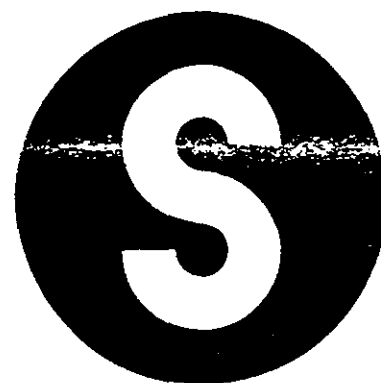


# Industrial Construction File



1957

*roofing and siding* **4**

*masonry treatments,  
waterproofing* **5**

*thermal insulation* **6**

*doors and windows* **7**

PLAINTIFF'S  
EXHIBIT  
K-743

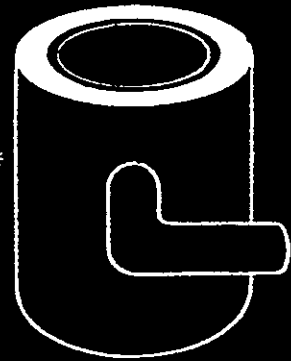
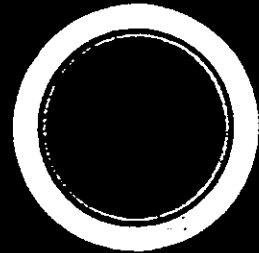
PERIODICAL  
TABLE  
S.S.S.

**Sweet's  
Catalog  
Service**

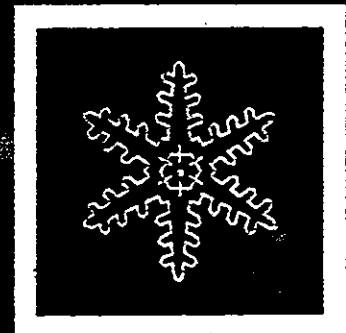
04 SERIALS

OWENS-CORNING  
**FIBERGLAS**  
THE GLASS PEOPLE

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Ow



# **industrial insulations manual**



AD-A-710-100-370

1013.001



# industrial insulations manual

*If you specify, buy or use industrial insulations,  
we believe you will find this Fiberglas\* Manual a  
ready source of ideas for saving money and  
achieving efficiency.*

*We do not claim that Fiberglas insulations are  
your best choice for every industrial use. But  
within their fields of application—which covers  
almost every industrial need—these carefully  
engineered products offer you extra values because of  
their unique combination of properties. Here  
are some of the benefits you can expect . . .*

\*T. M., Owens-Corning Fiberglas Corp.

Fiberglas  $k = .25$

Insulation "A"  $k = .32$

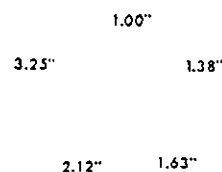
Insulation "B"  $k = .34$  (100°F. mean temp.)

Insulation "C"  $k = .41$

Insulation "D"  $k = .52$

## greater efficiency with equal thicknesses

Because the maze of fine Fiberglas fibers entraps countless tiny air cells, Fiberglas insulations have exceptionally low "k" values. Result . . . when equal thicknesses are specified, Fiberglas products give superior heat control . . . as shown by the typical illustration above. This feature can be of value when rigid control of heat in process equipment or maximum effective heat-control is desired.



## lesser thicknesses for equal efficiency

The low "k" value of Fiberglas insulations means that, where a certain insulating efficiency is desired, it can be achieved with lesser thicknesses of Fiberglas insulation as the illustration of a typical condition above shows. Thus, maximum economy consistent with insulating requirements is often possible using Fiberglas insulations.

#### Lower maintenance problems

Organic Fiberglas insulations offer long life to users. They won't rot, shrink, warp or buckle. Their weight . . . reducing danger of sagging. They won't corrode or accelerate corrosion of metal. Because of their resilient nature, stand up well.

#### Wide temperature range

the most complete line of industrial insulations. Properly specified and applied these insulations offer superior performance at temperatures from

#### A solution for every industrial insulation problem

Fiberglas insulation to specifically meet almost any insulation need in their temperature range. A variety of types, sizes and densities permits the user a desirable combination of cost, performance and any other specific properties.

#### Lower application costs

The ease and workability of Fiberglas insulations make for fast, inexpensive application. All insulations are easy to cut and fit. Factory application eliminates the need for job site application of

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*high temperature insulation  
for indoor and outdoor piping  
up to 1200° F.  
operating temperature*

## Kaylo pipe insulation

*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 up to 1200° F.*

*This thoroughly tested and field-proven material contains the physical properties most desired for efficient, durable insulation work. Kaylo Pipe Insulation's thermal effectiveness, high strength and moisture resistance are unattained by most other insulating materials.*

*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.*

### 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 Multi-segmental forms, they are furnished but not adhered.

### 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 3½" in diameter.

**forms**—Kaylo Pipe Insulation is available in sectional or multisegmental form depending upon pipe size. All insulation is furnished in 3' sections.

\*T. M. Owens-Illinois Glass Co.

### offers . . .

**high efficiency**—Among the most efficient insulations for temperatures up to 1200°F. Low "k" results from extremely small and numerous insulating air spaces.

**simplified dimensional standards**—Sizes are designed to permit nesting of one size over another to produce greater thicknesses than available in single layer or to produce "broken joint" concept.

**water resistance**—Kaylo Pipe Insulation retains an appreciable percentage of its strength even after complete saturation in water. After a cycle of soaking and drying, it returns to its original thermal efficiency and strength with no shrinkage or warping.

**high strength**—High flexural strength, compressive strength and resistance to abrasion far above normal requirements for heat insulation, greatly reduce installation and service breakage.

**easy fabrication**—Ordinary tools of the trade sufficient for all cutting, sawing or scoring. Non-irritating to the skin and non-toxic. Offers pleasant handling characteristics.

**long life**—Remains strong and efficient over the years. Dimensionally stable with little shrinkage. Has superior life characteristics over other types of high temperature insulations.

**versatility**—Performs efficiently at temperatures through the hot water and low pressure steam range in addition to temperatures in the superheated steam range. One high temperature material to do the job usually requiring combinations of two different insulating materials.

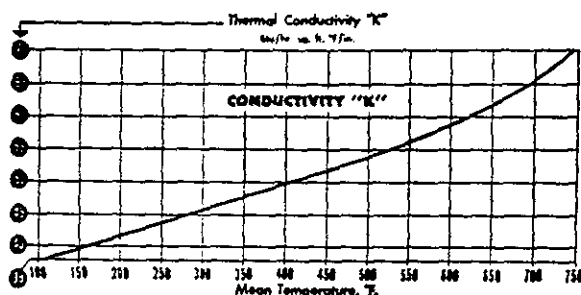
### limitations

Kaylo Pipe Insulation is designed for temperatures up to 1200°F. and is not recommended when operating temperatures of piping exceed this limit.

## physical properties

|                                                                                  |                                  |
|----------------------------------------------------------------------------------|----------------------------------|
| density                                                                          | approximately 11 lb. per cu. ft. |
| flexural strength                                                                | 50 lb. per sq. in.               |
| compressive strength (at 5% deformation)                                         |                                  |
| before heating                                                                   | 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.               |
| loss in weight                                                                   |                                  |
| after heating for 24 hours                                                       |                                  |
| at 750°F.                                                                        | 5.5%                             |
| at 1000°F.                                                                       | 7.9%                             |
| at 1200°F.                                                                       | 9.8%                             |
| after boiling for 24 hours (after drying)                                        | 0.2%                             |
| resistance to abrasion (conventional tumbling test-loss in weight after 10 min.) |                                  |
| before heating                                                                   | 2.2%                             |
| after heating for 24 hours                                                       |                                  |
| at 750°F.                                                                        | 3.7%                             |
| at 1000°F.                                                                       | 5.7%                             |
| at 1200°F.                                                                       | 6.9%                             |
| dimensional stability                                                            |                                  |
| linear shrinkage after heating for 24 hours                                      |                                  |
| at 750°F.                                                                        | 0.8%                             |
| at 1000°F.                                                                       | 0.9%                             |
| at 1200°F.                                                                       | 1.5%                             |
| elongation after saturation (max.)                                               | 0.04%                            |
| moisture adsorption (volume)                                                     |                                  |
| after 6 hours exposure in atmosphere of 120°F. and 90% relative humidity         | 0.9%                             |

## thermal conductivity



## specification compliance

HH-I-523a Insulation Block, Pipe Covering and Cement, Thermal, Calcium Silicate (For Temperatures up to 1200°F.)  
MIL-I-2781B Insulation Pipe Covering, Thermal



Kaylo Pipe Insulation applies easily and quickly with standard application methods.



Kaylo Pipe Insulation presents a superior final appearance when applied to a variety of irregularly-shaped high temperature vessels.

## design data

The following data is 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.

## recommended thicknesses

Economical thicknesses of insulation vary to a substantial degree in different industries principally because of:

- 1: Cost of fuel and operation time
- 2: Fixed charges or anticipated life of installation

Because these two factors vary greatly by industry, a single table of recommended thickness would be only an approximation. To approach more closely a true "Economical Thickness," the recommended thickness data on the following three pages is presented for three major industry groups:

- 1: Commercial and Industrial
- 2: Power and Utility
- 3: Process and Industries

## exceptions

Economical Thickness recommendations may not apply where insulation is applied for process temperature control, personnel protection or fire protection for specific areas. Refer to Kaylo Performance Data Book for insulation design for such conditions. See pages 43-45.

## insulation thickness standards

This table presents reference data for information on the actual thicknesses according to the simplified Dimensional Standard system. See pages 46-47.

## insulation efficiencies

This table and graph enable making the determination of thermal efficiencies for thicknesses from 1"-5" for pipe to air temperatures from 100° to 1200°F. See page 47.

design data

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# recommended thickness of Kaylo pipe insulation

## COMMERCIAL AND INDUSTRIAL DESIGN

(Figures are based on ambient still air at 80° F)

| pipe temp.<br>Temperature<br>Difference | 280F   |      |      |     | 480F   |      |      |     | 680F   |       |      |     |
|-----------------------------------------|--------|------|------|-----|--------|------|------|-----|--------|-------|------|-----|
|                                         | 200F   |      |      |     | 400F   |      |      |     | 600F   |       |      |     |
| pipe size                               | T      | HL   | E    | ST  | T      | HL   | E    | ST  | T      | HL    | E    | ST  |
| 1/2                                     | 1"     | 32.5 | 76.1 | 106 | 2"     | 56   | 86.8 | 105 | 2 1/2" | 73.3  | 91.1 | 107 |
| 3/4                                     | 1"     | 38.9 | 76.7 | 110 | 2"     | 59   | 87.8 | 108 | 2 1/2" | 81.8  | 91.9 | 109 |
| 1                                       | 1"     | 40.8 | 80.2 | 107 | 2"     | 64   | 89.2 | 107 | 3"     | 86.0  | 93.1 | 107 |
| 1 1/4                                   | 1 1/2" | 38.0 | 85.1 | 99  | 2 1/2" | 67   | 91.0 | 105 | 3 1/2" | 93.0  | 94.1 | 106 |
| 1 1/2                                   | 1 1/2" | 42.6 | 85.3 | 101 | 2"     | 73.9 | 91.2 | 107 | 3 1/2" | 97.8  | 94.5 | 107 |
| 2                                       | 1 1/2" | 48.3 | 86.4 | 101 | 2 1/2" | 79.5 | 92.3 | 106 | 3 1/2" | 108.0 | 95.1 | 108 |
| 2 1/2                                   | 1 1/2" | 50.0 | 88.2 | 99  | 2"     | 94   | 92.4 | 110 | 3 1/2" | 115.0 | 95.6 | 107 |
| 3                                       | 1 1/2" | 63.7 | 87.5 | 103 | 2 1/2" | 102  | 93.2 | 109 | 4"     | 125.0 | 96.1 | 107 |
| 4                                       | 1 1/2" | 76.8 | 88.0 | 105 | 2 1/2" | 120  | 93.7 | 110 | 4"     | 145.0 | 96.4 | 109 |
| 5                                       | 1 1/2" | 91.4 | 88.3 | 106 | 3"     | 124  | 94.6 | 106 | 4"     | 164.0 | 96.7 | 109 |
| 6                                       | 1 1/2" | 107  | 88.4 | 107 | 3"     | 141  | 94.8 | 108 | 4 1/2" | 172.0 | 97.1 | 109 |
| 7                                       | 1 1/2" | 116  | 88.9 | 107 | 3"     | 152  | 95.1 | 107 | 4 1/2" | 188.0 | 97.2 | 109 |
| 8                                       | 1 1/2" | 129  | 89.0 | 107 | 3"     | 167  | 95.2 | 108 | 4 1/2" | 206.0 | 97.3 | 109 |
| 9                                       | 1 1/2" | 142  | 89.1 | 108 | 3"     | 181  | 95.4 | 109 | 4 1/2" | 222.0 | 97.4 | 111 |
| 10                                      | 1 1/2" | 151  | 89.6 | 107 | 3"     | 200  | 95.4 | 110 | 5"     | 226.0 | 97.6 | 109 |
| 12                                      | 1 1/2" | 174  | 89.8 | 108 | 3 1/2" | 206  | 95.9 | 107 | 5"     | 256   | 97.7 | 109 |
| 14                                      | 1 1/2" | 202  | 89.1 | 110 | 3 1/2" | 227  | 95.9 | 108 | 5"     | 280   | 97.7 | 111 |
| 16                                      | 2"     | 182  | 91.3 | 104 | 3 1/2" | 253  | 96.0 | 108 | 5 1/2" | 293   | 97.9 | 109 |
| 18                                      | 2"     | 202  | 91.4 | 104 | 3 1/2" | 280  | 96.0 | 109 | 5 1/2" | 321   | 97.9 | 109 |
| 20                                      | 2"     | 222  | 91.4 | 104 | 3 1/2" | 305  | 96.1 | 109 | 5 1/2" | 350   | 97.9 | 111 |
| 24                                      | 2"     | 262  | 91.5 | 105 | 3 1/2" | 358  | 96.1 | 110 | 5 1/2" | 400   | 98.0 | 111 |

T—Recommended Thickness. HL—Heat Loss Btu/Lin. Ft./hr. E—Insulation Efficiency. ST—Surface Temperature.

# **piping to 1200°F.**

## **design data**

### **recommended thickness of Kaylo pipe insulation**

#### **POWER AND UTILITY INDUSTRIES**

*(Figures are based on ambient still air at 80° F)*

| pipe temp.<br>temperature<br>difference | 280F   |      |      |     | 480F   |      |      |     | 680F   |      |      |     | 880F   |     |      |     | 1080F  |     |      |     | 1280F  |     |      |     |
|-----------------------------------------|--------|------|------|-----|--------|------|------|-----|--------|------|------|-----|--------|-----|------|-----|--------|-----|------|-----|--------|-----|------|-----|
|                                         | 200F   |      |      |     | 400F   |      |      |     | 600F   |      |      |     | 800F   |     |      |     | 1000F  |     |      |     | 1200F  |     |      |     |
| pipe size                               | T      | HL   | E    | ST  | T      | HL   | E    | ST  | T      | HL   | E    | ST  | T      | HL  | E    | ST  | T      | HL  | E    | ST  | T      | HL  | E    | ST  |
| 1/2                                     | 1"     | 32.5 | 76.1 | 106 | 1 1/2" | 58.4 | 85.2 | 113 | 2"     | 83.6 | 89.8 | 118 | 2 1/2" | 104 | 93.0 | 116 | 3"     | 128 | 94.8 | 116 | 3 1/2" | 150 | 96.1 | 115 |
| 3/4                                     | 1"     | 38.9 | 76.7 | 110 | 1 1/2" | 67.4 | 86.0 | 117 | 2"     | 95.0 | 90.6 | 122 | 2 1/2" | 116 | 93.7 | 120 | 3"     | 143 | 95.3 | 122 | 3 1/2" | 170 | 96.5 | 123 |
| 1                                       | 1"     | 40.8 | 80.2 | 107 | 1 1/2" | 73.4 | 87.7 | 116 | 2"     | 103  | 91.8 | 121 | 2 1/2" | 132 | 94.2 | 117 | 3 1/2" | 155 | 95.8 | 122 | 3 1/2" | 193 | 96.8 | 125 |
| 1 1/4                                   | 1"     | 52.0 | 79.6 | 113 | 1 1/2" | 82.2 | 88.9 | 117 | 2 1/2" | 108  | 93.1 | 117 | 3"     | 140 | 95.1 | 122 | 3 1/2" | 172 | 96.6 | 124 | 4"     | 203 | 97.4 | 123 |
| 1 1/2                                   | 1"     | 52.6 | 81.8 | 110 | 1 1/2" | 92.3 | 89.0 | 121 | 2 1/2" | 119  | 93.3 | 121 | 3"     | 158 | 95.3 | 125 | 3 1/2" | 178 | 96.8 | 122 | 4"     | 206 | 97.6 | 121 |
| 2                                       | 1"     | 60.8 | 82.9 | 111 | 1 1/2" | 105  | 89.9 | 122 | 2 1/2" | 128  | 94.2 | 119 | 3"     | 165 | 95.9 | 124 | 4"     | 190 | 97.2 | 121 | 4 1/2" | 228 | 97.9 | 125 |
| 2 1/2                                   | 1"     | 69.9 | 83.5 | 112 | 1 1/2" | 108  | 91.3 | 117 | 2 1/2" | 151  | 94.3 | 124 | 3"     | 164 | 96.1 | 122 | 4"     | 204 | 97.5 | 121 | 4 1/2" | 245 | 98.1 | 123 |
| 3                                       | 1"     | 82.6 | 83.7 | 114 | 2"     | 116  | 92.2 | 115 | 2 1/2" | 164  | 94.9 | 123 | 3 1/2" | 190 | 96.8 | 121 | 4 1/2" | 222 | 97.7 | 121 | 5"     | 263 | 98.3 | 124 |
| 4                                       | 1"     | 98.2 | 84.7 | 114 | 2"     | 139  | 92.7 | 118 | 3"     | 172  | 95.8 | 118 | 3 1/2" | 222 | 97.0 | 124 | 4 1/2" | 252 | 98.0 | 123 | 5 1/2" | 295 | 98.4 | 125 |
| 5                                       | 1"     | 120  | 84.7 | 116 | 2"     | 164  | 92.9 | 119 | 3"     | 199  | 96.0 | 120 | 4"     | 233 | 97.5 | 120 | 4 1/2" | 288 | 98.1 | 125 | 5 1/2" | 328 | 98.5 | 123 |
| 6                                       | 1"     | 156  | 83.0 | 122 | 2"     | 185  | 93.2 | 120 | 3"     | 227  | 96.1 | 122 | 4"     | 262 | 97.6 | 122 | 5"     | 305 | 98.5 | 123 | 6"     | 355 | 98.7 | 123 |
| 7                                       | 1 1/2" | 116  | 88.9 | 107 | 2"     | 206  | 93.4 | 121 | 3"     | 244  | 96.4 | 121 | 4"     | 288 | 97.7 | 123 | 5"     | 333 | 98.5 | 124 | 6"     | 384 | 98.8 | 127 |
| 8                                       | 1 1/2" | 129  | 89.0 | 107 | 2"     | 228  | 93.5 | 122 | 3"     | 268  | 96.5 | 122 | 4"     | 315 | 97.8 | 124 | 5"     | 362 | 98.5 | 125 | 6"     | 420 | 98.9 | 129 |
| 9                                       | 1 1/2" | 142  | 89.1 | 108 | 2"     | 238  | 93.9 | 120 | 3"     | 291  | 96.6 | 123 | 4"     | 340 | 97.7 | 125 | 5 1/2" | 376 | 98.6 | 124 | 6"     | 456 | 98.9 | 130 |
| 10                                      | 1 1/2" | 151  | 89.6 | 107 | 2"     | 267  | 93.8 | 122 | 3"     | 322  | 96.6 | 125 | 4 1/2" | 344 | 98.0 | 122 | 5 1/2" | 405 | 98.7 | 125 | 6"     | 498 | 98.9 | 132 |
| 12                                      | 1 1/2" | 174  | 89.8 | 108 | 2"     | 308  | 93.9 | 123 | 3 1/2" | 330  | 97.0 | 120 | 4 1/2" | 391 | 98.1 | 123 | 6"     | 444 | 98.8 | 124 | 6"     | 564 | 99.0 | 134 |
| 14                                      | 1 1/2" | 202  | 89.1 | 110 | 2 1/2" | 294  | 94.7 | 118 | 3 1/2" | 366  | 97.0 | 122 | 4 1/2" | 429 | 98.1 | 125 | 6"     | 482 | 98.8 | 126 | 6"     | 614 | 99.0 | 136 |
| 16                                      | 1 1/2" | 228  | 89.1 | 111 | 2 1/2" | 330  | 94.8 | 119 | 3 1/2" | 407  | 97.0 | 123 | 5"     | 441 | 98.3 | 122 | 6"     | 525 | 98.8 | 127 | 6"     | 688 | 99.0 | 139 |
| 18                                      | 1 1/2" | 253  | 89.2 | 111 | 2 1/2" | 366  | 94.8 | 119 | 3 1/2" | 450  | 97.1 | 124 | 5"     | 484 | 98.3 | 123 | 6"     | 584 | 98.9 | 128 | 6"     | 740 | 99.0 | 140 |
| 20                                      | 1 1/2" | 279  | 89.2 | 111 | 2 1/2" | 401  | 94.9 | 120 | 3 1/2" | 494  | 97.1 | 125 | 5"     | 526 | 98.3 | 123 | 6"     | 636 | 98.9 | 129 | 6"     | 810 | 99.1 | 143 |
| 24                                      | 1 1/2" | 331  | 89.2 | 111 | 2 1/2" | 472  | 94.9 | 121 | 4"     | 517  | 97.5 | 120 | 5"     | 613 | 98.4 | 125 | 6"     | 740 | 98.9 | 131 | 6"     | 925 | 99.1 | 148 |

Insulation Thickness, HL—Heat Loss Btu/Lin. ft./hr. E—Insulation Efficiency. ST—Surface Temperature.

### ***recommended thickness of Kaylo pipe insulation***

## PROCESS INDUSTRY

(Figures are based on ambient still air at 80° F)

| pipe temp.             |        | 280F |      |     |        | 480F |      |     |        | 680F |      |     |        | 880F |      |     |        | 1080F |      |     |        | 1280F |      |    |  |
|------------------------|--------|------|------|-----|--------|------|------|-----|--------|------|------|-----|--------|------|------|-----|--------|-------|------|-----|--------|-------|------|----|--|
| temperature difference |        | 200F |      |     |        | 400F |      |     |        | 600F |      |     |        | 800F |      |     |        | 1000F |      |     |        | 1200F |      |    |  |
| pipe size              | T      | HL   | E    | ST  | T      | HL   | E    | ST  | T      | HL   | E    | ST  | T      | HL   | E    | ST  | T      | HL    | E    | ST  | T      | HL    | E    | ST |  |
| 1/2                    | 1'     | 32.5 | 76.1 | 106 | 1'     | 70.8 | 82.0 | 130 | 1 1/2' | 129  | 88.5 | 129 | 1 1/2' | 134  | 90.8 | 145 | 2'     | 158   | 93.6 | 144 | 2 1/2' | 175   | 95.5 | 14 |  |
| 3/4                    | 1'     | 38.9 | 76.7 | 110 | 1'     | 84.5 | 82.5 | 138 | 1 1/2' | 108  | 89.3 | 136 | 2'     | 135  | 92.5 | 137 | 2'     | 179   | 94.2 | 150 | 2 1/2' | 196   | 95.9 | 14 |  |
| 1                      | 1'     | 40.8 | 80.2 | 107 | 1'     | 89.0 | 85.0 | 132 | 1 1/2' | 118  | 90.6 | 135 | 2'     | 147  | 93.5 | 136 | 2 1/2' | 188   | 95.6 | 139 | 2 1/2' | 225   | 96.3 | 14 |  |
| 1 1/4                  | 1'     | 52.0 | 79.6 | 113 | 1'     | 114  | 84.6 | 144 | 1 1/2' | 132  | 91.6 | 136 | 2'     | 173  | 93.9 | 144 | 2 1/2' | 203   | 95.7 | 144 | 3'     | 236   | 96.9 | 14 |  |
| 1 1/2                  | 1'     | 52.6 | 81.8 | 110 | 1'     | 115  | 86.3 | 138 | 1 1/2' | 148  | 91.7 | 141 | 2'     | 169  | 94.8 | 135 | 2 1/2' | 224   | 95.9 | 149 | 3'     | 259   | 97.0 | 15 |  |
| 2                      | 1'     | 60.8 | 82.9 | 111 | 1'     | 133  | 87.2 | 140 | 1 1/2' | 169  | 92.3 | 143 | 2'     | 204  | 94.9 | 144 | 2 1/2' | 241   | 96.4 | 146 | 3'     | 279   | 97.2 | 14 |  |
| 2 1/2                  | 1'     | 69.9 | 83.5 | 112 | 1'     | 152  | 87.7 | 143 | 1 1/2' | 174  | 93.4 | 136 | 2'     | 216  | 95.6 | 140 | 2 1/2' | 256   | 96.9 | 143 | 3'     | 298   | 97.7 | 14 |  |
| 3                      | 1'     | 82.6 | 83.7 | 114 | 1'     | 180  | 87.9 | 146 | 1 1/2' | 222  | 93.0 | 149 | 2 1/2' | 234  | 96.0 | 138 | 3'     | 279   | 97.2 | 142 | 3 1/2' | 321   | 97.9 | 14 |  |
| 4                      | 1'     | 98.2 | 84.7 | 114 | 1'     | 215  | 88.6 | 147 | 2'     | 222  | 94.5 | 136 | 2 1/2' | 276  | 96.3 | 142 | 3'     | 323   | 97.4 | 144 | 3 1/2' | 375   | 98.1 | 14 |  |
| 5                      | 1'     | 120  | 84.7 | 116 | 1 1/2' | 199  | 91.4 | 131 | 2'     | 262  | 94.7 | 139 | 2 1/2' | 318  | 96.5 | 144 | 3'     | 375   | 97.6 | 148 | 4'     | 393   | 98.4 | 14 |  |
| 6                      | 1'     | 156  | 83.0 | 122 | 1 1/2' | 232  | 91.5 | 133 | 2'     | 297  | 94.9 | 140 | 2 1/2' | 364  | 96.6 | 147 | 3 1/2' | 380   | 98.1 | 140 | 4'     | 441   | 98.5 | 14 |  |
| 7                      | 1 1/2' | 116  | 88.9 | 107 | 1 1/2' | 252  | 91.9 | 132 | 2'     | 332  | 95.1 | 142 | 2 1/2' | 405  | 96.7 | 148 | 3 1/2' | 417   | 98.2 | 142 | 4'     | 486   | 98.6 | 14 |  |
| 8                      | 1 1/2' | 129  | 89.0 | 107 | 1 1/2' | 280  | 92.0 | 133 | 2'     | 366  | 95.2 | 143 | 2 1/2' | 431  | 96.9 | 147 | 3 1/2' | 456   | 98.1 | 143 | 4'     | 532   | 98.6 | 14 |  |
| 9                      | 1 1/2' | 142  | 89.1 | 108 | 1 1/2' | 307  | 92.1 | 134 | 2'     | 384  | 95.5 | 141 | 2 1/2' | 470  | 97.0 | 148 | 3 1/2' | 495   | 98.1 | 145 | 4'     | 576   | 98.6 | 15 |  |
| 10                     | 1 1/2' | 151  | 89.6 | 107 | 1 1/2' | 328  | 92.4 | 133 | 2'     | 430  | 95.4 | 143 | 3'     | 458  | 97.4 | 141 | 3 1/2' | 545   | 98.2 | 147 | 4 1/2' | 581   | 98.8 | 14 |  |
| 12                     | 1 1/2' | 174  | 89.8 | 108 | 1 1/2' | 380  | 92.5 | 134 | 2'     | 496  | 95.5 | 145 | 3'     | 526  | 97.4 | 142 | 3 1/2' | 623   | 98.2 | 149 | 4 1/2' | 660   | 98.8 | 14 |  |
| 14                     | 1 1/2' | 202  | 89.1 | 110 | 1 1/2' | 439  | 92.1 | 138 | 2'     | 566  | 95.3 | 149 | 3'     | 585  | 97.4 | 145 | 4'     | 624   | 98.4 | 144 | 4 1/2' | 725   | 98.8 | 15 |  |
| 16                     | 1 1/2' | 228  | 89.1 | 111 | 1 1/2' | 496  | 92.1 | 139 | 2'     | 636  | 95.4 | 150 | 3'     | 655  | 97.4 | 147 | 4'     | 694   | 98.4 | 145 | 5'     | 742   | 98.9 | 14 |  |
| 18                     | 1 1/2' | 253  | 89.2 | 111 | 1 1/2' | 553  | 92.2 | 140 | 2 1/2' | 589  | 96.2 | 139 | 3'     | 725  | 97.5 | 148 | 4'     | 764   | 98.4 | 147 | 5'     | 815   | 99.0 | 15 |  |
| 20                     | 1 1/2' | 279  | 89.2 | 111 | 1 1/2' | 608  | 92.2 | 141 | 2 1/2' | 646  | 96.2 | 140 | 3'     | 794  | 97.5 | 149 | 4'     | 835   | 98.5 | 147 | 5'     | 888   | 99.0 | 15 |  |
| 24                     | 1 1/2' | 331  | 89.2 | 111 | 1 1/2' | 721  | 92.2 | 141 | 2 1/2' | 759  | 96.3 | 141 | 3 1/2' | 819  | 97.8 | 141 | 4'     | 976   | 98.5 | 149 | 5'     | 1032  | 99.0 | 15 |  |

T—Recommended Thickness.      HL—Heat Loss/lin. ft./hr.      E—Insulation Efficiency.      ST—Surface Temperature.

**design data**

**insulation thickness standards**

**IRON PIPE SIZES (IPS)**

| nom.<br>pipe<br>size | O.D.<br>of<br>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.  |
| 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    | 8.66  |                     |       |         |       |          |       |         |       |
| 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 |
| 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 | 4.54     | 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 | 4.54     | 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 |
| 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 |
| 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 | 3.98    | 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 |

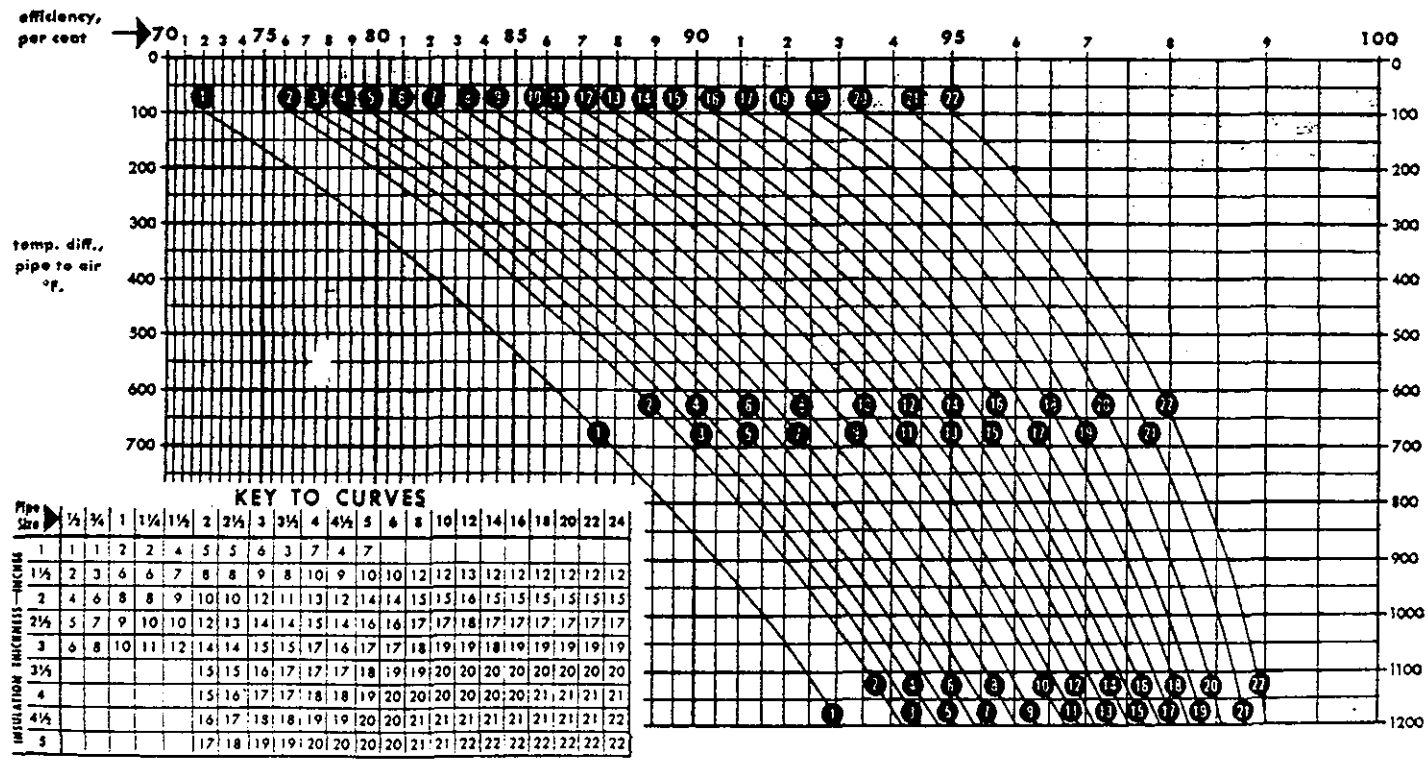
design data

insulation thickness standards

COPPER TUBING (CT)

| O. D. of<br>tube<br>(nom.) | nom.<br>tube<br>size | single layer |      |          |      |
|----------------------------|----------------------|--------------|------|----------|------|
|                            |                      | nom. 1"      |      | nom. 1½" |      |
|                            |                      | actual       | O.D. | actual   | O.D. |
| ½"                         | ¾"                   | 1.18         | 2.88 | 1.49     | 3.50 |
| ¾"                         | ½"                   | 1.11         | 2.88 | 1.42     | 3.50 |
| ¾"                         | ¾"                   | 1.05         | 2.88 | 1.61     | 4.00 |
| ¾"                         | ¾"                   | .99          | 2.88 | 1.55     | 4.00 |
| 1½"                        | 1"                   | 1.17         | 3.50 | 1.42     | 4.00 |
| 1½"                        | 1¼"                  | 1.05         | 3.50 | 1.55     | 4.50 |
| 1½"                        | 1½"                  | 1.17         | 4.00 | 1.42     | 4.50 |
| 2½"                        | 2"                   | .91          | 4.00 | 1.41     | 5.00 |
| 2½"                        | 2½"                  | .91          | 4.50 | 1.45     | 5.56 |
| 3½"                        | 3"                   | .91          | 5.00 | 1.73     | 6.66 |

insulation efficiencies



## **specification**

*for insulation of piping  
with Kaylo pipe insulation*

### **1: Insulating materials**

All heated pipes shall be insulated to the thickness noted on drawings or as shown in the following table with Kaylo Pipe Insulation as distributed by Owens-Corning Fiberglas Corporation.

### **TABLE OF RECOMMENDED INSULATION THICKNESS**

Recommended Thicknesses vary according to use.

(See pages 43-45 for Complete Recommended Thickness Table.)

### **2: Application**

All Pipe Insulation shall be applied over clean, dry surfaces, butting adjoining sections firmly together. Insulation on pipes under 12" diameter shall have factory-applied canvas pasted neatly in place and be secured with factory furnished bands spaced on not greater than 18" centers.

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 fabricated mitered segments of pipe insulation equal in thickness to the insulation on the adjoining pipe. Fittings on pipe size of 3" and smaller may be insulated with 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 and bands. 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 1/2" 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 1/4" coat of finishing cement. Portland cement to a maximum of 25% dry weight may be added if a harder finish is desired. Insulation located indoors shall be further finished with 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 1/8" dry coat and shall be troweled neatly over the fitting and lapped over the jacket on the adjacent pipe.

*The specification is recommended as written. Minor variances of application procedure may be made at the discretion and responsibility of the design engineer to meet specific job requirements.*

*for insulation of piping with Kaylo pipe insulation*

*high temperature insulation  
and fireproofing  
for indoor or outdoor piping  
up to 1800° F.  
operating temperature*

## Kaylo-20 pipe insulation

Kaylo-20 Insulation, a new high-temperature calcium silicate heat insulation developed and manufactured by Owens-Illinois extends the range of Kaylo Heat Insulation offered by Owens-Corning Fiberglas\*\* to include temperatures up to 1800° F. with all the properties of moisture resistance and high strength of standard Kaylo material.

This new product, which is a light pink color and can in this way be distinguished from standard Kaylo material, combines the most desirable physical characteristics of heat insulation materials to a degree not equalled by most other materials in its temperature range. It is designed for all high temperature applications including fireproofing.

### 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". 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.

### 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 3½".

**forms**—Kaylo-20 Pipe Insulation is available in sectional or multi-segmental form depending upon pipe size. All insulation is furnished in 3' sections.

\*T.M., Owens-Illinois Glass Co.

\*\*T.M., Owens-Corning Fiberglas Corp

### offers . . .

**simplified dimensional standards**—O.D.'s of insulation correspond to those of standard pipe assuring proper fit for each pipe size and permit nesting of insulation to build up greater thicknesses than those available in standard thicknesses. Kaylo-20 Insulation also may be used with outer layers of standard Kaylo or Fiberglas Pipe Insulation to provide the ultimate balance of cost and efficiency.

**high efficiency**—Kaylo-20 Insulation ranks among the most efficient insulations in its temperature range.

**water resistance**—Kaylo-20 Pipe Insulation retains an appreciable percentage of its strength even when saturated with water. After being soaked and then dried, it returns to its original thermal efficiency and strength without shrinkage or warping.

**high strength**—Kaylo-20 Insulation has flexural strength, compression strength and resistance to abrasion far above normal requirements for heat insulation, reducing breakage during installation and in service.

**easy fabrication**—Kaylo-20 Insulation can be cut, scored or sawed with ordinary tools of the trade. It is non-irritating to the skin and non-toxic.

**low shrinkage**—Kaylo-20 Insulation is highly dimensionally stable at the temperatures for which it is designed. Even at 1800° F. it will not crumble but retains its original form.

**fireproofing**—The resistance of this insulation to high temperatures makes it extremely useful for fireproofing piping.

### 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.

Kaylo-20 products are presently available on a made-to-order basis only. Properties and characteristics have been determined from laboratory tests only. Data is subject to change without notice and is subject to normal manufacturing and testing tolerances.

### physical properties

#### density:

approximately 12 lbs. per cu. ft.

#### flexural strength:

50 lbs. per sq. in.

#### compressive strength:

100 lbs. per sq. in. at 5% deformation

#### dimensional stability:

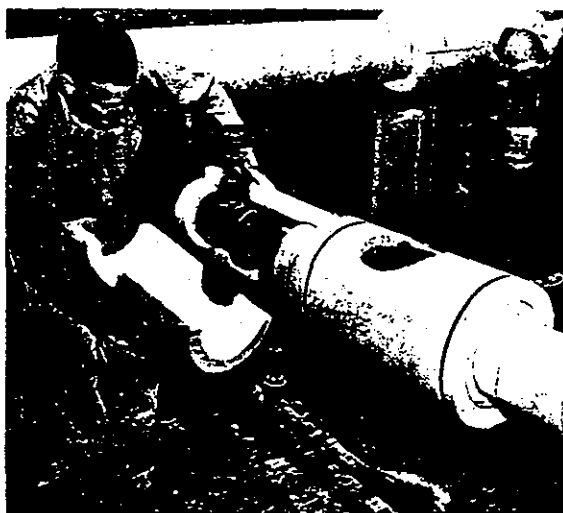
(linear shrinkage after heating for 6 hours at 1800°F.)  
less than 1.5%

#### moisture adsorption (by volume):

(after 6 hours exposure in atmosphere of 120°F. and 90% relative humidity) 0.9%

#### working temperature:

up to 1800°



Light in weight, Kaylo-20 Pipe Insulation is easily fabricated and requires no special application techniques.



Kaylo-20 Pipe Insulation is adaptable to vessels of unconventional size and shape. Used on pipes, breechings, ducts and boilers, it is shown here on steam lines of a power station's turbines.

## design data

The table below has been developed to serve as a guide to recommended thicknesses for Kaylo-20 Pipe Insulation. 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.

### recommended thicknesses

| nom.<br>pipe<br>size | temp. difference—hot surface to air, deg. F. |      |      |      |      |      |      |      |
|----------------------|----------------------------------------------|------|------|------|------|------|------|------|
|                      | 1100                                         | 1200 | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 |
| ½                    | 2 ½                                          | 3    | 3    | 3 ½  | 3 ½  | 4    | 4 ½  | 4 ½  |
| ¾                    | 2 ½                                          | 3    | 3    | 3 ½  | 3 ½  | 4    | 4 ½  | 4 ½  |
| 1                    | 2 ½                                          | 3    | 3    | 3 ½  | 3 ½  | 4    | 4 ½  | 5    |
| 1 ¼                  | 2 ½                                          | 3    | 3    | 3 ½  | 4    | 4 ½  | 5    | 5    |
| 1 ½                  | 3                                            | 3    | 3    | 3 ½  | 4    | 4 ½  | 5    | 5 ½  |
| 2                    | 3                                            | 3    | 3 ½  | 4    | 4 ½  | 4 ½  | 5    | 5 ½  |
| 2 ½                  | 3 ½                                          | 3 ½  | 4    | 4    | 4 ½  | 5    | 5 ½  | 6    |
| 3                    | 3 ½                                          | 3 ½  | 4    | 4    | 4 ½  | 5    | 5 ½  | 6    |
| 3 ½                  | 3 ½                                          | 4    | 4 ½  | 4 ½  | 5    | 5 ½  | 6    | 6 ½  |
| 4                    | 3 ½                                          | 4    | 4 ½  | 4 ½  | 5    | 5 ½  | 6    | 6 ½  |
| 6                    | 4                                            | 4 ½  | 5    | 5    | 5 ½  | 6    | 6 ½  | 7    |
| 8                    | 4 ½                                          | 4 ½  | 5    | 5    | 5 ½  | 6    | 6 ½  | 7    |
| 10                   | 4 ½                                          | 5    | 5    | 5 ½  | 6    | 6 ½  | 7    | 7 ½  |
| 12                   | 5                                            | 5    | 5 ½  | 5 ½  | 6    | 6 ½  | 7    | 7 ½  |
| 14                   | 5                                            | 5 ½  | 5 ½  | 6    | 6 ½  | 7    | 7 ½  | 8    |
| 16                   | 5                                            | 5 ½  | 6    | 6 ½  | 7    | 7 ½  | 8    | 8 ½  |
| 18                   | 5                                            | 5 ½  | 6    | 6 ½  | 7    | 7 ½  | 8    | 8 ½  |
| 20                   | 5 ½                                          | 6    | 6 ½  | 7    | 7 ½  | 8    | 8 ½  | 9    |
| 24-72                | 5 ½                                          | 6    | 6 ½  | 7    | 7 ½  | 8    | 8 ½  | 9    |

For temperatures up to 1200°F. use standard Kaylo recommended thicknesses listed in IN6.A2.

design data

insulation thickness standards

IRON PIPE SIZES (IPS)

| nom.<br>pipe<br>size | O.D.<br>of<br>pipe | single layer only |      |          |       | single or double layer |       |          |       |         |       |
|----------------------|--------------------|-------------------|------|----------|-------|------------------------|-------|----------|-------|---------|-------|
|                      |                    | nom. 1"           |      | nom. 1½" |       | nom. 2"                |       | nom. 2½" |       | nom. 3" |       |
|                      |                    | actual            | O.D. | actual   | O.D.  | actual                 | O.D.  | actual   | O.D.  | actual  | O.D.  |
| 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    | 8.66  |
| 2                    | 2.38               | 1.04              | 4.50 | 1.57     | 5.56  | 2.12                   | 6.66  | 2.62     | 7.66  | 3.12    | 8.66  |
| 2½                   | 2.88               | 1.04              | 5.00 | 1.87     | 6.66  | 2.37                   | 7.66  | 2.87     | 8.66  | 3.37    | 9.66  |
| 3                    | 3.50               | 1.00              | 5.56 | 1.55     | 6.66  | 2.05                   | 7.66  | 2.55     | 8.66  | 3.05    | 9.66  |
| 3½                   | 4.00               | 1.30              | 6.66 | 1.80     | 7.66  | 2.30                   | 8.66  | 2.80     | 9.66  | 3.36    | 10.78 |
| 4                    | 4.50               | 1.05              | 6.66 | 1.55     | 7.66  | 2.05                   | 8.66  | 2.55     | 9.66  | 3.11    | 10.78 |
| 4½                   | 5.00               | 1.30              | 7.66 | 1.80     | 8.66  | 2.30                   | 9.66  | 2.86     | 10.78 | 3.36    | 11.78 |
| 5                    | 5.56               | 1.02              | 7.66 | 1.52     | 8.66  | 2.02                   | 9.66  | 2.58     | 10.78 | 3.08    | 11.78 |
| 6                    | 6.63               | .95               | 8.66 | 1.45     | 9.66  | 2.02                   | 10.78 | 2.52     | 11.78 | 3.03    | 12.81 |
| 7                    | 7.63               |                   |      | 1.52     | 10.78 | 2.02                   | 11.78 | 2.53     | 12.81 | 3.16    | 14.06 |
| 8                    | 8.63               |                   |      | 1.52     | 11.78 | 2.03                   | 12.81 | 2.66     | 14.06 | 3.16    | 15.06 |
| 9                    | 9.63               |                   |      | 1.53     | 12.81 | 2.16                   | 14.06 | 2.66     | 15.06 | 3.17    | 16.09 |
| 10                   | 10.75              |                   |      | 1.59     | 14.06 | 2.09                   | 15.06 | 2.61     | 16.09 | 3.06    | 17.00 |
| 11                   | 11.75              |                   |      | 1.58     | 15.06 | 2.09                   | 16.09 | 2.55     | 17.00 | 3.05    | 18.00 |
| 12                   | 12.75              |                   |      | 1.59     | 16.09 | 2.05                   | 17.00 | 2.55     | 18.00 | 3.05    | 19.00 |
| 14                   | 14.00              |                   |      | 1.42     | 17.00 | 1.92                   | 18.00 | 2.42     | 19.00 | 2.92    | 20.00 |
| 15                   | 15.00              |                   |      | 1.42     | 18.00 | 1.92                   | 19.00 | 2.41     | 20.00 | 2.92    | 21.00 |
| 16                   | 16.00              |                   |      | 1.41     | 19.00 | 1.91                   | 20.00 | 2.41     | 21.00 | 2.91    | 22.00 |
| 17                   | 17.00              |                   |      | 1.41     | 20.00 | 1.91                   | 21.00 | 2.41     | 22.00 | 2.91    | 23.00 |
| 18                   | 18.00              |                   |      | 1.41     | 21.00 | 1.91                   | 22.00 | 2.41     | 23.00 | 2.91    | 24.00 |
| 19                   | 19.00              |                   |      | 1.41     | 22.00 | 1.91                   | 23.00 | 2.41     | 24.00 | 2.91    | 25.00 |
| 20                   | 20.00              |                   |      | 1.41     | 23.00 | 1.91                   | 24.00 | 2.41     | 25.00 | 2.91    | 26.00 |
| 21                   | 21.00              |                   |      | 1.41     | 24.00 | 1.91                   | 25.00 | 2.41     | 26.00 | 2.91    | 27.00 |
| 22                   | 22.00              |                   |      | 1.41     | 25.00 | 1.91                   | 26.00 | 2.41     | 27.00 | 2.91    | 28.00 |
| 23                   | 23.00              |                   |      | 1.41     | 26.00 | 1.91                   | 27.00 | 2.41     | 28.00 | 2.91    | 29.00 |
| 24                   | 24.00              |                   |      | 1.41     | 27.00 | 1.91                   | 28.00 | 2.41     | 29.00 | 2.91    | 30.00 |
| 25                   | 25.00              |                   |      | 1.46     | 28.00 | 1.98                   | 29.00 | 2.50     | 30.00 | 3.02    | 31.00 |
| 26                   | 26.00              |                   |      | 1.46     | 29.00 | 1.98                   | 30.00 | 2.50     | 31.00 | 3.02    | 32.00 |
| 27                   | 27.00              |                   |      | 1.46     | 30.00 | 1.98                   | 31.00 | 2.50     | 32.00 | 3.02    | 33.00 |
| 28                   | 28.00              |                   |      | 1.46     | 31.00 | 1.98                   | 32.00 | 2.50     | 33.00 | 3.02    | 34.00 |
| 29                   | 29.00              |                   |      | 1.46     | 32.00 | 1.98                   | 33.00 | 2.50     | 34.00 | 3.02    | 35.00 |
| 30                   | 30.00              |                   |      | 1.46     | 33.00 | 1.98                   | 34.00 | 2.50     | 35.00 | 3.02    | 36.00 |
| 31                   | 31.00              |                   |      | 1.46     | 34.00 | 1.98                   | 35.00 | 2.50     | 36.00 | 3.02    | 37.00 |
| 32                   | 32.00              |                   |      | 1.46     | 35.00 | 1.98                   | 36.00 | 2.50     | 37.00 | 3.02    | 38.00 |
| 33                   | 33.00              |                   |      | 1.46     | 36.00 | 1.98                   | 37.00 | 2.50     | 38.00 | 3.02    | 39.00 |
| 34                   | 34.00              |                   |      | 1.46     | 37.00 | 1.98                   | 38.00 | 2.50     | 39.00 | 3.02    | 40.00 |
| 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 |

COPPER TUBING (CT)

| O.D. of<br>tube<br>(nom.) | nom.<br>tube<br>size | single layer |      |          |      |
|---------------------------|----------------------|--------------|------|----------|------|
|                           |                      | nom. 1"      |      | nom. 1½" |      |
|                           |                      | actual       | O.D. | actual   | O.D. |
| ½                         | ¾                    | 1.18         | 2.88 | 1.49     | 3.50 |
| ¾                         | 1                    | 1.11         | 2.88 | 1.42     | 3.50 |
| 1                         | 1½                   | 1.05         | 2.88 | 1.61     | 4.00 |
| 1½                        | 2                    | .99          | 2.88 | 1.55     | 4.00 |
| 2                         | 3                    | 1.17         | 3.50 | 1.42     | 4.00 |
| 3                         | 4                    | 1.05         | 3.50 | 1.55     | 4.50 |
| 4                         | 5                    | 1.17         | 4.00 | 1.42     | 4.50 |
| 5                         | 6                    | .91          | 4.00 | 1.41     | 5.00 |
| 6                         | 8                    | .91          | 4.50 | 1.45     | 5.56 |
| 8                         | 10                   | .91          | 5.00 | 1.73     | 6.66 |

← Sizes above 3" available in multiple layers.

Note: 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.

## specification

*for insulation of piping  
with Kaylo-20 pipe insulation*

### 1: Insulating materials

All heated pipes shall be insulated to the thickness noted on drawings or as shown in the following table with Kaylo 20 Pipe Insulation as distributed by Owens-Corning Fiberglas Corporation.

### TABLE OF RECOMMENDED INSULATION THICKNESS

Recommended Thicknesses vary according to use.

(See pages 50-51 for Complete Recommended Thickness Table.)

### 2: Application

All Pipe Insulation shall be applied over clean, dry surfaces, butting adjoining sections firmly together. Insulation on pipes under 12" diameter shall have factory-applied canvas pasted neatly in place and be secured with factory furnished bands spaced on not greater than 18" centers.

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 fabricated mitered segments of pipe insulation equal in thickness to the insulation on the adjoining pipe. Fittings on pipe size of 3" and smaller may be insulated with a suitable insulating or refractory 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 and bands. 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 1/2" 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 1/4" coat of finishing cement. Portland cement to a maximum of 25% dry weight may be added if a harder finish is desired. When located indoors, finish with canvas neatly pasted in place.

When located outdoors, cover with asphalt weatherproof mastic reinforced with an open mesh glass fabric. Mastic shall be applied in sufficient thickness to give a 1/8" dry coat and shall be troweled neatly over the fitting and lapped over the jacket on the adjacent pipe.

*The specification is recommended as written. Minor variances of application procedure may be made at the discretion and responsibility of the design engineer to meet specific job requirements.*