orders only)	Fabrication: Standard, open ends, rectangular shapes. Special, fully enclosed. Blankets may have facings on one or both sides. Double faced blankets may have different facing on each side

DATA FOR DETERMINING WEIGHTS OF FIBERGLAS SEWN BLANKETS

FACING MATERIALS (Lbs. Per Sq. Ft.)		INSULATION (Lbs. Per Sq. Ft.)								
		Density Lbs. Per Cu. Ft.	Thickness							
			½"	⅜"	1"	1½"	2"	2½"	3"	3½"	4"
55 Lb. Sisalkraft	.060	1½	—	—	.125	.188	.250	.313	374	.436	.500
Kraft Paper	.026										
14 Lb. Plain Asbestos Paper	.140	2½	—	.156	.208	.313	.417	.520	.625	.730	.835
Plain Muslin	.016										
Flameproofed Muslin	.017	3	.125	.188	.250	.375	.500	.625	.750	.875	1.000
Flameproofed Cotton Duck	—										
Fiberglas Cloth†	.011										
Cotton Thread §	.004	4½	.188	.282	.375	.563	.750	.937	1.225	1.310	1.313
Flameproofed Cotton Thread §	.006										
Fiberglas Thread §	.008	6	.250	.375	.500	.750	1.000	1.250	1.500	1.750	—

Note: The values given are subject to a tolerance of plus and minus 10 per cent.
† Value for ECC-108 Cloth.
§ Value based on stitching on 4" centers.

SOUND ABSORPTION OF FIBERGLAS SEWN BLANKETS*

EXCERPTS FROM TESTS MADE AT RIVERBANK LABORATORIES BY METHODS PRESCRIBED BY ACOUSTICAL MATERIALS ASSN. TO MAR. 1, 1940

Material	Type Wool and Density	Thickness	Mounting‡	Coefficients 128	256	512	1024	2048	4096 (4000)	Noise* Reduction Coefficient	Unit Size Tested	Light Reflection Value	Weight Lbs. per Sq. Ft.	Facing	Test No.
FIBERGLAS SEWN BLANKET	Type N 1.50 lb.	1"	2	.26	.40	.70	.93	.88	.82	.75	Strips 22" wide	.73	.18	Fiberglas Cloth	40-12
FIBERGLAS SEWN BLANKET	Type TW-F 4 lb.	2"	1	.62	.85	.99	.99	.86	Not tested	.90	Various, 24" x 48" and 24" x 76"		.69	Muslin	268

*Noise reduction coefficient is the average of the coefficients at frequencies of 256, 512, 1024 and 2048 cycles, given to the nearest 5 per cent. This average coefficient is recommended for use in comparing materials for noise-quieting purposes as in offices, banks, corridors, etc.
‡ Mounting 1—Cemented to plaster board.
Mounting 2—Nailed to 1" x 2" wood furring strips, 12" O.C.

DOMESTIC BOILER MANUFACTURERS

Fiberglas Sewn Blankets designed to be wrapped completely around a domestic boiler or furnace are fabricated from Fiberglas Insulating Wool, Type TW-F, sewn to a Kraft or reinforced asbestos paper facing. The blankets are made to size within the limits given below under "Forms and Sizes." They may be secured in place with metal bands and tie-wires and are easily applied. They provide a highly efficient thermal insulation material.

SOUND-ABSORBING APPLICATIONS

In acoustical applications, Fiberglas Sewn Blankets, fabricated from Fiberglas Thermal and Acoustical Insulations and faced with Fiberglas Cloth or flameproofed muslin, find use in radio studios, motion picture sound studios, and as a fabric ceiling in night clubs and restaurants. The combination of fire-safety and excellent sound-absorbing qualities with unusual decorative and lighting potentialities makes Fiberglas Sewn Blankets a unique material for such applications.

FORMS AND SIZES

Fiberglas Sewn Blankets are made to customers' specifications as to size, thickness, type and density of insulation, stitching and facing materials within the following limits.

Width: Minimum 10", maximum 120".

Length: Minimum 48", maximum limited only by handling and packaging requirements resulting from thickness and size requirements.

Minimum Order: 2000 square feet.

Owens-Corning Fiberglas Corporation, Toledo, Ohio, should be consulted with regard to sizes not obviously or plainly possible either because of wool production limitations or by reason of available widths of facing materials.

PHYSICAL CHARACTERISTICS

Fire-Safety. Fiberglas thermal and acoustical insulations are made of glass to which only a small amount of lubricant or binder is added; hence, they are fire-safe materials. The degree that Fiberglas Sewn Blankets tend to reduce fire hazard depends largely upon the choice of facing materials.

Thermal Conductivity. The thermal conductivity of Fiberglas Insulating Wool, Types TW-F and N, and Fiberglas PF Insulation are shown in the charts at the right. These values are substantially accurate since the effect of various facing materials is practically negligible.

Temperature Limits. Fiberglas PF Insulation is recommended for temperatures up to 600°F. Fiberglas Insulating Wool, Types TW-F and N, may be used up to 1000°F. Within these ranges, the temperature limits for Fiberglas Sewn Blankets are determined by the temperature limit of the facing material selected.

Vibration does not injure Fiberglas Sewn Blankets. A series of significant tests made on Fiberglas Sewn Blankets show that under service conditions the insulations did not sag, settle or shake down.

Sound Absorption. The sound absorption characteristics of Fiberglas are excellent. Test data are shown on page 2.

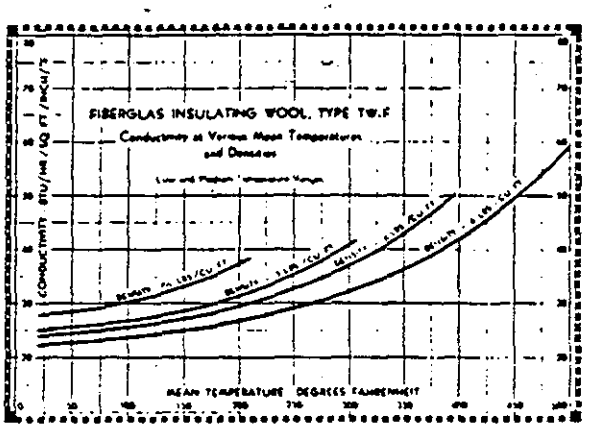
Heat Capacity. The heat capacity (the amount of heat that a material stores up in itself) of Fiberglas at a density of 3 pound per cubic foot is .050 Btu per degree F. per square foot 1" thick based on its specific heat of approximately .20 Btu per pound per degree F.

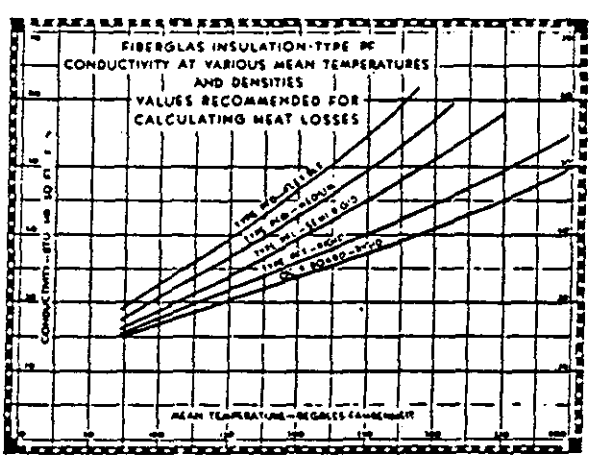
Moisture Adsorption and Vapor Resistance of Fiberglas Sewn Blankets vary with the facing material used. Fiberglas has very low vapor resistance. Tests show that the moisture adsorption of Fiberglas insulation conditioned in a relative humidity of 90% for 96 hours is less than .1% by weight. This combination of characteristics makes Fiberglas a superior insulation in applications where condensation may occasionally be a problem.

Weathering properties of Fiberglas Insulating Wool are exceptionally good. This wool, made of chemically stable glass, will withstand repeated wetting and drying.

Non-Corrosive. Severe tests on Fiberglas Insulating Wool in contact with both aluminum and steel, during which the test samples were subjected to alternating damp and dry conditions, indicate that these metals are in no wise injured by the presence of the glass fibers.

Sanitary. Fiberglas Insulating Wool has no odor in itself, nor does it tend to absorb odors. It provides no sustenance for insects, rodents or other vermin.







Fiberglas aircraft cabin insulating blanket being installed on cabin skin of a transoceanic passenger plane. Light weight, resistance to vibration and fire safety make Fiberglas aircraft blankets outstanding for this application.



Fiberglas Sewn Blankets being installed in a streamline train for heat and sound insulation. Ease of application, light weight, and the ability to withstand vibration make Fiberglas Sewn Blankets particularly applicable in this field.

APPLICATION METHODS

Methods of installing Fiberglas Sewn Blankets vary with every application and purpose. In general, blankets used in a horizontal position require no particular support. Under vibration they tend to fluff up or expand so far as the covering will permit and thus retain their designed thickness.

When placed in a vertical position in a panel or vehicle side wall, it is common practice to attach the blanket securely to top and bottom members, making the attachment wherever possible at the stitching points. Fastening in this manner is more important where the panels hang in air spaces without friction against the enclosing walls than when they are enclosed in panels having no extra air space. In the latter case, friction against sides of the insulated enclosure, plus the substantial self-supporting character of the blankets, usually makes further attachment unnecessary.

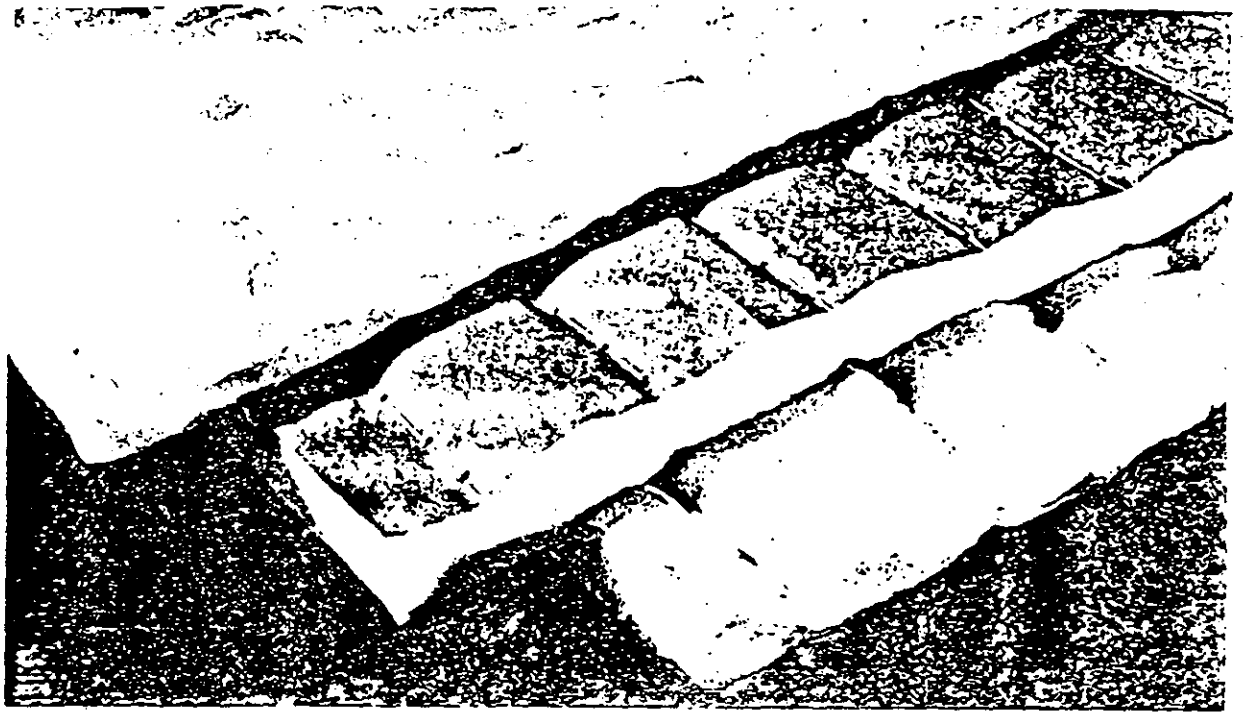
PACKAGING

For minimum quantities, prices and packaging, see Fiberglas Standards P4.4.1.

FIBERGLAS
STANDARDS
OWENS-CORNING
FIBERGLAS
CORPORATION

D4.4.1
REVISED
JUNE 28, 1946

FIBERGLAS SEWN BLANKETS



FIBERGLAS CLOTH FACE PAPER FACE MUSLIN FACE

Shown above are Fiberglas Sewn Blankets with three different facings: Fiberglas Cloth, paper and muslin.

FIBERGLAS* Sewn Blankets are fabricated thermal and acoustical insulation materials. They are manufactured from various forms of Fiberglas insulation (a mineral wool made of highly resilient glass fibers) faced on one or both sides with a non-metallic, flexible material such as paper or cloth.

They are available in many forms and are efficient in service, light in weight and easily applied.

SOUND-ABSORBING APPLICATIONS

In acoustical applications, Fiberglas Sewn Blankets, fabricated from Fiberglas insulating wools and faced with Fiberglas Cloth or flameproofed muslin, find use in radio studios and motion picture sound studios. The combination of fire-safety and excellent sound-absorbing qualities makes Fiberglas Sewn Blankets a unique material for such applications.

TRANSPORTATION FIELD

Fiberglas Sewn Blankets are used extensively in refrigerated railway freight cars, railway passenger cars, trucks, trailers, and buses. The facing and the stitching facilitate handling these blankets in large sizes.

*FIBERGLAS is the trade name (Reg. U. S. Pat. Off.) of glass manufactured in any fiber or filament form by Owens-Corning Fiberglas Corporation.

Note: This sheet supersedes D4.4.1, dated January 1, 1945, and D9.3.1, dated June 1, 1944.

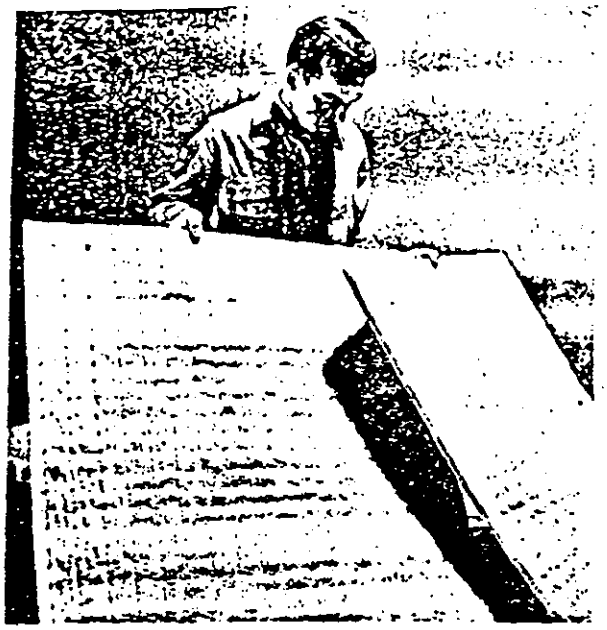
In low temperature applications in refrigerated freight cars and trailers, flameproof muslin or Sisalkraft or Kraft paper face is usually used. Sewn Blankets faced with Fiberglas Cloth are used to insulate exhausts, heater ducts, and other high temperature pipes and fittings or wherever a completely noncombustible blanket is required.

PORTABLE SHELTERS

Fiberglas Sewn Blankets are used to insulate tents and huts used as shops or living quarters. This application has been thoroughly tested in military services in arctic regions. The light weight of the Fiberglas insulation contributes to ease in moving the unit, and the blankets are unaffected by rolling or folding. Insulated huts of this nature are suitable for construction, ranching, and forestry projects where short-term installations that provide warm living quarters and work areas are needed.

DOMESTIC BOILER MANUFACTURERS

Fiberglas Sewn Blankets designed to be wrapped completely around a domestic boiler or furnace are fabricated from Fiberglas Insulating Wool, Type TW-F, sewn to a Kraft or reinforced asbestos paper facing. The blankets are made to size within the limits given on Page 3 under "Forms and Sizes." They are easily applied and may be secured in place with metal bands and tie-wires. They provide a highly efficient thermal insulating material.



Fiberglas Duct Insulation, Type TW-N, showing Class B at left, which is slightly more rigid than Class A at right. Both classes are made with Fiberglas PF Insulation faced on both sides with flameproofed muslin.

NAVAL USES

Various types of Fiberglas Sewn Blankets are purchased under Navy Department Specifications to serve specific uses on naval vessels. The following are standard forms.

Fiberglas Sound-Absorbing Blankets, Type N, are made of 3-lb. density Fiberglas Insulating Wool, Type N, faced on both sides with flameproofed muslin and stitched on 4" centers with flameproofed cotton thread. They are purchased under Navy Department Specification 59 B 4 in a standard size of 24" x 48" and in ½", 1", 1½", 2" and 3" thicknesses.

Fiberglas Duct Insulation, Type TW-N, is made of Fiberglas PF Insulation faced on both sides with muslin and stitched on 2" centers with cotton thread. It is made in two classes according to the density of the Fiberglas PF Insulation used; Class A for 4½-lb. density and Class B for 6-lb. density. The purpose of the facing is to provide a base that facilitates cementing the insulation to the duct work and also facilitates the application of a finish of suitable lagging cloth. Fiberglas Duct Insulation, Type TW-N, is purchased under Navy Department Specification 32 G 5 in the standard sizes of 24" x 48" and 24" x 72" and in thicknesses of ½", ¾" and 1".

PHYSICAL CHARACTERISTICS

Fire-Safety. Fiberglas insulations are made of glass to which only a small amount of lubricant or binder is added; hence, they are fire-safe materials. The degree that Fiberglas Sewn Blankets tend to reduce fire hazard depends largely upon the choice of facing materials.

Temperature Limits. Fiberglas PF Insulation is recommended for temperatures up to 600°F. Fiberglas Insulating Wool, Types TW-F and N, may be used up to 1000°F. Within these ranges, the temperature limits are determined by facing material selected.

Moisture Adsorption and Vapor Resistance of Fiberglas Sewn Blankets vary with the facing material used. Fiberglas insulation has very low vapor resistance. Tests show that the moisture adsorption of Fiberglas insulation conditioned in a relative humidity of 90 percent for 96 hours is less than .1 percent by weight. This combination of characteristics makes Fiberglas a superior insulation in applications where condensation may occasionally be a problem.

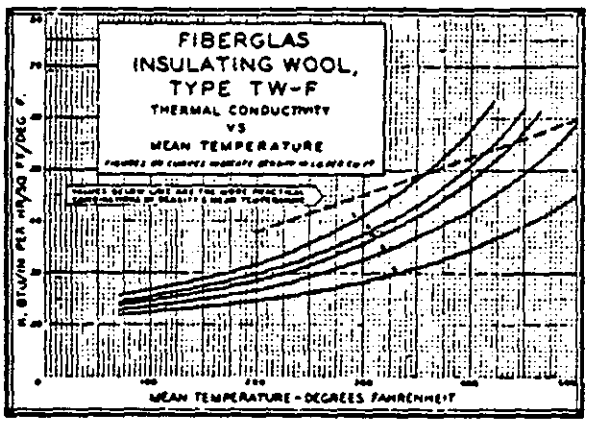
Non-Corrosive. Severe tests on Fiberglas insulating wool in contact with both aluminum and steel, during which the test samples were subjected to alternating damp and dry conditions, indicate that these metals are in nowise injured by the presence of the glass fibers.

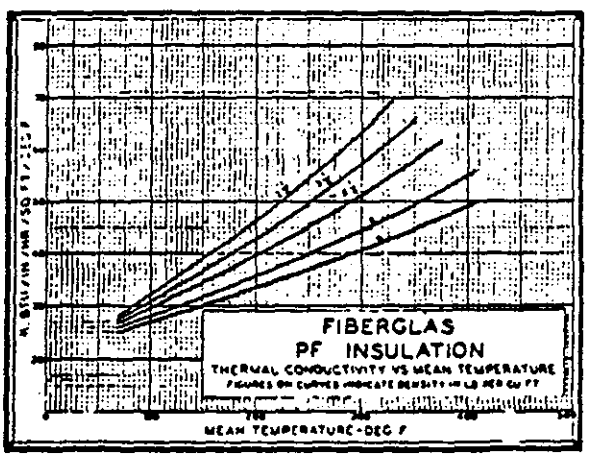
Sanitary. Fiberglas insulating wool has no odor in itself, nor does it tend to absorb odors. It provides no sustenance for insects, rodents or other vermin.

Weathering properties of Fiberglas insulating wool are exceptionally good. Accelerated weathering tests in which Fiberglas materials were apparently unchanged after the equivalent of 40 years exposure assure long insulation life.

Heat Capacity. The heat capacity (the amount of heat that a material stores up in itself) of Fiberglas insulation at a density of 3 pounds per cubic foot is .050 Btu per degree F. per square foot 1" thick based on its specific heat of approximately .20 Btu per pound per degree F.

Thermal Conductivity. The thermal conductivities of Fiberglas Insulating Wool, Type TW-F, and Fiberglas PF Insulation are shown in the charts below. The thermal conductivity of Type N is similar to Type TW-F.





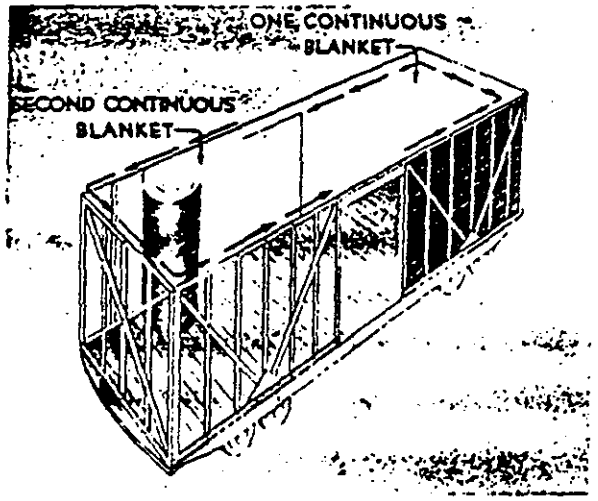


Fiberglas Sewn Blankets being installed in a streamline train for heat and sound insulation. Ease of application, light weight, and the ability to withstand vibration make Fiberglas Sewn Blankets particularly applicable in this field.

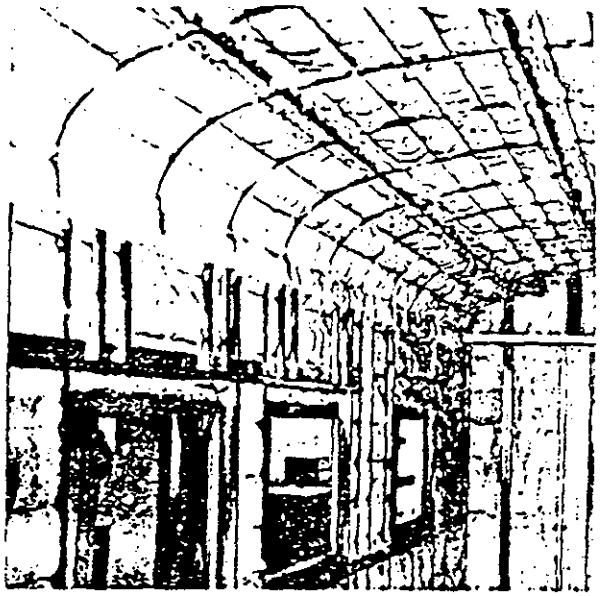
Vibration does not injure Fiberglas Sewn Blankets. A series of significant tests in which Fiberglas sewn blankets were subjected to more than a million ½-inch vibrations at the rate of 250 per minute show that under service conditions the insulation did not sag, settle, or shake down.

SOUND ABSORPTION

The sound absorption qualities of Fiberglas are excellent, particularly at low frequencies. Results of tests made at Riverbank Laboratories are shown on page 4. Although these tests were made on blankets of only 1" Type N Wool and 2" Type TW-F Wool, experience with other Fiberglas acoustical products indicates substantial increases in noise reduction with increased thickness or density.



Fiberglas Sewn Blankets can be made large enough so that one blanket, some 60 feet long, will reach from door to door of a refrigerator freight car.



The interior of the completely insulated streamline car above demonstrates the installation advantage of Fiberglas Sewn Blankets. No support is needed to hold the blankets in place until the finish is applied.

APPLICATION METHODS

Methods of installing Fiberglas Sewn Blankets vary with every application and purpose. In general, blankets used in a horizontal position require no support.

When placed in a vertical position in a panel or vehicle side wall, it is common practice to attach the blanket securely to top and bottom members, making the attachment wherever possible at the stitching points. Fastening in this manner is more important where the blankets hang in air spaces without friction against the enclosing walls than when they are enclosed in panels having no extra air space. In the latter case, friction against sides of the insulated enclosure, plus the substantial self-supporting character of the blankets, usually makes further attachment unnecessary.

FORMS AND SIZES

Fiberglas Sewn Blankets are made to customers' specifications as to size, thickness, type and density of insulation, stitching and facing materials within the following limits.

Width: Open edge blankets: minimum 10"; maximum 120".

Enclosed edge blankets: minimum 24"; maximum: 1" thick—115"; 2" thick—111"; 3" thick—108"; 4" thick—104".

Length: Minimum 48", maximum limited only by handling and packaging requirements resulting from thickness and size requirements.

Owens-Corning Fiberglas Corporation, Toledo, Ohio, should be consulted with regard to sizes not obviously or plainly possible either because of wool production limitations or by reason of available widths of facing materials.

PACKAGING

For minimum quantities, prices and packaging, see Fiberglas Standards P4.4.1.

TYPES OF FIBERGLAS SEWN BLANKETS

INSULATIONS	THICKNESSES	DENSITIES (Pounds per Cubic Foot)
Fiberglas Insulating Wool, Type TW-F	Standard: ¾", 1", 1½", 2", 2½", 3", 3½", 4" Special: ¾" to 4" by ¼" increments	Standard: 3 lbs. Special: 1½ lbs. (min. thickness 2"), 4½ lbs., and 6 lbs. (max. thickness 3¾").
Fiberglas Insulating Wool, Type N	Standard: ½", 1", 1½", 2", 3", 3½", and 4". Special: ½" to 4" by ¼" increments.	Standard: 1½ lbs. (min. thickness 1"), 3 lbs. Special: 4½ lbs., and 6 lbs. (max. thickness 3¾").
Fiberglas PF Insulation	Consult Toledo Office for available sizes and densities other than those listed under Fiberglas Duct Insulation, Type TW-N.	

FACING MATERIALS	SEWING
Muslin, Plain Muslin, Flameproofed Flameproofed Cotton Duck Fiberglas Cloth	Materials: Cotton thread (for papers and plain cloths). Flameproofed cotton thread (for flameproofed cloths). Fiberglas Thread (for Fiberglas cloths). Spacings: Standard, rows 6" on centers. Special, 2" (max. blanket width 48") to 8" (min. blanket width 12") on centers. All chain stitched.
Sisalkraft paper Kraft paper (Min. 50-lb.) Reinforced Asbestos paper (special orders only)	Fabrication: Standard, open ends, rectangular shapes. Special, fully enclosed. Blankets may have facings on one or both sides. Double faced blankets may have different facing on each side

DATA FOR DETERMINING WEIGHTS OF FIBERGLAS SEWN BLANKETS

FACING MATERIALS (Lbs. Per Sq. Ft.)	
55 Lb. Sisalkraft	.060
Kraft Paper	.026
14 Lb. Plain Asbestos Paper	.140
Plain Muslin	.016
Flameproofed Muslin	.017
Flameproofed Cotton Duck	—
Fiberglas Cloth †	.011
Cotton Thread §	.004
Flameproofed Cotton Thread §	.006
Fiberglas Thread §	.008

INSULATION (Lbs. Per Sq. Ft.)									
Density Lbs. Per Cu. Ft.	Thickness ½"	¾"	1"	1½"	2"	2½"	3"	3½"	4"
1½	—	—	.125	.188	.250	.313	374	.436	.500
2½	—	.156	.208	.313	.417	.520	.625	.730	.835
3	.125	.188	.250	.375	.500	.625	.750	.875	1.000
4½	.188	.282	.375	.563	.750	.937	1.225	1.310	1.313
6	.250	.375	.500	.750	1.000	1.250	1.500	1.750	—

Note: The values given are subject to a tolerance of plus and minus 10 per cent.
† Value for No. 108 Cloth.
§ Value based on stitching on 4" centers.

SOUND ABSORPTION OF FIBERGLAS SEWN BLANKETS

EXCERPTS FROM TESTS MADE AT RIVERBANK LABORATORIES BY METHODS PRESCRIBED BY ACOUSTICAL MATERIALS ASSN. TO MAR. 1, 1940

Material	Type Wool and Density	Thickness	Mounting‡	Coefficients 128	256	512	1024	2048	4096 (4000)	Noise† Reduction Coefficient	Unit Size Tested	Light Reflection Value	Weight Lbs. per Sq. Ft.	Facing	Test No.
FIBERGLAS SEWN BLANKET	Type N 1.50 lb.	1"	2	.26	.40	.70	.93	.88	.82	.75	Strips 22" wide	.73	.18	Fiberglas Cloth	40-12
FIBERGLAS SEWN BLANKET	Type TW-F 4 lb.	2"	1	.62	.85	.99	.99	.86	Not tested	.90	Various, 24" x 48" and 24" x 76"		.69	Muslin	268

†Noise reduction coefficient is the average of the coefficients at frequencies of 256, 512, 1024 and 2048 cycles, given to the nearest 5 per cent. This average coefficient is recommended for use in comparing materials for noise-quieting purposes as in offices, banks, corridors, etc.
‡ Mounting 1—Cemented to plaster board.
Mounting 2—Nailed to 1" x 2" wood furing strips, 12" O.C.

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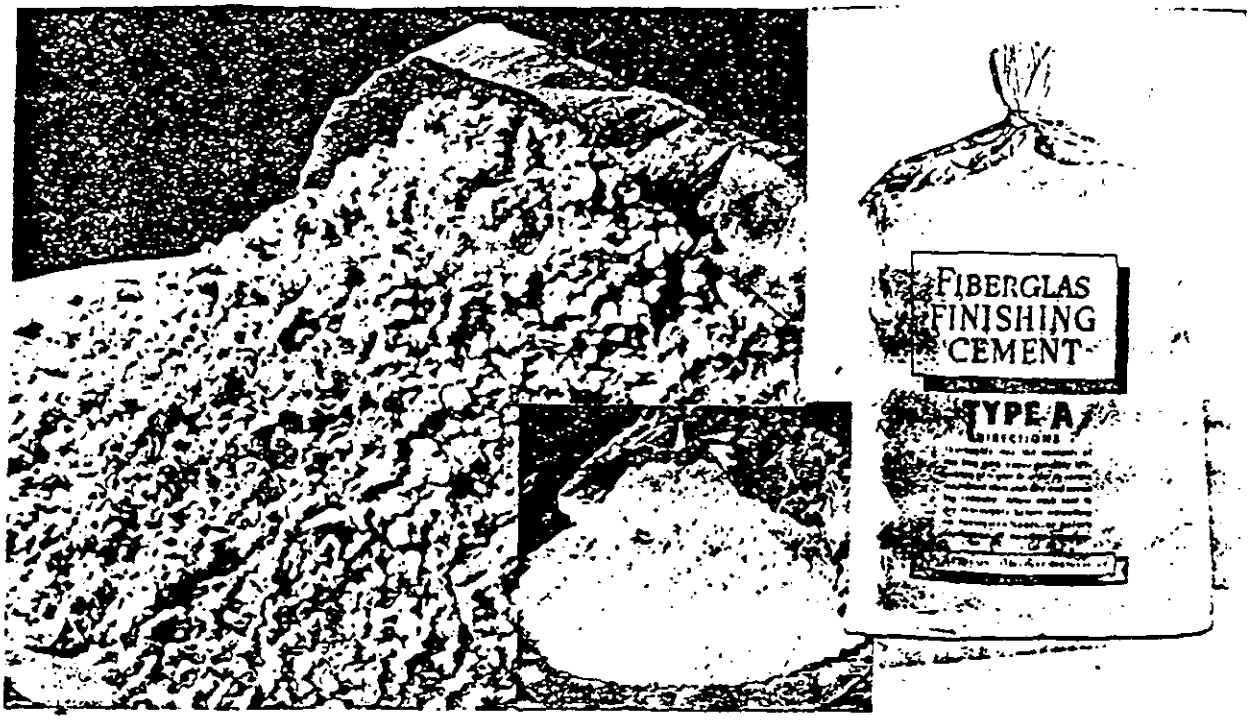
#133

FIBERGLAS STANDARDS
OWENS-CORNING FIBERGLAS CORPORATION

For the duration of the war the specifications herein are subject to modifications without further notice to meet priority and allocation requirements or shortages in purchased materials.

G5.4.1
REVISED
FEB. 12, 1944

FIBERGLAS INSULATING CEMENT—FIBERGLAS FINISHING CEMENTS—O-C MASTIC FINISH



Fiberglas Insulating Cement (left) is made up of pellets of Fiberglas Wool containing almost countless dead air cells. The cement, mixed, applied and dried, is actually a porous mat of dead air cells assuring low thermal conductivity. Fiberglas Finishing Cement (center) provides a suitable finish; it is not used primarily for insulating purposes.

FIBERGLAS* INSULATING CEMENT may be applied on almost any kind of equipment that produces or transfers heat. It provides a monolithic insulation for pipes, tanks, ovens and other types of heated equipment, both regular or irregular shapes, indoors and out, combining excellent thermal insulating value, ease of application and appearance. It may be used over steel, brick, and insulation blocks and blankets. When located outdoors or exposed to moisture or abrasion, a jacket of sheet metal or roofing felt or a coating of O-C Mastic Finish should be applied to protect the cement.

Fiberglas Insulating Cement is made of nodulated Fiberglas Insulation, dry-mixed with refractory-type materials. It is easily mixed on the job. Approximately 32 to 36 gallons of clean fresh water should be used for each 100 lbs. of dry cement. When the cement is to be used on a hot porous surface such as fire brick, an additional 4 gallons per 100 lbs. of cement should be used. When applied and dried, it comprises countless dead air cells that assure low conductivity.

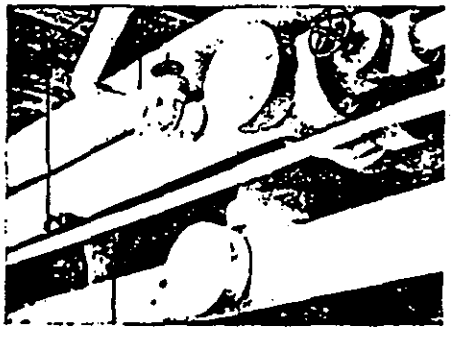
Fiberglas Insulating Cement is easy to apply, a feature that lowers installation time. Other advantages include full reclaimability up to 1000°F., low shrinkage or drying, good adhesive strength, and the provision of an excellent base for either Fiberglas Finishing Cements or O-C Mastic Finish.

Thermal Conductivity of Fiberglas Insulating Cement is not more than .75 Btu sq. ft. per hour, per degree F. temperature difference, per inch thickness of material, at a mean temperature of 300°F.; and .64 Btu at 100°F. mean temperature. (See chart on page 2 for conductivity at various mean temperatures.)

FIBERGLAS FINISHING CEMENTS, TYPES A AND B, are used to provide excellent finished appearance for insulated pipes, tanks, ovens, and other heated equipment.

Fiberglas Finishing Cements are made of light-density Fiberglas material combined with asbestos fibers and suitable binders. They are easily mixed with approximately 15 to 15¼ gallons of clean water for each 100 lbs. of cement used. They may be used as a scratch coat, finish coat, or both. While providing some insulating value, they are not

*Fiberglas is the trade name (Reg. U. S. Pat. Off.) of glass manufactured in any fiber or filament form by Owens-Corning Fiberglas Corporation.

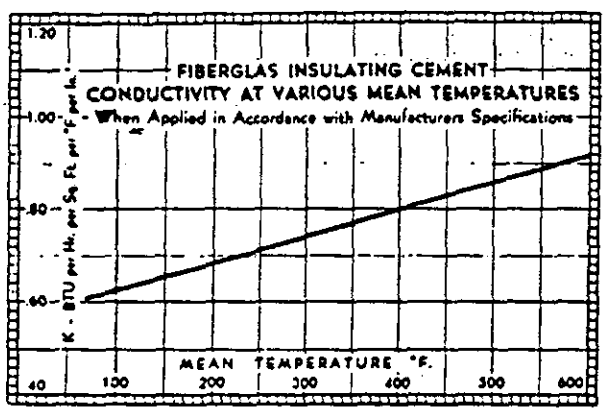


Here are flanges covered with Fiberglas Finishing Cement. Appearance reflects the enduring performance of the product in actual use.

RECOMMEND THICKNESS FOR INSULATING CEMENT*

°F	Thickness (inches)
Up to 199	1
200 to 399	1½
400 to 499	2½
500 to 599	3
600 to 699	3½
700 to 899	4
900 to 1099	4½
1100 to 1299	5
1300 to 1599	5½

* Usually applied ½" thick over blankets and blocks as a base coat for desired finish. For built-up applications on irregular surfaces, thicknesses may be used up to the practical limit.



recommended primarily for insulating purposes. They are true finishing cements and are not reclaimable.

Type A Finishing Cement should be used when the highest quality finish is desired. It is easily workable and gives more coverage than Type B Finishing Cement. The latter should be used where a finish combining both economy and good appearance is desired.

When the equipment so finished is exposed to excessive moisture or abrasion, supplementary protection should be provided by use of a tight weatherproof jacket of sheet metal or by a coating of O-C Mastic Finish.

O-C MASTIC FINISH is made of an asphalt emulsion to which long asbestos fibers have been added. It is used as a protective finish for the insulation on pipe lines, tanks, boilers, ducts, breechings, converters, digesters and other types of equipment that are exposed to moisture or excessive abrasion. It comes in ready-mixed plastic form of troweling consistency and should be protected against freezing during storage and application.

It has great durability under extremes of weather, and in most cases is sufficiently elastic so that it will not crack under atmospheric changes. It is recommended for application where adjacent temperatures do not exceed 450°F.

It is easily applied and can be troweled to a smooth surface finish. It is advisable to reinforce with one-inch galvanized wire mesh netting.

Black when applied, it turns to a dark gray color under service.

CHARACTERISTICS OF CEMENT AND FINISHES

For temperature limits, covering capacity, volumetric shrinkage, trowelability, etc., see the table below.

PACKAGING

For complete packaging specifications, minimum quantities and prices, see Fiberglas Standards E15.1.2, Prices—Fiberglas Pipe Insulations and Cements.

APPLICATION OF INSULATING CEMENT

Mixing the Cement. The cement should be mixed in a clean box or other container and may be used at once, although Fiberglas Insulating Cement gives greater troweling ease if allowed to soak over night or if it is mixed with hot water.

Physical Properties	Fiberglas Insulating Cement	Fiberglas Finishing Cement—Type A	Fiberglas Finishing Cement—Type B	O-C Mastic Finish
Wet Coverage	62 board feet per 100 pounds.	36 board feet per 100 pounds.	35 board feet per 100 pounds.	45 sq. ft. ¼" thick per 100 pounds.
Dry Coverage	52 board feet per 100 pounds.	30 board feet per 100 pounds.	25 board feet per 100 pounds.	45 sq. ft. ⅛" thick per 100 pounds.
Appearance When Dry	Light tan, relatively smooth, hard finish	Dull white, smooth, hard finish	Dull white, smooth, hard finish	Grey-black, smooth, tough finish
Temperature Limits	Recommended to 1400 degrees F. Can be used to 1600 degrees F. Fully reclaimable to 1000 degrees F.	No change to 800 degrees F.—slight warpage at 1000 degrees F. Not reclaimable.	Will withstand 800 degrees F.—slight warpage at 1000 degrees F. Not reclaimable.	Will withstand up to 450 degrees F. Not reclaimable.

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The workman is applying a coating of insulating cement, which adheres firmly to the wire netting. When dry, a weatherproof coat of O-C Mastic Finish will be applied.



Plastic and adhesive characteristics of Fiberglas Insulating Cement permit direct application to highly irregular surfaces and around pipe flanges, bends, fittings and valves.

Preparation of Surface. Surfaces to be insulated with Fiberglas Insulating Cement should be cleaned of dirt, loose scale, paint, oil or grease. Paint or grease should be removed with a caustic solution which then should be washed off with clean fresh water. Porous surfaces, such as fire brick, should be wet down thoroughly before the application of the insulating cement. If possible, the surface to be insulated should be kept hot to facilitate drying the cement.

Reinforcement. Anchorage, where required or specified, should be provided in the form of clip angles, nuts or masonry nails of proper size. Additional support is recommended when cement is to be applied to light gauge metallic surfaces or when the surface expansion and contraction is excessive.

Application on Steel Surfaces. Fiberglas Insulating Cement of the recommended thickness (see table page 2) should be built up in separate coats not greater than ¾". The first coat should be spotted on by hand then completely roughed in. Subsequent coats, ¾" thick or less, should be applied after the preceding coats have dried until the total recommended thickness is reached.

When the total insulation thickness is greater than one inch; or when the cement is to be applied to the under side of equipment; or, when the equipment is subject to vibration, a layer of galvanized wire netting should be applied between every second coat. When used, the wire netting should be stretched tightly over the dry cement and securely wired in place with 16 gauge wire.

Application on Brick Surfaces. Fiberglas Insulating Cement should be applied to a thickness that will result in a safe temperature gradient for all materials in the composite construction. Where reinforcing is required, masonry nails approximately 1½" long should be driven into the mortar joints on approximately 8- to 12-inch centers so that the heads extend ¾" from the surface of the brick. The first layer of cement should be applied nearly flush with the nail heads. Then galvanized wire netting should be stretched tightly over the cement and secured to the nails. The second layer of insulating cement should be applied approximately ½" to ¾" thick.

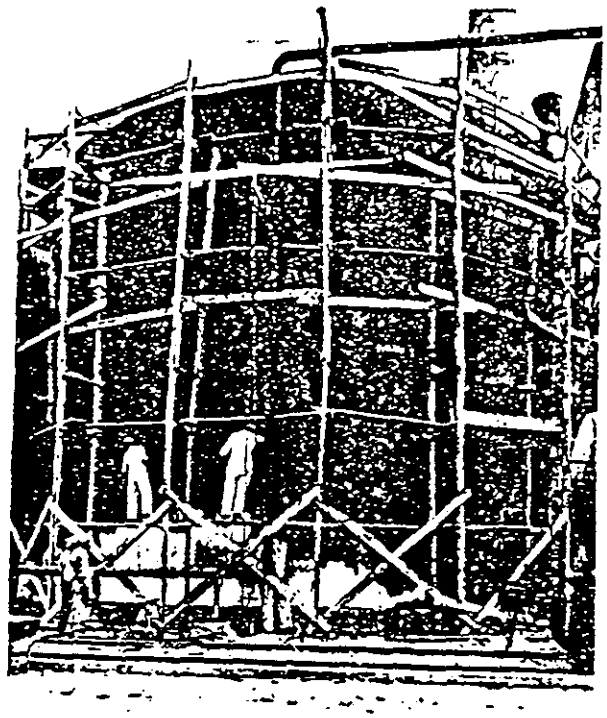
APPLICATION OF FINISH

Fiberglas Insulating Cement may be finished with Fiberglas Finishing Cement if located indoors and not exposed to moisture or abrasion; or with O-C Mastic Finish when located out of doors or exposed to moisture.

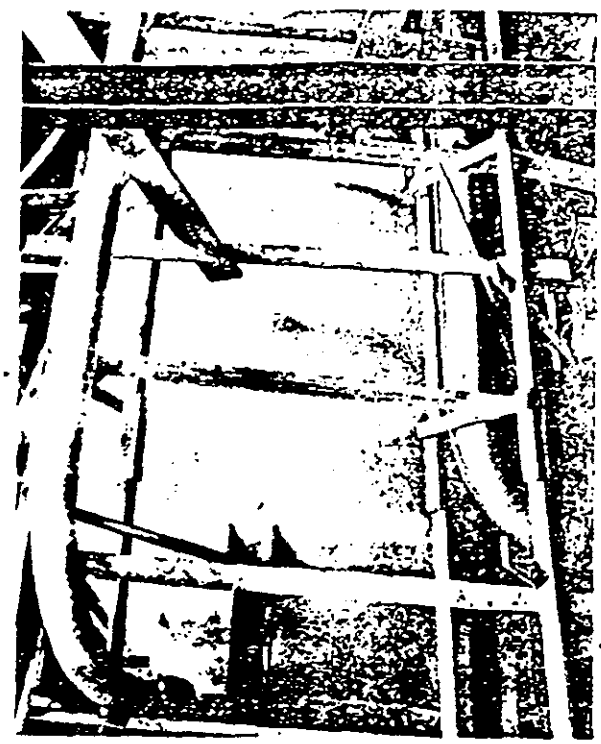
Fiberglas Finishing Cements should be applied ¼" to ½" thick either in one or two coats. If two coats are applied, the first should be applied ¼" thick and the second ¼" thick, allowing the first to dry before the second is applied. In such cases, the first coat should be left rough.

The addition of 25% by weight of portland cement in the last coat of finishing cement gives a harder surface finish.

O-C Mastic Finish should be stirred thoroughly in the container before application. Prior to the application of the O-C Mastic Finish and after the cement has thoroughly dried, 1" galvanized wire netting should be stretched tightly over the surface and wired in place with 16 gauge wire. The finish should be troweled in place approximately ½" thick (wet), which will dry to about ⅛". It is important that it is troweled well into the wire netting. O-C Mastic Finish is usually applied over a base coat of either insulating or finishing cement.



Tank owned by a large paper mill, insulated with Fiberglas Metal Mesh Blankets, covered with ½" of Fiberglas Insulating Cement and finished with O-C-Mastic Finish.



This Tank was covered with High Temperature Block, and then Fiberglas Insulating and Finishing Cements were applied over the blocks.

These hot air ducts were entirely insulated with Fiberglas Metal Mesh Blankets. Fiberglas Insulating Cement, covered with Fiberglas Finishing Cement was then applied to secure a highly stable, smooth, hard finish. Note the clean application. Fiberglas Finishing Cement provides an excellent finish and is easy to apply. It lowers time required in installation.

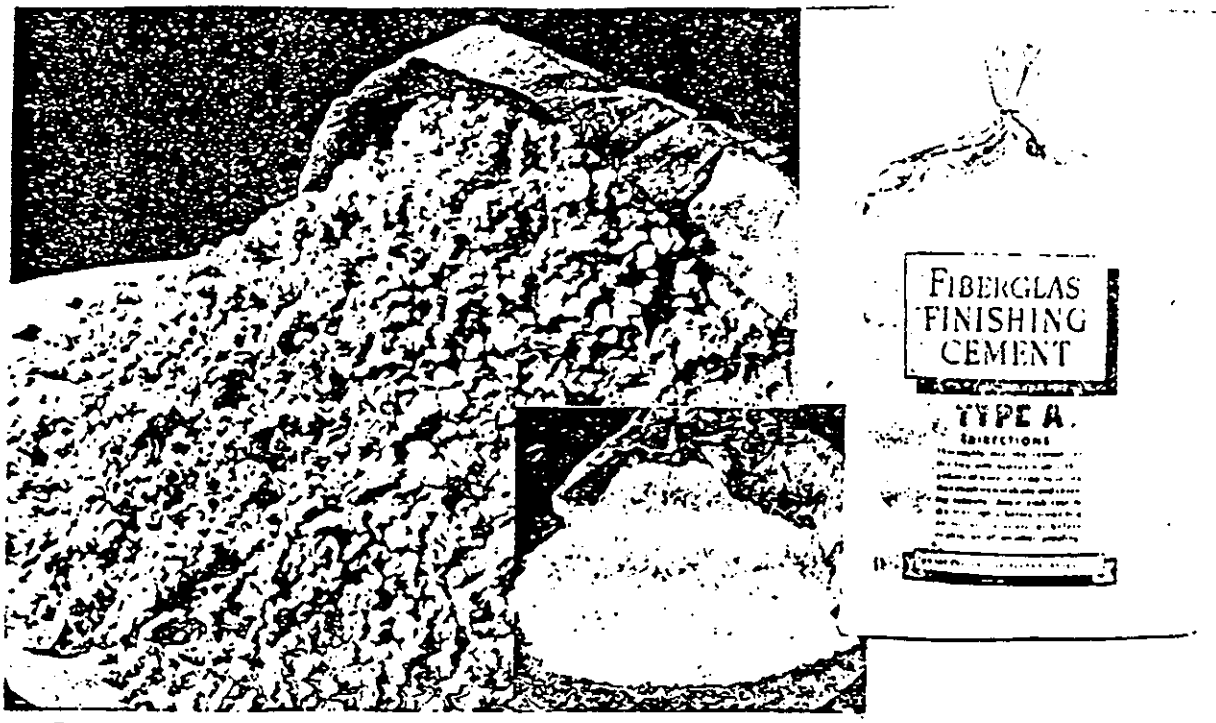


FIBERGLAS STANDARDS
OWENS-CORNING FIBERGLAS CORPORATION

For the duration of the war the specifications herein are subject to modifications without further notice to meet priority and allocation requirements or shortages in purchased materials

D4.8.1
JUNE 1, 1944

FIBERGLAS INSULATING CEMENT—FIBERGLAS FINISHING CEMENTS—O-C MASTIC FINISH



Fiberglas Insulating Cement (left) is made up of pellets of Fiberglas Wool containing almost countless dead air cells. The cement, mixed, applied and dried, is actually a porous mat of dead air cells assuring low thermal conductivity. Fiberglas Finishing Cement (center) provides a suitable finish; it is not used primarily for insulating purposes.

FIBERGLAS* INSULATING CEMENT may be applied on almost any kind of equipment that produces or transfers heat. It provides a monolithic insulation for pipes, tanks, ovens and other types of heated equipment, both regular or irregular shapes, indoors and out, combining excellent thermal insulating value, ease of application and appearance. It may be used over steel, brick, and insulation blocks and blankets. When located outdoors or exposed to moisture or abrasion, a jacket of sheet metal or a coating of O-C Mastic Finish should be applied to protect the cement.

Fiberglas Insulating Cement is made of nodulated Fiberglas Insulation, dry-mixed with refractory-type materials. It is easily mixed on the job. Approximately 28 gallons of clean fresh water should be used for each 100 lbs. of dry cement. When the cement is to be used on a hot porous surface such as fire brick, an additional 4 gallons per 100 lbs. of cement should be used. When applied and dried, it comprises countless dead air cells that assure low thermal conductivity.

Fiberglas Insulating Cement is easy to apply, a feature that lowers installation time. Other advantages include full reclaimability up to 1000°F., low shrinkage on drying, good adhesive strength, and the provision of an excellent base for either Fiberglas Finishing Cements or O-C Mastic Finish.

Thermal Conductivity of Fiberglas Insulating Cement is not more than .75 Btu sq. ft. per hour, per degree F. temperature difference, per inch thickness of material, at a mean temperature of 300 F.; and .64 Btu at 100°F. mean temperature. (See chart on page 2 for conductivity at various mean temperatures.)

FIBERGLAS FINISHING CEMENTS, TYPES A AND B, are used to provide excellent finished appearance for insulated pipes, tanks, ovens, and other heated equipment.

Fiberglas Finishing Cements are made of light-density Fiberglas material combined with asbestos fibers and suitable binders. They are easily mixed with approximately 15 to 15½ gallons of clean water for each 100 lbs. of cement used. They may be used as a scratch coat, finish coat, or both. While providing some insulating value, they are not

*Fiberglas is the trade name (Reg. U. S. Pat. Off.) of glass manufactured in any fiber or filament form by Owens-Corning Fiberglas Corporation.



Here are flanges covered with Fiberglas Finishing Cement. Appearance reflects the enduring performance of the product in actual use.

Note: This sheet supersedes G5.4.1, dated February 12, 1944.

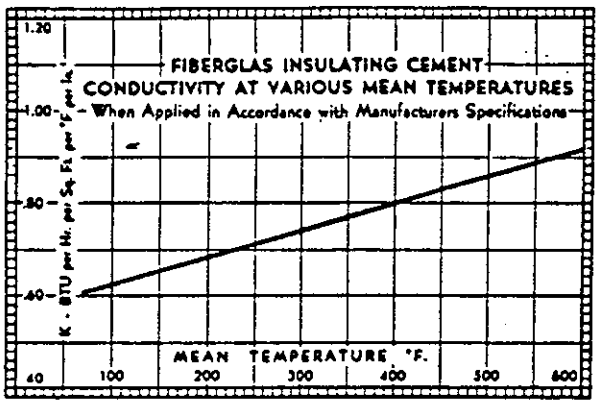
Printed in U.S.A.

EXHIBIT Q

RECOMMEND THICKNESS FOR INSULATING CEMENT*

°F	Thickness (Inches)
Up to 200	1
200 to 400	1½
400 to 500	2½
500 to 600	3
600 to 700	3½
700 to 900	4
900 to 1100	4½
1100 to 1300	5
1300 to 1600	5½

* Usually applied ½" thick over blankets and blocks as a base coat for desired finish. For built-up applications on irregular surfaces, thicknesses may be used up to the practical limit.



recommended primarily for insulating purposes. They are true finishing cements and are not reclaimable.

Type A Finishing Cement should be used when the highest quality finish is desired. It is easily workable and gives more coverage than Type B Finishing Cement. The latter should be used where a finish combining both economy and good appearance is desired.

When the equipment so finished is exposed to excessive moisture or abrasion, supplementary protection should be provided by use of a tight weatherproof jacket of sheet metal or by a coating of O-C Mastic Finish.

O-C MASTIC FINISH is made of an asphalt emulsion to which long asbestos fibers have been added. It is used as a protective finish for the insulation on pipe lines, tanks, boilers, ducts, breechings, converters, digesters and other types of equipment that are exposed to moisture or excessive abrasion. It comes in ready-mixed plastic form of troweling consistency and should be protected against freezing during storage and application.

When applied and dried, it has great durability under extremes of weather, and in most cases is sufficiently elastic so that it will not crack under atmospheric changes. It is recommended for application where adjacent temperatures do not exceed 450°F.

It is easily applied and can be troweled to a smooth surface finish for most permanent results. It is advisable to reinforce with one-inch galvanized wire mesh netting.

Black when applied, it turns to a dark gray color under service.

CHARACTERISTICS OF CEMENT AND FINISHES

For temperature limits, covering capacity, volumetric shrinkage, trowelability, etc., see the table below.

PACKAGING

For complete packaging specifications, minimum quantities and prices, see Fiberglas Standards P4.6.1.

APPLICATION OF INSULATING CEMENT

Mixing the Cement. The cement should be mixed in a clean box or other container and may be used at once, although Fiberglas Insulating Cement gives greater troweling ease if allowed to soak over night or if it is mixed with hot water.

Physical Properties	Fiberglas Insulating Cement	Fiberglas Finishing Cement—Type A	Fiberglas Finishing Cement—Type B	O-C Mastic Finish
Wet Coverage	62 board feet per 100 pounds.	36 board feet per 100 pounds.	35 board feet per 100 pounds.	45 sq. ft. ¼" thick per 100 pounds.
Dry Coverage	52 board feet per 100 pounds.	30 board feet per 100 pounds.	25 board feet per 100 pounds.	45 sq. ft. ⅛" thick per 100 pounds.
Appearance When Dry	Light tan, relatively smooth, hard finish	Dull white, smooth, hard finish	Dull white, smooth, hard finish	Grey-black, smooth, tough finish
Temperature Limits	Recommended to 1400 degrees F. Can be used to 1600 degrees F. — Fully reclaimable to 1000 degrees F.	No change to 800 degrees F.—slight warpage at 1000 degrees F. Not reclaimable.	Will withstand 800 degrees F.—slight warpage at 1000 degrees F. Not reclaimable.	Will withstand up to 450 degrees F. Not reclaimable.

Do Not Remove From Binder



The workman is applying a coating of insulating cement, which adheres firmly to the wire netting. When dry, a weatherproof coat of O-C Mastic Finish will be applied.



Plastic and adhesive characteristics of Fiberglas Insulating Cement permit direct application to highly irregular surfaces and around pipe flanges, bends, fittings and valves.

Preparation of Surface. Surfaces to be insulated with Fiberglas Insulating Cement should be cleaned of dirt, loose scale, paint, oil or grease. Paint or grease should be removed with a caustic solution which then should be washed off with clean fresh water. Porous surfaces, such as fire brick, should be wet down thoroughly before the application of the insulating cement. If possible, the surface to be insulated should be kept hot to facilitate drying the cement.

Reinforcement. Anchorage, where required or specified, should be provided in the form of clip angles, nuts or masonry nails of proper size. Additional support is recommended when cement is to be applied to light gauge metallic surfaces or when the surface expansion and contraction is excessive.

Application on Steel Surfaces. Fiberglas Insulating Cement of the recommended thickness (see table page 2) should be built up in separate coats not greater than ¾". The first coat should be spotted on by hand then completely roughed in. Subsequent coats, ¾" thick or less, should be applied after the preceding coats have dried until the total recommended thickness is reached.

When the total insulation thickness is greater than one inch; or when the cement is to be applied to the under side of equipment; or, when the equipment is subject to vibration, a layer of galvanized wire netting should be applied between every second coat. When used, the wire netting should be stretched tightly over the dry cement and securely wired in place with 16 gauge galvanized wire.

Application on Brick Surfaces. Fiberglas Insulating Cement should be applied to a thickness that will result in a safe temperature gradient for all materials in the composite construction. Where reinforcing is required, masonry nails approximately 1½" long should be driven into the mortar joints on approximately 8- to 12-inch centers so that the heads extend ¾" from the surface of the brick. The first layer of cement should be applied nearly flush with the nail heads. Then galvanized wire netting should be stretched tightly over the cement and secured to the nails. The second layer of insulating cement should be applied approximately ½" to ¾" thick.

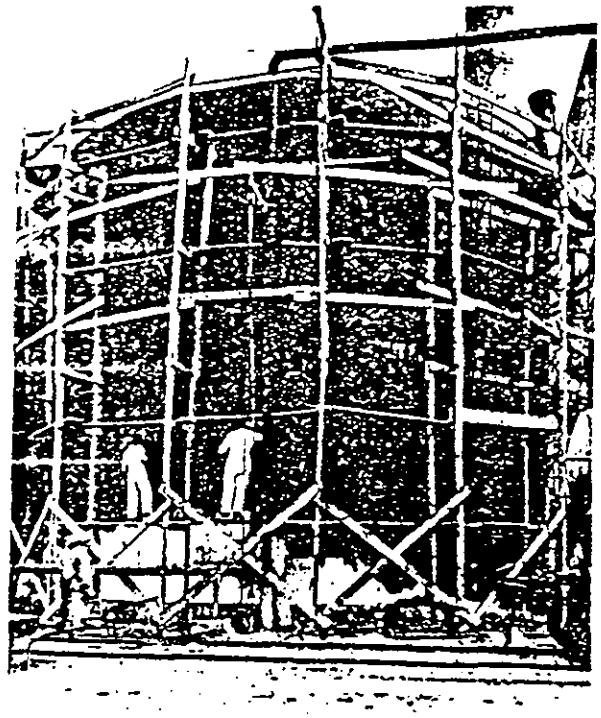
APPLICATION OF FINISH

Fiberglas Insulating Cement may be finished with Fiberglas Finishing Cement if located indoors and not exposed to moisture or abrasion; or with O-C Mastic Finish when located out of doors or exposed to moisture.

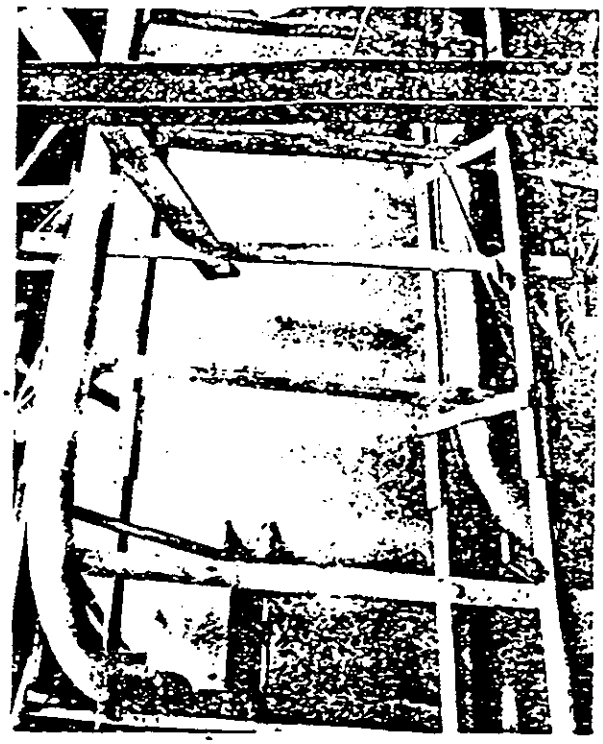
Fiberglas Finishing Cements should be applied ¼" to ½" thick either in one or two coats. If two coats are applied, the first should be applied ¼" thick and the second ¼" thick, allowing the first to dry before the second is applied. In such cases, the first coat should be left rough.

The addition of 25% by weight of portland cement in the last coat of finishing cement gives a harder surface finish.

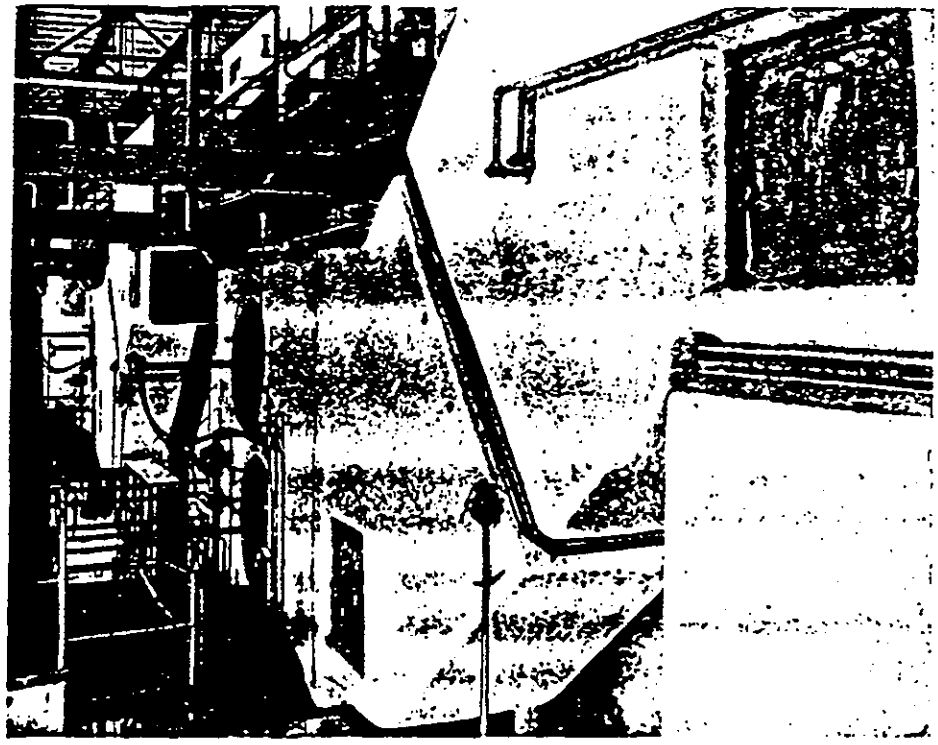
O-C Mastic Finish is usually applied over a base coat of either insulating or finishing cement. It should be stirred thoroughly in the container before application. Prior to the application of the O-C Mastic Finish and after the cement has thoroughly dried, 1" galvanized wire netting should be stretched tightly over the surface and wired in place with 16 gauge wire. The finish should be troweled in place approximately ¼" thick (wet), which will dry to about ⅛". It is important that it is troweled well into the wire netting.



Tank owned by a large paper mill, insulated with Fiberglas Metal Mesh Blankets, covered with ½" of Fiberglas Insulating Cement and finished with O-C Mastic Finish.



This Tank was covered with High Temperature Block (1200°), and then Fiberglas Insulating and Finishing Cements were applied over the blocks.



These hot air ducts were entirely insulated with Fiberglas Metal Mesh Blankets. Fiberglas Insulating Cement, covered with Fiberglas Finishing Cement was then applied to secure a highly stable, smooth, hard finish. Note the clean application. Fiberglas Finishing Cement provides an excellent finish and is easy to apply. It lowers time required in installation.

FIBERGLAS
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OWENS-CORNING
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D4.8.1
JANUARY 3, 1947

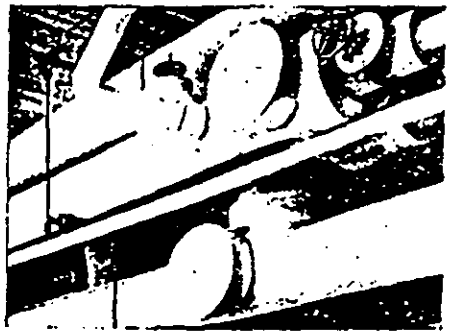
FIBERGLAS INSULATING CEMENT
FIBERGLAS FINISHING CEMENTS
O-C MASTIC FINISH



Fiberglas Insulating Cement (left) is a plastic insulation recommended for application directly on heated equipment, or over metal mesh blankets or block type insulation as a base for finishes. Fiberglas Finishing Cement, Type A (center) gives a smooth surface for painting. Fiberglas Finishing Cement, Type B (left) gives a more granular surface.

FIBERGLAS INSULATING CEMENT provides a monolithic insulation for pipes, tank, ovens, and other heated equipment; both regular or irregular shapes, indoors and out. It combines good thermal insulating value and ease of application. It may be used over steel, brick, and insulation blocks and blankets. When located outdoors or exposed to moisture or abrasion, a jacket of sheet metal or a coating of O-C Mastic Finish should be applied to protect the cement.

Fiberglas Insulating Cement is made of nodulated Fiberglas Insulation, dry-mixed with refractory-type materials. It is easily mixed on the job. Approximately 28 gallons of clean fresh water should be used for each 100 lbs. of dry cement. When the cement is to be used on a hot porous surface such as fire brick, an additional 4 gallons per 100 lbs. of cement should be used. When applied and dried, it comprises countless dead air cells.



Here are flanges covered with Fiberglas Finishing Cement. Appearance reflects the enduring performance of the product in actual use.

Fiberglas Insulating Cement is easy to apply, a feature that lowers installation time. Other advantages include full reclaimability up to 1000°F., low shrinkage or drying, good adhesive strength, and the provision of an excellent base for either Fiberglas Finishing Cements or O-C Mastic Finish.

Thermal Conductivity of Fiberglas Insulating Cement is not more than .75 Btu sq. ft. per hour, per degree F. temperature difference, per inch thickness of material, at a mean temperature of 300°F.; and .64 Btu at 100°F. mean temperature. (See chart on page 2 for conductivity at various mean temperatures.)

FIBERGLAS FINISHING CEMENTS, TYPES A AND B, are used to provide a smooth finished appearance for insulated pipes, tanks, ovens, and other heated equipment.

Fiberglas Finishing Cements are made of light-density Fiberglas material combined with asbestos fibers and suitable binders. They are easily mixed with approximately 15 to 15½ gallons of clean water for each 100 lbs. of cement used. They may be used as a scratch coat, finish coat, or both. While providing some insulating value, they are not

*FIBERGLAS is the trade name (Reg. U.S. Pat. Off.) of a variety of products made of or with glass fibers by Owens-Corning Fiberglas Corporation.

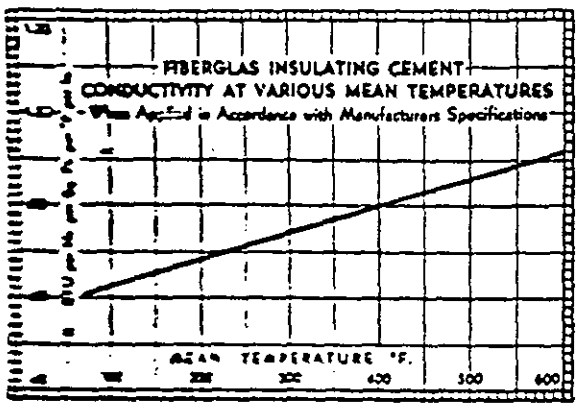
This sheet supersedes D4.8.1, dated June 1, 1944. Printed in U. S. A.

EXHIBIT Q

RECOMMEND-THICKNESS FOR INSULATING-CEMENT*

°F	Thickness (Inches)
Up to 200	1
200 to 400	1½
400 to 500	2½
500 to 600	3
600 to 700	3½
700 to 900	4
900 to 1100	4½
1100 to 1300	5
1300 to 1600	5½

*Usually applied ½" thick over blankets and blocks as a base coat for desired finish. For built-up applications on irregular surfaces, thicknesses may be used up to the practical limit.



recommended primarily for insulating purposes. They are true finishing cements and are not reclaimable.

Type A Finishing Cement should be used when the highest quality finish is desired. It is easily workable and gives more coverage than Type B Finishing Cement. The latter should be used where a finish combining both economy and good appearance is desired.

When the equipment so finished is exposed to excessive moisture or abrasion, supplementary protection should be provided by use of a tight weatherproof jacket of sheet metal or by a coating of O-C Mastic Finish.

O-C MASTIC FINISH is made of an asphalt emulsion to which long asbestos fibers have been added. It is used as a protective finish for the insulation on pipe lines, tanks, boilers, ducts, breechings, converters, digesters and other types of equipment that are exposed to moisture or excessive abrasion. It comes in ready-mixed plastic form of troweling consistency and should be protected against freezing during storage and application.

When applied and dried, it has great durability under extremes of weather, and in most cases is sufficiently elastic so that it will not crack under atmospheric changes. It is recommended for application where adjacent temperatures do not exceed 450°F.

It is easily applied and can be troweled to a smooth surface finish for most permanent results. It is advisable to reinforce with one-inch galvanized wire mesh netting.

Black when applied, it turns to a dark gray color under service.

CHARACTERISTICS OF CEMENT AND FINISHES

For temperature limits, covering capacity, volumetric shrinkage, trowelability, etc., see the table below.

PACKAGING

For complete packaging specifications, minimum quantities and prices, see Fiberglas Standards P4.6.1.

APPLICATION OF INSULATING CEMENT

Mixing the Cement. The cement should be mixed in a clean box or other container and may be used at once, although Fiberglas Insulating Cement gives greater troweling ease if allowed to soak over night or if it is mixed with hot water.

Physical Properties	Fiberglas Insulating Cement	Fiberglas Finishing Cement—Type A	Fiberglas Finishing Cement—Type B	O-C Mastic Finish
Wet Coverage	42 board feet per 100 pounds.	36 board feet per 100 pounds.	35 board feet per 100 pounds.	45 sq. ft. ¼" thick per 100 pounds.
Dry Coverage	32 board feet per 100 pounds.	30 board feet per 100 pounds.	25 board feet per 100 pounds.	45 sq. ft. ⅛" thick per 100 pounds.
Appearance When Dry	Light tan, relatively smooth, hard finish	Dull white, smooth, hard finish	Dull white, smooth, hard finish	Grey-black, smooth, tough finish
Temperature Limits	Incinerates at 1400 degrees F. Can be used to 1500 degrees F.—fully reclaimable to 1200 degrees F.	No change to 800 degrees F.—slight warpage at 1000 degrees F. Not reclaimable.	Will withstand 800 degrees F.—slight warpage at 1000 degrees F. Not reclaimable.	Will withstand up to 450 degrees F. Not reclaimable.

FIBERGLAS
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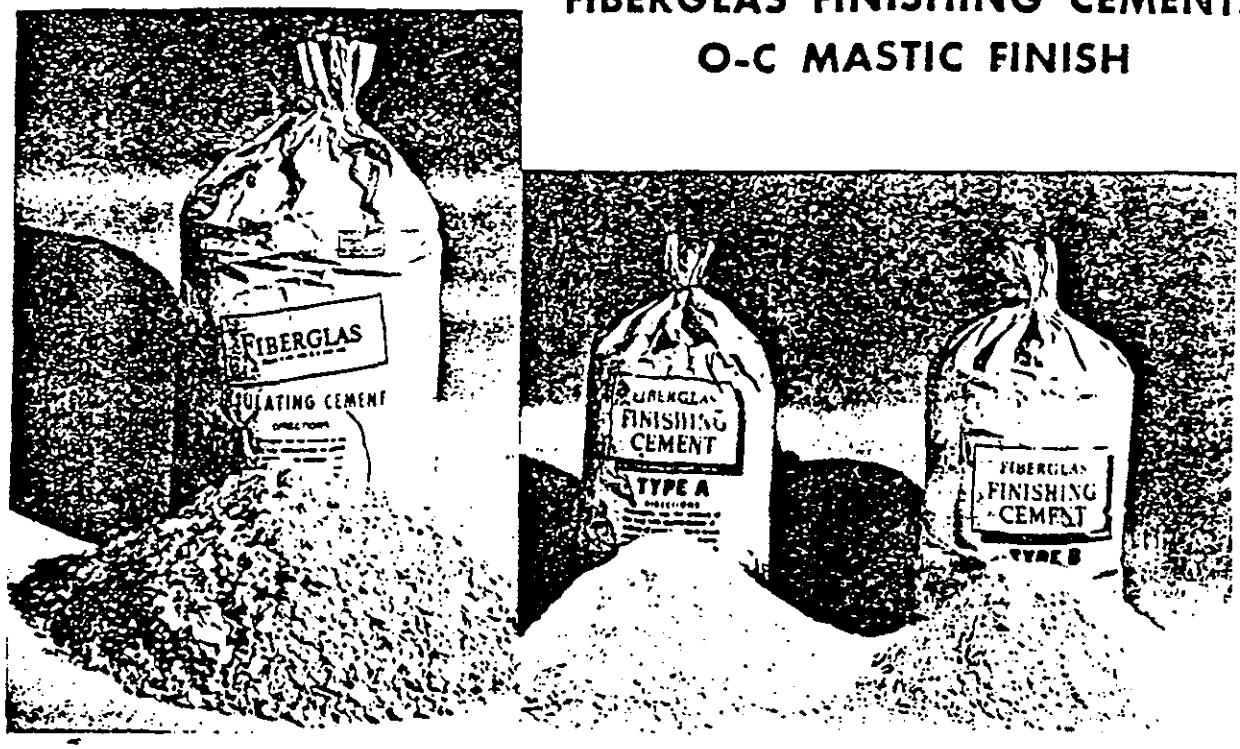
CORPORATION

MASTER FILE COPY

D4.8.1
DECEMBER 8, 1947

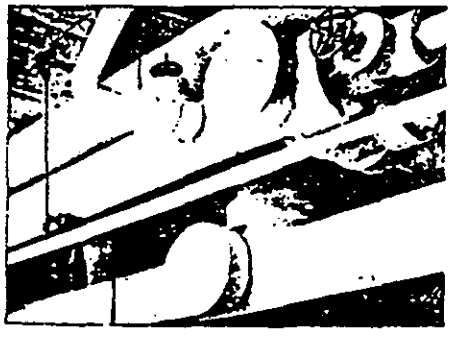
FIBERGLAS INSULATING CEMENT
FIBERGLAS FINISHING CEMENTS
O-C MASTIC FINISH



Fiberglas Insulating Cement (left) is a plastic insulation recommended for application directly on heated equipment, or over metal mesh blankets or block type insulation as a base for finishes. Fiberglas Finishing Cement, Type A (center) gives a smooth surface for painting. Fiberglas Finishing Cement, Type B (right) gives a more granular surface.

FIBERGLAS INSULATING CEMENT provides a monolithic insulation for pipes, tank, ovens, and other heated equipment; both regular or irregular shapes, indoors and out. It combines good thermal insulating value and ease of application. It may be used over steel, brick, and insulation blocks and blankets. When located outdoors or exposed to moisture or abrasion, a jacket of sheet metal or a coating of O-C Mastic Finish should be applied to protect the cement.

Fiberglas Insulating Cement is made of nodulated Fiberglas Insulation, dry-mixed with refractory-type materials. It is easily mixed on the job. Approximately 28 gallons of clean fresh water should be used for each 100 lbs. of dry cement. When the cement is to be used on a hot porous surface such as fire brick, an additional 4 gallons per 100 lbs. of cement should be used. When applied and dried, it comprises countless dead air cells.



Here are flanges covered with Fiberglas Finishing Cement. Appearance reflects the enduring performance of the product in actual use.

Fiberglas Insulating Cement is easy to apply, a feature that lowers installation time. Other advantages include full reclaimability up to 1000°F., low shrinkage or drying, good adhesive strength, and the provision of an excellent base for either Fiberglas Finishing Cements or O-C Mastic Finish.

Thermal Conductivity of Fiberglas Insulating Cement is not more than .75 Btu sq. ft. per hour, per degree F. temperature difference, per inch thickness of material, at a mean temperature of 300°F.; and .61 Btu at 100°F. mean temperature. (See chart on page 2 for conductivity at various mean temperatures.)

FIBERGLAS FINISHING CEMENTS, TYPES A AND B, are used to provide a smooth finished appearance for insulated pipes, tanks, ovens, and other heated equipment.

Fiberglas Finishing Cements are made of light-density Fiberglas material combined with asbestos fibers and suitable binders. They are easily mixed with approximately 15 to 15½ gallons of clean water for each 100 lbs. of cement used. They may be used as a scratch coat, finish coat, or both. While providing some insulating value, they are not

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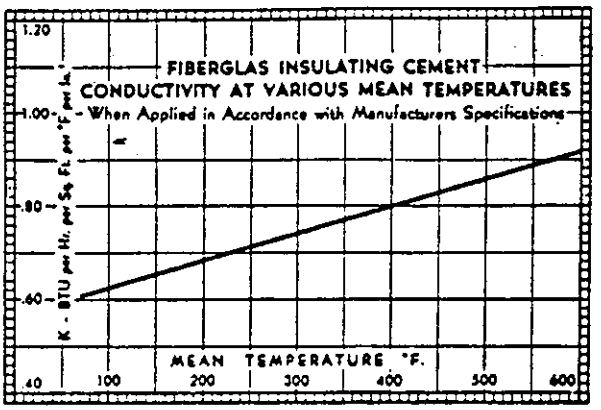
This sheet supersedes D4.8.1, dated June 1, 1944.
3rd Printing, April, 1948

RECOMMEND THICKNESS FOR INSULATING CEMENT*

°F	Thickness (Inches)
Up to 200	1
200 to 400	1½
400 to 500	2½
500 to 600	3
600 to 700	3½
700 to 900	4
900 to 1100	4½
1100 to 1300	5
1300 to 1600	5½

* Usually applied ½" thick over blankets and blocks as a base coat for desired finish. For built-up applications on irregular surfaces, thicknesses may be used up to the practical limit.



recommended primarily for insulating purposes. They are true finishing cements and are not reclaimable.

Type A Finishing Cement should be used when the highest quality finish is desired. It is easily workable and gives more coverage than Type B Finishing Cement. The latter should be used where a finish combining both economy and good appearance is desired.

When the equipment so finished is exposed to excessive moisture or abrasion, supplementary protection should be provided by use of a tight weatherproof jacket of sheet metal or by a coating of O-C Mastic Finish.

O-C MASTIC FINISH is made of an asphalt emulsion to which long asbestos fibers have been added. It is used as a protective finish for the insulation on pipe lines, tanks, boilers, ducts, breechings, converters, digesters and other types of equipment that are exposed to moisture or excessive abrasion. It comes in ready-mixed plastic form of troweling consistency and should be protected against freezing during storage and application.

When applied and dried, it has great durability under extremes of weather, and in most cases is sufficiently elastic so that it will not crack under atmospheric changes. It is recommended for application where adjacent temperatures do not exceed 450°F.

It is easily applied and can be troweled to a smooth surface finish for most permanent results. It is advisable to reinforce with one-inch galvanized wire mesh netting.

Black when applied, it turns to a dark gray color under service.

CHARACTERISTICS OF CEMENT AND FINISHES

For temperature limits, covering capacity, volumetric shrinkage, trowelability, etc., see the table below.

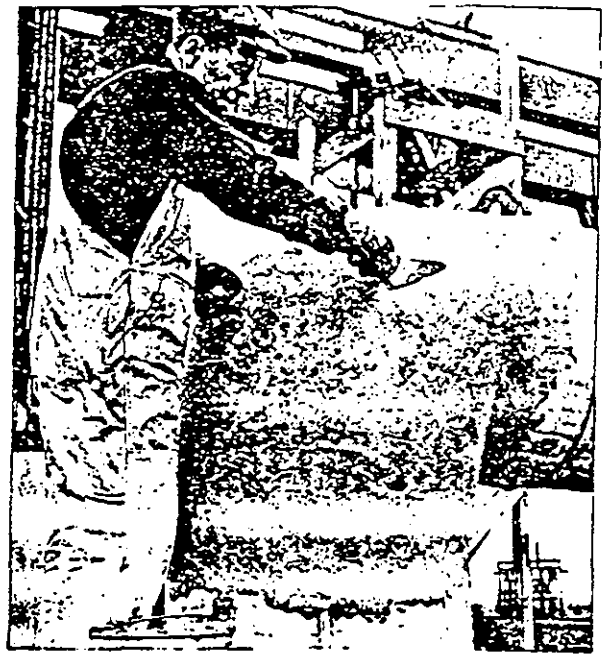
PACKAGING

For complete packaging specifications, minimum quantities and prices, see Fiberglas Standards P4.6.1.

APPLICATION OF INSULATING CEMENT

Mixing the Cement. The cement should be mixed in a clean box or other container and may be used at once, although Fiberglas Insulating Cement gives greater troweling ease if allowed to soak over night or if it is mixed with hot water.

Physical Properties	Fiberglas Insulating Cement	Fiberglas Finishing Cement—Type A	Fiberglas Finishing Cement—Type B	O-C Mastic Finish
Wet Coverage	62 board feet per 100 pounds.	36 board feet per 100 pounds.	35 board feet per 100 pounds.	45 sq. ft. ¼" thick per 100 pounds.
Dry Coverage	52 board feet per 100 pounds.	30 board feet per 100 pounds.	25 board feet per 100 pounds.	45 sq. ft. ⅛" thick per 100 pounds.
Appearance When Dry	Light tan, relatively smooth, hard finish	Dull white, smooth, hard finish	Dull white, smooth, hard finish	Grey-black, smooth, tough finish
Temperature Limits	Recommended to 1400 degrees F. Can be used to 1500 degrees F. — Fully reclaimable to 1000 degrees F.	No change to 800 degrees F.—slight warpage at 1000 degrees F. Not reclaimable.	Will withstand 800 degrees F.—slight warpage at 1000 degrees F. Not reclaimable.	Will withstand up to 450 degrees F. Not reclaimable.



The workman is applying a coating of insulating cement, which adheres firmly to the wire netting. When dry, a weatherproof coat of O-C Mastic Finish will be applied.



Plastic and adhesive characteristics of Fiberglas Insulating Cement permit direct application to highly irregular surfaces and around pipe flanges, bends, fittings and valves.

Preparation of Surface. Surfaces to be insulated with Fiberglas Insulating Cement should be cleaned of dirt, loose scale, paint, oil or grease. Paint or grease should be removed with a caustic solution which then should be washed off with clean fresh water. Porous surfaces, such as fire brick, should be wet down thoroughly before the application of the insulating cement. If possible, the surface to be insulated should be kept hot to facilitate drying the cement.

Reinforcement. Anchorage, where required or specified, should be provided in the form of clip angles, nuts or masonry nails of proper size. Additional support is recommended when cement is to be applied to light gauge metallic surfaces or when the surface expansion and contraction is excessive.

Application on Steel Surfaces. Fiberglas Insulating Cement of the recommended thickness (see table page 2) should be built up in separate coats not greater than ¾". The first coat should be spotted on by hand then completely roughed in. Subsequent coats, ¾" thick or less, should be applied after the preceding coats have dried until the total recommended thickness is reached.

When the total insulation thickness is greater than one inch; or when the cement is to be applied to the under side of equipment; or, when the equipment is subject to vibration, a layer of galvanized wire netting should be applied between every second coat. When used, the wire netting should be stretched tightly over the dry cement and securely wired in place with 16 gauge galvanized wire.

Application on Brick Surfaces. Fiberglas Insulating Cement should be applied to a thickness that will result in a safe temperature gradient for all materials in the composite construction. Where reinforcing is required, masonry nails approximately 1½" long should be driven into the mortar joints on approximately 8- to 12-inch centers so that the heads extend ¾" from the surface of the brick. The first layer of cement should be applied nearly flush with the nail heads. Then galvanized wire netting should be stretched tightly over the cement and secured to the nails. The second layer of insulating cement should be applied approximately ½" to ¾" thick.

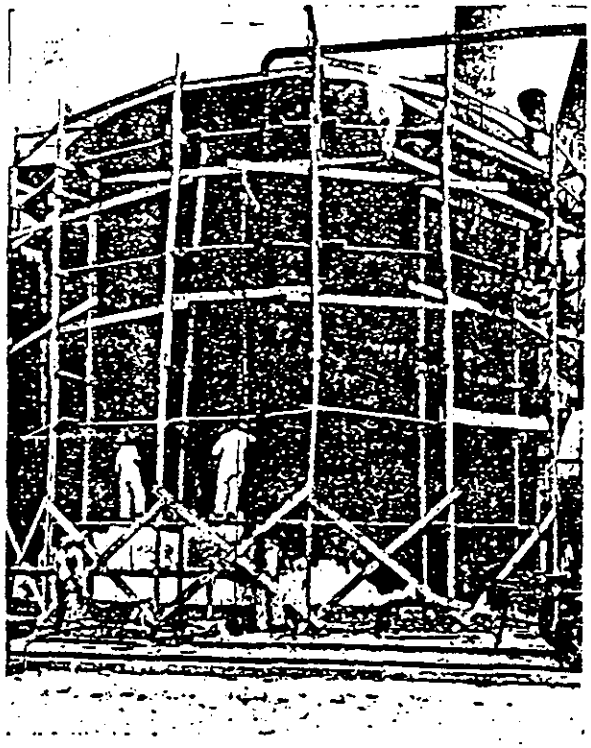
APPLICATION OF FINISH

Fiberglas Insulating Cement may be finished with Fiberglas Finishing Cement if located indoors and not exposed to moisture or abrasion; or with O-C Mastic Finish when located out of doors or exposed to moisture.

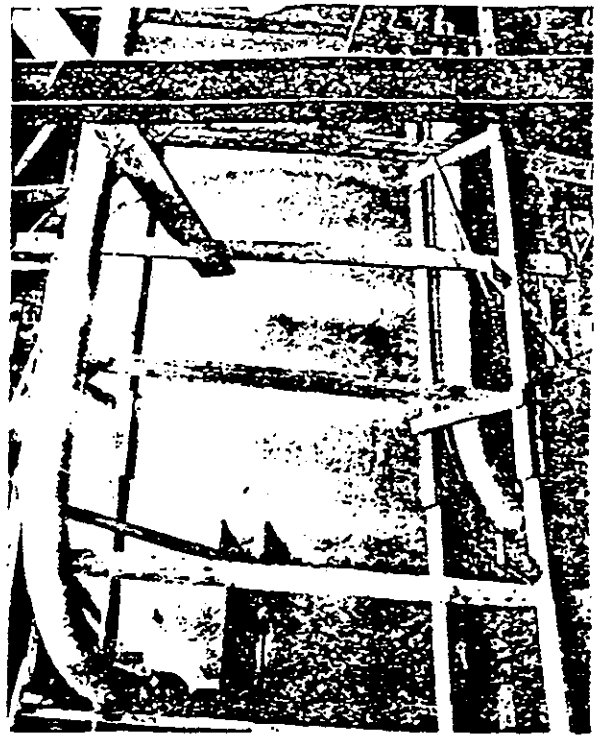
Fiberglas Finishing Cements should be applied ¼" to ½" thick either in one or two coats. If two coats are applied, the first should be applied ¼" thick and the second ¼" thick, allowing the first to dry before the second is applied. In such cases, the first coat should be left rough.

The addition of 25% by weight of portland cement in the last coat of finishing cement gives a harder surface finish.

O-C Mastic Finish is usually applied over a base coat of either insulating or finishing cement. It should be stirred thoroughly in the container before application. Prior to the application of the O-C Mastic Finish and after the cement has thoroughly dried, 1" galvanized wire netting should be stretched tightly over the surface and wired in place with 16 gauge wire. The finish should be troweled in place approximately ¼" thick (wet), which will dry to about ⅛". It is important that it is troweled well into the wire netting.



Tank owned by a large paper mill, insulated with Fiberglas Metal Mesh Blankets, covered with ½" of Fiberglas Insulating Cement and finished with O-C Mastic Finish.



This Tank was covered with High Temperature Block (1200°), and then Fiberglas Insulating and Finishing Cements were applied over the blocks.



These hot air ducts were entirely insulated with Fiberglas Metal Mesh Blankets. Fiberglas Insulating Cement, covered with Fiberglas Finishing Cement was then applied to secure a highly stable, smooth, hard finish. Note the clean application. Fiberglas Finishing Cement provides an excellent finish and is easy to apply. It lowers time required in installation.

Printed in U. S. A.

PRIMARY GENERAL LIABILITY - PRODUCTS LIABILITY COVERAGE

Policy Year	Policy Number	Products Liability Bodily Injury Policy Limits Occurrence	Products Liability Bodily Injury Policy Limits Aggregate	Insurer
9/1/42 - 9/1/43	31 LC 40	$1,000,000	$1,000,000	Aetna C&S
9/1/43 - 9/1/44	31 AL 27	1,000,000	1,000,000	Aetna C&S
9/1/44 - 9/1/45	31 AL 34	1,000,000	1,000,000	Aetna C&S
9/1/45 - 9/1/46	31 AL 55 RR	1,000,000	1,000,000	Aetna C&S
9/1/46 - 9/1/52	31 AL 84 RR/ 31 AL 125 RR	1,000,000	1,000,000	Aetna C&S
9/1/52 - 9/1/53	31 AL 340 RR	1,000,000	1,000,000	Aetna C&S
9/1/53 - 9/1/54	31 AL 341 RRY	1,000,000	1,000,000	Aetna C&S
9/1/54 - 9/1/55	31 AL 343 RRY	1,000,000	1,000,000	Aetna C&S
9/1/55 - 9/1/56	31 AL 350 RRY	1,000,000	1,000,000	Aetna C&S
9/1/56 - 9/1/57	31 AL 575 RRY	1,000,000	1,000,000	Aetna C&S
9/1/57 - 9/1/58	31 AL 579 RRY	1,000,000	1,000,000	Aetna C&S
9/1/58 - 9/1/59	31 AL 989 RRY	1,000,000	1,000,000	Aetna C&S
9/1/59 - 9/1/60	31 AL 993 RRY	1,000,000	1,000,000	Aetna C&S
9/1/60 - 9/1/61	02 AL 11052 RRY	1,000,000	1,000,000	Aetna C&S
9/1/61 - 9/1/62	02 AL 11056 RRY	1,000,000	1,000,000	Aetna C&S
9/1/62 - 9/1/63	02 AL 13426 RRY	1,000,000	1,000,000	Aetna C&S
9/1/63 - 9/1/64	2 AL 13432 SR (Y)	1,000,000	1,000,000	Aetna C&S
9/1/64 - 9/1/65	2 AL 15805 SR (Y)	1,000,000	1,000,000	Aetna C&S
9/1/65 - 9/1/66	02 AL 018710 SR (Y)	1,000,000	1,000,000	Aetna C&S
9/1/66 - 9/1/67	02 AL 020095 SR (Y)	1,000,000	1,000,000	Aetna C&S
9/1/67 - 9/1/68	02 AL 106187 SR (Y)	1,000,000	1,000,000	Aetna C&S
9/1/68 - 9/1/69	02 AL 108363 SR (Y)	1,000,000	1,000,000	Aetna C&S
9/1/69 - 9/1/70	02 AL 110044 SR (Y)	1,000,000	1,000,000	Aetna C&S
9/1/70 - 9/1/71	02 AL 112067 SR (Y)	1,000,000	1,000,000	Aetna C&S
9/1/71 - 9/1/72	02 AL 113640 SR (Y)	1,000,000	1,000,000	Aetna C&S
9/1/72 - 9/1/73	002 AL 115204 SRA (Y)	1,000,000	1,000,000	Aetna C&S
9/1/73 - 9/1/74	02 AL 116006 SRA (Y)	1,000,000	1,000,000	Aetna C&S
9/1/74 - 9/1/75	02 AL 116023 SRA	1,000,000	1,000,000	Aetna C&S
9/1/75 - 9/1/76	02 AL 116050 SRA	1,000,000	1,000,000	Aetna C&S

EXHIBIT R

9/1/76 - 9/1/77	02 AL 116071 SRA	$1,000,000	$5,000,000	Aetna C&S
9/1/77 - 9/1/78	02 AL 211004 SCA	1,000,000	10,000,000	Aetna C&S
9/1/78 - 9/1/79	02 GL 7 SCA	1,000,000	10,000,000	Aetna C&S
9/1/79 - 9/1/80	65 AL 212532 SCA	1,000,000	2,000,000	Aetna C&S
9/1/80 - 9/1/81	65 AL 212541 SCA	1,000,000	2,000,000	Aetna C&S
9/1/81 - 9/1/82	65 AL 212548 SCA	1,000,000	2,000,000	Aetna C&S

OWENS-CORNING FIBERGLAS CORPORATION
UMBRELLA LIABILITY COVERAGE

Policy Term	Company	Policy Number	(In SM) Limits of Liability
Earlier Years	No Umbrella Liability Coverage		
10/22/57 - 10/22/58	Lloyd's	D87/256	100/ 100
10/22/57 - 10/22/58	Lloyd's	D87/257	400/ 400
10/22/57 - 10/22/58	Lloyd's	D87/258	500/ 500
10/22/57 - 10/22/58	Lloyd's	D87/259	4,000/ 4,000
10/22/58 - 9/1/59	Lloyd's	D88/481	100/ 100
10/22/58 - 9/1/59	Lloyd's	D88/482	400/ 400
10/22/58 - 9/1/59	Lloyd's	D88/483	500/ 500
10/22/58 - 9/1/59	Lloyd's	D88/484	4,000/ 4,000
9/1/59 - 10/1/60	Lloyd's	D89/385	100/ 100
9/1/59 - 10/1/60	Lloyd's	D89/386	400/ 400
9/1/59 - 10/1/60	Lloyd's	D89/387	500/ 500
9/1/59 - 10/1/60	Lloyd's	D89/388	4,000/ 4,000
10/1/60 - 10/1/61	Lloyd's	D860/382	100/ 100
10/1/60 - 10/1/61	Lloyd's	D860/383	400/ 400
10/1/60 - 10/1/61	Lloyd's	D860/384	500/ 500
10/1/60 - 10/1/61	Lloyd's	D860/385	4,000/ 4,000
10/1/60 - 10/1/61	Lloyd's	D860/423	5,000/ 5,000
10/1/61 - 10/1/62	Lloyd's	D861/382	1,000/ 1,000
10/1/61 - 10/1/62	Lloyd's	D861/383	4,000/ 4,000
10/1/61 - 10/1/62	Lloyd's	D861/384	5,000/ 5,000
10/1/62 - 10/1/63	Lloyd's	D862/285	1,000/ 1,000
10/1/62 - 10/1/63	Lloyd's	D862/286	4,000/ 4,000
10/1/62 - 10/1/63	Lloyd's	D862/287	5,000/ 5,000
10/1/63 - 10/1/64	Employers Liability Assurance Corp. Ltd.	E16-8011-001	1,000/ 1,000
10/1/63 - 10/1/64	Lloyd's	D863/234	14,000/14,000
10/1/64 - 10/1/67	Aetna C&S	02 XS 8 SC	15,000/15,000
10/1/67 - 10/1/70	Aetna C&S	02 XS 8 SC	25,000/25,000
10/1/70 - 10/22/70	Aetna C&S	02 XS 703 SC	25,000/25,000
10/22/70 - 10/22/71	Home	HEC 9793041	25,000/25,000
10/22/71 - 10/22/72	Home	HEC 9794729	25,000/25,000
10/22/72 - 10/22/73	Home	HEC 4428775	25,000/25,000

[illegible]	[illegible]	Policy Number	Limits of Liability
10/22/73 - 10/22/74	Home	HEX 4428775	25,000/25,000
6/18/74 - 10/22/76	Midland	XL1110170544	5,000/ 5,000
6/18/74 - 10/22/76	National Union	CE 1011835	5,000/ 5,000
6/18/74 - 10/22/76	North River	XS 3619	25,000/25,000
6/18/74 - 10/22/76	First State	921434	15,000/15,000
7/9/74 - 10/22/76	Affiliated FM	XL 72515	10,000/10,000
7/9/74 - 10/22/76	Ins. Co. NA	XCP 6633	10,000/10,000
7/9/74 - 10/22/76	North River	XS 3672	30,000/30,000 **
10/22/74 - 10/22/75	Aetna C&S	02 XS 1704 SCA	25,000/25,000
10/22/75 - 10/22/76	Aetna C&S	02 XS 1705 SCA	25,000/25,000
10/22/75 - 10/22/76	Lexington	GC 5502955	5,000/ 5,000
10/22/76 - 10/22/77	Aetna C&S	02 XS 1712 SCA	25,000/25,000
10/22/76 - 10/22/77	First State	923542	10,000/10,000
10/22/76 - 10/22/77	Midland	XL 151996	5,000/ 5,000
10/22/76 - 10/22/77	National Union	1189233	5,000/ 5,000
10/22/76 - 10/22/77	North River	XS 4073	30,000/30,000
10/22/77 - 9/1/78	Aetna C&S	02 XS 1723 SCA	25,000/25,000
10/22/77 - 9/1/78	First State	925625	10,000/10,000
10/22/77 - 9/1/78	North River	XS 4423	40,000/40,000
9/1/78 - 9/1/79	Aetna C&S	02 XS 2733 SCA	25,000/25,000
9/1/78 - 9/1/79	First State	926735	10,000/10,000
9/1/78 - 9/1/79	North River	5220004104	40,000/40,000
9/1/78 - 9/1/79	North River	5220004113	25,000/25,000
3/8/79 - 9/1/79	Lloyd's	L-NC-7070	22,000/22,000
3/8/79 - 9/1/79	British Cos.	C-NC-7070	2,500/ 2,500
3/8/79 - 9/1/79	North River	5220004203	5,500/ 5,500
3/8/79 - 9/1/79	First State	927953	5,000/ 5,000
3/9/79 - 9/1/79	Allianz	UM3599515	5,000/ 5,000
3/9/79 - 9/1/79	Assoc. Intl.	AEL00163-C	7,500/ 7,500
3/9/79 - 9/1/79	Columbia Cas.	RDX416-98-56	2,500/ 2,500
9/1/79 - 9/1/80	Northbrook	63-006-012	25,000/25,000
9/1/79 - 9/1/80	Intl. Surplus Lines	XSI 5731	40,000/40,000
9/1/79 - 9/1/80	Midland	XL 153013	2,500/ 2,500
9/1/79 - 9/1/80	Transit Casualty	SCU 955271	7,500/ 7,500
9/1/79 - 9/1/80	Intl. Surplus Lines	XSI 5732	25,000/25,000
9/1/79 - 9/1/80	National Union Fire	1224753	5,000/ 5,000
9/1/79 - 9/1/80	Intl. Surplus Lines	XSI 5733	25,000/25,000
9/1/79 - 9/1/80	Granite State	6179-1549	3,000/ 3,000
9/1/79 - 9/1/80	Employers Mutual Cas.	MMO 70960	5,000/ 5,000
9/1/79 - 9/1/80	Integrity	XL 201337	2,000/ 2,000
9/1/79 - 9/1/80	Gibraltar	GMX 00232	10,000/10,000

** Reduced to $25,000,000 effective October 22, 1975.

Policy Term	Company	Policy Number	(In $M) Limits of Liability
9/1/79 - 9/1/80	Granite State	6179-1662	7,000/ 7,000
9/1/79 - 9/1/80	Midland	XL 153014	2,500/ 2,500
9/1/79 - 9/1/80	National Union Fire	1224754	5,000/ 5,000
9/1/79 - 9/1/80	Zurich International	ZI 7162	1,500/ 1,500
9/1/79 - 9/1/80	Haftpflichtverband	EWI 1021	1,000/ 1,000
9/1/79 - 9/1/80	Birmingham Fire	SE 6073551	5,000/ 5,000
9/1/79 - 9/1/80	Excess	EL 10-87	1,000/ 1,000
9/1/79 - 9/1/80	Southern American	XX 800201	1,500/ 1,500
9/1/79 - 9/1/80	Seguros La Commercial	0148	1,000/ 1,000
9/1/79 - 9/1/80	Landmark	FE 4000221	2,000/ 2,000
9/1/79 - 9/1/80	American Centennial	XC-00-00-88	2,500/ 2,500
9/1/79 - 9/1/80	Gibraltar	GMX 00236	2,000/ 2,000
9/1/79 - 9/1/80	Transit Casualty	SCU 955258	2,500/ 2,500
9/1/79 - 9/1/80	Allianz	AU 5003102	5,000/ 5,000
9/1/79 - 9/1/80	Intl. Surplus Lines	XSI 5734	9,000/ 9,000
9/1/79 - 9/1/80	Royale Belge	1250965/79	1,500/ 1,500
9/1/80 - 9/1/81	Northbrook	63-007-045	25,000/25,000
9/1/80 - 9/1/81	Intl. Surplus Lines	XSI 6285	40,000/40,000
9/1/80 - 9/1/81	Midland	XL 706744	2,500/ 2,500
9/1/80 - 9/1/81	Transit Casualty	MUX 967039	7,500/ 7,500
9/1/80 - 9/1/81	Intl. Surplus Lines	XSI 6286	25,000/25,000
9/1/80 - 9/1/81	National Union Fire	122 60 49	5,000/ 5,000
9/1/80 - 9/1/81	Intl. Surplus Lines	XSI 6287	25,000/25,000
9/1/80 - 9/1/81	Granite State	6180-2514	3,000/ 3,000
9/1/80 - 9/1/81	Gibraltar	GMX 00719	10,000/10,000
9/1/80 - 9/1/81	Integrity	XL 201765	2,000/ 2,000
9/1/80 - 9/1/81	Allianz	AUX 5200169	5,000/ 5,000
9/1/80 - 9/1/81	Granite State	6180-2515	15,000/15,000
9/1/80 - 9/1/81	Midland	XL 706745	2,500/ 2,500
9/1/80 - 9/1/81	National Union Fire	122 60 50	5,000/ 5,000
9/1/80 - 9/1/81	Zurich International	ZIB 7453/2	1,500/ 1,500
9/1/80 - 9/1/81	Haftpflichtverband	EWI 1035	1,000/ 1,000
9/1/80 - 9/1/81	Birmingham Fire	SE 6073686	5,000/ 5,000
9/1/80 - 9/1/81	Southern American	XX 800360	5,500/ 5,500
9/1/80 - 9/1/81	Seguros La Commercial	FS1005	1,000/ 1,000
9/1/80 - 9/1/81	American Centennial	CC-00-13-17	3,000/ 3,000
9/1/80 - 9/1/81	Gibraltar	GMX 007020	2,000/ 2,000
9/1/80 - 9/1/81	Transit	MUX 967040	7,500/ 7,500
9/1/80 - 9/1/81	Allianz	AUX 5200169	5,000/ 5,000
9/1/80 - 9/1/81	Intl. Surplus Lines	XSI 6288	15,000/15,000
9/1/80 - 9/1/81	Royale Belge	1250965/80	2,000/ 2,000
9/1/80 - 9/1/81	Integrity	XL 201765	4,000/ 4,000
9/1/81 - 9/1/82	Northbrook	63 008 192	25,000/25,000
9/1/81 - 9/1/82	Transit Casualty	MUX 967065	7,500/ 7,500
9/1/81 - 9/1/82	Midland	XL 724521	2,500/ 2,500
9/1/81 - 9/1/82	Intl. Surplus Lines	XSI 7710	40,000/40,000

Policy Term	Company	Policy Number	(In $M) Limits of Liability
9/1/81 - 9/1/82	Intl. Surplus Lines	XSI 7711	25,000/25,000
9/1/81 - 9/1/82	National Union Fire	1186421	5,000/ 5,000
9/1/81 - 9/1/82	Integrity	XL 203363	2,000/ 2,000
9/1/81 - 9/1/82	Allianz	AUX 520 1229	5,000/ 5,000
9/1/81 - 9/1/82	Gibraltar	GMX 01308	10,000/10,000
9/1/81 - 9/1/82	Intl. Surplus Lines	XSI 7712	28,000/28,000
9/1/81 - 9/1/82	National Union Fire	1186422	5,000/ 5,000
9/1/81 - 9/1/82	Central Natl. of Omaha	CNZ 00 60 19	1,000/ 1,000
9/1/81 - 9/1/82	American Centennial	CC 00 24 55	3,000/ 3,000
9/1/81 - 9/1/82	American Centennial	CC 00 24 56	6,000/ 6,000
9/1/81 - 9/1/82	Integrity	XL 203364	4,000/ 4,000
9/1/81 - 9/1/82	Allianz	AUX 520 1230	11,000/11,000
9/1/81 - 9/1/82	Transit Casualty	MUL 967066	7,500/ 7,500
9/1/81 - 9/1/82	Midland	XL 724522	2,500/ 2,500
9/1/81 - 9/1/82	Gibraltar	GMX 01309	2,000/ 2,000
9/1/81 - 9/1/82	Royale Belge	1250965-81	2,000/ 2,000
9/1/81 - 9/1/82	Haftpflichtverband	EWI 1047	1,000/ 1,000
9/1/81 - 9/1/82	Southern American	XX 800472	10,000/10,000
9/1/81 - 9/1/82	Birmingham Fire	SE 6073042	5,000/ 5,000
9/1/81 - 9/1/82	Intl. Surplus Lines	XSI 7713	35,000/35,000
9/1/81 - 12/17/81	Continental	SRX 3196793	5,000/ 5,000
12/17/81 - 9/1/82	Old Republic	OZX 14146	5,000/ 5,000

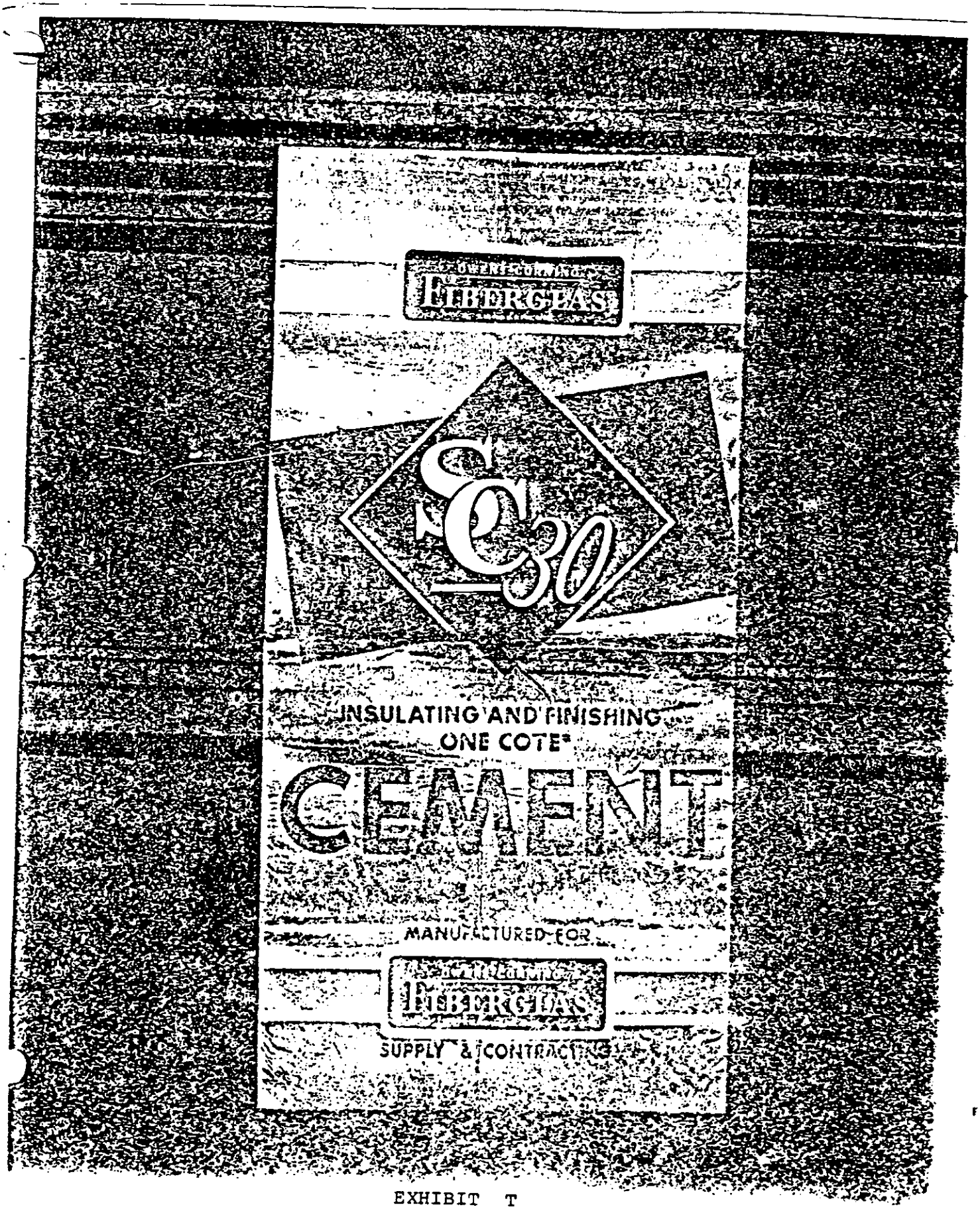

FIBERGLAS
C30
INSULATING AND FINISHING
ONE COTE
CEMENT
MANUFACTURED FOR
FIBERGLAS
SUPPLY & CONTRACT

EXHIBIT T

OWENS-CORNING

FIBERGLAS

INSULATING AND FINISHING

ONE COTE® CEMENT

A white, multi-purpose, fast setting insulating & finishing cement for [illegible] fittings and over fibrous insulations.

50 lbs. Net Weight

INSTRUCTIONS

1

Remove all dirt, rust, grease, paint, dust, etc. from the surface over which SC-10 is to be applied.

2

Mix 50 lb. cement (contents of one bag) with 5½ to 7 gallons of clean, fresh water.

CAUTION: Do not mix more SC-10 than can be used in 2 hours.

3

Apply mixed cement when surface is below 150° F. and above 40° F. with [illegible]

4

Cement will set in about 2½ hours at room temperature.

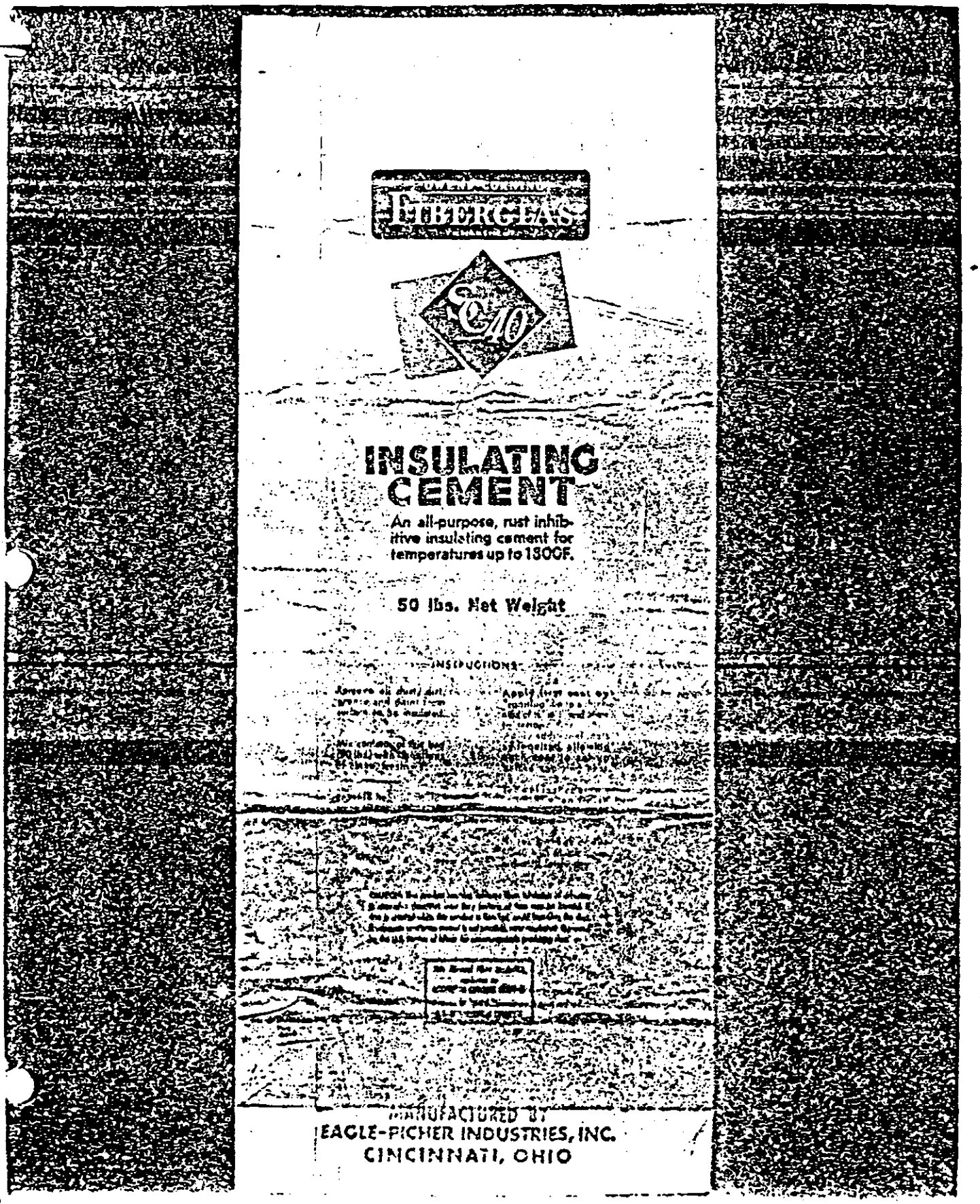
Avoid forced drying until 24 hours after application, for full strength.

For maximum coverage store bagged cement in a dry place.

[illegible]

MANUFACTURED BY
EAGLE-PICHER INDUSTRIES, INC.
CINCINNATI, OHIO


FIBERGLAS
C-40
INSULATING
CEMENT
FIBERGLAS


FIBERGLAS
EAGLE
INSULATING
CEMENT
An all-purpose, rust inhibitive insulating cement for temperatures up to 1300F.
50 lbs. Net Weight
INSTRUCTIONS
MANUFACTURED BY
EAGLE-PICHER INDUSTRIES, INC.
CINCINNATI, OHIO

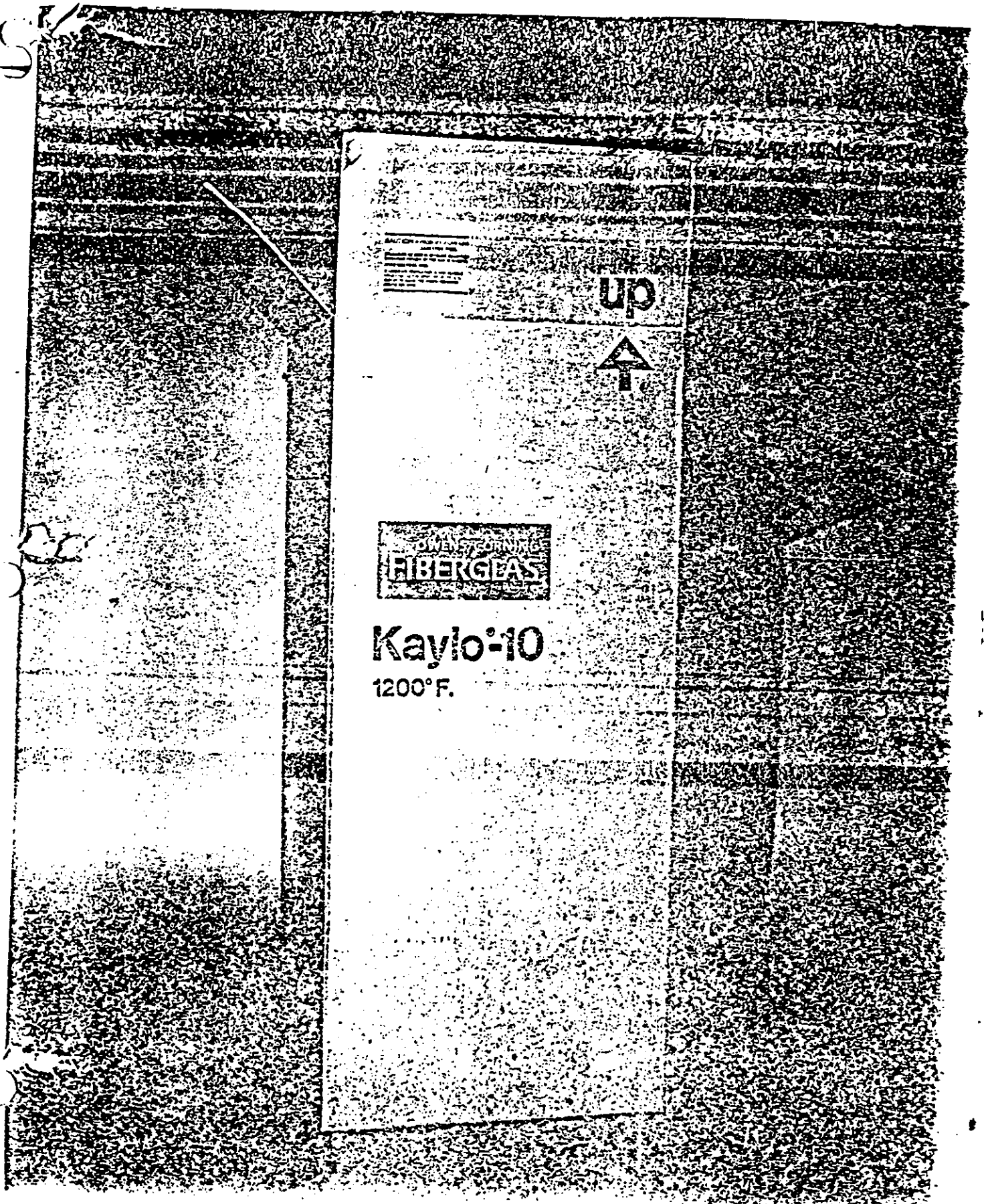


EXHIBIT U

CAUTION - PRODUCT CONTAINS
ASBESTOS FIBER

INHALATION OF DUST IN EXCESSIVE QUANTITIES
OVER LONG PERIODS OF TIME MAY BE HARMFUL

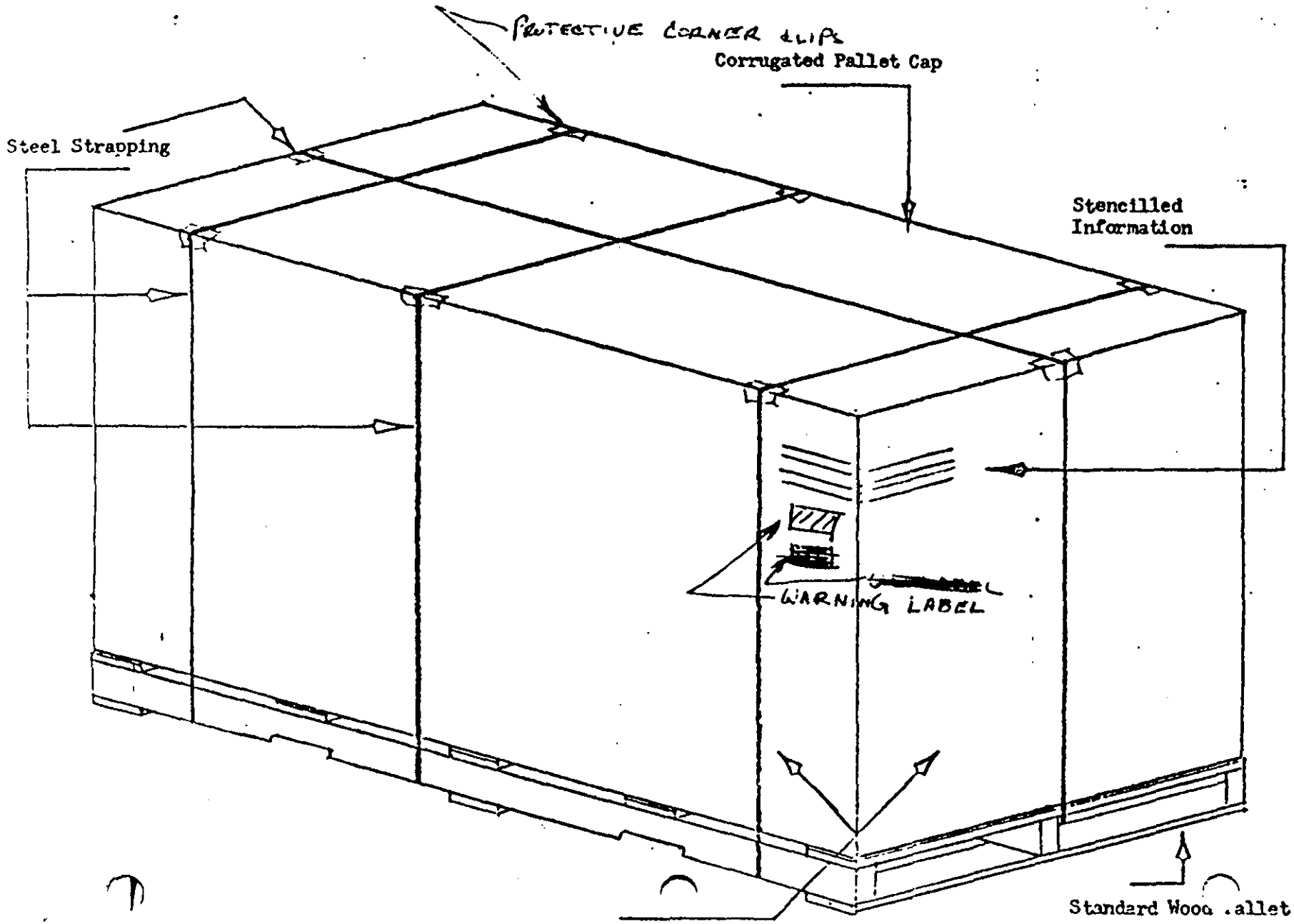
AVOID BREATHING DUST

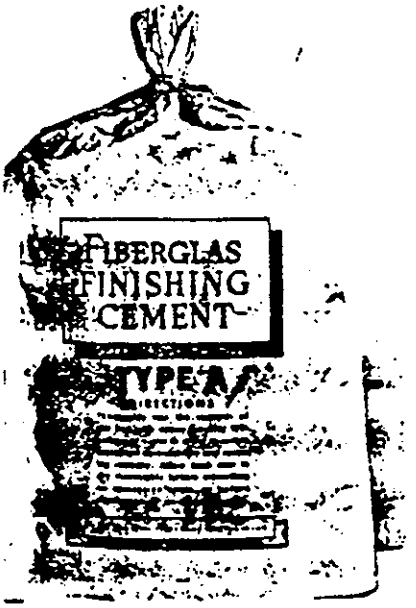
IF ADEQUATE VENTILATION IS NOT POSSIBLE
WEAR RESPIRATORS APPROVED BY THE U. S.
BUREAU OF MINES FOR PNEUMOCONIOSIS
PRODUCING DUST

up

Fyrcor products were available in various sizes and was shipped on wood pallets wrapped in corrugated material as per attached drawing.

EXHIBIT S


PROTECTIVE CORNER CLIPS
Corrugated Pallet Cap
Steel Strapping
Stencilled Information
WARNING LABEL
Standard Wood Pallet


FIBERGLAS
FINISHING
CEMENT
TYPE A

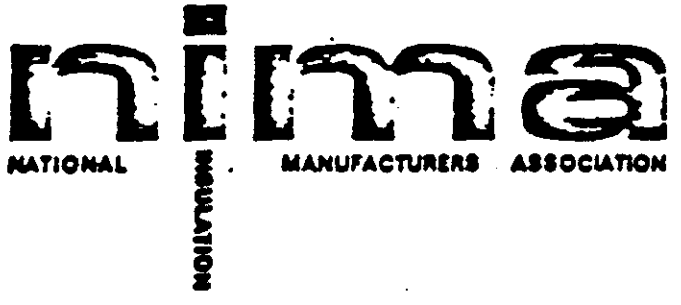

FIBERGLAS
FINISHING
CEMENT
TYPE A
FINISHING
CEMENT

EXHIBIT V

Exhibit W

RECOMMENDED HEALTH SAFETY PRACTICES

For Handling
And Applying
Thermal
Insulation Products
Containing
Mineral Fibers



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Introduction 2
Housekeeping 4
Physical Contact with Mineral Fibers 5
Exposure to Excessive Mineral Fiber Dusts 6
Respiratory Equipment 7

INTRODUCTION

Mineral fiber is a generic term and is applied principally to glass wool, rock wool and slag wool. The basic physical structure of each of these materials is a lightweight mass of intermingled mineral fibers processed from a molten state into a fibrous form.

Mineral fiber products are produced in numerous forms for a wide range of uses and applications. Despite the diversity of applications, the health safety practices for handling, fabricating and applying these materials are very similar.

Mineral fiber products will differ primarily in density, rigidity, shape, and fiber dimension, depending upon use and requirements. Products manufactured from coarse fibers may cause some irritation.

Generally these health safety problems can be classified into two major areas:

(1) *Physical contact with mineral fibers.* Contact with mineral fiber particles, as with many other fibers, may result in itching and skin irritation. Particles may enter the eyes particularly during overhead applications.

(2) *Exposure to excessive mineral fiber dusts.* Mineral fiber products when cut or fabricated can produce some dust. Inhalation of excessive quantities of any dust, including mineral fiber dust, may result in some respiratory irritation.

Manufacturers of Thermal Insulation Products containing mineral fiber have for years been taking protective measures to control excessive dust.

The National Insulation Manufacturers Association recommends the following practices for handling and applying thermal insulation products containing mineral fiber to protect the worker.

Insulation contractors and applicators are urged to study these recommended practices carefully and to see that they are observed by all workers handling insulation materials. As with Safety Regulations, it is in the interest of both employer and employee to see that health safety practices are strictly observed.

Prepared By
COMMITTEE ON SAFETY AND HEALTH

NATIONAL INSULATION
NIMA
MANUFACTURERS ASS'N.

HOUSEKEEPING

An organized housekeeping program should be maintained in all areas and on all operations at all times.

A major source of excessive airborne dust is from loose materials, scrap, and debris distributed throughout the job area and disintegrated by trampling on, running over, etc. Much of the airborne contamination can be eliminated by exercising simple good housekeeping practices.

Specific standards and practices designed for providing safe, clean and orderly working conditions should be defined.

Efficient supervisory control, planning of systematic cleaning plus day to day follow-up are the basic requirements for dust control and health protection.

PHYSICAL CONTACT WITH MINERAL FIBERS

1 If particles accumulate on exposed skin areas, do not rub or scratch. Remove the particles by washing thoroughly with soap and warm water. If water is not available, use dry wash materials (waterless soap and paper towels).

2 Long-sleeve shirts, long trousers and caps should be worn to cover maximum skin areas to avoid contact with the mineral fibers. Clothing should be loose fitting at collars, wrist bands and waist to eliminate skin irritation.

3 Barrier creams applied to exposed skin areas will provide protection against skin irritation. They should be used prior to handling the material and re-applied according to instructions.

4 Good personal hygiene practices are essential. Thoroughly wash exposed skin areas periodically and shower at end of work day. Change and launder work clothing frequently, separate from other articles.

5 Proper work methods and practices that will eliminate creating excessive dust should be adhered to at all times.

6 Suitable gloves should be worn whenever handling abrasive materials.

7 Mineral fiber slivers that superficially penetrate the skin should be removed by thoroughly washing. Those embedded in the skin should be removed immediately and medical treatment administered.

8 Safety glasses, goggles or face shields should be worn when applying materials overhead or in areas where airborne particles may get into the eyes.

EXPOSURE TO EXCESSIVE MINERAL FIBER DUSTS

1 When mineral fiber materials are machine sawed, die cut, slit, etc., mechanical dust collecting systems adequately designed to remove dust at the source should be installed.

2 Hand cutting, jacket stripping, etc., should be done in a manner that will create minimal airborne dust. Proper methods and tools will help considerably to abate dust.

3 When working in confined spaces, dust collecting systems adequately designed should be provided to remove dust from the source. If conditions prevent collecting dust, use exhaust blowers to provide general room air changes. Avoid exhausting into other work areas. If mechanical exhaust equipment cannot be used to remove excessive dusts, *Respirators should be worn.

4 When applying mineral fiber insulation overhead, workers should be clothed as described on page 5, wear eye protection and *Respirators if excessive dust is generated.

5 When mineral fiber thermal insulations are stripped from piping or other surfaces, the area in which stripping takes place should be confined by means of curtains, portable partitions, etc., to prevent excessive dust concentrations in adjacent areas. All workers in the stripping area engaged in tearing off, handling, cleaning and disposing of material should be clothed as described on page 5, wear eye protection and *Respirators.
Where circumstances permit, materials should be wetted down prior to and during removal. Where applicable, portable mechanical exhaust ventilation should be used to remove airborne dusts from the area.

6 Avoid unnecessary rehandling of scrap by locating disposal equipment as close to working area as possible. Do not permit accumulation of scrap and debris on floor and other surfaces.

* *Bureau of Mines-approved respirators. See page 7.*

RESPIRATORY EQUIPMENT

Only U.S. Bureau of Mines-approved respiratory equipment is recommended for use. Approved respiratory equipment should be used at all operations where dust control is not adequate.

The efficiency and effectiveness of respiratory equipment is dependent upon proper care, cleaning and maintenance. A systematic procedure should be established to assure that this is done.

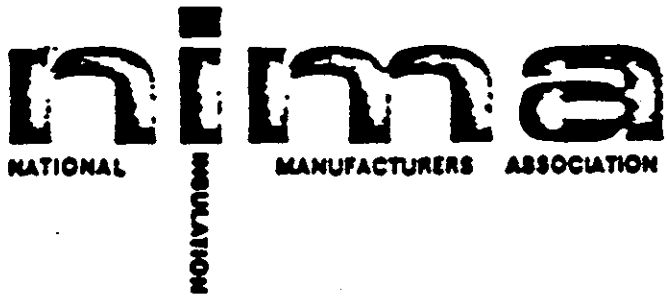
Lists of currently approved respiratory equipment can be obtained from:

Bureau of Mines
United States Department of the Interior
Nineteenth and E Streets, N.W.
Washington, D.C. 20240

American Industrial Hygiene Association
14125 Prevost
Detroit, Michigan 48227

RECOMMENDED HEALTH SAFETY PRACTICES

For Handling And Applying Thermal Insulation Products Containing Asbestos



INTRODUCTION

The modern mass production of hundreds of natural and synthetic materials, such as asbestos, has brought the need to protect workers from certain health risks, known or suspected.

Manufacturers of Thermal Insulation Products containing asbestos have for years been taking protective measures to eliminate excessive exposures to inhalation of dusts that may be injurious.

Based on the fact that all materials can be handled safely, the National Insulation Manufacturers Association recommends the following practices for handling and applying Thermal Insulation Products containing asbestos and/or other potentially injurious materials to protect the worker.

Insulation contractors and applicators are urged to study these recommended practices carefully and to see that they are observed by all workers handling insulation materials. As with Safety Regulations, it is in the interest of both employer and employee to see that health protection practices are strictly observed.

Prepared By
COMMITTEE ON SAFETY AND HEALTH

NATIONAL INSULATION
NIMA
MANUFACTURERS ASS'N.

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FOR HEALTH SAFETY'S SAKE

Three major points to keep in mind in the handling and use of materials containing asbestos:

- *Take every precaution to keep dust to a minimum.*
- *Wear U.S. Bureau of Mines-approved Respirators when exposed to excessive dusts. (See Page 15)*
- *Maintain good housekeeping at all times.*

HOUSEKEEPING

An organized housekeeping program should be maintained in all areas and on all operations at all times.

A major source of excessive airborne dust is from loose materials, scrap and debris distributed throughout the job area and disintegrated by trampling on, running over, etc. Much of the airborne contamination can be eliminated by exercising simple good housekeeping practices.

Specific standards and practices designed for providing safe, clean and orderly working conditions should be defined.

Efficient supervisory control, planning of systematic cleaning plus day to day follow-up are the basic requirements for dust control and injury prevention.

PIPE AND BLOCK INSULATIONS

Warehousing, Storage and Handling

Under normal conditions, the handling, storage and warehousing of undamaged cartons of pipe and block insulations, containing asbestos, present no health safety problems. If cartons are broken or materials damaged while insulation is being handled, the following steps should be taken:

1 If spillage occurs, debris should be cleaned up immediately. Repack usable materials.

2 Care should be taken to avoid generating dust when piling, stacking or placing pieces into containers.

3 When cleaning spillage, vacuum equipment is recommended for picking up dust and small particles.

4 If large quantities of spillage occurs and cleaning involves sweeping and/or shoveling that could create excessive airborne dust, *Respirators should be worn.

5 Only usable material should be returned from the job site to the warehouse.

6 When returning material from the job site, clean dust and debris off cartons. Repack odd lot pieces. Close cartons.

*Bureau of Mines-approved respirators. See page 15.

Fabrication in Warehouse and Job Site Shops

1 Open and remove the material from cartons with care.

2 Handle and stack pieces of material in a manner that will avoid generating dust and breakage.

3 Mechanical dust collecting systems adequately designed to remove dust at the source should be installed on power-operated, fixed and portable equipment in the warehouse shop and/or in the job site shop.

4 All machines should be furnished with suitable waste containers for the collection of scrap and waste to prevent the material from falling on the floor and generating dust.

5 Shop-fabricated pieces of Thermal Insulation such as fittings, segments, etc., should be placed in containers. Care should be taken when handling these pieces during piling, stacking and packing.

6 Containers should be closed after packing and remain closed until the material is used.

Application Procedures

1 Unpacking and application of the material should be done in a manner that will minimize airborne dust.

2 Avoid dropping, throwing or unnecessary rough handling of insulation materials.

3 Keep floors and surfaces clean of scrap, shavings and debris. Put unusable material into waste containers immediately.

4 Hand sawing, cutting, jacket stripping, etc. should be done in a manner that will create minimal airborne dust. Use of proper methods and tools will help considerably towards dust abatement.

5 When working in confined spaces, portable dust collectors or exhaust blowers should be provided to remove dust from the source.

(Continued on Next Page)

Application Procedures (Cont'd)

6 If conditions prevent collecting or exhausting dust from the source, use exhaust blowers to provide general room air changes.

7 Avoid exhausting into other working areas.

8 In confined spaces, if mechanical exhaust equipment cannot be used, *Respirators should be worn.

9 When wiring or banding insulation and applying jackets or facings, care should be taken to avoid generating excessive dust, using the precautionary measures described above.

10 Surplus usable materials should be placed in cartons, which should be closed and returned to the warehouse.

*Bureau of Mines-approved respirators. See page 18.

CEMENTS

Warehousing, Storage and Handling

Handling and storage of closed bags containing cements do not present health safety hazards provided bags are unopened and not broken.

1 When unloading railroad cars and trucks, if there is excessive loose material resulting from opened or broken bags, *Respirators should be worn during clean-up and unloading.

2 Spillage should be cleaned up and open or broken bags repacked, resealed or discarded immediately to prevent distribution of dust into other areas.

3 If bags are damaged and spillage occurs in the warehouse, material should be cleaned up immediately to prevent distribution into other areas. Vacuum equipment is recommended for this cleaning.

4 If large quantities of spillage occurs and cleaning involves sweeping and/or shoveling that could create excessive dust, *Respirators should be worn.

*Bureau of Mines-approved respirators. See page 18.

Application of Cements

Opening, dumping and discarding of bags should be done with the utmost care to avoid generating excessive dust.

1 Open the bag wide enough to empty without shaking.

2 When dumping, keep bag on the mortar box mixing level to avoid dropping.

3 Do not shake bags.

4 Place empty bags in a container, wet down contents, and discard.

5 Mixing area should be well ventilated but free from heavy drafts that will cause dry material to become airborne.

6 Material should be mixed in a mortar box, pail or tub and not on the floor.

7 Wet the material and mix into a slurry as quickly as possible.

8 When mixing cement in a confined space where proper ventilation is inadequate, *Respirators should be worn.

Cleaning

1 Bag breakage, cleaning up dry cement and discarding bags at the mixing area should be done in the same manner as recommended under *Warehousing, Storage and Handling.*

2 Wet down tools, mortar boxes, wheelbarrows, mixing containers, and any spillage before scraping and cleaning.

3 Cements should be handled wet whenever possible. Wet material will create no dust problem.

*Bureau of Mines-approved respirators. See page 15.

SPRAYING OF THERMAL INSULATION

Spraying Areas

Spraying of Thermal Insulation Products containing asbestos requires special precautionary measures. Refer to the Sprayed Mineral Fiber Manufacturers Association for Sprayed Fiber Application Practices.*

1 The equipment and machinery to be sprayed should be shielded by adequate wind breaks and, where practicable, drop cloths to prevent excessive dust and contamination in adjacent areas.

2 Workers not engaged in the spraying operations should wear *Respirators when entering an area within 15 feet of the spraying machine, nozzle or equipment.

3 Where Sprayed Fiber Application Practices cannot be followed and excessive airborne dust is generated, it is recommended that portable mechanical exhaust ventilation be used to remove airborne dust. Exhaust must be located to avoid contamination of other occupied areas.

Application

1 All personnel in the immediate area engaged in the machine feeding and spraying operation should wear *Respirators, whether in confined or open areas, ventilated or not ventilated.

2 *Respirators should be worn after the spraying operation has been concluded and until the generated dust concentration has cleared.

*For copy of Practices, write to Executive Secretary, Sprayed Mineral Fiber Manufacturers Association, P.O. Box 437, Westfield, New Jersey 07090

*Bureau of Mines-approved respirators. See page 15.

Other Workmen

All personnel not involved with the machine feeding and spraying operation should be kept from the spraying area until the generated dust concentration has cleared.

Cleaning

1 Spillage and excess spraying materials should be cleaned up immediately after spraying operations have been completed.

2 Settled dust and fly material should be removed from all surfaces to avoid airborne contamination. Vacuum cleaning is recommended for this purpose.

3 Scrap spray material should be wet down and placed in closed containers for disposal.

4 Tools, ladders, etc. should be cleaned wet.

5 Avoid brushing, sweeping and shoveling dry material whenever possible.

6 *Respirators should be worn during clean-up.

*Bureau of Mines-approved respirators. See page 18.

STRIPPING OF THERMAL INSULATION

Stripping Area

Careful work methods, use of proper tools, and wetting down will minimize excessive dusts in stripping operations.

1 The area in which stripping takes place should be confined by means of curtains, portable partitions, etc., to prevent excessive dust contamination in adjacent areas.

2 If area cannot be confined, only workmen engaged in stripping should be permitted in the work location.

Stripping and Tearing Off

1 All personnel in the stripping area engaged in tearing off, handling, cleaning and disposing of material should wear *Respirators.

2 Where circumstances permit, materials should be wetted down prior to and during removal.

3 Where applicable, portable mechanical exhaust ventilation should be used to remove airborne dust.

4 Avoid unnecessary re-handling of scrap.

(Continued on Next Page)

*Bureau of Mines-approved respirators. See page 18.

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Stripping of Thermal Insulation (cont'd)

Stripping and Tearing Off (cont'd)

5 Locate truck, dumpster bucket or final disposal equipment as close to stripping site as possible.

6 Wet down scrap material before shoveling, hauling or dumping.

7 Do not permit accumulation of scrap and debris on floor and other surfaces.

8 Vacuum equipment is recommended for cleaning up during and after stripping.

Other Workmen

1 Personnel not involved in the stripping and tearing off operation should not be permitted in the stripping area.

2 If it is essential for other workmen to be in the work area, *Respirators should be worn by them.

*Bureau of Mines-approved respirators. See page 15.

RESPIRATORY EQUIPMENT

Only U.S. Bureau of Mines-approved respiratory equipment is recommended for use with asbestos, silica and other pneumoconiosis-producing dusts. Approved respiratory equipment must be used at all operations where dust control is not sufficient to maintain airborne dust concentration within allowable limits for asbestos and other pneumoconiosis-producing dusts, as established by governmental and professional agencies.

The efficiency and effectiveness of respiratory equipment is dependent upon proper care, cleaning and maintenance. A systematic procedure should be established to assure that this is done.

Lists of currently approved respiratory equipment can be obtained from:

Bureau of Mines
United States Department of the Interior
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Washington, D.C. 20240

American Industrial Hygiene Association
14125 Prevost
Detroit, Michigan 48227

IN THE UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
HOUSTON DIVISION

IN RE: ASBESTOS RELATED LITIGATION	§ §	MASTER ASBESTOS DOCKET NO. 100

DEFENDANT OWENS-CORNING FIBERGLAS CORPORATION'S
RESPONSES TO MASTER SET OF REQUEST FOR ADMISSIONS

TO: ALL COUNSEL OF RECORD:

1. You are now in the business of manufacturing, selling or distributing products containing asbestos.

ANSWER: Denied.

2. You have been in the past in the business of manufacturing, selling or distributing products containing asbestos.

(a) This was true during a part of the time between 1940 and 1972.

(b) Between 1940 and 1972, your products were sold or distributed in Texas.

(c) After 1972 some of your asbestos products were still in place where installed earlier.

ANSWER: (a-c) Admitted.

3. You knew your products inquired about above contained asbestos.

ANSWER: Admitted.

4. You gave no warning to the plaintiff(s) in this case of the dangers of asbestos.

ANSWER: Denied.

5. Asbestos is a known cause of asbestosis.

(a) A known cause of mesothelioma.

(b) A known cause of cancer of other bodily organs.

(c) A known cause of lung or bronchial damage.

ANSWER: (A-5) Admit that this defendant is now aware of medical literature which seems to indicate that prolonged inhalation and retention in the lungs of asbestos fibers may result in asbestosis under certain circumstances in certain individuals.

(a) Admit, this defendant is now aware of medical literature which seems to indicate varying degrees of relationships between certain types of cancer, including mesothelioma and inhalation of asbestos dust.

(b) Defendant objects to this request, as it lacks a definition of "other bodily organs," and as such is too speculative.

(c) This defendant admits that bronchogenic carcinoma may be caused, accelerated or aggravated by exposure

to asbestos; however, the risk is greatly enhanced by cigarette smoking.

Respectfully submitted,

FULBRIGHT & JAWORSKI
800 MBank Building
Houston, Texas 77002
(713) 651-5151

By _____
Samuel E. Stubbs
State Bar No. 19434500

ATTORNEYS FOR THE DEFENDANT,
OWENS-CORNING FIBERGLAS CORPORATION

CERTIFICATE OF SERVICE

A copy of these request for admissions has been served upon each attorney of record by United States mail on 12/23, 1985.

_____
Samuel E. Stubbs

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