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Application Methods for Mineral Wool Pipe Insulation

HARRY E. LEWIS, Executive Director, and **Charles E. Young**, Chairman, Specifications Committee, of the Industrial Mineral Wool Institute, explain the methods of applying the various types of mineral wool insulation to heated piping and illustrate the comments with sketches. Tables give the thicknesses of molded type insulation and recommended minimum thicknesses

THE SPECIFICATION OF insulating materials and application methods is governed by the physical and operating characteristics of the particular heated equipment or surface to be insulated. The most common type of equipment requiring insulation is piping — carrying water, steam, gas, oil, chemicals and other materials. Pipe insulation contributes in large proportion to the efficiency of a system and therefore is of direct concern to the engineers and contractors who design, install, operate and maintain piping services.

The four particular conditions which must first be considered in specifying insulation on a given pipe line are (1) temperature of the pipe contents, (2) outside diameter of the pipe, (3) location of the pipe (indoors or outdoors) and (4) degree of exposure to external damage. These conditions are most common; among others are orientation of piping (horizontal, vertical or diagonal), exposure to moisture, and vibration.

Two Common Types of Insulation

There are two common types of mineral wool pipe insulation, *blanket* and *molded*. Blanket type pipe insulation is mineral wool reinforced on one or both sides by a suitable confining material and bound to form a nonrigid insulating section. De-

signed and manufactured to have both maximum flexibility and high thermal efficiency, it is produced in sizes to fit piping from 2 in. diameter and up. The most common confining materials used are either metal lath or wire netting, both of which are secured by wire or cord ties through the mineral wool itself. Blanket type pipe insulation is commercially manufactured in 24 in. long single layer sections, 1 in. to 4 in. thick, for standard pipe sizes. Standard blankets are selected having dimensions which will assure a snug fit to the pipe at specified insulation thicknesses.

Molded type mineral wool pipe insulation consists of mineral wool combined with bonding ingredients to form a rigid insulation. This type of pipe insulation combines rigidity and strength with good insulating

characteristics and is shaped to be particularly easy to install. Molded pipe insulation is manufactured in single and double layer thicknesses. Each section is 36 in. long, a standard length found generally most useful. To insulate small diameter piping, molded type mineral wool is supplied in sections (half cylinders), which are fitted together over the pipe. For larger pipe sizes, molded type insulation is manufactured in segments (usually four). The manufacturer maintains a tolerance of $\frac{1}{16}$ in. for all dimensions so that it will fit tightly.

In order to facilitate specification, standard and double standard thicknesses of molded type pipe insulation for standard-weight steel pipe have been set forth by the industry. [see Commercial Standard CS117-49, "Mineral Wool Insulation for Heated Industrial Equipment".] Table 1 gives these thicknesses for nominal pipe sizes from $\frac{1}{2}$ to 14 in. and up. Molded type pipe insulation may also be manufactured in 1, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3 and 4 in. thicknesses for all nominal pipe sizes given in the table.

On large piping, usually 14 in. in diameter and up, it is often very satisfactory to apply mineral wool insulating cement, particularly where irregular surfaces are encountered in combination with the piping. The insulation thickness required by pipe temperature is built up on the pipe in separate layers. It is recommended that each layer be no thicker than $\frac{3}{4}$ in. Each layer should be allowed to dry thoroughly before the application of further insulating cement.

More heat will be saved on any pipe line if the thickness of the insulation is increased; however, the cost of insulation per foot of piping also increases. There is, therefore, an economic thickness of insulation which will result in maximum heat savings per dollar of cost. Table 2 gives recommended minimum insula-

TABLE 1—MOLDED TYPE pipe insulation—thickness* for standard-weight steel pipe sizes

Pipe size, in.			
Nominal	Actual OD	Standard thickness	Double standard thickness
$\frac{1}{2}$	0.840	$\frac{7}{8}$	$1\frac{1}{4}$
$\frac{3}{4}$	1.050	$\frac{7}{8}$	$1\frac{1}{4}$
1	1.315	$\frac{7}{8}$	$1\frac{1}{4}$
$1\frac{1}{4}$	1.660	$\frac{7}{8}$	$1\frac{1}{4}$
$1\frac{1}{2}$	1.900	$\frac{7}{8}$	$1\frac{1}{4}$
2	2.375	$1\frac{1}{2}$	$2\frac{1}{8}$
$2\frac{1}{2}$	2.875	$1\frac{1}{2}$	$2\frac{1}{8}$
3	3.500	$1\frac{1}{2}$	$2\frac{1}{8}$
$3\frac{1}{2}$	4.000	$1\frac{1}{2}$	$2\frac{1}{8}$
4	4.500	$1\frac{1}{2}$	$2\frac{1}{4}$
$4\frac{1}{2}$ b	5.000	$1\frac{3}{8}$	$2\frac{1}{4}$
5	5.563	$1\frac{3}{8}$	$2\frac{1}{4}$
6	6.625	$1\frac{3}{8}$	$2\frac{1}{4}$
7 b	7.625	$1\frac{3}{4}$	$2\frac{1}{2}$
8	8.625	$1\frac{3}{4}$	$2\frac{1}{2}$
9 b	9.625	$1\frac{3}{4}$	$2\frac{1}{2}$
10	10.750	$1\frac{3}{4}$	$2\frac{1}{2}$
11 b	11.750	$1\frac{3}{4}$	$2\frac{1}{2}$
12	12.750	$1\frac{1}{2}$	3
14 and up	—	$1\frac{1}{2}$	3

*In addition to the thicknesses specified above, molded type pipe insulation may be manufactured in thicknesses of 1, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3 and 4 in. for all nominal pipe sizes.

bThese pipe sizes are not listed as standard for steel pipe in Simplified Practice Recommendation R57-32, Wrought Iron and Wrought Steel Pipe, Valves and Fittings.

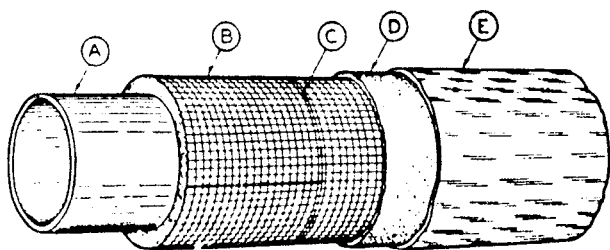


FIG. 1—HOW BLANKET type mineral wool insulation is applied. A, bare pipe; B, blanket mineral wool wrapped circumferentially around bare pipe; C, joints secured with No. 16 ga galvanized wires; D, insulating cement; E, asphaltic or other specified finish

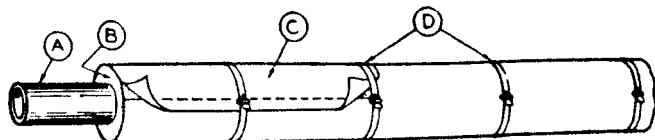


FIG. 2—SINGLE LAYER METHOD of applying molded insulation. A, bare pipe; B, sectional mineral wool pipe insulation; C, canvas jacket or other specified finish; D, metal bands

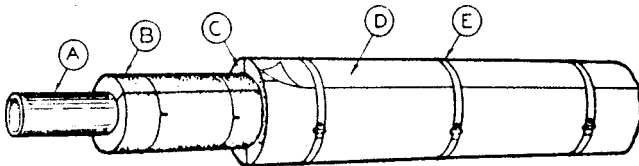


FIG. 3—DOUBLE LAYER APPLICATION of molded pipe insulation. A, bare pipe; B, first layer secured with No. 16 ga galvanized wires; C, second layer applied with all joints staggered; D, canvas jacket or other specified finish; E, metal bands

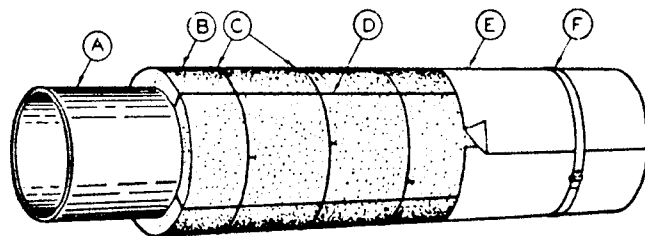


FIG. 4—SEGMENTAL MOLDED insulation is applied similarly to sectional insulation. A, bare pipe; B, segmental pipe insulation; C, No. 16 ga galvanized wires; D, insulating cement, when required; E, canvas jacket or other specified finish; F, metal bands

tion thicknesses for blanket type pipe insulation, 150 F to 1200 F, and molded type pipe insulation, from below 275 F to 600 F. For each type of pipe insulation, the recommended minimum thicknesses are given for three ranges of pipe diameter. Note that the data for molded type pipe insulation refer to the standard and double standard insulation thicknesses given in Table 1.

The thicknesses in Table 2 are recommended for indoor applications. When piping is located outdoors, it is recommended that the insulation thickness be increased not less than $\frac{1}{2}$ in. Because earth is of some insulating value, the thickness may be decreased $\frac{1}{2}$ in. when piping is installed underground.

Applying Blanket Type Pipe Insulation

Usually applied on straight piping and long radius bends of 2 in. standard pipe size or larger, blanket type pipe insulation (Fig. 1) is first wrapped circumferentially around the bare pipe. The longitudinal edges are then secured by tying or lacing with 16 ga galvanized soft iron wire, preferably on the underside of the piping. The mineral wool blanket sections are tightly butted

together on the pipe to provide an unbroken insulation covering.

The materials and method for finishing blanket type insulation depend upon whether it is located indoors or outdoors. Generally accepted materials for finishing insulation on indoor piping include mineral wool insulating cement, roofing felt, asphaltic mastic or emulsion and canvas. Insulating cement is applied over the blanket type insulation in two $\frac{1}{4}$ in. layers. The first layer is trowelled on and allowed to dry before the second is applied. As the second alternative finish, asphalt saturated roofing felt is wrapped around the piping, lapped at least 2 in. and often sealed with an asphaltic compound or lap cement. Roofing

felt should be securely held over the pipe with copper wire or galvanized iron bands spaced on approximately 6 in. centers along the pipe.

To apply an asphaltic finish to indoor piping covered with blanket type pipe insulation, a $\frac{1}{4}$ in. layer of mineral wool insulating cement is first applied and, when dry, is covered with 1 in. galvanized wire netting stretched over the surface and tightly wired in place. Asphaltic mastic or emulsion is then trowelled into the wire netting to provide a $\frac{1}{8}$ in. dry thickness (or about $\frac{1}{4}$ in. when wet). As a base for a canvas pipe jacket, a layer of flameproof paper, 1/16 in. thick asbestos paper or a $\frac{1}{4}$ in. layer of insulating cement is first applied. The canvas jacket

TABLE 2—RECOMMENDED MINIMUM insulation thicknesses for mineral wool pipe insulation

Temperature, F	Blanket type Thickness, in.			Temperature, F	Molded type Thickness, in.		
	Pipes 2 in. to 4 in.	Pipes 4 in. to 6 in.	Pipes 6 in. and up		Pipes below 2 in.	Pipes 2 in. to 4 in.	Pipes 4 in. and up
150 to 250	1	1	1	Up to 275	Std.	Std.	Std.
250 to 350	1	1	1	275 to 350	Std.	Std.	1½
350 to 450	1	1	1½	350 to 425	Std.	1½	2
450 to 550	1	1½	1½	425 to 500	1½	2	Dbl. std.
550 to 650	1½	1½	2	500 to 600	2	Dbl. std.	Dbl. std.
650 to 750	1½	2	2				
750 to 900	2	2	2½				
900 to 1,050	2	2½	3				
1,050 to 1,200	2½	3½	4				

is then sewn or pasted over the base material. To insure a tight cover on a sewn canvas jacket, the stitches should be spaced at no more than 1/3 in. intervals along the pipe.

When blanket type pipe insulation covers piping located either outdoors or exposed to moisture or accidental damage, it is usually finished and weatherproofed by sheet metal jackets, roofing felt or an asphalt compound. A sheet metal jacket should be at least 28 ga. single or double galvanized. The seams are lapped downward against the weather and secured with galvanized metal bands, 1/2 in. wide or greater, which are machine-stretched and crimped. It is not recommended that the bands be spaced at much more than 6 in. centers along the pipe.

The roofing felt finish is applied in the same manner outdoors as described above for indoor locations. To avoid the possibility of wetting the insulation, it is very important to lap the roofing felt downward. An asphaltic finish is applied in the same manner outdoors as in indoors, mak-

ing certain that the asphaltic coat is sufficiently thick and even at all points.

Application of Molded Type Pipe Insulation

The single and double layer methods of applying sectional molded type pipe insulation are illustrated in Figs. 2 and 3. In Fig. 2, single layer sectional insulation is placed over the piping, with all sections tightly butted together, and is covered with a canvas jacket and banded in place. Double layer application of sectional pipe insulation in Fig. 3 requires that the first layer be secured in place with loops of wires placed on approximately 8 in. centers. The second layer is tightly fitted directly over the first layer with all joints staggered to avoid aligning edges. As with the single layer application, a canvas jacket (or other finish) and metal bands follow.

Application of segmental molded type pipe insulation in Fig. 4 is similar to the procedure followed with sectional insulation. Although Fig. 4 shows a single layer method,

double layer segmental pipe insulation can also be obtained. On such large diameter piping, mineral wool insulating cement is often trowelled over the installed segments before applying the canvas jacket or other finish.

A canvas jacket is a most satisfactory finish for molded type pipe insulation located indoors and not exposed to moisture or abrasion. The canvas jacket is drawn tightly over the pipe and smoothly pasted at all lapping edges. The metal bands should be secured over the canvas at both the center and ends of each length of insulation. When factory-weight canvas is specified, insulation and canvas are supplied as a unit.

Molded type pipe insulation installed on outdoor piping or in locations where accidental damage or wetting might occur is finished in one of the ways recommended for blanket type pipe insulation under similar conditions. All four finishing methods are excellent, the finish most appropriate for particular conditions being selected.

HOW WE OVERCAME FLOW OBSTRUCTION

By Carl A. Ramstad, Scott Paper Co.

THE USE OF AN orifice for the measurement of the flow of sulphite waste liquor presented the possibility of obstruction due to solid matter carried along the bottom of the pipe. At the same time, the small percentage of fiber in the liquor would probably build up around the edge and cause a false differential.

Therefore, to obtain an accurate flow measurement, a pitot-venturi device connected to a flow meter was decided upon. A water purge was connected to each line.

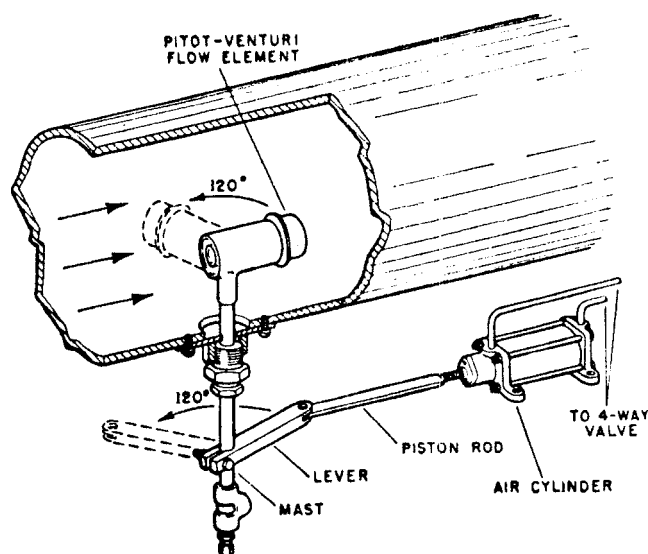
It was soon learned that the purges were insufficient to keep the head clean and that incorrect values were being given.

An experiment, which turned out to be satisfactory, was decided on.

The plant salvage department provided a small air cylinder with which a sliding stem four-way air valve had been used. The cylinder was suspended from a bracket so that the piston travel was at right angles to the mast of the pitot-venturi. The piston

rod was connected to a lever fastened to the mast and long enough to provide an angle of rotation of about 120 deg. When air was applied to the back side of the piston, the head was turned far enough to flush fiber off, and thus give an accurate reading.

To make the device automatic, a time switch was used to energize a solenoid operated valve. This provided an output to a small diaphragm motor mounted on the four-way valve which, in turn, determined which direction the piston should travel. The timer was set to close the circuit for about 40 or 50 sec every 15 min. This reversed the pressure to the



THIS SCHEME is used to flush fiber off the flow element in a sulphite waste liquor line. A time switch energizing a solenoid operated air valve makes the device automatic

cylinder and turned the head automatically.

The reading is in error as long as the head is turned, but the percentage of error in point of time is quite small. [Reproduced from "Taylor Technology" through the courtesy of Taylor Instrument Cos.]