MINERAL WOOL INSULATION FOR HEATED INDUSTRIAL EQUIPMENT

(Second Edition)

COMMERCIAL STANDARD CS117–49

[Supersedes CS117–44]

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A RECORDED VOLUNTARY STANDARD
OF THE TRADE

UNITED STATES DEPARTMENT OF COMMERCE
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COMMERCIAL STANDARD FOR MINERAL WOOL INSULATION FOR HEATED INDUSTRIAL EQUIPMENT

In September 1943 the Industrial Mineral Wool Institute proposed the establishment of a commercial standard for mineral wool insulation for heated industrial equipment. This led to the development of a recommended standard, which was subsequently accepted by the trade and finally issued as Commercial Standard CS117–44, Mineral Wool: Blankets, Blocks, Insulating Cement, and Pipe Insulation for Heated Industrial Equipment.

A recommended revision of this standard was circulated on March 1, 1949, to the trade for written acceptance. Those concerned have since accepted and approved for promulgation the standard shown herein.

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COMMERCIAL STANDARD CS117–49

for

MINERAL WOOL INSULATION FOR HEATED INDUSTRIAL EQUIPMENT

(SECOND EDITION)

PURPOSE

1. The purpose of this standard is (a) to establish minimum specifications for insulating heated surfaces with mineral wool for the guidance of manufacturers, distributors, installers, contractors, engineers, and users; (b) to avoid delays and misunderstandings; and (c) to provide a standard basis for certifying quality of material and installation.

SCOPE

2. This standard covers minimum physical requirements and standards for mineral wool in the form of loose and granulated wool, felts, blankets, industrial batts, blocks or boards, pipe insulation, and insulating cement, for insulating heated industrial equipment. It also includes thicknesses of insulation required for various operating temperatures, recommended methods of installation, and a method of guaranteeing compliance with the standard. The range of types, classes, thermal conductivities, temperature limits, and sizes of mineral wool products for insulating heated industrial equipment are shown in table 1.

DEFINITIONS

3. *Mineral wool.*—Mineral wool insulation is rock, slag, or glass processed from a molten state into fibrous form.

3a. *Loose.*—Mineral wool as originally processed and collected in a fluffy mass without regard to form or dimension.

3b. *Granulated.*—Mineral wool mechanically processed into nodules.

3c. *Felt.*—Mineral wool with binder added, manufactured in semi-rigid form and furnished in flat sheets or rolls.

3d. *Blanket.*—Mineral wool with or without binder, reinforced on one or both sides with various types of confining media and suitably bound together.

3e. *Industrial batt.*—Mineral wool without binder, manufactured in flat sheets or rolls.

3f. *Block or board.*—Mineral wool in rigid form, with binder, with or without surface coating, and normally furnished in flat rectangular pieces.

3g. *Pipe insulation, blanket-type.*—Mineral wool reinforced on one or both sides by various types of confining media and suitably bound together to form a nonrigid pipe insulation.

3h. *Pipe insulation, molded-type.*—Mineral wool combined with other ingredients to form a rigid pipe insulation.

3i. *Insulating cement.*—A dry mixture of mineral wool and other ingredients which, when mixed together with water to proper troweling consistency, is suitable for application on heated equipment.

REQUIREMENTS

4. *Insulation.*—The insulation shall be mineral wool in one of the following forms: loose, granulated, felt, blanket, industrial batt, block or board, pipe insulation, blanket- or molded-type, or insulating cement.

4a. *Applicability.*—Materials shall be of a type having physical characteristics suited to their intended use.

4b. *Thermal conductivity.*—The thermal conductivity (*k*), expressed as Btu per hour per square foot per degree Fahrenheit for a thickness of 1 in., shall not exceed the values shown in table 1 for each product at the mean temperature shown. The thermal conductivity shall be determined as described in test method XI of Commerical Standard CS131–46, or later revision.

4c. *Density.*—The installed density shall be as recommended by the manufacturer and shall comply with the thermal conductivity specified in paragraph 4b. The density shall be determined in accordance with the test methods described in Commercial Standard CS131–46, or later revision, as follows:

	Test method
Insulating cement	IV
Industrial batt, blanket, felt, and blanket-type pipe insulation	V(a)
Block or board insulation	V(b)
Molded-type pipe insulation	V(c)

4d. *Incombustibility.*—All mineral wool insulation shall meet the requirements of the incombustibility classification when tested in accordance with test method VI of Commercial Standard CS131–46, or later revision.

4e. *Temperature resistance.*—The mineral wool insulation, when tested at the temperature of intended usage in accordance with test method X of Commercial Standard CS131–46, or later revision, shall show no changes which adversely affect its serviceability, provided that the temperature of use does not exceed the maximum temperature limit of the product as listed in table 1.

4f. *Classes.*—Mineral wool products for heated surfaces shall be listed in classes having maximum temperature limits as follows:

Class	°F
A	600
B	1,000
C	1,200
D	1,600
E	1,800

TABLE 1. *Types, conductivities, classes, and unit sizes of mineral wool products*

Types	Maximum thermal conductivity (k) at ° F mean temperature			Maximum recommended temperature limit		Unit sizes
	200	300	400	Class	° F up to—	
Loose wool	0.37	0.46	0.55	B D	1,000 1,600	Packaged in bags containing up to 40 lb each.
Granulated wool	.37	.46	.55	B D	1,000 1,600	Packaged in bags containing up to 40 lb each.
Felts	.44	.55	------	A	600	1 to 4 in. thick by 24 in. wide by 30 or 48 in. long.
Blankets	.41	.47	.53	B C	1,000 1,200	1 to 6 in. thick by 24 in. wide by 48 or 96 in. long.
Industrial batts	.35	.47	.60	B C	1,000 1,200	1 to 4 in. thick by 24 in. wide by 48 in. long.
Blocks or boards	.50	.53	.56	A C D	600 1,200 1,000	Blocks: 1 to 4 in. thick by 6 or 12 in. wide by 18 or 36 in. long. Boards: 1 to 3 in. thick by 12 to 36 in. wide by 36 or 48 in. long.
Pipe insulation, blanket-type.	.41	.47	.53	B C	1,000 1,200	1 to 4 in. thick by 24 in. long, fabricated to fit 2-in. and larger pipe.
Pipe insulation, molded-type.	.40	.46	.52	A	600	⅞ to 4 in. thick by 36 in. long to fit ½- to 14-in. and larger steel pipe sizes.
Insulating cement	.70	.75	.80	C E	1,200 1,800	Packaged in bags containing 50 lb each.

4g. *Dimensions.*—All measurements of dimensions shall be made in accordance with Commercial Standard CS131–46, or later revision.

4h. *Felt.*—For felt mineral wool, a minus tolerance of ⅛ in. shall be permitted in all dimensions.

4i. *Blankets.*—Blankets shall be supported on one or both sides by metal lath, wire netting, canvas, paper, or other facing material secured by wire or cord ties through the material. The types of facing materials shall be specified by the purchaser. For installations on which the subsequent application of insulating cement is specified, expanded metal lath shall be furnished on one side of the blankets. Standard sizes of blankets shall be as listed in table 1 and no dimension shall be less than that specified.

4j. *Industrial batts.*—Standard sizes of industrial batts shall be as listed in table 1 and no dimension shall be less than that specified.

4k. *Blocks or boards.*—Blocks or boards shall be manufactured with square corners and with sides and ends parallel. Standard sizes shall be as listed in table 1, subject to a tolerance of plus or minus ⅛ in. in all dimensions.

4l. *Pipe insulation, blanket-type.*—Blanket-type pipe insulation shall be secured on one or both sides by metal lath, wire netting, or other facing material secured by wire or cord ties through the material. It shall be furnished in a single layer, in sections 24 in. long, and for standard pipe sizes. The dimensions shall be such that a snug fit will be obtained when the insulation is installed on the pipe at the specified thickness.

4m. *Pipe insulation, molded-type.*—Molded-type pipe insulation shall be furnished in single- or double-layer thicknesses, as shown in table 2, and in sections or segments 36 in. long for standard pipe sizes. A tolerance of plus or minus 1/16 in. in all dimensions shall be permitted.

TABLE 2. *Molded-type pipe insulation—thicknesses[a] for standard-weight steel pipe sizes*

Pipe size		Standard thickness	Double standard thickness
Nominal	Actual O. D.		
in.	*in.*	*in.*	*in.*
½	0.840	⅞	1¾
¾	1.050	⅞	1¾
1	1.315	⅞	1¾
1¼	1.660	⅞	1¾
1½	1.900	⅞	1¾
2	2.375	1 1/32	2 1/16
2½	2.875	1 1/32	2 1/16
3	3.500	1 1/32	2 1/16
3½	4.000	1 1/32	2 1/16
4	4.500	1⅛	2¼
4½ [b]	5.000	1⅛	2¼
5	5.563	1⅛	2¼
6	6.625	1⅛	2¼
7 [b]	7.625	1¼	2½
8	8.625	1¼	2½
9 [b]	9.625	1¼	2½
10	10.750	1¼	2½
11 [b]	11.750	1¼	2½
12	12.750	1½	3
14 and up	----------	1½	3

[a] In addition to the thicknesses specified above, molded-type pipe insulation may be manufactured in thicknesses of 1, 1½, 2, 2½, 3, and 4 in. for all nominal pipe sizes.
[b] These 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.

4n. *Insulating cement.*—When tested in accordance with test method I of Commercial Standard CS131–46, or later revision, insulating cement shall show an adhesion to steel of not less than 3 lb per sq in. When tested in accordance with test method IV of Commercial Standard CS131–46, or later revision, insulating cement shall show a volume change on drying of not more than 20 percent and a dry coverage of not less than 45 sq ft, 1 in. thick per 100 lb of dry cement.

5. *Auxiliary materials.*

5a. Finishing cements may be used to provide a smooth, hard surface over insulating materials in locations not subject to excessive moisture or abrasion.

5b. Asphaltic weatherproof finish may be used to provide a watertight protective finish over insulating materials in locations where excessive moisture or abrasion is encountered or wherever else specified within its temperature limit. This asphaltic finish shall consist of a fibrated asphalt emulsion, which, for weatherproofing purposes, shall be applied to a minimum dry thickness of ⅛ in. (See par. 17c (1) and similar references to weatherproof finish over the various product forms of mineral wool.)

5c. Miscellaneous materials, such as adhesives, attachment devices, canvas, paper, metal fabrics, asbestos-cement sheets, roofing felt,

paint, sheet metal, etc., shall be of a type and quality satisfactory for use in the applications hereinafter described.

RECOMMENDED INSTALLATION REQUIREMENTS

6. The following represents recommended installation requirements, based upon long experience, for maximum service in the use of mineral wool products for insulating heated industrial equipment.

7. Piping, vessels, boilers, and all other operating equipment shall be inspected and tested for leaks, mechanical defects and operations, and repairs and adjustments completed before applying insulation, to avoid the necessity of its subsequent removal for such purposes.

8. All mineral wool insulating products and accessory materials shall be installed in a neat, workmanlike manner in accordance with the following recommendations and subject to the approval of the purchaser.

APPLICATION (GENERAL)

9. *Selection of mineral wool products.*

9a. The different types of mineral wool products described in paragraphs 3 and 4 are designed to serve a wide range of operating conditions for most types of heated equipment. In many cases, several forms of mineral wool products will perform equally satisfactorily, hence their choice should be based on a consideration of the specific equipment and operating conditions, together with the pertinent performance properties and relative costs.

(1) Loose wool, granulated wool, and industrial batts usually are low in cost from a material standpoint. They require a structural means of retention and protective finish such as an exterior metal shell or masonry.

(2) Mineral wool felts and blankets combine low material cost and excellent thermal value with a degree of product rigidity. They are not designed for load-bearing service.

(3) Mineral wool blocks or boards are rigid, have higher compressive strength, and thus are installed, for example, on the top of heated equipment where workmen may have to cross the insulation for maintenance reasons.

(4) Blanket-type mineral wool pipe insulation, characterized by its flexibility and high thermal efficiency, is manufactured in sizes to fit pipe lines 2 in. and up.

(5) Molded-type mineral wool pipe insulation has rigidity and strength and is preformed to facilitate installation on heated pipe lines.

(6) Mineral wool insulating cement is used to even surfaces on blanket and block or board insulation, after application on the equipment, and to form a suitable base on which to apply a finishing coat. Because of its good adhesive strength, mineral wool insulating cement may be built up to desired thickness on valves, fittings, and equipment of irregular shape.

10. *Thickness of insulation.*

10a. The selection of the economical thickness of mineral wool insulation to be installed is governed largely by the operating temper-

ature maintained, the cost of heat delivered, the number of hours operated per year, and by the effectiveness and the total cost of the applied insulation. Other factors which determine insulation thickness are the maintenance of precise temperature control, protection against damage by corrosion, freezing, or fire, and personal safety of workmen.

10b. The thickness of blankets, blocks or boards, insulating cement, and pipe insulation to be applied for various operating conditions shall be not less than recommended in table 3, unless otherwise approved by the purchaser. The installed thicknesses of felts, industrial batts, loose wool, and granulated wool shall be the same as the recommended minimum thicknesses for blankets in table 3, within the temperature limits designated in table 1, and consistent with the thermal performance required.

10c. External surfaces of heated multilayer brick constructions shall be insulated to a thickness no greater than that which will result in a safe temperature and a safe temperature gradient for all materials used in the composite construction.

11. *Fastenings and supports.*

11a. Adequate means shall be provided to maintain the insulation in contact with the surface in order to prevent accidental displacement. Suitable fastenings and supports for this purpose shall be agreed upon by the purchaser and applying contractor.

11b. Types, extent, number, and spacing of fastenings and supports will be determined by the nature, shape, and position of the heated surface, the type of insulation, the type of surface finish to be applied, and by the service conditions, such as vibration, weather, corrosive fumes, wetting, or mechanical injury.

(1) When specified the insulation shall be fully enclosed. The enclosure may consist of metal sheets or a masonry wall spaced away from the heated surface to support the insulation externally. (See figs. 1 and 2.)

(2) On vertical surfaces, blankets and blocks or boards may be supported by (a) horizontal angles attached to the surface at suitable intervals (see figs. 1 and 3), (b) wires attached perpendicular to the surface over which insulation may be impaled (see fig. 4), (c) studs inserted through the insulation and welded by gun-type equipment to the metal surface behind (see fig. 5), (d) bolts welded to or inserted through the metal surface (see figs. 6 and 7), (e) screws (see fig. 8), or (f) tie wires (see fig. 9). Lacing wires at the edges or over the face of the insulation may be employed to secure it to the supports, and circumferential bands or wires may be installed over the insulation to insure permanent contact. (See fig. 10.)

(3) On horizontal surfaces having insulation applied on the under sides, the supports shall be similar to those on vertical surfaces and sufficiently close together to prevent sagging of the insulation. On horizontal surfaces with insulation applied on the upper side, fastenings will be required only to prevent accidental displacement or damage from external causes.

TABLE 3. *Recommended minimum insulation thicknesses*

The insulation thicknesses listed in this table are recommended for indoor locations; for outdoor locations, increase insulation thickness not less than ½ in. For underground application, thickness may be decreased ½ in. when specified. (See par. 10.)

BLANKET INSULATION [1]

Temperature	Thickness	Temperature	Thickness
°F	in.	°F	in.
Up to 300	1	700 to 900	2½
300 to 500	1½	900 to 1,100	3
500 to 700	2	1,100 to 1,200	3½

BLOCK OR BOARD INSULATION

Temperature	Thickness
°F	in.
Up to 200	1
200 to 400	1½
400 to 500	2
500 to 600	2½
600 to 700	3
700 to 900	3½
900 to 1,100	4
1,100 to 1,300	4½
1,300 to 1,500	5
1,500 to 1,600	5½

INSULATING CEMENT [2]

Temperature	Thickness
°F	in.
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 1,100	4½
1,100 to 1,300	5
1,300 to 1,600	5½
1,600 to 1,800	6½

PIPE INSULATION

Blanket-type				Molded-type			
Temperature	Thickness			Temperature	Thickness		
	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
°F	in.	in.	in.	°F			
150 to 250	1	1	1	Up to 275	Std	Std	Std.
250 to 350	1	1	1	275 to 350	do	do	1½".
350 to 450	1	1	1½	350 to 425	do	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.	Do.
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				

[1] (Refer to par. 10b.) These recommended minimum thicknesses also apply to felts, industrial batts, loose wool, and granulated wool at corresponding temperatures.

[2] Usually applied over blankets and blocks or boards ½ in. thick, as a base coat for desired finish. For built-up applications of insulating cement on irregular surfaces, thicknesses may be used up to the practical limit.

11c. Attachment to brick or refractory masonry surfaces may be by nails driven into mortar joints, by expansion bolts, or by rods or bolts embedded in the masonry. (See fig. 11.)

11d. Adhesives, rope-and-spring girdles, or other suitable means may be employed for temporary support of the insulation during application. Such supports shall be replaced by permanent fastenings before the final finish is applied.

12. *Protection.*

12a. Insulation and auxiliary materials shall be protected against mechanical damage and weather exposure during installation. Thereafter periodic inspection shall be made and the insulation maintained to insure continued satisfactory performance.

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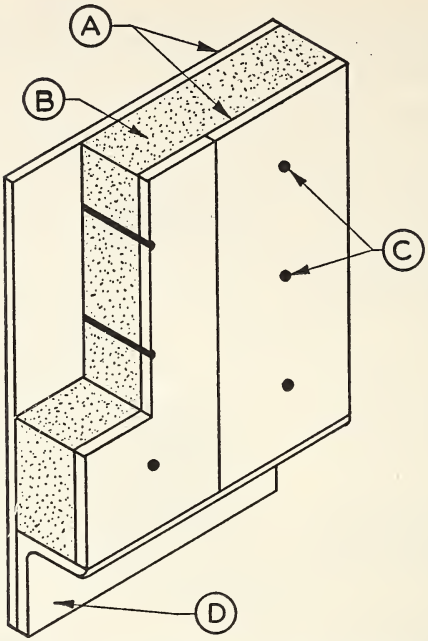

FIGURE 1. *Insulation enclosed between metal sheets.*
A, Metal sheets; *B*, mineral wool insulation; *C*, fastenings; *D*, horizontal support.

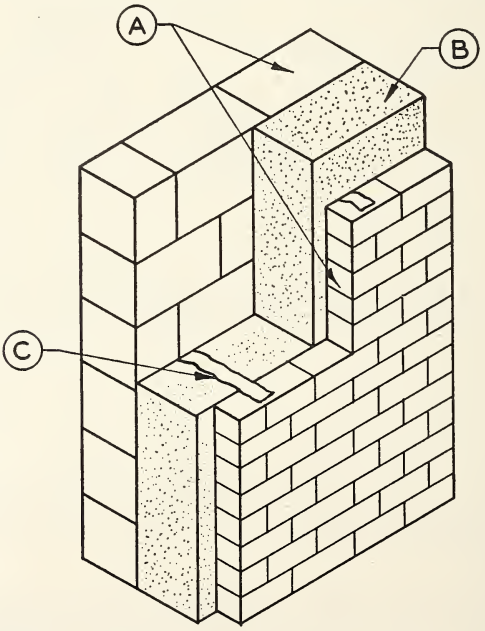

FIGURE 2. *Insulation enclosed between masonry walls.*
A, Masonry walls; *B*, mineral wool insulation; *C*, metal tie.

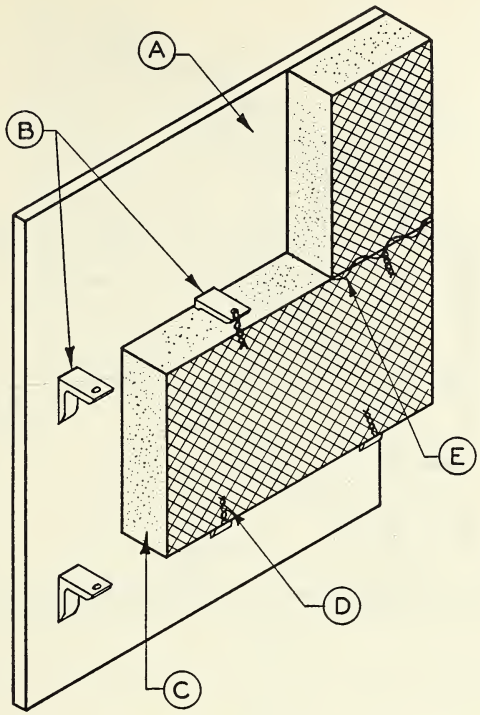

FIGURE 3. *Blanket insulation supported by clip angles.*

A, Heated surface; *B*, clip angles; *C*, blanket insulation; *D*, tie wires from clip angles to metal mesh facings; *E*, lacing wire between blankets.

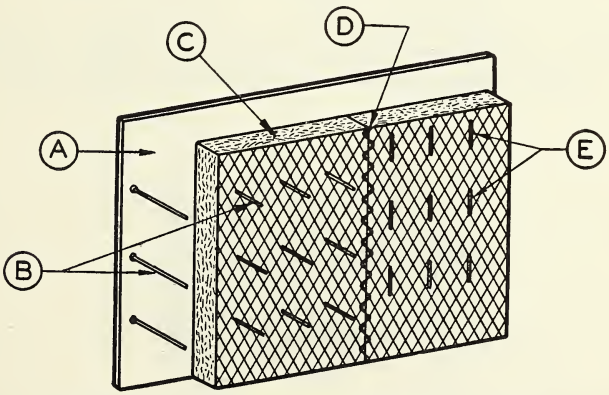

FIGURE 4. *Blanket insulation impaled on wires.*

A, Heated surface; *B*, wires; *C*, blanket insulation; *D*, lacing wire; *E*, wires bent over on face of insulation.

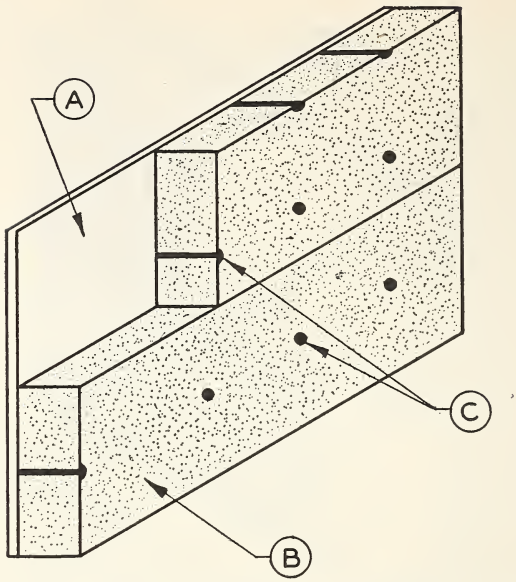

FIGURE 5. *Insulation attached by welding with stud gun after insulation is in place.*
A, Heated surface; *B*, mineral wool insulation; *C*, large head studs.

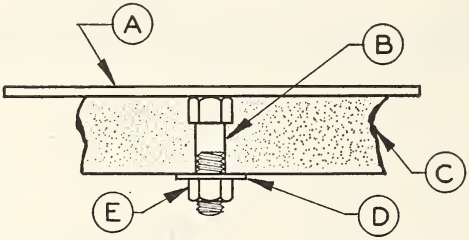

FIGURE 6. *Insulation attached by bolts with heads welded to metal surface.*
A, Heated surface; *B*, bolt; *C*, mineral wool insulation; *D*, washer; *E*, nut.

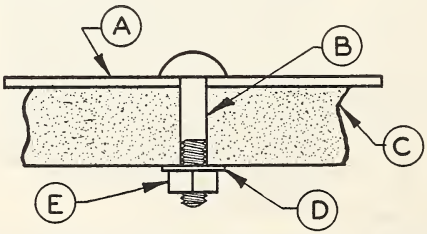

FIGURE 7. *Insulation attached by bolts through drilled holes.*
A, Heated surface; *B*, bolt; *C*, mineral wool insulation; *D*, washer; *E*, nut.

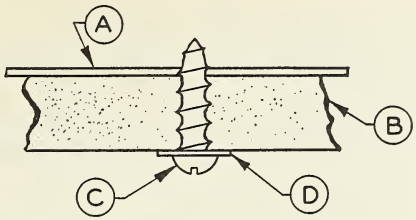

FIGURE 8. *Insulation attached to light-gage metal surface by sheet metal screw and washer.*

A, Heated surface; *B*, mineral wool insulation; *C*, screw; *D*, washer.

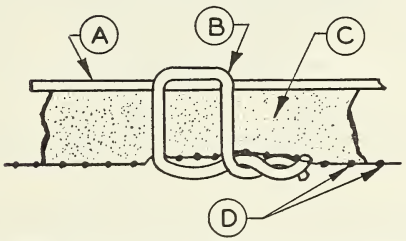

FIGURE 9. *Blanket insulation held on by hairpin wires through twin holes in metal surfaces.*

A, Heated surface; *B*, hairpin wire; *C*, blanket insulation; *D*, metal mesh.

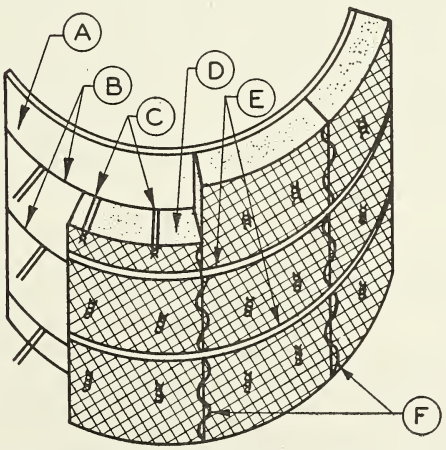

FIGURE 10. *Blanket insulation held on by tie wires attached to wire girdles and exterior circumferential bands.*

A, Heated surface; *B*, girdles; *C*, tie wires; *D*, blanket insulation; *E*, circumferential bands; *F*, lacing wires.

APPLICATION (DETAIL)

FELTS, INDUSTRIAL BATTS, LOOSE WOOL, AND GRANULATED WOOL

13. *Preparation of surface.*

13a. The surface to be insulated shall be inspected. All loose particles, rust, scale, or dirt shall be removed and any leaks or other damage repaired.

14. *Installation of insulation.*

14a. Felts, industrial batts, loose wool, and granulated wool shall be installed in enclosed spaces adequately supported to prevent loss of or damage to the insulation.

(1) Felts and industrial batts may be installed by using temporary fastenings such as wires or adhesives, and then covering with permanent enclosures such as metal sheets, wire netting, or other specified material.

(2) Loose and granulated wool shall be installed in spaces previously prepared to provide for the specified thickness.

BLANKET INSULATION

15. *Preparation of surface.*

15a. The surface to be insulated shall be inspected. All loose particles, rust, scale, or dirt shall be removed and any leaks or other damage repaired.

15b. Suitable anchorage for the blankets shall be provided in the form of wire cables, nuts, clip angles, or No. 9-gage galvanized wires, welded or otherwise securely affixed to the surface on specified centers. (See figs. 3 to 10.)

16. *Installation of blankets.*

16a. On *curved* metal surfaces, blankets of specified thickness (see table 3) shall be secured to the supports with the expanded-lath side exposed, edges tightly butted together, then laced together or tied at frequent intervals along the edges with No. 16-gage galvanized wire, and finally banded or wired circumferentially. (See figs. 10 and 13.)

16b. On *flat* surfaces, blankets shall be applied with the expanded-lath side exposed, by impaling them over No. 9-gage galvanized wires welded perpendicular to the surface. The extending ends of the wires then shall be bent upward at right angles and pushed into the blanket. The blankets shall be butted, then laced together or tied at frequent intervals along all edges with No. 16-gage galvanized wire. (See fig. 10.)

(1) As an alternate method of application, blankets may be applied on flat surfaces by using No. 9-gage galvanized-wire girdles and No. 16-gage galvanized hairpin wires (see fig. 11), or clip angles welded to the surfaces (see fig. 3).

16c. On *masonry* surfaces, blankets of specified thickness with the expanded metal-lath face exposed shall be secured to No. 9-gage galvanized-wire girdles and No. 16-gage galvanized hairpin wires affixed to attachments embedded in the surface, as outlined in paragraph 11c. The edges should be tightly butted and laced together or tied at frequent intervals with No. 16-gage galvanized wire. (See fig. 11.)

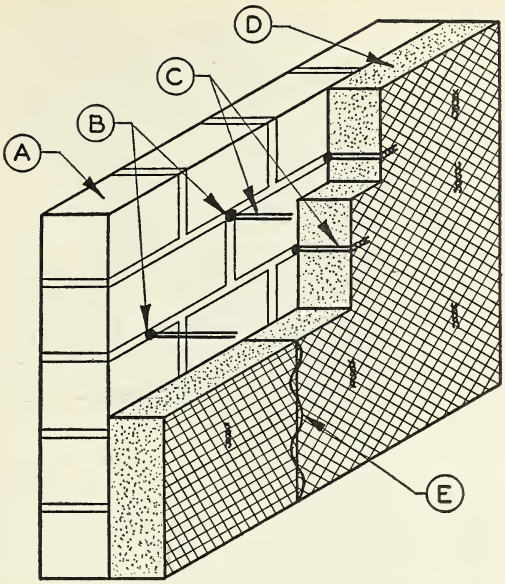

FIGURE 11. *Application of blanket insulation by hairpin wires affixed to nails embedded in masonry joints.*

A, Masonry surface; *B*, masonry nails; *C*, hairpin wires; *D*, blanket insulation; *E*, lacing wire.

16d. *Expansion joints for large metal vessels.*

(1) Expansion joints should be provided every 12 to 16 ft on heated equipment where temperatures in excess of 600° F. are encountered. They shall consist of spaces approximately 1½ to 2 in. wide between successive rows of blankets. (See fig. 12.) After the application of blankets and of the first ¼-in. coat of insulating cement, but before the second coat, a strip of asphaltic mastic approximately 4 in. wide shall be applied around the vessel over the first coat of insulating cement and immediately below the space left between blankets. When this strip of weatherproofing has dried, the space between the blankets shall be packed with loose mineral wool. The second ¼-in. coat of insulating cement shall then be applied over the entire vessel area except over the narrow strips of weatherproofing immediately below the expansion joints. After the cement has thoroughly dried, a layer of No. 20-gage, 1-in. galvanized-wire mesh netting shall be tightly stretched over the insulating cement and permanently secured in place.

A separating layer of 20-lb. rosin-sized paper is applied over the narrow strip of weatherproofing and a 12-in.-wide strip of ¼-in. galvanized hardware cloth is applied to cover both the expansion joint and rosin-sized paper. The top edge of the hardware cloth shall be securely laced and fastened to the 1-in. wire mesh previously applied,

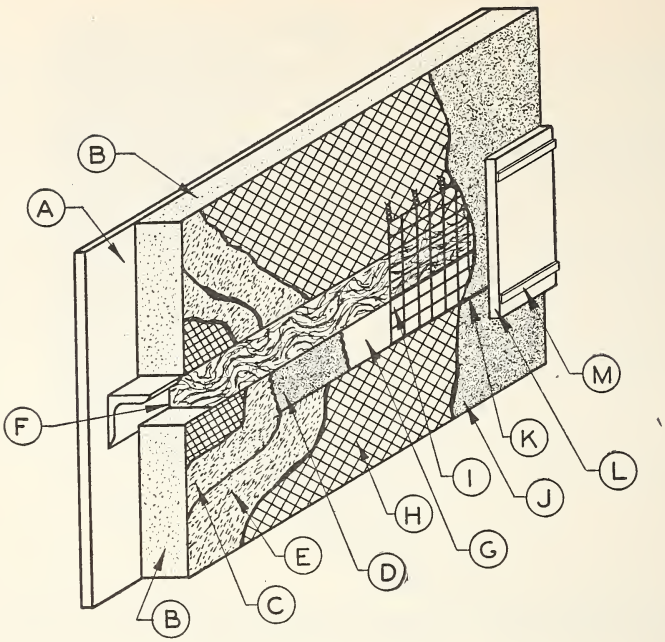

FIGURE 12. *Expansion joints for large metal vessels (see par. 16d).*

A, Heated surface; *B*, blanket insulation; *C*, first ¼ in.-layer of insulating cement; *D*, asphalt mastic strip; *E*, second ¼-in. layer of insulating cement; *F*, loose wool fill; *G*, rosin-sized paper; *H*, 1-in. galvanized wire mesh; *I*, 1-in. galvanized hardware cloth; *J*, asphalt mastic; *K*, line of cleavage; *L*, 12-in.-wide No. 24-gage metal band; *M*, ½-in.-wide steel straps.

leaving the bottom edge of the hardware cloth free to move up or down with expansion and contraction.

The entire vessel shall then be covered with weatherproofing mastic, striking off a line of cleavage with the point of a trowel at the lower edge of each hardware cloth expansion shield.

As an added protection against weather damage, a 12-in. band of No. 24-gage metal may be added over the entire expansion-joint area.

17. *Application of finish.*

17a. After the blankets are in position and carefully secured, a ¼-in. layer of mineral wool insulating cement shall be applied. This coat shall be forced well into the expanded metal lath to form a strong key. Sufficient cement shall be applied to level off the surface. A second ¼-in. troweled coat of insulating or finishing cement shall be applied after the first coat has dried. Portland cement to a maximum of 25 percent dry weight may be added to this coat if a harder finish is desired.

17b. Insulation located *indoors* and not exposed to moisture or abrasion may be further finished as described below.

(1) When specified, a layer of asphalt weatherproof mastic finish may be applied instead of canvas. After the second coat of cement has thoroughly dried, 1-in. galvanized-wire netting shall be stretched tightly over the

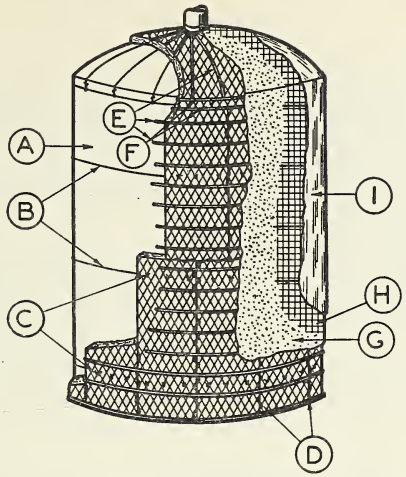

FIGURE 13. *Application of mineral wool blanket insulation on curved surfaces.*
A, Bare surface; *B*, No. 9-gage galvanized-wire girdles spaced 4 ft. on centers; *C*, blanket insulation 2 ft. by 8 ft. wired to girdles; *D*, blanket edges laced with No. 16-gage galvanized wires; *E*, ½- or ¾-in. galvanized bands spaced approximately 8 in. on centers; *F*, two or more bands at top; *G*, insulating cement; *H*, 1-in. galvanized-wire netting secured in place with No. 16-gage galvanized wires; *I*, finishing cement or asphaltic finish.

surface and wired in place with No. 16-gage galvanized wire. Asphalt weatherproof mastic finish shall then be applied, sufficiently thick (approximately ¼ in. thick, wet) to provide a minimum dry thickness of ⅛ in., troweling it well into the wire netting.

(2) When specified, a 6- or 8-oz canvas jacket shall be sewed or pasted smoothly in place. If sewed, stitches shall be spaced not more than ⅓ in. apart, with seams located where least visible.

17c. Insulation located *outdoors* or exposed to moisture or abrasion shall be protected by one of the methods described below.

(1) After the cement has thoroughly dried, 1-in. galvanized-wire netting shall be stretched tightly over the surface and wired in place with No. 16-gage galvanized wire. Asphalt weatherproof mastic finish shall then be applied, sufficiently thick (approximately ¼ in. thick, wet) to provide a minimum dry thickness of ⅛ in., troweling it well into the wire netting.

(2) When specified on smooth regular surfaces, the cement and asphaltic coatings may be omitted, and the surface weatherproofed instead with a sheet-metal jacket. The sheet-metal jacket shall be no lighter than No. 28 gage, single or double galvanized, and shall be suitably anchored to the surface. Seams shall be lapped 2 in. against the weather and secured with metal screws, or provided with a locked or flange-crimped joint, or otherwise sealed, to prevent the entry of moisture. After providing for expansion and contraction of the metal jacket, it shall be secured in place with ½-in. or ¾-in.-wide galvanized metal bands, machine-stretched and crimped, on specified centers.

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BLOCK OR BOARD INSULATION

18. *Preparation of surface.*

18a. The surface to be insulated shall be inspected. All loose particles, rust, scale, or dirt shall be removed and any leaks or other damage repaired. Brick surfaces shall be made true and even as required for block or board insulation.

18b. Suitable anchorage for the insulation shall be provided as outlined in paragraph 11.

19. *Installation of blocks or boards.*

19a. On *curved* metal surfaces, blocks or boards of specified thickness (see table 3) shall be butted closely together with joints staggered, employing a suitable method of anchorage. (See par. 11.) Following application, any voids or openings between blocks or boards shall be filled with insulating cement. A layer of 1-in. galvanized-wire netting shall be stretched tightly over the blocks and secured in place with No. 16-gage galvanized soft iron wire. (See fig. 14.)

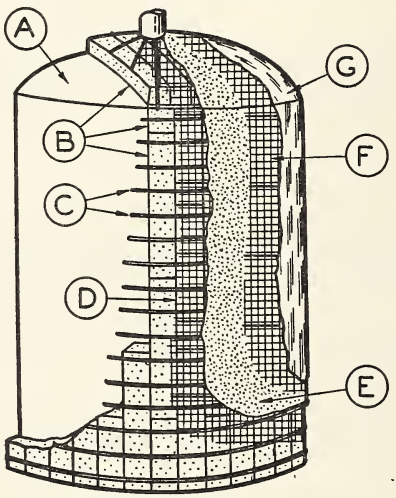

FIGURE 14. *Application of mineral wool block insulation on curved surfaces.*

A, Bare surface; *B*, mineral wool blocks applied with joints staggered; *C*, ½- or ¾-in. galvanized bands spaced approximately 8 in. on centers; *D*, 1-in. galvanized-wire netting secured in place with No. 16-gage galvanized wires; *E*, insulating cement; *F*, 1-in. galvanized-wire netting secured in place with No. 16-gage galvanized wires; *G*, finishing cement or asphaltic finish.

19b. On *flat* metal surfaces, blocks or boards of specified thickness shall be properly secured, using the means of anchorage provided. (See par. 11.) Blocks shall be butted closely together with joints staggered and secured as required with steel bands or wire on specified centers, as shown in figure 15. Following application, any voids or openings between blocks or boards shall be filled with insulating cement.

(1) When a subsequent application of insulating cement is specified, 1-in. galvanized-wire netting shall be stretched tightly over the blocks and wired securely in place.

(2) On rectangular equipment such as ducts or breechings, corner bead shall be installed when specified. (See fig. 15.)

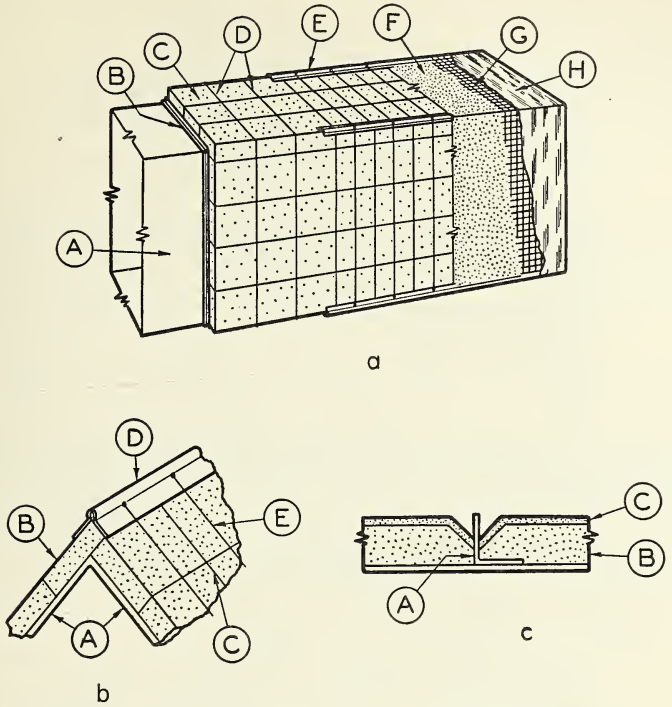

FIGURE 15. *Application of mineral wool blocks on flat or rectangular surfaces.*

a, Application where insulation thickness is greater than stiffener height. *A*, Bare surface; *B*, stiffener ribs; *C*, mineral wool blocks; *D*, No. 16-gage galvanized reinforcing wires or ½-in. galvanized bands applied over blocks; *E*, corner bead secured over blocks at corners with No. 16-gage galvanized wires; *F*, insulating cement; *G*, 1-in. galvanized wire netting stretched tightly over insulating cement and wired in place; *H*, finishing cement or asphaltic finish.

b, Enlarged details showing application of corner bead. *A*, Metal duct; *B*, mineral wool blocks; *C*, No. 16-gage galvanized wire over blocks; *D*, corner bead; *E*, No. 16-gage galvanized wires drawn through perforations in corner bead.

c, Application where insulation thickness is equal to or less than stiffener height. *A*, Stiffener; *B*, mineral wool blocks; *C*, insulating cement and specified finish beveled back at rib.

19c. Expansion joints should be provided every 12 to 16 ft. on heated equipment where temperatures in excess of 600° F are encountered.

The application of block or board with expansion joints shall follow the method set forth in paragraph 16d and illustrated in figure 12.

19d. On *masonry* surfaces, blocks or boards of specified thickness (table 3) shall be butted closely together with joints staggered, using an appropriate means of support (par. 11). Following application, any voids or openings between blocks or boards shall be filled with insulating cement.

(1) For installation of blocks or boards *between* brick or other structural materials, see figure 16.

20. *Application of finish.*

20a. After the blocks or boards are secured in place and reinforced with 1-in. galvanized-wire netting, a ¼-in. coat of insulating cement shall be applied to level off the surface. A second ¼-in. troweled coat of insulating or finishing cement shall be applied after the first coat

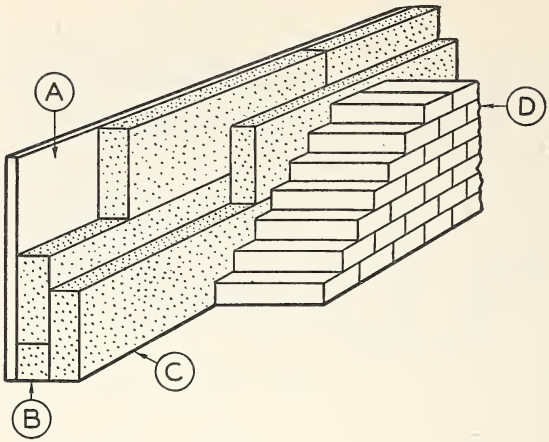

FIGURE 16. *Application of mineral wool blocks between structural supports.*

A, Bare surface; *B*, first layer of mineral wool blocks against steel casing; *C*, second layer of blocks applied with all joints staggered; *D*, brick.

has dried. Portland cement to a maximum of 25 percent dry weight may be added to this coat if a harder finish is desired.

20b. Insulation located *indoors* and not exposed to moisture or abrasion may be further finished as described below.

(1) When specified, a layer of asphalt weatherproof mastic finish may be applied. After the second coat of cement has thoroughly dried, 1-in. galvanized-wire netting shall be stretched tightly over the surface and wired in place with No. 16-gage galvanized soft iron wire. Asphaltic finish shall then be applied, sufficiently thick (approximately ¼ in. thick, wet) to provide a minimum dry thickness of ⅛ in., troweling it well into the wire netting.

(2) When specified, a 6- or 8-oz canvas jacket shall be sewed or pasted smoothly in place. If sewed, stitches shall be spaced not more than ⅓ in. apart, with seams located where least visible.

20c. Insulation located *outdoors* or exposed to moisture or abrasion shall be protected by one of the methods described below.

(1) After the cement has thoroughly dried, 1-in. galvanized-wire netting shall be stretched tightly over the surface and wired in place with No. 16-gage galvanized soft iron wire. Asphalt weatherproof mastic finish shall then be applied, sufficiently thick (approximately ¼ in. thick, wet) to provide a minimum dry thickness of ⅛ in., troweling it well into the wire netting.

(2) When specified, the insulating cement, wire netting, and asphalt mastic coating may be omitted, and the surface weatherproofed instead with a sheet-metal jacket. The sheet-metal jacket shall be no lighter than No. 28-gage, single or double galvanized, and shall be suitably anchored to the surface. Seams shall be lapped 2 in. against the weather and secured with metal screws, or

provided with a locked or flange-crimped joint to prevent the entry of moisture. After providing for expansion and contraction of the metal jacket, it shall be secured in place with ½-in. or ¾-in. galvanized metal bands, machine-stretched and crimped, on specified centers.

INSULATING CEMENT (BUILT-UP APPLICATIONS)

21. *Preparation of surface.*

21a. The surface to be insulated shall be carefully inspected and all loose particles, rust, scale, or dirt removed and leaks or other damages repaired. Paint or grease shall be removed with a caustic solution which then shall be washed off with water. When possible, the surface to be insulated shall be kept warm to facilitate drying.

22. *Installation of insulating cement.*

22a. Before being applied, insulating cement shall be mixed with clean, fresh water to troweling consistency.

22b. On *curved* or *flat* steel surfaces, insulating cement of specified thickness (see table 3) shall be built up by applying separate coats, each no greater than ¾ in. thick. The first coat shall be spotted on by hand, then completely roughed in. After the preceding coats have dried, additional successive coats, each ¾ in. thick or less, shall be applied until the total specified thickness is reached. (See fig. 17.)

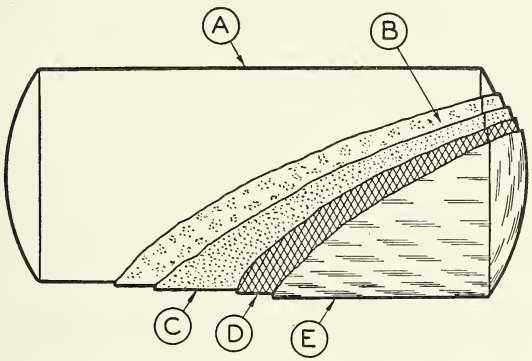

FIGURE 17. *Application of mineral wool insulating cement on curved steel surfaces.*

A, Cleaned bare surface; *B*, first coat of insulating cement spotted on roughly by hand; *C*, second coat of insulating cement; *D*, 1-in. galvanized-wire netting; *E*, finishing cement or asphaltic finish.

(1) When the total insulation thickness is greater than 2 in. 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 No. 16-gage galvanized wire.

22c. On heated brick surfaces, insulating cement shall be applied to specified thickness, but no greater than will result in a safe temperature gradient for all materials used in the composite construction. Where reinforcing is required, masonry nails of suitable length shall

be driven into the mortar joints on approximately 12-in. centers so that the heads project from the surface of the bricks. Successive layers of insulating cement shall be applied until the desired thickness is reached. (See fig. 18.) Before the last layer of insulating cement is applied, 1-in. mesh galvanized-wire netting shall be stretched tightly over the dried cement and secured to the nails. The last coat shall be troweled carefully into the wire mesh and applied in sufficient thickness to cover the nail heads.

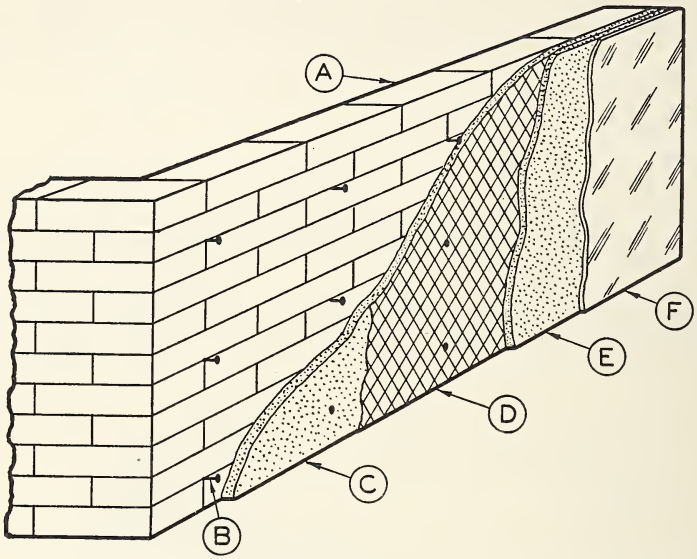

FIGURE 18. *Application of mineral wool insulating cement on brick surface.*

A, Heated brick surface; *B*, nails embedded in masonry joints spaced approximately on 12-in centers with heads projecting about ¾ in. from the surface; *C*, first coat of insulating cement applied nearly flush with nail heads; *D*, 1-in. galvanized wire mesh secured to nail heads; *E*, second coat of insulating cement; *F*, cement or asphaltic finish.

(1) If the insulated surface is to be weatherproofed, No. 16-gage galvanized hairpin wires shall be affixed to the nail heads and permitted to extend through the overlying cement to provide anchorage for the weatherproof finish.

23. *Application of finish.*

23a. Insulating cement located *indoors* and not exposed to moisture or abrasion shall be finished, when specified, with a ¼-in. troweled coat of finishing cement. Portland cement to a maximum of 25 percent dry weight may be added to this coat if a harder finish is desired.

(1) When specified, a 6- or 8-oz. canvas jacket may be sewed or pasted smoothly in place. If sewed, stitches shall be spaced not more than ⅓ in. apart, with seams located where least visible.

(2) When specified, a layer of asphalt weatherproof finish shall be applied instead of canvas. After the cement has thoroughly dried, 1-in. mesh galvanized-wire netting shall be stretched tightly over the surface and wired in place with No. 16-gage galvanized wire. Asphaltic

finish shall then be applied, sufficiently thick (approximately ¼ in. thick, wet) to provide a minimum dry thickness of ⅛ in., troweling it well into the wire netting.

23b. Insulating cement located *outdoors*, or exposed to moisture or abrasion, shall be finished with an asphalt weatherproof mastic finish.

(1) After the cement has thoroughly dried, 1-in. mesh galvanized-wire netting shall be stretched tightly over the surface and wired in place with No. 16-gage soft iron galvanized wire. Asphalt weatherproof mastic finish shall then be applied, sufficiently thick (approximately ¼ in. thick, wet) to provide a minimum dry thickness of ⅛ in., troweling it well into the wire netting. (See figs. 17 and 18.)

BLANKET-TYPE PIPE INSULATION

24. *Preparation of surface.*

24a. Piping, valves, and fittings to be insulated shall be tested for leaks and other defects, pipe hangers relocated as required, and all other preliminary operations completed before the insulation is applied.

25. *Installation on pipes.*

25a. Blanket-type pipe insulation of specified thickness (see table 3) shall be applied on pipes and long-radius bends of 2-in. standard pipe size, or greater.

(1) Before being applied, the insulation shall first be formed roughly to fit the pipe. It shall then be applied to the pipe, and the abutting edges pulled together tightly at the longitudinal joint and secured by tying or lacing with No. 16-gage galvanized soft iron wire. The insulation should be turned to bring the seam to the lower side. Pipe insulation shall be spaced a sufficient distance from flanges to permit removal of the bolts when flanges are opened. Adjacent lengths shall be butted closely together and laced with wire. Exposed ends of the wires shall be bent over and pressed into the insulation to leave no sharp projections. (See fig. 19.)

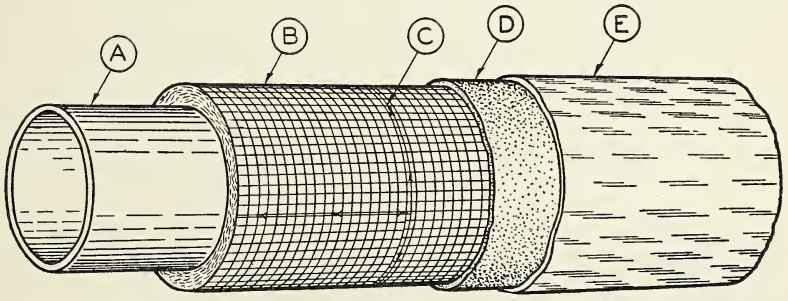

FIGURE 19. *Application of blanket-type mineral wool pipe insulation on pipes.*

A, Bare pipe; *B*, blanket-type insulation wrapped circumferentially around bare pipe; *C*, joints secured with No. 16-gage galvanized wires; *D*, insulating cement; *E*, asphaltic or other specified finish.

(2) When specified, blanket-type pipe insulation shall be furnished with an integral galvanized-metal jacket. It shall be applied snugly around the pipe and bolted along the flanged longitudinal joint. No further finish is required.

26. *Installation on valves, flanges, and fittings.*

26a. Valves, flanges, and fittings for 2-in. standard pipe size or larger shall be insulated with blanket-type pipe insulation of thickness equal to the insulation on adjacent piping. The insulation shall be applied after the finish has been installed over the insulation on the adjacent piping. It shall be formed to fit by cutting it along the circumferential edges and then shall be secured in place by wiring the longitudinal joint. All cut edges shall be laced together with No. 16-gage soft iron galvanized wire and the ends of the wire loops bent over and pressed into the insulation to leave no sharp projections. (See fig. 20.)

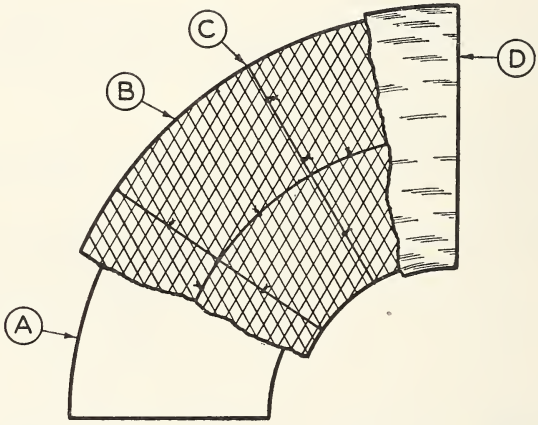

FIGURE 20. *Application of blanket-type mineral wool pipe insulation on large valves and fittings.*

A, bare fitting; *B*, blanket-type pipe insulation; *C*, joints secured with No. 16-gage galvanized wires; *D*, insulating cement or other specified finish.

26b. As alternate applications on valves, flanges, and fittings, insulating cement or block insulation may be used.

(1) Insulating cement shall be built up in ¾-in. coats to a thickness equal to the insulation on adjacent piping. (See par. 22a and fig. 21.)

(2) Blocks ¼ in. thick less than the insulation on adjacent piping shall be carefully fitted and wired securely in place. A ¼-in. coat of insulating cement shall then be applied, troweling it well into the cracks between adjacent blocks.

27. *Application of finish.*

27a. Blanket-type pipe insulation located *indoors* and not exposed to moisture or abrasion shall be finished as described below. (See fig. 19.)

(1) When specified, pipes, valves, flanges, and fittings shall be finished with mineral wool insulating cement applied in

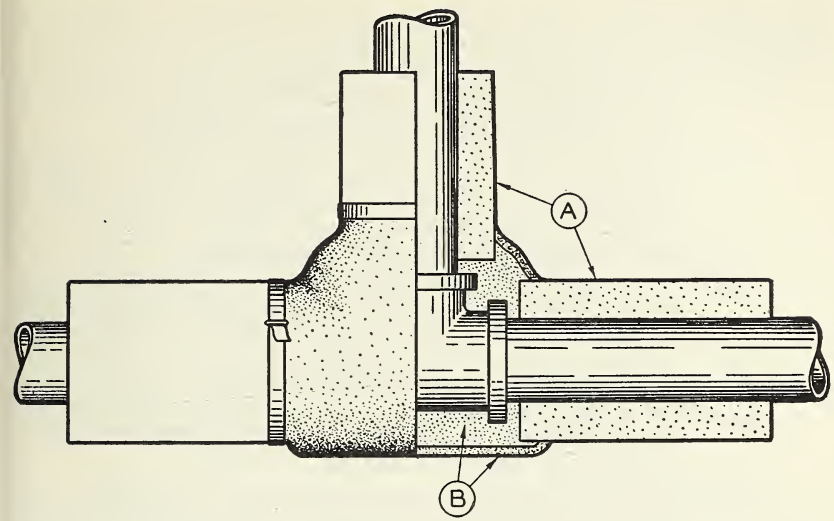

FIGURE 21. *Application of mineral wool insulating cement to valves, flanges, and fittings.*

A, sectional pipe insulation; *B*, insulating cement and other specified finish.

two separate ¼-in. coats. A sufficiently thick first coat shall be applied and allowed to dry in order to form an even base on which to apply the finishing coat.

(2) Pipes, valves, flanges, and fittings may be finished with a roofing-felt jacket, when specified. Roofing felt shall be smooth-surfaced, asbestos, asphalt-saturated and coated, weighing not less than 45 lb. per roll of 108 sq. ft. Seams shall be lapped at least 2 in. and, when specified, shall be sealed with lap cement. The roofing-felt jacket shall then be secured in place with copper-clad steel wires, copper wires, or galvanized bands spaced on approximately 6-in. centers.

(3) Pipes, valves, flanges, and fittings may be finished with asphaltic finish when specified. A ¼-in. coat of insulating cement shall be applied and when it has dried, 1-in. galvanized-wire netting shall be stretched tightly over the surface and wired in place with No. 16-gage soft iron galvanized wire. Asphaltic finish shall then be applied, sufficiently thick (approximately ¼ in. thick, wet) to provide a minimum dry thickness of ⅛ in., troweling it well into the wire netting.

(4) Pipes, valves, flanges, and fittings shall be finished, when specified, with a canvas jacket, sewed or pasted over a layer of flameproof paper, 1/16-in.-thick asbestos paper, or a ¼-in. coat of insulating or finishing cement. If sewed, stitches shall be spaced not more than ⅓ in. apart, with seams located where least visible.

27b. Blanket-type pipe insulation located *outdoors* or exposed to moisture or abrasion shall be weatherproofed as described below.

(1) Pipes, valves, flanges, and fittings shall be finished with a sheet-metal jacket, roofing felt, asphaltic finish, or other suitable weatherproof cover, as specified.

(2) Sheet-metal jackets shall be no lighter than No. 28-gage, single- or double-galvanized. Seams shall be lapped 2 in. against the weather and secured in place with ½- or ¾-in. galvanized metal bands, machine-stretched and crimped, on approximately 6-in. centers.

(3) When a roofing-felt finish is specified it shall be smooth-surfaced, asbestos, asphalt-saturated and coated, weighing not less than 45 lb. per roll of 108 sq. ft. Seams shall be lapped at least 2 in. against the weather; and when specified, shall be sealed with lap cement. The roofing-felt jacket shall then be secured in place with copper-clad steel wires, copper wires, or galvanized bands spaced on approximately 6-in. centers.

(4) Pipes, valves, flanges, and fittings may be finished with asphaltic finish when specified. A ¼-in. coat of insulating or finishing cement shall be applied, and when the cement has thoroughly dried, 1-in. galvanized-wire netting shall be stretched tightly over the surface and wired in place with No. 16-gage galvanized wire. Asphaltic finish shall then be applied, sufficiently thick (approximately ¼ in. thick, wet) to provide a minimum dry thickness of ⅛ in., troweling it well into the wire netting.

MOLDED-TYPE PIPE INSULATION

28. *Preparation of surface.*

28a. Piping, valves, and fittings to be insulated shall be tested for leaks and other defects, pipe hangers relocated as required, and all other preliminary operations completed before the insulation is applied.

29. *Installation on pipes.*

29a. Molded-type mineral wool pipe insulation of specified thickness (see tables 2 and 3) shall be applied in sectional or segmental form, of single- or double-layer construction, as specified. At flanges, pipe insulation shall be spaced a sufficient distance from the flanges to permit easy removal of bolts when flanges are opened.

(1) Adjacent pieces of sectional pipe insulation shall be butted closely together and banded in place. (See fig. 22.)

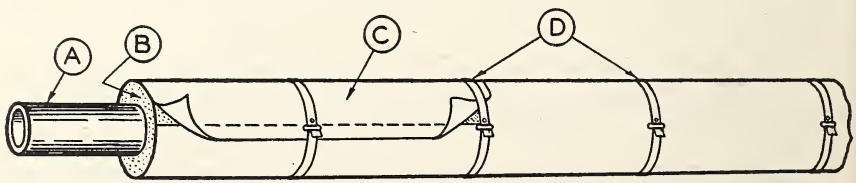

FIGURE 22. *Application of mineral wool sectional pipe insulation, single-layer.*
A, Bare pipe; *B*, sectional pipe insulation; *C*, canvas jacket or other specified finish; *D*, metal bands.

(2) Segmental pipe insulation should be secured in place with separate loops of No. 16-gage galvanized wire, spaced on approximately 8-in. centers. Ends of wires shall be bent over and pressed into the insulation, leaving no sharp projections. (See fig. 23.)

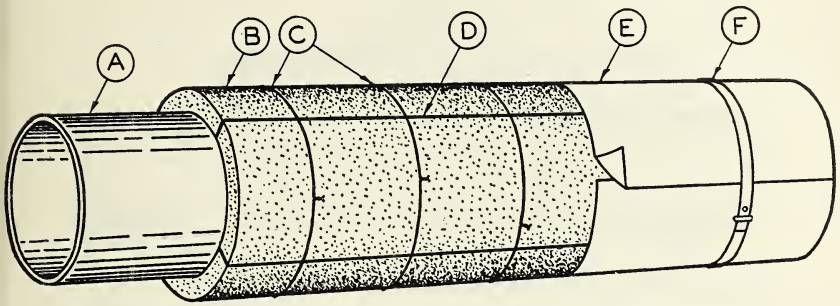

FIGURE 23. *Application of mineral wool segmental pipe insulation.*

A, Bare pipe; *B*, segmental pipe insulation; *C*, No. 16-gage galvanized wires; *D*, insulating cement, when required; *E*, canvas jacket or other specified finish; *F*, metal bands.

(3) Double-layer pipe insulation, either in sectional or segmental form, shall be applied with circumferential and longitudinal joints staggered, omitting the canvas jacket between layers. The first layer shall be wired in place with separate loops of wire spaced on approximately 8-in. centers. The second layer shall be applied snugly over the first layer and secured in place. (See fig. 24).

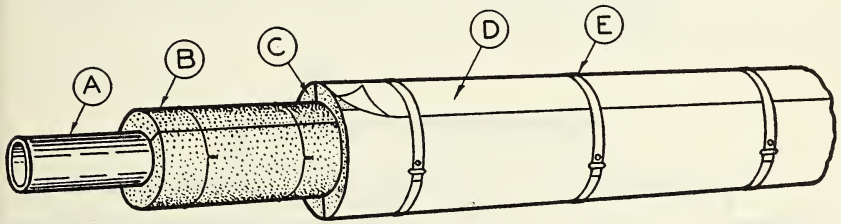

FIGURE 24. *Application of mineral wool sectional pipe insulation, double-layer.*

A, Bare pipe; *B*, first layer secured with No. 16-gage galvanized wires; *C*, second layer applied with all joints staggered; *D*, canvas jacket or other specified finish; *E*, metal bands.

30. *Installation on valves, flanges, and fittings.*

30a. Valves, flanges, and fittings shall be covered with insulating cement, block insulation, or molded-type pipe insulation, as specified.

(1) Insulating cement shall be built up in ¾-in. coats to a thickness equal to the insulation on adjacent piping. (See par. 22a and fig. 21.)

(2) Blocks ¼ in. thick less than the insulation on adjacent piping shall be carefully fitted and wired securely in place. A ¼-in. coat of insulating cement shall then be applied, troweling it well into the cracks between adjacent blocks. (See fig. 25.)

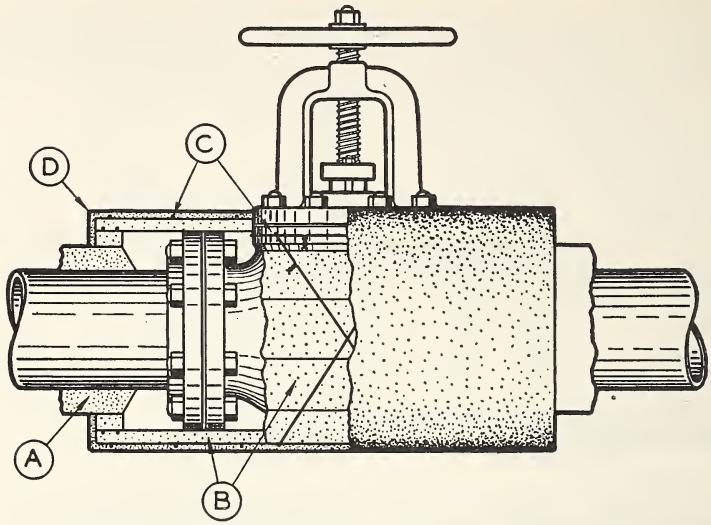

FIGURE 25. *Application of mineral wool block insulation to large fittings.*

A, Pipe insulation; *B*, block insulation; *C*, No. 16-gage galvanized wires; *D*, insulating cement or other specified finish.

(3) Molded-type pipe insulation may be used to insulate flanged couplings. Rings of sectional pipe covering 1½ to 2 in. wide should be wired in place on each side of the flange, selecting an insulation thickness that will provide an outside diameter equal to or greater than the flange diameter. A piece of sectional pipe insulation long enough to cover the flange then should be banded in place. (See fig. 26.)

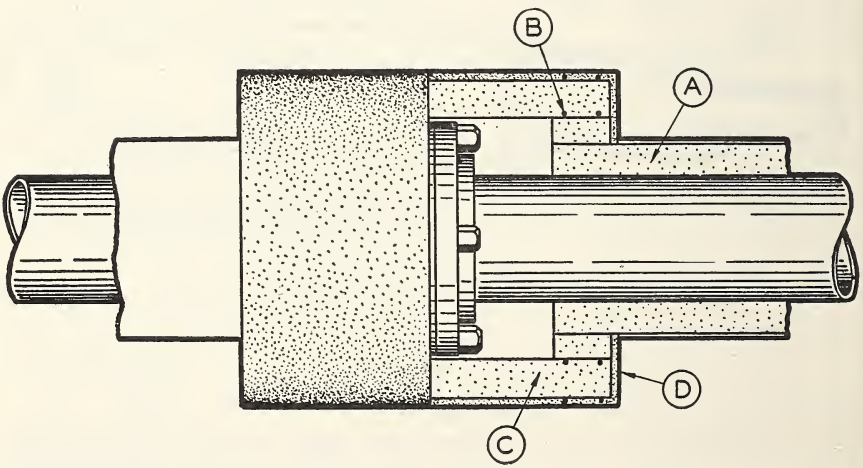

FIGURE 26. *Application of molded-type mineral wool pipe insulation to flanges and fittings.*

A, Sectional pipe insulation; *B*, No. 16-gage galvanized wires or galvanized bands; *C*, sectional or segmental pipe insulation; *D*, insulating cement or other specified finish.

31. *Application of finish located indoors.*

31a. Molded-type pipe insulation located *indoors* and not exposed to moisture or abrasion shall be finished with a canvas jacket.

(1) The factory-weight canvas jacket furnished shall be drawn tight and smoothly pasted down at all side and end laps. Factory bands shall be applied, one binding the adjacent ends and one at the center of each section.

(2) When extra-weight canvas jacket is specified, the factory-weight canvas and bands (if furnished) shall be omitted. The pipe insulation shall be covered with a layer of flameproof paper, 1/16-in. asbestos paper, or a 1/4-in. coat of insulating or finishing cement. The specified 6- or 8-oz canvas jacket shall then be pasted or sewed neatly in place as specified. If sewed, stitches shall be spaced not more than 1/8 in. apart, with seams located where least visible.

31b. Insulation on flanges, valves, and fittings located *indoors* or not exposed to moisture or abrasion shall be covered with a 1/4-in. coat of insulating or finishing cement. Portland cement to a maximum of 25 percent dry weight may be added to this coat if a harder finish is desired.

(1) When specified, a 6- or 8-oz canvas jacket shall be sewed or pasted neatly over the dry cement. Sewed canvas jackets on valves, flanges, and fittings shall be made continuous with the canvas on adjacent pipe, when specified, by overlapping or blind stitching. If sewed, stitches shall be spaced not more than 1/8 in. apart and seams shall be placed where least visible.

32. *Application of finish located outdoors.*

32a. Molded-type pipe insulation and fittings located *outdoors* or exposed to moisture or abrasion shall be provided with a weatherproof protective finish in the same general manner as specified for blanket-type pipe insulation. (See par. 27b.)

GUIDES FOR PAINTING

33. When specified, insulation finishes shall be painted for identification purposes in accordance with "Scheme for the Identification of Piping Systems," issued by the American Standards Association (A13–1928).

34. The application of paint should be deferred until the insulated equipment has been operated at the design temperature for a sufficient length of time thoroughly to dry out all components of the installation.

35. When weatherproof finishes of the emulsified-asphalt or roofing-felt types are to be painted, they should be primed with at least one coat of aluminum paint, before applying lead-in-oil paint. Asphalt-base paint may be used directly over the asphaltic finish when a black color is specified.

36. Canvas should be given at least one coat of glue size followed by two coats of lead-in-oil paint.

37. Galvanized metal is not ordinarily painted immediately following its application. If painting is required, it should be done in accordance with the manufacturer's directions.

38. Insulating cements and finishing cements ordinarily dry to a light color, and may be painted with a nonpenetrating paint such as aluminum.

MAINTENANCE

39. In order to maintain high thermal efficiency in conjunction with long insulation life, the following recommendations are made:

(a) Inspect all insulation jobs periodically, particularly those located outdoors or exposed to moisture, vibration, or abrasion.

(b) When equipment is moved, or if for other reasons the finish of the insulation is damaged or becomes loose, repair or replace it as required to prevent deterioration.

(c) For advice on problems in connection with any specific insulation application, consult the manufacturer or the contractor who applied it.

GUARANTEE LABELS AND CERTIFICATES

40. *Manufacturer's labels.*—In order that the purchaser may be assured of obtaining mineral wool insulation conforming to the requirements of this standard, it is recommended that products complying therewith bear a certificate, label, or imprint containing the following wording:

> This mineral wool product is guaranteed to conform to the requirements of Commercial Standard CS117–49, as developed by the trade under the procedure of the National Bureau of Standards, and issued by the United States Department of Commerce.
>
> ----------
> Name of manufacturer

41. The following is an illustration of the label adopted by the members of the Industrial Mineral Wool Institute to assure distributors and users of receiving mineral wool insulation that conforms to the requirements of this commercial standard.

FIGURE 27. *Facsimile of Industrial Mineral Wool Institute label.*

42. *Contractor's certificate.*—It is recommended that the installer or contractor furnish a certificate guaranteeing that the insulation is installed in accordance with this standard. The following wording is recommended for this certificate:

This _____ has been insulated with Class
(type of equipment)
_____ Mineral Wool _____, installed in com-
(type)
pliance with the recommended installation requirements of Commercial Standard CS117–49, as developed by the trade under the procedure of the National Bureau of Standards, and issued by the United States Department of Commerce.

Date _____

_____
(Company name)

_____
(Address)

EFFECTIVE DATE

43. Having been passed through the regular procedure of the Commodity Standards Division, and approved by the acceptors hereinafter listed, this commercial standard was issued by the United States Department of Commerce, effective from June 1, 1949.

EDWIN W. ELY,
Chief, Commodity Standards Division.

HISTORY OF PROJECT

On September 21, 1943, the Industrial Mineral Wool Institute requested the cooperation of the National Bureau of Standards in the establishment of a commercial standard for mineral wool insulation for heated industrial equipment. A draft of the proposed commercial standard was submitted on November 1, 1943, to technical, distributor and consumer organizations, Goverrment agencies, and to manufacturers for their review and comment.

On December 10, 1943, a meeting was held in Cleveland, Ohio, to review and consider all comments received. The standard was then adjusted in accordance with the composite recommendation of those concerned and circulated on January 7, 1944, to the trade for written acceptance.

Following acceptance by a satisfactory majority, and in the absence of active opposition, an announcement was issued on April 25, 1944, that the standard had been accepted as a recorded voluntary standard of the trade, effective for new production from May 25, 1944. It was issued as Commercial Standard CS117–44, Mineral Wool: Blankets, Blocks, Insulating Cement, and Pipe Insulation for Heated Industrial Equipment.

FIRST REVISION

On September 22, 1948, the Industrial Mineral Wool Institute submitted a proposed revision in which the major changes were the addition of requirements for loose, granulated, and felted forms of mineral wool, with nine new and two revised illustrations showing methods of fastening and application of the mineral wool to various types of surfaces. These changes having been approved by the standing committee, the recommended revision was circulated on March 1, 1949, to those directly concerned for consideration and acceptance.

Approval of the revision was announced on May 2, 1949, the revised standard, designated CS117–49, Mineral Wool Insulation for Heated Industrial Equipment, to be effective for new production from June 1, 1949.

STANDING COMMITTEE

The following individuals comprise the membership of the standing committee, which is to review, prior to circulation for acceptance, revisions proposed to keep the standard abreast of progress. Comment concerning the standard and suggestions for revision may be addressed to any member of the committee or to the Commodity Standards Division, National Bureau of Standards, which acts as secretary for the committee.

H. E. Lewis (chairman), The Eagle-Picher Sales Co., American Building, Cincinnati 1, Ohio.
C. A. Smucker, Owens-Corning Fiberglas Corp., Newark, Ohio.
E. A. Fairlamb, National Gypsum Co., Buffalo, N. Y.
K. M. Ritchie, Baldwin-Hill Co., 500 Breunig Avenue, Trenton 2, N. J.
Harold M. Aber, The Aber Co., Inc., P. O. Box 212, Shreveport, La.
John Reilly, The Reilly-Benton Co., Inc., 613 Hibernia Building, New Orleans 12, La.
L. A. Foster, L. A. Foster Co., 1519 North Broadway, St. Louis 6, Mo.
Frederick J. Heaslip, Fairbanks, Morse & Co., 600 S. Michigan Avenue, Chicago, Ill. (representing National Association of Purchasing Agents).
Henry E. Aldrich, American Boiler & Affiliated Industries, 15 Park Row, New York 7, N. Y.
R. J. Potbury, Bureau of Yards and Docks, Department of the Navy, Washington 25, D. C.

ACCEPTANCE OF COMMERCIAL STANDARD

If acceptance has not previously been filed, this sheet properly filled in, signed, and returned will provide for the recording of your organization as an acceptor of this commercial standard.

Date_____

Commodity Standards Division,
National Bureau of Standards,
Washington 25, D. C.

Gentlemen:

We believe that the Commercial Standard CS117–49 constitutes a useful standard of practice, and we individually plan to utilize it as far as practicable in the

production [1] distribution [1] purchase [1] testing [1]

of mineral wool insulation for heated industrial equipment.

We reserve the right to depart from it as we deem advisable.

We understand, of course, that only those articles which actually comply with the standard in all respects can be identified or labeled as conforming thereto.

(Cut on this line)

Signature of authorized officer_____
(In ink)

(Kindly typewrite or print the following lines)

Name and title of above officer_____

Organization_____
(Fill in exactly as it should be listed)

Street address_____

City, zone, and State_____

[1] Underscore which one. Please see that separate acceptances are filed for all subsidiary companies and affiliates which should be listed separately as acceptors. In the case of related interests, trade associations, trade papers, etc., desiring to record their general support, the words "General Support" should be added after the signature.

TO THE ACCEPTOR

The following statements answer the usual questions arising in connection with the acceptance and its significance:

1. *Enforcement.*—Commercial standards are commodity specifications voluntarily established by mutual consent of these concerned. They present a common basis of understanding between the producer, distributor, and consumer and should not be confused with any plan of governmental regulation or control. The United States Department of Commerce has no regulatory power in the enforcement of their provisions, but since they represent the will of the interested groups as a whole, their provisions through usage soon become established as trade customs, and are made effective through incorporation into sales contracts by means of labels, invoices, and the like.

2. *The acceptor's responsibility.*—The purpose of commercial standards is to establish for specific commodities, nationally recognized grades or consumer criteria and the benefits therefrom will be measurable in direct proportion to their general recognition and actual use. Instances will occur when it may be necessary to deviate from the standard and the signing of an acceptance does not preclude such departures; however, such signature indicates an intention to follow the commercial standard where practicable, in the production, distribution, or consumption of the article in question.

3. *The Department's responsibility.*—The major function performed by the Department of Commerce in the voluntary establishment of commercial standards on a Nation-wide basis is fourfold: first, to act as an unbiased coordinator to bring all interested parties together for the mutually satisfactory adjustment of trade standards; second, to supply such assistance and advice as past experience with similar programs may suggest; third, to canvass and record the extent of acceptance and adherence to the standard on the part of producers, distributors, and users; and fourth, after acceptance to publish and promulgate the standard for the information and guidance of buyers and sellers of the commodity.

4. *Announcement and promulgation.*—When the standard has been endorsed by a satisfactory majority of production or consumption in the absence of active valid opposition, the success of the project is announced. If, however, in the opinion of the standing committee or the Department of Commerce, the support of any standard is inadequate, the right is reserved to withhold promulgation and publication.

ACCEPTORS

The organizations and individuals listed below have individually accepted this standard for use as far as practicable in the production, distribution, or purchase of mineral wool insulation for heated industrial equipment. In accepting the standard they reserved the right to depart therefrom as they individually deem advisable. It is expected that articles which actually comply with the requirements of this standard in all respects will be regularly identified or labeled as conforming thereto, and that purchasers will require such specific evidence of conformity.

ASSOCIATIONS

(General Support)

American Society of Sanitary Engineering, McKeesport, Pa.
Industrial Mineral Wool Institute, New York, N. Y.
National Cooperative Refinery Association, The, McPherson, Kans.

FIRMS AND OTHER INTERESTS

Accurate Insulation Co., Los Angeles, Calif.
Adams, Franklin O., Tampa, Fla.
Allen, George W., LaPorte, Ind.
American Crystal Sugar Co., Denver, Colo.
American Enka Corp., Enka, N. C.
American Potash & Chemical Corp., Trona, Calif.
American Rock Wool Corp., Chicago, Ill.
American Steel Foundries, Chicago, Ill.
American Thread Co., New York, N. Y.
Anaconda Copper Mining Co., Butte, Mont.
Andrews, Jones, Biscoe & Goodell, Boston, Mass.
Ansco, Division of General Aniline & Film Corp., Binghamton, N. Y.
Ashland Oil & Refining Co., Ashland, Ky.
Atlantic City Electric Co., Atlantic City, N. J.
Austin, City of, Austin, Tex.
Baldwin-Hill Co., Trenton, N. J.
Bayou State Oil Corp., Hosston, La.
Beech-nut Packing Co., Canajoharie, N. Y.
Belle Alkali Co., Belle, W. Va.
Belli, Edo J., Chicago, Ill.
Belli Co., Inc., Trenton, N. J.
Bellman, Gillett & Richards, Toledo, Ohio.
Berger, F. E.—R. L. Kelley & Associates, Champaign, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Beuttler, W. M., Sioux City, Iowa.
Bickford, Robert Turner, Elmira, N. Y.
Bishop, Horatio W., La Mesa, Calif. (General support.)
Boehm, George A., New York, N. Y.
Bovard, William R., Kansas City, Mo. (General support.)
Brooks-Borg, Des Moines, Iowa.
Brown & Bigelow, St. Paul, Minn.
Brown Co., Berlin, N. H.
Brust & Brust, Milwaukee, Wis.
Camlet, J. Thomas, Passaic, N. J.
Cannon & Mullen, Salt Lake City, Utah
Carey, Philip, Manufacturing Co., The, Cincinnati, Ohio.
Carney Co., Inc., The, Mankato, Minn.
Carver, George P., Engineering Co., Boston, Mass.
Central of Georgia Railway Co., Savannah, Ga.
Cities Service Oil Co., New York, N. Y.
Coates, Henry T., & Associates, New York, N. Y.
Coffeyville, City of, Municipal Light & Power Department, Coffeyville, Kans.
Colorado Insulating Co., Denver, Colo.
Columbia Mlneral Wool Co., Chicago, Ill.
Combined Locks Paper Co., Combined Locks, Wis.
Combustion Engineering-Superheater, Inc., New York, N. Y.
Connecticut Light & Power Co., The, Waterbury, Conn.
Connecticut Power Co., The, New London, Conn.
Conrad & Cummings, Binghamton, N. Y.
Coolidge, Shepley, Bulfinch & Abbott, Boston, Mass.
Corn Products Refining Co., Chicago, Ill.
Corson, G. & W. H., Inc., Plymouth Meeting, Pa.
Coxe Stoker Engineering Co., Hazleton, Pa.
Cram & Ferguson, Boston, Mass.
Crane Co., Chicago, Ill.
Crang Industries Ltd., Toronto, Ontario, Canada.
Crowell & Lancaster, Bangor, Maine.
Dallas, City of, Water Works & Sewage Disposal, Dallas, Tex.
Dallas Power & Light Co., Dallas, Tex.
Daugherty Refinery, Division of L. Sonneborn Sons, Inc., Petrolia, Pa.
Day & Zimmermann, Inc., Philadelphia, Pa.
Dayton Power & Light Co., The, Dayton, Ohio.
Deere & Co., Moline, Ill.
DeJarnette, Charles W., Des Moines, Iowa. (General support.)
Detrick, M. H., Co., Aurora, Ill.
Detroit Edison Co., The, Detroit, Mich.
Detroit Sulphite Pulp & Paper Co., Detroit, Mich.
Dietel, G. J., Buffalo, N. Y.
Dow Chemical Co., Midland, Mich.
Dunlop Tire & Rubber Corp., Buffalo, N. Y.
Eagle-Picher Sales Co., The, Cincinnati, Ohio.
Elektrokemisk, A. S., New York, N. Y.
English, Miller & Hockett, Hutchinson, Kans.
Everett, H. F., & Associates, Allentown, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Federal Building Material Co., Tulsa, Okla.
Federal Portland Cement Co., Inc., The, Buffalo, N. Y.
Feltrok Insulation Manufacturing Co., Tacoma, Wash.
Fetzer & Fetzer, Salt Lake City, Utah.
Firestone Tire & Rubber Co., The, Akron, Ohio.
Flannagan, Eric G., Henderson, N. C.
Forty-Eight Insulations, Inc., Aurora, Ill.
Foster, L. A., Co., St. Louis, Mo.
Frazier-Simplex, Inc., Washington, Pa.
Fuel Economy Engineering Co., St. Paul, Minn.
Globe-Wernicke Co., The, Norwood, Ohio.
Gorman-Lavelle Plumbing & Heating Co., The, Cleveland, Ohio.
Grand Island, City of, Water & Light Department, Grand Island, Nebr.
Great Western Sugar Co., The, Denver, Colo.
Greenwood Electric Light & Water Plant, Greenwood, Miss.
Gulf States Paper Corp., Tuscaloosa, Ala.
Gypsum Lime & Alabastine, Canada, Ltd., Toronto, Canada.

Hahn, Stanley W., Detroit, Mich.
Hannaford, Samuel, & Sons, Cincinnati, Ohio.
Haralson & Mott, Fort Smith, Ark.
Helfenstellar, Hirsch & Watson, St. Louis, Mo.
Hershey Chocolate Corp., Hershey, Pa.
Higgins, Charles H., New York, N. Y.
Hoeppner-Bartlett Co., Eau Claire, Wis.
Holmes Foundry Co., Ltd., Sarnia, Ontario, Canada.
Hooker Electrochemical Co., Niagara Falls, N. Y.
Hope, Frank L., San Diego, Calif.
Hughes Tool Co., Houston, Tex.
Imperial Tobacco Co., Ltd., The, Richmond, Va.
Inland Paper Board Division, Federal Paper Board Co., Inc., Versailles, Conn.
Insulating Products Co., Aurora, Ill.
Insulation Products Ltd., Hamilton, Ontario, Canada.
Interlaken Mills, Fiskeville, R. I.
International Shoe Co., St. Louis, Mo.
Ivey, Edwin J., Inc., Seattle, Wash.
Jamme, Bernard E., Summit, N. J.
Jersey Central Power & Light Co., Long Branch, N. J.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Kansas City Star Co., Flambeau Paper Division, Park Falls, Wis.
Kansas State College, Department of Architecture, Manhattan, Kans. (General support.)
Keystone Steel & Wire Co., Peoria, Ill.
Latenser, John, & Sons, Omaha, Nebr.
Law, Law, Potter & Nystrom, Madison, Wis.
Levine, Ernest, New Brunswick, N. J.
Levy, Will, St. Louis, Mo.
Lockhart Power Co., Lockhart, S. C.
Logansport, City of, Logansport, Ind.
Magma Copper Co., Superior, Ariz.
Magnolia Petroleum Co., Beaumont, Tex.
Mann & Co., Hutchinson, Kans.
Marathon Corp., Rothschild, Wis.
Materiales Aislantes, S. A., Monterrey, N. L., Mexico.
Merrill, Simms & Roehrig, Honolulu, Oahu, T. H.
Miller & Vrydagh, Terre Haute, Ind.
Milwaukee Solvay Coke Co., Milwaukee, Wis.
Mooser, William, San Francisco, Calif.
Morell, N. L., Bethlehem, Pa.
Morton Salt Co., Manistee, Mich.
Mueller, Hair & Hetterich, Hamilton, Ohio.
Muhlenberg Bros., Reading, Pa.
National Gypsum Co., Buffalo, N. Y.
National Rock Wool Sales, Inc., Lagro, Ind.
Nazareth Cement Co., Nazareth, Pa.
Nelson, Albert L., St. Louis, Mo.
Newton Falls Paper Mill, Inc., Newton Falls, N. Y.
Northwestern Public Service Co., Huron, S. Dak.
Oklahoma, University of, Norman, Okla.
Oneida, Ltd., Oneida, N. Y.
Overbagh, H. Malcolm, Hollis, N. Y.
Owens-Corning Fiberglas Corp., Toledo, Ohio.
Pasadena Municipal Light & Power Department, Pasadena, Calif.
Pennsylvania Institution for Defective Delinquents, Huntingdon, Pa.
Pennsylvania Salt Manufacturing Co. of Washington, Tacoma, Wash.
Pepper, George W., Jr., Philadelphia, Pa.
Pepsi-Cola Co., New York, N. Y.
Perfect Seal Rock Wool Manufacturing Co., Walworth, Wis.
Phelps & Dewees & Simmons, San Antonio, Tex.
Philadelphia, City of, Bureau of Water, Department of Public Works, Philadelphia, Pa.
Pillsbury Mills, Inc., Minneapolis, Minn.
Pittsburgh Plate Glass Co., Barberton, Ohio.
Poe, C. W., Co., The, Cleveland, Ohio.
Port Huron Sulphite & Paper Co., Port Huron, Mich.
Post Power Supply Co., Appleton, Wis.
Public Service Co., of New Hampshire, Manchester, N. H.
Resnikoff, Abraham, New York, N. Y.
Revere Sugar Refinery, Charlestown, Mass.
Rhinelander Paper Co., Rhinelander, Wis.
Ritchie, James H., & Associates, Boston, Mass.
Riverton Lime & Stone Co., Inc., Riverton, Va.
Robert & Co. Associates, Inc., Atlanta, Ga.
Rohm & Haas Co., Philadelphia, Pa.
Rosenblatt & Kerstein, Inc., Charleston, W. Va.
Russell, Crowell, Mullgardt & Schwarz, St. Louis, Mo.
Saint Croix Paper Co., Woodland, Maine.
Salem Lime & Stone Co., Salem, Ind.
Schaeffler, Joseph C., New Rochelle, N. Y.
Sealtite Insulation Manufacturing Corp., Waukesha, Wis.
Seattle, City of, Department of Lighting, Seattle, Wash.
Servel, Inc., Evansville, Ind.
Shell Oil Co., Inc., New York, N. Y.
Shutze & Armistead, Atlanta, Ga.
Sleeper, Harold R., New York, N. Y.
Smith, Hinchman & Grylls, Inc., Detroit, Mich.
South Carolina Power Co., Charleston, S. C.
Southern Colorado Power Co., Pueblo, Colo.
Southwestern Gas & Electric Co., Shreveport, La.
Spreckels Sugar Co., San Francisco, Calif.
Spun Rock Wools, Ltd., Thorold, Ontario, Canada.
Standard Brands, Inc., New York, N. Y.
Staub & Rather, Houston, Tex.
Stetson, John B., Co., Philadelphia, Pa.
Stoetzel, Ralph, Chicago, Ill.
Tampa Electric Co., Tampa, Fla.
Taylor, Ellery Kirke, Haddonfield, N. J.
Taylor, Ellis Wing, Los Angeles, Calif.
Temple, Seth J., & Arthur, Davenport, Iowa.
Texas Technological College, Department of Architecture, Lubbock, Tex. (General support.)
Tex-Rock Insulation Manufacturing Co., Temple, Tex.
Thorne, Henry Calder, Ithaca, N. Y.
Tidmarsh Engineering Co., Tucson, Ariz.
Tobin Packing Co., Albany, N. Y.
Toledo, City of, Division of Water, Toledo, Ohio.
United Insulating Co., Little Rock, Ark.
United States Mineral Wool Co., South Milwaukee, Wis., and Stanhope, N. J.
United States Rock Wool Co., Salt Lake City, Utah.
Virginia, City of, Water and Light Department, Virginia, Minn.
Virginian Polytechnic Institute, Blacksburg, Va. (General support.)
Virginia Railway Co., The, Princeton, W. Va.
Vogel, Willis A., Toledo, Ohio.
Walsh, Louis A., Waterbury, Conn.
Watervliet Paper Co., Watervliet, Mich.
Welch, Carrol E., Huntington, N. Y.
West, Albert E., Boston, Mass.
West Texas Utilities Co., Abilene, Tex.
Western Electric Co., New York, N. Y.
White, J. G., Engineering Corp., The, New York, N. Y.
Whittenton Manufacturing Co., Inc., Taunton, Mass.
Wickes Boiler Co., The, Saginaw, Mich.
Wight & Wight, Kansas City, Mo.
Wigton-Abbott Corp., Plainfield, N. J.
Wilbur-Suchard Chocolate Co., Inc., Lititz, Pa.
Willatsen, Andrew, Seattle, Wash.
Williams, Coile & Blanchard, Newport News, Va.
Willson, Fred F., Bozeman, Mont.
Wilson, Adrian, Los Angeles, Calif.
Wilson, Town of, Inc., Wilson, N. C.
Wolff & Munier, Inc., New York, N. Y.
Woolsulate, Inc., Salt Lake City, Utah.
Wright & Wright, Detroit, Mich. (General support.)
Wyandotte Chemicals Corp., Wyandotte, Mich.
Zimmerman, A. C., Los Angeles, Calif.

U. S. GOVERNMENT

Agriculture, United States Department of, Division of Purchase, Sales and Traffic, Washington, D. C.
Army, Department of the, Washington, D. C.
Federal Works Agency, Public Buildings Administration, Washington, D. C. (General support.)
Interior Department, Office of Indian Affairs, Washington, D. C.
Justice Department, Bureau of Prisons, Washington, D. C.
Navy, Department of the, Bureau of Yards and Docks, Washington, D. C.
United States Capitol Power Plant, Washington, D. C.

COMMERCIAL STANDARDS

CS No. Item

0–40. Commercial standards and their value to business (third edition).
1–42. Clinical thermometers (third edition).
2–30. Mopsticks.
3–40. Stoddard solvent (third edition).
4–29. Staple porcelain (all-clay) plumbing fixtures.
5–46. Pipe nipples, brass, copper, steel, and wrought iron (second edition).
6–31. Wrought-iron pipe nipples (second edition). Superseded by CS5–46.
7–29. Standard weight malleable iron or steel screwed unions.
8–41. Gage blanks (third edition).
9–33. Builders' template hardware (second edition).
10–29. Brass pipe nipples. Superseded by CS5–46.
11–41. Moisture regains of cotton yarns (second edition).
12–48. Fuel oils (sixth edition).
13–44. Dress patterns (fourth edition).
14–43. Boys' button-on waists, shirts, junior and sport shirts (made from woven fabrics) (third edition).
15–46. Men's pajama sizes (made from woven fabrics) (third edition).
16–29. Wall paper.
17–47. Diamond core drill fittings (fourth edition).
18–29. Hickory golf shafts.
19–32. Foundry patterns of wood (second edition).
20–47. Staple vitreous china plumbing fixtures (fourth edition).
21–39. Interchangeable ground-glass joints, stopcocks, and stoppers (fourth edition).
22–40. Builders' hardware (nontemplate) (second edition).
23–30. Feldspar.
24–43. Screw threads and tap-drill sizes.
25–30. Special screw threads. Superseded by CS24–43.
26–30. Aromatic red cedar closet lining.
27–36. Mirrors (second edition).
28–46. Cotton fabric tents, tarpaulins and covers (second edition).
29–31. Staple seats for water-closet bowls.
30–31. Colors for sanitary ware. (Withdrawn as commercial standard, March 15, 1948.)
31–38. Wood shingles (fourth edition).
32–31. Cotton cloth for rubber and pyroxylin coating.
33–43. Knit underwear (exclusive of rayon) (second edition).
34–31. Bag, case, and strap leather.
35–47. Hardwood plywood (third edition).
36–33. Fourdrinier wire cloth (second edition).
37–31. Steel bone plates and screws.
38–32. Hospital rubber sheeting.
39–37. Wool and part wool blankets (second edition). (Withdrawn as commercial standard, July 14, 1941.)
40–32. Surgeons' rubber gloves.
41–32. Surgeons' latex gloves.
42–43. Structural fiber insulating board (third edition).
43–32. Grading of sulphonated oils.
44–32. Apple wraps.
45–48. Douglas fir plywood (eighth edition).
46–49. Hosiery lengths and sizes (fourth edition).
47–34. Marking of gold-filled and rolled-gold-plate articles other than watchcases.
48–40. Domestic burners for Pennsylvania anthracite (underfeed type) (second edition).
49–34. Chip board, laminated chip board, and miscellaneous boards for bookbinding purposes.
50–34. Binders board for bookbinding and other purposes.

CS No. Item

51–35. Marking articles made of silver in combination with gold.
52–35. Mohair pile fabrics (100-percent mohair plain velvet, 100-percent mohair plain frieze, and 50-percent mohair plain frieze).
53–35. Colors and finishes for cast stone.
54–35. Mattresses for hospitals.
55–35. Mattresses for institutions.
56–49. Oak flooring (third edition).
57–40. Book cloths, buckrams, and impregnated fabrics for bookbinding purposes except library bindings (second edition).
58–36. Woven elastic fabrics for use in overalls (overall elastic webbing).
59–44. Textiles—testing and reporting (fourth edition).
60–48. Hardwood dimension lumber (second edition).
61–37. Wood-slat venetian blinds.
62–38. Colors for kitchen accessories.
63–38. Colors for bathroom accessories.
64–37. Walnut veneers.
65–43. Methods of analysis and of reporting fiber composition of textile products (second edition).
66–38. Marking of articles made wholly or in part of platinum.
67–38. Marking articles made of karat gold.
68–38. Liquid hypochlorite disinfectant, deodorant, and germicide.
69–38. Pine oil disinfectant.
70–41. Phenolic disinfectant (emulsifying type) (second edition) (published with CS71–41).
71–41. Phenolic disinfectant (soluble type) (second edition) (published with CS70–41).
72–38. Household insecticide (liquid spray type).
73–48. Old growth Douglas fir, Sitka spruce, and Western hemlock standard stock doors (fourth edition).
74–39. Solid hardwood wall paneling.
75–42. Automatic mechanical draft oil burners designed for domestic installations (second edition).
76–39. Hardwood interior trim and molding.
77–48. Enameled cast-iron plumbing fixtures (second edition).
78–40. Ground-and-polished lenses for sun glasses (second edition) (published with CS79–40).
79–40. Blown, drawn, and dropped lenses for sun glasses (second edition) (published with CS78–40).
80–41. Electric direction signal systems other than semaphore type for commercial and other vehicles subject to special motor vehicle laws (after market).
81–41. Adverse-weather lamps for vehicles (after market).
82–41. Inner-controlled spotlamps for vehicles (after market).
83–41. Clearance, marker, and identification lamps for vehicles (after market).
84–41. Electric tail lamps for vehicles (after market).
85–41. Electric license-plate lamps for vehicles (after market).
86–41. Electric stop lamps for vehicles (after market).
87–41. Red electric warning lanterns.
88–41. Liquid burning flares.
89–40. Hardwood stair treads and risers.
90– . (Reserved for power shovels and cranes).
91–41. Factory-fitted Douglas fir entrance doors.

CS No.	Item
92–41.	Cedar, cypress, and redwood tank stock lumber.
93–41.	Portable electric drills (exclusive of high frequency).
94–41.	Calking lead.
95–41.	Lead pipe.
96–41.	Lead traps and bends.
97–42.	Electric supplementary driving and passing lamps for vehicles (after market).
98–42.	Artists' oil paints.
99–42.	Gas floor furnaces—gravity circulating type.
100–47.	Porcelain-enameled steel utensils (third edition).
101–43.	Flue-connected oil-burning space heaters equipped with vaporizing pot-type burners.
102– .	(Reserved for Diesel and fuel-oil engines).
103–48.	Rayon jacquard velour (with or without other decorative yarn) (second edition).
104–49.	Warm-air furnaces equipped with vaporizing type oil burners (third edition).
105–48.	Mineral wool insulation for low temperatures (second edition).
106–44.	Boys' pajama sizes (woven fabrics) (second edition).
107–45.	Commercial electric-refrigeration condensing units (second edition). (Withdrawn as commercial standard September 4, 1947).
108–43.	Treading automobile and truck tires.
109–44.	Solid-fuel-burning forced-air furnaces.
110–43.	Tire repairs—vulcanized (passenger, truck, and bus tires).
111–43.	Earthenware (vitreous-glazed) plumbing fixtures.
112–43.	Homogeneous fiber wallboard.
113–44.	Oil-burning floor furnaces equipped with vaporizing pot-type burners.
114–43.	Hospital sheeting for mattress protection.
115–44.	Porcelain-enameled tanks for domestic use.
116–44.	Bituminized-fiber drain and sewer pipe.
117–49.	Mineral wool insulation for heated industrial equipment (second edition).
118–44.	Marking of jewelry and novelties of silver.
(E) 119–45.[1]	Dial indicators (for linear measurements).
120–48.	Standard stock ponderosa pine doors (third edition).
121–45.	Women's slip sizes (woven fabrics).
122–45.	Western hemlock plywood.
123–49.	Grading of diamond powder (second edition).
(E) 124–45.[1]	Master disks.
125–47.	Prefabricated homes (second edition).
126–45.	Tank mounted air compressors.
127–45.	Self-contained mechanically refrigerated drinking water coolers.
128–45.	Men's sport shirt sizes—woven fabrics (other than those marked with regular neckband sizes).
129–47.	Materials for safety wearing apparel (second edition).
130–46.	Color materials for art education in schools.
131–46.	Industrial mineral wool products, all types—testing and reporting.
132–46.	Hardware cloth.
133–46.	Woven wire netting.
134–46.	Cast aluminum cooking utensils (metal composition).
135–46.	Men's shirt sizes (exclusive of work shirts).
136–46.	Blankets for hospitals (wool, and wool and cotton).
137–46.	Size measurements for men's and boys' shorts (woven fabrics).
138–47.	Insect wire screening.
139–47.	Work gloves.
140–47.	Testing and rating convectors.
141–47.	Sine bars, blocks, plates, and fixtures.
142–47.	Automotive lifts.
143–47.	Standard strength and extra strength perforated clay pipe.
144–47.	Formed metal porcelain enameled sanitary ware.
145–47.	Testing and rating hand-fired hot-water-supply boilers.
146–47.	Gowns for hospital patients.
147–47.	Colors for molded urea plastics.
148–48.	Men's circular flat and rib knit rayon underwear.
149–48.	Utility type house dress sizes.
150–48.	Hot-rolled rail steel bars (produced from T-section rails).
151–48.	Body measurements for the sizing of apparel for infants, babies, toddlers, and children (for the knit-underwear industry).
152–48.	Copper naphthenate wood-preservative.
153–48.	Body measurements for the sizing of apparel for girls (for the knit-underwear industry).
154– .	(Reserved for wire rope.)
155–49.	Body measurements for the sizing of apparel for boys (for the knit-underwear industry).
156–49.	Colors for polystyrene plastics.
157–49.	Ponderosa pine and sugar pine plywood.
158–49.	Model forms for girls' apparel.
159–49.	Sun-glass lenses made of ground and polished plate glass, thereafter thermally curved.

[1] Where "(E)" precedes the CS number, it indicates an emergency commercial standard, drafted under war conditions with a view toward early revision.

NOTICE.—Those interested in commercial standards with a view toward accepting them as a basis of everyday practice may secure copies of the above standards, while the supply lasts, by addressing the National Bureau of Standards, Washington 25, D. C.

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