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General Data Sheets

on

Johns-Manville Products

Contents

JOHNS-MANVILLE JM PRODUCTS

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JOHNS-MANVILLE INTERNATIONAL CORPORATION

292 MADISON AVENUE, NEW YORK

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Johns-Manville Products

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Brief Descriptions of J-M Materials

Brief Descriptions of J-M Materials

The following brief descriptions of J-M Materials are intended to serve as a convenient source of reference. Detailed descriptions are contained in other data sheets.

These brief descriptions are divided into the following major groups, in the order given:

BMC—Celite for Concrete, Mortar and Asphalt Paving Mixtures
BMF—Floorings
BMM—Building Materials, Miscellaneous
BMR—Roofing and Shingles
BMS—Sound Control
BMT—Transite Products
BMW—Waterproofing and Miscellaneous Asphalt Products
EL—Electrical Materials
FI—Filter-Aids and Mineral Fillers
FR—Friction Materials
IN—Insulation
PK—Packings and Furnace Expansion Joints
RE—Refractory Cements
SP—Specialties
TX—Textiles, Papers and Fibres

BMC—Celite for Concrete, Mortar and Asphalt Paving Mixtures

Celite. Finely ground diatomaceous silica for improving workability, uniformity, water-tightness and other properties of concrete, plaster and mortar, and to increase the stability of asphalt paving mixtures. Shipped in 50-lb. paper bags.

BMF—Floorings and Asphalt Plank

Acidam Blocks. A combination of asphalt and mineral aggregate, furnished in blocks weighing approximately 84 lb. each, which are melted down in the field with the Acidam Gum. Similar to Acid-Resisting Industrial Flooring Blocks, but with an asphalt content which has a softening point of 200 deg. F. Used where heat and acid conditions prevail, generally for tank lining.

Acidam Gum. A solid asphaltic compound, used only in connection with Acidam Blocks to obtain proper working consistency of the mixture.

Asphalt Boat Deck Covering. A mastic of asphalt and fine aggregate, similar to J-M Standard Industrial Flooring, furnished in blocks which are melted down, on the job, with an asphalt flux of a penetration depending upon service conditions. Designed to prevent rust and corrosion of the steel decks of car-floats, tugs, cargo vessels, and similar equipment.

Asphalt Bridge Plank. A preformed slab made of a mixture of asphalt, fibre, and finely divided mineral filler, principally Celite. Weighs 7 lb. per sq. ft., 1" thick. Furnished in standard sizes of 1", 1¼", 1½" and 2" thick, 8" wide, in lengths of 3 ft. and 6 ft., either with straight sides or shiplap edges. Plank 1½" thick is also furnished in 10" width. Used as a waterproof, resilient, durable, shock-absorbing wearing surface for bridge flooring.

Asphalt Fluxes, Nos. 5, 15, 25, 40 and 60. Asphalt compounds used as fluxes in melting down Industrial Flooring Blocks, to govern the consistency of the finished floor. Numbers indicate penetration.

Cove Base. A colored sanitary cove base for use with J-M Tile Flooring Type A. Furnished in the same colors as the tile, in units 18" long, 6" high and 3/16" thick at the joining edges.

Fibrated Asphalt Emulsion N-13-F. A clay-asphalt-water emulsion containing fibre which, when mixed with portland cement and sand, is used for a leveling course under J-M Tile Flooring. Furnished in 10, 30 and 55 gallon containers.

Hot Mastic Flooring Blocks. A compound of asphalt and fine mineral aggregate, similar to Standard Industrial Flooring Blocks, furnished in blocks weighing approximately 80 lb. each. Melted down in the field with J-M Asphalt Fluxes and used in 5/16" or ⅜" thickness as a sub-floor for J-M Tile Flooring.

Industrial Flooring Blocks, Acid-Resisting. A combination of asphalt and fine acid-resisting mineral, such as silica flour and silica sand, furnished in blocks weighing approximately 84 lb. each. Melted down in the field with J-M Asphalt Fluxes and used for general flooring work under acid conditions.

Industrial Flooring Blocks, Special No. 20. A combination of asphalt and limestone dust only, not acid-resisting, furnished in blocks weighing approximately 84 lb. each. Melted down in the field with J-M Asphalt Fluxes and used for general flooring work. Since these blocks contain no sand, a smaller number are required for a given area, which is of advantage at points to which high freight rates apply.

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Industrial Flooring Blocks, Standard. A combination of asphalt, limestone dust and fine sand, furnished in blocks weighing approximately 84 lb. each. Melted down in the field with J-M Asphalt Fluxes and used for general flooring.

Magnesite Flooring. A composition flooring consisting of mineral magnesite, to which is added special binders, wet with a magnesium chloride solution, and handled as a cement. Used for certain types of transportation equipment to provide a decorative flooring surface in various color combinations. Serves for ordinary traffic conditions but not recommended where subjected to continued moisture. Magnesite scratch coat material is shipped in sacks weighing 60 to 75 lb. each. Magnesium chloride for the solution, is shipped in crystal form in 100-lb. sacks. The chloride solution is made by adding water, to a Baumé test of 22 deg.

Masticoke Flooring Blocks. A combination of asphalt and finely graded coke, furnished in blocks weighing approximately 70 lb. each. Melted down in the field and used generally as a wearing surface for passenger car floors. No flux is necessary with Masticoke blocks.

Road Surfacer Compound. An asphaltic product of low melting point, used as the asphalt constituent, with a mineral aggregate, in a mastic wearing surface or weatherproof fire decking for bridges and railroad trestles. Shipped in drums of approximately 475 lb.

Tile Flooring, Type A. A resilient, durable floor surfacing of flat individual tiles, set in J-M Type A Tile Cement. (Also see Cove Base.) The tiles are made of asbestos fibre, asphalt and pigments. They are furnished in nine colors: black, gray, tan, blue, brown mahogany, Indian red, olive green, ivy green, and sea green, with border of the same material in the same colors. Tiles are made 6" x 6", 6" x 12", 9" x 9", 9" x 18", 12" x 12" and 12" x 24". Border material furnished 9" x 18", 9" x 27, 12" x 24" and 18" x 24". Border and tile made in 3/16" and 1/8" thicknesses, weighing respectively, 2 lb. and 1.35 lb. per sq. ft.

Truss Plate. A steel car floor plate consisting of two pressed sheets of copper bearing steel riveted together to form a hollow sheet, and furnished 30" wide and any length up to 120". Weighs approximately 2.7 lb. per sq. ft. Overlaid with a 3/8" thickness of Masticoke, Magnesite or similar wearing surface.

Type A Tile Cement. A waterproof cement used for laying J-M Tile Flooring, Type A. Covering capacity, approximately 80 sq. ft. per gal. Weighs approximately 10 lb. per gal. Furnished in 1, 5, 30 and 55 gal. containers.

BMM—Building Materials, Miscellaneous

Asbestos Caulking Putty. A plastic asbestos waterproofing material which will not dry out, for setting wood and metal door frames, skylights, scuttles, copings, etc., for pointing up cracks in masonry, for glazing steel sash and for miscellaneous caulking. Furnished in 5, 10 and 25-lb. cans, and in 50 and 150-lb. drums. The 10-lb. cans are packed 12 to the case and the 5-lb. cans 24 to the case.

Asbestoside. A white-surfaced asbestos felt siding having the general characteristics of J-M Asbestos Roofings. Furnished on special order in heavy and extra heavy weights in sheets 16" x 50". For vertical application it can also be furnished in rolls 32" wide.

Asbestos Paper. A practically pure asbestos product used as a protection against heat, a fire-retardant in walls, floors and ceilings and as a divorcing membrane with flooring and waterproofing. Special grades are used in chemical filtration and in electrolytic and allied processes. Thicknesses vary from .015 to 1/16" and weights per 100 sq. ft. run 6, 8, 10, 12, 14, 16 and 35 lb. Standard rolls are 18", 24" and 36" wide, weighing 50 and 100 lb.

Asbestos Slaters' Felt. A high grade asbestos felt impregnated with asphalt for sheathing houses and as a liner under shingles, tile or slate. Furnished in rolls of 324 sq. ft., 32" wide, weighing 45 lb. per roll.

Asbestos Wall Board. A laminated sheet building material made of asbestos fibre and portland cement subjected to hydraulic pressure. It is light cream in color and furnished in three thicknesses, 3/16", 1/4" and 3/8". Standard size sheets are 48" x 48" and 48" x 96". Principally used for inside partitions, ceilings and for similar work.

Asbestos Wall Panel. Similar to Asbestos Wall Tile, but unscored and polished. Available in the standard colors and sizes of Asbestos Wall Tile.

Asbestos Wall Tile. A rigid asbestos and portland cement sheet grooved in 4" squares to simulate tile. It is lacquered in white, ivory, light blue, light green and on special order in black, for use as a wall finish. Unscored sheets with a polished finish are available on special order. All sheets are furnished 31 3/4" x 48 1/2" x 1/4" thick to cover an area 32" x 48". Complete installation accessories are supplied as required.

Asphalt Felt. An asphalt-saturated rag felt used as a liner under shingles, slate or tile and as a sheathing. Also used in certain classes of built-up roofs. Furnished in three weights in rolls 36" wide. The 30-lb. weight is supplied in rolls of 216 sq. ft., weighing 60 lb.; the 15-lb. weight in rolls of 432 sq. ft., weighing 60 lb.; and the 12-lb. weight in rolls of 432 sq. ft., weighing 48 lb.

Bevel Board. Made of the same material as Insulating Board, but the long edges are ship-lapped and beveled and the short edges beveled only. Used where a tile effect is desired. Furnished 1/2" thick in sizes 6" x 12", 12" x 12", 12" x 24", 24" x 24", 24" x 32" and 18" x 32".

Blue Plaster Board. A heavy weight, dry sheathing paper, furnished in rolls 36" wide, colored light blue, used for lining walls in inexpensive house construction and also as a sheathing. The 250-sq. ft. rolls weigh 30 lb. and 500-sq. ft. rolls weigh 60 lb.

Bric-Side Shingles. Similar to Asphalt Shingles except that the exposed tab is given a second coating of asphalt in which is embedded a second layer of slate, thereby forming a thick butt and giving the appearance of brickwork when applied as a shingle siding. Furnished in dull red, bright red and buff in size 6" x 30" for 2 1/2" exposure with 1" headlap. It takes 192 strips or 3 bundles per sq. Approximate weight 210 lb. per sq.

Deadening Felt. Unsaturated rag felt for use in walls and floors to keep out sounds and drafts. Also used under linoleum. Approximately 450 sq. ft. per roll, 36" wide. Made in two weights, 1 lb. and 1½ lb. per sq. yd. Weight per roll, 50 lb. for 1-lb. felt, and 75 lb. for 1½-lb. felt.

Home Insulation (Type A and Banroc Loose). Forms of Banroc (rock wool) for insulating residences by filling the spaces between studs in side walls and between floors and ceilings. Home Insulation Type A is used with blowing equip-

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ment; Banroc Loose is placed by hand. Both may be used in one house, depending upon the construction. Type A weighs approximately 10 lb. per cu. ft. as packed in the wall. Banroc Loose is stuffed by hand in openings made in the sheathing and in inaccessible places that cannot be blown.

Housline. Composed of a heavy layer of hair felt stitched between a sheet of waterproof felt and a sheet of building paper. Used as insulation under floors and in the walls of dwellings. It also has considerable sound-absorption value. Furnished in rolls 18" or 36" wide, containing 125 and 250 sq. ft. and weighing 25 and 50 lb., respectively.

Housline Tape. Felted hair tape 2" wide with a burlap reinforcement in the center and a 1-5/16" strip of kraft paper stitched to one side. Used as a weather strip around door and window frames. Packed in rolls of 50 linear feet, 20 rolls per bag or 36 rolls per crate.

Industrial Board. Similar to Insulating Board except that it is furnished 3 ft. x 6 ft.

Insulating Board. A product made from wood fibres compressed and formed into boards, used for insulation and structural purposes. It is furnished 4 ft. wide and in lengths of 6 ft., 7 ft., 8 ft., 9 ft., 10 ft. and 12 ft. The thicknesses are ½" and 1", the latter consisting of two ½" boards stapled together. The weight is approximately 0.75 lb. per sq. ft., ½" thick.

No. 2 Tarred Felt. A high-grade waterproof tarred sheathing felt, wind-proof, moisture-proof, does not rot. Furnished in rolls 32" wide, containing 432 sq. ft. and weighing 65 lb.

Plaster Lath. The same material as Insulating Board in sheets 18" x 48" with long edges ship-lapped. Applied rough side out to give a good key for the plaster coat. Thicknesses are ½" and 1", the latter consisting of two ½" boards stapled together.

Rigid Roofinsul. A strong, rigid insulation board composed of wood fibres compressed into board form. Mostly used under built-up roofs for an insulation. Size 24" x 48". The standard thickness is ½". If sheets of greater thickness are desired, 2 or more sheets are stapled together with ½" shiplap joints on all edges.

Rosin-Sized Sheathing Paper. An inexpensive red sheathing paper, in rolls 36" wide, for sheathing houses, protecting new woodwork, etc. Furnished in three weights—4, 5 and 6 lb. per 100 sq. ft. Rolls contain approximately 500 sq. ft. and weigh about 20, 25 and 30 lb. each.

Tarred Slaters' Felt. An inexpensive tarred sheathing felt, in rolls 36" wide, used as a liner under roofs and on walls. Each roll contains 500 sq. ft. and weighs 30 lb.

Tarred Thread Felt. A tarred waterproof sheathing felt, in rolls 36" wide, with 9 threads running lengthwise of the sheet to prevent tearing. Waterproof, wind-proof, does not rot. In 250-sq. ft. rolls it weighs 21 lb. and in 500-sq. ft. rolls, 42 lb.

Transite-Encased Insulating Board. A casing material composed of a core of ½" or 1" Insulating Board, with a sheet of ⅛" Flat Transite cemented to each side. It is ideally adapted for insulating housings where temperatures do not exceed 230 deg. F., as well as for a siding in building construction. Furnished in sheets 42" x 96" or in smaller cut sizes on special order.

Weathertite Building Paper. A strong kraft building paper saturated with asphalt and coated on the surface with an additional thin film of asphalt. It is odorless and verminproof. Furnished in 500-sq. ft. rolls, 36" wide, weighing 35 lb. per roll.

BMR—Roofing and Shingles

Asbestos Shingles

Johns-Manville Rigid Asbestos Shingles are made of asbestos fibre and portland cement, moulded under tremendous pressure into rigid, monolithic slabs. They provide a permanent, weather-proof, fireproof roof which can be designed to harmonize with any architectural style and color scheme, because of the variety of sizes, shapes and colors available.

Asphalt Shingles

All J-M Asphalt Shingles are made of heavy, asphalt-saturated rag felt, into one surface of which is embedded crushed slate in a wide variety of colors and blends. All carry the Underwriters' Class C label.

Bric-Side Shingles. See "Building Materials, Miscellaneous" Section.

Giant Hexagonal Shingles. Giant weight material in strips 36" long and 12-1/3" wide to give 4-2/3" exposure and 3" headlap. 86 strips or 3 bundles, per sq., weighing about 225 lb.

Giant Individual Shingles. American Method individual shingles cut from Giant weight material in size 12" x 16" for 5" exposure and 6" headlap. 225 shingles, or 4 bundles, per sq., weighing about 315 lb.

Giant Strip Shingles. American Method strip shingles cut from Giant weight material in strips 36" long and 12" wide to give 5" exposure and 2" headlap. 80 strips, or 3 bundles, per sq., weighing above 245 lb.

Slatekote Starting Strips. Cut from standard 85-lb. weight Slatekote Roofing (see under Ready-to-Lay Roofings) for use with asphalt shingles, as starter shingles. Also used for lining valleys and covering hips and ridges. Strips are 9", 12" and 24" wide, weighing about 21, 28 and 56 lb., respectively, per 36-ft. roll.

Standard Individual Shingles. Individual shingles cut from standard weight material in size 9" x 12¾" for 4" exposure and 4¾" headlap. 378 shingles, or 4 bundles, per sq., weighing about 240 lb.

Standard Strip Shingles. 4-tab, self-spacing strip shingles of standard weight material, 36" long, in two widths: 10" width gives 4" exposure and 2" headlap; 100 strips, or 2 bundles, per sq., weighing 195 lb. 12½" width gives 4" exposure and 4½" headlap. 100 strips or 3 bundles, per sq. weighing about 250 lb.

Standard 11⅓" Hexagonal Shingles. Standard weight material in strips 36" long and 11-1/3" wide to give 4-2/3" exposure and 2" headlap. 86 strips, or 2 bundles, per sq. weighing about 160 lb.

Standard 12⅓" Hexagonal Shingles. Same as Giant Hexagonal (above) except made from standard weight material. 86 strips, or 2 bundles, per sq., weighing about 175 lb.

Standard 12½" Double-Coverage Hexagonal Shingles.

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Standard weight material in strips 36" long and 12½" wide to give 4" exposure and 4½" headlap. 100 strips, or 3 bundles, per sq., weighing above 215 lb.

Asbestos Ready-to-Lay Roofings

Asbestoside. See "Building Materials, Miscellaneous" Section.

Flexstone Slate-Surfaced Roofing. Heavy asphalt-impregnated felt, slate-surfaced on one side in red, green or blue-black. Used on steep-roofed buildings where color is desired. Shipped in 1-sq. rolls, 32" wide, with 2" selvage. Weight about 85 lb. per roll. Underwriters' Class B label.

Flexstone Smooth-Surfaced Roofing. Plies of asphalt-impregnated asbestos felt, cemented together with asphalt. Furnished in sheets 32" x 80", 6 sheets per square. Heavy (3-ply) shipped in 5-sq. crates, weighing about 66 lb. per sq. Extra Heavy (4-ply) shipped in 4-sq. crates, weighing about 98 lb. per sq.

Salamander White Top Roofing. See under "Built-up Roofing Felts and Cap Sheets."

White Top Roofing. Plies of asphalt-impregnated asbestos felts cemented together with asphalt, with a white (unimpregnated) asbestos felt on top. Used where a white, light-reflecting surface is desired; for example, on sawtooth roofs and on tank tops. Supplied in three weights: Standard (3-ply), in 1 or 2-sq. rolls, 32" wide, weighing about 55 lb. per sq.; Heavy (3-ply), in 1 or 2-sq. rolls, 32" wide, weighing about 63 lb. per sq.; and Extra Heavy (4-ply), six 32" x 80" sheets per sq., 4 sqs. per crate, weighing about 92 lb. per sq. Furnished with 1½" selvage edge but should be laid with 2" laps.

Asphalt Ready-to-Lay Roofings

Pilot Roofing. Highest quality smooth-surfaced asphalt roofing for permanent steep-roofed buildings. Furnished in 1-sq. rolls (108 sq. ft), 36" wide, in three weights: Medium, 45 lb. per sq.; Heavy, 55 lb. per sq.; and Extra Heavy, 65 lb. per sq. All carry Underwriters' Class B label when applied to pitches exceeding 4" to the foot.

Planet Roofing. Smooth-surfaced asphalt roofing. Lower-priced than Pilot Roofing and used on temporary structures. Furnished in 1-sq. rolls (108 sq. ft.), 36" wide, in three weights: Light, 35 lb. per sq.; Medium, 45 lb. per sq.; and Heavy, 55 lb. per sq.

Slatekote Diamond-Point Roofing. Same as Standard Slatekote Roofing except that material is slit in diamond point fashion through center so that when taken apart, two diamond point strips are obtained. In red, green and blue black colors, the width is 36". In variegated color (Bronzetone), the width is 32". Furnished in 1-sq. rolls, weighing about 100 lb. Underwriters' Class C label.

Slatekote Roofing (standard type). Heavy asphalt-saturated rag felt, slate-surfaced on one side. 85-lb. weight (per square) carries Underwriters' Class C label and is supplied in red, green, blue-black, variegated (Bronzetone) and tile red colors. 75-lb. weight in red, green, and blue-black. Both furnished in 1-sq. rolls, 36" wide, with 2" selvage.

Split Sheet Slatekote Roofing. See under "Built-up Roofing Felts and Cap Sheets."

Built-Up Roofing Felts and Cap Sheets

Asbestos Felt Strips. 4" wide strips of 15-lb. asbestos roofing felt for use in flashing. Furnished in rolls of 121½ linear feet.

Asbestos Roofing Felt 15-lb. Asphalt-impregnated asbestos felt used in connection with J-M System of Flashing. Furnished in 3-sq. rolls (324 sq. ft.), 32" wide, weighing 45 lb., or 15 lb. per sq.

Asbestos Roofing Felt 20-lb. Asphalt-impregnated asbestos felt, coated one side with asphalt, for use in asbestos and combination built-up roofs. Furnished in 3-sq. rolls (324 sq. ft.), 32" wide, weighing 60 lb.

Asphalt-Saturated Fabrics. Used for waterproofing purposes in connection with asbestos felts on spray decks, etc. See "Waterproofing and Miscellaneous Asphalt Products" Section.

Barge Roofing: A 4-ply roofing for barges made of 1 layer of asphalt-impregnated asbestos felt on bottom, then a layer of burlap, followed by 2 additional layers of asbestos felt, all cemented together with asphalt. Furnished in sheets 32" x 80", crated 4 sqs. to the crate. Weight about 90 lb. per sq.

Bonded Asphalt-Saturated Rag Felt 15-lb. Asphalt-saturated rag felt used on Bonded Slag, Gravel, or Slatekote-Surfaced Roofs. Furnished in 4-sq. rolls (432 sq. ft), 36" wide, weighing 60 lb., or 15-lb. per sq.

Flexstone Roofing, Extra Heavy. Composed of four layers of asbestos felt, thoroughly impregnated and cemented together with asphalt. Used over Class A and Super Class A Roofs where there is light foot traffic. Furnished in sheets 32" x 80", 6 sheets per square. Weight uncrated, 74 lb. per sq.; crated, 98 lb. per sq.

No. 30 Combination Base Felt. Asphalt-saturated rag felt (uncoated), used as base felt in Combination 30 Roofs. Furnished in 2-sq. rolls (216 sq. ft.), 36" wide, weighing 67 lb. Nominal weight 30-lb. per sq.

No. 45 Base Felt. Heavy rag felt, thoroughly saturated and coated with asphalt. Used as a base felt in Combination 45 Roofs. Furnished in 1-sq. rolls (108 sq. ft.) 36" wide, weighing 45 lb.

Salamander White Top Asbestos Roofing. A 2-ply material composed of an unimpregnated and an impregnated asbestos felt cemented together, used with white surface exposed as a cap sheet on sawteeth and other pitched surfaces for light reflection. Furnished in 2-sq. rolls (216 sq. ft.), 32" wide, weighing 60 lb., or 30-lb. per sq. Has 1½" selvage edge, but should be laid with 2" lap.

Split Sheet Slatekote Roofing. Heavy asphalt-saturated rag felt 36" wide with 17" of top surface covered with crushed slate in red, green, blue-black, white, or chrome orange. Used principally over built-up roofs where color is desired. Furnished in 1-sq. rolls (108 sq. ft.) weighing 50 lb. Each roll covers 51 sq. ft. weather area.

Standard Asbestos Built-Up Roofing Felt 60-lb. An extra heavy asbestos felt, thoroughly impregnated and coated, and sanded. Used as a base sheet on Class A and Super Class A Roofs. Furnished in 1-sq. rolls (108 sq. ft.), 32" wide, weighing 60 lb.

Standard Asphalt-Saturated Rag Felts: Not used in connection with Bonded Roofs. The 15-lb. felt is furnished in 4-sq. rolls (432 sq. ft.), 36" wide, weighing 60 lb. The 30-lb. felt is furnished in 2-sq. rolls (216 sq. ft.), 36" wide, weighing 60 lb.

3-ply Flashing Material. Sheet consisting of a center layer of asphalt-saturated rag felt, with asphalt-impregnated asbestos felt on each side, cemented to the rag felt with asphalt. Used in connection with J-M System of Flashing. Also used, cut to required width, for edging. Furnished in sheets 32" x 80"; also in 8", 10-2/3" and 16" wide strips.

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Roofing Cements, Coatings and Accessories

Asbestos Fibrous Enamel. A high-grade roof coating made of asbestos fibre and asphalt of the right consistency for brush application. In black, it is made in two consistencies, with the asbestos fibre ground or unground. In red, it is furnished in unground consistency only. Both shipped in 1, 5, 30 and 55-gal. containers.

Asbestos Roof Putty. A high-grade roof putty made of asbestos fibre and asphalt. Used for patching leaky roofs, constructing and repairing flashings, and for various other purposes. Furnished in red, gray and black in 1, 5, 10, 25, 50 and 150-lb. containers. Black is also furnished in 500-lb. drums.

Asbestos Slaters' Felt. Used as a liner under shingles and for other purposes. See "Building Materials, Miscellaneous" Section.

Asphalt Felt. Used as a liner under shingles and for other purposes. See "Building Materials, Miscellaneous" Section.

Bonded Roofing Asphalts. Used on all J-M Bonded Built-Up Roofs. No. 1 F. D. (melting point 150 to 165 deg. F.) used on dead-level decks (pitch ¼" per foot or less). No. 6 (melting point about 150 deg. F.) used on pitches from ¼" to 1½" per foot. No. 170 (melting point about 170 deg. F.) used on pitches from 1½" to 3" per foot. No. 190 (melting point about 190 deg. F.) used on pitches from 3" to 6" per foot, and for in-between mopping on pitches from 6" to 9" per foot. All furnished in solid form in 500-lb. drums.

Concrete Primer. See "Waterproofing and Miscellaneous Asphalt Products" Section.

Expansion Joint Filler. See "Waterproofing and Miscellaneous Asphalt Products" Section.

Lap Cement. Similar to the cement packed in each roll of ready-to-lay roofing, but put up in 1, 5, 25 and 50-gal. containers for use where roofing is shipped without accessories.

Ready-Mixed Asbestile. A heavy-bodied plastic cement, composed of asbestos, asphalt and other mineral ingredients used as the cementing agent in the J-M System of Flashing. Furnished in 25, 50, 150 and 300-lb. containers.

Regal Roof Coating. An asphalt roof coating for all kinds of roofs. Furnished in 1, 5, 25 and 50-gal. containers.

Rosin-Sized Sheathing Paper. See "Building Materials, Miscellaneous" Section.

Standard Asphalt Waterproofing Cement. See "Waterproofing and Miscellaneous Asphalt Products" Section.

Standard Roofing Asphalts. Furnished in three types with melting points of 150, 170 and 190 deg. F. Not used on Bonded Roofs. Shipped in solid form in 500-lb. drums.

Insulated Roofs

Insulated Rot-Proof Roof. Complete roof for severe condensation conditions, as in paper mills. Built of W. R. Corrugated Transite, cork mastic, sheet cork and a J-M Built-Up Roof.

Rigid Roofinsul. A strong, rigid insulation board composed of wood fibres compressed into board form. Used under built-up roofs for an insulation. Size 24" x 48". The standard thickness is ½". If sheets of greater thickness are desired, 2 or more sheets are stapled together with ½" ship-lap joint on all edges.

Transite Insulated Roof. A light-weight insulated roof made of Corrugated Transite, aerated gypsum, and a J-M Built-Up Roof. An exceptionally good roof, but not suitable under severe moisture conditions; in such cases the Insulated Rot-Proof Roof (above) should be used.

BMS—Sound Control

Acoustical Cement. A heat and moisture resisting adhesive used for affixing Akoustikos Felt to surfaces being treated with the Nashkote types of acoustical correction.

Acoustical Size. A special water-resisting adhesive used to secure the finishing membrane to Akoustikos Felt in the Nashkote types of acoustical correction.

Akoustikos Felt. A punched felt used in the Nashkote types of acoustical treatment. It is composed of goat hair and asbestos fibre and is supplied in ½", ¾" and 1" thicknesses, having different degrees of sound absorption.

Blast Hair Blanket. A temporary acoustical correction, 2" thick, made of cattle hair quilted in muslin and supplied in 4 ft. x 25 ft. rolls.

Broadcasting and Recording Studio Treatment. A broadcasting and sound picture studio acoustical treatment consisting of rock wool, 4" thick, finished with decorated sheets of perforated metal.

Isolation chairs and wall or ceiling isolators. Shock absorbing units, consisting of metal supports or fasteners, to which studding, sleepers or joists can be fastened, and one or more layers of heavy, cushioning felt, which comes between the structural member and the metal fastener. These units are used in sound isolation constructions.

Isolation Felt. A sound isolation adaptation of 1" hair felt encased in waterproof sheathing paper. Used chiefly as a sound-deadening medium and to prevent drum action in wall and ceiling treatments.

Isolation Fill. A sound isolation adaptation of loose rock wool used in the space between the finished floor and the floor structure as a sound-damping medium and to prevent drum action. Also used in platform constructions for the same purpose.

Isolation Platforms. A construction designed to prevent machine vibrations from being transmitted to the supporting structures.

Kribble Kloth. A perforated Sanitas finishing membrane, applied on Nashkotes Type B.

Nashkote Type Acoustical Finishes. Acoustical treatment consisting of Akoustikos Felt cemented to the surface to be treated with Acoustical Cement and covered with a membrane secured by Acoustical Size. This membrane may be painted muslin (Nashkotes Type A, AIS and ACS, in which Type A resembles smooth plaster, AIS rough plaster and ACS Caen stone), or it may be Kribble Cloth (Nashkotes Type B-332, B-085, B-068 and B-045, in which the numerals following B, refer to size of perforations), or it may be awning cloth, burlap, etc. (Nashkote Type F). Sometimes no finishing membrane is used and the surface of the felt is sized to result in a unique texture (Nashkote Type C).

Nashtile. An acoustical material consisting of punched felt

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in various tile sizes, sprayed with a special composition finish which results in an attractive-textured surface.

No. 2000 Paint. A lithopone and oil paint used in finishing Nashkotes Type A, AIS and ACS.

Rockoustile. A rock wool product manufactured in variously-sized tiles, distinctively attractive and not unlike Travertine. It can be furnished color-tinted as well as in its natural gray.

Rockoustile Cement. A fireproof adhesive especially adapted for applying Rockoustile.

Sanacoustic Holorib. An acoustical treatment consisting of perforated and enameled Holorib metal sheets furnished in various lengths and gauges, and backed by a rock wool sound-absorbing element. Holorib metal with a J-M Rock Cork sound-absorbing element can be combined with Rigid Roofinsul and a J-M Built-Up Roof to form a complete roof deck, including a metal ceiling, acoustical treatment, thermal insulation and a built-up roof, all in one.

Sanacoustic Panels. An acoustical treatment consisting of large sheets of perforated metal, attractively finished and backed by a special rock wool sound-absorbing element.

Sanacoustic Tile. An acoustical treatment consisting of perforated sheet steel tiles finished in baked enamel, containing a special rock wool sound-absorbing element and furnished in various sizes. The whole unit snaps into special metal T-bars which have been secured to the surface to be treated. For use under damp and humid conditions, the metal tile and accessories are furnished in aluminum.

Sanitas. As used by Johns-Manville, Sanitas is a specially prepared fabric in various colors, which is washable and fireproof. Johns-Manville uses it principally in making Kribble Kloth.

Stevens System of Sound Isolation, now called the Johns-Manville System of Sound Isolation. A shock-absorbing construction designed to retard the transmission of noise and vibrations through floors, partitions and ceilings.

BMT—Transite Products

All Transite products are composed of asbestos fibre and portland cement, united under tremendous pressure into dense, monolithic materials. Transite products are fireproof, weatherproof, corrosion-resistant and have great strength and durability. The various Transite products are listed below:

Accessories. Ridge roll, louvre blades and corner roll. Made of Transite moulded to the desired shape for use in conjunction with application of Corrugated Transite. See also W. R. Accessories.

Black. Made in standard size sheets 42" x 96", 3/16" and ¼" thick, similar to standard Transite except that it is black in color. Used as a base for blackboards, No. 1 finish being standard and No. 2 finish being polished.

Corrugated. Manufactured in corrugated form for fireproof and maintenance-free roofing and siding. Made with 4.2" pitch and 1½" depth of corrugations, approximately 7/16" thick on ridge and valley and 5/16" on slope. Furnished 42" wide and in lengths of from 3 ft. to 11 ft. Special sizes within these limitations can also be supplied. Weight approximately 4.1 lb. per sq. ft. uncrated, or 4.5 lb. per sq. ft. crated. See also W. R. Corrugated.

Ducts. Transite ducts insure fireproof, corrosion-proof and maintenance-free construction. Used with excellent results for many years for round-house smoke ducts and similar purposes. Furnished either round or square in any size required within the limitations of standard 42" x 48" or 42" x 96" flat sheets. Shipped knocked down, ready for assembly.

Encased Insulating Board. See "Building Materials, Miscellaneous" Section.

Fasteners. Of various types for use in the application of Corrugated Transite. These consist of cadmium-plated bolts and nuts and hot-dipped galvanized clips.

Flat. Generally recognized as the outstanding fireproof, corrosion-resisting building sheet on the market. Standard finish is sufficiently smooth for practically all purposes. Can also be furnished sanded on one side (S-1-S) or two sides (S-2-S) to provide special smoothness and closer thickness control. Made in sheets 36" x 48" and 42" x 48" in thicknesses from ⅛" to 4"; and 42" x 96" in thicknesses from 3/16" to 2". Special sizes within these limitations can also be supplied. Weight approximately 124 lb. per cu. ft.

Forge Jacks. Built-up Transite fume-proof stacks for use over forges in foundries and for similar purposes. Either ventilating or non-ventilating types may be obtained with square or rectangular hoods and stacks, or with moulded hoods and round or oval stacks. Designed to order for each individual job.

Insulated Rot-proof Roof. See "Roofing and Shingles" Section.

Lipped Flat Transite. Flat sheets formed with 3" lip along one side or end, the lip being offset the thickness of the sheet so as to overlap snugly the adjoining sheet. Used for roofing and siding where a flat, instead of corrugated, material is desired. Furnished 42" x 96" and either 5/16" or 7/16" thick.

Motion Picture Projection Booths. Panel type fireproof booth of flat Transite on steel frame, shipped knocked down and easily assembled on job. Furnished in various sizes. Individual panels also supplied for enlarging existing booths.

Pipe. Transite in pipe form for vents, flues and cable protection, as well as pressure lines for water, gas, and process liquors. Class "S" for vents and flues furnished in sizes from 2" to 40". Classes "A" and "B" for pressures of 37½ and 75 lb. per sq. in., respectively, are also furnished in sizes from 2" to 40". Classes "C" and "D" for pressures of 150 and 225 lb. per sq. in., respectively, are furnished from 2" to 24" and larger on special order.

Rough Cast. Flat Transite sheets with special pitted surface used with stained Transite battens in residential construction to simulate Tudor or half timber exterior stucco work. Furnished 42" x 96", ⅜" thick.

Smoke Jacks. Built-up Transite fume-proof stacks for use in railroad round-houses to conduct smoke from the engine smoke stacks. Either ventilating or non-ventilating types may be obtained with square or rectangular hoods and stacks, or with moulded hoods and round or oval stacks. Made in a wide variety of sizes and designs.

Transite Insulated Roof. See "Roofing and Shingles" Section.

Ventilators. A moulded Transite stationary ventilator, with or without damper, for use where fireproof, fume-proof and weather-proof construction is required. Made in various sizes.

White. Furnished on special order in standard size flat

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sheets either standard or sanded finish. Generally used for exteriors of bake ovens and for similar uses where a white finish is desired. Not a standard material.

W. R. Corrugated. Same as standard Corrugated Transite, except that sheets are partially impregnated with a special bituminous compound to afford maximum impermeability and acid-resistance. Furnished in same sizes as standard Corrugated. Weight approximately 4.2 lb. per sq. ft. uncrated, or 4.5 lb. per sq. ft. crated.

W. R. Flat. Same as standard Flat Transite, except that sheets are partially impregnated with a special bituminous compound to afford maximum impermeability and acid-resistance. Furnished 42" x 48", ⅛", 3/16" and ¼" thick; 42" x 96", ¼" thick; and 48" x 48" and 36" x 48", ⅛" and 3/16" thick. Weight of ¼" thick material is approximately 3 lb. per sq. ft. uncrated, or 3.3 lb. per sq. ft. crated.

W. R. Accessories. Ridge roll, corner roll, louvre blades, etc. Same as standard material, except for bituminous impregnation.

BMW—Waterproofing and Miscellaneous Asphalt Products

Asphalt Cements and Coatings

Acid Tank Cements. Special asphalt products for meeting particular acid conditions. Acid Resisting Compound is a solid material which is heated and used on walls and tanks as a water and acid resisting material. It contains silica as a filler. Acid Tank Cement No. 2180 is a plastic composition containing mineral filler and asbestos, and is useful in electrolytic copper refineries. Acid Tank Enamel No. 2181 consists of blended asphalt, which is applied hot to steel or concrete tanks intended for water or dilute mineral acids. Acid Tank Enamel No. 2182 is similar to No. 2181, except that it contains about 20% of acid-resisting mineral filler and fibre, which makes it resist somewhat higher temperatures. Acid Tank Cement Primer No. 2187 is used as a preliminary coating before applying Nos. 2180, 2181 and 2182.

Aertite Coating. A tough rubbery asphaltic-asbestos coating for troweling over the clean exterior of boiler walls, where the temperature on the Aertite does not exceed 250 deg. F. It is also used for miscellaneous sealing against dampness, air and moisture and as a weather-proofing over insulation on heated equipment. For a 1/16" thickness, it will take 25 to 40 lb. per 100 sq. ft. Furnished in 25, 50, 150, 300 and 500-lb. containers.

Aquadam. A black elastic, tacky material for cold application, used to keep dampness out of masonry, hollow tile, etc. Also used as a coating for sides and back of cut stone to prevent discoloration due to alkali in the cement. Applied to the inside of exterior walls, it provides a damp-proof film, which is a good base for plaster. Ordinarily 1 gal. will cover 75 sq. ft. for the first coat, and 125 sq. ft. for the second coat. Aquadam is furnished in 1, 5, 25 and 50-gal. containers.

Asbestos Fibrous Enamel. An asphaltic-asbestos compound, black (or red), which forms a weather-resisting protective coating. It is applied at about 70 deg. F. to clean, dry surfaces. Furnished in two consistencies, ground and unground, with covering capacities of 150 sq. ft., and 90 to 100 sq. ft. per gal., respectively. Shipments are made in 1, 5, 30 and 55-gal. containers.

Asphalt Brick Filler. Similar to Expansion Joint Filler, but for use in pouring joints in brick or block paving, and for repairing concrete roadways where the concrete has cracked.

Bitumen Enamel. An acid- and alkali-resisting solid asphaltic material for the protection of metal and concrete surfaces which are subject to corrosion from air or aqueous solutions. It is made to comply with U. S. Navy Specification 52 B-10 and has a covering capacity of approximately 200 sq. ft. per 100 lb., applied 1/16" thick. Furnished in 400-lb. drums.

Bitumen Solution. A quick-drying asphaltic liquid, used as a primer for Bitumen Enamel or any other asphaltic material which is to be applied to metal and concrete surfaces. It is made to comply with U. S. Navy Specification 52 B-10 and has a covering capacity of approximately 200 sq. ft. per gal. Furnished in 25 and 50-gal. drums.

Bituminous Putty. An elastic asphaltic-asbestos compound, little affected by temperature and vibration, and used as a filler and flashing material to prevent water infiltration in recesses where a permanent seal is difficult to maintain.

Concrete Primer. A thin asphaltic product, used for coating the surfaces of concrete, gypsum, tile, brick, stone, etc., to counteract the dust film, prevent moisture absorption and afford anchorage for subsequent bituminous applications. Exceptionally porous surfaces, like gypsum, will need two coats. Concrete primer ordinarily covers about 100 sq. ft. per gal. Furnished in 1, 5, 25 and 50-gal. containers.

Expansion Joint Filler. An asphaltic compound of great ductility and tenacity, which is heated to 450 deg. F. and used in pouring expansion joints.

No. 40 Tank Top Cement. A viscous, oil-resisting compound which is thinned to proper consistency with denatured alcohol, and applied to porous surfaces to prevent or retard oil and water penetration. It is a specialized product, principally used in the oil industry.

Pickling Tank Cement 150. An asphaltic compound used in lining wood and concrete tanks, where an acid-resisting coating is necessary. The melting point is 212 deg. F., or 175 deg. F. on special order. It is heated to 450 deg. F. and used hot. Furnished in 450-lb. drums.

Red Tank Top Putty. A semi-solid mineral compound used for pointing up and sealing in specialized waterproofing and oil-proofing work in the oil industry.

Resisto Compounds. This group includes Resisto Putty, Primer, Wood Primer and Paint. All are used up to 250 deg. F. for protecting insulation, metal, tile, brick, masonry, wood, etc., where humidity is high or acid fumes are present. One of the primers is ordinarily brushed on and allowed to dry before the other materials are applied. The Putty weighs 90 lb. per cu. ft. and is shipped in 10, 50 and 500-lb. containers. Primer will cover 100 to 175 sq. ft. per gal., and is shipped in 1, 5 and 50-gal. containers. Wood Primer covers 125 to 150 sq. ft. per gal., and is shipped in 1, 5 and 50-gal. containers. Paint covers 90 sq. ft. per gal., and is shipped in 1, 5 and 50-gal. containers.

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Self-Healing Waterproofing Cement. An asphaltic compound which moves readily under high temperatures, but is ideal for membrane waterproofing work on brine decks and between wood floors. The melting point of the standard material is 125 deg. F., but the material can be furnished with a melting point of 90 deg. F. Both types are furnished in 500-lb. bbls.

Standard Asphalt Waterproofing Cement. An exceptionally pure bitumen, useful in waterproofing work over a wide range of temperature, and remarkably immune to the action of acids, alkalies, brine and water. It is heated to 450 deg. F. and mopped on while hot. One ton will cover about 3,000 sq. ft. of surface, ⅛" thick.

Waterproofing Asphalt No. 6. A solid asphaltic compound, sometimes used in waterproofing work where hydrostatic pressure will not be encountered. This material is not generally useful on high class work, because it deforms at relatively low temperatures.

Preformed Expansion Joints

A and R Expansion Joint. A superior type of preformed expansion joint principally used in concrete highways and sidewalks, which possesses the faculty of recovering thickness after compression. It is furnished in slab form or cut to size, and in thicknesses of ⅜", ½", ⅝", ¾", ⅞" and 1". Other thicknesses can be supplied on special order.

Felt-Sided Expansion Joint. A widely-used preformed expansion joint, composed of a bituminous core, confined between two sheets of felt. It is furnished in slab form or cut to size, and in thicknesses of ¼", ⅜", ½", ⅝", ¾", ⅞" and 1". Other thicknesses can be supplied on special order.

Waterproofing Felts and Fabrics

Asbestos Pipe Line Felt. A 15-lb. asbestos felt impregnated with asphalt or coal tar, as ordered, plain or with wire inserted lengthwise for greater tensile strength. Used to provide an enduring membrane in pipe protection. Furnished in rolls of various widths and lengths for application by traveling field wrapping machine, stationary yard or mill machine or by hand.

Asphalt-Saturated Fabrics. Woven cotton, manufactured in two weights, which find their principal application in conjunction with asbestos felts in built-up membrane waterproofing work. Before saturation, Type A weighs 4 oz. per sq. yd. and Type B, 5 oz. per sq. yd. Standard rolls, 36" wide, contain 58 linear yards.

No. 1 Acid-Resisting Felt. An asphalt-saturated and coated rag felt, used with J-M Industrial Flooring over concrete or wood sub-bases, where liquids, particularly acids, are present in volume. Furnished in rolls of 108 sq. ft., 36" wide.

No. 50 Asbestos Waterproofing Felt. A strong, asphalt-impregnated, asbestos felt used in waterproofing work where a thick and durable felt is required. Furnished in two-square rolls (216 sq. ft.), 32" wide, weighing about 70 lb. per roll.

15-lb. Asbestos Waterproofing Felt. Similar to No. 50 but lighter in weight. It is frequently used with saturated cotton fabrics in building up membrane waterproofing. Furnished in 3-sq. rolls (324 sq. ft.), 32" wide, weighing about 45 lb. per roll.

EL—Electrical Materials

Armaturo Tape. A tape made of high grade asbestos paper run up on both sides of a cotton mesh, for magnet and armature winding. Furnished in rolls in standard widths of ½", ¾" and 1", and in thickness of .015" and .025". Other widths and thicknesses on special order.

Asbestoment. A chemically neutral powder, used, when mixed with water, to impregnate Niagrite for fireproofing electrical cables. Also used as a coating over the Niagrite. Furnished in 100-lb. bags.

Asbestos Ebony. A densely-pressed hard sheet of asbestos fibre and binding cement, impregnated with an insulating compound and used for switchboards, controller plates, switch bases, etc. Has high dielectric strength, insulation resistance, strength and durability. Sheets are furnished 36" x 48" from ⅛" to 4" thick; 42" x 48" from ¼" to 4" thick; and 42" x 96" from ¼" to 2" thick, or finished panels of any size within these limits.

Asbestos Ebony, Moulded. Similar to Asbestos Ebony sheets but is moulded in special shapes with holes, counter-bores, slots or grooves, as required. Used principally where small panels are required for switches, starters, meters, etc. Panels can be furnished in thicknesses from ¼" to 1½" and in sizes up to 20" x 25". Tubes and rods can also be furnished in lengths up to 12" with wall or diameter from ¼" to ½".

Asbestos Ebony Accessories:

Asbestos Ebony Filler Compound, a putty glaze for treating Asbestos Ebony surfaces that have been marred slightly. Furnished in 1-gal. and 5-gal. cans.

Asbestos Ebony Filler Wax, for filling deep pits or gouges in Asbestos Ebony. Furnished in sticks.

Asbestos Ebony Lacquer, used for surface finishing of Asbestos Ebony panels. Furnished in quart and gallon cans.

Ebony Cleaning and Polishing Fluid, for use on unlacquered Asbestos Ebony. Furnished in quart, gallon and 5-gallon cans.

Asbestos Listings and Braided Asbestos Tubing. See "Textiles, Papers and Fibres" Section.

Electrobestos. A heat-resistant moulded material composed of asbestos fibre, high temperature clays and binding cement, pressed very dense. Used for heater or oven parts, resistance mounts, heater cores, etc., for temperatures up to 1200 deg. F. Standard Electrobestos is used where rapid temperature changes are encountered. Electrobestos "X" is harder and stronger. Electrobestos is moulded on order in the form of sheets 30" x 30" and ¼" to 1" thick; panels from ¼" to 1½" thick and sizes up to 20" x 25"; tubes up to 12" long with from 3/16" to 5/16" wall; and rods up to 12" long with diameter from ¼" to ½".

Electrobestos Arc Deflectors. Separator pieces between contact fingers of railway controllers. Moulds for many styles are carried in stock. Special shapes can be furnished from blueprint or model.

Electrobestos Cable Protectors. Tapered twin half-round sections of Electrobestos for installation between cable and duct at the point where cable enters manhole, to protect the cable sheath. Furnished 6¼" long with inside diameter of 2".

Electrobestos Lehr Rolls. Hollow cylinders which are placed over rotating conveyor shafts, used by licensees of Libbey-Owens Sheet Glass Co., of Toledo, O., for carrying sheet glass

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through annealing lehrs. Also used in other industries for similar purposes.

Electrobestos Stove Pipe Insulators. A tubular Electrobestos product for encasing stove pipe, to prevent damage from live wires touching the exposed pipe. The standard sizes are for 4", 5" and 6" pipe, and have a minimum wall thickness of ½". Can also be furnished of Asbestos Ebony Moulded.

Fibroid Asbestos Paper Tape. A thin fireproof paper made of asbestos fibre, used for wrapping magnet and armature wires. Made in widths of ⅜" and over in multiples of 1/16", and in thicknesses from .006" to .035". Widths up to 36" made specially to order.

Friction Tapes. Cotton sheeting impregnated with an insulating compound and coated with a high grade adhesive rubber composition, used for covering wire joints. J-M brands are: Jomanco, No. 3, A.S.T.M., No. 5, J-M Friction, and J-M White Tape. Furnished in standard friction tape widths.

Niagrite. Commercially pure asbestos tape with or without reinforcement, which is impregnated with Asbestoment and wrapped on electrical cables to form a fireproof, arc-proof protection. The Niagrite is furnished in widths of 1½", 2" and 3", in thicknesses of 3/32", ⅛", 3/16" and ¼", and in rolls of 15 ft. Special "B" Niagrite (reinforced with jute cloth) is most generally used.

Orangeburg Fibre Conduit. (Made by The Fibre Conduit Co., Orangeburg, N. Y.) Impregnated tubular ducts, made of macerated wood pulp formed on a mandrel, dried and densely impregnated with pitch. Used extensively as an underground ductway for power cables, telephone and signal lines. Furnished in 5 ft. lengths, except in 1" size which is furnished in 4 ft. lengths. Standard diameters are from 1" to 5". Larger sizes on special order. Bends, elbows, crosses, tees, etc., are also supplied.

Orangeburg Fibre Conduit Accessories:

P. & B. Compound No. 2 is an asphalt base paint, used for waterproofing Fibre Conduit joints. Furnished in pint, quart, half gallon, gallon and 5-gallon cans and in 50-gallon barrels.

Orangeburg Fibre Conduit Tooling Lathe. A portable lathe, hand operated, for tooling Socket or Harrington joints on Orangeburg Fibre Conduit.

Splicing Compounds. Uncured rubber tapes, which when wound on a joint become a homogeneous mass. J-M grades are Alpha, A.S.T.M., and Brooklyn. Furnished ¾" wide in 4-oz. and 8-oz. rolls.

Transite. Made of asbestos fibre and portland cement, combined under pressure into dense, monolithic, unlaminated sheets. Transite has high strength and great durability and is widely used in the electrical industry for cell structures and in the construction of many types of electrical apparatus. (Also see "Transite Products" Section.)

FI—Filter-Aids and Mineral Fillers

Celite Filter-Aids

Filter-Cel. Finely ground but otherwise untreated diatomaceous silica (Celite) for filtration purposes. Used where suspended solids are exceptionally small or colloidal. Rate of flow considerably lower than that of Standard or Hyflo Super-Cel. Packed in bags of approximately 90 lb.

Hyflo Super-Cel. Finely ground, heat-treated and specially processed diatomaceous silica (Celite) for filtration purposes. This material gives the highest rate of flow and, on most liquids, perfect clarity. It is the most generally used of the Celite Filter-Aids. Packed in bags of approximately 95 lb.

Standard Super-Cel. Finely ground and heat-treated diatomaceous silica (Celite) for filtration purposes. This material is midway between Filter-Cel and Hyflo Super-Cel in rate of flow and fineness of precipitate which it will remove. Packed in bags of approximately 90 lb.

Mineral Fillers

Celite Grade C-3. Heat-treated coarse and granular particles of diatomaceous silica, 3-mesh and finer. Color: Pink. Packed in bags of approximately 100 lb.

Celite Grade Coarse. Coarsely ground natural diatomaceous silica powder. Light cream in color. Packed in bags of approximately 110 lb.

Celite Grade FC. Finely ground natural diatomaceous silica powder from especially selected strata of highest purity as regards silica content. Light cream in color. Packed in bags of approximately 90 lb.

Celite Grade HSC. Finely ground heat-treated and specially processed diatomaceous silica powder. Color: Snow white. Packed in bags of approximately 95 lb.

Celite Grade SOC. Finely ground natural diatomaceous silica powder. Light cream in color. Packed in bags of approximately 95 lb.

Celite Grade SS. Special grade of practically bone dry heat-treated diatomaceous silica powder, used principally in battery boxes. Packed in bags of approximately 90 lb.

Celite Grade SSC. Finely ground heat-treated diatomaceous silica powder. Practically bone dry. Color: Pink. Packed in bags of approximately 90 lb.

Micro-Cel "S" Grade. A precipitated calcium silicate prepared so as to remove all combined and free moisture. Used as a reinforcing pigment in rubber. Very finely divided and absolutely free from grit. Color: White. Packed in bags of approximately 100 lb.

Micro-Cel "F" Grade. Same as Micro-Cel "S" Grade except that it has a very definite accelerating effect on the time of cure and is recommended only where this property is beneficial. Packed in bags of approximately 100 lb.

Micro-Cel "C" Grade. Same as Micro-Cel "F" Grade except that it is coarser. Packed in bags of approximately 100 lb.

Snow Floss. Most finely ground of all natural diatomaceous silica powders. Light cream in color. Packed in bags of approximately 80 lb.

Super Floss. Heat-treated and specially processed diatomaceous silica. Very finely ground. Color: Snow white. Packed in bags of approximately 100 lb.

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FR—Friction Materials

Asbesto-Metallic Friction Blocks, Types 100 and 120. Made of asbestos, brass wire and rubber composition, hydraulically pressed in a mould, heat-treated or cured under pressure to the required shape. Minimum thickness ⅜", maximum thickness 4". Maximum area, 400 sq. in. Maximum length 120° of circumference but not over 24" long chord. Weights per cu. ft.: Type 100, 138 lb.; Type 120, 122 lb.

Asbesto-Metallic Friction Blocks, Types 101 and 121. Combination blocks of the same material as Types 100 and 120, respectively, but reinforced with a rigid backing to offer a more secure hold for fasteners. Thickness ⅜" and less. Weight per cu. ft. approximately 4 lb. less than blocks of facing material.

Asbestos Moulded Friction Linings, Types 200 (Standard) and 220 (Low Friction). Made of a composition similar to Asbesto-Metallic Friction Blocks, but instead of being moulded, the mixed material is built up into large sheets under pressure and at the same time heat-treated or vulcanized. The semi-finished material is in sheet form 36" x 42", in thicknesses from ⅛" to ⅜" from which flat rings or curved pieces which can be cut from such a sheet are furnished. Weighs approximately 1.3 oz. per cu. in.

Asbestos Friction Facings, Types 750 and 751. Made of asbestos millboard, treated with an oil binder and baked. Commonly known in the trade as "moulded facings" but are not a moulded facing in the strict sense of the word, although their appearance suggests it. Maximum thickness ½". Maximum diameter with ground face, 18". Larger sizes, unground, can be furnished.

Folded and Compressed Brake Linings and Clutch Facings:

Standard Folded and Compressed, Type 600, is made of asbestos cloth woven from asbestos yarn with brass wire inserted, properly impregnated, folded to required size, hydraulically pressed and cured by heat. **Super Folded and Compressed, Type 610,** has a more open weave and the friction compound is slightly heavier. Minimum thickness of both types of brake lining ⅛"; maximum thickness 1"; widths 1" to 24". Clutch facings are also furnished in both types of material.

Woven Brake Linings and Clutch Facings:

Standard Woven Brake Lining, Type 300, is woven solid to size from asbestos yarn with brass wire inserted. It is then impregnated with an asphaltic oil compound and calendared between heated rolls which increases density and sizes the lining to the required dimensions. Furnished ⅛" to 5/16" thick, in widths of 1" to 24". Clutch facings are also furnished (Standard Woven Facings, Type 350), sizes being governed by the sizes of the lining.

Standard Woven Brake Lining, Type 302, is the same as Type 300 except that it has a special impregnation for service in oil.

Giant Woven Brake Lining, Type 400, differs from Standard Woven, Type 300, only in weave, because of the greater thickness and density required. Furnished ⅜" to 1" thick, in widths of 2" to 12". Clutch facings are also furnished (Giant Woven Facings, Type 450), sizes being governed by the sizes of the lining. Maximum diameter 12", but can be cut into keystone-shaped segments for large disc clutches.

Rotary Woven Brake Lining, Type 401, is similar to Type 400 but is made especially for use in rotary drill rigs in 1-3/16" standard thickness and in widths from 8" to 12". Other sizes can also be furnished.

Giant Woven Brake Lining, Type 402, is the same as Type 400 except that it has a special impregnation for service in oil. Clutch facings, Type 452, also furnished.

Heavy Duty Woven Brake Lining, Type 500, is similar to Standard Woven, Type 300, but is woven oversize and calendared to the finished size with square edges. Furnished 3/16", ¼", 5/16", and ⅜" thick, in widths from 1½" to 6".

IN—Insulation

Aertite Coating. Often used in the same manner as Insulkote, as a weather-proof coating over insulation on out-door work. For a 1/16" coating, 25 to 40 lb. are required per 100 sq. ft., depending upon the surface. Furnished in 25, 50, 150, 300 and 500-lb. containers. Temperature limit 250 deg. F. (See also "Waterproofing and Miscellaneous Asphalt Products" Section.)

Air Cell Pipe Insulation. Made of corrugated asbestos paper, built up to various ¼"-ply thicknesses for use on domestic heating systems. (See also Improved Asbestocel.)

Anti-Sweat Pipe Insulation. Made of laminated wool felt, protected inside and out with waterproofing felts. Used to insulate cold water pipes and to prevent condensation. Furnished in 3-ft. sections, in thicknesses of ½" and ¾" solid construction, and 1", 1½" and 2" broken joint construction to fit standard pipe sizes. Waterproofing felts also used between layers on broken joint construction.

Asbestocel (in flexible roll form). Made of a plain and a corrugated asbestos sheet cemented together to an approximate thickness of ¼". Used for hot-air heater or furnace pipes. At least two layers should be used. Furnished 37½" wide, in rolls of about 250 sq. ft. Temperature limit 300 deg. F.

Asbestocel, Improved. See Improved Asbestocel.

Asbestos Blankets. Flexible insulation made of asbestos cloth, filled with asbestos fibre, and quilted. Used for covering irregular surfaces where removable insulation is desired, such as on the shells of paper digesters, casings of steam turbines and flange covers in pipe lines. Furnished to order in single or double layer constructions. Temperature limit 800 deg. F.

Asbestos Cement. See Cements.

Asbestos Combination Spiral Pipe Insulation. Consists of a layer of Ceilinite (also see), 2½" wide and ¼" thick, over which is wrapped a layer of No. 1091 Asbestos Listing. Used on irregular runs of pipe, or where severe vibration is encountered, as on automobile exhaust pipes and on locomotives. Temperature limit 1000 deg. F.

Asbestos Fire-Felt. See Fire-Felt.

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Asbestos Paper and Roll Board. Used where a material of minimum thickness is required, principally as a protection against heat and as a fire-retardant between floors, walls and ceilings. Also used for wrapping hot air heater pipes. Paper is furnished in thicknesses from .015" to 1/16". Roll Board (heavy asbestos paper) is furnished in thicknesses of 3/32" and ⅛". Both are supplied in standard rolls, 18", 24" and 36" wide, weighing 50 or 100 lb. per roll, and in special widths to order.

Asbesto-Sponge Felted Pipe Insulation, Sheets and Blocks. The most efficient insulation obtainable in these forms for temperatures up to 700 deg. F. Built up of laminated asbestos felts, in which are embedded small particles of spongy, cellular material. Withstands rough usage and can be removed and replaced without injury. Furnished in sheets 24" x 36", and blocks 6" x 36", from ½" to 4" thick. Weight approximately 3½ lb. per sq. ft. per inch thick. Pipe insulation furnished in 3-ft. sections in thicknesses from the standard (approximately 1") to 3", for standard pipe sizes. Temperature limit 700 deg. F., although it is often used as a second layer, outside a layer of Superex, at much higher operating temperatures.

Asbestos Roll Fire-Felt. See Fire-Felt.

Asbestos Sheet Millboard. Recommended where relatively thin sheets or boards are required for protection against fire, heat, and acid fumes. Used as a fireproof lining for floors, partitions, ceilings and elevator shafts. Also used in ranges, stoves, gas-grate backs, etc. Made in a number of grades of various densities and fire-resisting properties. Furnished in standard sheets 42" x 48" and 1/32" to ½" thick.

Banroc Blankets. Composed of Banroc (rock wool) felted between various metal fabrics, such as galvanized wire netting, copper bearing metal lath, and rib lath. Used for insulating ovens, oil refinery equipment and for similar purposes. Standard sizes 24" x 96" and 24" x 48", and 1" to 6" thick. Temperature limit 1000 deg. F.

Banroc Granulated. Same as Banroc Loose (below) except in granulated form. Furnished in 50-lb. bags.

Banroc Loose. Loose rock wool fibre produced from fused argillaceous limestone, blown into fibres by means of steam jets. Used as an insulating filling in ovens, fireless cookers, electric and gas ranges and similar equipment. Packed in place to required density; usually 12 lb. per cu. ft. is sufficient. Furnished in 50-lb. bags. Temperature limit 1000 deg. F.

Banroc Pipe Insulation. Made of rock wool in two types: Style No. 25 manufactured with wire netting inside and metal lath outside and used where a cement finish is desired. Furnished in 2-ft. sections, 1" to 4" thick, for pipe sizes of 2" and larger. Style No. 65 made with a 24-ga. galvanized iron outer casing to provide a waterproof and fireproof jacket. Adapted where insulation must be frequently removed. Furnished in 2-ft. sections, 1½" to 4" thick, for pipe sizes of 2" and larger. Special shapes can also be furnished for flanges and bends. Temperature limit of both types 1000 deg. F.

Bevel Board. See "Building Materials, Miscellaneous" Section.

Boiler Covers. See Economy and Keystone.

Brine and Ammonia Sealing Compound. A liquid asphaltic compound used in coating the sealing membrane of Built-up Brine and Ammonia insulation on cold pipes. Furnished in 1, 2, 3, 5, 25 and 50-gal. containers.

Built-up Brine and Ammonia Pipe Insulation. Composed of 2, 3 or 4 layers of 1" hair felt thoroughly sealed with a waterproof membrane. Used on pipes carrying low temperature liquids such as brine and ammonia.

Built-up Hair Felt Pipe Insulation. Composed of the required number of layers of 1" hair felt secured to the pipe with jute twine and finished with a waterproof jacket. Used to prevent water lines from freezing, the thickness needed varying with conditions.

Carinsul. A rigid panel insulation consisting of felted cattle hair, with burlap at the center and stiffened with heavy asbestos paper cemented to both sides. It is used primarily behind letter boards on steel passenger cars. Furnished ¼" and ½" thick, in sheets 40" x 72", or cut to dimensions.

Ceilinite. Made from Asbestos Roll Fire-Felt, reinforced on one side with asbestos cloth. Used as an inter-lining in steel cars, for fireproofing electrical apparatus such as switch boxes, and for similar purposes requiring a strong, flexible, fireproof felt. Furnished in rolls 36" wide and 100 ft. long, and in 3/32", ⅛", 3/16" and ¼" thicknesses.

Cements:

Lap Cement. A liquid asphalt used for cementing the laps of ready-to-lay roofings when used as weather-proofing over insulation. See "Roofing and Shingles" Section.

85% Magnesia Cement. Composed of the same material as 85% Magnesia sectional and block insulation. It is essentially an insulating and not a finishing cement. Packed in 60-lb. bags, which cover 35 sq. ft. 1" thick; or 58 sq. ft. 1" thick per 100 lb. Temperature limit 600 deg. F.

No. 302 Insulating Cement. An excellent finishing cement, made from asbestos fibres and binding materials, which provides a hard, durable and attractive surface. Packed in 100-lb. bags, covering 25 sq. ft., 1" thick. Temperature limit 1000 deg. F.

No. 304 Hot Blast Cement. Made from long fibre asbestos. Packed in 100-lb. bags, which cover 18 sq. ft. 1" thick. Temperature limit 1200 deg. F.

No. 319 Semi-Refractory Cement. A combined insulating and semi-refractory cement used to protect block or brick insulation in flues, stacks, etc. Packed in 50-lb. bags, which cover 7½ sq. ft. 1" thick; or 15 sq. ft. 1" thick per 100 lb. Temperature limit 1600 deg. F.

No. 340 Insulating Cement. An insulating and finishing cement lower in covering capacity and price than No. 302. Packed in 100-lb. bags which cover 18 sq. ft. 1" thick. Temperature limit 1000 deg. F.

No. 352 Insulating Cement. General utility short-fibre cement. Packed in 100-lb. bags, which cover 19 sq. ft. 1" thick. Temperature limit 1000 deg. F.

No. 400 Insulating Cement. A medium grade insulating cement. Packed in 100-lb. bags, which cover 25 sq. ft. 1" thick. Temperature limit 700 deg. F.

No. 450 Insulating Cement. A high-grade insulating cement for applying in thicknesses equal to block insulation where the latter cannot be used. Adheres readily to hot or cold surfaces but is not a finishing cement. Packed in 60-lb. bags which cover 21½ sq. ft. 1" thick; or 36 sq. ft. 1" thick per 100 lb. Temperature limit 1200 deg. F.

Superex Insulating Cement. The same material used in Superex sectional and block insulation. Packed in 75-lb. bags, which cover 30 sq. ft. 1" thick, or 40 sq. ft. 1" thick per 100 lb. Temperature limit 1600 deg. F.

Combination Spiral Pipe Insulation. See Asbestos Combination Spiral Pipe Insulation.

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Cork Insulation. A full line of natural cork insulation is carried by Johns-Manville, including corkboard sheets and lagging, granulated rock, and cork pipe insulation, moulded fittings and accessories.

Dry Zero Blanket Insulation. The lightest commercial insulation known, weighing 2 oz. per board foot. Made of kapok fibre enclosed between burlap or muslin, stitched on 6" centers. Used principally on refrigerator cars and airplanes. Furnished 1", 1½", 2" and 2½" thick in rolls 4 ft. x 50 ft. for airplane blankets, and 9 ft. wide by any length for refrigerator cars. Also cut to dimensions.

Economy Range Boiler Cover. Made of hair felt 1, 2 or 3 plies thick (each ply 1"), lined with muslin and finished on the outside with sewed canvas cover and lacing hooks for ready application to standard size range boilers. (Also see Keystone Range Boiler Cover.)

Engineers' Insulating Tape. Consists of 2" wide Ceilinite (also see) and asbestos listing, stitched together down the center with a ¼" marginal extension on the listing for sealing the joints. Used on irregular runs of pipe, or where severe vibration is encountered, as on automobile exhaust pipes and on locomotives. Temperature limit 1000 deg. F.

Fibro-Cel. A mixture of diatomaceous silica and long fibre asbestos. Since it does not settle under vibration or sift through cracks, it is well adapted for use as a filling material on gas generator sets, etc. Usually packed to density of 18 lb. per cu. ft. Furnished in 80-lb. bags. Temperature limit 1800 deg. F.

Fibrous Adhesive. Used for the adhesion of sheet, block or brick insulation to flat or curved surfaces. For application to metal surfaces, approximately 50 lb. are required per 100 sq. ft.; for sticking to brick, concrete, etc., 75 lb. per 100 sq. ft. Furnished ready to use in 80, 180, 365 and 600-lb. containers.

Fil-Insul. An asbestos filling material used where a resilient, non-settling insulation is desired. Because of its fibrous nature, it will not sift through cracks. Weight approximately 17 lb. per cu. ft. packed to proper density. Temperature limit 1000 deg. F.

Fire-Felt:

Asbestos Fire-Felt Pipe Insulation, Sheets and Blocks. Similar to Super Fire-Felt (below), except that it is heavier and has greater mechanical strength. Used where insulation is needed that will not fracture or crumble on surfaces that move or vibrate. Sheets and blocks in same sizes as Super Fire-Felt. Weight in 1" thickness about 3.3 lb. per sq. ft. Also furnished in 3-ft. sections for pipe insulation, 1" to 3" thick, to fit standard pipe sizes. Temperature limit 1000 deg. F.

Asbestos Roll Fire-Felt. A soft, flexible asbestos felt that may be folded, bent or wrapped around pipes and heated surfaces. Furnished 3/32", ⅛", 3/16" and ¼" thick in rolls 3 ft. wide, containing about 100 sq. ft.

Super Fire-Felt Sheets and Blocks. Made of felted asbestos fibre to provide a light-weight, efficient, resilient insulation. Can be easily moulded into irregular shapes. Furnished in sheets 24" x 36", and blocks 6" x 36", ½" to 4" thick; also in special sizes and shapes. Weight of 1" thick material about 1.7 lb. per sq. ft. Temperature limit 700 or 1000 deg. F., depending upon character of construction.

Thermo Fire-Felt Sheets. Similar to Asbestos Fire-Felt, except that it has a cellular asbestos structure completely enclosed in the center of the sheet, giving it increased efficiency and resiliency. Furnished in sheets 24" x 36", and 1½" to 3" thick. Weight of 1½" thickness about 3.5 lb. per sq. ft. Temperature limit 1000 deg. F.

Vitro Fire-Felt Sheets. Similar to Thermo Fire-Felt except that the cellular asbestos structure is vitrified to increase rigidity. Furnished in sheets 24" x 36", and 1½" to 3" thick. Weight of 1½" thickness about 5 lb. per sq. ft. Temperature limit 1000 deg. F.

Hair-Felt. See Standard Hair Felt.

Hairinsul. Blanket insulation for refrigerator cars. Made either of all cattle hair or mixture of cattle hair and other fibres in specified proportions, felted between two layers of waterproof paper and stitched on approximately 5" centers. Furnished ½", ¾", and 1" thick, and is covered with 80, 90 or 100-lb. paper as specified. Rolls of any width required up to 108" and in any practicable length. Also cut to templet as ordered.

Home Insulation. See "Building Materials, Miscellaneous" Section.

Housline. See "Building Materials, Miscellaneous" Section.

Improved Asbestocel Pipe Insulation, Sheets and Blocks. Made of plain and corrugated asbestos sheets with cross-corrugations at regular intervals, built up to the required thickness. Used on medium or low pressure boilers, warm air ducts and domestic steam and hot water piping. The cross-corrugated construction gives considerably higher efficiency than ordinary Air Cell Insulation. Sheets 36" x 36" and blocks 6" x 36" are furnished four plies per inch of thickness in thicknesses of ½" to 4", weighing about 1 lb. per sq. ft. 1" thick. Pipe insulation made in 3-ft. sections in thicknesses of from two to six ¼" plies to fit standard pipe sizes. Fine Corrugated Improved Asbestocel is 6 plies to the inch. Sheets and blocks in same sizes as standard material; weight 1.3 lb. per sq. ft. 1" thick. Pipe insulation in 3-ft. sections in 4, 6 and 9-ply thicknesses. Temperature limit 300 deg. F.

Industrial Board. See "Building Materials, Miscellaneous" Section.

Insulating Board. See "Building Materials, Miscellaneous" Section.

Insulkote. A durable, easily applied, weather-proof coating, for insulated surfaces. Dark gray in color and can be painted with aluminum paint if desired. "Insulkote for Winter Use" should be specified if temperatures during application may be below 45 deg. F. Applied in one coat, ¼" thick, it will cover 45 sq. ft. per 100 lb. Furnished in 50, 150, 300 and 500-lb. containers.

Insulkote Primer. A thin asphalt emulsion for use on porous surfaces prior to application of Insulkote.

Keystone Range Boiler Cover. Made of 1 layer of asbestos paper, ½" hair felt, 1 layer of rosin-sized paper and canvas cover, with lacing hooks for ready application to standard size range boilers. (Also see Economy Range Boiler Cover.)

Lap Cement. See Cements.

85% Magnesia Cement. See Cements.

85% Magnesia Pipe Insulation, Blocks and Lagging. One of the most efficient commercial insulations. Made of 85% carbonate of magnesia and 15% asbestos fibre. Blocks are 3" x 18" or 6" x 36", flat or curved, in thicknesses of ½" to 4". Other sizes, including lagging, furnished on special order. Pipe insulation furnished in 3-ft. sections in the following thicknesses: Standard, 1½", 2", 2½", Double Standard, and 3", to fit pipe sizes up to 10" or 12". For larger sizes curved segments or lagging are supplied. Temperature limit 600 deg. F., although magnesia is often used as a second layer, outside a layer of Superex, at much higher operating temperatures.

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Pan-O-Cel Sheet Insulation. Self-supporting panel insulation made of finely corrugated asbestos felts, sealed within sheets of asbestos felt coated with refractory solution. Used in the construction of dry rooms, ovens operated at low temperatures and similar heated enclosures. Type A has a temperature limit of 500 deg. F. Type B (more moisture-resistant) has a temperature limit of 250 deg. F. Both types furnished in standard sheets 36" x 36", 36" x 72" and 36" x 48", and 1" to 4" thick.

Plaster Lath. See "Building Materials, Miscellaneous" Section.

Rigid Roofinsul. See "Roofing and Shingles" Section.

Rock Cork Asphalt. Used in the application of Rock Cork Sheets and Lagging. Melting point 190 to 200 deg. F.

Rock Cork Sheets, Lagging, Disks and Granulated. A highly efficient material for cold storage and refrigerating equipment. Made from rock wool, combined with a waterproof binding ingredient. Standard size sheets are 18" x 36" x 1½", 2½", 3" and 4" thick; also 18" x 18" x 1". Lagging is furnished for diameters from 11" to 20 ft. and is supplied 18" long, in thicknesses of 1½", 2", 3" and 4", and from 2" to 5" wide, depending upon diameter of cylinder. One-piece disks are 18" maximum diameter. Larger disks up to 36" diameter made in two pieces. Granulated Rock Cork is a loose, moisture resisting filling for insulating the sides of ice freezing tanks, etc. Packed in place to a density of about 14 lb. per cu. ft. Shipped in 50-lb. bags. Temperature limit of all Rock Cork products 100 deg. F.

Rock Wool. See Banroc.

Roll Fire-Felt. See Fire-Felt.

Roofinsul, Rigid. See "Roofing and Shingles" Section.

Salamander Insulation. A flexible blanket insulation and sound-deadener for application between the outside and inside steel plates on steel passenger cars. Composed of various plies of ¼" cattle hair enclosed between kraft paper and then between asbestos paper and stitched on about 5" centers. Furnished in thicknesses of 1, 2, 3 and 4 plies, and 36", 48" or 54" wide, or cut to size.

Sil-O-Cel C-3. A course, granular calcined diatomaceous silica (Celite) for use as an insulating filling on high temperature equipment. Weight loose, 28 lb. per cu. ft.; packed 31 lb. per cu. ft. Also used in making Sil-O-Cel C-3 Concrete. Furnished in 100-lb. bags. Temperature limit 2000 deg. F.

Sil-O-Cel C-3 Concrete. Semi-refractory insulating concrete for lining furnace doors and bases and for monolithic construction of japanning, enameling and core ovens, etc. Made on job by mixing four parts of Sil-O-Cel C-3 with one part portland cement by volume. 32 lb. of C-3 required per cu. ft. of concrete. Concrete weighs about 60 lb. per cu. ft. Crushing strength about 1000 lb. per sq. in. Temperature limit 1800 deg. F.

Sil-O-Cel C-22 Brick. Moulded and calcined diatomaceous silica (Celite) insulating brick for use behind refractory linings in high temperature furnaces, etc. Also used without fire brick protection for lining electrically heated or muffle type furnaces. Crushing strength 550 lb. per sq. in. Furnished 9" x 4½" x 2½", 9" x 4½" x 3", and also as No. 1 and No. 2 arch brick. Weight of 2½" brick about 2¼ lb. each. Packed 25—9" x 4½" x 2½" brick per carton. Mortar furnished for laying. Temperature limit 2000 deg. F.

Sil-O-Cel Coarse Grade. Coarsely ground diatomaceous silica (Celite) for use as an insulating filler. Usually packed to density of 22 lb. per cu. ft. Furnished in 100-lb bags. Temperature limit 1600 deg. F.

Sil-O-Cel Insulating Mortar. Special diatomaceous silica (Celite) mortar for laying Sil-O-Cel brick.

Sil-O-Cel Insulating Powder. Finely ground diatomaceous silica (Celite) for use as an insulating filler. Weight loose, about 12 lb. per cu. ft.; packed, 15 to 17 lb. per cu. ft. Furnished in 100-lb. bags. Temperature limit 1600 deg. F.

Sil-O-Cel Natural Brick. Natural diatomaceous silica (Celite) insulating brick. The most efficient insulating brick obtainable. Crushing strength of 2½" brick 400 lb. per sq. in. Furnished 9" x 4½" and 1¼", 2", 2½" and 3" thick; also as No. 1 and No. 2 arch brick. Weight of 2½" brick, 1¾ lb. each. Packed 25–2½" brick per carton. Mortar furnished for laying. Temperature limit 1600 deg. F.

Sil-O-Cel Super Brick. Moulded and calcined diatomaceous silica (Celite) insulating brick for use behind refractory linings in high temperature furnaces, etc. Also used without fire brick protection for lining electrically heated and muffle type furnaces. Crushing strength 350 lb. per sq. in. Furnished 9" x 4½" x 2½" and as No. 1 and No. 2 arch brick. Weight of 2½" brick about 2¼ lb. each. Packed 25—2½" brick per carton. Temperature limit 2500 deg. F.

Standard Hair Felt. Made from selected cattle hair and adapted to a wide variety of insulation requirements at low or moderate temperatures. Furnished from ¼" to 2" thick, in bales 6 ft. x 50 ft., 3 ft. x 100 ft., and 3 ft. x 50 ft.

Superex Pipe Insulation and Blocks. A combination of diatomaceous silica and asbestos fibre, bonded together. A highly efficient material for insulating boiler walls, furnaces, etc. Blocks are 3" x 18" and 6" x 36", flat or curved, in thicknesses of 1" to 4". Other sizes on special order. Weight about 2 lb. per sq. ft. 1" thick. Pipe insulation furnished in 3-ft. sections, 1" to 3" thick, for pipe sizes up to 10" or 12". For larger pipe sizes, segments are furnished. One or more layers of 85% Magnesia or Asbesto-Sponge Felted are often used outside of Superex, this construction being known as Superex Combination Insulation. Temperature limit 1600 deg. F.

Super Fire-Felt. See Fire-Felt.

Tankinsul. A hair felt insulation with a layer of building paper on each side, firmly stitched in place. Used in oil industry on moderate temperature tanks. Furnished ½" or ¾" thick, from 3 ft. to 6 ft. wide, in bales 50 ft. long. Usually several layers are used.

Thermo-Felt. An asbestos hair felt composed of 50 per cent cattle hair and 50 per cent asbestos. Used in steel passenger cars and street cars. Furnished in 50-ft. bales, 40" wide, and ¼", ½" and ¾" thick.

Thermo Fire-Felt. See Fire-Felt.

Transite. See "Transite Products" Section.

Transite-Encased Insulating Board. See "Building Materials, Miscellaneous" Section.

Underground Insulation System. A complete system of underground insulation, consisting of asbestos fibre insulation, vitrified tile conduit, iron roll frames, underdrains, broken stone bed, etc. Used for insulating underground pipes carrying steam or hot water.

Vapor Tight Insulated Tank Top. Insulation and waterproof roofing finish for tops of wood or steel tanks in the oil industry, to reduce evaporation losses.

Vitribestos Pipe Insulation and Sheets. Made of vitrified asbestos felts, previously corrugated to form a cellular structure. Sheets are used for lining stacks, building theatre curtains, etc. Flat sheets are 36" x 36" and 36" x 72", and curved

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sheets are 24" x 36". Furnished ½" to 3" thick. Weight 1.8 lb. per sq. ft. 1" thick. Pipe insulation made 1" thick only, in standard pipe sizes. Temperature limit 700 deg. F.

Vitribestos Solution. A refractory coating for application to edges of Vitribestos Sheets when cut in the field. Furnished in 1, 5, 25 and 50-gal. containers.

Vitro Fire-Felt. See Fire-Felt.

Wool Felt Pipe Insulation. Used where a low price material is required for hot or cold water pipes. Corrugated Hot Water Wool Felt is made from alternate layers of plain and corrugated wool felt, lined with asbestos paper. Solid Hot Water Wool Felt is made of laminations of wool felt, lined with asbestos paper. Cold Water Wool Felt is made from laminations of wool felt, lined with waterproofing felt. All types furnished in 3-ft. sections in thicknesses of ½", ¾", 1", double ½", and double ¾".

Zero Pipe Insulation. Composed of layers of hair felt and wool felt, with a layer of saturated wool felt inside to prevent the hair felt from coming in direct contact with the pipe. Used to prevent water pipes from freezing under ordinary moderate conditions. Must be weather-proofed when used outdoors. Furnished in 3-ft. sections, 1¼" thick only, for standard pipe sizes.

PK—Packings and Furnace Expansion Joints

Packings

Acid Resisting Packing (Styles No. 2017 and 2018). Braided blue African asbestos fibre, lubricated to resist acids and caustics.

Air Pump Packing (Style No. 55). For use against air, particularly on the air end of air-compressors. Made of braid over braid of asbestos yarn reinforced with fine copper wire, impregnated and graphited.

Air Pump Packing Sets (Style No. R-15-55). A combination set of Kearsarge R-15 and Air Pump R-55, for the steam and air ends of air compressors.

Aqua Hydraulic Packing (Style No. 182). For use on inside-packed pumps against hot or cold water and oil. Made of first quality duck laminated with white rubber.

Armorflax Packing (Style No. 370). Rod packing for use against fresh or salt cold water, and crude oil. Made of a square-braided flax core covered on three sides with several plies of heavy duck to protect the flax from direct pressure and hold it in place.

Asbestos Cord (Styles No. 285 and 274). Made of strands of 1, 2 or 3-ply asbestos yarn, twisted to the required diameter and sized to give a smooth, hard finish. No. 285 is the higher grade of finer yarn.

Asbestos Gaskets for Hot Oil (Style No. 71). Gaskets cut from No. 70 Asbestos Sheet, for use against hot oil.

Asbestos Rope:

No. 196. Made of twisted strands of commercially pure asbestos roving of high quality.

No. 200. Same as No. 196 but made from pure asbestos roving and thus suitable for higher temperatures.

No. 203. Similar to No. 200, but the pure asbestos roving strands are each made up of a number of smaller strands.

No. 566. Braided round, in one or two jackets of commercially pure asbestos over a core of twisted asbestos rope. Sizes ¼" to ¾" inclusive, one jacket; ⅞" and larger, two jackets.

No. 580. Plaited asbestos yarn in square cross-section.

No. 581. Same as No. 580 except with wire insertion.

No. 702. Braided solid round, in jackets one over the other, of commercially pure asbestos yarn.

No. 733. Same as No. 702 except braided square.

No. 787. Same as No. 566 except braided square.

No. 788. Same as No. 702 except that pure asbestos yarn is used.

No. 857. Same as No. 566 except that pure asbestos yarn is used.

No. 869. Same as No. 857 except braided square.

No. 873. Same as No. 788 except braided square.

No. 4196. Same as No. 196 except that plain commercially pure asbestos roving is used.

No. 4200. Made of twisted strands of pure asbestos, the center strands bonded with a suitable compound.

Asbestos Sheet Packing (Style No. 70). For use against hot oil. Made of compressed asbestos fibres and a special binder.

Asbestos Wick:

No. 195. Made by twisting together several strands of commercially pure asbestos roving.

No. 199. Made of a single strand of pure asbestos roving.

No. 202. Same as No. 195 except that pure asbestos roving is used.

No. 4195. Same as No. 199 except that commercially pure asbestos roving is used.

No. 4199. Made of a single strand of pure twisted asbestos, with a small cotton yarn in the center to add tensile strength.

No. 4202. Made by twisting several strands of pure asbestos, each of which has a small cotton yarn through the center.

Besta-Monia Packing (Style No. 172). Laminated duck and rubber packing for ammonia service on reciprocating rods.

Braided Copper Packing (Style No. 280). For use as header rings on high-pressure service; as end rings on heavy horizontal plungers; or as bushing rings where there is a large space between the bottom of the stuffing box and the rod. Made of pure copper wire plaited in square cross-section.

Braided Cotton Packing (Styles Nos. 262, 263, 264 and 265). For use on the liquid end of pumps in service against cold liquids where a cotton base packing is desirable. Made of long-staple cotton, braided or plaited.

Braided Wool Packing (Style No. 2019). Valve stem and

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rod packing for use against weak acids. Made of long fibre wool plaited and impregnated or left dry.

Caustic Packing (Styles No. 73 and 74). Valve stem and rod packing for use against caustic soda and other similar corrosive chemicals. Made of blue African asbestos yarn, impregnated with a special caustic-resisting compound. Style No. 73, braided layer over layer. Style No. 74, plaited, for centrifugal service.

Centripac Packing (Styles No. 7, 11 and 18). Constructed and lubricated especially for use on centrifugal pumps against hot or cold, fresh or salt water, oil, ammonia, brine and some weak acids. Also furnished with special lubricant and no wire, for use against cold gasoline and other cold mineral oils. Made of asbestos yarn, with or without wire in each strand, plaited square, lubricated and graphited.

Cord, Asbestos. See Asbestos Cord.

Cross-Diagonal Packing (Style No. 271). Laminated rubber and duck packing, diagonally cut, for use against hot and cold water, low-pressure steam, ammonia, light oils and mineral seal oil. Efficient on worn rods.

Diaphragm Rubber Sheet Packing (Style No. 115). Duck-inserted rubber sheet for use in making diaphragms on damper regulators, reducing valves and similar service.

Duro Rod Packing (Style No. 171). Made of heavy laminated duck for steam or hydraulic service where pressures are not excessive.

Felted Asbestos Gaskets (Style No. 220). Gaskets cut from No. 219 Felted Asbestos Sheet, for use under high temperatures.

Felted Asbestos Sheet Packing (Style No. 219). For use against high temperatures. Made of long-fibre asbestos and a special binder containing no rubber.

Flax-Copper Combination Packing (Style No. 278). For use as end rings in severe hydraulic service. Made of plaited flax fibre and copper wire, lubricated and graphited.

Flax Packing (Styles No. 181, 188, 189, 240 and 2000). For hydraulic use. Made of braided flax fibres with various lubricants for various service conditions. Styles 240 and 181 are treated with a waterproof compound and graphited.

Gasoline Rod Packing (Styles No. 293, 322 and 323). Specially treated twisted or braided coil packing for use against cold gasoline and other mineral oils.

Groove Packings:

C-17. For use on furnace doors. Made of a twisted asbestos core, over which are braided jackets of asbestos yarn, all covered with an open-mesh braided jacket of copper wire.

C-176 and C-177. For packing converter bottoms and similar service. C-176 is made of frictioned asbestos cloth wrapped on an asbestos core. C-177 is similar except that the asbestos cloth is wire-inserted.

C-216. For use on water gas generator doors. Made of successive jackets of asbestos yarn impregnated with a heat resisting compound, braided over an asbestos rope core.

C-790. For use on hot blast stove clean-out doors, boiler explosion doors, and similar service. Made of braid over braid of wire-inserted asbestos yarn.

C-872. For use on butterfly valves and similar apparatus. Made of jackets of pure asbestos yarn, wire-inserted, braided one over the other to a square cross-section.

High-Pressure Diagonal Rod Packing (Style No. 183). A rubber and duck cushion combined with cut wedges of rubber-frictioned laminated duck held together with a braided cotton jacket, for use against medium and low pressure steam, particularly where rods are scored, worn, or out of alignment.

High Temperature Packing (Style No. 5). Made of pure asbestos with a copper wire center, for use where the temperatures are too high to permit the use of standard lubricated packings.

Hollow Core Packing (Style No. 390). Rod packing for use against steam and water where an extremely resilient packing is desired. Made of plies of duck cemented with rubber, with a hollow center, lubricated and graphited.

Hot Oil Packing (Styles No. 731 and 871). For use against hot oil. Made of braid over braid of asbestos yarn with a special sealing compound between the layers. Style No. 731 made of asbestos yarn with 10% carbon content; Style No. 871 made of pure asbestos yarn.

Hydraulic Packing (Styles No. 109, 110, and 111). Black rubber cloth inserted sheet packing; also made with cloth one side and both sides.

Jewett Packing (Style No. 10). For use on valve stems, centrifugal pumps and rods, against steam, hot or cold, fresh or salt water, gas, air, crude and other heavy oils and certain chemicals which require a packing containing no rubber. Made of braided jacket over jacket of asbestos yarn and fine copper wire, over a thin lead ribbon core, lubricated and graphited.

Jute Packing (Styles No. 4181 and 4191). For hydraulic service. Braided first quality jute with center and corners of the same material, and lubricated. Style No. 4181 (W.P.H.) same as No. 4191 but treated with a waterproof compound and graphited.

Kearsarge Boiler Handhole and Manhole Gaskets (Style No. 116). Made from copper wire-inserted asbestos cloth treated with a heat-resisting compound and folded into shape, providing an unbroken, rounded shoulder on the outer edge where the gasket is exposed to pressure.

Kearsarge Cut Gaskets (Style No. 126). Gaskets cut from Kearsarge Sheet, for use primarily against steam, but can also be used against air, water, ammonia and various chemicals. Particularly adapted for rough flanges.

Kearsarge Gasketing Tape (Style No. 120). Folded tape woven of wire-inserted asbestos yarn and treated with a heat-resisting compound, for use against steam, air, water, ammonia, and various chemicals.

Kearsarge Jointless Tube Plate Gaskets (Style No. 118). Made from copper wire-inserted asbestos yarn woven seamless into tubular ring form and folded, then treated with a heat-resisting compound.

Kearsarge Lute Coil Gasketing (Styles No. 128 and 129). For gas purifier boxes and similar service. Made of asbestos cloth, with or without wire, folded back and forth to the required size and covered with the same material. The center folds are impregnated with a heat-resisting compound. The jacket is untreated.

Kearsarge Rod and Plunger Packing (Styles No. 166 and 15). For use against steam, air or gas, Style No. 166 made of asbestos fabric folded back and forth upon itself, with an expansion back of rubber and a graphited two-ply asbestos cloth cover over the entire wearing surface. No. 15 has no rubber expansion back.

Kearsarge Sheet Packing (Style No. 100). Made from frictioned brass wire-inserted asbestos cloth, for use against steam, water, and air.

Kearsarge Tubular Gasketing (Style No. 124). Designed

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primarily for emergency use, but adapted for making irregular-shaped gaskets or packing groove joints. Made of wire-inserted asbestos cloth treated with a heat-resisting compound and rolled with a hollow center.

K. U. Packing (Style No. 90). Rod packing designed primarily for use against steam, but also adapted for air and hot or cold water. Made with a square-folded core of wire-inserted asbestos fabric with the folds cemented to each other with a rubber compound, covered on three sides with a jacket of the same fabric, bonded to the center block.

Liberty Red Rubber Gaskets (Style No. 142). Gaskets cut from Liberty Red Rubber Sheet. Cut gaskets can be furnished from any J-M rubber sheet packing.

Liberty Red Rubber Sheet Packing (Styles No. 107 and 108). Red rubber compound sheet, made with or without wire insertion.

Liberty Red Rubber Tubular Gasketing (Style No. 125). For use against medium and low-pressure steam and in hydraulic service. Made of red rubber cloth-inserted, with a hollow center.

Light Weight Hydraulic Packing (Style No. 295). Rod packing for use against crude oil, gasoline, benzine, naphtha, mineral seal oil and hot or cold water. Made of laminated light rubber and coarse duck.

Low-Pressure Diagonal Rod Packing (Style No. 184). Similar to High-Pressure Diagonal packing, but with a braided jute cushion, for use against low-pressure steam and cold water.

Mobilene Gaskets (Style No. 141). Gaskets cut from Mobilene Sheet, for use on gas and gasoline engines.

Mobilene Sheet Packing (Style No. 101). A frictioned Asbesto-Metallic sheet for packing gas and gasoline engine parts.

Mogul Packing (Styles No. 193, 222, and 223). Long fibre asbestos yarn, twisted or braided, lubricated and graphited. For use against steam, oil, water, ammonia or chemicals, or where packing containing no rubber is necessary.

Moulded Packing Cups. Made of composition asbestos and rubber compound in several cupped or flanged cross-sections.

Oil Field Spiral Packing (Style No. 156). Laminated duck and rubber for use on the steam end of slush pumps, and general rod service for oil field conditions.

Oil Proof Sheet Packing (Style No. 112). A black rubber sheet for use against oil. Made of a compound which will not deteriorate as rapidly as other similar sheet packings.

Plaited Asbestos Rope (Style No. 580 and 581). A long fibre asbestos yarn plaited into square cross-section, with or without wire insertion.

Polish Rod Ring Packing (Style No. 373). A polish rod (oil equipment) packing of special rubber and graphite composition.

Pump Valves (Styles No. 300, 415, 416, 420, 424 and 430):

No. 300. For use against hot or cold water, oils, naphtha, benzine, paraffin and weak acids or alkalies, at pressures to 300 lb. and temperatures to 300 deg. F. Made of duck impregnated with a resinous compound.

No. 415. Hard rubber compound, for use in cold water service at pressures from 200 to 400 lb.

No. 416. Medium hard rubber compound, for use against fresh, salt or alkaline water at pressures to 200 lb.

No. 420. Tough soft rubber compound, for marine condenser and similar service.

No. 424. Hard rubber compound, for use against hot water at pressures to 300 lb. and temperatures to 300 deg. F.

No. 430. Hard rubber compound, for use against oil, acids, ammonia, syrups and similar liquids, at pressures to 300 lb. and temperatures to 300 deg. F.

Rajah Packing (Styles No. 2 and 6). Valve stem and rod packing for use against steam, hot or cold oil and water, at high temperatures. Made of a solid braid of asbestos yarn, surface-treated with a heat-resisting compound and graphited.

Rope, Asbestos. See Asbestos Rope.

Rubber Rings (Style No. R-140). For use between rings of W.P.H. Flax on reciprocating pipe-line pumps. Made of a special rubber compound.

Sea Ring Packing. A moulded packing for use against steam, water, brine or similar fluids, which will not attack the materials of which it is made. Composed of asbestos and other plain or impregnated fabrics, according to service conditions, with a flexible lip. Packs against the fluid by the fluid pressure, freeing itself automatically on the return stroke, thus eliminating friction and conserving power.

Seigelite Gaskets (Style No. 712). Gaskets cut from Seigelite Sheet, for use against gasoline, benzine, oil and greases. Approved by the Underwriters' Laboratories, Inc., for use against hazardous liquids.

Seigelite Sheet Packing (Style No. 711). A fibrous impregnated sheet of high tensile strength, approved by the Underwriters' Laboratories, Inc., for use against hazardous liquids.

Semi-Metallic Packing (Style Nos. 350 and 351). A combination of non-abrasive metal and asbestos fibre, lubricated and graphited, for use against steam, air, water and oil for any pressure and to 500 deg. F. On vacuum pumps, front and end rings of a soft packing should be used with it.

Service Flange Joint Gaskets (Style No. 61). Gaskets cut from Service Sheet for use against steam, air, hot or cold water, ammonia, oil and certain chemicals.

Service Sheet Packing (Style No. 60). An asbestos compound sheet for use against steam, gas, air, water, ammonia and certain chemicals.

Slush Pump Rings (Style No. 474). For use on rods at either fluid or mud end of slush pumps. Made of a special rubber and graphite compound. ***Combination Slush Pump Sets (R-476)*** consist of a Low-Pressure Diagonal ring, Style No. 184, between two Slush Pump rings.

Slush Pump Sleeves (Style No. 478). Made of rubber, treated to withstand the severe service.

Slush Pump Valve Inserts (Style Nos. 207 and 209). For use on valves of slush pumps to protect the valve seat. Style No. 207 is made of an all-rubber compound; Style No. 209 of laminated cotton fabric and rubber compound, for high pressure conditions.

Square Hydraulic Packing (Style No. 290). For use on inside-packed pumps against hot or cold water and cold oil. Made of laminated rubber and duck.

Thermo Rod Packing (Style No. 789). For use only against oils or gases at high temperatures. Made of pure asbestos yarn jackets, braided over a twisted core of pure asbestos yarn and annealed iron wire, with a coating of special heat-resisting compound between the jackets.

Throttle Packing Sets (Kearsarge, Style No. R-15; Universal, Style No. R-32; and Thermo, Style No. R-65). Sets

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of packing for use on locomotive steam throttles, each for a particular service:

R-15 for throttles controlling saturated or superheated steam, located in the back head above the water line, or in the steam dome.

R-32 for throttle stuffing boxes in the back head below the water line.

R-65 for throttles controlling superheated steam, located in the front end or in the smoke box.

Tucks Packing (Style No. 186). For use on inside-packed pumps against cold water at medium pressures. Made of laminated heavy duck and black rubber.

Universal Piston Packing (Style No. 33). For inside-packed pumps against hot or cold water, brine, air and oils, made of a continuous piece of asbestos and duck fabric folded back and forth to present a wearing surface of rounded shoulders which cannot work loose from each other.

Universal Rod and Plunger Packing (Style No. 32). For use against steam, air and hot or cold water, where rods are worn or out of alignment or where there is much vibration. Made of asbestos and cotton fabrics united with a heat-resisting rubber compound and wrapped around a non-hardening rubber core.

Victor Rod Packing (Style No. 173). For use against low-pressure steam and water. Made of plies of duck cemented around a rubber core, lubricated and graphited.

Wick, Asbestos. See Asbestos Wick.

Woven Asbestos Gasketing Tape (Style Nos. 121 and 122). For use under high temperatures where more than ordinary strength is required. Made of asbestos yarn, with or without wire, woven solid to the required size.

Expansion Joint Materials

Asbestos Jelly-Roll. Rolled asbestos sheet millboard, either with a hollow center or, in the larger sizes, with J-M No. 4200 Asbestos Rope as a core. Used to pack boiler and still setting expansion joints. J-M Asbestos Jelly-Rolls are made in standard sizes of 1", 1¼", 1½", 1¾", 2", 2½", 3", 3½" 4", 4½", 5", 5½", and 6" diameter, in 5' 9" lengths.

Asbestos Rope No. 4200. Made of twisted strands of pure asbestos, the center strands bonded with a suitable compound, in sizes from ⅜" to 1", increasing by increments of ⅛". Can be furnished when necessary as large as 2".

RX Fibre. Asbestos fibre used as an insulating filler and to pack interstices between Asbestos Jelly-Rolls (above), in boiler and still setting expansion joints. Packs to approximately 12½ lb. per cu. ft. Furnished in 12½-lb. bags.

RE—Refractory Cements

Firecrete. A dry refractory cement which is mixed with water and used for either poured or tamped monolithic linings in domestic oil-burning furnaces, and is also adapted for pre-moulding special refractory shapes. It sets without heat and can be used up to 2600 deg. F. Furnished in 100-lb. bags containing sufficient material for 0.8 cu. ft. of finished refractory construction.

Fireite Asbestos Furnace Cement. A plastic, readily workable, odorless paste which adheres firmly to clean castings and sheet metal. Grade SS (slow setting) is used for setting ash-pits, fire-pots, doors, dampers or other sections of furnaces, boilers, heaters and stoves, where heat is to be applied soon after application. Grade FS (fast setting) is used for sealing sections of steel radiators. Packed in 1, 2, 5, 10, 25, 50, 100, 250, 500 and 850-lb. containers.

No. 20 Plastic Refractory Cement. Has a silica base, sets without heat and can be used to 2700 deg. F. for setting fire brick and for wash-coating. It is also suitable for patching small holes and cracks in old linings, and mixed with crushed fire brick, for large patches. Approximately 400 lb. are required for setting 1000 brick with a brick-to-brick joint, and 500-600 lb. with a bond joint. For wash-coating, an average of about 150 lb. of cement (thinned) will cover 100 sq. ft. Furnished plastic in 5, 10, 25, 50, 100, 250, 500 and 850-lb. cans or drums.

No. 26 Refractory Cement. Has an aluminum silicate base, takes a medium air set, vitrifies at 900 deg. F. and can be used to 2600 deg. F. for setting fire brick with a bond joint. Sometimes used for patching and cement gun work. From 600 to 700 lb. are required for setting 1000 brick. Furnished dry in 100-lb. bags.

No. 30 Refractory Cement. Has a silicon carbide base, vitrifies at 1850 deg. F. and can be used to 3000 deg. F. for setting fire brick with a bond joint. Sometimes used for patching. From 800 to 900 lb. are required for setting 1000 brick. Furnished dry in 100-lb. bags.

No. 31 Refractory Cement. Has an aluminum silicate base, vitrifies at 1450 deg. F. and can be used to 3100 deg. F. for setting fire brick with a bond joint. From 600 to 700 lb. are required per 1000 brick. Furnished dry in 100-lb. bags.

No. 32 Refractory Cement. Has an aluminum silicate base, vitrifies at 1250 deg. F. and can be used to 3100 deg. F. for setting fire brick with a brick-to-brick joint, and for wash-coating. From 400 to 500 lb. are required for setting 1000 brick. For wash-coating with equal weights of cement and water, an average of 90 lb. of cement are required per 100 sq. ft. of surface. The cement is furnished dry in 100-lb. bags.

No. 33 Super-Refractory Cement. Has a processed kaolin or aluminum silicate base, vitrifies at 1000 deg. F. and can be used to 3300 deg. F. for setting fire brick with a bond joint and for plaster coating. From 750 to 850 lb. are required for setting 1000 brick. For plaster coating which averages ¼" thick, 400 lb. are required per 100 sq. ft. The cement is furnished dry in 100-lb. bags.

No. 34 Refractory Cement. Has a chrome base, vitrifies at 1000 deg. F., and can be used to 3400 deg. F. for setting fire brick with a brick-to-brick joint and for monolithic rammed-in linings in certain types of furnaces. For setting fire brick, 600 to 700 lb. are required per 1000 brick. For monolithic linings, about 200 lb. are required for 1 cu. ft. of finished refractory construction. Furnished dry in 100-lb. bags.

No. 35 Super-Refractory Cement. Has a processed alumina base, vitrifies at 1200 deg. F. and can be used to 3500 deg. F. for setting fire brick with a bond joint. Sometimes used for patching. From 750 to 850 lb. are required for setting 1000 brick. For patching, about 130 lb. of cement are required per cubic foot of finished work. The cement is furnished dry in 100-lb. bags.

Plastic Fire Brick Material (P.F.B.M.). Has an aluminum silicate base, vitrifies at 1500 deg. F. and can be used to 3000 deg. F. for heavy patching and the replacing of destroyed brickwork. From 125 to 130 lb. are required per cubic foot of finished work. Furnished plastic, ready for use in 100, 250 and 500-lb. drums.

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TX—Textiles, Papers and Fibres

Asbestos Cloth. A soft flexible textile, resistant to heat and chemicals, which is manufactured from asbestos yarn. It is woven of any standard yarn to weigh a certain amount per sq. yd. Standard widths are 36" and 40", and standard rolls contain 50 linear yards. Asbestos cloth is used for innumerable industrial purposes. Sometimes it is wire-inserted for additional strength.

Asbestos Clothing. Fireproof garments made to order of asbestos cloth. Used as a protection against acid and flame.

Asbestos Cord, Wick and Rope. See "Packings and Furnace Expansion Joints" Section, for the principal applications of these products.

Asbestos Fibre. A fluffy unburnable product, composed of smooth and non-tubular threadlike material, obtained by mechanically treating natural asbestos rock. The different kinds have unique and varied chemical and physical characteristics, which have led to widely diversified industrial use.

Asbestos Listings. Flexible, fireproof, woven tapes, used for wrapping electric wires and hot pipes, and for light conveyor belts and lead-in tapes.

Asbestos Paper. An unburnable paper-machine product, used for many purposes, but principally as a liner and fire-retardant. Furnished in weights ranging from 6 to 35 lb. per 100 sq. ft. Standard widths of roll are 18", 24" and 36". Special grades of asbestos paper are also manufactured to meet specific industrial needs.

Asbestos Roll Board. Similar to asbestos paper and furnished in the same widths of roll, but somewhat heavier. The 3/32" board weighs 53 lb. per 100 sq. ft., and the 1/8" board 68 lb.

Asbestos Roving. The soft, cylindrical strand of asbestos fibre as it comes from the carding machine. It is an intermediate product in the manufacture of asbestos yarn. Furnished in various weights and grades, wound on cheeses or cones.

Asbestos Yarn. A twisted product, spun from asbestos roving, which usually contains small percentages of admixed vegetable fibre. Yarns of more than one ply are sometimes twisted with fine wire for additional strength. Furnished in various weights and grades on spools or tubes.

Braided Asbestos Tubing. Commercially pure asbestos yarn braided cylindrically and wound flat on spools. Used for wire covering and other purposes as a protection against heat and chemicals. Diameters range from 1/64" to 1 3/8".

Specialties

Asbestos Lead Joint Runner. The most convenient and practical device known for pouring lead joints in cast-iron gas and water pipe, or standard salt-glazed vitrified sewer pipe. It is made of specially prepared solid asbestos rope, of square cross section, having a ferrule on each end and provided with a clamp device for fastening in place on the pipe. Manufactured in various sizes to fit iron pipe ranging from 2" to 48".

Ferro Compound. An iron cement which is mixed with water to the consistency of a stiff putty and used for smoothing over and filling up blow holes, sand holes, etc., in iron and steel castings. It is not an ordinary iron paint or putty but a permanent repair. It metallizes in a few hours and becomes like a part of the casting itself. Packed in 1, 5, 10, 25, 50, 100 and 250-lb. containers. Where strong air or hydraulic pressure is to be met, Leak-No Metallic Compound is recommended in preference to Ferro Compound.

Ferrotite. A liquid material for stopping up small sand holes and porous spots inside hollow castings of steel, iron or bronze. It is stirred thoroughly, poured into the cavity, and allowed to remain two or three hours. Then it is poured out and saved, and the castings allowed to stand for three or four hours. The application of pressure when forcing it into the crevices is sometimes advantageous. Standard size containers include 1 and 5 gallon cans, and 50 gallon drums.

Leak-No Metallic Compound. An iron cement which permanently repairs cracks, spongy spots, sand holes or blow holes in anything made of iron or steel. When used according to the directions which accompany each container, it will expand and contract with the metal and will stop any ordinary leak against oil, steam, gas, air, ammonia or water. Leak-No will stand pressure and any heat or chemical action that iron can endure. It requires from four to twenty-four hours to metallize, depending upon the size of the leak and the pressure. Packed in 1/4-lb., 1-lb., 5-lb., 10-lb., 25-lb. and 50-lb. containers. The 1/4-lb. cans are packed 12 to the case.

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INDEX

Celite for Concrete, Mortar and Asphalt Paving Mixtures

(*For complete list of data sheets, see other side of this page*)

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Celite for Concrete, Mortar and Asphalt Paving Mixtures

Complete List of Data Sheets Available

Brochures, Folders, etc.

Celite for Concrete (description, advantages and application), 28 pp. 8½" x 11", form CC-1A.

Celite in Mortars, Plasters and Stuccos (description, advantages and application), 12 pp. 8½" x 11", form CC-4A.

Celite for Concrete and Mortars Folder, form CC-3A.

★Catalog pages

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Celite for Concrete

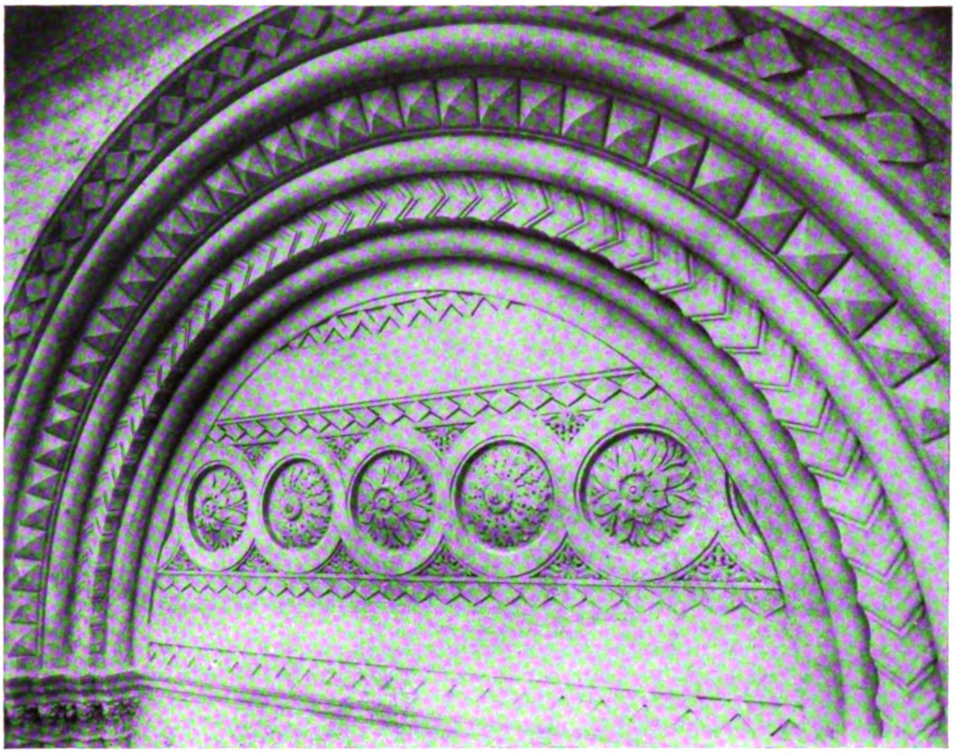

Fig. 1. First Baptist Church, Los Angeles, Calif. 3 lb. or 0.3 cu. ft. Celite per bag of cement in 1:2½:3½ mix. Ornamental details cast in place in plaster mould. Allison & Allison, Los Angeles, Architects; Weymouth Crowell Co., Los Angeles, Contractors

CELITE is a specially prepared grade of diatomaceous silica for use in portland cement mixtures. Because it is practically pure amorphous silica, it is a permanent element in concrete, mortar and stucco and does not affect the time of set. It is produced from practically limitless deposits of constant high quality. The milling and manufacturing operations are closely controlled and the production of material of absolute uniformity is assured at all times. The material is exceptionally light, weighing about 10 lb. per cu. ft., loosely screened.

Celite is not a substitute for portland cement. It acts rather in the capacity of a microscopic or ultra-fine aggregate which serves to impart plasticity, or workability, and provide uniformity in portland cement mixtures.

All of the desirable features of concrete, such as uniformity, strength, water-tightness, appearance, and durability, depend to a great extent on the workability of the mixture. If a mix is not workable it is almost impossible to place it in a uniform, homogeneous mass. Unless a uniform, homogeneous mass is secured, the effective strength, water-tightness and durability of the concrete are reduced.

A degree of workability may be secured by using an excessive quantity of sand but this requires more water, which reduces the strength of the concrete. Excess water is also used in an effort to promote workability, but while this will help to "flow" the concrete into place, segregation of aggregates is difficult to avoid and furthermore, the strength of the concrete is reduced, both by the excess water and the segregation. Concrete may also be made workable by the use of excess cement beyond that required for the necessary strength. This expedient has often been resorted to in the past, but it has the distinct disadvantage of adding greatly to the cost of the concrete.

True workability can be most effectively and most economically secured by the addition to the mix of a small percentage of Celite. The use of this material is the best and most economical means of insuring better concrete under average field conditions.

January, 1931 (Cancelling 4-J-1-A-1 to 1-K, dated February 21, 1929)

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Celite has been used with satisfaction in many large projects throughout the United States and other countries. It has the endorsement of the engineer and the architect because of the pronounced improvement in the quality of the concrete. It is of value to the contractor because of its exceptional effect in producing workability, and because of the savings effected when it is used. In the pages which follow will be found complete information on how Celite is used, as well as considerable general information on the factors which affect the strength, uniformity, watertightness, and other properties of finished concrete.

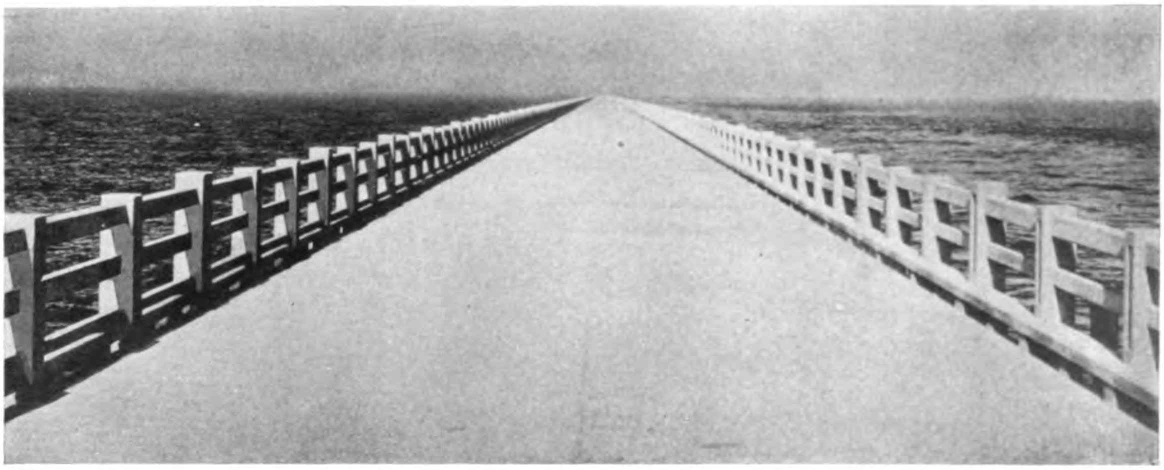

Fig. 2. San Francisco Bay toll bridge, the longest highway bridge in the world—connecting Hayward and San Mateo, California. 2 lb. or 0.2 cu. ft. Celite per bag of cement in 1:1.8:2.08 mix used for piles; slabs made with 3 lb. of Celite per bag of cement in 1:2.8:4.11 mix. San Francisco Bay Toll Bridge Company, A. W. Deuel, Resident Engineer; Waddell and Hardesty, Supervising Engineers; Raymond Concrete Pile Co., Contractors

How Celite is Used

Celite is furnished in the form of a light weight powder in extremely finely divided form. No changes in equipment or in methods of mixing and placing concrete are necessary in order to use it. Celite is packed in sacks for convenient handling and is simply added at the mixer with the other dry materials. The concrete is handled in the usual manner.

Celite is most conveniently used by dumping a bag or several bags of Celite into a box or bin from which it is added at the mixer by means of a bucket, scoop or other suitable measure. The proper amount to use can be quickly gauged by measuring the volume of the weight to be used in any given mix.

The quantity of Celite which should be used depends on the proportions of the mixture and the nature and gradation of the aggregate. In general, more Celite is used to advantage in the mixtures containing the smaller relative proportions of cement, although *in any case the amount of Celite constitutes only a very small proportion of the entire mixture.* In the table which follows, showing amounts of Celite which should be used, minimum and maximum quantities are indicated for each of the five typical mixes given. The exact amount of Celite which should be used is governed largely by the nature of the aggregate. In extreme cases of harsh working aggregate, it is generally advisable to use the maximum quantities of Celite indicated.

Amount of Celite which should be added per bag (94 lb.) of cement

Concrete Mix	Economic Limits	Recommended Average
1:1½:3	1½–3 lb. or 0.15–0.3 cu. ft. Celite	2 lb. or 0.2 cu. ft. Celite
1:2½:3½	2–4 lb. or 0.2 –0.4 cu. ft. Celite	3 lb. or 0.3 cu. ft. Celite
1: 2 :4	2–4 lb. or 0.2 –0.4 cu. ft. Celite	3 lb. or 0.3 cu. ft. Celite
1:2½:5	3–6 lb. or 0.3 –0.6 cu. ft Celite	4 lb. or 0.4 cu. ft. Celite
1: 3 :6	4–8 lb. or 0.4 –0.8 cu. ft. Celite	5 lb. or 0.5 cu. ft. Celite

NOTE: Volumes of Celite to be determined on air-dried material fluffed through an 8-mesh sieve.

Mixing Water:

Only sufficient water should be used in any concrete to insure a thorough mixing of the mass to the desired consistency. With Celite, on account of the increased workability, concrete can be placed at a less slump, or drier consistency, than with plain concrete, and strengths will be improved.

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How Celite Improves Workability

Workability in concrete may be defined as a measure of the effort required to place the concrete. We speak of concrete as being workable when it can be handled and placed in a uniform mass with a minimum of effort. This requires that the concrete shall retain its cohesiveness and not segregate. Excessively wet concrete will go into place readily but it is by no means truly workable because the coarse aggregate settles or segregates and the mass is not uniform.

Proper workability is the basis for all the beneficial qualities desired in concrete construction—uniformity, high effective strength (reduction of extremes between high and low strengths), water-tightness, lower costs for handling, placing and finishing, and the assurance of good appearing concrete.

Anyone observing the way in which concrete made with Celite handles and looks as compared to the same mix without Celite, will quickly grant that there is an improvement in workability and uniformity. That this increase in workability can be measured was first demonstrated by tests made at the U. S. Bureau of Standards.[1] The results of these tests were summarized in a paper read before the American Concrete Institute in 1924, as follows:

> **"The workability of any concrete mixture is about equally benefited by one part of Celite, two parts of kaolin, or three parts of hydrated lime such as used in these tests, if the consistency as measured by the flow table is kept constant. . . . For example, in a 1:2:4 mixture the maximum percentages to be recommended are about 4% of Celite, 8% of kaolin, and 12% of hydrated lime, by weight of cement. The improvement in workability which is effected by these maximum additions, is about that which should be expected from a 25% increase in the cement content."**

Distinction between Consistency and Workability:

The meaning of these two terms is often confused, whereas a sharp distinction should be drawn between them when applied to concrete mixes. Consistency is dependent upon the water content and is measured by the slump or flow tests. Workability is governed by the physical properties of the ingredients and refers to the ease with which the concrete can be properly handled and placed.

[1] "A Penetration Test for the Workability of Concrete Mixtures with Particular Reference to the Use of Certain Powdered Admixtures," A.S.T.M. 1923; and "Economic Value of Admixtures," Amer. Conc. Inst. 1924.

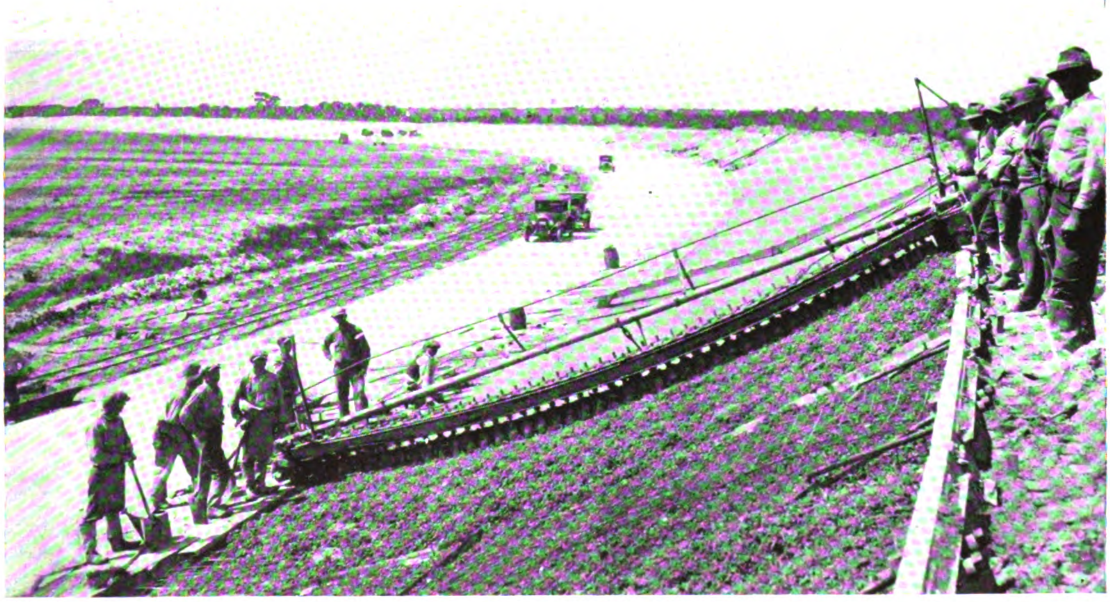

Fig. 3. Test track—2.5 miles long—of Packard Motor Car Co., near Utica, Michigan. 2 lb. or 0.2 cu. ft. Celite per bag of cement gave excellent results, enabling "dry" mix to be used, and giving perfect finish. Uniformity secured with Celite insures full effective slab thickness. R. D. Baker Co., Contractors

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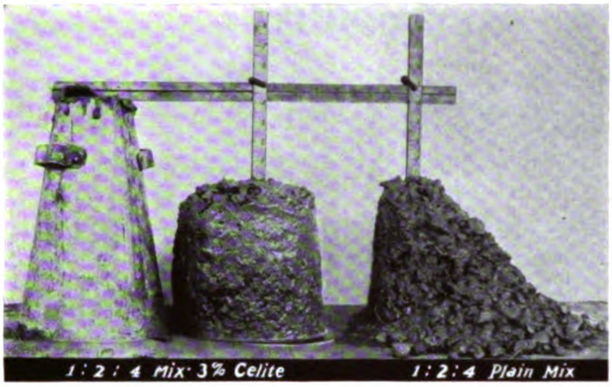

Fig. 4. Slump no measure of workability. Both specimens 1:2:4 mix and same slump, 4". Note that Celite concrete (left) shows far greater cohesiveness and appears richer

For instance, it is quickly recognized that a 1:2:4 mixture of a given slump or flow is easier to mix and place than a 1:3:6 mixture of the same slump or flow. In other words, the richer mixture is the more workable. From this it is seen that similar consistency or the same slump or flow does not imply equal degrees of workability. Figure 4 shows how plain concrete and concrete containing Celite having the same slump may be entirely different in appearance and characteristics.

When added to a concrete mix Celite has a decided drying effect due to its high absorption. Therefore, to retain the same slump when Celite is added to plain concrete, more water must be added. Tests by Pearson and Hitchcock at the U. S. Bureau of Standards, and G. A. Smith at the Johns-Manville Laboratories, show that additional water can be added to concrete containing Celite with no sacrifice of strength. In no case should water be added to concrete containing Celite, in excess of that required to give the same slump as would be used without Celite.

The workability of the mix is increased within certain limits by the use of additional mixing water in the case of concrete containing Celite as well as concrete without it. The point should be borne in mind, however, that the desired workability can be secured in almost every case with a drier consistency when Celite is used in the concrete.

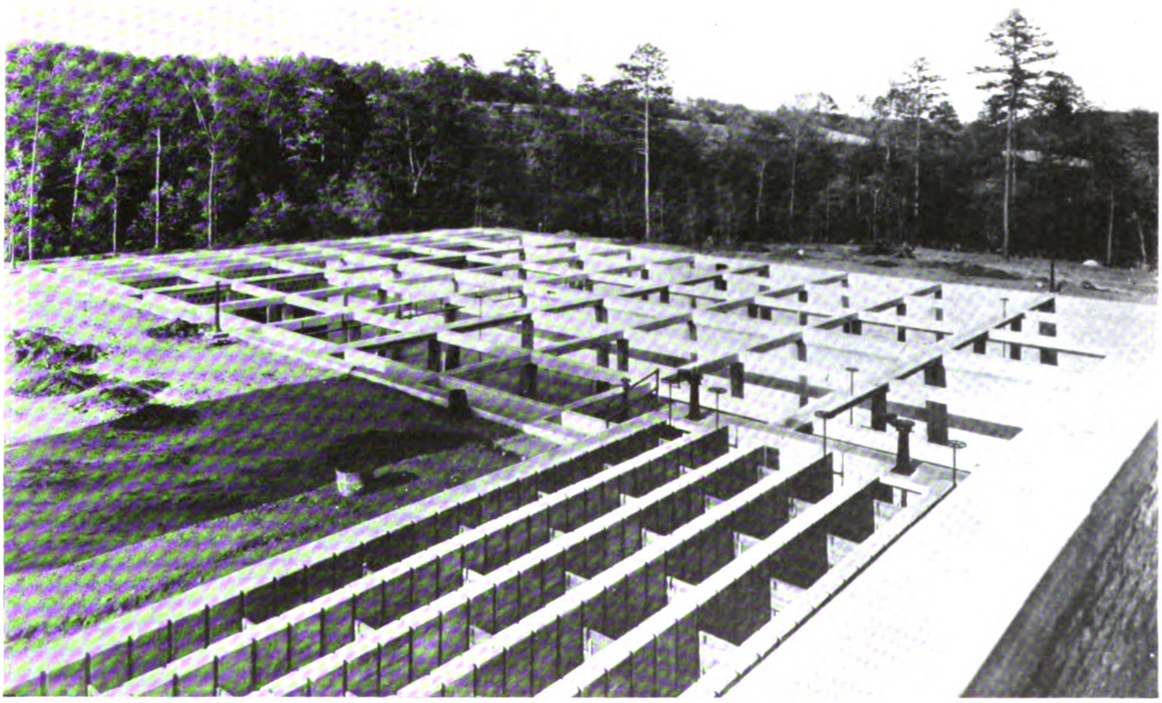

Fig. 5 Filtration plant, City of Spartanburg, South Carolina. 3 lb. (0.3 cu. ft.) Celite used per bag of cement—1:2:4 mix. Thoroughly water-tight job secured. Solomon Norcross & Keis, Atlanta, Georgia, Engineers; Tucker & Laxton, Inc., Charlotte, North Carolina, Contractors

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By securing a more workable mixture of drier consistency, other benefits naturally follow:

Easier and cleaner discharge from mixer.

The concrete can be placed with less labor and manipulation.

It will flow into place in the forms around the most intricate reinforcing, filling completely all corners and recesses.

Relatively dry concrete can be satisfactorily handled by chutes without the need for excess water and without segregation of the concrete in the forms. Celite concrete has been successfully handled in chutes for over 500 feet.

In cases where central mixing is employed no segregation will be encountered in transit from the mixer to the forms, and difficulties in dumping trucks will be reduced.

In concrete gun work, Celite enables drier consistencies and lower pressures to be used without danger of stoppages in the pipe.

When the forms are removed, the concrete containing Celite will be found to have a smooth, uniform texture, free from honeycombs. This type of concrete costs the least to finish.

The greater uniformity of concrete containing Celite insures the maximum degree of water-tightness as well as uniform strength values throughout the structure.

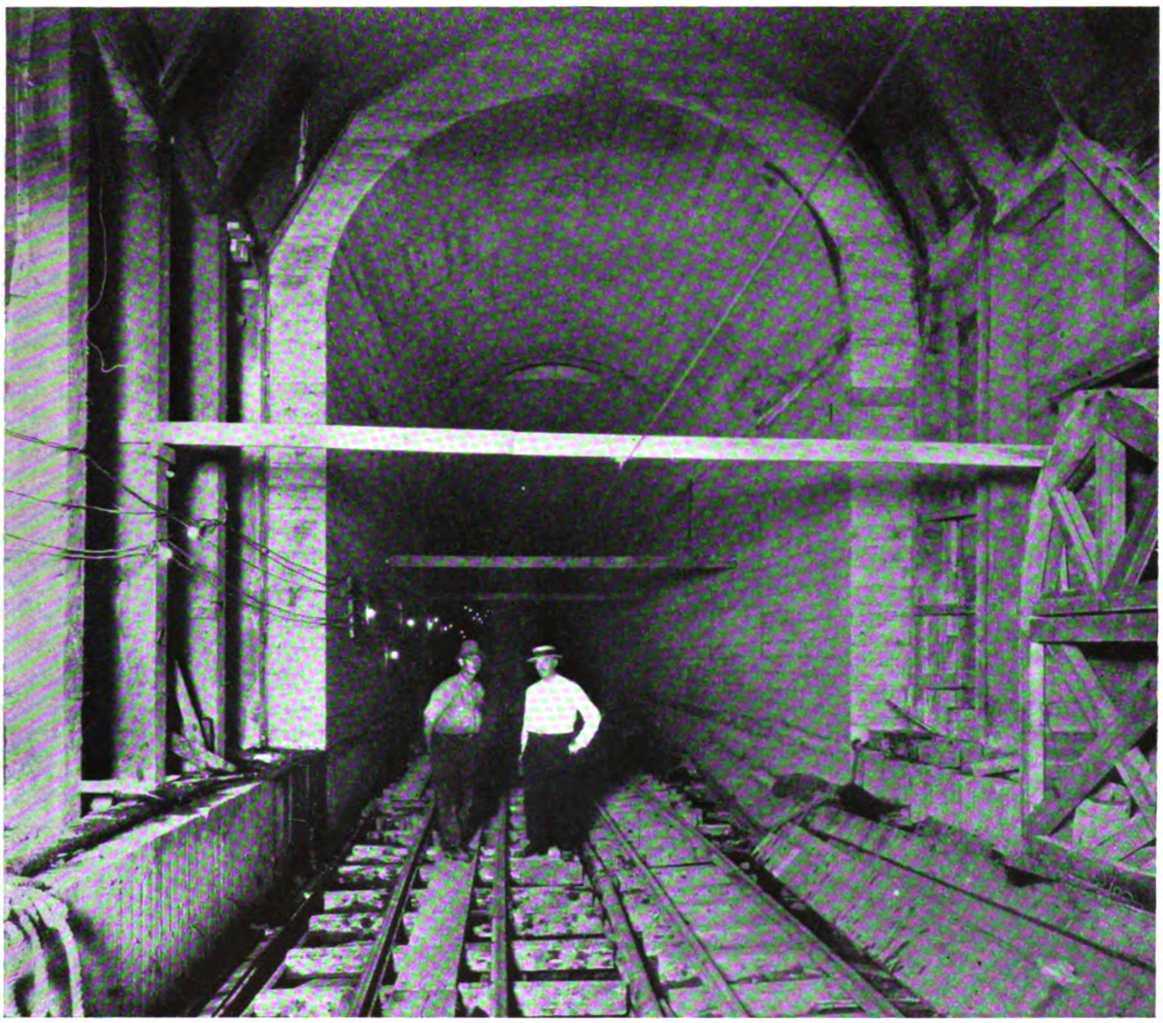

Fig. 6. Cascade tunnel of the Great Northern Railway, Washington. The longest tunnel in the Western Hemisphere. 2 lb. (0.2 cu. ft.) Celite per bag of cement in a 1:2:4 mix. A. Guthrie and Co., St. Paul, Minnesota, Contractors

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The Effect of Celite on Strength and Uniformity

The average strength of a concrete structure does not determine its actual effective strength if there is a great variation in the strength of the different sections. When concrete fails it is analogous to a chain breaking at its weakest link. By eliminating these weak "links" (areas of low strength) and securing a more uniform concrete, the effective strength of the mass is greatly increased.

The more uniform distribution of cement and aggregate, which Celite makes possible, results in more uniform strength values. Thus, Celite provides a factor of safety which enables the placing of field concrete with a degree of dependability not generally possible except under conditions approaching laboratory control. In all cases where cores have been drilled from field concrete it has been found that concrete containing Celite shows far less variation from the average strength than plain concrete placed under similar conditions. In many instances this variation has been reduced 50% or more.

From the water-cement ratio theory we know that the drier the mix (within reasonable limits) the greater will be the strength of the final concrete. There must be sufficient water in a concrete mixture to effect hydration of the cement and to take care of the absorption of the aggregates. In addition to this, extra water is added to give fluidity to the mixture so that it can be handled and placed. It is this extra, or free, water needed for fluidity which reduces the strength of the concrete.

Celite takes up water rapidly in a concrete mix due to its absorbent nature; in fact, the water absorbed by Celite amounts to approximately 200% by weight of the Celite added. Thus, three pounds of Celite will absorb six pounds, or about three-fourths of a gallon, of water, and where the strength of concrete is designed by the water-cement ratio this water absorbed by the Celite must be allowed for. In other words, what may be termed as the "*effective* water-cement ratio" should be calculated. If this is not done job strengths will be considerably higher when Celite is used, than the *initial* water-cement ratio indicates.

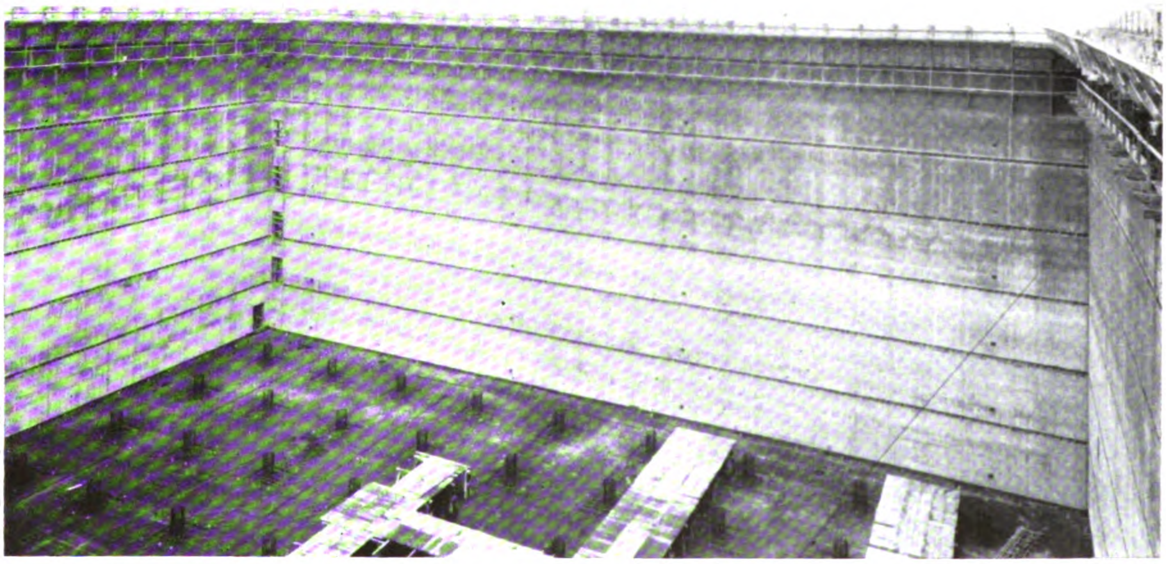

Fig. 7. Cold storage plant of the City Fuel & Ice Co., Cleveland, Ohio. 3 lb. or 0.3 cu. ft. Celite per bag of cement used in 1:2:4 mix. One uninterrupted pour using sliding forms. Not one patch required on entire wall surface. Ball Ice Machine Co., Designers; Blome-Sinek Co., General Contractors; E. W. Sproul Construction Co., Sub-contractors for wall construction

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The drying effect of Celite on a concrete mix is illustrated in Fig. 8. When Celite is added the slump will be reduced if no extra water is used—but the concrete containing Celite will have equal or greater workability and much higher strength. On the other hand, if an additional amount of water is added to offset the drying action of the Celite, the workability will be very greatly increased and, provided that only enough extra water is added to give the same or a lesser slump, the strength will be at least equal to that of the plain concrete.

The following summary of actual tests brings out the fact that plain and Celite concretes of similar consistencies have practically the same strength:

	Plain 1:2:4 Mix	1:2:4 Mix +3%* Celite
Consistency as measured by flow table	91**	90**
Slump—Inches	6.5	6.9
Per cent additional water actually added to Celite mix to give same consistency	....	219***
Initial Water-Cement Ratio	1.046	1.151
Effective Water-Cement Ratio Celite Mix	....	1.055
28-day Strength (average of 15 tests)	2175	2165
90-day Strength (average of 15 tests)	3208	3307

*Based on weight of cement.
**Per cent increase in diameter of original specimen.
***Based on weight of Celite.

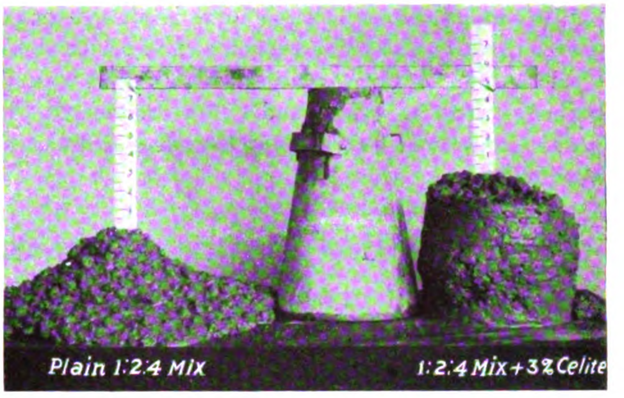

Fig. 8. Drying effect of Celite. Both specimens same mix and water content, specimen on right containing Celite. Note that the plain concrete has a slump of 7½", while the slump of the Celite concrete is 4½". Although Celite dries a mix, the plasticity is greatly improved and the Celite concrete is the more truly workable

Note that two water-cement ratios are shown for the Celite concrete. The *initial* water-cement ratio does not provide for the absorption of the Celite—whereas the *effective* water-cement ratio is calculated by deducting the water absorbed by the Celite (based on 200% by weight of the Celite).

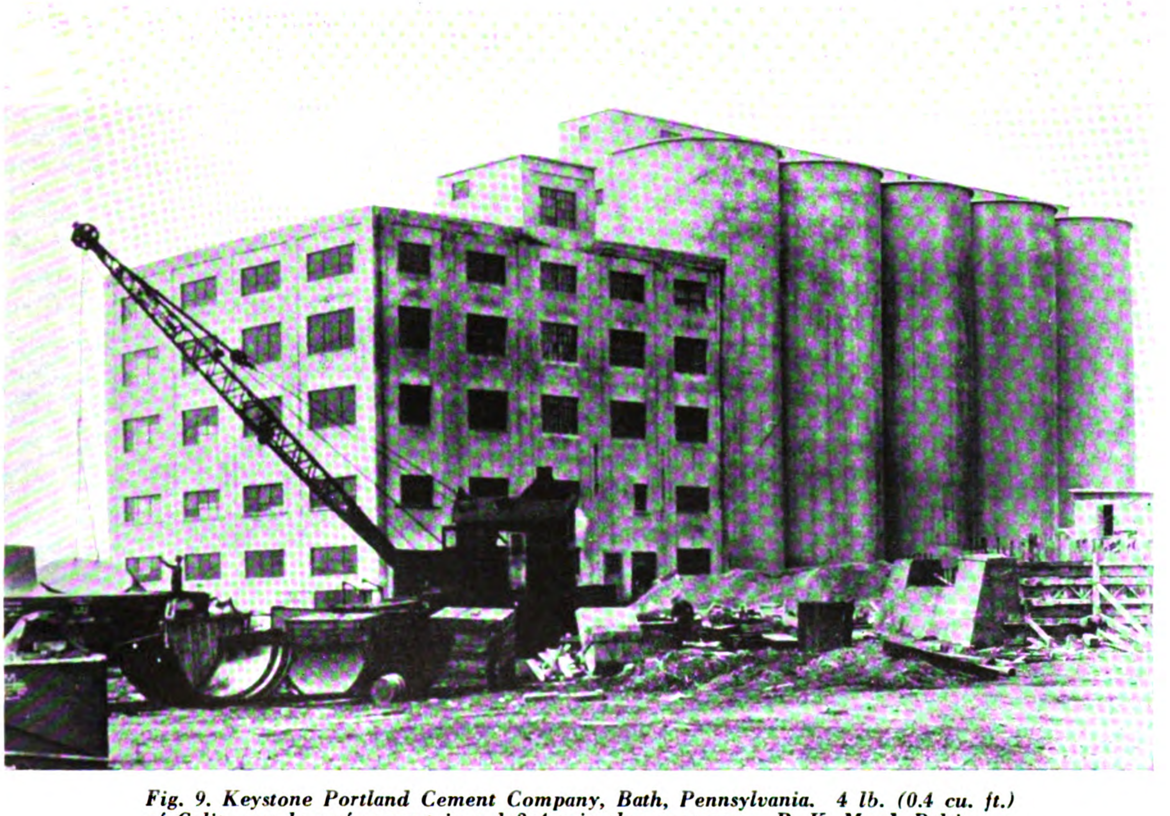

Fig. 9. Keystone Portland Cement Company, Bath, Pennsylvania. 4 lb. (0.4 cu. ft.) of Celite per bag of cement in a 1:2:4 mix slag aggregate. R. K. Mead, Baltimore, Maryland, Consulting Engineer; M. A. Long, Baltimore, Maryland, Contractor

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This indicates that if a job curve is plotted for the predicted strength of any particular mix on the water-cement ratio, approximately equal strengths can be expected from the plain and Celite concretes of the same water-cement ratio (using the *effective* w/c ratio for the Celite concrete).

It should always be borne in mind that in practically all cases drier consistencies can be employed with Celite concrete than with plain concrete, and that in such cases, higher strengths will be made possible by the use of Celite.

Celite Insures Maximum Water-tightness and Resistance to Destructive Agents

Water-tight Concrete:

Celite affords the most effective means which can be employed to insure a water-tight concrete. Water-tightness, with the aid of Celite, is effected in two ways: First, by insuring more uniform concrete with a uniform distribution of voids throughout the mass; and second, by decreasing the void size which is a function of the extreme fineness of the material. Furthermore, due to its siliceous composition it is absolutely permanent and produces concrete of maximum durability.

The following data are taken from tests reported on March 29, 1928, by the Pierce Testing Laboratories, Inc., Denver, Colorado:

Mix	W/C Ratio	Relative Loss of Water	Relative Water-Tightness	Relative Strength 28 days
Plain 1:2:4	0.9	100	100	100
Same +5%* Lime	0.9	65.5	152	128.2
Same +3%* Celite	0.9	31.1	321	128.9

*Based on weight of cement.

Concrete in Sea Water, Sulphate Waters:

The value of finely divided siliceous materials in combining with the free lime which is formed as concrete hardens is particularly emphasized in cases where concrete structures may be subjected to the action of sea water as would prevail in the case of concrete piles, piers, jetties, etc.

Celite, being practically pure silica, is the most effective material which can be used under such conditions. The physical water-tightness insured by Celite is an additional advantage of great importance.

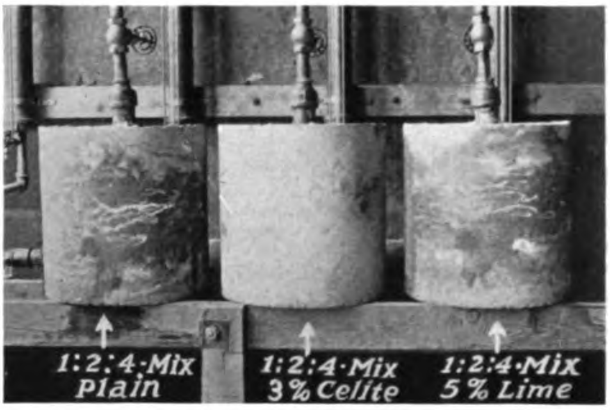

Fig. 10. Permeability test by Pierce Testing Laboratories, Inc., Denver, Colorado. Photographed after completion of test, maximum pressure 200 lb. per sq. in. Note relative dryness of Celite cylinder

Diatomaceous silica was used in a number of concrete ships built during the World War. These hulls have now been exposed to the action of sea water continuously since 1918. Three of these ships were thoroughly inspected in 1926, after having been exposed to the action of sea water for eight years, and the concrete was found to be in perfect condition and thoroughly water-tight.

The use of Celite is also particularly advantageous in other concrete work which is subjected to sulphates, such as concrete electrolytic cells, concrete silos, sewage disposal plants, and structures exposed to drainage or irrigation waters from sulphate soils.

Celite More than Pays for Itself

From the standpoint of the contractor and the man who pays for the finished work, the fact that Celite can be used in concrete at no extra cost is of particular importance.

The cost of using Celite is more than offset in practically all cases by the saving in the cost of placing and finishing, and by the increased yardage of finished concrete which is secured.

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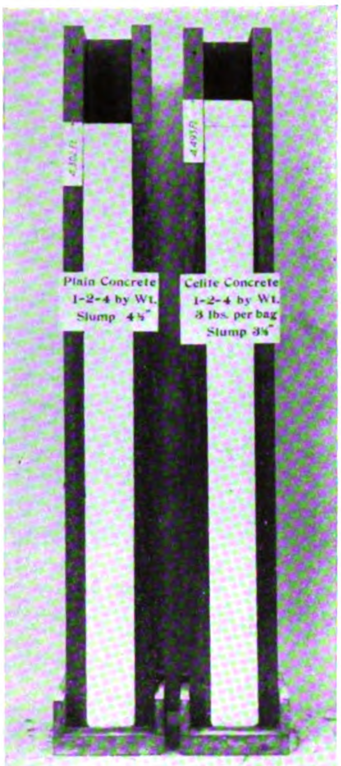

Fig. 11. Columns cast with equal quantities cement and aggregates. 5% average increased yield secured with Celite in above mix

The testimony of contractors handling concrete construction of every type shows clearly that the labor costs of placing and finishing can be greatly reduced with the aid of this material, due to the improved workability and better finish secured.

Also, the increased volume or yield of concrete will in most cases cover the cost of the Celite used. This increased yardage is the result of adding additional solid material to the mix in the form of microscopic particles which not only serve to fill the smaller voids in the concrete but also add to the volume of the mixture. Celite is added in small percentages by weight but these small weight additions occupy relatively large volumes. The addition of three pounds of Celite per bag of cement in an average 1:2:4 mix will result in an increase of from four to five per cent in the total volume of the finished concrete.

Yield tests have been made by many engineers and laboratories. A test by the Robert W. Hunt Company, Chicago, Illinois, is typical of the average results secured: Screen tests were made on the materials used and all materials carefully measured. Two columns of concrete were poured, one of plain 1:2:4 mix and the other the same mix containing 4% of Celite by weight of cement. The increased yield secured in this test amounted to 6.12%.

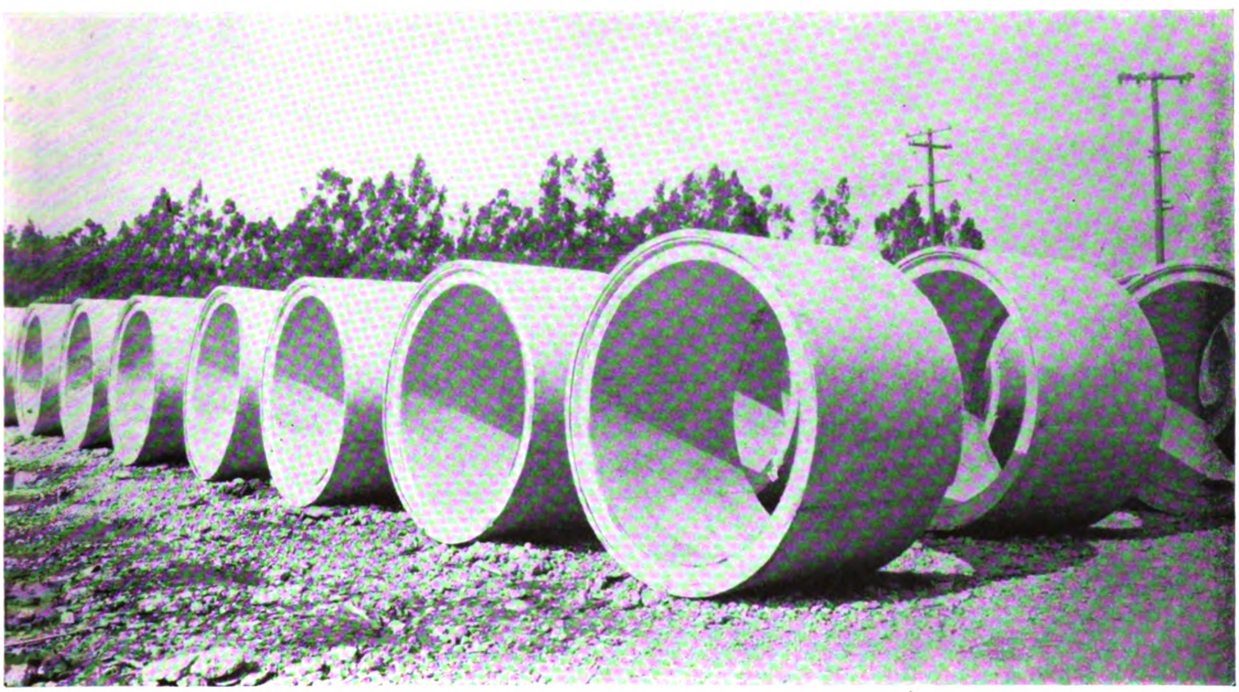

Fig. 12. Many concrete pipe manufacturers are using Celite and securing a better product at a lower cost. The pipe pictured above are 1:2:4 mix with 3 lb. Celite (0.3 cu. ft.) per bag of cement

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Fig. 13. Bayway Terminal Warehouse, Bayway, New Jersey. 3 lb. Celite (0.3 cu. ft.) per bag of cement in a 1:2:4 mix. Used on entire job. Particularly excellent finish secured on floors. Shore Construction Co., Newark, New Jersey, Contractors

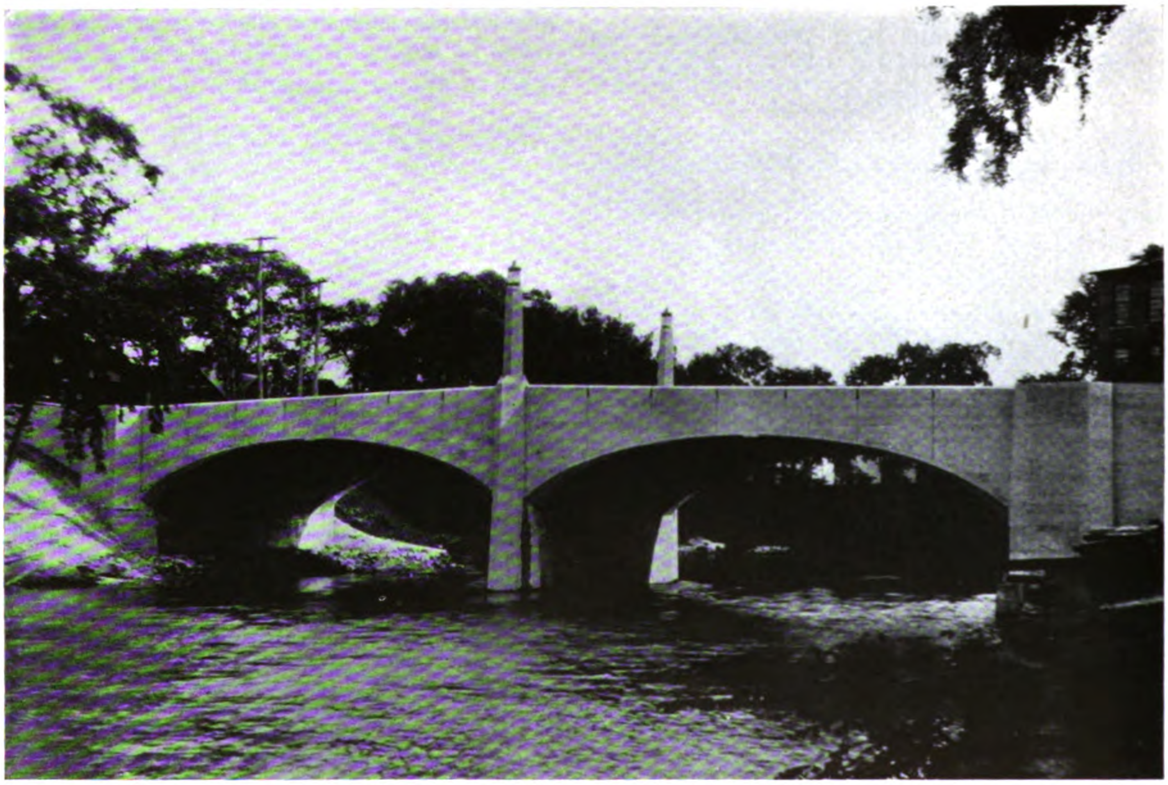

Fig. 14. Canal Street Bridge, Nashua, New Hampshire. 25 tons Celite used on job. Fred T. Ley & Co., Inc., Springfield, Massachusetts, Contractors; J. R. Worcester & Co., Boston, Massachusetts, Engineers

Celite in Mortars, Plasters and Stuccos

ARCHITECTS and engineers have long recognized the advantages of Celite in improving quality of mortars, plasters and stuccos. Masonry and plastering contractors also are familiar with its benefits in increasing plasticity and working properties and otherwise contributing to better results in their work.

Celite is a specially prepared grade of diatomaceous silica of exceptionally high purity and uniformity. Its structure is such that it acts as an extremely finely-divided aggregate which imparts increased plasticity to a mortar mixture and reduces the void size, thus assuring an impermeable finished job of neat appearance and uniform strength.

Celite is furnished in the form of a light weight powder, packed in sacks for convenient handling. It is added to the mixture with the other ingredients, the mixture being handled in the same manner as usual. No changes in equipment are required.

Celite Improves Plasticity:

The proper use of Celite in portland cement mortars, plasters and stuccos will be found effective in correcting the "short working" qualities of these mixtures. In comparing a mortar in which Celite is used with a plain cement mortar, it can be readily seen that the Celite mortar is the more "fatty" and "buttery" of the two, has a better slip under the trowel, and spreads more readily.

Texture and Appearance:

A finished job of neat, clean-cut appearance naturally follows as a result of this improvement in the plasticity and working qualities of the mixture. The mortar has the ability to stand up on the brick without slopping over and the joints can be "cut" and "struck" without disfiguring the surface. Stuccos and plasters will also have a desirable sharpness of detail

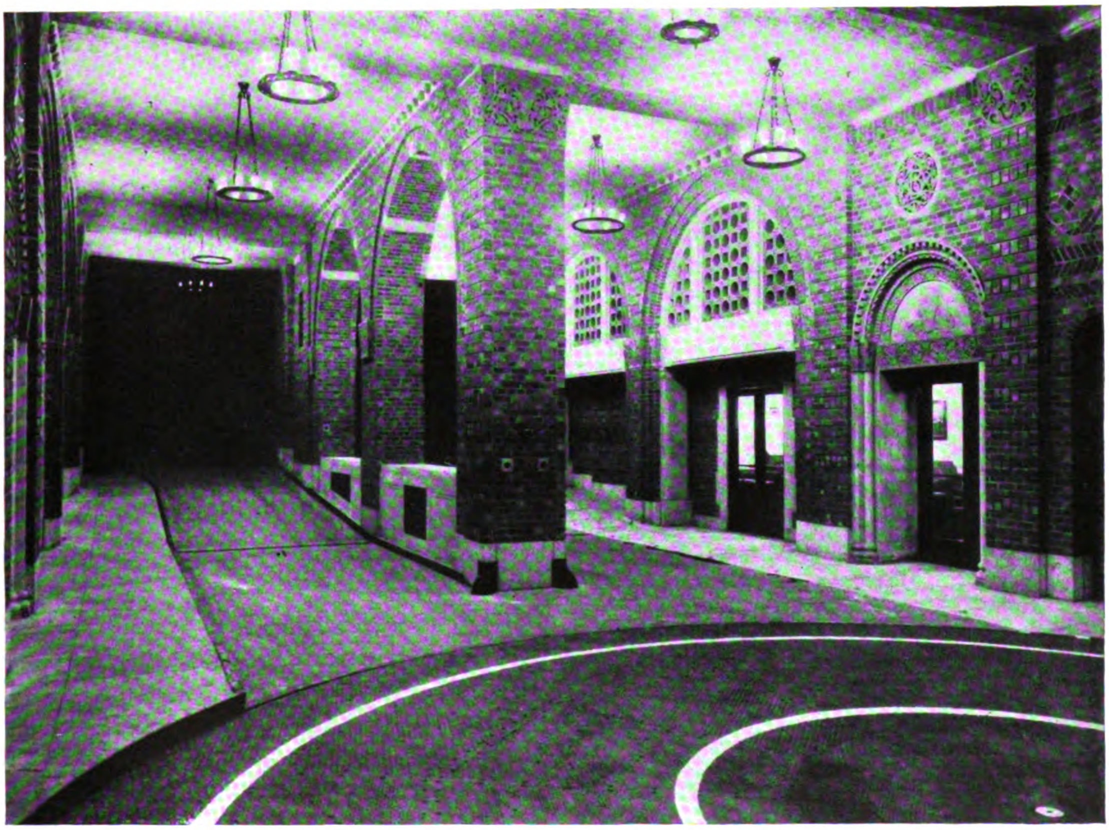

Fig. 1. Baltimore & Ohio Railroad Bus Terminal, New York City. Celite was used to increase the working properties and spread of the mortar mixture. Sloan & Robertson, New York, N. Y., Architects; Chas. T. Wills, Inc., New York, N. Y., Contractors

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and the various textures required for special finishes are more readily obtained.

Effect of Celite on Strength:

The bonding strength of a mortar is another important factor which is largely governed by the plasticity of the mixture. By making a mortar "fatty" and easier to spread properly in all classes of masonry work, the addition of Celite helps to insure a strong bond. The advantage of Celite in this connection is further emphasized by its ability to hold the water within the mortar, thus allowing more time for the placing of the brick before the workability of the mixture has been lost.

Comparative tests have definitely proved that the compressive and tensile strengths of a portland cement mortar in which Celite is used will be at least equal to, if not greater than, those of a plain cement mortar of similar proportions.

Impermeability of Celite Mortars:

In order to prevent seepage of water into the walls, a mortar should be made as nearly impermeable as possible. Its resistance to seepage depends upon the size and distribution of the voids, which in turn are determined by the "fattiness" or plasticity of the mortar and the quantity of mixing water used.

Fig. 2. The use of Celite in brick mortars improves the working properties of the mixture, increases the spread and helps to assure an impermeable joint of neat appearance

When Celite is used, a minimum amount of mixing water is required to produce this desirable plastic condition. Furthermore, the addition of the minute

Fig. 3. Nurses House, Department of Mental Diseases of Commonwealth of Massachusetts, Waltham, Mass. Celite was used in all mortars in proportions varying from 0.6 to 0.8 cu. ft. (6 to 8 lb.) per bag of cement. Gordon Robb, Boston, Architect; Cummings, Matthews Co., and C. S. Cunningham & Sons Co., Boston, Contractors

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Celite particles serves to fill in the open spaces in the mixture, reducing the void size and resulting in a more uniform distribution of the voids throughout the material. Celite mortars, because of their greater water-tightness, are better able to withstand frost action, and have maximum resistance to the destructive effect of extreme weather conditions and to the penetration of water and moisture.

Efflorescence:

Efflorescence, the white deposits that form on the surface of many masonry jobs, sometimes presents a serious problem to the contractor. Such deposits, which are also objectionable from the standpoint of architect and owner, result from the dissolution of soluble salts in the materials used. These salts are carried in solution to the surface and left there upon evaporation of the moisture. Obviously, the condition is more likely to occur with a porous mortar than with one which is resistant to the penetration of water or moisture. Water entering through shrinkage cracks may also start efflorescence.

Celite is an inert material containing no soluble salts and, therefore, cannot cause efflorescence in itself. It is, moreover, effective in retarding the formation of these deposits by assuring full, impermeable joints. Due to the relative dryness of mortars in which Celite is used, there is also less shrinkage upon setting and drying and consequently less possibility of water entering through shrinkage voids.

Fig. 4. 75 Prospect Street Apartment, East Orange, New Jersey, 0.6 cu. ft. (6 lb.) Celite per bag cement in 1:3 mix for mortar. Concrete made with 0.3 cu. ft. (3 lb.) Celite per bag cement in 1:2:4 mix. John B. Peterkin New York, Architect; Salmond Scrimshaw Co., Arlington, New Jersey, Owners and Contractors

How Celite is Used in Mortars, Plasters and Stuccos

Celite is used in varying proportions in the different mortar, plaster and stucco mixtures, the amounts being determined by the mix itself and by the advantages sought through the addition of the Celite. In general, however, it will be found that the recommended averages as given below will prove satisfactory as to strength, cost, appearance and weather-resisting qualities from the standpoint of contractor, engineer, architect and owner. For practical purposes in job measurement, the weight of Celite, loose, may be considered as 10 lb. per cu. ft.

Cement-Sand Mortars:

Celite is added to a portland cement and sand mortar in the proportion of from one-half to one cubic foot* (5 to 10 lb.) per bag of cement. An addition of 0.6 to 0.8 cu. ft. (6 to 8 lb.) per bag of cement is recommended for the usual 1:3 portland cement mortar mixture. This amount, when used with the average sand, will make a mortar of these proportions "fat" and of excellent working qualities with a good spread. If a coarse, washed sand is used, a larger proportion of Celite can be added to produce the desired working qualities. Celite prevents the water from being absorbed from the mortar at too rapid a rate and allows the proper bonding of the succeeding course of brick, stone or other masonry units.

On many jobs, hydrated lime is added to portland

*Volumes referred to are based on loose (not packed) measurement.

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cement mortars to impart plasticity. Celite can be used either with or without the lime for this purpose, but it cannot be substituted for the cement. It will, however, make a cement mortar "fat" and "buttery," so that no lime is required in the mixture.

Portland Cement Stucco and Plaster Mixtures:

Celite is added to stucco and plaster mixtures in the same proportions as are used in mortars to make these mixtures plastic and workable. Portland cement plaster containing Celite will spread easily, finish with sharper detail and withstand severe weather conditions. A very satisfactory plaster can be obtained by using the following mixes:

Scratch Coat:

3 cu. ft. of clean sharp sand, 1 sack portland cement, 0.5 cu. ft. (5 lb.) Celite, and sufficient fibre.

Brown Coat:

3 cu. ft. of clean sharp sand, 1 sack portland cement, 0.5 cu. ft. (5 lb.) Celite.

Fig. 5. United Artists Theatre Building, Detroit, Michigan. C. Howard Crane, Architect; Walbridge-Aldinger Co., Contractors. Celite was used in all mortar and concrete

Fig. 6. Villa Riviera, Long Beach, California. Celite proved highly satisfactory in the stucco mixtures used in the construction of this large cöoperatively-owned apartment. Richard D. King, Los Angeles, California, Architect: Kinne & Westerhouse, Los Angeles, California, Contractors

The use of portland cement mortar mixtures for stucco and plaster work that are richer than 1 part cement to 3 parts sand, should be avoided because of the excessive shrinkage in these rich mortars. A leaner mix with Celite as a plasticizing agent prevents excessive shrinkage.

Lime and Gypsum Mortar and Plaster:

When lime-sand mixtures are used without cement, the addition of 1 to 1½ cu. ft. (10 to 15 lb.) of Celite per bag of lime will increase the plasticity and spread. The strength will be increased and a better mortar or plaster will result.

Celite will also produce "fattiness" when used with lime mortar where the lime has been "over-burned" or with a gypsum mortar where the gypsum works "short" or "dead." In some cases, natural cements and masonry cements work "short" on the job. The addition of Celite to these mortars will also result in an improvement in their working qualities.

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Celite for Asphalt Paving Mixtures

Fig. 1. Celite used with excellent results in asphalt paving on Chapala Street, Santa Barbara, Calif. Richardson Construction Co., Santa Barbara, Calif., Contractors

Celite, diatomaceous silica in extremely finely divided form, is widely used in sheet asphalt paving mixtures to increase stability, or shear strength. In the manufacture of Celite, the material is carefully selected and milling is closely controlled to insure high purity and uniformity at all times. Celite weighs approximately 10 lb. per cu. ft., loosely screened. Chemically, it consists of practically pure amorphous silica (SiO_2). In fineness, about 92% will pass a 200-mesh sieve, although the bulk of the material is of such microscopic size that the particles are measurable only by elutriation methods. It has a high voidage content, from 75% to 80%.

The final test of any sheet asphalt mixture is its durability in use. It should not soften excessively in hot weather, or crack in cold. It should not rut under traffic. Various engineers and laboratories engaged in the testing of asphalt paving mixtures agree that the properties of sheet asphalt which determine its behavior and durability in service can be best determined by measuring its shear strength, or stability.

Various methods of measuring stability are employed. In one method, stability is measured by the load required to shear off the free section of a cylindrical test specimen, both ends of which are held in a frame or mould. In another method, a cylindrical test specimen is held in a cylindrical mould equipped with a snugly fitting plunger, and stability or shear strength is measured by the load required to start movement of the mixture through a circular orifice in the bottom of the mould.

Effect of Celite in Asphalt Paving Mixtures:

Celite has been thoroughly investigated by various asphalt engineers, both in the laboratory and in the field, and has been found to give superior types of

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mixtures when incorporated in correct quantity to a properly proportioned mix.

Because of its peculiar needle-like and cellular structure with the tremendous surface exposed per unit of weight, Celite has a great deal more pronounced effect in hardening, toughening and strengthening the finished asphalt than have the more or less spherical-shaped particles of limestone dust or portland cement. This effect is so pronounced that 1 part by weight of Celite replaces 4 to 5 parts by weight of the usual fine mineral filler such as limestone dust, portland cement, etc., to give considerably higher shear strengths or stability.

A Celite mix is easy to rake. Under the roller it works ideally without crawling, checking, or honeycombing. Most of the compression is obtained under the first rolling.

In an asphaltic concrete base or binder course, Celite prevents lateral motion and aids stability. Celite streets show less moving and cracking than those laid with the ordinary mixes.

In sheet asphalt work Celite minimizes rutting, buckling and cracking. It enables a mix to be laid which is sufficiently plastic so that it will not crack and which has sufficient rigidity so that it will not buckle.

Recommendations:

For sheet asphalt paving mixtures of sand, asphalt cement, and finely-divided mineral fillers in which limestone dust or portland cement are used as the mineral fillers, Celite is used to replace 25% by weight of the limestone dust or portland cement to obtain approximately double the shear strengths of the straight limestone dust and straight portland cement mixtures.

For sheet asphalt paving mixtures of sand, asphalt cement, and Celite as the finely-divided mineral filler, quantities of Celite from 3½% to 5% of the total weight of the mixture give considerably higher shear strengths.

In asphaltic concretes where from 2% to 6% of finely-divided mineral filler is used (based on the entire weight of the mix) the finely-divided mineral filler can be replaced upon a volume basis by Celite to give a more durable and tenacious mixture.

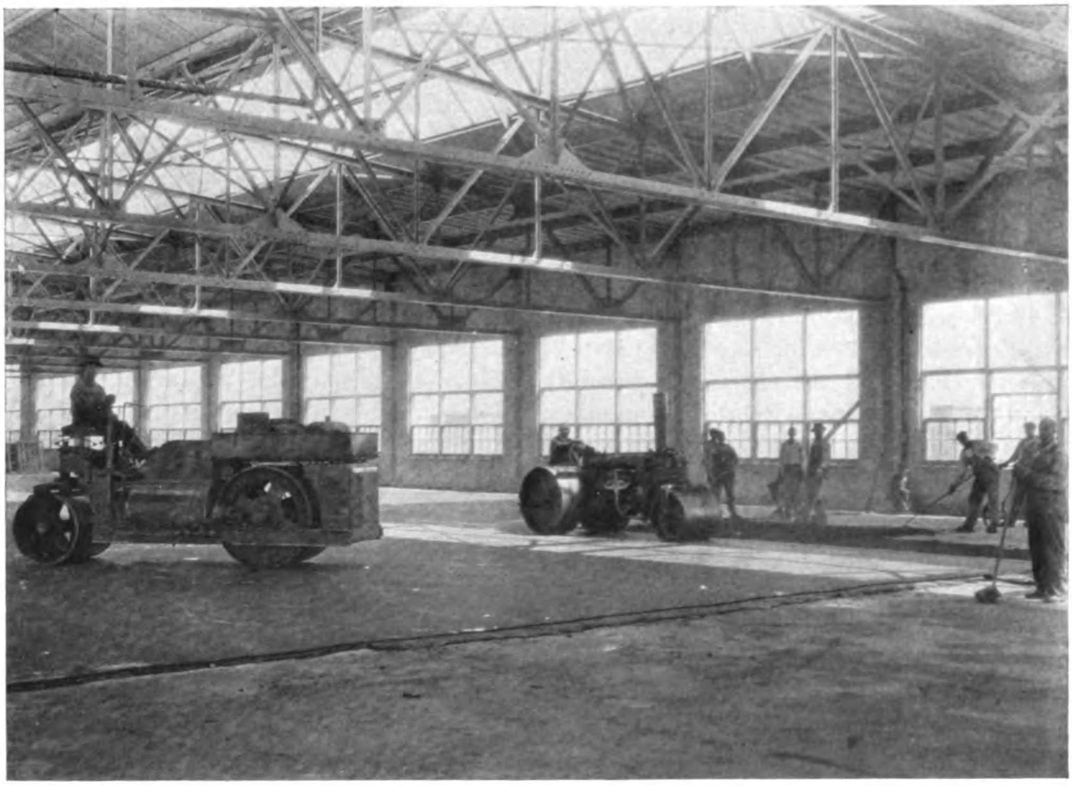

Fig. 2. In the plant of the Kohler Company, Kohler, Wisconsin, Celite was used in 20,000 square yards of asphalt flooring.

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Floorings

(*For complete list of data sheets, see other side of this page*)

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Floorings

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Car Flooring:

Reducing the Weight of Car Flooring (J-M Truss Plate, Masticoke, Magnesite, Tile Flooring Type A) 16 pp. 8½" x 11", form RR-11-A

Tile Flooring, Type A:

Description and application, 16 pp. 8½" x 11", form FL-1A

★Catalog pages

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J-M Industrial Flooring

J-M Industrial Flooring on Pier B of the Canadian Pacific Ry. at Vancouver, B. C.

J-M Industrial Flooring has a wider range of adaptability than any other floor surfacing material. It is monolithic and smooth. It will not crack or buckle under atmospheric changes. It will not ravel or grind out under severe traffic. It is resistant to the action of most acids, brines and alkalies. It is waterproof, vermin-proof, fire-retardant, dustless, warm, and resilient under foot. Not only is the initial cost of installation low, but maintenance costs are lower than for similar types of flooring.

J-M Industrial Flooring consists of a selected mineral aggregate bonded with asphalt. The mineral aggregate in the finished floor depends upon the thickness of the floor but usually ranges in size from that which passes a 3/4″ screen down to that passing a 200-mesh screen, so graded as to secure the smallest percentage of voids obtainable in practice. The asphalt which is used to bond the aggregate is selected for the conditions to be encountered in service.

To insure the proper percentage of fine mineral aggregate and its thorough mixing with the asphalt, J-M Industrial Flooring Blocks, composed of asphalt, limestone dust or silica flour, and sand in certain fixed proportions, and weighing approximately 84 lb. each, are manufactured at the factory.

On the job these blocks are melted down, at approximately 450 deg. F., with J-M asphalt fluxes, and combined with the coarse mineral aggregate, such as torpedo sand, gravel, or crushed stone or granite. The hot mastic is then poured into place and spread to the proper thickness.

The floor can be put into service as soon as it has cooled.

J-M Industrial Flooring Blocks:

To meet various conditions, J-M Industrial Flooring blocks are manufactured in four types: Standard, Acid-Resisting, Acidam, and Special No. 20. The first two are most frequently used.

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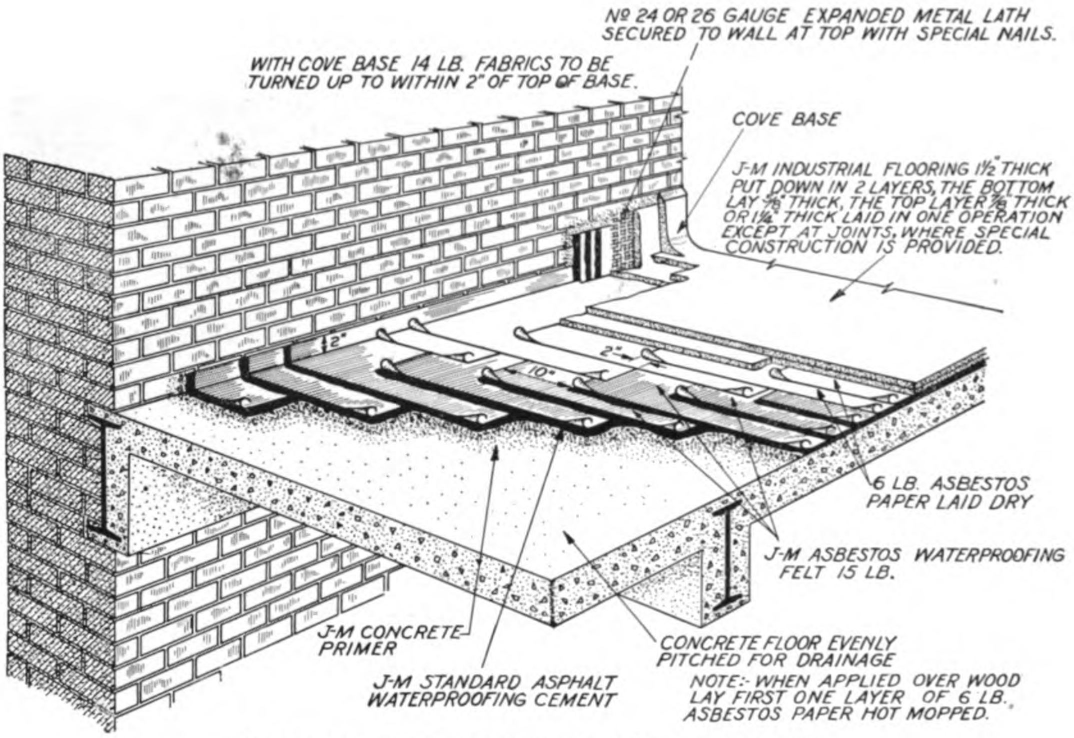

Construction details of J-M Standard Industrial Flooring

Standard Block: Composed of 15% asphalt, 25% sand, and 60% limestone dust (at least 75% of the limestone dust passing a 200-mesh screen).

Acid-Resisting Block: Made of 18% asphalt, 32% silica sand, and 50% silica flour. Silica flour is used instead of limestone dust because of its resistance to most acids.

Acidam Block: Also acid-resisting. Used almost entirely for tank lining. The asphalt in this block has a higher softening point than that in the Standard or Acid-Resisting blocks, as this material is used on vertical surfaces and also must withstand higher temperatures than those ordinarily encountered by flooring material.

Special No. 20 Block: Contains 20% asphalt and 80% limestone dust. The asphalt in this block is somewhat harder than that in the Standard or Acid-Resisting blocks. As this block contains no sand, smaller quantities are required for laying a finished floor than with the other types. This is of advantage at points to which high freight rates apply. It is slightly higher in price than the other blocks.

J-M Asphalt Fluxes:

J-M Asphalt Fluxes, shipped with the flooring block, vary in consistency from asphalts much harder than that used in the block itself, to those somewhat softer, and are designated by their penetration figures, as No. 5, No. 15, No. 25, No. 40, and No. 60. The lower the number (or penetration), the harder the asphalt. With the asphalt in the block having a 25 penetration, Flux No. 40 or No. 60 will naturally soften the floor. The reverse is true with the harder fluxes, Nos. 5 and 15.

No. 5, the hardest flux, is used where extreme service conditions are encountered, and temperature changes are not abrupt. Adapted for temperatures ranging from 75 to 90 deg. F.

No. 15 is a medium hard flux and is recommended where service conditions are severe and temperature changes are more or less abrupt. Adapted for temperatures ranging from 50 to 75 deg. F.

No. 25 has the same penetration as the matrix of the blocks and is used where an increase in asphalt content is desired.

No. 40 is a medium soft flux, and is recommended

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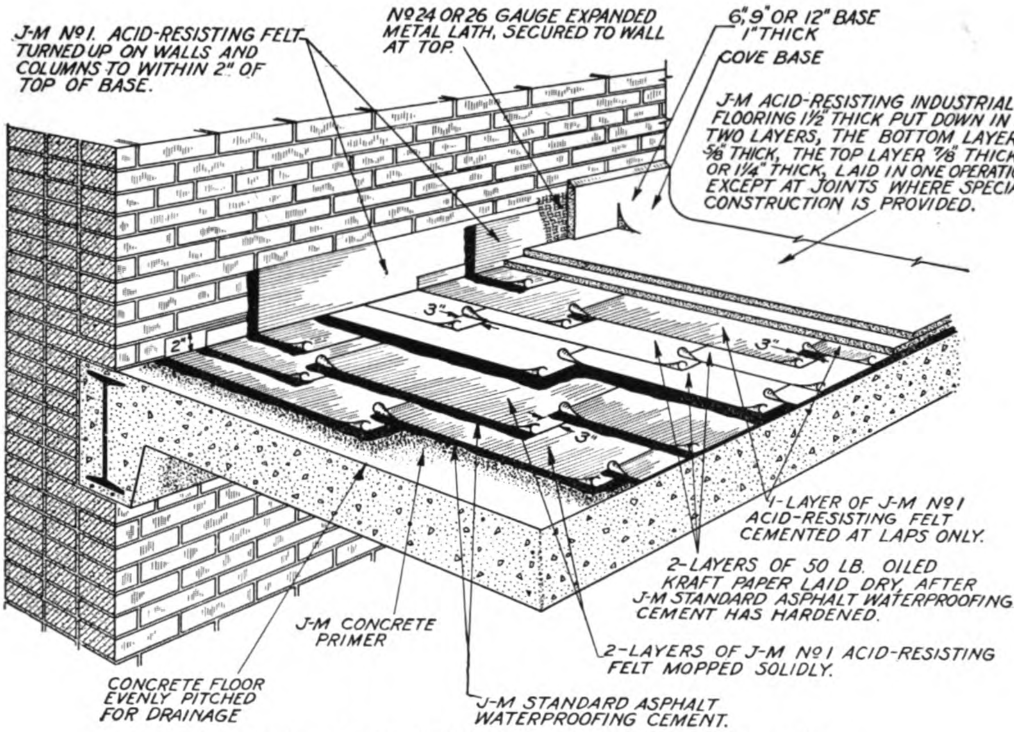

Construction details of J-M Acid-Resisting Industrial Flooring

for floors in rooms having temperatures ranging from 30 to 50 deg. F.

No. 60 is the standard soft flux, generally used in cold room work and for refrigerator floors where continued low temperatures provide all necessary hardness. Recommended for temperatures below 30 deg. F. Also used for waterproofing work where Industrial Flooring protection is provided over a waterproofing membrane, principally on bridge floors and on roofs.

Floor Thickness:

J-M Industrial Flooring is laid in various thicknesses from 1″ to 3″, according to requirements. A 1″ thickness is generally specified for foot traffic, 1¼″ for average light trucking, 1½″ for heavy trucking and 2″ or 3″ for exceptionally heavy duty such as steamship piers, docks, and railroad loading platforms.

It can be laid over any substantial base such as wood, concrete, brick or tile, which in itself is strong enough to carry the required load without excessive vibration. The Industrial Flooring does not add structural strength. It is merely a floor covering or topping to protect the base over which it is applied.

J-M Industrial Flooring weighs approximately 12 lb. per sq. ft., 1″ thick; other thicknesses in proportion.

Uses of Industrial Flooring:

The uses of J-M Industrial Flooring are almost unlimited. It is suited not only to heavy foot or wheel traffic in industrial plants, factories, warehouses and institutions, where the floors suffer severely from general hard usage, but, because of the adaptability of its construction and its peculiar natural qualities, is a highly satisfactory top flooring in public buildings, school houses (corridors, stair treads, basements, locker and wash rooms), railroad platforms and concourses, freight houses, machine shops, chemical laboratories, packing houses, laundries, battery rooms, gymnasiums and hotel or restaurant kitchens. In fact, for every type of building, except residences, the wear-resisting, sanitary, non-slip, waterproof, noiseless and fire-retarding qualities of J-M Industrial Flooring make it a logical floor surfacing.

Exceptional Conditions:

There are unusual floor conditions which demand special attention. Ordinary indentations of heavy

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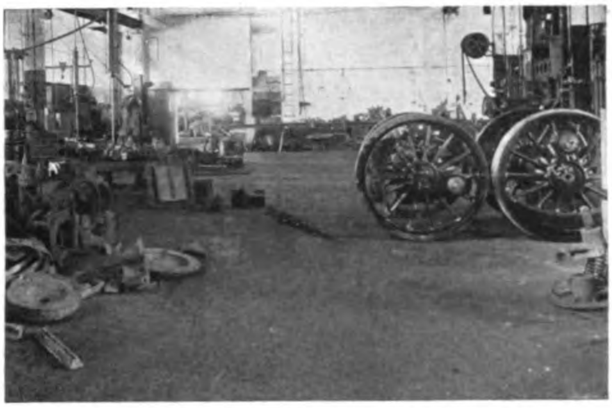


J-M Industrial Flooring at the Holcomb Steel Co. plant, Syracuse, N. Y.

loads will iron out of J-M Industrial Flooring under traffic, but where temperatures are high and loads are left standing on small bearing areas for long periods of time, such indentations cannot be expected to iron out readily. Such conditions are generally found around printing and punch presses and similar equipment. Armor plates should be used in such cases.

Oil drip or splash in machine shops and around screw cutting machines, etc., necessitate a certain amount of protection in the way of sawdust or sand to absorb the oil. This is nothing more or less than "good housekeeping" which is necessary for any type of flooring, not only to protect the floor, but also from the standpoint of neatness around the plant. A slight amount of oil is not harmful to J-M Industrial Flooring, but will rather tend to increase its life.

For roof gardens, promenade roofs, etc., where the flooring is exposed to the direct rays of the sun, it is likely that during the heat of the day the flooring will become quite soft, and chair and table legs will penetrate the floor to some depth. Such marks will not iron out under the light traffic the roof receives. Strips or glass domes under the legs of the chairs and tables will increase the bearing surface and reduce such indentations.

On roofs that may be used for gymnasium purposes or tennis courts, etc., a J-M Built-Up Roof or membrane waterproofing should be applied before the Industrial Flooring is installed. The flooring in this instance provides a protection for the roofing material and allows the roof to be used for the purpose intended.

Acid Resistance:

Where there are acid conditions, every flooring has certain limitations. There is no such thing as an *acid-proof* floor. Some acids will destroy the asphalt, and others the silica aggregate. J-M Acid-Resisting Flooring is, however, highly acid-resistant. J-M Industrial Flooring material will stand up under certain acid conditions at normal temperatures when the same acids, heated, would destroy them. In general, J-M Acid-Resisting Flooring will withstand the action of acids at normal temperatures, as follows:

Sulphuric Acid: J-M Acid-Resisting Flooring will prove satisfactory under this acid up to a 50% solution at room temperatures. Acid-Resisting floors are not guaranteed to resist heated sulphuric acid, although laboratory tests would indicate safety on unconfined acid of 50% concentration at temperatures up to 125 deg. F.

Hydrochloric Acid: A 35% solution of commercial acid in water at room temperatures has practically no effect on J-M Acid-Resisting Flooring materials.

Nitric Acid: A 20% solution of nitric acid will not affect J-M Acid-Resisting materials at room temperatures, but, above that percentage and temperature, the acid has a decided effect. Warm nitric acid is very injurious.

Hydrofluoric Acid: A 45% solution will dissolve silica rapidly. J-M Acid-Resisting Flooring in many cases has withstood the action of a 10% solution satisfactorily but generally it is not recommended where hydrofluoric acid conditions prevail.

J-M Acid-Resisting Industrial Flooring in the laboratory at Williams College, Williamstown, Mass.

When the floor is exposed to mild, organic acids, J-M Industrial Flooring will give more satisfactory service than any other type, provided it is kept clean by daily flushing with hot water and a cleanser. Without such proper maintenance, any floor will give trouble under similar conditions.

Battery rooms require a flooring not only immune to the action of the acids used, but which also will withstand the static load of the batteries without an appreciable settlement of the battery supports into the floor surface. J-M Industrial Flooring, of a particular specification, has met these requirements in a manner satisfactory to such concerns as the Electric Storage Battery Company, the New York Edison Company and the New York Telephone Company.

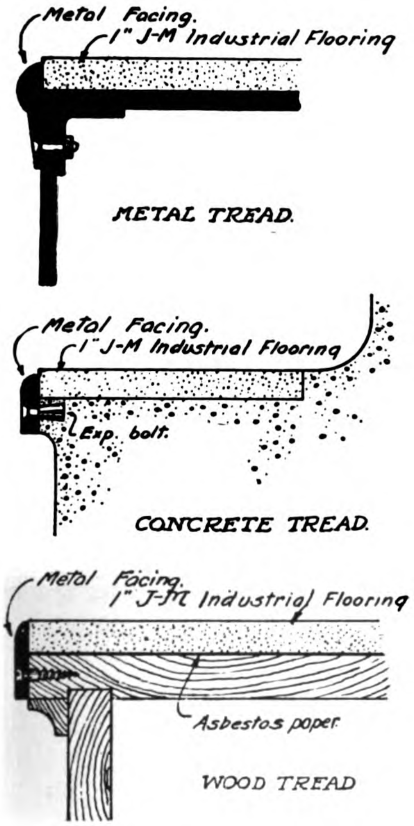
The following table compiled from authoritative data shows the various properties of J-M Industrial Flooring and other types of flooring. The numerals indicate the comparative value of the floor in question, based on 100 as absolute.

Comparison of Floorings

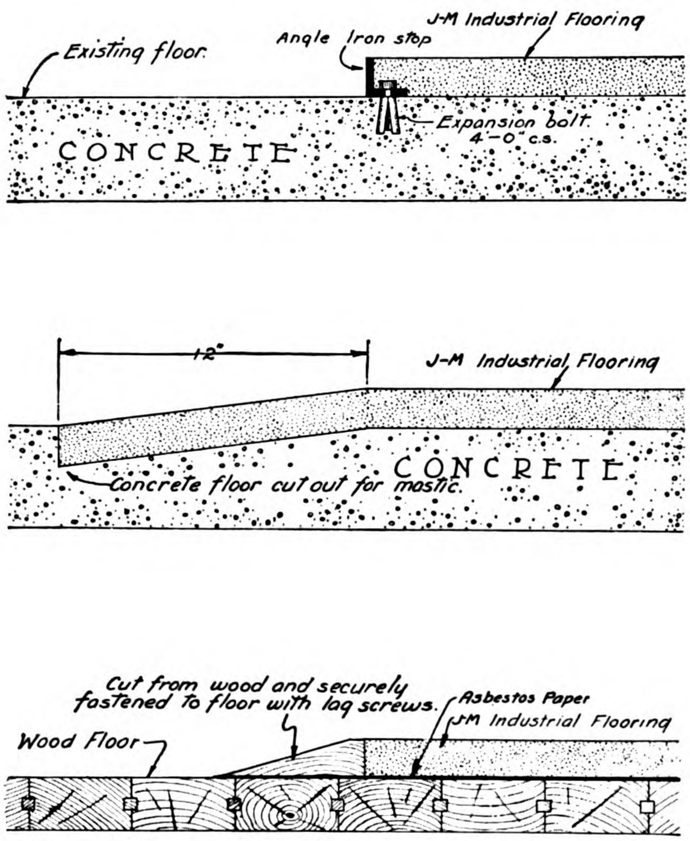
	J-M Industrial Flooring	Common Brick	Paving Brick	Concrete	Maple	Oak	Pine
1. Acid-Resistant	100	80	100	50	30	33	30
2. Alkali-Resistant	100	95	100	70	90	90	80
3. Durable	75	50	100	90	50	50	40
4. Elastic	60	0	5	1	90	90	80
5. Fire Resistant	75	100	100	100	0	0	0
6. Non-Abrading	95	0	30	10	95	95	88
7. Non-Slip	100	100	30	70	50	50	60
8. Quiet	75	10	5	5	50	50	60
9. Resilient	90	0	4	1	90	90	90
10. Sanitary	70	6	50	40	35	35	0
11. Thermal Insulation	60	10	0	5	90	90	90
12. Waterproof	100	0	10	60	25	25	25
Average	83.3	38.4	44.5	41.8	57.9	58.2	53.6

Repair:

When accident or unusually severe use causes wear in spots, repairs are made more easily, more economically and more satisfactorily with J-M Industrial Flooring than with any other type. The affected portion may be chiselled out, remelted with the proper amount of flux and aggregate, and re-laid. The patch becomes an integral part of the original floor, with no unsightly edges.



J-M Industrial Flooring stair tread details



Details of connection between J-M Industrial Flooring and existing floors

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J-M Industrial Flooring Plank No. 45

25,000 sq. ft. of ½" Industrial Flooring Plank No. 45 at the Stern-Auer Shoe Co., Chillicothe, Ohio, have stood up under chairs and small-castored hand trucks for over a year—and remain as smooth as when laid

Johns-Manville Industrial Flooring Plank No. 45 is manufactured from selected asphalts, fibres and fillers which are compressed into rectangular planks or slabs 12" x 24" in ⅜" and ½" thicknesses.

It possesses considerable resilience although capable of supporting heavy loads. The material is waterproof, odorless, quiet, dustless and never corrugates, checks, splits, warps or decays.

It is recommended for use on warehouse or manufacturing floors where a suitable base or sub-floor exists and where heavy static loads are not resting on small bearing areas. In such installations as shoe factories, loading platforms, transfer platforms, freight house floors and trucking aisles, Industrial Flooring Plank No. 45 stands up under the extremes of light hand trucking and severe motor trucking.

Industrial Flooring Plank No. 45 is not a substitute for mastic flooring. There are certain conditions where Industrial Flooring Plank is giving satisfactory service where a hot mastic flooring would not be recommended. The material must be expected to mark to some extent under static loads with small bearing areas and does not afford as fast and easy hand trucking with heavy loads on small wheel platform trucks as obtained over concrete floors. It should not be used where acid conditions exist or in the presence of vegetable or animal oil or hot drippings of any kind. It requires a waterproof membrane beneath to make a completely waterproof job.

J-M Industrial Flooring Plank will eventually conform to the contour of the underfloor. When laying Industrial Plank over old wood or concrete floors, irregularities in the floor should be smoothed to a level surface by patching with cement grout or cold sand mastic. Aside from some stiffening effect, the plank does not impart structural strength. The sub-floor must support the specified load.

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Application

The governing factor in determining the proper thickness of Industrial Flooring Plank No. 45 is the base upon which it is to be laid. Over steel plate, troweled concrete surfaces and new wood sub-floors possessing no appreciable irregularities and offering a continuous solid base, the 3/8" thickness is recommended. Over screed finish concrete, floors that have been patched, and wood sub-floors where there is a space of from 1/8" to 1/4" between members, 1/2" Industrial Flooring Plank should be used. Where openings greater than 1/4" are encountered, they should be filled with a suitable material or a metal strip used to bridge the openings.

The sub-floor should first be brought to a plane surface with differences in elevation not exceeding 1/8" in six inches. When the sub-floor is wood, adjacent members of the sub-floor must not differ in elevation more than 1/16", while the spacing between members should not be more than 1/4". Worn, irregular concrete should be brought to a plane surface by flushing and troweling with cement grout.

Over a wood base, Industrial Flooring Plank No. 45 is applied in J-M Tile Cement. It is possible to apply the material with nails, using 8d casing nails, spaced 2½" from the edge and not more than 10" apart, but this is not recommended for industrial trucking surfaces. Application over wood in J-M Tile Cement makes a faster trucking surface in addition to protecting the wood from moisture. Laying the plank in Tile Cement costs no more than nailing and may be accomplished more rapidly.

Over concrete, Industrial Flooring Plank No. 45 is laid in J-M Tile Cement, which is applied cold at the rate of about 50 sq. ft. per gallon. When laid over steel plates, the asphalt cement may be J-M Regal Roof Coating or J-M Waterproofing Asphalt No. 6. Over felt and other waterproof surfaces only J-M Waterproofing Asphalt No. 6 should be used.

The joints between planks should be closed as tightly as possible by crowding each plank, as it is laid, against those already in place.

At the Elkland Leather Co., Elkland, Pa., Industrial Plank No. 45 provides a durable surfacing for transfer platforms and other locations subjected to severe traffic

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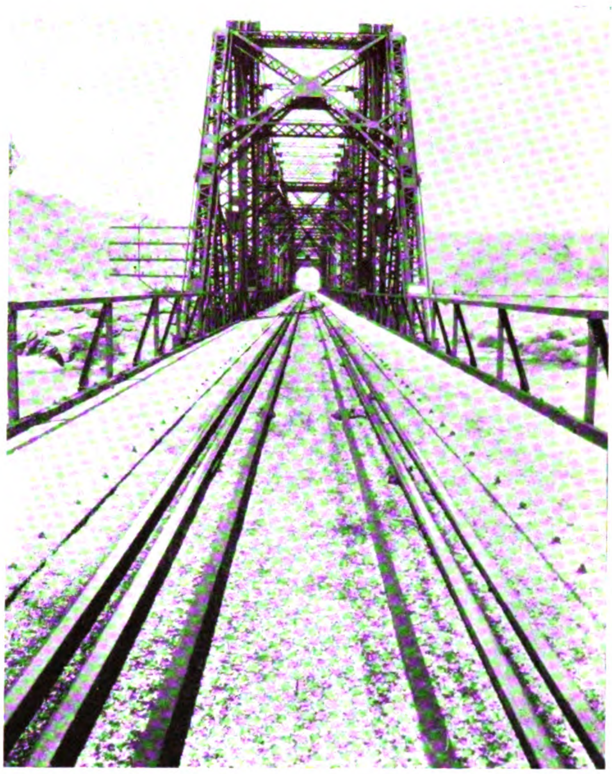
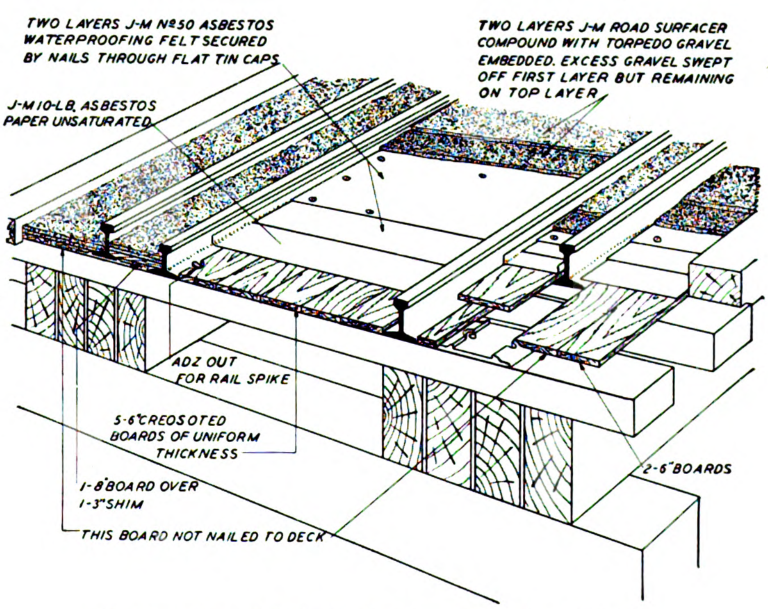
Fire-decking for Railroad Bridges

To guard the timber work of railroad trestles and bridges from the fire hazard of locomotive droppings, molten brake shoes, etc., and provide a waterproof protection against the elements and drip from cars, Johns-Manville furnishes a built-up fire-decking, composed of creosoted planking over the ties, on which is laid one course of J-M 10-lb. Asbestos Paper (unsaturated), over which is shingled two layers of J-M No. 50 Asbestos Waterproofing Felt, the felts and paper nailed to the planking by galvanized nails through flat tin caps. Over the felt is applied two layers of J-M Road Surfacer Compound, into which washed torpedo gravel is rolled.

J-M Road Surfacer Compound is an asphaltic product of low melting point, shipped in drums of approximately 475 lb. It is heated, on the job, to 350 deg. F., and spread over the Asbestos Felt to a thickness of approximately 1/8″. Into the hot compound is rolled a 1/4″ to 1/2″ thick layer of gravel which will pass a 1/2″ screen and be retained on a 3/16″ screen. Any surplus gravel which does not adhere to the Road Surfacer Compound is swept off the first layer. A second layer of compound is then applied, followed by a second layer of gravel, rolled in, all of which is allowed to remain for a weather surface.



J-M Fire-decking on 1300-ft. bridge over the Colorado River



Construction of J-M Fire-decking for Railroad Bridges

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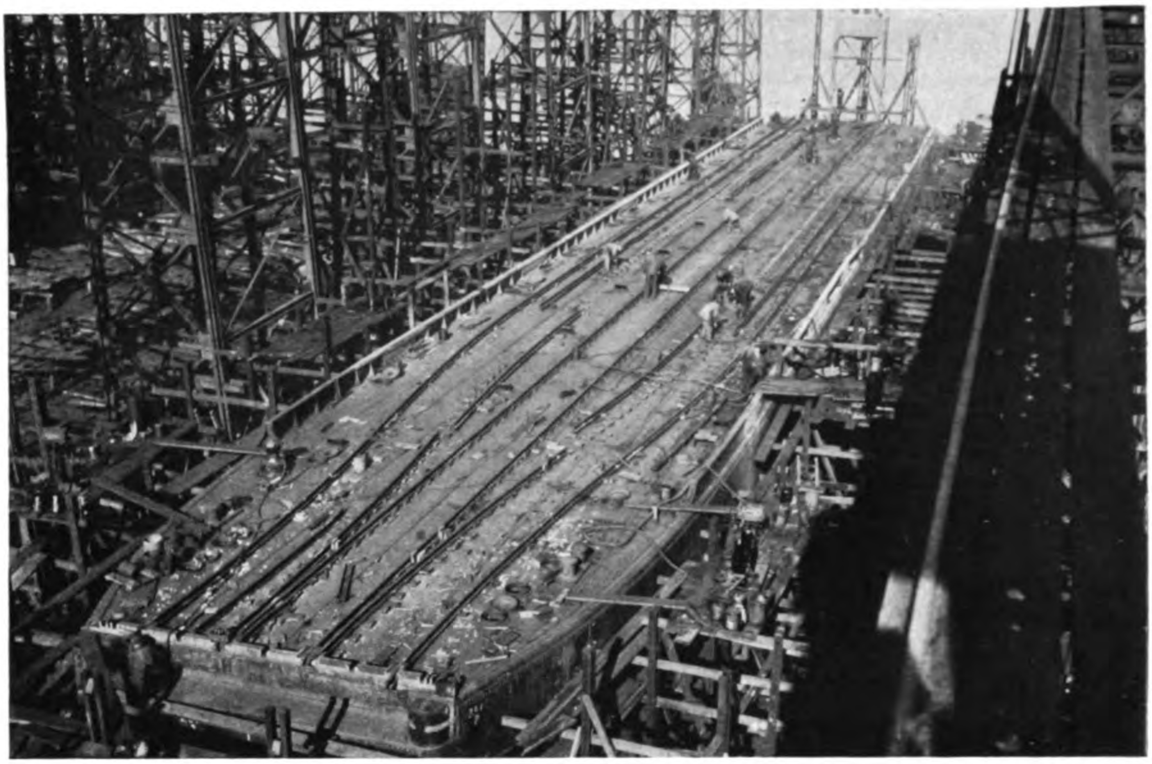
J-M Asphalt Boat Deck Covering



J-M Asphalt Boat Deck Covering on a car-float

J-M Asphalt Boat Deck Covering is a composition mastic of asphalt and fine aggregate, similar to J-M Standard Industrial Flooring, furnished in blocks which are melted down with an asphalt flux of a penetration depending upon service conditions, poured in place and screeded to the desired thickness.

It is designed to prevent rust and corrosion of the steel decks of car-floats, tugs, cargo vessels, and similar marine equipment and thus eliminate the continual expense of removing and replacing protective coatings of paint.

It has been successfully used on a number of car-floats of the New York Central, the Erie and the Sante Fe railroads.

Application:

After the steel surface has been thoroughly cleaned of rust, paint, grease, etc., it is heavily coated with J-M Concrete Primer, which is allowed to dry for at least 12 hours.

Onto the dry priming coat one layer of J-M 15-lb. Asbestos Waterproofing Felt is hot-mopped with J-M Standard Asphalt Waterproofing Cement.

Over this felt the Asphalt Boat Deck Covering, melted to 450 deg. F., is applied in one or two coats to a thickness of $\frac{3}{4}''$ to $1\frac{1}{2}''$, depending upon conditions of service to which the deck will be subjected.

When the Asphalt Boat Deck Covering has cooled, the deck may be immediately put in service.

Repairs to spots accidentally damaged may be made easily by cutting out the affected portion, adding the scrap to a sufficient quantity of new material, re-melting the mixture, pouring it in place and leveling. By piling the hot material for a short time on the cut edges to soften them, the patch will make a perfect bond and become an integral part of the deck covering.

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J-M Asphalt Bridge Plank

J-M Asphalt Plank on bridge for Ohio State Highway Department, Circleville, Ohio

J-M Asphalt Bridge Plank is a light-weight, durable, waterproof, resilient, shock-absorbing material for bridge flooring.

The increasing demands of vehicular traffic necessitate a wearing surface material of these characteristics for the roadway of bridges, particularly steel structures. For these, J-M Asphalt Bridge Plank is of particular advantage, since reducing the dead weight on the structure is desirable and the floor is the only section of the bridge where such reduction may be obtained. On the more or less obsolete bridges built before the advent of the automobile and motor truck, the weight of the floor slab and pavement is also of vital importance.

Numerous traffic surfaces have been developed for bridge work but, with few exceptions, their maintenance is costly, they do not adequately protect the sub-floor from injury, and they are not sufficiently resilient to reduce vibration. Among the exceptions are pre-formed slabs of fibrous, asphaltic nature.

J-M Asphalt Bridge Plank is a mixture of asphalt, fibre and finely divided mineral filler, principally Celite, pressed under heat into slabs. The standard sizes and approximate weights are:

Size	Approx. Weight, lb. per sq. ft.
½" x 12" x 48" Straight Side	3.75
¾" x 12" x 48" " "	5.63
1" x 12" x 48" " "	7.25
1¼" x 8" x 72" Straight Side or Ship Lap	8.75
1½" x 8" x 72" " " " " "	10.50
2" x 8" x 72" " " " " "	14.00

Straight sides are used principally on bridge work as this form of plank is most economically applied, while the ship-lap edge is designed primarily for waterproofing protection, since, because of the overlapping edges, it knits together somewhat more readily.

Selection of Proper Thickness and Size:

The 1" or 1¼" thickness is recommended for all bridges where the traffic count is less than 5000 per day, provided vehicles do not follow exactly the same path.

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Where the traffic count is greater than 5000 or, regardless of density, should vehicles follow exactly the same path, the 1½″ thickness should be used. Occasionally it is necessary to apply the plank over a worn and irregular sub-floor. Under such conditions, no less than 1½″ thick material should be used, or under extreme conditions, 2″.

The ½″ and ¾″ thicknesses are recommended for use on sidewalks, ramps, elevated station platforms, stair treads and other areas where no static or heavy moving loads are encountered and service is principally foot traffic. For more severe service, J-M Industrial Flooring Plank No. 45, described on another data sheet, is recommended. Asphalt Bridge Plank, ½″ and ¾″ thick, is also used in two layers with broken joints for protecting membrane waterproofing. This construction is superior, for this purpose, to one layer of thicker plank.

Characteristics of J-M Asphalt Bridge Plank

Light in Weight:

A most important characteristic. J-M Asphalt Bridge Plank offers the unique feature of a heavy-duty, traffic-bearing surface which is only slightly over half the weight of concrete and far lighter than mixtures of mineral and asphalt or tar. This advantage in weight is obtained through judicious use of Celite as a filler, which weighs but ten pounds per cubic foot.

Not only does Celite impart the decided advantage of light weight, but it also results in many other desirable characteristics, among which are an increase in resistance to temperature and greater toughness and stability.

Highly Stable:

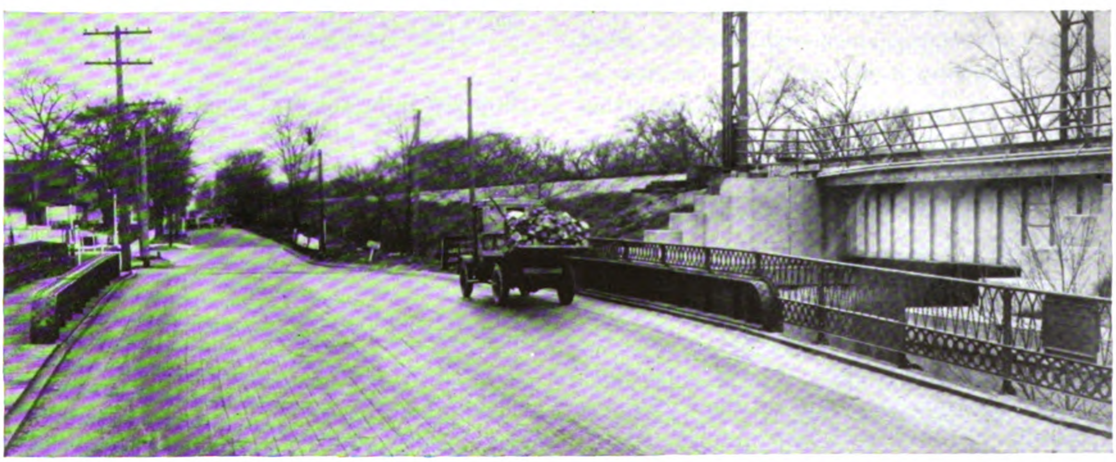
Asphalt Bridge Plank does not cold-flow or surface-corrugate. The fibrous filler used is responsible for the resistance to cold-flow, the horizontal movement of the pavement surface which creates waves in the surface. The fibres interlock and mat together, so that a high degree of stability is maintained.

Tough Under All Temperatures:

Celite, the principal mineral filler used in J-M Asphalt Bridge Plank, is a finely divided, siliceous mineral powder, with a *true* specific gravity of 1.9 to 2.0. (Its low density is responsible for its weight of 10 lb. per cu. ft.). Chemically, Celite consists of almost pure amorphous silica, which is totally unaffected by any atmospheric temperature. In fineness, about 95% will pass through a 200-mesh sieve. Each particle of Celite has a definite size and shape, being of a peculiar needle-like and cellular structure, and it has a much more pronounced effect in hardening and toughening the finished plank than have the approximately spherical-shaped particles of other mineral fillers such as limestone dust, portland cement and rock dust. These latter materials also have relatively higher specific gravities.

Knits and Heals under Traffic:

The peculiar ability of Asphalt Bridge Plank to knit together and heal under traffic is directly trace-



J-M Asphalt Bridge Plank on West Railroad Ave., Evanston, Ill.

able to the high percentage of asphalt it contains—not less than 30%. Adjacent slabs under the ironing action of traffic will in time *knit together* so uniformly that the joint disappears. By *healing under traffic* is meant the disappearance of indentations made in the surface by steel tires, treads of caterpillar tractors, calks on horse shoes, etc. Asphalt Bridge Plank is not a hard, unyielding material. On the contrary, it is relatively easily indented, but, due to its high asphalt content and the fibrous filler, such indentations are ironed out, or closed up, by passing wheels.

Many years ago metal was looked upon as the most resisting tread for vehicular wheels, yet rubber has demonstrated its superiority due to its ability to absorb impact and dissipate the resulting forces. Similarly, the hardness of a traffic surface has little to do with its satisfactory performance. Asphalt Bridge Plank does not possess any great degree of hardness, but it does possess the ability to yield—and *recover*.

Does Not Become Brittle in Cold Weather:

Many types of bituminous pavements become objectionably brittle at low temperatures and disintegrate under frost action. The special asphalt and fibre content of Asphalt Bridge Plank keeps it from being so handicapped, as is demonstrated by the fact that nails may be driven through it near the edge, at zero temperature, without splitting the slab.

Countersinking nails in J-M Asphalt Bridge Plank

Cutting a J-M Asphalt Bridge Plank

Easily Applied:

In form, each Asphalt Bridge Plank resembles a piece of lumber and may be handled in a similar manner. The principal difference lies in its flexibility. It should always be remembered that, unless applied to a practically continuous base, the material will sag. In storing Asphalt Bridge Plank, care must be taken to pile it on a plane surface, and not more than five feet high.

J-M Asphalt Bridge Plank is applied to a wood sub-floor simply by nailing the slabs in place, taking care to make tight joints in the manner described in following pages. No special tools are required. There is no tendency for nails to work up through the plank as the shank of the nail is heavily coated and preserved with asphalt, and further, the countersinking of nail heads permits the surface to close over the nail and lock it in place.

On concrete, the plank may be laid in either hot or emulsified asphalt.

In cutting slabs, a chisel or the blade of a hatchet should be driven through the cut. It is possible to saw Asphalt Bridge Plank but the mineral content soon ruins the saw teeth.

Fire-Resisting:

J-M Asphalt Bridge Plank does not support combustion and is considered as a fire-resisting material.

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Applying J-M Asphalt Bridge Plank

Does Not Check, Split or Warp:

There is no brooming effect possible in Asphalt Bridge Plank, so prevalent in wood where, as the grain is cut, the surface splinters and ravels.

J-M Asphalt Bridge Plank does not check because, unlike wood, it does not dry out. It is a homogeneous mass and therefore cannot split along a given plane. It does not warp because it is inert and, for all practical purposes, waterproof.

Allows Traffic Immediately After Application:

Unlike many pavements which must be given time to set or harden, Asphalt Bridge Plank is ready for duty the moment it is laid. When desired, traffic may even be continued over the structure during application. This feature is important in eliminating detours on highways and preventing traffic congestion in cities.

Will Carry All Types of Live Loads:

Occasionally some unusual load, as a threshing machine, steam shovel or caterpillar tractor with metal treads, does some injury to the surface of the bridge. While such unusual loads may dent Asphalt Bridge Plank appreciably, the indentations will disappear under subsequent traffic, and no permanent injury will be done.

Highly Resilient:

The resiliency of Asphalt Bridge Plank is due to the high fibre content, and the fact that the fibres are interlocked and matted together by the great pressure under which the material is formed.

Easily Maintained:

Should some unusual condition result in injury to some portion of the bridge, it is a very simple matter to replace only the affected slabs and obtain, without securing special machinery for mixing or applying, a job equally as good as when the entire surface was first laid. There are no unsightly patches when Asphalt Bridge Plank is used.

Dustless, Quiet and Dry:

Asphalt Bridge Plank is not subject to abrasion and being of fibrous character, has no tendency to grind off under traffic. An Asphalt Bridge Plank floor remains dustless.

Because of its composition, an Asphalt Bridge Plank floor is quiet under all types of traffic, damping vibration and tending to absorb wheel and hoof noise.

The waterproof quality of Asphalt Bridge Plank affords a quick run-off and rapid drying after a rain.

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Application

Asphalt Bridge Plank may be handled as lumber. Because it is more or less plastic, it must be stored on a flat surface to prevent sagging. Once laid, however, it will not warp or twist.

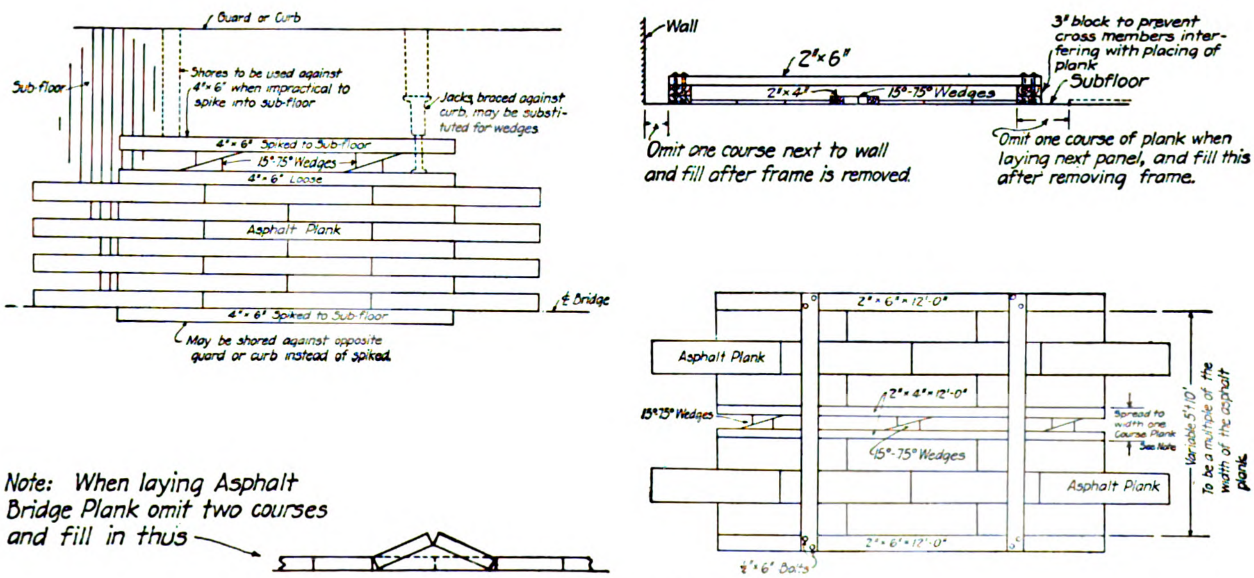
It can be cut with an ordinary hatchet or chisel. Sawing is possible but not recommended because the mineral ruins the saw teeth.

On wood-decked bridges, J-M Asphalt Bridge Plank is always laid parallel to the direction of traffic, and nailed in place. Every effort should be made to secure a smooth base, as the plank will tend to conform to irregularities in the base if they are not removed. Where the base is of concrete, the plank is laid in emulsified asphalt, or in hot J-M Asphalt 190 over a priming coat of J-M Concrete Primer. All holes and depressions in worn concrete must be leveled with mortar or an accepted cold patch mixture before the asphalt cement is applied.

Patching holes in sub-floor with cold patch material before laying Asphalt Bridge Plank

Because a close end and side fit between planks is desirable to assure smoothness of surface and the proper degree of water-tightness, pressure must be applied to the side and end when laying the material. The most convenient method of accomplishing this is made clear in the accompanying drawings.

No special tools are required for laying up J-M Asphalt Bridge Plank. The material is nailed direct to the wooden sub-flooring, the nails being countersunk in order that traffic may close the hole over the nailhead, effectively sealing it in place. As no time is required for setting or drying, traffic may be resumed immediately after the planking has been nailed down, a decidedly important consideration where bridges are already taxed to capacity.



Details of applying Asphalt Bridge Plank

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Asphalt Bridge Plank on Railroad Bridges

On ballasted deck railroad bridges, the waterproofing is usually a built-up membrane of felts or fabric laid in asphalt. Such a membrane requires substantial protection which will be sufficiently elastic and ductile to avoid puncturing the membrane under pressure and yet carry the ballast load and stand up under the impact of traffic.

Asphalt Bridge Plank meets such requirements to a remarkable degree and at the same time is, in itself, sufficiently waterproof to form a valuable addition to the waterproofing element as well as serving as a protection.

From a construction standpoint Asphalt Bridge Plank affords additional advantages in that it can be laid in cold as well as hot weather, without mixers, heaters or other bulky equipment, and may be readily applied to pitched or warped surfaces.

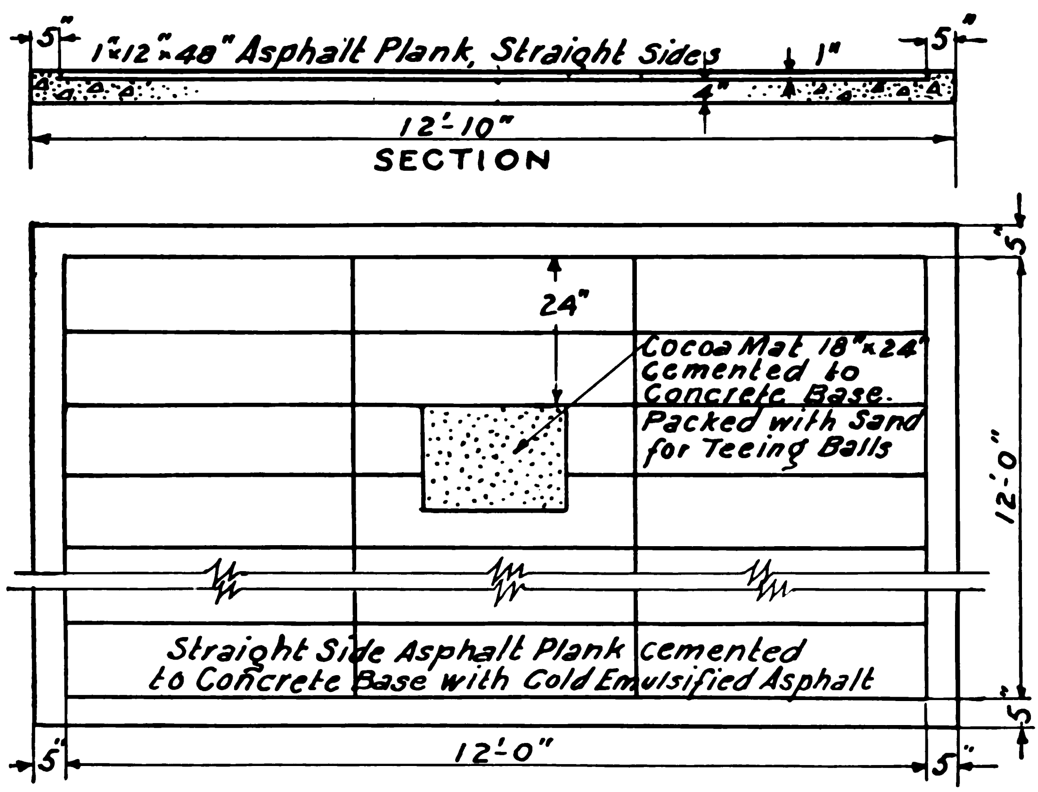
Used as a waterproofing protection, laid in hot asphalt, the 3-ft. length of plank with ship-lap edges, proves most adaptable and most economical in labor.

Asphalt Bridge Plank for Golf Tees

Tees constructed of Asphalt Bridge Plank have been found to improve playing conditions and avoid costly maintenance of clay or grass tees. The plank provides firm footing for both spiked or rubber soled shoes, is perfectly level and solid and remains in the same good playing condition during wet or dry weather. Once laid, no maintenance is required.

The tee consists of a 1:2:4 concrete base, 12′ 10″ square, with a curb 1″ high and 5″ wide surrounding an area of 144 sq. ft., floored with 1″ x 12″ x 48″ straight side J-M Asphalt Bridge Plank. The plank is cemented to the concrete base with asphalt emulsion and tamped or rolled to insure a solid union with the concrete base. Spaced 29″ from the front of the tee is an ordinary cocoa door mat which is cemented to the concrete base flush with the Asphalt Bridge Plank, the plank being cut to accommodate the mat, as illustrated. This mat, packed with sand, permits teeing the ball in the usual manner.

Grass is brought to the curb which sets off the tee and presents a neat appearance.



Construction details of Asphalt Bridge Plank Golf Tee

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J-M Car Flooring Materials

Suburban car on the Chicago & North Western Railway, floored with J-M Masticoke

J-M Truss Plate Flooring is a steel car flooring designed to receive a wearing surface of either J-M Masticoke alone, or Masticoke with a topping of J-M Tile Flooring Type A or J-M Magnesite Flooring, depending on the character of service.

The chief advantages of J-M Truss Plate Flooring are:

Light weight: Approximately 25% less than any other combination of flooring materials. With Masticoke or Magnesite, it weighs approximately 5.7 lb. per sq. ft. of complete floor. With Masticoke surfaced with Tile Flooring Type A, the weight is approximately 6.7 lb. per sq. ft. of complete floor.

Strength: More than twice that of the average car floor. With a Masticoke top surfacing, the weight of steel is 47.3% of the floor total. Bracing stiffness per foot in depth, 4,875 lb.. Carrying capacity, 100 lb. per sq. ft. (laboratory tests).

Low rate of Heat Transmission: 7.0 B.t.u. per sq. ft. per 24 hours, per deg. F. temperature difference—which compares favorably with that of wood floors or other types of steel floor construction.

Wearing Surface: Waterproof, durable, non-slip and of pleasing appearance. Thickness of only 3/8" or 1/2" required, through use of Truss Plate which provides the strength of the floor structure.

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J-M Truss Plate

Truss Plate is made of two sheets of 22 U.S.S. gauge steel in which staggered rows of oval cones have been pressed, riveted together through the tops of the cones to form a hollow finished plate with an overall thickness of ¾″. The steel used is alloyed with copper, which serves to retard corrosion.

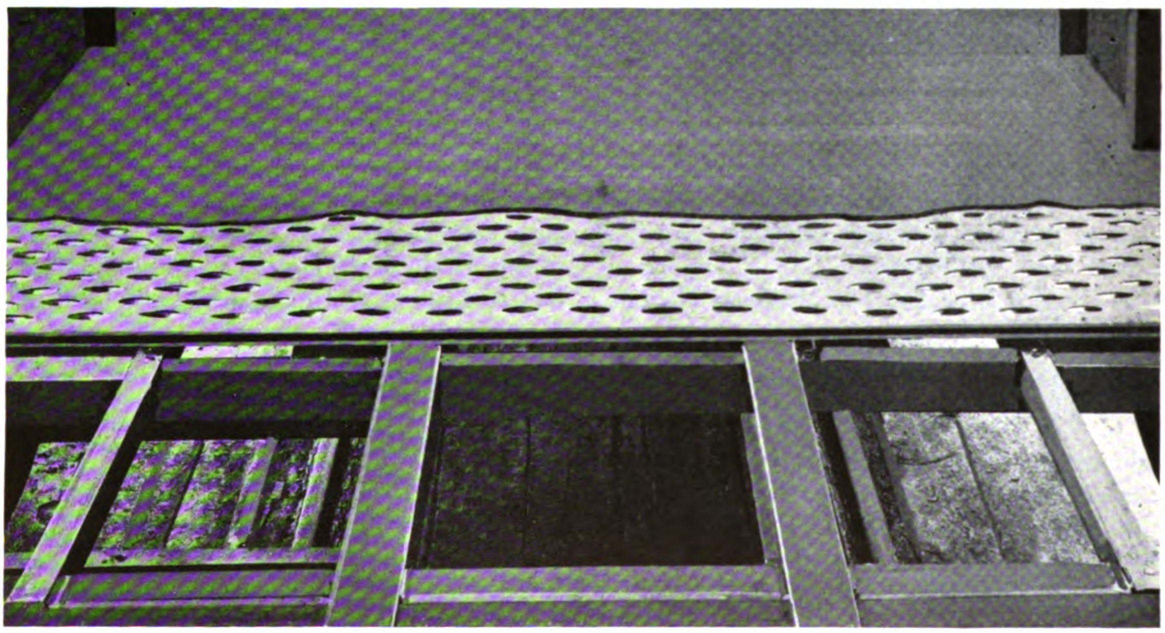
The cones or depressions measure 3½″ by 1⅜″ at the base, and are arranged in alternate rows of five and six each, with a slight overlap. The rows of cones are spaced on 2½″ centers, both ways, with the outside row 2½″ from the edge of the plate to allow for splicing the plates together. At the ends of the plate the distance varies, depending upon the overall length of the sheet.

The two long sides of the plate have the upper sheet of steel crimped down, so that the four sheets of steel may be brought together when joining the plates. The ends of the top plate are not crimped because it is frequently desirable to alter the length of the plates in the shop.

Truss Plate is made 30″ wide and furnished any length up to a maximum of 120″. It weighs approximately 2.7 lb. per sq. ft.

The finished Truss Plate is coated inside and out with a corrosion-resisting paint, which protects the underside and aids in bonding surfacing material.

J-M Truss Plate



J-M Truss Plate bolted to car beams and overlaid with J-M Masticoke Flooring

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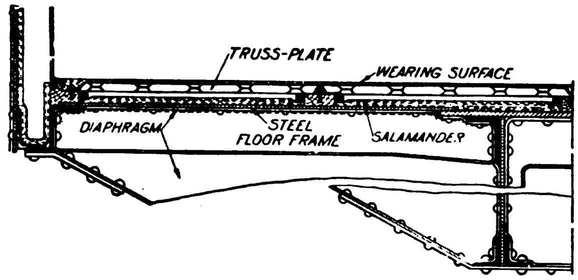
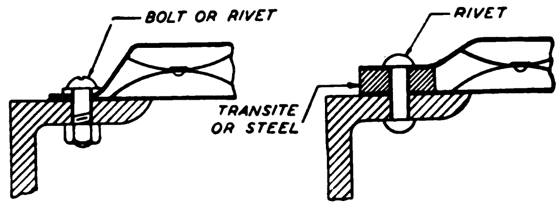
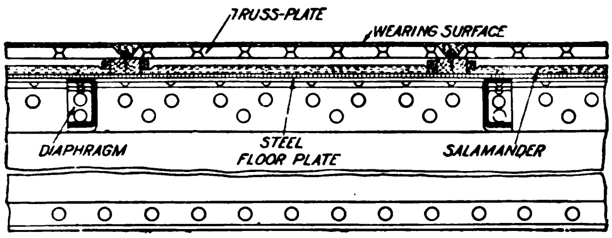


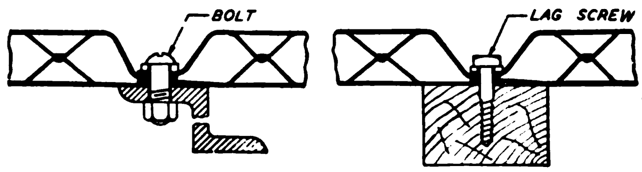
Section of car underframe



Two alternate methods of securing Truss Plates to side sills



Longitudinal section



Two alternate methods of joining Truss Plates and securing them to transverse sills

Application:

The application of J-M Truss Plate to a car frame requires no more skill or labor than any other type of steel floor. It may be applied to car under-frames either in conjunction with the conventional flat steel protection plate or without such protection.

Where the steel protection plate is used, J-M Truss Plates are laid like other types of steel sub-flooring. Where the protection plate is not used, the Truss Plate is secured directly to the center, side, and intermediate sills. If transverse sills are used they should be placed so that the joints of the Truss Plates will rest on them and be secured to them. Truss Plates are joined by dove-tailing or lapping the edges and bringing them together with 1/4" bolts or rivets on 6" to 9" centers.

Truss Plates should be fastened to wood stringers at the center and side sills, and under the seat pedestals, by 5/16" wood or lag screws 1½" long, spaced on 6" to 9" centers.

A filler strip is used between the plates to facilitate the application of Truss Plate to the side sill. If the filler strip is not used, the upper sheet can be drawn down to the lower sheet by the bolts or rivets regularly used to hold the plates.

The correct method of applying fasteners to the body of J-M Truss Plate is to drill a hole in the top sheet large enough to pass the rivet head, bolt head, or washer, and then to draw up against the lower sheet only.

Holes for steam pipes, water pipes, drains, etc., may be cut conveniently with a torch, using a piece of steel plate 1/4" thick with a hole of the proper size to serve as a guide.

Truss Plate Flooring in Electric Railway Cars:

In the majority of steam railway equipment, the floor construction consists of a double floor, with insulation between the J-M Truss Plate Flooring and the false floor. In electric railway car construction only a single floor is usual, which is not protected on the underside. Consequently, wheel-wash and wind-driven rain and snow can come in contact with the underside of the floor, with injurious results.

The substantial flat surface of the under-sheet of J-M Truss Plate makes it possible to protect it with a waterproofing felt, which is cemented to the underside of the Truss Plate during application. This felt not only protects the floor against the elements, but acts as a cushion between the steel floor plates and the under-frame which minimizes the transmission of sound.

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In electric railway car construction, it is also necessary to provide ready access to the motors and other controlling apparatus, through trap doors in the floor. Such trap doors are made by constructing a frame for the trap door opening with T-bars, welded together. The trap door is then constructed of steel angles, welded together, with J-M Truss Plate set into the angle frame.

J-M Masticoke

Masticoke provides a wearing surface that is durable, non-skid, thoroughly waterproof and a pleasing dark gray in color. It is sufficiently plastic to endure the stresses of car operation without the formation of cracks.

It is an asphalt composition material, furnished in blocks which are melted at 475 deg. F., poured into place, screeded with a wood float, and rolled to the desired thickness, 3/8" or 1/2". When it has cooled to a surface hardness, it is sprinkled with fine sand which is thoroughly rubbed into the surface with the wood float.

If it is ever necessary to rip out a portion of the floor to gain access to the under-frame, a Masticoke floor can be readily repaired simply by melting sufficient new material and applying it to the sub-floor, heaping it over the cut edges till they are softened by the heat, and then leveling. The fresh material will bond perfectly with the old and under foot traffic will, in a short time, show no patch mark.

Masticoke in Electric Railway Cars:

J-M Masticoke flooring makes a satisfactory surface over wood floors, as well as on J-M Truss Plate. When applied over a wood sub-floor, the wood floor is first covered with a divorcing medium consisting of a layer of J-M 15-lb. Asbestos Felt held in place by 18-gauge 1/2" square mesh galvanized iron wire netting, stapled or nailed on 6" centers both ways. The purpose of this divorcing membrane is to prevent the transmission of any weaving action of the floor boards to the Masticoke wearing surface.

Masticoke is then applied over the felt and wire mesh in the usual manner.

Where it is desired that the finished floor surface be absolutely level, brass angle strips of the proper height are laid over the 1/2" galvanized wire mesh so as to divide the floor into spaces 2 1/2 ft. square. The Masticoke is then worked into each individual square which is finished before proceeding further. The angle strips, of height to come flush with the surface of the floor, are not removed and improve the appearance of the finished floor.

Masticoke as a Sub-floor:

In addition to its use as a finished wearing surface, Masticoke is frequently used as a base for J-M Tile Flooring Type A.

J-M Tile Flooring Type A

Where a floor is sought to provide a color harmony with other equipment, yet the qualities of a Masticoke sub-floor are desired, J-M Tile Flooring Type A is laid as a top finish over a 3/8" thick base of Masticoke, using J-M Tile Cement for a bond.

The advantages of J-M Tile Flooring Type A as a floor surface are discussed in other pages. For car flooring, its fire-resistance, resiliency and sound-muffling qualities and its ease of cleaning and repair make it particularly desirable. Burning cigarettes, cigars or matches will not leave a permanent stain and much of the noise originating under the floor area is limited by this material.

For transportation equipment, the tile is furnished 3/16" thick, in various colors, in sizes 6" x 6", 6" x 12", 9" x 9", 9" x 18" and 12" x 12" with border material 9" x 27" and 12" x 24". In 3/16" thickness, it weighs approximately 2 lb. per sq. ft.

J-M Magnesite

Where a colored wearing surface is desired, J-M Magnesite composition flooring, which consists of Magnesite to which is added special binders, can be furnished to practically any specification.

This type of floor surfacing is not recommended where severe traffic conditions are encountered or where it will be subjected to extreme moisture or constant dampness. For such severe conditions, the use of Masticoke is recommended.

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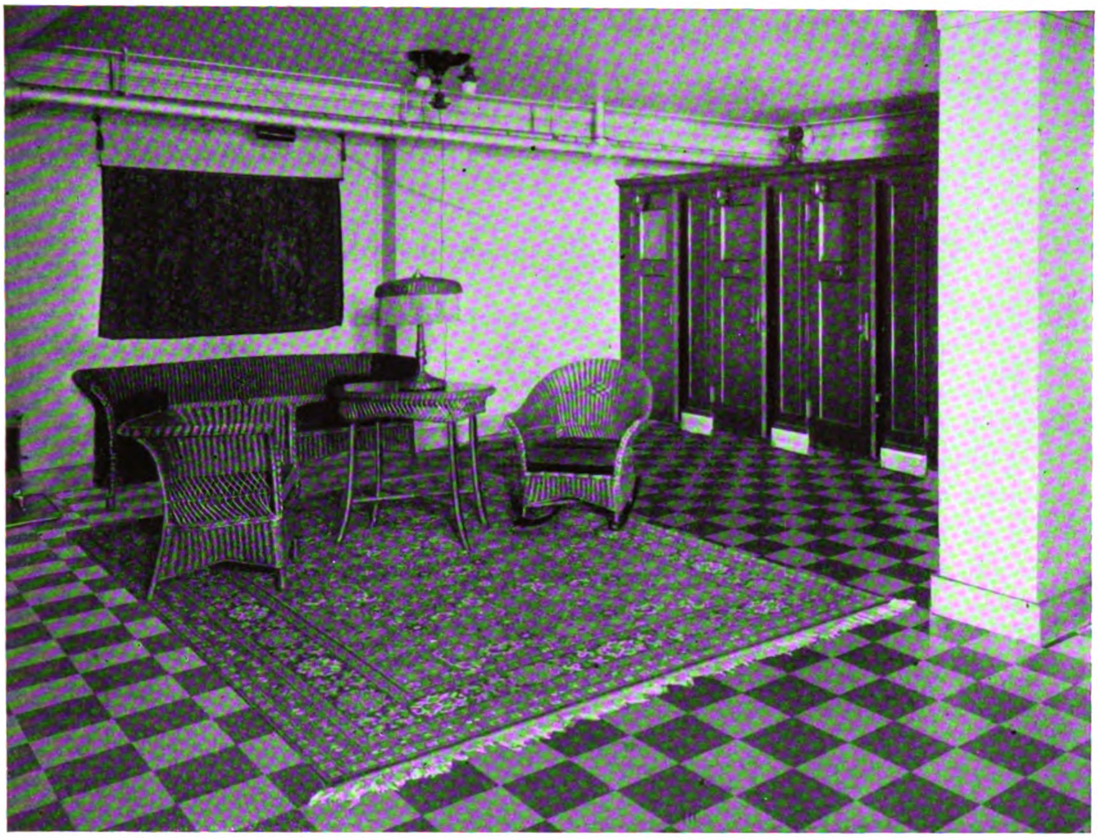
J-M Tile Flooring Type A



J-M Tile Flooring, laid in a bank where other resilient floors would not stay down because of moisture, looks better today than when installed six years ago

J-M Tile Flooring is a decorative, yet decidedly utilitarian, resilient floor surfacing, manufactured in individual flat tile units which are laid over a leveled sub-floor in a special plastic waterproof cement. The tile provide a permanently smooth, durable and attractive floor surface, with many possible color combinations.

J-M Tiles

The tiles are made of specially prepared asphalts, asbestos fibre and mineral pigments, and will not fade, buckle, curl, or become rough or spotty on the surface. They are sufficiently resilient to insure quiet, restful walking, and, since the cement in which they are set is waterproof and of unusual adhesiveness, will not loosen when laid on floors below grade, where moisture conditions make other resilient floor coverings go to pieces rapidily. They have proved exceptionally durable under heavy foot traffic, several installations showing no appreciable wear after six years of service. They are odorless, non-absorbent, waterproof and do not originate dust. When laid, they are fire-retardant and have been officially approved for use in fireproof buildings in many large cities, notably New York where the fire laws are unusually stringent.

Thickness and Weight:

J-M Tile are made in two thicknesses, 3/16″ and 1/8″, weighing approximately 2 lb. and 1.35 lb. per sq. ft., respectively.

The 3/16″ thickness is standard for all traffic, over any type of sub-floor, and must be used where the sub-floor is of wood. Tile 1/8″ thick should not be used except over a concrete sub-floor and then only where the traffic is light.

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Colors and Sizes:

J-M Tile are furnished in twelve plain colors:

Black	Red
Gray	Olive Green
Tan	Ivy Green
Verte Blue	Apple Green
Brown Mahogany	Terra Cotta
Buff	Rose Taupe

and in ten mottled colors:

Designation	Base or Field Color	Splash Color
No. 1 Mottled	Black	Ivy Green
No. 2 "	Ivy Green	Black
No. 3 "	Black	Red
No. 4 "	Red	Black
No. 5 "	Black	Tan
No. 6 "	Tan	Black
No. 7 "	Black	Gray
No. 8 "	Gray	Black
No. 9 "	Mahogany	Buff
No. 10 "	Verte Blue	Black

The mottling is unlike the ordinary marble imitation of other composition tile and varies with every tile, producing an unusually attractive appearance.

Borders are also supplied of the same material in the same colors, which permit unlimited pleasing color combinations.

The tile are made in the following sizes:

Square Tile	Oblong Tile	Border
6″ x 6″	6″ x 12″	9″ x 18″
9″ x 9″	9″ x 18″	9″ x 27″
12″ x 12″	12″ x 24″	12″ x 24″
		18″ x 24″

Colored Cove Base

A sanitary cove base, to be used in connection with J-M Tile Flooring, is furnished in the J-M Tile colors, in units 3/16″ thick, 18″ long and 6″ high. It can be applied against any smooth, firm wall-backing, such as cement, plaster, or wood.

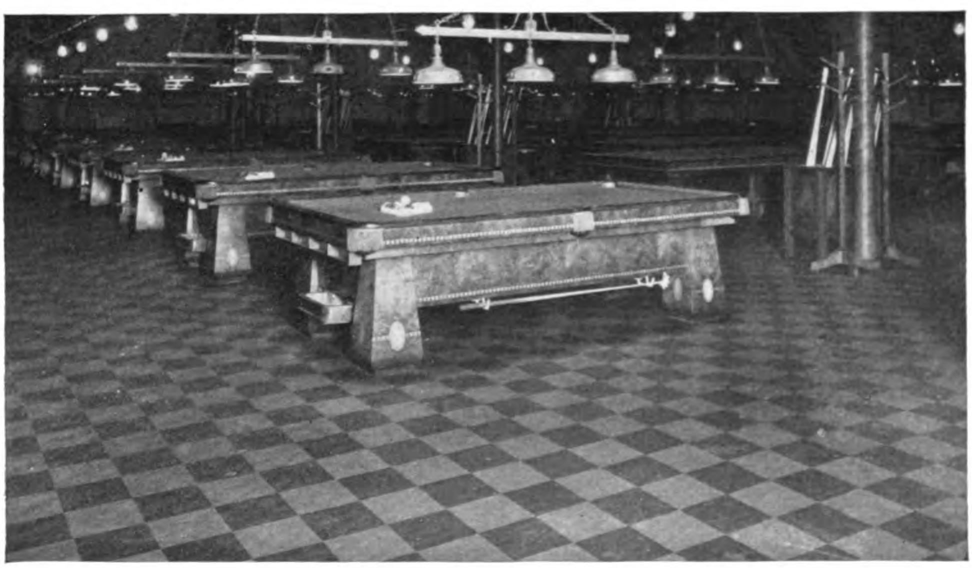
The same cement in which the tile are laid is used to attach the J-M Cove Base, the cove base being heated before being applied so that it will conform to any slight irregularities in the contour of the wall. Where a filler is required to provide a better backing for the underside of the cove part of the base, a leveling mixture composed of J-M Fibrated Asphalt Emulsion N-13-F, portland cement and sand is used, as described later under "Sub-Floor Leveling."

Internal or external angles, or other moulded shapes, cannot be furnished. Corner joints must be mitred, where necessary, on the job.

A cove base of terrazzo, rubber or other material can also be used with J-M Tile Flooring, if desired.

J-M Type A Tile Cement

J-M Type A Tile Cement, used for laying J-M Tile Flooring, is a special formula emulsified asphalt cement of greater waterproofing and adhesive qualities than the cement ordinarily used for such purposes.



In this billiard parlor, J-M Tile Flooring is subjected to extreme concentrated traffic around the tables. It shows no evidence of wear and does not stain from cigarettes, cigars, matches, etc. Over 15,000 sq. ft. are installed in this room

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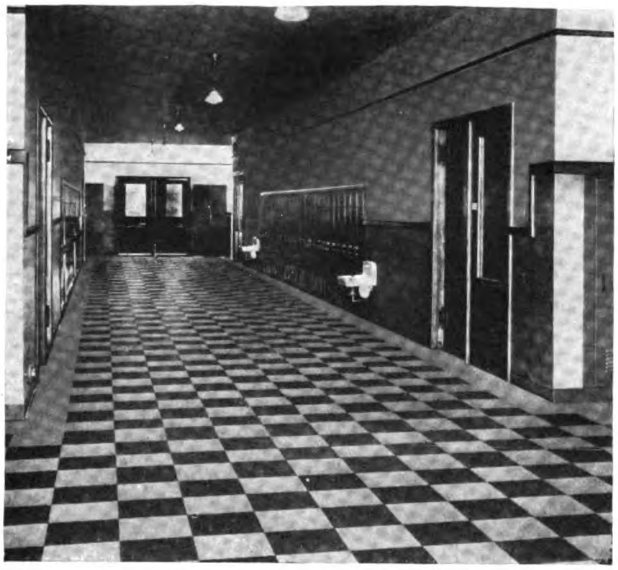
It can be used for laying J-M Tile in basements, or over concrete at or below grade, provided there is no hydrostatic pressure, and provided the temperature is not below 50 deg. F. Ideal conditions call for a temperature around 70 deg. F. when laying tile with this cement. For below-grade work the cement should be allowed to dry at least two hours before laying the tile.

The spreading capacity of J-M Type A Tile Cement averages 80 sq. ft. per gallon over acceptable smooth surfaces required for laying J-M Tile Flooring.

Primer can be prepared on the job by adding an equal quantity of water to the tile cement to reduce it to a brushing consistency.

J-M Tile Cement is furnished in 1, 5, 30 and 55 gallon containers, and weighs approximately 10 lb. per gallon.



J-M Tile Flooring is rapidly becoming the standard flooring for corridors, stair-treads and many other places in schools. It meets every requirement

Maintenance of J-M Tile Flooring

J-M Tile Flooring is not only lower in first cost than any other style of resilient flooring, but the customary maintenance given to linoleum and similar soft floor coverings is all that is necessary to keep it in good condition.

A suds solution made with warm water and almost any good neutral soap can be used to clean J-M Tile floors without injuring the material. Soap powders usually contain sal soda and similar alkalies which do not readily dissolve in water and should not be used because they may leave a white sediment in the joints of the tile. Many soap powders are so strong and harsh that they will destroy the luster on the surface of the tile rather than improve its appearance.

J-M Tile Flooring, properly maintained, needs no waxing. Dry-buffing with a circular disc electric power machine, equipped with a soft brush, will soon build up a natural luster on the surface of the tile that is far more attractive and satisfactory than a wax finish. However, while waxing is not recommended, some architects and owners insist upon its use. Many waxes are injurious to floor coverings. The proper material and method of application depend upon the color of tiles and other conditions. Upon request, specifications for waxing each individual job will be furnished.

Resiliency and comfort are advantages of J-M Tile Flooring which hard floors do not have. Since it is resilient, it should receive proper care to protect its appearance and prolong its wear. It should be protected against sharp point loads of furniture or equipment, and heavy static loads. Office swivel chairs, beds, etc., should be equipped with ball-bearing casters with wide soft rubber treads. For portable furniture, such as straight chairs, desks, etc., glides should be used instead of metal domes. Straight chairs may be equipped with rubber crutch tips or rubber sleeves.

J-M Tile Flooring is not recommended where there will be excessive trucking, unusually heavy static loads, constant spillage of gasoline, oil in volume, or concentrated heat.

If necessary, J-M Tile Flooring can be easily and economically repaired simply by replacing one or more tiles. The tiles do not fade or change color, so new tiles will not leave an unsightly, patched effect. When it is desired to extend the existing tile floor, due to the removal of partitions, tile can be added without evidence of change in the appearance or decorative effect of the floor.

Guarantee

J-M Tile Flooring is fully guaranteed against any defects in material for a period of one year from date of completion of the job. With reasonable care J-M Tile Flooring will last for many years.

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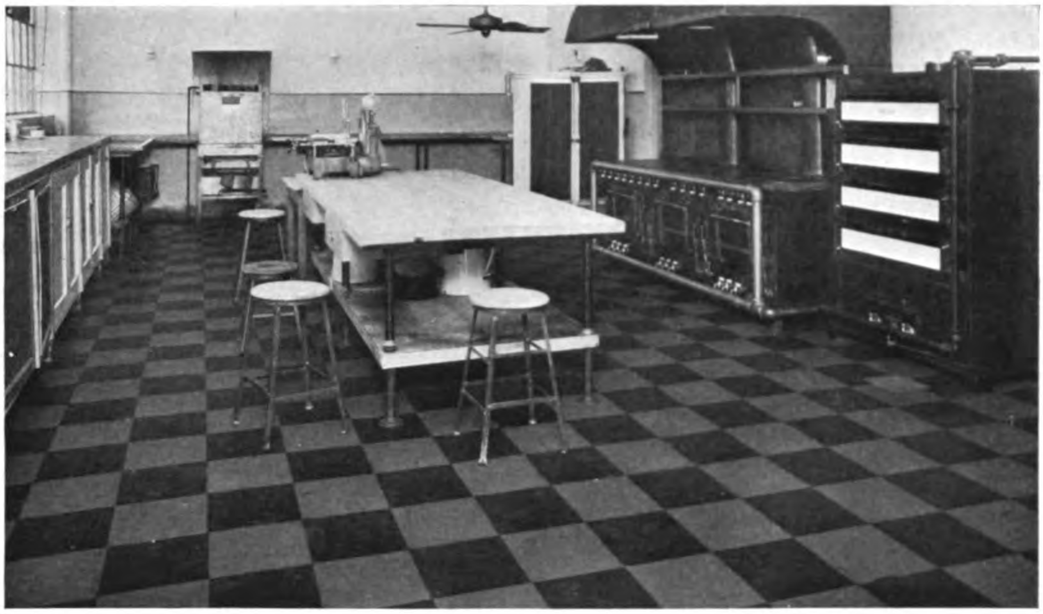
Sub-Floors for J-M Tile Flooring



In kitchens, J-M Tile Flooring provides a flooring that is comfortable, sanitary and waterproof

All sub-floors for J-M Tile Flooring must be perfectly smooth and even. The cement used for laying the tile is designed to provide permanent, waterproof adhesion, and has not enough body to level holes, bumps, or other surface irregularities. The tile will follow the contour of the underfloor and reflect any unevenness underneath. If the tiles are forced to bridge low or high spots, they may break under traffic.

Suitable sub-floors over which J-M Tile Flooring may be laid include concrete, wood and steel, and also asphalt mastic, magnesite, terrazzo, and other smooth composition surfaces, whether used merely for leveling or in new construction.

Concrete Sub-Floors:

Concrete sub-floors should be made of good hard mix with a smooth steel-troweled finish. They should be free from dust, plaster, paint and other surface treatments, and should not show any tendency to crumble, scale or otherwise deteriorate. If the floor is level and smooth, all lines struck upon the surface of concrete sub-floors may be filled with a mixture of J-M Tile Cement and sand. Otherwise the surface must be leveled with a mixture composed of J-M Fibrated Asphalt Emulsion N-13-F, portland cement and sand, as described later, before J-M Tile Flooring is laid.

Wood Sub-Floors:

J-M Tile Flooring cannot be laid directly over old rough, worn or uneven wood floors. A leveling course of magnesite composition or a mixture composed of J-M Fibrated Asphalt Emulsion N-13-F, portland cement and sand, must first be applied over the wood to provide a smooth, even and firm surface for the tile.

If a wood floor, either new or old, is free from undue vibration and is constructed of tongued and grooved finished wood flooring not over three inches face width, which can be scraped or sanded so that it will be perfectly smooth and even on the surface, J-M Tile Flooring 3/16" thick can be laid over the wood without a leveling course. In such a case a divorcing membrane of J-M 15-lb. Asbestos Felt is first cemented to the wood sub-floor, and the tile then cemented to the felt.

The felt will not level the floor and is not intended

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to serve that purpose. Neither is it intended as a cushion underneath the tile, which is undesirable. The combination of tile cement and felt serves as a protection against slight movement in the wood sub-floor caused by expansion and contraction.

Steel Sub-Floors:

Before laying the tile, steel sub-floors are primed with J-M Tile Cement, thinned with water and laid with a divorcing felt cemented to the steel in the same manner as on wood floors, or they may be leveled as described for concrete.

Asphalt Mastic Sub-Floors:

J-M Hot Mastic Flooring is an excellent sub-flooring for J-M Tile Flooring, as it has the advantage of being waterproof, will not scale or separate, and the tile can be applied the day after the hot mastic floor has been installed. This saves considerable time in construction, as cement generally requires one to three weeks for drying and curing.

J-M Hot Mastic Flooring is an asphalt mastic composed of asphalt of the requisite penetration for the service conditions and a fine mineral aggregate, mixed and formed into blocks at the factory. The blocks weigh approximately 80 lb. each.

On the job, these blocks are melted with the proper asphalt flux, to a temperature of approximately 450 deg. F., poured in place and spread to the desired thickness. For a sub-floor over which J-M Tile Flooring is to be laid, 5/16″ or 3/8″ is usually sufficient to give a proper foundation for any traffic.

Magnesite Composition Sub-Floors:

To obtain the level, smooth surface on a wood floor necessary for the satisfactory application of J-M Tile Flooring, a magnesite composition sub-floor may be used, consisting of a mastic of magnesite and magnesium chloride, spread to a thickness of not less than 3/8″, over a wire netting of 27-gauge galvanized metal lath or 2″ hexagonal mesh galvanized iron wire, which has been nailed down on approximately 4″ centers over a divorcing membrane of J-M 15-lb. Asbestos Felt.

Magnesite composition flooring is a cement composed of finely ground magnesite, wet with a solution of magnesium chloride and handled exactly as a portland cement mixture.

Magnesite scratch coat materials can be purchased from recognized manufacturers of magnesite products. The scratch coat is usually shipped in sacks weighing from 60 to 75 lb. each. The magnesium chloride is shipped in crystal form in 100-lb. sacks.

The chloride solution is made by dissolving the crystals in (usually) an equal weight of water, to a Baumé test of 22 deg. measured by a hydrometer.

When the magnesite sub-floor is dry, the entire surface should be brushed with a fine but stiff wire brush, or broom, to remove all traces of uncombined chloride, and the tile applied over the magnesite with J-M Tile Cement.

Sub-Floor Leveling with Fibrated Asphalt Emulsion N-13-F

If the bare floor is of concrete, steel or other similarly firm material, it is primed with J-M Tile Cement thinned to a brushing consistency with water, and then leveled to a 1/2″ maximum fill with a mixture of J-M Fibrated Asphalt Emulsion N-13-F, portland cement and sand in a 1:1:2 or 1:1½:3 mix. Should the maximum fill be 1″, the mastic is composed of the Fibrated Asphalt Emulsion, portland cement, sand and gravel or broken stone in a 2:1:2:3 mix, in the order indicated.

Because of the impervious nature of the Fibrated Asphalt Emulsion mixture, it should be allowed to dry thoroughly, which will require about 48 hours. For the same reason, it is advisable to wait several hours after spreading the tile cement on the *dry* leveling fill, before laying the tile.

When the Fibrated Asphalt Emulsion fill is used on wood floors, a diamond mesh expanded metal lath is nailed to the primed wood base on 6″ centers and the same method of filling followed as for concrete, the sub-floor being screeded to at least 3/8″ thick.

J-M Fibrated Asphalt Emulsion N-13-F is an asphaltic compound, of which approximately 15 gals. are required for 100 sq. ft. of leveling course 1/2″ thick composed of a mixture of the asphalt emulsion, portland cement and sand in the proportions 1:1½:3. J-M Fibrated Asphalt Emulsion N-13-F, is furnished in 10, 30 or 55-gal. containers.

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Building Materials, Miscellaneous

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Building Materials, Miscellaneous

Complete List of Data Sheets Available

Brochures

Asbestos Wall Tile, "Colorful Walls of Lasting Beauty," 8 pp., 8½" x 11", form WT-1A
Home Insulation, "The Invisible Home," 24 pp. 8½" x 11", form HI-4A
Insulating Board and Plaster Lath, 24 pp. 8½" x 11", form IB-7A

★ Catalog pages

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J-M Home Insulation

The Williams Inn, Williamstown, Mass., insulated with J-M Home Insulation

J-M Home Insulation consists of special grades of Banroc (rock wool) for placing in walls, ceilings, and floors, to retard the flow of heat through them. Its purpose is to keep the building warm in winter and cool in summer, thereby providing greater comfort with lower fuel bills. Improved methods of installation permit the insulation of new and existing homes to be accomplished without disturbance or inconvenience.

The two types of Home Insulation are described below, both of which are fireproof and vermin-proof, clean, dry and non-conductive of electricity.

Type A Home Insulation: Refined Banroc Granulated, designed for use in blowing equipment. Weighs approximately 10 lb. per cu. ft. as packed in the wall.

Banroc Loose: Standard Banroc Loose for stuffing by hand in openings made in the sheathing and for inaccessible places that cannot be blown. Weighs from 10 to 12 lb. per cu. ft., packed in place.

The Utility of Insulation

Heating systems vary in efficiency. One system may heat a house with less fuel cost than another system, under like conditions of service, but the gain or loss by the use of either system is but a small amount when compared with the saving or loss due to the type of house construction employed.

A survey made by the Dominion Fuel Board of Canada shows that an annual reduction of $30,000,000 in domestic fuel costs would be assured, if all residential buildings in Canada were insulated. It was found that the cities of Montreal, Toronto, Hamilton and Ottawa could save nearly $7,000,000 annually in fuel bills alone.

The Indiana Public Service Commission estimated that in 1920 in the State of Indiana, over $54,000,000 was spent for fuel for domestic purposes. Of this, 25% could have been saved by insulation and the

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Residence at North Caldwell, N. J., insulated with J-M Home Insulation

people of the State of Indiana could profit annually by approximately $13,500,000.

At the Armour Institute of Technology in Chicago, Professor J. C. Peebles conducted a series of practical tests on the economies to be effected by insulation as applied to the walls and roofs of several frame and brick bungalows, 26′ x 32′ x 10′. He found that with *thick* insulation an average annual saving of 6 tons of fuel was possible, as well as an initial economy of $375 and $225, respectively, in the cost of hot water or steam heating plants for such bungalows.

Applying this survey information to the entire United States would reveal an annual possible fuel reduction of $100,000,000, or larger.

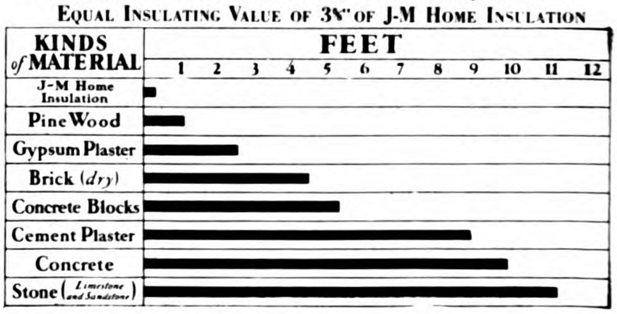
A pound of coal contains from 12,000 to 14,500 B.t.u. When this is burned in the average domestic heating system, it has been estimated that about 40% is lost up the chimney through imperfect combustion, etc. The remaining 60% goes to heat the house. It is from this 60% that most of the saving can be accomplished.

Although houses are of many shapes, there are only a few types of building wall construction, namely: solid masonry, hollow tile, frame construction of clapboards, shingles, brick veneer, and stucco. The frame wall construction comprises by far the greater portion of the dwellings erected in the last few years and is the type that can be most conveniently insulated after it has been built.

The term "dead air space" is commonly used in building construction as applying to the space between the walls, and the popular impression is that this has a certain insulation value because it acts like the walls in a thermos bottle. It has been conclusively shown, however, that this notion is fallacious and that the material which contains the greatest number of small confined air spaces per unit volume is the best insulator.

It is obvious that the most practical method of home insulation is to fill every void and crevice of a house with a material containing these minute air spaces. Johns-Manville has done just this in the system of Home Insulation.

COMPARATIVE THICKNESSES OF VARIOUS WALLS REQUIRED TO EQUAL INSULATING VALUE OF 3⅝" OF J-M HOME INSULATION



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This beautiful home at Larchmont, N. Y., is insulated with J-M Home Insulation

The Advantages of Insulation

Home Insulation is an investment which pays dividends as soon as it is installed. The immediate benefits include:

Reduced Fuel Costs:

A survey covering a large number of individual cases indicates that for an average insulated house of six to eight rooms, an annual saving of one third of the fuel bill may be expected. This figure may safely be taken as a fair average, although numerous examples of greater savings have been recorded.

Reduced Initial Investment:

Due to the reduced heat losses through the walls and roof, smaller radiators, and smaller heating plant and piping can be installed. In typical cases it has been proved that by complete insulation with 3⅝" of J-M Home Insulation, the total necessary steam or hot water areas may be safely reduced to 60% of that required in uninsulated constructions.

Reduced Furnace Operations:

In an insulated house it is possible to reduce materially the usual period of furnace operation by the judicious use of fireplaces, cookstoves, and auxiliary heaters during the chilly days of spring and autumn. With reduced furnace operation there is a consequent saving of labor in the handling of fuel and ashes. In addition, the heating plant will require considerably less attention because of the ease of maintaining comfortable temperatures.

General Home Comfort:

(a) Warmer in winter. No rooms "hard to heat" are found in an insulated house.

(b) Cooler in summer. The second floor rooms can be kept within 2 deg. F. of the temperature of the lower floors and the indoor temperature from 8 to 15 deg. F. lower than outside temperature.

(c) Waste attic space formerly used as storage space only, can be used as extra bedrooms, play rooms, etc.

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Filling in between the joists of an unfloored attic with J-M Home Insulation, insures warm rooms below

Health:

(a) Frame walls, if uninsulated, usually permit air infiltration in large quantities, resulting in drafts.

(b) Ventilation is under positive control in the insulated house.

(c) Insulation aids in preventing excessive air change in a house and thus considerably reduces the evaporation required to moisten the indoor air properly. Many of the colds and respiratory diseases experienced during the heating season are caused by high room temperatures and low humidity.

Aids in Preventing Fires:

The average frame house, due to its construction, is a fire hazard. Filling the walls and ceilings with a fireproof material will not only lessen "forced" furnace operation but will eliminate the possibility of any passage of flame between the walls.

Adds to Property Value:

House insulation has received wide publicity in the past few years through advertising, government reports, magazine articles, etc., and it is safe to predict that in the near future an uninsulated house will not be considered a good investment.

Reduces Noise:

Insulation in a house eliminates disturbing outside noises to a great extent. The same is true of noises from bathrooms, kitchens or adjacent apartments or stores.

Applying Insulation to Existing Homes

Type A Home Insulation is blown into the home with compressed air. This is the only practical method of insulating the walls of homes already constructed and it can also be used in homes under construction.

The work is done on the outside and there is no litter, dust or disturbance inside the house. The usual home activities continue without interruption and shrubs, trees, and lawns are unharmed. All the work is done by well-trained, experienced, courteous men.

The Home Insulation is applied uniformly and to a thickness of not less than 3⅝" unless the space to receive the material is less than this, in which case the insulation is applied to fill the space. All exterior walls above the foundation wall and where necessary, roofs, ceilings, attics, garages, and other areas, are completely insulated.

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The density of the insulation in place does not exceed 10 lb. per cu. ft., at which density the U. S. Bureau of Standards has found it to have a conductivity of 0.27 B.t.u. per sq. ft. per hour per inch thickness per degree Fahrenheit difference between surface temperatures.

Openings are made at the top of wall panels, and the insulation installed by inserting the nozzle of the hose from the blowing machine into each hole and blowing the material into the panel. Sacking is packed around the nozzle to prevent the material from blowing back into the operator's face.

Home Insulation is blown only at low pressures (no more than 2 lb. per sq. in.) to eliminate the danger of blowing the plaster off the walls and to prevent the material from blowing back out of the filling hole. Too much pressure prevents the material from packing properly in place. With 2-lb. pressure it will pack to the required uniform density.

In insulating the third story of old houses, that have one or more rooms above the ceiling joists, it is necessary to get between the roof and the walls of the upper story room and insulate the side walls of the room from behind. This is done by boarding up the studs with J-M Insulating Board and blowing behind it, or by nailing Diamond Cross Cord paper across the studs and blowing behind the paper. It may be necessary to make an opening in the roof large enough to allow workmen to enter. The entire ceiling, including the portion from the eaves to the walls of the room, is insulated by blowing.

Blowing J-M Home Insulation into the walls of a frame house

When the attic is unused for living quarters, the floor is insulated to stop heat leakage through the roof

It is always important that all portions around windows be insulated thoroughly, as considerable air infiltration takes place around window framing. Insulation should be kept out of window weight space.

In the case of open joists on unfloored attics, the man operating the nozzle stands on the joists and sprays the material to the desired thickness between the joists. If the attic is floored, it is necessary to remove a few floor boards and insert the hose between each pair of joists until the end of the hose touches the eaves. The material is then blown, and as the space fills up, the hose is slowly withdrawn.

All expansion tanks, water tanks, or pipes above an insulated attic floor must be carefully insulated, as they are subject to freezing upon completion of the insulation of the top floor ceiling.

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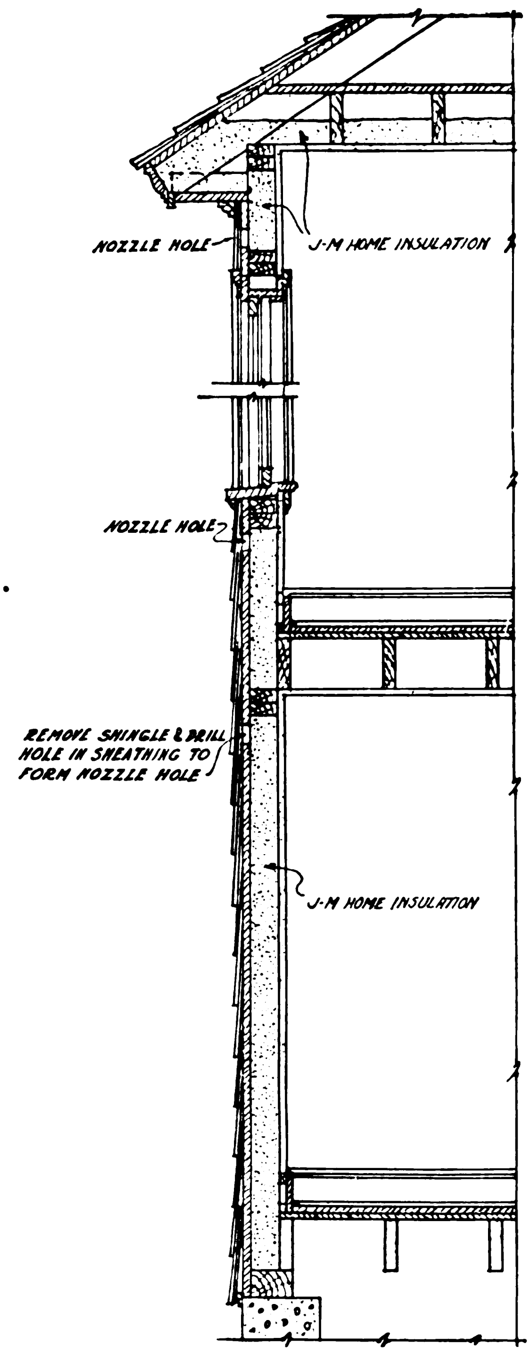

Home Insulation applied to balloon and braced framing construction

Applying Insulation to Homes Under Construction

It has been found that new houses can be blown equally as well as old houses, the difference being that new houses are insulated from the inside.

One method is to apply the insulation after the outside sheathing is in place and before the lath and plaster are installed. This is done by nailing Diamond Cross Cord paper with nailing strips between the studs and blowing behind the paper.

The second method is to install the Home Insulation after the scratch coat of plaster has been applied and before the finish coat is applied. By making openings between each stud space on all exterior walls through the scratch coat of plaster, about 3" from the ceiling of the room, the walls may be blown as described in the old house method, except that the work is done from the interior.

Window frames and door frames should be carefully caulked wherever possible, as these points are great sources of air infiltration. This can be done with Banroc Loose.

In balloon frame construction (where the space between the studding on the basement foundation is open to the cellar), this space is closed at the bottom with rough lumber or boards before insulating.

In insulating the ceilings of the top floor, Home Insulation is applied after the lath and plaster have been put on the ceilings of the upper rooms and before the rough flooring, if any, is applied to the floor joists in the attic.

Proper application is just as important in the work of Home Insulation as is the material itself. For this reason, in every community, contractors have been selected by Johns-Manville as qualifying in experience and business integrity to carry the J-M franchise. Each of these organizations is identified by the name "Home Insulation Company." These companies are prepared to furnish and install Home Insulation to the complete satisfaction of the home owner.

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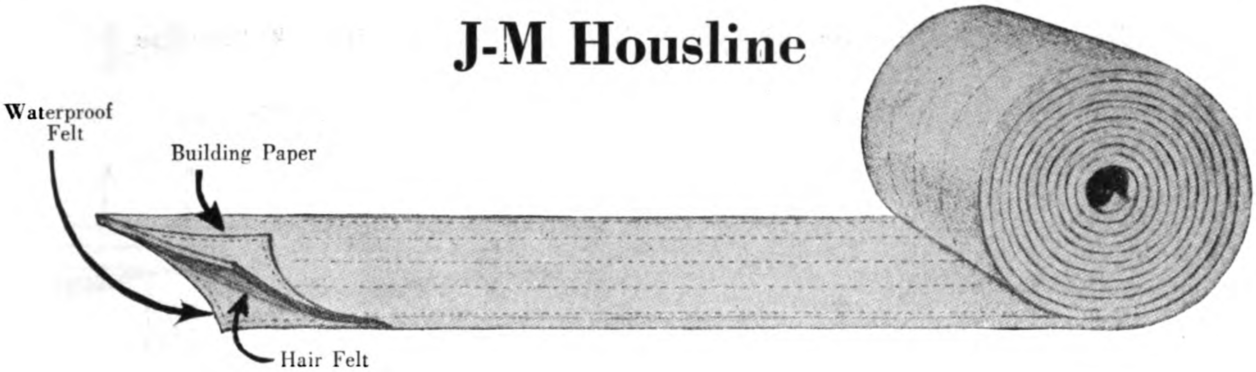
J-M Housline



Housline is composed of a heavy layer of thoroughly cleansed cattle hair, securely stitched between a sheet of waterproof felt and a sheet of building paper. The hair possesses great insulating value because of innumerable dead air cells which are occasioned by the crossing of the hairs in all directions. The greater the number of air cells, the greater the efficiency of the product.

The best grade of cattle hair is used in Housline. It is chemically treated, which renders it vermin-proof and odorless. It does not dry out; nor will it split, pack down or rot. It will last as long as the building in which it is used. It will not carry flame as it merely chars and shrivels when in contact with fire. It is flexible, thereby allowing for ease and economy of application. By not "packing" it affords maximum insulation by assuring an even distribution of hair over the entire area. Many flexible insulating materials "pack" to a point where all the insulating value is bunched at the bottom with the top bare.

The material is furnished in standard rolls of 250 sq. ft., 36″ wide and about 15″ in diameter, weighing approximately 50 lb.; and in rolls of 125 sq. ft., 18″ wide and about 15″ in diameter, weighing approximately 25 lb.

Method of Application:

For heat insulation in the walls of frame buildings, Housline is used successfully between studding and sheathing, sheathing and siding, and studding and inside lathing.

Where applied to the roof of a new house the method preferred is over the sheathing and under the roof covering with the waterproof side uppermost. This affords an exceptionally wind-tight roof and makes the building cooler in summer and warmer in winter.

For re-roofing over old shingles, particularly with strip shingles, the beveled wooden strips may be omitted and Housline laid with the waterproof side up. The old shingles are cut out at the gables and eaves and a wood strip about 4″ wide inserted. With the present prices of lumber, this application of Housline is usually not more expensive than the use of beveled strips, and an infinitely warmer house is assured.

For unfinished attics or air spaces in old houses. Housline is applied directly to the rafters, lapping all joints two inches. It may be carried directly across the rafters or secured on the sides of the rafters with lath or, preferably, furring strips.

Where air space is small and there is no floor, Housline should be laid across the floor beams and secured with lath nailed along the beams.

On frame partitions Housline is applied between the studding and lath on one or both sides.

In the air space under flat or slightly sloping roofs, as in apartment buildings or two family houses, the top floor will be much cooler in summer, and will require less radiation to heat in winter when Housline is applied to the underside of roof beams.

For sound-deadening in floors, Housline Tape should be tacked to floor beams with the paper side up and the rough flooring laid as usual. When all electrical, plumbing and steam fitting work is complete, the Housline is laid waterproof side up, on rough floor, the joints butted. The finish floor should be laid at right angles to longitudinal stitching of Housline. This will prevent boards pinching the paper when taking up. The finish floor should be toe-nailed, and nailing into the beams avoided.

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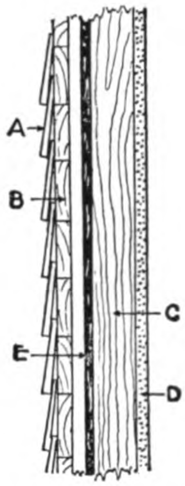
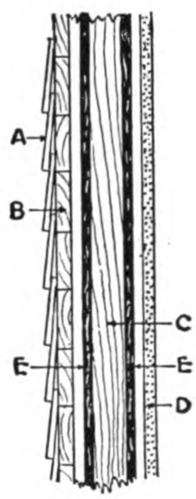
Diagrammatic Drawings of Typical Wall Constructions for J-M Housline

Vertical Sections

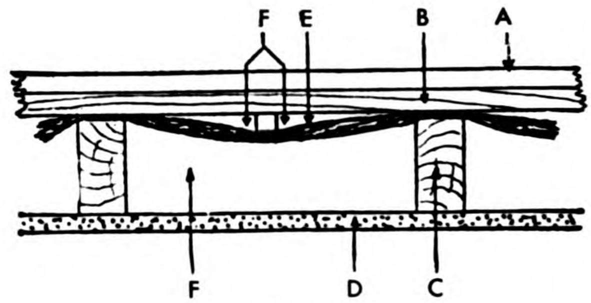


One layer Housline

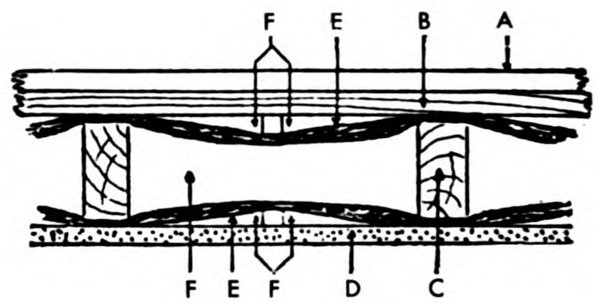


Two layers Housline

Horizontal Sections



One layer Housline



Two layers Housline

Key to References in Diagrams

A—Clapboards
B—Sheathing
C—Studding
D—Lath and Plaster
E—Insulator (Housline)
F—Air Space

J-M Housline Tape

Housline Tape is a felted hair tape 2″ wide made with a burlap reinforcement in the center and a 1$\frac{5}{16}$″ strip of kraft paper securely stitched on one side.

It is put up in rolls of 50 linear feet, packed 20 rolls to a bag or 36 rolls per crate. Shipping weight per roll 1½ lb.; per bag, 32 lb.; per crate, 100 lb.

It is an effectual weather strip around door and window frames. It is not only good for wind and cold, but keeps out dampness.

It is applied with paper side against the face of the outside casing entirely around the frame so that the masonry will butt squarely against the hair side. To complete, the joint should be pointed up with J-M Asbestos Roof Putty or mortar.

January, 1931 (Cancelling 4-I-10-A-1, 4-I-10-W-1 and 4-I-11-A-1, dated February 21, 1929)

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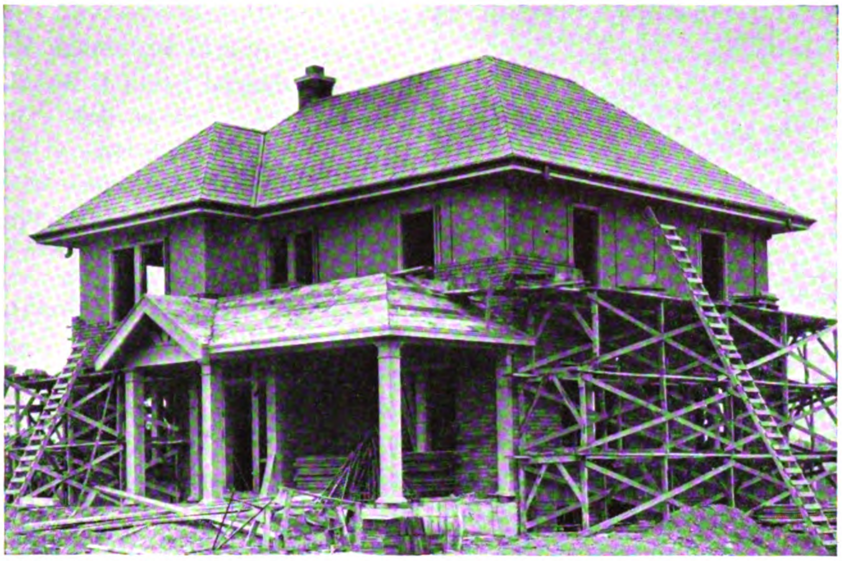
J-M Insulating Board, Industrial Board, Plaster Lath, and Bevel Board



J-M Insulating Board as sheathing under brick veneer

J-M Insulating Board

J-M Insulating Board is a light-weight efficient material composed of shredded wood, each board being a homogeneous mass of interlacing fibres. In addition to its high insulating value and moisture resistance, this material has great structural strength and rigidity. It is economical and easily installed and can be cut, sawed and nailed in the same manner as wood. It is furnished 4′ wide, in lengths of 6′, 7′, 8′, 9′, 10′ and 12′, and in thicknesses of ½″ and 1″. It can be furnished with ship-lapped edges if desired. The weight is approximately 0.75 lb. per sq. ft., ½″ thick.

Used in place of wood sheathing, J-M Insulating Board has higher mechanical strength, provides better insulation, and eliminates drafts. Greater home comfort results both in cold and warm weather and fuel bills during the winter months are appreciably reduced. On the walls of homes, it may be used under wood siding, shingles, stucco or brick. It is also ideally suited for the exterior and interior of summer cottages, garages and sheds. As a lining for attics, porches and basements, it creates new, comfortable rooms in the house.

J-M Plaster Lath

J-M Plaster Lath is the same as the Insulating Board, except that it is furnished in size 18″ x 48″ with the long edges ship-lapped. Thicknesses are ½″ and 1″. J-M Plaster Lath replaces wood lath, metal lath and other plaster bases. It has a plaster bond two and one-half times greater than that of wood lath. It completely eliminates unsightly lath marks and, due to the strong bond with plaster, lessens the possibility of plaster cracking.

J-M Insulating Board and Plaster Lath provide a good base for any plastics, paints or other types of finishes. Due to its pleasing color and texture, the material is also often left in its natural form and the joints battened with Transite or wood strips.

There are many other uses of J-M Insulating Board and Plaster Lath, such as partitions in apartment buildings and offices, table pads, and linoleum and carpet lining. On the farm, for example, it is used not only in the home, but also for insulating the dairy barn, the chicken brooder, laying house, hog house, milk house and other buildings.

NOTE: Wherever these materials are stated to be greater than ½″, the thickness is secured by stapling ½″ sheets together.

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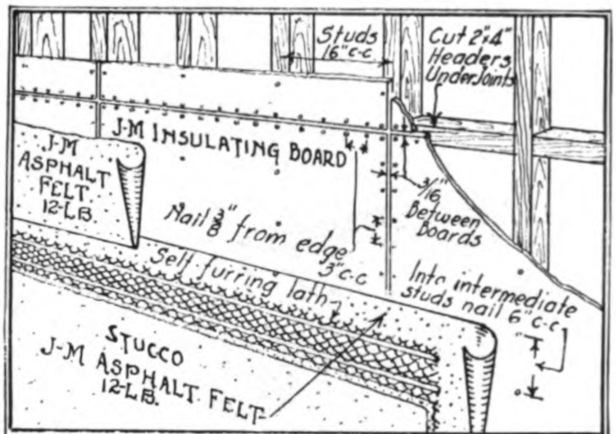
J-M Bevel Board

J-M Bevel Board is also the same material as Insulating Board, except that the long edges are ship-lapped and beveled and the short edges beveled only. It is used where a tile effect is desired. Bevel Board is furnished ½" thick in the following sizes: 6" x 12", 12" x 12", 12" x 24", 24" x 24", 24" x 32" and 18" x 32".



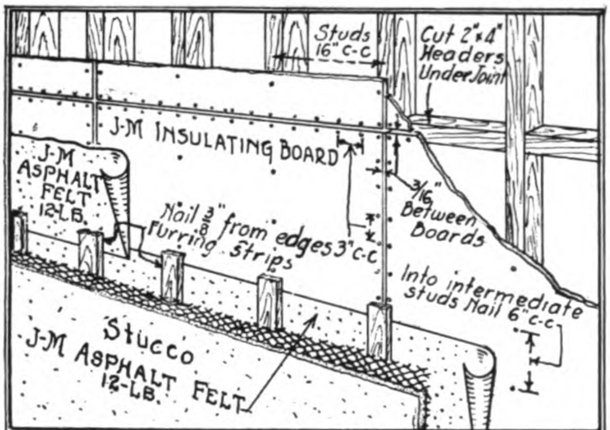
Application of J-M INSULATING BOARD as exterior sheathing under stucco (& self-furring lath)

J-M Industrial Board

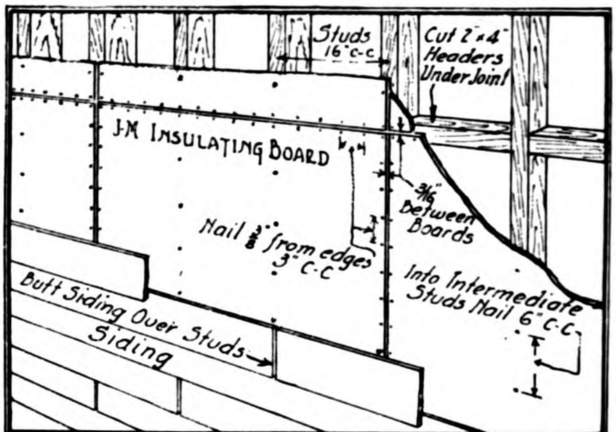
J-M Industrial Board is the same material as Insulating Board, except that it is furnished in size 3' x 6'; and in thicknesses of ½" and 1". It has many industrial uses where an efficient insulating material in the form of a strong, rigid board is required.

J-M Rigid Roofinsul

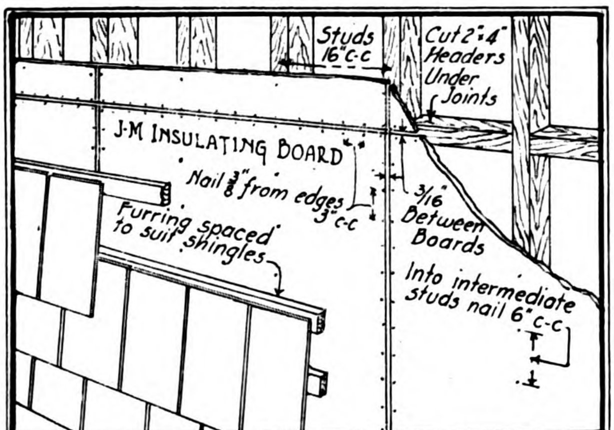
J-M Rigid Roofinsul is the same as J-M Insulating Board, except that it is furnished as a roof insulation, 24" x 48" in size, and in thicknesses of ½", 1", 1½" and 2". (See "Roofing and Shingles" Section).



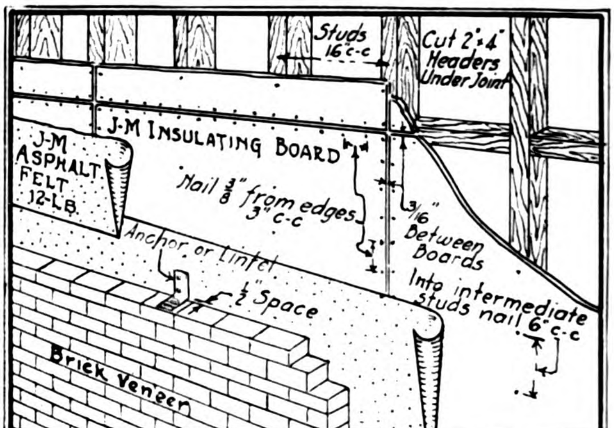
Application of J-M INSULATING BOARD as exterior sheathing under stucco (& wood lath)



Application of J-M INSULATING BOARD as exterior sheathing under wood siding



Application of J-M INSULATING BOARD as exterior sheathing under shingles.



Application of J-M INSULATING BOARD as exterior sheathing under brick veneer

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J-M Insulating Board as an Interior or Exterior Finish

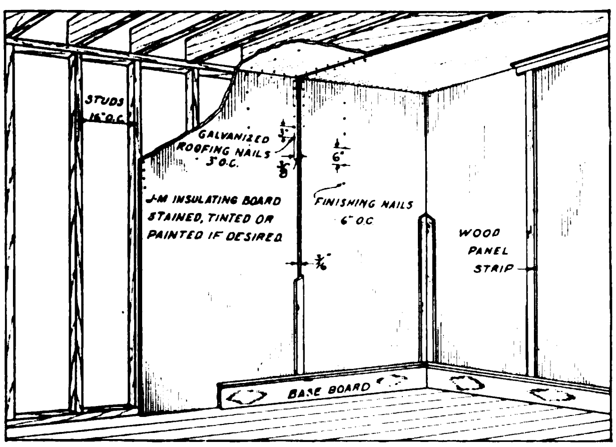
Interior Finish and Insulation:

J-M Insulating Board is applied lengthwise to studs, rafters, etc., with ample bearing for nailing along all edges and 3/16″ space at all joints. To obtain a good interior finish, an even and true frame surface is necessary. Studs, joists and rafters should be accurately spaced 16″ center to center and where necessary extra studs, joists or headers should be used. Where joints are to occur in the Insulating Board, 2″ x 4″ headers are cut in between frame members to provide nailing facilities.

Strips of Insulating Board are secured to the back of door and window casings before applying the large sheets of Insulating Board, to make snug joints and prevent air leakage. Where rafters, beams, frames, chimneys or other structures are to project beyond the board surface, the Insulating Board is patterned to fit snugly and seal the joints.

Where nails are to be exposed, 1¾″ finishing nails are driven at an angle of about 30° until the heads are beneath the surface of the board. Otherwise galvanized roofing nails 1½″ long, with ⅜″ round flat heads are used. Starting at the top, the first nails are driven into intermediate frame members on 6″ centers and then ⅜″ from all edges of the board on 3″ centers.

Where it is desired to have a broad V-groove, all joints of the J-M Insulating Board should preferably be beveled before application. This can be done by passing edges over a circular saw tilted to the desired angle, or by use of a special beveling tool or of a sand-paper block. Edges are easily rounded with sand-paper.



J-M Insulating Board as interior finish and insulation

Various types of finishes may be used or panel strips may be applied over the joints. If a plaster finish is desired, J-M Plaster Lath should be used and applied according to the directions for the application of J-M Plaster Lath.

In attics, J-M Insulating Board is applied lengthwise under the rafters and over the joists. If the eaves are not tight, all spaces at the eaves are closed off and the joist spaces at the ends are blocked to prevent hot or cold air leakage.

Where attic flooring is already in place, J-M Insulating Board is applied to the floor, nailing through the longitudinal center of each board, 6″ center to center, and ⅜″ from each edge, 3″ center to center. The finish may be wood flooring, linoleum, carpet, or other floor covering.

Insulating Board may be applied to the underside of floor joists, as in basements, or it may be placed between the rough and finish floors, or, preferably, in both places. When applied between rough and finish floors, the Insulating Board is laid with edges in moderate contact. The finish floor is nailed through the Insulating Board into the sub-floor. Where there is no sub-floor, the finish floor is nailed through the Insulating Board into the joists. The finish floor in such cases must be of sufficient thickness to take the necessary weight.

Exterior Finish and Insulation:

J-M Insulating Board is applied lengthwise to studs, rafters, etc., with ample bearing for nailing along all edges and 3/16″ space at all joints. Studs, joists and rafters should be accurately spaced 16″ center to center and where necessary extra studs, joists or headers should be used. Where joints are to occur in the Insulating Board, 2″ x 4″ headers are cut in between frame members to provide nailing facilities.

Galvanized nails 1½″ long x ⅜″ head are driven on 6″ centers on all studs and cross bracing. After

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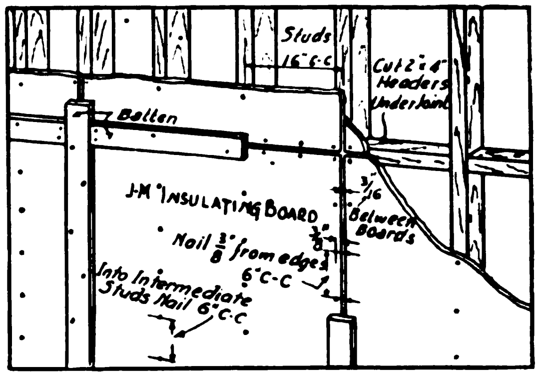
the Insulating Board is erected, all joints are battened with ¼″ x 4″ strips of Flat Transite or ½″ x 4″ wood strips. Galvanized nails, 2″ long, are used for nailing battens.

The use of J-M Insulating Board for exterior finish is recommended only in semi-permanent construction, such as summer cottages, construction shacks, etc. To secure the best results, the Insulating Board should be given a size coat, and two coats of lead and oil paint. Batten strips are often painted a contrasting color for architectural effect. In temporary construction painting is not necessary.



J-M Insulating Board as exterior finish and insulation

Application of J-M Plaster Lath

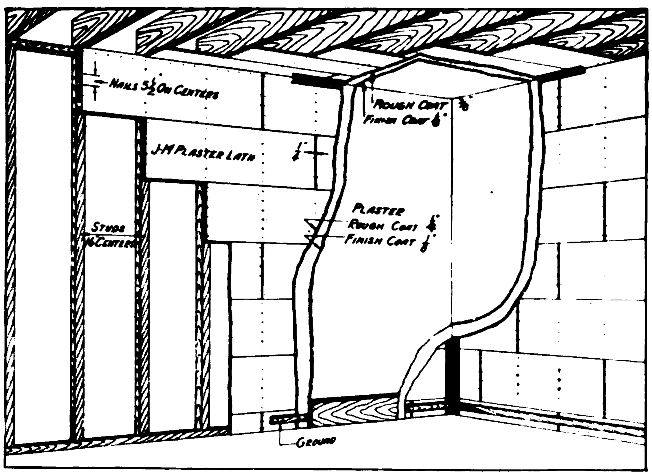
J-M Plaster Lath is applied to studs, furring strips, joists and rafters, with the long dimension horizontal and with coarse side exposed and end joints broken. The end joints are centered over studs and ¼″ space allowed between sheets. Ship-lapped joints are butted but sheets are not forced tightly into place. Strips of Insulating Board or Plaster Lath are secured to the back of door and window casings before setting sheets, to make snug joints and prevent air leakage.

Piecing out is done with strips of J-M Plaster Lath. To cut the Plaster Lath it is scored with a knife or the point of a hatchet and broken along the scored line.

Using ordinary 4d common nails or 1⅛″ blued nails, the ½″ Plaster Lath is first nailed into intermediate studs, then along the end joints, spacing all nails 5½″ center to center. At sills, headers and plates, nails are driven along the long edge also. The 1″ Plaster Lath is similarly applied, using 6d common nails.

On interior corners 4″ wide strips of metal lath or wire mesh, bent at right angles to extend 2″ on both sides, are stapled through the plaster lath into wood frame on 12″ centers. The exterior of exposed corners is reinforced with metal corner bead.

Only quick setting gypsum plaster with not more than 10% lime content should be used for the first coat. The first coat or the scratch coat and brown coat combined should not be less than ¼″ thick on side walls and ⅜″ thick on ceiling and the total plaster thickness not less than ⅜″ on side walls and ½″ on ceiling. Ventilation is *necessary* while the plaster is drying.



Application of J-M Plaster Lath

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Interior Finishes for J-M Insulating Board

Ordinary paints, varnishes, enamels, etc., are applied to J-M Insulating Board according to the manufacturer's specifications. Paint applied directly to the board will result in a stipple effect. To obtain a smooth finished effect, particularly for glossy finishes, it is necessary to build up the surface with size and several priming coats.

Battens should be applied after the board has been painted in order to avoid a paint line. If possible battens should be painted before fastening.

Staining and Tinting:

Any commercial stains used on wood may be used on J-M Insulating Board. Effective tinting may be accomplished by applying color with varnish and wiping it before it dries. Stencil effects in fresco or japan colors can be applied on glue size, paste water stains or kalsomined surfaces.

Water stains may be mixed with glue size or paste, and any color or tint used. Pastes colored with water stains dry slowly and other color tints may therefore be mottled into them after they have been applied. Kalsomine may be applied either over sized or unsized Insulating Board. When applied over the unsized board a small amount of glue should be added to the mixture.

Plastic Paints and Oil Cloths:

Plastic paints are applied according to the manufacturer's specifications. Some will require sizing or preparation of the surface of the board, in which case the paint manufacturer usually issues the necessary instructions.

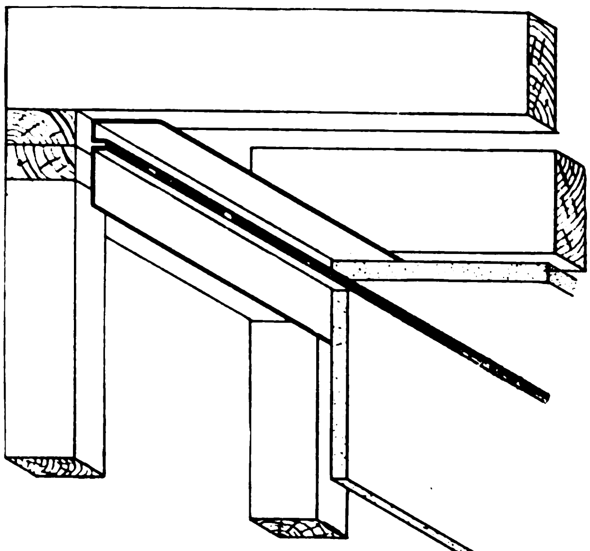
In preparation for plastic paints, 4″ strips of galvanized screen cloth are applied over joints and bonded to the board with plaster of paris or plastic paint mixed to the consistency of a thick paste. All galvanized screen cloth are applied over joints and tact with the paint should be given a preliminary wash with dilute acetic acid before erection. The screen should not be nailed except at ends when necessary to hold in place during application of bonding cement. The bonding cement is worked through the screen with a scraping knife or trowel, using a firm pressure to obtain good contact between the Insulating Board and the wire. The bonding cement should be spread to extend about 1″ beyond both edges of the screen. All corners should be treated in the same manner.

When recommended, joints may be filled with the plastic cements mentioned above and a strip of gummed paper applied over them, instead of the screen. Plastic paint should be applied in sufficient quantity to conceal the joint stripping. The paint may be textured and glazed.

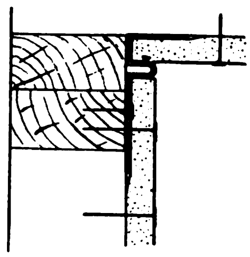
Oil cloth such as Sanitas and Wall-Tex may be successfully applied over J-M Insulating Board. Joints should be filled before application and manufacturer's specifications should be followed. Wallpaper is not recommended over Insulating Board.

Solidon:

Solidon is a finishing cement which can be applied directly to J-M Insulating Board. To obtain best re-



Ceiling angle in place



Detail of ceiling angle

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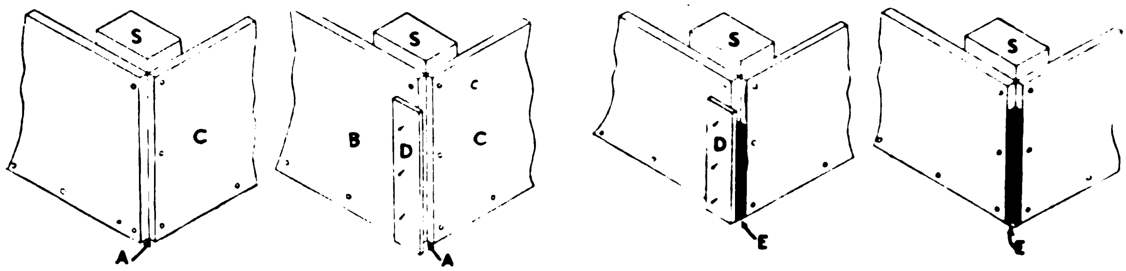

Application of Solidon to exterior corners

sults grooved metal corners should be installed at ceiling angles when the Insulating Board is erected.

All joints should be leveled with Solidon, using a trowel or large putty knife. If there is unevenness at the joints, extra Solidon should be applied 4″ or 5″ either side of joint and scraped off level.

Exterior corners should be treated as shown in the illustration by nailing Insulating Board (B) to the side of the stud (S), and by nailing Insulating Board (C) to the other side of the same stud, so that the edges of the boards just meet. Then by nailing a straight edge board (D) along one side of the angle, the corner may be filled with Solidon (E) and evened off. When the Solidon is dry, the board may be taken down and the Solidon solid corner remains.

Solidon-filled joints and corners should set at least 8 hours. Then Solidon is applied over the entire wall and ceiling—1/16″ to 1/8″ thick. For smooth plaster finish, the Solidon is allowed from 1 to 2 hours to take initial set and is then water-troweled like a white coat plaster. For textured finish the Solidon is textured as desired, immediately after application and before the initial set.

White lead paint may be applied over Solidon after it is thoroughly dry. Varnish size is applied, and followed, when dry, with the necessary number of coats of paint. If desired, the varnish size and the lead paint may be mixed in equal amounts and used as a priming coat. Then a finishing coat of paint may be applied.

In applying flat wall paint, the paint manufacturer's instructions should be followed in preparation of priming coat and application of paint. Solidon should not be coated with zinc sulphate. Where flat wall paint is used as a prime color coat in making imitation travertine finish with Solidon, the paint is mixed as directed by the manufacturers for prime coat of a flat wall paint. If color is not even, a second coat of the paint is applied.

Over-glazes are used on Solidon walls only after the wall has been painted or lacquered and the paint is thoroughly dry. Over-glazes, suitably colored, are brushed over the paint surface and wiped off with a soft cloth when partially dry, allowing some of glaze to remain in the depressions of the Solidon.

In applying wallpaper the Solidon is allowed to dry for one week at least. Solidon Wallpaper Sealer is then brushed over the entire surface of the wall. About 24 hours later, glue size and wallpaper may be applied to plaster walls.

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Transite-Encased Insulating Board

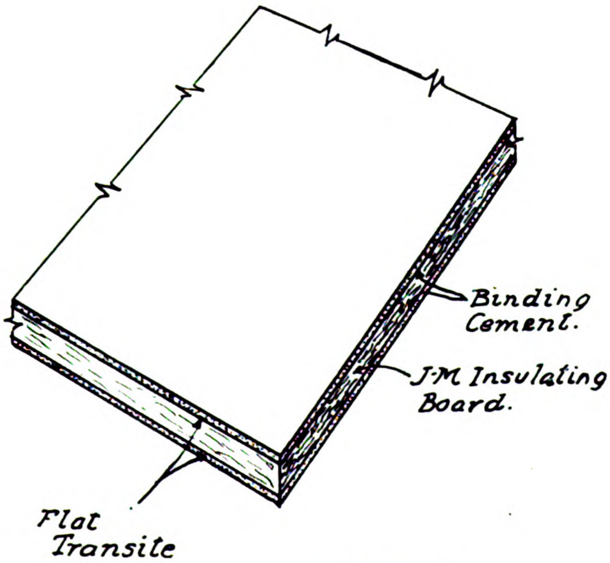
Dryer housing made of Transite-Encased Insulating Board

Transite-Encased Insulating Board is composed of a core of ½″ or 1″ J-M Insulating Board with a sheet of ⅛″ flat Transite cemented to each side. The sheets are supplied 42″ x 96″ and weigh approximately 4.1 lb. per sq. ft. with ½″ Insulating Board core, and approximately 4.9 lb. per sq. ft. with 1″ Insulating Board core. For service conditions the temperature limit is 230 deg. F.

Transite-Encased Insulating Board combines the desirable properties of Transite as a casing material and J-M Insulating Board as a structural insulating material. This commodity is ideally adapted for the construction of housings which are required to withstand moderate temperatures, as well as for a siding on buildings. Numerous other uses suggest themselves to everyone who sees how surprisingly strong it is. The hard, durable surface on each side and the efficient insulating core unite qualities not to be found to a like degree in any other building material.

Transite-Encased Insulating Board is not designed, nor should it be used, for conditions of extreme moisture or condensation. When Transite-Encased Insulating Board is used as a dryer wall or for other purposes where it is exposed to humidity, all joints and edges must be thoroughly sealed. As a cementing agent J-M Aertite Coating may be used.

Transite-Encased Insulating Board is furnished in standard size sheets, 42″ x 96″, or in smaller cut pieces on special order.



J-M Transite-Encased Insulating Board

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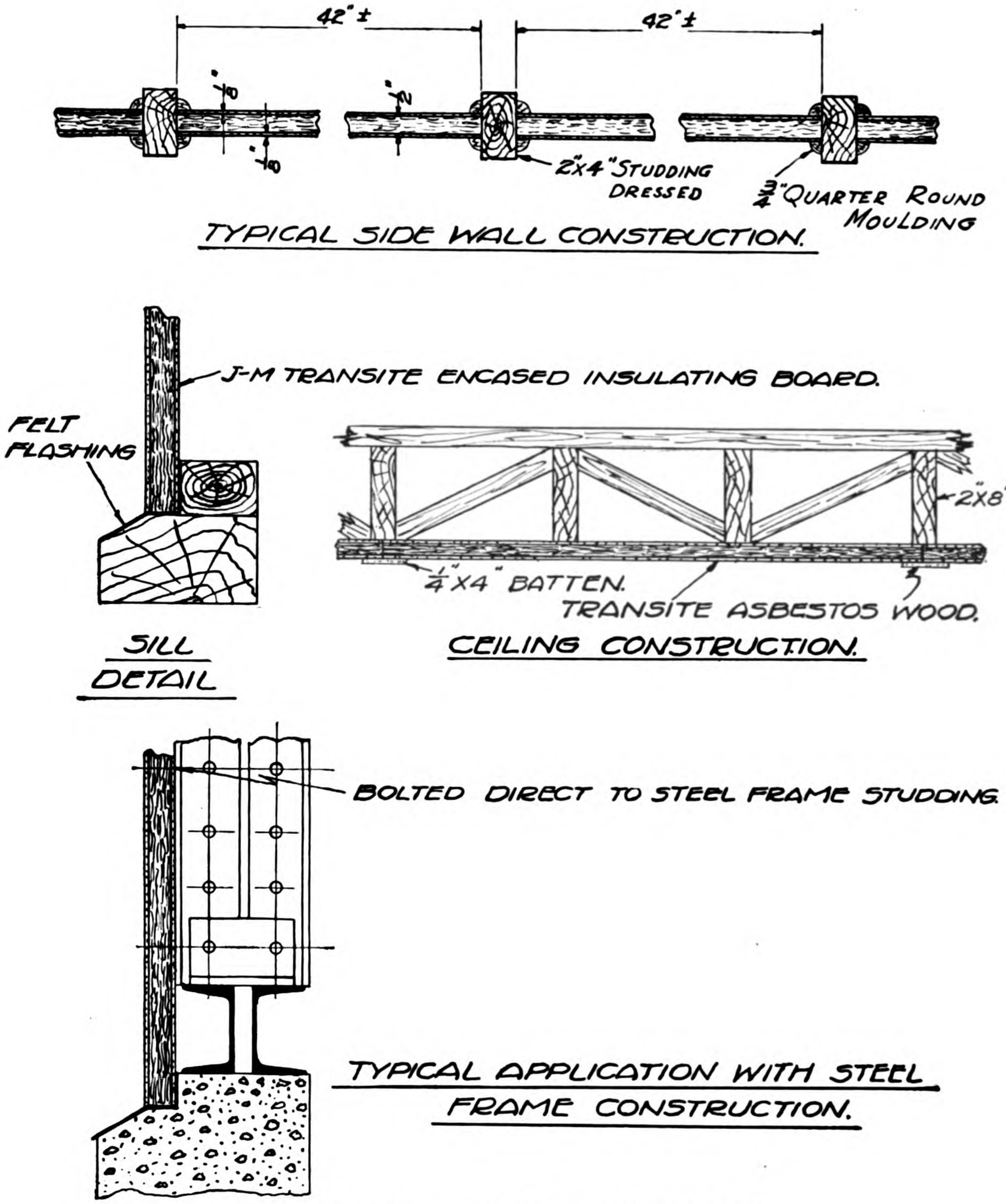
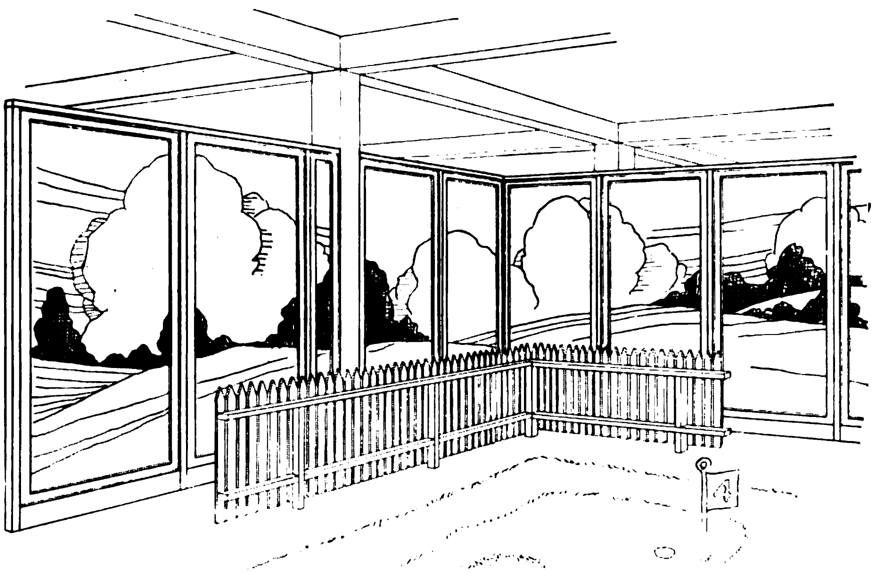


Construction details for Transite-Encased Insulating Board

J-M Asbestos Wall Board



J-M Asbestos Wall Board has been used effectively for a background on which to paint miniature golf course scenery

J-M Asbestos Wall Board is a laminated sheet building material formed of asbestos fibre and portland cement, colored a light cream and subjected to hydraulic pressure. In strength, durability and fireproof qualities this flat, rigid, mineral product is second only to Flat Transite and can be produced at lower cost. Transite has a monolithic structure which is of great advantage under severe service conditions. For resistance to heat, acid or alkali vapors and exposure to weather, nothing can equal Transite. Under less severe conditions, J-M Asbestos Wall Board serves an excellent purpose, replacing wood, plaster, or sheet metal.

For use as a fire-stop partition between domestic garages and dwellings, as an unburnable lining for detached garages, for ceilings and walls, sorting table tops, bath house partition walls and similar applications, Asbestos Wall Board will satisfactorily meet all requirements. It is essentially a material for inside use where its strength, durability, fireproof qualities and low cost make an ideal combination.

It will not rot or rust and does not chip, buckle or deteriorate. The quality of lasting indefinitely finds wide application for Asbestos Wall Board in industrial plants, public buildings, office buildings, machine shops, garages and residences.

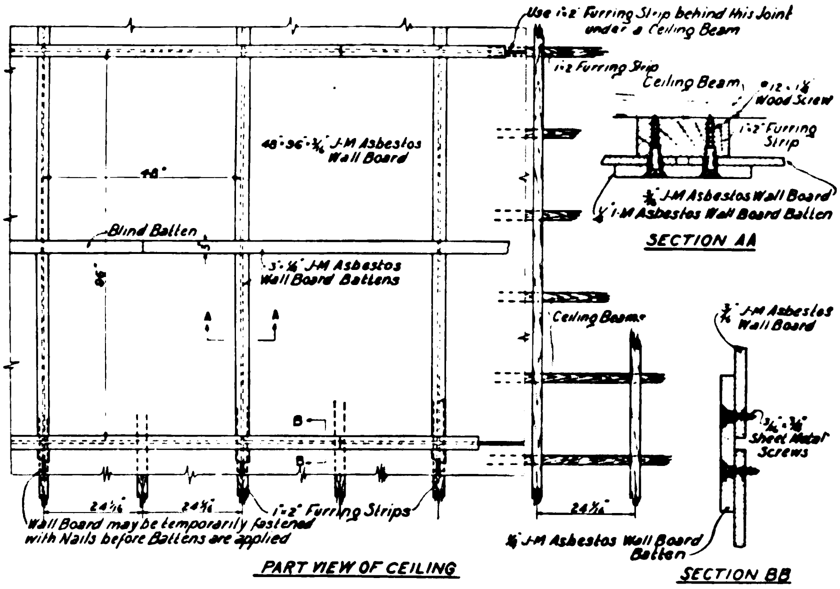
Extremes of temperatures from the hottest to the coldest weather will not affect the strength of Asbestos Wall Board. The passage of time hardens and toughens it. Its weight, as compared to heavier and bulkier materials, is much in its favor. The supporting framework can be lighter, resulting in greater interior space and lower cost.

J-M Asbestos Wall Board never needs paint or other surface protection, thus eliminating all maintenance expense. However, both sides are smooth and if desired, it can be painted or grained for architectural effects. In its natural color, it is well adapted to interior walls, ceilings, window casings, partitions, cabinets, baseboards, and other trim.

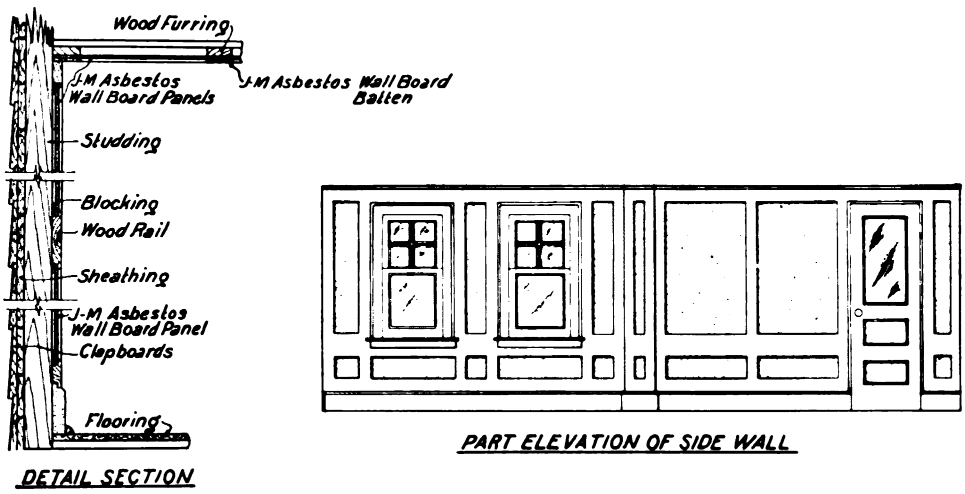
This material is usually applied by carpenters. It can be drilled with twist drills, punched, fastened with nails and screws and sawed with a hand saw, though a portable power saw should be used if much sawing is to be done. Butt joint construction is not recommended and battens should be used to cover both horizontal and vertical joints. Building movements may split the sheets unless slippage is allowed.

Asbestos Wall Board is furnished in flat sheets, 48″ x 48″ and 48″ x 96″ (plus or minus 1/16″), and in 3/16″, 1/4″ and 3/8″ thicknesses. Smaller size sheets are supplied on special order.

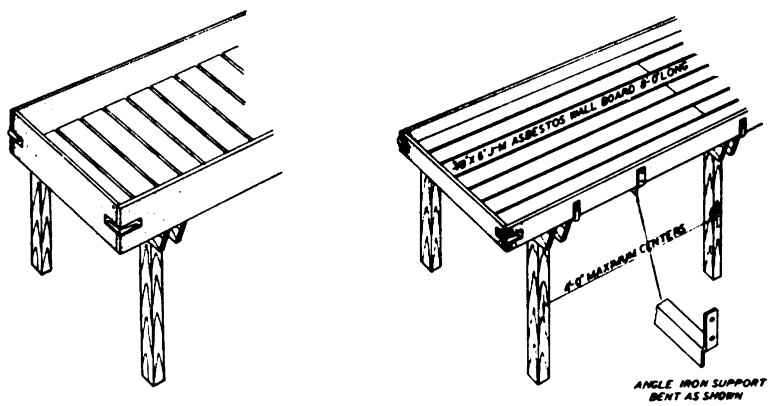
Printed in U. S. A.



Under-side ceiling construction details for J-M Asbestos Wall Board



One type of side-wall interior using J-M Asbestos Wall Board



J-M Asbestos Wall Board makes ideal flower benches for greenhouses

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J-M Asbestos Wall Tile

Asbestos Wall Tile provides an attractive, sanitary kitchen wall which can be kept clean with a minimum of effort

J-M Asbestos Wall Tile is a strong, rigid sheet of asbestos fibre and portland cement, grooved in 4″ squares to give the effect of individual units, and finished with high-grade lacquer enamel in white, ivory, light green, light blue, and on special order in black. Prior to lacquering, the sheets are impregnated with a waterproofing agent and sanded to provide a perfect finish for the application of lacquer materials. The grooves which mark the sheets into 4″ squares, are die-pressed as the sheet is made. The lacquer over the grooves prevents the accumulation of dirt.

Asbestos Wall Tile is colorful, durable, sanitary and waterproof. It can be kept clean with a minimum of effort. Dirt remains on the surface where it can be easily washed off. Due to the large size sheets, it can be quickly and economically installed either in new construction or in redecorating old rooms. With Asbestos Wall Tile the carpenter does the entire job from start to finish. It is readily cut with a saw, drilled and pierced with a nail. It does not shrink or buckle.

This material is not considered as a substitute for ordinary glazed ceramic tile, as in many ways it is superior. For example, with J-M Asbestos Wall Tile there is complete freedom from the maintenance costs involved in replacements when small units are used, and there is no possibility of cracks developing in the wall tile. It is uniform in appearance and will not crack or craze under service conditions.

Asbestos Wall Tile is the ideal material wherever a wall combining beauty and utility at moderate cost is desired. In the home it is used in bathrooms, kitchen, breakfast room, laundry and nursery. On the walls of commercial laundries, restaurants, hotels, office buildings, hospitals, etc., it provides cleanliness, beauty and durability. It is also used in barber shops, beauty parlors, and in similar locations where an attractive and easily cleaned finish is desired.

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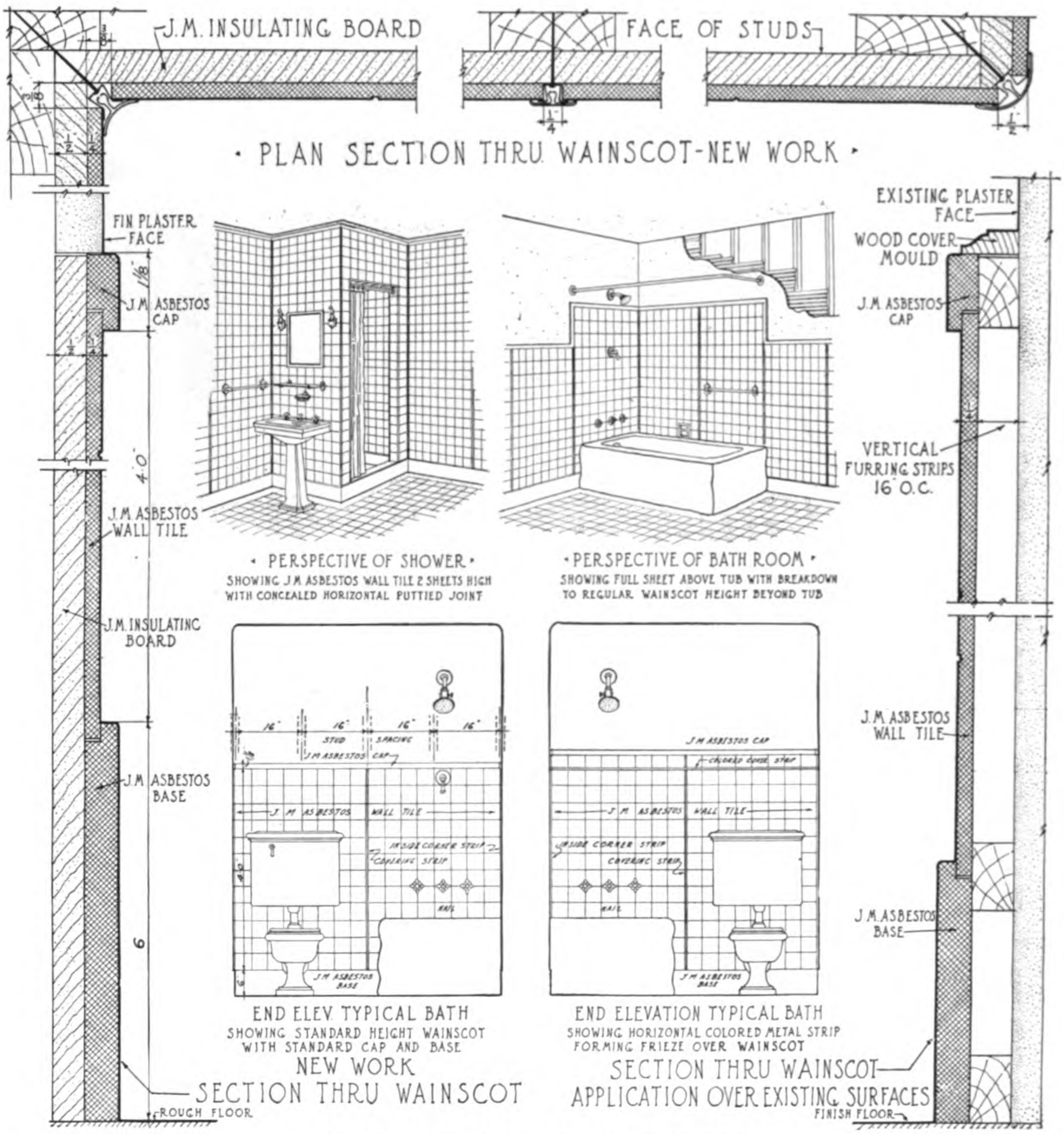

Construction details for J-M Asbestos Wall Tile

Accessories:

J-M Asbestos Wall Tile is held in place at the bottom by J-M Asbestos Base, which is rabbeted to receive the tile sheets. The base is made of the same material as the tile and measures ½" x 6". The top is held by a similarly constructed J-M Asbestos Cap which measures ½" x 1⅛". J-M Asbestos Base and J-M Asbestos Cap are furnished in the same colors as the sheets, except that black is also a standard color for contrasting effects. Their use not only adds to the attractiveness of the finished job but also simplifies application.

Metal strips and clips are furnished for covering joints and securing the sheets to the wall. These metal strips are furnished in the same colors as the cap and base.

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Application:

J-M Asbestos Wall Tile is quickly and easily installed by anyone familiar with the use of saw and hammer. Complete directions for application are included with every shipment made from the factory. The sheet form of construction saves undue expense and eliminates the many details of fitting small units. When J-M Asbestos Wall Tile is used, special preparation is unnecessary. J-M Insulating Board is nailed directly to the studding as a base for the tile sheets. This form of construction combines the desirable qualities of J-M Asbestos Wall Tile with the advantages of insulation against heat and cold.

The sheets are spaced with vertical joints open 1/4″, except at inside and outside corners. Special red brass spring fasteners are inserted into these spaces on 6″ centers and secured to the studding with nails. These spring fasteners not only hold the tile on the sides but serve as a channel into which the red brass joint strips (finished to match) are sprung into place.

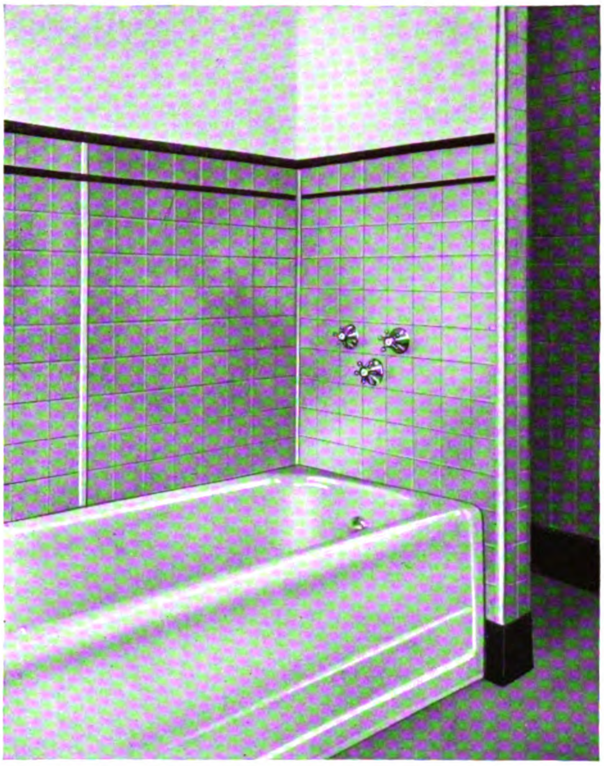
The sheets of Asbestos Wall Tile actually measure 31¾″ x 48½″. However, because of the space left between the sheets to receive the metal fasteners and because of the rabbeted design of base and cap moulding, each sheet will cover a wall area of 32″ x 48″, or 10-2/3 sq. ft. When erected with the standard base and cap moulding, one sheet in height, the top of the cap moulding is 55⅛″ above the floor line, or slightly over 4½′.

In re-decorating old rooms, the same method of application is employed. There is no need to dismantle the existing walls, the only requirement being suitable wood grounds for nailing.

Weights, Sizes, Shipping Data:

J-M Asbestos Wall Tile is furnished in sheets 31¾″ x 48½″ x ¼″ thick, to cover an area 32″ x 48″. The material weighs approximately 2½ lb. per sq. ft. uncrated, or 3 lb. per sq. ft. crated. A sheet weighs approximately 25 lb. J-M Asbestos Wall Tile is packed and shipped in wooden crates containing 12 sheets. Each crate contains sufficient material to cover 128 sq. ft., and weighs 375 to 400 lb.

J-M Asbestos Base, J-M Asbestos Cap, and the metal strips for straight inside and outside corner joints are furnished in 4′ lengths, packed in separate cases. The necessary clips for securing strips in place must be ordered separately, using 9 clips per 4′ strip.



Asbestos Wall Tile suits modern bathrooms

Each crate of J-M Asbestos Wall Tile will generally require 32′ of cap and 32′ of base, about eight 4-ft. lengths of the flat strips, five lengths of inside corner strips and one length of outside corner strip, although these quantities will naturally vary, depending on the character of the installation.

Small cans containing ⅛ pint of lacquer enamel similar to that used for coating Asbestos Wall Tile and accessories, can be furnished where necessary, for touching up the finished job.

Semi-finished material, i.e., the scored sheet, unlacquered but sanded, impregnated and primed, can be supplied where it is desired to apply some special color combination on the job.

Unscored sheets with a polished finish are available on special order in standard colors and sizes. In this form the product is called J-M Asbestos Wall Panel. It is ideally suited for the walls and ceilings of corridors, restaurants, candy stores, grocery stores—in fact any location recommended for wall tile, where an ungrooved finish without the tile effect is desired.

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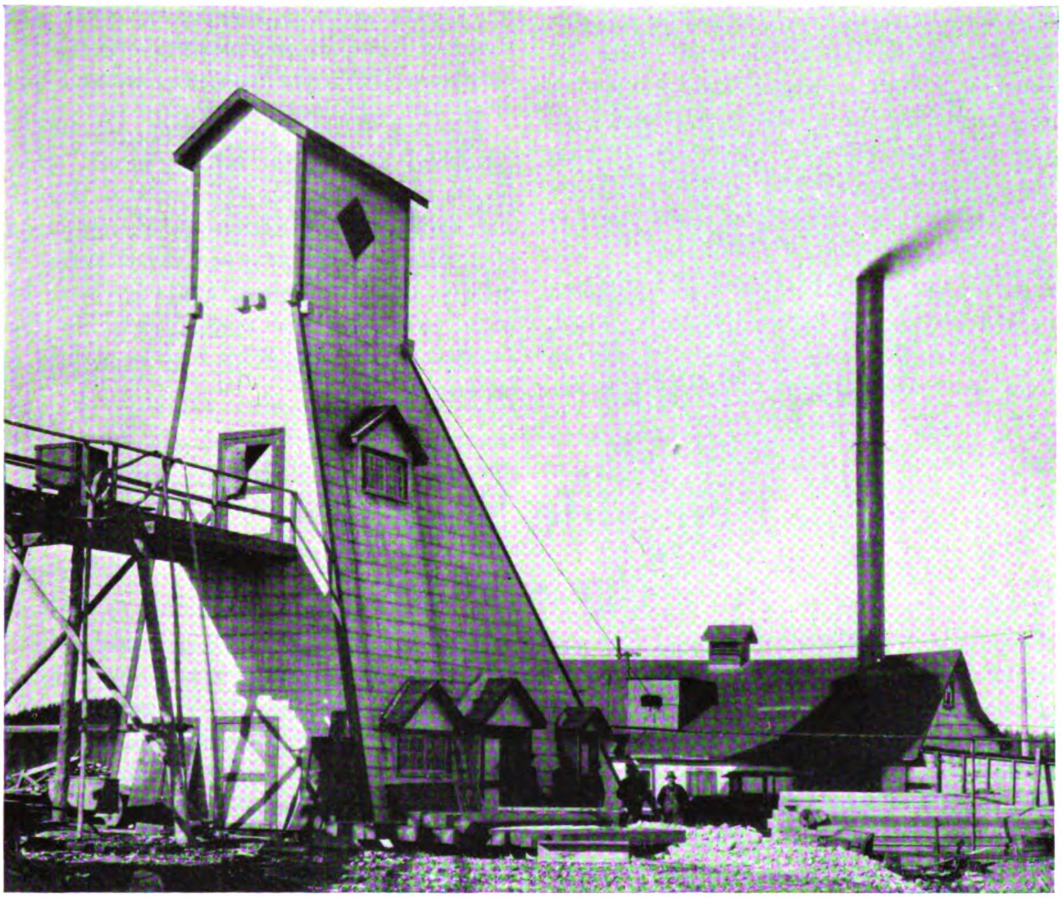
Asbestoside



Asbestoside on the head frame and hoist house of the Bidgood Gold Mine at Kirkland Lake, Ontario

The general characteristics of J-M Asbestos Roofings are embodied in Asbestoside, which is furnished in sheets for exterior siding. It is economical, fire-resisting and attractive in appearance. Painting or coating is never necessary and it is very successful in keeping out wind. Asbestoside is often applied over Housline.

Asbestoside is furnished on special order in sheets 16″ wide x 50″ long (or 32″ wide in roll form for perpendicular application), black on one side and white on the other. It is manufactured in two weights, heavy and extra heavy.

Application:

At all windows or door openings, an Asbestoside strip, 8″ or 10″ wide, should be first placed around the opening, butting the ends instead of overlapping. As the average window and door casing is not over 6″ wide, 2″ or more of the stripping will project beyond the casing. Asbestoside sheets are then applied horizontally on the sheathing, to overlap the strips around the doors and windows and to butt against the edges of the casing boards.

A strip of the same width as used at window openings should be applied at the corners of the building before the wood corner boards and side-wall sheets are put in place.

If wood corner boards are not used, a strip of Asbestoside 8″ wide may be applied on top of the Asbestoside sheets which have been run to the corner

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of the building. The 8″ strip is bent at right angles so that there will be a lap of approximately 4″ on each side of the corner.

Asbestoside sheets should be applied white side out, commencing at the top of the walls, near the eaves, by tucking 2″ of the upper edge of the first tier of sheets under the finish. All vertical and horizontal laps should be at least 2″ wide, using chalk lines to assure symmetry in the horizontal rows. Alternate rows should be started with half sheets to insure a block stone effect when completed.

With each square of Asbestoside special large headed, barbed, galvanized 7/8″ nails are supplied. It is desirable that the nails should be driven in straight lines, both vertically and horizontally, setting back from the edge of the sheets 1/2″, spacing them not over 2″ at vertical joints and not over 2½″ at horizontal joints. A pencil mark along the edge of the sheets assists in keeping the rows straight. If Pyramid Kaps are used instead of nails they should be placed 1/2″ from exposed edges and butted.

Where it is desired to apply Asbestoside perpendicularly, material in roll form 32″ wide is used. Sheets are cut from the roll not more than 10 ft. long. The details of application—strip, lapping, fastening, etc., are the same as when the material is applied horizontally. If desired, unplaned wood battens, 3″ to 6″ wide, may be applied over the laps of the finished job. These strips may be stained or painted as desired.

Bric-Side Shingles

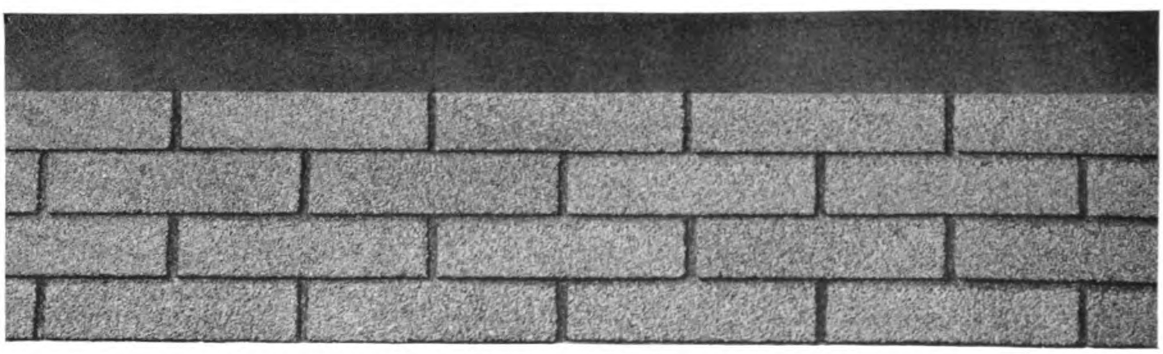
(for siding)

Bric-Side Shingles are similar to Asphalt Shingles except that the three exposed tabs are given a second coating of asphalt in which is embedded a second layer of slate, thereby forming a thick butt and giving the appearance of brickwork when applied. The upper portion is surfaced with blue-black or white slate so that when lapped to the top of the cutout the slate line is exposed around each tab, giving an appearance simulating that of black or white mortar joints.

Applied as shingle siding, this product forms an inexpensive but effective weather surface, attractive in appearance and resistant to fire and time.

Furnished in dull red, bright red, and buff, with black mortar joint, and bright red only with white mortar joint. The size is 6″ x 30″ for 2½″ exposure and 1″ headlap. There are 192 strips, or 3 bundles, per square, with a weight of approximately 210 lb.

Metal reinforced outside corner strips are furnished in dull red and buff with black mortar lines and in bright red with no mortar lines. Metal reinforced inside corner strips are furnished in dull red and buff only, with black mortar lines. Strips are 2½″ x 2½″ x 96″. Packed 96 lin. ft. per carton, weighing approximately 85 lb.



Bric-Side Shingles

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J-M Building Papers and Felts

Asbestos Paper:

A practically pure asbestos product used as a protection against heat, a fire-retardant in walls, floors and ceilings and as a divorcing membrane with flooring and waterproofing. Special grades are used in chemical filtration and in electrolytic and allied processes. Thicknesses vary from .015″ to 1/16″ and weights per 100 sq. ft. run 6, 8, 10, 12, 14, 16 and 35 lb. Standard rolls are 18″, 24″ and 36″ wide, weighing 50 and 100 lb.

Asbestos Slater's Felt:

A high-grade asbestos felt impregnated with asphalt for sheathing houses and as a liner under shingles, tile or slate. Furnished in rolls of 325 sq. ft., 32″ wide, weighing 45 lb. per roll.

Asphalt Felt:

An asphalt-saturated rag felt used as a liner under shingles, slate or tile and as a sheathing. Also used in certain classes of built-up roofs. Furnished in three weights in rolls 36″ wide. The 30-lb. weight is supplied in rolls of 216 sq. ft., weighing 60 lb.; the 15-lb. weight in rolls of 432 sq. ft., weighing 60 lb.; and the 12-lb. weight in rolls of 432 sq. ft., weighing 48 lb.

Blue Plaster Board:

A heavy weight, dry sheathing paper, furnished in rolls 36″ wide, colored light blue, used for lining walls in inexpensive house construction, and also as a sheathing. The 250-sq. ft. rolls weigh 30 lb. and the 500-sq. ft. rolls weigh 60 lb.

Weathertite Building Paper:

A strong kraft building paper saturated with asphalt and coated on the surface with an additional thin film of asphalt. It is odorless and vermin-proof. Furnished in 500-sq. ft. rolls, 36″ wide, weighing 35 lb. per roll.

No. 2 Tarred Felt:

A high-grade waterproof tarred sheathing felt, which is wind-proof, moisture-proof, and does not rot. Furnished in rolls 32″ wide, containing 432 sq. ft. and weighing 65 lb.

Asbestos Slater's Felt as a liner under Asbestos Shingles

Deadening Felt:

Unsaturated rag felt for use in walls and floors to keep out sounds and drafts. Also used under linoleum. 50 sq. yds. per roll, 36″ wide. Made in two weights, 1 lb. and 1½ lb. per sq. yd. Weight per roll, 50 lb. for 1-lb felt and 75 lb. for 1½-lb. felt.

Rosin-Sized Sheathing Paper:

An inexpensive red sheathing paper, in rolls 36″ wide, for sheathing houses, protecting new woodwork, etc. Furnished in three weights—4, 5 and 6 lb. per 100 sq. ft. Rolls weigh about 20, 25 and 30 lb. each.

Tarred Slater's Felt:

An inexpensive tarred sheathing felt, in rolls 36″ wide, used as a liner under roofs and on walls. Each roll contains 500 sq. ft. and weighs 30 lb.

Tarred Thread Felt:

A tarred waterproof sheathing felt, in rolls 36″ wide, with 9 threads running lengthwise of the sheet to prevent tearing. Waterproof, wind-proof and does not rot. Weight of 250-sq. ft. rolls, 21 lb.; weight of 500-sq. ft. rolls, 42 lb.

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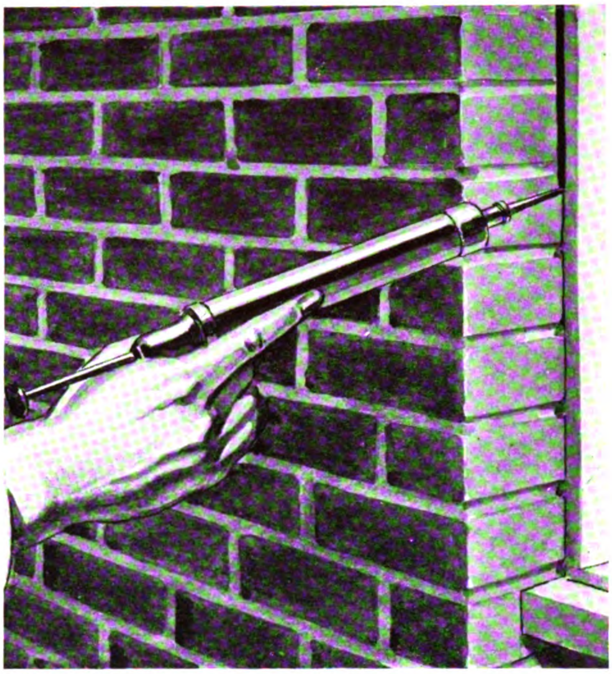
J-M Asbestos Caulking Putty

J-M Asbestos Caulking Putty is made of asbestos fibre, pigments and drying oils, blended to withstand alternate expansion and contraction and varying weather conditions. It will not dry or run in hot weather nor become brittle in cold weather, but will remain in a plastic condition indefinitely. J-M Asbestos Caulking Putty will adhere to wood, metal, brick or stone, and is recommended for use wherever it is desirable to caulk for protection against water, moisture, or infiltration of air.

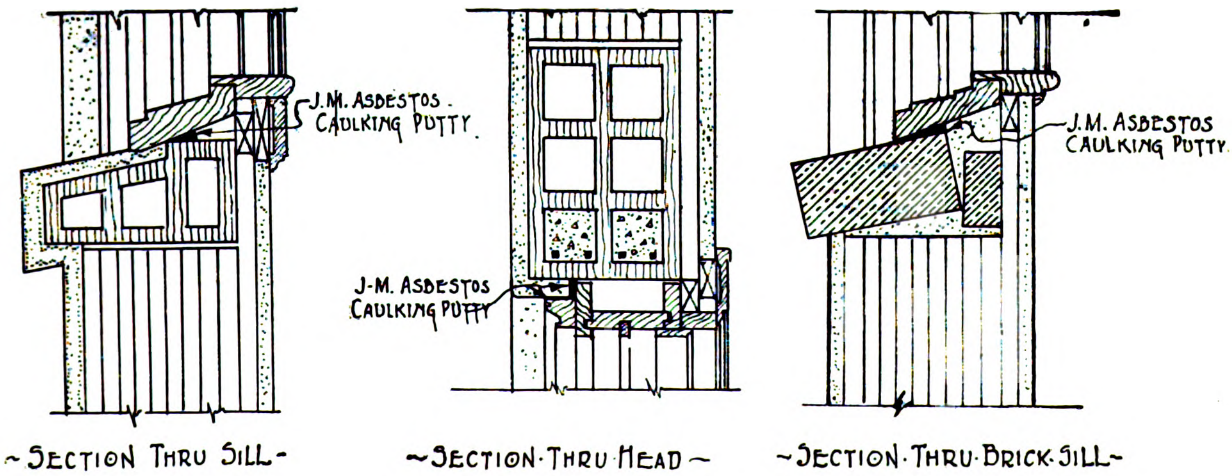
J-M Asbestos Caulking Putty is used for setting metal or wood window and door frames in wood, masonry or concrete walls; setting metal sash in art stone; setting skylights, scuttles, copings, etc.; pointing up or repairing tin, slate, glass, concrete, cement or stone; glazing steel sash; caulking around sewer, gas and water pipes where they pass through walls; and for caulking sidewalk lights.

Asbestos Caulking Putty is shipped in 150-lb. and 50-lb. drums and 25-lb., 10-lb. and 5-lb. cans. The 10-lb. cans are packed 12 to the case and the 5-lb. cans 24 to the case.

It may be applied with a trowel or putty knife but the most satisfactory method of application is to use the "Vital Automatic Glazing & Caulking Gun," sold by the Vital Manufacturing Company, Cleveland, Ohio.



J-M Asbestos Caulking Putty being applied with a caulking gun



Construction details showing location of Asbestos Caulking Putty

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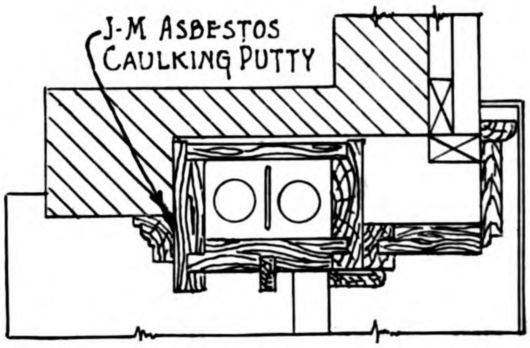
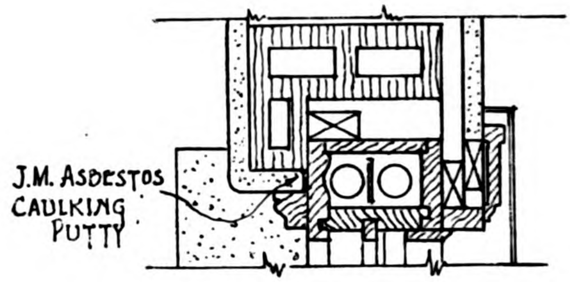
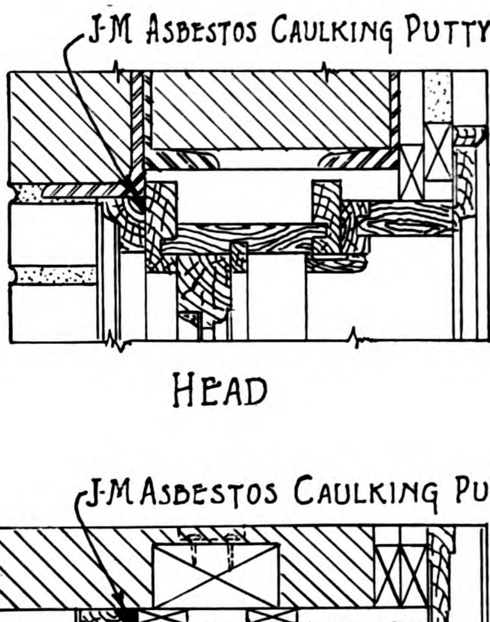


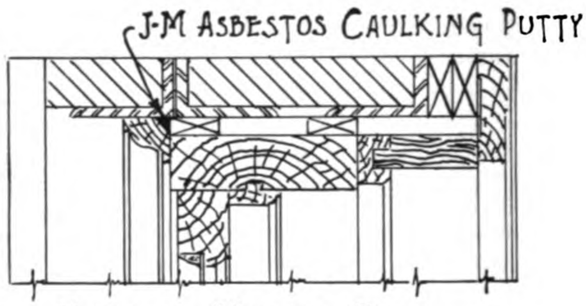
JAMB



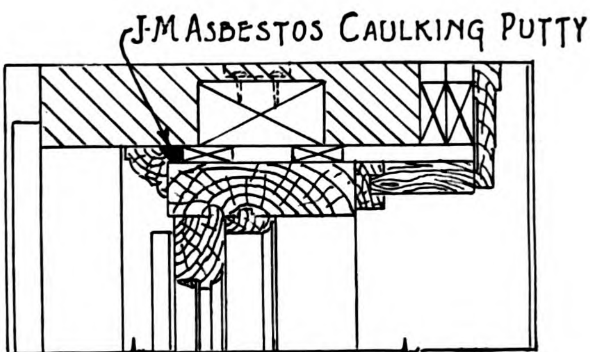
~SECTION·THRU·JAMB~



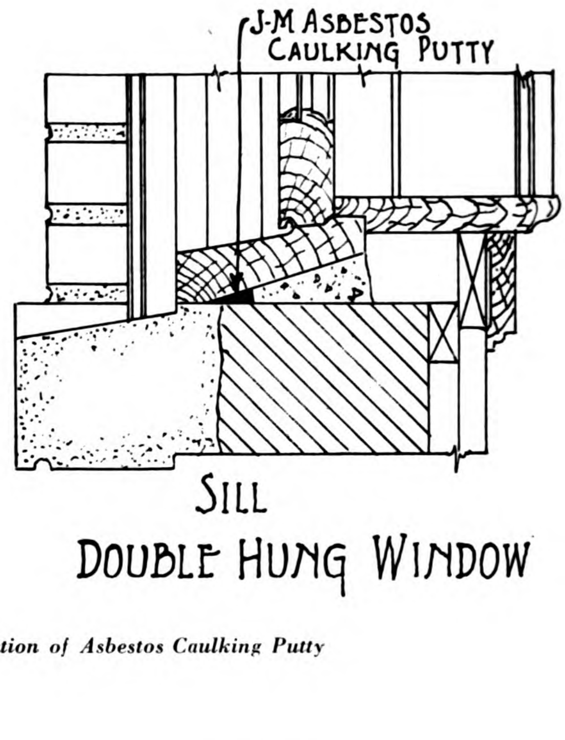
HEAD



HEAD & UPPER RAIL



JAMB & STILE



SILL

CASEMENT WINDOW

DOUBLE HUNG WINDOW

Construction details showing the location of Asbestos Caulking Putty

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INDEX

Roofing and Shingles

(*For complete list of data sheets, see other side of this page*)

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Roofing and Shingles

Complete List of Data Sheets Available

Bonded Built-up Roofs

Insulated Roofs

Ready-to-Lay Roofings

Roofing Accessories

Shingles

★Catalog pages.

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J-M Bonded Built-up Roofs

There is a J-M Built-up Roof for every requirement

Realizing that no type of built-up roof can be acceptable or usable under all conditions, Johns-Manville has developed a number of different types of built-up roofs, each one of which is designed to meet certain definite requirements. The construction and the slope of the roof, together with the expected life of the building and the amount of money available, are all prime considerations in the selection of the proper type of roof.

J-M Bonded Built-up Roofs are constructed of successive layers of saturated roofing felts. The kind of felt used, either asbestos or rag, and the number of layers vary with the different types of roofs. The final surfacing also varies, being either a smooth-surfaced coating, slag or gravel, or felt with a colored crushed slate surface. This makes possible selection according to individual preference for desired effect as well as to meet conditions in structure, protective requirements and service.

The various standard J-M Built-up Roofs are listed in the accompanying table. These roofs are classified on the basis of the kind of felt and number of layers used in their construction. The table also indicates the ratings of the Underwriters' Laboratories, Inc.

Asbestos Built-up Roofs

J-M Smooth-Surfaced Asbestos Built-up Roofs are the outcome of several decades of study and experience in producing durable, fireproof, weather-proof, light-weight roofs at a moderate cost. They are suitable for practically every type of industrial building, warehouse, office building, hotel, hospital and apartment house. They are built up of alternating layers of asphalt-saturated asbestos felt and roofing asphalt. The top finish is a high-grade, cold asphaltic roof coating.

Gravel or slag surfaced asbestos roofs make use of tar-saturated asbestos felts with moppings of coal tar pitch.

Combination Asbestos Felt and Rag Felt Built-up Roofs

Several types of Combination Roof Specifications are provided. These roofs make use of a 45-lb. or a 30-lb. asphalt-saturated rag base felt and two plies of 20-lb. asphalt-saturated asbestos finishing felts.

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TYPES OF JOHNS-MANVILLE BUILT-UP ROOFS

									Weight of Materials in Lbs.					Total Weight per Square			
Specification Number	Designation	Construction of Deck	Limitation of Roof Pitch (Inches per Foot)	Surface Finish	Type of Roofing Felts	Rating by Underwriters	Number of Plies of Felt	Layers of Asphalt (A) or Pitch (P)	Felts	Asphalt (A) Pitch (P)	Roof Coating	Gravel Surfacing	Slag Surfacing	Surfaced Smooth or with Crushed Slate	Gravel Surfaced	Slag Surfaced	Term of Guarantee Bond — Years
ASPHALT-SATURATED ASBESTOS FELT AND ASPHALT-SATURATED RAG FELT SPECIFICATIONS																	
FOR GENERAL PURPOSES																	
100	Super Class A	Wood	1/4 to 9	Smooth	Asbestos	A	One 60-lb. felt and three 20-lb. felts	A-3	120	A-90	8			218			20
101	Class A	Non-combustible				A	One 60-lb. felt and two 20-lb. felts	A-3	100	A-90	8			198			20
103		Wood				A	One 60-lb. felt and two 20-lb. felts	A-2	100	A-60	8			168			15
200	Comb. 45	Wood			Asbestos and Rag		One 45-lb. rag and two 20-lb. asbestos felts	A-2	85	A-60	8			153			15
201		Non-combustible					One 45-lb. rag and two 20-lb. asbestos felts	A-3	85	A-90	8			183			15
202	Comb. 30	Wood					One 30-lb. rag and two 20-lb. asbestos felts	A-2	70	A-60	8			138			10
203		Non-combustible					One 30-lb. rag and two 20-lb. asbestos felts	A-3	70	A-90	8			168			10
300	5-WF	Wood or Precast Gyp.	1/4 to 2	Gravel or slag	Rag	A	Five 15-lb. felts (two laid dry and three mopped)	A-4	75	A-160		400	300		635	535	20
301	5-WS		2 to 4	Slag		A*	Five 15-lb. felts	A-5	75	A-165			250			490	10
302	4-CF	Non-combustible except Precast Gyp.	1/4 to 2	Gravel or slag		A	Four 15-lb. felts	A-5	60	A-190		400	300		650	550	20
303	4-CS		2 to 4	Slag		A*	Four 15-lb. felts	A-5	60	A-165			250			475	10
304	4-WF	Wood or Precast Gyp.	1/4 to 2	Gravel or slag		A	Four 15-lb. felts (two laid dry and two mopped)	A-3	60	A-130		400	300		590	490	15
305	3-CF	Non-combustible except Precast Gyp.				A	Three 15-lb. felts	A-4	45	A-160		400	300		605	505	15
FOR USE OVER ROOFINSUL OR OTHER APPROVED RIGID INSULATION																	
104	4-A-I	Wood	1/4 to 9	Smooth	Asbestos	A	Four 20-lb. felts	A-4	80	A-120	8			208			20
105		Non-combustible				A	Four 20-lb. felts	A-4	80	A-120	8			208			20
108		Steel	1/2 to 9			A	Four 20-lb. felts	A-4	80	A-120	8			208			20
106	3-A-I	Wood	1/4 to 9			B	Three 20-lb. felts	A-3	60	A-90	8			158			15
107		Non-combustible				A	Three 20-lb. felts	A-3	60	A-90	8			158			15
109		Steel	1/2 to 9			A	Three 20-lb. felts	A-3	60	A-90	8			158			15
500		Wood					These specifications cover the application of Johns-Manville Rigid Roofinsul over the various types of roof deck construction designated, preparatory to receiving the roofing.										
501		Non-combustible															
502		Steel															
FOR USE WHERE A CRUSHED SLATE SURFACE FINISH IS DESIRED																	
400	Slatekote	Wood or Precast Gyp.	4 to 9	Crushed Slate	Rag	C	Two 15-lb. rag felts and two 50-lb. Slatekote felts	A-2	130	A-60				190			10
401		Non-combustible except Precast Gyp.				C	One 15-lb. rag felt and two 50-lb. Slatekote felts	A-3	115	A-90				205			10
402		Wood or Precast Gyp.	1 to 4			C	Three 15-lb. rag felts and two 50-lb. Slatekote felts	A-4	147	A-120				267			10
403		Non-combustible except Precast Gyp.				C	Three 15-lb. rag felts and two 50-lb. Slatekote felts	A-5	147	A-150				297			10
FOR USE UNDER PROMENADE TILE																	
112	4-A-P	Non-combustible	1/4 to 1/2	Smooth	Asbestos		Two plies rosin-sized paper and four 20-lb. asbestos felts	A-5	80	A-160				240			20
204	Comb 45				Asb. and Rag		Two plies rosin-sized paper; one 45-lb. rag felt and two 20-lb. asb. felts	A-4	85	A-130				215			10
FOR USE UNDER GRANOLITHIC FINISH																	
114	Super Class A	Non-combustible	1/4 to 1/2	Smooth	Asbestos		Two plies rosin-sized paper; one 60-lb. felt; three 20-lb. felts and two additional plies of rosin-sized paper	A-5	120	A-165				285			10
FOR USE UNDER LIGHT FOOT TRAFFIC NOT WARRANTING USE OF PROMENADE TILE, ETC.																	
102	Super Class AF	Wood	1/4 to 1	Smooth	Asbestos	A	One 60-lb. felt; three 20-lb. felts; and one 74-lb. Extra Heavy Flexstone felt	A-4	194	A-120				314			20
102-A	Class AF	Non-combustible				A	One 60-lb. felt; two 20-lb. felts; and one 74-lb. Extra Heavy Flexstone felt	A-4	174	A-120				294			20
FOR USE ON SPRAY DECKS																	
110	Class A with Fabric	Wood	1/4 to 2	Smooth	Asbestos and Fabric		One 60-lb. felt; one Type B Asphalt-Saturated Fabric; and two 20-lb. felts	A-4	111	A-115				226			10
111		Non-combustible					One 60-lb. felt; one Type B Asphalt-Saturated Fabric; and two 20-lb. felts	A-5	111	A-145				256			10
TAR AND GRAVEL SPECIFICATIONS																	
600		Wood or Precast Gyp.	1/4 to 2	Gravel or Slag	Tarred Asbestos		One ply rosin-sized paper (over wood). Five 15-lb. tarred asbestos felts (two laid dry and three mopped).	P-4	75	P-150		400	300		625	525	20
601			2 to 6	Slag			One ply rosin-sized paper (over wood). Five 15-lb. tarred asbestos felts. (Pitch used on in-between moppings—asphalt for embedding slag)	P-4 A-1	75	P-60 A-45			250			430	10
602		Non-combustible except Precast Gyp.	1/4 to 2 poured Gyp. 1/4 to 1 on others	Gravel or Slag			Four 15-lb. tarred asbestos felts	P-5	60	P-200		400	300		660	560	20
603			2 to 6	Slag			Four 15-lb. tarred asbestos felts. (Pitch used on in-between moppings-asphalt for embedding slag)	P-4 A-1	60	P-65 A-45			250			420	10
604		Wood or Precast Gyp.	1/4 to 2	Gravel or Slag			One ply rosin-sized paper (over wood). Four 15-lb. tarred asbestos felts (two laid dry and two mopped)	P-3	60	P-125		400	300		585	485	15
605		Non-combustible except Precast Gyp.	1/4 to 2 poured Gyp. 1/4 to 1 on others				Three 15-lb. tarred asbestos felts	P-4	45	P-175		400	300		620	520	15
612		Non-comb. under Promenade Tile	1/4 to 1	Smooth			Five 15-lb. tarred asbestos felts (laid two shingled; two shingled; and one final ply)	P-6	75	P-200				275			On Application

* Class A Underwriters rating on pitches up to and including 3 inches per foot

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TYPES OF JOHNS-MANVILLE BUILT-UP ROOFS (CONT.)

Specification Number	Designation	Construction of Deck	Limitation of Roof Pitch (Inches per Foot)	Surface Finish	Type of Roofing Felts	Rating by Underwriters	Number of Plies of Felt	Layers of Asphalt (A) or Pitch (P)	Weight of Materials in Lbs.: Felts	Asphalt (A) Pitch (P)	Roof Coating	Gravel Surfacing	Slag Surfacing	Surfaced Smooth or with Crushed Slate	Total Weight per Square: Gravel Surfaced	Slag Surfaced	Term of Guaranty Bond — Years
TAR AND GRAVEL SPECIFICATION (CONT.)																	
606	4-TIWF	Wood or Precast Gyp.	1/4 to 2	Gravel or slag	Tarred Asbestos		Over insulation: Four 15-lb. tarred asbestos felts.	P-5	65	P-200		400	300		665	565	20
607	4-TICF	Non-combustible except Precast Gyp.	1/4 to 2 poured Gyp. 1/4 to 1 on others	Gravel or slag	Tarred Asbestos		Over insulation: Four 15-lb. tarred asbestos felts.	P-5	65	P-200		400	300		665	565	20
608	3-TIWF	Wood or Precast Gyp.	1/4 to 2	Gravel or slag	Tarred Asbestos		Over insulation: Three 15-lb. tarred asbestos felts.	P-4	49	P-175		400	300		624	524	15
609	3-TICF	Non-combustible except Precast Gyp.	1/4 to 2 poured Gyp. 1/4 to 1 on others	Gravel or slag	Tarred Asbestos		Over insulation: Three 15-lb. tarred asbestos felts.	P-4	49	P-175		400	300		624	524	15
610	4-TIWS	Wood or Precast Gyp.	2 to 6	Slag	Tarred Asbestos		Over insulation: Four 15-lb. tarred asbestos felts. (Pitch used on in-between moppings – asphalt for embedding slag.)	P-3 A-1	65	P-75 A-45			250			435	10
611	4-TICS	Non-combustible except Precast Gyp.	2 to 6 poured Gyp. 1 to 6 on others	Slag	Tarred Asbestos		Over insulation: Four 15-lb. tarred asbestos felts. (Pitch used on in-between moppings – asphalt for embedding slag.)	P-3 A-1	65	P-75 A-45			250			435	10
612	See previous sheet																
613	4-TCL	Poured concrete or poured Gyp.	1/4 or less	Gravel or slag	Tarred Asbestos		Four 15-lb. tarred asbestos felts (laid two shingled, followed by two additional, shingled.)	P-5	65	P-200		400	300		665	565	20

Rag Felt Built-up Roofs

Johns-Manville can also furnish roofs made up of asphalt-saturated rag felts. The top surface of such roofs consists of gravel (maximum pitch 2″ per foot), or slag (maximum pitch 4″), or of a layer of J-M Split Sheet Slatekote (maximum pitch 9″). Slatekote is a heavy asphalt-saturated rag felt into which a coating of crushed slate is securely embedded at the factory. An ornamental surface can be obtained by the use of Slatekote which may be had in red, green or blue-black as standard colors and in white or chrome orange for airport construction.

Application and Inspection

Proper application is just as important in producing a built-up roof as are the materials themselves. For this reason, in every community J-M Approved Roofers have been appointed, these appointments being based on thoroughness of workmanship and on financial responsibility. Johns-Manville also maintains a corps of inspectors whose services are provided in connection with bonded built-up roofs. This inspection is required on every roof which is to be bonded, and is rendered before, during, and after the application of the roof.

Materials Used in J-M Bonded Built-up Roofs

Asbestos Felt Strips: 4″ wide strips of 15-lb. asphalt-saturated asbestos felt for use in flashing. Furnished in rolls of 121½ linear feet.

Asbestos Felt 15-lb.: Asphalt-saturated asbestos felt used in connection with J-M System of Flashing. Furnished in 3-sq. rolls (324 sq. ft.), 32″ wide, weighing 45 lb., or 15 lb. per sq.

Asbestos Roofing Felt 20-lb.: Asphalt-saturated asbestos felt, coated one side with asphalt, for use in asbestos and combination built-up roofs. Furnished in 3-sq. rolls (324 sq. ft.), 32″ wide, weighing 60 lb., or 20 lb. per sq.

Asbestos Roof Putty: A high-grade roof putty made of asbestos fibre and asphalt. Used for patch-

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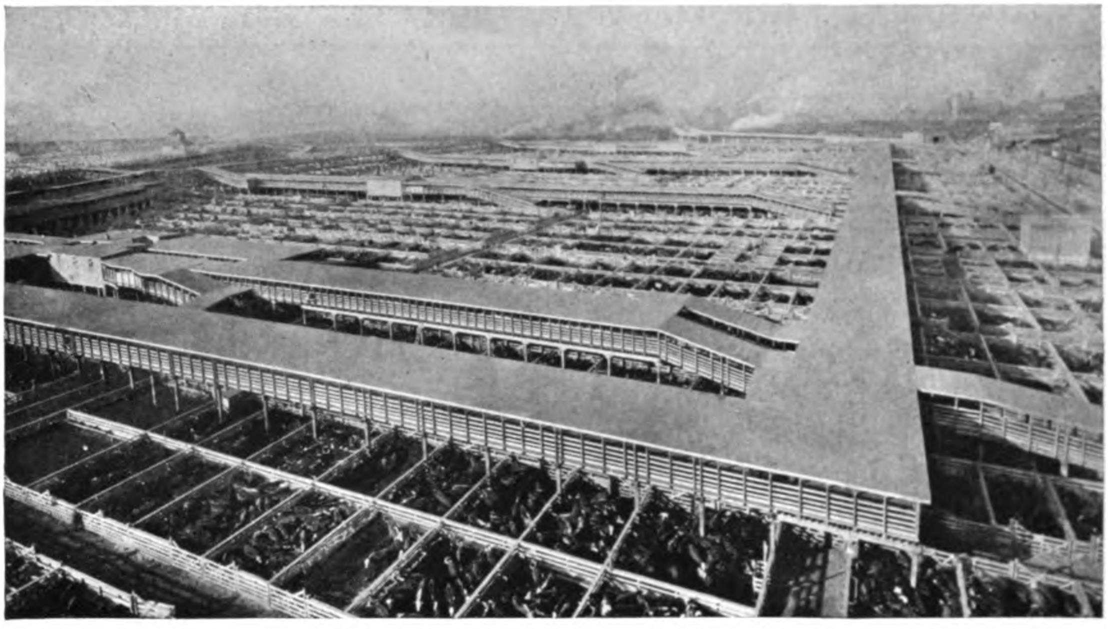


J-M Asbestos Built-up Roofs on the runways of the stock yards at Kansas City, Mo.

ing leaky roofs, constructing and repairing flashings, and for various other purposes. Furnished in red, gray and black in 1, 5, 10, 25, 50 and 150-lb. containers. Black is also furnished in 500-lb. drums.

Asphalt-Saturated Fabrics: Woven cotton fabrics, manufactured in two weights, which find their principal application in conjunction with asbestos felts in built-up membrane waterproofing work. Before saturation, Type A weighs 4 oz. per sq. yd. and Type B, 5 oz. per sq. yd. Standard rolls, 36″ wide, contain 522 sq. ft.

Barge Roofing: A 4-ply roofing for barges made of 1 layer of asphalt-saturated asbestos felt on bottom, then a layer of burlap, followed by 2 additional layers of asbestos felt, all cemented together with asphalt. Furnished in sheets 32″ x 80″, 6 sheets to the sq., 4 sqs. to the crate. Weight about 90 lb. per sq.

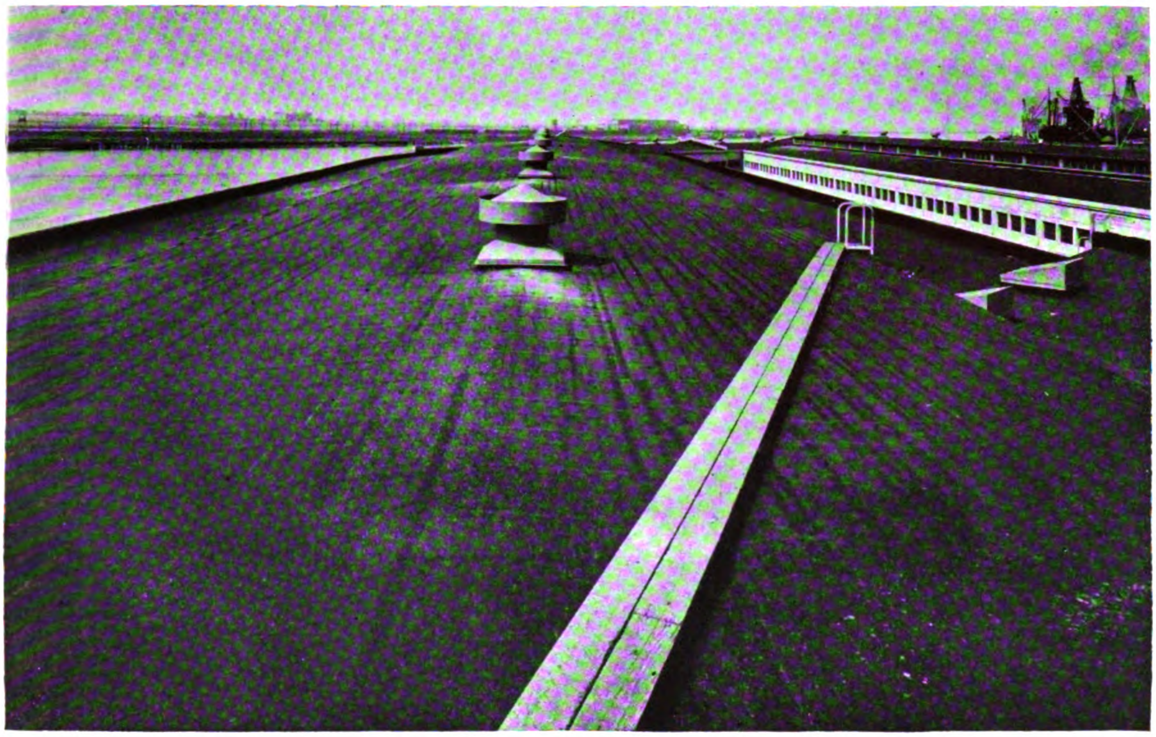
Bonded Asphalt-Saturated Rag Felt 15-lb.: Asphalt-saturated rag felt used on Bonded Slag, Gravel, or Slatekote Surfaced Roofs. Furnished in 4-sq. rolls (432 sq. ft.), 36″ wide, weighing 60 lb., or 15 lb. per sq.

Bonded Roofing Asphalts: Used on all J-M Bonded Built-up Roofs, except those in which tar-saturated asbestos felts are used. No. 1 F. D. (melting point 150 to 165 deg. F.) used on dead-level decks (pitch ¼″ per foot or less). No. 6 (melting point about 150 deg. F.) used on pitches from ¼″ to 1½″ per foot. No. 170 (melting point about 170 deg. F.) used on pitches from 1½″ to 3″ per foot. No. 190 (melting point about 190 deg. F.) used on pitches from 3″ to 9″ per foot. All furnished in solid form in drums of approximately 500 lb.

Bonded Roofing Pitch: Used with tar-saturated asbestos felts in J-M Bonded Tar and Gravel Roofs. Furnished in 350 and 550-lb. bbls.

Concrete Primer: A thin liquid asphalt especially prepared for priming concrete or gypsum decks to form a bond between the asphalt and the deck. It is always applied cold and must be allowed to dry thoroughly. If material thickens it may be thinned with gasoline, naphtha or benzine. Kerosene *must not* be used for this purpose. Covering capacity about 1 to 2 gal. per 100 sq. ft., depending upon the nature of surface to be covered. Furnished in 1, 5, 25 and 50-gal. containers.

Expansion Joint Filler: An asphaltic compound of great tenacity used for filling in expansion joints.



J-M Super Class A Built-up Roofs on the Grove St. docks, Port of Oakland, Calif.

Furnished in solid form in metal drums weighing approximately 500 lb. each. It must be melted down in a kettle and poured into place while hot.

Flexstone Roofing, Extra Heavy: Composed of four layers of asbestos felt, thoroughly saturated and cemented together with asphalt. Used over Class A and Super Class A Roofs where there is light foot traffic. Furnished in sheets 32″ x 80″, 6 sheets to the sq., crated 4 sqs. per crate. Weight uncrated, 74 lb. per sq.; crated, 98 lb. per sq.

No. 30 Combination Base Felt: Asphalt-saturated rag felt (uncoated), used as base felt in Combination 30 Roofs. Furnished in 2-sq. rolls (216 sq. ft.), 36″ wide, weighing 67 lb. Nominal weight 30 lb. per sq.

No. 45 Base Felt: Heavy rag felt, thoroughly saturated and coated with asphalt. Used as a base felt in Combination 45 Roofs. Furnished in 1-sq. rolls (108 sq. ft.) 36″ wide, weighing 45 lb.

Ready-Mixed Asbestile: A heavy-bodied plastic cement composed of asbestos fibre, asphalt and other mineral ingredients, designed to afford thorough water-tightness over asbestos base flashing where used in conjunction with the 4″ strips of asphalt-saturated asbestos felt. It is particularly adapted for use in the J-M System of Three-Course Asbestile on the flashing of parapet walls, and in the felt-stripping of base flashing material. Furnished in 25, 50, 150 and 300-lb. containers.

Regal Roof Coating: A high grade asphaltic roof coating, applied cold as the surface finish on smooth-surfaced J-M Bonded Built-up Roofs. One gallon (8 lb.) required per 100 sq. ft. of roof area. Furnished in 1, 5, 25 and 50-gal. containers.

Rigid Roofinsul: J-M Rigid Roofinsul is a strong rigid board of high insulating value, made of felted wood fibres. It is the ideal insulation for use over any type of roof deck in conjunction with built-up roofs. Furnished in boards ½″ thick, 2 ft. wide, and 4 ft. long. Where insulation more than ½″ thick is required, it can be furnished in two, three or four

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J-M Asbestos Built-up Roof on the hangar at Lakehurst, N. J.

thicknesses stapled together, with a ½″ ship-lap joint on all four edges.

Rosin-Sized Sheathing Paper: An inexpensive red sheathing paper sometimes used in connection with J-M built-up roofs. Furnished in rolls 36″ wide in three weights—4, 5 and 6 lb. per 100 sq. ft. Rolls contain approximately 500 sq. ft. and weigh about 20, 25 and 30 lb. each.

Salamander White Top Asbestos Roofing: A 2-ply material composed of an unsaturated and a saturated asbestos felt cemented together, used with the white surface exposed as a cap sheet on sawteeth and other pitched surfaces for light reflection. Furnished in 2-sq. rolls (216 sq. ft.), 32″ wide, weighing 60 lb., or 30 lb. per sq. Has 1½″ selvage edge, but should be laid with not less than 2″ lap.

Split Sheet Slatekote Roofing: Heavy asphalt-saturated rag felt, 36″ wide, with 17″ of top surface covered with crushed slate in red, green, blue-black, white, or chrome orange. Used principally over built-up roofs where color is desired. Furnished in 1-sq. rolls (108 sq. ft.) weighing 50 lb. Each roll covers 51 sq. ft. weather area.

Standard Asbestos Built-Up Roofing Felt 60-lb.: An extra heavy asbestos felt, thoroughly saturated and coated, and sanded. Used as a base sheet on Class A and Super Class A Roofs. Furnished in 1-sq. rolls (108 sq. ft.), 32″ wide, weighing 60 lb.

Standard Asphalt Waterproofing Cement: A specially compounded asphalt used particularly on spray decks and for other waterproofing work in connection with built-up roofs. Furnished in metal drums of approximately 500 lb.

Tar-Saturated Asbestos Roofing Felt 15-lb.: A tarred asbestos felt for use in J-M Bonded Tar and Gravel Roofs. Furnished in 4-sq. rolls (432 sq. ft.), 32″ wide, weighing 65 lb., or approximately 16 lb. per sq. Nominal weight, 15 lb. per sq.

3-Ply Flashing Material: Sheet consisting of a center layer of asphalt-saturated rag felt, with asphalt-saturated asbestos felt on each side, cemented to the rag felt with asphalt. Used in connection with J-M System of Flashing. Also used, cut to required width, for edging. Furnished in sheets 32″ x 80″, 6 sheets to the sq., crated 5 sqs. per crate. Also furnished in 8″, 10 2/3″ and 16″ wide strips.

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Application of J-M Bonded Built-up Roofs

Proper application is as important as the materials themselves

J-M Bonded Built-up Roofs can be applied over almost any type of roof deck. Wood decks should be of splined or tongue and groove boards and free from loose boards, large cracks or knot holes. All openings 1/4" or more in width must be covered with sheet metal nailed in place. The same requirements apply to old wood decks, and any damaged boards must be replaced with new boards.

Poured concrete or gypsum decks should be smooth, thoroughly set, dry, free from frost or the effects of freezing, properly graded to outlets and free from loose material.

Decks composed of precast concrete must be leveled, where necessary, with portland cement mortar or J-M Asbestos Roof Putty, and all joints pointed up with the same material. Precast gypsum decks should be prepared in the same manner, except that gypsum mortar should be used.

No J-M Bonded Built-up Roofs are applied over steel decks unless the pitch is at least 1/2" to the foot and unless at least one ply of half-inch thick approved rigid insulation is first applied to deck.

Book tile should be grouted over with approximately 1" of portland cement mortar and allowed to dry thoroughly before the built-up roof is applied.

Old gravel or slag surfaced roofs on wood decks will be satisfactory as a base for J-M Bonded Built-up Roofs provided all gravel or slag is carefully removed; any cracked or broken roofing felt is covered with two thicknesses of finishing felt or one thickness of base felt, nailed in place; and old roofing felts, where badly deteriorated, are entirely removed and the deck cleaned.

On old gravel or slag surfaced roofs over concrete decks, the old roof must be entirely removed and the concrete surface scraped clean, except where deck is surrounded by parapet walls or other vertical surfaces which afford protection against blow-offs, in which case the old felts may remain, provided they are scraped clean of all gravel or slag.

J-M Bonded Built-up Roofs may be applied over old ready or prepared, smooth or slate surface roofing. All projecting nails should be pulled or redriven and all cracked or broken roofing felts should be covered with two thicknesses of finishing felt or one thickness of base felt, nailed or mopped in place.

Application over tin roofs is the same as over wood, except that in addition to nailing, the base felt is solidly mopped to the tin. Standing seam tin roofs should be removed, or the standing seams hammered flat and nailed. Any buckles in tin should be cut and nailed and any loose tin also nailed. Where

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cracks or other openings occur in tin, they are covered with two thicknesses of finishing felt or one thickness of base felt, nailed or mopped in place.

Pitch or Incline of Roof:

Built-up roofs may be applied over absolutely flat decks, provided No. 1 F. D. Bonded Roofing Asphalt is used throughout and there is no objection on the part of the owner to water remaining on the surface of the finished roof. Dead level decks are not recommended, however, and all roofs should have sufficient pitch to drain water to outlets with reasonable promptness.

The pitch of Asbestos or Combination smooth-surfaced roofs is limited only by working facilities, usually 9″ to the foot maximum. On non-combustible decks where pitch is over 3″ to the foot, wood nailing strips should be embedded in deck on not over 4-ft. centers, at right angles to direction of felts.

On rag felt roofs, gravel is used for surfacing where the pitch does not exceed 2″ to the foot and slag where the pitch does not exceed 4″ to the foot. Slatekote surface over built-up roofs may be applied over surfaces pitched 4″ to the foot and over, and, for airport construction, on pitches 1″ to 4″ to the foot.

Application of Felts:

Felts should always be laid so that flow of water will be *over* or *parallel with*—never against—the laps. On smooth surface asbestos roofs where pitch does not exceed 3″ to the foot, the base felt may be run either parallel with, or at right angles to, the eaves; the finishing felts, only parallel with the eaves. Where pitch exceeds 3″ to the foot, all felts may be run either parallel with, or at right angles to, the eaves.

On Slatekote-surfaced rag felt roofs where pitch is 4″ or more to the foot, all felts may be run either parallel with, or at right angles to, the eaves.

Felts are rolled closely behind the mop and mopping should at no time be more than 3 ft. ahead of the roll. Sufficient asphalt should be used so that it will flood in an unbroken line ahead of the roll. The felts are broomed in while the asphalt is still hot. All nails are driven through flat tinned disks or caps.

The 20-lb. asphalt-saturated asbestos felt should always be laid coated side down.

Application of Asphalt:

Asphalt should not be heated above 450 deg. F., nor applied under 350 deg. F. on the map. Asphalt must be applied so that felts are embedded their full width and so that in no place shall felt touch felt, except as otherwise called for in the specifications.

The following quantities of asphalt are required per 100 sq. ft. of roof area:

Mopping over roof deck .... 30 lb.
Each mopping between plies of felts .... 30 lb.
Top mopping for receiving slag (pitches over 2″ but not exceeding 4″ per foot) .... 45 lb.
Top mopping for receiving gravel or slag (pitches 2″ per foot or under) .... 70 lb.

Where particularly specified by architect, engineer or owner, J-M Bonded Roofing Asphalt may be used as the top surfacing for smooth-surfaced asbestos or combination roofs. In such cases, the asphalt is applied hot, using 25 lb. per 100 sq. ft.

Application of Cold Coating:

J-M Regal Roof Coating is the standard surfacing for smooth-surfaced asbestos or combination roofs. It is applied cold at the rate of 1 gal. (8 lb.) per 100 sq. ft.

Insulation:

Certain J-M Bonded Built-up roofs may be applied over J-M Rigid Roofinsul, sheet cork, or other rigid insulation approved by Johns-Manville. The insulation must possess sufficient firmness to provide a suitable foundation for the built-up roof. Roofing bonds in such cases do not include the insulating material as part of the guarantee.

The method of applying insulation is described in another data sheet, in connection with the subject of "Asbestos Roofs Over Insulation." Approved insulation other than J-M Rigid Roofinsul, must be applied in accordance with the manufacturer's specifications, provided such specifications are at least equal to the Johns-Manville specifications.

Detailed Instructions and Specifications:

Detailed application instructions and specifications which must be followed by Johns-Manville Approved Roofing Contractors in the application of J-M Bonded Built-up Roofs, are available in special data sheets.

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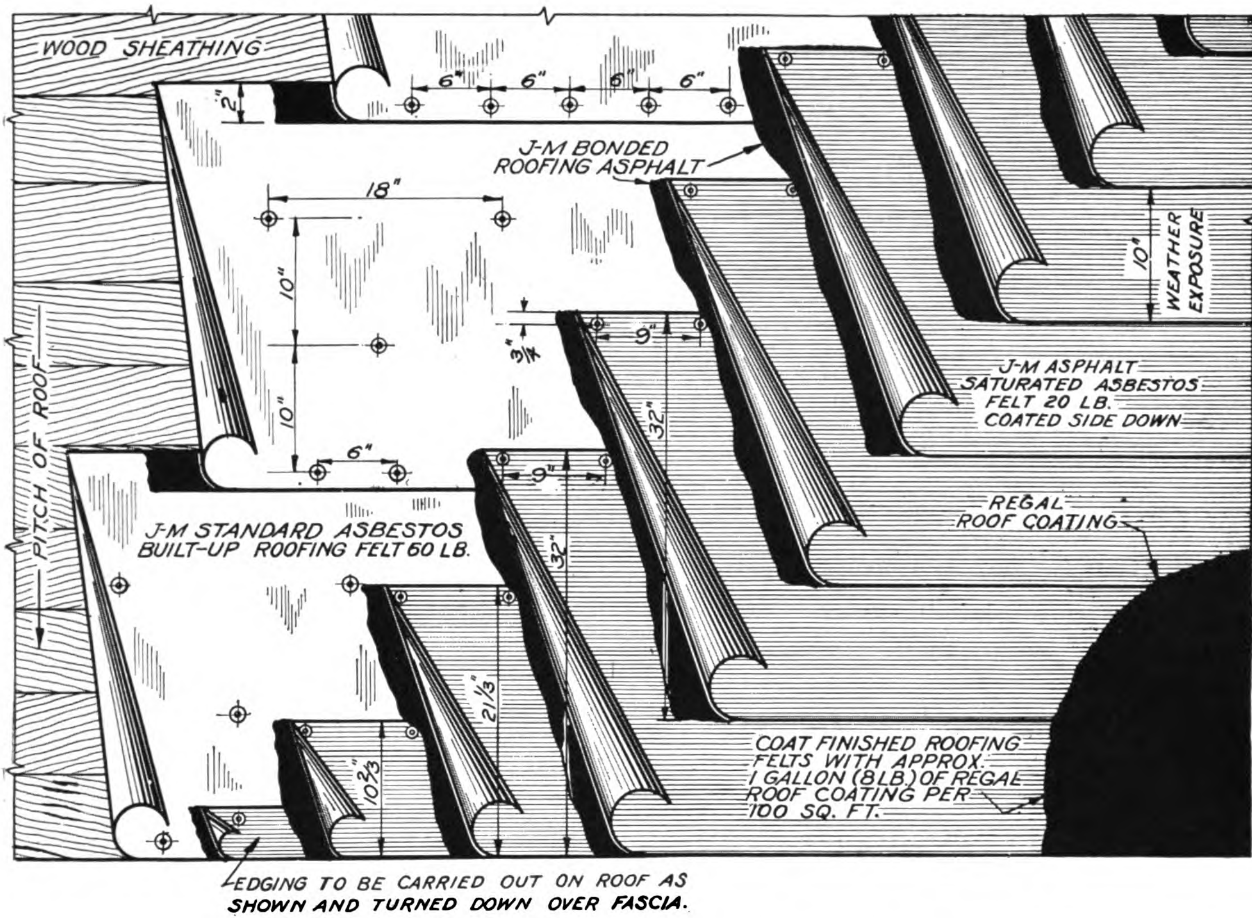
J-M Super Class A Built-up Roofs



Super Class A Roof over wood deck, Specification No. 100

The Super Class A Roof consists of a 60-lb. asbestos base felt and three plies of 20-lb. asphalt-saturated asbestos finishing felts.

Over wood decks, Specification No. 100, application is as shown in the above drawing. Guarantee Bond covers a period of 20 years.

For light foot traffic over wood decks, Specification No. 102 is applied as shown above, except that the Regal Roof Coating is omitted and a layer of J-M Extra Heavy Flexstone Roofing is applied in a mopping of asphalt. This is known as the Super Class AF Roof and carries a 20-year Guarantee Bond.

Where a granolithic surface is to be applied over the built-up roof (maximum pitch ½" to the foot), Super Class A Specification No. 114 is used. *(Granolithic surface over built-up roofs is applied only on concrete roof decks.)* To the deck are spot-mopped two plies of J-M Rosin-Sized Sheathing Paper. Then the 60-lb. asbestos base felt is laid in a mopping of asphalt, followed by the three plies of 20-lb. asphalt-saturated asbestos finishing felts embedded in asphalt. Regal Roof Coating is omitted and the deck is coated over with a finish mopping of asphalt. The granolithic surface, at least 2½" thick and provided with proper expansion joints, is then applied over two additional layers of J-M Rosin-Sized Sheathing Paper. Guarantee Bond on this roof, when granolithic surface is applied, is for a period of 10 years.

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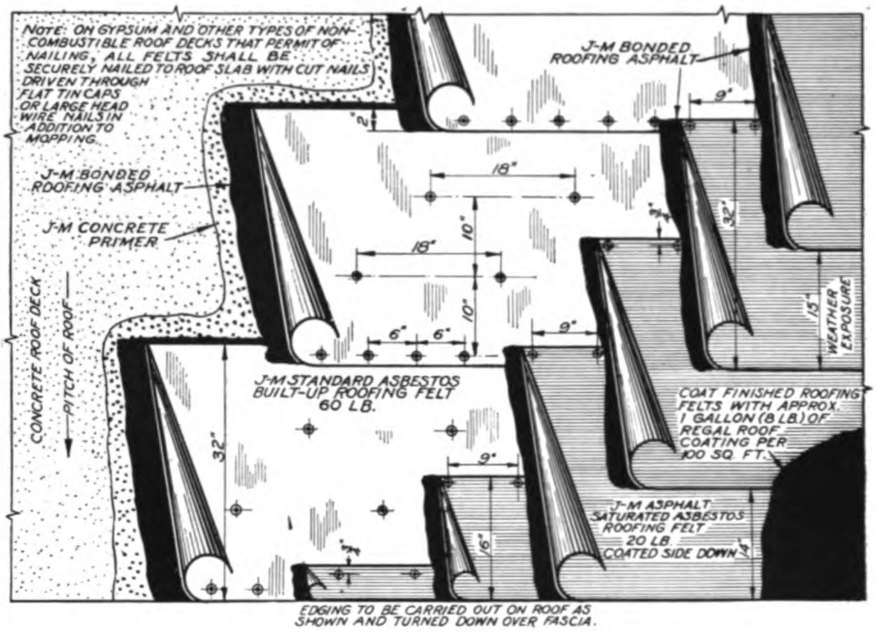
J-M Class A Built-up Roofs



Class A Roof over non-combustible deck, Specification No. 101

The Class A Roof consists of a 60-lb. asbestos base felt and two plies of 20-lb. asphalt-saturated asbestos finishing felts.

Over non-combustible decks, Specification No. 101, application is as shown in the above drawing. Where pitch exceeds 3″ per foot and deck itself does not permit nailing, nailing strips on not more than 4-ft. centers should be embedded in deck at right angles to the direction in which felts are run. Guarantee Bond over *non-combustible* decks covers 20 years.

For light foot traffic over non-combustible decks, Specification No. 102-A is applied as shown above, except that the Regal Roof Coating is omitted and a layer of J-M Extra Heavy Flexstone Roofing is applied in a mopping of asphalt. This is known as the Class AF Specification and also carries a 20-year Guarantee Bond.

Over wood decks, Specification No. 103, application is the same as shown above, except that no primer or mopping is used over the deck and the 60-lb. asbestos base felt is nailed dry directly to the sheathing and cemented at laps, as indicated for the Super Class A Roof on the preceding page. Over *wood* decks, the Class A Roof carries a 15-year Guarantee Bond.

On non-combustible spray decks, Specification No. 111 calls for a Class A Roof with the addition of one ply of J-M Type B Asphalt-Saturated Fabric solidly mopped over the 60-lb. asbestos base felt and overlaid with the two 20-lb. asphalt-saturated asbestos finishing felts. J-M Standard Asphalt Waterproofing Cement is used instead of J-M Bonded Roofing Asphalt for mopping over the roof deck and between the felts. J-M Standard Asphalt Waterproofing Cement is also used for surface mopping, instead of the cold application of Regal Roof Coating. Otherwise, application is the same as for Specification No. 101. Guarantee Bond is for 10 years.

On wood spray decks, Specification No. 110 calls for a Class A Roof with the addition of one ply of J-M Type B Asphalt-Saturated Fabric solidly mopped over the 60-lb. asbestos base felt and overlaid with the two 20-lb. asphalt-saturated asbestos finishing felts. J-M Standard Asphalt Waterproofing Cement is used for in-between moppings and for the surface finish instead of J-M Bonded Roofing Asphalt and J-M Regal Roof Coating. Otherwise, application is the same as for Specification No. 103. Guarantee Bond is for 10 years.

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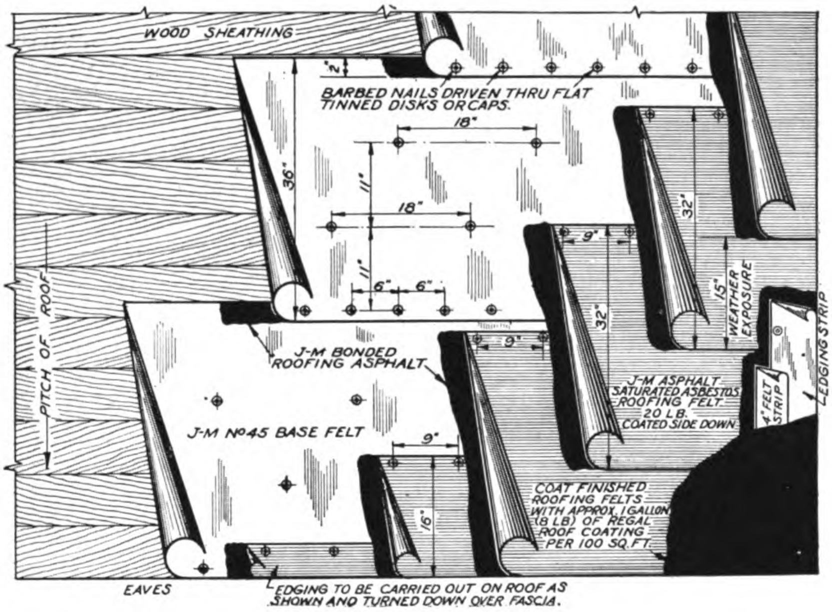
J-M Combination Built-up Roofs



Combination 45 Roof over wood deck, Specification No. 200

Combination 45 Roofs consist of a base of one layer of 45-lb. rag felt and two layers of 20-lb. asphalt-saturated asbestos finishing felts. Combination 30 Roofs consist of a base of one layer of No. 30 Combination Base Felt and two layers of 20-lb. asphalt-saturated asbestos finishing felts.

The Combination 45 Roof over wood decks, Specification No. 200, is applied as shown in the above drawing. The Guarantee Bond on this roof is for a period of 15 years.

The Combination 45 Roof over non-combustible decks, Specification No. 201, is applied in a similar manner to that shown above, except that the deck must first be primed and the base felt mopped in solidly with asphalt. Where pitch exceeds 3" to the foot and deck itself does not permit nailing, nailing strips on not more than 4-ft. centers should be embedded in deck at right angles to direction of felts. This roof also carries a 15-year Guarantee Bond.

The Combination 30 Roofs are applied as outlined above, the only difference being the use of a No. 30 Combination Base Felt, instead of a 45-lb. felt. Specification No. 202 over wood decks and Specification No. 203 over non-combustible decks each carry a 10-year Guarantee Bond.

For application under Promenade Tile (maximum pitch ½" to the foot), a Combination 45 Roof, Specification No. 204, is used. *(Promenade Tile over built-up roofs is applied only on concrete decks)*. Application of the Combination 45 Roof is the same as that called for in Specification No. 201, except that two plies of J-M Rosin-Sized Sheathing Paper are spot-mopped to the concrete deck prior to mopping the base and finishing felts in place. Regal Roof Coating is omitted and the deck is coated, instead, with a mopping of asphalt. Over the asphalt surfacing, 6" x 9" x 1" Promenade Tile are laid, either in a bedding of portland cement mortar not less than 1" thick or in hot J-M Bonded Roofing Asphalt. Expansion joints, 1" thick, filled with J-M Expansion Joint Filler, are provided on not greater than 20-ft. x 20-ft. centers and at all vertical walls. All other joints between tile are grouted with portland cement mortar. Guarantee Bond is for 10 years.

Specification No. 112, calling for four shingled plies of 20-lb. asphalt-saturated asbestos felt over two plies of Rosin-Sized Sheathing Paper, is also used under Promenade Tile. The Promenade Tile is laid as described above. This is known as a 4-A-P Roof and carries a 20-year Guarantee Bond.

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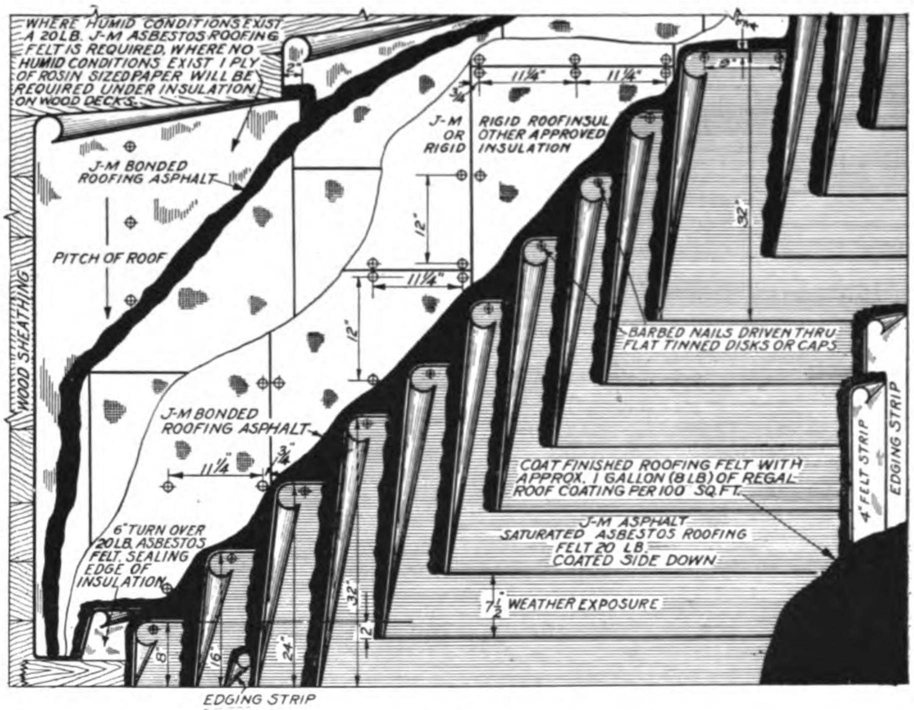
J-M Asbestos Built-up Roofs over Insulation



4-A-I Roof over wood deck, Specification No. 104

Over approved rigid insulation on wood, non-combustible or steel decks, J-M specifications call for either three or four plies of 20-lb. asphalt-saturated asbestos felt in shingle construction, with no base felt.

J-M Rigid Roofinsul is first applied in accordance with J-M standard specifications for the type of roof deck involved. Where humid conditions exist, regardless of type of roof deck, one ply of 20-lb. asphalt-saturated asbestos felt, lapped 6″, is required under the insulation. This felt is nailed to wood decks and cemented at laps, and each layer of insulation is mopped in solid and nailed through top layer into wood deck. On non-combustible and steel decks, the felt and each layer of insulation are solidly mopped in place.

Where humid conditions do not exist, 1 ply of J-M Rosin-Sized Sheathing Paper, lapped 6″, is required under insulation on wood decks, and the insulation is laid dry and securely nailed through into wood deck. On non-combustible and steel decks where humid conditions do not exist, the first layer of insulation is mopped directly to the primed deck and each succeeding layer solidly mopped in place.

The 4-A-I Roofs consist of four plies of 20-lb. asphalt-saturated asbestos felt, shingled with 7½″ weather exposure, over the insulation, all felts being solidly mopped and the roof finished with J-M Regal Roof Coating. Over wood, Specification No. 104, application is as shown in drawing. Over non-combustible decks, Specification No. 105, and over steel decks, Specification No. 108, the application of the roofing is exactly the same, the only variation being in the method of applying insulation, as mentioned above. Guarantee Bonds for 20 years apply to all 4-A-I Roofs.

The 3-A-I Roofs consist of three plies of 20-lb. asphalt-saturated asbestos felt, shingled with 10″ weather exposure instead of 7½″. Otherwise they are the same as the 4-A-I Roofs. Specification No. 106 is for wood decks; No. 107 for non-combustible decks; and No. 109 for steel decks. Guarantee Bonds on all 3-A-I Roofs are for a period of 15 years.

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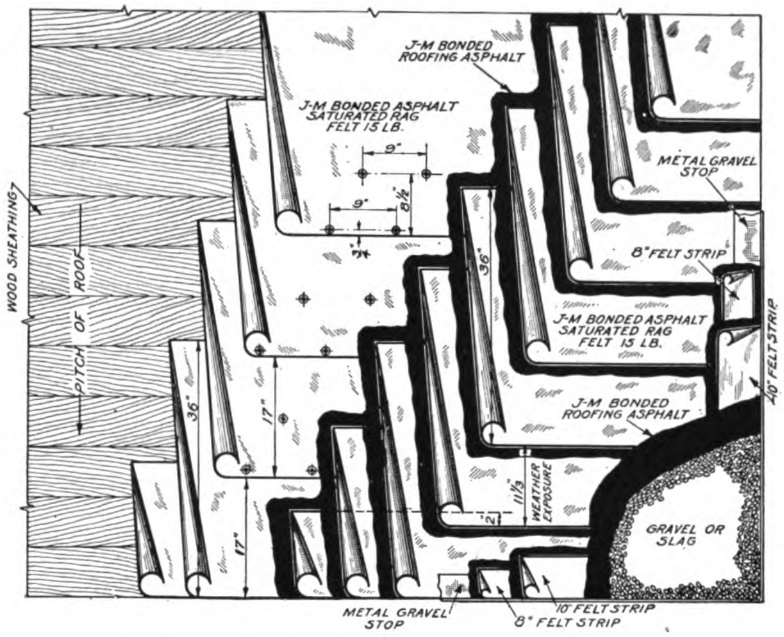
J-M Rag Felt Built-up Roofs

(Slag or Gravel Surfaced)



5-WF Roof over wood deck, Specification No. 300

Johns-Manville has a number of specifications for slag or gravel surfaced rag felt roofs for various roof decks, carrying Bonds of 10, 15 and 20 years.

The 5-WF Roof, Specification No. 300, is shown above. This roof is applied only over wood sheathing or precast gypsum slabs on inclines not exceeding 2″ per foot. Two layers of 15-lb. asphalt rag felt are first laid dry and nailed, followed by three additional plies solidly mopped with asphalt, the roof then being surfaced with slag or gravel embedded in hot asphalt. Guarantee Bond is for 20 years.

The 4-WF Roof, Specification No. 304, calls for two plies nailed dry and two plies mopped in, but otherwise is applied over wood or precast gypsum, on inclines not exceeding 2″ per foot, in the same manner as Specification No. 300. This roof carries a 15-year Guarantee Bond.

The 5-WS Roof, Specification No. 301, for application over wood or precast gypsum on inclines from 2″ to 4″ per foot, calls for five plies of 15-lb. asphalt rag felt in shingle construction to provide 6-4/5″ weather exposure. Sheets are mopped between plies, to within 4″ of back edge of underlying sheet. Slag surfacing is embedded in hot asphalt. Guarantee Bond for 10 years.

The 4-CF and 3-CF Roofs, Specification Nos. 302 and 305, respectively, are for application over book tile, poured or precast concrete or poured gypsum decks on inclines not exceeding 2″ per foot. They call for four or three plies, respectively, of 15-lb. asphalt rag felt mopped in place and surfaced with slag or gravel embedded in hot asphalt. Gypsum decks should first be primed. Book tile should be covered with at least 1″ of portland cement mortar. Over precast concrete, asphalt should be kept back 4″ from joints between slabs. Guarantee Bonds: 4-CF (4-ply), Specification No. 302, 20 years; 3-CF (3-ply), Specification No. 305, 15 years.

The 4-CS Roof, Specification No. 303, is for application over book tile, poured or precast concrete or poured gypsum decks on inclines from 2″ to 4″ per foot. Four plies of 15-lb. asphalt rag felt are mopped in place and surfaced with slag embedded in hot asphalt. Guarantee Bond for 10 years.

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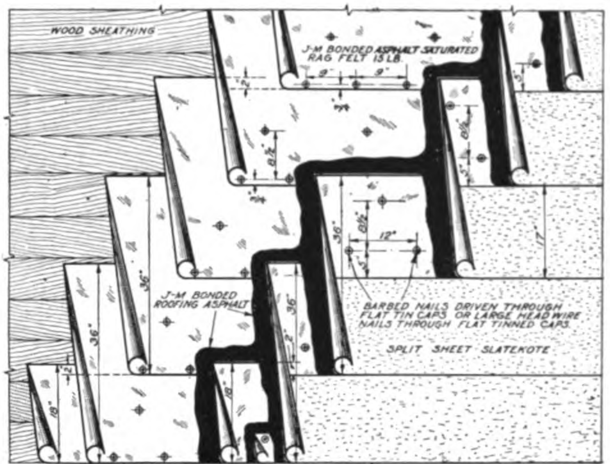
J-M Rag Felt Built-up Roofs

(Slatekote Surfaced)



Slatekote surfaced roof over steep wood deck, Specification No. 400

Slatekote surfaced rag felt roofs consist of one, two or three plies of 15-lb. asphalt rag felt, surfaced with two plies of Split Sheet Slatekote. They are particularly adapted to steep roofs. All of these roofs carry a 10-year Guarantee Bond.

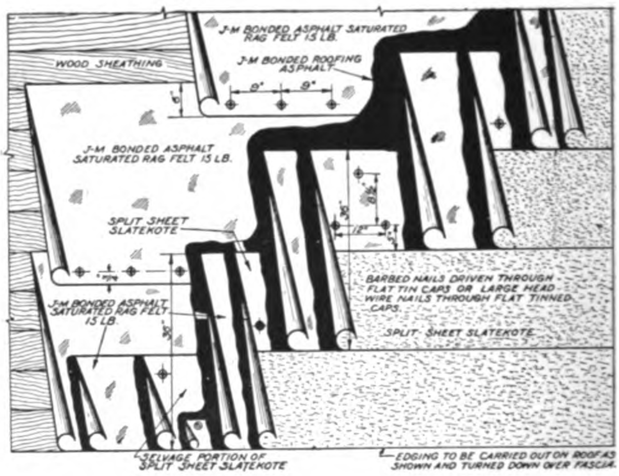
Specification No. 400 is for application over wood sheathing or precast gypsum slabs on inclines exceeding 4" to the foot, and is applied as shown above.

Specification No. 401, for use over poured gypsum or concrete decks on inclines exceeding 4" per foot, is applied in the same manner except that only one layer of 15-lb. asphalt rag felt, lapped 3", is used under the Split Sheet Slatekote, and the rag felt, in addition to nailing, is solidly mopped to the deck, which must first be primed.

Specifications Nos. 402 and 403 are designed particularly for airport construction on inclines from 1" to 4" per foot.

Over wood or precast gypsum, Specification No. 402, application is as shown in drawing. One ply of 15-lb. asphalt rag felt is first laid dry, nailed and lapped 6". An additional layer of rag felt is then mopped solidly in place, each sheet, as laid, being immediately covered for its entire width by a sheet of Split Sheet Slatekote also mopped and nailed. Each course of rag felt covered with Slatekote is followed by a similar course of rag felt and Slatekote applied in the same manner to cover the selvage portion of the Slatekote previously laid. Nailing is obtained only in the selvage portion of the Slatekote and this nailing is subsequently covered by the next ply of rag felt and Slatekote, as shown in the drawing.

Over poured gypsum or concrete decks, Specification No. 403 is applied as shown for Specification No. 402, except that the deck must first be primed and the first layer of asphalt rag felt mopped solidly to the deck. Where pitch exceeds 3" to the foot, nailing strips on not more than 4-ft. centers should be embedded in deck at right angles to direction of felts.



Slatekote surfaced roof over wood deck on airport, Specification No. 402

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J-M Bonded Tar and Gravel Built-up Roofs

(Tar-Saturated Asbestos Felts, with Bonded Pitch, Surfaced with Gravel or Slag)

General requirements in application of these roofs are the same as outlined for smooth-surfaced asbestos roofs and rag felt roofs on Data Sheet 3-B-10 (BMR-10), with the following exceptions:

Incline of Roof:

Flat Decks: For Tar and Gravel Roofs, flat decks are considered as within the following limits: On wood, precast gypsum or poured gypsum, over ¼″ but not exceeding 2″ to the foot; on poured concrete, precast concrete or book tile, over ¼″ but not exceeding 1″ to the foot.

Steep Decks: For Tar and Gravel Roofs, steep decks are those within the following limits: On wood, precast gypsum or poured gypsum, over 2″ but not exceeding 6″ to the foot; on poured concrete, precast concrete or book tile, over 1″ but not exceeding 6″ to the foot.

On non-combustible decks which do not permit nailing, wood strips are required for nailing felts, as follows:

Pitch, inches per foot	Nailing Strips
Over 1 but not exceeding 1½	6-ft. centers
" 1½ " " " 2	4 " "
" 2 " " " 3	3 " "
" 3 " " " 6	1 " "

Where insulation is to be applied over non-combustible decks which do not permit nailing, wood strips for nailing insulation are required on 2-ft. centers where incline is over 1″ but does not exceed 3″ to the foot, and on 1-ft. centers where incline exceeds 3″ to the foot.

Level Decks: Level decks are considered to be those having a pitch of ¼″ to the foot or less. Application of Tar and Gravel Specification No. 613 (4-TCL Roof) is limited to level *poured concrete* or *poured gypsum* decks.

Application of Pitch and Asphalt:

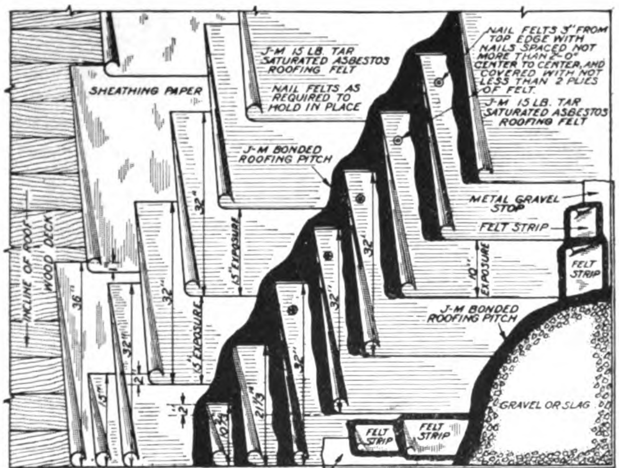
J-M Bonded Roofing Pitch is used throughout in the application of J-M Bonded Tar and Gravel Roofs, except for top pouring on *steep* roofs where asphalt is used to receive the slag. Pitch should not be heated above 375 deg. F.

J-M Bonded Roofing Asphalt, when used as the top pouring to receive the slag on *steep* roofs, is heated and applied as outlined for smooth-surfaced roofs on Data Sheet 3-B-10 (BMR-10).

Surfacing:

Gravel or slag is used for the top surfacing on roofs designated as "level" or "flat", the surfacing being embedded in J-M Bonded Roofing Pitch. On inclines designated as "steep", slag is used for the top surfacing, embedded in J-M Bonded Roofing Asphalt.

Types of J-M Bonded Tar and Gravel Built-up Roofs



5-TWF Roof over wood deck. Specification No. 600

All J-M Bonded Tar and Gravel Roofs are composed of J-M 15-lb. Tar-Saturated Asbestos Felts, J-M Bonded Roofing Pitch for in-between moppings, gravel or slag embedded in pitch for top surfacing on level or flat decks, and slag embedded in asphalt for top surfacing on steep decks.

The 5-TWF Roof, Specification No. 600, over wood or precast gypsum decks on inclines not exceeding 2″ to the foot, calls for one ply of sheathing paper (over wood only), two plies of 15-lb. tar-saturated asbestos felt laid dry and nailed, three additional plies of felt cemented with pitch and nailed, and surfaced with gravel or slag embedded in pitch. This roof is bonded for 20 years. Application is as shown in drawing.

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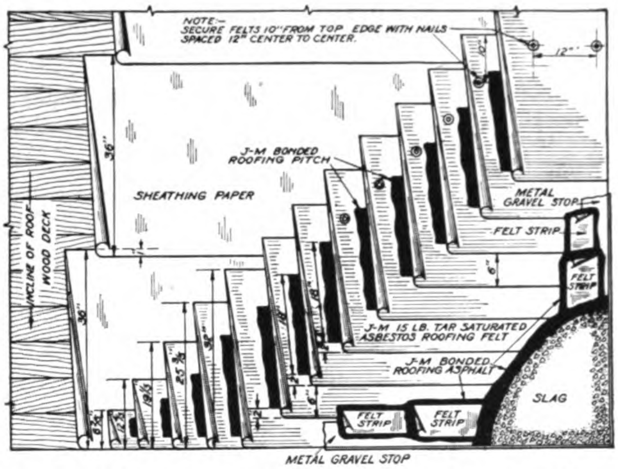
Application of the 4-TWF Roof, Specification No. 604, is the same, except that the roof consists of one ply of sheathing paper (over wood only) and four plies of felt, two laid dry and two cemented with pitch. Bond covers a period of 15 years.

The 5-TWS Roof, Specification No. 601, over wood or precast gypsum on inclines over 2″ but not exceeding 6″ per foot, consists of one ply of sheathing paper (over wood only), followed by five shingled plies of 15-lb. tar-saturated asbestos felt. The mopping of pitch is kept back 2″ from the lower edge of the overlying sheet and extends for a width of 18″, leaving 6″ of the upper edge of each sheet unmopped. Sheets are nailed 10″ from upper edge on 12″ centers.



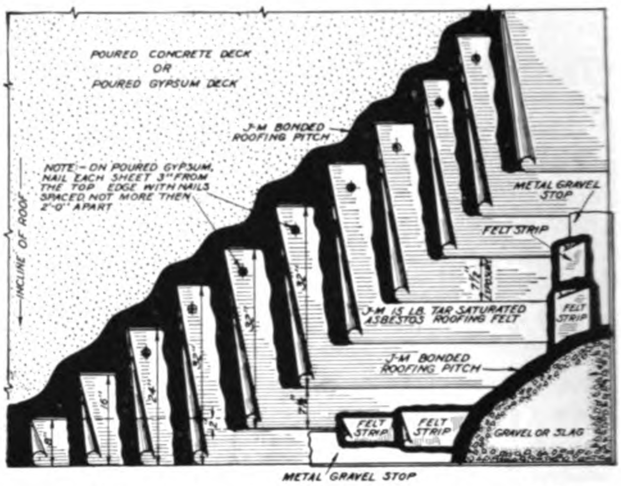
5-TWS Roof over wood deck. Specification No. 601

Surfacing consists of slag embedded in *asphalt*. Application is as shown in accompanying drawing. Bond is for 10 years.

The 4-TCF Roof, Specification No. 602, for application over book tile and poured or precast concrete on inclines not exceeding 1″ per foot, and over poured gypsum on inclines not exceeding 2″ per foot, calls for four plies of 15-lb. tar-saturated asbestos felt, cemented to roof deck and to each other with pitch and surfaced with gravel or slag embedded in pitch. Application is as shown in drawing. This roof is bonded for a period of 20 years.

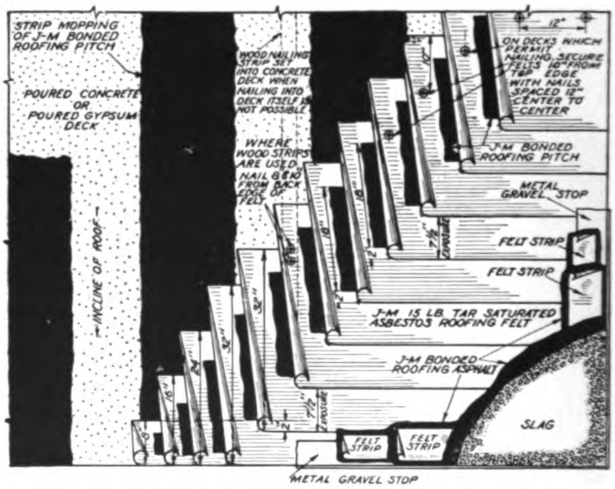
The 3-TCF Roof, Specification No. 605, is applied in the same manner as the 4-TCF Roof, Specification No. 602, the only difference being the use of three plies of felt, instead of four. The 3-TCF Roof is bonded for 15 years.

The 4-TCS Roof, Specification No. 603, for ap-



4-TCF Roof over poured concrete or gypsum deck. Specification No. 602

plication on poured concrete decks with inclines over 1″ but not exceeding 6″ per foot, and on poured gypsum decks with inclines over 2″ but not exceeding 6″ per foot, calls for four shingled plies of 15-lb. tar-saturated asbestos felts. Felts are cemented to roof deck in a path-mopping of pitch, as illustrated. The application of pitch between plies is kept back 2″ from the lower edge of the overlying sheet and extends for a width of 18″, leaving 4½″ of the upper edge of each sheet unmopped. Surfacing consists of slag embedded in *asphalt*. This roof is bonded for 10 years.



4-TCS Roof over poured concrete or gypsum deck. Specification No. 603

The 5-TCPF Roof, Specification No. 612, for application over concrete and to be overlaid with

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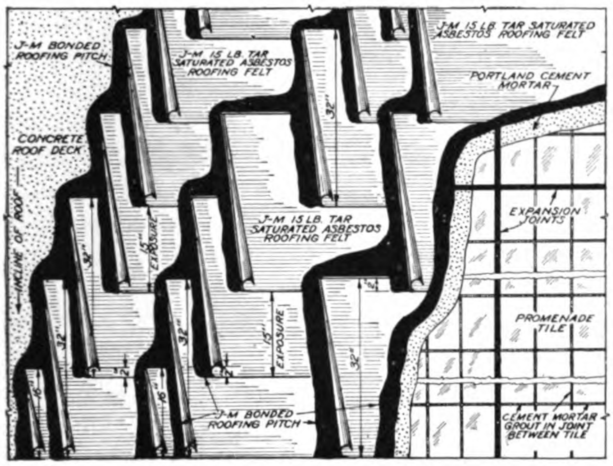
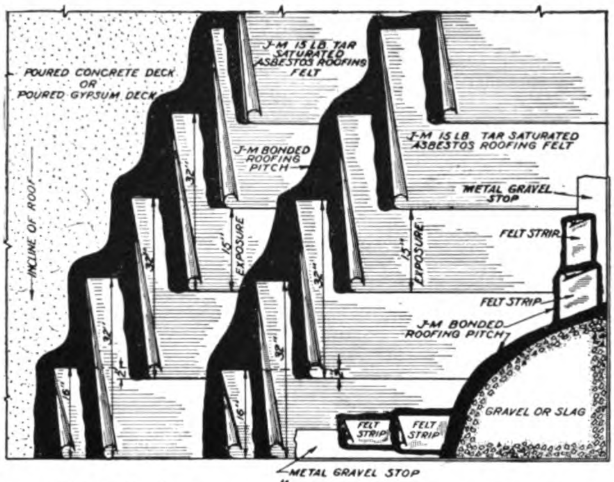


5-TCPF Roof overlaid with promenade tile.
Specification No. 612



4-TCL Roof over poured concrete or gypsum deck.
Specification No. 613

promenade tile, is limited to inclines not exceeding 1″ per foot. This specification calls for five plies of 15-lb. tar-saturated asbestos felt laid in the following manner: Two shingled plies are first laid and copper base flashing then applied. This is followed by two additional shingled plies, and then one final ply lapped 2″ only. All felts are solidly cemented to the roof deck or to each other with J-M Bonded Roofing Pitch. The surface is mopped with pitch and the promenade tile then applied in a bedding of portland cement mortar. For bond on this roof, consult Johns-Manville General Building Materials Distribution Department.

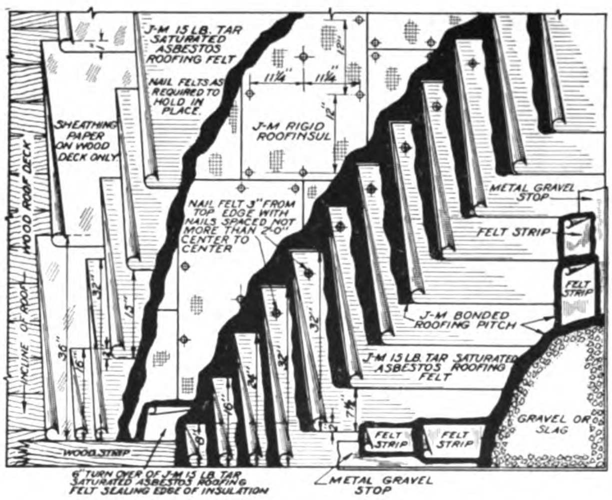
The 4-TCL Roof, Specification No. 613, is for application only over poured concrete or poured gypsum decks on inclines not exceeding ¼″ per foot. This specification calls for four plies of 15-lb. tar-saturated asbestos felt, laid two shingled followed by two additional shingled, all felts being solidly cemented to roof deck or to each other with pitch. The roof is surfaced with gravel or slag embedded in pitch. Bond is for a period of 20 years.

Tar and Gravel Roofs over Insulation

The 4-TIWF Roof, Specification No. 606, for application over insulation on wood or precast gypsum decks, on inclines not exceeding 2″ per foot, calls for four shingled plies of 15-lb. tar-saturated asbestos felt, nailed, cemented to insulation and to each other with pitch, and surfaced with gravel or slag embedded in pitch. Under the insulation one dry layer of sheathing paper (sheathing paper on wood deck only) and two dry shingled layers of 15-lb. tar-saturated asbestos felt are required. Application is shown in drawing. This roof is bonded for a period of 20 years.

The 3-TIWF Roof, Specification No. 608, is the same except that over the insulation three, instead of four, plies of felt are used. The 3-TIWF Roof is bonded for 15 years.

The 4-TIWS Roof, Specification No. 610, for application over insulation on wood or precast gypsum



4-TIWF Roof over insulation on wood deck.
Specification No. 606

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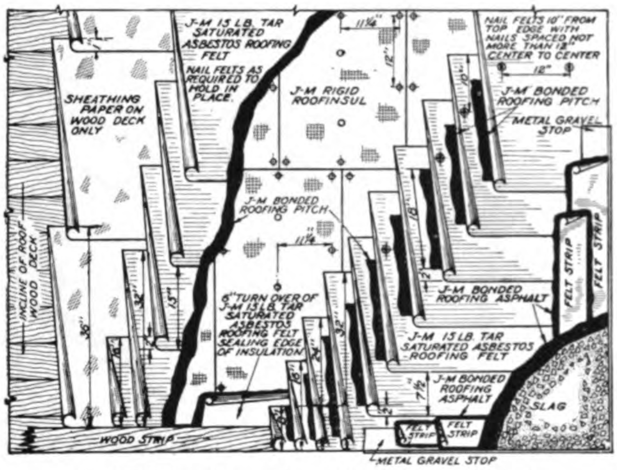
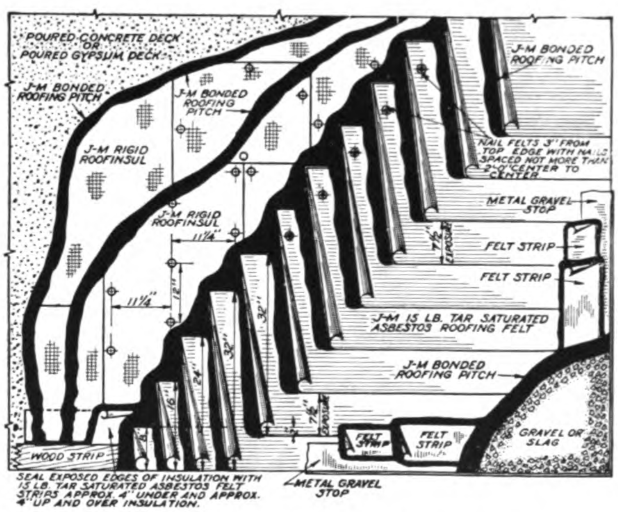


4-TIWS Roof over insulation on wood deck. Specification No. 610

decks, with inclines over 2″ but not exceeding 6″ per foot, is applied in the same manner as the 4-TIWF Roof, Specification No. 606, except that (a) the pitch mopping is kept back 2″ from the lower edge of the overlying sheet and extends for a width of 18″, leaving 4½″ of the upper edge of each sheet unmopped, (b) top surfacing consists of slag embedded in *asphalt*, and (c) the sheets are nailed 10″ from the upper edge instead of 3″. Sheathing paper and dry felts under the insulation are required the same as on flat decks. This roof is bonded for 10 years.

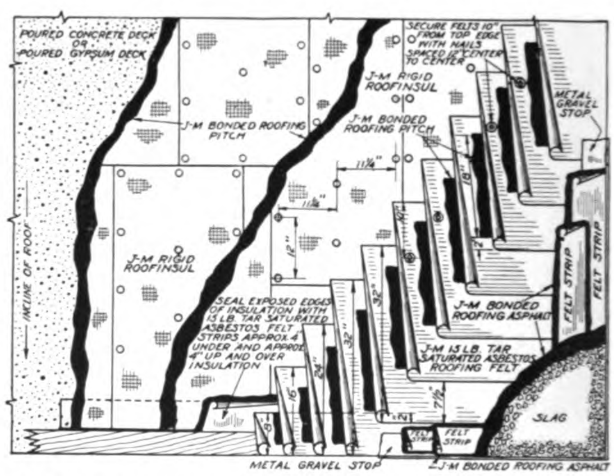


4-TICF Roof over insulation on poured concrete or gypsum deck. Specification No. 607

The 4-TICF Roof, Specification No. 607, for application over insulation on poured concrete decks with inclines not exceeding 1″ per foot, and on poured gypsum decks with inclines not exceeding 2″ per foot, calls for four shingled plies of 15-lb. tar-saturated asbestos felt cemented to insulation and to each other with pitch, and surfaced with gravel or slag embedded in pitch. This roof is bonded for 20 years.

The 3-TICF Roof, Specification No. 609, is the same except that three, instead of four, plies of felt are used. The 3-TICF Roof is bonded for 15 years.

The 4-TICS Roof, Specification No. 611, over insulation on poured concrete decks with inclines over 1″ but not exceeding 6″ per foot and over poured gypsum decks with inclines over 2″ but not exceeding 6″ per foot, is applied in the same manner as the 4-TICF Roof, Specification No. 607, except that (a) the pitch mopping is kept back 2″ from the lower edge of the overlying sheet and extends for a width of 18″, leaving 4½″ of the upper edge of each sheet unmopped, (b) top surfacing consists of slag embedded in *asphalt*, and (c) sheets are nailed 10″ from the upper edge instead of 3″. The 4-TICS Roof is bonded for a period of 10 years.



4-TICS Roof over insulation on poured concrete or gypsum deck. Specification No. 611

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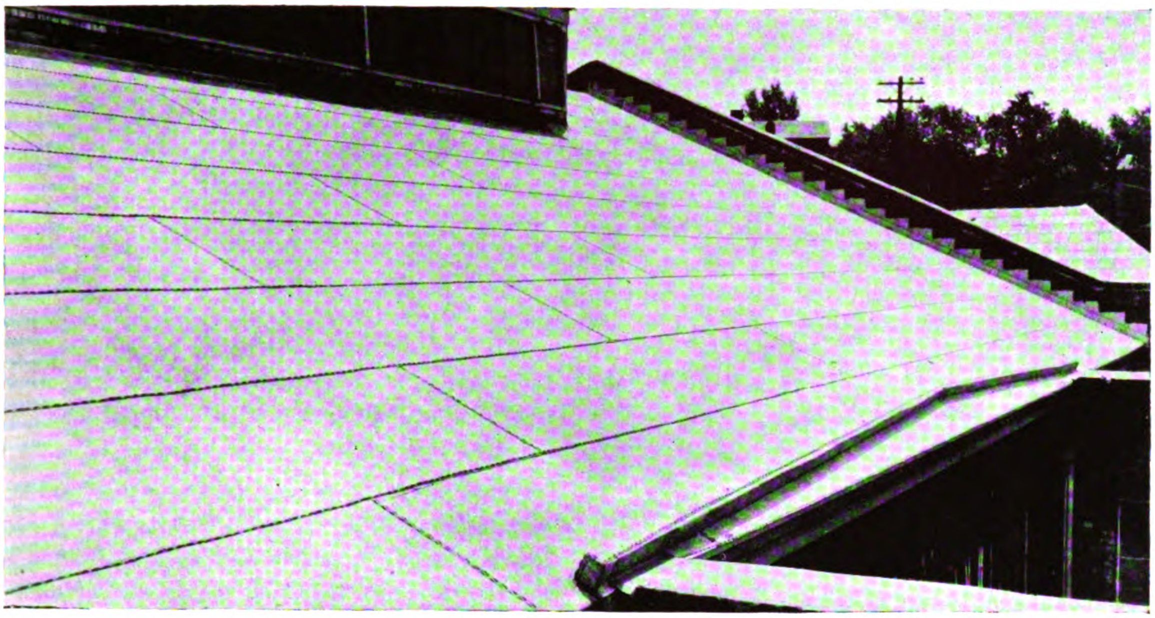
J-M Ready-to-Lay Roofings



Flexstone Roofing, applied with Pyramid Kaps, presents a neat appearance as well as providing a serviceable roof

Asbestos Ready-to-Lay Roofings

J-M Asbestos Ready-to-Lay Roofings are made of asbestos felt, thoroughly saturated with asphalt. They are rot-proof, weather-proof and highly fire-resisting, and have been approved by the Underwriters' Laboratories, Inc. Asbestos Ready-to-Lay Roofings are particularly adapted to pitched roofs of garages, service stations, houses, barns, sheds, factories, etc. Furnished in three general types as follows:

Flexstone Smooth-Surfaced Roofing:

This material is composed of either three or four plies of asphalt-saturated asbestos felt, cemented together with asphalt into a heavy, strong felt. Furnished in smooth-surfaced sheets, 32″ x 80″, six sheets per sq. All shipments include lap cement and galvanized nails. Pyramid Kaps can be furnished at a slight additional cost.

Three-ply material is designated as "Heavy" and is shipped in crates containing sufficient material for 500 sq. ft. of roof surface, the shipping weight being approximately 66 lb. per sq.

Four-ply material, Extra Heavy, is shipped in crates containing sufficient material for 400 sq. ft., the shipping weight being approximately 98 lb. per sq.

Flexstone Slate-Surfaced Roofing:

This material, which carries the Underwriters' Class B label, is a heavy asphalt-saturated asbestos felt, slate-surfaced on one side in red, green, or blue-black colors. Especially designed for steep-roofed buildings where color is desired in the finished roof. Furnished with lap cement and galvanized nails in 1-sq. rolls, 32″ wide, with 2″ selvage, rolls weighing approximately 85 lb.

J-M White Top Roofing:

J-M White Top Roofing is built up of plies of asphalt-saturated asbestos felts cemented together with asphalt, with a white (unsaturated) asbestos felt on top. This material finds wide application on saw-tooth roofs and is adapted to many other uses where light reflection is important. When used on tanks in the oil industry, for example, its white surface reflects the heat of the sun and minimizes evaporation losses by reducing the temperature within the tank. It has been used on many industrial buildings on the back

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of saw-tooth construction because of its clean, attractive, light-reflecting surface and its fireproof and weather-proof properties. It should not be laid on pitches under 3" to the foot.

J-M White Top Roofing is supplied in three weights: Standard (3-ply), in 1 or 2-sq. rolls, 32" wide, weighing approximately 55 lb. per sq.; Heavy (3-ply), in 1 or 2-sq. rolls, 32" wide, weighing approximately 63 lb. per sq.; and Extra Heavy (4-ply), in sheets, six 32" x 80" sheets per sq., 4 sqs. per crate, weighing approximately 92 lb. per sq. All shipments include lap cement and galvanized nails. Furnished with 1½" black selvage edge, but should be laid with not less than 2" lap.

Salamander White Top Roofing:

This is a 2-ply material composed of a saturated and an unsaturated asbestos felt cemented together to provide a white surface on one side. Used principally as a cap sheet for built-up roofs on saw-tooth construction where light reflection is required. Furnished in 2-sq. rolls (216 sq. ft.), 32" wide, weighing 60 lb., or 30 lb. per sq. Has 1½" selvage edge but should be laid with not less than 2" lap.

Asphalt Ready-to-Lay Roofings

Johns-Manville manufactures several types of asphalt roll roofings, composed of asphalt-saturated rag felt. They are all exceptionally high-grade asphalt roofings and can be depended upon for excellent service. They are somewhat lower in cost than roofings made from the more enduring asbestos felt. Asphalt ready-to-lay roofings are furnished smooth-surfaced and mineral-surfaced, as described below:

Smooth-Surfaced Asphalt Roofing:

Pilot Brand is the highest quality smooth-surfaced asphalt roofing and is recommended on permanent steep-roofed buildings. Furnished in 1-sq. rolls (108 sq. ft.), 36" wide, and including lap cement and galvanized nails. Pyramid Kaps can be furnished at a slight additional cost. Pilot Roofing is made in three weights: Medium, approximately 45 lb. per sq.; Heavy, approximately 55 lb. per sq.; and Extra Heavy, approximately 65 lb. per sq. All weights carry the Underwriters' Class C label when applied to pitches exceeding 4" to the foot.

Planet Roofing is lower priced than Pilot. However, it represents good value for use on temporary structures, sheds, tool shops, etc. Furnished in 1-sq. rolls (108 sq. ft.), 36" wide, and including lap cement and galvanized nails. Made in three weights: Light, Medium, and Heavy, weighing approximately 35, 45 and 55 lb. per sq., respectively.

Mineral-Surfaced Asphalt Roofing:

Slatekote mineral-surfaced roofings are especially adapted to use where color is desired in the finished roof. These materials are heavy asphalt-saturated rag felts, into which colored crushed slate is securely embedded in asphalt on the upper surface. Made in several types as follows:

Slatekote Roofing (standard type) is furnished in 1-sq. rolls (108 sq. ft.), 36" wide, with 2" selvage edge for lap. Lap cement and galvanized nails are included. Made in two weights, 85 and 75 lb. per sq. The 85-lb. weight carries the Underwriters' Class C label and is supplied in red, green, blue-black, variegated (Bronzetone) and tile red colors. Colors in the 75-lb. weight are red, green and blue-black.

Slatekote Diamond-Point Roofing provides the diamond-shaped pattern so popular for re-roofing purposes. Furnished in red, green, blue-black and variegated (Bronzetone) colors, in rolls 32" wide. The material is slit in diamond-point fashion through the center so that when taken apart two strips are obtained. All rolls contain sufficient material for 100 sq. ft. of roof area. Packed without nails or cement. Weight approximately 100 lb. per sq.

Split Sheet Slatekote Roofing is made 36" wide, with 17" slate surfacing and 19" selvage for cementing with asphalt. It is designed especially for use as a cap sheet over built-up roofs where color is desired. When used alone, it provides a semi-built-up roof at low cost. Furnished in red, green, blue-black, white and chrome orange colors, the latter two colors being especially suited to use on airport construction. Packed without nails or cement. Furnished in 1-sq. rolls (108 sq. ft.), 36" wide, weighing approximately 50 lb., and containing sufficient material for about 51 sq. ft. weather exposure.

Application of J-M Ready-to-Lay Roofings

Roof Pitches:

Ready-to-lay roofings are not suitable for use on flat surfaces, nor should they be used on roofs surrounded by parapet walls or other vertical surfaces where stoppage of leader outlets is possible, or on any other surface that cannot be depended upon to drain water freely at all times.

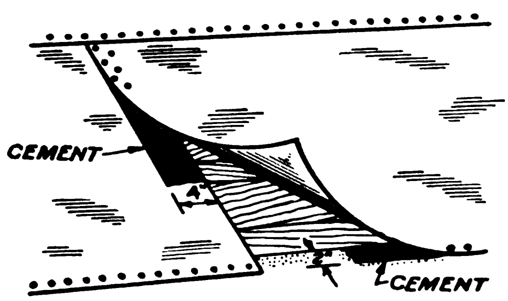
The minimum roof pitch over which smooth-surfaced ready-to-lay roofings should be applied is 2″ to the foot. White Top and mineral-surfaced ready-to-lay roofings should not ordinarily be laid on pitches of less than 3″ to the foot.

Roof Surfaces:

Ready-to-lay roofing is usually applied directly over the wood sheathing, which should be composed of well-seasoned roof boards, closely laid, preferably tongue and groove. Any loose nails should be redriven and knot holes or cracks covered with tin.

On old shingle roofs, removal of the old shingles is recommended, though the roofing can be applied over the shingles, provided all loose shingles are firmly nailed, all curled shingles split and nailed and the surface made as uniform as possible. Special large head roofing nails 1½″ long should be used, as the nails regularly furnished with the roofing are not long enough to penetrate through shingles and sufficiently into roof boards to hold. Walking on the finished roof should be avoided.

On old tin roofs, if the roof boards are laid close and in good condition, it is better to remove the tin. Application can be made over the tin, however, provided all standing seams and sharp edges are flattened down and nailed before roofing is applied.

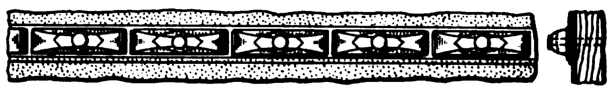


Vertical lap on asphalt roofings

Laps:

Roofing is always laid so that water runs over the laps, never against exposed edges. Horizontal laps should be at least 2″, sealed with lap cement and nailed ½″ from edge with nails on 2″ centers. On asbestos roofing, vertical end laps are butted, and under all vertical butted end joints, 6″ wide strips of roofing felt (included with shipments) are applied, centered under the joint. These strips are coated with lap cement, into which the ends of the roofing felts are firmly embedded and nailed 2″ on centers, ¾″ from edge. On asphalt ready-to-lay roofing, vertical laps, minimum 4″, are formed by lapping over the roofing felts and cementing them together securely, with nails 1″ apart, staggered.

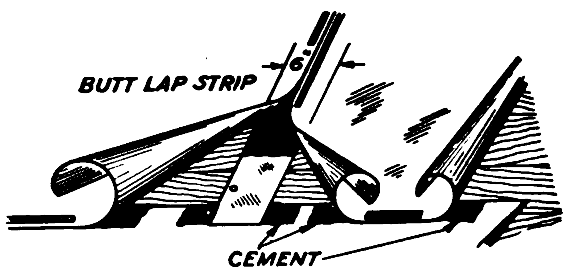
Pyramid Kaps provide a superior method of fastening laps and edging strips on smooth surface ready-to-lay roofing. They are particularly effective because they prevent buckling, puckering or tearing away at the laps and assure an evenly exerted pressure at all points. They should not be used, however, with mineral-surfaced roofings, nor with White Top Roofing.



Pyramid Kaps

Pyramid Kaps are made of zinc and are furnished in strips approximately 14¼″ long, ten caps to the strip. They are applied in a continuous line, end-to-end, along all horizontal and vertical laps, and edging strips; on horizontal laps, ¼″ from edge, and on each side of vertical joints, ¾″ from edge.

Complete directions for application accompany all shipments of J-M Ready-to-Lay Roofings.



Vertical lap on asbestos roofings

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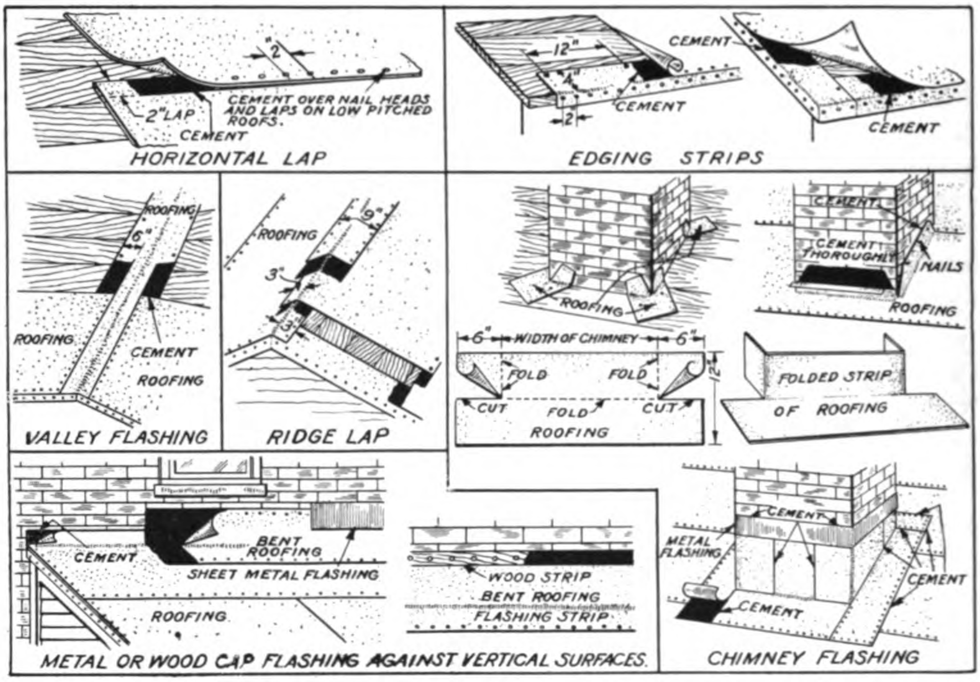

Ready-to-Lay Roofing application details

J-M Roofing Cements, Coatings and Accessories

J-M Asbestos Fibrous Enamel: A high-grade roof coating made of asbestos fibre and asphalt in the right consistency for brush application. Furnished in two colors, red and black; in black, made with asbestos fibre ground for a smooth coating, or unground for use where the roof is in bad condition, such as rusted metal roofs; in red, furnished unground only. Shipped in 1, 5, 30 and 55-gal. containers.

J-M Asbestos Roof Putty: A waterproofing cement, made of high-grade asbestos fibres and asphalt, used for patching leaky roofs, constructing or repairing flashings, setting flashing flanges around vent pipes and for various other purposes. Asbestos Roof Putty remains waterproof and plastic, expanding and contracting with the underlying surface. It adheres tightly to metal, felt, wood or glass. Furnished ready for use in red, gray and black, and in 1, 5, 10, 25, 50 and 150-lb. containers. Black also in 500-lb. drums.

J-M Lap Cement: This material is similar to the cement packed in each roll of ready-to-lay roofing but is shipped in 1, 5, 25 and 50-gal. containers for use where roofing is shipped without accessories.

J-M Regal Roof Coating: A high-grade asphaltic roof coating, applied cold as a surface finish on smooth-surfaced J-M Bonded Built-up Roofs. For such purposes, 1 gal. (8 lb.) is required per 100 sq. ft. Also used as a coating for other types of roofs. Furnished in 1, 5, 25 and 50-gal. containers.

Other Materials: J-M Ready-Mixed Asbestile and bonded roofing asphalts are described in connection with the subject of Bonded Built-up Roofs. Asbestos Caulking Putty, Asbestos Slaters' Felt, Asphalt Felt and Rosin-Sized Sheathing Paper are described in the section covering "Building Materials, Miscellaneous." Aquadam, Concrete Primer, Expansion Joint Filler and Standard Asphalt Waterproofing Cement are described in the "Waterproofing and Miscellaneous Asphalt Products" Section.

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J-M Rigid Roofinsul

Three layers of ½" J-M Rigid Roofinsul, to be overlaid with a J-M Built-up Roof

J-M Rigid Roofinsul is a light weight, efficient insulation composed of wood fibres compressed into board form.

In addition to its high insulating value and resistance to moisture absorption, Rigid Roofinsul has great structural strength and rigidity. It is economical and easily installed and can be cut, sawed and nailed in the same manner as wood. Due to its compact construction, it does not roughen at the edges when sawed, and nails do not pull through the board.

The material is especially designed for use as insulation over roof decks, principally under built-up roofs in industrial buildings to prevent condensation on the underside. It is important to keep insulation dry before and during application of the built-up roof. Heat transmission through various roof constructions is shown in the table on the next page.

This insulation may also be applied over rafters where the roof is to be Rigid Asbestos Shingles, slate, tile, etc. Furring strips or sheathing is applied horizontally over the insulation, spacing to suit shingles and nailing through into the rafters. Before the furring strips are installed, the insulation should be protected from the weather by the application of one ply of J-M Asbestos Slaters' Felt.

J-M Rigid Roofinsul is furnished 24" x 48". The standard thickness is ½". If sheets of greater thickness than ½" are desired, two or more sheets are stapled together with a ½" ship-lap joint on all four edges.

Application of Rigid Roofinsul under J-M Built-up Roofs:

Preparation of Deck: Non-combustible decks should be coated with J-M Concrete Primer, using two coatings where necessary. Steel decks should also be primed, unless previously shop-coated.

Wood strips of the same thickness as the insulation and approximately 4" to 6" wide are installed at all eaves and overhanging gable ends, flush with the edge of roof deck, to act as a stop for the insulation.

Where a bond is required on a J-M Built-up Roof over insulation on steel decks, the pitch must be at least ½" to the foot.

On non-combustible roof decks, where the pitch ex-

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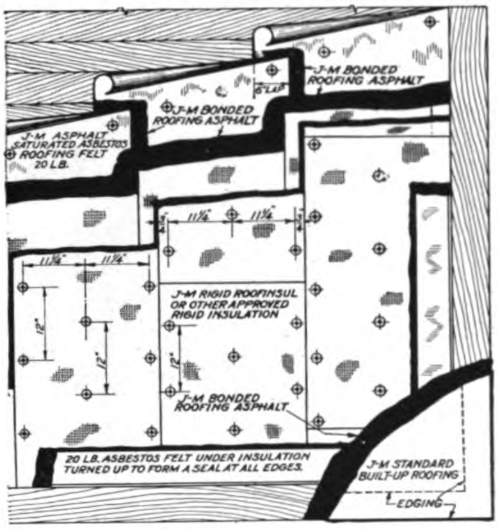


Application of J-M Rigid Roofinsul over wood decks where humid conditions exist

ceeds 3″ to the foot and the deck does not permit nailing, wood strips should be embedded in the deck on not greater than 2-ft. centers. The insulation is nailed to these strips on approximate 12″ centers.

Application of J-M Rigid Roofinsul: Where humid conditions exist, regardless of type of roof deck, one ply of J-M Asphalt-Saturated Asbestos Roofing Felt 20-lb., lapped 6″, is applied before the insulation is laid. This felt is nailed to wood decks and cemented at laps, and each layer of insulation is mopped in solid. The top layer is secured to the sheathing by nailing longitudinally along the edges and through the center of each sheet, with nails on 12″ centers. Nails should be long enough to penetrate at least ¾″ into wood deck. On non-combustible and steel decks, the felt and each layer of insulation are mopped solidly in place.

Where humid conditions do not exist, one ply of J-M Rosin-Sized Sheathing Paper, lapped 6″, is applied under insulation on wood decks, and the insulation is laid without being mopped. The insulation should, however, be nailed as described above. On non-combustible and steel decks where humid conditions do not exist, the first layer of insulation is mopped directly to the primed deck and each succeeding layer also solidly mopped in place. On non-combustible decks which permit nailing, the top layer is nailed as described for wood decks. Where deck does not permit nailing and where pitch exceeds 3″ to the foot, the insulation is nailed to wood strips, as outlined in connection with "Preparation of Deck." On steel decks where the pitch exceeds 3″ to the foot, the insulation is secured to the deck by means of steel darts or other devices furnished by the steel deck manufacturer.

All exposed edges of the insulation at eaves, gable ends, etc., should be sealed by a strip of asbestos felt around the edge, mopped 6″ on deck under the insulation and 6″ over the insulation.

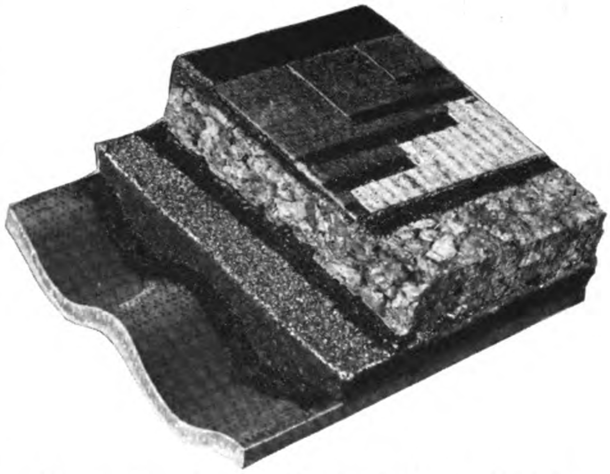
The built-up roof should be applied over the insulation immediately. No more insulation should be laid than can be completely covered with roofing felts on the same day.

Heat Losses for Insulated and Uninsulated Roof Constructions

Type of Roof	Thickness of J-M Rigid Roofinsul	Heat Loss in B. t. u. per sq. ft., per deg. F. temperature difference, per hour
	None	.533
⅞″ wood deck	½″	.296
and smooth-surfaced	1″	.205
built-up roof	1½″	.157
	2″	.127
	None	.381
1⅝″ wood deck	½″	.242
and smooth-surfaced	1″	.178
built-up roof	1½″	.140
	2″	.116
	None	.676
4″ concrete	½″	.336
and smooth-surfaced	1″	.223
built-up roof	1½″	.167
	2″	.134
	None	.625
5″ concrete	½″	.323
and smooth-surfaced	1″	.217
built-up roof	1½″	.164
	2″	.132
	None	.581
6″ concrete	½″	.310
and smooth-surfaced	1″	.212
built-up roof	1½″	.161
	2″	.129

J-M Insulated Rot-proof Roof*

While the J-M Insulated Rot-proof Roof was especially designed to withstand the severe moisture, heat and acid conditions encountered over the machine room in paper mills, it is equally suited to other industrial buildings where similar conditions soon destroy the ordinary roof deck. Regardless of how carefully a wood deck may be constructed, vapors penetrate the planking, condense on the underside of the built-up roof and rot starts at the top, unseen, and works down. While the problem of rot can be eliminated by the use of concrete, that of condensation and roof-drip remains.



Construction of a J-M Insulated Rot-proof Roof

The J-M Insulated Rot-proof Roof is built up of a deck of W.R. Corrugated Transite supported on steel purlins or wood rafters, a leveling fill of cork mastic, corkboard of the required thickness, and a J-M Asbestos Built-up Roof. This construction meets all the requirements of an ideal roof for paper mill service and many eminently successful J-M roofs are now in service. Its advantages are enumerated below.

1. **Waterproof on both sides.** Neither W.R. Corrugated Transite, nor the Built-up Roof absorb moisture. The construction is also inherently water-resistant throughout.

2. **High insulating qualities.** The thickness of corkboard is varied, according to conditions, as may be required to prevent condensation. The heat transmission through this roof is less than one-third that through wood of equal thickness. The need for special air-conditioning or ventilating systems is reduced through its use. The insulation value of the J-M roof will not be impaired during long years of service.

3. **Fire-Resisting.** The materials used are highly fire-resistant.

4. **Rot-proof and Acid-Resisting.** Because of its thorough water-tightness, no moisture can penetrate the J-M Insulated Rot-proof Roof. The Transite under-surface and the asbestos built-up roof are unaffected by the acid fumes encountered in paper mill service. The entire construction is rot-proof throughout.

5. **Floating Construction and Light Weight:** The roof is so secured to the steel work that both are allowed to move independently, providing a floating roof construction. This construction, exclusive of the steel work, weighs about 8 lb. per sq. ft. plus 1 lb. per sq. ft. per inch thickness of corkboard used.

6. **Low Maintenance.** The J-M Insulated Rot-proof Roof can be depended upon for many years of service with practically no maintenance.

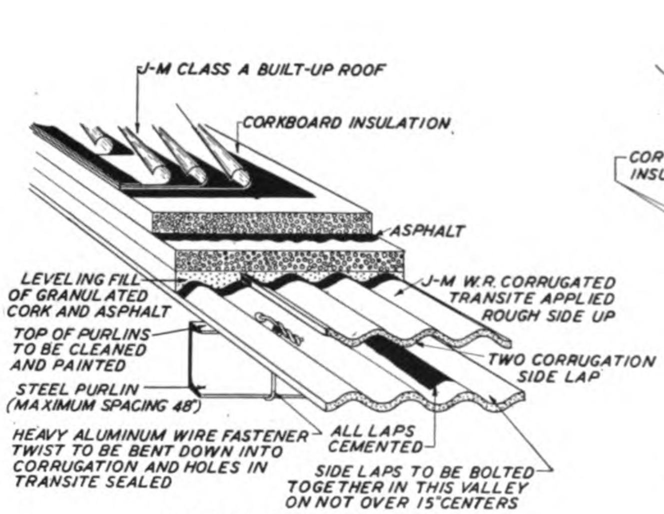
Construction of the J-M Insulated Rot-proof Roof:

Framework: Steel purlins or wood rafters should be spaced on not greater than 48″ centers. Steel is preferable to wood for the conditions encountered where a rot-proof roof is necessary. The top side of purlins or rafters should be given a finished paint job prior to application of the roof.

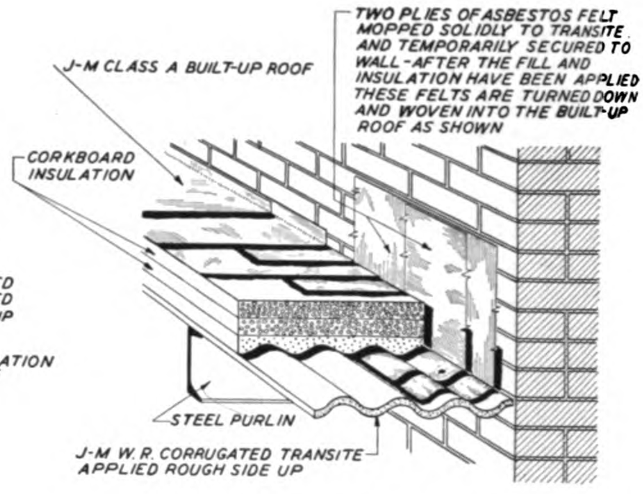
Pitch: All roofs of this type should have a good drainage pitch. Where pitch exceeds 2″ to the foot, wire mesh reinforcement for the leveling fill should be provided, anchored to the tie wires.

Application of W.R. Transite. W.R. Corrugated Transite is laid directly over the purlins or rafters, either in straight lap line construction with cut corner sheets or in staggered joint construction with square corner sheets. The Transite is applied rough side up, with a side lap of two corrugations and not less than 6″ end lap. All end laps are centered over purlins.

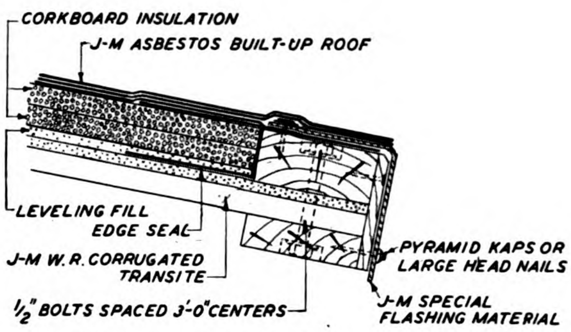
*Patented in United States.



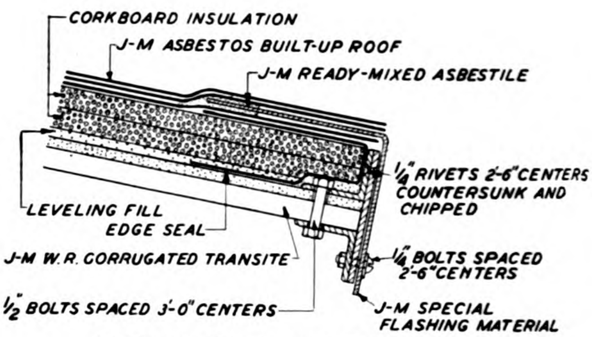
DETAIL OF ROOF DECK CONSTRUCTION



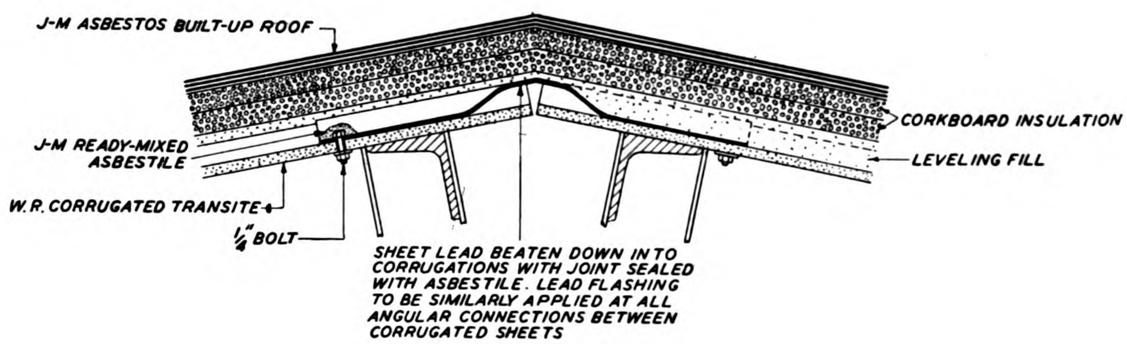
DETAIL OF INSULATION SEAL



DETAIL OF EAVE FINISH METHOD "A"



DETAIL OF EAVE FINISH METHOD "B"



DETAIL AT RIDGE

Construction details of J-M Insulated Rot-proof Roof

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J-M Insulated Rot-proof Roof over machine room, Combined Locks Paper Co., Combined Locks, Wisc.

At all overhanging eaves, gables, etc., where the Transite sheets bear on top of walls, the sheets are bedded in portland cement mortar to close the corrugations.

Side and end laps are thoroughly sealed with J-M Ready-Mixed Asbestile. The Asbestile should be kept well back of all edges exposed on the underside.

Fasteners: The Transite sheets are fastened to each purlin with 3/16″ diameter aluminum tie wires on approximately 18″ centers (wire as made by U. S. Aluminum Company, known as "2-S-O Coiled Wire, .187″ diameter"). The wires are bent "U" shaped, and passed up from the underside astride the purlin and through holes drilled in the Transite at the low point of the corrugations at either side and adjacent to the purlins. Washers are applied on the upper side over the projecting wire ends, and the ends twisted and bent down into the corrugations.

The Transite sheets are secured to each other at side laps with 1/4″ brass stove bolts spaced on approximately 15″ centers between the purlins, through holes drilled through the Transite at the low point of the second corrugation from the edge of the overlying sheet. Washers are used under both head and nut.

All fasteners on the upper side should be covered with J-M Ready-Mixed Asbestile.

Damp-proofing: Over the Transite, a heavy mopping of hot asphalt is applied to damp-proof the surface and provide a bond for the subsequent fill.

Eaves and Gables: At all overhanging eaves or gables, the deck is prepared to receive the fill and insulation by installing eave stops composed of wood planks (Method A) or steel angles (Method B), as indicated in drawings.

Sealing of Edges: Strips of 15-lb. asphalt-saturated asbestos felt are mopped solidly to the Transite in two-ply construction at all walls abutting the

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roof, at all openings, monitor and skylight curbs, overhanging eaves and gables and elsewhere as required to provide a complete seal. These felts extend out on the Transite at least 6″ and are turned up and temporarily secured vertically, this turn-up later being turned down and woven into the built-up roof.

Leveling Fill: The leveling fill is composed of 12-20 screened cork mixed with roofing asphalt (170 deg. F. melting point), in the approximate proportions of 125 lb. of asphalt to 90 lb. of cork. The fill is poured in place over the entire area of the roof, screeded and rolled to an approximately even plane not less than ¼″ thick over the ridge of corrugations. (Where pitch exceeds 2″ to the foot, wire mesh reinforcement should be provided for the leveling fill, anchored to the fasteners.)

Insulation: The leveling fill is heavily mopped with hot asphalt, into which, while hot, are embedded corkboard sheets of the proper thickness, depending upon the degree of insulation required. End joints are broken and all joints well driven up and finished flush on top surface. The corkboard is finished flush with all vertical surfaces and with the eave stop. When more than one layer is applied, each is laid in a mopping of hot asphalt and all joints staggered over those of the preceding layer.

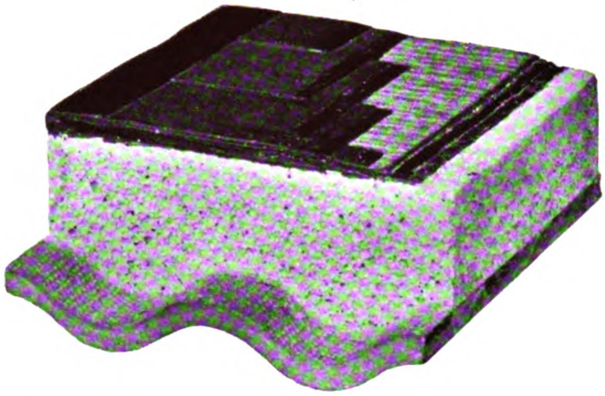
Built-up Roof: The outer asbestos felt sealing strip, previously mentioned, is turned down and mopped solidly to the surface of the corkboard. A J-M asbestos built-up roof is then applied in accordance with J-M standard specifications for this type of roof over non-combustible decks, omitting priming of the roof surface. The inner asbestos felt sealing strip, previously mentioned, is turned down and mopped solidly to the base felt of the built-up roof, prior to the application of the finishing felts.

Flashings: Necessary flashings are applied as called for in connection with built-up roof specifications.

J-M Transite-Insulated Roof*

The J-M Transite-Insulated Roof consists of a base of Corrugated Transite laid over skeleton steel construction, followed by a poured, monolithic layer of aerated gypsum, and a J-M Asbestos Built-up Roof. Transite provides fire-resistance, strength, durability and a light-reflecting under-surface. The aerated gypsum results in good insulating qualities and a light weight deck. The asbestos built-up roof insures a weather-proof and fire-resisting upper surface. The entire roof with a 2″ aerated gypsum fill, weighs approximately 12 lb. per sq. ft. complete, exclusive of steel framing.

This construction is particularly adapted for use on industrial buildings where a light weight, insulated, fire-resisting roof is required. It can be fastened directly to the steel purlins. The application is simple and rapid. (Note: This roof is not recommended for use under severe moisture conditions; in such cases the J-M Insulated Rot-proof Roof, described in other data sheets, should be used.)



Transite-Insulated Roof construction

(Corrugated Transite, aerated gypsum and asbestos built-up roof)

Construction of Transite-Insulated Roof

When erecting the Transite and pouring the insulation, mechanics should work from proper planking to protect work previously done.

Steel: Steel purlins should be spaced on not greater than 49″ centers.

Pitch: This roof may be laid on any pitch. It is always advisable to provide sufficient pitch for proper drainage. When the pitch is over 3″ to the foot, a light weight reinforcement should be installed in the insulation fill.

Aerated gypsum cannot be poured without top forming where the roof pitch exceeds ½″ to the foot. Top forms are generally made from dressed lumber nailed to 2x4's. It is necessary that the forms be weighted with bags of sand or gypsum, for there is a lifting effect in the material after it has been poured.

Gutters: Gutter or cricket construction is built up with scrap pieces of Transite, gypsum, etc., solidly bedded so that the monolithic gypsum pour will not exceed 3″.

Application of Transite: Corrugated Transite sheets are applied either in straight lap line construction with cut corner sheets or in staggered joint construction with square corner sheets. Standard construction with a side lap of one corrugation is employed, except that the sheets are laid rough-side up and with not less than 4″ end lap. End laps must occur over purlins.

Transite sheets are fastened to each purlin with 3/16″ diameter aluminum tie wires approximately on 18″ centers. (Wire as made by U. S. Aluminum Company, known as "2-S-O Coiled Wire, .187″ diameter"). This wire is carried around the steel through the valley of the corrugated sheets and twisted together on the top side, the twist being bent down into the corrugations. As the roof is not rigidly fastened to the steel framing, a certain amount of play is afforded between steel and slab which minimizes any tendency of the slab to crack.

Midway between each purlin the side lap is bolted together with a ¼″ x 1½″ rust-proofed boit with washers under both head and nut.

Eaves and Gables: At all overhanging eaves or gables, the deck is prepared to receive the fill in the following manner: Wood planks, coated with J-M Concrete Primer and thoroughly mopped with hot asphalt, are bolted under and over the Transite sheets flush with the edges before the insulation fill is applied. The underlying plank is approximately 2″ x 4″,

*Patented in United States.

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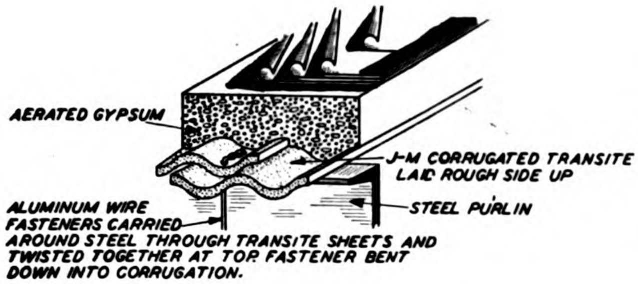
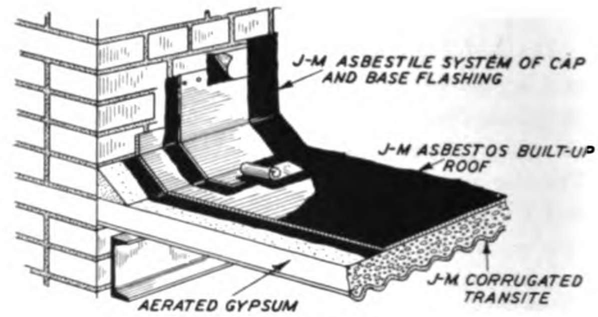
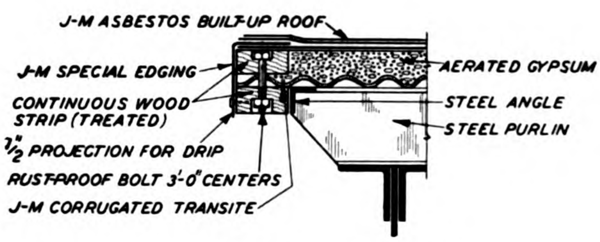


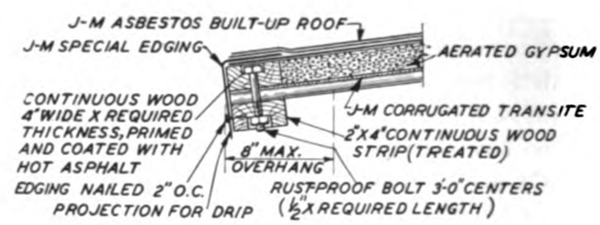
DETAIL AT SIDE-LAP



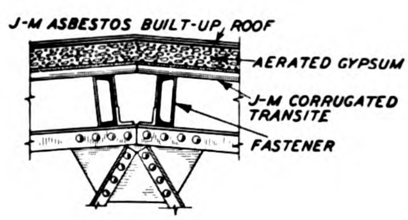
FLASHING DETAIL AT WALL



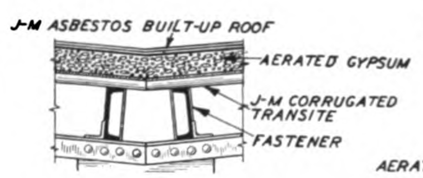
DETAIL OF GABLE



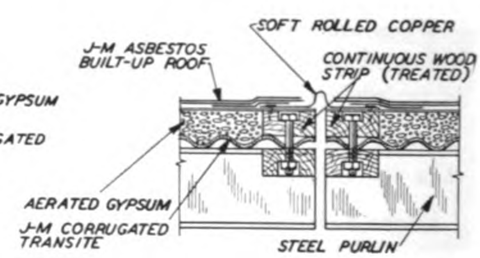
DETAIL OF EAVE



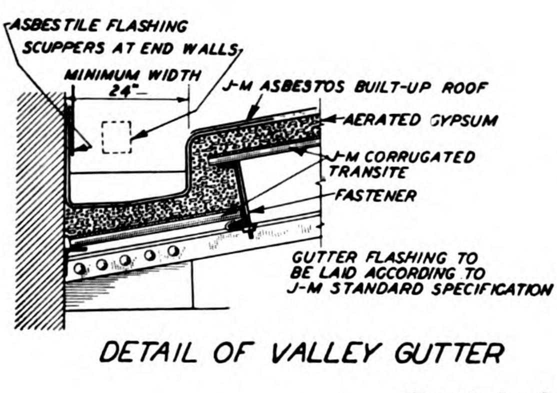
RIDGE DETAIL



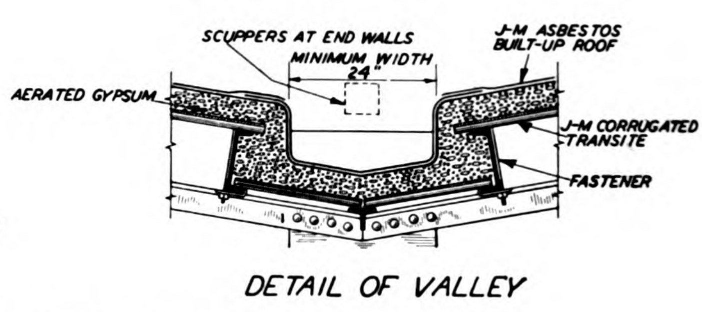
VALLEY DETAIL



EXPANSION JOINT



DETAIL OF VALLEY GUTTER



DETAIL OF VALLEY

Transite-Insulated Roof construction details

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Aerated gypsum fill partly in place over the Transite deck

and the overlying plank 4″ wide x required thickness, depending upon the depth of the insulation.

These planks are secured by ½″ galvanized bolts spaced on approximately 3-ft. centers, countersunk in overlying plank, passed through Transite sheets and underlying plank, and snugly taken up.

Reinforcement: If desired, a light mesh reinforcement may be laid over the top of the corrugations before the insulation is poured in place. This reinforcement may be secured to the wire fasteners with small tie wires suitable for the purpose. The reinforcement should be equal to American Welded Fabric 4″ x 8″ mesh No. 12 and No. 14 Gauge (electric welded), as manufactured by American Steel and Wire Company. A light steel angle is installed between purlins at all walls, edges of roofs, and overhangs, to support the side edge of the Transite sheets where no lap occurs.

Aerated Gypsum Insulation: The Transite deck is directly overlaid with a monolithic fill of aerated gypsum (equal to No. 24 Insulex, as manufactured by the Universal Gypsum Company), screeded to the proper pitch for drainage. The aerated gypsum is applied in accordance with the manufacturer's printed directions and the top side screeded to a hard surface.

The thickness of aerated gypsum will depend upon the degree of insulation required. A 1″ minimum thickness above the top of the corrugations of the Transite is required for structural purposes. A 2″ thickness, measured from ridge of corrugations, is ordinarily used.

Built-up Roof: When the aerated gypsum is properly set and dried, the deck is covered with a J-M built-up roof, applied in accordance with J-M standard specifications for the type of roof used. Due to the porous nature of aerated gypsum, better results will be obtained if primer is omitted before application of the built-up roof. Uncompleted work should be covered at night or in wet weather.

Flashings: Necessary flashings are applied as called for in built-up roof specifications.

Fireproofing Beams: The above construction does not provide for fireproofing of beams. Should this be necessary, either a hanging fireproof ceiling may be installed or the beams may be covered, to any thickness specified, with aerated gypsum, poured in place in suitable forms.

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Prevention of Condensation under roof decks

When air comes in contact with a cooler surface, such as the underside of a roof, its temperature is lowered. If the temperature of the surface is below the dew point of the water vapor in the air, the excess moisture is deposited on the surface as condensation. Insulation of the proper thickness will keep the temperature of the surface above the dew point and prevent the deposition of moisture.

The chart shows the total resistance to heat flow required to prevent condensation under various conditions. This chart and the accompanying tables of resistances can be used to determine the necessary thickness of insulation to accomplish this result.

Determination of Insulation Thickness:

Starting from room temperature on scale A, draw a vertical line to the point representing the relative humidity of the room air. From this point, draw a horizontal line to the point above scale B corresponding to the difference in temperature between inside air and outside air. Reading on the sloping curves, this point represents the total resistance required to prevent condensation.

From Table No. 1, the resistance offered by the roof structure, without insulation, is found, and the difference between this figure and the total resistance required represents the resistance which must be provided by the insulation. The thickness of insulation needed is obtained from Table No. 2. If the resistance falls between that provided by two standard thicknesses of J-M Rigid Roofinsul or Corkboard, the greater thickness should be used.

Example—J-M Insulated Rot-proof Roof:

With a room temperature of 62.5 deg. F., a relative humidity of 80%, and a temperature difference of 50 deg. F. between inside air and outside air, the chart shows that a total resistance of 5.0 is required to prevent condensation. From Table No. 1 the resistance of the J-M Insulated Rot-proof Roof, exclusive of corkboard, is found to be 1.31, leaving a resistance of 3.69 to be provided by the corkboard. Corkboard 1½″ thick would therefore be required to prevent condensation under these conditions.

Example—J-M Rigid Roofinsul over Steel Deck:

With the same temperature and humidity conditions used above, and a steel deck with insulation to be overlaid by a smooth-surface asbestos built-up roof, the thickness of J-M Rigid Roofinsul required is determined as follows:

A total resistance of 5.0 is required, as in the previous example. The resistance of the steel deck and built-up roof is found from the table to be 0.90, leaving a resistance of 4.10 to be provided by the insulation. Reference to Table No. 2 then shows a 1½″ thickness of J-M Rigid Roofinsul is required.

Example—J-M Smooth-Surfaced Built-up Roof over Stone Concrete:

With the same temperature and humidity conditions used above, suppose it were desired to determine how thick stone concrete would have to be, to prevent condensation.

The total resistance of 5.0 must be made up by adding 0.60 inside surface resistance, plus 0.30 Built-up Roof resistance, plus the necessary thickness of stone concrete. Dividing 4.1 by 0.12, this thickness is found to be approximately 34″.

[Note: For chart and tables, see other side of this sheet.]

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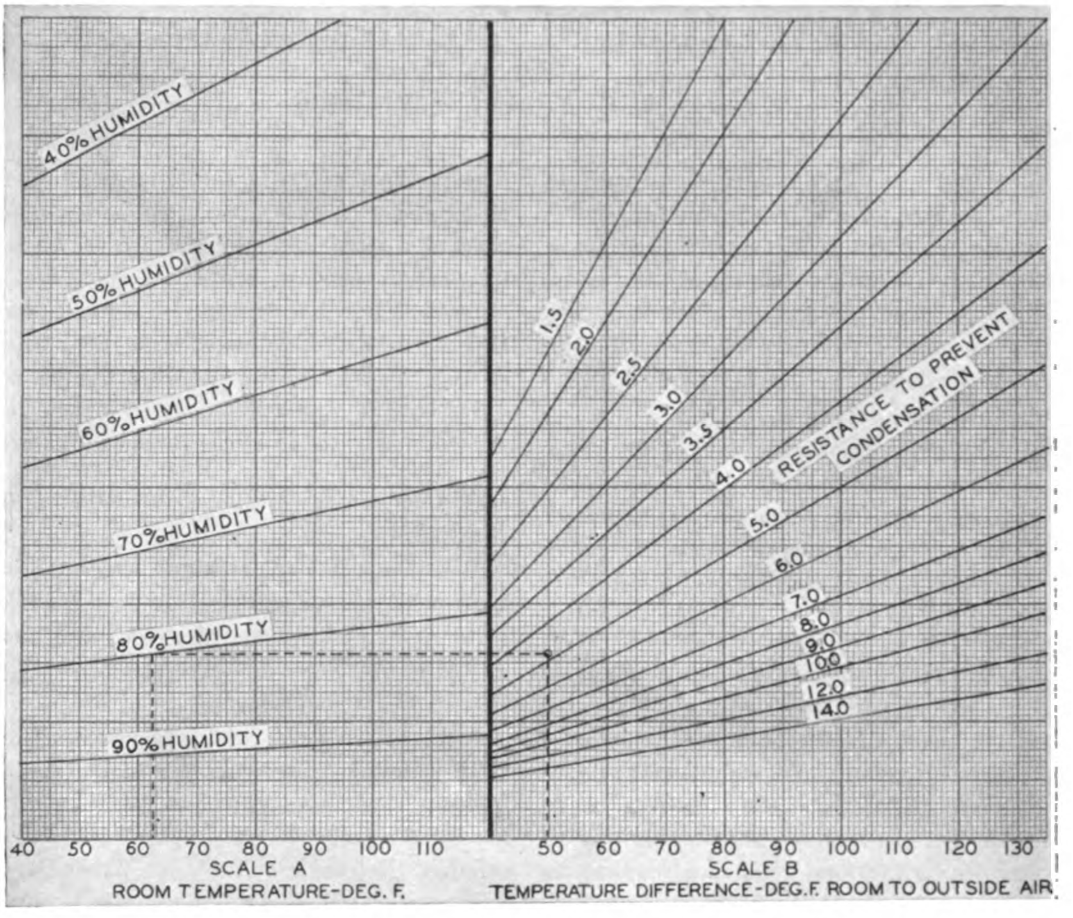

Chart to determine resistance required to prevent condensation

Table No. 1—Resistances of Uninsulated Roof Structures covered with Smooth-Surfaced Built-up Roofs

	Resistance
J-M Insulated Rot-proof Roof (exclusive of corkboard)	1.31
Concrete (stone) 4″ thick	1.38
" " 5″ "	1.50
" " 6″ "	1.62
Gypsum, 3″ thick, solid	2.10
Gypsum, 4″ " "	2.50
Steel	0.90
Wood, 7/8″ thick	1.77
" 1 5/8″ "	2.52
" 2 5/8″ "	3.52

*These resistances are per inch. Multiply by thickness in inches to obtain total resistance.

**Total resistance, based on actual thickness of built-up roof.

Table No. 2—Resistances of Materials and Surfaces

	Resistance
Cement tile (precast), per inch	0.12*
Concrete (cinder), per inch	0.40*
Concrete (stone), per inch	0.12*
Corkboard, per inch	3.33*
Gypsum, per inch	0.40*
Gypsum (aerated, 24 lb. per cu. ft.), per inch	1.30*
Rigid Roofinsul, per inch	3.00*
Wood, per inch	1.00*
Built-up Roof, Smooth-Surfaced	0.30**
Inside surface resistance	0.60
Outside surface resistance	0***

***Outside surface resistance may vary from 0 to 0.5, but is taken at 0 to allow for the most unfavorable conditions which obtain when surface is exposed to wind and rain.

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J-M Rigid Asbestos Shingles

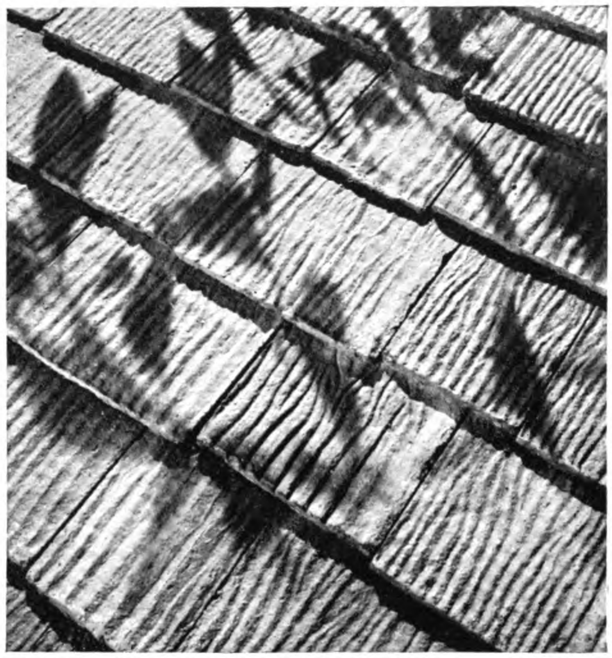
J-M Rigid Asbestos Shingles are made of a combination of asbestos fibre and portland cement united under great hydraulic pressure and cut to shingle shapes. They are fireproof, weather-proof, durable, and unaffected by climatic exposure.

J-M Asbestos Shingles are manufactured in various sizes, for application in the three styles known as the American Method, Hexagonal Method and Dutch Lap Method of laying shingles. They are furnished in uniform or tapered thicknesses, smooth or rough texture; applicable in one uniform color or in two or more colors laid in a blended design. Eave starters, ridge and hip shingles and ridge roll are provided as required by the various styles of shingles. J-M Asbestos Shingles are sold by the square, i.e., sufficient shingles to cover 100 sq. ft. of surface. They are made in thicknesses of 3/16″ and 1/4″. Tapered American Method shingles are also made with 1/4″, 5/16″ and 7/16″ butts. American Method shingles carry Underwriters' Class A label, for all styles; Hexagonal and Dutch Lap Method shingles, Underwriters' Class B label.

J-M Asbestos Shingles are produced in a wide range of colors which make possible the most effective harmony between house and surrounding shrubbery, trees and landscape. In developing their color range, Johns-Manville has sought to provide a wider choice than that found in natural quarry products, and to produce pleasing variegated effects without too sharply contrasting hues and shades.

The application of American Method shingles may be varied to obtain effects ranging from those in which the lines of the butts are straight and entirely regular, to those in which the shingles appear to have been placed quite at random, with no definite scheme of regularity.

The Salem shingle, one of the leading American Method styles of J-M Asbestos Shingles, was developed to meet the demand for a material which would produce the effect of the weathered, hand-hewn, wood shingle roofs of early New England, and yet have, in addition, the advantages of fireproofness and superior durability. Salem shingles can also be used effectively for side wall finish, and in such application can be whitewashed as readily as their prototypes, which were frequently treated in this way.



Salem roofs—not only colorful and artistic, but fireproof

Where economy is a governing factor, either the Hexagonal or the Dutch Lap Method may be employed. Due to their shape and size and the manner in which they are laid, these shingles provide full protection with the minimum amount of material and weight, resulting in a relatively low cost. The Dutch Lap Method gives the horizontal lines which are a characteristic of the American Method, rather than the diagonal lines of the Hexagonal (or French) Method. With this added quality, the cost of the Dutch Lap Method is only slightly in excess of that of the Hexagonal Method, which is the most economical form of any shingle covering.

Application of J-M Asbestos Shingles

J-M Asbestos Shingles are intended for use on pitched roofs only. For American Method shingles, the minimum allowable slope of roof is 4″ per foot; for Hexagonal and Dutch Lap Method, 5″ per foot.

When used over wood sheathing, one layer of J-M Asbestos Slater's Felt should be applied before the shingles are laid, lapped 4″ on all horizontal and end laps and 12″ on hips, ridges and valleys.

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Roof Surfaces:

The roofing boards should be of narrow width, well seasoned and laid in the usual manner with broken joints, with at least two nails at each rafter or purlin. A cant for the eave shingles should be provided, either by the projection of the cornice moulding 1/4″ above the roof boarding or by a lath, 1/4″ x 1½″, nailed parallel and flush with the lower edge of the roof boarding.

Satisfactory results can be secured by application directly over wood shingles, provided missing shingles are replaced, all loose shingles firmly nailed, all curled shingles split and nailed down, and the surface made as uniform as possible. It may be necessary to smooth out the old roof deck by nailing beveled wooden strips with the thick edges against the butts of the wooden shingles.

Nails:

On new roofs, nails should be galvanized iron roofing nails 1¼″ long, except for Salem roofs, which require 1½″ nails.

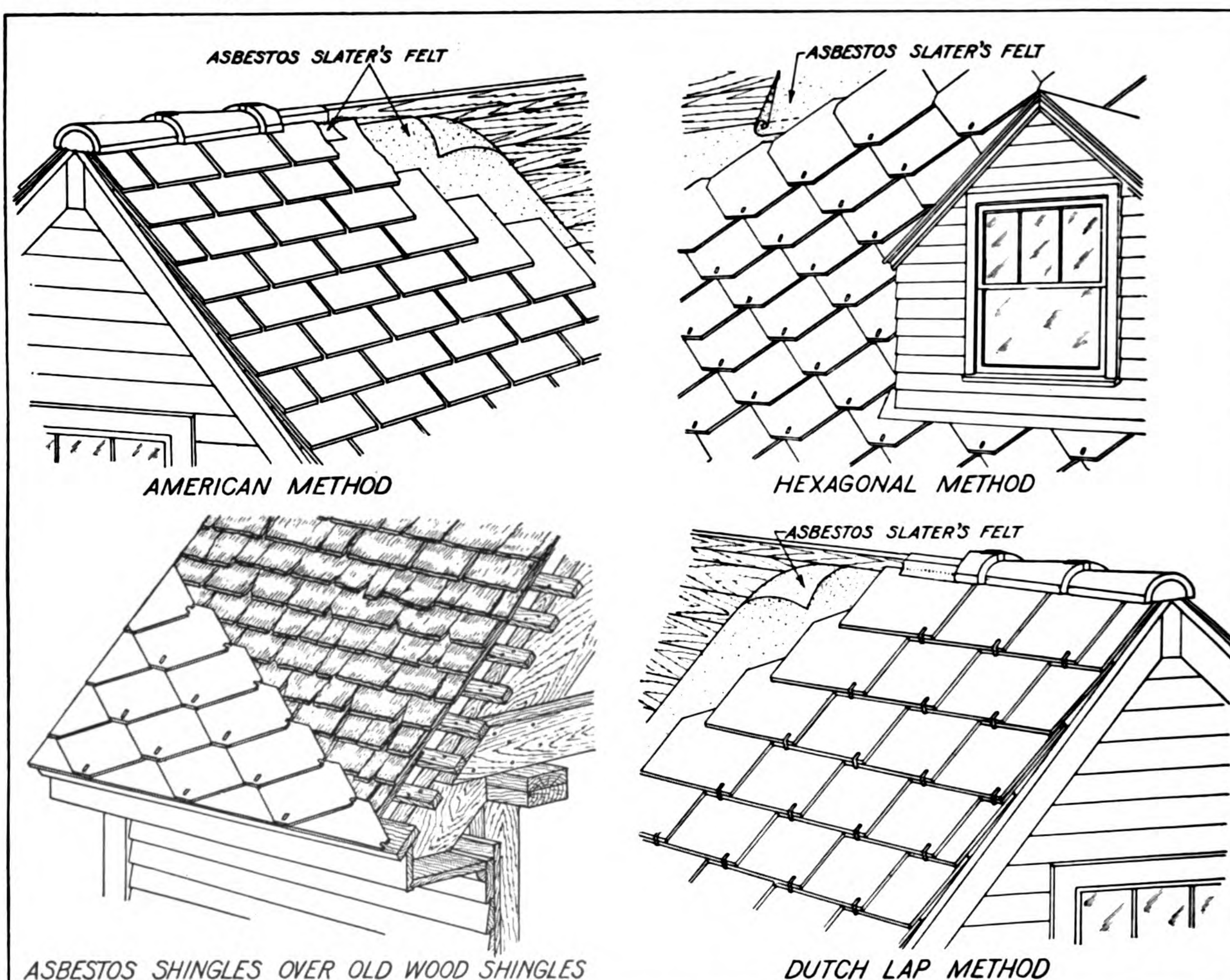
When the shingles are applied over old wood shingles, the nails should be 2″ long, except for Salem roofs, which require 2½″ nails.

Each shingle should be fastened with at least two nails, driven in firmly but not tight enough to put any stress on the shingle.

Ridge rolls should be lapped not less than 3″ and fastened with special ridge roll fasteners.

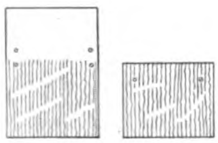
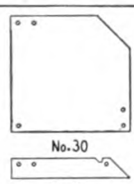
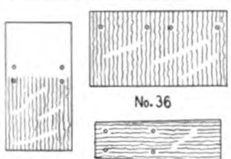
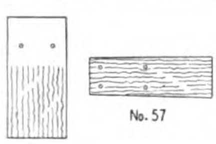
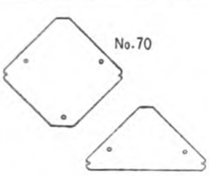
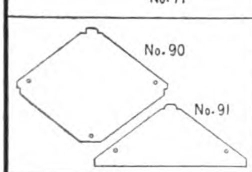
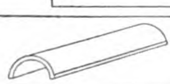
Complete Directions:

Complete directions for application, including flashing, and treatment of valleys, hips and ridges, accompany all shipments of J-M Asbestos Shingles.



Methods of laying Asbestos Shingles

JOHNS-MANVILLE RIGID ASBESTOS SHINGLES

SHINGLE SHAPE	SHINGLE NO. AND METHOD OF LAYING	SIZE, IN INCHES	APPROX. BUTT THICKNESS, IN INCHES	EXPOSURE TO WEATHER, IN INCHES	SHINGLE COLORS	APPROXIMATE WEIGHT, IN LBS.	NUMBER OF SHINGLES PER SQUARE	NUMBER OF SHINGLES PER BUNDLE	BUNDLES PER SQUARE	GALVANIZED NAILS PER SQ.	FOR STARTER, USE NUMBER	NO. PIECES PER 100 LIN. FT.
 No. 25 No. 26	No. 25 American method	Standard 12 x 17 Random widths: 5, 7 and 12 to order	1/4 (tapered)	7-1/2	Duo-Blend Gray Mulberry Duo-Blend Red Breton Red Sable Black Duo-Blend Green Moss Green Sage Green Copper *	560 per sq. 565 per sq.	160 (std. size)	16	10	1-3/4 lb. of 1-1/4"	26	
	No. 26 Starter shingle (use with No. 25)	9-1/2 x 12	1/4 (tapered)		Mixed colors	220 per 100 lin. ft.		20				100
	No. 27 Ridge & Hip shingle (use with Nos. 25, 30, 70 and 90)	16 long top, 4-19/32 wide butt, 5-11/32 wide	1/4 (tapered)	7-1/2	Same colors as No. 25	465 per 100 lin. ft.		17				340
 No. 30 No. 31	No. 30 Dutch Lap method	16-1/4 x 16-1/4	3/16 (uniform thickness)	One quarter side lap 12-3/16 x 13-1/4 (One third side lap 10-5/6 x 13-1/4)	Mottled Gray Mottled Red Mottled Green Mottled Blue-Black Mulberry Duo-Blend Red Duo-Blend Green Copper *	318 per sq. (1/4 side lap) 328 per sq. (1/4 side lap)	90 1/4 side lap (1/3 side lap 100)	15	6 1/4 side lap (1/3 side lap 6-2/3)	1 lb. of 1-1/4" and 90 (or 100) clinchers	31	
	No. 31 Starter shingle (use with No. 30)	3 x 16	3/16 (uniform thickness)		Mixed colors	60 per 100 lin. ft.		15				99
 No. 36 No. 35 No. 37	No. 35 American method	Standard 8-1/2 x 17 Random widths: 6, 8-1/2 and 11 to order	1/4 (tapered)	7-1/2	Granada Red Touraine Red Ebon Black Olive Green Sea Green	565 per sq.	225 (std. size)	15	15	2-1/4 lb. of 1-1/4"	36	
	No. 36 Starter shingle (use with No. 35)	9-1/2 x 17	1/4 (tapered)		Mixed colors	225 per 100 lin. ft.		18				72
	No. 37 Ridge & Hip shingle (use with No. 35)	16 long top, 4-19/32 wide butt, 5-11/32 wide	1/4 (tapered)	7-1/2	Same colors as No. 35	465 per 100 lin. ft.		17				340
Same shape and size as No. 35	No. 45 Siding shingle (American method)	Standard 8-1/2 x 17 Random widths: 6, 8-1/2 and 11 to order	1/4 (tapered)	8	Silver Gray	510 per sq.	210 (std. size)	15	14	2-1/4 lb. of 1-1/4"	36	
 No. 57 No. 55	No. 55 Salem Roofs * (American method)	Standard 8 x 16 Random widths: 6, 8, 10 and 16 to order	5/16 and 7/16 (tapered) Recommended proportions: 2/3-5/16" 1/3-7/16" laid random	7	No. 1 Weathered Gray No. 2 Weathered Black No. 3 Olive Green No. 4 Sea Green No. 5 Forest Brown No. 6 Autumn Brown No. 7 Granada Red No. 8 Touraine Red	5/16 butt, 625 per sq. 7/16 butt, 840 per sq. Laid in recommended proportions, 700 per sq.	260 (std. size)	5/16 butt 20 7/16 butt 10	13 26	3 lb. of 1-1/2	No. 55 shingle cut 9" long	
	No. 57 Ridge & Hip shingle (use with No. 55)	16 long top, 4-19/32 wide butt, 5-11/32 wide	5/16 (tapered)	7	Same colors as No. 55	510 per 100 lin. ft.		17				340
 No. 70 No. 71	No. 70 Hexagonal method	16 x 16	3/16 (uniform thickness)	13 x 13	Mottled Gray Mottled Red Mottled Blue-Black Mulberry Mottled Green Duo-Blend Red Duo-Blend Green Copper *	305 per sq. 315 per sq.	87	15	5-4/5	1 lb. of 1-1/4" and 87 storm anchors	71	
	No. 71 Starter shingle (use with No. 70)	20-15/16 wide	3/16 (uniform thickness)		Mottled Gray Same colors as No. 70	122 per 100 lin. ft. 125 per 100 lin. ft.		15				58
 No. 90 No. 91	No. 90 Diamond Thatch method **	18-3/4 high 26-1/2 wide	5/32 (full) (uniform thickness)	Equivalent to 12 x 18	Mottled Gray Mottled Blue-Black Duo-Blend Red Duo-Blend Green Copper *	260 per sq. 270 per sq.	68	17	4	3/4 lb. of 1-1/4" and 68 clinchers	91	
	No. 91 Starter shingle (use with No. 90)	26-1/2 wide	5/32 (full) (uniform thickness)		Mottled Gray Same colors as No. 90	100 per 100 lin. ft. 104 per 100 lin. ft.		15	3			45
	Ridge Roll	16 long (tapered)	3/8	13	Gray Red Blue-Black Green	372 per 100 lin. ft.		33 per crate				93

* Available only at Manville and Waukegan factories.
** Patent pending.

Printed in U.S.A.

J-M Asphalt Shingles

In addition to Asbestos Shingles, Johns-Manville also manufactures Asphalt Shingles of various shapes and in a wide range of colors. These shingles are made of heavy, asphalt-saturated rag felt, into the top surface of which crushed slate is embedded in asphalt. They provide attractive, colorful, durable roofs at low cost. They can, if desired, be applied directly on old roofs, which eliminates the cost and inconvenience incident to removal of the old roof. All J-M Asphalt Shingles carry Underwriters' Class C label.

The various styles of J-M Asphalt Shingles are described on the other side of this sheet, with data as to lap, exposure and weight and number per square.

Asphalt Shingle Accessories

Slatekote Starting Strips:

Slatekote Starting Strips are cut from standard 85-lb. Slatekote Roofing for use with J-M Asphalt Shingles, as starters. These strips are also used for lining valleys and covering hips and ridges.

Furnished in red, green, blue-black and variegated (bronzetone) colors. Starting strips are 9″, 12″ and 24″ wide, in rolls 36 ft. long, weighing about 21, 28 and 56 lb., respectively, per roll.

J-M Asphalt Felt:

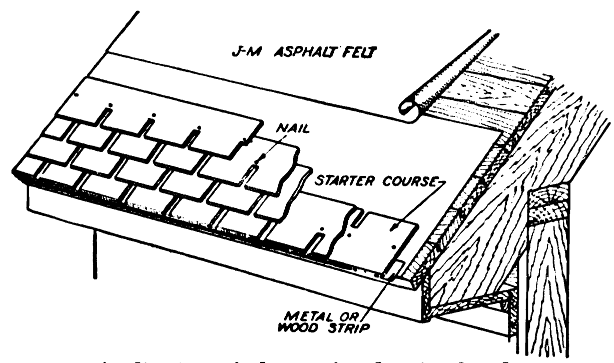
This is an asphalt-saturated rag felt used as a liner under shingles and for various other purposes. Furnished 36″ wide, in three weights. The 30-lb. felt is supplied in 2-sq. rolls (216 sq. ft.), weighing 60 lb.; the 15-lb. felt in 4-sq. rolls (432 sq. ft.), weighing 60 lb.; and the 12-lb. felt in 4-sq. rolls (432 sq. ft.), weighing 48 lb.

Application of J-M Asphalt Shingles

J-M Asphalt Shingles can be used on roofs where the pitch is 4″ to the foot, or more. When used over wood sheathing, one layer of J-M Asphalt Felt, lapped at least 2″, should be applied before the shingles are laid. On porch or dormer roofs with inclines less than 4″ to the foot, a double layer of J-M Asphalt Felt should be applied and the exposure of square-butt shingles should be reduced about half.

Roof Surfaces:

The roof surface should be dry, well-seasoned boards, closely laid, preferably tongue and groove.



Application of slate-surfaced strip shingles

Old wood shingles should preferably be removed, although satisfactory results can be secured by application directly over the wood shingles, provided missing shingles are replaced, all loose shingles firmly nailed, all curled shingles split and nailed down, and the surface made as uniform as possible. It may be necessary to smooth out the old roof deck by nailing beveled wooden strips with the thick edges against the butts of the wooden shingles.

Nails:

For Standard weight shingles on wood sheathing, 1″ No. 11 galvanized nails with 7/16″ heads are used. For Giant weight material, nails 1¼″ long should be used. For either weight of shingle applied over wood shingles, the nails should be 1½″ long.

Siding:

When used as siding, square tab shingles should not be exposed more than 3″ to the weather. Hexagonal shingles may be exposed 4⅔″, as on roofs, except the 12½″ Double Coverage Shingle which should be exposed only 4″ to the weather. Siding shingles should have the exposed butts secured at the lower corners with copper brads or small-headed nails. For Bric-Side Shingles, metal corner strips 2½″ x 2½″ x 8′0″, are available, in colors matching the shingles, for inside and outside corners.

Complete Directions:

Complete directions for the application of square tab, hexagonal, and individual shingles, including flashings, and treatment of valleys, hips and ridges, accompany all shipments of J-M Asphalt Shingles.

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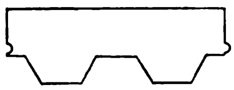
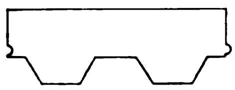
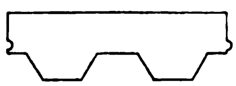
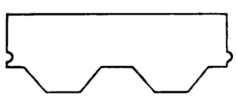
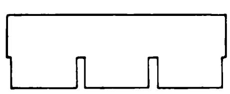
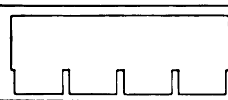
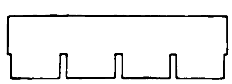
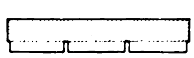
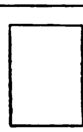
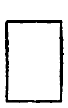
JOHNS-MANVILLE ASPHALT SHINGLES

Shingle Shape	Name of Shingle	Size in Inches	Head Lap in Inches	Exposure to Weather in Inches	Shingle Colors	Available at Manville-M Waukegan-W Gretna-G	Approx. Weight per Sq. in Lbs.	Number of Shingles per Sq.	Bundles per Sq.
	Giant Hexagonal	12-1/3 x 36	3	4-2/3	Fieldstone Green Standard Blue-Black Tile Red Blended Romany Reds Brittany Blend Blended Normandy Greens Chateau Green Burgundy Duo-Blend Gascony Duo-Blend	M W G M W G M W G M W G M W G M W G M W M W M W	225	86	3
	Standard 12-1/3" Hexagonal	12-1/3 x 36	3	4-2/3	Fieldstone Green Standard Blue-Black Tile Red Blended Romany Reds Standard Red	M W G M G M W M W G G	175	86	2
	Standard 11-1/3" Hexagonal	11-1/3 x 36	2	4-2/3	Fieldstone Green Standard Blue-Black Tile Red Blended Romany Reds Standard Red Brittany Blend Blended Normandy Greens Burgundy Duo-Blend Gascony Duo-Blend Picardy Duo-Blend	M W G M W G M W G M W W G M W G M W G M W G M W G M W	160	86	2
	Standard 12-1/2" Double Coverage Hexagonal	12-1/2 x 36	4-1/2	4	Fieldstone Green Standard Blue-Black Tile Red Blended Romany Reds Blended Normandy Greens	M W W W W W	215	100	3
	Giant Strip	12 x 36	2	5	Fieldstone Green Standard Blue-Black Tile Red Blended Romany Reds Brittany Blend Blended Normandy Greens Chateau Green	M W G M W G M W G M W M W M W M W	245	80	3
	Standard 12-1/2" Strip	12-1/2 x 36	4-1/2	4	Fieldstone Green Standard Blue-Black Standard Red Brittany Blend	M W G M W G M W G M W G	250	100	3
	Standard 10" Strip	10 x 36	2	4	Fieldstone Green Standard Blue-Black Tile Red Blended Romany Reds Standard Red Brittany Blend Blended Normandy Greens	M W G M W G M W G M W M W G M W G M W G	195	100	2
	Bric-Side (strip) (for siding)	6 x 30	1	2-1/2	Bright Red (Black mortar) Bright Red (White mortar) Red Black mortar Buff lines only	M W M M W M W	210	192	3
	Giant Individual	12 x 16	6	5	Fieldstone Green Standard Blue-Black Tile Red Blended Romany Reds Brittany Blend Chateau Green	M W G M W G M W G M W G M W M W	315	225	4
	Standard Individual	9 x 12-3/4	4-3/4	4	Fieldstone Green Standard Blue-Black Tile Red Blended Romany Reds Standard Red Brittany Blend	M W G M W G M M W G M W G	240	378	4

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Sound Control

(For complete list of data sheets, see other side of this page)

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Sound Control

Complete List of Data Sheets Available

Brochures

Banks and Offices, Acoustical Treatment in, 24 pp. 8½" x 11", form B-138 No. 3
Churches and Religious Institutions, Acoustical Treatment in, 24 pp. 8½" x 11", form AC-1
Restaurants and Cafeterias, Acoustical Treatment in, 20 pp. 8½" x 11", form AC-3A
Sanacoustic Sound-Absorbing Tile, 8 pp. 8½" x 11", form AB-5A
Sound Isolation (Anti-Vibration Platforms) 24 pp. 8½" x 11"
Sound Isolation System (General brochure) 40 pp. 8½" x 11"

★Catalog pages

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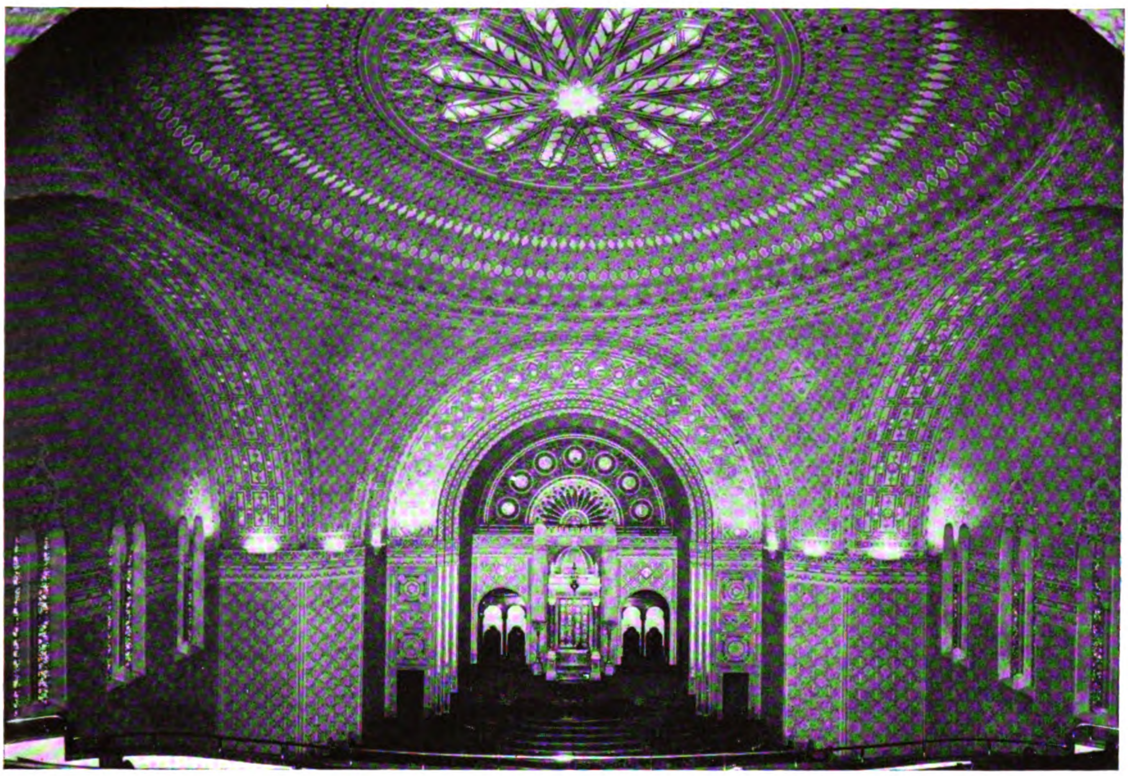
J-M Systems of Sound Control



J-M Acoustical Treatment permits the most elaborate decoration. Here the color tints were applied directly to Nashkote Type C

The practical commercial application of constructive and corrective acoustical science to auditoriums and public buildings, and of noise-reduction principles in factories and offices, was initiated by Johns-Manville in 1911. All of this work was predicated upon the researches of Prof. W. C. Sabine, of Harvard, who reduced the subject of sound as it relates to building interiors to an exact science. Prof. Sabine was retained by Johns-Manville as consultant and much of his later work, until his death in 1919, was prompted by problems arising during this relationship. Literally thousands of acoustical problems in new and existing buildings have been successfully solved since 1911, and the soundness of Prof. Sabine's theories has been definitely established.

Prof. Sabine determined the relationship between the absorbing power of the interior surfaces of rooms and their size so that the time required for the absorption or decay of sounds could be measured mathematically. He established standards of the permissible length of time that sound should remain audible due to continued reflection in variously sized rooms used for either speech or music. He also devised means of measuring the sound-absorbing capacity of practically all the materials used as interior finishes, as well as materials which might be used as concentrated absorbents.

Johns-Manville has developed the technique for the use and application of acoustical materials that has brought the science as disclosed by Prof. Sabine to the state of an art. J-M materials have been made to conform to very definite specifications, and in every case the design and finished product is built to fit a specific need or architectural requirement. Equally important in accomplishing the desired result is the scientific determination of just how much sound any material absorbs, the amount of sound-absorbing material required, and the placing of it in

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The proper use of acoustical treatment makes possible architectural effects which otherwise would be conducive to poor acoustics. Nashkote Type A is ideal for simulating smooth plaster

strategic locations in order to make it most effective.

To work out the practical applications of these principles, Johns-Manville maintains a staff of trained acoustical engineers in the principal cities of the United States, Canada and Europe for consulting work with owners and architects.

J-M Sound Control Materials:

There is a Johns-Manville sound control material adapted for every purpose and for every condition.

The Nashkote acoustical finishes consist of J-M Asbestos Akoustikos Felt (hair and asbestos fibres) cemented to the surface to be treated with a moisture- and heat-resisting cement, and covered with a membrane sized to the felt. This membrane may be painted muslin (Nashkotes Type A, AIS and ACS), or it may be Kribble Kloth (Nashkote Type B), or it may be awning cloth, burlap, etc. (Nashkote Type F.) Sometimes no finishing membrane is used and the surface of the felt is sized to result in a unique texture (Nashkote Type C).

Nashtile is an acoustical material consisting of punched felt in various tile sizes, sprayed with a special composition finish which results in an attractive textured surface.

Rockoustile is a rock wool product in tile form, distinctively attractive and not unlike travertine in appearance. If desired, it can be furnished in various color-tints as well as the natural gray of the material.

Sanacoustic Tile comes nearest to being a universal-purpose material. It consists of a perforated metal tile finished in baked enamel and containing a special rock wool pad as the absorbing medium. The whole unit snaps into metal tee bars which have been secured to the surface to be treated. Aluminum tile and accessories are used in damp and humid locations such as kitchens, natatoriums, etc.

Sanacoustic Panels have all the advantages of Sanacoustic Tile but are not limited to the tile form. This type of acoustical treatment consists of variously sized sheets of perforated metal, attractively finished and backed by a rock wool sound-absorbing element.

Sanacoustic Holorib, when used as an acoustical treatment alone, consists of perforated and enameled Holorib metal, backed by a rock wool sound-absorbing element. One of the novel features of this construction is that the Holorib metal with a J-M rock wool sound-absorbing element, can be combined with Rigid Roofinsul and a J-M Built-up Roof to provide a metal ceiling, acoustical treatment, thermal insulation and built-up roof, all in one.

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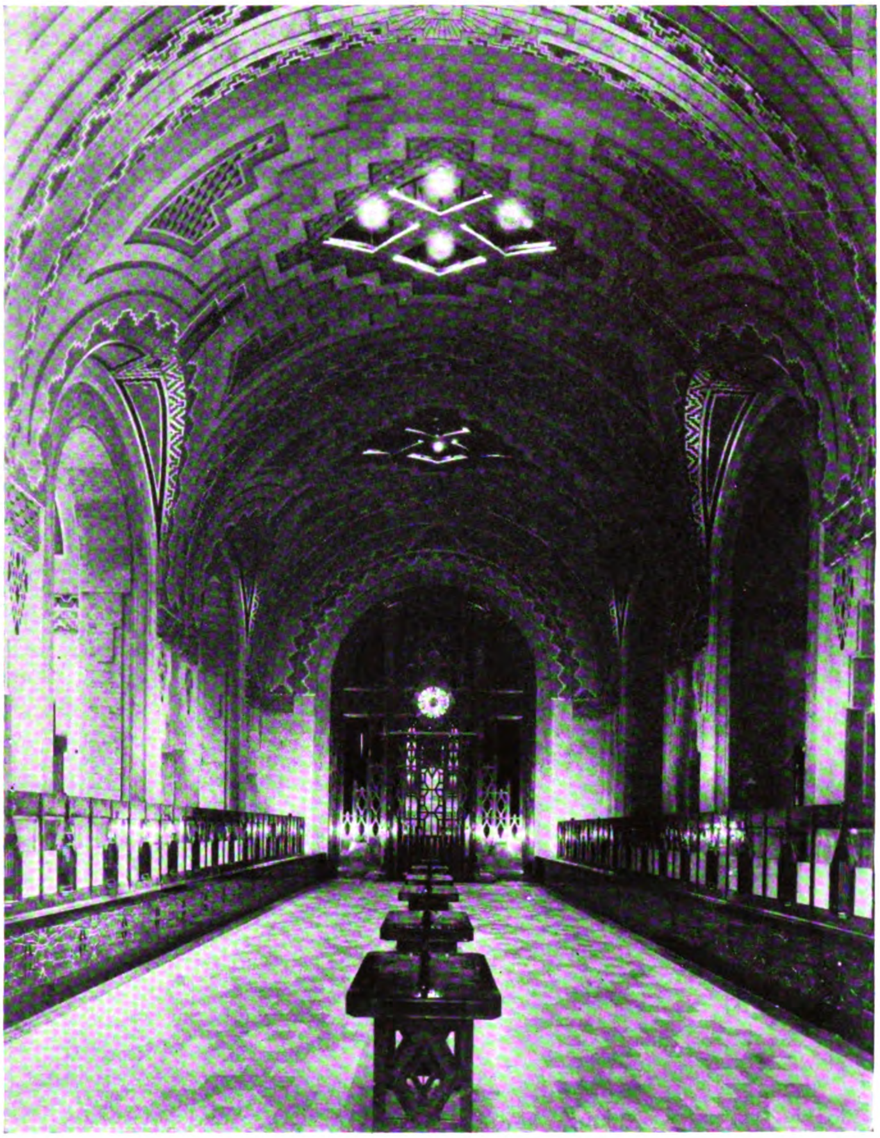
Tables of J-M Sound Control Materials



Sound control is necessary not only to assure good audition but also to eliminate excessive noise, as in this banking room of the Union Trust Co., Detroit, Mich., where Nashkote Type B was applied over the entire ceiling

The tables on the following pages sum up in condensed form all of the J-M acoustical materials, their principal uses, qualities and advantages. When considering an acoustical treatment the factors which are usually important are: high sound-absorbing efficiency, fire resistance, ease of upkeep, appearance, light reflection and vermin-proof qualities. J-M products have all of the properties sought in acoustical materials and satisfactory and efficient installation is assured by the J-M Approved Acoustical Contractor organizations, who through specialization in acoustical work, have obtained the exclusive J-M franchise. Contract prices for applied sound control work may be obtained from any of these companies.

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J-M Sound Control Materials

TABULATION OF VARIOUS TYPES OF J-M ACOUSTICAL MATERIALS

TYPE DESIGNATION	FOUNDATION REQUIRED	SIZE OF UNITS	LIMITATIONS OF SURFACE CONTOUR	CHARACTER OF FINISHED SURFACE	SOUND ABSORBING MEDIUM	FIRE RISK	OVER-ALL THICKNESS	WEIGHT PER SQUARE FOOT	UPKEEP REQUIRED	SOUND ABSORBING EFFICIENCY AT 512 CYCLES	ADAPTED FOR
NASHKOTE TYPE A Perforated after erection	Brown or putty coat of plaster floated smooth, concrete with leveling coat of plaster or cement, wood sheathing, plaster board, insulating board, flat sheet steel, wood studs, or joists on 12", 16" or 18" centers.	No Limitations	None	Smooth oil paint.	Asbestos Akoustikos Felt.	Fire resistance approved by Building Departments universally.	1/2" 3/4" 7/8"	7 oz. 10 oz. 13 oz.	Wash or repaint and perforate.	.43 .53 .67	Auditoriums, Churches, Theaters, Court Rooms. Wherever a high quality finish is required to match painted plaster.
NASHKOTE TYPE AIS				Painted sand finish plaster.			1/2" 3/4" 7/8"	8 oz. 11 oz. 14 oz.		.31 .38 .46	
NASHKOTE TYPE ACS				Imitation Caen stone.			1/2" 3/4" 7/8"	8 oz. 11 oz. 14 oz.		.31 .38 .46	
NASHKOTE B-332				Perforated oil cloth. 3/32" Diam. holes			1/2" 3/4" 7/8"	8 oz. 11 oz. 14 oz.	Wash or paint.	.43 .53 .67	Offices, Hospitals, Restaurants, and general quieting.
NASHKOTE B-085				Perforated oil cloth. .085" Diam. holes			1/2" 3/4" 7/8"	8 oz. 11 oz. 14 oz.		.36 .47 .60	
NASHKOTE B-068				Perforated oil cloth. .068" Diam. holes			1/2" 3/4" 7/8"	8 oz. 11 oz. 14 oz.		.39 .48 .63	
NASHKOTE B-045				Perforated oil cloth. .045" Diam. holes			1/2" 3/4" 7/8"	8 oz. 11 oz. 14 oz.		.39 .49 .64	Same as above and also for Auditorium Work.
NASHKOTE TYPE C				White faced felt, sized. Unique finish texture.			1/2" 3/4"	7 oz. 10 oz.	Wash or paint with spray.	.31 .42	High Auditorium, Church, or Armory Ceilings.
NASHKOTE TYPE F				Burlap, Rep, Brocade, Awning Cloth, or any dyed fabric.			1/2" 3/4" 7/8" 1 1/2" 1 3/4" 3"	8 oz. 11 oz. 14 oz. 21 oz. 28 oz. 42 oz.	Dry or vacuum clean.	.35 .49 .65 .72 .76 .77	All types of Auditoriums. For Church or Theater work where fabric finish is desirable.
NASHTILE		6"x12" 12"x12" 12"x24" 9"x18" 18"x18" Special Sizes		An individual texture resembling Travertine.			3/4"	13 oz.	Wash or spray with lacquer.	.38	All types of Auditoriums. For quieting where tile patterns are desired.

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J-M Sound Control Materials (continued)

<table>
<tr><th colspan="12">TABULATION OF VARIOUS TYPES OF
J-M ACOUSTICAL MATERIALS.</th></tr>
<tr><th>TYPE DESIGNATION</th><th>FOUNDATION REQUIRED</th><th>SIZE OF UNITS</th><th>LIMITATIONS OF SURFACE CONTOUR</th><th>CHARACTER OF FINISHED SURFACE</th><th>SOUND ABSORBING MEDIUM</th><th>FIRE RISK</th><th>OVER-ALL THICKNESS</th><th>WEIGHT PER SQUARE FOOT</th><th>UPKEEP REQUIRED</th><th>SOUND ABSORBING EFFICIENCY AT 512 CYCLES</th><th>ADAPTED FOR</th></tr>
<tr><td>ROCKOUSTILE</td><td>Same as Nashkote</td><td>6"x 12"
12"x 12"
12"x 24"
9"x 18"
18"x 18"
Special Sizes</td><td>None</td><td>An individual texture resembling Travertine</td><td rowspan="7">Rock Wool.</td><td>Same as Nashkote</td><td>1"</td><td>2 lb.</td><td>Clean with vacuum cleaner or sand paper.</td><td>.62</td><td>All types of Auditoriums. For quieting where tile patterns are desired.</td></tr>
<tr><td>SANACOUSTIC TILE ENAMELED STEEL</td><td rowspan="3">No Limitations</td><td rowspan="2">12"x 12"
12"x 24"
8"x 16"
16"x 16"</td><td rowspan="3">Flat walls or ceilings. Vaults of large radius.</td><td rowspan="2">Enameled perforated metal type 068 perforations.</td><td rowspan="6">Fireproof</td><td>1 1/4"</td><td>2.5 lb.</td><td rowspan="6">Wash or paint. Any media.</td><td rowspan="6">.82</td><td>Auditorium work or quieting of every type.</td></tr>
<tr><td>SANACOUSTIC TILE ENAMELED ALUMINUM</td><td>1 1/4"</td><td>2 lb.</td><td>Natatoriums Kitchens Dish-Washing Rooms (Corrosion Proof)</td></tr>
<tr><td>SANACOUSTIC HOLORIB</td><td>22" wide Lengths up to 12 ft. 24 gauge metal.</td><td>Enameled perforated Holorib type 332 or 068 perforations. Ribs on 11" centers</td><td>2 7/8"</td><td>2.5 lb.</td><td>Auditorium work or quieting of ever type.</td></tr>
<tr><td>SANACOUSTIC HOLORIB ROOF DECK</td><td>Purlins not over 7'-0" o.c. for 20 ga. 9'-0" o.c. for 18 ga.</td><td>18 1/8" wide 18 ga. and 20 ga. metal</td><td>Flat and pitched roofs.</td><td>Enameled perforated Holorib type 332 perforations. Ribs on 6" centers.</td><td>3"</td><td>7 lb.</td><td>Quieting of all types in area directly under roof.</td></tr>
<tr><td>SANACOUSTIC PANELS</td><td rowspan="3">No Limitations</td><td>Lengths 8 ft. and 10 ft. Widths 24", 30", 36", 40", and 48".</td><td rowspan="2">Flat walls or ceilings Vaults of large radius.</td><td rowspan="2">Enameled perforated metal type 068 perforations.</td><td>1 1/4"</td><td>2.5 lb.</td><td>Auditorium work or quieting of every type.</td></tr>
<tr><td>BROADCASTING AND RECORDING STUDIO TREATMENT</td><td>12"x 12"
12"x 24"
8"x 16"
16"x 16"
Large Sheets</td><td>4"</td><td>5.2 lb.</td><td>Radio or Sound Film Studios.</td></tr>
<tr><td>BLAST HAIR BLANKET</td><td>4'-0"x 25'-0"</td><td>None</td><td>Drapery Finish.</td><td>Hair Felt</td><td>Slow Burning</td><td>2"</td><td>8 oz.</td><td>Dry clean.</td><td>.85</td><td>Highly efficient straight line absorbent for Auditorium and Sound Film Studio work.</td></tr>
</table>

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The Widespread Need for Sound Control

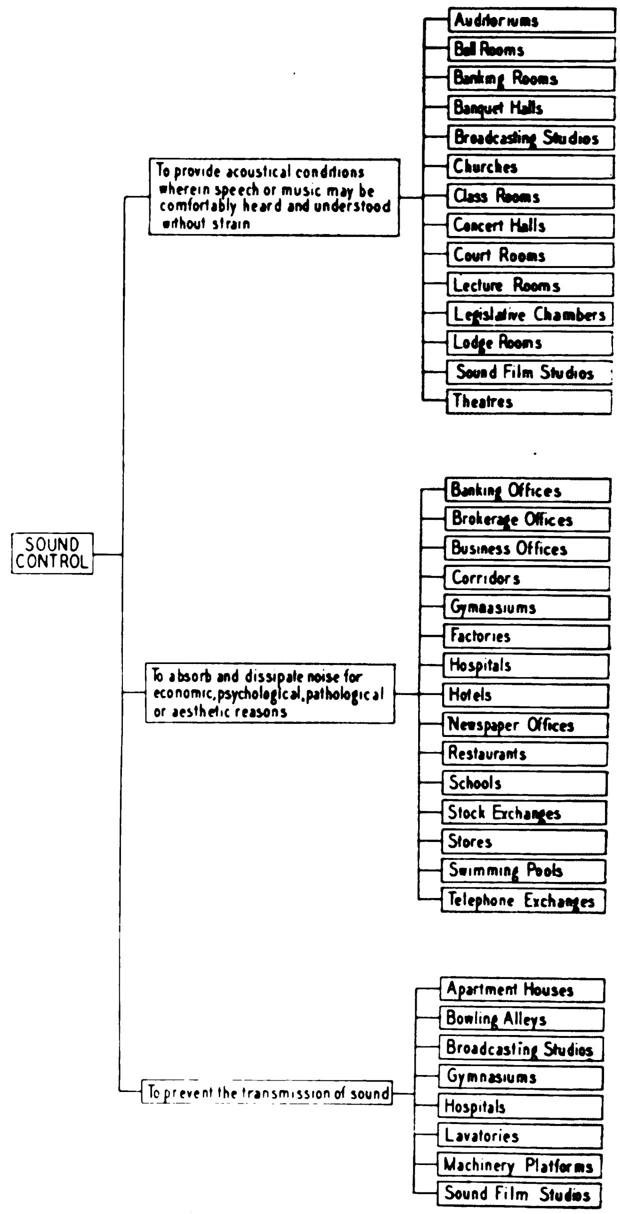
The chart opposite shows concisely the wide field of sound control. Wherever people gather indoors for entertainment, worship or education, the problem of hearing conditions or room acoustics always arises. A quieting treatment is needed where people are working, studying, eating, playing and even more where they are sick. In many such locations and particularly where the difficulty is due to noise transmission, as in apartment buildings, bowling alleys and machinery rooms, there is also an urgent necessity for J-M sound-isolating and vibration-eliminating constructions. The proper design and choice of materials while a building is being constructed permits of considerable economy, but it is usually feasible to apply corrective measures after the structure is erected.

Sound control work may be divided into three general groups as illustrated in the chart. These groups are interrelated and frequently overlap, but for a discussion of principles applying mainly to one class of work, such grouping is convenient.

The first general division is the control of sound or improvement of audition in auditoriums, theatres and churches, making it possible for the audience to enjoy the entertainment or hear the service with ease. To do this it is necessary to prevent echoes and excessive reverberation due to sound reflections from walls and ceiling. This is accomplished through the use of sound-absorbing treatment applied to the reflecting surfaces. It is also desirable to prevent so far as possible, extraneous noises from reaching the audience and interfering with music or speech.

Sound-absorbing treatments for reducing excessive noise constitute the second general division. Such treatments are applied in offices, banks, schools, hospitals, restaurants, factories, in fact wherever noise is produced that is objectionable. The purpose is to increase comfort, health and efficiency. These first two groups are sometimes classified together as referring to the acoustics of room interiors.

Sound isolation, or the prevention of sounds and vibrations generated in one place from reaching another through interposing partitions, ceilings and floors, is the third general division. The principles underlying sound isolation are entirely different from those employed in correcting interiors for air-borne sound, and in many cases both types of treatment are necessary.



Sound control falls into three natural classifications as indicated in the above chart

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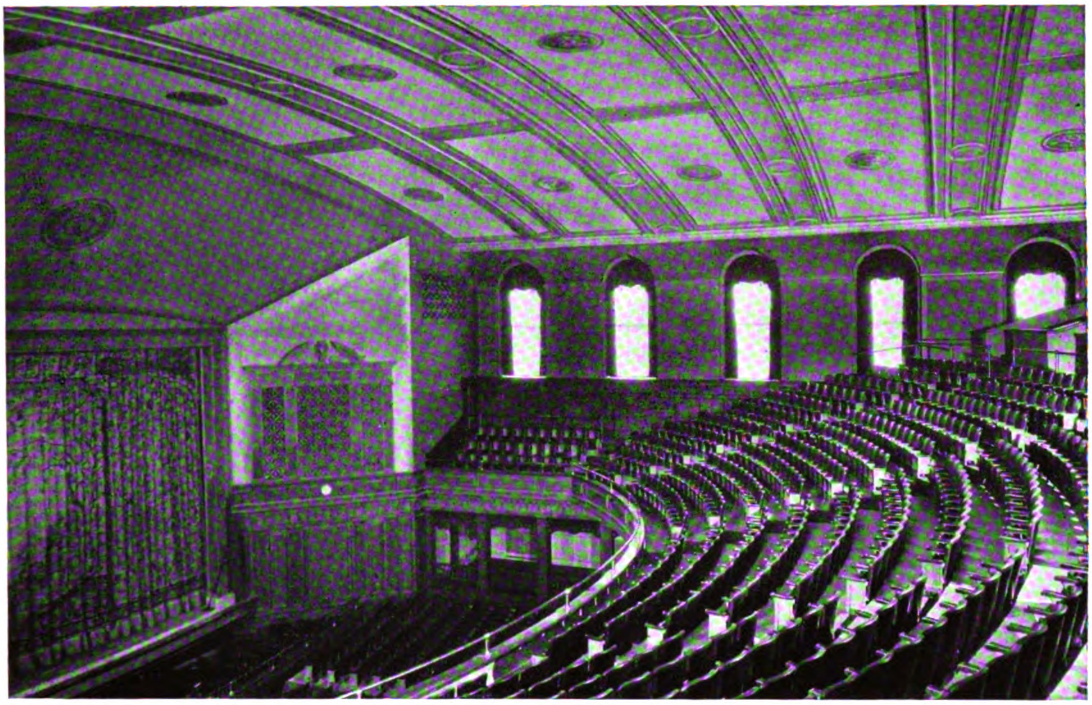
Auditorium and Studio Acoustics



Good acoustics is essential in every theatre, and Nashkote Type A is frequently employed because it is well adapted to use in ceiling panels

The phenomenon of the prolongation of sound due to continued reflection from hard interior surfaces is known as reverberation, and is the principal acoustical difficulty in auditoriums, churches and theatres. In an untreated interior it may take several seconds for every sound produced by a speaker or musical instrument to die out and become inaudible. During this time even a deliberate speaker will utter several succeeding syllables, or a singer several succeeding notes of music, and the result will be an accumulation of direct and reflected sound, resulting in a blurring or running together of the syllables of speech or the notes of music. The larger the room, the greater will be the undesirable effects of reverberation in impairing audition.

It is common knowledge that the mere act of furnishing a house or apartment softens and quiets the hollow, reverberant, sound-carrying quality of the rooms. This is because carpets, rugs, draperies and upholstered furniture all absorb from five to ten times as much sound as the bare floors and walls.

The action of materials in absorbing sound varies somewhat, depending upon the pitch of the sound and the nature of the materials themselves. High-pitched sounds are mostly absorbed by surface porosity and the porosity of the mass. Low-pitched sounds are absorbed more by the flexibility or yielding of the mass as a whole.

In general acoustical practice the sound-absorbing efficiency of materials is usually stated as their efficiency in absorbing sounds of the average pitch of speech and music. This corresponds to a frequency of 512 cycles per second, and reverberation analyses are ordinarily made on this basis. In broadcasting, recording, and sound picture studios, more exacting requirements must be met, and it is necessary to make reverberation analyses over several octaves. In noise elimination work the dominating frequencies of the noise to be dealt with are the deciding factors, and the efficiency of a material in absorbing sound at those frequencies should be considered in the selection of acoustical treatment.

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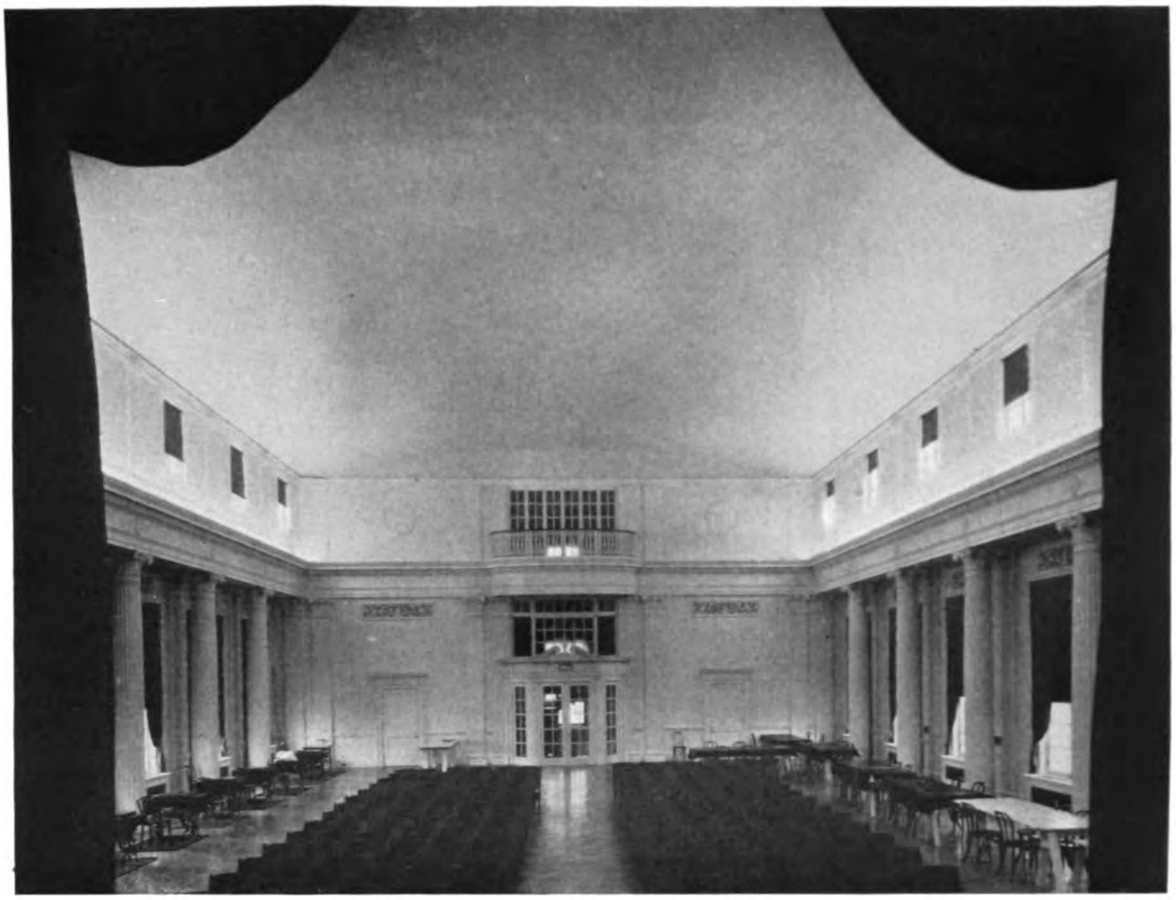

Auditorium in the Women of the World War Building, Washington, D. C., acoustically treated with Nashkote Type B

Auditorium Acoustics:

While carpets, rugs and draperies absorb sound and improve acoustical conditions in small rooms—more efficient, sanitary, fire-resistant and practical materials are needed in auditoriums. For this purpose Johns-Manville has developed materials which possess both of the qualities that absorb sound (porosity and flexibility) to an extraordinary degree, and also fulfill sanitation and fire-resistance requirements.

A good Wilton velvet carpet, for instance, absorbs 15% of the sound striking it, whereas J-M Sanacoustic Tile absorbs 82%—five and one-half times as much. In other words, covering the ceiling alone with such an acoustical material is more than equivalent to covering walls, floor and ceiling with a velvet carpet.

It is evident that by covering the walls and ceiling of a reverberant auditorium and changing the character of these surfaces so they absorb from 50% to 80% instead of only 2½% to 3%, any sound produced in it has to make only a few reflections from surface to surface before all of its energy has been absorbed, thus making succeeding syllables or musical notes stand out clean-cut and distinct.

If the dimensions of an auditorium and the nature of the interior finish and furnishings are known, it is possible to determine mathematically the quantity and location of absorbents which should be introduced to make speech and music clear and distinct, without unduly impairing loudness and carrying power.

To work out a desired architectural effect, an architect often employs contours or shapes which produce undesirable concentrations of sound or echoes. These effects can be nullified by covering the sound-reflecting surfaces with a sound-absorbing material, just as one might paint a light-reflecting surface a dull black to nullify the reflecting effect by absorbing the light.

It is evident that in auditoriums, the kind and

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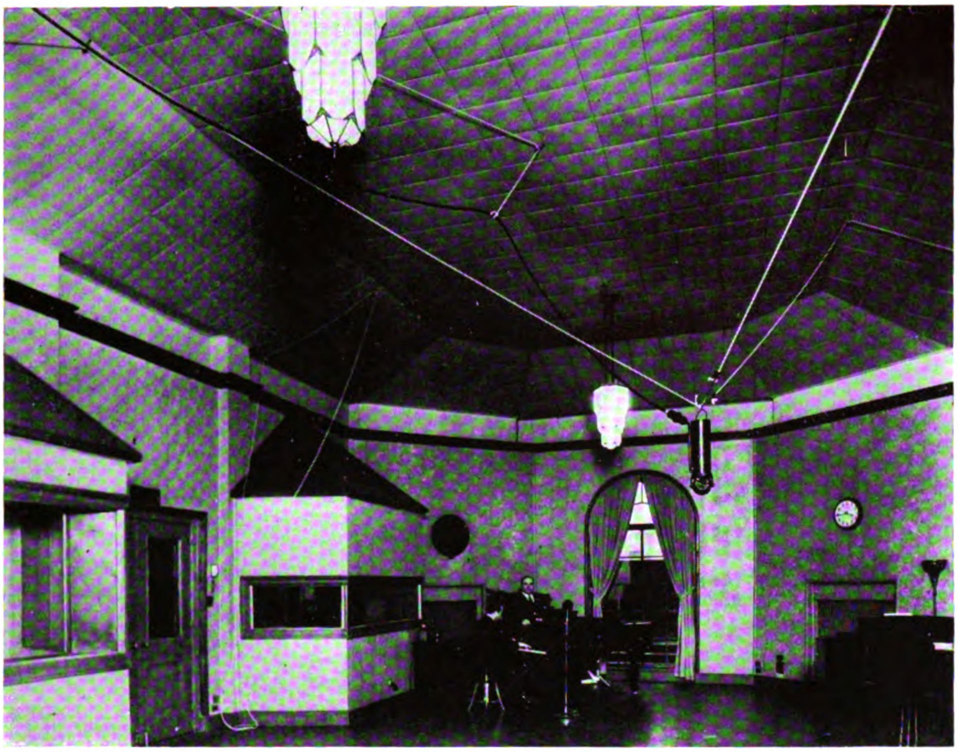

J-M Broadcasting and Recording Studio Treatment meets the exacting acoustical requirements of the Judson Radio Program Corporation

character of acoustical materials must be chosen with great care. It is not always desirable to have the most efficient sound-absorbing interior finish obtainable. The proper placing and distribution of the absorbent is frequently the most important factor.

J-M Nashkotes Type A and AIS are particularly well adapted to auditorium, church and theatre work, since in addition to having all of the recognized acoustical qualifications, their appearance resembles that of smooth and rough plaster, respectively. Their decorative possibilities are practically limitless and the surface presented by them is ideal for mural painting. It is possible to roll a perforating device over the painted surface and thus restore to the material its original absorption. Sanacoustic Tile and Rockoustile can also be used with equal acoustical success where a tile type of material is desired.

Studio Acoustics:

The acoustics of broadcasting and sound picture studios present a more difficult problem. Here the extent to which a material absorbs sounds of different frequencies is particularly important. The acoustical material used in correction must have a "straight line" absorption characteristic; that is, it must absorb all frequencies over the essential portions of the scale of pitch to very nearly the same degree.

Most acoustical materials are very good high frequency absorbers but their absorption at the lower frequencies is poor. The use of "peaked" absorbing materials in studios results in selective absorption of the higher frequencies so that the lower tones predominate and recorded or broadcast sound may lack tone quality and character, due to the loss of the upper partials and overtones. This literal filtering out of the high frequencies also causes distortion which makes music or speech sound unnatural.

Since the electrical recording and broadcasting processes are unavoidably attended by considerable distortion to the sound, it is desirable to have the "room effects" as perfect as possible. J-M Broadcasting and Recording Studio Treatment is incomparable in accomplishing this result. The construction consists of rock wool 4″ thick, finished with decorated sheets of perforated metal. This is the best "straight line" absorption treatment known and is recognized by the leading broadcasting systems and sound film producers as ideal for this kind of work.

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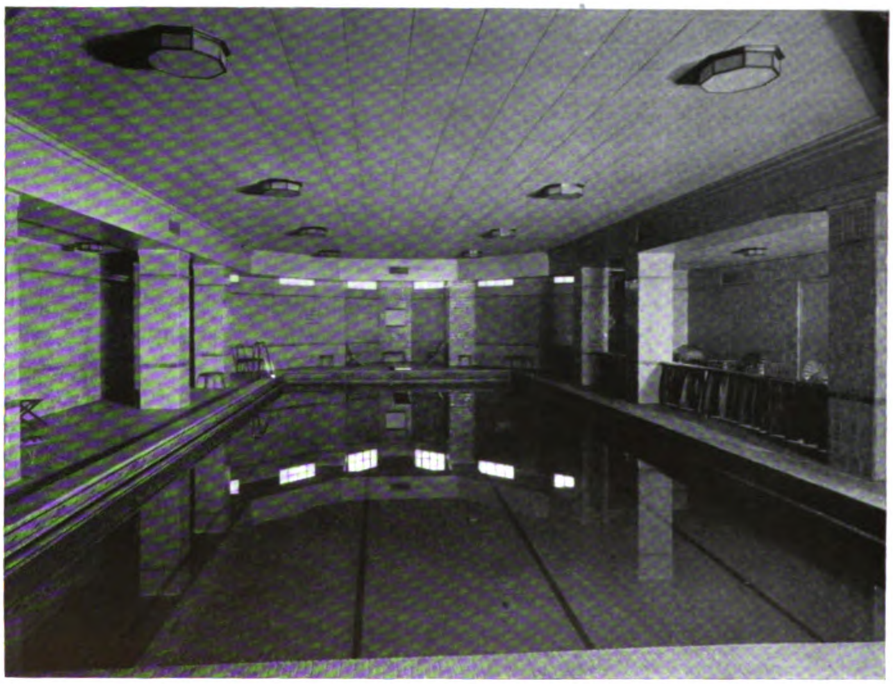
A brokerage office customers' room is the scene of many distractions, but the disturbing effect of noise is probably the worst. Sanacoustic Tile on the ceiling absorbs objectionable sound



Unless ceilings are treated to absorb sound, the noise of splash and chatter in a swimming pool soon reaches disagreeable proportions, and also endangers the lives of poor swimmers, whose calls for help could pass unnoticed. Sanacoustic Tile and fittings are made of aluminum where dampness is to be encountered

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Noise Control by Absorption

A business office of Montgomery Ward & Co., with Sanacoustic Tile on the ceiling. Progressive organizations are quick to realize that noise control methods constitute a highly profitable investment

In offices, banks, schools, hospitals, restaurants, and factories, the usual problem is not one of preserving the character of sound as produced, but rather one of absorbing sound as a means of noise reduction. The deleterious effects of noise upon the human individual and the importance of controlling this disturbing influence has received much attention.

The installation of sound-absorbing materials on the ceilings and walls of room interiors has proved to be the solution to the problem with respect to internal aerial noise. An acoustician can make calculations from the size and furnishings of the room, predict what the treatment will do, and later check this prediction by measurements.*

In noisy places where the treatment can be ingeniously localized on the ceiling directly over the source of sound, the effect is to absorb objectionable noise as fast as it is produced and to prevent the reinforcement and accumulation of sound energy—that building up of intensity which is so nerve-wracking.

*The unit most commonly used for denoting the loudness of a sound is the "decibel," abbreviated "db." The loudness of a given sound expressed in decibels is ten times the common logarithm of the quotient obtained by dividing the intensity of the given sound by the intensity of a barely audible sound of the same pitch. One decibel corresponds roughly to the slightest change in loudness that can be distinguished by the human ear.

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Corridor in Billings Memorial Hospital, University of Chicago, treated with Sanacoustic Tile

Hospitals and Sanitariums:

In hospitals and sanitariums, the difficulty is mainly with extraneous noises originating in diet kitchens, corridors, etc., and Sanacoustic Tile is admirably suited to the solution of the problem. Relative to the need of quieting treatment in such locations, Dr. L. F. Barker, of Johns Hopkins, points out that "When one goes to sleep it is much easier to cut off the sensory stimuli which arrive through the eye than those which arrive through the ear. We can put out the light and we can close our eyes, but there is no satisfactory way of closing our ears to extreme stimulation, and noises in the street, building or house, act on the brain and prevent sleep. When the body is strong and healthy, it is possible, as a rule, to grow accustomed to go to sleep and continue sleeping despite considerable noise. Most of us who live in cities learn this, but nervous people who are very delicately organized are often super-sensitive to sound. Almost all sick persons are in a state of pathological fatigue and loud, disagreeable noises increase this fatigue to a danger point."

Restaurants and Cafeterias:

In restaurants and cafeterias it has been proved that quieting treatments using Sanacoustic Tile or the Nashkotes have paid real dividends in making dining hours more restful and less nerve-wracking by eliminating the din that is usually incidental to the serving of food. Acoustical treatment also provides a solution to the problem arising when luncheons and banquets are followed by speeches.

Restaurant patrons appreciate quiet while dining. This installation is Sanacoustic Tile

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This business office of the Northwestern Life Insurance Co., Minneapolis, Minn., has its ceiling finished with Nashkote Type B

Offices and Factories:

Business organizations are recognizing that the comfort and health of their employees is a matter of vital consequence, not alone from the standpoint of increased output but also for purposes of an amiable relationship between management and employee. Discussing the effect of noise upon workers of all kinds, Babson's Reports, February 28, 1928, makes the following comment:

> "The increasing seriousness of industrial noise as a drag on efficiency, presents a problem to which most clients have paid little attention. Both in the factory and in the office the increasing volume and intensity of sound has reached a point where it ceases to be merely a nuisance and becomes a definite economic liability. As a result, efficiency has been reduced and production slowed up. Wherever office-quieting treatments have been installed there has been a decided improvement in efficiency. Wherever brains are active, noise costs money. We urge clients to examine the acoustic conditions in the various rooms of their offices and plants. Noise is today on every employer's payroll. Much of it can and should be removed."

Noise, in business offices and banks, is the result of increased noise-producing apparatus, the grouping together of large numbers of employees, and the use of hard, dense interior finishes which are excellent reflectors of sound and very poor absorbers.

The average office worker knows what a relief it is to have all hum, rattle and clamor cease when office work stops. Leading psychologists have shown that considerably more energy is required to do a given amount of work in a noisy room than in one which is quiet. Pressure on the brain is increased by noise and great strain is put upon the nervous system.

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Sound control is indispensable in the telephone exchange. This installation of Sanacoustic Tile is in the Hotel Pennsylvania, New York City

Results of Noise Reduction:

As an example of what may be accomplished through the abatement of noise, reference may be made to the results obtained from acoustical treatment installed in several large business offices. Properly applied sound-absorbing treatment in many cases represents a considerable investment, but one which returns a high percentage in the efficiency, contentment and health of workers. The following table shows the dividend-paying results obtained by several nationally known concerns.

These results would indicate that it is also possible to expect a higher overall efficiency of workers in acoustically treated offices. In the control division of the Aetna Life Insurance Company, the average increase in efficiency over a one-year period was 9.2%. Such calculation was possible because the company kept bonus records based on efficiency.

Firm	Type of Treatment	Type of Room	No. of Workers	Improvement Observed
Western Union Telegraph Co.	Nashkote B	Telephone Room	42	42% decrease in errors
Aetna Life Insurance Co.	Nashkote B	Control Room	30 to 40	29% less errors—typists 52% less errors—comptometrists
Rike-Kumler Co.	Sanacoustic Tile	General Office	69	24½% decrease in errors (typists, bookkeepers, etc.)
International Tel. & Tel. Co.	Nashkote B	General Office	40	75% decrease in errors

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The problem of noise always arises wherever people gather together, but is susceptible to control by J-M sound-absorbing treatments.

Mr. P. B. Griswold, Assistant Secretary of the Aetna Life Insurance Company at a recent meeting of the National Office Managers Association, said that the economy of acoustical treatment may be observed readily by assuming a 5% increase in efficiency on an average salary of $1000. The area of acoustical treatment per employee would be about 50 sq. ft., costing perhaps 60¢ or 70¢ per sq. ft. Thus a gross annual return of $50 would be realized on an expenditure of about $35.

Another considerable saving which results from the installation of acoustical treatment is the reduction in labor turnover, absence due to sickness, etc. Figures on these matters are very hard to obtain, but in the same discussion by Mr. Griswold, some interesting data are given:

> "Our employment department records show that while the acoustical treatment was effective compared with the corresponding period before treatment, there was a reduction of 45% in turnover and 37½% in days lost in the departments where the experiment was carried on. During the same period, the record covering all our home office employees shows a reduction of 20% in turnover and 22% in days lost."

In other words, the turnover was reduced more than twice as much in the acoustically treated department and the number of days lost was correspondingly smaller.

Noise Control Materials:

The selection of the most desirable acoustical material for use in controlling noise depends mainly upon its sound-absorbing efficiency. In other words, it is desired to absorb as much sound as possible, consistent with such factors as light reflection, sanitation, vermin-proof qualities, fire-resistance and appearance. The Nashkote Type B, Sanacoustic Tile, Sanacoustic Holorib and Rockoustile are all applicable to this kind of problem. The choice between them usually depends upon some quality

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or characteristic of the material which makes it particularly suitable for the purpose.

In new work Sanacoustic Tile has an advantage over the other materials in that its use eliminates the cost of metal lath and plaster. The same also holds for Sanacoustic Holorib, which can be so supplied as to comprise all the features of a built-up roof, a metal ceiling, thermal insulation and an acoustical treatment.

In restaurants and the like, elaborate decorative schemes are often preferred. In such cases a material having the appearance of smooth plaster is necessary as a base, and J-M Nashkote Type A is ideally suited to such application.

A Sanacoustic Tile ceiling is one of the attractive features of the Colonial Grill, Chicago, Ill.

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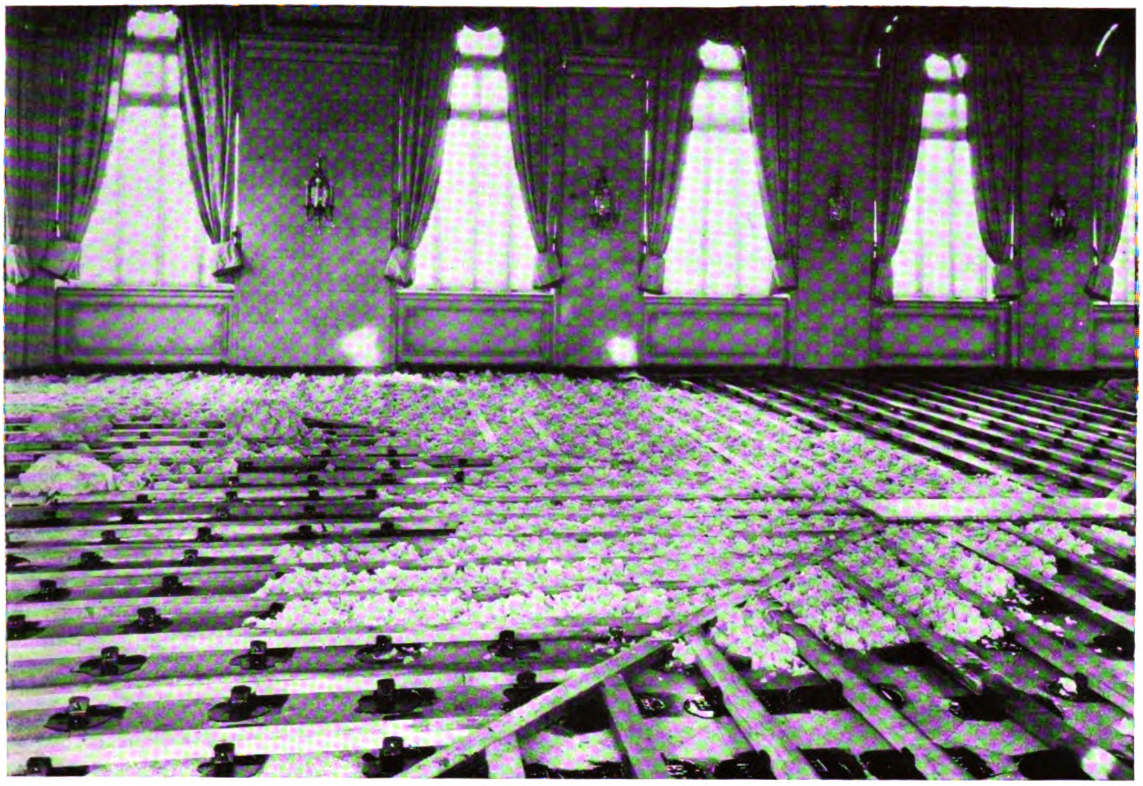
Sound Isolation



A J-M sound-isolated dance floor, as shown under construction, is one of the necessary adjuncts to the modern ballroom, as well to provide resiliency as to prevent transmission of sound

Present-day civilization requires the use of mechanical equipment, and the resulting noise has a serious effect upon the health, comfort and efficiency of everyone. More types of easily transmitted noise are being produced, while at the same time the standards of quiet are becoming more strict. The control of sound transmitted by structural vibration is accomplished by special construction of floors, walls and ceilings. These provisions can best be made when a building is being erected, though it is usually possible to apply corrective measures at any time.

Commercial buildings have a longer useful life if sound-treated, and may be used for many more kinds of business. A well-directed investment in sound control is good insurance against obsolescence and dissatisfaction of tenants. In other words, the use of sound-isolating treatment provides a means of obtaining maximum revenue. Higher rents may be charged in sound-treated apartment buildings because tenants appreciate the additional comfort and privacy. Similar treatments are advantageously installed in clubs or lodge buildings, in schools, hotels, hospitals, and churches. Broadcasting studios and music instruction or practice rooms should also be sound-isolated. Industrial buildings, where light manufacturing may be carried on adjacent to office spaces, and motion picture studios where sound pictures are produced, are other places requiring treatment. Sound control in many cases effects economies in design and construction, such as the placing of ventilating fans where needed throughout a building and isolating them, instead of grouping them at out-of-the-way places. Theatres, bowling alleys, billiard rooms and ballrooms may be built in close proximity if measures are taken to prevent the transmission of sound between them.

Overcoming the transmission of sounds and vibrations between rooms is an entirely different problem from the control of aerial noise by absorption. Obviously, there is no purpose served by making a room

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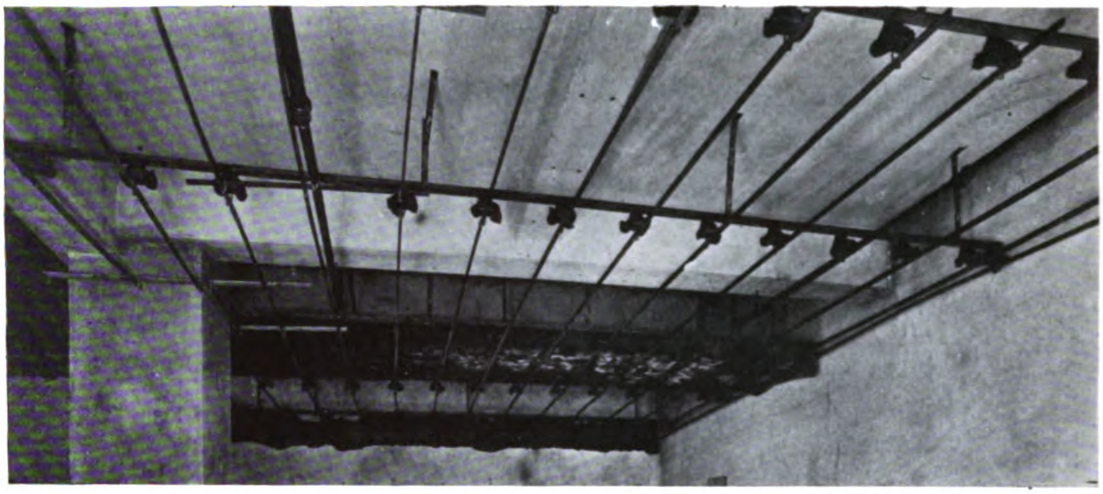


One method of constructing a J-M sound-isolated ceiling is to provide special steel furring from which to hang the ceiling isolators for supporting metal lath and plaster

interior acoustically perfect if there are disturbing noises of large magnitude present in an adjoining room. It might seem reasonable to put acoustical treatment in the offending room also. But experience has shown that interfering noise has to be reduced to a very low level before it ceases to be troublesome, and absorbent material alone is not enough to accomplish this. It is also true that effective means of vibration control may not do away with the need for acoustical treatment.

Sound goes through a floor or partition either by finding its way through crevices and cracks or by setting the entire wall, floor, or ceiling into vibration. In trying to make a wall or floor a sound isolator, it is first necessary to see that there are no openings and that windows and doors fit tightly.

The amount of sound transmitted through single partitions, floors, or ceilings by vibration is inversely proportional to the weight per square foot of the surface exposed to sound; that is, the heavier

In fireproof apartment sound-isolation construction, J-M floor chairs are grouted in with cement. Sound isolation fill is placed between the stringers the partition, the less sound will be transmitted. However, density alone is not the solution. Impact and machine vibrations are usually troublesome because they are easily transmitted through dense materials, hence the use of heavy, dense materials in construction does not wholly solve the general problem of isolating sound. Even if it did, such methods wuold oppose modern structural design, which attempts to utilize materials of maximum strength and lowest economic weight. For this reason the reduction of sound transmission by increasing weight and density is usually not practical or economical.

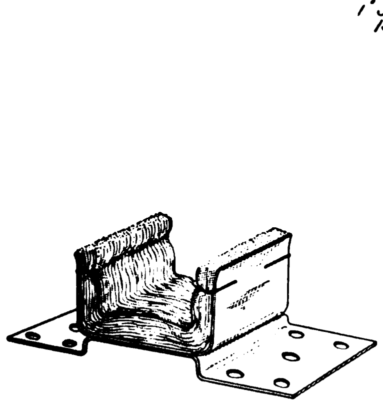
The use of double walls separated by air spaces or by materials differing greatly in density is sometimes advocated as a means of sound isolation. Such designs waste space, are difficult to obtain structurally, and their efficacy is much reduced by the necessity of having solid through-connections to support the structure.

J-M System of Sound Isolation:

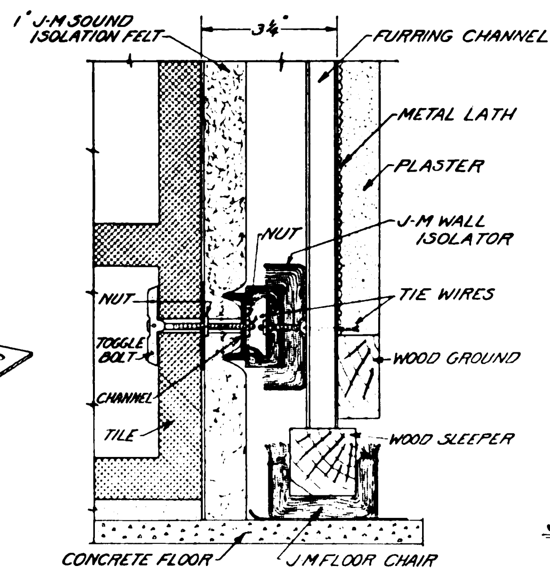
The idea of the J-M System of Sound Isolation (formerly the Stevens System) is to place a shock-absorbing construction between the light exposed surface of a room and the main structure, no solid through-connections being used. These light-weight units receive the vibration and transform it into mechanical energy and absorb it when transformed. Sound isolation felt or fill, used in connection with the isolators, adds a sound-damping medium and prevents drum action.

In this system cushioned isolators are installed at specified points to take up the shocks which the sound waves generate. A means is provided for securing a finished surface to a wall, ceiling or floor which not only holds the various parts together but also breaks the otherwise direct contact of solid materials which would conduct vibrations. The better qualities of the various methods of combating sound travel have been combined in this one system. In addition, it has been tested by actual use over a long period of years and the design of the parts is based upon experience which assures satisfactory installations at a minimum of cost to the user.

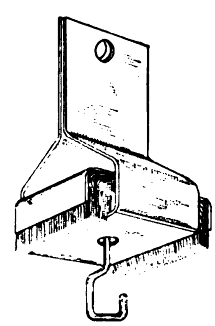
The J-M System also has the advantage of providing structural unity and because of this is adaptable to a large variety of uses in building construction, from the simple frame building to the most modern fireproof designs. The treatment is easily applied and may be installed during the erection of the building without the least interference with the schedule of operations. The parts are of such materials as to preclude deterioration from age. They are also vermin-proof and hence suitable for all types and conditions of buildings in which such treatments may properly be used.



ONE DESIGN OF J-M FLOOR CHAIR.



TYPICAL J-M WALL ISOLATING TREATMENT.



TYPICAL J-M CEILING ISOLATOR.

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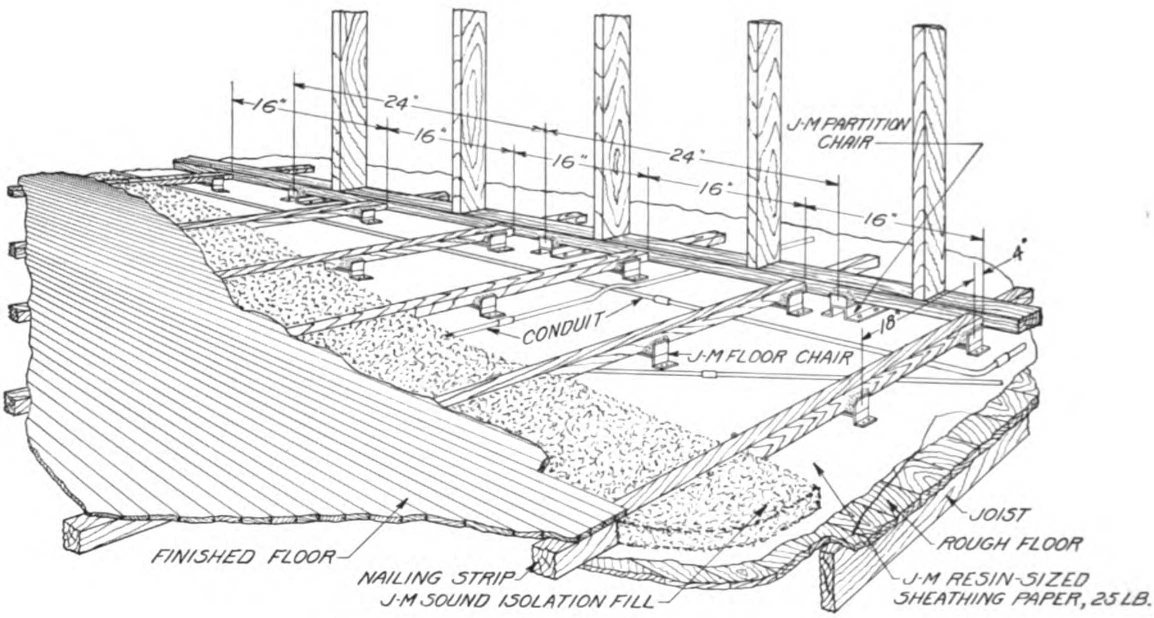
Somewhat aside from the sound-isolating properties is the resilience of floors treated with the J-M System. This is of particular importance in gymnasium, ball room and similar floors. This resilience makes it possible to walk, run or dance over these floors with a minimum of fatigue—a desirable factor for all floor work.

The shock-absorbing units ("chairs" or "isolators") consist of a metal support or fastener to which studding, sleepers or joists can be fastened, and one or more layers of heavy, cushioning felt, which comes between the structural member and the metal fastener. When these units are installed in a wall any sound impulse uses itself up in compressing the resilient felt and is largely prevented from reaching the structure beyond. There are different types of chairs and isolators for different constructions—for walls, floors, suspended ceilings, machinery platforms, etc.

In cases where sounds are produced on both sides of a partition and special conditions require quiet in each room, as with adjoining broadcasting studios or music rooms, it is advisable to install the light weight receiving surface in each room, supplemented with a sound-absorbing treatment for acoustical purposes.



Typical J-M system of floor and partition isolation

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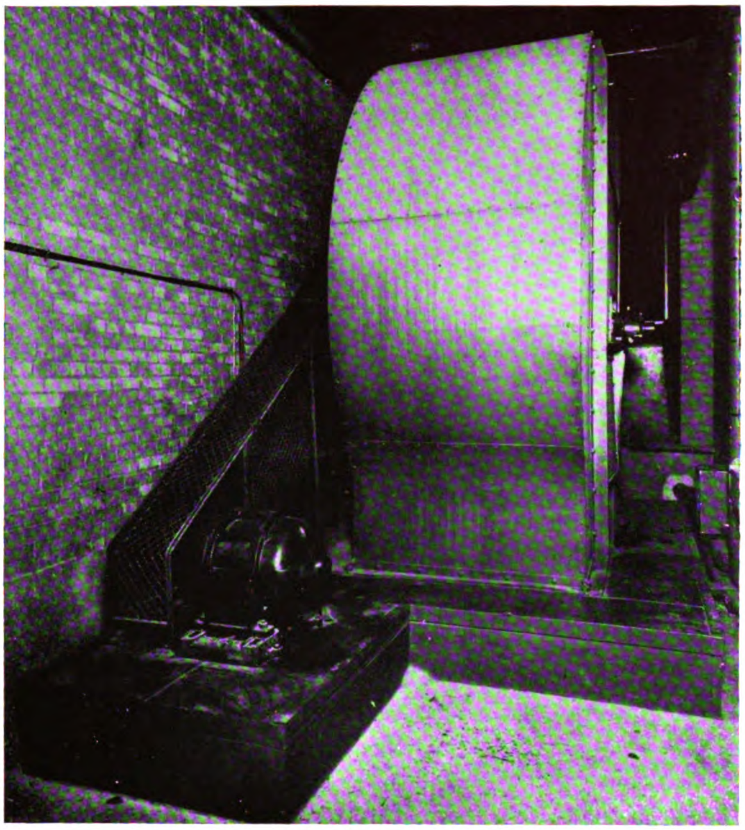
Sound Isolation Platforms



J-M sound isolation platforms, designed to fit the needs of the individual installation, make possible the allocation of machinery at points of economic advantage, without creating an intolerable disturbance in adjoining rooms

A vibration-isolating platform to be most efficient should embody a construction into which has been introduced a series of materials of different densities, having a definite cushioning effect and so installed as to have the least possible contact between the top of the platform and the supporting structure.

These features are a part of the J-M vibration-isolating platform, which consists of two or more tiers of stringers placed at right angles, and supported and separated from each other by vibration-absorbing chairs. The platform top is secured to the upper tier of stringers and the space between it and the floor is filled with a loose sound- and vibration-damping material held in place by means of an apron or skirting. The noise-producing vibration must pass from the platform top successively through wood, hair felt, steel, hair felt, wood, hair felt, steel, etc., to the supporting floor structure. Most of the vibration is damped out in the process of passing through these various mediums.

Different types of vibration-producing machinery, with the resultant variations of base size, loading, and vibration characteristics, necessitate the use of different types and spacings of chairs in order that the load per chair will not exceed its vibration-absorbing capacity. If the floor is light in weight or susceptible to relatively large deflections under load, the platform will not be as effective as when the supporting structure has greater weight and inertia. The platforms must be light in relation to the floor and building structure. When the platform top is of planking, the planks should be parallel with the direction of belt travel. Two units operating together by means of a belt or otherwise, should be mounted on one platform, although the intervening space may have only the maximum spacing of chairs.

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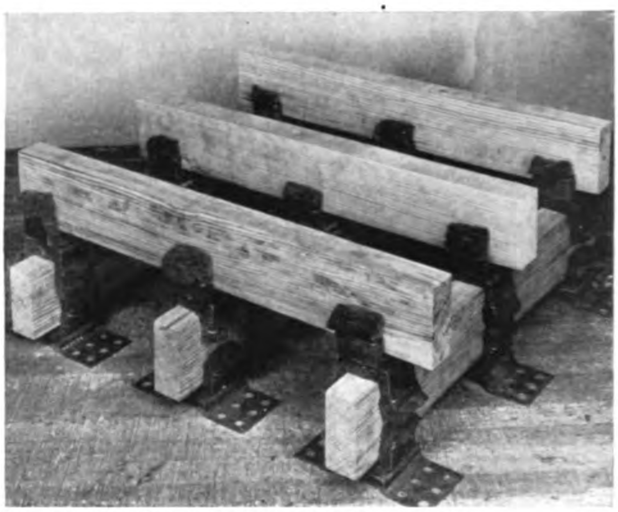
If more than one separate unit is to be mounted on a platform, care should be taken to avoid mounting two units together which have the same direction of rotation. If this is done, the natural frequencies of these units will, at times, get into step and set up extreme vibrations. However, if such procedure is necessary, the wood top and the upper tier of stringers around each unit may be sawed through, thus allowing each unit to vibrate independently.

The factor of greatest importance in the design of a platform is that the center of gravity of the equipment be directly over the center of resistance of the platform. The isolation fill is eliminated when the platform is below grade. Otherwise moisture might cause rotting of the wood stringers. When platforms are subject to excessive moisture or constant dripping, creosoted wood should be used throughout or the platform top covered with sheet metal, or both, depending on the condition. For certain types of equipment or where fire restrictions require, concrete tops and sometimes concrete aprons are used.

All pipes, ducts, conduit, etc., leading from the platform equipment, should be provided with flexible couplings or isolated from the structure to such a point as will eliminate the possibility of vibration transmissions. All hose connections should be looped and installed vertically since straight hose couplings do not always isolate.

In the isolation of laundry equipment, care should be taken to provide proper waterproofing and drainage. Copper gutters, made to suit the conditions, should be connected to the drainage system by means of flexible couplings.

Where clearance is a limiting factor or where there are other special conditions, it is possible to support the vibrating units from the sides or hang the platforms from the ceiling* or support them on wall



Model of J-M sound isolation platform construction, using two tiers of stringers

brackets. These devices are even applicable to small manufactured units such as electric refrigerators and other modern conveniences.

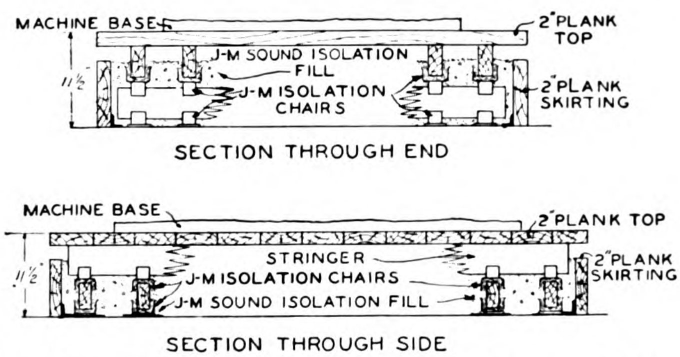
In order to design a platform intelligently it is necessary to obtain the following information:

(1) Base sizes, shaft loadings, and spacing of equipment units with their respective weights and live load points, if any.

(2) Description of the type of equipment and the conditions to be met in the building.

(3) Any additional information necessary to determine center of gravity, direction and spacing of top and bottom stringers, shape of platform and spacing of chairs.

J-M Approved Acoustical Contractors are familiar with J-M methods, and install all J-M sound control materials. The best of workmanship is necessary in producing a finished job, and this quality is assured in the personnel of J-M Approved Contractors.



One type of J-M sound isolation platform for bases of vibration-producing machinery

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INDEX

Transite Products

(For complete list of data sheets, see other side of this page)

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Complete List of Data Sheets Available on Transite Products

Corrugated:

Duct:

Flat:

General Data:

Motion Picture Booths:

Pipe:

Smoke Jacks and Forge Jacks:

Ventilators:

★ Catalog pages

Corrugated Transite Asbestos Sheets

Laying J-M Corrugated Transite Roofing. The cut corner construction permits a tight joint with straight lap lines, and results in a durable, attractive roof

Transite is an asbestos fibre and portland cement mixture formed under high pressure into dense, unlaminated, monolithic sheets of great structural strength, rigidity and durability. Corrugated Transite sheets are designed for use as roofing and siding, particularly over skeleton frame construction. This material has found wide application by railroads, public utilities and industrial plants due to its high resistance to acid fumes and atmospheric conditions and because of its strength, fireproof qualities, permanence without maintenance, and ease of application.

Corrugated Transite is most commonly used as a roofing, siding and partition material on skeleton frame industrial structures. It is also used as a roofing material for railroad stations, roundhouses, garages, barns, summer cottages and numerous other buildings. Because of its interesting texture and appearance, it has found acceptance as a decorative material for background in modern store window displays, decorative wall treatment in modernistic interiors, etc.

Accessories are furnished in the form of ridge rolls, corner rolls and louvres. Ventilators made of Transite are also supplied, as described in other data sheets. Special fasteners have also been designed for use with Corrugated Transite. Every detail of construction has been thoroughly worked out to assure rapid, economical erection.

Characteristics of Transite

Fireproof:

Transite offers resistance to fire which is unsurpassed by any other corrugated material. Not only is it non-combustible, but it will withstand high temperatures without melting or buckling. Its exceptional fire-resistance makes it the leading material of this nature for roofing, siding and partitions in industrial buildings, and especially those in which

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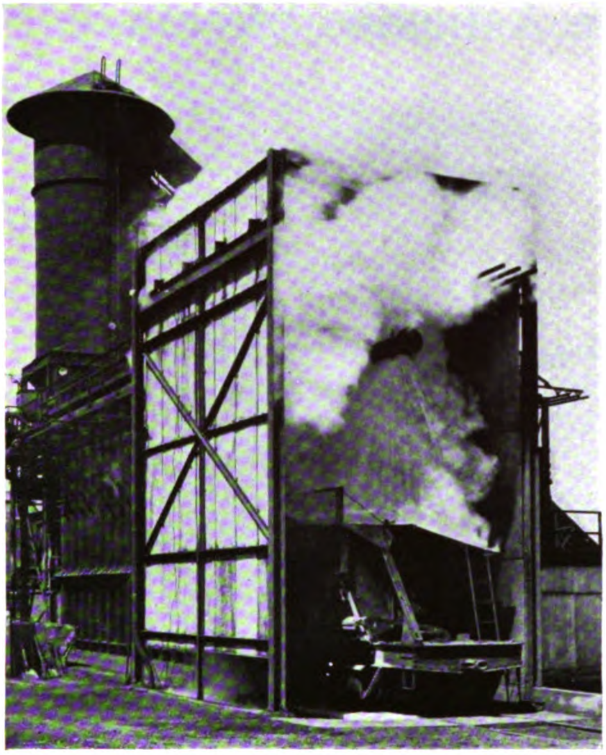

Transite used on a coke-quencher station

combustible products are manufactured. In the event of a fire in one of a closely related group of buildings, Transite prevents the destruction of the entire plant by limiting the fire to the one building or to a section of that building. This same property has led to its wide-spread use as a roofing over stills in oil refineries where it has proved effective in preventing spread of fires from one unit to another.

Corrosion-Resisting:

In that broad group of industries which involve the use of chemical processes, Corrugated Transite roofing and siding assures outstanding satisfaction since it is proof against corrosion by practically all the acids and gases common to industry. The fumes and vapors around gas plants and coke ovens, smelters and other metallurgical equipment do not affect Transite. In many chemical plants where roofing and siding previously had to be replaced frequently, Transite has been in use for many years with no necessity for maintenance or replacement. Salt air, which is so harmful to many roofing materials, has no effect on it.

In certain chemical industries, where unusually corrosive conditions are encountered, W. R. Transite is recommended. This material is thoroughly surface-impregnated with bitumen on sides and edges.

Not Affected by Sudden Temperature Changes:

Alternate conditions of high and low temperatures, common to many industrial operations, do not harm Corrugated Transite. The coke-quencher offers an outstanding example of this "shock-proof" quality. A car loaded with glowing coke, radiating heat at a temperature of about 1700 deg. F. against the Transite, is run into the quencher, and the cold water is turned on. Some of this water strikes the Transite, the rest hits the glowing coke and is promptly converted into steam. This steam strikes the water-cooled siding, and escapes to the atmosphere. This process is repeated in frequent cycles during the working day. Transite is the only corrugated material which has satisfactorily withstood the rigors of this unusual service.

Not Affected by Steam:

Dry or saturated steam does not destroy Corrugated Transite. It may be used over open vats, in boiler rooms and wherever steam, irrespective of its temperature or condition, is likely to come into contact with the roofing and siding. The close texture of Transite does not permit the steam to penetrate the material.

Transite on water-side coal handling equipment, United Electric Light & Power Co., New York City

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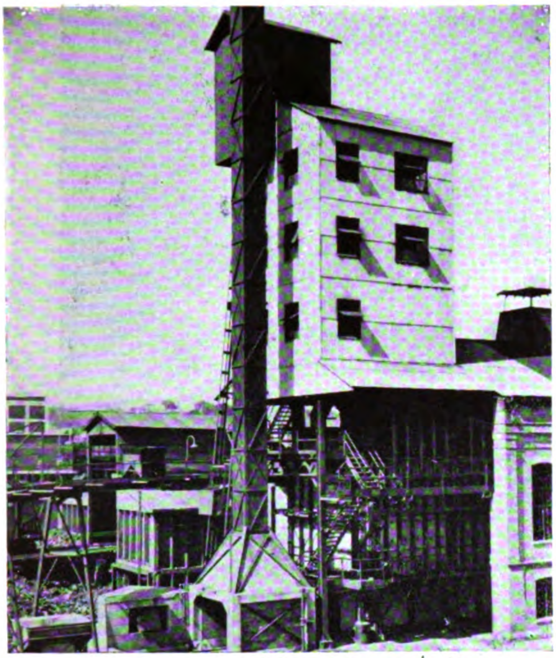


Corrugated Transite on U. G. I. Intermittent Ovens, Dubuque, Iowa

Weather-proof:

Hot sunshine, drenching rains and heavy frosts do not deteriorate Corrugated Transite. Rain and salt air do not corrode Transite even in neighborhoods where the atmosphere is heavily charged with chemical vapors and fine particles of mineral and chemical matter which are dissolved in the rain to form acids.

High Strength:

The combining of asbestos fibre and portland cement under high pressure results in a surprisingly strong sheet, the asbestos fibres acting as reinforcement of the cement. Because of its unusual strength, Corrugated Transite can be laid on roof purlins spaced 60″ center to center, and on siding girts spaced 72″ center to center. While Transite possesses ample strength for the purpose intended, it should not be subjected to overloading or undue shocks. Workmen should use "chicken ladders" on all roofing work.

Attractive Appearance:

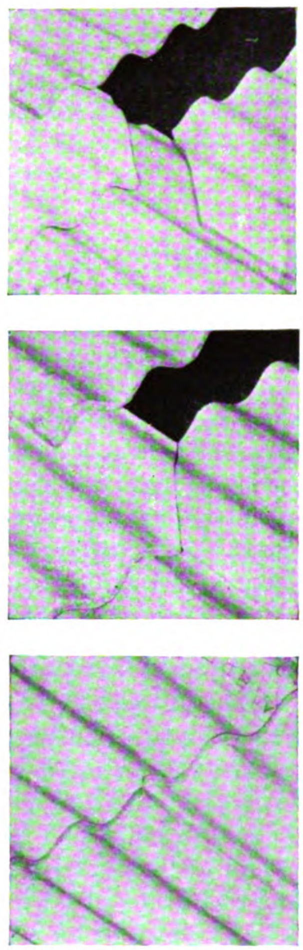
Transite is a pleasing light gray in color and uniform in texture, and results in an attractive structure. Its light-reflecting properties are often of advantage not only in interiors but also on exteriors in reflecting the heat of the sun. Transite can be painted if desired for architectural effects.

Easily Applied:

No special tools are required for the application of Transite. It can be installed as rapidly, and in the same general way, as any other corrugated material. It can be drilled with twist drills, punched, fastened with nails and screws and sawed with a hand saw, though a portable power saw should be used if much sawing is to be done.

Perfect Nesting of Corrugations:

An important feature of Corrugated Transite is the cut-corner construction of the sheets, later described, which permits sheets to be laid with side laps forming vertical lines. Furthermore, the inside and outside radii of the corrugations are the same, insuring perfect nesting at laps and a water-tight and wind-tight construction. If desired, the sheets can also be furnished with all corners square for staggered joint construction.



Illustrating cut-corner construction

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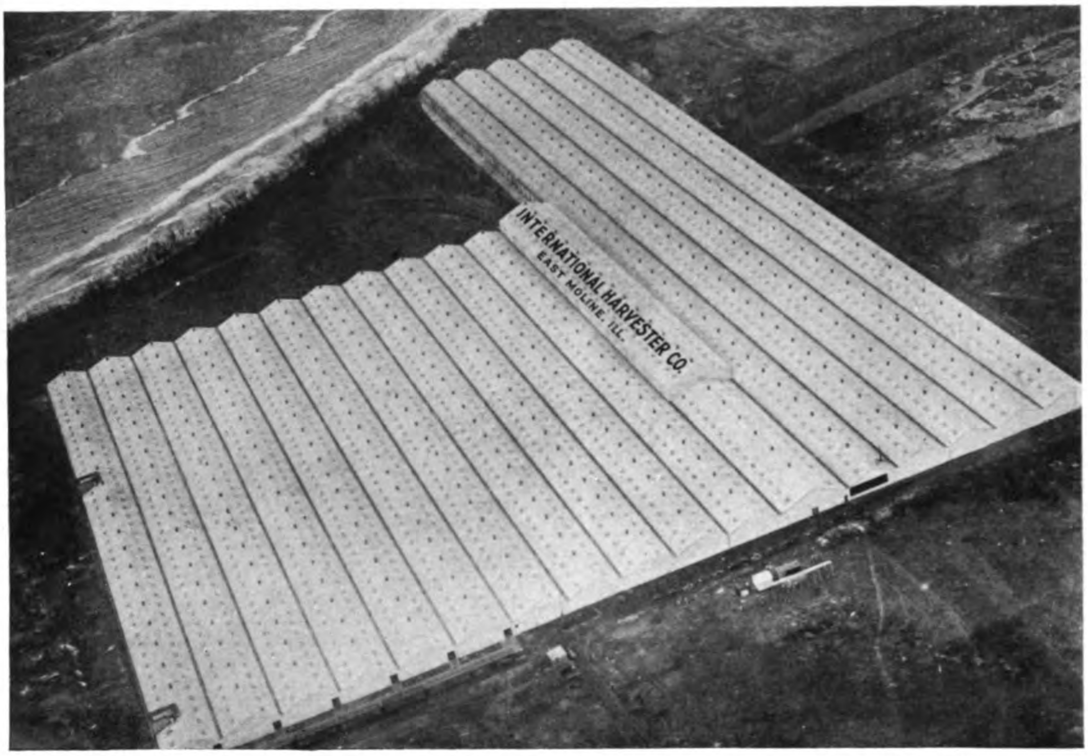

A million and a half square feet of Corrugated Transite on the roof and sides of the International Harvester Co. plant at East Moline, Ill.

Durable and Economical:

Transite will not rot, rust or corrode, nor will it warp, buckle or crack in service. It actually becomes tougher and stronger with age. Because it stands up for years under conditions that destroy other forms of roofing and siding, because it requires no painting or other maintenance, and because it reduces fire risks to a minimum, Corrugated Transite is decidedly economical. Users who keep accurate records of their corrugated roofing and siding costs over a period of years know that J-M Corrugated Transite assures the longest life and the lowest per-annum cost.

Where Corrugated Transite Is Used

The applications of Corrugated Transite for roofing and siding are practically unlimited. Throughout the country, hundreds of industrial plants, lumber mills, woodworking plants, machine shops and similar structures are built of this material. It is the leading fireproof material of corrugated type in use today for general industrial construction. Its peculiar characteristics have also led to many interesting applications in industry, aside from general building purposes.

Oil Refineries:

In oil refineries it is used for fireproof aprons and roofs over stills, for housings of various types, and for "flare-back" walls around tanks to prevent spread of burning oil to adjacent tanks in case of fire.

Railroads:

For railroads, it is an excellent material for switch towers, freight houses, way stations, and relay, battery and tool sheds. It has also been used very successfully for covering pedestrian overpasses and smoke baffles and is particularly suited for roofing and siding on round houses and car shops. Transite Smoke Jacks, Smoke Ducts and Ventilators, later described, are also widely used in round houses, because of their fireproofness and immunity to attack by fumes.

Chemical and Metallurgical Industries:

The chemical and metallurgical industries find in Transite the solution to some of their most aggravating building problems, since it is not harmed by most commercial acids. Where especially corrosive or humid conditions are encountered, W. R. Transite,

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which is impregnated with an acid-resisting compound, should be used.

In gas and coke plants, electro-chemical industries, smelters, refineries, etc., Transite is an ideal protective material because of its resistance to heat, steam and acid.

Mines and Quarries:

In the mining and quarrying industries, Corrugated Transite is used as the roofing and siding material for hoist houses, loader and crusher sheds, store houses and similar structures.

Coal Conveyor Housings:

In many public utility and industrial plants where large quantities of coal are handled, Transite is used with great success for the coal conveyor housings.

Warehouses and Docks:

Warehouses and docks are continually subjected to fire risks due not only to the type of materials stored, but also to the presence of locomotives and ships. Many thousands of square feet of Transite are in use on such buildings.

Garages and Hangars:

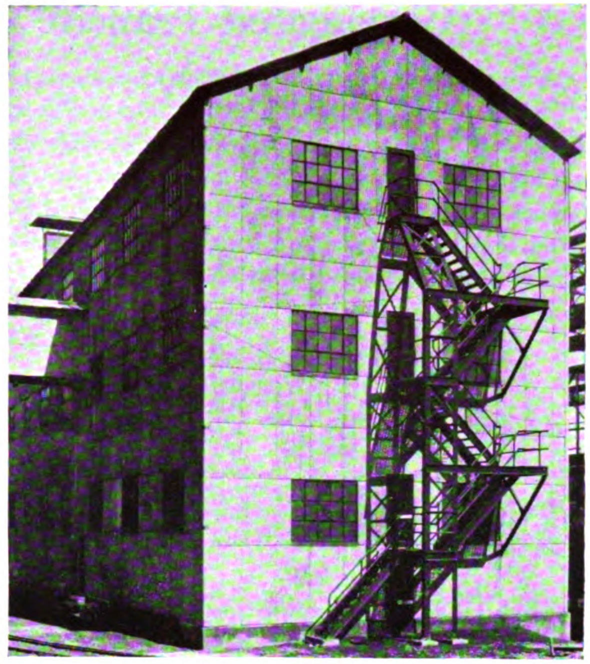
The automobile and bus garage and the airplane hangar all call for a fireproof, light-reflecting material which is easily erected, adapted to standard steel building frames, and one which, when completed, will be neat and businesslike in appearance. Where the traveling public uses the structure, as with bus and plane transport companies, the pleasing appearance and low cost of Transite waiting-rooms, terminals and hangars make it highly desirable for terminals, way-stations and stop-over points.

Fair and Exposition Buildings:

Fair and exposition buildings are used only intermittently, and represent a large investment, both in first cost and for reconditioning before using. Because Corrugated Transite is easily erected with a minimum expenditure for labor; because it requires no painting for its preservation or to enhance its appearance, and because it will outlive any other material used on open-frame construction, a Transite roofed and sided exposition building is an asset to any fair and exhibition association.

Employee Housing:

Companies operating in locations which require the maintenance of employee housing facilities use Transite very effectively to produce economical, fireproof houses of attractive appearance.



Corrugated Transite for roofing and siding. Milwaukee Coke and Gas Co., Milwaukee, Wis.

Corrugated and Flat Transite Combinations

Corrugated Transite is often used in combination with Flat Transite, especially for the smaller types of buildings, such as employees' houses, sheds, tool houses and similar structures. In such cases, corrugated is used for roofing and flat material for siding. Battens, also made of Transite, are placed over the butt joints on the siding, providing an effective seal against wind and rain. Corrugated and Flat Transite are also used in combination for the building of cell structures in the electrical industry.

Decorative Uses: In addition to its purely structural qualities, Transite is highly adaptable to decorative uses. In apartments and stores, and as a material for temporary displays and exhibits, it has unlimited possibilities. Combinations of the flat and corrugated sheets, with here and there a well-placed corner roll, permit architect and decorator to work out some unique modern designs. The natural color and finish of Transite further enhance its decorative value, particularly where concealed lighting is used.

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Corrugated Transite Dimensions and Weights

Corrugated Transite sheets have corrugations with a 4.2″ pitch and a depth of 1½″. The thickness is approximately 7/16″ at ridge and valley of corrugations and approximately 5/16″ on tangent, an average thickness of ⅜″. Sheets are furnished 42″, or ten corrugations, wide. Standard lengths and square foot areas of sheets are listed below:

Length	Sq. Ft. Area	Length	Sq. Ft. Area
3′0″	10.5	6′6″	22.75
3′6″	12.25	7′0″	24.5
3′9″	13.125	7′6″	26.25
4′0″	14.0	8′0″	28.0
4′3″	14.875	8′6″	29.75
4′6″	15.750	9′0″	31.50
4′9″	16.625	9′6″	33.25
5′0″	17.5	10′0″	35.0
5′3″	18.375	10′6″	36.75
5′6″	19.25	11′0″	38.50
6′0″	21.0		

Weights: Uncrated, approximately 4.1 lb. per sq. ft. Crated, approximately 4.5 lb. per sq. ft.

Sized Sheets: The dimensions listed above are approximate. Sheets cut to accurate size can be furnished, if required, at a slight extra charge for sizing. Unless otherwise specified, standard sheets will be shipped.

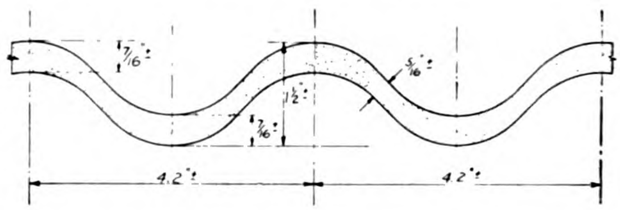
Cut Sheets: Sheets can be furnished any desired width or length that can be cut from standard sizes. Such special size sheets will be charged for on the basis of the next larger standard size. For example a sheet 37.8″ (nine corrugations) wide and 6′ 3″ long would be billed on the basis of a 42″ x 6′ 6″ sheet.

Curved Sheets: Curved sheets are manufactured to order. The minimum radius when curved lengthwise, with the arc parallel to the length of sheets, is 60″. When curved crosswise, with the arc parallel to the width of sheets, the minimum radius is 24″. Sheets may be curved either way, but not in combination.

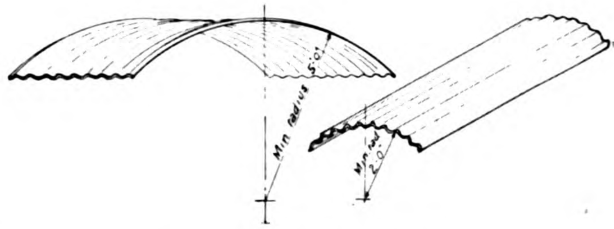
Cut-Corner Construction:

Corrugated Transite sheets are furnished in three types: Type X with all corners square; Type Y with one corner cut; and Type Z with two diagonal corners cut. These three types are shown in an accompanying illustration. The cut corners enable Transite to be laid with straight horizontal and vertical lap lines which further improve the appearance of the job.

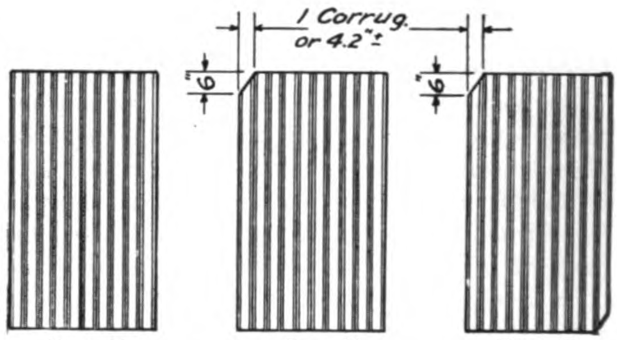
If desired, the sheets can also be furnished with all corners square for staggered joint construction.



Corrugated Transite sheet dimensions



Curved Corrugated sheets



Types of cut-corner sheets

Accessories:

Transite is furnished pre-shaped as ridge and corner rolls and louvre blades. It is also furnished in flat sheets, as described elsewhere. Special Transite ventilators are also described in other data sheets.

J-M Black Asbestos Roof Putty is used for cementing laps. This material is described in the "Roofing and Shingles" Section.

Corrosion-resisting bolts, drivescrews, washers and clips of various types have been designed especially for use with Corrugated Transite.

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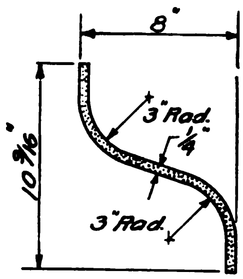
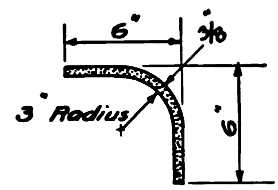
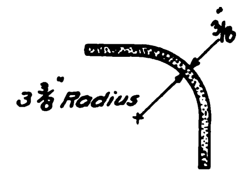


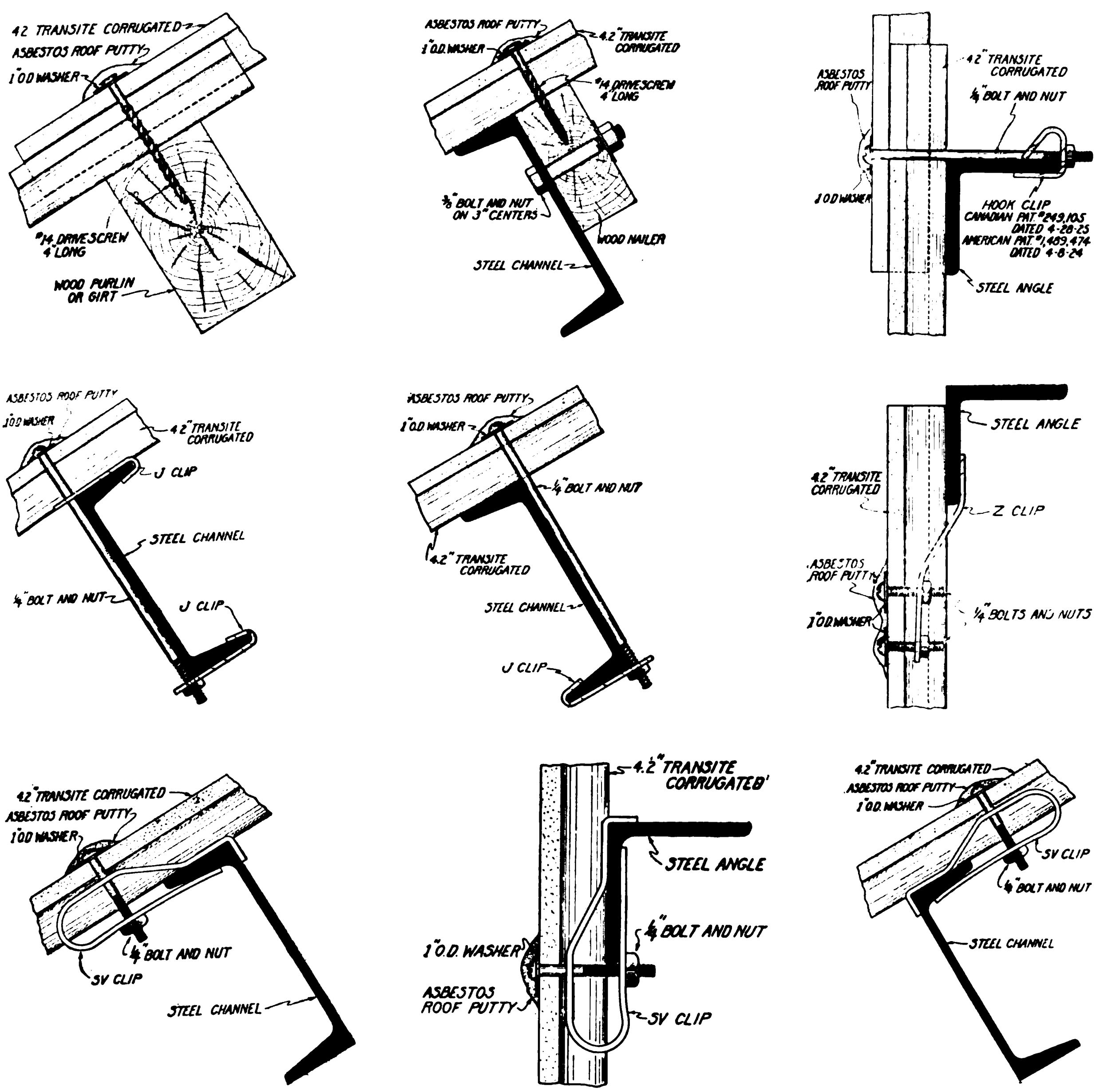
Louvre Blade. Type T
8'-0" long



Ridge Roll & Corner Roll
Type W 8'-0" long



Batten for Ridge &
Corner-Roll Joints.
Type U 6" long



Methods of fastening Corrugated Transite sheets

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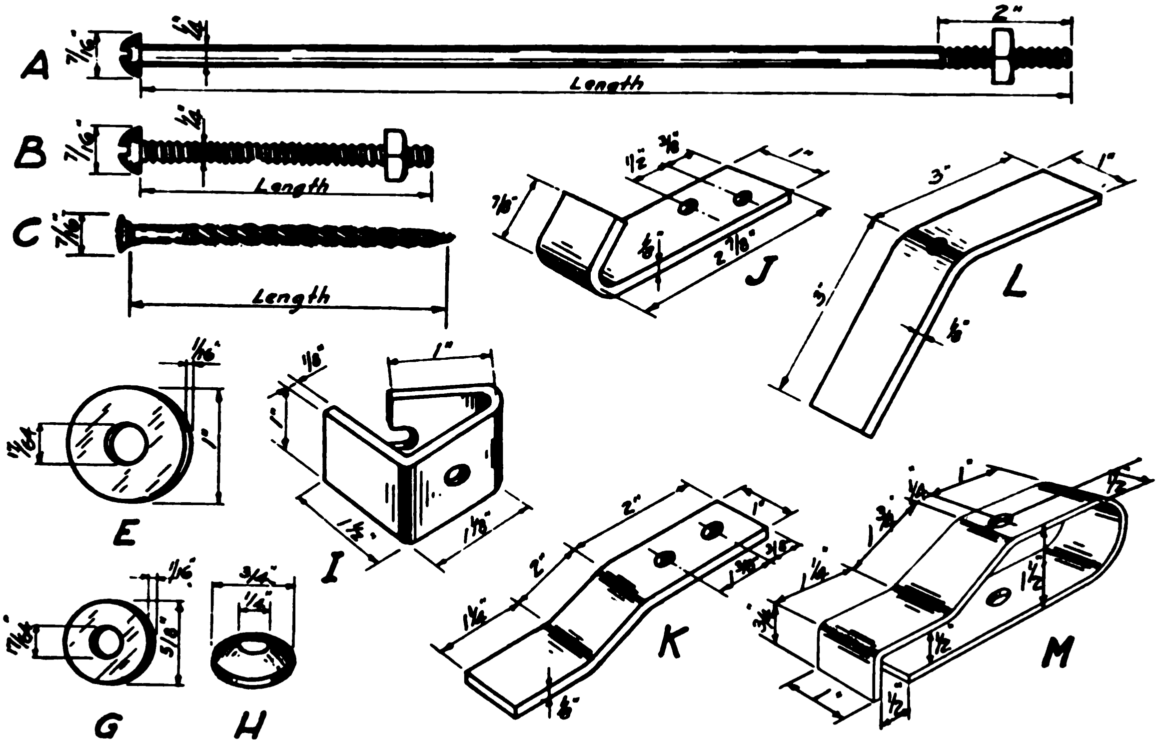


	FASTENER	SIZE	FINISH	WEIGHT		FASTENER	SIZE	FINISH	WEIGHT
B	SHORT BOLTS	1/4"X1 1/4"	CADMIUM PLATED	54 PER#	A	LONG BOLTS	1/4"X11 1/2"	CADMIUM PLATED	8 PER#
"	"	1 1/2"	"	48 "	"	"	12"	"	7 1/2 "
"	"	1 3/4"	"	44 "	"	"	12 1/2"	"	7 "
"	"	2	"	39 "					
"	"	2 1/2"	"	33 "					
A	LONG BOLTS	3	"	28 "					
"	"	3 1/2"	"	24 1/2 "	E	WASHERS	1" O.D.X 9/32"	"	74
"	"	4"	"	21 1/2 "	G	"	5/8" O.D.X 7/32"	"	225
"	"	4 1/2"	"	20 "	H	"	3/4" O.D.X 1/4"	LEAD (CUPPED)	77
"	"	5"	"	18 "					
"	"	5 1/2"	"	16 "	J	J CLIP 2 HOLE		CADMIUM PLATED	7 1/2
"	"	6"	"	15 "	J	J CLIP 3 HOLE		"	6
"	"	6 1/2"	"	14 "	I	HOOK CLIP		"	7
"	"	7"	"	13 "	K	Z CLIP		"	5 1/2
"	"	7 1/2"	"	12 "	L	TOGGLES		"	4 3/4
"	"	8"	"	11 "	C	DRIVESCREWS	#14-4"	"	28
"	"	8 1/2"	"	10 1/4 "	C	"	#14-3"	"	33
"	"	9"	"	10 "	M	SV CLIPS		"	3
"	"	9 1/2"	"	9 1/2 "					
"	"	10"	"	9 "					
"	"	10 1/2"	"	8 1/2 "					
"	"	11"	"	8 1/4 "					

Corrugated Transite Fasteners

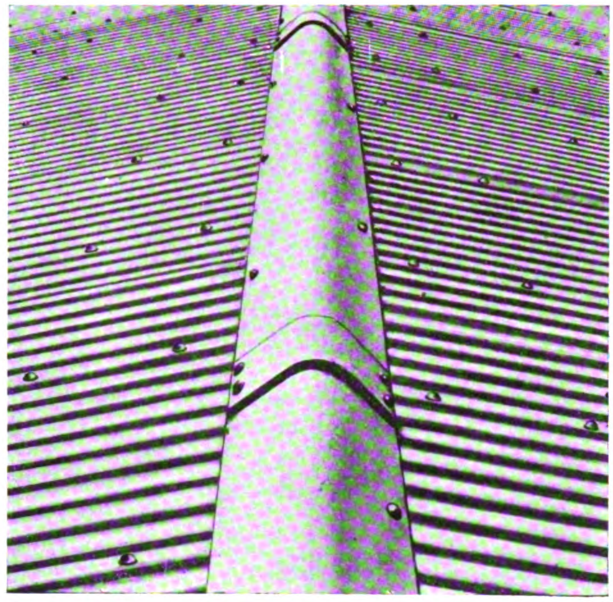
Erection of Corrugated Transite

Skilled labor is not needed for the proper erection of Corrugated Transite as it is speedily placed by the average workman.

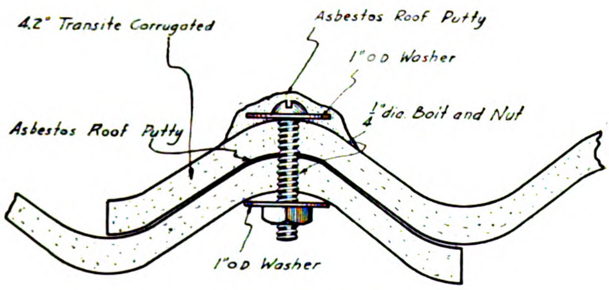
As with any other corrugated material, Transite should not be laid on roofs having a pitch of less than 2″ per foot. J-M Black Asbestos Roof Putty should be used in all laps.

Corrugated Transite is laid with a side lap of one corrugation, 4.2″, to give a weather exposure of approximately 37.8″. End laps are always specified as 6″. All end laps should occur over purlins or girts. Purlins should not be spaced on greater than 60″ centers, and side-girts should not be spaced on greater than 72″ centers.

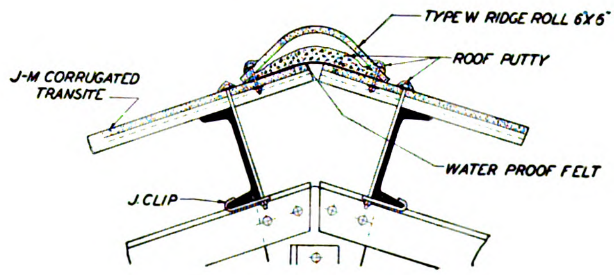
Complete directions for the erection of Corrugated Transite are available in special data sheets.



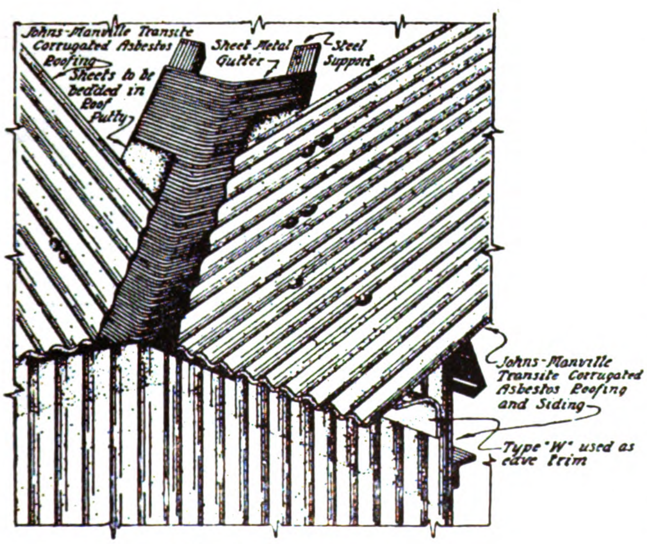
Transite Ridge Roll



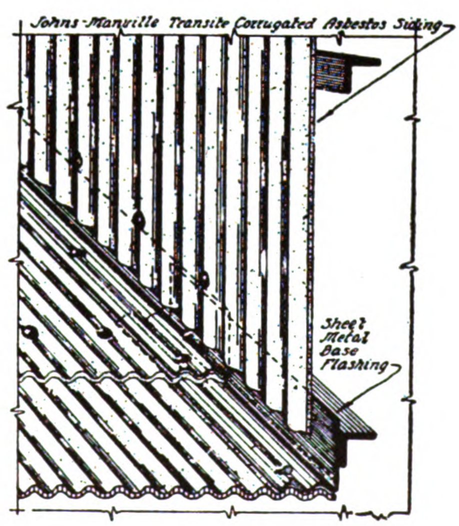
Side lap construction



Ridge Roll construction



Valley flashing



Side wall flashing

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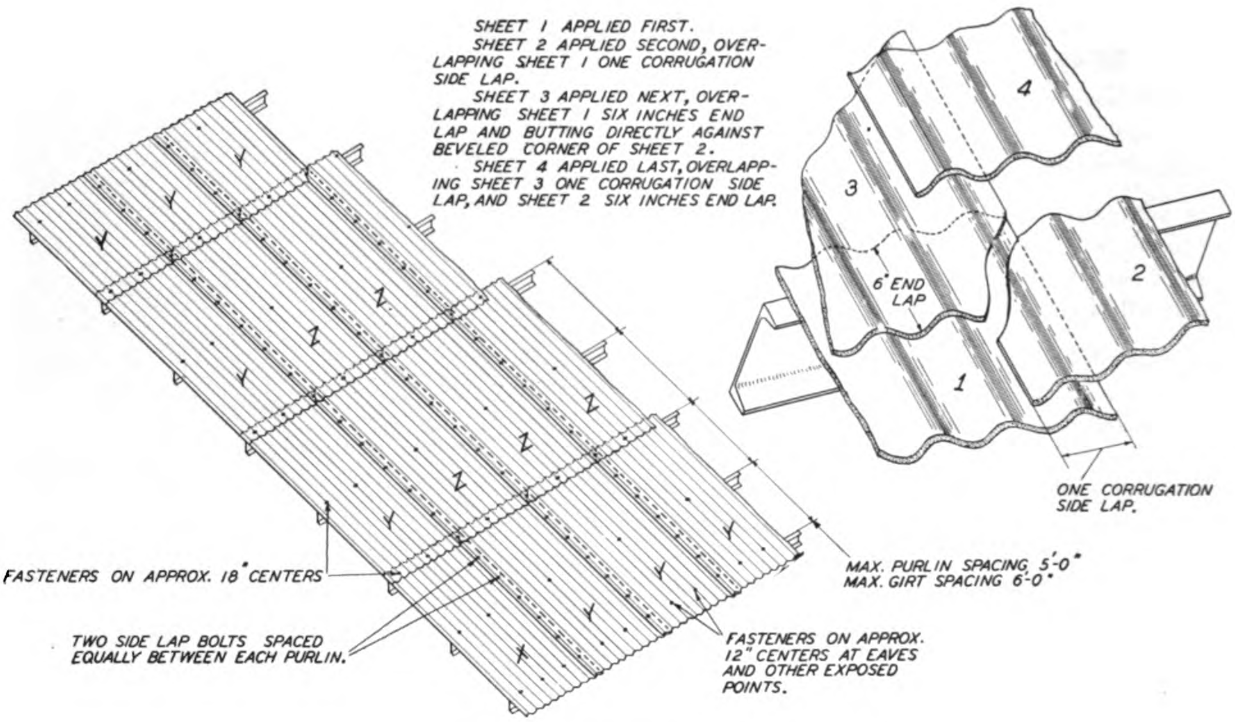
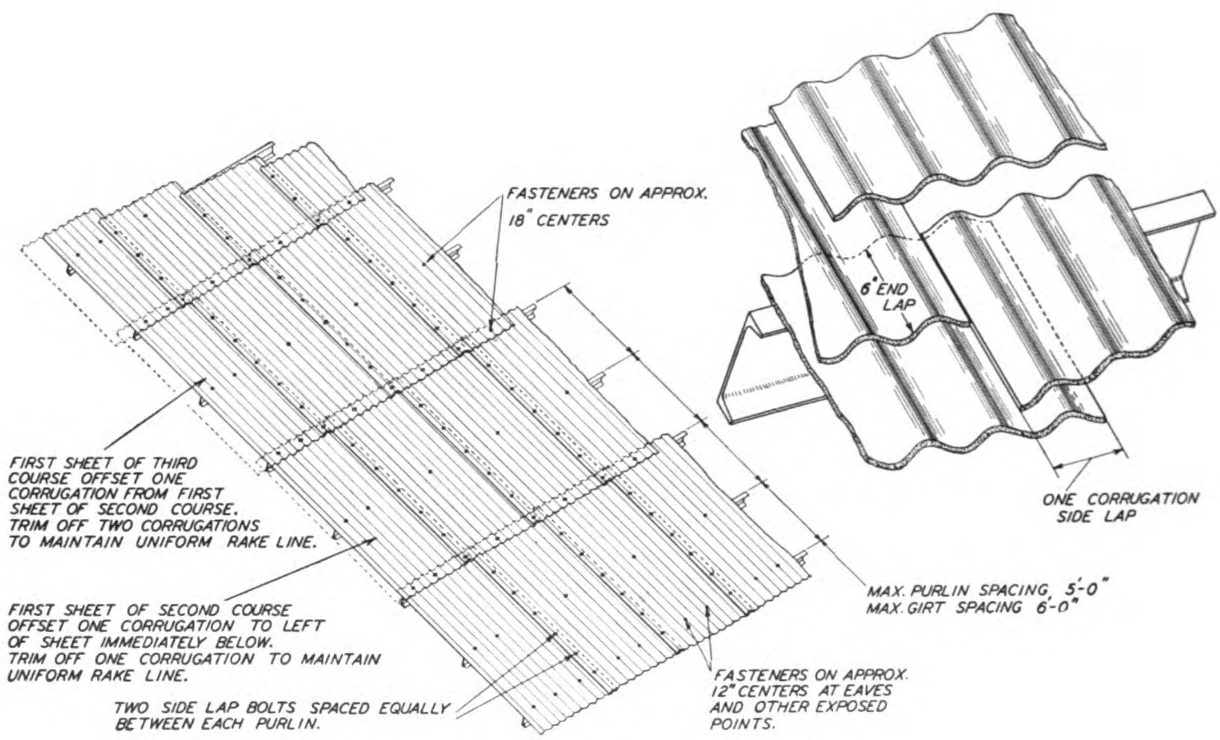


Straight lap line construction with cut-corner sheets



Staggered joint construction with square corner sheets

January, 1931 (Cancelling 4-B-2-A-18 and 4-B-5-B-2-D, dated in 1929)

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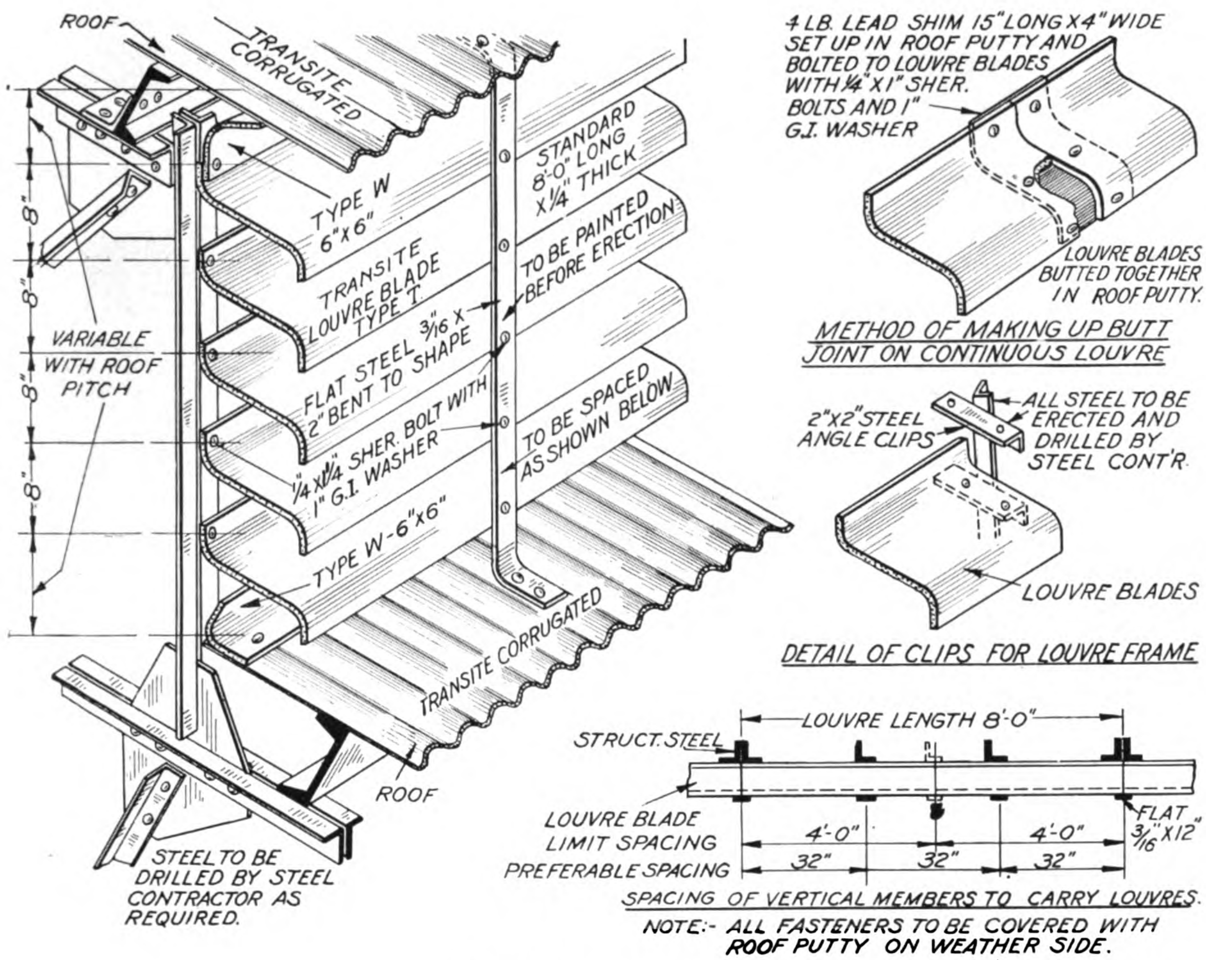
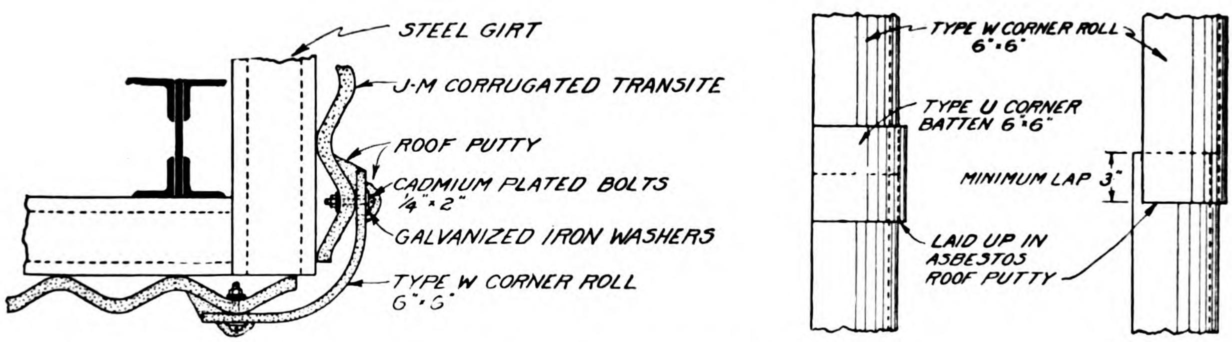


Transite Louvre construction



Transite Corner Roll construction details

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W. R. Corrugated Transite

W. R. Transite on the Standard Wholesale Phosphate and Acid Works, Baltimore, Md.

Corrugated Transite sheets can be furnished with a special bituminous impregnation to afford maximum impermeability where the material will be subjected to extreme and sustained moisture or acid conditions. It is used, for example, in the construction of lumber dry kilns and also is an important unit in the J-M Insulated Rot-proof Roof described in the "Roofing and Shingles" Section.

W. R. Corrugated Transite is furnished in the same sizes as standard Corrugated Transite. Sized, cut or curved sheets can be supplied as described for the standard material. Ridge rolls, corner rolls and louvre blades are also available in the same design as standard Transite.

The weight of W. R. Corrugated Transite is approximately 4.2 lb. per sq. ft. uncrated; or about 4.5 lb. per sq. ft. crated.

In the erection of W. R. Transite particular care should be exercised in the selection of fasteners that will withstand the conditions to be encountered. Double-thick clips with bolts not less than 3/8" diameter, made of black iron, are recommended. All clips, bolts, washers and nuts should first be cleaned and heated and then dipped in asphalt while hot. Any abraided portions of fasteners should be touched up with asphalt or bituminous paint after erection. When sheets are cut in the field all unimpregnated edges should also be coated.

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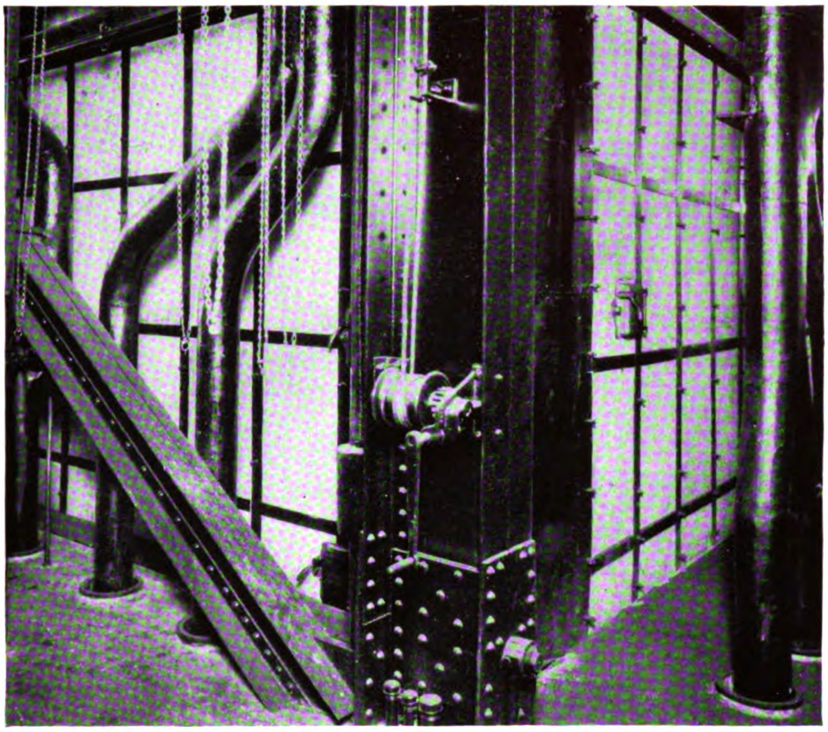
Flat Transite Asbestos Sheets



Transite casing over insulation on boiler water-wall

Transite is generally recognized as the outstanding fireproof, corrosion-resisting building sheet on the market today. It is composed of asbestos fibre and portland cement, united under tremendous pressure into sheets of remarkable strength, rigidity and durability.

Transite is light gray in color, and has a specific gravity of about 2.0, weighing approximately 124 lb. per cu. ft. It can be drilled with twist drills, punched, fastened with nails and screws and sawed with a hand saw (set 5 points to the inch). A portable power saw should be used, however, if much sawing is to be done. Transite may, if desired, be painted, varnished or grained in imitation of marble or hard woods.

Transite does not become warped, distorted or weakened in service; in fact, it actually strengthens and toughens with age. It offers high resistance to acid fumes and severe weather conditions. It has withstood severe fire tests and is widely used where fireproof qualities are of the utmost importance. Painting, finishing or protection against deterioration is never required.

Flat Transite is exactly the same material as Corrugated Transite, except for form. The characteristics of Transite are gone into in greater detail in connection with the description of the corrugated material on other data sheets. Both Flat and Corrugated Transite can be depended upon for permanent, maintenance-free construction.

Finishes:

Standard Transite is sufficiently smooth for practically all purposes, and thickness is controlled within plus/minus 1/32″ of nominal thickness. Material can be furnished, however, sanded on one side (S-1-S) or on two sides (S-2-S) to provide special smoothness and thickness control within plus/minus 1/64″. Unless otherwise specified, standard material is always furnished.

Where Flat Transite Is Used

Because of its strength, fireproofness, resistance to corrosion, weatherproof qualities, comparatively light weight, attractive appearance and durability, the

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Flat Transite half-timber effects on residence in Detroit, Mich.

applications of Transite are practically unlimited. It finds a wide use in thousands of industrial plants as well as in hospitals, libraries, office buildings, railway stations, machine shops, garages and residences.

General Industrial Uses:

In all types of industrial plants, Flat Transite is used for walls, ceilings and partitions. Its easy workability and the speed with which it can be erected are important advantages. Transite is also used in industrial plants for housings of various types and for ducts, bins, table and bench tops and other uses.

Furnace Casings:

It is an ideal material for casings over insulation on furnaces, boilers, tanks and other heated equipment. The 3/8" thick material is recommended, particularly on the larger types of equipment and where removable panel construction is required. Its relatively light weight and low thermal conductivity, compared with the steel casings otherwise used, and its corrosion-resistance, attractiveness and light-reflecting features combine to make Transite a highly satisfactory material for this purpose.

Residential Construction:

Transite is equally well adapted to interior and exterior use. Fireproof walls, ceilings, window trim, partitions and baseboards and other trim can be readily made of this material.

It lends itself particularly well to half-timber effects and has been used successfully for this purpose for many years. Such construction is stronger than cement stucco applied over wire lath and will not crack, scale or erode. It can be readily applied directly over wood or steel studding by the same carpenters used for the balance of the work. Either Standard finish or the Special Rough Cast Transite can be used for this purpose. Vertical and horizontal joints are covered with battens of the same material, of the width and thickness desired. Battens can be painted as required for architectural effects.

Flat Transite is also used in combination with Corrugated Transite for the complete construction of houses on skeleton framing. This type of building is easily erected, fireproof, durable, attractive and economical. It is especially adapted to employee housing construction.

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Flat Transite Sizes, Weights and Types

Flat Transite is furnished in the following sizes:

36″ x 48″, 1/8″ to 4″ thick
42″ x 48″, 1/8″ to 4″ thick
42″ x 96″, 3/16″ to 2″ thick

Thickness, Weights and List Prices (Uncut Sheets)

Approximate shipping weights in lb. per sq. ft.

Thickness Inches	Uncrated Standard	Uncrated Sanded	Crated Standard	Crated Sanded	List Prices per Sq. Ft.
1/8	1.7	1.4	1.8	1.5	$0.15
3/16	2.1	2.0	2.3	2.1	.225
1/4	2.8	2.6	3.0	2.8	.30
5/16	3.4	3.3	3.7	3.5	.38
3/8	4.0	3.9	4.4	4.2	.45
1/2	5.3	4.7	5.8	5.0	.60
5/8	6.9	6.7	7.5	7.2	.75
3/4	7.6	7.5	8.4	8.2	.90
7/8	8.9	8.7	9.7	9.4	1.05
1	10.1	9.9	11.0	10.7	1.20
1¼	13.0	12.8	14.0	13.8	1.50
1½	15.7	14.0	17.6	15.2	1.80
1¾	18.5	16.8	20.6	18.3	2.10
2	21.0	19.6	23.1	21.2	2.40
2½	26	25	28	27	3.00
3	31	30	34	33	3.60
3½	36	36	39	38	4.20
4	42	40	45	43	4.80

Uncut sheets run somewhat full in length and width. Material cut to special size is furnished, plus/minus 1/32″ of specified length and width. Material cut to a closer tolerance furnished only on special order.

Where thickness is not greater than ¼″, and a large number of duplicate shapes are involved, Transite pieces may be stamped out of sheet stock, thus eliminating more expensive machine work.

Transite is also furnished in corrugated sheets approximately ⅜″ thick, 42″ wide and in lengths of from 3 ft. to 11 ft. Corrugated Transite is fully described in other data sheets.

Flat Transite sheets may be formed or moulded into many designs to suit requirements. They may be curved in any one direction, with a minimum radius of 5″. Special sections of ridge and trim can also be furnished. Transite is also moulded into ducts, ventilators, etc., as described in other data sheets.

Rough Cast Transite

For securing exterior stucco effects in residential construction, a special "Rough Cast Transite" is furnished. This material has a texture similar to that of rough cement stucco and is used very effectively in obtaining attractive architectural effects. Rough Cast Transite is furnished in one standard size only, i.e., 42″ x 96″, and ⅜″ thick.

Standard Oil Co. filling station, Cleveland, O., sided with Rough Cast Transite

W. R. Flat Transite

Flat Transite sheets can be furnished with a special bituminous impregnation to afford maximum impermeability where the material will be subjected to extreme and sustained moisture or acid conditions.

W. R. Flat Transite is furnished in standard size sheets, 42″ x 48″, 1/8″, 3/16″ and 1/4″ thick; 42″ x 96″, 1/4″ thick; 48″ x 48″, 1/8″ and 3/16″ thick; and 36″ x 48″, 1/8″ and 3/16″ thick. The weight of W. R. Flat Transite, ¼″ thick, is approximately 3 lb. per sq. ft. uncrated; or about 3.3 lb. per sq. ft. crated.

Black Transite

Black Transite is similar to standard Transite except for color. Used as a base for blackboards. No. 1 Finish is standard and No. 2 Finish is polished. Made in standard flat sheets 42″ x 96″ and in thicknesses of 3/16″ and ¼″.

White Transite

A special White Transite can be furnished on order in standard size flat sheets with either standard or sanded finish. It is especially adapted to use for exteriors of bake ovens and for similar applications where a white finish is desired.

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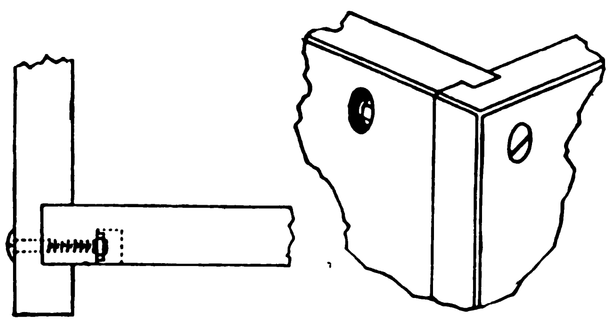


A good type of tongue-and-groove construction possible with ½" or greater thickness of Transite

Maximum Allowable Spans of Flat Transite

Thickness Inches	Ceiling Inches	Wall Inches
1/4	24	36
5/16	32	39
3/8	36	42
7/16	39	45
1/2	42	48
5/8	45	54
3/4	49	60
1	54	72

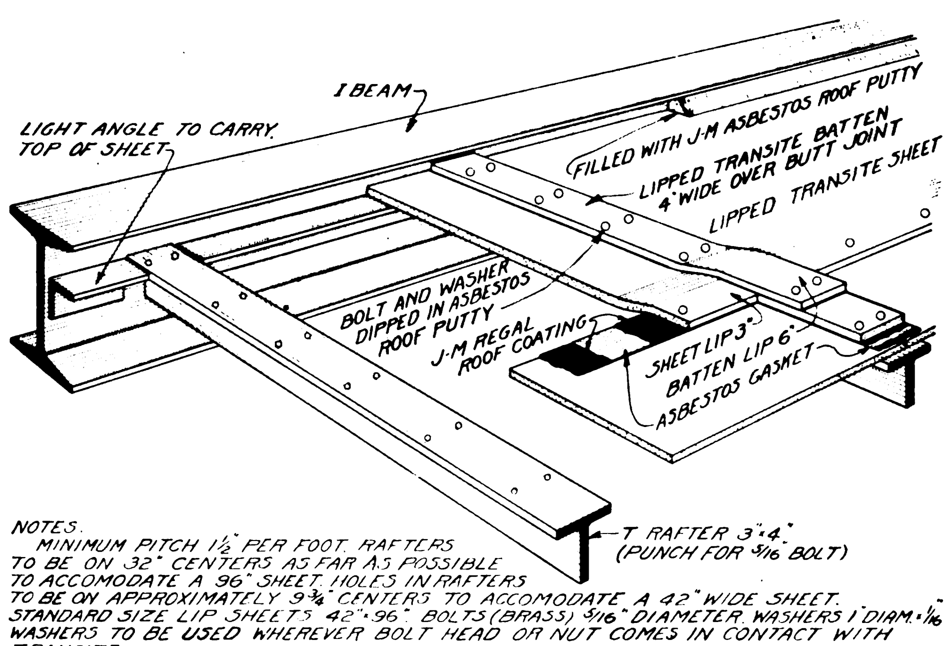
Flat Transite Asbestos Roofing

(Special Lip Construction)

Flat Transite can be furnished in "Special Lip Construction" for use where a roof of flat, instead of corrugated, material is desired. This product is formed with a 3" wide lip along one side or end, the lip being offset the thickness of the sheet so as to overlap snugly the adjoining sheet. The material is furnished 42" x 96" and either 5/16" or 7/16" thick.

Lipped Flat Transite may be applied over either wood or steel rafters. The maximum allowable span for 5/16" thick material is 32", and for 7/16" material, 36". For fastening over wood, either brass or galvanized screws and washers should be used. Over steel construction, brass, galvanized or other non-corroding bolts and washers are used. Sheets should be fastened along laps on approximately 9" centers, and to all rafters on approximately 10" centers.

The ends of the sheets should be butted, over which a lipped Transite batten at least 4" wide should be used. J-M Black Asbestos Roof Putty and Asbestos Gaskets should be used in all laps and under battens. All bolt and screw heads should also be covered with J-M Asbestos Roof Putty.



Lipped Flat Transite construction details

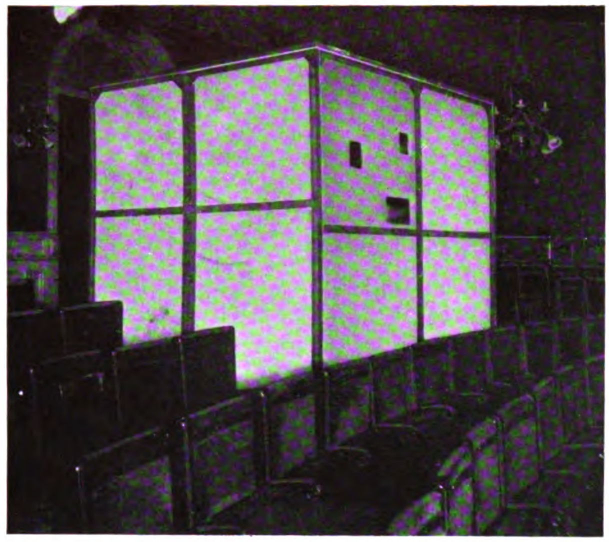
Transite Panel Type Motion Picture Projection Booth

Because of the high inflammability of motion picture film, laws have been enacted in practically all States requiring that the projecting machine be housed in a fireproof booth or enclosure. Transite Booths conform to the requirements in most of these States as well as to the regulations of insurance companies covering fireproof booths. They have many advantages over sheet metal booths, including lower sound transmission, greater fire resistance, higher electrical resistance and more attractive appearance. Transite is a pleasing light gray in color, and can be painted if desired to match interior trim.

Transite consists of asbestos fibre and portland cement united under great pressure into strong, rigid, unlaminated sheets. It possesses much greater fire-resistance than any other material suitable for booth construction. Water has no effect on it, even though the Transite were hot. It will not warp or shrink.

Transite Booths prevent, to a great extent, transmission of operation noise, thus eliminating this detraction from the quality of the program. In case of fire all openings are automatically closed, confining the flames within the booth.

These booths are built of Flat Transite sheets, ¼″ thick on sides and top and ⅜″ thick on floor, assembled on a steel frame. Panels are plainly marked so that they can be easily put together by any carpenter without the necessity of fitting, filing or drilling. The Transite is bolted on the inside of the skeleton frame, thus insulating the frame from electrical currents and making the booth fireproof. Joints are pointed up with J-M No. 20 Plastic Refractory Cement, providing smoke-tight construction.



Transite Panel Booth in school auditorium

A complete ventilating system, with galvanized iron pipe flues and an exhaust fan, can be furnished.

The Transite booth can be easily enlarged by the addition of standard panels.

Sizes, List Prices and Weights

Approximate Outside Dimensions		List Price	Crating,* extra	Approximate Crated Shipping Weight, lb.
No. 1 Massachusetts	6′ x 8′ x 8′–2″ high	$200.00	$13.00	1575
No. 2 Massachusetts	12′ x 8′ x 8′–2″ high	300.00	21.00	2450
No. 1 Massachusetts	3′ sections**	60.00	5.00	450
No. 1 Standard	6′ x 8′ x 7′–2″ high	200.00	12.00	1475
No. 2 Standard	9′ x 8′ x 7′–2″ high	250.00	16.00	1900
No. 3 Standard	12′ x 8′ x 7′–2″ high	300.00	20.00	2350
No. 1 Standard	3′ sections**	60.00	4.50	425
Junior***	4′ x 6′ x 7′–2″ high	135.00	8.00	950
Midget	4′ x 4′ x 7′–2″ high	115.00	6.00	800

*Crating for shipment is insisted upon by all express companies. All shipments by freight outside of New England must also be crated. Although it is not compulsory, shipments by freight in New England should be crated to insure against damage in transit. Unless this is done, serious delays in delivery or erecting of booths may result.

**3′ Section comprises the necessary panels, floor and fittings for a 3-ft. wide section for making addition to the above booths.

***In New York, Connecticut and New Jersey, Junior booths may be used in churches and schools "where not more than three exhibits are given per week."

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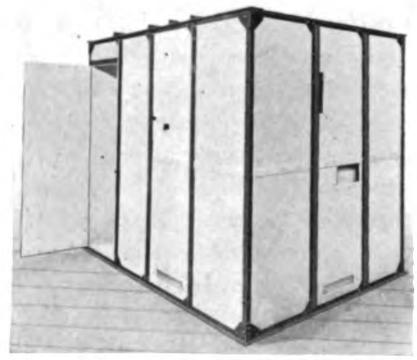
Individual Panels:

Individual panels, mounted on the standard steel frame, can also be furnished as follows:

Sizes and Weights of Individual Panels

Style	Description	Dimensions	List Price
"E"	End Panel	3′- 0″ wide x 7′-0″ long	$15.00
"E"	End Panel	3′- 0″ wide x 8′-0″ long	18.00
"S"	Side Panel	3′-10½″ wide x 7′-0″ long	18.00
"S"	Side Panel	3′-10½″ wide x 8′-0″ long	21.00
"T"	Top Panel	3′- 0″ wide x 8′-0″ long	18.00
"D"	L. H. Door	3′-10½″ wide x 7′-0″ long	40.00
"D"	L. H. Door	3′-10½″ wide x 8′-0″ long	43.00
"D-2"	R. H. Door	3′-10½″ wide x 7′-0″ long	40.00
"D-2"	R. H. Door	3′-10½″ wide x 8′-0″ long	43.00
"D-3"	L. H. Door	3′- 0″ wide x 7′-0″ long	40.00
"D-3"	L. H. Door	3′- 0″ wide x 8′-0″ long	43.00
"D-4"	R. H. Door	3′- 0″ wide x 7′-0″ long	40.00
"D-4"	R. H. Door	3′- 0″ wide x 8′-0″ long	43.00

NOTE: All list prices are for standard booths and panels. Whenever any change in design or dimension is required by State regulations, the above list prices do not apply.



Assembled Transite Panel Booth

State Regulations on Motion Picture Machine Booths:

Arkansas: Framing 1½″ x 1½″ x 3/16″. Intermediate steel 24″ max. centers. No. 20 BW Gauge sheet iron also approved.

Connecticut: Condition same as Massachusetts. Dimensions standard. Will also allow Junior.

Illinois: Intermediate steel 24″ max. centers. No. 20 U.S. Gauge sheet iron also approved.

Indiana: Framing 1½″ x 1½″ x ¼″. Intermediate steel 24″ max. centers. No. 20 U.S. Gauge sheet iron also approved.

Iowa: Standard booth approved.

Kentucky: Standard booth approved except 3/16″ thick sheet iron shutters required.

Maine: All authorities will accept standard booths. Sheet iron booths, as approved by the National Board of Fire Underwriters, also allowed.

Massachusetts: Asbestos Wood Booths required. Sheet iron booths not allowed. Dimensions of booths differ from our standards.

Michigan: Standard booths, except that band iron is required to cover both sides of all horizontal joints.

Nebraska: Framing 1½″ x 1½″ x ¼″. Intermediate steel 24″ max. centers. No. 20 U.S. Gauge sheet iron also approved.

New Hampshire: All authorities will accept standard booths. Sheet iron booths, as approved by the National Board of Fire Underwriters, also allowed.

New Jersey: Law passed March 27, 1912, requires asbestos booth. Standard booth approved, including Junior.

North Carolina: Standard booth approved.

North Dakota: Framing 1½″ x 1½″ x ¼″. Intermediate steel 24″ max. centers. No. 20 U.S. Gauge sheet iron also approved.

Ohio: Framing 1½″ x 1½″ x ¼″ steel angles. Intermediate steel 24″ max. centers.

Oklahoma: Framing 1½″ x 1½″ x 3/16″. Intermediate steel 24″ max. centers.

Pennsylvania: Standard booths approved, except in the city of Philadelphia where ½″ thick Asbestos Wood panels are required.

Rhode Island: Conditions same as Massachusetts. Dimensions, however, are standard.

South Dakota: Standard O.K.

Tennessee: Standard booth approved, also galvanized sheet iron of not less than No. 20 BW Gauge.

Vermont: All authorities will accept standard booths. Sheet iron booths, as approved by the National Board of Fire Underwriters, also allowed.

West Virginia: Framing 1½″ x 1½″ x ¼″. Intermediate steel 24″ max. centers. No. 20 U.S. Gauge sheet iron also approved.

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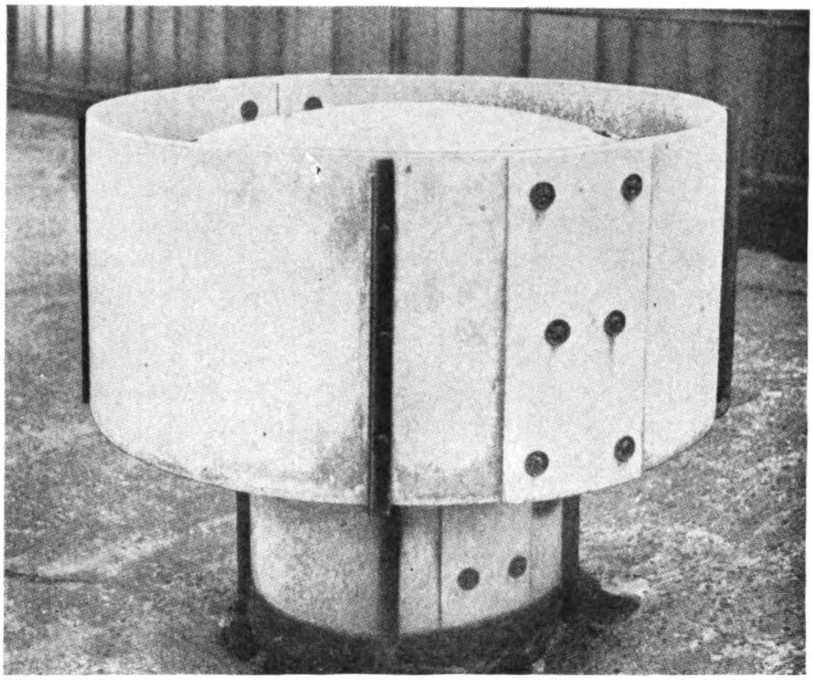
Transite Ventilators



Transite Ventilators are designed for use on all buildings where fireproof, fume-proof and weather-proof construction is desired. They are especially satisfactory for engine houses, gas and power houses, laboratories, factories, etc., where a corrosion-resisting ventilator is essential.

Transite Ventilators are designed to give the best possible air circulation. They never need painting and have proved most economical because of their long life and low maintenance cost.

The standard ventilator is cut square at the base as shown in drawing. When demanded, ventilators can be furnished with a special stock cut to the roof slope. This is not good construction, however. When ventilator is erected in this manner, the stack feet should be securely fastened to suitable steel framing.

All ventilators should be secured to a firm base which may be made of concrete or a steel frame, the inside of which is protected by Transite. Whatever the base, the foot of the ventilator must be securely bolted to it. All bolt and nut heads should be coated with J-M Asbestos Roof Putty. Suitable flashing of lead or copper should be installed where the base of ventilator joins the roof.

Transite ventilator properly installed

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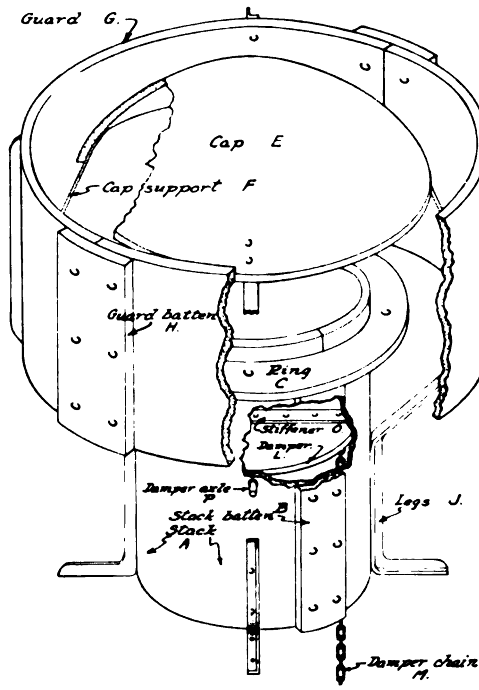

MEASUREMENTS AND DATA

Vent. inches	Weight (includes dampers) lb. Net	Weight Crated	Shipped assembled (A) or knocked down (KD)	Stack Inside dia., ins.	Stack Thickness, ins.	Stack No. of Battens	Ring Thickness, ins.	Ring Clips Number	Ring Clips Size, inches	Cap Thickness, ins.	Cap Brackets Number	Cap Brackets Size inches	Guard Thickness, ins.	Guard No. of Battens	Legs Number	Legs Size, inches	Damper Thickness, ins.	Damper Stiffener, inches	Damper Axle, inches	Damper Stops Number	Damper Stops Size, inches	Damper Axle bearing plates Number	Damper Axle bearing plates Size inches
10	56	95	A	10	¼	1	¼	4	1x1x3/16	¼	4	1x¼	⅜	2	4	1x1x3/16	¼	1x1x3/16	⅝x12	2	1½x1½x1½ x3/16	2	5¼x1½x¼
12	77	160	A	12	¼	1	¼	4	1½x1½x3/16	¼	4	1x¼	⅜	2	4	1x1x3/16	¼	1x1x3/16	⅝x14	2	1½x1½x2 x3/16	2	6½x1½x¼
16	152	350	A	16	5/16	2	5/16	4	2x2x¼	⅜	4	1x⅜	⅜	3	4	1x1x¼	⅜	1x1x3/16	⅝x18	2	1½x1½x1½ x¼	2	6x1½x⅛
18	210	460	A	18	⅜	2	⅜	4	2x2x¼	⅜	4	1x⅜	½	3	4	1¼x1¼x¼	⅜	1x1x3/16	⅝x20	2	1½x1½x1½ x¼	2	6⅝x1½x[illegible]
20	267	535	A	20	⅜	2	⅜	4	2½x2½x¼	⅜	4	1½x⅜	½	3	4	1½x1½x¼	½	1¼x1¼x¼	⅝x22	2	1½x1½x1½ x¼	2	6¾x1½x[illegible]
24	387	470	K D	24	⅜	2	⅜	6	3x3x¼	⅜	6	1½x⅜	½	4	6	1½x1½x¼	½	1½x1½x¼	⅝x26	2	1½x1½x1½ x¼	2	8¼x1½x[illegible]
30	768	870	K D	30	½	3	½	6	3½x3½x¼	½	6	1½x⅜	⅝	5	6	1½x1½x⅜	⅝	1½x1½x¼	⅝x33	2	1½x1½x1½ x¼	2	10x1½x½
*36	1089	1240	K D	36	½	3	½	6	4x4x¼	½	6	2x½	⅝	6	6	2x2x¼	⅝	1½x1½x¼	⅝x39	2	1½x1½x1½ x¼	2	10x1½x½
	Part Symbol See drawing			A		B	C	D		E	F		G	H	J		L	O	P	Q		S	

*Larger stacks can be furnished on special order.

Bolts, washers, etc., are not included in the preceding material schedule.

Ventilators may be furnished with or without dampers as required.

Damper is notched as required to pass all bolt heads in operating.

When specifying dampers, state whether the counterweight is to hold them open or closed, and specify length of chain needed.

Ventilators may be furnished with the necessary steel work either coated with black asphalt paint or heavily galvanized.

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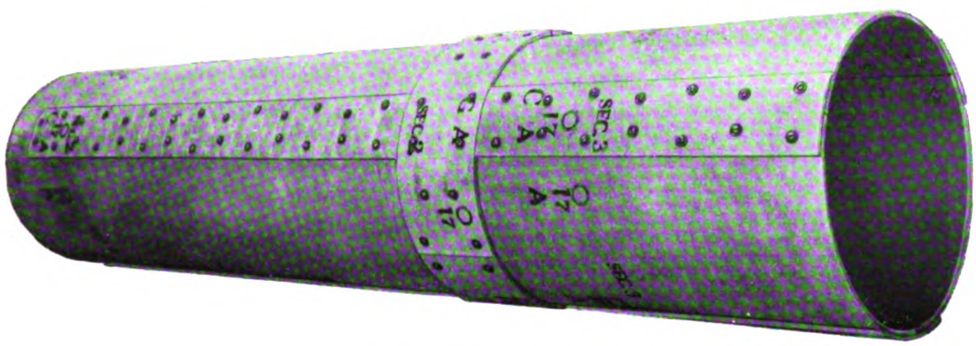
Transite Ducts

Transite Ducts are particularly adapted to many conditions where the use of sheet metal is not advisable because of its lack of resistance to corrosion. For example, Transite has been used with excellent results for many years for round house smoke ducts. Transite Ducts provide fireproof, corrosion-proof and maintenance-free construction.

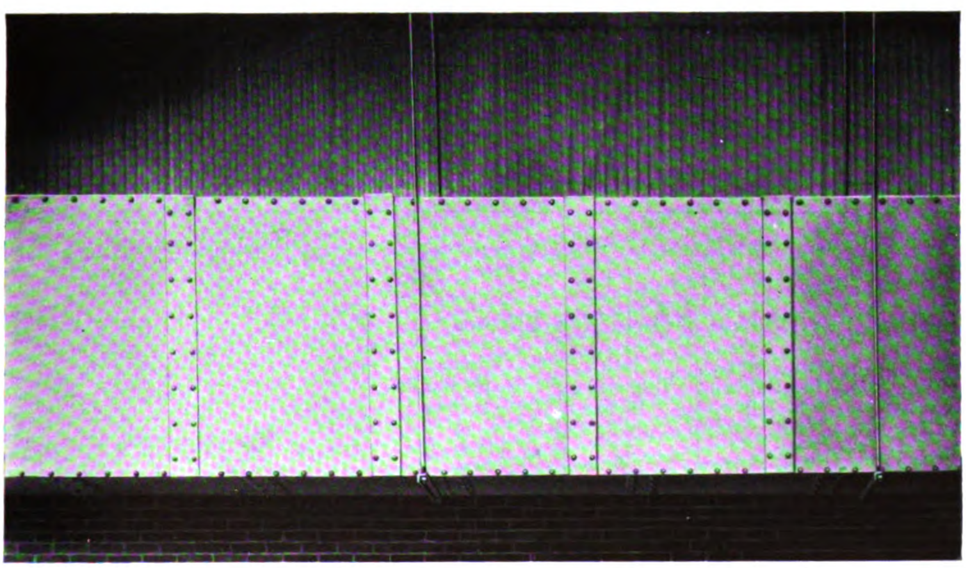
The round and square ducts shown are merely typical and many other types and sizes may be constructed according to requirements. Ducts are all manufactured from standard size sheets of Flat Transite, 42″ x 48″ or 42″ x 96″. Unless otherwise specified, all ducts are shipped "Knocked-down," having been previously erected and fitted at the factory.

All duct parts are bolted together with suitable bolts. Washers are used under the head and also between the nut and the Transite. The arrangement of battens, sections, collars, etc., vary, depending on sizes. Special heavy asbestos gaskets can be furnished for use under all battens and collars, if desired.

No attempt has been made to show details of hanging as this is governed by conditions. The assistance of Johns-Manville engineers with reference to details of construction will be gladly furnished on request.



Moulded Transite Duct



Square Transite Duct

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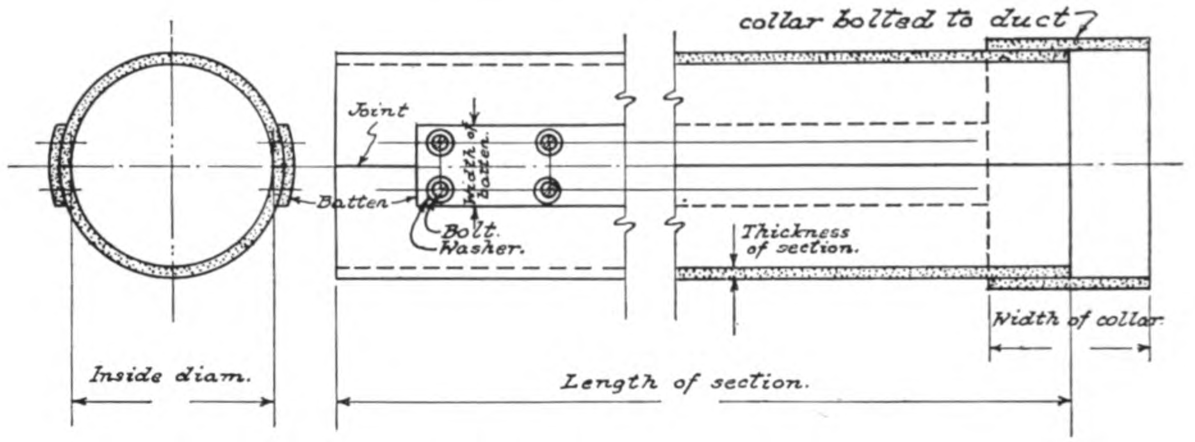


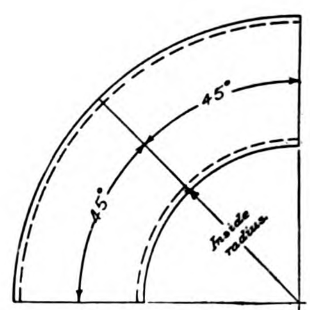
Data on Straight Lengths of Round Moulded Duct

Inside diam.	Thick. of section	Max. std. length	No. of sections	No. of battens	Width of battens	Width of collar	Pieces in collar	R. H. Stove Bolts	Washers	Approx. wt. per lin. ft. lb.	Approx. wt. per collar lb.
10″	1/4″	48″*	1	1	4″	8″	2	1/4″ Brass	Flat Brass	9	6
12″	1/4″	48″*	1	1	5″	8″	2	1/4″ Brass	Flat Brass	13	9
16″	5/16″	48″*	2	2	5″	8″	2	3/8″ Iron	3/8″ steel dished	18	11
18″	3/8″	48″*	2	2	6″	10″	2	3/8″ Iron	3/8″ steel dished	23	16
20″	3/8″	96″	2	2	6″	10″	2	3/8″ Iron	3/8″ steel dished	25	17 1/2
24″	3/8″	96″	2	2	6″	10″	2	3/8″ Iron	3/8″ steel dished	29	21
30″	3/8″	96″	3	3	6″	12″	3	3/8″ Iron	3/8″ steel dished	38	32
36″	1/2″	96″	3	3	8″	12″	3	3/8″ Iron	3/8″ steel dished	57	49
40″	1/2″	96″	3	3	8″	12″	3	3/8″ Iron	3/8″ steel dished	63	54
42″	1/2″	96″	4	4	8″	12″	4	3/8″ Iron	3/8″ steel dished	69	57
44″	1/2″	96″	4	4	8″	12″	4	3/8″ Iron	3/8″ steel dished	72	59
48″	1/2″	96″	4	4	8″	12″	4	3/8″ Iron	3/8″ steel dished	77	63
	5/8″	96″	4	4	8″	12″	4	3/8″ Iron	3/8″ steel dished	105	86
″	1/2″	96″	4	4	8″	16″	4	3/8″ Iron	3/8″ steel dished	80	87
	5/8″	96″	4	4	8″	16″	4	3/8″ Iron	3/8″ steel dished	111	122
60″	1/2″	42″ or 96″	2 or 5	2 or 5	10″	16″	5	3/8″ Iron	3/8″ steel dished	95	125
	5/8″	42″ or 96″	2 or 5	2 or 5	10″	16″	5	3/8″ Iron	3/8″ steel dished	135	180
72″	1/2″	42″ or 96″	3 or 6	3 or 6	12″	16″	6	3/8″ Iron	3/8″ steel dished	122	160
	5/8″	42″ or 96″	3 or 6	3 or 6	12″	16″	6	3/8″ Iron	3/8″ steel dished	155	200

All ducts are furnished unsanded.
*These sizes can be made in 96″ lengths if required, but 96″ lengths cannot be connected together with collars

Minimum Radius of Moulded Elbows

Inside Dia. of Duct Inches	Minimum Inside Radius Inches	Inside Dia. of Duct Inches	Minimum Inside Radius Inches
10	12	40	24
12	12	42	30
16	12	44	30
18	18	48	30
20	18	50	30
24	18	60	36
30	24	72	36
36	24		



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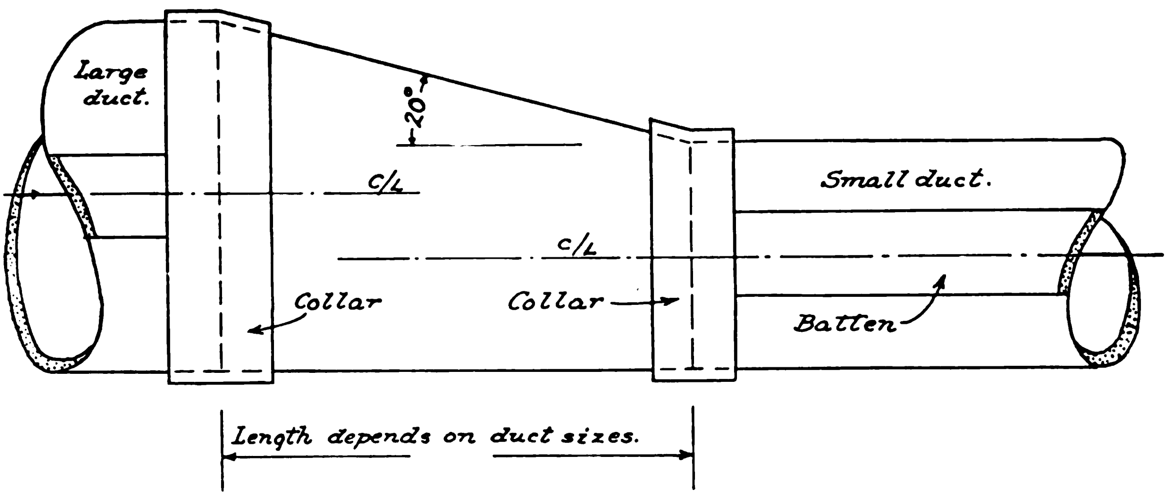
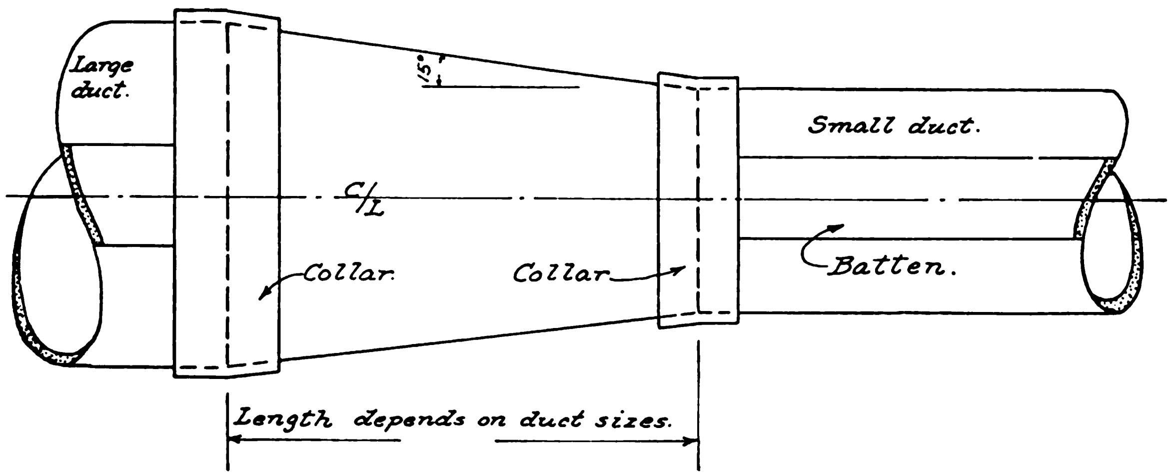
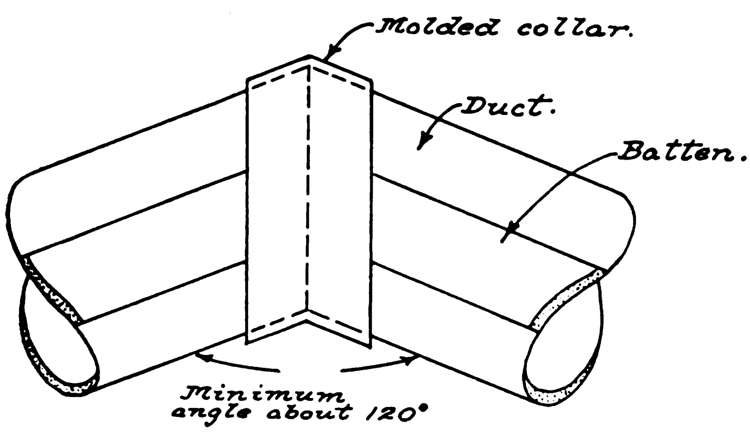
Round Duct Fittings



Constant bottom line reducer



Constant center line reducer



Moulded collar

Note: Designated angles are approximately the maximum. Thickness of Transite in the reducer equal to that of the smaller duct.

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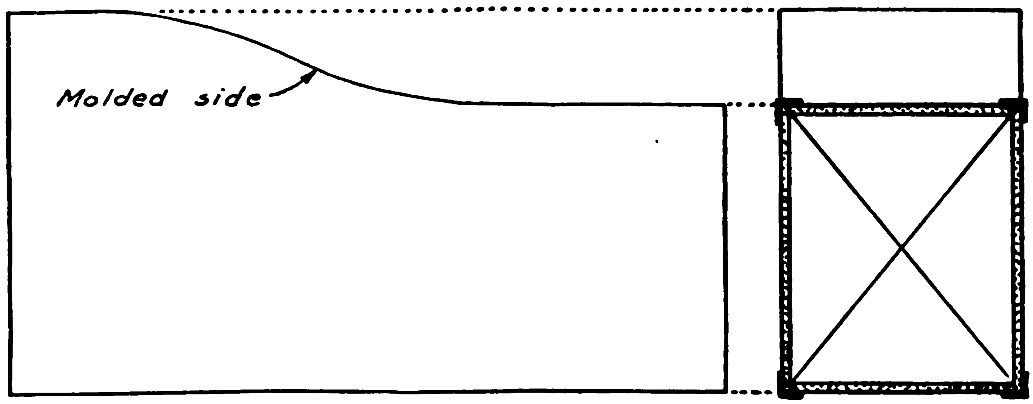
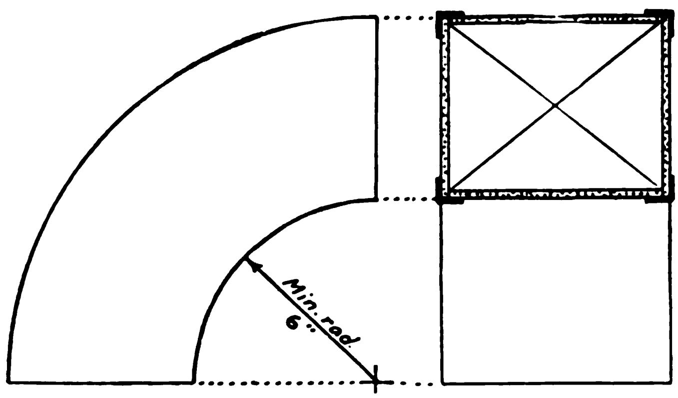
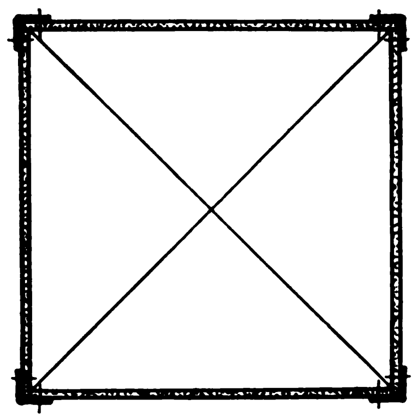
Square Duct Fittings



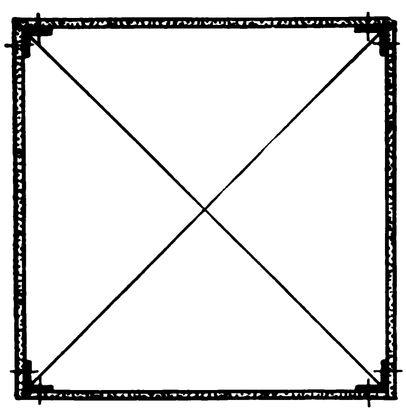
Reducer



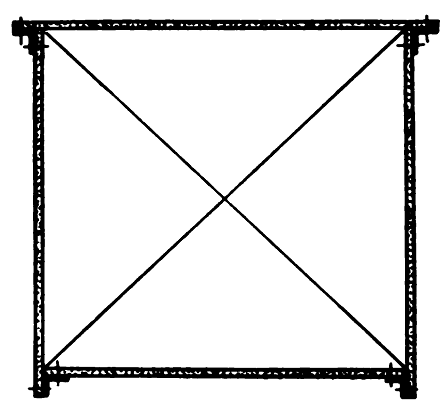
Elbow



Duct formed with exterior steel corners



Duct formed with interior steel framing



Duct formed with exterior steel framing

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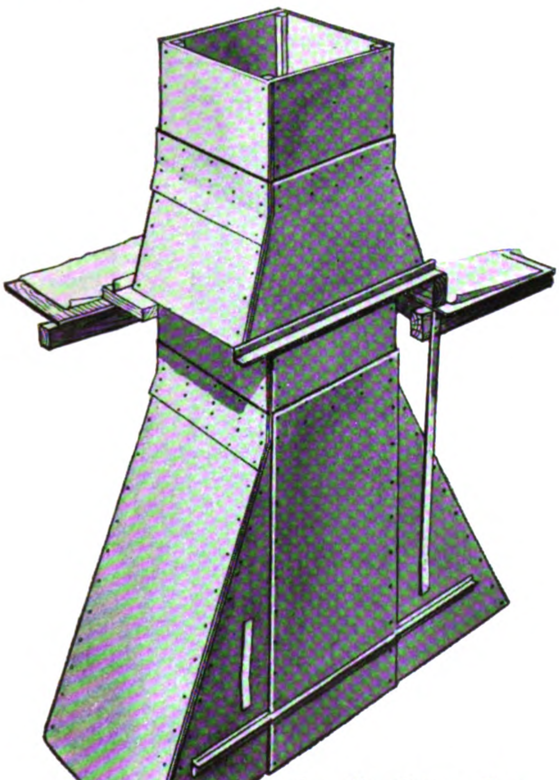
Transite Smoke Jacks

Johns-Manville has developed a series of Transite Smoke Jacks, constructed and designed to meet practically every round house need. The natural resistance of Transite to the corrosive effects of smoke fumes and the elements is responsible for its durability and freedom from maintenance. Painting or protective coatings are never necessary.

The selection of the proper type of Transite Smoke Jack for a particular condition is greatly simplified by the variety of styles and sizes in which they are made. Special designs can also be made up where conditions require them.

Transite Smoke Jacks are scientifically designed to embody the fundamental principles of round house smoke disposal. The questions of size, type, adaptability, economy, and maintenance have all been taken into consideration. All types have been standardized to as great an extent as possible. Erection is so simple that inexperienced workmen can assemble and erect them rapidly and economically.

New York Central engine terminal at Harmon, N. Y., showing four Transite Smoke Jacks in tandem over the drop pits



Cut Ventilating Transite Smoke Jack Type "AV"

In general, Transite Smoke Jacks may be classified as ventilating and non-ventilating, and each of these classifications may be subdivided into cut and moulded jacks. The type selected is determined by the requirements of the particular round house.

The ventilating smoke jack clears the house of the smoke which rises above the hood as the locomotive enters or leaves the round house. This is accomplished by having two concentric stacks, the inner stack telescoping into the outer one, thus providing an annular opening at the roof line. The smoke, rising to the roof, escapes to the atmosphere through this opening.

Simple ventilation may be accomplished by spreading two sides of the stack at the roof line. Smoke rising to the roof may enter the stack and escape to the atmosphere without making use of the double stack arrangement. This construction is illustrated opposite.

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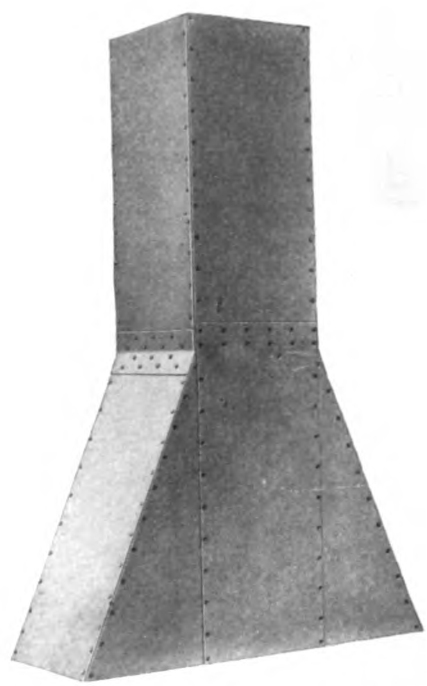
New York Central engine terminal at Selkirk, N. Y., where sixty-five type "N" Moulded Ventilating Transite Smoke Jacks are in service

The non-ventilating smoke jack is one in which the stack connecting with the hood passes through the roof and continues unbroken to the desired height. No provision is made for ventilating the round house or clearing out the smoke rising to the roof. The advantages of this type of jack are the reduced cost of the initial installation, and lightness in weight.

The cut smoke jack is one in which all of the component parts, with the exception of the collar connecting the hood to the stack, are cut from standard flat sheets of Transite. Advantages of this type are easier erection and the fact that all similar pieces are interchangeable. If one of the pieces should be damaged, a similar piece which will be an exact duplicate in every respect, can be ordered from the factory. Delivery of material is faster on flat sheets, because it is not necessary to allow time for seasoning.

The moulded smoke jack is one in which the sloping ends of the hood are made from curved pieces of Transite which have been moulded to the contour desired. They may have either round or oval stacks.



A typical Cut Non-ventilating Transite Smoke Jack

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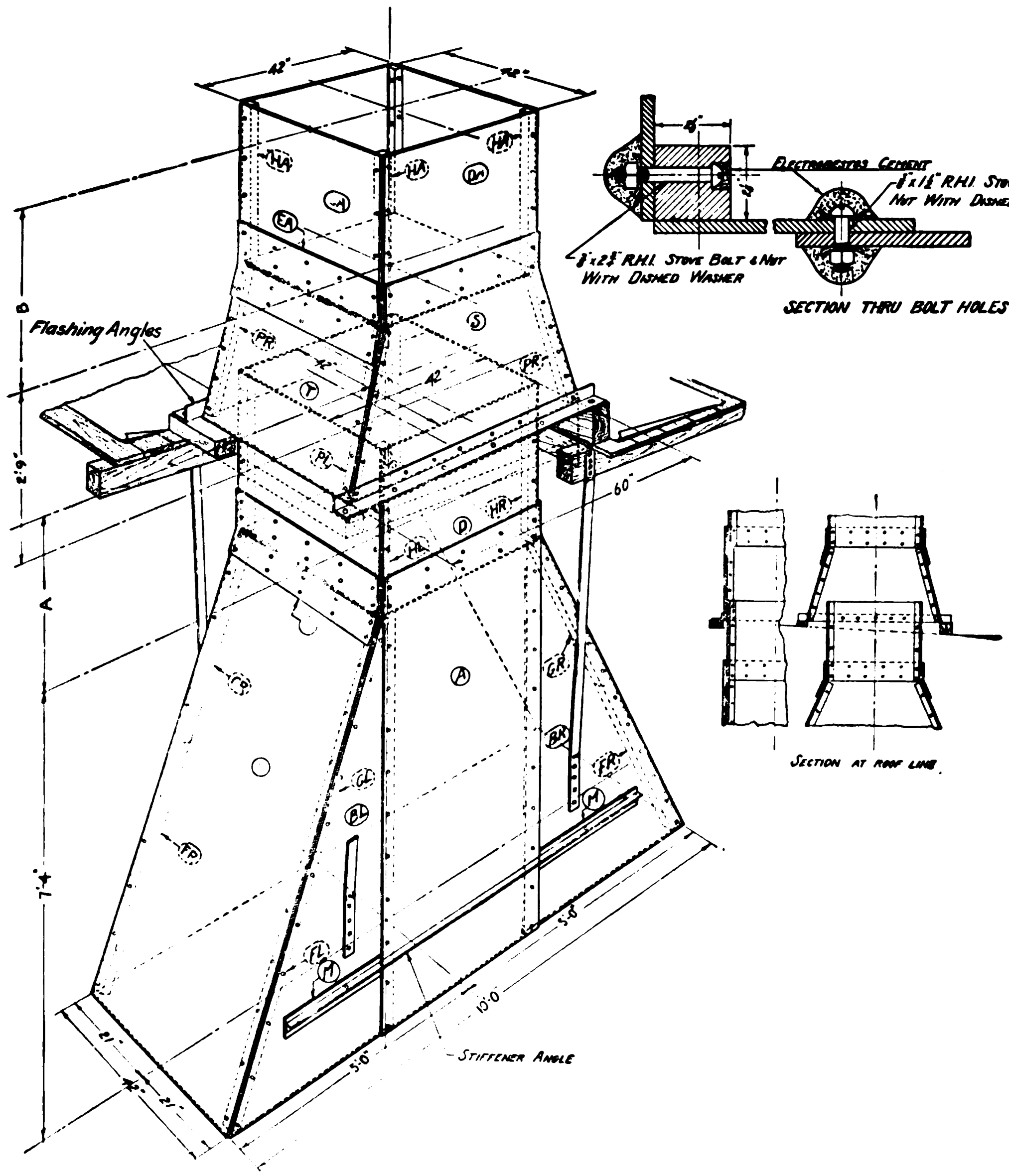

Type "AV" Smoke Jack is a ventilating cut jack making use of the venturi principle to provide ventilating action at the roof line. It eliminates the necessity of a double stack and has ample capacity for modern requirements

The principal advantage of this type is the fact that the curved parts of the hood produce a more uniform flow of gases to the stack, and eliminate the formation of eddy currents and gas pockets.

Sizes of Smoke Jacks:

Determination of the proper sizes of smoke jacks for various classes of power depends to a large extent upon the diameter of the driving wheels and the grate area of the locomotive. The hood should be sufficiently long to receive smoke from the locomotive stack at its limiting positions, due to adjustment of the driving wheels to bring the side rods in proper position for repair. The cross-section area of the stack bears a definite ratio to the grate area of the locomotive, since the stack must be of such size that it will readily carry off all the smoke from the locomotive. The American Railway Bridge & Build-

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ing Association in its report of October, 1924 states that a survey indicates that in a well-designed round house, the area of the stack should be about 10% of the grate area of the largest locomotive to be accommodated.

The ratios of the stack areas of Johns-Manville smoke jacks to the grate areas of several types of the larger locomotives are listed below. Figures shown for ratio of stack area to the grate area are based upon the following values for grate area:

Consolidation	2-8-0	50 sq. ft.
Mikado	2-8-2	70 " "
Santa Fe	2-10-2	88 " "
Mallet	0-8-8-0	100 " "

The smoke jacks tabulated above are of standard design and completely cover the requirements of railroad operations. Special types can be developed, if desired. Full information in regard to questions of size, design or erection will be furnished on request.

Data on Transite Smoke Jacks

Type of Jack	Drawing Number	Stack Section	Stack Area	Ratio of Stacks to Grate Area			
				Consol. 2-8-0	Mikado 2-8-2	Santa Fe 2-10-2	Mallet 0-8-8-0
J	1014	Round, 36" Diam.	7.06	.141	.101	.080	.071
K*	1015	Round, 36" Diam.	7.06	.141	.101	.080	.071
N*	720	Round, 30" Diam.	4.91	.098	.070	.056	.049
....	....	Round, 40" Diam.	8.73	.175	.125	.099	.087
AE*	1022	Square, 42"x42"	12.25	.245	.175	.139	.123
AN*	1021	Square, 42"x42"	12.25	.245	.175	.139	.123
AV*	1020	Square, 42"x42"	12.25	.245	.175	.139	.123
AW	1019	Rectangular, 21"x42"	6.13	.123	.087	.069	.061
AY	1018	Rectangular, 21"x42"	6.13	.123	.087	.069	.061
AZ	1017	Square, 42"x42"	12.25	.245	.175	.139	.123

*These are ventilating type jacks. The inner stack area is used to compute the above ratios. Type "N" can be furnished either ventilating or non-ventilating.

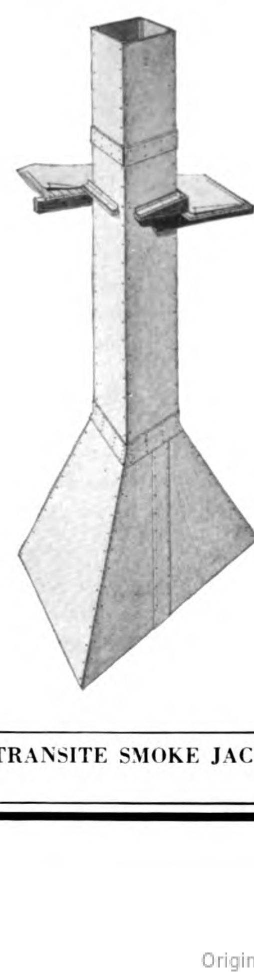
Transite Forge Jacks

The requirements of forge jacks are very similar to those of smoke jacks for round houses. Transite is an ideal material for this service also.

Due to the variety of types and sizes of forges, it is not practical to adopt standard designs such as have been developed for engine houses. The same general details of design are followed, however, and either ventilating or non-ventilating forge jacks may be obtained with square or rectangular hoods and stacks, or with moulded hoods and round or oval stacks.

Forge jacks usually require stacks much longer than are generally used with smoke jacks. It is, therefore, necessary to vary, at times, the thickness of material used in the stack, to provide the necessary mechanical strength for proper support.

Transite Forge Jacks are therefore designed for each individual job, from drawings showing the framing details of the building and the size and location of the forge.



Typical Cut Transite Forge Jack

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Transite Pipe

Twelve-inch Class B Transite Pipe for water mains in a large gas plant

Transite Pipe is composed of asbestos fibre and portland cement, combined under high pressure into a homogeneous dense structure, having high strength and unusual resistance to destructive agencies. The pipe is actually built up, by a process which enables accurate control of wall thickness and density and insures uniformity.

For the past fifteen years such pipe has been manufactured by Societa Anonima "Eternit" Pietra Artificiale, Genoa, Italy. The pipe is sold by them in Italy under the trade name "Eternit" and abroad under the trade name "Italit." Transite Pipe is now being made under the same manufacturing processes by Johns-Manville at the Waukegan, Illinois plant.

Classes of Transite Pipe:

Transite Pipe is manufactured in five classes:

Class	Working Pressure lb. per sq. in.	Test Pressure lb. per sq. in.
S	(Class "S," for low pressure conditions only)	
A	37.5	75
B	75	150
C	150	225
D	225	300

Classes S, A and B are manufactured in standard sizes ranging from 2″ to 40″ inside diameter. Classes C and D are manufactured in all sizes from 2″ to 24″, and above this on special order.

Uses of Transite Pipe:

Class S pipe is especially designed for use as vent stacks and flues. Its high resistance to corrosion makes it suitable for vents in industrial processes where metal pipe would be quickly attacked. It is used very successfully for vents from hoods in chemi-

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cal laboratories and for similar applications where a high degree of corrosion-resistance is essential.

The high resistance of Transite Pipe to the action of the condensate which forms in flue pipe from combustion equipment is of great advantage, as in many cases the condensate eats through the mortar joints of chimneys and damages plaster and decoration. For flues a special grade of heat-treated Class S pipe can be supplied for temperatures up to 800 deg. F.

Split longitudinally, it can be applied over felt-wrapped underground pipe lines to protect the wrapping and coating at river crossings and locations of unusual soil stress.

Class S pipe is also used for protecting overhead electric cables against fire hazard and, in the case of cables already erected, can be split longitudinally and applied without disturbing the cable or messenger. Transite pipe is not recommended, however, for arc-protection of underground cables in manholes.

The pressure pipe, Classes A, B, C and D, is used for delivering hot or cold water, gas, brine, and various process liquors and solutions under pressure. In carrying process liquors, a threaded Transite coupling can be supplied where desired so that the solution will not be contaminated by contact with foreign materials. For light pressures, such as in irrigation systems with heads of 75 ft. or less, a special form of Class S pipe with Bell and Spigot joints is available. While Class S pipe is adapted to use at low pressures, it is not generally recommended for pressure work and should not be employed for such purposes without approval of Johns-Manville engineers.

While Transite Pipe is highly resistant to many chemicals, it is not recommended for carrying strong acid solutions.

Transite Pipe Uses

Some of the applications of Transite Pipe are indicated below:

Structural:	Class of Pipe	Type of Coupling
Downspouts	S	B&S
Sewer vents	S	B&S
Soil piping and sewer connections	S	B&S
Sewage ejection lines	A,B,C,D	L.J. or D.
Lally columns	A,B,C,D	None required
Vents for house boilers, space and water heaters, etc.	S	B&S or Taper
Round chimney flues	S	Butt or Socket
Water supply and distribution mains	A,B,C,D	L. J.

Mining, Metallurgical and Chemical:	Class of Pipe	Type of Coupling
Mine water supply and drainage	All	Taper, D., B&S
Mill end product lines	A,B or C	L.J. or D.
Vents from acid pots, chlorinators, settling tanks and various chemical apparatus	S	B&S or Taper
Large stacks	A or B	Sleeve
Mine sluices	B,C or D	D. or L. J.
Public Utilities:		
Water mains and branches	A,B,C,D	L. J.
Low pressure gas conduit (at pressures over 10 lb. per sq. in., use special impregnated pipe)	D	D.
Fire protection for overhead telephone and power cables	S	Sleeve
Railroad and General Industrial:		
Railroad yard water lines	A,B,C,D	L. J.
Smoke jacks	S	Special
Industrial water supply and fire lines	A,B,C,D	L. J.
Municipal water supply and distribution mains	A,B,C,D	L. J.
Viscose and raw water lines for rayon plants	A,B,C	D. or L. J.
Sulphite and other lines for pulp and paper industry	A,B,C,D	D. or L. J.
Brine lines in refrigeration plants	B,C or D	D.
Oiled textiles, linoleum and celluloid lines	B,C or D	D. or L. J.
Breweries and distilleries	A,B,C,D	D. or L. J.
Salines and salt works	A,B,C,D	L. J.

NOTE: B&S indicates Bell and Spigot; L. J., Lock Joint; D., Dresser (or Dayton, Victaulic, etc.).

Physical Properties of Transite Pipe:

Transite Pipe has a density of from 115 to 125 lb. per cu. ft., depending upon size and class, as compared with 450 lb. per cu. ft. for cast iron and 490 lb. for steel.

The pipe has a dense, close-grained structure. It is highly resistant to external and internal corrosion, tuberculation, electrolysis and chemical reaction and for especially severe conditions it can be treated with asphalt or other saturating compound.

Conductivity: The thermal conductivity of Transite Pipe is approximately 6.0 B.t.u. per sq. ft., per 1″ thick, per deg. F. temperature difference per hour.

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Transite Pipe installation in industrial plant

Although the heat transfer through the walls of Transite Pipe is much less than through the walls of metal conduits, it should never be depended upon to prevent condensation on the outside of the pipe or freezing of liquids inside.

Electrical Characteristics: Transite Pipe has a puncture voltage when dry of approximately 15,000 volts per inch thick. Its insulation resistance is approximately 125,000 megohm cms.

Absorption: Although tests on small sections of pipe indicate that these specimens, immersed in water until absorption stops, will absorb about 7% of their weight, under actual conditions the pipe is practically impermeable to water at all pressures within the bursting limit.

Capacity: Transite Pipe has a very smooth interior surface and tests have indicated that it has about 13% higher delivery capacity than new and clean cast iron of the same diameter and under the same conditions of head and installation. This is not reduced with length of service as is often the case with iron pipe.

Joints for Transite Pipe:

Several types of joints are available as shown in drawings. The Simplex and Gibault joints are used universally in European practice. For American practice, the Lock Joint coupling is an accepted type of joint for water service and the Dresser coupling is well-known to all gas and oil companies. The Victaulic joint with rubber gasket may also be used with Transite Pipe.

Class S pipe for use as domestic flue pipe, electrical conduit, etc., is furnished with taper joints up to 12″ in diameter. A special machine for field-cutting of taper joints is made by Huhn Manufacturing Co., New York City. On sizes over 12″ in diameter, a sleeve is supplied with the pipe to be cemented on with joint compound. A socket type joint can also be furnished on small diameter Class S pipe where conditions demand it, as in installing flue pipe in

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existing chimneys. The socket joint can also be supplied for electrical conduit if required.

Joint Compounds:

Bell and Spigot or sleeve joints can be filled with hemp and cement, or hemp and lead. As lead must be carefully caulked to prevent damage to the pipe, the use of "Leadite" (The Leadite Co., Philadelphia, Pa.), or "Hydrotite" (Hydraulic Development Co., Boston, Mass.), is preferable. Hydrotite of a special acid-proof composition can also be furnished, known as "Hydrotite B."

For Class S pipe, H. J. Cement is best adapted for use in taper couplings. J-M No. 20 Plastic Refractory Cement (see Refractory Cements Section) is also suitable for use in taper joint couplings but should not be used for outside work where exposed to moisture or weather. J-M Asbestoment (see Electrical Materials Section) should be used in Bell and Spigot joints and in sleeve type joints where the annular space around the pipe is from ¼″ to ½″.

Fittings:

A full line of elbows, tees, crosses, laterals, reducers and other standard fittings can be supplied for the Class S pipe made of the same material as the pipe with standard Bell and Spigot joints. These can also be supplied up to 12″ in diameter, with spigot ends machined to fit taper couplings. Special fittings can be moulded to meet unusual conditions.

For the pressure pipe, all valves, elbows and fittings are of metal. In the larger sizes of pressure pipe, specially designed cast iron "dutchmen" or nipples are introduced on either side of the valve or fitting to compensate for the difference in wall thickness between Transite and cast iron pipe.

Method of Laying:

There are no problems presented in the laying of Transite Pipe and no special skill is required. Either skilled or unskilled labor may be employed. All joints permit of laying the pipe to curves of long radius such as the curves of roadways. Sharp bends in pressure pipe are made with special metal fittings. Branches can be taken off service lines under pressure by first placing a special cast iron split sleeve or saddle fitting over the pipe at the point of outlet, ahead of which is then placed a valve. The cut is made through the valve opening to the exact size of the branch, after which the valve is closed and the remainder of the branch laid.

Sizes and Weights of Class S Transite Pipe

*Indicates sizes made at Waukegan; other sizes are at present imported from Italy.

WAUKEGAN MANUFACTURE						ITALIAN MANUFACTURE			
Inside diameter, Inches	Wall thickness, Inches	Outside diameter, Inches	Weight of pipe only, lb. per lin. ft.	Length	Weight of Taper coupling or sleeve, lb. per lin. ft.	Inside diameter, Inches	Outside diameter, Inches	Length	Wt. lb. per lin. ft. including 1 coupling per length of pipe
2*	.32	2.64	1.9	9′ 10″	1.2	......	......	....	....
2.5*	.32	3.14	2.3	9′ 10″	1.4	......	......	....	....
3*	.32	3.64	2.7	9′ 10″	1.6	......	......	....	....
4*	.32	4.64	3.5	9′ 10″	2.4	......	......	....	....
5*	.36	5.72	4.9	9′ 10″	3.2	......	......	....	....
6*	.36	6.72	5.8	9′ 10″	4.3	......	......	....	....
7*	.36	7.72	6.7	9′ 10″	4.8	......	......	....	....
8*	.40	8.80	8.5	13′ 1½″	6.8	......	......	....	....
9	......	......	......	....	....	8.858	9.646	13′ 1½″	11.0
10*	.40	10.80	10.5	13′ 1½″	10.0	......	......	....	....
12*	.44	12.88	13.8	13′ 1½″	14.2	......	......	....	....
14	......	......	......	....	....	13.78	14.616	13′ 1½″	18.7
16*	.47	16.94	19.5	13′ 1½″	24.4	......	......	....	....
18	......	......	......	....	....	17.717	18.740	13′ 1½″	28.8
20*	.51	21.02	26.3	13′ 1½″	40.5	......	......	....	....
22	......	......	......	....	....	21.653	22.756	13′ 1½″	39.6
24*	.59	25.18	36.4	13′ 1½″	52.0	......	......	....	....
26	......	......	......	....	....	25.59	26.850	13′ 1½″	50.8
28	......	......	......	....	....	27.559	28.898	13′ 1½″	58.0
30	......	......	......	....	....	29.528	30.866	13′ 1½″	64.0
32*	.71	33.42	84.6	13′ 1½″	104.0	......	......	....	....
34	......	......	......	....	....	33.164	34.882	13′ 1½″	75.7
36	......	......	......	....	....	35.433	36.929	13′ 1½″	85.0
38	......	......	......	....	....	37.401	38.898	13′ 1½″	89.5
40	......	......	......	....	....	39.37	40.945	13′ 1½″	98.7

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Taps can be made for insertions if corporation cocks are used in the same manner and with the same tools employed with cast iron pipe. The threads cut in this way are remarkably strong.

When laying joints of the Lock Joint or Simplex types, a J-M engineer should be present to insure the proper method being used in starting the work.

Hangers:

For overhead lines at least two hangers should be employed per length of pipe, spaced at about one-fifth of a pipe length from the joint. Hangers should be of a type to prevent lateral movement or "weaving" due to pressure and should also be capable of supporting the weight. Valves 6" and larger should be supported on extra hangers.

Advantages of Transite Pipe

The advantages of Transite Pipe over cast iron and other metal conduit can be summarized as follows:

Freedom from oxidation, both overhead and underground.

Not subject to electrolytic action of wandering currents which cause rapid destruction of metallic pipe walls. Transite Pipe is a non-conductor.

Higher corrosion resistance. Superior to metal conduit for the carrying of chemical solutions (not strong acids).

Non-tuberculating. The formation of ferruginous tubercles and iron sponge in cast iron pipe causes softening of the walls, pollution of the water, and great reduction of the carrying capacity of the pipe.

More hygienic, since water keeps better in cement than in metal.

Higher carrying capacity. Transite Pipe has a smoother surface than any metal pipe.

More uniform structure. Transite Pipe has a dense and uniform structure throughout.

Considerably lighter in weight. Unit weight approximately one-fourth that of cast iron or steel.

Not necessary to protect Transite Pipe. Transite does not require any of the forms of protection used for metal pipe since Transite is non-corrodible and non-electrolytic.

Greater workability. Transite Pipe can be turned, drilled, threaded, and sawed in the same way as hard wood. Service connections, small taps, etc., can be made with great speed and accuracy in the field and made completely tight against water leakage. (In threading Transite Pipe, a coarse thread with a large pitch should be used).

Economical. Costs less than metal pipe

Sizes and Weights of Standard Fittings for Class S Transite Pipe

Weights in lb. per coupling.—Fig. Nos. refer to drawings of Class S fittings.

SIZE		Fig. 2 90° Ell	Fig. 4 45° Ell	Fig. 7 Tee	Fig. 12 Lateral	Fig. 14 Double Lateral	Fig. 16 Wye	Fig. 18 Cross	Fig. 19 Double Square Branch	Fig. 20 3-Way Branch	Fig. 26 Offset
mm.	Inches (Nominal)										
80	3	3.3	2.6	5.7	6.2	11.0	5.5	7.7	11.0	11.5	5.1
100	4	4.0	3.3	7.3	7.9	13.9	7.1	10.4	13.9	14.3	6.6
125	5	5.7	4.9	10.4	11.2	19.4	9.9	13.7	19.4	19.4	9.0
150	6	6.8	6.0	12.8	13.4	23.2	12.6	16.5	23.2	23.8	11.2
175	7	8.2	7.5	15.4	16.1	28.0	15.0	20.0	28.0	28.6	13.4
200	8	10.4	9.5	19.4	20.3	34.9	19.2	25.0	34.9	36.0	17.2
225	9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
250	10	12.8	11.7	24.2	26.0	43.7	23.8	33.0	43.7	45.0	21.4
300	12	18.5	17.0	36.3	36.8	63.5	34.6	45.0	63.5	66.0	31.8
350	14	55.0	44.0	72.5	103.6	150.0	99.2	93.0	150.0	154.0	70.6
375	15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
400	16	75.0	53.0	99.0	134.5	163.0	127.9	132.0	163.0	167.0	92.6
450	18	102.0	66.0	128.0	174.2	251.0	159.0	172.0	251.0	258.0	119.1
500	20	118.0	88.0	161.0	227.2	332.0	207.0	214.0	332.0	335.0	143.3
550	22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
600	24	181.0	132.0	247.0	301.5	452.0	265.0	320.0	452.0	460.0	212.0
650	26	250.0	172.0	263.0	369.0	.....	.....	370.0	.....	.....	247.0
700	28	307.0	216.0	320.0	451.0	.....	.....	410.0	.....	.....	309.0
750	30	353.0	234.0	375.0	537.0	.....	.....	487.0	.....	.....	353.0
800	32	424.0	290.0	454.0	667.0	.....	.....	620.0	.....	.....	420.0
850	34	477.0	309.0	530.0	773.0	.....	.....	708.0	.....	.....	486.0
900	36	590.0	376.0	650.0	940.0	.....	.....	885.0	.....	.....	596.0
950	38	685.0	407.0	740.0	1080.0	.....	.....	1025.0	.....	.....	685.0
1000	40	774.0	461.0	926.0	1170.0	.....	.....	1325.0	.....	.....	774.0

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Sizes and Weights of Classes A, B, C and D Transite Pressure Pipe

Inside diameter, Inches	CLASS A			CLASS B			CLASS C			CLASS D		
	Thickness, Inches	Outside diameter, Inches	Weight lb. per lin. ft.	Thickness, Inches	Outside diameter, Inches	Weight lb. per lin. ft.	Thickness, Inches	Outside diameter, Inches	Weight lb. per lin. ft.	Thickness, Inches	Outside diameter, Inches	Weight lb. per lin. ft.
2	.32	2.64	1.86	.36	2.72	2.13	.40	2.80	2.41	.44	2.88	2.70
3	.32	3.64	2.67	.36	3.72	3.04	.40	3.80	3.42	.44	3.88	3.80
4	.36	4.72	3.94	.40	4.80	4.42	.47	4.94	5.28	.51	5.02	5.77
5	.40	5.80	5.42	.47	5.94	6.46	.55	6.10	7.66	.63	6.26	8.90
6	.40	6.80	6.42	.55	7.10	9.04	.63	7.26	10.48	.71	7.12	11.95
7	.40	7.80	7.43	.59	8.18	11.24	.71	8.12	13.75	.79	8.58	15.45
8	.40	8.80	8.43	.63	9.26	13.65	.79	9.58	17.42	.91	9.82	20.35
9	.40	9.80	9.44	.67	10.34	16.26	.91	10.82	22.62	1.03	11.06	25.92
10	.40	10.80	10.44	.71	11.42	19.10	.99	11.98	27.30	1.14	12.28	31.88
12	.47	12.94	14.72	.79	13.58	25.40	1.18	14.36	39.00	1.34	14.68	44.85
14	.55	15.10	20.10	.95	15.90	35.65	1.38	16.76	53.25	1.58	17.16	61.85
15	.59	16.18	23.10	1.03	17.06	41.45	1.50	18.00	62.20	1.70	18.40	71.25
16	.63	17.26	26.30	1.10	18.20	47.2	1.58	19.16	69.8	1.81	19.62	80.9
18	.71	19.42	33.35	1.18	20.36	56.8	1.77	21.54	87.8	2.05	22.10	103.1
20	.79	21.58	41.2	1.34	22.68	71.8	1.97	23.94	108.6	2.29	24.58	128.0
22	.87	23.74	49.9	1.46	24.92	86.0	2.17	26.34	131.5	2.48	26.96	152.4
24	.95	25.90	59.5	1.58	27.16	101.5	2.36	28.72	156.0	2.72	29.44	182.4
26	1.03	28.06	69.9	1.73	29.46	120.4	2.56	31.12	183.5	2.96	31.92	215.0
28	1.10	30.20	80.4	1.85	31.70	138.5	2.76	33.52	213.1	3.19	34.38	249.6
30	1.18	32.36	92.3	1.97	33.94	158.0	2.96	35.92	244.9	3.39	36.78	284.0
32	1.26	34.52	105.2	2.13	36.26	182.5	3.15	38.30	277.9	3.62	39.24	323.9
34	1.34	36.68	119.0	2.25	38.50	204.8	3.35	40.70	314.0	3.86	41.72	367.0
36	1.42	38.84	133.4	2.36	40.72	227.0	3.55	43.10	352.5	4.10	44.20	413.0
38	1.50	41.00	148.8	2.52	43.04	256.2	3.74	45.48	392.0	4.29	46.58	455.5
40	1.58	43.16	165.0	2.68	45.36	287.0	3.94	47.88	434.8	4.53	49.06	506.5

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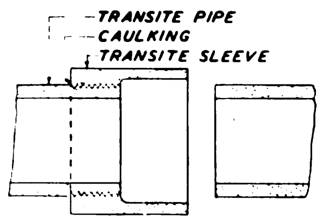

FIG 1
BELL & SPIGOT JOINT
FOR CLASS S PIPE AND
LOW PRESSURE LINES

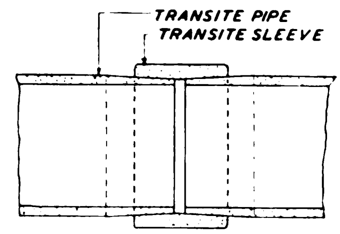

FIG 2
TAPER COUPLING
CLASS S PIPE

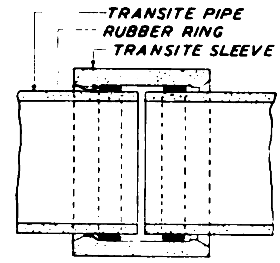

FIG 3
SIMPLEX JOINT
CLASSES A&B PIPE

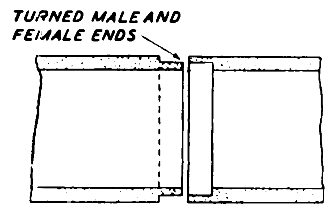

FIG 4
SOCKET JOINT
CLASS S PIPE

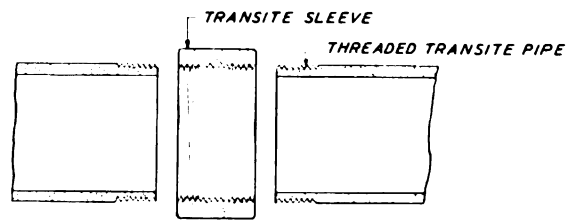

FIG 5
THREADED COUPLING
CLASSES S&A PIPE

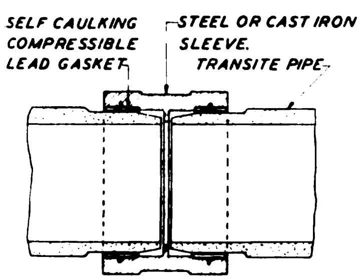

FIG 6
LOCK JOINT COUPLING
CLASSES A,B,C & D PIPE

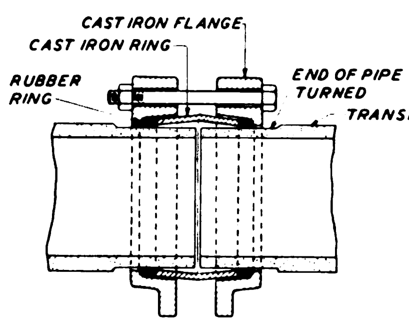

FIG 7
GIBAULT JOINT
(FOR EUROPEAN SERVICE)
CLASSES A,B,C & D PIPE

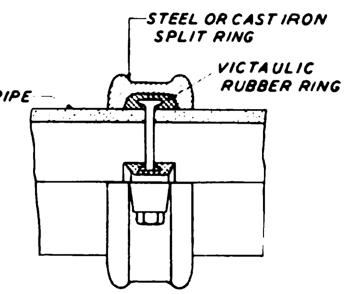

FIG 8
VICTAULIC JOINT
CLASSES A,B,C & D PIPE

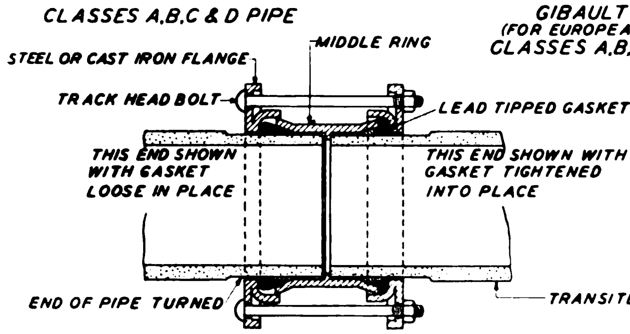

FIG 9
DRESSER COUPLING
CLASSES A,B,C & D PIPE

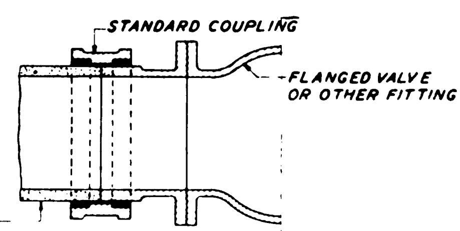

FIG 10
CAST IRON FLANGED DUTCHMAN FOR
PRESSURE PIPE 10" DIAMETER AND OVER

Various Transite Pipe Couplings

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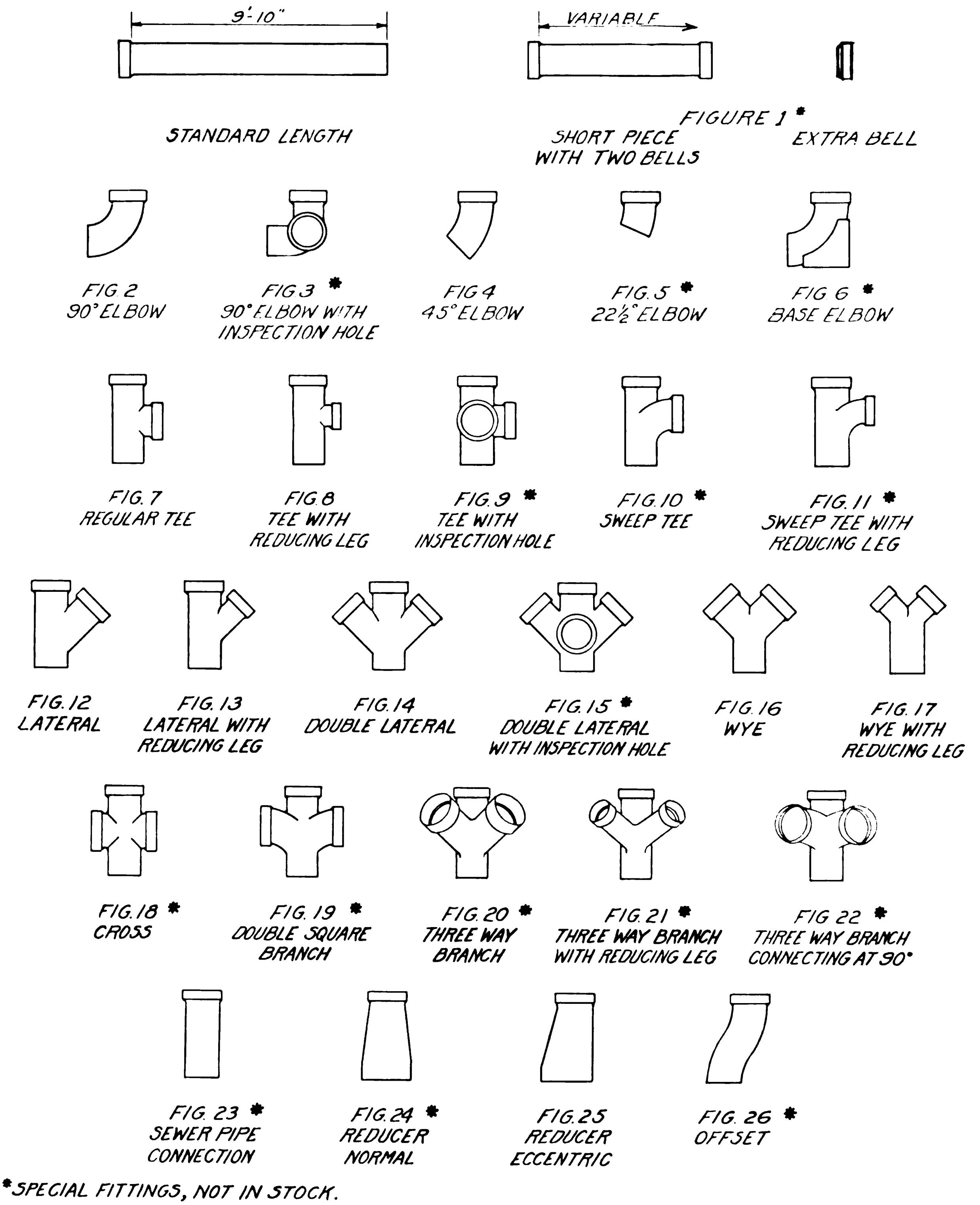

Fittings for Class S Transite Pipe

INDEX

Waterproofing and Miscellaneous Asphalt Products

(*For complete list of data sheets, see other side of this page*)

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Waterproofing and Miscellaneous Asphalt products

Complete List of Data Sheets Available

Brochures

Preformed Expansion Joints and Asphalt Bridge Plank, 12 pp. 8½" x 11", form EX-2A
Underground Pipe Protection, "Safeguarding Your Pipe Line Investment," 12 pp. 8½" x 11", form OI-1A

★Catalog pages

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J-M Waterproofing and Damp-proofing

J-M Waterproofing on the Niagara River bridge of the Michigan Central R.R.

J-M Waterproofing is a treatment designed to render concrete and masonry structures impervious to water, more commonly where hydrostatic pressure exists. Damp-proofing is a protection against the penetration of moisture by absorption and capillary action.

Method of Damp-proofing:

Damp-proofing is used both above and below ground level, but its primary purpose is to prevent staining of brick, stone, concrete, and interior plastering. Damp-proofing is ordinarily accomplished by bituminous surface coatings, used without reinforcing materials.

Methods of Waterproofing:

Experience has shown that positive waterproofing is best accomplished by the membrane method, which consists in the application of a protective skin or covering over the surface to be waterproofed. This covering is built up of bituminous materials reinforced with felted or woven fabrics which completely surround or overlay the waterproofed structure. All plies are thoroughly coated with bitumen, and bonded together and to the concrete. The treatment is usually applied on the outside of the structure so that the water pressure has a tendency to keep it in place. If applied on the inside, it is usually necessary to overlay the treatment with concrete.

As a matter of expediency, J-M Asphalt Mastic Waterproofing is used in subway construction where a membrane would be impractical because the material is subjected to abrasion during the progress of the work. This mastic waterproofing is a properly proportioned combination of asphalt and selected mineral filler, thoroughly mixed at a temperature of 450 deg. F. and applied hot to the concrete. Sometimes subway specifications call for brick cemented with mastic as a protection to a membrane. In many instances the mastic serves merely as a roof to deflect water to sewer drains. The mastic method is not recommended where the use of the membrane method is at all feasible.

The success of membrane waterproofing depends upon the design of the membrane structure, the selection of the proper bituminous materials, and careful workmanship in application. Membranes should be constructed of felts and fabrics which have the qualities of permanence, strength and flexibility. The bituminous material in most common use is asphalt.

J-M Standard Asphalt Waterproofing Cement is carefully manufactured from selected asphaltic crude of great purity which is especially adapted to waterproofing work. J-M Asbestos Waterproofing Felts have greater resistance to water than either asphalt-saturated rag felts or cotton fabrics and are preferably used as the outer reinforcing agents in waterproofing membranes. Cotton fabric is used primarily for its tensile strength and, when specified, is placed in the center of the membrane. In this position no water can reach it and it is protected from mold and bacterial action.

Johns-Manville recommends the use, wherever possible, of asbestos felts and fabrics in combination. Standard specifications have been developed for the use of saturated fabrics without any felts, but experience indicates that a combination of fabrics and felts is better practice. However, on railroad bridge waterproofing and some other types of work the use of fabrics only is well established.

Certain engineers and architects specify fabrics entirely, even up to 5-ply, and disapprove the use of felts, supposing that the introduction of reinforcing materials other than fabrics supplies a cleavage line in the membrane and a consequent tendency to separate under movement. This theory does not apply when J-M Asbestos Waterproofing Felts are used, because of their thorough asphalt impregnation.

General Recommendations:

The following recommendations serve as a guide in waterproofing and damp-proofing work. No definite specification can be written to cover any character of construction until the individual requirements of the particular job are analyzed.

If the concrete is dry, the installation should ordinarily be started with an application of J-M Concrete Primer. The only places where it is usually impossible to have dry concrete is in boiler pits, elevator pits, etc. In such cases, J-M No. 50 Asbestos Waterproofing Felt is used as a substantial base on which to build the specified membrane, and no concrete primer is used. When 5-ply protection is required, the introduction of this sheet results in a 6-ply protection.

Some variation will be experienced in the quantities of materials required. Ordinarily, 1 gal. of J-M Concrete Primer will cover 100 sq. ft. On horizontal surfaces, J-M Standard Asphalt Waterproofing Cement should run 30 lb. per mopping, except for the surface mopping which should run 25 lb. Each of these quantities is increased 5 lb. on vertical surfaces. Asbestos Waterproofing Felts will run square for square with the work, and the quantity depends only on the number of plies. Each ply of Asphalt-Saturated Fabric will run 1.1 squares (12.2 sq. yds.) per 100 sq. ft. of treated surface.

The quantities of Self-Healing Waterproofing Cement required are approximately the same as for J-M Standard Asphalt Waterproofing Cement. For each coat of Aquadam, 1 gal. is required per 100 sq. ft. of surface.

Specification No. 1—Waterproofing: Two plies of J-M No. 50 Asbestos Waterproofing Felt laid in J-M Standard Asphalt Waterproofing Cement. Used in waterproofing concrete railroad bridges, bridge abutments, viaducts, and in other locations where no hydrostatic pressure exists.

Specification No. 2—Waterproofing: Two plies of J-M Asphalt-Saturated Fabric laid in J-M Standard Asphalt Waterproofing Cement. Used as an alternate to No. 1 when fabric only is specified.

Specification No. 3—Waterproofing: Three plies of J-M 15-lb. Asbestos Waterproofing Felt laid in J-M Standard Asphalt Waterproofing Cement. Used for floors, walls and sidewalks, where no pressure exists.

Specification No. 4—Waterproofing: Three plies of J-M 15-lb. Asbestos Waterproofing Felt laid in J-M Self-Healing Waterproofing Cement. Used between wood floors.

Specification No. 5—Waterproofing: Two plies of J-M No. 50 Asbestos Waterproofing Felt and one central ply of J-M Asphalt-Saturated Fabric, all laid

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in J-M Standard Asphalt Waterproofing Cement. This specification is as light as should be used in floors and walls where surface seepage may set up hydrostatic pressure. Also used on elevated concrete highways.

Specification No. 6—Waterproofing: Three plies of J-M Asphalt-Saturated Fabric laid in J-M Standard Asphalt Waterproofing Cement. Used as an alternate to No. 5 where fabric only is specified. Sometimes used in preference to No. 2 where greater strength is required.

Specification No. 7—Waterproofing: Four plies of J-M 15-lb. Asbestos Waterproofing Felt with one central ply of J-M Asphalt-Saturated Fabric, all laid in J-M Standard Asphalt Waterproofing Cement. Used on floors and walls of foundation work, where hydrostatic pressure will not exceed 10 ft. of water. As the grade line is approached, it may be shingled off to 3-ply. Deep foundation work requires special attention.

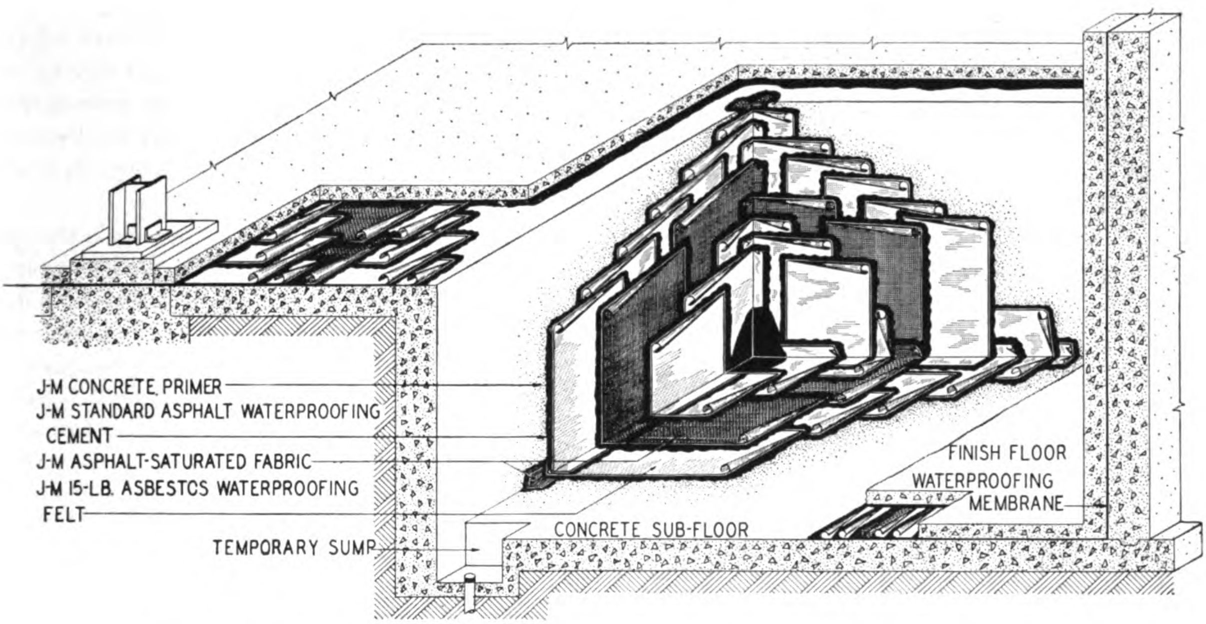
Specification No. 8—Damp-proofing: Two coats of Aquadam applied 24 hours apart. No primer is necessary where Aquadam is to be applied. This specification is used on the inside surface of exterior walls above grade, before plastering.

Specification No. 9—Damp-proofing: One mopping of J-M Standard Asphalt Waterproofing Cement. Used on the exterior of foundation walls below grade where conditions are mild.

Specification No. 10—Damp-proofing: One ply of J-M 15-lb. Asbestos Waterproofing Felt laid in J-M Standard Asphalt Waterproofing Cement. Used on the exterior of foundation walls below grade.

Detailed information on waterproofing and damp-proofing is available on special data sheets. Particular attention is given to wood floors, old basement floors and walls, waterproofing in connection with J-M Industrial Flooring, spray and brine decks over wood, concrete and cork, and steel and concrete swimming pools.

Johns-Manville waterproofing and damp-proofing materials are supplied to contractors with full directions for application. As to the materials themselves, Johns-Manville assumes full responsibility for quality and fitness for use.



Waterproofing specification No. 7 applied to basement foundation and elevator or boiler pit. Pumps on the sump relieve ground water hydrostatic pressure until the sub-floor is set, waterproofing applied, and the finish floor completed, after which the sump is closed and similarly waterproofed. Concrete reinforcing is not shown

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J-M Waterproofing and Damp-proofing Materials

J-M Waterproofing Felts and Fabrics

Asphalt-impregnated felts made of asbestos fibre and a small percentage of chemically-treated cattle hair are the best for membrane waterproofing work because they last indefinitely, have great tensile strength, and are able to carry an abundance of waterproofing asphalt.

J-M No. 50 Asbestos Waterproofing Felt is approximately 0.045" in thickness. It has a strength with the grain of not less than 50 lb. per inch, determined with a Scott Strength Tester, pull 18" per minute, 3" between jaws. This strength enables it to bridge ordinary expansion cracks without fracture. Its water absorption, based on immersion for 24 hours, is not more than 5%. This felt is furnished in two-square rolls (216 sq. ft.), 32" wide, weighing approximately 70 lb. per roll.

J-M 15-lb. Asbestos Waterproofing Felt is similar to No. 50 but lighter in weight. It is most often used in connection with saturated cotton fabrics, or with No. 50 Asbestos Waterproofing Felt in building up membrane waterproofing. 15-lb Asbestos Waterproofing Felt is furnished in three-quarter rolls (324 sq. ft.), 32" wide, weighing approximately 45 lb. per roll.

J-M No. 1 Acid-Resisting Felt is asphalt-saturated and coated rag felt, furnished in rolls of 108 sq. ft., 36" wide. It is recommended for use with J-M Industrial Flooring as a membrance over concrete or wood sub-bases where liquids, particularly acids, are present in volume. Membrane treatment furnishes insurance against leakage through the flooring. Felts are laid dry and the heat of the flooring as applied is sufficient to bond them together.

J-M Asphalt-Saturated Fabrics are made of woven cotton, saturated with asphalt, to meet the specifications of the American Society for Testing Materials, the American Railway Engineering Association, the Federal Specification Board and the U. S. Bureau of Standards. Two types are manufactured, both of which find their principal application in built-up membrane waterproofing work. Type A weighs 4 oz. per sq. yd. before saturation and Type B, 5 oz. per sq. yd. Their respective strengths by the grab method are 50 x 50 and 70 x 70, though Type B is furnished with a strength of 80 x 80 on special order. Type B is sometimes used unsaturated. Both "A" and "B" are shipped in standard rolls of 58 linear yards, approximately 36" wide.

Aquadam

Aquadam is a black, elastic, tacky material for cold application, which is used to keep dampness out of masonry, hollow tile, etc. It forms a bituminous. damp-proofing envelope over the entire surface treated. It is also used as a coating for sides and back of cut stone to prevent discoloration due to alkali in the cement. Limestone, granite, marble and other cut stones—thoroughly coated with Aquadam—are protected from stain and penetration of dampness.

The best masonry or hollow tile construction cannot in itself be damp-proof. When dampness penetrates, it not only causes annoyance but creates an unsightly condition which means continued expense, because redecoration is no cure for damage. In buildings where the decoration is not important, a damp condition is often expensive for other reasons.

When properly applied to the inside of exterior walls before the plaster is put on, Aquadam acts as a permanent damp-proof film, occupying practically no space and yet wonderfully effective. Plaster adheres securely to it and there is no necessity for furring and lathing. Where furring and lathing are desired, however, it is important to coat the walls with Aquadam because, in addition to keeping out dampness, it also prevents the infiltration of air.

Aquadam should be applied in two coats, the first coat being allowed to penetrate the surface treated. before the second coat is applied. Covering capacities depend upon porosity and evenness of the surface but it is usually safe to estimate 1 gal. of Aquadam to 75 sq. ft. of surface for the first coat, and 125 sq. ft. of surface for the second coat. Aquadam is furnished in 1, 5, 25 and 50-gal. containers.

J-M Self-Healing Waterproofing Cement

J-M Self-Healing Waterproofing Cement is an asphaltic compound with a very low congealing point and a melting point of 125 deg. F.

Its use is restricted to certain kinds of waterproofing work because of its extremely viscous nature and its tendency to move readily under high temperatures.

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J-M Waterproofing on a spray loft

It is ideal for brine decks in packing-house hog-coolers and for waterproofing work between wood floors. On special order, this product may also be obtained with a melting point of 90 deg. F. Furnished in 500-lb. bbls.

J-M Standard Asphalt Waterproofing Cement

J-M Standard Asphalt Waterproofing Cement is a solid asphaltic compound, generally useful in waterproofing work and only slightly affected over a wide range of temperature.

This material is 99½% pure bitumen and contains no vegetable or other organic matter that will disintegrate or decay. It is superior because of the high-quality raw material used and the great care taken in preparation. Due to the purity of the natural asphalt used in this product, it possesses remarkable immunity to the action of acids, alkalies, brine and water.

Before applying this material, it is heated to a temperature of 450 deg. F., and mopped on while hot. One ton will cover approximately 3,000 sq. ft. of surface, ⅛" thick.

J-M Waterproofing Asphalt No. 6

J-M Waterproofing Asphalt No. 6 is a solid asphaltic compound sometimes used in waterproofing work. Because of its susceptibility to plastic deformation at relatively low temperatures, this material should not be used on high class waterproofing work, and must never be used where hydrostatic pressure will be encountered.

J-M Concrete Primer

J-M Concrete Primer is a scientifically compounded asphalt primer for non-combustible surfaces to afford anchorage for subsequent bituminous applications. The formula is based on years of experience and the primer is furnished ready for use with all ingredients properly processed.

The surfaces of concrete, gypsum, tile, brick, and stone ordinarily require a priming coat before asphalt will successfully adhere to the surface. J-M Concrete Primer counteracts the dust film and prevents moisture absorption before asphalt is applied. Gypsum or

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other porous surfaces require two coats of primer in order to assure positive results.

J-M Concrete Primer weighs approximately 8 lb. per gal. Its covering capacity depends upon the porosity of the surface treated. One gallon usually covers about 100 sq. ft. It is furnished in 1, 5, 25 and 50-gal. containers.

J-M Bitumen Enamel and Bitumen Solution

J-M Bitumen Enamel is an acid and alkali-resisting solid asphaltic material for the protection of metal and concrete surfaces which are subject to corrosion from air or aqueous solutions. It is made to comply with U. S. Navy Specification 52 B-10 and has a covering capacity of approximately 200 sq. ft. per 100 lb. applied 1/16″ thick. Furnished in 400-lb. drums.

J-M Bitumen Solution is a quick-drying asphaltic liquid, used as a primer for Bitumen Enamel or any other asphaltic material which is to be applied to metal and concrete surfaces. It is made to comply with U. S. Navy Specification 52 B-10 and has a covering capacity of approximately 200 sq. ft. per gal. Furnished in 25 and 50-gal. drums.

Bitumen Solution and Bitumen Enamel have been extensively used by the U. S. Navy Department for years, and have proved highly successful on car floats of the New York Central and Santa Fe Railroads. They have been used on metal work in holds and false bottoms of ships as protection against bilge water and on inside surfaces of steel barges, water tanks and settling tanks. Other applications have included protection of water seal tank tops, structural steel work in sewage plants and in dams, dry docks and steel lock gates for canals and the inside of all types of sewage pipes. As an inside coating on steel coal hoppers, these two materials prevent disintegration from the action of the sulphuric acid in wet coal.

Application:

Metal surfaces to be coated should be weathered and thoroughly cleaned of rust, scale, dirt, oil or grease. Steel should be sandblasted or hammer-scaled if necessary, and a wire brush should be used on the entire surface for final cleaning. One coat of Bitumen Solution is applied cold to the clean steel with No. 10/0 Ship Bottom Brushes. Work on vertical surfaces is started at the top. In the case of car float compartments or similar equipment, the ceiling coat can be applied two or three hours after the walls are completed. The overhead work is done from the floor with brushes wired to long poles so that the men do not stand directly under the work.

Care must be taken that the solution is not applied to a damp surface. In locations where the brush cannot be handled well, spraying the solution is more satisfactory than brushing. If applied over graphite or red lead and oil paint, the Bitumen Solution will streak to some extent, but after it dries, Bitumen Enamel can be satisfactorily applied.

After the Bitumen Solution has dried 36 to 48 hours, Bitumen Enamel is heated to 450 deg. F. and is applied with Bituminous Daubers, Type No. 175. On vertical surfaces, the enamelers start work from the bottom and work up to the height they can reach from a standing position. The first stroke is across at the very bottom and the rest of the strokes are up and down. When the fumes get too strong in enclosed places, it may be necessary to alternate the work. The top section of the walls and ceilings is done from scaffolding. The ceiling can be started 24 to 36 hours after the walls have been completed.

Brushes and daubers can be secured from W. E. Warner & Co., 136 Center St., New York City.

J-M Asbestos Fibrous Enamel

J-M Asbestos Fibrous Enamel consists of asphalt, asbestos fibre and pigment, thinned to the proper consistency with volatile solvent. It forms a moisture- and weather-resisting protective coating which is tenacious, durable, elastic and free from pores. The material will not run or check in hot weather, or crack in cold weather.

Application is easy on both horizontal and vertical areas. The enamel should be applied in two coats to clean, dry surfaces free from rust, scale, and dirt. In cold weather, it should be placed in a warm room and brought to a temperature of 65 to 75 deg. F. prior to use. Thinning should be avoided and only resorted to when absolutely necessary, in which cases gasoline only should be used.

Asbestos Fibrous Enamel is furnished in red or black, and in two consistencies—ground and unground, the essential difference being in the fibre length. The ground material has a covering capacity of approximately 150 sq. ft. per gal. and the unground material 90 to 100 sq. ft. The black color should be used wherever possible. Shipments are made in 1, 5, 30 and 55-gal. containers.

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Mopping-in J-M Asbestos Waterproofing Felt

J-M Pickling Tank Cement 150

J-M Pickling Tank Cement 150 is an asphaltic compound for use principally in lining the inside of wood or concrete tanks where an acid-resisting coating is necessary. It is sometimes used for flooding inaccessible areas in tanks as a protection against acids. The melting point is 212 deg. F., although a softer material can be furnished if desired, with a melting point of 175 deg. F.

In lining wood tanks, Pickling Tank Cement is used to coat the tongues and grooves of the boards when the tank is being built, and the boards are tightly drawn together and held in place permanently by wooden dowels. After the tank is erected the inside is primed and given from two to four coats of Pickling Tank Cement. It is then immune to all the cold commercial acids, including hydrofluoric.

In applying, the cement should be heated in suitable kettles and brought to a temperature of not more than 450 deg. F., stirred constantly, and then mopped on the surface while hot. J-M Pickling Tank Cement 150 is furnished in 450-lb. drums.

J-M Acid Tank Cements

(Special Products)

In addition to J-M Pickling Tank Cement 150, Johns-Manville manufactures a line of acid-resisting asphalt cements useful on concrete or steel tanks in many industries.

J-M Acid-Resisting Compound is an asphaltic compound containing silica as a filler. It has a melting point of approximately 140 deg. F. and is applied hot over a priming coat. It is used on walls and tanks both as a water-resisting and an acid-resisting material.

J-M Acid Tank Cement No. 2180 is a plastic composition of about the same consistency as J-M Ready-Mixed Asbestile. (See "Roofing and Shingles" Section.) It consists of an acid-resisting asphalt base combined with fine mineral filler and asbestos fibre. It is applied over J-M Acid Tank Cement Primer No. 2187. Usually more than one coat is required and at least 48 hours are necessary between coats for proper drying. When properly applied and thoroughly

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dried this product gives a coating which will meet the acid conditions usually encountered in electrolytic copper refineries.

J-M Acid Tank Enamel No. 2181 consists of blended asphalts having a penetration at 77 deg. F. of between 15 and 20 and a melting point of approximately 225 deg. F. It is applied hot to concrete and steel tanks which have previously been primed with J-M Acid Tank Cement Primer No. 2187. This compound is suitable for water storage tanks and is resistant to diluted mineral acids.

J-M Acid Tank Enamel No. 2182 is similar to No. 2181 except that it contains approximately 20% of acid-resisting mineral filler and fibre. It is applied and used in the same way as No. 2181 but will resist somewhat higher temperatures.

J-M Acid Tank Cement Primer No. 2187 is composed of an acid-resisting asphalt compound thinned with motor gasoline to suitable consistency for application. It is used as a primer for Nos. 2180, 2181 and 2182.

J-M Bituminous Putty

J-M Bituminous Putty is an asphaltic compound, containing volatile solvent and asbestos fibre, and used as a filler and flashing to prevent the infiltration of water in recesses where a permanent seal is hard to maintain with Standard Asphalt Waterproofing Cement. It forms an elastic bond which is but little affected by temperature change and vibration and therefore finds application in sealing bridge waterproofing membranes to the sides of the girders.

J-M Expansion Joint Filler

J-M Expansion Joint Filler is a carefully treated asphaltic compound of great ductility and tenacity, used principally for pouring expansion joints in construction work of every character. The material is heated to a temperature of 450 deg. F. and care exercised in pouring, especially in large volume, or in the presence of dampness which might cause honeycombing.

J-M No. 40 Tank Top Cement

This material is a viscous, oil-resisting compound which is thinned to proper consistency with denatured alcohol, and applied to porous surfaces to prevent or retard oil and water penetration. It is a specialized product, principally used in the oil industry. Supplied in cans or drums as required.

J-M Red Tank Top Putty

This is a semi-solid mineral compound used for pointing up and sealing in specialized waterproofing and oil-proofing work in the oil industry. Supplied in cans or drums as required.

J-M Asphalt Brick Filler

J-M Asphalt Brick Filler is an asphaltic compound very similar to Expansion Joint Filler, possessing a great measure of tenacity and ductility. It is used chiefly for the pouring of joints in brick or block paving, or for repairs to concrete roadways where the concrete has cracked. This material resists the abrasive action of wheel traffic and prevents cracking and chipping of the blocks.

It is waterproof and remains sufficiently ductile at low temperatures to take care of any movement in the pavement. At high temperatures it is sufficiently stable not to flow to low points in the pavement. Under proper construction conditions, cracking or crowning is prevented and long wearing qualities of the pavement are assured.

J-M Resisto Compounds

Resisto compounds are used for protecting insulation or insulation construction, metal, tile, brick, masonry, wood, etc., where the temperature is not in excess of 250 deg. F. The group includes Resisto Putty, Resisto Primer, Resisto Wood Primer and Resisto Paint.

Although these materials may be used for exterior work, they are most useful in interior finishing and sealing, where the humidity is high or where acid fumes are present.

As there is a great variety of acid fumes, and the action of such fumes depends very largely on temperature, the amount of moisture present and other factors which vary, the Resisto Compound being considered should be tested by applying it to some of the material which it is to protect and placing it under the same conditions it will be subjected to in service, and noting the results.

A few uses for these Resisto Compounds are:

Dryer room walls	Paper machine hoods
Dry kiln walls	Can dryer housings
Breechings, flues and gas ducts	Vulcanizing press housings
	Tentering frame housings

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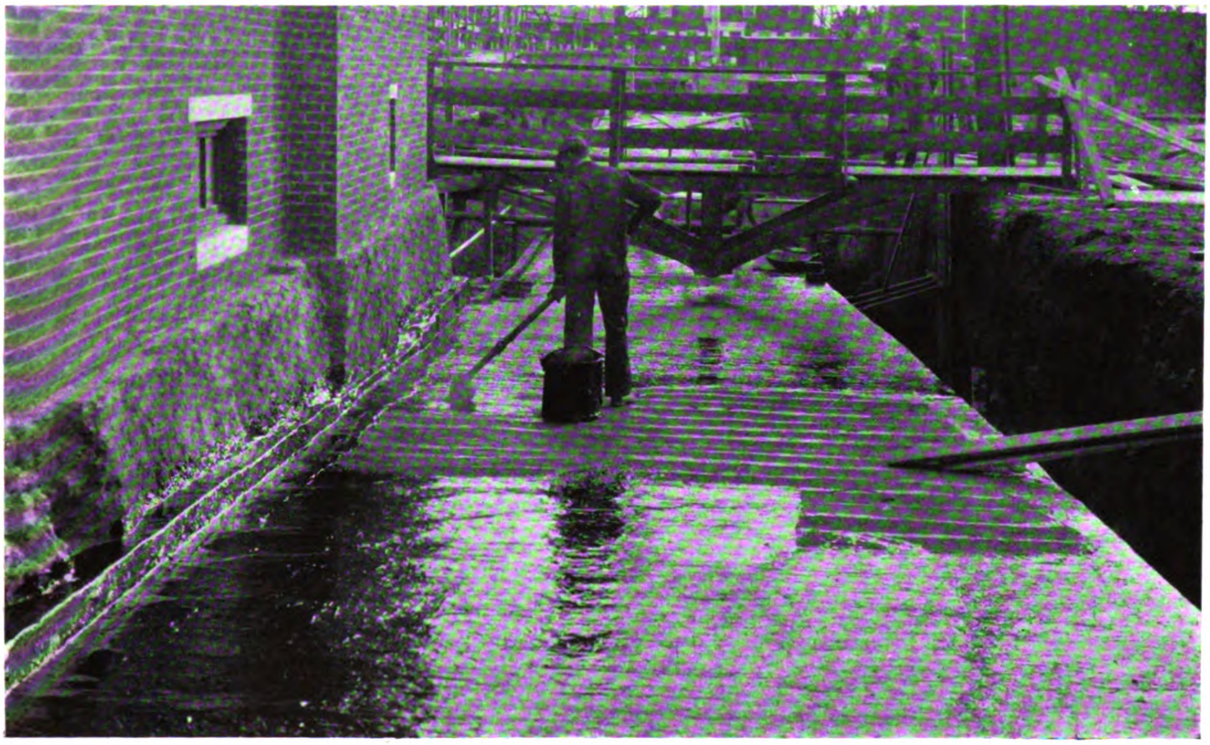
Resisto Putty: Used primarily as a filler for cracks and holes and also for filleting corners, sealing holes over bolt heads, etc. It is essential that surfaces to be sealed be first prepared with a priming coat of Resisto Primer or Resisto Wood Primer. The Resisto Putty is easily applied with a trowel or putty knife. 100 lb. covers 200 to 220 sq. ft., 1/16″ thick. Weight approximately 12 lb. per gal. or 90 lb. per cu. ft. Furnished in 10, 50 and 500-lb. containers.

Resisto Primer: Used as a priming coat before the application of Resisto Putty. It is also recommended for priming most surfaces, with the exception of wood, before the use of Resisto Paint. The covering capacity varies from 100 to 175 sq. ft. per gal., depending upon the condition of the surface. Weight approximately 7.5 lb. per gal. Easily applied by means of a brush. Shipped in 1, 5 and 50-gal. containers.

Resisto Wood Primer: Used on wood surfaces only, as a priming coat before Resisto Paint or Resisto Putty is applied. It must be allowed to dry 24 hours before the application of a second coat or the finishing coat of Resisto Paint or Putty. The covering capacity varies from 125 to 150 sq. ft. per gal., depending upon the porosity of the wood. Weight approximately 7.5 lb. per gal. Easily applied with a brush. Shipped in 1, 5 and 50-gal. containers.

Resisto Paint: May be applied directly to cast iron or porous surfaces such as brick and rough surface tile, but when applied to surfaces with a smooth or glazed finish a preliminary application of Resisto Primer or Resisto Wood Primer is essential. Resisto Paint has a covering capacity of approximately 90 sq. ft. per gal. Weight about 10 lb. per gal. Its consistency allows very satisfactory brush application. Shipped in 1, 5 and 50-gal. containers.



J-M Waterproofing on sidewalk vault, Media County Court House, Media, Pa.

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Aertite Coating

Aertite Coating is a tough, rubbery asphaltic asbestos coating in plastic form for covering the outside of boiler walls to prevent the infiltration of cold air into the combustion chamber where the temperature on the Aertite does not exceed 250 deg. F. When a positive pressure is carried in a boiler, Aertite will prevent furnace gases and dust from blowing out into the boiler room.

Suction in a boiler, caused either by induced or natural stack draft, draws the cold outside air through the cracks. This air leakage impairs combustion and also reduces the temperature of gases which are used for generating steam.

Aertite Coating, applied to the outside of the boiler wall, eliminates air infiltration by providing a coating over the entire boiler setting which remains air-tight because of its adhesive and ductile qualities.

It is conservative to estimate that if air leakage through boiler walls amounts to 5% of the actual quantity of air required for proper combustion and high efficiency, 1% of the fuel burned is wasted. However, as leakage often exceeds 50%, instead of 5%, fuel wastage is correspondingly greater. A test made at one of the largest power plants in New York City showed the following increases in carbon dioxide by the use of Aertite:

> Per cent of carbon dioxide in flue gases taken from back of first baffle—13.5% increased to 13.8%.
>
> Per cent of carbon dioxide in flue gases taken from back of second baffle—11.6% increased to 13.5%.

This shows that the amount of CO_2 was increased 2¼% after gases had passed the first baffle and 16.4% after gases had passed the second baffle, and that the application of Aertite reduced air leakage to such an extent that the quantity of carbon dioxide in the flue gases back of the second baffle was about equal to the quantity back of the first baffle—which means practically no loss due to air infiltration.

Application of Aertite Coating:

Before applying Aertite, the boiler walls are thoroughly wire-brushed. Openings around doors and all large wall cracks are filled with J-M No. 4202 Asbestos Wick and J-M No. 20 Plastic Refractory Cement. The Aertite is troweled on the outside to a thickness of approximately 1/16″. If it has partially dried, a small amount of gasoline may be added. In applying, a rag saturated with kerosene is handy for keeping the trowel clean.

To determine leakage, a square of cardboard, pierced with a small hole and fastened to a wood frame, may be pressed against a boiler wall and the edges temporarily sealed. The inrush of air through the hole shows the leakage.

Aertite is black in color, but after 10 days it can be painted with aluminum paint. If some other color is desired, the Aertite should first be painted with aluminum paint and the other color then applied.

Aertite is furnished in 25, 50, 150, 300 and 500-lb. containers. The quantity to cover 100 sq. ft. depends upon the number and variety of cracks and the way the wall has been pointed up. For a coating of 1/16″ thickness, it will take 25 to 40 lb. per 100 sq. ft. of boiler wall surface.

In addition to its primary use as a boiler wall coating, Aertite is often used in other locations for miscellaneous sealing against dampness, air and moisture. It is also widely used as a weather-proofing over insulation on heated equipment such as oil stills, towers, etc., in which cases the insulating cement finish is first primed with J-M Concrete Primer. Aertite is well adapted for use in connection with insulation on refrigeration equipment.

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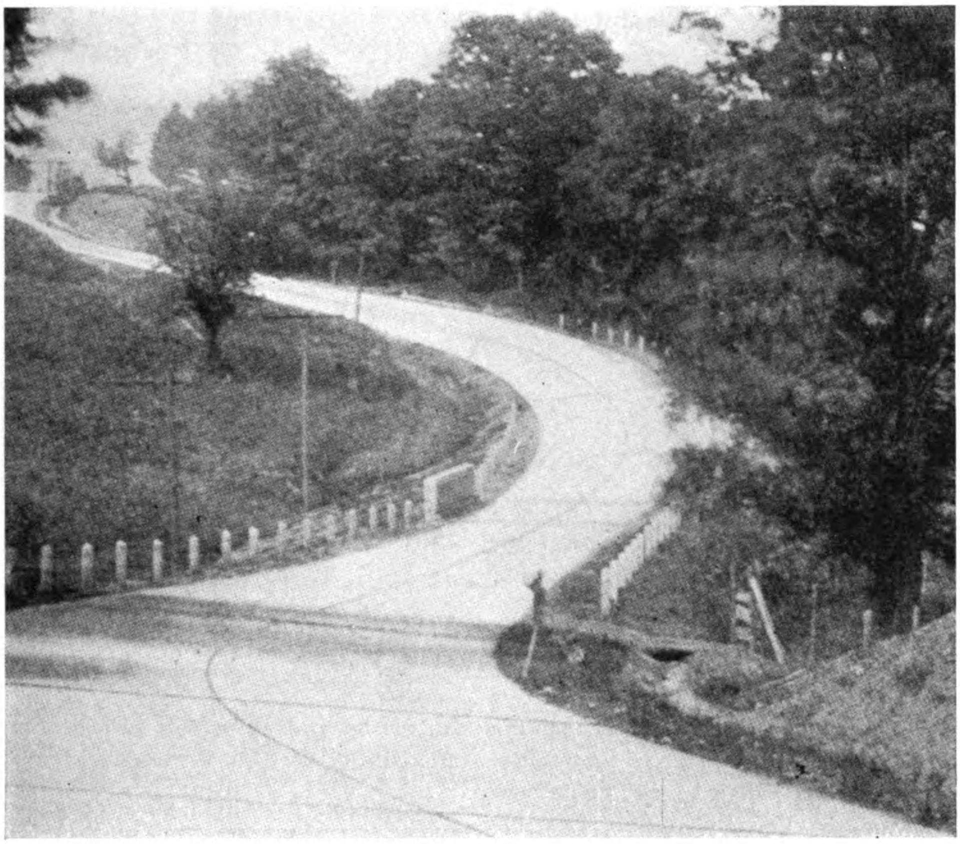
J-M Preformed Expansion Joints



A and R Expansion Joints minimize the expense of maintaining concrete highways

J-M Preformed Expansion Joints consist of strips of bituminous composition designed to accommodate the constant changes in size of pavements, walls, reservoirs, sidewalks, floors, dams, swimming pools, and the like, resulting from variations in temperature and moisture.

Johns-Manville A and R Expansion Joint is a composition of rubber to provide elasticity, asphalt to preserve the rubber and lend life to the joint, and fibre to reinforce the mass and permit easy handling. This superior type of joint is available at a price comparing favorably with ordinary preformed bituminous expansion joints. It is furnished in slab form or cut to size, and in thicknesses of 3/8″, 1/2″, 5/8″, 3/4″, 7/8″ and 1″. Other thicknesses on special order.

J-M Felt-Sided Expansion Joint is a widely used product composed of a bituminous core, principally asphalt, confined between two sheets of felt. Felt-sided expansion joint provides for expansion but it does not possess the faculty of recovering thickness after compression. Neither does it resist displacement, being non-compressible within itself. It is furnished in slab form or cut to size, and in thicknesses of 1/4″, 3/8″, 1/2″, 5/8″, 3/4″, 7/8″ and 1″. Other thicknesses can be supplied on special order.

Probably paving work offers the best illustration of expansion joint applications. One mile of concrete road under an annual temperature change of 135 deg. F., will vary in length about 47″ from temperature change alone, based on a coefficient of expansion of 0.0000055. Furthermore, many authorities are of the opinion that moisture variation causes greater change in volume than temperature variation.

A and R type joint is only slightly displaced when the concrete is expanding, recovers thickness after being compressed, retains its life indefinitely without

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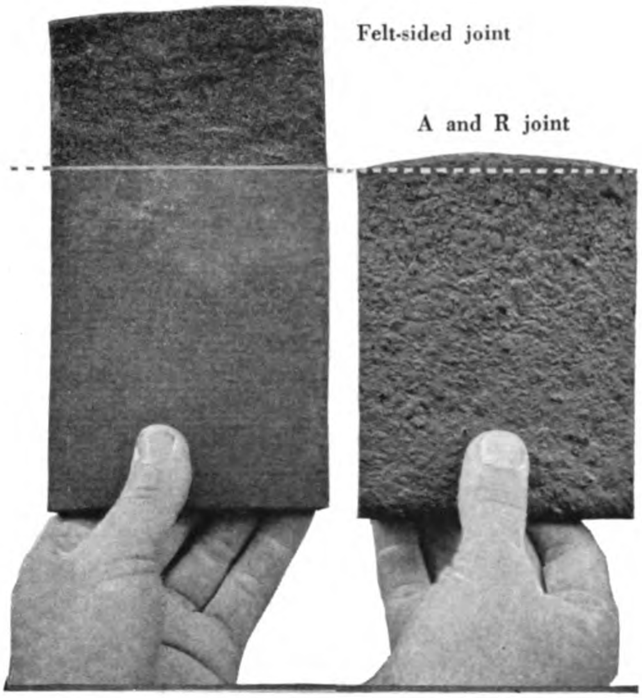


Comparison of A and R (right) and felt-sided expansion joint. Both were the same size before being compressed as they would be in service

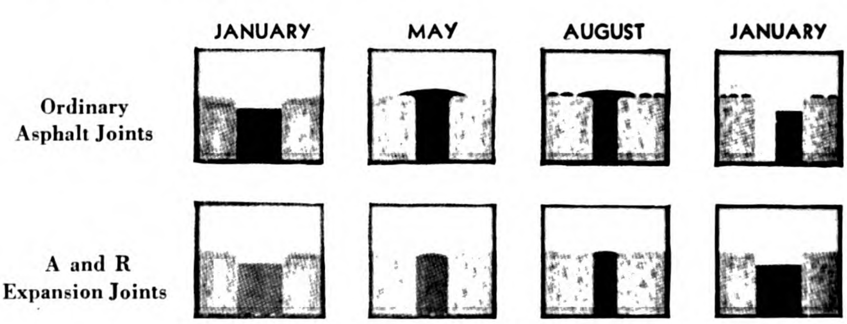
The A and R joint returned to its original thickness, while the felt-sided joint was permanently deformed

maintenance and bonds to the concrete better than the felt-sided type. A material percentage of the asphalt core of the felt-sided joint will be displaced as concrete expands during the summer months. This displaced asphalt core is battered down by traffic, spread on the surface of the road and never returns to the space between the slabs of concrete. Maintenance becomes necessary, or the void space left by concrete contracting away from the joint in cool weather will permit water to enter and will fill with dirt and become a solid.

Some difference of opinion exists as to the proper thickness and spacing of expansion joints, but generally, the use of ½″ thick joints at intervals of 30 ft., or the equivalent, will provide for conditions in all parts of the United States.

Expansion Joints are placed transversely in pavements and curbs at predetermined intervals. They are also placed longitudinally through the center area and along the curbs in wide pavements and streets.

In applying either type of preformed expansion joint, it is important that the joint be placed vertically and at right angles to the direction of expansion. During installation, the expansion joint strip is supported by a channel cap or bulkhead, which is later removed. Material specifications and full application directions are available in special data sheets.



From January to January in the life of a highway expansion joint

Underground Pipe Protection

The oil and gas industries have long realized the great annual loss occasioned by corrosion of pipe lines. Corrosion shortens the life of the line, makes necessary costly repairs and causes loss of operating revenue during shutdowns for reconditioning.

The extent of underground corrosion varies with the location. In some places, it is so rapid that protection of the line is absolutely essential for any reasonable life. Even where conditions are less severe, the economy of suitable protection is generally recognized, since reconditioning cost is from three to eight times that of protection applied when the line is first laid. With proper initial protection, a satisfactory physical life is assured.

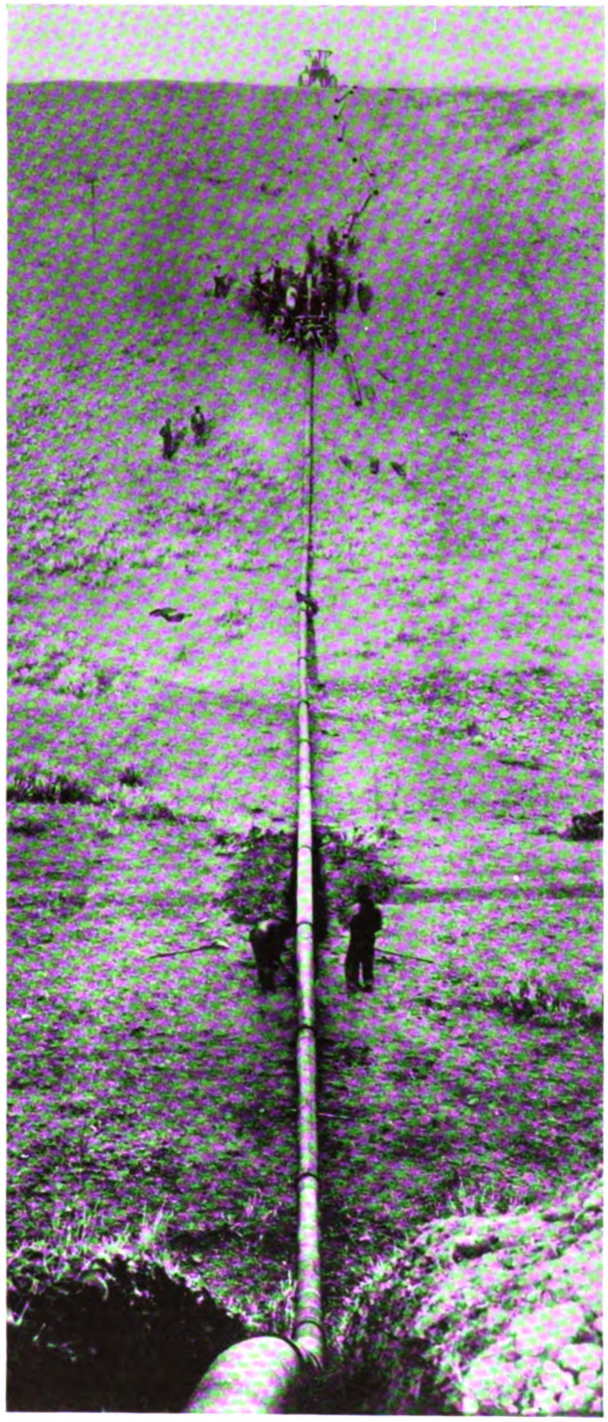
While there is a diversity of opinion as to the underlying causes of corrosion, it is agreed that the major objectives in underground pipe protection are to maintain the exterior surface of the pipe dry and free from contact with the soil. With these two requirements adequately met, electrolysis and the corrosive action of soil moisture in combination with alkalies and organic acids, are prevented.

Secondary, yet equally important, considerations are to relieve the pipe protection from soil stress, the "accordion" movement of soil when alternately wet and dry, which tends to draw a coating from the pipe; and also to prevent any distortion or rupture of the coating through movement of the pipe, settlement of the trench fill and other natural causes.

A very small amount of water in the soil, through the promotion of chemical reaction, will seriously reduce the useful life of the pipe. Soil apparently dry may not actually be so, or it may not stay dry. Ditch digging, irrigation, and natural changes in drainage near the pipe line frequently alter moisture conditions. Soil disturbed by trenching is more permeable, and the trench itself tends to become a drainage ditch. In certain areas, floods and changes in river courses affect soil moisture conditions rapidly. The best pipe line protection is that which will keep water away from the metal permanently.

Requirements of Underground Pipe Protection:

To seal the pipe surface effectively against moisture, a protecting medium must be used which is chemi-



J-M Asbestos Pipe Line Felt assures enduring protection for underground pipe lines

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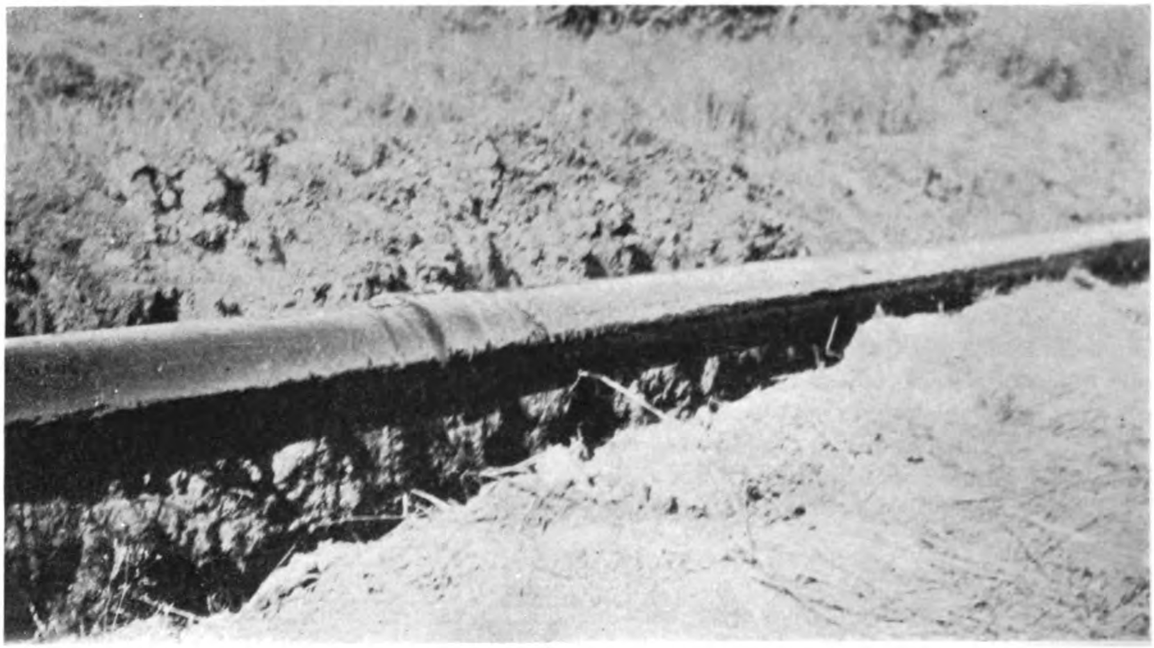

A protected line ready to be lowered into the ditch

cally inert, insofar as its effect upon the pipe is concerned, and which is also proof against disintegration from age, soil bacteria, water and soil acids or alkalies. It must be incapable of diffusion into the soil and must remain unaffected by temperature changes.

The protecting medium must have dielectric strength sufficiently high to withstand stray currents, which would cause electrolysis. It must remain in close contact with the pipe and be strong enough to resist soil stress, especially in those sections of the country where clay predominates, because wet earth tends to pull protective coatings from the pipe. The material used must be sufficiently tough to withstand tear or abrasion when the pipe is lowered into the trench. It must also stand up under possible pipe movement in soil containing stones, sharp gravel, etc., and all of these qualities must be maintained indefinitely.

J-M Underground Pipe Protection:

For a number of years it has been the practice among many of the leading pipe line operators to protect their lines with J-M Asbestos Pipe Line Felt wrapped over a bituminous application of an asphaltic, paraffin or coal-tar base—the felt being furnished impregnated with the same material as the coating.

The felt is wrapped either "bonded" (adhering to the coating)— or "unbonded" (distinct from the coating beneath). In a bonded wrapping the wrapper becomes a substantial reinforcement for resisting distortion of the bitumen and increases the waterproofing properties of the protection. The virtue of the unbonded job is in the wrapper taking the strains of soil stress, without disturbing the waterproofing beneath. Some soil conditions demand a combination of both the bonded and the unbonded application.

The value of J-M Asbestos Pipe Line Felt has been proved over many years by the satisfactory protection it has given to thousands of miles of gas and oil lines. It offers the following advantages:

1. The waterproofing is positive. In combination with the bitumen it completely seals the pipe surface, giving it a monolithic waterproof armor.
2. Of mineral base, with no organic constituents, J-M Asbestos Pipe Line Felt is highly resistant to soil chemicals, water or soil bacteria.
3. Unlike animal or vegetable fibres, asbestos fibres are non-tubular and so do not permit capillary action.
4. The electrical resistance of bitumen combined with asbestos is well in excess of the maximum require-

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ments for protection against any stray currents.

5. A built-up protection of bitumen and J-M Asbestos Pipe Line Felt is tough enough to resist soil stress and the abrasive action from trench settlement and pipe movement.
6. Bitumen is not soluble and is chemically and electrically inert, and asbestos is virtually indestructible. For over thirty years asbestos felt has been used with great success as reinforcement in subsoil waterproofing.

Methods of Applying Underground Pipe Protection

A traveling type cleaning and priming machine in operation—(Photograph through courtesy of the W-K-M Co.)

Hand labor alone was used for a number of years in the application of pipe line felt. The felt was wrapped in one of three ways—the "straight-away" method, wherein one piece of felt, about 40 ft. long and slightly wider than the circumference of the pipe, was wrapped longitudinally; or the "circumferential sheet" method; or spirally, in narrow widths.

Yard Wrapping:

Subsequently yard wrapping was developed, first by simple home-made devices for turning the pipe and later by using a specially designed stationary machine wherein the pipe was fed to the machine and automatically coated and wrapped. Yard wrapping is done at some central distributing point on the operating company's property and is used by gas companies and others owning systems that call for much small-diameter pipe or comparatively short stretches of pipe of larger diameter.

Mill Wrapping:

Mill-wrapping was developed by Hill-Hubbell & Company for furnishing a means of wrapping at the pipe mill, sizes from ½" to 26". The pipe protection is finished with Kraft paper, and the pipe secured in bundles on gondola cars and shipped to the field, where the joints in the assembled line are coated and wrapped.

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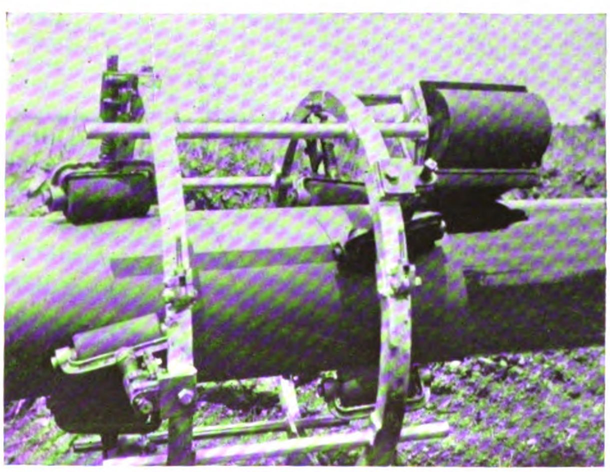
A train load of protected pipe

Machine Wrapping in the Field:

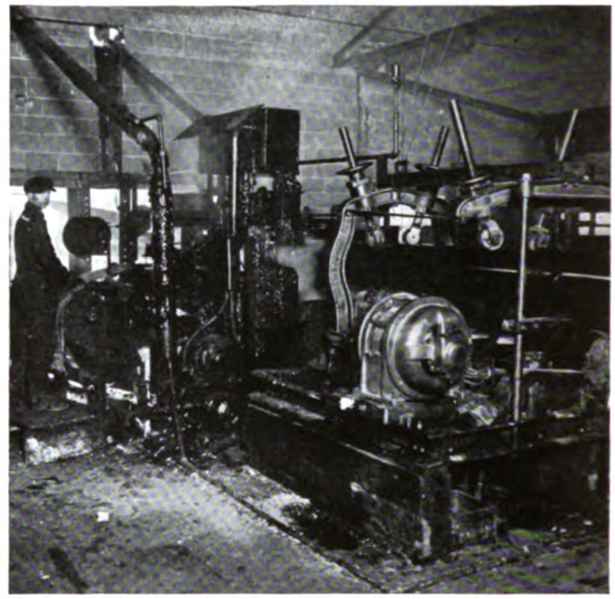
For long pipe lines constructed under ordinary conditions, and for the reconditioning of lines, there has long been a demand for a traveling machine which would wrap pipe better and faster than by the usual hand labor, and at less expense.

Johns-Manville and the W-K-M Company developed a rotary machine which travels on the pipe, is easy to operate and does a uniformly high-grade job of wrapping at the rate of 15 linear feet per minute. This machine has long since passed the experimental stage and many hundred miles of 4″, 8″, 10″, 16″ and 20″ pipe have been successfully wrapped with this piece of equipment.

The machine not only gives a far better, tighter job with a uniform lap not obtained by hand wrapping, but it does it much faster and at considerably less cost. The wrapping of a mile to a mile and a half of pipe per day is readily possible—with only two pairs of men alternating at the machine.



J-M—W-K-M Rotary Type Field Wrapping Machine



Mechanical spiral wrapping machine for mill wrapping. Applying the asbestos felt to the bitumen-coated pipe

For lines with patented couplings, a similarly constructed saddle type machine is used.

Description of J-M—W-K-M Machines:

Rotary Type: This type consists of circular angle-frames carrying a roll of felt, the entire load being supported on spring-mounted rubber rollers with ball bearings. These rollers serve the purposes of supporting the frame, determining the travel of the machine, and ironing out all wrinkles in the felt as it is wrapped on the pipe. They are located so that they ride only on the wrapped part of the pipe, without touching the bituminous coating ahead.

The machine can be readily and quickly put on or taken off the line, as the frame is split and hinged for disassembling. It weighs approximately 400 lb. complete and is easily operated by a two-man crew. The felt is usually applied with a 1″ lap, and the machine progresses at the rate of 15 ft. per minute.

It is customary to have one machine for every line gang, usually one to every fifty-mile section to be wrapped. These machines wrap a bonded or an unbonded job with equal facility.

Saddle Type: This machine is virtually the upper half of the rotary type machine. It is not spun on the pipe, but the pipe is rotated under it by a

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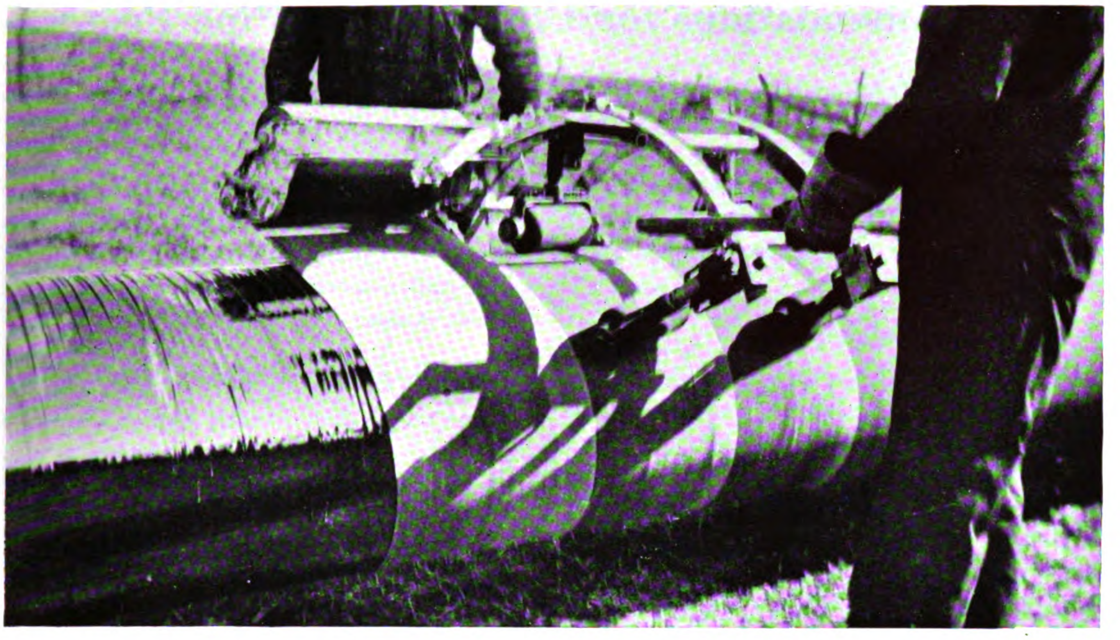

The J-M—W-K-M saddle type field wrapping machine for lines with patented couplings. The pipe is rotated by a rolling rig and the machine rides along the pipe

"rolling rig," and the machine rides along the pipe.

Rotary or saddle machines may be licensed on a nominal rental basis from either Johns-Manville, the W-K-M Company at Houston, Texas, or the Pipe Line Service Corporation, Chicago.

Application of the Bitumen:

Application of the bitumen coating in the field is by the usual method of "ragging," except when the saddle type machine is used. A canvas strip about eighteen inches wide is held under the pipe, the hot bitumen is poured on top of the pipe, flows around the surface, and two men, one on each end of the rag, work it back and forth under and along the pipe surface. When the saddle machine is used, the bitumen is applied through a metal shield on the machine.

For a bonded job with the rotary type machine, the machine follows closely behind the application of the hot bitumen so that the Asbestos Pipe Line Felt is "ironed" by the rollers into the bitumen while the latter is still fluid.

If a high melting point enamel is used for the coating and an unbonded felt wrapping is used to protect it, the asbestos felt is machine-wrapped as soon as the enamel has hardened. The same procedure is followed if a cold asphalt paint or grease compound is used for the coating. If an emulsified asphalt coating is to be protected by an asbestos wrapping, it is necessary to await the initial dehydration of the emulsion before applying the felt.

"Ragging" the line

J-M Recommendations for Underground Pipe Protection

The general recommendation for the protection of underground pipe lines is first to establish a thoroughly waterproof structure of asbestos felts and properly processed bitumen. For conditions of exceptional soil stress, a waterproofing structure of satisfactory life can be assured by supplementary unbonded felts.

Condition of Pipe Surface:

It is absolutely essential that the pipe be thoroughly cleaned prior to the application of any protection. This means not only the removal of all grease and dirt, but also of all loose and fixed mill scale, which is conducive to localized corrosion and pitting. If the pipe has not been properly cleaned at the mill it must receive this treatment in the field by some mechanical means such as that afforded by the W-K-M Cleaning and Priming Machine. In reconditioning of old lines in the field, a machine of this type is, of course, invaluable.

Field Wrapping—Standard Bonded Job:

1. The pipe is thoroughly cleaned and primed.
2. When primer has dried, the hot coating is applied by "ragging." For a bonded job the bitumen coating should be of such nature that it will not harden before the felt can be wrapped into it—otherwise an unbonded job will result.
3. The spiral wrapping of J-M Asbestos Pipe Line Felt follows immediately and is applied by the Johns-Manville—W-K-M Rotary Type Machine.
4. Hot coating is applied to the exterior of the felt, by "ragging."

Additional Protection: For tide-water soil, river crossings and cinder fill, two additional wrappings of J-M Asbestos Pipe Line Felt are added, with hot bitumen applied between the felts and on the exterior. Extremely abrasive conditions can be met by applying over the waterproofing a casing of J-M Transite Asbestos Pipe—plain ends—split lengthwise and secured with non-corroding wire or corrosion-resisting Signode straps.

Field Wrapping—Standard Unbonded Job:

Same as standard bonded method, except that the high melting point bitumen or enamel is allowed to dry or harden before wrapping the felt, and there is no coating applied to the exterior of the felt. In this case the felt acts as a protective casing to take the soil-stress.

Field Wrapping—Lines with Patented Couplings:

For lines with Dresser couplings, etc., the above recommendations for field wrapping apply, except that the pipe is turned (by hand or motor) beside the trench, and the pipe wrapped by the Johns-Manville—W-K-M Saddle Type Machine. The bitumen is applied through a metal shield spreader on the machine.

Yard Wrapping—Mill Wrapping:

The foregoing recommendations for the field application of a bonded job are applicable to yard and mill wrapping, except that it is customary to apply a layer of Kraft paper over the outer bitumen coating, in order to prevent the pipe sticking together during storage and transportation.

INDEX

Electrical Materials

(*For complete list of data sheets, see other side of this page*)

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Electrical Materials

Complete List of Data Sheets Available

Brochure

J-M Service to the Electrical Industry (Asbestos Ebony, Transite, Electrobestos), 20 pp. $8\frac{1}{2}$" x 11", form EL-1A

★Catalog pages

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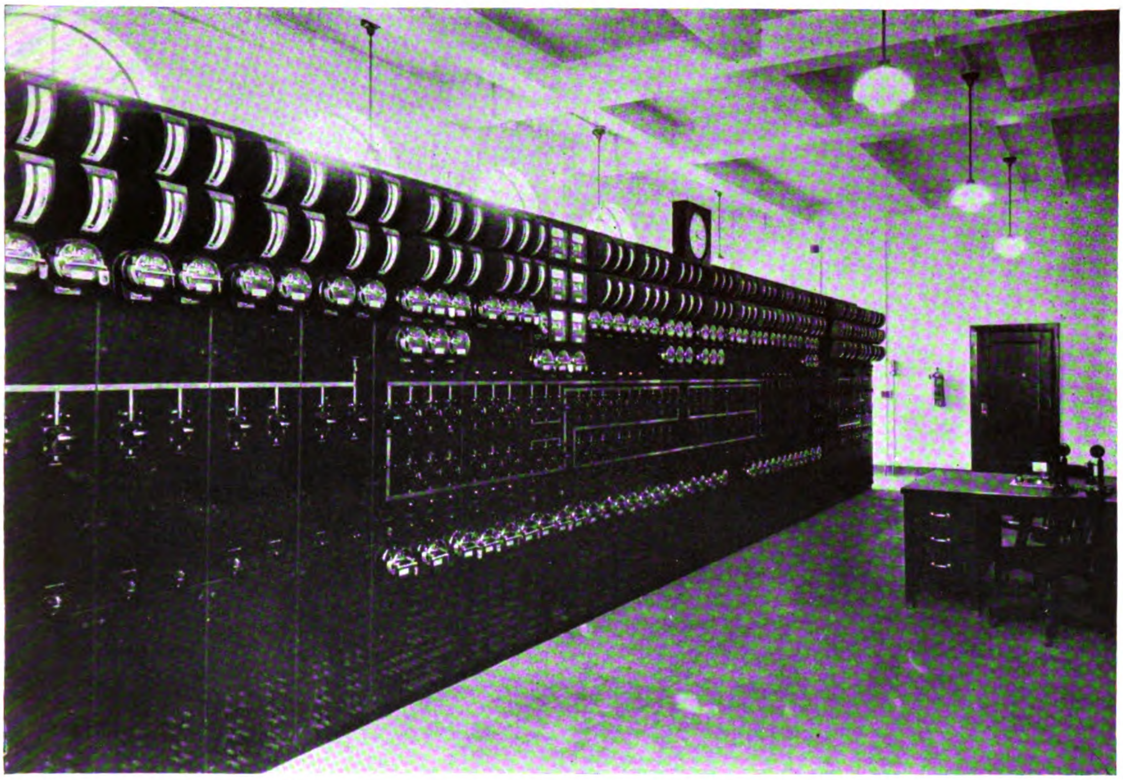
Asbestos Ebony



Asbestos Ebony panel board at Smith St. Substation of the Westchester Lighting Company, Port Chester, N. Y.

J-M Asbestos Ebony is an ideal electrical insulation, ebony-like in appearance, which is employed for switchboards, controller plates, switch bases, bus-bar supports, etc. It is purely a mineral product, composed of asbestos fibre and binding cement, bonded under tremendous pressure, impregnated with a special insulating compound, and capable of enduring severe conditions. Because of its structure, it will withstand shock and vibration, is unaffected by rapid temperature changes, will not shrink, crack or buckle, and is uniform in texture throughout. It is extremely durable, actually becoming stronger with age.

J-M Asbestos Ebony has a specific gravity of about 2.05 and weighs approximately 128 lb. per cu. ft. The safe working temperature limit of Asbestos Ebony is about 300 deg. F.

Advantages of J-M Asbestos Ebony:

High Dielectric Strength and Insulation Resistance: The dielectric strength of Asbestos Ebony, 1" thick, is 52,500 volts, and its D. C. insulation resistance is 4,000,000 megohms per inch cube. High dielectric strength and insulation resistance are assured at all times because of the absolute uniformity of the material.

Immunity to Moisture: Asbestos Ebony may be safely relied upon as an ideal insulator in damp locations. After six hours of sea water immersion, followed by rinsing, a drying period of eighteen hours and six hours of exposure to steam vapor, megger readings on either side average 220 megohms. The United States Navy specifies that a material which shows a reading of 25 megohms after such exposure is acceptable for use on naval vessels. The superior insulating qualities of Asbestos Ebony are therefore apparent.

Light Weight: The relatively light weight of Asbestos Ebony compared with other materials for similar purposes not only results in lower transportation

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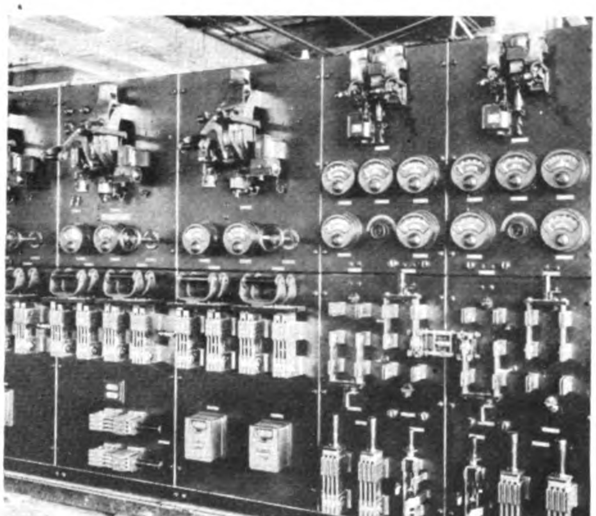
and handling costs but also in many cases will permit of lighter framework.

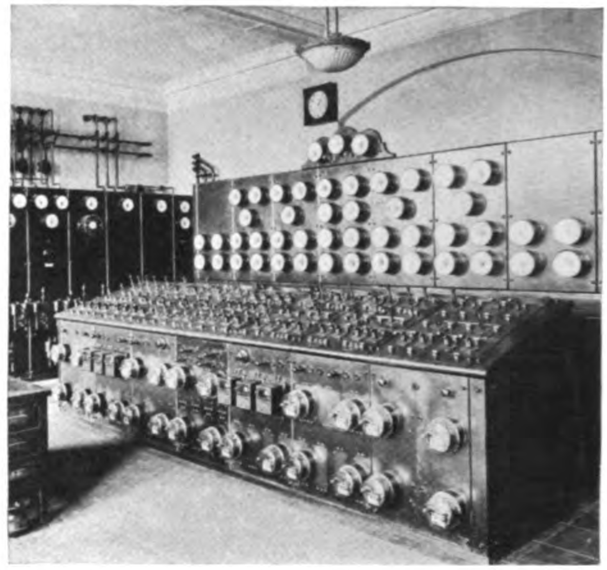
Workability: The machining operations necessary to prepare Asbestos Ebony for erection or assembly are rapidly and easily accomplished. Drilling, machining, etc., are executed without the breakage that attends such operations when performed on more brittle materials. Detailed instructions for machining, drilling, finishing, etc., will be furnished on request.

Strength and Durability: Asbestos Ebony in the standard thicknesses regularly utilized in electrical construction, combines a generous margin of safety in tension or compression with the ability to withstand shock and vibration that is inherent in a fibrous material. The practical demonstration of this faculty is found in the use of Asbestos Ebony aboard U. S. Naval vessels, where the shock of broadside firing must be absorbed without cracking or fracture. Also, the opening and closing of heavy automatic switches, relays, and circuit breakers often occur in a manner that communicates the resultant vibrations either directly or indirectly to panels and bases of this material.

Asbestos Ebony is comparatively light, but it is dense, uniform, monolithic. There are no laminations



After engine-room switchboard, U. S. S. Lexington, installed by General Electric Co. Moist atmosphere and the repercussion of gun fire have no effect upon this board of Asbestos Ebony



Asbestos Ebony meter board at Bureau of Power and Light, Dept. of Public Service, City of Los Angeles, Cal.

and it will not shrink, crack, warp or buckle under severe service conditions.

Asbestos Ebony is a permanent material. It will not rust, nor is it subject to rot or decay. It remains uninjured after exposure to water, oil, gas and ordinary chemicals. Sudden temperature changes, encountered in electrical work by reason of arcs or flash-overs, do not result in ruptures such as often occur in more brittle materials. Asbestos Ebony actually grows stronger and tougher with age.

Asbestos Ebony is regularly manufactured at Nashua, N. H. Emergency orders for Western points can be readily supplied from Waukegan, Ill., at slight additional cost. Ebony is also stocked by many panel fabricators throughout the country, who offer prompt and efficient service.

Finishes

J-M Asbestos Ebony is supplied in two finishes:

Standard finish—on material of 1/8″ or 3/16″ thickness—is a deep, everlasting black.

Switchboard finish—on material of ¼″ to 4″ thickness, inclusive—is a finer, smoother surface than Standard finish, in the same deep, everlasting black.

While Asbestos Ebony is regularly finished in lacquer, all thicknesses can be furnished unlacquered if desired.

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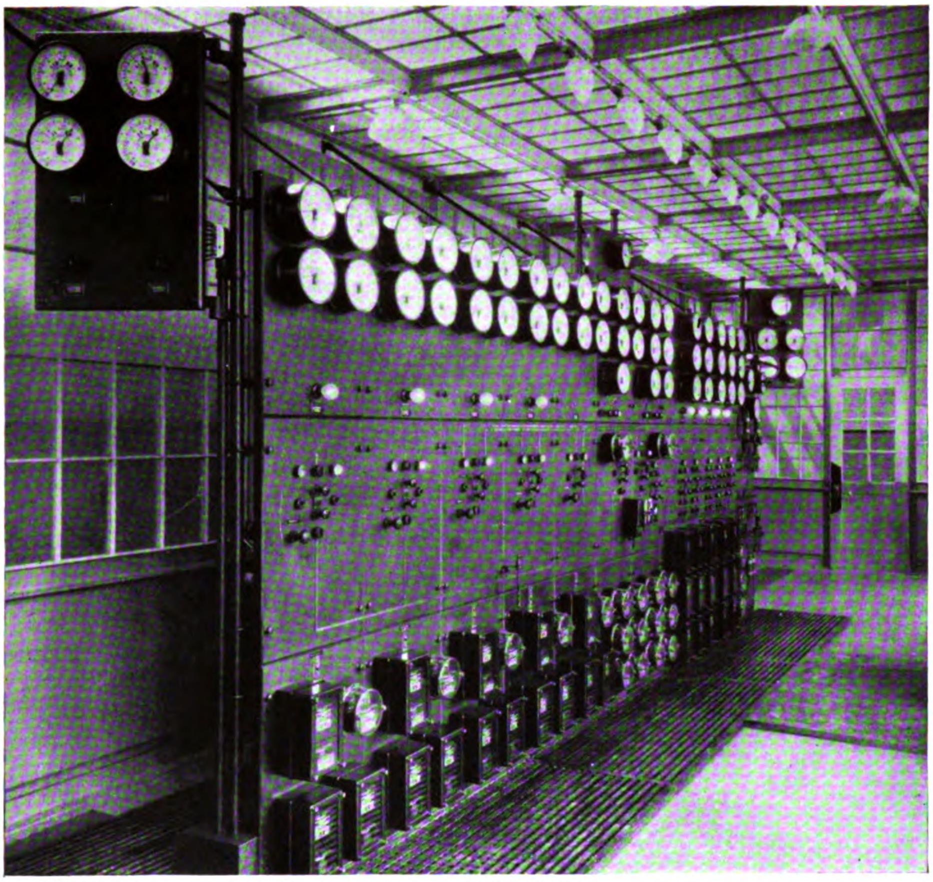


Pacific Gas & Electric Company, San Francisco, Cal. Panels of Asbestos Ebony in a well-designed and lighted control room

Sizes and Weights

Thickness, Inches	Sheet Sizes,* Inches	Approximate Weight, Lb. Per Sq. Ft. Uncrated	Crated
1/8	36 x 48 only	1.5	1.584
3/16	"	2.08	2.2
1/4	36 x 48, 42 x 48 and 42 x 96	2.75	3.0
5/16	" " "	3.5	3.8
3/8	" " "	4.25	4.6
1/2	" " "	5.43	5.9
5/8	" " "	6.88	7.5
3/4	" " "	7.85	8.7
7/8	" " "	9.0	9.8
1	" " "	10.35	11.5
1 1/4	" " "	12.85	14.4
1 1/2	" " "	15.0	17.0
1 3/4	" " "	17.8	21.0
2	" " "	20.65	23.0
2 1/2	36 x 48 and 42 x 48	25.85	28.0
3	" "	31.0	35.0
3 1/2	" "	36.2	40.0
4	" "	41.4	46.0

***Standard uncut sheets measure a fraction of an inch larger than nominal sizes given. Therefore, if ordered cut to exact size they are classed as cut panels.**

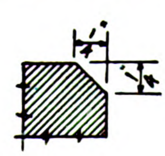
All Asbestos Ebony is furnished ± 1/64″ on thickness.

Cut Panels

Cut panels can be furnished within the size limitations of standard sheets. Standard uncut sheets measure a fraction of an inch larger than nominal sizes given. Therefore, if ordered cut to exact size they are classed as cut panels. Cut panels will be furnished within ± 1/32″ on length and width.

Bevels

Any desired bevel may be furnished but bevels are usually 1/8″, 1/4″, 3/8″, or 1/2″, with 1/4″ the most popular. Bevels are measured as per sketch; thus a 1/4″ bevel would have a projected measurement across face of panel of 1/4″ and 1/4″ down edge.



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Asbestos Ebony Accessories

Asbestos Ebony Filler Compound:

Asbestos Ebony Filler Compound is a putty glaze for treating Asbestos Ebony surfaces which have been marred or scratched slightly. It is applied with a putty knife, fine sanded and lacquered. Furnished in 1-gallon and 5-gallon cans.

Asbestos Ebony Filler Wax:

This material is used for filling deep pits, gouges or erroneous drillings. Used much after the manner of sealing wax as it is melted into the cavity, the excess scraped off to slightly below the panel surface, then a glazing of Asbestos Ebony Filler Compound applied and the rough spot fine sanded and lacquered.

In the case of a sizable hole drilled through a thick panel, it is sometimes desirable to turn down an Asbestos Ebony plug to fill the opening, finishing up with a fine sanding, Filler Compound and Lacquer. Asbestos Ebony Filler Wax is furnished in sticks.

Asbestos Ebony Lacquer:

This material is used for surface-finishing Asbestos Ebony panels. This is the identical lacquer used by Johns-Manville and is carefully mixed in proper proportions for use direct from container. It should be applied with spraying equipment and its covering capacity is about 300 sq. ft. per gallon. Furnished in quart and gallon cans.

Ebony Cleaning and Polishing Fluid:

Ebony Cleaning and Polishing Fluid is adapted only for use on unlacquered Asbestos Ebony. Furnished in quart, gallon and 5-gallon cans.

North Side Pumping Station, Sanitary District of Chicago, Ill. Control bench and instrument boards of Asbestos Ebony

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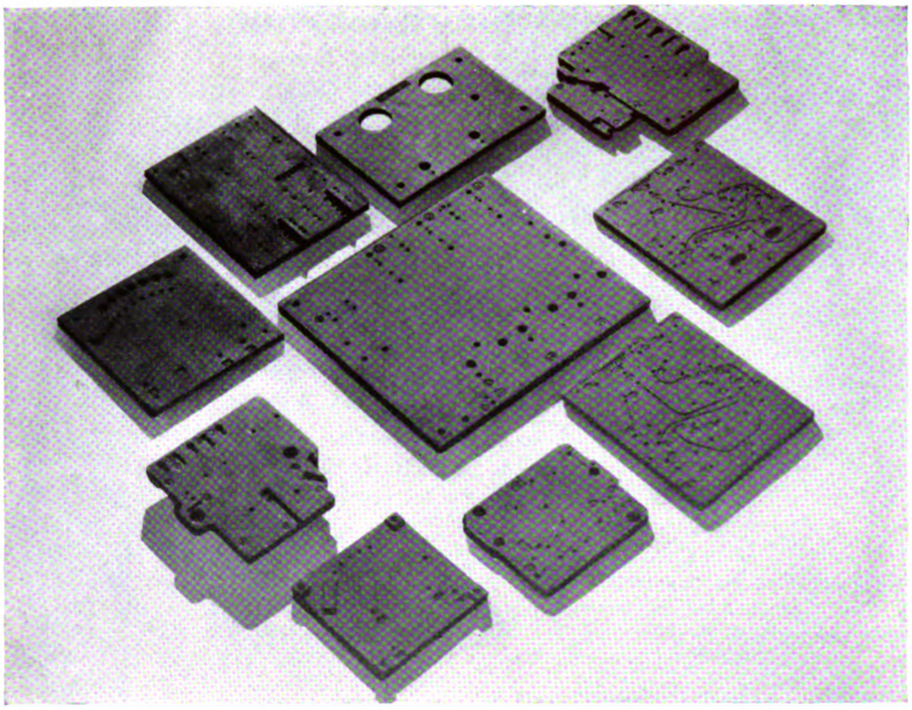
Asbestos Ebony Moulded



A representative group of parts made from Asbestos Ebony Moulded. To manufacturers of electrical appliances, Johns-Manville offers a service which is prompt, efficient and economical

Asbestos Ebony Moulded is similar to and has practically the same characteristics as Asbestos Ebony Sheets, except that it is moulded into special shapes with counterbores, slots or grooves, as desired. It is used principally where small panels are required for switches, starters, meters, etc. Asbestos Ebony Moulded is strong electrically and mechanically and makes a very presentable appearance. It has a working temperature limit of 300 deg. F. It will not deteriorate with age, will not absorb moisture, and will withstand successfully the action of ordinary laboratory acids.

Finishes:

Asbestos Ebony Moulded is supplied in the following three finishes:

Finish No. 101—Sanded and lacquered dull black finish on all surfaces. This finish cannot be furnished on pieces with ribs, plateaus or bosses, as the sanding operation may injure the raised portion.

Finish No. 202—Unsanded and lacquered dull black finish. This finish is standard on all panels where there are plateaus, ribs or bosses.

Finish No. 303—Unlacquered and unsanded. Suitable for concealed locations or where appearance is not an important factor.

Limit Sizes of Special Moulded Shapes:

Thickness	Square Pieces	Oblong Pieces
¼″	6″ x 6″	6″ x 6″
⅜″	8″ x 8″	8″ x 8″
½″	12″ x 12″	12″ x 12″
⅝″	12″ x 12″	12″ x 14″
¾″	15½″ x 15½″	15″ x 16″
1″	16″ x 16″	16″ x 18″
1½″	20″ x 20″	20″ x 25″

Tubes and rods can also be furnished in lengths up to 12″, with wall or diameter from ¼″ to ½″.

Design Limitations:

Inserts may be used in a great many ways except in edges of panels. Where inserts are wanted in edge, holes may be drilled and tapped to good advantage. Holes may be moulded in face of panel to the correct size and screws may be used to make their own thread.

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The Murray Low Loss Reactor. The reactor arms used are made of Asbestos Ebony Moulded. Manufacturers, Metropolitan Device Corporation, Brooklyn, N. Y.

Most dimensions can be held to within plus or minus 1/64″. Bosses on face or back of panel must have the following drafts: 1/16″ high, 1/32″ draft; ⅛″ high, 1/16″ draft; ¼″ high, ⅛″ draft. A great many bases or panels have raised sections from ¼″ to 1″ or more and in some cases these require only a slight draft, depending on moulding method.

Depressions or grooves may be made one-half the total thickness of the moulded piece, or slightly more. Draft to the depressions should run approximately the same as required on bosses up to ¼″ high.

All name plates, numbers or letters are moulded with a raised letter in a sunken panel. Top of figures is 1/64″ below surface of panel so that sanding or finishing may be done without injuring figures.

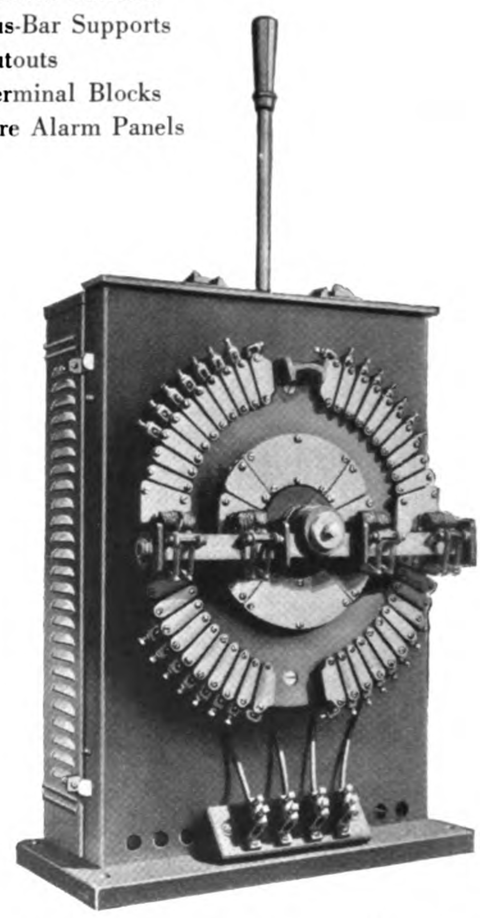
In many cases rounded edges can be moulded as easily as square. In straight panels a 1/16″ round edge may be put on in finishing at a slight cost. Bevels may be moulded, on either four or eight edges, except in cases of uneven surface.

Asbestos Ebony Moulded can be made from blueprints, unless a complicated panel is desired, in which case a model should be submitted. The following information is also required: Mechanical and electrical stresses to be encountered; temperatures and chemical conditions involved; approximate daily requirements.

Uses:

Among the many uses of Asbestos Ebony Moulded are the following:

- Control Panels
- Meter Bases
- Switch Bases
- Rheostat Face Plates
- Knife Switch Bases
- Circuit Breaker Mounts
- Farm Lighting, Refrigerating, Starter Panels, etc.
- Regulator and Contactor Panels, etc.
- Oil Switch Mountings
- Elevator Control Panels
- Arc-Welding, Battery Charging and Testing Panels
- Combination Fuse and Switch Blocks
- Ground and Line Insulators
- Resistance and Shunt Bases
- Current Barriers
- Bus-Bar Supports
- Cutouts
- Terminal Blocks
- Fire Alarm Panels



Dinkey Controller for crane hoists, with center dial of Asbestos Ebony Moulded. Manufacturers, The Electric Controller & Mfg. Co., Cleveland, Ohio

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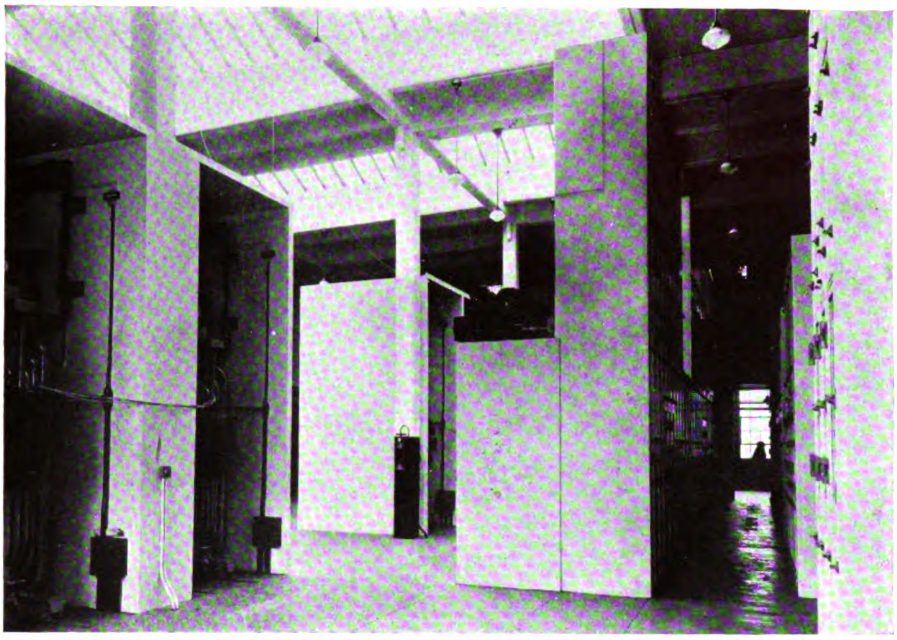
Transite Asbestos Sheets
(for electrical purposes)



Transite cell structure at the Westchester Lighting Company Port Chester (N. Y.) plant

Transite is the leading fireproof material on the market for use where high dielectric strength is not required. It is composed of asbestos fibre and portland cement, combined under tremendous pressure into a homogeneous, dense mass having high strength and great durability.

Transite is light gray in color, and has a specific gravity of about 2.0, weighing approximately 124 lb. per cu. ft. It can be drilled with twist drills, punched, fastened with nails and screws and sawed with a hand saw (set 5 points to the inch). A portable power saw should be used, however, if much sawing is to be done. Transite may, if desired, be painted, varnished or grained in imitation of marble or hard woods.

Transite is particularly adapted for use as a structural material wherever an arc may possibly occur. Transite is not an electrical insulator and it cannot be used as is Asbestos Ebony for the mounting of current carrying parts, but its resistance to heat, flame or arc is substantially greater than that of Asbestos Ebony. Transite does not become warped, distorted or weakened in service. In fact, it strengthens with age.

It is suitable for use under constant temperatures up to 800 deg. F., and for instantaneous temperatures —such as those developed by an arc—far in excess of this figure.

Finishes:

Standard Transite is sufficiently smooth for practically all purposes, and thickness is controlled within plus or minus 1/32″ of nominal thickness. Material can be furnished, however, sanded on one side (S-1-S) or on two sides (S-2-S) to provide special smoothness and thickness control within plus or minus 1/64″. Unless otherwise specified, standard material is always furnished.

Sheet Sizes:

Flat Transite is furnished in the following sizes:

Nominal Sheet Size Inches	Thickness Inches
36 x 48	⅛ to 4
42 x 48	⅛ to 4
42 x 96	⅛ to 2

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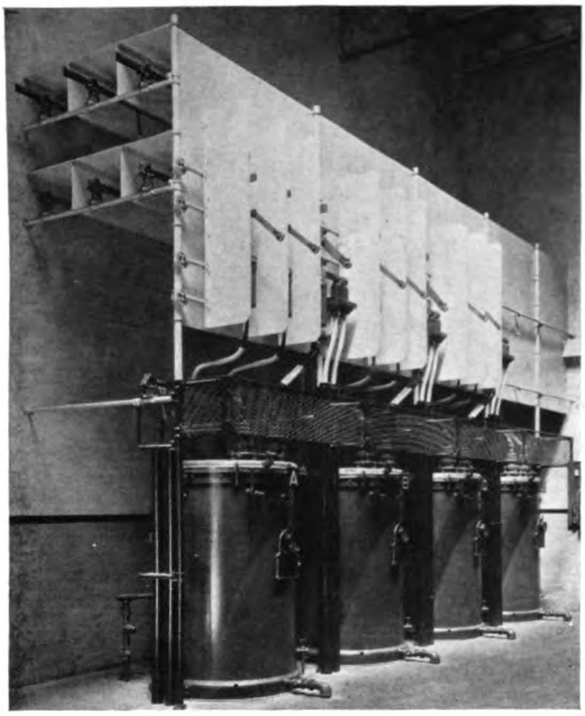

Pacific Gas & Electric Company, Station "J", San Francisco, Cal. Efficient though inexpensive protection is gained by the use of Transite for bus and switch partitions

Thickness, Weights and List Prices (Uncut sheets)

Approximate shipping weights in lb. per sq. ft.

Thick-nesses, Inches	Uncrated		Crated		List prices per sq. ft
	Standard	Sanded	Standard	Sanded	
⅛	1.7	1.4*	1.8	1.5*	$0.15
3/16	2.1	2.0	2.3	2.1	.225
¼	2.8	2.6	3.0	2.8	.30
5/16	3.4	3.3	3.7	3.5	.38
⅜	4.0	3.9	4.4	4.2	.45
½	5.3	4.7	5.8	5.0	.60
⅝	6.9	6.7	7.5	7.2	.75
¾	7.6	7.5	8.4	8.2	.90
⅞	8.9	8.7	9.7	9.4	1.05
1	10.1	9.9	11.0	10.7	1.20
1¼	13.0	12.8	14.0	13.8	1.50
1½	15.7	14.0	17.6	15.2	1.80
1¾	18.5	16.8	20.6	18.3	2.10
2	21.0	19.6	23.1	21.2	2.40
2½	26	25	28	27	3.00
3	31	30	34	33	3.60
3½	36	36	39	38	4.20
4	42	40	45	43	4.80

List prices are F.O.B. Nashua, N.H. or Waukegan, Ill., except 36" x 48" sheets which are F.O.B. Nashua, N. H. only.

*42" x 96" sheets, for manufacturing reasons, cannot be furnished sanded in the ⅛" thickness, and weights of 42" x 96" x ⅛" sheets are 2.2 lb. per sq. ft. uncrated, and 2.5 lb. per sq. ft. crated.

Uncut sheets run somewhat full in length and width. Material cut to a special size is furnished plus or minus 1/32" of specified length and width. Material cut to a closer tolerance will be furnished only on special order.

Where thickness is not greater than ¼", and a large number of duplicate shapes are involved, Transite pieces may be stamped out of sheet stock, thus eliminating more expensive machine work.

Transite is also furnished in corrugated sheets approximately ⅜" thick, 42" wide and in lengths of from 3 ft. to 11 ft. This material is fully described elsewhere in connection with its use as roofing and siding.

Both flat and corrugated Transite when so ordered are furnished with a special bituminous impregnation to afford maximum impermeability where the material may be subjected to extreme moisture conditions. It is used, for example, in the construction of outdoor switch housings. This material is known as W. R. Transite. Flat sheets are furnished 42" x 48", ⅛", 3/16" and ¼" thick; 42" x 96", ¼" thick; and 48" x 48" and 36" x 48", ⅛" and 3/16" thick. Corrugated W. R. Transite is furnished in the same sizes as the standard material.

Applications of Transite for Electrical Purposes:

One of the most important applications of Transite is for the building of cell structures. It has been used for many years for doors, barriers, ducts, shelves and covers, and many structures have been built completely of Transite. Its light weight, high strength, fireproof qualities, easy workability and pleasing appearance make it an ideal material for this purpose. Full information is available on this application.

Transite is well adapted for the housing of many types of electrical apparatus and for the construction of various electrical appliances. A partial list follows.

- Electric Ovens, Driers, etc.
- Constant Temperature Rooms
- Indoor or Outdoor Housings for:
  - Potential and Current Transformers
  - Automatic or Hand-operated Switches
  - Regulators, Circuit Breakers, etc.
- Resistance Bases or Housings
- Walls or Liners for Fuse Boxes
- Lightning Arrester Boxes, etc.
- Arc Barriers or Partitions
- Fireproof Walls
- Flooring over Electrical Apparatus
- Troughs or Ducts around heavily loaded Cables
- Arc Deflectors for Controllers

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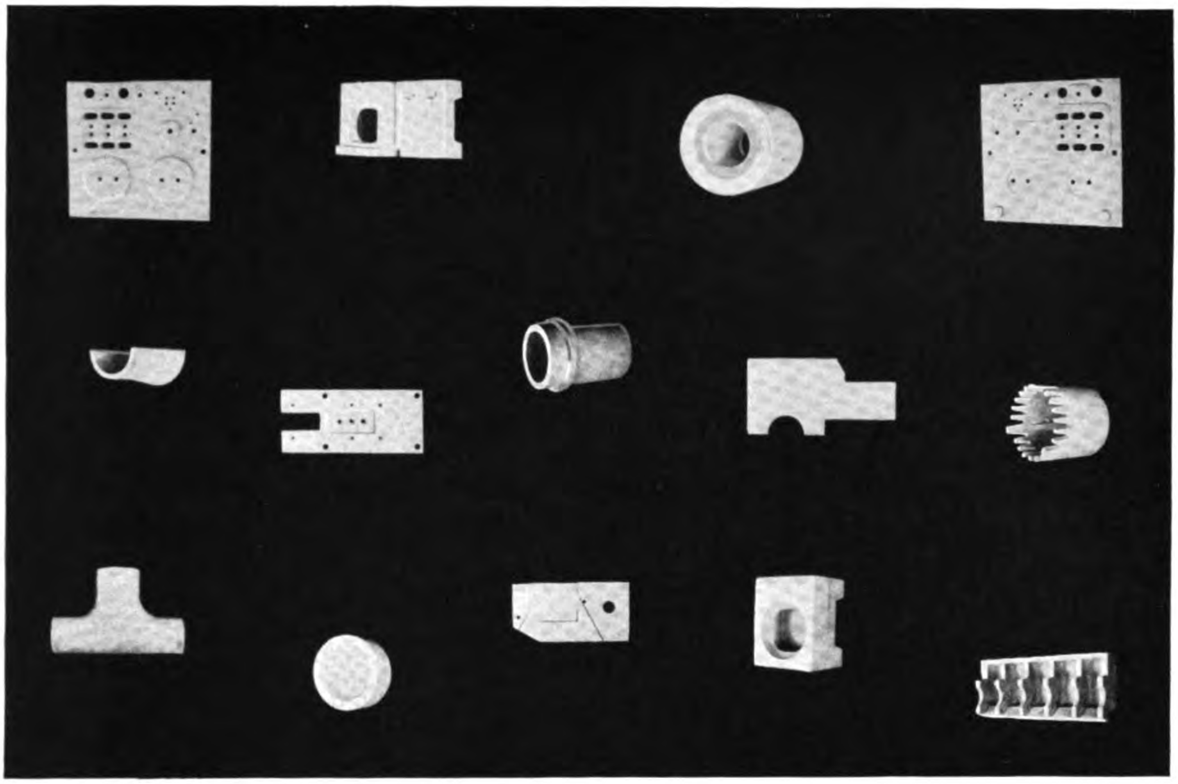
Electrobestos



Hundreds of parts can be cheaply moulded of Electrobestos, a few of which are shown in the above photograph

Electrobestos is composed of asbestos fibre and high temperature clays, moulded to shape in a cold plastic mass, impregnated with a liquid binder, and heat treated. In the electrical industry, it is widely used for arc or flame barriers, and for parts of small ovens, muffles, or other apparatus exposed to heat. It is also well adapted to the manufacture of arc chutes and deflectors, grid buttons, rheostats and shunt bases, and is particularly suited for moulding panel shapes and ribbed parts.

There are two kinds of J-M Electrobestos—differing according to the conditions of service. Where a material which combines moderate structural strength with great adaptability to sudden temperature changes is required, plain Electrobestos should be used. Electrobestos-X is a slightly harder material and possesses greater structural strength, but offers slightly less resistance to the stress of expansion and contraction under sudden temperature changes.

Physical Properties:

Electrobestos weighs approximately 120 lb. per cu. ft. It is not moisture-proof, tests showing an absorption of 12% on oven-dried material immersed in water at room temperature for 24 hours. Insulation resistance tests show that Electrobestos when oven-dry does not permit any leakage but dielectric strength and insulation resistance are, of course, dependent upon moisture content and the material is not recommended for the mounting of current carrying parts. Two-inch cubes show an average crushing strength of over 1800 lb. per sq. in. Samples tested at 1200 deg. F. showed a modulus of rupture of 1750 lb. per sq. in.

Electrobestos may be safely exposed to steady or intermittent heat conditions up to 1200 deg. F.

Arc Deflectors:

The high resistance of Electrobestos to the deteriorating effects of constantly arcing contacts makes it

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eminently suitable for use in the form of arc deflectors. Moulds for many styles of deflector plates are carried in stock. Special shapes can be furnished from blueprint or model.

Trays for Muffle Furnaces:

Where enameling or vitrifying processes are carried on in muffle furnaces, Electrobestos trays for holding the parts to be treated usually show a large saving over the expense involved in the use of other materials employed for this purpose. Electrobestos trays can be furnished cut to size or in sheets measuring up to 30″ x 30″.

Electrobestos Panels:

Depressed letters, or letters raised in a sunken panel, can be inexpensively included in panels moulded of Electrobestos.

Panels can be supplied up to the following dimensions:

Thickness	Square Pieces	Oblong Pieces
¼″	6″ x 6″	6″ x 6″
⅜″	8″ x 8″	8″ x 8″
½″	12″ x 12″	12″ x 12″
⅝″	12″ x 12″	12″ x 14″
¾″	15½″ x 15½″	15″ x 16″
1″	16″ x 16″	16″ x 18″
1½″	20″ x 20″	20″ x 25″

Electrobestos Heating Appliances:

Small furnaces and ovens are inexpensively moulded of Electrobestos. The use of moulded pieces offers a method of reducing the number of parts required per unit, and simplifies assembly. In such appliances, walls of Electrobestos often will provide sufficient insulation, without necessitating the use of another material.

Moulded Electrobestos Cable Protectors:

Moulded Electrobestos Cable Protectors are used by many public utility companies to protect cables against damage from abrasion or from electrical blowouts at points where conduits terminate and the cables run into manholes.

They are made in twin halves and are inserted between duct and cable after the cable is drawn in. Not only do they protect the lead sheath, but they also successfully withstand any arc which may occur and thus help to prevent damage to surrounding cables. They are treated with paraffin to resist moisture. Furnished 6¼″ long with an inside diameter of 2″.

Electrobestos Sheets:

Electrobestos is usually supplied in finished moulded pieces. Where material in sheet form is required, however, it can be furnished 30″ x 30″ in thicknesses of ¼″, ½″, ¾″ and 1″.

Tubes and Rods:

Tubes and rods of Electrobestos can also be furnished. Tubes up to 3″ long should have a 3/16″ wall; up to 6″ long, a ¼″ wall; and up to 12″ long, a 5/16″ wall. Rods up to 3″ long, not less than ¼″ diameter; up to 6″, not less than ⅜″ diameter; and up to 12″ long, not less than ½″ diameter.

Design Limitations:

Lateral holes and recesses are impracticable. Walls should be ¼″ on moderate size pieces or on pieces of box or box cover shape. Spiral threads or grooves or threaded holes are impracticable to mould in this material. Where there are holes through the pieces, there must be from 3/32″ to 1/8″ wall between any two holes or between the hole and the outside of piece. Where there are shallow depressions moulded in a piece, the walls should be at least ⅛″.

On practically all pieces no dimension can be guaranteed closer than plus or minus 1/64″ and in many cases, due to design of the piece, an allowance of at least plus or minus 1/32″ is necessary. Depressed lettering is possible in many cases and raised lettering with 1/16″ face is sometimes possible. Inserts as a rule cannot be moulded into this material. Occasionally, however, inserts can be moulded in, and in some cases cemented in.

Instructions for Ordering:

When submitting inquiries in regard to simple parts, a blueprint will serve to explain the necessary details. If a complicated piece is involved, the request for information should be accompanied by a model and a statement of operating conditions. Such a statement should give essential technical information, viz., the mechanical and electrical stresses, operating temperatures and chemical action to which the part will be subjected, together with an estimate as to approximate daily requirements.

Niagrite-Asbestoment Cable Fireproofing

J-M Niagrite-Asbestoment is an inexpensive and easily applied combination of materials used to protect each cable in a manhole or vault from damage through arc due to breakdown of an adjacent cable. Whenever one cable fails, the resulting arc not only causes the destruction of the cable within which it occurs, but also menaces all cables within its immediate vicinity and is likely to cause expensive damage to equipment, a large outlay for repairs and, what is most important, a severe interruption of service.

In the event of a "breakdown" in a cable, it is impossible to save the conductor itself, but it is possible so to protect all adjacent cables that they are reasonably secure from communicated damage. Niagrite-Asbestoment is the only protection on the market which meets manhole arc conditions satisfactorily and at the same time is inexpensive and easy to apply.

J-M Niagrite:

J-M Niagrite is commercially pure asbestos felted tape, supplied in widths of 1½″, 2″ and 3″ and in thicknesses of 3/32″, 1/8″, 3/16″ and 1/4″, and, unless otherwise ordered, in rolls of 15 ft. It is furnished in the following four types: Without reinforcement; reinforced with J-M No. 1047 Asbestos Cloth, known as Special "A" Niagrite; with J-M No. 1091 Asbestos Listing; and with strong, coarse jute cloth. The latter is known as Special "B" Niagrite and is most generally used.

J-M Asbestoment:

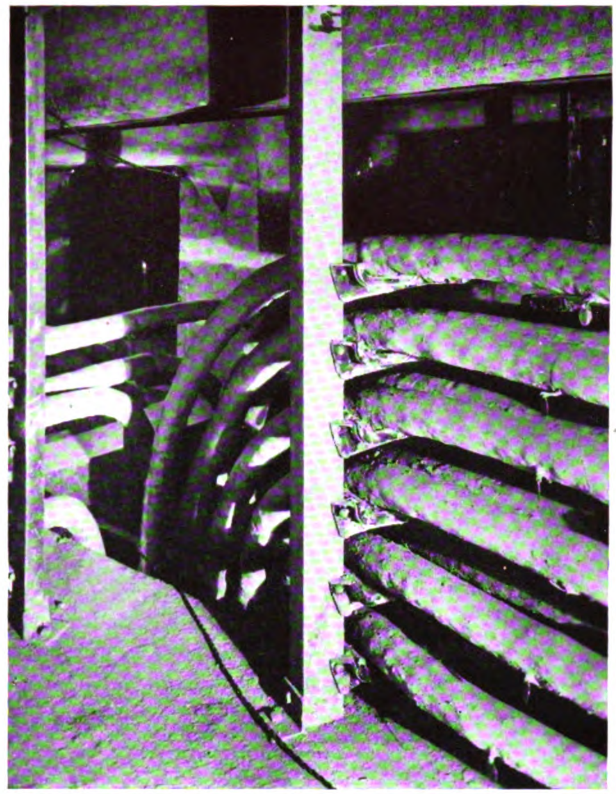
J-M Asbestoment is a chemically neutral powder, packed in 100-lb. bags with complete directions. It is used with Niagrite on the job, not only to impregnate the Niagrite, but also as a coating.

Advantages of Niagrite-Asbestoment:

The advantages of Niagrite-Asbestoment may be summarized as follows:

1. Highest resistance to the disastrous effect of an arc. Tests have shown this construction offers 2½ times the protection of ½″ portland cement over muslin and ¼″ rope carrier.

2. Higher thermal conductivity and thus better heat dissipation than paper, oiled linen, varnished cambric or rubber used in direct contact with the conductors.



A typical installation of Niagrite-Asbestoment in a large power plant

3. Withstands immersion, constant or intermittent, without effect on the fireproofing. It absorbs and holds a moderate amount of moisture without effect on either Niagrite or Asbestoment.

4. Ease and economy of application. Fifty per cent more Niagrite-Asbestoment than cement with wire lath and paraffined muslin can be applied by identical gangs.

5. No chemical reaction. There need be no paraffin or other insulating compounds applied to prevent corrosive action. Niagrite and Asbestoment are chemically neutral.

6. Minimum damage through bending. Niagrite-Asbestoment can be bent around a 20″ diameter drum without damage. Changing a cable from one rack to another in manhole work can therefore be accomplished without harm to fireproofing.

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Material Quantities per 1,000 ft. of cable

(Two thicknesses of Niagrite and two 1/8" layers of Asbestoment)*

O. D. of cable, ins.	Niagrite width, ins.	Thickness of Niagrite 3/32" Niagrite, ft.	3/32" Asbestoment, lb.	1/8" Niagrite, ft.	1/8" Asbestoment, lb.	3/16" Niagrite, ft.	3/16" Asbestoment, lb.	1/4" Niagrite, ft.	1/4" Asbestoment, lb.
1	1 1/2	5500	365	5762	385	6286	420	...	...
1 1/2	1 1/2	7596	510	7858	525	8382	555	...	...
2	2	...	...	7465	665	7858	700	8250	735
2 1/2	2	...	...	9037	800	9430	835	9820	870
3	3	...	...	...	...	7334	980	7596	1010
3 1/2	3	...	...	...	...	8382	1120	8640	1150
4	3	...	...	...	...	9430	1250	9690	1290

Note: The above figures cover straight cable only. Bends require extra material, as Niagrite must be lapped on the inside of all turns. Figures also do not include splices, which are generally twice the diameter of the cable proper and require several times as much Niagrite.

*Niagrite figured on formula $\frac{3\pi\ (8D+16T+1)}{12W}$ = ft. of tape required per foot of cable;

where D = cable diameter; T = thickness of Niagrite; W = width of tape.

Asbestoment figured on basis of 1 lb. per 15-ft. roll of 1½" width; 1½ lb. per roll of 2" width and 2 lb. per roll of 3" width.

Application of Niagrite-Asbestoment:

Careful workmanship in applying Niagrite-Asbestoment is an absolute necessity, as with any material intended for protection against arc. The dry Asbestoment should first be thoroughly mixed; after which it should be mixed with water in large butter tubs, using two parts water to one part Asbestoment by volume. The roll of Niagrite is then loosened and completely immersed in the Asbestoment solution until thoroughly soaked, which requires about twenty minutes. The solution should be continually agitated while Niagrite is being impregnated. The Niagrite is then wound on the cable spirally with butted joints, after which a coating of the Asbestoment solution is applied approximately 1/8" thick.

A second layer of Niagrite and an Asbestoment coating is applied in exactly the same manner after the first layer has dried.

List Prices and Weights of Niagrite

Prices per 1,000 linear ft. F.O.B. Manville, N. J.—Weights in ounces per linear foot.

Thickness, inches	Width, inches	Special "B" *(reinforced with jute cloth) List Price	Special "B" Weight oz. per foot	Special "A" (reinforced with No. 1047 cloth) List Price	Special "A" Weight oz. per foot	Without Reinforcement List Price	Without Reinforcement Weight oz. per foot
3/32	3	$89.00	2 1/3	$146.50	2	$53.50	2
3/32	2	64.00	1 1/2	......	...	48.00	1 1/3
3/32	1 1/2	57.00	1	......	...	47.00	1
1/8	3	94.00	2 1/3	152.00	2 1/3	59.50	2 1/2
1/8	2	67.00	1 1/2	......	...	52.00	1 2/3
1/8	1 1/2	59.00	1	......	...	50.00	1 1/4
3/16	3	107.00	4 1/2	169.00	4	78.50	4
3/16	2	75.00	3	124.00	2 2/3	64.50	2 2/3
3/16	1 1/2	66.00	2 1/4	102.50	2	59.50	2
1/4	3	120.00	4 1/2	185.00	4	97.00	4 2/3
1/4	2	83.00	3	135.00	2 2/3	77.00	3
1/4	1 1/2	72.00	2 1/4	111.00	2	69.00	2 1/3

Niagrite reinforced with No. 1091 Listing, prices on application.

*Special "B" Niagrite 3" wide, 3/16" thickness, is used exclusively by the majority of large public utilities. It is recommended as a standard.

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Orangeburg Fibre Conduit

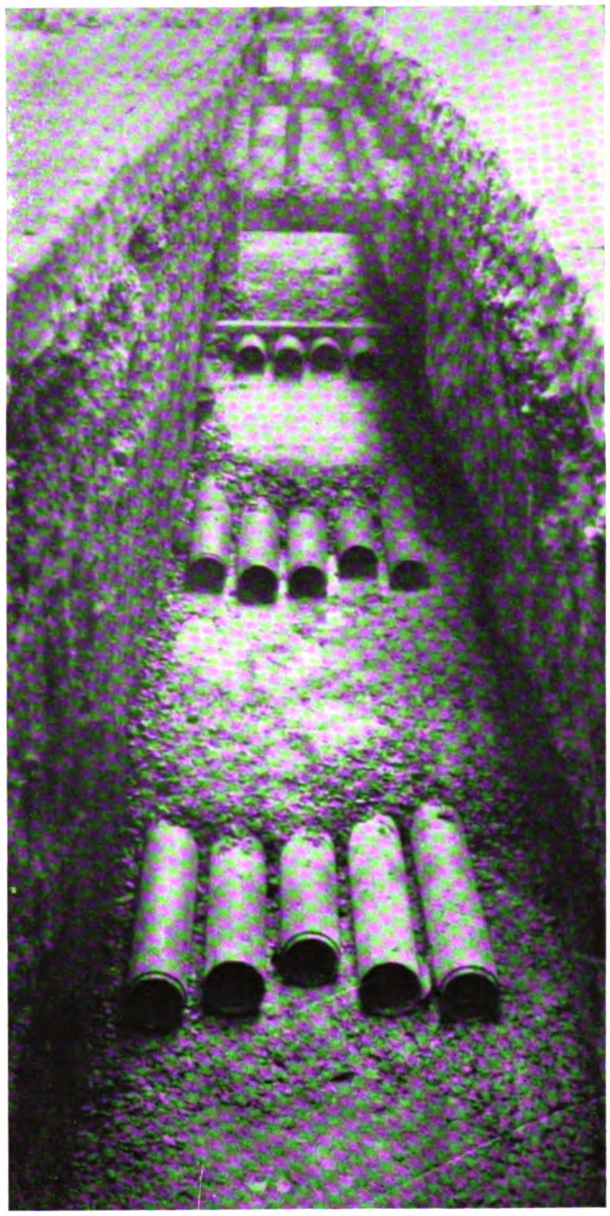
For over 37 years, Orangeburg Fibre Conduit has been the standard underground ductway for electric cables. Johns-Manville is the sole selling agent for this material, which is manufactured by The Fibre Conduit Company, Orangeburg, N. Y., with plants at Orangeburg, N. Y. and Richmond, Ind. The conduit is designed for underground distribution of power and telephone cables and signal wires, generator leads, transformer leads, and ducts in floors and retaining walls. It is particularly suitable for such installations because of its high insulating qualities, lightness, resistance to corrosion, freedom from hysteresis, and ease and speed of installation. Due to its smooth surface and relative softness, it cannot damage the lead sheath. Absolutely tight joints can be obtained quickly and easily.

In the manufacture of Orangeburg Fibre Conduit, finely divided wet wood fibre is wrapped in a thin film upon a forming mandrel under pressure until the fibres become felted and form a solid, homogeneous wall. It is then thoroughly dried and impregnated with an insulating and waterproofing preservative which permeates the entire structure.

Orangeburg Fibre Conduit has been manufactured and sold for the past thirty-seven years under the following specifications:

1. The conduit shall be thoroughly saturated with an insulating and preserving compound.
2. The walls shall be compact and incapable of separation into layers when heated to 212 deg. F.
3. The material shall not be affected by acids which may be present in the ground, and shall itself be free from all substances which might corrode the sheath of leaded cable.
4. The bore shall be straight; the cross section shall not vary at any point more than 1/8" from a true circle; and the inner surface shall be free from dents or other obstructions, as gauged by the ability to pass a 36" long mandrel of 1/4" less diameter than the nominal size of the conduit.
5. The inner surface shall be free from any considerable excess of compound and there shall be no rough or flaky areas of any considerable size.
6. The lengths shall be 5 feet, but shorter lengths may be furnished not to exceed 15% of each shipment; no length to be less than 36".
7. The standard sizes shall be of the following nominal inside diameters: 2", 2½", 3", 3½", 4", 4½" and 5".
8. The wall shall be approximately as follows:

2" conduit	1/4"	4" conduit	5/16"
2½" "	1/4"	4½" "	5/16"
3" "	1/4"	5" "	3/8"
3½" "	9/32"		



Orangeburg Fibre Conduit laid tier-by-tier method in a 14-tube bank

9. The Harrington joint shall be cut on a taper, with tapered coupling to fit, and so proportioned that the ends of the conduit will not butt.
10. The Socket joint shall be slightly tapered and the inside reamed so that there will be no appreciable offset at the joint.

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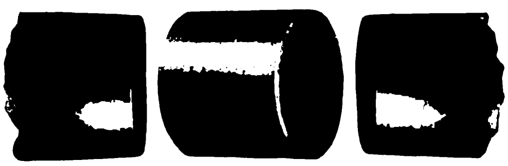
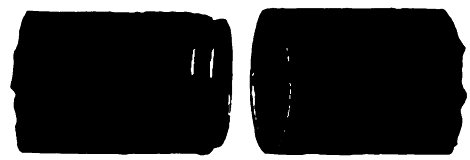


Harrington Joint Type
(Tapered Sleeve)



Socket Joint Type

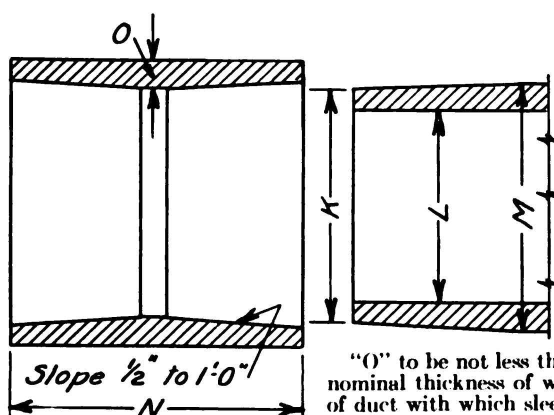
Harrington Joint (Tapered Sleeve):

The ends of the Harrington joint conduit are cut on a taper, with tapered couplings to fit, so proportioned that the ends of the conduit will not butt. This is done to make sure that the ends of the conduit will fit tightly into the tapered coupling, (see drawing).

The majority of users prefer this type of joint for the following reasons:

1. Flexibility in laying conduit with the possibility of departing from a perfectly straight line in passing minor obstacles.
2. Certainty of tight joints, easily made.
3. Less waste from breakage, as slight fractures near the conduit ends are entirely and safely covered by the coupling.

One coupling is furnished with each length of conduit, the list price including cost of coupling.



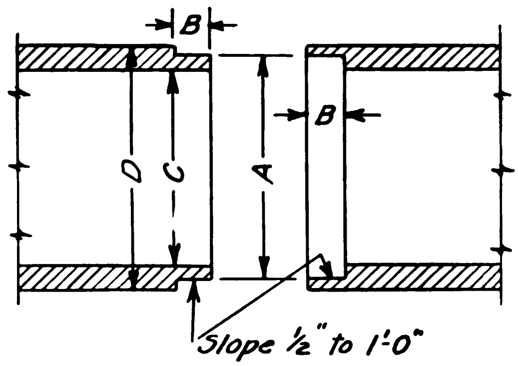
"O" to be not less than nominal thickness of wall of duct with which sleeve is used.

Harrington Joint (Tapered Sleeve)

Size	2"	2½"	3"	3½"	4"	4½"	5"
K	2⅜"	2⅞"	3 7/16"	3⅞"	4⅜"	4 15/16"	5½"
L	2"	2½"	3 1/16"	3½"	4"	4½"	5"
M	2½"	3"	3 9/16"	4 1/16"	4⅝"	5⅛"	5¾"
N	3"	3"	3½"	3½"	4"	4"	4"
Wall	¼"	¼"	¼"	9/32"	5/16"	5/16"	⅜"

Socket Joint (Mortise and Tenon):

With this type of joint, each length of conduit is machined with a male and female end, both slightly tapered, uniform in size and reamed during the process of cutting so that there will be no appreciable offset on the inside of the pipe at the joints. In the sizes from 1" to 3" inclusive, the length of the joint is ⅜": in the 3½", 4", 4½" and 5" sizes the length is ½". As the joints are cut by machine, the connection secured is perfect in fit and alignment. This type of joint is slightly cheaper than the Harrington and it may also be preferred because the need of a stock of couplings is obviated. However, more care is necessary to make certain that the joints are tight and there is more waste from broken ends if the conduit is exposed to rough handling, than in the case of the Harrington joint.



Socket Joint

Size	2"	2½"	3"	3½"	4"	4½"	5"
A	2 9/32"	2¾"	3 5/16"	3 23/32"	4 7/32"	4¾"	5⅜"
B	⅜"	⅜"	⅜"	½"	½"	½"	½"
C	2"	2½"	3 1/16"	3½"	4"	4½"	5"
D	2½"	3"	3 9/16"	4 1/16"	4⅝"	5⅛"	5¾"
Wall	¼"	¼"	¼"	9/32"	5/16"	5/16"	⅜"

Fibre Conduit Shipment Lengths:

1"—75%, 4'; 25%, 36" and over.

1½"—60%, 5'; 40%, 36" and over.

2" to 5"—85% to 90%, 5'; 10% to 15%, 36" and over in multiples of 6".

6" to 18"—Generally 5' but privilege is reserved to ship shorter lengths, not less than 36".

An extra charge will be made for cutting to special length, furnishing material to sketch and material cut to waste.

January, 1931 (Cancelling 6-D-1-A-1 to 6-D-1-W-2-B, dated in 1929 and 1930)

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List Prices and Shipping Data

Material listed in bold face type is *Standard*. Material listed in light face type is *Special*, is not regularly carried in stock and may require a little longer time to make up.

HARRINGTON OR TAPERED SLEEVE JOINT FIBRE CONDUIT
(Coupling included with each length)

Approx. Inside Diameter, inches	Approx. Wall Thickness, inch	List Price per ft.	Bulk: Approx. No. of Feet Minimum Carload 30,000 lb.	Bulk: Approx. Net Weight per ft. lb.	Crated: Standard Crate contains, ft.	Crated: Approx. Gross Weight per ft. lb.
1	1/4	$0.22	......	0.45	500	.66
1½	1/4	.18	41,900	0.71	300	1.26
2	**1/4**	**.11**	**29,750**	**1.00**	**200**	**1.55**
2½	**1/4**	**.12**	**24,775**	**1.20**	**200**	**1.8**
3	**1/4**	**.13**	**20,500**	**1.45**	**150**	**2.2**
3½	**9/32**	**.15**	**17,000**	**1.75**	**125**	**2.7**
4	**5/16**	**.16**	**14,500**	**2.05**	**100**	**3.25**
4½	**5/16**	**.21**	**11,675**	**2.55**	**80**	**4.1**
5	**3/8**	**.27**	**9,300**	**3.20**	**60**	**4.9**
6	3/8	.52	7,475	3.98	45	5.68
8	1/2	1.90	......	6.75	30	9.5

To derive price per foot for conduit without couplings, deduct 4/25 of price of coupling from price per foot of conduit.

SOCKET JOINT FIBRE CONDUIT

Approx. Inside Diameter, inches	Approx. Wall Thickness, inch	List Price per ft.	Bulk: Approx. No. of Feet Minimum Carload 30,000 lb.	Bulk: Approx. Net Weight per ft. lb.	Crated: Standard Crate contains, ft.	Crated: Approx. Gross Weight per ft. lb.
1	1/4	$0.18	......	0.40	500	.65
1½	1/4	.15	43,100	0.69	300	1.19
2	**1/4**	**.10**	**31,300**	**0.95**	**200**	**1.43**
2½	**1/4**	**.11**	**25,850**	**1.15**	**200**	**1.65**
3	**1/4**	**.12**	**21,250**	**1.40**	**150**	**1.95**
3½	**9/32**	**.14**	**17,500**	**1.70**	**125**	**2.45**
4	**5/16**	**.15**	**14,875**	**2.00**	**100**	**2.95**
4½	**5/16**	**.19**	**12,400**	**2.40**	**80**	**3.65**
5	**3/8**	**.24**	**9,925**	**3.00**	**60**	**4.6**
6	3/8	.48	8,200	3.63	45	5.33
8	1/2	1.70	......	6.30	30	9.1
10	1/2	2.05	......	8.30	10	17.7
12	5/8	2.35	......	12.40	5	25.6
18	3/4	4.50	......	16.00	5	40.0

45° bend—5′ long, 36″ radius

90° bend—5′ long, 36″ radius

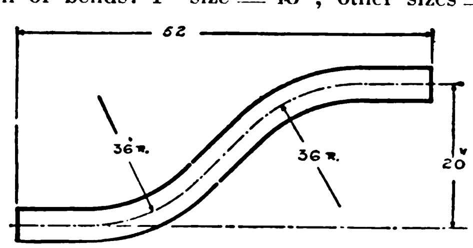
"S" bend—5′ long, offset 20″

Fibre Conduit Bends:

In making bends the conduit is first formed in the usual manner. When the wet fibre structure is removed from the mandrel it is bent on a special form to the radius and degree desired; after which it is dried and thoroughly saturated with an insulating and preserving impregnating compound. Do not confuse bends with elbows.

Dimensions of Standard Bends:

Length of bends: 1″ size = 48″; other sizes = 60″.



Standard "S" Bend—all sizes of conduit from 2″ to 5″

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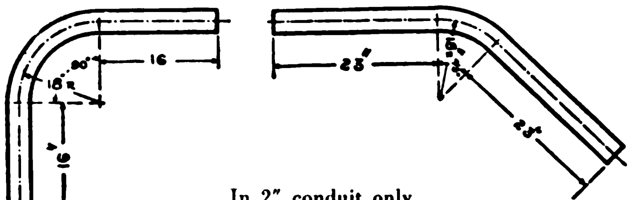
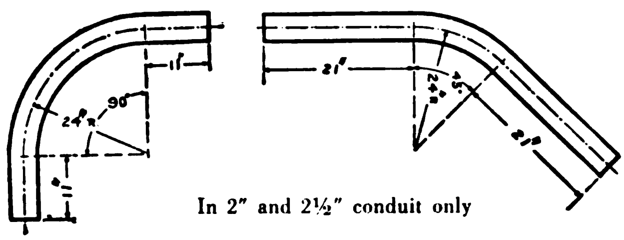
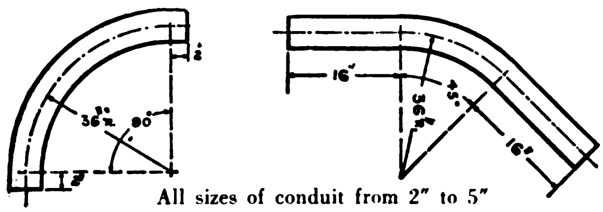


In 2″ conduit only



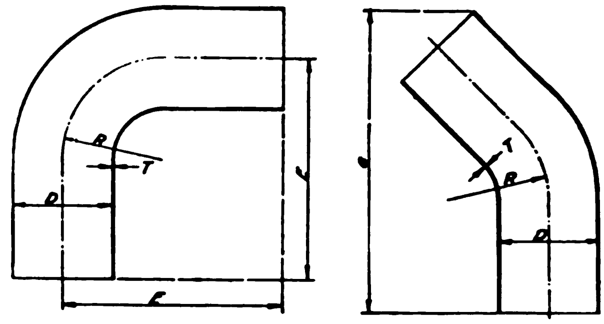
In 2″ and 2½″ conduit only



All sizes of conduit from 2″ to 5″

Standard Elbows:

Short radius elbows can be furnished as listed below. Elbows of other radii are special and will be billed at special prices. Do not confuse elbows with bends.



Dimensions below are in inches and approximate only.

D	2	2½	3	3½	4	4½	5
R	2½	2½	3	3	3½	4½	5
E	6	6½	6½	7	7½	8	11
G	8½	9	9	9½	10½	12	16
T	¼	¼	¼	9/32	5/16	5/16	⅜

List Prices and Shipping Data: Bends and Elbows

Material listed in bold face type is *Standard.* Material listed in light face type is *Special,* is not regularly carried in stock and may require a little longer time to make up. Length of bends: 1″ size = 48″; other sizes = 60″.

HARRINGTON JOINT (Tapered Sleeve) (Coupling included with each bend or fitting)

Approx. Inside Diameter, inches	Approx. Wall Thickness, inch	Standard Bends, each	Bulk, Approx. Net Wgt. per Bend, lb.	Crated: Standard Crate of Bends contains, pieces	Crated: Approx. Gross Wgt. per Bend Crated, lb.	Radius Standard 45° and 90° Bends	Radius Standard "S" Bends 20″ Offset	45° and 90° Elbows each	Approx. Net Wgt. per Elbow lb.	Standard Crate of Elbows contains, pieces	Approx. Gross Wgt. per Crated Elbow, lb.
1	¼	$2.15	1.8	50	4.2	18″	18″	$2.10	0.5	200	1.0
1½	¼	2.45	3.55	30	9.1	18″-24″-36″	36″	2.35	0.75	150	1.5
2	**¼**	**1.85**	**5.0**	**25**	**11.3**	**18″-24″-36″**	**36″**	**2.25**	**1.77**	**100**	**3.05**
2½	**¼**	**1.90**	**6.0**	**25**	**12.4**	**24″-36″**	**36″**	**2.25**	**2.3**	**100**	**3.7**
3	**¼**	**2.00**	**7.25**	**20**	**14.7**	**36″**	**36″**	**2.35**	**3.0**	**75**	**4.8**
3½	**9/32**	**2.30**	**8.75**	**15**	**21.3**	**36″**	**36″**	**2.35**	**3.5**	**50**	**6.2**
4	**5/16**	**2.45**	**10.25**	**12**	**25.7**	**36″**	**36″**	**2.45**	**4.65**	**50**	**7.6**
4½	**5/16**	**3.50**	**12.75**	**9**	**29.3**	**36″**	**36″**	**3.25**	**5.9**	**40**	**8.8**
5	**⅜**	**4.50**	**16.0**	**6**	**45.8**	**36″**	**18″**	**4.25**	**7.3**	**20**	**13.0**
6	⅜	7.00	19.9	4	49.9	36″	18″	8.40	10.0	6	24.5
8	½	13.50	33.75	4	74.0	24″	18″	15.50	19.0	4	40.0

SOCKET JOINT

Approx. Inside Diameter, inches	Approx. Wall Thickness, inch	Standard Bends, each	Bulk, Approx. Net Wgt. per Bend, lb.	Crated: Standard Crate of Bends contains, pieces	Crated: Approx. Gross Wgt. per Bend Crated, lb.	Radius Standard 45° and 90° Bends	Radius Standard "S" Bends 20″ Offset	45° and 90° Elbows each	Approx. Net Wgt. per Elbow lb.	Standard Crate of Elbows contains, pieces	Approx. Gross Wgt. per Crated Elbow, lb.
1	¼	$2.00	1.6	75	4.2	18″	18″	$2.00	0.25	200	0.8
1½	¼	2.25	3.44	30	8.84	18″-24″-36″	36″	2.15	0.5	150	1.4
2	**¼**	**1.75**	**4.75**	**25**	**10.55**	**18″-24″-36″**	**36″**	**2.15**	**1.53**	**100**	**2.7**
2½	**¼**	**1.80**	**5.75**	**25**	**12.05**	**24″-36″**	**36″**	**2.15**	**2.05**	**100**	**3.7**
3	**¼**	**1.85**	**7.0**	**20**	**14.55**	**36″**	**36″**	**2.20**	**2.55**	**75**	**4.55**
3½	**9/32**	**2.15**	**8.5**	**15**	**20.55**	**36″**	**36″**	**2.20**	**3.06**	**50**	**5.86**
4	**5/16**	**2.25**	**10.0**	**12**	**25.25**	**36″**	**36″**	**2.25**	**4.2**	**50**	**7.0**
4½	**5/16**	**3.25**	**12.0**	**9**	**28.45**	**36″**	**36″**	**3.00**	**5.7**	**40**	**8.6**
5	**⅜**	**4.25**	**15.0**	**6**	**44.2**	**36″**	**18″**	**4.00**	**7.0**	**20**	**12.7**
6	⅜	6.00	18.15	4	48.15	36″	18″	7.40	8.5	6	22.5
8	½	12.00	31.5	4	71.0	24″	18″	14.00	17.0	4	38.0
10	½	....	....	....	....	....	....	18.00	32.0	2	79.5
12	⅝	....	....	....	....	....	....	23.50	47.0	1	142.0
18	¾	....	....	....	....	....	....	45.00	150.0	1	280.0

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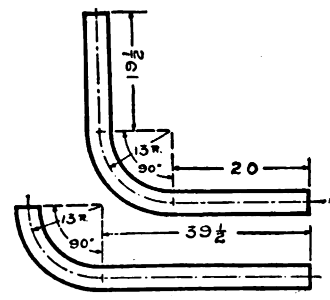
Special Angle or Radius Bends:

Special angle or radius bends can be formed to dimensions desired, within the limits given in table below, if not mitred. If mitred, any degree or radius desired may be obtained, and bend can be made anywhere in the length of pipe. In ordering, send sketch or state where the bend is desired. Such bends are made to order and take a special price.

Dimensions of Special Bends

Conduit Bend I. D., inches	Not mitred, Shortest Radius, inches	Mitred, Shortest Radius, inches	"S" Bend Maximum Offset, inches	Not mitred, Radius, inches
1	8	...	16	8
1½	12	...	36	18
2	18	2½	36	18
2½	24	2½	28	24
3	30	3	24	36
3½	36	3½	20	36
4	36	4	20	36
4½	36	4½	20	36
5	36	5	20	18



Examples of Special Bends

Longest radius possible in 5-ft. length (all diameters)

90°—36″
60°—54″
45°—72″
30°—108″

Longest radius possible in 4-ft. length (1″ conduit)

90°—30″
60°—45″
45°—60″
30°—75″

List Prices of Miscellaneous Fittings

HARRINGTON JOINT (Tapered Sleeve)

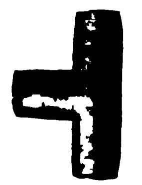
Conduit Size, inches	Tees, each	Caps or Plugs, each	Crosses, each	Solid Bushings, each	Split Bushings, each	Extra Couplings: List, each	Extra Couplings: Net Wgt., each	Extra Couplings: Gross Wgt., Cr., each
1	$2.75	$0.90	$3.35	.....	.....	$0.13	0.01	0.15
1½	2.95	.95	3.65	$0.21	$0.24	.15	.02	.3
2	3.25	.85	4.00	.22	.25	.10	.22	.44
2½	3.25	.85	4.00	.24	.28	.11	.3	.55
3	3.30	.90	4.15	.27	.30	.12	.45	.83
3½	3.30	.95	4.15	.30	.33	.14	.5	.92
4	3.45	1.00	4.35	.33	.36	.15	.55	1.20
4½	5.10	1.00	6.40	.40	.45	.18	.65	1.53
5	9.00	1.25	11.00	.50	.55	.22	1.0	1.81
6	11.50	1.50	14.00	.....	.....	.52	1.5	2.4
8	18.50	2.50	22.50	.....	.....	1.00	2.0	3.0

SOCKET JOINT

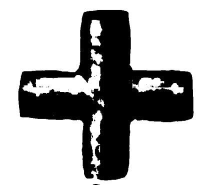
Conduit Size, inches	Tees, each	Caps or Plugs, each	Crosses, each	Solid Bushings, each	Split Bushings, each	Rough Fit Couplings, for Butt Joints
1	$2.50	$0.90	$3.05	.....	.....	$0.11
1½	2.75	.95	3.35	$0.21	$0.24	.11
2	3.00	.85	3.60	.22	.25	.12
2½	3.00	.85	3.60	.24	.28	.13
3	3.05	.90	3.75	.27	.30	.14
3½	3.05	.95	3.75	.30	.33	.16
4	3.15	1.00	3.85	.33	.36	.18
4½	4.70	1.00	5.80	.40	.45	....
5	8.00	1.00	9.50	.50	.55	....
6	10.00	1.20	11.50	.....	.....	....
8	16.00	2.00	18.00	.....	.....	....
10	21.00	2.75	24.00	.....	.....	....
12	27.00	3.50	30.00	.....	.....	....
18	49.00	.....	.....	.....	.....	....

JUNCTION BOXES

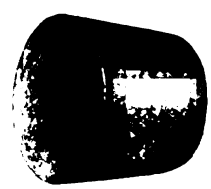
All sizes, one to four Socket or Harrington joint openings, $6.60 each



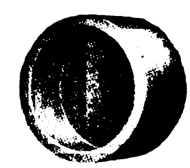
Tee



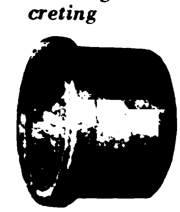
Cross



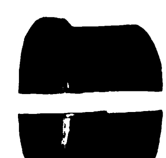
Plug for closing duct mouths during concreting



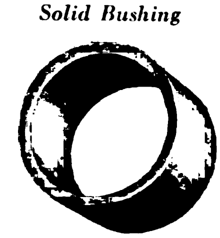
Cap for sealing duct ends



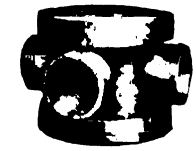
Solid Bushing



Split Bushing



Rough Fit Coupling for joining butted ends, or reinforcing conduit



Junction Box

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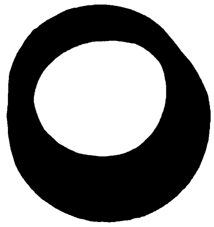
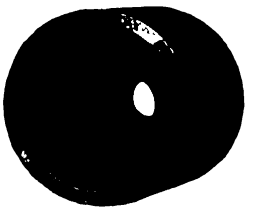
List Prices of Miscellaneous Fittings (continued)



Reducer
(Fibre to Fibre)



Adapter
(Fibre to Iron Pipe)

REDUCERS

For connecting Socket or Harrington Joint Conduit of different sizes.

I. D. Small End, ins.	Inside Diameter, Large End											
	2"	2½"	3"	3½"	4"	4½"	5"	6"	8"	10"	12"	18"
		$	$	$	$	$	$	$	$	$	$	$
1	....	....	....	....	....	....	2.50	2.50	5.00			
1½	....	....	....	....	....	....	2.50	2.50	5.00			
2	....	0.75	0.90	1.00	1.25	1.50	2.50	2.50	5.00			
2½	....	....	.90	1.00	1.00	1.50	2.50	2.50	5.00			
3	....	....	....	1.00	1.00	1.50	2.00	2.50	5.00			
3½	....	....	....	....	1.00	1.25	1.75	2.50	5.00			
4	....	....	....	....	....	1.25	1.50	2.00	5.00			
4½	....	....	....	....	....	....	1.25	1.50	5.00			
5	....	....	....	....	....	....	....	1.35	5.00			
6	....	....	....	....	....	....	....	....	3.50	10.00		
8	....	....	....	....	....	....	....	....	....	8.00	12.50	
10	....	....	....	....	....	....	....	....	....	....	10.00	15.00
12	....	....	....	....	....	....	....	....	....	....	....	15.00
18												....

ADAPTERS

For connecting Socket or Harrington Joint Fibre Conduit with iron pipe. Adapters fit over the conduit and the iron pipe. No threads are cut for the iron pipe.

I. D. Iron Pipe, inches	I. D. of Socket or Harrington Joint Fibre Conduit										
	2"	2½"	3"	3½"	4"	4½"	5"	6"	8"	10"	12"
	$	$	$	$	$	$	$	$	$		
1	0.70	1.00	1.10	1.20	1.35	1.50	1.75	1.75	2.00		
1½	60	1.00	1.10	1.20	1.35	1.50	1.75	1.75	2.00		
2	.40	.70	.90	1.00	1.35	1.50	1.75	1.75	2.00		
2½	....	.50	.75	1.00	1.00	1.50	1.75	1.75	2.00		
3	....	....	.60	.90	1.00	1.50	1.75	1.75	2.00		
3½	....	....	....	.70	1.00	1.25	1.50	1.75	2.00		
4	....	....	....	....	.80	1.25	1.50	1.50	2.00		
4½	....	....	....	....	....	1.00	1.25	1.50	2.00		
5	....	....	....	....	....	....	1.25	1.35	2.00		
6	....	....	....	....	....	....	....	1.35	2.00		
8	....	....	....	....	....	....	....	....	2.00		
10											
12											
18											

Jointing Compound

P. & B. Compound No. 2 is recommended for waterproofing joints of fibre conduit. This is an asphalt-base paint, which hardens within a few hours and provides a strong moisture-resisting joint.

To figure quantity of P. & B. Compound No. 2 required for an installation, use basis of one pint per thousand feet of conduit per inch of inside diameter for Harrington joints, or one-half pint per thousand feet per inch inside diameter for socket joints.

This contemplates painting the ends with a brush. If ends are dipped instead of painted, double the above quantities. Painting results in a better job.

Furnished in 50-gallon barrels and in 5-gallon, 1-gallon, ½-gallon, 1-quart and 1-pint cans.

Orangeburg Fibre Conduit Tooling Lathe

The Orangeburg Fibre Conduit Tooling Lathe is practically indispensable on large jobs. While a passable joint may be cut by hand, such joints are not tight and take considerable time to make. There are always short lengths to be cut, as well as broken ends to be retooled. An Orangeburg Fibre Conduit Tooling Lathe is inexpensive. It takes only a short time on a sizable job to save, through its use, the entire cost—$30.00.

The device is rapid in operation. It is easy to carry and is quickly set up, ready for use. Also, the rugged carrying case will withstand severe service. After an hour's experience with this method, an ordinary workman can readily cut 300 or more ends per day. Spare parts can be readily furnished at nominal cost.

Operation:

The tooling lathe consists of two parts, a chuck and a crank. The chuck is equipped with two rubber expanding rings. When inserted inside the conduit, the

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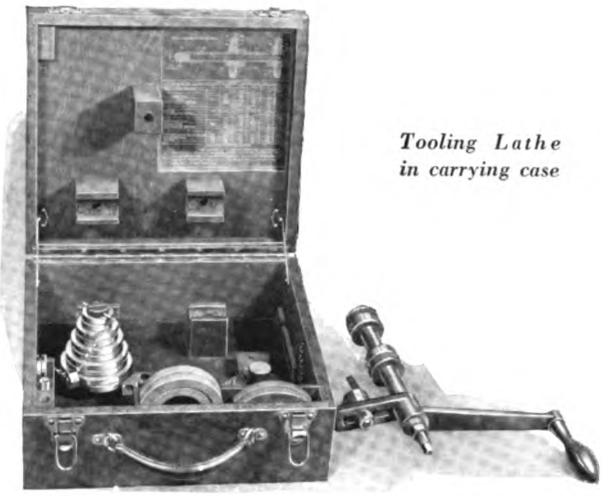
rubber rings are compressed, thus increasing the diameter until both rings grip the walls of the bore. The crank, on which the cutting blade is mounted, is then rotated on the chuck shaft until the joint is made. A stop on the crank prevents over-cutting.

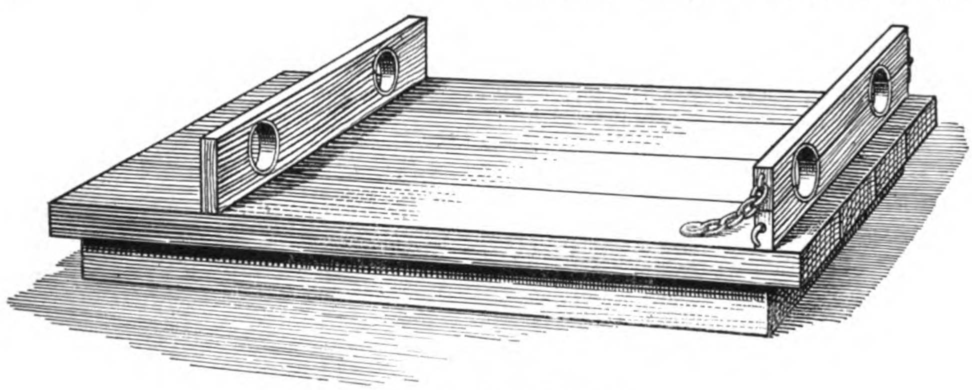
A bench top, such as illustrated, will save considerable time on the job. The vertical board at the left is cut with various size openings to accommodate the size of conduit being used. The vertical board at the right is made in the same way, but the openings are lined with thin rubber strips. This board is then split down the center, one end being fitted with a hinge and the other with a hook and chain. Thus, the conduit may be rapidly clamped into place for the jointing operation, making it unnecessary for the workmen to hold the conduit while tooling.

Knives are furnished for cutting both standard types of Fibre Conduit Joints—either socket type (mortise and tenon), or Harrington type (tapered sleeve). During the cutting operation with socket joints, a change from a male to a female joint, or vice versa, is made merely by reversing the tool holder. With Harrington joint the female joint is in the coupling. It is economical to purchase these couplings direct from the factory, as a special size tube is used in their manufacture.



Tooling Lathe in carrying case

When using Harrington Joint Conduit, long radius bends may be satisfactorily made up with the tooling lathe by using short sections of Fibre Conduit joined with couplings. It is not recommended that this practice be followed on curves with less than a 5-ft. radius, as the conduit ends, under such conditions, may offer resistance to the rodding wires or cable grips. This plan is not recommended for Socket Joint Conduit, as the joints would not be sufficiently tight.



Conduit cutting workbench

Uses of Orangeburg Fibre Conduit and Fittings

Power Houses:

Orangeburg Fibre Conduit is particularly suitable for power house installations because of its very high insulating properties and extreme lightness, offering important advantages over iron pipe for cables which lead from generators to switchboard, transformers to switchboard and generators to transformers. It will last indefinitely where iron pipe will corrode and rust; it eliminates hysteresis losses when used in alternating current installations; and it is inexpensive and easy to install. In addition bends of varying radii, as well as "S" bends, tees, elbows, crosses, and junction boxes, suitable for the most complicated installations, can be obtained.

Material for power house installations is furnished cut to sketch and marked for easy identification.

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Light and Power Companies:

For the distribution of light and power cables throughout the underground district.

For laterals from manhole to distributing pole, using an Orangeburg Fibre Conduit 90° bend to conduct cable vertically from lateral.

For underground distribution of residential service.

For protection of ground wires in joint pole construction.

For generator leads, exciter leads, etc. and for bus-bar covers, in power houses and substations.

For wall and roof bushings.

For underground distribution in connection with ornamental street lighting systems.

Municipalities:

For ornamental street lighting systems, Orangeburg Fibre Conduit is particularly well adapted because of its ease and flexibility of installation, which is of great advantage when work must be done in congested streets. The further points of merit of this conduit are its smooth bore with no offsets at the joints; an inside surface which will not injure the sheath of the cable; joints that may be made water-tight and gas-tight; high insulating and non-hygroscopic properties; no deterioration from rust or corrosion; and a system which allows the removal of cables and the pulling in of new cables.

For reserve ductways installed at right angles to direction of road, under macadam or other expensive roadways to accommodate water or gas service.

Railroads and Street Railways:

For generator, exciter, transformer and switchboard leads in power houses and substations.

For underground distribution of signal wires, and telephone and telegraph wires.

For general distribution of underground feeder cables.

For conducting feeder cables underground between tracks.

For ducts in retaining walls in connection with track elevation construction.

For general wiring in round-houses.

Telephone Companies:

For distribution of telephone cables throughout the underground district. The conduit can be laid either with or without a protecting envelope of concrete, depending on local conditions.

For laterals from manhole to distributing pole, using an Orangeburg Fibre Conduit 90° bend to conduct cable from lateral to straight sections up the pole.

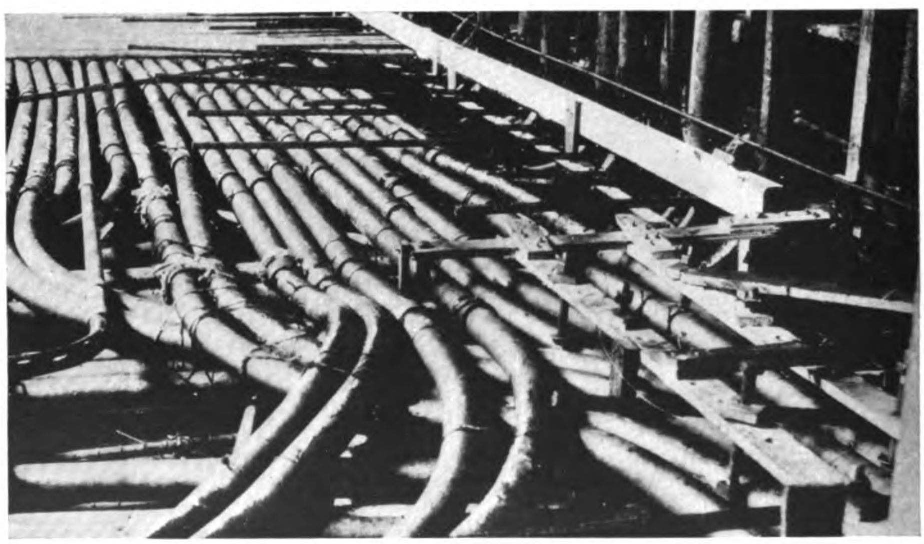
For underground distribution of residential service.

For conducting leads from battery to battery panel; from battery to power board or from panel to relay rack, through concrete floor in the apparatus room.

For protection of ground wires in joint pole construction.

For underground crossing of railroad tracks.

For fume vents in battery rooms. (Orangeburg Fibre Conduit can be furnished up to 18″ diameter for this purpose).



Orangeburg Fibre bends in power house construction—United Electric Light Co., Springfield, Mass. Stone & Webster, Inc., Engineers and Constructors

Installation of Orangeburg Fibre Conduit

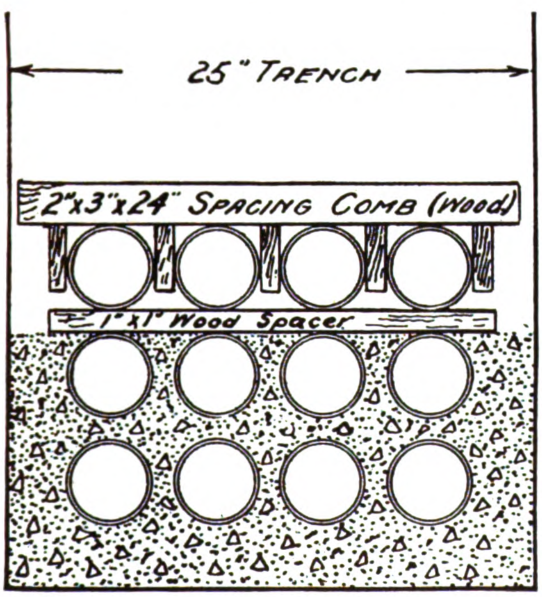
Tier-by-Tier Method:

This method consists first of placing on the bed of the trench a foundation of concrete. Then the lowest tier of ducts is installed, holding them at the desired horizontal separation by wooden or concrete combs, spaced on approximately 3-ft. centers, with staggered joints. The space between the ducts is then filled with concrete and concrete is spread over them until the desired vertical separation is obtained. The operation is repeated tier by tier until the required number of ducts has been laid, the tiers held at the desired vertical separation by spacers.

Concrete is usually 3″ thick under the bottom tier, above the top tier, and between the outer conduit and sides of trench. Ducts are separated from each other vertically and horizontally by from 1″ to 3″ of concrete, depending upon voltage to be carried and the amount of ventilation in the ducts.

Concrete is generally of 1:3:5 mix with the stone passing ¾″ screen. The amount of water should be carefully watched so the concrete is just fluid enough to be easily tamped around the ducts with no superfluous moisture. J-M Celite in the proportion of 0.4 cu. ft. (about 4 lb.) per bag of cement will result in a relatively dry concrete of high workability.

Intact sections of pavement and base serve as braces for top of ditch. Conduit installation by Los Angeles Gas and Electric Corp., Los Angeles, Calif.



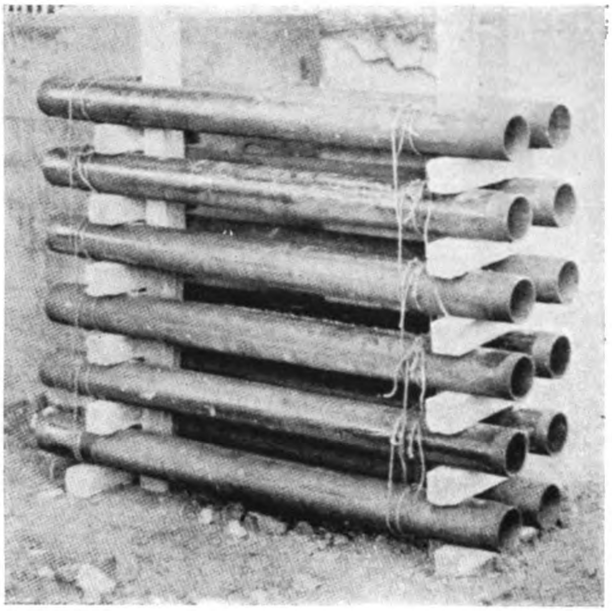
Wood spacers are removed when tiers are partly concreted

The tier-by-tier method insures accurate spacing of ducts and, because concrete is placed in relatively small sections, a more uniform filling with practically no possibility of voids in the concrete.

Built-Up Method:

With this method the several tiers of duct are all placed in position one above the other before any concrete is poured. The ducts are held in proper position by concrete separators.

In some instances, rectangular separators at sufficient intervals to support the duct rigidly, are used. In such cases it is necessary, in order to prevent ducts from "floating" when concrete is poured, to bind the ducts in groups of four with hemp twine. (See next page.)



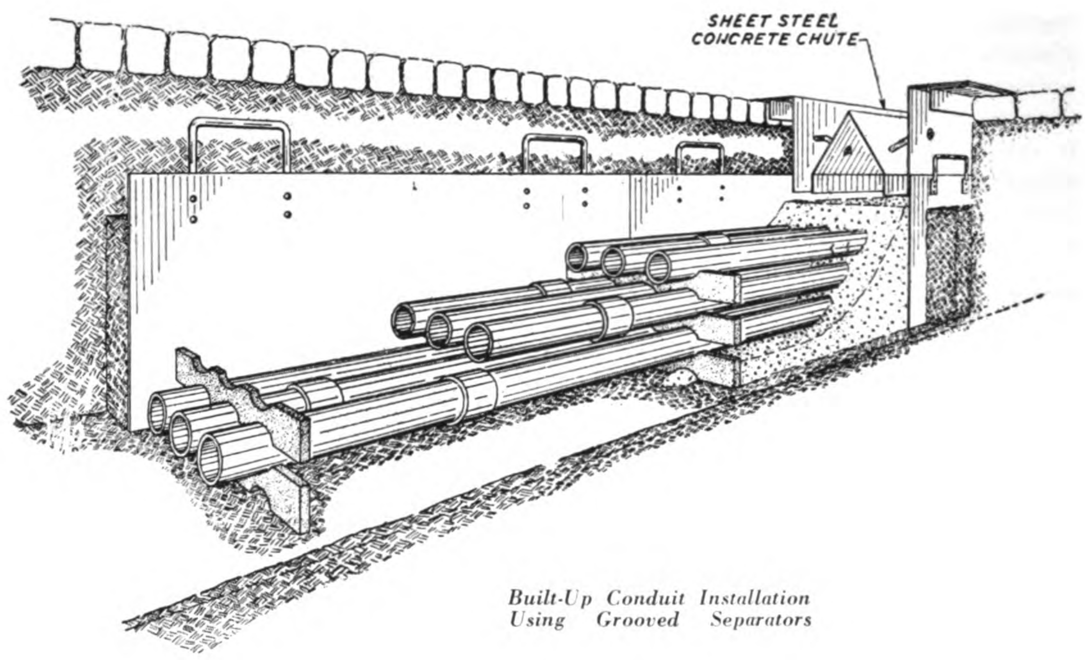
Conduit tied together for "Built-Up Method"

A more satisfactory separator consists of a concrete form, grooved top and bottom, into which the ducts are laid. Sand bags or other suitable weights are then placed on top of the upper tier of ducts to prevent movement.

Concrete of the same mix mentioned under "Tier-by-Tier Method," is then placed in the trench, care being taken to deposit it slowly enough to prevent damage to the ducts.

In a deep trench it is advisable to pour the concrete on a board laid over the duct, from which it may then be shoveled in small lots and tamped into place. On long runs a deflecting trough of steel may be advisable, the concrete flowing from each side of the trench toward the middle.

The advantage of this method, provided the job is done carefully, is that the concrete, being placed in one continuous pour, is monolithic.



Built-Up Conduit Installation Using Grooved Separators

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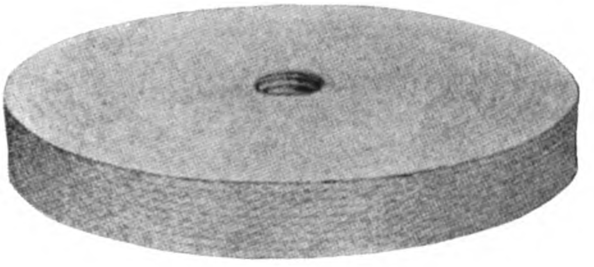
Armaturo Asbestos Tape



Armaturo Asbestos Tape is especially adapted to magnet and armature work. It is a combination of asbestos fibre and cotton mesh cloth, the asbestos fibre being run up on both sides of the cotton mesh without filler or sizing. The asbestos insures dielectric and heat-resisting qualities, while the cotton mesh gives strength, the latter being particularly desirable where the product is used in connection with winding machines.

Armaturo Asbestos Tape is ideal for winding field coils. There have been occasions where, after running 50,000 miles, field coils wound with Armaturo Asbestos Tape have been removed and showed no signs of deterioration.

Wrapping field coils with one or two layers of Armaturo Asbestos Tape will greatly increase the life of the coil and more than pay for the expense of installation. When properly protected from the action of the air by asbestos tape, coils have been run at 15 or 20 deg. F. higher than the temperature at which the coil material would carbonize.

Armaturo Asbestos Tape is fireproof and designed for use where thin asbestos woven tape has heretofore been used. The carbon content of Armaturo Asbestos Tape is less than 10%.

Sizes and Weights:

Armaturo Asbestos Tape is made in standard widths of ½″, ¾″ and 1″ and in standard thicknesses of .015″ and .025″. The .015″ thick tape ½″ wide is put up in ½-lb. rolls, the ¾″ in ¾-lb. rolls and the 1″ in 1-lb. rolls, the 1″ material running about 200 ft. per lb. The .025″ thick tape ½″ wide is supplied in ⅝-lb. rolls, the ¾″ in 15/16-lb. rolls, and the 1″ in 1¼-lb. rolls, the 1″ wide material running 110 ft. per lb. Other thicknesses can be furnished on special order.

J-M Asbestos Listings

J-M Asbestos Listings are fireproof, flexible, woven tapes, suitable for wrapping electrical wires and coils. Also used for insulating small diameter hot pipes and as belts or lead-in tapes where temperatures are too high for cotton fabrics. See details in the "Textiles, Papers and Fibres" Section.

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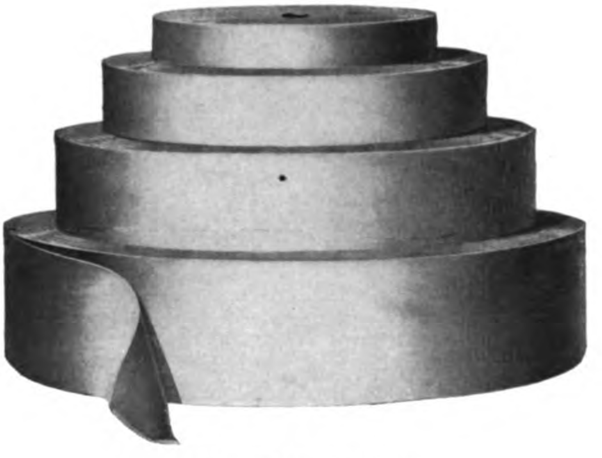
Fibroid Asbestos Paper Tape



Rolls of Fibroid Tape

Fibroid Asbestos Paper Tape is a thin fireproof paper made from specially selected asbestos fibres and is used for wrapping both magnet and armature wires. It is furnished in widths of 3/8″ and over in multiples of 1/16″ and in thicknesses from .006″ to .035″. In the thinner sizes it may not be held to exact thicknesses and reasonable tolerances must be allowed.

It is put up in firm coils about 7″ in diameter, 1″ hole, cut with smooth edges. A roll of 1″ wide material weighs about 1 lb. Widths up to 36″ are made specially to order.

Approximate yardages in these 7-inch rolls are:

.006″	thick	160 yards
.010″	"	86-2/3 "
.015″	"	65-1/3 "
.020″	"	46-2/3 "
.035″	"	32-2/3 "

Dimensions and List Prices

Thickness	Width	List prices per pound: 100 lb. or more	25 to 99 lb.	Less than 25 lb.
.006″ to .01″	3/8″ (cut from special long fibre paper)...	$1.12	$1.32	$1.52
	1/2″ (or more) (cut from special long fibre paper).......	.92	1.12	1.32
.01″ to .014″	3/8″................	.68	.88	1.08
	1/2″ (or more).......	.48	.68	.88
.015″ to .035″	3/8″................	.48	.68	.88
	1/2″ (or more).......	.28	.48	.68

J-M Braided Asbestos Tubing

J-M Braided Asbestos Tubing is made of commercially pure asbestos yarn braided into flexible tubing of various sizes. Its principal electrical use is for covering wires to protect them from heat or chemicals. Complete information is given in the "Textiles, Papers and Fibres" Section.

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J-M Friction Tapes

J-M Friction Tapes are woven from carefully selected sheetings, impregnated with an insulating compound, and coated with a high-grade adhesive rubber composition. The advantages of J-M tapes are: High dielectric strength; strong friction; high tensile strength; exceptionally few pin holes; and good yardage. The various types of J-M Friction Tapes are listed below:

Jomanco Tape:

This tape is of the highest quality and is used principally by manufacturers of electrical machinery because of its high insulation and its ability to resist heat. It is dark gray in color and contains 50 yds. to the lb., commercial weight, in ¾″ width. It is made in 4-oz. and 8-oz. rolls only.

No. 3 Tape:

No. 3 Friction Tape is a great favorite with wire men. It is used for both inside and outside work on account of its adhesive qualities and strong friction. This tape is a fine insulator and is also adapted for armature and cable work. It meets United States Navy specifications for quality. It is made in black only and contains about 50 yds. to the lb., commercial weight, in the ¾″ width. It is made in 4-oz. and 8-oz. rolls only.

J-M A.S.T.M. Friction Tape:

This is a net-weight tape, made especially to meet the friction tape specification of the American Society for Testing Materials. It runs 55 to 58 yds. per lb. in ¾″ width, and is furnished in 8-oz. rolls only. Many railways, public utilities, etc., specify A.S.T.M. tape because of its excellent quality.

J-M No. 5 Tape:

This is a black friction tape, very sticky, strong in friction and free from pinholes. It is particularly adapted for outside work and is very durable. It is made in black only and contains about 43 yds. to the lb., commercial weight, in the ¾″ width. It is made in 4-oz. and 8-oz. rolls only.

J-M Friction Tape:

This is an inexpensive tape intended primarily for use in the automotive field but also used to some extent in the electrical field. It is a strong, closely woven solid fabric heavily impregnated with a special compound. It has remarkable adhesive properties and durability. It is not affected by moderate temperatures or moisture and will not dry out with age. It will not corrode wires and has no pinholes, lumps, or thin spots. Its insulating efficiency is exceptional because the saturation of the fabric is heavy and even. It can be used on wires subjected to oil.

For the electrical industry, J-M Friction Tape is usually packed in 4-oz. or 8-oz. cartons and averages 40 yds. per lb., commercial weight, in ¾″ width. For the automotive field, and for hardware and radio dealers, etc., it is packed in attractive counter display containers of 1, 2 and 4-oz. rolls. When packed in this manner it averages 38 yds. per lb., commercial weight, in ¾″ width.

J-M White Tape:

J-M White Tape is manufactured with the same care as the other J-M brands, but as a coloring material must be employed with the impregnating compound to attain whiteness, its friction and durability are more or less decreased. No white tape is as satisfactory as gray or black tape, and the use of Jomanco, a gray tape, is recommended, wherever possible. Where gray or black tape may not be used, however, J-M White Tape will give service equal to or better than any other white tape on the market. It runs 38 yds. to the lb., commercial weight, in ¾″ width and is made in 8-oz. rolls only.

J-M Splicing Compounds

J-M Splicing Compounds are uncured rubber tapes, used under the Underwriters' rules to cover all wire splices intended for lighting or power. They are furnished in three grades under the names "Alpha," "A.S.T.M.," and "Brooklyn."

In application, the material is served over the joint in lapped spirals until a thickness is obtained which will give electrical protection equivalent to the adjacent insulation on the wires. The tape vulcanizes into one solid tube under average atmospheric conditions. Standard practice also demands a further wrapping of friction tape to preserve the rubber tape from mechanical injury.

Alpha Splicing Compound:

This material is carefully compounded and is exceptionally strong and very elastic. When wound in place, it forms a solid tube, thus making a thoroughly water-tight joint. It is an excellent material for cables and all outside work. It is furnished in ¾" width and contains about 17 yds. to the lb., commercial weight, in ¾" width. Made in 4-oz. and 8-oz. rolls.

A.S.T.M. Splicing Compound:

Made to meet the current specification for splicing compound of the American Society for Testing Materials. Furnished ¾" wide and contains 17½ yds. to the lb., net weight. Made in 8-oz. rolls only.

Brooklyn Splicing Compound:

This material is strong and elastic. Although not as high quality as Alpha, it nevertheless provides a water-tight joint. It is furnished in ¾" width and contains about 14 yds. to the lb., commercial weight. Made in 4-oz. and 8-oz. rolls.

INDEX

Filter-Aids and Mineral Fillers

(For complete list of data sheets, see other side of this page)

NOTE: Further related uses of Celite are treated in the "Celite for Concrete, Mortar, and Asphalt Paving Mixtures" section.

Asbestos Fibre and Cloth

Asbestos fibre and cloth of various types are also used in filtering processes, particularly in the filtration of chemicals. These materials are described in the "Textiles, Papers and Fibres" section.

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Filter-Aids and Mineral Fillers

Complete Index of Data Sheets Available

Celite Filter-Aids:

Celite Mineral Fillers:

Brochures, etc.

Celite Filter-Aids Brochure (description, advantages and applications of filter-aids), 20 pp. 8½"x11", form FA-1A.

Celite Filter-Aids Booklet (same as brochure, except somewhat condensed and fewer illustrations), 16 pp. 3½"x6", form FA-1A.

★Catalog pages

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Celite Filter-Aids

FILTRATION is usually accomplished by forcing a liquid, under pressure, through a cloth or screen. Theoretically, the liquid should pass through the openings of the filter cloth and the impurities should remain upon the cloth. But what actually happens in many cases is that the finer suspended solids pass with the liquid through the comparatively coarse openings in the ordinary filter cloth; the larger particles remain behind upon the cloth to clog the openings, smear the cloth, and slow down or entirely stop the flow through the filter press.

Such difficulties are particularly emphasized in what may be termed "clarification filtrations," where the particles to be removed are non-rigid, slimy, or colloidal in size. Oils, sugar syrups, glucose and cereal beverages are among the many products which present this type of filtration problem. The gelatinous, finely divided suspended matter cannot be completely removed, nor can even indifferent clarification be effected economically unless a filter-aid is added before the liquid passes through the press.

A small quantity of filter-aid assures the formation of an open, porous cake on the cloth, which traps all suspended matter and greatly increases the rate of flow. It facilitates the removal of suspended matter from the liquids; the resultant filtrates are brilliantly clear and free from impurities, and the cake easily removed without injury to the cloth.

A filter-aid should be finely divided, porous, light in weight, inert and should not affect the chemical or physical characteristics of the filtrate. It must have a low specific gravity in order to remain in suspension while the liquid is being filtered.

The Celite Filter-Aids—Hyflo Super-Cel, Standard Super-Cel and Filter-Cel, are ideal filter-aids, possessing all these properties. They are milled from exceptionally pure diatomaceous silica (Celite), the individual particles being microscopic in size, porous and inert. These filter-aids increase the capacity of the filter, reduce operating costs, and assure filtrates that are clear, brilliant and free from all suspended matter.

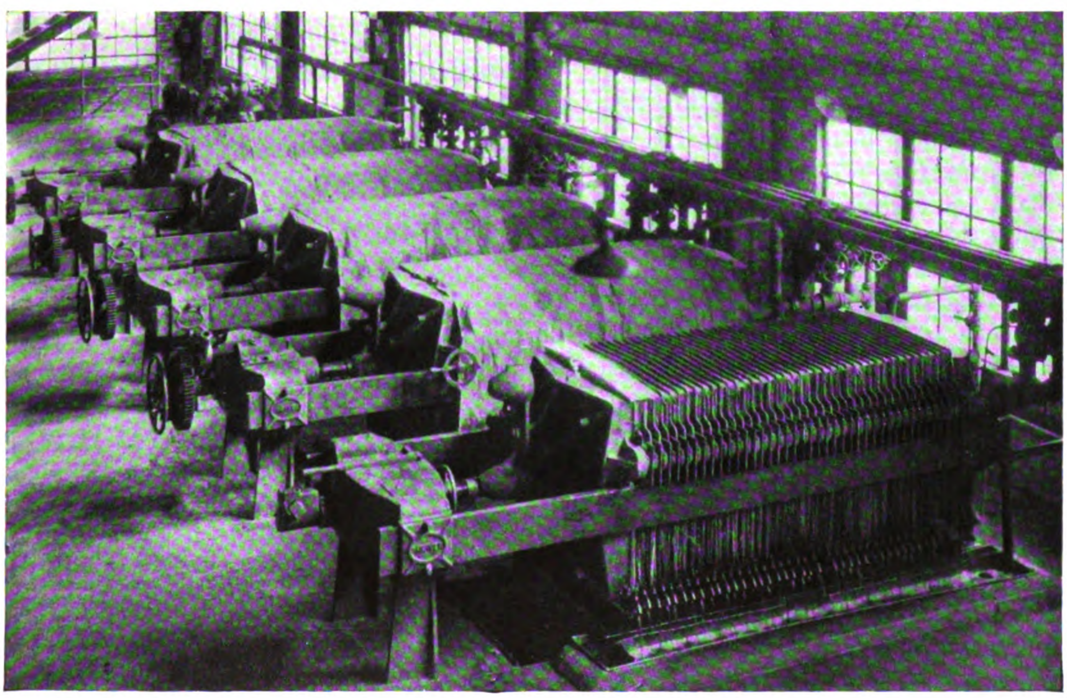

Fig. 1. These plate and frame presses have a total filter area of 4,444 square feet and filter 210,000 gallons of cane sugar refinery syrups daily, running on 12-hour cycles between filter cleanings. Hyflo Super-Cel enables the cake to be washed in the filter and gives the presses a filtering efficiency of 2.0 gallons per square foot of filter area per hour over the total cycle.

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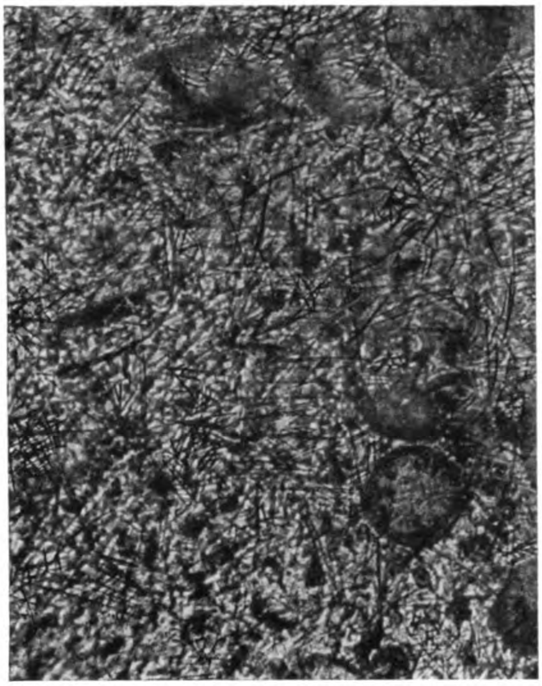
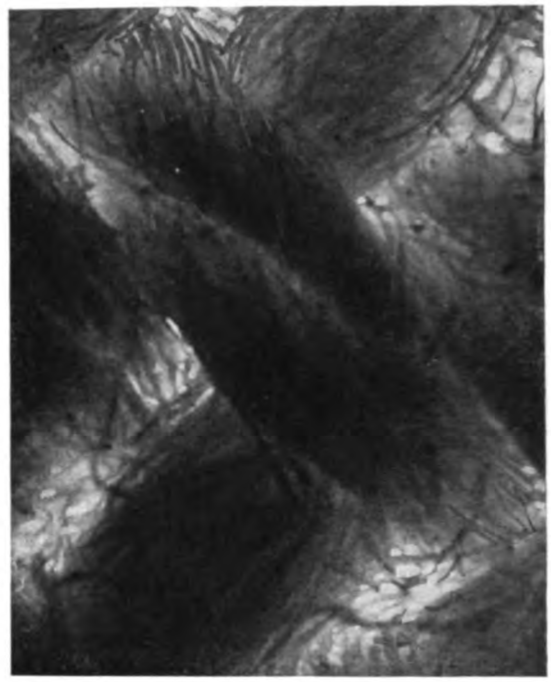

Fig. 2. At the left is the filter-aid, Super-Cel, enlarged 200 diameters. The pore channels through a matte of this material, just visible even at high magnification, are much smaller than the finest particles of any suspended precipitate. In comparison, closely woven filter cloth shown opposite at equal magnification, is an "open screen" which can retain only the coarser solid particles occurring in the liquids being filtered.

How Celite Filter-Aids Are Used:

A small quantity of the proper Celite Filter-Aid is added to the liquid to be filtered. This quantity ordinarily varies from $\frac{1}{10}$ to $\frac{1}{2}$ of 1% of the weight of the liquid, depending upon the nature and amount of the suspended matter present.

After the filter-aid is well stirred into the liquid, the mixture is passed through the filter where the filter-aid and the impurities are retained as a porous film or cake against the filter cloth, allowing the clear liquid to run through.

Celite Filter-Aids are used with all types of pressure filters. The best results on a manufacturing scale are obtained with pressure filters of the type having space for the accumulation of the impurities in the form of a filter cake, such as plate and frame, leaf type, and vacuum filters. Filter-aids must always be used with a retaining medium such as cotton or woolen cloths, fine metal screens, wire cloths, etc. The filter-aid, with the suspended impurities, forms a porous cake which can be cleanly and completely parted from the filter cloth.

Selection of the Proper Filter-Aid:

Hyflo Super-Cel, Standard Super-Cel and Filter-Cel build up filter cakes of varying porosities. Hyflo Super-Cel causes the formation of a cake having the largest sized pores, Standard Super-Cel one with smaller pores and Filter-Cel one with pores still smaller. These differences in pore size are very small —microscopic, in fact.

Considerably higher rates of flow are obtained through Hyflo Super-Cel than through Standard Super-Cel and considerably higher rates of flow through Standard Super-Cel than through Filter-Cel. Filter-Cel (smallest size pore spaces) removes slimy or colloidal type material of less than 0.1 micron in size (1 micron is 39/1,000,000 of an inch).

Due to these three varying cake porosities, a filter-aid can be chosen which will give maximum rate of flow and the required clarification. In the great majority of industrial filtrations, Hyflo Super-Cel will completely screen the fine solid matter out of suspension and is generally used because of its high flow rate. Should the suspended solids, however, be

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excessively small or colloidal, Standard Super-Cel and Filter-Cel should be tried successively.

For the usual filtrations the grade of filter medium necessary is now well known. While there are often exceptions, the partial list below shows the usual Celite Filter-Aids which should be used for various types of "clarification" filtrations.

Hyflo Super-Cel

Adhesives	Metallurgical Solutions
Animal Oils	Molasses
Cereal Beverages	Petroleums
Chemical Products	(Crude and Refinery Oils)
Cider	Pyroxylin Bases
Dyestuffs	Shellac
Fish Oils	Soap Lye
Glucose	Sorghum
Glue (Some Liquors)	Sugar Syrups, Beet
Lacquers	Sugar Syrups, Cane
Lard (Dry rendered)	Varnish
Liquid Soap	Vegetable Oils
Maltose	Waxes
Maple Syrup	

Standard Super-Cel

Cane Sugar (Thin Juices)	Grape Juice
Extracts	Pectin
Fruit Juices (Generally)	Pharmaceuticals
Gelatine	Water Treatment
Glue (Some Liquors)	Wine

Filter-Cel

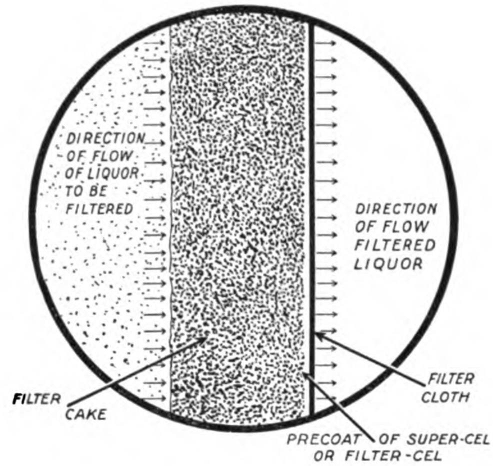
Lard (Wet rendered)	Milk Sugar
Metallurgical	Sewage
(Precious metal filtrations)	Vinegar

Any filtration calling for removal of ultra-microscopic size material.

Quantity of Filter-Aid Necessary:

The proper quantity of filter-aid depends more upon the nature, than upon the quantity, of suspended impurities. Sufficient filter-aid must be used to obtain the required degree of clarification and a reasonable rate of flow. This amount usually involves having enough filter-aid present to envelop and surround completely the suspended substances. In this way a filter cake of the required porosity is obtained. The percentage of filter-aid necessary to provide for perfect clarification, protection of the cloths, proper cake formation, etc., is generally from $\frac{1}{10}$ to $\frac{1}{2}$ of 1% of the weight of the liquid.

The capacity of a press and the length of the filtering cycle can be increased by using a higher percentage of filter-aid. As the actual filtering area of filtering equipment in a plant is fixed and limited, varying the amount of the filter-aid provides an economical method for making the capacity of the plant elastic.



An enlarged sketch illustrating the manner in which a filter-aid prevents the passage of finely divided impurities through the filter cloth

THE FILTER CAKE. All the impurities suspended in the liquid being filtered are accumulated here. The cake is kept open by the filter-aid which is mixed with the charge liquid.

THE PRECOAT. A thin film of filter-aid is deposited on the filter cloths by precoating. This thin film is open to the passage of clear liquids but is positively impervious to all solid impurities. It serves to keep the main filter cake containing the impurities being removed from coming in direct contact with the filter cloth.

THE FILTER CLOTH. Its sole function is to support the filter cake. Slimes and gums do not reach it to clog the meshes and slow down filtration, or penetrate the cloth and cause cloudy filtrates.

Fig. 3. Diagrammatic cross-section through a filter cake

Filtration Procedure Using Celite Filter-Aids:

A typical filtration system is illustrated in Fig. 4. An initial charge of water, solvent or previously filtered clear liquid containing a suspension of filter-aid is mixed in the precoating tank. (Unfiltered or "raw" liquid may be used in precoating but it is not so desirable). Usually from 5 to 10 lb. of filter-aid per 100 sq. ft. of filter area are used for this precoat charge, the exact quantity depending on the cloth-smearing tendency of the precipitate. The volume of the initial charge must be from 125% to 150% of the volumetric capacity of the press, pump and pipe lines.

While preparing the precoat, a predetermined quantity of filter-aid is added to the main batch of liquid in the mixing tank, which should be equipped

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with a paddle or other means of continuous agitation to insure keeping the filter-aid uniformly dispersed in the liquid. This tank is usually equipped with a pump capable of putting through the batch in a definite time cycle, at pressures up to 60 lb. per sq. in. When a separate pump is used for the precoating, as in large installations, it is usually a low pressure centrifugal pump.

The precoat suspension is then pumped through the press at a low pressure (below 10 lb. per sq. in.), depositing the filter-aid in a thin film over the entire surface of the filter cloth. To insure a uniform precoat layer, the pump should be large enough, as a rule, to force liquid through the press at the rate of 10 to 20 gal. per sq. ft. per hour. Regardless of what liquid is used for the precoat suspension, the liquid, after flowing through the press, is usually circulated back to the precoating tank until it runs absolutely clear.

Where the liquid used to suspend the filter-aid for precoating is the same as the liquid in the main charge to be filtered, the flow from the filter is turned to the clear liquid receiving tank as soon as clarity of filtrate is obtained. Just before the precoating tank is empty, the draw-off valve on the mixing tank is opened and the outlet valve on the precoating tank is closed. Thus a continuous flow to the filter is obtained. The precoat tank should not be allowed to empty before the main charge is admitted to the press, or there will be a period when there is no pressure upon the precoat film and it may slide from the cloth.

When the precoating filter-aid is suspended in water, the water is run to waste. Otherwise the procedure is as above. However, should dilution be undesirable, air pressure can be applied to the filter and the precoat tank outlet valve closed just before the precoat tank is empty. This air pressure will blow the excess water out of the filter. The main charge of liquid is then admitted to the press and the air line closed.

At the end of a cycle, when the cake space of the press has been filled or the rate of flow has dropped to a minimum, the press is stopped and made ready for another cycle. The impurities which have been trapped are securely held in the filter-aid cake. The capillary channels of the filter cake are filled with the liquid filtered. By pumping hot or cold water, or some other solvent to suit the conditions, through

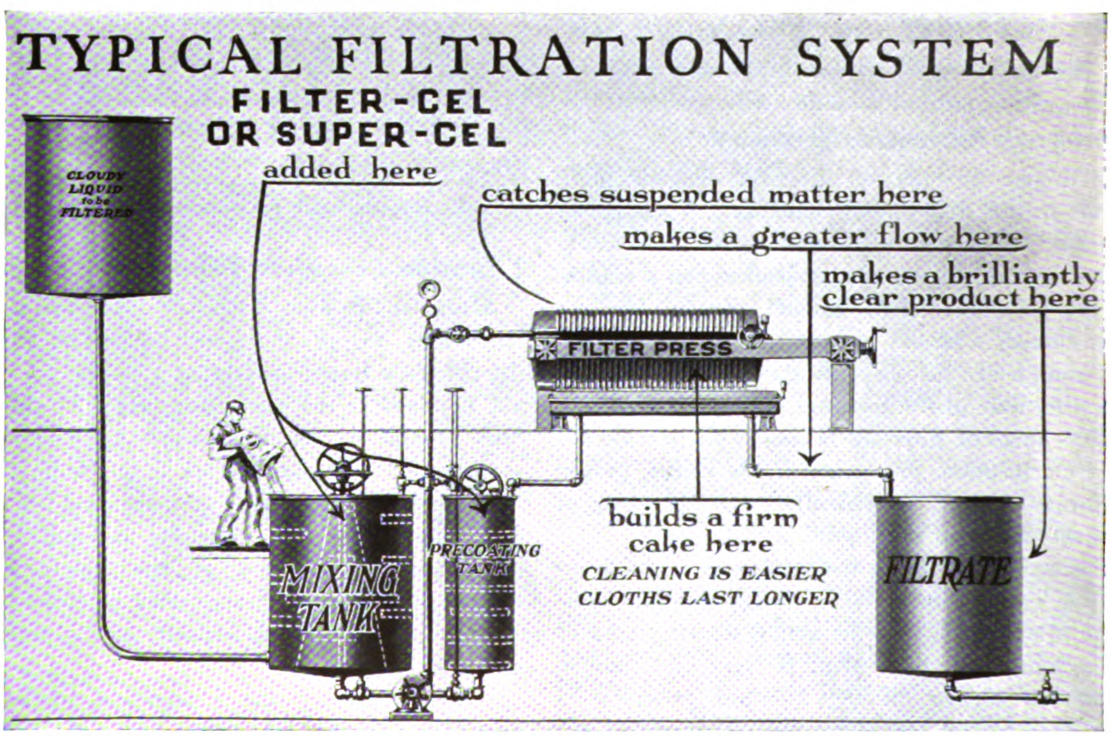

Fig. 4. Layout of a filter station using Celite Filter-Aids

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the cake, the liquid can be displaced and removed. It is usually necessary to pump the wash liquid into the filter cake at about 10 lb. higher pressure than the final filtering pump pressure. The press is then opened and the cake drops cleanly from the cloth.

Function of the Filter-Aid:

In clarification filtrations, the suspended solids are usually of such a nature that if sufficient filter-aid is not used, the cloths of the press become slimed, stiff, and impervious. The cloths then have to be removed and laundered or replaced at the end of each filtering cycle; the press is out of commission in the meanwhile, and the capacity of the filter station is greatly reduced. With the use of the filter-aid, long filtration cycles are assured and the filter cloth remains open and porous.

While the function of the precoat is to protect the cloths and insure a brilliant filtrate at the beginning of the operation, the addition of from $\frac{1}{10}$ to $\frac{1}{2}$ of 1% of the filter-aid to the entire batch is necessary to secure good results through the run. The filter-aid in the main batch prevents the sliming of the filter-aid precoat and continues to build up an open porous cake which allows the filtration to proceed. The pores of the precoat are otherwise quickly clogged by the slimes in the pressure liquid and the flow of the press choked.

While precoating is not always considered necessary, the heavily charged precoat liquid first entering the press gives the cloths the same positive protection that a large excess of filter-aid in the main body of the liquid would afford, and insures the same brilliance of filtrate toward the end of the cycle when the higher pressures are being used. Precoating is practically always done on large scale work where continuous operation of the filter presses is an absolute necessity.

On leaf type filters particularly, precoating is employed due to the fact that the cloths are sewed on the frames and cannot be removed and cleaned without considerable difficulty. Other types of leaf filters are provided with metal cloths which are soldered to the leaf frames. Keeping the cloths clean on this type of press is essential for continuous operation.

In many ordinary filtrations when enough filter-aid is added, the cake is so porous and breaks from the cloth so cleanly that the precoat is unnecessary. Such conditions are usually found in plate and frame installations on certain products but the filter cloths are removed frequently (sometimes at the end of each cycle) and washed before the next run to prevent fermentation or hardening of the cloths.

Rates of Flow:

The capacity of a pressure filter is usually expressed as so many gallons (or fraction of a gallon) per sq. ft. of filter area per hour on the total cycle, which includes the "dead" time on the press (cleaning, filling, washing, etc.). Rates of flow in "clarification filtrations" are based upon:

1. Filter area.
2. Amount of filter-aid and type of filter-aid used.
3. Length of filter cycle.
4. Pump pressure.
5. Treatment, concentration and temperature of liquid.
6. Dead time on press according to make of press, cake content and treatment.

The Super-Cels and Filter-Cel are now so universally used that the rate of filtration of practically every liquid in important processes is known. For example, dense viscous liquids such as sugar syrups, varnishes, etc., are filtered with Celite Filter-Aids with press capacities of 2 to 10 gal. per sq. ft. per hour. With free filtering, non-viscous liquids such as vinegar, cereal beverages, etc., capacities of 20 or more gal. per sq. ft. per hour can be obtained.

When a filter press is started on a new cycle, the rate of flow declines sooner or later to a point be-

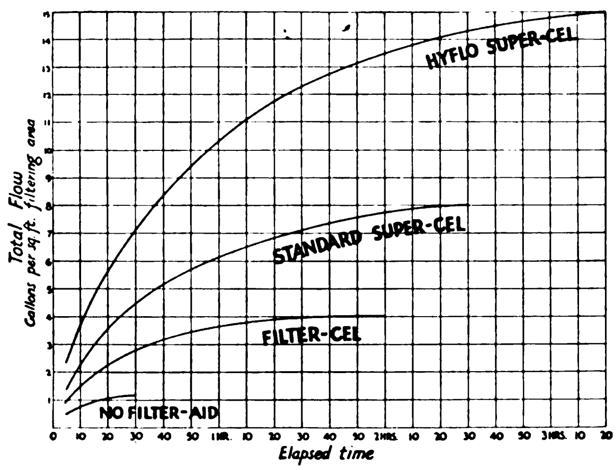

Fig. 5. Relative rates of flow and filtering capacities obtained with Super-Cel, Filter-Cel, and no filter-aid, in filtering typical liquids; quantities of the filter-aids being the same.

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yond which it is not economical to continue operation. The press is then opened up and cleaned in preparation for another cycle. With increased pump pressure no marked falling off in the rate of flow over an extended period of time would be exhibited by a liquid with an absolutely free-filtering precipitate. In actual practice, however, the liquids which must be filtered exhibit a falling off in rate of flow as filtration proceeds and as the filter cake builds up in thickness and resistance. The rate of decline in flow depends on the nature of the liquid and the amount and nature of solids present.

The purpose of using Celite Filter-Aids is to make slow-filtering precipitates (or other solids to be removed) act more like free-filtering precipitates in the filter press, in addition to insuring the highest possible clarity of finished filtrates. It has been found in many cases that a slight increase in the percentage of filter-aid added, not only increases the rate of flow but also makes longer filtration cycles possible. The result in such cases is that the cost of filtration is decreased due to the increase in output per unit of time, labor and equipment.

Filter Cloths:

Due to the fact that one result of using a filter-aid is to transfer the true filtering surface from the face of the cloth to the filter-aid, special and expensive weaves and heavy weight filter cloths are not necessary. In leaf filters a light 200 drill cotton cloth is satisfactory as there is no wear upon the cloth. In the smaller sized plate filters, up to and including 24 in., an open weave 10-oz. duck is satisfactory. In still larger plate filters, 12-oz. and 14-oz. ducks are recommended due to the harder service expected from the cloths. Also, in the case of the larger plate filters, 36 in. and greater, where the wear upon the cloths is excessive or labor untrustworthy, a double layer of cloth is desirable. Next to the plate is laid a 14 or 16-oz. burlap. Over this is laid a 12 or 14-oz. duck. The burlap is used to prevent cutting the duck when tightening up the filter. The burlap also helps to keep the lighter cloth from being forced so tightly against the filter surface as to prevent proper drainage of the filtered liquid to the outlet channels. Only the duck requires laundering at intervals as the duck protects the coarse burlap beneath.

Wire screens and metal cloths are finding increased fields in many of the chemical industries. The ability of Celite Filter-Aids as a precoat to protect such cloths widens the field greatly for this type of fabric. On leaf type rotary pressure filters, the leaves are usually covered with metal cloth, in spite of its higher cost per square foot, on account of the high labor cost of dressing the filter. It is particularly essential to protect the more expensive metal cloth on such filters with a Celite Filter-Aid film to insure continued life of the metal cloth.

A 60 x 60 twilled cloth is the coarsest weave recommended for use with Celite Filter-Aids, and will retain any of the Celite Filter-Aids satisfactorily. The 80 x 70 twilled will often prove more satisfactory and 20 x 150 and 16 x 200 are also used successfully. These metal cloths can now be obtained in Monel metal, brass, bronze, steel, etc.

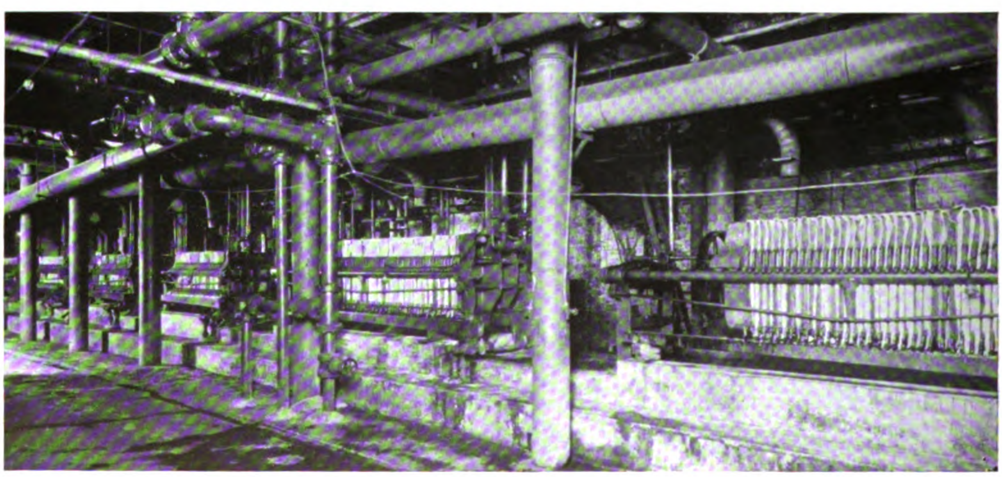

Fig. 6. Celite Filter-Aids are used in this battery of filter presses for the clarification of high-grade syrups.

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Pumps and Pump Operation:

Ordinarily a centrifugal pump gives best results. There are no pulsations to pack the filter cake and so tend to close the flow channels through it. However, due to the churning action in the pump, some soft suspended particles may be broken into many smaller ones and so cause a liquid to be more difficult to filter.

Other types of pumps which are often used are the triplex belt-driven plunger pump or the regular steam-driven duplex reciprocating pump with ball valves on the water end. A pump of this type should be large enough so that it can be run slowly to avoid pulsation. An air chamber on the pump is usually used.

Regardless of the type of pump used it is advisable to start the filtration at a low pressure and either allow this to increase by itself as the cake builds up, or regulate it so that the maximum pressure is not reached much before the end of the filter cycle. This procedure produces a filter cake of more open texture and usually gives a larger output from the filter than would be obtained were full pressure exerted at the start.

Proper Agitation:

A most important factor in securing best results with Super-Cel and Filter-Cel is to make sure that they are completely and intimately mixed with the liquid and the mixture *kept agitated* the entire time the press is in operation. The importance of thorough and continuous agitation cannot be over-emphasized.

Methods of Adding Filter-Aid:

With good agitation in the press feed tank and with adequate time allowed for mixing the filter-aid and the liquid, good results are secured when the material is added dry.

To be assured definitely that the filter-aid will be mixed intimately with the liquid, the filter-aid should be mixed with water, solvent, or clean liquid and added to the liquid to be filtered in the form of a cream suspension.

Full information on various methods of adding filter-aids is given in special data sheets.

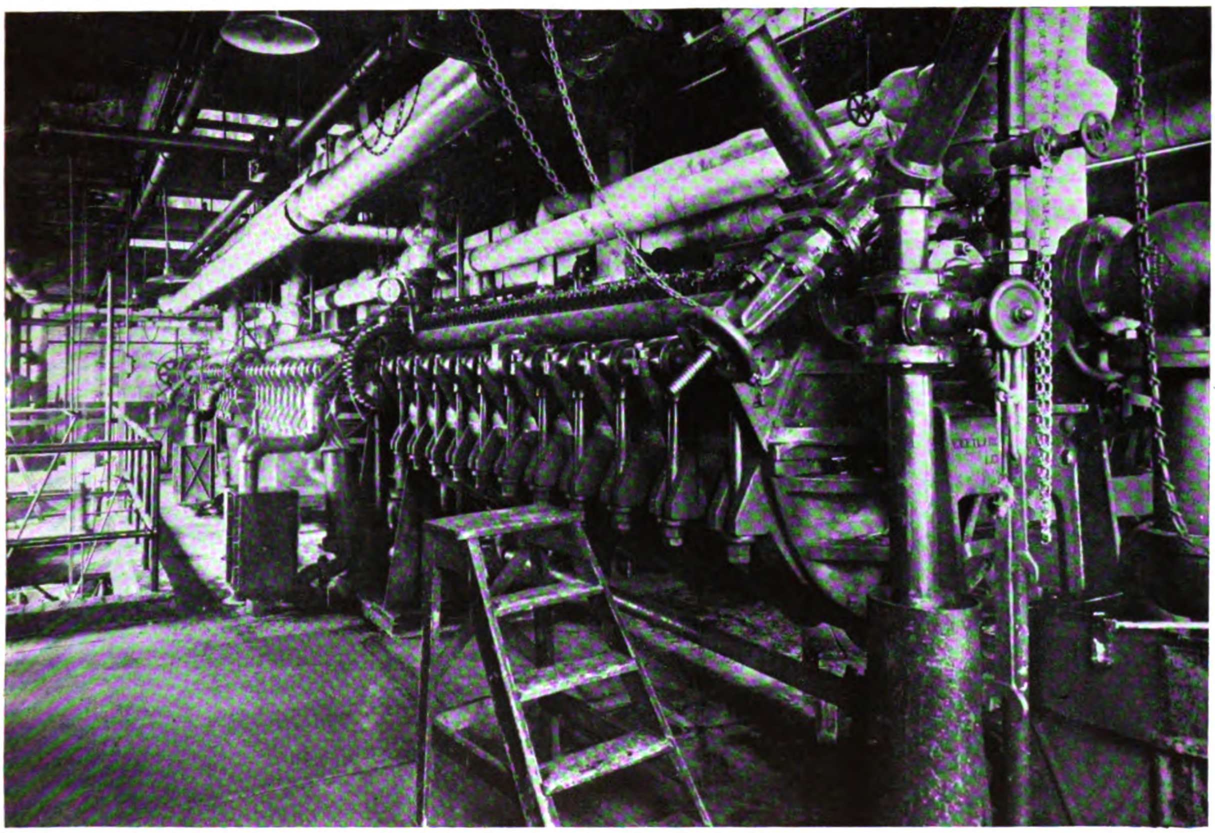

Fig. 7. The Sweetland filters at the Long Island City plant of the National Sugar Refining Co. Celite Filter-Aids are used in the various syrups to obtain the highest filtration efficiency.

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Advantages of Celite Filter-Aids

Clarity: Filtration with Celite Filter-Aids gives a complete and positive separation of solid and liquid. The filtrates obtained are clear, brilliant, and free from all suspended matter.

Increased Capacity: Filtration with Celite Filter-Aids greatly increases the capacity of filters, due to the formation on the cloth of a highly porous cake instead of a slime. Without Celite Filter-Aids many "clarification filtrations" could not be accomplished.

Longer Cycles: Less labor is required to operate due to the greater capacity and longer cycles.

Reduced Operating Costs: The Super-Cels and Filter-Cel make possible the use of labor-saving types of filters for the clarification of viscous and slow filtering products that otherwise could not be filtered. The wear and tear on filter cloths is greatly reduced due to the readiness with which press cakes containing Celite Filter-Aids are separated from the cloths and due to the less frequent filter cleanings necessary. The cloths are usually ready for the next cycle without further cleaning; costs for laundering and replacement of cloth are therefore reduced to a minimum. Thinner and less expensive grades of cloth are used with Celite Filter-Aids, giving results superior to those obtained with a heavier cloth.

With increased capacity and longer cycles, power charges are lower and production can be obtained with fewer filter units, resulting in decreased investment, depreciation, and maintenance costs.

Increased Recovery: The use of the Super-Cels or Filter-Cel gives a porous filter cake that permits washing with a minimum of solvent to obtain a complete recovery of soluble substances. Yield is also increased by the fact that less frequent cleaning of the filters cuts down liquid losses from that cause.

Improved Color: The color of products is improved by filtration with Celite Filter-Aids wherever the coloring is insoluble, no matter how finely divided.

Celite Filter-Aids Are Chemically Inactive: This makes mechanical clarification possible without affecting in any way the chemical composition, nature, taste, odor, etc., of the liquid.

Flexibility of Filter Station: One great advantage to the user of Super-Cel or Filter-Cel lies in the flexibility of the filter station which is made possible. Should increased production be called for, the use of a higher proportion of filter-aid will enable the filter area at hand to clarify greatly increased amounts of liquid. Sudden excess requirements or surges of liquid particularly difficult to filter can be handled without additional equipment by merely increasing temporarily the percentage of filter-aid employed.

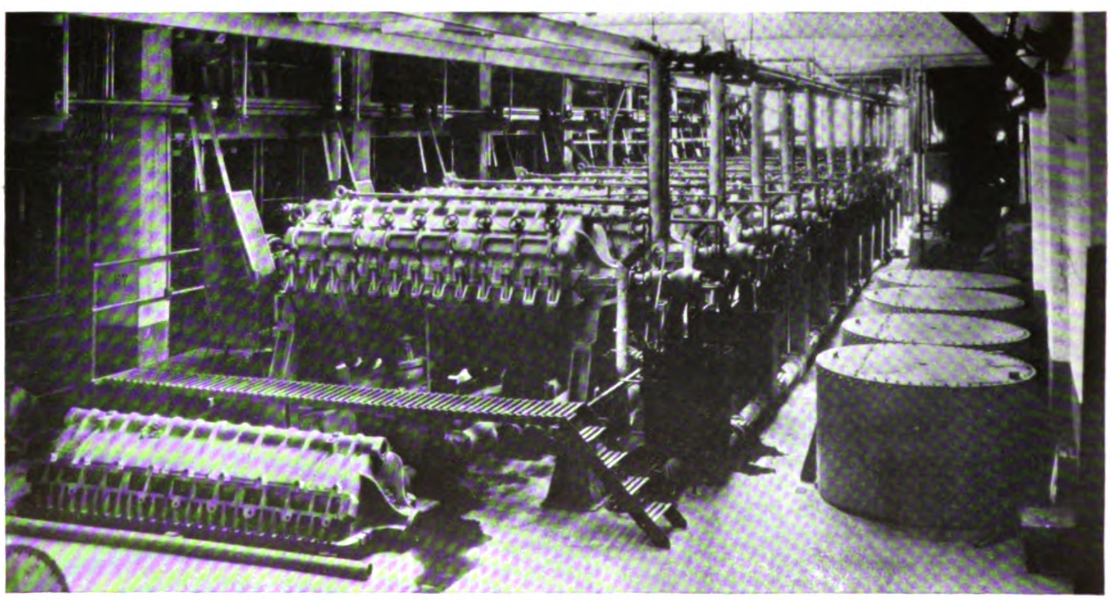

Fig. 8. Vallez filters at the Pennsylvania Sugar Co., Philadelphia, Pa., filtering sugar refinery syrup with the aid of Celite Filter-Aids.

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Celite Mineral Fillers

Celite Mineral Fillers are prepared from an especially pure form of diatomaceous silica. Unusual manufacturing facilities under careful control make possible the production of unlimited tonnages of a large number of absolutely uniform powders and granules of amorphous silica. Fillers can be supplied to meet almost every industrial requirement.

The standard grades are listed below:

Celite Grade FC: Finely ground natural powder from especially selected strata of highest purity as regards silica content. Light cream in color. Packed in bags of approximately 90 lb.

Celite Grade SSC: Finely ground heat-treated powder. Practically bone-dry. Color: Pink. Packed in bags of approximately 90 lb.

Celite Grade HSC: Finely ground heat-treated and specially processed powder. Color: Snow white. Packed in bags of approximately 95 lb.

Celite Grade SS: Special grade of practically bone-dry heat-treated powder, used principally in battery boxes. Packed in bags of approximately 90 lb.

Celite Grade SOC: Finely ground natural powder. Light cream in color. Packed in bags of approximately 95 lb.

Celite Grade Coarse: Coarsely ground natural powder. Light cream in color. Packed in bags of approximately 110 lb.

Celite Grade C-3: Heat-treated coarse and granular particles of diatomaceous silica, 3-mesh and finer. Color: Pink. Packed in bags of approximately 100 lb.

Snow Floss: Most finely ground of all natural powders. Light cream in color. Packed in bags of approximately 80 lb.

Super Floss: Heat-treated and specially processed. Very finely ground. Color: Snow white. Packed in bags of approximately 100 lb.

Micro-Cel "S" Grade: A precipitated calcium silicate prepared so as to remove all combined and free moisture. Used as a reinforcing pigment in rubber. Very finely divided and absolutely free from grit. Color: White. Packed in bags of approximately 100 lb.

Micro-Cel "F" Grade: Same as Micro-Cel "S" Grade except that it has a very definite accelerating effect on the time of cure and is recommended only where this property is beneficial. Packed in bags of approximately 100 lb.

Micro-Cel "C" Grade: Same as Micro-Cel "F" Grade except that it is coarser. Packed in bags of approximately 100 lb.

General Characteristics of Celite Mineral Fillers

Fineness: The particle size of the various fillers ranges from porous granular materials to powders so fine that every particle is less than 2½ microns and practically all less than 1 micron in size. (A micron is 39/1,000,000 of an inch).

Light Weight: Most of the finely powdered grades are as light as 8 lb. per cu. ft. The heaviest material, Celite Grade C-3, weighs 28 lb. per cu. ft. The light weight of Celite Fillers is a valuable characteristic in many cases. For example, in dry powder mixtures for dusting, the bulk greatly increases the area covered. Where the finished product, such as polish, is sold on a volume basis, the extra bulk is especially important.

Chemically Inert: All of these fillers (except Micro-Cel) are composed of amorphous silica ranging from 89% to 95% SiO_2. Because of their siliceous composition they are inert to practically all chemical re-agents except strong alkalies and strong acids. Incidentally, due to the high silica content, they are highly fire-resistant, the melting point being above 2900 deg. F.

Color: These fillers are available in snow white, light cream, and deep pink.

Porosity: Each individual particle of Celite, regardless of how minute in size it may be, is very porous or cellular. The material is, therefore, very absorbent and the various grades will absorb from 200% to 300% of their own weight of liquid.

Surface Area: Because of the low density and high degree of porosity, Celite Fillers expose a tremendous surface area per unit of weight and often replace from two to six times their weight of heavier fillers.

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Strengthening Effect: Celite is composed of very irregularly shaped and spicular particles which, when used in products formed under pressure, cause the formation of a strong, interlocking skeleton. This property is of particular advantage in imparting added strength, toughness, and durability to rubber, asphalt and gum plastics, and other molded products.

Scouring, Cleaning, and Abrasive Action: The individual particles of Celite are relatively hard but the particles are so small that a delicate degree of abrasiveness is secured. Celite is the base in many polishes and cleansers now on the market.

General Applications of Celite Mineral Fillers

Polishes: Various grades, with different degrees of abrasiveness, are regularly used to meet specific requirements of gold and silver polishes, automobile polishes, furniture polishes, metal polishes, and cleansers. Snow Floss is usually used for auto polishes and Super Floss for silver paste polishes. Celite Grade FC is also employed for metal polishes.

Paint, Enamel, Varnish, Lacquer: The flatting of paints, varnishes and lacquers is accomplished either by the addition of a proper vehicle, such as turpentine, or by the proper Celite Filler, usually Super Floss. Super Floss produces the dull flat effect, and the partially soluble and semi-oily additional agents of the first type, which slows down drying, are not needed. In pigment-carrying materials such as paints, enamels and lacquers, Super Floss is more than a flatting agent. It is highly transparent in oil and yields a consistency only obtainable with three times the volume of ordinary filler. Due to its high oil absorption, more oil is worked into the film and a more permanent finish is obtained. As a diluent or base for certain types of dry colors and pigments, Celite is a valuable inert filler. For certain colors it acts as an extender.

Molded Articles: Many types of articles molded under pressure with various binders such as gums, rosins, asphalt, Gilsonite, and rubber, contain Celite powders as integral fillers to decrease weight and to increase toughness and resistance to chemical action and water. Often a Celite Filler will also reduce the amount of some expensive ingredients. Celite Grade FC, Celite Grade SS, and Super Floss are most suitable for this work.

Heat Insulating Compounds: Celite Fillers are compounded with various binders such as portland cement, gypsum, plaster, lime, etc., in the making of insulating plastics and shapes which weigh as little as 20 lb. per cu. ft.; some withstanding temperatures as high as 1800 deg. F. Celite Grade SOC is recommended for use in most cases.

Catalyst Carriers: The tremendous surface area presented by these lightweight inert fillers affords the maximum exposure of the catalyst. The complete recovery of the catalyst by chemical solution later on in the process is made possible by the inert nature of the filler.

Absorptive Packings: Their porosity and inert nature make Celite Powders ideal for carboy packing and, generally, for packing any corrosive or combustible liquid. Celite Grade SOC is usually used for this purpose. Celite Grade FC, alone or in conjunction with other materials such as charcoal and portland cement, is used as a lightweight filler in cylinders for acetylene and other gases.

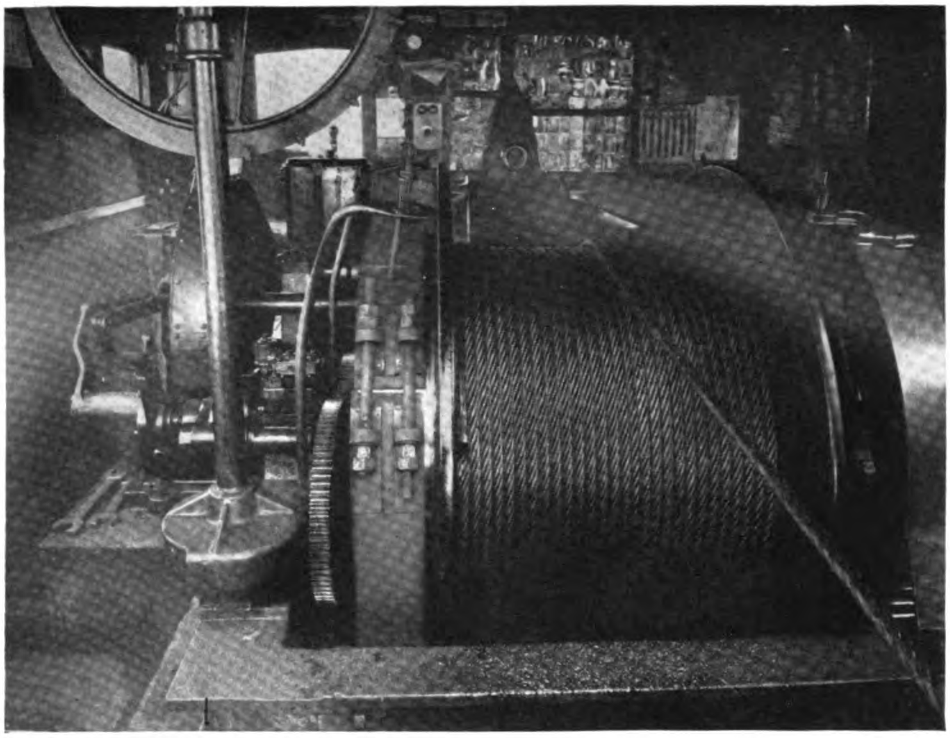
Dynamite: Celite Grade FC is an effective absorbent in dynamite and the product remains stable and unchanged.

Source of Active Silica: Due to the tremendous surface area and diatomaceous structure of Celite Grade FC, its high silica content is readily available. This quality is taken advantage of, for example, in the manufacture of ultramarine and phosphoric acid.

Match Head Composition: As an essential ingredient of match head composition, Celite is to be found in the majority of such products.

Insecticides: An inert carrier for insecticides should be one which scatters in settling, clings to the vegetation, enables the plant to continue breathing, and carries the poison. Its fluffy, porous nature, with large surface area, makes Celite Grade FC eminently satisfactory for this purpose.

J-M Brake Blocks, Brake Linings and Clutch Facings



J-M Asbesto-Metallic Brake Blocks on the incline hoist of a large coal company

Temperatures, pressures, velocities and frictional coefficient requirements, varying with every design and use, so affect the service and durability of friction materials that no one material can be expected to meet adequately every requirement. The reputation which J-M friction materials have achieved is due not alone to the peculiar advantages of asbestos in such service and the care and precision with which the products are manufactured, but also to the diverse characteristics of the various types of J-M materials available, which makes possible a selection of the proper friction material for the particular conditions encountered.

J-M Asbestos Friction Materials are of both the flexible and rigid types. The rigid type is noted for mechanical strength, uniformity of friction, smooth, quiet operation and long life on severe low-speed work. The flexible types wear well on light loads with high speed, have high friction and are readily adaptable to all sizes of drums. Both types possess, to an unusual degree, the following three fundamentals for satisfactory service required of a friction material:

Heat resistance: High temperatures may result from insufficient area for cooling and severe high pressure, or light continuous slipping.

Mechanical strength: A sudden stop effects a severe shock on the structure of the friction material, which tends to disintegrate it.

Durability: Reasonable life in a friction material depends on the frequency of its use and whether that use is moderate or severe.

Proper selection is the key to satisfaction, and the J-M line of friction materials is extensive enough to make such selection possible.

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Flexible Types of J-M Friction Materials

	Type No.
Standard Woven Brake Lining	303 and 304
Giant Woven Brake Lining	400 and 404
Rotary Brake Lining (Woven)	410
Heavy Duty Woven Brake Lining	500
Standard Folded and Compressed Brake Lining	600
Super Folded and Compressed Brake Lining	610
Standard Woven Clutch Facings	350 and 354
Giant Woven Clutch Facings	450 and 454
Standard Folded and Compressed Clutch Facings	600
Super Folded and Compressed Clutch Facings	610

Rigid Types of J-M Friction Materials

Asbesto-Metallic Friction Blocks	100, 101, **110, 111,** 120 and 121
Asbestos Moulded Friction Lining	**200,** 210 and 220
Asbestos Friction Facings	750 and 751

The coefficient of friction, size limits, dimension tolerances and service conditions for J-M friction materials are given in a table on a following page.

J-M Asbesto-Metallic Brake Blocks on the main donkey engine, bringing 100,000 feet of lumber along the "skyline" every day. (See lower illustration)

Friction Material Recommendations

Only one set of J-M Asbesto-Metallic Brake Blocks on a brake that handled 53 million feet of lumber in 2 years

High Temperature and Light Service

It is obvious that high temperature requirements are best cared for by a structure which will remain intact even when subjected to a temperature which will destroy the bonding or impregnating material. The woven type of friction material meets this requirement as the structure is tied together by interlocked wires and, even though it be weakened, will still function for some time. However, if the material is also subjected to severe shock and heavy pressure, the weakened structure naturally will not last very long. Such destructive temperatures, however, are seldom encountered and are significant of poor design and thermal inefficiency.

In light service where Standard Woven Lining, Type 303, is giving satisfaction, the use of Giant Woven

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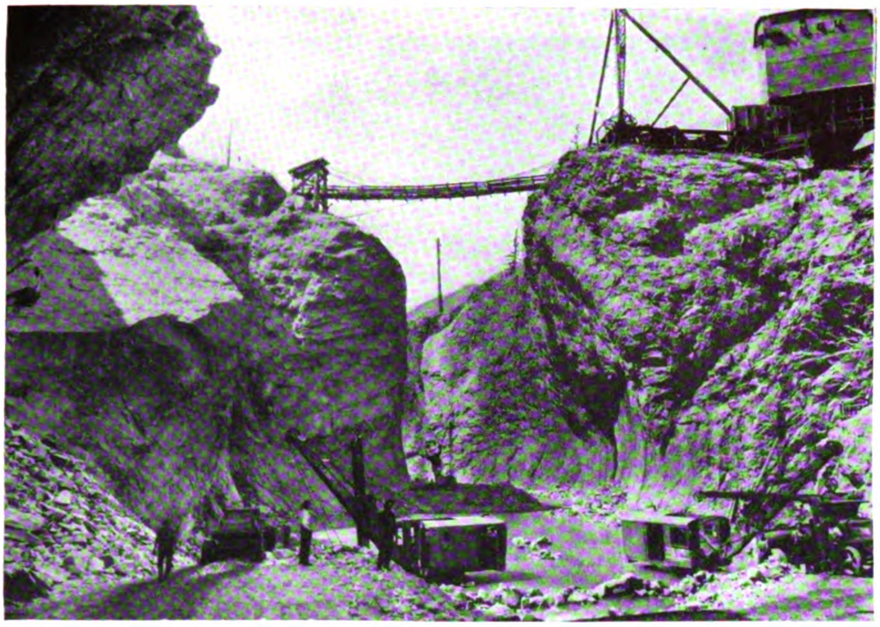

J-M Friction Clutch Facings on Northwest machines handling the rock at the Diablo dam site on the Skagit River in Washington State

Lining, Type 400, or Heavy Duty Lining, Type 500, would result in longer service, but this increased life is usually not of sufficient importance to warrant their replacing Standard Woven Lining.

Giant Woven Lining, Type 400, and Heavy Duty Lining, Type 500, being of woven structure, densely compressed, are better suited for conditions where the friction material is subjected to shock and pressure. They are strong, heavy-duty linings for heavy-duty service. Temperatures which are destructive to this type of material are far above those at which brakes or clutches should be operated. Should temperatures be above 600 deg. F., satisfactory results cannot be expected of any brake or clutch.

Low Temperature and Light Service

When the temperature is not high but service shocks are reasonably severe, Standard Folded and Compressed Lining, Type 600, may be used successfully, as it is mechanically strong. High temperatures, however, will tend to destroy the bond and possibly release the laminations of cloth.

For high temperature resistance in a folded and compressed material, Super Folded and Compressed Lining, Type 610, will be found more satisfactory. It is high in friction, however, and may not be suitable for that reason.

On cast iron, Folded and Compressed Linings are most satisfactory.

All of the flexible linings are capable of giving long life in reasonable service, where shock is not extreme. Should the brake drum be made of steel and pressure on brake rather severe, a folded and compressed lining will have a tendency to cut the drum. Here a woven lining will be more satisfactory.

Severe Service

For service where shock is very severe, a moulded lining is necessary. In this case, sudden and severe application of the brake tends to crush or shear the material and break it up, to be thrown out as dust by the revolving wheel. High mechanical strength is absolutely necessary and Asbesto-Metallic Friction Blocks or Moulded Friction Linings are desirable. Where temperature is also a factor, again block material should be used, as it is the most satisfactory material which combines both mechanical strength and temperature resistance. Where the temperature is not severe but the friction material is subjected to shocks,

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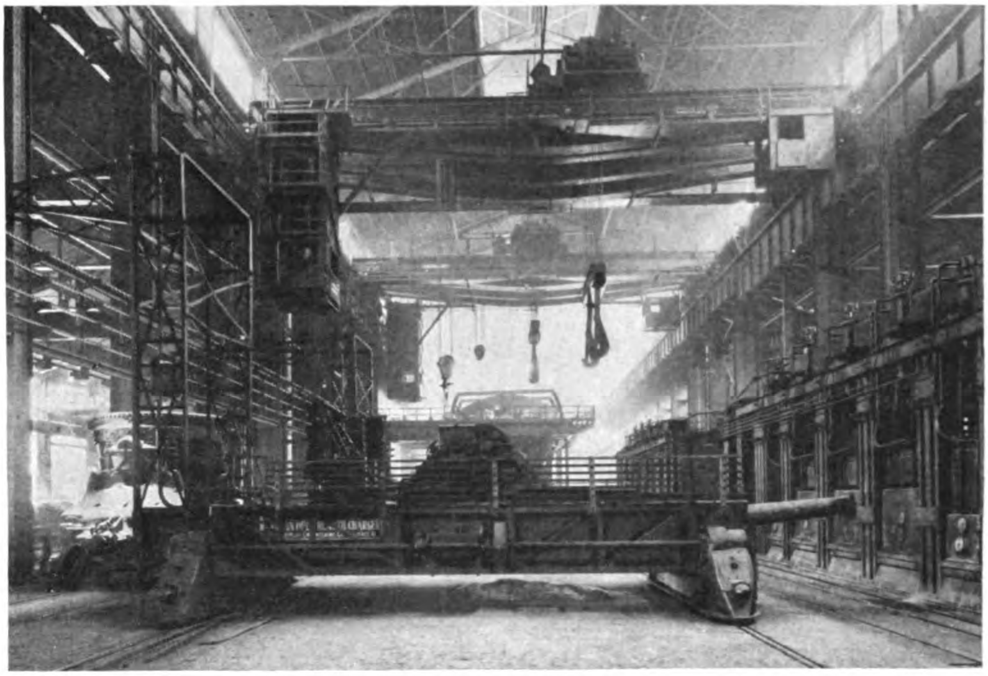

J-M Super Folded and Compressed Brake Lining on a Morgan crane in a large steel plant

and a high strength material is necessary, Moulded Friction Lining should be used.

Asbesto-Metallic Friction Blocks and Moulded Linings are supplied in three degrees of friction. For cast iron the standard material, Type 100, is satisfactory. When steel is used for the brake drum and service is severe, it is necessary to use the types with lower friction, Types 110 or 120, as the standard material, Type 100, might cut the drum.

Reducing the friction and increasing the pressure is always advisable, as this tends also to increase the life of the brake. The design of the equipment, however, may not always permit this to be done.

If uniformity of friction is a prime requisite, the selection should be a moulded material, as its friction is more uniform than either woven or folded and compressed material, due to its structure and low friction.

Oil Operation

Either Standard Woven or Giant Woven type can be furnished with a special oil-resisting impregnation which will permit it to function satisfactorily in oil. These linings for oil service are known as Type 304 and Type 404, respectively.

Friction material for clutch facings to be operated in oil should be selected for its oil-resisting qualities, which limits the selection to the two types of woven or moulded, Types 354 and 454, or 750 and 751, respectively. Limitations in the size of Types 750 and 751 govern their selection. Moulded lining has given satisfactory results when operated in castor oil, mineral oils being more destructive.

Types of J-M Friction Materials

While the design of the equipment and the service to which it is subjected must govern the selection of the suitable friction material, the following tables of recommendations will guide in selecting a satisfactory material. These tables are based on information from the field where successful applications of the various materials have been made. It must be remembered, however, that no positive assurance can be given of the ultimate success of the material selected, due to the various factors to be considered which make many brake lining problems of necessity matters for individual consideration. However, some one of the J-M materials will be found to meet the particular requirements.

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J-M FRICTION MATERIAL RECOMMENDATION CHART FOR ALL TYPES OF INDUSTRIAL BRAKES AND CLUTCHES

EXTERNAL CONTRACTING AND INTERNAL EXPANDING BRAKES AND CLUTCHES; POST AND SHOE BRAKES; MECHANICAL LOAD BRAKE BANDS; PLANETARY AND CLUTCH HOLDING BAND.

FRICTION METAL	SERVICE	THICKNESS OF MATERIAL	TYPES OF J-M FRICTION MATERIAL (Column Figures Indicate Recommended Suitability)													
			100 101	110 111	120 121	200	210	220	303	304	400	404	410	500	600	610
Cast Iron Dry	Light	5/16 or less				1	1	1	4 *				For Oil Field Rotaries	5	3	2
		3/8 or more	1	1	1						2 *				3	2
	Medium	5/16 or less				1	1	1	4 *					5	3	2
		3/8 or more	1	1	1						2 *				3	2
	Severe	5/16 or less				1	1	1	4 *					5	3	2
		3/8 or more	1	1	1						2 *				3	2
High Carbon Steel Dry	Light	5/16 or less				1	1	1	4 *					5	3	2
		3/8 or more	1	1	1						2 *				3	2
	Medium	5/16 or less				1	1	1	4 *					5	3	2
		3/8 or more	1	1	1						2 *				3	2
	Severe	5/16 or less					1	1	2					3		4
		3/8 or more		1	1						2					3
Low Carbon Steel Dry	Light	5/16 or less				1	1	1	2					3		4
		3/8 or more	1	1	1						2					3
	Medium	5/16 or less					1	1	2					3		4
		3/8 or more		1	1						2					3
	Severe	5/16 or less						1	2							
		3/8 or more			1						2					
Cast Iron or All Steels Running In Oil	All Services	5/16 or less								1						
		3/8 or more										1				

* On light or medium service and not undue shock, use woven lining or facings under constant slipping or extreme temperatures in preference to types 600 and 610

DISC AND PLATE CLUTCHES AND BRAKES

FRICTION METAL	SERVICE	TYPES OF J-M FRICTION MATERIAL (Column Figures Indicate Recommended Suitability)													
		100 101	110 111	120 121	200	210	220	350	354	450	454	600	610	750	751
Cast Iron Dry	Light	1	1	1	1	1	1	1		1		3	2	5	4
	Medium	1	1	1	1	1	1	1		1		3	2	5	4
	Severe	1	1	1	1	1	1	2		2		4	3		5
High Carbon Steel Dry	Light	1	1	1	1	1	1	1		1		3	2	5	4
	Medium	1	1	1	1	1	1	1		1		3	2	5	4
	Severe			1		1	2	2		2		4	3		5
Low Carbon Steel Dry	Light	1	1	1	1	1	1	1		1		3	2	5	4
	Medium		1	1		1	1	2		2			3		4
	Severe			1			1	2		2					3
Cast Iron or All Steels Running In Oil	All Services								1		1				

CONE CLUTCHES AND BRAKES

FRICTION METAL	SERVICE	TYPES OF J-M FRICTION MATERIAL (Column Figures Indicate Recommended Suitability)									
		100 101	110 111	120 121	200	210	220	350	354	600	610
Cast Iron Dry	Light	1	1	1	1	1	1	1		3	2
	Medium	1	1	1	1	1	1	1		3	2
	Severe	1	1	1	1	1	1	2		4	3
High Carbon Steel Dry	Light	1	1	1	1	1	1	1		3	2
	Medium	1	1	1	1	1	1	1		3	2
	Severe			1		1	2	2		4	3
Low Carbon Steel Dry	Light	1	1	1	1	1	1	1		3	2
	Medium		1	1		1	1	2		4	3
	Severe			1			1	2			3
Cast Iron or All Steels Running In Oil	All Services								1		

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J-M INDUSTRIAL FRICTION LININGS AND BRAKE BLOCKS

MATERIAL	COEFFICIENT OF FRICTION	SIZE LIMITS (INCHES)	TOLERANCES (INCHES)		FOR USE UNDER DRY OR OIL CONDITIONS
			THICKNESS	WIDTH	
Type 303 Standard Woven Lining (wire-inserted)	.40 ± .07	1/8 to 5/16 thick 1 to 24 wide 50 ft. rolls or cut lengths	±.010	To 6 ± 1/16 6 1/4 to 24 as close as possible	Dry (Small amount of oil has no serious effect)
***Type 304 Standard Woven Lining (wire-inserted)	.40 ± .07	1/8 to 5/16 thick 1 to 24 wide 50 ft. rolls or cut lengths	±.010	To 6 ± 1/16 6 1/4 to 12 ± 1/8 12 1/4 to 24 ± 3/16	Oil
Type 400 Giant Woven Lining (wire-inserted)	.40 ± .07	3/8 to 1 thick 2 to 12 wide 50 or 25 ft. rolls or cut lengths	To 3/8 +.025 -.005 Over 3/8 +.031 -.010	2 to 4 ± 1/16 4 to 6 + 3/32 - 1/16 Over 6, not more than + 1/4	Dry (Small amount of oil has no serious effect)
***Type 404 Giant Woven Lining (wire-inserted)	.40 ± .07	3/8 to 1 thick 2 to 12 wide 50 or 25 ft. rolls or cut lengths	To 3/8 +.025 -.005 Over 3/8 +.031 -.010	2 to 4 ± 1/16 4 to 6 + 3/32 - 1/16 Over 6, not more than + 1/4	Oil
Type 410 Rotary Lining (Woven) (wire-inserted)	.40 ± .07	1 3/16 thick 8 to 12 wide Cut lengths	± 1/16	As close as possible	Dry
Type 500 Heavy Duty Woven Lining (wire-inserted)	.40 ± .07	3/16 to 3/8 thick 1 1/2 to 6 wide 50 or 25 ft. rolls or cut lengths	+.025 -.005	1 1/2 to 4 ± 1/16 4 to 6 + 3/32 - 1/16	Dry
Type 600 Standard Folded and Compressed Lining (wire-inserted)	.40 ± .07	1/8 to 1 thick 1 to 24 wide 50 ft. rolls or cut lengths	To 3/16 ±.010 1/4 to 3/4 ±.015 Over 3/4 +.030 -.015	To 6 ± 1/16 6 1/4 to 12 ± 1/8 12 1/4 to 24 ± 3/16	Dry (Oil will penetrate and swell material. Small amount of oil has no serious effect.)
Type 610 Super Folded and Compressed Lining (wire-inserted)	.45 ± .07	1/8 to 1 thick 1 to 24 wide 50 ft. rolls or cut lengths	To 3/16 ±.010 1/4 to 3/4 +.020 -.010 Over 3/4 +.030 -.010	To 6 ± 1/16 6 1/4 to 12 ± 1/8 12 1/4 to 24 ± 3/16	Dry (Oil will penetrate and swell material. Small amount of oil has no serious effect.)
*Types 100 and 101 Asbesto-Metallic Friction Blocks (wire-inserted)	.40 ± .05	Maximum length 120° of circumference but not over 24 long chord 400 sq. in. maximum area Types 100, 110 and 120 3/8 minimum thickness 4 maximum thickness Types 101, 111 and 121 3/8 or less	Types 100, 110 and 120 To 1 thickness and 20 radius: all dimensions ± 1/32 radius ± 1/8 Over 1 thickness and 20 radius: all dimensions ± 1/16 radius ± 1/4 Types 101, 111 and 121 Thickness +0.000 -.031 Width ± 1/32		Dry
*Types 110 and 111 Asbesto-Metallic Friction Blocks (wire-inserted)	.35 ± .05				
*Types 120 and 121 Asbesto-Metallic Friction Blocks (wire-inserted)	.30 ± .03				
**Type 200 Moulded Friction Lining (wire-inserted)	.35 ± .05	1/8 to 3/8 thick Maximum width: curved 18 flat 36 126 maximum length depending on curvature	±.010	Width ± 1/32 Length ± 1/8	Dry or limited oil
**Type 210 Moulded Friction Lining (wire-inserted)	.25 ± .03				
**Type 220 Moulded Friction Lining (wire-inserted)	.15 ± .03				

J-M FRICTION FACINGS

Type 350 Standard Woven Facing (wire-inserted)	.40 ± .07	1/8 to 5/16 thick 1 to 24 wide 18 maximum diameter with ground face	±.010 Disc: +.010 -.005	Width of flange ± 1/32	Dry
***Type 354 Standard Woven Facing (wire-inserted)	.40 ± .07	1/8 to 5/16 thick 1 to 24 wide 18 maximum diameter with ground face	±.010 Disc: +.010 -.005	Width of flange ± 1/32	Oil
Type 450 Giant Woven Facing (wire-inserted)	.40 ± .07	3/8 to 1 thick 12 maximum diameter	±.010	Width of flange ± 1/32	Dry
***Type 454 Giant Woven Facing (wire-inserted)	.40 ± .07	3/8 to 1 thick 12 maximum diameter			Oil
Type 600 Standard Folded and Compressed Facing (wire-inserted)	.40 ± .07	1/8 to 1 thick 36 maximum diameter			Dry
Type 610 Super Folded and Compressed Facing (wire-inserted)	.45 ± .07	1/8 to 1 thick 36 maximum diameter	To 1/4 +.015 -.010 Over 1/4 +.030 -.015	Width of flange ± 1/16	Dry
Types 750 and 751 Asbestos Friction Facings (no wire)	.30 ± .03	1/2 maximum thickness 18 maximum diameter with ground face	±.010 unless otherwise specified ±.005 possible	Width of flange ± 1/32	Dry or oil

*Since these blocks are die-moulded, flat discs or rings can be supplied to a maximum diameter of 32 inches.
**Flat discs or rings of this material can be supplied to a maximum diameter of 40 inches.
***Furnished on order only. Not standard.

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J-M Woven Brake Linings
Types 303, 304, 400, 404, 410, and 500

J-M Standard Woven Brake Lining on the brakes of a pipe liner operating on the Gulf Oil Co.'s 10″ line from Oklahoma to Pittsburgh

J-M Woven Brake Lining is of the flexible type, woven solid to size from asbestos yarn with brass wire inserted. It is impregnated under pressure with an asphaltic oil compound which bonds the fibres and imparts additional frictional quality. The impregnated tape is then calendered between heated rolls, which increases its density and sizes the lining to the desired dimensions. The finished material is dark brown or black in color.

Types 303, 400 and 500 are designed for dry operation, but are not seriously affected by small quantities of oil. Types 304 and 404 are intended for oil conditions.

Standard Woven Lining, Type 303: Average normal coefficient of friction, operated dry on steel drums, 0.40 ±0.07; on cast iron, slightly lower, but more uniform.

Made in thicknesses of 1/8″, 5/32″, 3/16″, 1/4″ and 5/16″, in widths from 1″ to 24″ in 1/4″ increments. Furnished in 50-ft. rolls and cut pieces.

Manufacturing tolerances: Thickness, ±0.010″; widths, to and including 6″, ±1/16″; 6 1/4″ to 24″, as close as possible.

Standard Woven Lining, Type 304: Same as Type 303 except with special impregnation for service in oil. Furnished to order only.

Giant Woven Lining, Type 400: Differs from Standard Woven Lining, Type 303, only in weave, because of the greater thicknesses and density required. Has the same average normal coefficient of friction.

Made in thicknesses of 3/8″, 1/2″, 5/8″, 3/4″, 7/8″ and 1″, in widths from 2″ to 12″, with 1/4″ increments to 5″ and 1/2″ increments from 5″ to 12″. Furnished in 50-ft. rolls in widths to 4″, 25-ft. rolls in widths from 4″ to 6″, and in cut pieces.

Manufacturing tolerances: Thickness, 3/8″, +0.025″/—0.005″; over 3/8″, +0.031″/—0.010″; width, 2″ to and including 4″, ±1/16″; 4 1/4″ to and including 6″, +3/32″/—1/16″; over 6″, not more than +1/4″.

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J-M Rotary Lining stands up under service on deep wells

Giant Woven Lining, Type 404: Same as Type 400 except with special impregnation for service in oil. Furnished to order only.

Rotary Lining (Woven), Type 410: Similar to Giant Woven Lining, Type 400, but made especially for use on rotary drill rigs, in 1 3/16″ thickness as standard, and in widths from 8″ to 12″, in ½″ increments. Furnished in cut pieces. Other sizes can be furnished on request.

Manufacturing tolerances: Thickness, ±1/16″; width, as close as possible.

Heavy Duty Woven Lining, Type 500: Similar to Standard Woven Lining, Type 303, but woven oversize and calendered to the finished size with square edges. Although quite stiff, it will conform to the band diameters on which it is properly used. Average normal coefficient of friction, operated dry on steel drums, 0.40 ±0.07; on cast iron, slightly lower but more uniform.

Made in thicknesses of 3/16″, ¼″, 5/16″ and ⅜″; in widths from 1½″ to 5″, in ¼″ increments, 5½″ and 6″. Furnished in 50-ft. rolls in widths to 4″, 25-ft. rolls in widths from 4″ to 6″, and in cut pieces.

Manufacturing tolerances: Thickness, +0.025″/—0.005″; width, 1½″ to 4″ inclusive, ±1/16″; 4¼″ to 6″ inclusive, +3/32″/—1/16″.

J-M Folded and Compressed Brake Lining Types 600 and 610

J-M Folded and Compressed Brake Lining is of the flexible type, formed of asbestos cloth woven from asbestos yarn with brass wire inserted. The cloth is coated both sides with a rubber compound which serves as a binder and also imparts additional frictional quality. It is then folded to the required size, hydraulically pressed and cured by heat. The finished material is light gray in color.

It is designed for dry operation, but is not seriously affected in service by a small amount of oil, though a large quantity would make the lining swell, due to the effect of the oil on the binding compound.

Super Folded and Compressed, Type 610: Differs from Standard Folded and Compressed Lining, Type 600, in weave of cloth and in the friction compound used, the weave being more open and the compound slightly heavier. Average normal coefficient of friction, operated dry on steel drums, 0.45 ±0.07.

Standard Folded and Compressed, Type 600: Average normal coefficient of friction, operated dry on steel drums, 0.40 ±0.07; on cast iron, slightly lower but more uniform.

Both styles of Folded and Compressed Lining are made in thicknesses ⅛″, 5/32″, 3/16″, ¼″, 5/16″, ⅜″, ½″, ⅝″, ¾″, ⅞″ and 1″, in widths of 1″ to 24″, with increments of ¼″ to 10″, and ½″ from 10″ to 24″. Furnished in 50-ft. rolls and cut pieces.

Manufacturing tolerances:

Thickness (Type 600):	
To and including 3/16″	±0.010″
¼″ to ¾″	±0.015″
Over ¾″	+0.030″/—0.015″
Thickness (Type 610):	
To and including 3/16″	±0.010″
¼″ to ¾″	+0.020″/—0.010″
Over ¾″	+0.030″/—0.010″
Width (Types 600 and 610):	
To and including 6″	±1/16″
6¼″ to and including 12″	±⅛″
12½″ to and including 24″	±3/16″

J-M Asbesto-Metallic Friction Blocks
Types 100, 101, 110, 111, 120 and 121

J-M Asbesto-Metallic Friction Blocks are of the rigid class, made of an asbestos, brass wire and rubber composition, hydraulically pressed in a mould under pressure of about 2,500 lb. per sq. in. and then cured by heat, under pressure, to the required shape.

The difference in the types lies primarily in their friction value, which is modified by changing the composition of the block, chiefly with the addition of graphite.

Types 100, 110 and 120: In appearance, Types 100, 110 and 120 are hard, black blocks, with asbestos fibres and brass wire ends showing on the surface. They have high mechanical strength, and are tough and uniform in texture. Designed for dry operation, in spite of their rubber bonding material they are less affected by oil than is the flexible rubber-bonded type of brake lining, due to their extreme hardness and density which retards penetration.

The average normal coefficient of friction of Type 100 is 0.40 ±0.05; of Type 110, 0.35 ±0.05; of Type 120, 0.30 ±0.03.

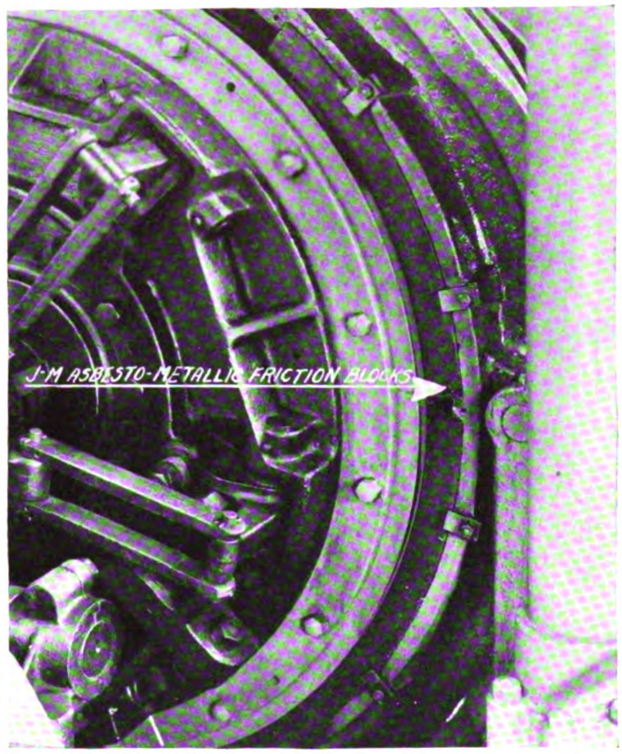
The weight per cubic foot of Type 100 is 138 lb., of Type 110, 125 lb. and of Type 120, 122 lb.

The minimum thickness of these styles is 3/8″, due to the nature of the material. The maximum size of a single square block is 20″ (400 sq. in.), or one which has no single dimension greater than 24″ or 120° of circumference. The maximum thickness is 4″.

Manufacturing tolerances: To 1″ thick and to 20″ radius, all dimensions, ±1/32″; radius, ±1/8″. Over 1″ thick and over 20″ radius, all dimensions, ±1/16″; radius, ±1/4″.

It is possible to mould holes or counterbores for fastenings. In most cases, however, these can be drilled with presses at hand, just as are other friction materials.

Types 101, 111 and 121: Types 101, 111 and 121 are combination blocks which are furnished when less than 3/8″ thickness is desired. They have a friction face of the same material as Types 100, 110 and 120, respectively, but are reinforced with a rigid backing to offer a more secure hold for fasteners. The average normal coefficient of friction is the same as that of the facing material but the weights per cu. ft. are 132 lb. for Type 101; 120 lb. for Type 111; and 118 lb. for Type 121.



J-M Asbesto-Metallic Friction Blocks

Manufacturing tolerances: 3/8″ thick or less, thickness, +0.0″/—.031″; width, ±1/32″.

Because Asbesto-Metallic friction material is too rigid to be easily conformed, and also since existing moulds can sometimes be adapted for the desired block, thus saving mould charges, it is advisable to give sketches and accurate dimensions when ordering this type of material. The illustrations give an idea of the great variation in possible shapes and will also indicate the dimensions required when ordering.

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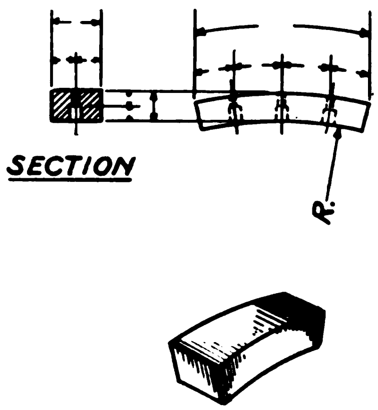
Typical Asbesto-Metallic Friction Blocks

Block No.	Description
1, 2, 3	Types of blocks used for steam shovels, dredges, stationary hoists, etc.
4, 5, 6	Types of blocks used for multiple disc clutches and brakes.
7, 8, 9, 10	Types of blocks used for coal dock and mine hoisting machinery.
11 and 12	Types of blocks used for electric hoists and traveling cranes.



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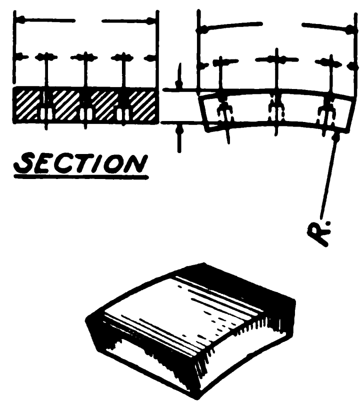

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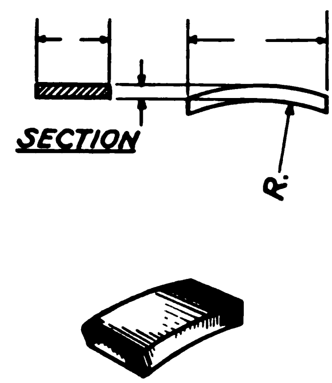

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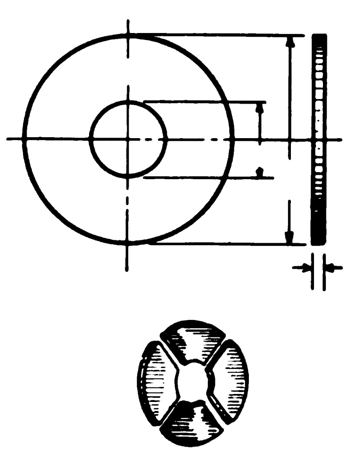

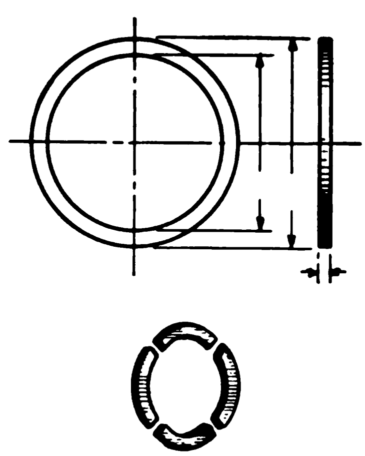

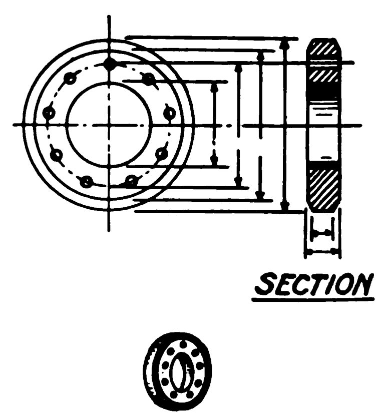

CAN BE MADE IN SEGMENTS IF SIZE REQUIRES

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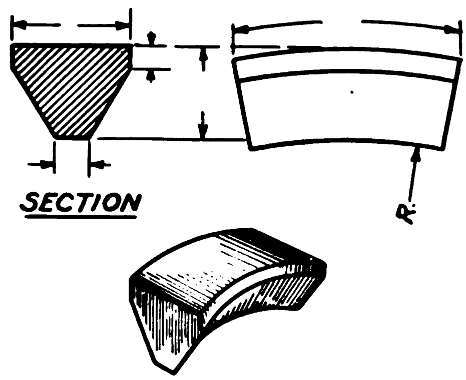
Typical Asbesto-Metallic Friction Blocks (*continued*)



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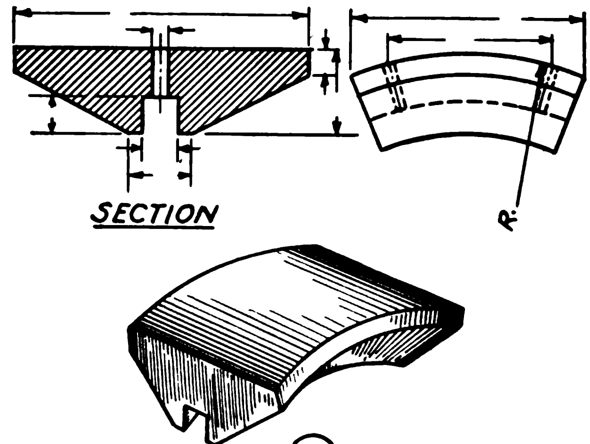

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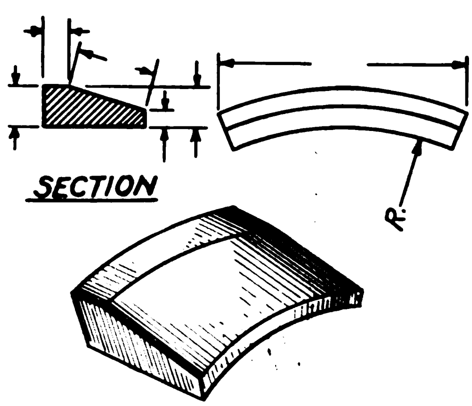

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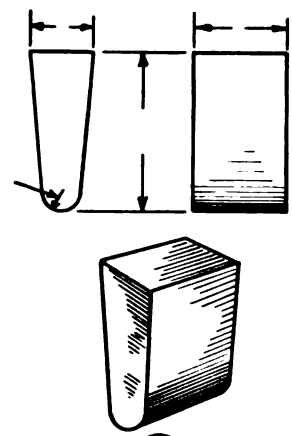

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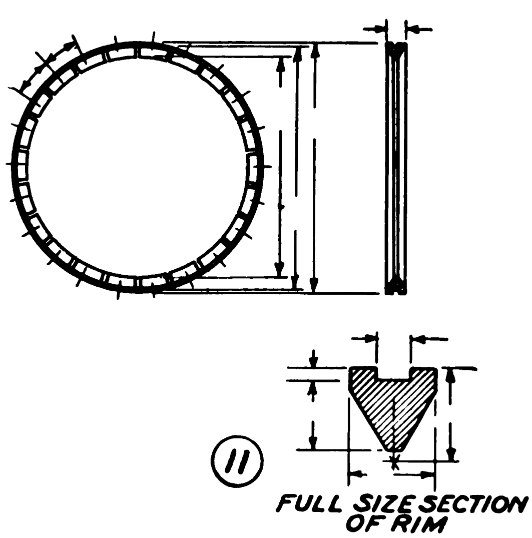

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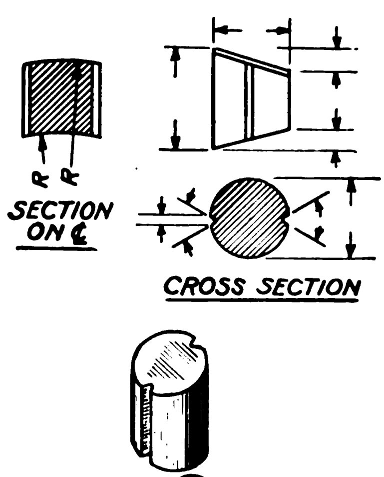

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J-M Moulded Friction Lining
Types 200, 210 and 220

J-M Moulded Friction Lining is of the rigid class, with the physical characteristics of Asbesto-Metallic Friction Blocks. Its composition is similar to the brake block material, a rubber compound of asbestos, brass wire, and fillers. However, instead of being moulded, the mixed material is slowly built up in large sheets to the desired thickness by a felting process under heavy pressure, and at the same time is vulcanized.

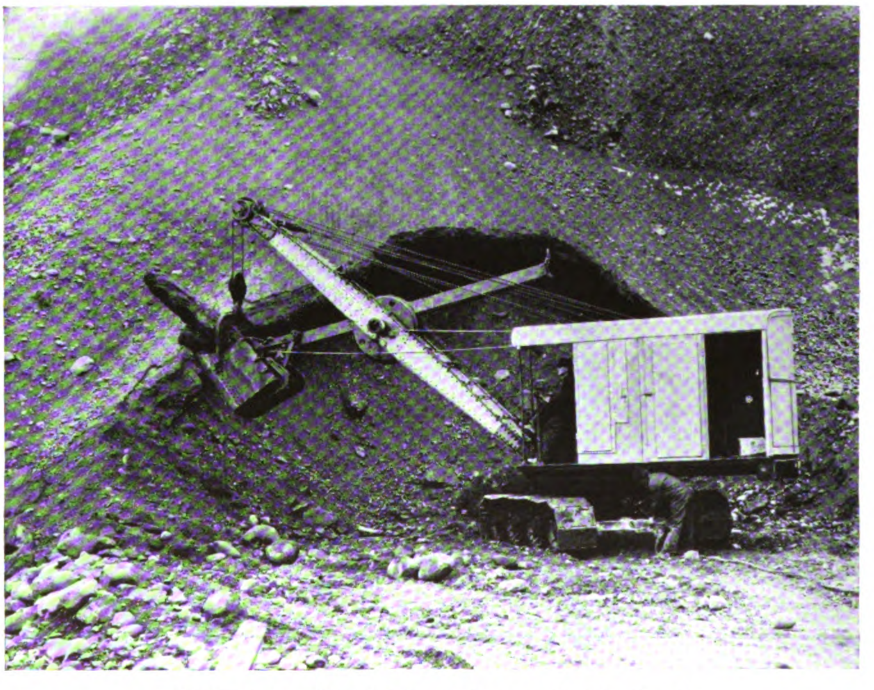
Like Asbesto-Metallic Friction Blocks, Moulded Friction Lining is furnished in three types, 200, 210 and 220, differing primarily in friction value. Being uniform in structure, the material gives very uniform friction, especially when used against cast iron. Average normal coefficient of friction of Type 200 (standard), 0.35 ±0.05; of Type 210 (medium friction), 0.25 ±0.03; of Type 220 (low friction), 0.15 ±0.03.

The semi-finished material is in sheet form 36″x126″, in thicknesses from 1/8″ to 3/8″. Irregular shapes, such as V brake blocks, cannot be formed directly, but flat rings, curved strips or any special-shaped piece, not thicker than 3/8″, which can be moulded or cut from a 36″x126″ sheet, can be furnished. Maximum width of curved strips, 18″; maximum length, 126″, depending on the curvature.

Manufacturing tolerances: Thickness, ±0.010″; width, ±1/32″; length, ±1/8″.

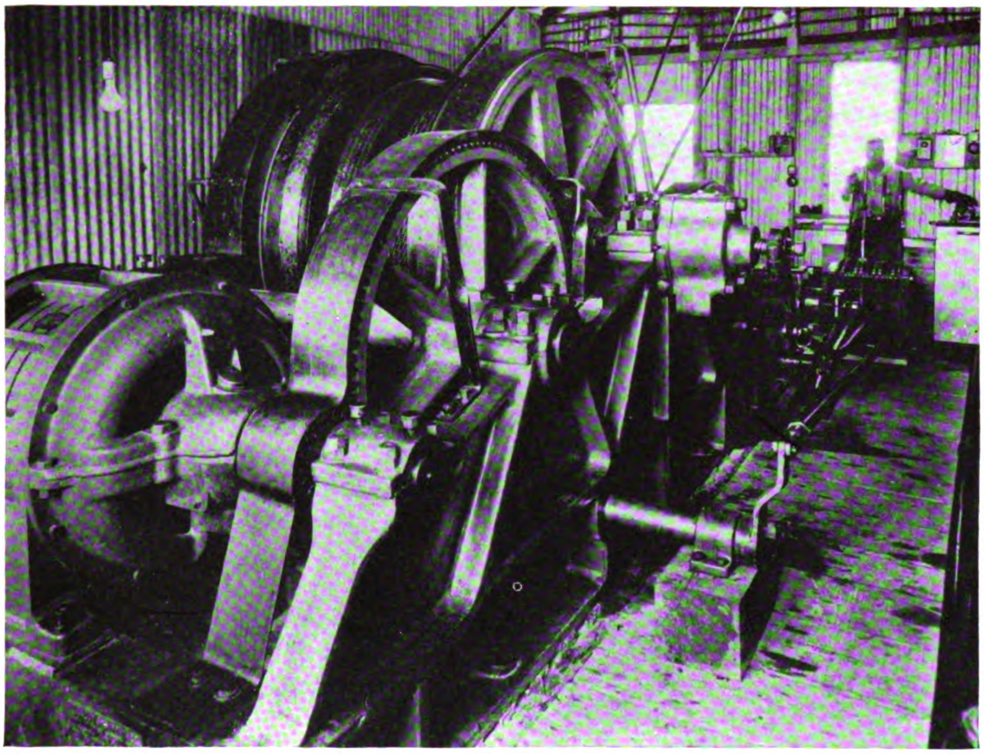
The finished material is a black, dense piece, too hard and rigid to be easily conformed to other dimensions than as produced. It weighs approximately 1.3 oz. per cu. in. Designed for dry operation or with limited lubrication, the penetration of oil into its surface is very slow. It can be readily drilled for fastenings with the customary machines. It is quiet and smooth in operation.

Facings for cone clutches can be made in segmental form, within the limitations of the dimensions given.



J-M Friction Material in service on electric shovel

J-M Clutch Facings
Woven, Types 350, 354, 450 and 454
Folded and Compressed, Types 600 and 610



J-M Friction Materials on the Hudson River bridge at Fort Lee, N. J. Asbesto-Metallic Blocks and Folded and Compressed Cone Clutch Facings on the hoists of the J. S. Mundy Hoisting Engine Co.

Clutch facings, woven or folded and compressed, are classed as flexible material, although the finished material is quite rigid. The woven facings are generally formed from a flat tape curved edgewise, with the ends fastened to make a ring; the folded and compressed, a ring built up of annular strips of cloth.

Standard Woven Facings, Types 350 and 354, are made from the same tape as Standard Woven Brake Lining, Type 303, and consequently are governed in sizes by that material. Type 354 furnished to order only. The unimpregnated woven tape, finished but untreated, is formed into the desired shape, impregnated with a friction compound and baked. The impregnation of Type 354 is oil-resisting so that these facings can be operated under full lubrication. The common form of ring is the butted and joined type in which the tape of proper width and thickness is curved edgewise and stapled to form a ring. The width of the facing in proportion to its diameter is the governing factor in the size of ring possible. Where the inside curvature is too great to be made from an edgewise curved tape, a stamped ring must be used. Endless rings can be supplied by stamping from wide stock within the limit of an outside diameter of 24″. The maximum thickness is 5/16″.

Large rings and facings for cone clutches can be produced without moulds. . To produce small rings

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accurately and in quantity, a simple mould is necessary, for which a small charge is made. Conical facing tolerances: Thickness, ±0.010″, width of flange, ±1/32″. Disc facing tolerances: Thickness, +0.010″/—0.005″; width of flange, ±1/32″.

Giant Woven Facings, Types 450 and 454, are similarly made, but from the thicker tape used for Giant Woven Brake Lining, Type 400, and are used when facings of greater thickness than 5/16″ are required. They are, however, limited to sizes not greater than 12″ diameter, the width of the material. Since it cannot be curved edgewise, it can be made only in flat pieces, but these can be cut into keystone-shaped segments for use on large disc clutches. Type 454 has a special impregnation for service in oil and is furnished to order only. Manufacturing tolerances: Thickness, ±0.010″; width of flange, ±1/32″.

The flat faces of Type 450 rings, and Type 350 in sizes under 18″, may be ground, which makes the surfaces more accurate, though it reduces somewhat the life of the facing. For heavy duty service on industrial equipment, facings should be left unground.

Standard Folded and Compressed Facings, Type 600, and Super Folded and Compressed Facings, Type 610, are made from the same materials as the Folded and Compressed Brake Linings of the same type numbers.

For cone clutch facings, it is only necessary to curve the standard brake lining edgewise to fit the cone in question. Each diameter and the angle of the cone, in addition to the width and thickness of facing desired, must be given.

Disc facings can be built up to the desired size from strips of the treated cloth and, for small sizes, cured in a mould. Since these are generally demanded in large sizes, the size of the press in which the material is cured is practically the only limit to the size of the facing which can be furnished. It is necessary that both inside and outside diameter and thickness be given.

Manufacturing tolerances: Type 600, thickness. ±0.10″; width of flange, ±1/32″. Type 610, thickness, to ¼″, +0.015″/—0.010″; over ¼″, +0.030/″—0.015″; width of flange, ±1/16″.

J-M Asbestos Friction Facings Types 750 and 751

Asbestos Friction Facings are of the rigid class and are made of asbestos millboard, treated with an oil binder and baked. They are commonly known in the automotive trade as "moulded facings," but are not a moulded facing in the strict sense of the word, though their appearance suggests that they might have been produced by such a process. The finished material resembles millboard in texture but is light or dark brown depending on the impregnation used.

Type 751 is dark brown in color and contains an asphaltic oil compound. It is capable of resisting somewhat higher temperatures than Type 750. It also has better wearing qualities under such conditions. It is supplied as standard.

Type 750 is light brown in color and is impregnated with a special oil binder, which is capable of being baked to a hard but not brittle state.

Both types are adapted to either dry or oil operation and, being hard and homogeneous, have high mechanical strength and uniform friction characteristics. Average normal coefficient of friction is 0.30 ±0.03.

Since they are formed from asbestos millboard. these facings are limited to flat rings or pieces, with a maximum thickness of ½″. Rings greater than 18″ in diameter cannot be produced with ground surfaces. Larger sizes, unground, can be furnished if desired.

The most common form is a small annular ring 8″, 10″, 12″ or 14″ outside diameter. Since the material is surface-ground to finished dimension, the accuracy of the finished product is close.

Manufacturing tolerances: Thickness, ±0.010″, unless otherwise specified, ±.005 possible; width of flange, ±1/32″.

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Friction Material Application

Asbestos friction materials are usually fastened in position with either rivets or bolts. Moulded blocks, being relatively thick and of large size, are usually fastened in place with standard bolts or heavy solid rivets, as shown in Figs. 1 to 4.

Thin sections for attaching to wood filler blocks are usually secured with brass screws, as shown in Fig. 5. This method is not satisfactory for severe service as the heat may char the wood block around the screws and allow the friction blocks to loosen.

Sometimes a metal insert, generally of brass, is moulded in the brake block material and a steel cap screw used as a fastening, as shown in Fig. 6. If the hole for the cap screw is elongated so that the major axis of the hole is radial, in a clutch in which a V block is used, or across the band, in a band type brake, it is possible to align the blocks readily by applying pressure to the brake or clutch with the bolts of the blocks loose. With the blocks in proper position, the bolts are then tightened. There should be no clearance on the bolts in line with the force on the blocks, as the blocks might slip and shear the bolts. All bolts and screws should have heavy steel lock-washers to prevent loosening under vibration. Inserts cannot be moulded in Moulded Friction Lining, Types 200, 210 and 220, as this lining is generally of thin section.

On large sized industrial linings of the flexible types, bolts are generally employed. Linings less than ½" thick are usually secured to the bands by rivets (see Figs. 7, 8, 9 and 10).

Countersinking:

Fastenings of any type should never be permitted to come in contact with the brake drum or clutch plate, as they might cut or abrade it. The heads should be countersunk below the friction material surface as far as can conveniently be done without weakening the holding power of the fastening.

In flexible materials, it is customary to counterbore at least half the thickness; in rigid materials, which are much stronger physically, about two-thirds of the thickness. V-type blocks obviously do not require sinking the bolts as there is little possibility of their contact with the friction drum. Sinking the heads of fastenings in a flexible lining is sometimes accom-

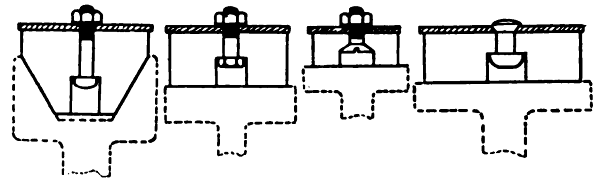

Fig. 1 *Fig. 2* *Fig. 3* *Fig. 4*

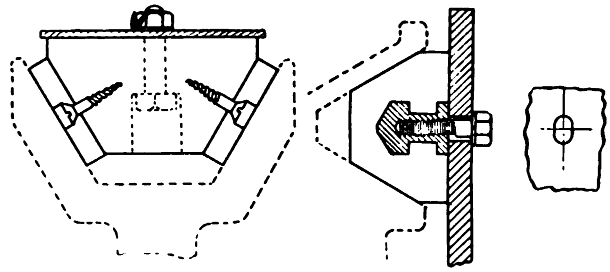

Fig. 5 *Fig. 6*

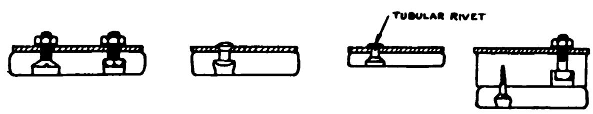

Fig. 7 *Fig. 8* *Fig. 9* *Fig. 10*

plished merely by forcing the rivet head into the material, but this is not good practice. It is better workmanship to drill and counterbore for the fastening by removing material from lining. This is easily accomplished by standard drills and counterbores and the use of portable electric drills or drill presses. Rigid materials such as Asbesto-Metallic Friction Blocks can be readily drilled with a wood point drill or wood bit.

Several machines are manufactured for drilling and counterboring brake lining, and rivet presses also are available for use in the automotive trade. These can be adapted in many cases for use on industrial braking equipment. Drilling and counterboring machines, as well as a full line of rivets, may be obtained through Johns-Manville.

Fastening Material:

Due to wear of the friction material, it is sometimes impossible to prevent occasional contact of the fastenings with the drums. Every effort must be made, therefore, to prevent the possible cutting, scoring, or

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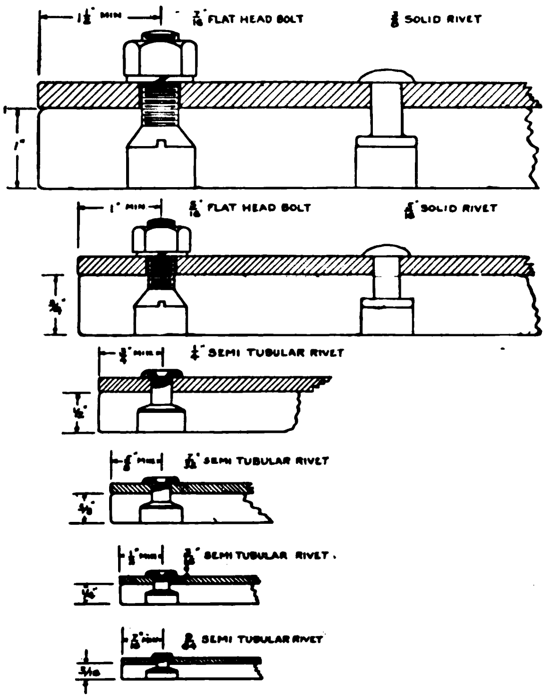

Application of fasteners

wearing away of the drum by the proper selection of the fastening material.

The materials generally employed for bolts and rivets are iron, steel, copper, brass and aluminum, or alloys referred to under one of the above groups.

Iron and steel are highly abrasive to the friction drum surface and should be used only where high strength is necessary and there is little possibility of fastenings touching the drum surface.

Copper is also highly abrasive to steel drums and, while quite tough, ductile and strong, should be avoided where the drum is of steel. When used against cast iron, copper tends to wear the drum surface but the wear is not rapid and the surface still remains smooth. For steel drums, the most satisfactory fastening material is brass.

Aluminum rivets are generally quite small and are used chiefly on small brakes and clutches such as are found on automobiles. They are not quite as strong as brass but are cheaper and, when of soft aluminum, do not readily cut the drums. Some aluminum rivets contain copper to increase the strength but these should be avoided as they are destructive to soft drums of steel.

Number of Fastenings Required:

While friction materials normally require little more than contact with the band to keep them from sliding, there are times when considerable stress is brought on the fastenings, such as by a sudden vigorous application of the brake, and sufficient fastenings must be provided to prevent possible slipping of the friction material. Practice varies considerably, due to the nature of the service and the particular material to be held in place.

In the case of hard, moulded blocks, where the mechanical strength of the material is high, a few high strength bolts, such as steel, will hold the material without difficulty. If softer fastening material is used, a greater number of fastenings are necessary, depending, of course, upon the service.

The following table is based on average practice:

Flexible Linings	*Fastenings*	*Allowable friction surface per fastening*
To steel bands	Light service, 1/8" to 3/16" rivets	4 sq. in.
	Medium service, 1/4" rivets	8 sq. in.
	Heavy service, 5/16" rivets	10 sq. in.
To wooden blocks	Medium service, 3/8" screws	4 sq. in.
Moulded Blocks		
Heavy blocks	Heavy service, 3/8" to 1/2" bolts	10 sq. in.
Moulded linings to steel bands	Heavy service, 1/4" to 5/16" rivets	8 sq. in.
Thin moulded to wooden blocks	Medium service, 3/16" to 3/8" screws	6 sq. in.

Efforts should be made to distribute fasteners proportionately over the area.

Replacing Fabric Rings with Moulded:

On clutches or brakes of the disc type, it is frequently desirable to replace asbestos fabric rings with rings of a moulded type. The fabric material has usually been fastened by rivets arranged near the edge of the material, in order to hold it down against the metal. Usually a large number of rivets are used, to prevent the fabric from bulging and also to lessen the chance of its stretching at the rivet holes.

This is the correct way to fasten a flexible material like asbestos fabric but it is not the correct method of fastening a solid material such as Asbesto-Metallic or Moulded Friction Facings.

The proper method of fastening Asbesto-Metallic or Moulded Friction rings is to use about half the number of rivets that would be used for fabric, and keep the rivets away from the edges of the rings.

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Insulation

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APPLICATIONS OF INSULATION *(cont.)*

Boiler and Boiler Setting Insulation* (*cont.*)** (Also see ***Breeching)

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APPLICATIONS OF INSULATION *(cont.)*

APPLICATIONS OF INSULATION *(cont.)*

Furnaces, Kilns, Regenerators, Hot Blast Stoves, Mains and Bustle-Pipes (cont.)

Hot Blast Stoves (See Furnaces)

Kilns (See Furnaces)

Miscellaneous Applications of Insulation

Ovens (See Dryers)

Pipe Insulation

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APPLICATIONS OF INSULATION *(cont.)*

Pipe Insulation (cont.)

Refrigeration (See Cold Storage)

Regenerators (See Furnaces)

Stacks (See Breeching)

Stills and Towers

Tanks

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APPLICATIONS OF INSULATION *(cont.)*

***Tanks* (*cont.*)**

COMMODITIES

***Miscellaneous Insulating Materials* (*Cements, Fillers, Finishes, etc.*)**

Pipe Insulation Materials

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COMMODITIES *(cont.)*

★ Catalog pages

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COMMODITIES *(cont.)*

Pipe Insulation Materials (*cont.*)

Sheets and Blocks (*includes blankets, bricks, millboard, paper and roll board*)

★ **Catalog pages**

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COMMODITIES *(cont.)*

Sheets and Blocks (*includes blankets, bricks, millboard, paper and roll board*) (*cont.*)

TECHNICAL INSULATION DATA

★ Catalog pages

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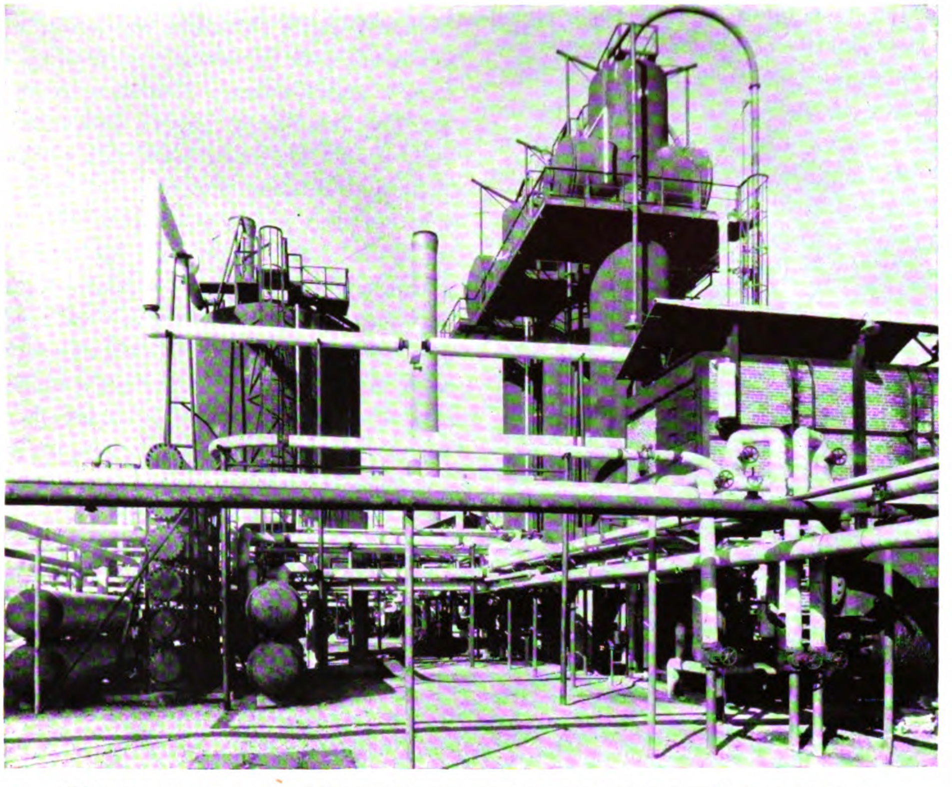
Insulation



Wherever heated or refrigerated equipment is used, J-M Insulating Materials reduce operating costs and improve performance

INSULATION is used to retard heat flow where it is desired to maintain a temperature either higher or lower than that of the surroundings. Whether heating or refrigerating is involved, insulation is essential to economical operation.

In industrial furnaces, while fuel saving is the principal advantage of insulation and the one most readily convertible into dollars and cents, there are other attendant advantages which in many classes of work are considered to be at least as important as the saving of fuel. First among these is the improvement in the quality of heat-treated products which is brought about by the more uniform heat distribution and more accurate temperature control which is possible with insulated equipment.

Other advantages of industrial furnace insulation are increased capacity of the equipment; protection to brickwork from rapid temperature changes; reduction of internal strains and cracking; and an improvement in working conditions about the equipment.

In the case of boilers, insulation over bare metal surfaces is even more essential than over brickwork. Steam pipe insulation reduces condensation, permitting the delivery of drier steam, and through heat saving pays for itself several times each year.

From the standpoint of economical operation, insulation of low temperature equipment and structures is especially important. A ton of refrigeration, which is equivalent to the removal of 288,000 B.t.u. per 24 hours, costs approximately ten times as much as the equivalent number of B.t.u. when produced for heating purposes. The necessity for much heavier insulation on low temperature work than is customary for high temperatures is therefore immediately apparent. Furthermore, many forms of cold storage demand that temperatures be controlled within a narrow range, a condition equally common in the cold processing of oils and chemicals. Such close temperature control cannot be maintained without adequate insulation.

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Thickness of Insulation

The economical thickness of insulation depends primarily upon the temperature and the cost of heat. The thickness is ordinarily computed on the basis of fuel costs and operating conditions so the heat which passes through the insulation is only that portion which may not economically be saved. Sometimes special conditions require thicker insulation than would be warranted by fuel saving.

The economical thickness of pipe insulation also depends on the pipe size. While it is a fact that small pipes would have to be more heavily insulated to give the same saving of heat, it is nevertheless true that the larger pipes should be provided with thicker insulation in order that the maximum net saving be realized. A 1″ pipe with 1″ thick insulation will lose heat more rapidly per square foot of pipe area than a 10″ pipe with the same thickness of insulation; because the outside surface of the insulation on the 1″ pipe is nearly 200% greater than that of the pipe, while the outside area of the insulation on a 10″ pipe is less than 20% greater. As a result of the greater area of material through which heat may flow, the losses from the 1″ pipe must be greater.

The matter of net saving takes into account both the saving per year and the cost per year of effecting that saving. Therefore, since the insulation on a 1″ pipe costs from 1½ to 3 times as much per square foot of pipe surface as on a 10″, and since each inch of thickness on a 10″ pipe saves more heat than the same on a 1″, it is at once evident that it pays to put a thicker insulation on a 10″ than on a 1″ pipe.

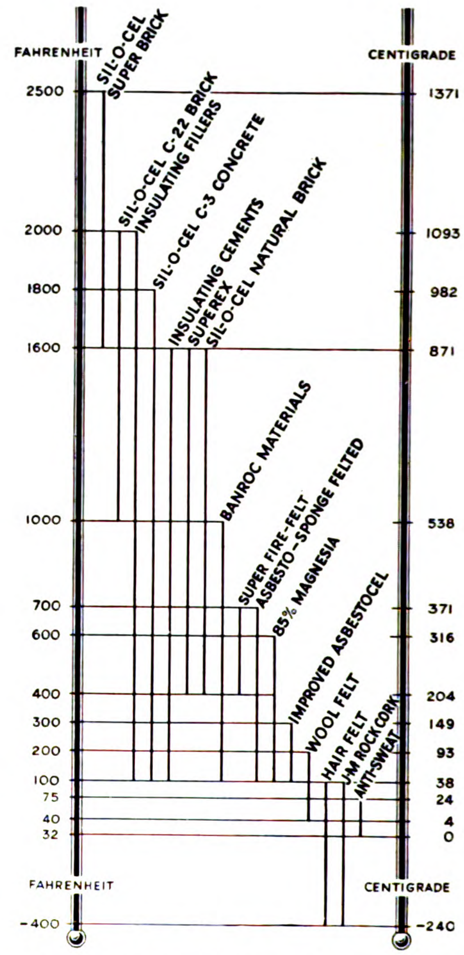
Selection of Insulation

To be adaptable, insulation must be of such form as to be easily applied. It must have heat-resisting qualities sufficient to withstand successfully the highest temperatures to which it will be subjected. It must be sufficiently strong and durable to assure long life. Adaptability also depends upon many other conditions incidental to the particular application.

The efficiency of a commercial insulation depends primarily upon the small voids which it contains. In order to be most effective, the voids must be enclosed and so small that circulation within them and radiation across them will be at a minimum. Small void size is particularly important at high temperatures because of the rapid increase in convection and radiation with rise in temperature.

From the four basic mineral products—asbestos, magnesium carbonate, diatomaceous silica (Celite), and rock wool made from argillaceous limestone—Johns-Manville furnishes insulation in the forms of sectional pipe covering; insulating sheets, blocks, bricks and blankets; insulating cements, fillers and finishes; insulating papers and felts; as well as a light-weight aggregate used with portland cement for making insulating concrete. A wide range of cork and hair felt products complete the line.

There is a J-M product for every heat-insulating purpose. Materials are available for use throughout the entire range of temperatures used in industrial processes, from the extreme sub-zero temperatures used in the treatment of oils, chemicals, etc., to 3000 deg. F. and more, used in many modern industrial plants. The temperatures below are those applied to the insulation, rather than process temperatures.



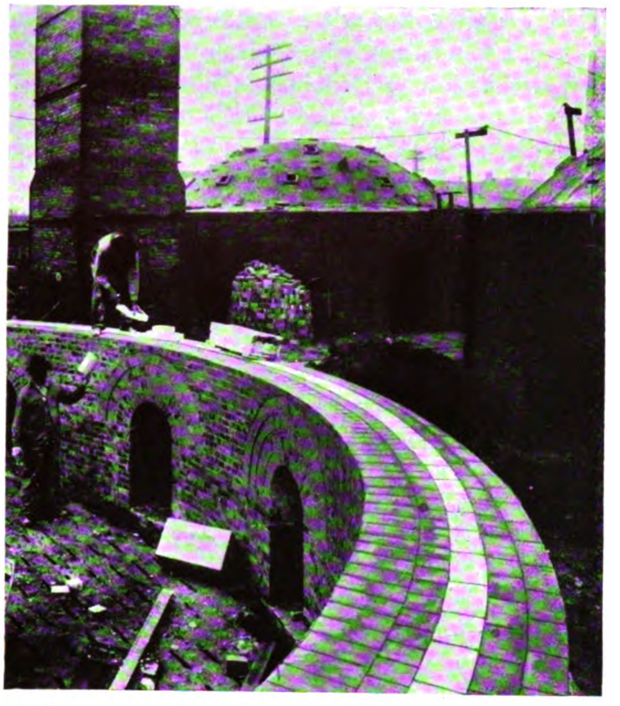
J-M Insulating Materials cover the entire range of industrial temperatures

Sil-O-Cel Insulating Brick

There are three types of Sil-O-Cel Insulating Brick: Sil-O-Cel Super Brick (calcined) for temperatures as high as 2500 deg. F., Sil-O-Cel C-22 Brick (calcined) for temperatures up to 2000 deg. F., and Sil-O-Cel Natural Brick for temperatures to 1600 deg. F. These three types of Sil-O-Cel brick are ordinarily used behind fire brick linings in boilers, still furnaces, heat treating furnaces, kilns and other types of high temperature equipment. Sil-O-Cel Super Brick and Sil-O-Cel C-22 Brick are often used, without fire brick protection, as an inner lining in high temperature flues and in electrically heated and muffle type furnaces.

All types of Sil-O-Cel brick are furnished in standard fire brick size, 9″ x 4½″ x 2½″, and as No. 1 and No. 2 arch brick. Packed in fibre cartons of 25 9″ straight brick or an equivalent volume of other sizes. Sil-O-Cel Natural Brick are also supplied in 1¼″, 2″ and 3″ thicknesses. Sil-O-Cel C-22 Brick are also supplied 3″ thick.

A special Sil-O-Cel Mortar of high insulating value is furnished with the brick at the rate of 80 lb. per thousand brick. Using this mortar insures a wall of practically the same insulating value throughout.



"Core wall" of Sil-O-Cel Natural Brick in down-draft brick kiln for firing refractories

Sil-O-Cel Natural Brick

For temperatures to 1600 deg. F.

Sil-O-Cel Natural Brick are cut from the pure mineral Celite. They will serve indefinitely at temperatures up to 1600 deg. F. without loss of effectiveness. This type of Sil-O-Cel brick is the most efficient insulating brick obtainable and is used in preference to other types of Sil-O-Cel brick except where very severe temperatures are encountered.

Sil-O-Cel Natural Brick have a crushing strength of over 400 lb. per sq. in., equivalent to 29 tons per sq. ft., and so are amply strong for structural purposes. They should not be used as bonds, however, and fire brick, red brick, or metal bonds should always be used where bonding of walls is necessary.

Sil-O-Cel Natural Brick are sized after cutting so that accurate, smooth surfaces are assured. This enables the brick to be laid up with thin joints and permits bonding with the fire brick where required.

Sil-O-Cel Natural Brick of the size 9″ x 4½″ x 2½″ weigh approximately 1¾ lb. each; the shipping weight, including fibre cartons and Sil-O-Cel Mortar, being about 1 ton per thousand 9″ straight brick.

Sil-O-Cel C-22 Brick

For temperatures to 2000 deg. F.

Sil-O-Cel C-22 Brick are a calcined semi-refractory type of insulating brick suitable for use where the insulation will be subjected to temperatures behind refractory linings as high as 2000 deg. F., at which temperature they will not shrink or deteriorate in any way.

Sil-O-Cel C-22 Brick have a crushing strength of about 550 lb. per sq. in., equivalent to 40 tons per sq. ft. While this is ample for structural purposes, they should not be used as headers in bonding walls except in cases where they are used as a veneer wall.

Sil-O-Cel C-22 Brick are furnished true to size within the limits prescribed for No. 1 fire brick. This makes possible correct bonding with the fire brick.

Sil-O-Cel C-22 Brick weigh approximately 2¼ lb. each; the shipping weight, including fibre cartons and

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Sil-O-Cel Mortar, being about 2600 lb. per thousand 9″ straight brick.

In addition to its use inside casings, Sil-O-Cel C-22 Brick are often used as the outside course in the combustion zone and first pass of water-tube boilers. They are also used as a combination insulating and face brick course on the outside of bake ovens and similar equipment where an exterior wall of pleasing appearance and wear-resisting properties is desired.

Under certain conditions Sil-O-Cel C-22 Brick may be used without an inside refractory lining. An example of this is furnace doors, which may be composed entirely of Sil-O-Cel C-22 Brick where temperatures may reach a maximum of 1800 deg. F. Sil-O-Cel C-22 Brick are also used very successfully as an inner lining in high temperature flues and in electrically heated and muffle type furnaces.

Sil-O-Cel Super Brick

For temperatures to 2500 deg. F.

Sil-O-Cel Super Brick (patented) are a calcined semi-refractory type of Sil-O-Cel Brick designed for exceptionally severe insulating service where subjected to temperatures behind the refractory in excess of 2000 deg. F. They can be used where they will come in contact with temperatures up to 2500 deg. F.

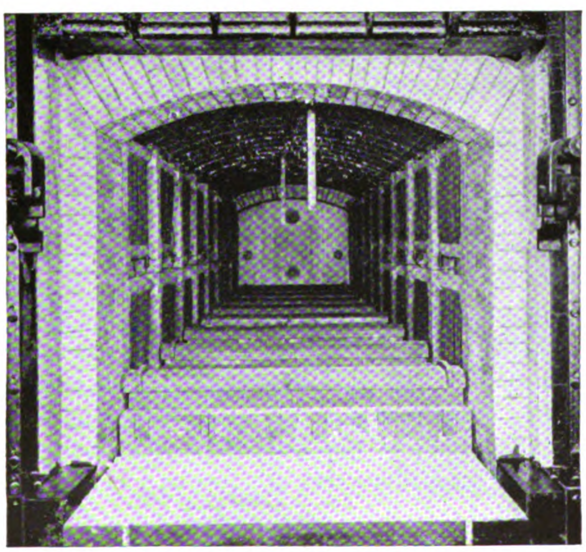
Sil-O-Cel Super Brick are much higher in insulating efficiency than any other insulating brick on the market which can be used above 2000 deg. F.

They have a crushing strength of 350 lb. per sq. in., equivalent to 25 tons per sq. ft. While this is ample for structural purposes, they should not be used as headers in bonding walls, except where they are used in veneer wall construction.

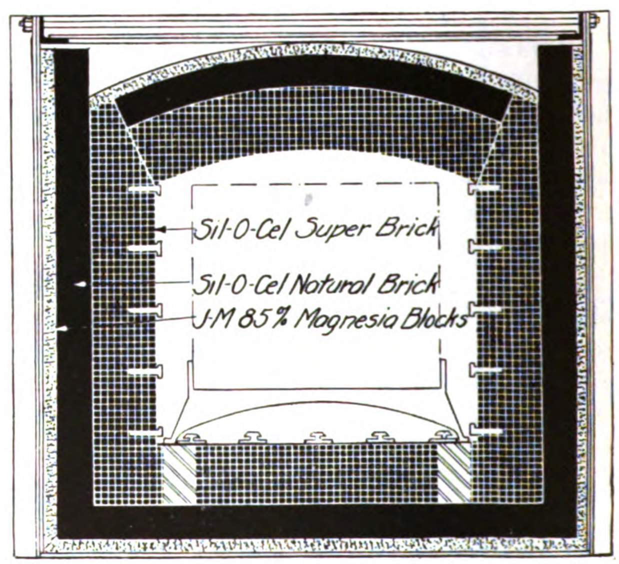
Sil-O-Cel Super Brick weigh about 2¼ lb. each; the shipping weight, including the fibre cartons and Sil-O-Cel Mortar, being approximately 2600 lb. per thousand 9″ straight brick.

In many cases it is possible to cut down on the thickness of first-quality fire brick when Sil-O-Cel Super Brick are used. For instance, in equipment where Sil-O-Cel Natural Brick would be used behind 13½″ of fire brick, Sil-O-Cel Super Brick could be safely used back of 9″, or in some cases as low as 4½″, of refractory.

Sil-O-Cel Super Brick are used successfully without fire brick protection for lining electrically heated or muffle type furnaces operating at temperatures as high as 2000 deg. F. This combining of the refractory and insulating course not only results in a saving in construction costs but also cuts down on the heat storage capacity of the masonry. Less heat is wasted when the furnace is shut down and the furnace can be brought up to temperature again in a very short time and with minimum expense for heat.



Electrically heated furnace, designed by Ryan, Scully & Company, Philadelphia. Sil-O-Cel C-22 Brick, 4½″ thick, used as inner lining in walls, car top, and arch, backed up with 9″ Sil-O-Cel Natural Brick



Electric heat-treating furnace (up to 2000 deg. F.) utilizing Sil-O-Cel Materials as combination refractory and insulation. Designed and built by Falls Electric Furnace Corp., Buffalo, N. Y.

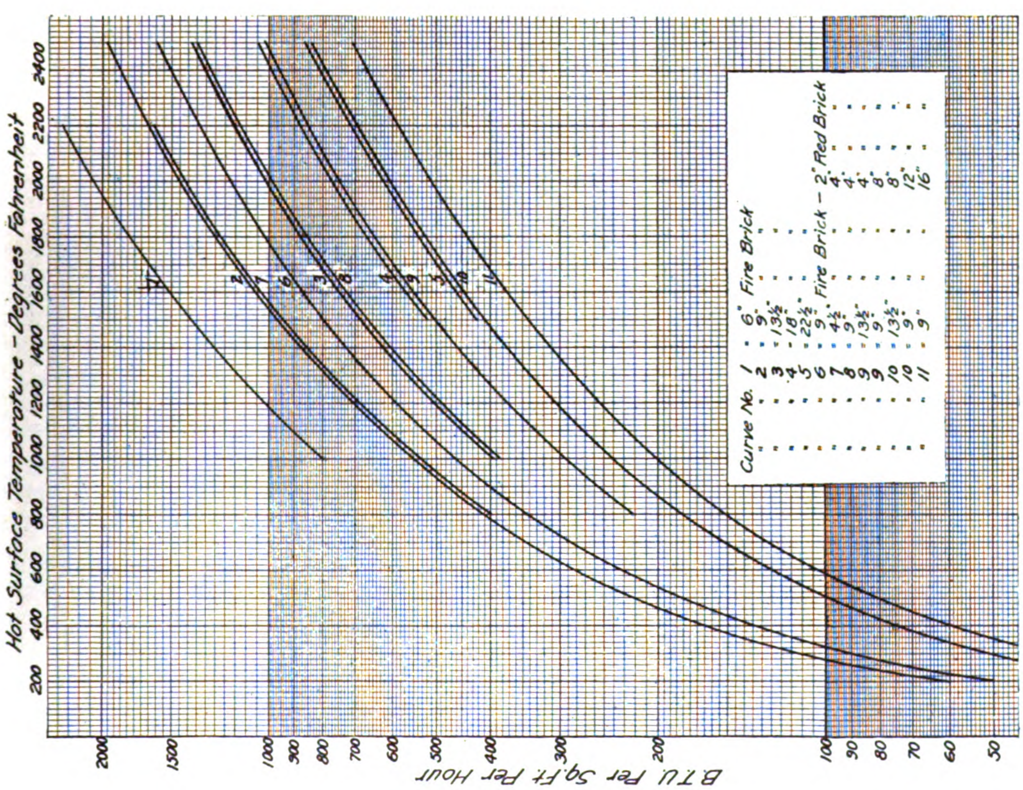


Chart A—Heat losses through uninsulated furnace walls

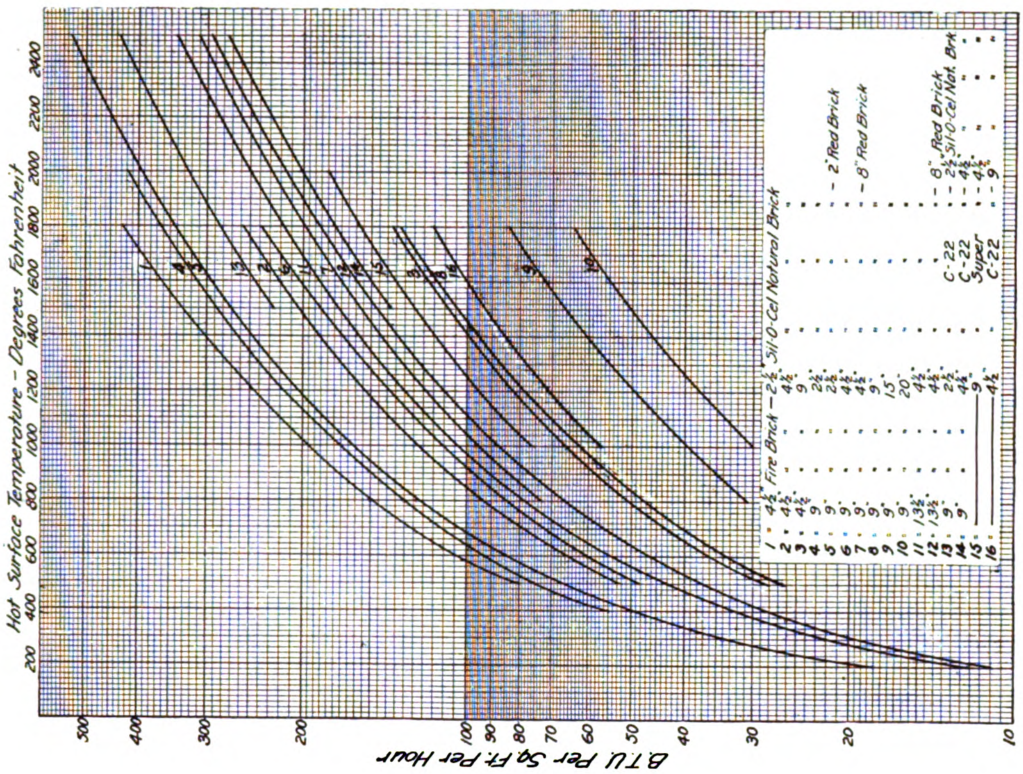


Chart B—Heat losses through furnace walls insulated with Sil-O-Cel Natural Brick and combinations

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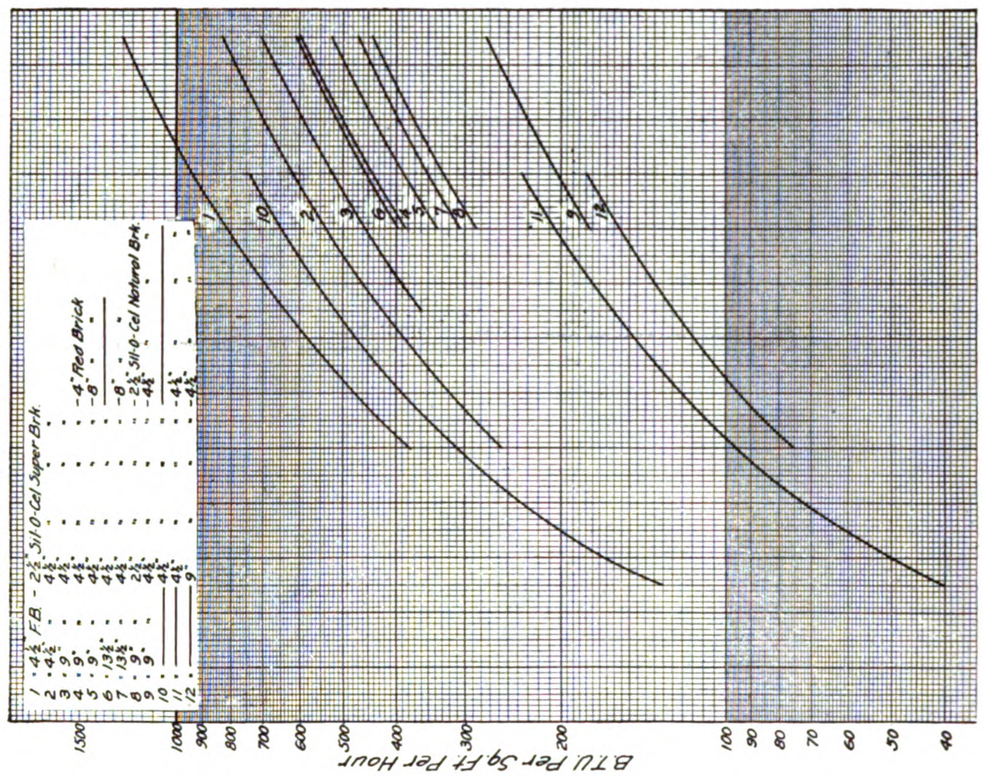


Chart D—Heat losses through furnace walls insulated with Sil-O-Cel Super Brick and combinations

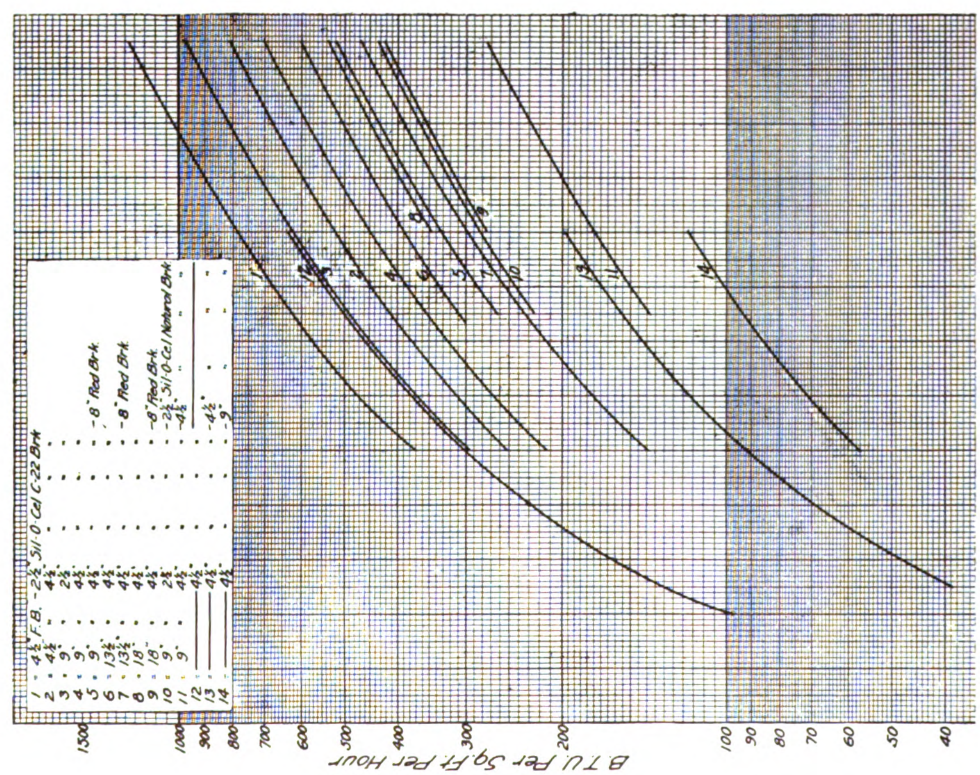
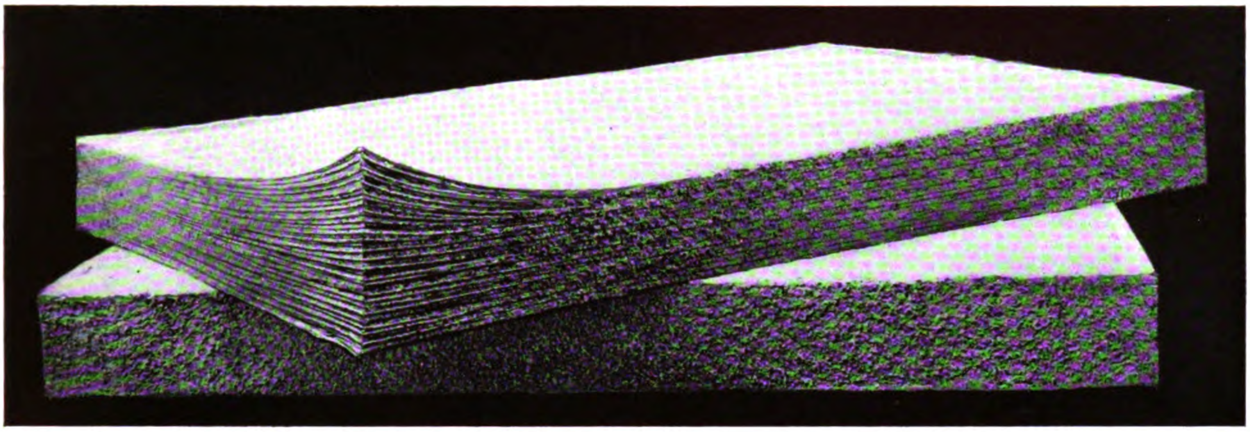


Chart C—Heat losses through furnace walls insulated with Sil-O-Cel C-22 Brick and combinations

Asbesto-Sponge Felted Sheets and Blocks

For temperatures to 700 deg. F.



Asbesto-Sponge Felted sheets and blocks are used for efficiently insulating any surface to which they may be fitted, provided the temperature of the surface to which the material is applied does not exceed 700 deg. F.

Asbesto-Sponge Felted sheets and blocks are constructed by building up to the required size and thickness, felts composed of asbestos fibre and small particles of spongy cellular material. The remarkable efficiency of this material is due to the enormous number of minute confined dead air spaces in the felt itself as well as the dead air spaces formed between the layers of the felt as built up to produce the finished product.

Due to the nature of the materials used and the construction of Asbesto-Sponge Felted sheets and blocks, they withstand vibration, shocks, and the rough usage of shipment and general handling without crumbling, pulverizing or loss of efficiency. They will not deteriorate in service and can be removed and replaced without impairing their insulating value.

Asbesto-Sponge Felted sheets and blocks are flexible and conform to curved surfaces of boilers, tanks, etc., without the necessity of special moulding for each required radius.

The pasting strips, by which the laminations are bound together, run the length of the block, which allows great flexibility and ease of application to curved surfaces. Where these pasting strips are desired to run across the block, they can be so furnished, but such change must be specifically stated in the order.

Furnished in sheets, 24″ x 36″ and blocks 6″ 36″, from ½″ to 4″ in thickness.

Weight approximately 3½ lb. per sq. ft., per inch of thickness.

List prices per square foot

Thickness		Thickness		Thickness		Thickness	
1″	$.30	1⅝″	$.49	2¼″	$.68	2⅞″	$.87
1⅛″	.34	1¾″	.53	2⅜″	.72	3″	.90
1¼″	.38	1⅞″	.57	2½″	.75	3¼″	.98
1⅜″	.42	2″	.60	2⅝″	79	3½″	1.05
1½″	.45	2⅛″	.64	2¾″	.83	4″	1.20

Also furnished in sectional pipe insulation form as described in another data sheet.

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Asbesto-Sponge Felted Sheets and Blocks
Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot, per degree temperature difference, per hour. Efficiency expressed in percent of bare surface losses.

Insulation thickness, inches		Temperature of surface—deg. Fahr 125	175	225	275	325	375	425	475	525	575
		Temperature difference between surface and air—deg. Fahr. 50	100	150	200	250	300	350	400	450	500
1	Heat Loss, B.t.u.	.333	.341	.350	.360	.369	.379	.389	.399	.409	.420
	Efficiency %	82.91	84.16	85.41	86.50	87.50	88.37	89.27	90.11	90.84	91.46
1½	Heat Loss, B.t.u.	.236	.242	.248	.254	.261	.268	.275	.283	.290	.298
	Efficiency %	87.88	88.76	89.67	90.47	91.15	91.78	92.42	92.99	93.50	93.94
2"	Heat Loss, B.t.u.	.183	.187	.192	.197	.203	.208	.214	.220	.226	.232
	Efficiency %	90.65	91.31	92.02	92.61	93.12	93.61	94.10	94.55	94.94	95.29
2½	Heat Loss, B.t.u.	.149	.153	.157	.161	.166	.170	.175	.179	.184	.189
	Efficiency %	92.36	92.89	93.46	93.96	94.39	94.79	95.19	95.55	95.88	96.16
3	Heat Loss, B.t.u.	.126	.129	.132	.136	.140	.144	.148	.152	.156	.160
	Efficiency %	93.54	94.01	94.48	94.90	95.26	95.58	95.92	96.23	96.51	96.75
3½	Heat Loss, B.t.u.	.109	.112	.115	.118	.121	.125	.128	.132	.135	.139
	Efficiency %	94.41	94.81	95.21	95.56	95.88	96.18	96.47	96.74	96.97	97.18
4	Heat Loss, B.t.u.	.096	.098	.101	.104	.107	.110	.113	.116	.119	.122
	Efficiency %	95.07	95.43	95.78	96.09	96.37	96.63	96.89	97.12	97.33	97.52

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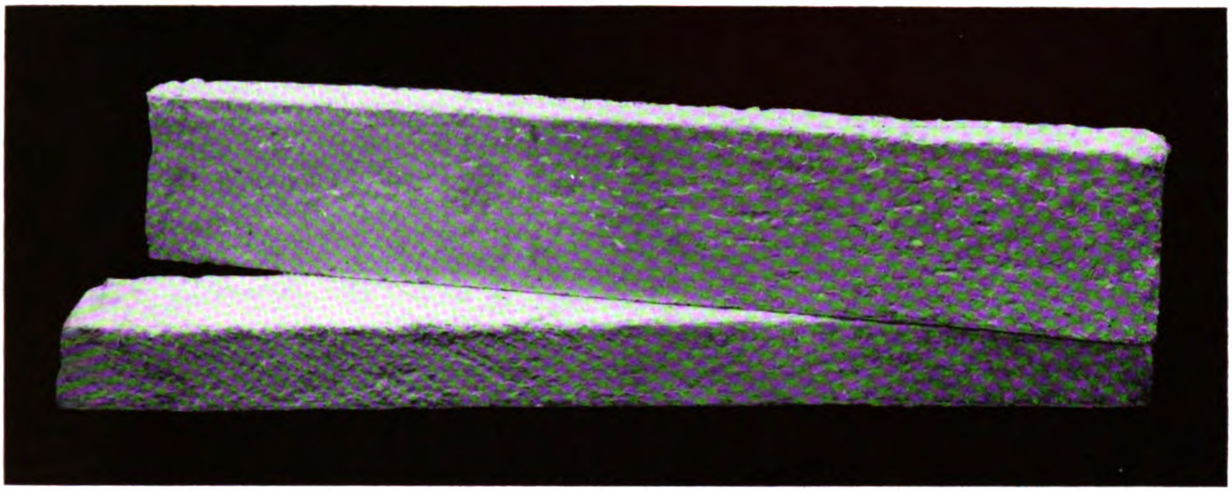
J-M 85% Magnesia Blocks and Lagging

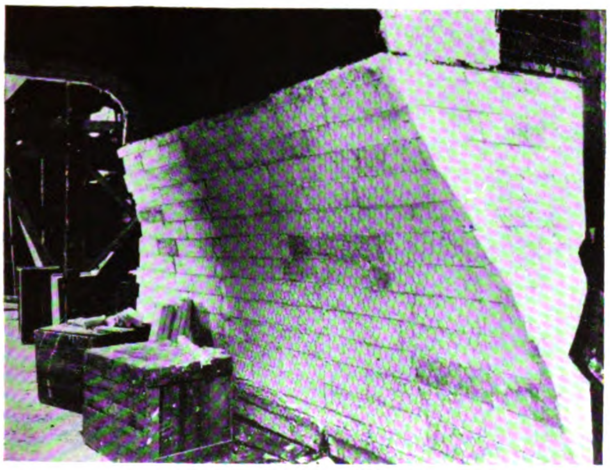
For temperatures to 600 deg. F.



J-M 85% Magnesia blocks and lagging are used for insulating flat, curved or irregular surfaces where temperatures do not exceed 600 deg. F.

85% Magnesia blocks and lagging are composed of carbonate of magnesia bonded with asbestos fibre, moulded and machined into block form, and are especially light and highly efficient.

This material is particularly adapted to conditions requiring high insulating value and light weight, or where surfaces are so irregular that it is necessary to use a material easily cut and fitted.



Breeching being insulated with Magnesia. Block sizes are convenient in applying insulation over metal surfaces

Unless this form of block insulation is protected by an air space or some other material with greater heat-resisting qualities, it should not be applied to surfaces whose temperatures exceed 600 deg. F. It is often used at much higher operating temperatures outside a layer of Superex. This construction is known as Superex Combination Insulation and is described further in connection with Superex blocks.

85% Magnesia blocks are furnished in standard sizes 3″ x 18″ and 6″ x 36″, flat or curved, from ½″ to 4″ in thickness. Other sizes, and lagging, furnished on special order.

Weight about 1.4 lb. per sq. ft. per inch thick.

List prices per square foot

Thickness		Thickness		Thickness		Thickness	
¾″ or less	$.27	1½″	$.45	2¼″	$.68	2⅞″	$.87
⅞″	.30	1⅝″	.49	2⅜″	.72	3″	.90
1″	.30	1¾″	.53	2½″	.75	3¼″	.98
1⅛″	.34	1⅞″	.57	2⅝″	.79	3½″	1.05
1¼″	.38	2″	.60	2¾″	.83	4″	1.20
1⅜″	.42	2⅛″	.64				

Also furnished in sectional pipe insulation form, as described in another data sheet.

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(EL) ELECTRICAL MATERIALS
(FI) FILTER-AIDS & MINERAL FILLERS
(FR) FRICTION MATERIALS
MAT'LS. MISC.
(IN) INSULATION
ROOFING & SHINGLES
(BMS) SOUND CONTROL
(BMT) TRANSITE PRODUCTS
(BMW) WATERPROOFING & MISC. ASPH. PROD.

85% Magnesia Blocks and Lagging
Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot, per degree temperature difference, per hour.
Efficiency expressed in percent of bare surface losses.

Insulation thickness, inches		125	175	225	275	325	375	425	475	525	575
	Temperature of surface—deg. Fahr. / Temperature difference between surface and air—deg. Fahr.	50	100	150	200	250	300	350	400	450	500
1	Heat Loss, B.t.u.	.374	.380	.386	.393	.399	.405	.411	.418	.425	.432
	Efficiency %	80.82	82.34	83.92	85.25	86.48	87.57	88.67	89.65	90.47	91.22
1½	Heat Loss, B.t.u.	.268	.271	.275	.280	.284	.288	.292	.296	.301	.306
	Efficiency %	86.25	87.40	88.54	89.50	90.38	91.16	91.95	92.66	93.26	93.78
2	Heat Loss, B.t.u.	.208	.211	.214	.217	.221	.224	.228	.231	.234	.238
	Efficiency %	89.33	90.19	91.08	91.85	92.52	93.13	93.70	94.28	94.76	95.16
2½	Heat Loss, B.t.u.	.171	.173	.175	.178	.181	.183	.186	.189	.192	.196
	Efficiency %	91.20	91.96	92.71	93.32	93.87	94.38	94.87	95.32	95.70	96.04
3	Heat Loss, B.t.u.	.145	.146	.148	.150	.153	.155	.157	.159	.162	.165
	Efficiency %	92.56	93.22	93.84	94.37	94.82	95.24	95.67	96.06	96.37	96.65
3½	Heat Loss, B.t.u.	.125	.127	.129	.131	.133	.135	.137	.139	.141	.143
	Efficiency %	93.59	94.11	94.62	95.08	95.49	95.86	96.22	96.55	96.84	97.09
4	Heat Loss, B.t.u.	.110	.112	.113	.115	.117	.119	.121	.123	.124	.126
	Efficiency %	94.36	94.79	95.29	95.68	96.03	96.35	96.66	96.95	97.22	97.44

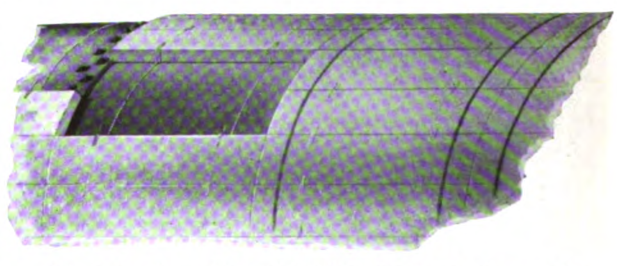
J-M 85% Magnesia Locomotive Boiler Lagging

Practically all locomotive boilers are lagged with 85% Magnesia, furnished in various thicknesses, curved, straight or tapered to fit the surface of the boiler, in accordance with dimension blueprints submitted by the railroads or builders. Magnesia lagging used in boiler insulation is applied in blocks 6″ wide and ranging in length from 24″ to 36″. To obtain a uniform outline it is common practice to taper the blocks to provide for the thickness of the boiler sheets at the seam lap.

For pressures below 100 lb., 1½″ 85% Magnesia blocks should be used; for pressures above 100 lb., 2″ 85% Magnesia blocks, except for temperatures above 600 deg. F., when Superex Combination Insulation, consisting of a first layer of 1½″ or 2″ of Superex followed by a layer of 85% Magnesia, should be applied to a total thickness of 4″.

The blocks are applied either by wiring them with circumferential tie wires and finishing with a ½″ coat of asbestos cement applied in two layers over hexagonal wire reinforcement, or by the following method:

Wires are passed around the boiler at about 4″ from the ends of every course of blocks. Special T-hooks for fastening engage the wires, and the blocks are slipped under the hooks, which hold them firmly in place. This method of fastening permits the removal, when necessary, of a single block without disturbing the others. When all blocks are laid, a planished jacket is fastened on around the lagging, closing the joints and binding the blocks securely together.



Method of applying J-M 85% Magnesia Locomotive Boiler Lagging

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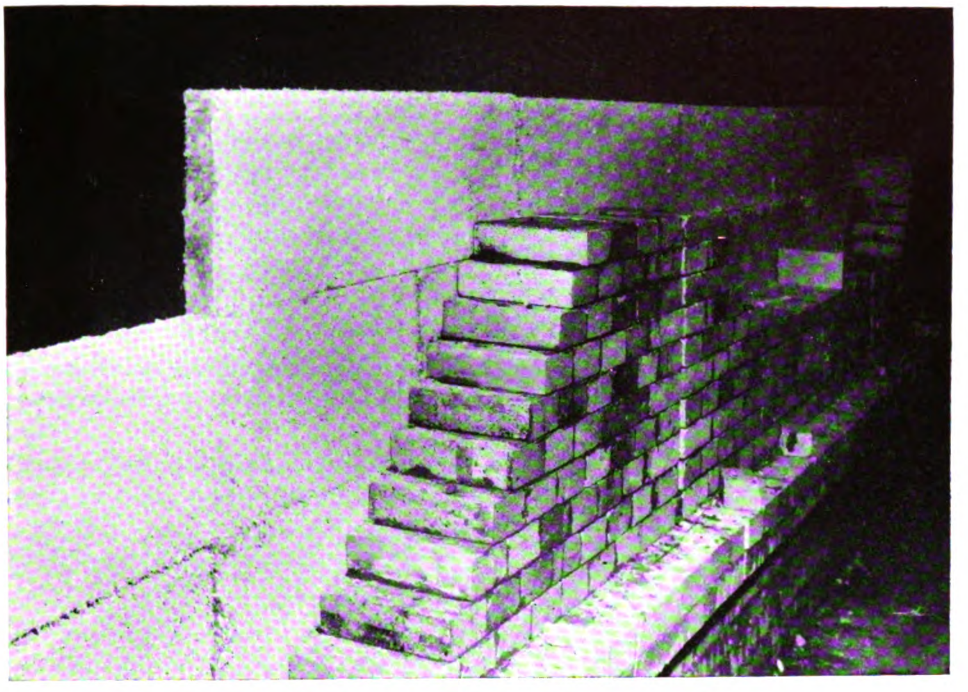
Superex Blocks

For temperatures to 1600 deg. F.



Superex insulation is a combination of diatomaceous silica and asbestos fibre, bonded together, producing an insulation in which are combined the essential qualities of high heat resistance and exceptional insulating value. It is the most generally adaptable material for application where the insulation must resist temperatures between 600 and 1600 deg. F.

It has a low thermal conductivity, will safely withstand temperatures up to 1600 deg. F. with negligible shrinkage, and, although weighing only approximately 24 lb. per cu. ft., possesses ample strength for all purposes for which it is recommended.

Superex block insulation is regularly furnished in standard sizes 3″x18″ and 6″x36″, flat and curved, in thicknesses 1″ to 4″. Other sizes furnished on special order.

List prices per square foot

Thickness		Thickness		Thickness		Thickness	
1″ or less	$.30	1⅝″	$.49	2¼″	$.68	2⅞″	$.87
1⅛″	.34	1¾″	.53	2⅜″	.72	3″	.90
1¼″	.38	1⅞″	.57	2½″	.75	3¼″	.98
1⅜″	.42	2″	.60	2⅝″	.79	3½″	1.05
1½″	.45	2⅛″	.64	2¾″	.83	4″	1.20

Superex is also furnished as pipe insulation as described in another data sheet.

Superex Combination Insulation

Insulating materials having a high refractory value are generally lower in insulating value. It is also usual that materials for higher temperatures are more expensive. The proper insulation for a given application is one which has a refractory value high enough to withstand the temperature requirements, yet which also has high insulating value and is satisfactory in other respects.

If the drop in temperature through the first layer of insulation is sufficient, then, for the second layer, a material of lesser refractory value but of greater efficiency and lower cost may be used.

Combinations of insulation generally consist of Superex and Magnesia or Superex and Asbesto-Sponge Felted. These combinations give greater insulating efficiency and heat resistance for a given insulation thickness. The Superex is always used next to the hot surface as a protection for the other insulation, which, though high in insulation value, is compara-

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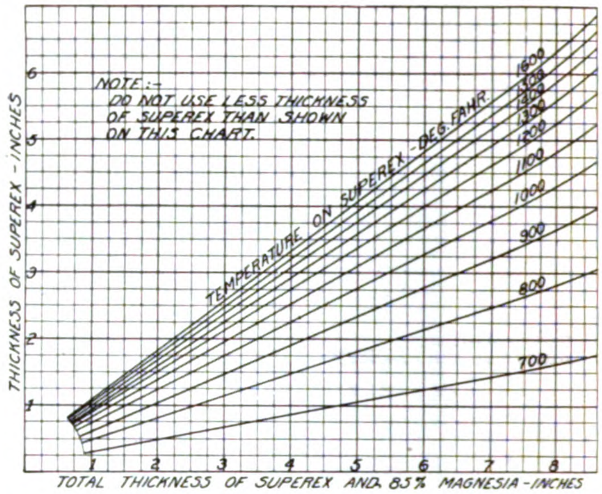
tively low in heat resistance. The proper combination and thickness is usually governed by the maximum operating temperature, average operating temperature, cost of heat and degree of temperature control required. This information permits a determination of the correct thickness of the inner layer to resist temperature and the total economic thickness of insulation to accomplish the desired purpose.

In computing an individual job, the necessary thickness of Superex to protect the outer layer of insulation would be figured on the basis of maximum temperature on the inner face of the Superex. The thickness of the outer layer would then be figured so that the total heat lost through the insulation would be only that portion which might not economically be saved.

The figures in the following table for Superex Combination Insulation over metal surfaces are approximations based on conditions commonly found in practice. In order to use the table it is only necessary to select the insulation combination which corresponds to the maximum temperature to be applied to the inner surface of Superex in service.

Where a greater thickness of insulation than that given in the table is used, the relative thickness of Superex to Magnesia or Asbesto-Sponge Felted should not be less than the proportions shown. The usual finish over the insulation is hard finish asbestos cement, ½″ thick. If the cement finish is used outdoors, either the last ¼″ of cement is replaced with Insulkote or an additional ¼″ of Insulkote is applied over the ½″ thick cement.

Superex Combination Insulation, 3½″ thick, applied between Transite casing and fire brick in Gyro Process Tube Still



Proper thickness of Superex and Magnesia (with ½″ cement finish) for flat surfaces

Block insulation on metal surfaces

Maximum temperature on Superex, deg. F.	Thickness of Superex, inches	Thickness of Asbesto-Sponge Felted or 85% Magnesia, inches	Total thickness of block insulation, inches
300	.....	2	2
400	.....	2½	2½
500	.....	3	3
600	.....	3½	3½
750	1½	2½	4
900	2*	2*	4
1000	2½*	2*	4½
1200	3½	1½	5

*Where Asbesto-Sponge Felted is used as the second layer at operating temperatures of 750 to 1000 deg. F., the Superex may be ½″ thinner and the Asbesto-Sponge Felted ½″ thicker than shown above.

Superex Combination Insulation is also furnished for application to pipes, but is not used on pipes smaller than 2″. High temperature lines, 1½″ and smaller, are insulated with a single layer of Superex.

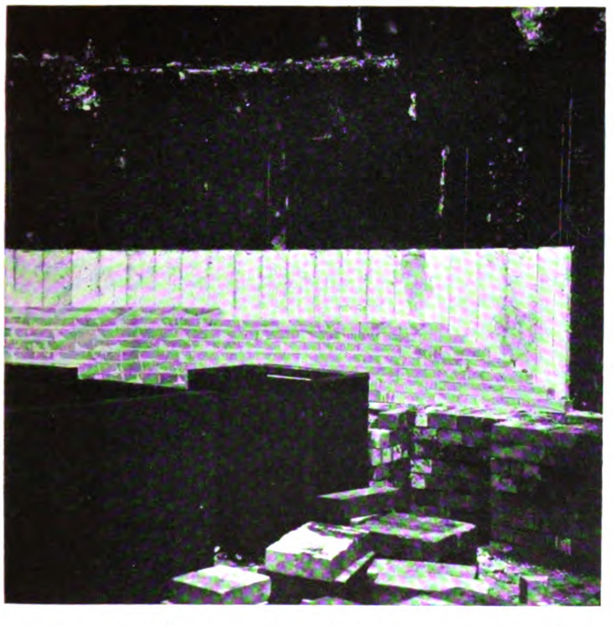
Furnace Insulation:

The same principles of combination insulation apply to the insulating of furnaces as to metal surfaces, except that brickwork has appreciable resistance in itself to the flow of heat. This changes the economic thickness of insulation and also introduces another factor which affects the thickness of Superex to be used, namely, the increasing of temperature on the Superex materially above the temperature of the brick exterior if uninsulated.

In this class of work it is also sometimes necessary to restrict the thickness of Superex when used alone, in order not to exceed the temperature limit of the insulation. Where the use of brick shapes is advantageous, Sil-O-Cel Natural Brick are used instead of Superex Blocks. Sil-O-Cel C-22 Brick and Sil-O-Cel Super Brick are used to take care of insulating requirements in the range of temperature so high that more than 1600 deg. F. will be applied on the insulation.

Furnace insulation is a highly profitable investment from the standpoint of heat saving alone. Added to this is the lessening of internal strains and reduction in spalling because of the smaller temperature differential between the inside and outside of the refractory. Wall cracks, caused by uneven expansion and contraction, are fewer and smaller. Properly applied, the insulation tends to seal cracks in furnace walls and prevents infiltration of air or the extrusion of furnace gases.

When insulation is placed over the exterior of furnace brickwork, resistance is introduced in the path of heat flowing directly to the outside. This promotes heat flow along the walls, and cooler portions of the furnace are raised to a higher temperature. Sharp temperature changes are obviated and adjacent brickwork is protected against widely varying rates of expansion. Lower temperatures may be used in the heating zone and adequate temperatures still be maintained throughout all portions of the furnace setting. This saves fuel and further prevents rapid deterioration of the refractories.



Erecting the lining in a hot blast stove. Superex blocks are laid against the shell, and Sil-O-Cel C-22 Brick and fire brick built up inside

Surface Combustion drawing furnace at automobile factory, being insulated with Superex Combination Insulation

The modern furnace wall is cased with Transite sheets or with steel plate. Care is taken to leave the main supporting steel sufficiently exposed to the air so that its strength will not be affected by the heat.

It has been found entirely satisfactory to apply Superex and Magnesia blocks and Sil-O-Cel brick between the refractory and buckstays except at places of unusual thrust, such as opposite a sprung arch, or where castings and steel work are hung into the brickwork. In such locations the fire brick is carried through the insulation to the outside of the furnace.

When it is expedient to erect the furnace brickwork before the casing is applied, a space equivalent to the thickness of the insulation is left between the outside face of the brick and the inside face of the buckstays. Then insulating blocks or bricks are erected to fill this space and the Transite casing secured flush with the back of the buckstays by steel battens and toggle bolts or other suitable means.

Where the furnace brickwork is erected flush with the back of the buckstays, light angles may be clipped or spot-welded to the buckstays to allow the application of insulation between vertical steel members. These angles serve to support the 3/8" Transite casing.

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Heat losses through fire brick walls

Bare and insulated with Superex with Transite casing

Loss given in B.t.u. per sq. ft., per hour
Temperature of air, 80 deg. F.

Thickness of Superex, inches	Inside temperature, deg. F.																	
	1000		1200		1400		1600		1800		2000		2200		2400		2600	
	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.
4½″ fire brick																		
0 (bare)	980	1.065	1262	1.127	1569	1.189	1903	1.251	2261	1.313	2641	1.375	3043	1.437	3478	1.499	3936	1.561
1½	268	.291	312	.305	422	.319	508	.334	601	.349	701	.365						
2	217	.236	276	.247	340	.258	410	.270	487	.283								
2½	183	.199	233	.208	286	.217	345	.227	410	.238								
3	158	.172	202	.180	248	.188	298	.196	353	.205								
3½	139	.151	177	.158	218	.165	263	.173	312	.181								
4	125	.136	159	.142	195	.148	235	.155	278	.162								
4½	113	.123	144	.128	177	.134	213	.140	253	.147								
9	61	.066	77	.069	95	.072	114	.075										
9″ fire brick																		
0 (bare)	554	.602	706	.630	869	.658	1042	.686	1229	.714	1425	.742	1635	.770	1852	.798	2084	.826
1½	223	.242	283	.253	348	.264	418	.275	492	.286	572	.298	658	.310	748	.322		
2	187	.203	237	.212	291	.221	349	.230	412	.240	480	.250	554	.261				
2½	160	.174	204	.182	251	.191	303	.199	358	.208	416	.217						
3	141	.154	179	.161	221	.168	266	.175	315	.183	367	.191						
3½	127	.138	161	.144	198	.150	237	.156	280	.163	326	.170						
4	114	.124	145	.129	178	.135	214	.141	253	.147								
4½	104	.113	132	.118	162	.123	195	.128	230	.134								
9	58	.063	73	.065	90	.068	108	.072										
13½″ fire brick																		
0 (bare)	392	.426	497	.444	611	.463	732	.481	860	.500	995	.518	1139	.537	1288	.555	1447	.574
1½	192	.209	243	.217	297	.225	356	.234	418	.243	484	.252	554	.261	629	.271	708	.281
2	165	.179	208	.186	255	.193	306	.201	360	.209	417	.217	479	.226	546	.235		
2½	144	.151	182	.163	223	.169	267	.176	315	.183	366	.190	420	.198				
3	129	.140	162	.145	199	.151	239	.157	281	.163	327	.170	375	.177				
3½	115	.126	146	.131	180	.136	216	.141	254	.147	295	.154						
4	105	.114	133	.119	163	.124	196	.129	231	.134	269	.140						
4½	98	.106	123	.110	150	.114	180	.119	213	.124								
9	56	.061	71	.063	87	.066	104	.069	123	.072								
18″ fire brick																		
0 (bare)	304	.330	384	.343	470	.356	561	.369	659	.383	761	.396	869	.410	982	.424	1104	.438
1½	168	.182	213	.189	260	.197	310	.204	364	.212	421	.219	482	.227	546	.235	613	.243
2	147	.160	186	.166	227	.172	271	.178	318	.185	368	.192	421	.199	478	.207	540	.215
2½	131	.142	165	.147	201	.152	240	.158	282	.164	328	.171	378	.178	430	.185	485	.193
3	118	.128	148	.132	181	.137	216	.142	254	.148	295	.154	339	.160	388	.167		
3½	107	.116	134	.120	164	.125	197	.130	233	.135	270	.140	308	.145				
4	98	.107	124	.111	152	.115	181	.119	213	.124	248	.129	285	.134				
4½	91	.099	114	.102	140	.106	167	.110	198	.115	231	.120						
9	53	.058	67	.060	83	.063	100	.066	118	.069								
22½″ fire brick																		
0 (bare)	250	.271	315	.281	386	.292	459	.302	538	.313	620	.323	708	.334	798	.344	895	.355
1½	150	.163	188	.169	230	.175	275	.181	323	.188	373	.194	426	.201	483	.208	543	.215
2	133	.144	168	.149	205	.155	245	.161	287	.167	332	.173	379	.179	429	.185	482	.191
2½	120	.129	150	.134	183	.139	219	.144	258	.150	300	.156	344	.162	390	.168	438	.174
3	108	.117	136	.121	166	.126	199	.131	234	.136	272	.141	312	.147	355	.153		
3½	99	.107	124	.111	152	.116	183	.120	216	.125	250	.130	286	.135				
4	91	.099	115	.103	141	.107	169	.111	198	.115	229	.119	263	.124				
4½	85	.092	106	.095	131	.099	157	.103	184	.107	213	.111						
9	51	.056	65	.058	80	.061	96	.063	113	.066								

June, 1931 (Cancelling 9-X-10-A-1 to 3, dated in 1928 and 1929)

Printed in U.S.A.

Heat losses through fire brick walls

Bare and insulated with Superex with ½" cement finish

Loss given in B.t.u. per sq. ft., per hour
Temperature of air, 80 deg. F.

Thickness of Superex, inches	Inside temperature, deg. F.																	
	1000		1200		1400		1600		1800		2000		2200		2400		2600	
	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.	Total	Per deg.
4½" fire brick																		
0 (bare)	980	1.065	1262	1.127	1569	1.189	1903	1.251	2261	1.313	2641	1.375	3043	1.437	3478	1.499	3936	1.561
1½	243	.264	308	.275	379	.287	455	.299	536	.311	622	.324	....	....	....	....	....	....
2	200	.218	255	.227	313	.237	375	.247	443	.258	....	....	....	....	....	....	....	....
2½	169	.185	214	.192	264	.201	319	.211	378	.221	....	....	....	....	....	....	....	....
3	149	.162	189	.169	232	.176	279	.184	329	.192	....	....	....	....	....	....	....	....
3½	132	.144	168	.150	206	.156	247	.163	292	.170	....	....	....	....	....	....	....	....
4	119	.130	151	.135	186	.141	223	.147	263	.153	....	....	....	....	....	....	....	....
4½	109	.118	138	.123	169	.128	202	.133	238	.139	....	....	....	....	....	....	....	....
9	59	.064	75	.067	93	.070	112	.073	....	....	....	....	....	....	....	....	....	....
9" fire brick																		
0 (bare)	554	.602	706	.630	869	.658	1042	.686	1229	.714	1425	.742	1635	.770	1852	.798	2084	.826
1½	206	.224	262	.233	320	.242	381	.251	447	.260	518	.270	594	.280	....	....	....	....
2	175	.190	221	.197	271	.205	324	.213	380	.221	441	.230	507	.239	....	....	....	....
2½	153	.166	194	.173	238	.180	284	.187	334	.194	....	....	....	....	....	....	....	....
3	134	.146	170	.152	208	.158	250	.164	294	.171	....	....	....	....	....	....	....	....
3½	120	.130	152	.136	187	.142	225	.148	265	.154	....	....	....	....	....	....	....	....
4	110	.119	139	.124	170	.129	204	.134	241	.140	....	....	....	....	....	....	....	....
4½	99	.108	126	.112	155	.117	185	.122	218	.127	....	....	....	....	....	....	....	....
9	57	.062	72	.064	89	.067	106	.070	....	....	....	....	....	....	....	....	....	....
13½" fire brick																		
0 (bare)	392	.426	497	.444	611	.463	732	.481	860	.500	995	.518	1139	.537	1288	.555	1447	.574
1½	179	.194	225	.201	275	.208	328	.216	385	.224	446	.232	509	.240	575	.248	645	.256
2	155	.168	196	.174	239	.181	285	.187	334	.194	387	.201	444	.209	....	....	....	....
2½	136	.148	172	.154	211	.160	252	.166	296	.172	342	.178	392	.185	....	....	....	....
3	122	.133	155	.138	189	.143	226	.149	266	.155	307	.160	352	.166	....	....	....	....
3½	111	.121	141	.125	172	.130	205	.135	241	.140	....	....	....	....	....	....	....	....
4	101	.110	128	.114	157	.119	187	.123	220	.128	....	....	....	....	....	....	....	....
4½	94	.102	119	.106	145	.110	173	.114	204	.118	....	....	....	....	....	....	....	....
9	54	.059	68	.061	84	.064	102	.067	120	.070	....	....	....	....	....	....	....	....
18" fire brick																		
0 (bare)	304	.330	384	.343	470	.356	561	.369	659	.383	761	.396	869	.410	982	.424	1104	.438
1½	158	.172	199	.178	243	.184	289	.190	339	.197	395	.203	445	.210	504	.217	565	.224
2	140	.152	176	.157	214	.162	255	.168	300	.174	346	.180	394	.186	448	.193	505	.200
2½	124	.135	157	.140	191	.145	228	.150	268	.156	311	.162	356	.168	....	....	....	....
3	112	.122	141	.126	173	.131	207	.136	242	.141	280	.146	320	.151	....	....	....	....
3½	103	.112	130	.116	158	.120	189	.124	222	.129	257	.134	295	.139	....	....	....	....
4	95	.103	120	.107	146	.111	175	.115	205	.119	236	.123	272	.128	....	....	....	....
4½	88	.095	110	.098	135	.102	161	.106	189	.110	....	....	....	....	....	....	....	....
9	52	.057	66	.059	81	.061	97	.064	115	.067	....	....	....	....	....	....	....	....
22½" fire brick																		
0 (bare)	250	.271	315	.281	386	.292	459	.302	538	.313	620	.323	708	.334	798	.344	895	.355
1½	142	.154	178	.159	218	.165	258	.170	303	.176	350	.182	398	.188	450	.194	505	.200
2	126	.137	159	.142	194	.147	231	.152	270	.157	312	.162	356	.168	402	.173	452	.179
2½	113	.123	143	.128	176	.133	210	.138	246	.143	284	.148	324	.153	....	....	....	....
3	104	.113	130	.116	158	.120	190	.125	224	.130	260	.135	297	.140	....	....	....	....
3½	96	.104	121	.108	148	.112	176	.116	206	.120	238	.124	272	.128	....	....	....	....
4	88	.096	111	.099	136	.103	163	.107	192	.111	221	.115	252	.119	....	....	....	....
4½	82	.089	103	.092	127	.096	152	.100	179	.104	....	....	....	....	....	....	....	....
9	50	.055	64	.057	78	.059	93	.061	111	.064	....	....	....	....	....	....	....	....

Printed in U. S.A.

(BMW) WATERPROOFING & MISC. ASPH. PROD.

(BMT) TRANSITE PRODUCTS

(BMS) SOUND CONTROL

ROOFING & SHINGLES

MAT'LS. MISC.

(IN) INSULATION

(FR) FRICTION MATERIALS

(FI) FILTER-AIDS & MINERAL FILLERS

(EL) ELECTRICAL MATERIALS

Fire-Felt Sheets and Blocks

Super Fire-Felt

For temperatures to 700 or 1000 deg. F.

Super Fire-Felt is constructed of asbestos fibre which is felted and formed into sheets, blocks and special shapes. The long fibre used is processed and felted to produce an insulation light in weight and low in thermal conductivity.

Super Fire-Felt is frequently used in boiler tube doors where considerable mechanical strength is required to withstand the vibration due to the opening and closing of doors. For air passages over ventilated boiler walls this material finds excellent application. It is designed and recommended for use where insulation in relatively large sheets is desirable and where a resilient insulation is necessary because the material will be subjected to compression or strain, due to expansion or contraction. However, it should not be used where unusually high resistance to compression is required.

Compression under load

Thickness before load is applied, inches	Applied Load		Approximate compression, inches
	lb. per sq. ft.	lb. per sq. in.	
2	200	1.4	1/8
2	400	2.8	1/4
2	600	4.2	3/8
2	800	5.6	1/2

Super Fire-Felt, used between metal sheets or between a brick lining and steel shell, will give satisfactory service at temperatures up to 1000 deg. F.

Super Fire-Felt Sheets

However, where less effectively supported, or where subjected to removal and replacement, 700 deg. F. is the temperature limit of the material.

Super Fire-Felt is furnished standard in sheets 24″ x 36″ and blocks 6″ x 36″, from 1/2″ to 4″ in thickness, in increments of 1/4″ up to 2″ thick and increments of 1/2″ from 2″ to 4″ thick; also in special sizes and shapes. Weight approximately 1.7 lb. per sq. ft. per inch of thickness.

As Super Fire-Felt is readily moulded, it is recommended for the insulation of apparatus requiring special or irregular shapes. These moulded shapes are particularly effective and satisfactory because of the ease of application and the elimination of the many joints necessary where insulation in the form of small blocks is used.

Where special or irregular shapes are required, complete dimensions and details, with blueprints, should accompany the order or request for quotation.

Super Fire-Felt Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot, per degree temperature difference, per hour.
Efficiency expressed in percentage of bare surface losses.

Insulation thickness inches		Temperature of surface—deg. Fahr. 175	275	375	475	575	675	775	875	975
		Temperature difference between surface and air—deg. Fahr. 100	200	300	400	500	600	700	800	900
1	Heat Loss, B.t.u.	.368	.391	.416	.442	.469	.497	.525	.554	.584
	Efficiency %	82.90	85.32	87.26	89.08	90.49	91.50	92.28	92.85	93.28
2	Heat Loss, B.t.u.	.204	.217	.230	.245	.260	.275	.290	.306	.322
	Efficiency %	90.52	91.85	92.95	93.33	94.72	95.30	95.74	96.05	96.30
3	Heat Loss, B.t.u.	.141	.150	.159	.169	.180	.191	.202	.213	.224
	Efficiency %	93.45	94.37	95.12	95.81	96.34	96.74	97.03	97.25	97.42
4	Heat Loss, B.t.u.	.108	.115	.123	.130	.138	.146	.155	.164	.173
	Efficiency %	94.98	95.68	96.26	96.78	97.19	97.50	97.72	97.88	98.00

June, 1931 (Cancelling 9-D-5-A-1 to 9-D-8-A-1, dated in 1929 and 1930)

Printed in U.S.A.

Asbestos Fire-Felt

For temperatures to 1000 deg. F.

Asbestos Fire-Felt sheets and blocks, suitable for temperatures up to 1000 deg. F., are made by felting and moulding asbestos fibre into sheet or block form, producing a heat-resisting material which is strong and resilient, and which will not readily powder or crumble even when applied to surfaces that move or vibrate. It is generally used in place of Super Fire-Felt where greater mechanical strength is required.

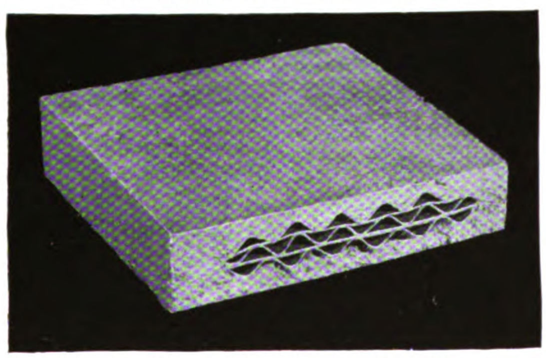
Furnished in standard flat or curved sheets 24″ x 36″, and blocks 6″ x 36″. Thicknesses and approximate weights are given below:

Thickness, inches	Weight, lb. per sq. ft.	Thickness, inches	Weight, lb. per sq. ft.
½	1.8	2	5.9
¾	2.6	2½	7.1
1	3.3	3	8.1
1¼	4.0	3½	9.0
1½	4.7	4	9.7
1¾	5.3		

Like Super Fire-Felt, it is readily moulded and where special or irregular shapes are required, complete dimensions and details, with blueprints, should accompany the order or request for quotation.

Thermo Fire-Felt

For temperatures to 1000 deg. F.



Construction of Thermo Fire-Felt Sheet

Thermo Fire-Felt is a resilient sheet or block insulation, suitable for temperatures up to 1000 deg. F. It is made in the same manner as Asbestos Fire-Felt by felting and moulding asbestos fibre into sheets of proper size and thickness, but with the addition of a cellular asbestos structure imbedded in the center of each sheet. This cellular structure does not extend to the edges of the sheet, but is completely sealed in. The efficiency of the material is increased because of the confined air spaces.

Besides increasing efficiency, the cellular structure provides greater resiliency, which makes Thermo Fire-Felt suited to conditions where expansion and contraction are large factors.

Thermo Fire-Felt is furnished in standard sheets 24″ x 36″, in thicknesses of 1½″, 1¾″, 2″, 2½″ and 3″. It can also be furnished in curved sheets or sheets of special size.

Weight approximately 3½ lb. per sq. ft. of 1½″ thickness, plus about 1 lb. for each additional ½″ thickness.

Vitro Fire-Felt

For temperatures to 1000 deg. F.

Vitro Fire-Felt is recommended for particularly severe conditions up to 1000 deg. F. It is similar in construction to Thermo Fire-Felt, except that the imbedded cellular asbestos structure is vitrified to give greater rigidity and heat-resisting qualities.

Vitro Fire-Felt is furnished standard in 24″ x 36″ sheets, flat or curved, in thicknesses of 1½″, 1¾″, 2″, 2½″ and 3″. Weight approximately 5 lb. per sq. ft. of 1½″ thickness, plus about 1½ lb. for each additional ½″ thickness.

A decided advantage in the use of large sized sheets in which the various forms of Fire-Felt are furnished is that this permits application with few joints, compared with the large number required with a small block material. This decreases heat loss through joints and permits greater speed in insulating large areas.

The process of manufacturing will not permit furnishing sheets to exact dimensions. It is necessary to provide for the following tolerances:

Length and width of sheets, ± ¼″
Length of blocks, ± ¼″
Width of 6″ blocks, ± ⅛″
Thickness, ± ⅛″ per 1″ of thickness.

List prices per square foot

Thickness		Thickness	
1 inch or less	$ .30	2½ inches	$ .75
1¼ inches	.38	3 "	.90
1½ "	.45	3½ "	1.05
1¾ "	.53	4 "	1.20
2 "	.60		

Printed in U.S.A.

Pan-O-Cel Sheets

Type A—for temperatures to 500 deg. F.
Type B (more moisture-resistant)—for temperatures to 250 deg. F.

Pan-O-Cel is a rigid, self-supporting panel of insulation, made up of laminations of Fine Corrugated Asbestocel, built-up to the desired thickness, with the outside sheet on each side coated with a refractory compound. Enclosing this built-up sheet, are wrapped two layers of asbestos felt, coated on each side with a refractory solution.

The coatings of refractory solution not only give stiffness and strength to the entire sheet, but also insure relatively high resistance against puncture and absorption of moisture by the sheet. All edges of the sheet are sealed with heavy refractory-coated asbestos felt, as described above for the sides, which provides adequate reinforcement as well as a seal.

Pan-O-Cel sheets are suitable for use in the construction of practically all types of dry rooms, japanning ovens, core ovens or similar heated enclosures.

The sheets may be supported in angle iron or other suitable framework, with one side exposed directly to the heated air inside the oven or dryer.

In the majority of cases the exposed surface of the sheet requires no protection, but conditions and location of the housing must be considered.

If a housing is to be located where heavy objects are likely to fall against it, some protection should be provided. This may consist of railings, metal jacket protection or Transite.

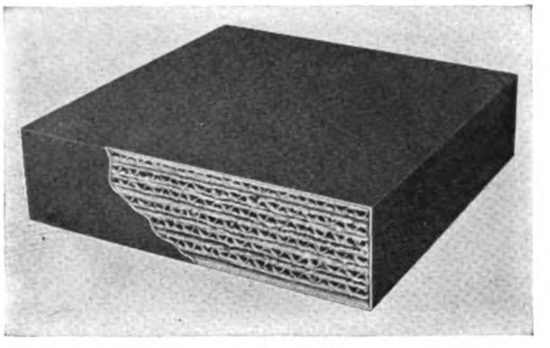
Pan-O-Cel sheets are made in two types, as follows:

Type A, with a temperature limit of 500 deg. F.

Type B, with a temperature limit of 250 deg. F., is the same as Type A, but is made to stand more severe moisture conditions than Type A and is used where high humidity conditions obtain.

Both types of Pan-O-Cel are made in standard sheets 36″ x 36″, 36″ x 72″ and 36″ x 84″ and in special sizes up to 68″ x 100″. Thickness 1″ to 4″.

Since the process of manufacture does not allow furnishing sheets in exact dimensions, it is necessary



to provide for tolerance of ± 1/8″ in width and length of sheets and ± 1/16″ in thickness.

Approximate weights

Thickness, inches	Lb. per sq. ft.	Thickness, inches	Lb. per sq. ft.
1	2.5	3	5.1
1½	3.3	3½	5.5
2	4.0	4	5.9
2½	4.6		

Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per sq. ft., per deg. F. temperature difference, per hour. Efficiency expressed in per cent of bare surface losses

Insulation thickness, inches		Temperature of surface—deg. Fahr. 175 / Temperature difference between surface and air—deg. Fahr. 100	275 / 200	375 / 300	475 / 400
1	Heat Loss, B.t.u.	.488	.526	.568	.615
	Efficiency %.....	77.32	80.26	82.57	84.76
1½	Heat Loss, B.t.u.	.343	.371	.400	.430
	Efficiency %.....	84.06	86.07	87.73	89.34
2	Heat Loss, B.t.u.	.265	.286	.309	.332
	Efficiency %.....	87.68	89.26	90.52	91.77
2½	Heat Loss, B.t.u.	.215	.233	.252	.271
	Efficiency %.....	90.00	91.25	92.27	93.28
3	Heat Loss, B.t.u.	.182	.197	.213	.229
	Efficiency %.....	91.54	92.60	93.46	94.32

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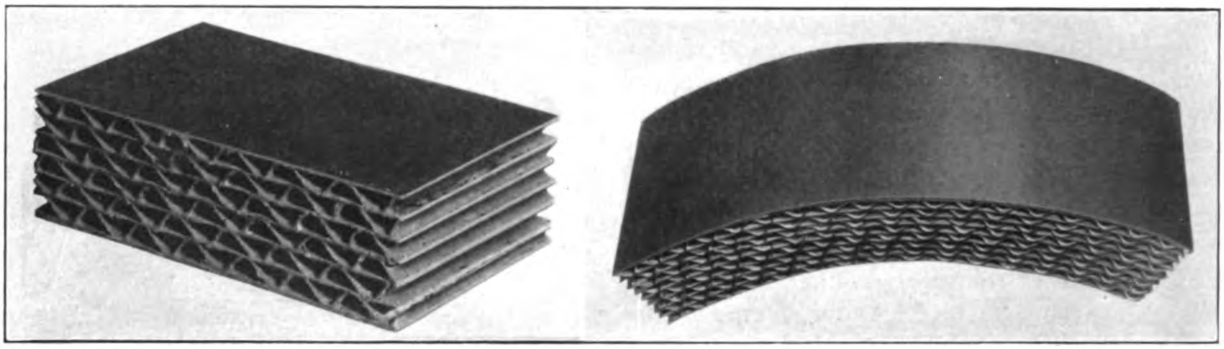
Vitribestos Sheets

For temperatures to 700 deg. F.



Vitribestos is particularly recommended for lining smokestacks and flues, building theatre curtains and for use where a strong, stiff insulating sheet is required that will resist temperatures to 700 deg. F.

It is made of asbestos felts which have been corrugated and built up to form a cellular sheet. These sheets are processed and vitrified, which increases their resistance to moisture and high temperatures.

Vitribestos sheets are made either flat or curved to any radius. They provide a more satisfactory and practical steel stack or flue lining than fire brick because they are much lighter in weight and have a greater insulating value per inch of thickness.

Vitribestos lining, 2″ thick and weighing less than 5 lb. per sq. ft., is a more efficient insulator than fire brick lining, 5″ thick and weighing approximately 50 lb. per sq. ft. The brick lining obviously reduces the cross section of the stack much more than the thinner Vitribestos lining.

Vitribestos is regularly furnished in standard size flat sheets, 36″ x 36″ and 36″ x 72″, and curved sheets, 24″ x 36″, in thicknesses from ½″ to 3″. Other sizes furnished on special order. Curved sheets are curved along the 24″ dimension.

Weight approximately 1.8 lb. per sq. ft. per inch of thickness.

List prices per square foot

Thickness		Thickness	
1 inch or less	$ .30	2¼ inches	$ .68
1¼ inches	.38	2½ "	.75
1½ "	.45	2¾ "	.83
1¾ "	.53	3 "	.90
2 "	.60		

Vitribestos, when used as a stack lining or for building fireproof theatre curtains, is held in place and supported by steel angles, the application of which depends upon the construction of the stack or type of theatre curtain required. Full details will be furnished by the nearest Johns-Manville office.

Vitribestos can also be furnished in pipe covering form, on special order.

Printed in U.S.A.

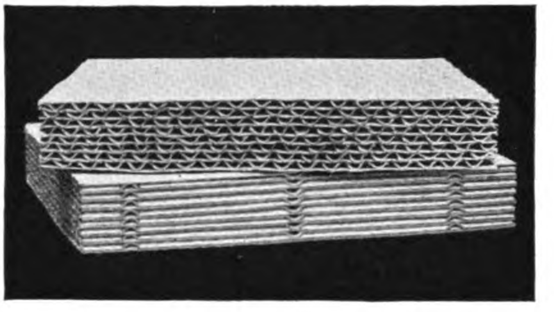
Improved Asbestocel Sheets and Blocks

For temperatures to 300 deg. F.

Improved Asbestocel sheets and blocks are used for insulating medium or low pressure boilers, feed-water heaters, dry rooms, warm air ducts and other surfaces whose temperatures are not extreme. Temperature limit, 300 deg. F.

Improved Asbestocel sheets and blocks are made of alternate plain and corrugated asbestos felts, built up in layers to the proper thickness. The main corrugations are crossed at right angles by other corrugations. These cross corrugations not only make the sheet stronger and more durable, but also form a barrier to the circulation of air.

Improved Asbestocel is furnished standard in 4 plies per inch of thickness in sheets 36″ x 36″, and blocks 6″ x 36″, from ½″ to 4″ in thickness. Weight of 4-ply material approximately 1 lb. per sq. ft. per inch of thickness.



This material can also be furnished in 6 plies per inch of thickness, known as Fine Corrugated Improved Asbestocel. Weight of Fine Corrugated approximately 1.3 lb. per sq. ft. per inch of thickness.

Both types of Improved Asbestocel are also furnished in the form of sectional pipe insulation as described in another data sheet.

Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot, per degree temperature difference, per hour.
Efficiency expressed in percent of bare surface losses.

Insulation thickness, inches		Temperature of surface—deg. Fahr. 125 / Temperature difference between surface and air—deg. Fahr. 50	175 / 100	225 / 150	275 / 200
1	Heat Loss, B.t.u.	.411	.424	.444	.464
	Efficiency %	78.90	80.30	81.50	82.59
1½	Heat Loss, B.t.u.	.295	.306	.320	.335
	Efficiency %	84.86	85.79	86.67	87.43
2	Heat Loss, B.t.u.	.231	.239	.250	.262
	Efficiency %	88.15	88.90	89.60	90.16
2½	Heat Loss, B.t.u.	.190	.197	.206	.216
	Efficiency %	90.25	90.85	91.40	91.90
3	Heat Loss, B.t.u.	.161	.167	.175	.183
	Efficiency %	91.76	92.25	92.71	93.14
3½	Heat Loss, B.t.u	.140	.145	.152	.159
	Efficiency %	92.83	93.25	93.68	94.04
4	Heat Loss, B.t.u.	.123	.128	.134	.141
	Efficiency %	93.69	94.06	94.42	94.71

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Banroc Blankets

For temperatures to 1000 deg. F.

Banroc Blanket Insulation is a flexible insulating material composed of special annealed Banroc, a long fibre, white rock wool, felted and secured between metal fabrics of various types. The density and thickness of bat used are carefully controlled so that the blankets will not run under size when subjected to compression in shipping or handling, thereby insuring full insulation value. All edges are smooth, full and square. They can be used for the insulation of ovens, oil refinery equipment and for similar purposes where they will not be subjected to temperatures over 1000 deg. F.

In the manufacture of Banroc Blankets, the felted Banroc is sewed with galvanized wire between metal fabrics of various types, depending upon the use to which the material is to be put. The metal fabrics used are No. 12 mesh fly screen wire, 1″ galvanized wire netting, heavy copper bearing metal lath, 3/8″ rib lath, and 3/4″ rib lath. A special type copper bearing lath is used exclusively, because of its rust-resisting properties.

Standard types of Banroc Blankets

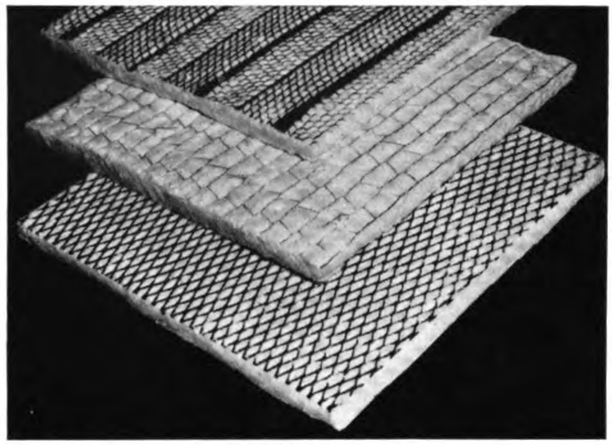
Style No.	Type of Metal Fabric
102	1″ wire mesh on both sides
112	1″ wire mesh and metal lath
122	Metal lath on both sides
132	1″ wire mesh and 3/8″ rib lath
132-A*	Same as No. 132 except rib turned out
142	Metal lath and 3/8″ rib lath
142-A*	Same as No. 142 except rib turned out
152	1″ wire mesh and 3/4″ rib lath
152-A*	Same as No. 152 except rib turned out
162	Metal lath and 3/4″ rib lath
162-A*	Same as No. 162 except rib turned out
172**	3/8″ rib lath on both sides
182	Asbestos paper on both sides
192	No. 12 mesh-fly screen wire on both sides

*On this type of blanket, the turned out rib provides an air space, where such an air space is desired.

**Ribs may be turned in or out, and run lengthwise or across the blanket, or at right angles to each other, as specified.

Sizes:

With the exceptions noted later, Banroc Blankets are furnished in standard sizes, 24″ x 96″ and 24″ x 48″, and in thicknesses of 1, 1 1/4, 1 1/2, 1 3/4, 2, 2 1/2, 3, 4, 5 and 6 inches. Style No. 182 is made 24″ x 48″ in thicknesses up to and including 3″; and 24″ x 24″ in 4″ thickness only. Style No. 192 is furnished 24″ x 96″ and 24″ x 48″ in thicknesses up to and including 2″. Banroc Blankets can, if necessary, be manufactured in special sizes, not over 24″ wide nor more than 96″ long, and in special thicknesses.



Various Banroc Blankets, showing metal fabrics used. Top, rib lath; center, wire mesh; bottom, expanded metal lath

No. 102-R Banroc Blanket is specially manufactured for certain classes of tank insulation. It is the same as No. 102 except for the addition of J-M Medium Pilot Roofing under the mesh on one side. This is not a standard blanket and list prices do not apply. Prices on application.

A metal-jacketed Banroc Blanket can be furnished on order, for use where this type of finish is desired. This consists of Style No. 112 Blanket with No. 18 or No. 20-gauge rust-resisting sheet iron secured over the wire mesh by means of special shoulder rivets, extending through the blanket and fastened under washers on the metal lath side. Blueprint of the equipment should accompany request for quotation.

Where desired, other than the standard styles of blankets can be furnished, or other than special annealed wool used. The various types of Banroc Wool are described in another data sheet.

All Banroc Blankets are shipped in special hardwood crates, regardless of quantity ordered or method of shipment.

June, 1931 (Cancelling 9-D-13-A-1, dated May 1, 1930)

Printed in U.S.A.

List prices per square foot, crated

Thickness	BLANKET STYLE NO. 102	112	122	132 132-A	142 142-A	152 152-A	162 162-A	172	182	192
1"	$ .40	$ .45	$ .55	$ .60	$ .60	$ .70	$ .75	$ .75	$ .65	$ .60
1¼"	.45	.53	.60	.65	.65	.75	.83	.83	.70	.65
1½"	.50	.60	.65	.70	.70	.80	.90	.90	.75	.70
1¾"	.55	.65	.70	.75	.75	.85	.95	.95	.80	.75
2"	.60	.70	.75	.80	.80	.90	1.00	1.00	.85	.80
2½"	.70	.80	.85	.90	.90	1.00	1.10	1.10	.95	....
3"	.80	.90	.95	1.00	1.00	1.10	1.20	1.20	1.05	....
4"	.95	1.05	1.10	1.15	1.15	1.25	1.35	1.35	1.20	....
5"	1.10	1.20	1.25	1.30	1.30	1.45	1.55	1.55	....	....
6"	1.25	1.35	1.40	1.45	1.45	1.65	1.75	1.75	....	....

Approximate weight, lb. per sq. ft., crated

Thickness	BLANKET STYLE NO. 102	112	122	132	142	152	162	172	182	192
1"	1.47	1.60	1.79	1.70	1.72	1.94	2.06	1.91	1.51	1.47
1¼"	1.80	2.12	2.20	2.10	2.23	2.36	2.48	2.37	1.87	1.83
1½"	2.22	2.45	2.62	2.50	2.74	2.69	2.91	2.64	2.23	2.19
1¾"	2.59	2.75	2.93	2.84	2.94	2.93	3.17	2.95	2.57	2.56
2"	2.96	3.05	3.25	3.18	3.15	3.17	3.42	3.27	2.92	2.94
2½"	3.70	3.68	3.89	3.81	3.98	3.98	4.22	4.06	3.61	....
3"	4.35	4.36	4.45	4.35	4.64	4.69	4.95	4.76	4.38	....
4"	5.94	5.80	6.13	5.88	6.11	6.25	6.44	6.21	5.79	....
5"	7.31	8.08	7.70	7.64	7.76	7.73	7.92	7.73	....	....
6"	8.94	8.94	9.29	8.64	9.08	9.19	9.39	9.23	....	....

For export when order is less than 20,000 sq. ft. board measure, add 0.90 lb. per square foot board measure to above weights. When more than 20,000 sq. ft. board measure, add 0.50 lb. per square foot board measure.

Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot, per degree temperature difference, per hour.
Efficiency expressed in per cent of bare surface loss.

Insulation thickness, including ½" cement finish		Temperature of Surface, deg. F. 175	225	275	325	375	475	575	675	775	875	975
		Temperature Difference between Surface and Air, deg. F. 100	150	200	250	300	400	500	600	700	800	900
1½"	Heat loss, B.t.u. .	.286	.294	.302	.310	.318	.334	.351	.369	.386	.406	.431
	Efficiency, %	86.71	87.75	88.67	89.50	90.25	91.73	92.87	93.70	94.30	94.55	95.10
2"	Heat loss, B.t.u. .	.207	.213	.220	.226	.233	.246	.260	.275	.288	.304	.322
	Efficiency, %	90.38	91.13	91.74	92.34	92.86	93.91	94.72	95.30	95.80	95.90	96.30
2½"	Heat loss, B.t.u. .	.163	.168	.174	.179	.185	.196	.207	.219	.230	.249	.259
	Efficiency, %	92.42	93.00	93.47	93.93	94.33	95.14	95.79	96.26	96.61	96.79	97.00
3"	Heat loss, B.t.u. .	.135	.139	.144	.148	.153	.162	.172	.182	.192	.203	.216
	Efficiency, %	93.73	94.21	94.60	94.98	95.31	95.98	96.51	96.89	97.17	97.38	97.50
3½"	Heat loss, B.t.u. .	.114	.118	.122	.126	.130	.138	.147	.156	.164	.174	.186
	Efficiency, %	94.71	95.08	95.43	95.73	96.02	96.58	97.01	97.33	97.55	97.70	97.90
4½"	Heat loss, B.t.u. .	.088	.091	.094	.097	.100	.106	.113	.121	.129	.138	.147
	Efficiency, %	95.87	96.21	96.47	96.71	96.93	97.38	97.70	97.93	98.11	98.22	98.32
5½"	Heat loss, B.t.u. .	.072	.074	.077	.079	.082	.087	.092	.098	.105	.112	.119
	Efficiency, %	96.66	96.92	97.11	97.32	97.48	97.84	98.13	98.26	98.48	98.56	98.63
6½"	Heat loss, B.t.u. .	.060	.062	.065	.067	.069	.073	.078	.083	.089	.095	.102
	Efficiency, %	97.10	97.30	97.60	97.75	97.89	98.19	98.43	98.58	98.69	98.77	98.83

Printed in U.S.A.

J-M Rock Cork

J-M Rock Cork is a low-temperature insulating material manufactured from Banroc, a loose rock wool, combined with a waterproof binding ingredient, moulded into sheet form and baked. Its recommended range of use covers all applications between the lowest temperatures and 100 deg. F. For duct insulation, when Fibrous Adhesive is used instead of asphalt and when the Rock Cork is securely fastened, the Rock Cork may be used at temperatures as high as 180 deg. F.

Rock Cork has been used for over twenty years with exceptional success as insulation for all kinds of cold storage construction. The qualities responsible for its wide use include:

1. Low conductivity at low temperatures and the ability to retain this low conductivity.
2. Non-absorption of moisture.
3. Possibility of thorough sealing against penetration of air.
4. Structural strength to permit handling and applying without breakage; and ease of sawing and working on the job.
5. Immunity to vermin, mold and odor.

Characteristics of Rock Cork

The conductivity of J-M Rock Cork is 0.33 B.t.u. per sq. ft., per deg. F. temperature difference, per inch thick, per hour. Due to the natural interlacing of the fibres, a large number of minute dead-air cells are formed, which are responsible for the high insulating value. The unchanging characteristics of Rock Cork assure continued low conductivity during service. There are no pockets in which moisture may collect to lower the insulating efficiency.

Rock Cork has been subjected to flotation tests in water for periods as long as five years with no appreciable absorption except for the surface fibres, and with no deterioration in the product. Moisture penetration tests by various authorities also demonstrate its high resistance to absorption.

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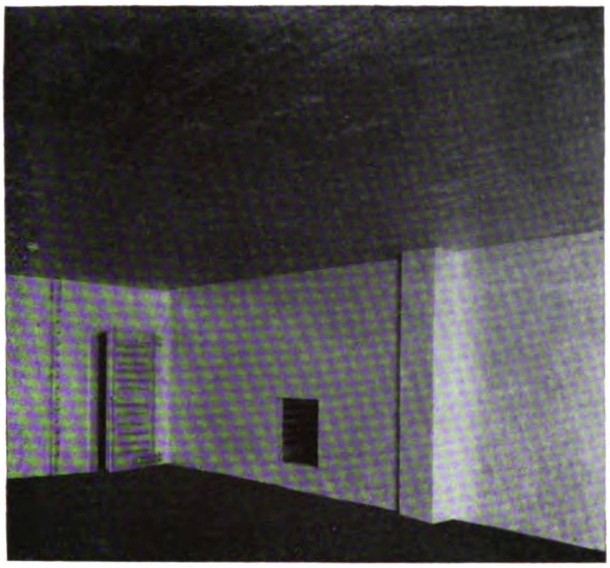


When some of the interior walls of a room are solid Rock Cork partitions, where portland cement plaster must necessarily be used, Johns-Manville recommends a finish of portland cement plaster over Rock Cork on the building walls as well. For better waterproofing, the recommended interior finish for ceilings and building walls insulated with Rock Cork is a smoothly troweled ¼″ thick coat of Insulkote

Due to the nature of the waterproof binder, this material furnishes an ideal base for an asphaltic adhesive medium or finish, assuring an air-tight, waterproof seal.

The binding material with which Banroc is combined, in the manufacture of J-M Rock Cork, gives the material a firm structure which permits ready handling and installing in any type of construction. It has, however, sufficient flexibility to follow slight irregularities of the surface to be insulated, eliminating voids between the insulation and the wall.

The sheets can be curved in the field to fit tanks 20 ft. or greater in diameter, eliminating the necessity of lags for this class of equipment.

All materials used in the manufacture of Rock Cork are odorless, and the most sensitive food products will not absorb offensive odors from this material. Due to its mineral composition, it will not harbor rats, insects or vermin of any kind. Extensive tests conducted by the engineering department of one of the largest manufacturers of domestic refrigerators demonstrate that Rock Cork will not, under any conditions, support the growth of bacteria or mold.

The fibrous nature of Rock Cork permits absolutely tight joints, not possible with the granular edges of other material.

Sizes and Types of Rock Cork

J-M Rock Cork sheets are furnished in the following standard sizes and thicknesses: 18″ x 36″, in thicknesses of 1½″, 2″, 2½″, 3″ and 4″, and 18″ x 18″ in 1″ thickness. Other sizes, within the above limitations and of standard thicknesses, can be furnished on special order.

The sheets weigh approximately 1.25 lb. per sq. ft. per inch of thickness, uncrated. They are packed in cartons, size 18¼″ x 12½″ x 36″. Cartons contain 54 board feet and weigh about 80 lb., packed.

Rock Cork in lagging form for curved surfaces is made to accommodate diameters from 11″ to 20 ft., and is supplied 18″ long, in thicknesses of 1½″, 2″, 3″ and 4″, and from 2″ to 5″ wide, depending on the diameter.

Flat discs are furnished in 1½″, 2″, 3″ and 4″ thicknesses in one piece up to 18″ diameter; and in two pieces for larger diameters up to 36″.

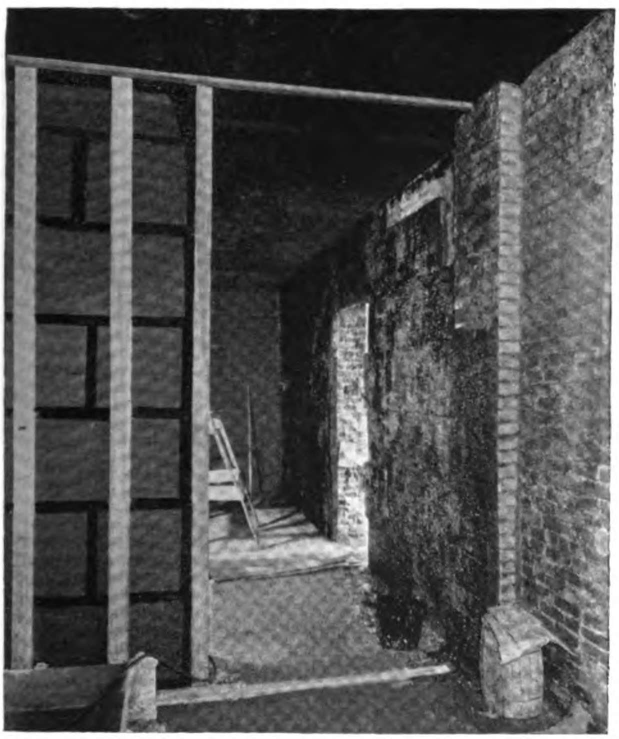
Rock Cork is also manufactured in granular form for use as a loose, moisture-resisting filler for insulating the sides of ice freezing tanks and similar equipment. Granulated Rock Cork should be packed to a density of about 14 lb. per cu. ft. Furnished in 50-lb. bags.

In building solid Rock Cork partitions as at the left and in the background, the first layer is stuck to the temporary studding and the second layer applied in a ½″ bed of portland cement mortar

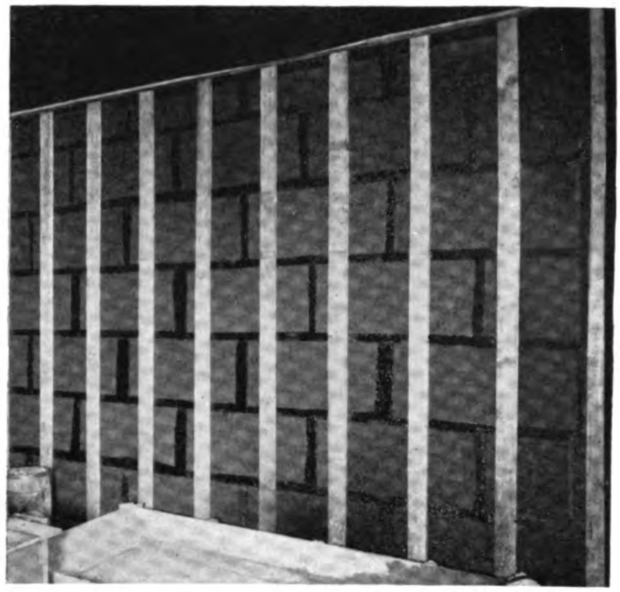
Applications of J-M Rock Cork

J-M Rock Cork in sheet and lagging form is used as a standard cold insulation for any form of cold storage construction or refrigerating equipment. Rock Cork sheets have been successfully applied to ice storage rooms, ice manufacturing tanks, hog chill rooms, meat coolers, fruit and vegetable coolers, ice cream hardening rooms, general cold storage rooms and domestic refrigerators. This material has also been used on equipment for the treatment of lubricating oil. It serves exceptionally well as insulation on ducts of air-conditioning installations. Careful inspection of jobs insulated with J-M Rock Cork as far back as 1908, show the material to be in perfect condition after these many years of service.

Within the last twenty years there has been a definite recognition of the value of low-temperature insulation. The immense increase in food storage and transportation, the growth in the manufacture of ice, ice cream and cold drinks, the utilization of refrigeration in rayon, petroleum, and other chemical processes at very low temperatures, have all tended to focus attention on proper insulation.



The uneven brick wall at the right is trued up with a coat of portland cement mortar before the Rock Cork is applied. Note the solid Rock Cork partition being erected at the left



Rock Cork sheets make ideal partitions where it is desired to divide refrigerated rooms. The temporary studs are removed after erection and a finish of portland cement plaster is applied

Thicknesses Recommended

While many factors, such as the cost of refrigeration, and local atmospheric and temperature conditions, may govern the amount of insulation which should be used, the thicknesses of sheets or lagging given in the following table are recommended for general requirements:

Temperature range, deg. F.	Thickness
−60 to −40	12″—Three layers
−40 to −25	10″—Three layers
−25 to −15	8″—Two layers
−15 to 0	7″—Two layers
0 to 15	6″—Two layers
15 to 25	5″—Two layers
25 to 40	4″—One or two layers
40 to 50	3″—Single layer
Above 50	2″—Single layer

In the use of low-temperature insulation in granular form, it is customary to employ twice the thickness recommended for sheets or lagging.

Applying J-M Rock Cork

The application of low-temperature insulation of any type involves more care than is common with insulation against heated surfaces. With low temperatures, the insulation must not only be permanently waterproofed but must also be sealed against the infiltration of moist air which in time would condense

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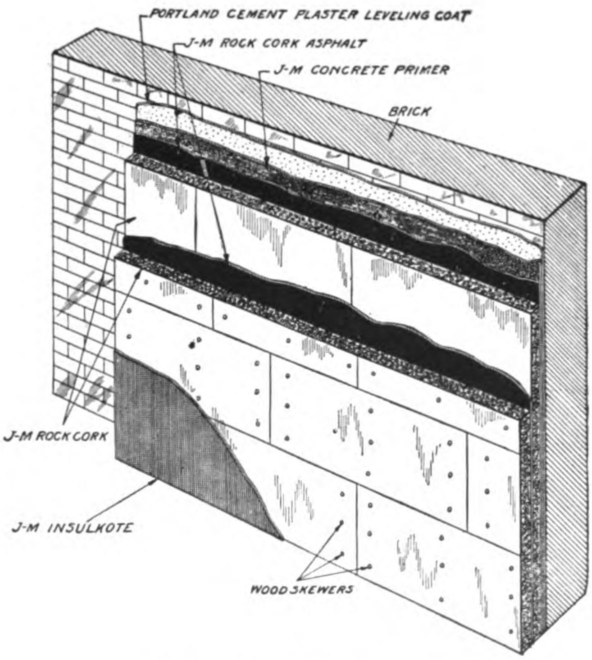
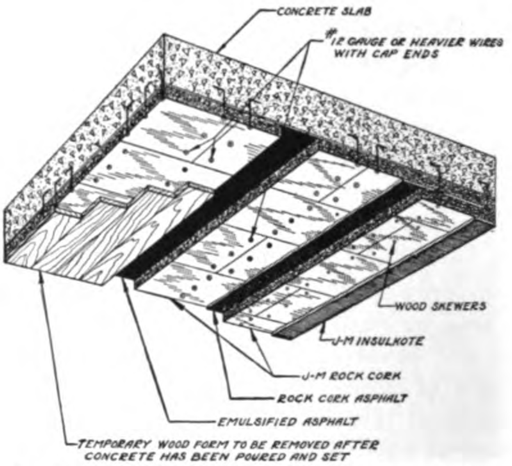
and destroy any insulation. While portland cement may be used for adhesion of Rock Cork, asphalt has the distinct advantage of providing waterproof construction, a most important feature in applying any low temperature insulation. Asphalt also sets much quicker than portland cement plaster, making possible more rapid application. J-M Rock Cork Asphalt 190, shipped in 450-lb. drums, is prepared especially for this work.

The recommended finish for Rock Cork is J-M Insulkote, which embodies the elasticity and adhesion necessary for a durable waterproofing. It should be applied after the Rock Cork has been given a brush coat of hot asphalt. Insulkote may be painted, if desired. Aluminum paint can be applied directly on the Insulkote. Any other type of paint requires a prime coat of shellac or varnish. Portland cement plaster may also be used as a finish over Rock Cork but is not recommended due to the comparative ease with which water penetrates it.

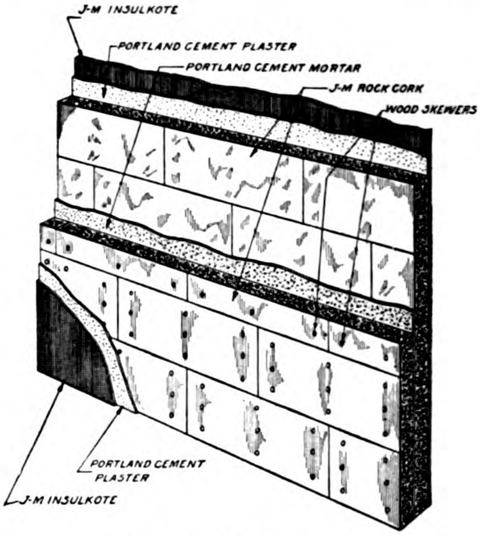
J-M Rock Cork is applied in accordance with the specifications which have been developed and found sound during 21 years experience with this material on all kinds of refrigeration work. The application of Rock Cork by J-M Approved Insulation Contractors is in accordance with these specifications.



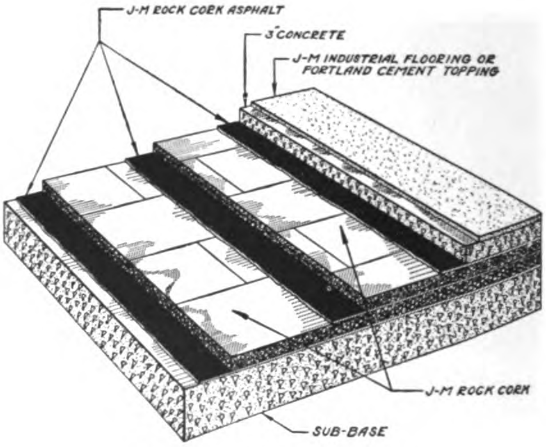
Rock Cork on masonry wall



Rock Cork construction for ceiling insulation



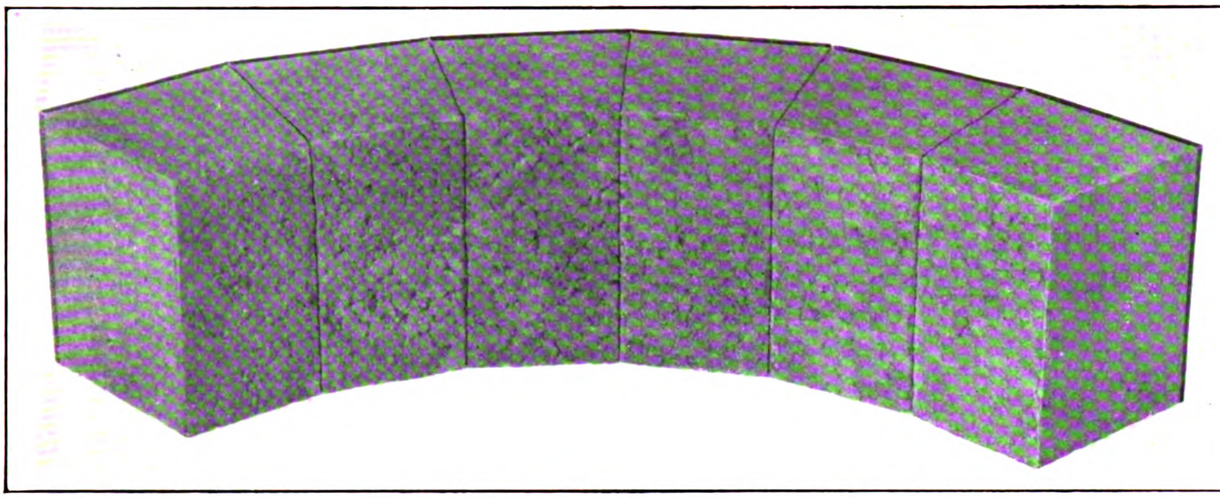
Solid Rock Cork partition



Rock Cork floor insulation

Printed in U.S.A.

J-M Cork Lagging, Discs and Sheets



J-M Cork Lagging and Discs

J-M Cork Lagging and Discs are used in insulating large cylindrical surfaces such as ice water tanks, cold water tanks and filters, brine coolers and other equipment operated at low temperatures.

Standard Cork Lagging weighs approximately 1.25 lb. per sq. ft., 1″ thick, and is furnished beveled to the proper radius to fit accurately the cylindrical surface to which it is to be applied.

Corkboard Quality (Beveled Corkboard) Cork Lagging and Discs have a density of from 0.8 to 0.9 lb. per sq. ft., per inch thick. As they are somewhat fragile, compared to Standard Cork Lagging, they should only be used on relatively large diameters.

Lags are furnished 3 feet long, in thicknesses of 1″, 1½″, 2″, 3″, 4″, 5″, 6″ and 8″, and in widths varying from approximately 2″ to 6″, depending upon the diameter of the cylinder to which they are to be applied. Discs are furnished in the same thicknesses as lags.

When ordering Cork Lagging, the following information is necessary:

1. A rough sketch of the tank to be covered, with the outside dimension and height and, if the tank has flanged ends, the diameter of the flanges; if round ends on the other side of the flanges, the distance from the flange to the top of the bulge.
2. The thickness of Lagging desired, and whether it is to be Corkboard density (0.8 to 0.9 lb.) or Standard Lagging density (1.25 lb.).
3. Whether the tank is to have discs or not.
4. Whether the Lagging is to be covered one side or two sides with mastic finish, or left uncoated.
5. What sundries are desired, such as wire, Waterproof Cement, Seam Filler, Asphaltic Paint, Brine Putty and, possibly, Granulated Cork.

J-M Cork Sheets

J-M Corkboard Sheets weigh approximately 0.8 to 0.9 lb. per sq. ft. per inch thick and are furnished in flat sheets 12″ x 36″ and 24″ x 36″, in thicknesses of 1″, 1½″, 2″, 3″ and 4″. Packed in fibre cartons containing 72 board feet.

Standard Cork Lagging Sheets (density approximately 1.25 lb. per board foot) are furnished for flat surfaces in sheets 12″ x 36″ and in the same thicknesses as Standard Lagging. Lagging sheets 24″ x 36″ can also be obtained on special order.

June, 1931 (Cancelling 9-D-14-A-2, dated September 1, 1928)

Printed in U.S.A.

J-M Asbestos Sheet Millboard

J-M Asbestos Sheet Millboard is recommended for general use requiring sheet or board for protection against fire, heat, acid fumes, etc. It is frequently used as a fireproof lining for floors, partitions, ceilings, elevator shafts, ranges, stoves, grates, gas backs, etc. It also has many industrial uses.

Millboard can be cut with shears to any size desired and fastened with nails or screws.

The size of the standard sheet is 42" x 48". Shipped in crates containing approximately 350 lb.

Average Weights

Thickness, inches	Per sheet, 42" x 48", pounds	Per square ft., ounces
1/32	2.5	2.9
3/64	3.5	4.0
1/16	4.6	5.3
5/64	6.0	6.9
3/32	7.0	8.0
1/8	9.0	10.3
5/32	11.3	12.9
3/16	13.3	15.2
1/4	17.6	20.1
5/16	21.4	24.4
3/8	25.2	28.8
1/2	31.5	36.0

Asbestos Sheet Millboard is made in several grades, the characteristics and uses of which may be described as follows:

No. 106 Millboard:

This grade is most commonly used because it is low in price and will take care of the majority of conditions where Millboard is required. It will withstand temperatures up to about 800 deg. F., but is not generally recommended for use at temperatures above 400 deg. F.

No. 105 Millboard:

This grade is slightly higher quality than No. 106 Millboard, since it contains longer fibre and is therefore somewhat stronger and more resilient. It will also withstand higher temperatures and may be used for temperatures up to about 900 deg. F.

Laying J-M Millboard over Superex blocks between side walls and brick pier in base of asphalt still

No. 101, No. 102 and No. 103 Millboard:

These three grades of Millboard are of still higher quality than No. 105 in grade of fibre and heat resistance. They will withstand temperatures up to about 1000 deg. F. The difference between the three grades is that No. 101 is hard and stiff, No. 102 is of medium hardness and No. 103 is soft and pliable.

No. 101-S Millboard:

This grade is similar in composition to No. 101, but is made hard and dense for conditions requiring an especially strong sheet.

C-Stock Millboard:

This grade of Millboard contains an especially long grade of fibre and is used for a great many conditions where a board of unusual heat-resisting properties is required. It is generally suitable for use at temperatures up to 1200 deg. F. At higher temperatures than this it becomes quite brittle, but it has been successfully used for conditions where the temperatures ran as high as 1800 deg. F. and where brittleness was not a serious objection.

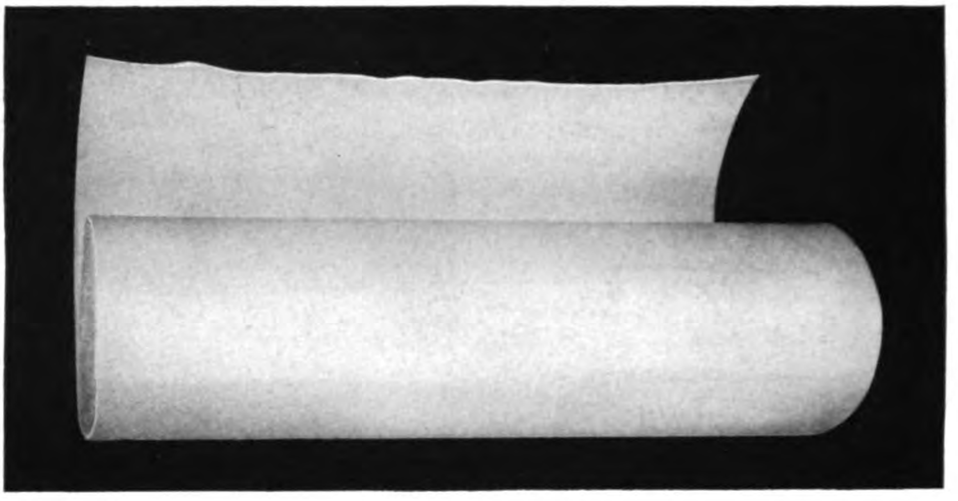
No. 219-S Millboard:

This is a particularly high grade Millboard, specially treated to give it somewhat greater density and strength. This grade is principally used for gaskets on hot oil, gas and tar lines, oil stills, etc.

June, 1931 (Cancelling 9-D-20-A-1 and 9-D-21-A-1, dated in 1928 and 1930)

Printed in U.S.A.

J-M Asbestos Paper and Roll Board



J-M Asbestos Paper and Roll Board are intended for use when an insulating material of minimum thickness is required.

Asbestos Paper is used principally as a protection against heat or as a fire retardant between walls, floors and ceilings, and frequently is used for wrapping furnace or heater pipes, although its extreme thinness makes it necessarily less efficient as an insulator than either Asbestocel in flexible roll form or Roll Fire-Felt. In order to obtain any great degree of insulation, several wraps are necessary.

Furnished in standard rolls, 18″, 24″ and 36″ wide, weighing 50 or 100 lb. per roll, and in special widths to order, 12″ wide and up.

Special grades of J-M Asbestos Paper are supplied for use in the filtration of chemicals and in electrolytic and kindred processes.

Approximate weights and thicknesses of J-M Asbestos Paper and Roll Board (heavy Asbestos Paper) are as follows:

Asbestos Paper

Approx. thickness,* inches	Approx. weight* per 100 sq. ft., pounds
.015	6
.018	8
.020	10
.025	12
.028	14
1/32	16
1/16	35

Asbestos Roll Board

3/32	53
1/8	68

*The actual weights of Paper may vary ± 10%.

Actual thickness of Roll Board may vary ± .02″.

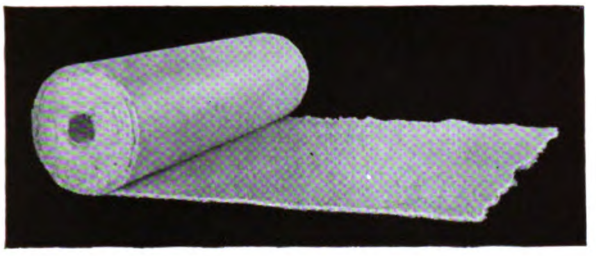
If material requiring closer limits is necessary, application may be made to the nearest Johns-Manville office.

June, 1931 (Cancelling 9-D-20-A-1 and 9-D-21-A-1, dated in 1928 and 1930)

Printed in U.S.A.

Asbestos Roll Fire-Felt

For temperatures to 1000 deg. F.



J-M Asbestos Roll Fire-Felt is adaptable to a wide variety of uses on account of its great flexibility and its insulating and heat-resisting properties. It is a soft felt of asbestos fibre that may be folded, bent or wrapped around pipes and heated surfaces.

It is especially adapted to wrapping around pipes which are too close to adjacent pipes, other equipment or partitions to permit the use of sectional insulation.

Asbestos Roll Fire-Felt is furnished in thicknesses of 3/32″, 1/8″, 3/16″, and 1/4″ in rolls 3 ft. wide containing approximately 100 sq. ft.

List prices and approximate weights

Thickness, inches	Pounds per sq. ft.	List price per sq. ft.
3/32	0.38	$.16
1/8	0.59	.20
3/16	0.75	.26
1/4	1.2	.30

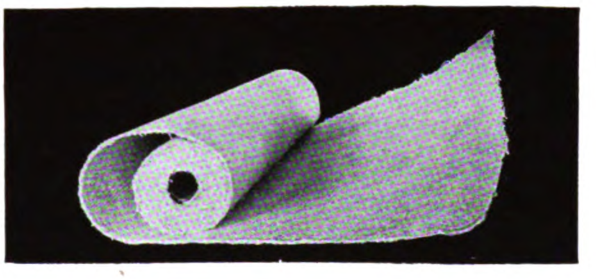
Ceilinite

For temperatures to 1000 deg. F.

Ceilinite is used as an interlining in steel cars, in fireproofing electrical apparatus, such as switch boxes, and for similar services demanding a strong, flexible, fireproof felt.

It is made from Asbestos Roll Fire-Felt, reinforced on one side only with asbestos cloth.

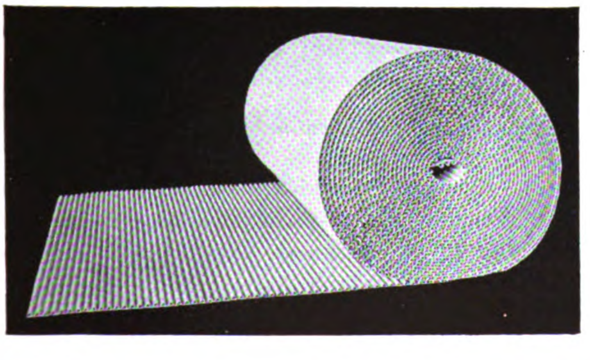
Furnished in rolls 36″ wide, in 3/32″, 1/8″, 3/16″ and 1/4″ thicknesses, 100 sq. ft. to the roll.



Asbestocel (flexible roll form)

For temperatures to 300 deg. F.

Asbestocel in flexible roll form is particularly adapted to insulating hot air heater casings and furnace pipes. Temperature limit, 300 deg. F.



This material is made by fastening together a plain and a corrugated asbestos felt into a single sheet, approximately 1/4″ thick. It is applied by wrapping one or more times around the pipe to be insulated and fastening with wire wound around it spirally. Additional fastening should be provided by wire rings placed about every 18″. At least two layers of Asbestocel should be applied on warm air furnace pipes.

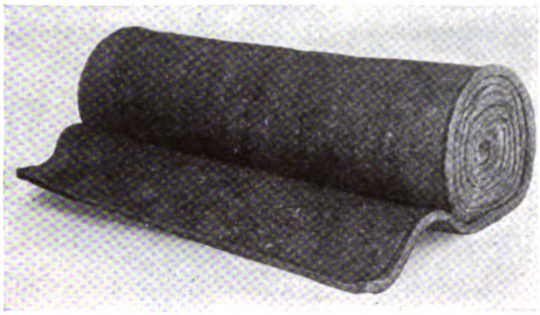
To provide a neater finished appearance, Asbestos Paper may be pasted over the surface of the Asbestocel after it has been wired on.

Furnished in rolls 37″ wide, containing approximately 250 sq. ft.

Printed in U.S.A.

J-M Standard Hair Felt

For temperatures below 200 deg. F.



J-M Standard Hair Felt is used for refrigerator car insulation and for the insulation of fittings on cold water pipes insulated with Anti-Sweat. It is also used in J-M Built-up Brine and Ammonia Insulation, J-M Built-up Hair Felt Insulation and for miscellaneous insulating purposes.

Detailed specifications for the use of Hair Felt under various conditions are contained in other data sheets.

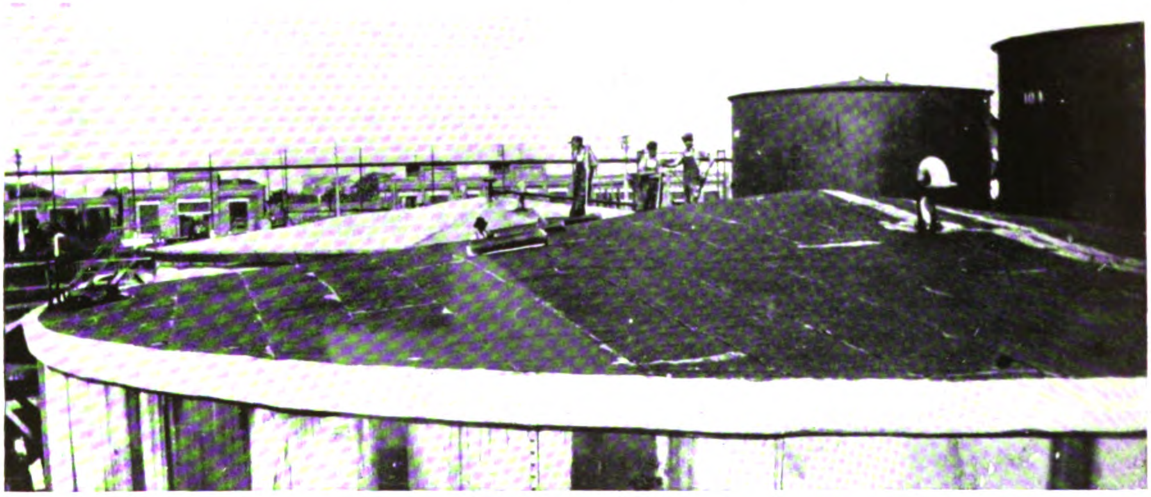
J-M Standard Hair Felt is made from 100% selected cattle hair by an improved felting process. It is furnished 6 ft. wide x 50 ft. long, 3 ft. wide x 100 ft. long, and 3 ft. wide x 50 ft. long. For all other sizes there is an additional cutting charge.

List prices and approximate weights

Thickness, inches	List price, per square foot	Weight per sq. ft., ounces	Weight per bale of 300 sq. ft., pounds
¼	$.08	4	75
½	.10	6	112½
¾	.13	9	170
1	.16	12	225
1½	.23	18	337
2	.30	24	450

Tankinsul

For temperatures below 200 deg. F.



Tankinsul on roof of tank before application of roofing finish

Tankinsul is a hair felt insulation with a layer of building paper on each side firmly stitched in place. Used in the oil industry on moderate temperature tanks. It is furnished ½″ or ¾″ thick in bales 3 ft. or 6 ft. wide containing 50 linear feet. Usually several layers are used. Approximate weight, 9 oz. per sq. ft. for the ¾″ thickness. Approximate weight of this thickness per bale of 300 sq. ft., 170 lb.

June, 1931 (Cancelling 9-D-22-A-1 to 9-D-30-A-1, dated in 1928, 1929 and 1930)

Printed in U.S.A.

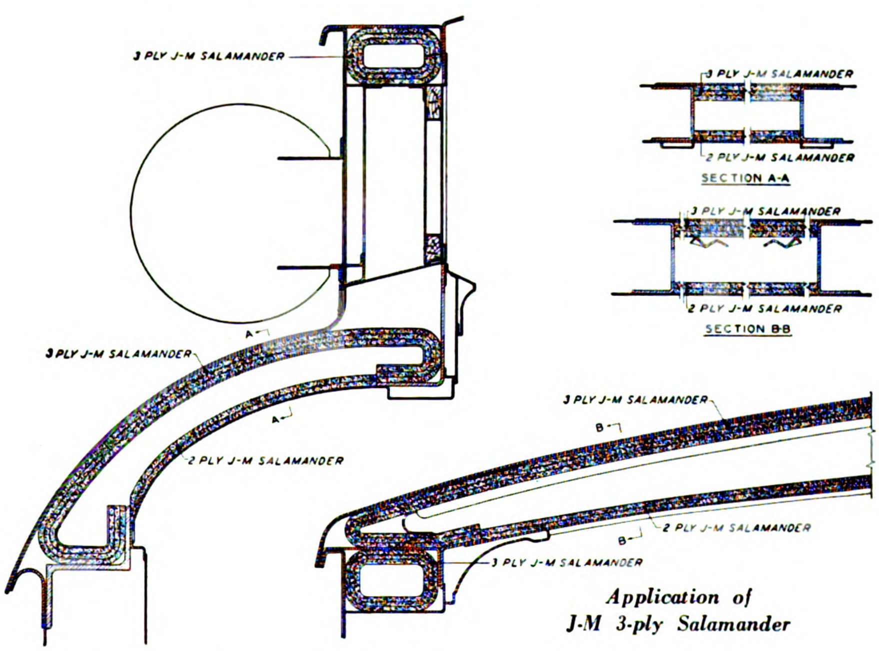
J-M Salamander
Steel Passenger Car Insulation

J-M Salamander Insulation properly applied to the inside of the outside metal plates, and the outside of the inside metal finish, keeps steel passenger cars warm in winter and cool in summer, and provides an excellent sound deadening material. Its principal characteristics are high insulating efficiency, moderate cost, ease of application, great durability and practically indefinite life.

Salamander Insulation is a built-up material of individual plies each approximately 1/4″ thick. A single ply consists of a bat of chemically-cleaned 100% cattle hair enclosed between kraft paper and then between asbestos paper and stitched together on approximate 5″ centers. The assembled plies forming the standard thickness, are stitched together on approximate 5″ centers midway between the stitching of the individual plies, with a layer of muslin gauze applied to the two outside surfaces of the insulation.

By the very nature of its construction, Salamander Insulation will withstand severe abuse incident to careless application or handling in car shops or storehouses. The stitching holds the hair filler securely in place, and the layers of paper enclosing the hair are sufficiently flexible to allow the material to be doubled on itself without fracture. This characteristic is of great importance when the material is cut into small pieces for application between and around posts or carlines of a steel car.

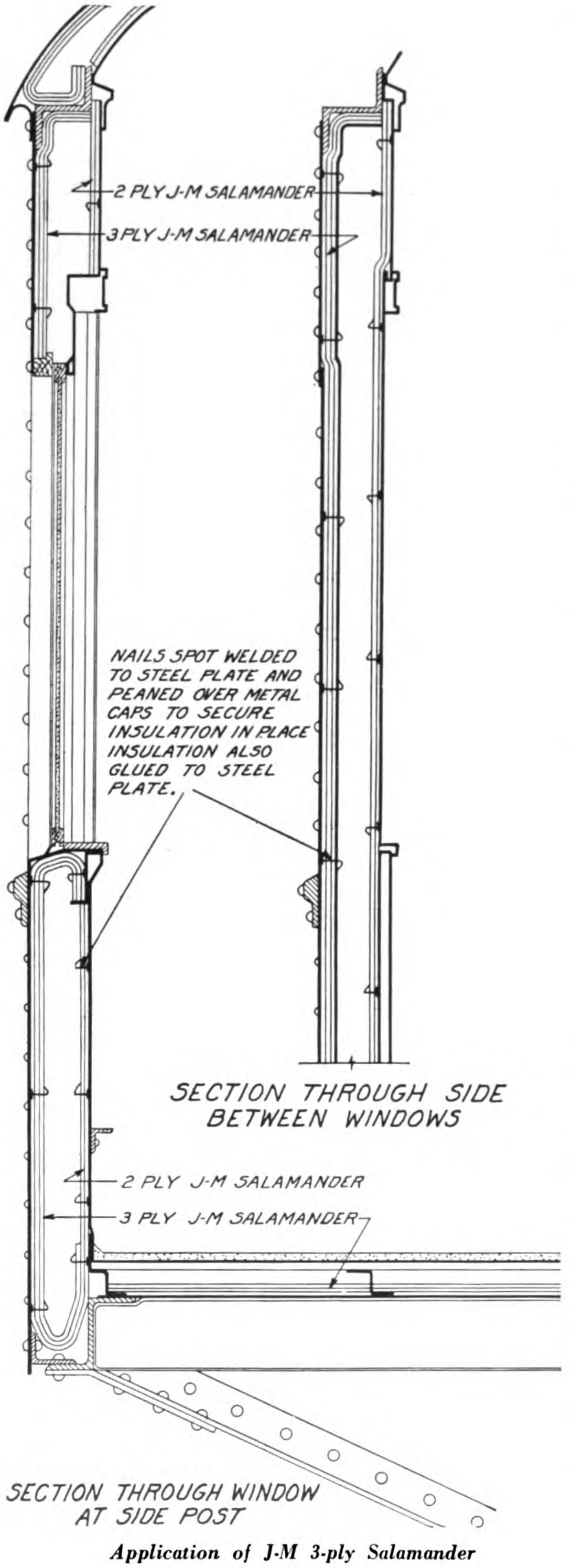
Three-ply Salamander Insulation has a conductivity of 0.25 B.t.u. per sq. ft., per hour, per inch thick, per deg. F. temperature difference. This conductivity value has been determined and published by the United States Bureau of Standards, in their Letter Circular No. 227 dated April 19, 1927, and is the lowest conductivity of any commercial steel passenger car insulation tested by the Bureau of Standards.



Application of J-M 3-ply Salamander

June, 1931 (Cancelling 10-I-8-A-1 to 1-B and 10-I-8-A-4 and 5, dated in 1929)

Printed in U.S.A.



Application of J-M 3-ply Salamander

Inasmuch as Salamander is an all-hair product, it is indestructible from natural causes. It is fireproof to the extent that it will not propagate flame or support combustion, after the source of the flame has been removed.

Salamander steel passenger car insulation has a comparatively low moisture absorption, and practically no capillary attraction. Under ordinary atmospheric conditions, Salamander will absorb only about 5% of its own weight of moisture. The thermal conductivity of the insulation is not materially affected, even after subjection to such extreme conditions as complete submersion in water.

It can be applied at a very reasonable cost, and will last the life of the equipment on which it is used.

It was the first standard insulation for steel passenger cars and it is still the recognized standard on all Class No. 1 Railroads in the United States, Canada and many foreign countries.

Sizes and Weights

J-M Salamander Insulation is furnished in thicknesses of 1, 2, 3, and 4-ply; 36″, 48″ or 54″ wide, or cut to size, and has the following weights per sq. ft.:

Thickness, (1 ply = ¼″ approx.)	Weight, lb. per 100 sq. ft.	Sq. ft. per bale
1-ply	27	500
2-ply	45¾	250
3-ply	64½	200
4-ply	83¼	200

Thermo-Felt Steel Passenger Car Insulation

Thermo-Felt is an asbestos hair felt composed of 50 per cent cattle hair and 50 per cent asbestos fibre. Used in steel passenger cars and street cars. Furnished in 50-ft. bales, 40″ wide, and ¼″, ½″ and ¾″ thick.

Carinsul Steel Passenger Car Insulation

Carinsul is a felted cattle hair insulation, with a burlap center, backed on either side with a heavy asbestos paper. It is a panel form of insulation and is recommended for use back of the letterboard on steel passenger cars, as its rigidity permits its use without any guard or protection against raising and lowering of windows.

Furnished in ¼″ and ½″ thicknesses, in sheets 40″ x 72″, or cut to dimensions required.

June, 1931 (Cancelling 10-I-8-A-1 to 1-B and 10-I-8-A-4 and 5, dated in 1929)

Printed in U.S.A.

J-M Hairinsul Refrigerator Car Insulation

J-M Hairinsul refrigerator car insulation is a blanket type of insulation which consists of either all cattle hair or a mixture of cattle hair and other fibres in specified proportions, all chemically cleansed, felted between two layers of waterproof paper and stitched on approximate 5″ centers.

All-Hair Hairinsul: An insulating blanket, the filler of which is 100% cattle hair.

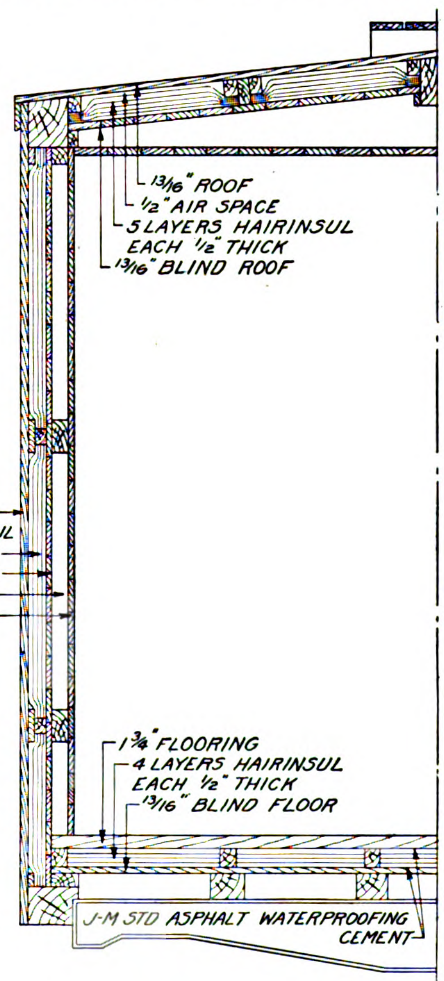
No. 25 Hairinsul: An insulating blanket, the filler of which is 75% cattle hair and 25% other fibre, of the nature of jute.

No. 50 Hairinsul: An insulating blanket, the filler of which is 50% cattle hair and 50% other fibre, of the nature of jute.

The introduction of other fibre than hair is in no way an adulteration, for, while the other fibre does not in itself have the permanence or the insulating efficiency of hair, it has a very desirable effect, because it makes it possible to felt the material more perfectly and, by so doing, more than compensates for the difference in thermal efficiency of the two materials. This other fibre is stiffer than hair, and prevents the blanket from becoming more compact under pressure.

Hairinsul meets completely two of the principal requirements of refrigerator car insulation: resistance to moisture absorption and freedom from disintegration in the presence of moisture. Hair in itself has practically no absorptive qualities or capillary attraction and, as a consequence, the material will retain its original characteristics and will not be affected even if totally submerged in water and subsequently dried out. The waterproof paper enclosing the Hair Felt of course resists the penetration of moisture into the insulation, and will not in itself absorb more than a minute quantity of water vapor.

The material being furnished in wide blanket form, it is possible to apply it in one piece, extending from the sill to the plate and from one side door to the other around the end of the car, thereby elimi-



Application of J-M Hairinsul to refrigerator car

Printed in U.S.A.

nating all joints in the material and the possibility of air or heat leakage.

It can be compressed over framing posts, or under belt rails, has sufficient mechanical strength to support itself in the wall section with a minimum amount of fasteners or nailing strips, and will not sift down under vibration in service.

All-Hair Hairinsul refrigerator car insulation has a conductivity of 0.26 B.t.u. per sq. ft., per hour, per inch thick, per deg. F. temperature difference, as determined by the U. S. Bureau of Standards and published in their Letter Circular No. 227 dated April 19, 1927.

Hairinsul is furnished ½", ¾" and 1" thick, covered with waterproof paper weighing 80 lb., 90 lb., or 110 lb. per 1000 sq. ft., as specified. Hairinsul is furnished covered with 80 lb. paper, unless otherwise ordered. The material is furnished in rolls of any specified width up to 108" and of practically any length desired. In special cases, it will be cut to templet as ordered.

Hairinsul has the following weights per sq. ft. for the various thicknesses:

Thickness	With 80-lb. paper cover	With 90-lb. paper cover	With 110-lb. paper cover
½"	7 oz.	8 oz.	8½ oz.
¾"	9½ oz.	10½ oz.	11 oz.
1"	11½ oz.	12 oz.	12½ oz.

Dry Zero Insulation

Dry Zero is primarily a low-temperature insulation used chiefly on refrigerator cars and refrigerated trucks. It should not be used for temperatures exceeding 200 deg. F.

The fibre is placed between two layers of burlap by a special process, which gives maximum thermal efficiency, resiliency and proper density. The burlap is chemically treated to retard rot, kill bacteria, and to prevent the growth of fungi. The stitching twine is also treated. The blanket is stitched longitudinally on 6" centers, and the edges stitched tight with an interlocking stitch. The thickness of a 2" blanket at the stitches is about 1".

The particular advantages of Dry Zero are:

1. Exceptionally efficient. The U. S. Bureau of Standard tests show Dry Zero to have a conductivity of 0.24 B.t.u. per sq. ft. per inch thick, per deg. F. temperature difference, per hour.

2. Light in weight. Dry Zero blankets weigh 4.25 oz. per sq. ft., 2" thick.

3. Resilient. The extreme resilience of the Dry Zero blanket insures proper thickness and density after handling.

4. Withstands vibration. Because of its resilience, Dry Zero is not impaired by vibration or impact. Vibration has the effect of expanding the material and, therefore, does not destroy its insulating value.

5. Odorless. Dry Zero blankets are entirely odorless.

6. Moisture repellent. The fibre is not affected by moisture, the water tending to run off the surface rather than penetrate.

7. Rot and vermin proof. There is no evidence of the fibre ever having rotted. Microscopic examination of material from 10 to 12 years old showed no evidence of deterioration.

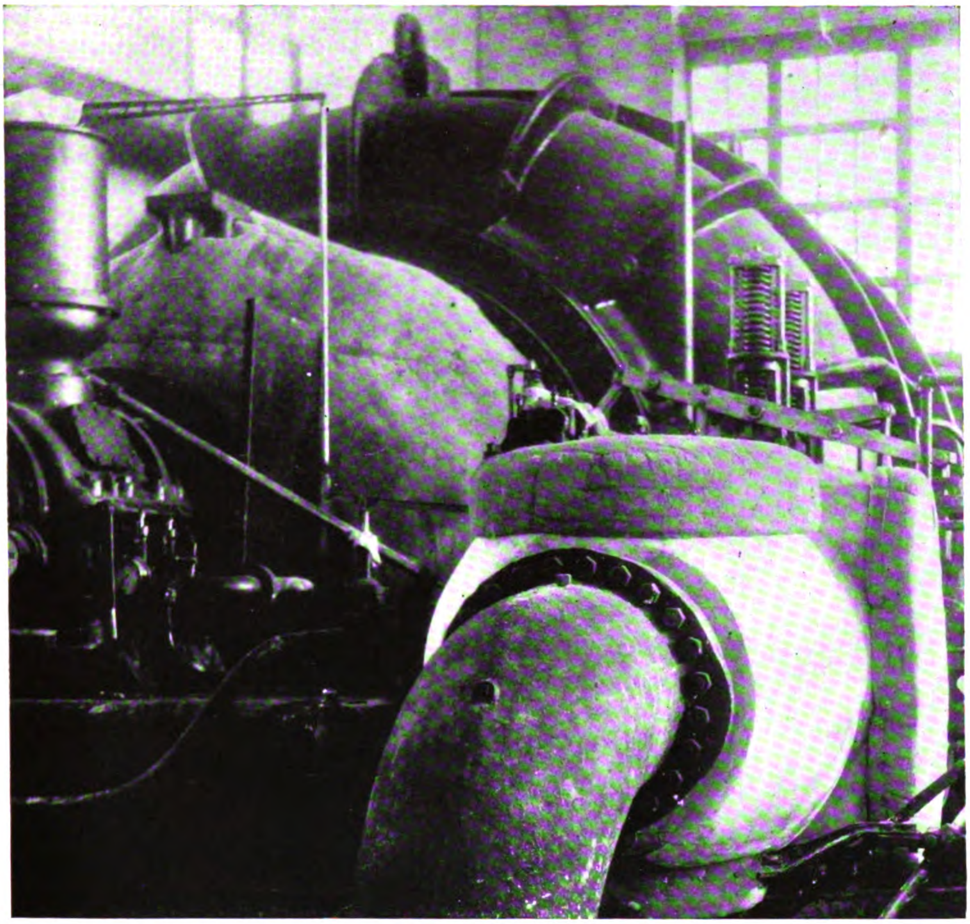
Sizes and Thicknesses:

Dry Zero Blankets are furnished in thicknesses of 1", 1½", 2" and 2½", in rolls 9 ft. wide by any desired length.

Blankets of special shapes and sizes are also regularly furnished. An extra charge is made on such special shapes to cover cost of cutting and stitching. Blankets should not be cut on the job as it is difficult to do this without disturbing the filling.

J-M Asbestos Blankets

For temperatures to 800 deg. F.



J-M Asbestos Blankets used for the removable portions of turbine insulation. Superex Combination Insulation is used on parts where frequent removal is not necessary

J-M Asbestos Blankets are made of asbestos cloth in envelope form, filled with brown asbestos fibre and tufted with copper wire at close intervals. The edges and seams are sewed with asbestos cord, using sewed-on monel metal hooks or rings in lieu of holes through the cloth.

Asbestos Blankets meet the demand for removable insulation to give quick accessibility to bolt heads of turbine flanges, fitting flanges and valve bonnets. Also, for oil field boilers, they yield large returns upon the initial investment. Thermal efficiency, durability and ease of removal are the chief advantages.

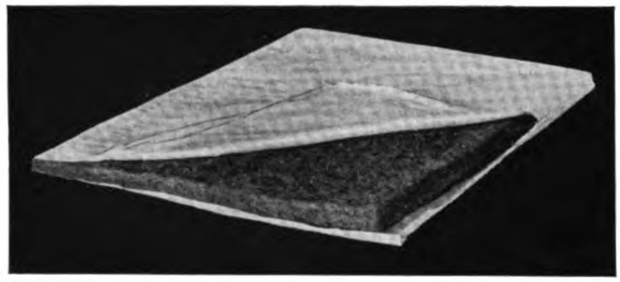
The following table gives the number of layers of blankets and the thickness of each layer recommended for various temperatures:

Temperature, deg. F.	Recommended thickness
Below 338	1½″
338 to 387	2″
388 to 499	2½″
500 to 599	3″ (2—1½″ layers)
600 to 800	4″ (2—2″ layers)

J-M Asbestos Blankets are made to suit each individual case. Recommendations furnished on request.

Printed in U.S.A.

Economy Range Boiler Cover



Economy Range Boiler Covers are especially recommended for use under conditions requiring maximum heat economy. Standard 1, 2 and 3-ply Economy Range Boiler Covers are made for tanks or boilers heated by coal, electricity, gas or oil.

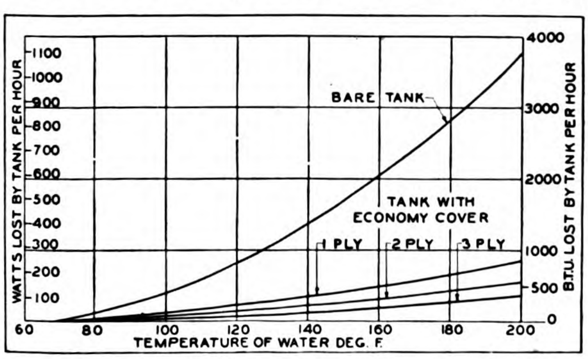
These covers are constructed of either one, two or three layers of hair felt, each of which is covered with muslin, and quilted. This thickness of each layer is approximately 1″. A finish cover of heavy canvas is supplied, with brass eyelets and cord for lacing.

The 1-ply thickness may be sufficient where a low-cost fuel is used, but for any electrical system a 2-ply cover is needed, and in cases where fuel is particularly

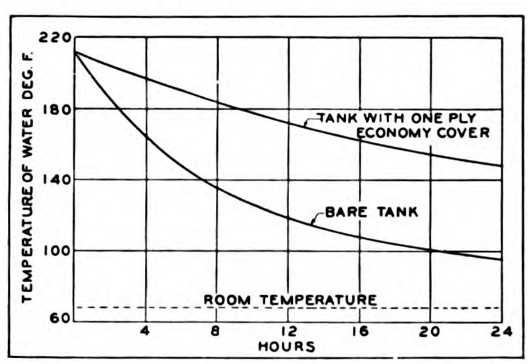
Table I—Dimensions, List Prices and Comparison of Heat Losses

Range boiler commercial rating, gal.	Standard dimension (inches) dia. x height	List Prices, Each			Loss in radiation, B.t.u. per month*			
		1-ply 1″ thick	2-ply 2″ thick	3-ply 3″ thick	Bare	3-ply cover	2-ply cover	1-ply cover
18	12x36	$27.00	$41.50	$59.00	1,097,000	134,000	190,000	276,000
24	12x48	41.00	67.50	71.00	1,410,000	167,000	239,000	340,000
24	14x36	41.00	67.50	82.00	1,310,000	152,000	218,000	329,000
30	12x60	41.00	67.50	94.50	1,720,000	199,000	286,000	425,000
36	12x72	45.00	76.50	98.00	2,035,000	232,000	336,000	496,000
36	14x54	45.00	76.50	102.00	1,857,000	206,000	300,000	446,000
40	14x60	45.00	76.50	105.00	2,045,000	225,000	328,000	490,000
48	14x72	52.50	84.50	114.00	2,405,000	261,000	382,000	574,000
52	16x60	52.50	84.50	123.00	2,365,000	252,000	368,000	560,000
63	16x72	59.00	96.00	136.00	2,780,000	291,000	428,000	656,000
66	18x60	59.00	96.00	141.00	2,700,000	277,000	410,000	629,000
79	18x72	62.50	103.50	145.00	3,175,000	321,000	478,000	734,000
82	20x60	62.50	103.50	150.50	3,040,000	312,000	454,000	704,000
98	20x72	66.00	113.50	156.00	3,570,000	352,000	525,000	824,000
100	22x60	66.00	113.50	161.50	3,395,000	335,000	498,000	777,000
120	22x72	73.50	125.00	169.00	3,975,000	383,000	576,000	905,000
120	24x60	73.50	125.00	177.00	3,760,000	360,000	544,000	855,000
144	24x72	78.50	132.50	197.50	4,380,000	415,000	629,000	990,000
168	24x84	86.00	146.50	210.00	5,015,000	469,000	714,000	1,110,000
192	24x96	93.00	161.00	222.00	5,630,000	525,000	800,000	1,260,000

*Water temperature 100 deg. F. above room temperature. Tank operated continuously for 730 hours per month.



Losses from uncovered 30-gallon galvanized iron tank as compared with losses from same tank insulated with Johns-Manville Standard Economy Hot Water Tank Cover, with average room temperature assumed at 68 deg. F.



Cooling rate of 30-gallon tank, 12″ diam. 60″ long, insulated with 1-ply Johns-Manville Standard Economy Hot Water Tank Cover, compared with that of a bare or uncovered galvanized tank

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expensive or where it is desirable to maintain the high temperature of the water for considerable periods, a 3-ply cover should be used.

All hot water pipes should also be insulated with 3-ply (or heavier) Improved Asbestocel, using insulating cement for covering the fittings.

Heating Equivalents

1 kilowatt hour, equivalent to	3415 B.t.u.
1 cu. ft. gas, usually equivalent to	450-600 B.t.u.
1 lb. oil, equivalent to	17,500-18,600 B.t.u.
1 lb. coal, equivalent to	11,000-13,500 B.t.u.

To find fuel equivalent to heat losses in Table I, divide B.t.u. from the table by B.t.u. equivalent to 1 lb. or 1 cu. ft. of fuel; then divide the result by heating efficiency. This gives actual fuel required to make up for radiation loss.

Table II—Electric heat saving per month

30 gallon tank insulated with Economy Range Boiler Cover

Water temperature	Saving per month*		
	1-ply	2-ply	3-ply
100 deg. F.	$ .58	$ .68	$ .75
125 deg. F.	1.42	1.60	1.73
150 deg. F.	2.66	2.98	3.16
175 deg. F.	4.21	4.67	4.95
200 deg. F.	6.19	6.82	7.20

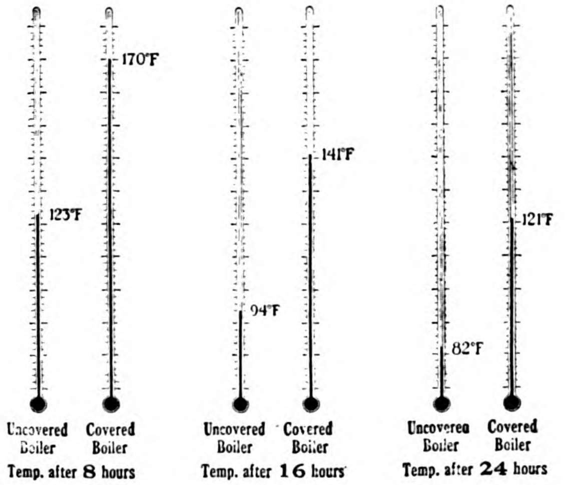
*These figures are based on cost of electricity at 1¢ per kw. hour. At other electric rates the saving is proportional to the rate.

Keystone Range Boiler Cover

Keystone Range Boiler Covers prevent waste of heat and fuel, keep the temperature of the room in which the boiler is located comfortable and help keep hot water hot when fires are low or even entirely out.

The Keystone Range Boiler Cover consists of a special asbestos lining that comes in contact with the boiler; next, an insulating hair felt of high efficiency covered with rosin-sized paper and on the outside a strong 8-oz. canvas jacket with lacing hooks that permit the cover to be applied easily and quickly.

Where water is heated electrically, or with gas controlled by a thermostat, an Economy Range Boiler Cover should be used.



An example of what a range boiler cover will accomplish

Keystone covers are furnished to fit boilers listed below or made up special for odd sizes.

Dimensions of boilers and List prices of Covers

Boiler capacity, approximate number of gallons	Diameter, in inches	Height, in feet	List Price, each
18	12	3	$6.40
24	12	4	7.00
24	14	3	6.75
30	12	5	7.80
32	14	4	7.45
36	12	6	8.20
36	14	4½	8.10
40	14	5	8.50
42	16	4	8.10
48	14	6	8.85
52	16	5	9.25
63	16	6	9.60
66	18	5	9.75
79	18	6	10.25
82	20	5	9.90
88	20	6	11.70
100	22	5	10.80
120	22	6	12.85
120	24	5	11.70
144	24	6	13.60
168	24	7	15.60
192	24	8	18.20

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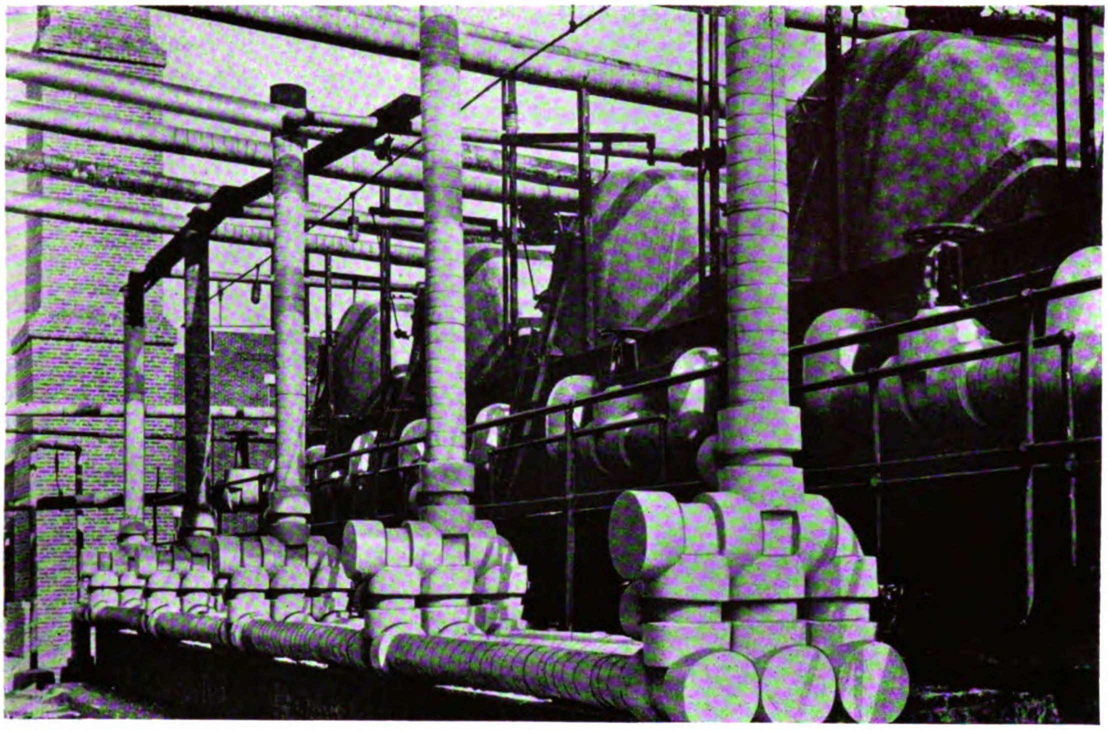
J-M Pipe Insulation



Charging and traveling lines on pressure stills, effectively insulated with J-M materials

Johns-Manville furnishes many kinds of insulation in a form suitable for insulating pipes conveying hot or cold fluids. The insulation which should be selected for a particular application depends on the requirements of the individual job.

Asbesto-Sponge Felted is the most efficient commercial insulation for pipes conveying hot liquids and vapors at temperatures not exceeding 700 deg. F. Its laminated construction gives sufficient mechanical strength to withstand severe usage and vibration, which makes it particularly desirable where the insulation is subjected to rough treatment. Another advantage is the fact that it can be taken off and placed on other pipe of the same size without deterioration from the consequent handling and transportation.

J-M 85% Magnesia is extensively used for steam line insulation requirements where the insulation is not subject to mechanical injury and where the temperatures do not exceed 600 deg. F. It is light, efficient and slightly lower in price than Asbesto-Sponge Felted.

In the range of temperatures so high that Asbesto-Sponge Felted or 85% Magnesia should not be used, Superex Pipe Insulation is the proper material. Sometimes Asbesto-Sponge Felted is used outside of Superex for mechanical protection of the Superex and to increase insulating efficiency. Magnesia is also often used as an outside layer where the insulation is not subjected to abrasion, because it is a little more economical in first cost and is a slightly better insulator than Superex. These combinations of Superex and Asbesto-Sponge Felted or 85% Magnesia are known as Superex Combination Insulation.

Generally speaking, Asbesto-Sponge Felted, 85% Magnesia, or Superex will solve any insulation problem on heated pipes which ordinarily arises, but other materials are available and frequently may be used to advantage.

Complete information on these materials and on Cork, Built-up Brine and Ammonia, Anti-Sweat and other pipe insulation for cold work appears in the insulation data sheets.

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List Prices of J-M Pipe Insulation*

(prices per linear foot, subject to discount)

Nominal pipe size, inches	Standard thick	1½ inches thick	Double Standard** thick	2 inches thick	2½ inches thick	3 inches thick (broken joint)
½	$0.22	$0.46	$0.65	$0.75	$1.00	$1.20
¾	.24	.49	.70	.80	1.05	1.35
1	.27	.52	.75	.85	1.10	1.40
1¼	.30	.56	.80	.90	1.15	1.45
1½	.33	.60	.85	.95	1.20	1.55
2	.36	.64	.90	1.00	1.25	1.65
2½	.40	.70	1.00	1.05	1.35	1.75
3	.45	.76	1.10	1.15	1.50	1.90
3½	.50	.82	1.20	1.25	1.65	2.05
4	.60	.88	1.40	1.35	1.80	2.20
4½	.65	.94	1.50	1.45	1.95	2.35
5	.70	1.00	1.60	1.55	2.10	2.50
6	.80	1.10	1.80	1.70	2.25	2.70
7	1.00	1.20	2.25	1.85	2.40	2.90
8	1.10	1.35	2.50	2.00	2.55	3.15
9	1.20	1.50	2.70	2.20	2.80	3.40
10	1.30	1.65	2.90	2.40	3.05	3.65
12	1.85	1.85	4.10	2.70	3.40	4.10
14 o. d.	2.10	2.10	4.60	3.00	3.80	4.60
16 o. d.	2.35	2.35	5.10	3.30	4.20	5.10
18 o. d.	2.60	2.60	5.60	3.60	4.60	5.60
20 o. d.	2.85	2.85	6.00	4.00	5.00	6.00
24 o. d.	3.30	3.30	7.00	4.50	5.75	7.00
30 o. d.	4.00	4.00	8.40	5.50	6.95	8.40

*These list prices do not apply to Built-up Brine and Ammonia and Built-up Hair Felt. See special list prices on Cork, Banroc and on Superex, 85% Magnesia and Asbesto-Sponge Felted when used for Superex Combination Insulation.

**Only 85% Magnesia made in this thickness.

Pipe insulation is supplied in canvassed sections 3 ft. long, split for ready application, and with lacquered metal bands. Segmental insulation, when supplied for Superex or Magnesia, is furnished in 3-ft. lengths, without canvas and bands. Segments are approximately 6" wide, except for the piece to close the circle.

Anti-Sweat Insulation is made in ½", ¾", 1", 1½" and 2" thicknesses. Use standard thick list prices for thicknesses 1" and under.

Asbestos Fire-Felt is made in 1" to 3" thicknesses. Use column headed standard thick for 1" thickness.

Asbesto-Sponge Felted Insulation is made in thicknesses from the standard (approximately 1") to 3". Thicknesses up to and including 2½" will be furnished single layer construction, unless otherwise ordered. 3" thick will be furnished broken joint construction of two equal thickness layers, unless otherwise specified.

Improved Asbestocel (coarse corrugated) is made in thicknesses of two, three and four ¼" plies. For all thicknesses, use prices for standard thick. Fine Corrugated Improved Asbestocel is made in four and six plies (6 plies per inch). Use standard thick prices for all thicknesses.

85% Magnesia Insulation is made in Standard, 1½", Double Standard, 2", 2½", and 3" (broken joint) thicknesses. Insulation for the smaller pipe sizes is furnished sectional. For pipe sizes larger than 10", single layer insulation, or the inner layer of double layer insulation, is furnished in segments, except that when specifically ordered, 12" and 14" sizes can be furnished in sectional form 1½" thick, and 12" size in sectional form 2" thick. Second layer insulation is furnished segmental when it is to be applied on pipes 9" or larger, except that 1½" and 2" thick second layers on 9" pipes, and 1½" thick second layers on 10" pipes, may be secured in sectional form when specifically so ordered.

Superex Insulation is made in 1" to 3" thicknesses. Use column headed standard thick for 1" thickness. The smaller pipe sizes are furnished sectional. Pipe sizes larger than 10" are furnished segmental.

Wool Felt is made in ½", ¾", 1", Double ½" and Double ¾" thicknesses. For Double ½" and under, use standard thick list prices. For Double ¾", use 1½" thick list prices.

Zero Insulation is made in one thickness only, approximately 1¼". Use standard thick list prices.

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Asbesto-Sponge Felted Pipe Insulation

For temperatures to 700 deg. F.

Asbesto-Sponge Felted Insulation is the most efficient commercial heat insulation for pipes conveying steam or fluids, the temperatures of which do not exceed 700 deg. F.

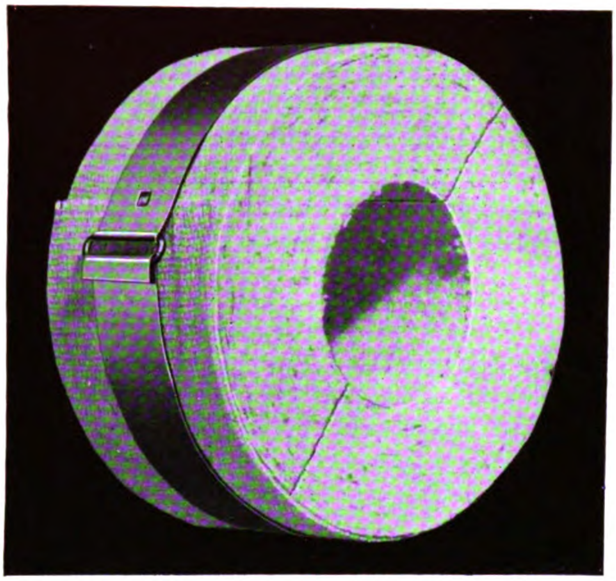
It is especially designed to withstand, permanently without disintegration, the high steam temperatures, as well as vibration and wear and tear, encountered in modern steam engineering practice.

Constructed from felts composed of asbestos fibres and small particles of spongy cellular material, the insulation is built up in laminations, about forty of these felts per inch of thickness, cemented together at intervals to the required thickness. In sectional pipe insulation, these felts are wound one over the other continuously until the desired thickness is obtained and the cylinder of insulation is split lengthwise to permit application.

The principal advantages of Asbesto-Sponge Felted Insulation over other types lie in its high efficiency and in the permanency with which it retains this high efficiency in service. Soaking Asbesto-Sponge Felted in water and then drying it out again has practically no effect upon its efficiency.

The reason for its high efficiency is that its construction, made up as it is from thin sheets of an asbestos felt containing a large proportion by volume of a spongy material, gives an enormously large number of very minute, completely enclosed air spaces per unit volume. It is a well-known fact that small, completely enclosed air spaces are the best form of insulation commercially available. The laminated structure also provides air spaces between the sheets in addition to those in the felt.

Asbesto-Sponge Felted costs more than 85% Magnesia because it is a fabricated and not a moulded material. The cost of pipe insulation, however, is but a small part of the entire job. There are such items as cement, canvas, paste, sewing twine, paint, labor on pipe and fittings, expenses of mechanics, etc. The cost of an Asbesto-Sponge Felted job is therefore not much more than that of an 85% Magnesia job at the time of application, and is much less when the *constant* saving and sturdiness is considered. It is the cheapest *per year* heat insulation made.



Asbesto-Sponge Felted Insulation is so constructed as to eliminate breakage in shipping, handling and after applying. The felted nature of the material makes it flexible to a considerable extent, and the insulation before and after application will stand much abuse without becoming damaged. It can be removed and replaced many times without loss of insulating efficiency.

Asbesto-Sponge Felted is especially adaptable to all sizes of piping, with the minimum expenditure for labor. This particularly applies to large pipe sizes, where this insulation is furnished in one piece, as compared with moulded forms of insulation furnished in segments.

Asbesto-Sponge Felted Insulation is furnished in 3-foot sections, in thicknesses from standard (approx. 1″) to 3″, to fit accurately any commercial size of steam pipe, finished with a canvas jacket and furnished with lacquered bands for holding in place. The pipe insulation in 3″ thickness is furnished in two-layer broken joint construction, unless solid construction is specified. Thicknesses less than 3″ are furnished solid construction, unless otherwise specified.

When furnished with but one longitudinal joint, as is the case in pipe sizes 3″ and larger, the heat leak-

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age through joints is reduced to the minimum, and the application is made easier.

For pipe sizes above 10″ moulded forms of insulation are furnished in segmental form, as such moulded insulation cannot be successfully shipped and handled in one piece. On the 14″ size, the number of these segments is nine, which means that there are nine times as many longitudinal joints on this size of moulded insulation as on Asbesto-Sponge Felted.

Asbesto-Sponge Felted Insulation is also furnished in sheet or block form as described in another data sheet.

Waterproof Jacket

Asbesto-Sponge Felted Pipe Insulation can be furnished with an integral waterproof asbestos jacket attached at the factory. This 3-ply jacket is supplied with a 4″ wide side lap and with strips of felt 7″ wide for a double circumferential wrap at the ends. The jacket is split so that the pipe insulation can be applied in the regular manner. The laps are turned downward to shed water and sealed with Lap Cement. The side laps of circumferential strips are made on the opposite side from the jacket lap. No. 16 B. and S. gauge Copperweld wire rings are applied over the jacket on not greater than 4″ centers.

When Asbesto-Sponge Felted with integral waterproof jacket is used, it is necessary to order 17 oz. of ¾″ x ¾″ copper-clad steel staples, and the following quantities of J-M Lap Cement, per 100 linear feet of pipe:

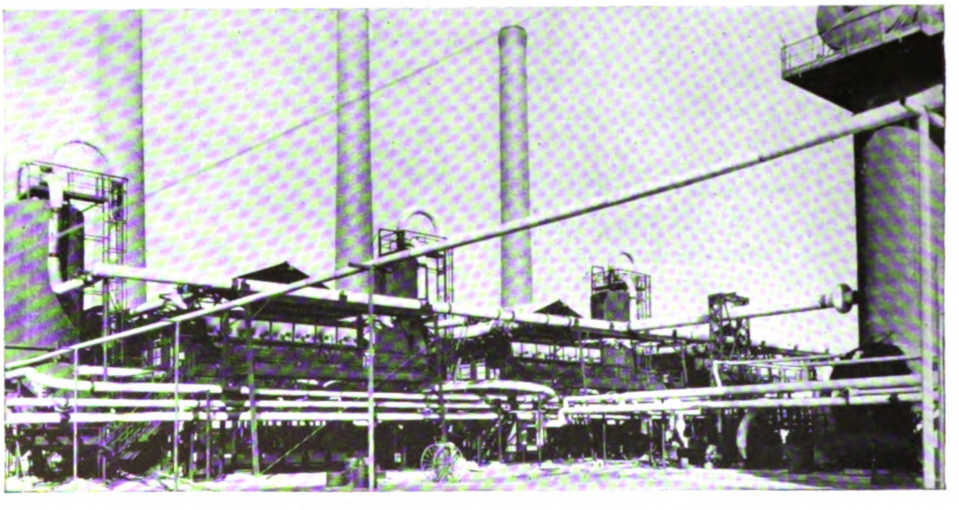
Pipe Size, inches	Insulation thickness	
	Less than 2″	2″ or more
½–3	1 gal.*	1½ gal.*
3½–7	1½ "	2 "
8–14	2 "	2½ "

*Lap Cement, a liquid asphalt cement, furnished in 1, 5, 25 and 50 gal. containers.

Weight in pounds per standard 3-foot section, uncrated.

Thickness, inches	Nominal pipe sizes, inches																	
	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
Std.*	4.35	4.70	5.26	6.00	6.42	7.38	8.31	9.52	10.60	11.60	12.50	13.80	15.70	17.70	19.70	21.70	23.80	27.08
1½	8.95	9.50	10.40	11.40	12.00	13.30	14.70	16.50	17.90	19.40	20.80	22.70	25.60	28.30	31.00	34.00	37.20	43.00
2	13.00	13.60	14.80	16.20	17.00	18.80	20.70	23.10	25.20	27.10	29.00	31.50	35.20	39.10	43.00	47.50	51.30	59.20
3	25.40	26.50	28.20	29.70	31.60	34.30	37.20	41.00	43.80	46.70	49.70	53.70	59.30	65.20	70.80	76.80	83.50	95.50

* Note—Standard thickness is approximately 1″ thick in all pipe sizes.



Asbesto-Sponge Felted withstands severe service on outdoor lines

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Asbesto-Sponge Felted Insulation Specification for pipes conveying heated fluids

MATERIALS

The insulation furnished under this specification shall be Johns-Manville Asbesto-Sponge Felted Insulation, composed of laminated asbestos felts of a porous nature in order to provide maximum insulating value. This porosity shall be obtained by means of porous material imbedded into and forming part of the felt itself. There shall be not less than 37 nor more than 42 laminations per nominal inch of thickness.

The material shall be furnished in sectional form for application to pipes and in block form for application to irregular surfaces, such as fittings.

The hard finish Asbestos Cement furnished under this specification shall be a long fibre first quality asbestos cement suitable to withstand the temperatures to which it will be subjected.

THICKNESS

(a) *Piping:*

(1) *Indoors:*

All piping located indoors shall be insulated to a thickness not less than that given in the following table, for the temperature conditions stated therein.

Steam pressure or condition	Temperature	Thickness of insulation		
		Pipes larger than 4″	Pipes 2″ to 4″	Pipe smaller than 2″
Hot Water........	....	1″	1″	1″
0 to 25 lbs......	212 to 266°F.	1″	1″	1″
25 to 100 lbs.....	267 to 337°F.	1½″	1″	1″
100 to 200 lbs.....	338 to 387°F.	2″	1½″	1″
Low Superheat....	388 to 499°F.	2½″	2″	1½″
Superheat........	500 to 599°F.	3″	2½″	2″
High Superheat...	600 to 700°F.	3½″	3″	2″

(2) *Outdoors:*

All piping located outdoors, or exposed to the weather, shall be insulated to thicknesses not less than ½″ greater than those given in the foregoing table for piping located indoors.

(b) *Fittings, Valves and Flanges:*

See other data sheets.

APPLICATION

(a) *Piping:*

1½″ thick and less:

All sectional insulation 1½″ and less in thickness shall be applied in a single layer with the joints tightly drawn together and the insulation held in place with not less than three separate loops of 16-gauge annealed iron wire.

2″ thick and greater:

All sectional insulation 2″ and greater in thickness shall be applied in two layers to make up the thickness specified.*

The first layer, with all joints tightly butted, shall be securely wired to the pipe with not less than 3 loops of 16-gauge annealed iron wire on pipes up to and including 6″, and not less than 4 loops on larger pipes.

The second layer shall be applied over the first so that both circumferential and horizontal joints are broken, and shall be held in place on pipes up to and including 6″ with not less than three loops of 16-gauge annealed iron wire.

On pipes 8″ and larger the second layer shall be held in place by not less than 4 loops of 16-gauge annealed iron wire. The ends of these wire loops shall be tightly twisted together and shall be bent over and hammered into the insulation so as to leave no projection.

The insulation on bends shall be given a thin finishing coat of hard finish Asbestos Cement to present a smooth, even surface.

Canvas shall in all cases be omitted from the inner layer of insulation where the insulation is applied in two layers.

All of the above insulation shall be stopped off a sufficient distance from all flanges to permit the easy removal of the bolts after a bevel of cement is made

*3″ thick Asbesto-Sponge Felted is regularly furnished double-layer. For 2″ and 2½″ thickness, orders should call specifically for double-layer material.

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from the pipe to the outside of the insulation at an angle of 45° with the axis of the pipe.

(b) *Fittings, Valves and Flanges:*

See other data sheets.

FINISH

(a) *Piping:*

(1) *Indoors:*

All insulation on piping located indoors shall be enclosed in an extra jacket of 8-oz. canvas sewed on over rosin-sized paper. All seams shall be located where least visible and the stitches shall be not less than three to the inch.

Where re-canvasing is not desired, the light canvas jacket regularly furnished with the insulation shall be neatly pasted down over all laps.

All cement surfaces shall be finally finished with a jacket of 8-oz. canvas neatly and securely pasted on.

(2) *Outdoors:*

All insulation on piping located outdoors or exposed to the weather if not equipped with an integral waterproof jacket, shall be finished with a Double Coated Flexstone weatherproof jacket. All joints in the jacket shall be lapped at least 3″ and sealed with Lap Cement.* The jacket shall be securely wired in place by means of loops of No. 16 B. & S. gauge Copperweld wire placed on not less than 4″ centers.

On horizontal pipes the seams of the weatherproof jacket shall be placed at the side of the pipe with the lap turned down in order to shed the water.

Piping located close to the ground or where there is danger of the jacket being subjected to mechanical injury shall be protected by means of a suitable metal jacket. Piping exposed to fire hazard may be protected with a J-M Asbestos Firetard Insulation Jacket.

(b) *Fittings, Valves and Flanges:*

See other data sheets.

PAINTING

All insulation finished with a jacket of 8-oz. canvas, shall be finally painted with first, one coat of glue sizing and then not less than two coats of first quality lead and oil paint, of color selected by the purchaser.

All of the above insulation shall be applied by the manufacturer of the materials used, or his approved contractor.

Asbesto-Sponge Felted Insulation Specification for underground steam and hot water pipes within buildings

Insulation:

All underground steam and hot water lines within building, such as unexcavated spaces or pipe trenches, shall be insulated with Asbesto-Sponge Felted Insulation with integral waterproof jacket, to a thickness not less than that specified for the same line in the building.

Application:

On all horizontal pipes, the insulation shall be applied with the longitudinal joint on the side of the pipe, the lap of the integral waterproof jacket extending downward, and tightly sealed with Lap Cement.*

The circumferential joint shall be covered with strips of waterproofing felt 7″ wide tightly sealed with Lap Cement.

As each section is applied, the covering shall be secured with rings of not lighter than 16 B. & S. gauge Copperweld steel wire, wound once around the jacket and the ends twisted together. These rings shall be placed on not greater than 6″ centers.

Fittings shall be insulated and finished in the same manner as specified for outdoor lines.

*A liquid asphalt cement furnished in 1, 5, 25, and 50-gal. containers.

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Asbesto-Sponge Felted (sectional) Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.
Efficiency expressed in percent of bare pipe losses.

Insulation thickness, inches	Temperature of pipe—deg. Fahr.	125	175	225	275	325	375	425	475	525	575
	Temperature difference between pipe and air—deg. Fahr.	50	100	150	200	250	300	350	400	450	500
	Nominal pipe size ½″										
1	Heat Loss, B.t.u.	.619	.638	.658	.677	.697	.717	.738	.758	:779	.800
	Efficiency %	68.26	70.36	72.59	74.60	76.39	78.00	79.65	81.20	82.55	83.74
1½	Heat Loss, B.t.u.	.566	583	.601	.618	.636	.654	.673	.691	.710	.729
	Efficiency %	70.98	72.91	74.95	76.80	78.45	79.92	81.44	82.86	84.09	85.19
2	Heat Loss, B.t.u.	.507	.522	.538	.553	.569	.585	.602	.618	.635	.652
	Efficiency %	74.00	75.78	77.59	79.24	80.72	82.05	83.40	84.70	85.77	86.75
2½	Heat Loss, B.t.u.	.473	.486	.500	.513	.527	.541	.555	.570	.585	.600
	Efficiency %	75.73	77.41	79.18	80.75	82.15	83.43	84.70	85.86	86.90	87.80
3	Heat Loss, B.t.u.	.439	.452	.465	.478	.492	.505	.519	.533	.547	.562
	Efficiency %	77.49	79.00	80.62	82.06	83.32	84.51	85.69	86.80	87.75	88.56
	Nominal pipe size ¾″										
1	Heat Loss, B.t.u.	.565	.582	.599	.617	.635	.653	.672	.690	.709	.728
	Efficiency %	71.02	72.96	75.03	76.82	78.49	79.97	81.46	82.90	84.11	85.21
1½	Heat Loss, B.t.u.	.509	.524	.540	.555	.571	.587	.604	.620	.637	.654
	Efficiency %	73.90	75.66	77.50	79.17	80.65	82.00	83.35	84.65	85.73	86.71
2	Heat Loss, B.t.u.	.453	.466	.480	.493	.507	.521	.536	.550	.565	.580
	Efficiency %	76.77	78.37	80.00	81.50	82.82	84.03	85.22	86.37	87.34	88.21
2½	Heat Loss, B.t.u.	.419	.430	.442	.453	.465	.477	.490	.502	.515	.528
	Efficiency %	78.51	80.04	81.59	83.00	84.25	85.36	86.49	87.56	88.45	89.26
3	Heat Loss, B.t.u.	.384	.395	.407	.418	.430	.442	.455	.467	.480	.493
	Efficiency %	80.30	81.65	83.05	84.30	85.44	86.45	87.45	88.42	89.25	89.98
	Nominal pipe size 1″										
1	Heat Loss, B.t.u.	.508	.524	.540	.556	.573	.589	.606	.623	.641	.658
	Efficiency %	73.94	75.66	77.50	79.15	80.59	81.95	83.29	84.55	85.64	86.62
1½	Heat Loss, B.t.u.	.457	.471	.485	.499	.514	.528	.543	.558	.574	.589
	Efficiency %	76.57	78.11	79.79	81.26	82.59	83.80	85.02	86.16	87.14	88.02
2	Heat Loss, B.t.u.	.401	.413	.425	.437	.450	.462	.475	.488	.502	.515
	Efficiency %	79.42	80.83	82.30	83.60	84.75	85.84	86.90	87.90	88.75	89.53
2½	Heat Loss, B.t.u.	.370	.380	.390	.400	.411	.421	.432	.443	.455	.466
	Efficiency %	81.02	82.35	83.75	85.00	86.07	87.09	88.09	89.02	89.80	90.53
3	Heat Loss, B.t.u.	.340	.350	.360	.370	.381	.391	.402	.413	.424	.435
	Efficiency %	82.56	83.75	85.00	86.11	87.09	88.00	88.91	89.76	90.50	91.16
	Nominal pipe size 1¼″										
1	Heat Loss, B.t.u.	.467	.481	.496	.510	.525	.540	.556	.571	.587	.603
	Efficiency %	76.05	77.68	79.32	80.85	82.21	83.45	84.66	85.84	86.85	87.75
1½	Heat Loss, B.t.u.	.415	.427	.440	.452	.465	.478	.492	.505	.519	.533
	Efficiency %	78.71	80.16	81.66	83.04	84.25	85.36	86.43	87.49	88.37	89.16
2	Heat Loss, B.t.u.	.370	.380	.391	.401	.412	.423	.435	.446	.458	.470
	Efficiency %	81.02	82.35	83.71	84.97	86.05	87.03	88.00	88.95	89.74	90.45
2½	Heat Loss, B.t.u.	.328	.337	.347	.356	.366	.376	.387	.397	.408	.419
	Efficiency %	83.17	84.35	85.55	86.64	87.60	88.46	89.32	90.16	90.85	91.49
3	Heat Loss, B.t.u.	.301	.310	.319	.328	.338	.347	.357	.367	.378	.388
	Efficiency %	84.56	85.60	86.71	87.70	88.55	89.36	90.15	90.90	91.53	92.12

June, 1931 (Cancelling 9-B-2-X-3 to 3-B and 9-B-2-X-4 to 4-B, dated September 1, 1928)

Printed in U.S.A.

ASBESTO-SPONGE FELTED (SECTIONAL)
HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiency expressed in percent of bare pipe losses.

Insulation thickness, inches		Temperature of pipe—deg. Fahr. 125	175	225	275	325	375	425	475	525	575
		Temperature difference between pipe and air—deg. Fahr. 50	100	150	200	250	300	350	400	450	500
	Nominal pipe size 1½"										
1	Heat Loss, B.t.u.	.444	.458	.472	.486	.501	.515	.530	.545	.561	.576
	Efficiency %	77.22	78.71	80.34	81.78	83.02	84.20	85.38	86.50	87.43	88.30
1½	Heat Loss, B.t.u.	.392	.404	.416	.428	.441	.453	.466	.479	.493	.506
	Efficiency %	79.90	81.24	82.67	83.94	85.05	86.09	87.14	88.14	88.95	89.70
2	Heat Loss, B.t.u.	.341	.351	.361	.371	.382	.392	.403	.414	.426	.437
	Efficiency %	82.50	83.73	84.95	86.08	87.05	87.97	88.88	89.74	90.45	91.12
2½	Heat Loss, B.t.u.	.307	.316	.325	.334	.344	.353	.363	.373	.384	.394
	Efficiency %	84.25	85.33	86.45	87.46	88.34	89.17	89.99	90.75	91.39	92.00
3	Heat Loss, B.t.u.	.280	.288	.297	.305	.314	.323	.333	.342	.352	.362
	Efficiency %	85.64	86.64	87.62	88.55	89.35	90.09	90.82	91.52	92.12	92.64
	Nominal pipe size 2"										
1	Heat Loss, B.t.u.	.414	.427	.440	.453	.467	.480	.494	.508	.523	.537
	Efficiency %	78.78	80.16	81.66	83.00	84.18	85.28	86.37	87.41	88.27	89.07
1½	Heat Loss, B.t.u.	.361	.372	.384	.395	.407	.419	.432	.444	.457	.470
	Efficiency %	81.49	82.73	84.00	85.19	86.20	87.15	88.09	89.00	89.76	90.45
2	Heat Loss, B.t.u.	.312	.321	.330	.339	.349	.358	.368	.378	.389	.399
	Efficiency %	84.00	85.09	86.25	87.26	88.17	89.02	89.85	90.64	91.28	91.90
2½	Heat Loss, B.t.u.	.279	.287	.295	.303	.312	.320	.329	.338	.348	.357
	Efficiency %	85.69	86.66	87.70	88.64	89.43	90.18	90.93	91.63	92.20	92.75
3	Heat Loss, B.t.u.	.254	.261	.269	.276	.284	.292	.300	.309	.318	.327
	Efficiency %	86.97	87.87	88.79	89.64	90.37	91.04	91.73	92.34	92.88	93.36
	Nominal pipe size 2½"										
1	Heat Loss, B.t.u.	.391	.403	.416	.428	.441	.454	.468	.481	.495	.509
	Efficiency %	79.95	81.30	82.67	83.94	85.05	86.07	87.10	88.08	88.91	89.65
1½	Heat Loss, B.t.u.	.339	.349	.360	.370	.381	.392	.403	.414	.426	.437
	Efficiency %	82.60	83.80	85.00	86.11	87.09	87.97	88.88	89.74	90.45	91.12
2	Heat Loss, B.t.u.	.291	.299	.308	.316	.325	.334	.344	.353	.363	.373
	Efficiency %	85.07	86.11	87.16	88.14	88.99	89.75	90.52	91.26	91.87	92.42
2½	Heat Loss, B.t.u.	.259	.266	.273	.280	.288	.295	.303	.311	.320	.328
	Efficiency %	86.71	87.65	88.62	89.50	90.24	90.95	91.65	92.30	92.83	93.31
3	Heat Loss, B.t.u.	.236	.242	.249	.255	.262	.269	.277	.284	.292	.300
	Efficiency %	87.90	88.76	89.63	90.43	91.12	91.74	92.36	92.96	93.46	93.91
	Nominal pipe size 3"										
1	Heat Loss, B.t.u.	.372	.383	.395	.406	.418	.430	.442	.454	.467	.479
	Efficiency %	80.92	82.20	83.54	84.76	85.84	86.80	87.81	88.75	89.54	90.26
1½	Heat Loss, B.t.u.	.321	.331	.341	.351	.361	.371	.382	.392	.403	.414
	Efficiency %	83.54	84.62	85.80	86.84	87.76	88.62	89.46	90.29	90.97	91.59
2	Heat Loss, B.t.u.	.272	.280	.288	.296	.305	.313	.322	.331	.341	.350
	Efficiency %	86.05	87.00	88.00	88.90	89.66	90.40	91.12	91.80	92.36	92.90
2½	Heat Loss, B.t.u.	.239	.246	.253	.260	.268	.275	.283	.290	.298	.306
	Efficiency %	87.74	88.56	89.46	90.25	90.92	91.56	92.20	92.82	93.32	93.78
3	Heat Loss, B.t.u.	.217	.223	.230	.236	.243	.219	.256	.263	.271	.278
	Efficiency %	88.87	89.64	90.41	91.14	91.77	92.36	92.94	93.48	93.93	94.35

June, 1931 (Cancelling 9-B-2-X-3 to 3-B and 9-B-2-X-4 to 4-B, dated September 1, 1928)

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ASBESTO-SPONGE FELTED (SECTIONAL)
HEAT LOSSES AND EFFICIENCIES (*continued*)

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.
Efficiency expressed in percent of bare pipe losses.

Insulation thickness, inches		125	175	225	275	325	375	425	475	525	575
	Temperature of pipe—deg. Fahr.	125	175	225	275	325	375	425	475	525	575
	Temperature difference between pipe and air—deg. Fahr.	50	100	150	200	250	300	350	400	450	500
	Nominal pipe size 3½″										
1	Heat Loss, B.t.u.	.360	.371	.383	.394	.406	.418	.431	.443	.456	.469
	Efficiency %	81.54	82.26	84.04	85.21	86.25	87.17	88.11	89.02	89.78	90.46
1½	Heat Loss, B.t.u.	.309	.318	.328	.337	.347	.357	.368	.378	.389	.400
	Efficiency %	84.15	85.22	86.34	87.35	88.24	89.05	89.85	90.64	91.28	91.88
2	Heat Loss, B.t.u.	.262	.269	.277	.284	.292	.300	.309	.317	.326	.335
	Efficiency %	86.55	87.50	88.45	89.35	90.11	90.80	91.48	92.14	92.70	93.20
2½	Heat Loss, B.t.u.	.228	.235	.242	.249	.256	.263	.271	.278	.286	.294
	Efficiency %	88.30	89.08	89.92	90.66	91.33	91.93	92.53	93.12	93.59	94.02
3	Heat Loss, B.t.u.	.204	.210	.216	.222	.229	.235	.242	.249	.257	.264
	Efficiency %	89.54	90.23	91.00	91.67	92.24	92.80	93.33	93.84	94.24	94.64
	Nominal pipe size 4″										
1	Heat Loss, B.t.u.	.350	.361	.372	.383	.395	.406	.418	.430	.443	.455
	Efficiency %	82.05	83.24	84.50	85.60	86.61	87.55	88.47	89.35	90.08	90.75
1½	Heat Loss, B.t.u.	.300	.309	.319	.328	.338	.347	.357	.367	.378	.388
	Efficiency %	84.61	85.65	86.71	87.70	88.55	89.36	90.15	90.90	91.53	92.12
2	Heat Loss, B.t.u.	.252	.259	.267	.274	.282	.290	.298	.306	.315	.323
	Efficiency %	87.07	87.96	88.87	89.71	90.45	91.10	91.78	92.42	92.94	93.44
2½	Heat Loss, B.t.u.	.220	.226	.233	.239	.246	.253	.260	.267	.275	.282
	Efficiency %	88.71	89.50	90.29	91.04	91.67	92.24	92.83	93.38	93.84	94.27
3	Heat Loss, B.t.u.	.197	.203	.209	.215	.221	.227	.234	.240	.247	.254
	Efficiency %	89.90	90.56	91.29	91.94	92.52	93.04	93.55	94.06	94.46	94.84
	Nominal pipe size 4½″										
1	Heat Loss, B.t.u.	.345	.356	.367	.378	.389	.400	.412	.424	.436	.448
	Efficiency %	82.30	83.46	84.70	85.80	86.82	87.74	88.64	89.50	90.23	90.90
1½	Heat Loss, B.t.u.	.291	.300	.309	.318	.328	.337	.347	.357	.368	.378
	Efficiency %	85.07	86.06	87.12	88.06	88.89	89.66	90.43	91.15	91.75	92.32
2	Heat Loss, B.t.u.	.245	.252	.260	.267	.275	.282	.290	.297	.305	.313
	Efficiency %	87.44	88.30	89.16	89.98	90.69	91.35	92.00	92.64	93.16	93.64
2½	Heat Loss, B.t.u.	.214	.220	.226	.232	.239	.245	.252	.259	.267	.274
	Efficiency %	89.02	89.78	90.58	91.30	91.90	92.48	93.05	93.58	94.02	94.44
3	Heat Loss, B.t.u.	.191	.196	.202	.207	.213	.219	.226	.232	.239	.246
	Efficiency %	90.20	90.90	91.58	92.24	92.78	93.28	93.77	94.26	94.64	95.00
	Nominal pipe size 5″										
1	Heat Loss, B.t.u.	.337	.347	.358	.368	.379	.390	.401	.412	.424	.435
	Efficiency %	82.72	83.89	85.09	86.18	87.15	88.04	88.94	89.78	90.50	91.16
1½	Heat Loss, B.t.u.	.286	.295	.304	.313	.322	.331	.341	.350	.360	.370
	Efficiency %	85.34	86.30	87.34	88.25	89.09	89.85	90.60	91.32	91.94	92.48
2	Heat Loss, B.t.u.	.238	.245	.252	.259	.267	.274	.282	.289	.297	.305
	Efficiency %	87.79	88.62	89.50	90.28	90.95	91.60	92.22	92.84	93.35	93.80
2½	Heat Loss, B.t.u.	.207	.213	.219	.225	.232	.238	.245	.251	.258	.265
	Efficiency %	89.38	90.10	90.87	91.56	92.14	92.70	93.24	93.78	94.22	94.62
3	Heat Loss, B.t.u.	.185	.190	.196	.201	.207	.212	.218	.224	.231	.237
	Efficiency %	90.51	91.18	91.84	92.46	92.99	93.48	93.99	94.45	94.82	95.18

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ASBESTO-SPONGE FELTED (SECTIONAL)
HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiency expressed in percent of bare pipe losses.

Insulation thickness, inches		Temperature of pipe—deg. Fahr. 125 / Temperature difference between pipe and air—deg. Fahr. 50	175 / 100	225 / 150	275 / 200	325 / 250	375 / 300	425 / 350	475 / 400	525 / 450	575 / 500
	Nominal pipe size 6"										
1	Heat Loss, B.t.u.	.327	.337	.348	.358	.369	.379	.390	.401	.413	.424
	Efficiency %	83.24	84.35	85.50	86.55	87.50	88.37	89.25	90.06	90.75	91.38
1½	Heat Loss, B.t.u.	.277	.285	.294	.302	.311	.320	.330	.339	.349	.359
	Efficiency %	85.75	86.76	87.75	88.66	89.46	90.18	90.90	91.60	92.18	92.70
2	Heat Loss, B.t.u.	.228	.235	.242	.249	.256	.263	.270	.277	.285	.292
	Efficiency %	88.30	89.08	89.92	90.66	91.33	91.93	92.56	93.14	93.62	94.07
2½	Heat Loss, B.t.u.	.198	.203	.209	.214	.220	.226	.233	.239	.246	.253
	Efficiency %	89.85	90.56	91.29	91.98	92.54	93.06	93.57	94.08	94.49	94.86
3	Heat Loss, B.t.u.	.176	.181	.186	.191	.196	.201	.207	.213	.220	.226
	Efficiency %	90.98	91.60	92.25	92.84	93.36	93.84	94.39	94.72	95.07	95.41
	Nominal pipe size 7"										
1	Heat Loss, B.t.u.	.322	.332	.342	.352	.363	.373	.384	.395	.407	.418
	Efficiency %	83.48	84.60	85.75	86.82	87.70	88.56	89.69	90.21	90.89	91.50
1½	Heat Loss, B.t.u.	.269	.277	.286	.294	.303	.311	.320	.329	.339	.348
	Efficiency %	86.20	87.14	88.08	88.96	89.74	90.46	91.17	91.84	92.40	92.93
2	Heat Loss, B.t.u.	.222	.228	.235	.241	.248	.255	.262	.269	.276	.284
	Efficiency %	88.61	89.40	90.21	90.96	91.60	92.18	92.78	93.34	93.82	94.23
2½	Heat Loss, B.t.u.	191	.196	.202	.207	.213	.219	.225	.231	.238	.244
	Efficiency %	90.20	90.90	91 58	92.24	92.78	93.28	93.80	94.28	94.67	95.04
3	Heat Loss, B.t.u.	169	.174	.179	.184	.189	.194	.200	.205	.211	.217
	Efficiency %	91.33	91.92	92.55	93.10	93.60	94.05	94.49	94.92	95.27	95.59
	Nominal pipe size 8"										
1	Heat Loss, B.t.u.	.314	.324	.334	.344	.354	.364	.375	.386	.398	.409
	Efficiency %	83.90	84.95	86.08	87.10	88.00	88.84	89.65	90.44	91.08	91.69
1½	Heat Loss, B.t.u.	.264	.272	.280	.288	.297	.305	.314	.323	.333	.342
	Efficiency %	86.45	87.36	88.33	89.20	89.94	90.64	91.34	92.00	92.54	93.06
2	Heat Loss, B.t.u.	.217	.223	.230	.236	.243	.249	.256	.263	.271	.278
	Efficiency %	88.87	89.64	90.41	91.14	91.77	92.36	92.94	93.48	93.93	94.35
2½	Heat Loss, B.t.u.	.186	.191	.197	.202	.208	.213	.219	.225	.232	.238
	Efficiency %	90.46	91.13	91.79	92.44	92.95	93.46	93.96	94.43	94.80	95.16
3	Heat Loss, B.t.u.	.165	.169	.174	.178	.183	.188	.194	.199	.205	.211
	Efficiency %	91.54	92.16	92.75	93.32	93.80	94.24	94.65	95.07	95.41	95.71
	Nominal pipe size 9"										
1	Heat Loss, B.t.u.	.312	.321	.331	.341	.351	.362	.373	.384	.395	.407
	Efficiency %	84.00	85.09	86.20	87.20	88.10	88.90	89.72	90.49	91.15	91.73
1½	Heat Loss, B.t.u.	.261	.269	.277	.285	.294	.302	.311	.319	.328	.337
	Efficiency %	86.61	87.50	88 45	89.30	90.04	90.74	91.42	92.10	92.65	93.16
2	Heat Loss, B.t.u.	.213	.219	.225	.232	.239	.245	.252	.259	.267	.274
	Efficiency %	89.08	89.81	90.62	91.30	91.90	92.48	93.05	93.58	94.02	94.44
2½	Heat Loss, B.t.u.	.182	.187	.192	.197	.203	.208	.214	.220	.227	.233
	Efficiency %	90.66	91.32	92.00	92.61	93.12	93.62	94.10	94.55	94.91	95.26
3	Heat Loss, B.t.u.	.161	.165	.170	.174	.179	.184	.189	.194	.200	.205
	Efficiency %	91.74	92.34	92.92	93.47	93.94	94.36	94.79	95.19	95.52	95.83

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ASBESTO-SPONGE FELTED (SECTIONAL) HEAT LOSSES AND EFFICIENCIES *(continued)*

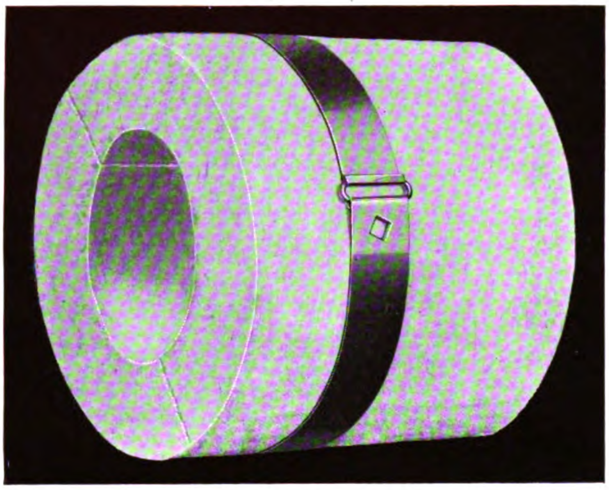
Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.
Efficiency expressed in percent of bare pipe losses.

Insulation thickness, inches	Temperature of pipe—deg. Fahr. → Temperature difference between pipe and air—deg. Fahr. →	125 50	175 100	225 150	275 200	325 250	375 300	425 350	475 400	525 450	575 500
	Nominal pipe size 10″										
1½	Heat Loss, B.t.u.	.255	.263	.271	.279	.287	.295	.304	.312	.321	.330
	Efficiency %	86.92	87.79	88.70	89.53	90.27	90.95	91.62	92.26	92.80	93.30
2	Heat Loss, B.t.u.	.209	.215	.221	.227	.234	.240	.247	.253	.260	.267
	Efficiency %	89.29	90.02	90.79	91.48	92.07	92.64	93.19	93.74	94.17	94.58
2½	Heat Loss, B.t.u.	.178	.183	.188	.193	.199	.204	.210	.215	.221	.227
	Efficiency %	90.87	91.50	92.16	92.76	93.26	93.74	94.21	94.68	95.04	95.39
3	Heat Loss, B.t.u.	.157	.161	.165	.169	.174	.178	.183	.188	.194	.199
	Efficiency %	91.95	92.52	93.13	93.66	94.10	94.54	94.95	95.34	95.65	95.96
	Nominal pipe size 12″										
1½	Heat Loss, B.t.u.	.252	.259	.267	.274	.282	.290	.299	.307	.316	.325
	Efficiency %	87.07	87.96	88.87	89.71	90.45	91.10	91.75	92.40	92.92	93.40
2	Heat Loss, B.t.u.	.205	.210	.216	.222	.228	.234	.241	.247	.254	.261
	Efficiency %	89.50	90.23	91.00	91.67	92.28	92.82	93.36	93.88	94.30	94.70
2½	Heat Loss, B.t.u.	.173	.178	.183	.188	.193	.198	.204	.209	.215	.221
	Efficiency %	91.13	91.74	92.37	92.94	93.46	93.92	94.38	94.82	95.18	95.51
3	Heat Loss, B.t.u.	.152	.156	.160	.164	.169	.173	.178	.182	.187	.192
	Efficiency %	92.20	92.76	93.34	93.84	94.28	94.69	95.09	95.49	95.81	96.10
	Nominal pipe size 14″										
1½	Heat Loss, B.t.u.	.249	.256	.264	.271	.279	.287	.295	.303	.312	.320
	Efficiency %	87.22	88.10	89.00	89.83	90.55	91.20	91.86	92.50	93.00	93.50
2	Heat Loss, B.t.u.	.202	.207	.213	.218	.224	.230	.236	.242	.249	.255
	Efficiency %	89.64	90.38	91.12	91.82	92.42	92.95	93.50	94.00	94.42	94.82
2½	Heat Loss, B.t.u.	.172	.176	.181	.185	.190	.195	.201	.206	.212	.218
	Efficiency %	91.18	91.83	92.46	93.06	93.56	94.02	94.47	94.90	95.24	95.57
3	Heat Loss, B.t.u.	.150	.154	.158	.162	.166	.170	.175	.179	.184	.189
	Efficiency %	92.31	92.85	93.42	93.92	94.38	94.78	95.18	95.57	95.88	96.16
	Nominal pipe size 16″										
1½	Heat Loss, B.t.u.	.247	.254	.262	.269	.277	.282	.292	.300	.309	.317
	Efficiency %	87.34	88.20	89.08	89.90	90.61	91.29	91.95	92.57	93.08	93.56
2	Heat Loss, B.t.u.	.201	.206	.212	.217	.223	.228	.234	.240	.247	.253
	Efficiency %	89.69	90.44	91.16	91.86	92.45	93.00	93.55	94.06	94.46	94.86
2½	Heat Loss, B.t.u.	.170	.174	.179	.183	.188	.193	.198	.203	.209	.214
	Efficiency %	91.28	91.92	92.55	93.12	93.63	94.08	94.54	94.97	95.32	95.65
3	Heat Loss, B.t.u.	.149	.152	.156	.159	.163	.167	.172	.176	.181	.186
	Efficiency %	92.36	92.94	93.50	94.03	94.48	94.88	95.26	95.64	95.94	96.22
	Nominal pipe size 18″										
1½	Heat Loss, B.t.u.	.245	.252	.259	.266	.274	.281	.289	.297	.306	.314
	Efficiency %	87.44	88.30	89.21	90.02	90.72	91.38	92.03	92.64	93.14	93.62
2	Heat Loss, B.t.u.	.200	.205	.210	.215	.221	.226	.232	.238	.245	.251
	Efficiency %	89.74	90.48	91.25	91.94	92.52	93.06	93.60	94.10	94.51	94.90
2½	Heat Loss, B.t.u.	.167	.171	.176	.180	.185	.189	.194	.199	.205	.210
	Efficiency %	91.44	92.06	92.66	93.24	93.73	94.20	94.65	95.07	95.41	95.73
3	Heat Loss, B.t.u.	.147	.150	.154	.157	.161	.165	.169	.173	.178	.182
	Efficiency %	92.46	93.04	93.58	94.11	94.55	94.94	95.34	95.71	96.01	96.30

Printed in U.S.A.

J-M 85% Magnesia Pipe Insulation

For temperatures to 600 deg. F.



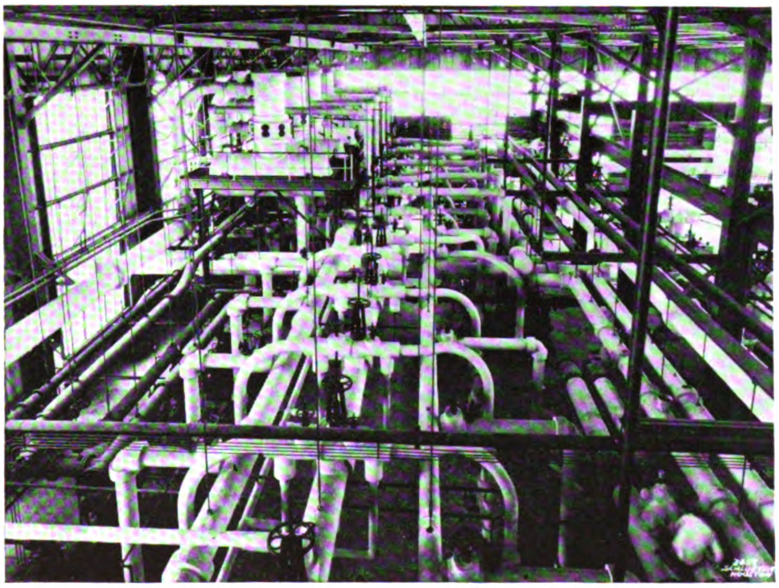
J-M 85% Magnesia Insulation, suitable for temperatures up to 600 deg. F., combines the high insulating qualities of carbonate of magnesia and asbestos, affording a light, efficient insulation.

Under actual service conditions, J-M 85% Magnesia has proved to be the most durable and efficient insulation of the moulded type. The J-M manufacturing process produces an 85% Magnesia with the maximum number of voids or minute dead-air cells which increase its natural resistance to heat transmission and reduce its weight. In addition, it provides maximum mechanical strength consistent with high efficiency.

85% Magnesia Pipe Insulation is made in sections and segments 3 ft. long and in the following thicknesses: Standard, 1½″, 2″, 2½″, Double Standard, and 3″ (broken joint), with canvas jacket and brass lacquered bands, to fit standard pipe sizes.

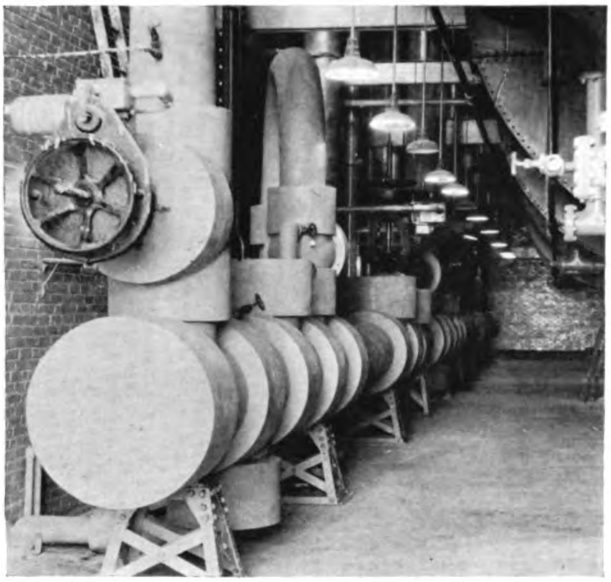
Insulation for the smaller pipe sizes is furnished sectional. For pipe sizes larger than 10″, single layer insulation, or the inner layer of double layer insulation, is furnished in segments, except that when specifically ordered, 12″ and 14″ sizes can be furnished in sectional form, 1½″ thick, and 12″ size in sectional form, 2″ thick.

Second layer insulation is furnished segmental when it is to be applied on pipes 9″ or larger, except that 1½″ and 2″ thick second layers on 9″ pipes, and 1½″ thick second layers on 10″ pipes, may be secured in sectional form when specifically so ordered.



J-M 85% Magnesia on the steam lines of the Newgulf plant of the Texas Gulf Sulphur Co.

Printed in U.S.A.



J-M 85% Magnesia Pipe Insulation on main steam header

The terms Standard Thick and Double Standard Thick apply *only* to 85% Magnesia Pipe Insulation. Double Standard is furnished in two layers, each layer Standard thick. The table gives actual thickness of Standard and Double Standard Thick Magnesia.

Pipe size, inches	Standard thick, inches	Double Standard thick, inches	Pipe size, inches	Standard thick, inches	Double Standard thick, inches
½	⅞	1¾	6	1⅛	2¼
¾	⅞	1¾	7	1¼	2½
1	⅞	1¾	8	1¼	2½
1¼	⅞	1¾	9	1¼	2½
1½	⅞	1¾	10	1¼	2½
2	1 1/32	2 1/16	12	1½	3
2½	1 1/32	2 1/16	14	1½	3
3	1 1/32	2 1/16	16	1½	3
3½	1 1/32	2 1/16	18	1½	3
4	1⅛	2¼	20	1½	3
4½	1⅛	2¼	24	1½	3
5	1⅛	2¼	30	1½	3

Also furnished in the forms of block and lagging as described in another data sheet.

Weight in pounds per standard 3-foot section, uncrated

Thickness, inches	Nominal pipe sizes, inches																	
	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
Std.	1.62	1.85	2.02	2.39	2.74	3.77	4.30	5.0	5.57	6.83	7.42	8.05	9.35	11.9	13.2	14.5	16.1	23.0
1½	3.77	4.12	4.59	5.10	5.52	6.27	7.16	8.1	8.88	9.70	10.50	11.40	13.10	14.7	16.3	18.0	19.8	23.0
Dbl. Std.	4.86	5.31	5.80	6.42	7.23	9.82	10.90	12.3	13.40	16.40	17.60	19.00	21.50	27.3	29.9	32.6	35.7	50.7
2	6.11	6.75	7.30	7.89	8.40	9.42	10.60	11.9	12.90	14.00	15.20	16.40	18.60	20.8	23.0	25.1	27.5	31.6
2½	8.95	9.80	10.50	11.25	11.90	13.20	14.50	16.1	17.40	18.80	20.00	21.55	24.50	27.3	29.9	32.6	35.7	40.9
3	12.40	13.20	14.00	15.20	16.00	17.40	19.10	21.1	22.60	24.20	25.90	27.70	31.10	34.4	37.5	40.7	44.3	50.7

June, 1931 (Cancelling 9-B-3-A-1, dated September 1, 1928)

Printed in U.S.A.

J-M 85% Magnesia Insulation Specification for pipes conveying heated fluids

MATERIALS

The insulation furnished under this specification shall be Johns-Manville 85% Magnesia suitable for use at temperatures up to 600 deg. F. without cracking, crumbling or otherwise failing mechanically. This material shall contain not less than 95% by weight of a mixture of hydrated basic magnesium carbonate [$4MgCO_3 \cdot Mg(OH)_2 \cdot 5H_2O$] and long fibre asbestos. The mixture of magnesia and asbestos shall be homogeneous throughout and such that not less than 85% shall be hydrated basic magnesium carbonate and not less than 10% asbestos fibre.

The material shall be furnished in sectional or segmental form for application to pipes and in block form for application to irregular surfaces, such as fittings.

The hard finish Asbestos Cement furnished under this specification shall be a long fibre first quality asbestos cement suitable to withstand the temperatures to which it will be subjected.

THICKNESS

(a) *Piping:*

(1) *Indoors:*

All piping located indoors shall be insulated to a thickness not less than that given in the following table, for the temperature conditions stated therein.

Steam pressure or condition	Temperature	Thickness of Insulation		
		Pipes larger than 4"	Pipes 2" to 4"	Pipes smaller than 2"
Hot Water....	....	Std.	Std.	Std.
0 to 25 lbs..	212 to 266° F.	Std.	Std.	Std.
25 to 100 lbs...	267 to 337° F.	1½"	Std.	Std.
100 to 200 lbs...	338 to 387° F.	2"	1½"	Std.
Low Superheat.	388 to 499° F.	Dbl. Std.	2"	1½"
Superheat.....	500 to 600° F.	3"	Dbl. Std.	2"

(2) *Outdoors:*

All piping located outdoors, or exposed to the weather, shall be insulated to thicknesses not less than ½" greater than those given in the foregoing table for piping located indoors.

(b) *Fittings, Valves and Flanges:*

See other data sheets.

APPLICATION

(a) *Piping:*

2½" thick and less (except Double Standard):

All sectional insulation 2½" and less in thickness, except Double Standard, shall be applied in a single layer, with the joints tightly butted together and the insulation held in place with not less than three separate loops of 16-gauge annealed iron wire.

3" thick and Double Standard:

All sectional insulation 3" and Double Standard in thickness shall be applied in two equal layers to make up the thickness specified.

The first layer with all joints tightly butted shall be securely wired to the pipe with not less than 3 loops of 16-gauge annealed iron wire on pipes up to and including 6", and not less than 4 loops on larger pipes.

The second layer shall be applied over the first so that both circumferential and horizontal joints are broken, and shall be held in place on pipes up to and including 6" with not less than three loops of 16-gauge annealed iron wire.

On pipes 8" and larger the second layer shall be held in place by not less than 4 loops of 16-gauge annealed iron wire. The ends of these wire loops shall be tightly twisted together and bent over and hammered into the insulation so as to leave no projection.

Segmental block insulation and that on bends shall be given a thin finishing coat of hard finish Asbestos Cement to present a smooth, even surface.

Canvas shall in all cases be omitted from the inner layer of insulation where the insulation is applied in two layers.

All of the above insulation shall be stopped off a sufficient distance from all flanges to permit the easy removal of the bolts when the ends of the insulation are beveled back from the pipe to the outside of the insulation at an angle of 45 degrees with the axis of the pipe.

Printed in U.S.A.

(b) *Fittings, Valves and Flanges*:
See other data sheets.

FINISH

(a) *Piping:*

(1) *Indoors:*

All insulation on piping located indoors shall be enclosed in an extra jacket of 8-oz. canvas sewed on over rosin-sized paper. All seams shall be located where least visible and the stitches shall be not less than three to the inch.

Where re-canvasing is not desired the light canvas jacket regularly furnished with the insulation shall be neatly pasted down over all laps.

All cement surfaces shall be finally finished with a jacket of 8-oz. canvas neatly and securely pasted on.

(2) *Outdoors:*

All insulation on piping located outdoors or exposed to the weather shall be finished with a Double Coated Flexstone weatherproof jacket. All joints in the jacket shall be lapped at least 3″ and sealed with Lap Cement.* The jacket shall be securely wired in place by means of loops of No. 16 B. & S. gauge Copperweld wire placed on not less than 4″ centers.

On horizontal pipes the seams of the weatherproof jacket shall be placed at the side of the pipe with the lap turned down in order to shed the water.

Piping located close to the ground or where there is danger of the jacket being subjected to mechanical injury, shall be protected by means of a suitable metal jacket.

(b) *Fittings, Valves and Flanges:*
See other data sheets.

PAINTING

All insulation finished with a jacket of 8-oz. canvas, shall be finally painted with first, one coat of glue sizing and then not less than two coats of first quality lead and oil paint, of a color selected by the purchaser.

All of the above insulation shall be applied by the manufacturer of the materials used, or his approved contractor.

*A liquid asphalt cement, furnished in 1, 5, 25 and 50-gal. containers.

Printed in U.S.A.

J-M 85% Magnesia (sectional) Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiency expressed in percent of bare pipe losses.

Insulation thickness, inches	Temperature of pipe—deg. Fahr.	125	175	225	275	325	375	425	475	525	575
	Temperature difference between pipe and air—deg. Fahr.	50	100	150	200	250	300	350	400	450	500
Nominal pipe size ½"											
Std.	Heat Loss, B.t.u.....	.788	.803	.819	.834	.850	.867	.883	.900	.916	.933
	Efficiency %........	59.51	62.70	65.89	68.72	71.18	73.40	75.68	77.69	79.45	81.05
1½	Heat Loss, B.t.u.....	.650	.660	.671	.681	.692	.703	.715	.726	.737	.749
	Efficiency %........	66.65	69.34	72.03	74.45	76.54	78.42	80.29	82.00	83.48	84.79
Dbl. Std.	Heat Loss, B.t.u.....	.615	.624	.633	.643	.653	.664	.674	.685	.696	.707
	Efficiency %........	68.45	71.00	73.63	75.89	77.85	79.62	81.41	83.00	84.40	85.63
2	Heat Loss, B.t.u.....	.585	.594	.603	.612	.621	.631	.641	.651	.661	.671
	Efficiency %........	70.00	72.40	74.89	77.05	78.95	80.64	82.33	83.87	85.19	86.36
2½	Heat Loss, B.t.u.....	.540	.548	.556	.564	.573	.581	.590	.599	.608	.618
	Efficiency %........	72.30	74.55	76.80	78.85	80.57	82.18	83.74	85.15	86.37	87.44
3	Heat Loss, B.t.u.....	.506	.513	.521	.528	.536	.545	.553	.562	.571	.580
	Efficiency %........	74.05	76.15	78.29	80.18	81.83	83.28	84.75	86.06	87.20	88.21
Nominal pipe size ¾"											
Std.	Heat Loss, B.t.u.....	.714	.728	.742	.756	.771	.787	.803	.819	.835	.852
	Efficiency %........	63.40	66.17	69.10	71.63	73.86	75.85	77.87	79.70	81.29	82.69
1½	Heat Loss, B.t.u.....	.581	.589	.598	.608	.618	.628	.638	.649	.659	.670
	Efficiency %........	70.20	72.62	75.09	77.20	79.05	80.70	82.41	83.91	85.23	86.37
Dbl. Std.	Heat Loss, B.t.u.....	.547	.555	.564	.573	.583	.592	.602	.611	.621	.631
	Efficiency %........	71.95	74.20	76.54	78.50	80.24	81.84	83.40	84.85	86.08	87.17
2	Heat Loss, B.t.u.....	.519	.528	.536	.545	.553	.562	.570	.579	.588	.598
	Efficiency %........	73.40	75.45	77.65	79.54	81.25	82.75	84.28	85.64	86.82	87.85
2½	Heat Loss, B.t.u.....	.476	.483	.491	.498	.505	.513	.522	.530	.538	.547
	Efficiency %........	75.56	77.55	79.54	81.32	82.87	84.26	85.60	86.85	87.94	88.89
3	Heat Loss, B.t.u.....	.443	.450	.457	.464	.471	.478	.486	.493	.501	.508
	Efficiency %........	77.29	79.10	80.95	82.60	84.04	85.34	86.60	87.77	88.76	89.67
Nominal pipe size 1"											
Std.	Heat Loss, B.t.u.....	.652	.665	.678	.692	.706	.720	.734	.749	.764	.780
	Efficiency %........	66.55	69.09	71.78	74.04	76.05	77.90	79.75	81.43	82.87	84.15
1½	Heat Loss, B.t.u.....	.522	.530	.539	.548	.557	.566	.575	.584	.594	.604
	Efficiency %........	73.21	75.38	77.54	79.43	81.11	82.64	84.15	85.52	86.69	87.72
Dbl. Std.	Heat Loss, B.t.u.....	.489	.497	.505	.513	.521	.529	.538	.547	.555	.564
	Efficiency %........	74.94	76.90	78.97	80.76	82.34	83.77	85.16	86.44	87.56	88.54
2	Heat Loss, B.t.u.....	.462	.470	.478	.486	.494	.501	.509	.517	.525	.533
	Efficiency %........	76.33	78.15	80.10	81.76	83.25	84.63	85.96	87.19	88.24	89.16
2½	Heat Loss, B.t.u.....	.421	.428	.435	.442	.449	.456	.463	.470	.477	.484
	Efficiency %........	78.40	80.12	81.88	83.41	84.77	86.00	87.24	88.35	89.31	90.16
3	Heat Loss, B.t.u.....	.390	.397	.403	.409	.415	.422	.428	.435	.442	.449
	Efficiency %........	80.00	81.55	83.20	84.65	85.93	87.05	88.20	89.21	90.09	90.87
Nominal pipe size 1¼"											
Std.	Heat Loss, B.t.u.....	.600	.613	.626	.639	.652	.665	.678	.692	.706	.721
	Efficiency %........	69.20	71.50	73.90	76.03	77.90	79.60	81.30	82.84	84.16	85.34
1½	Heat Loss, B.t.u.....	.472	.480	.488	.496	.504	.512	.520	.528	.537	.547
	Efficiency %........	75.80	77.70	79.66	81.39	82.91	84.30	85.66	86.91	87.92	88.89
Dbl. Std.	Heat Loss, B.t.u.....	.440	.448	.456	.463	.471	.478	.486	.493	.501	.509
	Efficiency %........	77.44	79.20	81.00	82.64	84.04	85.34	86.60	87.77	88.76	89.65
2	Heat Loss, B.t.u.....	.415	.422	.428	.435	.442	.448	.455	.463	.470	.478
	Efficiency %........	78.71	80.40	82.16	83.69	85.03	86.26	87.45	88.52	89.46	90.28
2½	Heat Loss, B.t.u.....	.375	.381	.387	.393	.398	.404	.410	.417	.424	.432
	Efficiency %........	80.77	82.30	83.86	85.25	86.51	87.61	88.69	89.66	90.50	91.22
3	Heat Loss, B.t.u.....	.346	.351	.357	.362	.367	.373	.379	.385	.391	.398
	Efficiency %........	82.26	83.69	85.11	86.42	87.56	88.56	89.55	90.46	91.24	91.91

June, 1931 (Cancelling 9-B-3-X-3 to 3-B and 9-B-3-X-4 to 4-B, dated in 1928 and 1929)

Printed in U.S.A.

J-M 85% MAGNESIA (SECTIONAL) HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiency expressed in percent of bare pipe losses.

Insulation thickness, inches	Temperature of pipe—deg. Fahr.	125	175	225	275	325	375	425	475	525	575
	Temperature difference between pipe and air—deg. Fahr.	50	100	150	200	250	300	350	400	450	500

Nominal pipe size 1½"

Std.	Heat Loss, B.t.u.....	.575	.586	.598	.611	.623	.636	.650	.663	.677	.691
	Efficiency %........	70.50	72.77	75.10	77.09	78.89	80.49	82.09	83.56	84.81	85.95
1½	Heat Loss, B.t.u.....	.447	.454	.461	.469	.477	.485	.493	.502	.511	.519
	Efficiency %........	77.09	78.90	80.77	82.40	83.83	85.12	86.40	87.56	88.55	89.45
Dlb. Std.	Heat Loss, B.t.u.....	.416	.422	.428	.435	.442	.450	.457	.465	.473	.482
	Efficiency %........	78.68	80.39	82.16	83.69	85.02	86.20	87.40	88.47	89.40	90.20
2	Heat Loss, B.t.u.....	.391	.397	.403	.410	.417	.423	.430	.437	.444	.451
	Efficiency %........	79.95	81.55	83.20	84.62	85.86	87.03	88.15	89.16	90.05	90.83
2½	Heat Loss, B.t.u.....	.351	.357	.362	.368	.374	.380	.386	.392	.398	.405
	Efficiency %........	82.00	83.41	84.91	86.19	87.32	88.34	89.36	90.29	91.08	91.77
3	Heat Loss, B.t.u.....	.324	.329	.334	..339	.345	.350	.356	.362	.368	.373
	Efficiency %........	83.38	84.71	86.09	87.29	88.30	89.27	90.19	91.04	91.75	92.42

Nominal pipe size 2"

Std.	Heat Loss, B.t.u.....	.496	.506	.516	.526	.536	.547	.557	568	.579	.590
	Efficiency %........	74.55	76.49	78.50	80.27	81.83	83.22	84.64	85 92	87.02	88.01
1½	Heat Loss, B.t.u.....	.412	.419	.427	.434	.442	.449	.457	.464	.472	.479
	Efficiency %........	78.88	80.54	82.21	83.72	85.02	86.22	87.40	88.50	89.42	90.26
2	Heat Loss, B.t.u.....	.356	.362	.367	.373	.379	.385	.392	.398	.405	.412
	Efficiency %........	81.74	83.17	84.71	86.00	87.16	88.19	89.19	90.14	90.92	91.63
Dbl. Std.	Heat Loss, B.t.u.....	.352	.357	.363	.368	.373	.379	.385	.391	.398	.405
	Efficiency %........	81.95	83.41	84.87	86.19	87.35	88.36	89.39	90.31	91 08	91 77
2½	Heat Loss, B.t.u.....	.318	.323	.328	.333	.338	.344	.350	.356	.362	.367
	Efficiency %........	83.69	84.99	86.33	87.50	88.55	89.45	90.35	91.18	91.89	92.54
3.	Heat Loss, B.t.u.....	.292	.296	.301	.306	.311	.315	.320	.325	.330	.335
	Efficiency %........	85.02	86.25	87.46	88.51	89.46	90.33	91.18	91.94	92.60	93.19

Nominal pipe size 2½"

Std.	Heat Loss, B.t.u.....	.470	.480	.490	.500	.510	.520	.530	.540	.551	.562
	Efficiency %........	75.90	77.70	79.58	81.24	82.71	84.05	85.39	86.61	87.65	88.57
1½	Heat Loss, B.t.u.....	.381	.389	.397	.404	.412	.420	.428	.435	.443	.451
	Efficiency %........	80.46	81.92	83.45	84.85	86.04	87.11	88.20	89.21	90.07	90.83
2	Heat Loss, B.t.u.....	.332	.337	.342	.348	.353	.358	.364	.370	.376	.382
	Efficiency %........	82.98	84.34	85.75	86.94	88.04	89.01	89.96	90.83	91.57	92.24
Dbl. Std.	Heat Loss, B.t.u.....	.327	.332	.337	.342	.348	.353	.358	.364	.370	.376
	Efficiency %........	83.24	84.57	85.95	87.16	88.20	89.16	90.13	90.98	91.71	92.36
2½	Heat Loss, B.t.u....	.293	.298	.303	.308	.313	.319	.324	.330	.335	.340
	Efficiency %........	84.98	86.15	87.36	88.44	89.39	90.21	91.06	91.82	92.49	93.09
3	Heat Loss, B.t.u.....	269	.273	.277	.281	.285	.290	.294	.299	.304	.309
	Efficiency %........	86.21	87.30	88.45	89.46	90.34	91.10	91.89	92.60	93.19	93.72

Nominal pipe size 3"

Std.	Heat Loss, B.t.u.....	.448	.458	.467	.477	.487	.497	.507	.517	.527	.537
	Efficiency %........	77.02	78.70	80.54	82.10	83.49	84.75	86.02	87.19	88.19	89.09
1½	Heat Loss, B.t.u.....	.364	.370	.377	.383	.390	.397	.403	.410	.418	.425
	Efficiency %........	81.34	82.80	84.29	85.63	86.79	87.81	88.89	89.84	90.64	91.36
2	Heat Loss, B.t.u.....	.310	.315	.320	.326	.331	.337	.342	.348	.353	.359
	Efficiency %........	84.10	85.35	86.66	87.77	88.78	89.66	90.56	91.37	92.09	92.70
Dbl. Std.	Heat Loss, B.t.u.....	.303	.309	.314	.319	.325	.330	.335	.341	.347	.352
	Efficiency %........	84.46	85.64	86.92	88.03	88.98	89.87	90.76	91.54	92.22	92.84
2½	Heat Loss, B.t.u. ..	.274	.278	.283	.287	.292	.296	.301	.306	.311	.316
	Efficiency %........	85.95	87.08	88.20	89.24	90.10	90.92	91.70	92.41	93.03	93.58
3	Heat Loss, B.t.u.....	.248	.252	.256	.260	.264	.268	.272	.276	.280	.285
	Efficiency %........	87.29	88.29	89.33	90.25	91.05	91.78	92.50	93.16	93.72	94.21

June, 1931 (Cancelling 9-B-3-X-3 to 3-B and 9-B-3-X-4 to 4-B, dated in 1928 and 1929)

Printed in U.S.A.

J-M 85% MAGNESIA (SECTIONAL) HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.
Efficiency expressed in percent of bare pipe losses.

Insulation thickness, inches	Temperature of pipe—deg. Fahr. / Temperature difference between pipe and air—deg. Fahr.	125 / 50	175 / 100	225 / 150	275 / 200	325 / 250	375 / 300	425 / 350	475 / 400	525 / 450	575 / 500
Nominal pipe size 3½″											
Std.	Heat Loss, B.t.u.....	.435	.444	.453	.462	.472	.481	.491	.501	.511	.521
	Efficiency %........	77.70	79.35	81.12	82.66	84.00	85.24	86.46	87.58	88.55	89.41
1½	Heat Loss, B.t.u.....	.350	.356	.363	.369	.376	.382	.389	.396	.403	.410
	Efficiency %........	82.05	83.44	84.87	86.15	87.26	88.28	89.27	90.18	90.96	91.66
2	Heat Loss, B.t.u.....	.297	.302	.307	.312	.317	.322	.327	.333	.338	.343
	Efficiency %........	84.77	85.96	87.20	88.29	89.26	90.12	90.99	91.74	92.42	93.03
Dbl. Std.	Heat Loss, B.t.u.....	.289	.294	.298	.303	.308	.313	.318	.324	.330	.336
	Efficiency %........	85.19	86.33	87.58	88.63	89.56	90.40	91.24	91.96	92.60	93.18
2½	Heat Loss, B.t.u.....	.258	.263	.268	.272	.277	.282	.287	.292	.298	.303
	Efficiency %........	86.76	87.76	88.83	89.80	90.61	91.35	92.09	92.76	93.32	93.84
3	Heat Loss, B.t.u.....	.236	.240	.244	.247	.251	.255	.259	.263	.267	.271
	Efficiency %........	87.90	88.84	89.83	90.75	91.49	92.18	92.86	93.48	94.04	94.49
Nominal pipe size 4″											
Std.	Heat Loss, B.t.u.....	.403	.411	.419	.427	.436	.444	.453	.462	.471	.479
	Efficiency %........	79.31	80.90	82.54	83.99	85.22	86.36	87.50	88.55	89.44	90.26
1½	Heat Loss, B.t.u.....	.340	.346	.352	.358	.365	.371	.378	.385	.392	.399
	Efficiency %........	82.58	83.91	85.34	86.55	87.62	88.60	89.58	90.46	91.21	91.89
2	Heat Loss, B.t.u.....	.286	.291	.296	.301	.306	.311	.316	.321	.326	.331
	Efficiency %........	85.34	86.50	87.65	88.71	89.63	90.46	91.29	92.03	92.69	93.28
Dbl. Std.	Heat Loss, B.t.u.....	.269	.273	.278	.282	.286	.290	.295	.300	.305	.310
	Efficiency %........	86.20	87.30	88.42	89.41	90.30	91.10	91.87	92.55	93.16	93.70
2½	Heat Loss, B.t.u.....	.252	.256	.260	.264	.268	.272	.277	.281	.286	.290
	Efficiency %........	87.09	88.09	89.16	90.19	90.91	91.66	92.36	93.04	93.59	94.11
3	Heat Loss, B.t.u.....	.227	.230	.233	.236	.240	.244	.248	.252	.256	.260
	Efficiency %........	88.35	89.30	90.29	91.15	91.87	92.52	93.16	93.75	94.26	94.71
Nominal pipe size 4½″											
Std.	Heat Loss, B.t.u.....	.395	.403	.411	.419	.428	.436	.444	.453	.462	.472
	Efficiency %........	79.74	81.25	82.86	84.29	85.49	86.63	87.75	88.76	89.65	90.41
1½	Heat Loss, B.t.u.....	.332	.338	.344	.350	.356	.362	.368	.375	.382	.389
	Efficiency %........	82.98	84.29	85.65	86.89	87.94	88.90	89.85	90.70	91.44	92.10
2	Heat Loss, B.t.u.....	.278	.283	.288	.292	.297	.302	.307	.313	.318	.323
	Efficiency %........	85.75	86.84	88.00	89.05	89.94	90.75	91.54	92.24	92.88	93.44
Dbl. Std.	Heat Loss, B.t.u.....	.259	.263	.268	.273	.277	.282	.287	.291	.296	.301
	Efficiency %........	86.71	87.76	88.83	89.75	90.61	91.35	92.09	92.78	93.36	93.88
2½	Heat Loss, B.t.u.....	.243	.247	.251	.255	.259	.263	.267	.272	.276	.280
	Efficiency %........	87.54	88.50	89.54	90.45	91.22	91.94	92.64	93.26	93.82	94.31
3	Heat Loss, B.t.u.....	.218	.222	.226	.229	.233	.236	.240	.244	.248	.252
	Efficiency %........	88.81	89.69	90.59	91.40	92.11	92.75	93.38	93.95	94.44	94.88
Nominal pipe size 5″											
Std.	Heat Loss, B.t.u.....	.385	.393	.401	.411	.418	.426	.434	.443	.452	.460
	Efficiency %........	80.25	81.73	83.29	84.58	85.84	86.94	88.04	89.02	89.86	90.65
1½	Heat Loss, B.t.u.....	.324	.329	.336	.342	.349	.355	.362	.368	.374	.381
	Efficiency %........	83.38	84.71	86.00	87.16	88.16	89.11	90.02	90.88	91.62	92.25
2	Heat Loss, B.t.u.....	.272	.277	.282	.286	.291	.296	.300	.305	.310	.315
	Efficiency %........	86.05	87.11	88.25	89.27	90.14	90.92	91.73	92.44	93.06	93.60
Dbl. Std.	Heat Loss, B.t.u.....	.253	.257	.262	.266	.271	.275	.280	.284	.289	.293
	Efficiency %........	87.03	88.05	89.09	90.02	90.81	91.56	92.28	92.96	93.52	94.04
2½	Heat Loss, B.t.u.....	.237	.241	.245	.249	.253	.257	.261	.265	.270	.274
	Efficiency %........	87.85	88.80	89.79	90.65	91.41	92.12	92.80	93.42	93.95	94.43
3	Heat Loss, B.t.u.....	.211	.215	.218	.221	.225	.228	.232	.235	.239	.243
	Efficiency %........	89.17	90.00	90.91	91.71	92.37	93.01	93.60	94.17	94.64	95.06

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J-M 85% MAGNESIA (SECTIONAL) HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiency expressed in percent of bare pipe losses.

Nominal pipe size 6"

Insulation thickness, inches		125 / 50	175 / 100	225 / 150	275 / 200	325 / 250	375 / 300	425 / 350	475 / 400	525 / 450	575 / 500
Std.	Heat Loss, B.t.u.	.373	.382	.390	.399	.407	.415	.424	.432	.440	.449
	Efficiency %	80.86	82.24	83.75	85.01	86.21	87.26	88.30	89.29	90.14	90.87
1½	Heat Loss, B.t.u.	.314	.319	.325	.330	.336	.342	.348	.354	.361	.367
	Efficiency %	83.89	85.16	86.45	87.61	88.60	89.51	90.40	91.22	91.90	92.54
2	Heat Loss, B.t.u.	.261	.265	.269	.273	.278	.282	.287	.292	.297	.302
	Efficiency %	86.61	87.68	88.79	89.75	90.57	91.35	92.09	92.76	93.34	93.87
Dbl. Std.	Heat Loss, B.t.u.	.241	.245	.249	.253	.257	.261	.265	.269	.274	.279
	Efficiency %	87.64	88.61	89.61	90.50	91.29	92.00	92.70	93.32	93.86	94.34
2½	Heat Loss, B.t.u.	.225	.229	.232	.236	.240	.244	.248	.252	.256	.261
	Efficiency %	88.45	89.35	90.34	91.15	91.87	92.52	93.16	93.75	94.26	94.69
3	Heat Loss, B.t.u.	.201	.204	.207	.210	.213	.217	.220	.224	.227	.231
	Efficiency %	89.69	90.50	91.37	92.11	92.78	93.35	93.94	94.45	94.91	95.30

Column heads: Temperature of pipe—deg. Fahr. (upper figure) / Temperature difference between pipe and air—deg. Fahr. (lower figure).

Nominal pipe size 7"

Insulation thickness, inches		125 / 50	175 / 100	225 / 150	275 / 200	325 / 250	375 / 300	425 / 350	475 / 400	525 / 450	575 / 500
Std.	Heat Loss, B.t.u.	.340	.347	.354	.361	.368	.375	.388	.390	.398	.405
	Efficiency %	82.55	83.88	85.25	86.45	87.52	88.49	89.44	90.34	91.08	91.77
1½	Heat Loss, B.t.u.	.307	.312	.317	.322	.328	.334	.340	.346	.352	.359
	Efficiency %	84.25	85.50	86.79	87.91	88.88	89.75	90.62	91.40	92.11	92.70
2	Heat Loss, B.t.u.	.252	.257	.261	.265	.270	.274	.278	.283	.288	.293
	Efficiency %	87.08	88.05	89.13	90.06	90.85	91.60	92.34	92.97	93.54	94.04
Dbl. Std.	Heat Loss, B.t.u.	.218	.221	.224	.228	.231	.235	.239	.243	.247	.251
	Efficiency %	88.81	89.70	90.66	91.45	92.17	92.79	93.41	93.98	94.46	94.90
3	Heat Loss, B.t.u.	.193	.196	.199	.202	.205	.209	.212	.215	.219	.223
	Efficiency %	90.10	90.89	91.70	92.42	93.06	93.60	94.16	94.66	95.09	95.47

Nominal pipe size 8"

Insulation thickness, inches		125 / 50	175 / 100	225 / 150	275 / 200	325 / 250	375 / 300	425 / 350	475 / 400	525 / 450	575 / 500
Std.	Heat Loss, B.t.u.	.336	.343	.351	.357	.364	.371	.378	.386	.393	.401
	Efficiency %	86.76	84.05	85.41	86.60	87.66	88.60	89.57	90.41	91.19	91.85
1½	Heat Loss, B.t.u.	.298	.303	.308	.314	.320	.326	.332	.338	.345	.351
	Efficiency %	84.71	85.91	87.16	88.22	89.15	90.00	90.85	91.62	92.26	92.87
2	Heat Loss, B.t.u.	.246	.250	.254	.258	.262	.267	.272	.276	.281	.286
	Efficiency %	87.38	88.39	89.41	90.32	91.12	91.81	92.50	93.16	93.70	94.19
Dbl. Std.	Heat Loss, B.t.u.	.212	.215	.218	.222	.226	.229	.233	.237	.241	.245
	Efficiency %	89.12	90.00	90.91	91.66	92.34	92.97	93.57	94.12	94.59	95.02
3	Heat Loss, B.t.u.	.187	.190	.193	.196	.199	.202	.205	.208	.211	.215
	Efficiency %	90.41	91.16	91.95	92.65	93.26	93.80	94.35	94.84	95.27	95.64

Nominal pipe size 9"

Insulation thickness, inches		125 / 50	175 / 100	225 / 150	275 / 200	325 / 250	375 / 300	425 / 350	475 / 400	525 / 450	575 / 500
Std.	Heat Loss, B.t.u.	.331	.338	.345	.352	.359	.366	.373	.380	.387	.394
	Efficiency %	83.02	84.29	85.62	86.80	87.82	88.79	89.72	90.59	91.32	91.99
1½	Heat Loss, B.t.u.	.295	.300	.306	.311	.317	.322	.328	.334	.340	.346
	Efficiency %	84.86	86.05	87.25	88.32	89.25	90.15	90.96	91.72	92.38	92.96
2	Heat Loss, B.t.u.	.242	.246	.250	.254	.258	.263	.267	.271	.276	.281
	Efficiency %	87.59	88.55	89.59	90.46	91.29	91.94	92.64	93.28	93.82	94.29
Dbl. Std.	Heat Loss, B.t.u.	.207	.210	.213	.217	.220	.224	.228	.231	.235	.239
	Efficiency %	89.38	90.24	91.13	91.86	92.55	93.14	93.72	94.27	94.73	95.11
3	Heat Loss, B.t.u.	.184	.186	.189	.192	.195	.198	.201	.204	.207	.210
	Efficiency %	90.56	91.35	92.12	92.80	93.39	93.92	94.46	94.94	95.36	95.73

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J-M 85% MAGNESIA (SECTIONAL) HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiency expressed in percent of bare pipe losses.

Insulation thickness, inches		Temperature of pipe—deg. Fahr.									
		125	175	225	275	325	375	425	475	525	575
		Temperature difference between pipe and air—deg. Fahr.									
		50	100	150	200	250	300	350	400	450	500
Nominal pipe size 10"											
Std.	Heat Loss, B.t.u.....	.327	.334	.341	.348	.355	.362	.369	.376	.383	.390
	Efficiency %........	83.23	84.46	85.79	86.94	87.96	88.90	89.82	90.69	91.41	92.08
1½	Heat Loss, B.t.u.....	.290	.295	.300	.306	.311	.317	.323	.328	.334	.340
	Efficiency %........	85.12	86.30	87.50	88.52	89.46	90.28	91.10	91.87	92.53	93.09
2	Heat Loss, B.t.u.....	.237	.241	.245	.249	.253	.257	.261	.265	.270	.275
	Efficiency %........	87.84	88.80	89.79	90.65	91.44	92.12	92.80	93.42	93.95	94.41
Dbl. Std.	Heat Loss, B.t.u.....	.203	.206	.210	.213	.216	.220	.223	.227	.230	.234
	Efficiency %........	89.59	90.42	91.25	92.01	92.68	93.26	93.86	94.38	94.84	95.24
3	Heat Loss, B.t.u.....	.178	.181	.184	.187	.190	.193	.196	.199	.202	.205
	Efficiency %........	90.87	91.59	92.34	92.99	93.56	94.08	94.60	95.07	95.47	95.84
Nominal pipe size 12"											
Std.	Heat Loss, B.t.u.....	.284	.289	.295	.300	.306	.311	.317	.323	.328	.334
	Efficiency %........	85.44	86.56	87.70	88.75	89.63	90.46	91.26	92.00	92.65	93.21
2	Heat Loss, B.t.u.....	.231	.235	.239	.243	.247	.251	.255	.259	.264	.269
	Efficiency %........	88.15	89.05	90.04	90.89	91.64	92.30	92.97	93.58	94.08	94.53
2½	Heat Loss, B.t.u.....	.197	.200	.203	.206	.209	.213	.216	.219	.223	.227
	Efficiency %........	89.90	90.70	91.54	92.27	92.92	93.47	94.04	94.58	95.00	95.39
Dbl. Std.	Heat Loss, B.t.u.....	.172	.175	.178	.181	.184	.187	.190	.193	.196	.199
	Efficiency %........	91.18	91.87	92.58	93.21	93.76	94.26	94.76	95.22	95.61	95.95
Nominal pipe size 14"											
Std.	Heat Loss, B.t.u.....	.281	.286	.292	.297	.302	.308	.313	.319	.325	.330
	Efficiency %........	85.59	86.70	87.84	88.85	89.76	90.55	91.36	92.09	92.72	93.29
2	Heat Loss, B.t.u.....	.228	.232	.236	.240	.244	.248	.252	.256	.260	.265
	Efficiency %........	88.30	89.21	90.16	91.00	91.74	92.39	93.05	93.65	94.17	94.61
2½	Heat Loss, B.t.u.....	.194	.197	.200	.203	.206	.209	.213	.216	.220	.224
	Efficiency %........	90.05	90.85	91.66	92.38	93.02	93.59	94.13	94.64	95.07	95.44
Dbl. Std.	Heat Loss, B.t.u.....	.169	.172	.175	.177	.180	.183	.186	.189	.192	.195
	Efficiency %........	91.34	92.00	92.71	93.36	93.90	94.40	94.87	95.31	95.70	96.04
Nominal pipe size 16"											
Std	Heat Loss, B.t.u.....	.278	.283	.288	.293	.298	.303	.309	.315	.320	.326
	Efficiency %........	85.75	86.84	88.00	89.00	89.90	90.70	91.49	92.18	92.82	93.38
2	Heat Loss, B.t.u.....	.224	.228	.232	.236	.240	.244	.248	.252	.256	.260
	Efficiency %........	88.51	89.40	90.34	91.15	91.87	92.52	93.16	93.75	94.26	94.71
2½	Heat Loss, B.t.u.....	.189	.192	.195	.199	.202	.205	.209	.212	.215	.219
	Efficiency %........	90.31	91.07	91.88	92.54	93.16	93.71	94.24	94.74	95.18	95.54
Dbl. Std.	Heat Loss, B.t.u.....	.165	.168	.171	.174	.176	.179	.182	.185	.188	.191
	Efficiency %........	91.54	92.19	92.88	93.47	94.04	94.51	94.98	95.41	95.78	96.12
Nominal pipe size 18"											
Std	Heat Loss, B.t.u.....	.275	.280	.285	.290	.296	.301	.306	.311	.316	.322
	Efficiency %........	85.90	86.97	88.12	89.11	89.97	90.76	91.57	92.28	92.92	93.46
2	Heat Loss, B.t.u.....	.222	.226	.230	.234	.238	.242	.246	.250	.254	.258
	Efficiency %........	88.61	89.49	90.42	91.22	91.94	92.58	93.22	93.80	94.31	94.76
Dbl. Std.	Heat Loss, B.t.u.....	.186	.190	.193	.196	.200	.203	.206	.210	.213	.217
	Efficiency %........	90.46	91.16	91.96	92.65	93.22	93.78	94.32	94.79	95.22	95.59
3	Heat Loss, B.t.u.....	.162	.165	.167	.170	.173	.175	.178	.181	.184	.187
	Efficiency %........	91.69	92.33	93.04	93.60	94.14	94.63	95.09	95.51	95.88	96.20

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Superex Pipe Insulation

For temperatures to 1600 deg. F.

Superex is the most adaptable material for insulating surfaces where the material applied must resist temperatures between 600 and 1600 deg. F.

It is a combination of diatomaceous silica and asbestos fibre, bonded together, producing an insulation in which are combined the essential qualities of high heat resistance and exceptional insulating value.

It has a low thermal conductivity, which is maintained in service. It will safely withstand temperatures up to 1600 deg. F. and, although weighing only about 24 lb. per cu. ft., possesses ample strength.

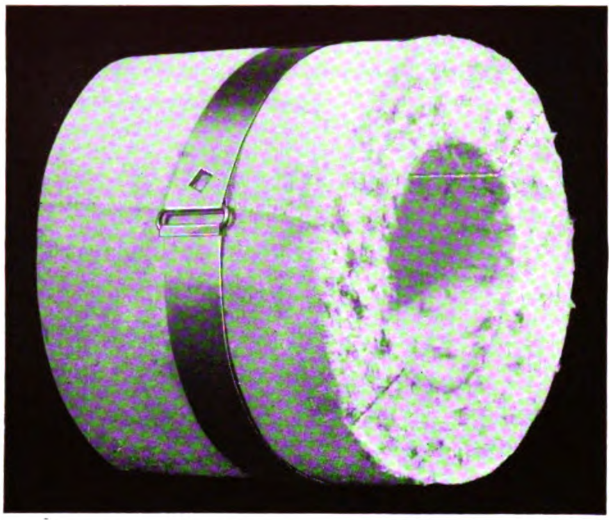
Superex Insulation is supplied in standard sections and segments, 3 ft. long, in thicknesses from 1″ to 3″, for standard pipe sizes.

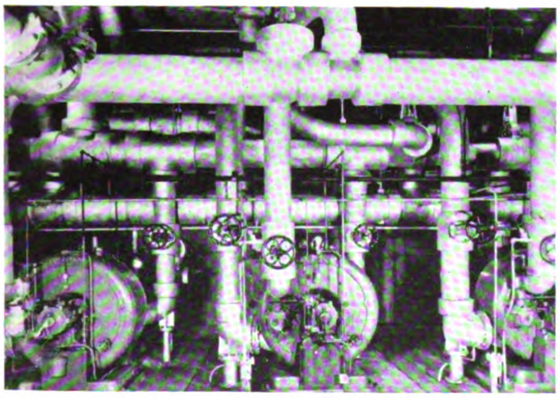
The smaller pipe sizes are furnished sectional. Pipe sizes larger than 10″ are furnished segmental. Segments are approximately 6″ wide, except for the piece to close the circle.

Superex is also furnished in blocks as described in another data sheet.

Superex Combination Insulation

Superex Insulation is often used as an inner layer in combination with other Johns-Manville materials, such as 85% Magnesia or Asbesto-Sponge Felted, to combine the greater insulation efficiency of these materials with the high heat resistance of Superex. In this construction, Superex is used as protection for the other insulation which, although high in insulating value, is comparatively low in heat resistance.





Superex Combination Pipe Insulation at Avon Station of Cleveland Electric Illuminating Co.

Recommended Thicknesses:

Tables A and C, which follow, give J-M standard recommendations for the use of Superex Insulation as a protective inner layer for 85% Magnesia or Asbesto-Sponge Felted insulation, when the combination is used to insulate pipes at temperatures up to 1000 deg. F.

It is to be noted that the list prices in Tables A and C do not conform with the regular list prices on sectional insulation and are to be used only for Superex Combination Insulation.

Instructions for ordering:

When ordering Superex Combination Insulation, the order should specify:

1. Linear feet of covering
2. Pipe size
3. Superex Combination Insulation, Table A or C
4. Thickness of material (85% Magnesia or Asbesto-Sponge Felted) for outer layer.

For example:

To order 300 ft. of Superex Combination Insulation for 8″ pipe, consisting of 1½″ Superex Insulation over which is to be applied 2″ thick 85% Magnesia, the order should read: "300 ft. 8″ pipe size Superex Combination Insulation. Table A, 85% Magnesia 2″ thick."

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Table A—Temperatures 600 to 799 deg. F.

Inner layer, Superex Insulation				Outer layer, 85% Magnesia or Asbesto-Sponge Felted Insulation.						
					List price, outer layer, per linear foot					
					Thickness of insulation					
Nominal pipe size, inches	Approx. thickness, inches	Approx. weight per section, pounds	List price, inner layer, per lin. ft.	Nominal pipe size, second layer, inches	Std.	1½"	Dbl. Std.††	2"	2½"	3"‡‡
1½ and smaller ***										
2	1¼	7.35	$ .64	4½	$ .65	$ .94*	$1.50	$1.45**	$1.95	$2.35
2½	1 5/16	8.95	.70	5	.70	1.00*	1.60	1.55**	2.10	2.50
3	1 9/16	12.80	.76	6	.80	1.10*	1.80	1.70**	2.25	2.70
3½	1 5/16	11.25	.82	6	.80	1.10*	1.80	1.70**	2.25	2.70
4	1 9/16	15.30	.88	7	1.00	1.20*	2.25	1.85**	2.40	2.90
4½	1 5/16	13.45	.94	7	1.00	1.20	2.25	1.85*	2.40**†	2.90
5	1½	17.10	1.00	8	1.10	1.35	2.50	2.00*	2.55**†	3.15
6	1½	19.65	1.10	9	1.20	1.50	2.70	2.20*	2.80**†	3.40
7	1½	22.05	1.20	10	1.30	1.65	2.90	2.40*	3.05**†	3.65
8	1½	24.45	1.35	11	1.60	1.75	3.50	2.55*	3.25**	3.85
9	1½	27.00	1.50	12	1.85	1.85	4.10§	2.70*	3.40**§	4.10§
10	1 9/16	31.10	1.65	14	2.10	2.10	4.60§	3.00*§	3.80**§	4.60§
12‡	1 9/16	36.15	1.85	16	2.35§	2.35§	5.10§	3.30*§	4.20**§	5.10§
14‡	1½	37.60	2.10	17	2.50§	2.50§	5.35§	3.45*§	4.40**§	5.35§
16‡	1½	42.50	2.35	19	2.75§	2.75§	5.80§	3.80*§	4.80**§	5.80§
18‡	1½	47.90	2.60	21	3.00§	3.00§	6.25§	4.15*§	5.20**§	6.25§
20‡	1½	52.30	2.85	23	3.20§	3.20§	6.75§	4.40*§	5.60**§	6.75§
24‡	1½	62.00	3.30	27	3.65§	3.65§	7.70§	5.05*§	6.40**§	7.70§
30‡	1½	76.75	4.00	33	4.40§	4.40§	9.40§	6.05*§	7.60**§	9.40§

* Recommended thickness for 600 to 699 deg. F.
** Recommended thickness for 700 to 799 deg. F.
*** Apply single layer only of Superex, 2" thick.
† Double Standard thick 85% Magnesia may be substituted for the 2½" thick single layer 85% Magnesia, if desired.
†† Double Standard thick is supplied in two layers, and applies only to 85% Magnesia.
‡ Superex Insulation for pipe sizes larger than 10" is furnished in segmental blocks.
‡‡ Double layer.
§ 85% Magnesia for these sizes is furnished in segmental blocks. Asbesto-Sponge Felted is always furnished sectional.

Table C—Temperatures 800 to 1000 deg. F.

Inner layer, Superex Insulation			Outer layer, 85% Magnesia or Asbesto-Sponge Felted Insulation		
Nominal pipe size, inches	Thickness, inches	List price per lin. ft.	Nominal pipe size, second layer, inches	Thickness, inches*	List price per lin. ft.
1½ and smaller**					
2	1 9/16	$0.64	5	1½	$1.00
2½	1 13/16	1.05	6	1½	1.10
3	2 1/16	1.15	7	1½	1.20
3½	1 13/16	1.25	7	1½	1.20
4	2 1/16	1.35	8	1½	1.35
4½	1 13/16	1.45	8	2	2.00
5	2	1.55	9	2	2.20
6	2 1/16	1.70	10	2	2.40
7	2	1.85	11	2	2.55
8	2	2.00	12	2	2.70
9	2⅛	2.20	14	2§	3.00
10	2⅛	2.40	15	2§	3.15
12†	2⅛	2.70	17	2§	3.45
14†	2	3.00	18	2§	3.60
16†	2	3.30	20	2§	4.00
18†	2	3.60	22	2§	4.30

* Greater thicknesses of 85% Magnesia or Asbesto-Sponge Felted than those given in Table C should not be used.
** Apply single layer only of Superex, 2" thick.
† Superex Insulation for pipe sizes larger than 10" is furnished in segmental blocks.
§ 85% Magnesia for these sizes is furnished in segmental blocks. Asbesto-Sponge Felted is always furnished sectional.

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Superex Combination Insulation Specification (with 85% Magnesia) for pipes conveying heated fluids

INSULATION

All piping 2″ and larger, and at temperatures of 600 deg. F. and above, shall be insulated with Johns-Manville Superex Combination Insulation, consisting of a layer of insulation next to the pipe which shall be of suitable material to resist the temperatures to which it will be subjected and which will lower the temperature on the outer layer of insulation, subsequently applied, to a point below its temperature limit.

All piping 1½″ and smaller shall be insulated with single layer Johns-Manville Superex Insulation.

The outer layer (or layers) shall consist of Johns-Manville 85% Magnesia.*

All fittings, valves, flanges, etc., included in the above piping shall be insulated with the same materials used for insulating the piping.

MATERIALS

(a) *High temperature insulation:*

The inner layer of insulation next to the pipe, furnished under this specification, shall be Johns-Manville Superex Pipe Insulation, suitable for temperatures up to 1600 deg. F.

(b) *85% Magnesia:**

The outer layer of insulation, furnished under this specification, shall be Johns-Manville 85% Magnesia, suitable for temperatures up to 600 deg. F.

All pipe insulation shall be furnished in sectional or segmental form for application to piping, and in block form for application to irregular surfaces such as fittings.

The hard finish Asbestos Cement furnished under this specification shall be long fibre, first quality asbestos cement, suitable to withstand the temperatures to which it will be subjected.

THICKNESS

(a) *Piping:*

(I) *Indoors:*

All piping located indoors shall be insulated to not less than the thickness given in the following table, for the temperature conditions stated therein.

Temperatures	600°–699°F.		700°–799°F.		800°–1000°F.	
	Thickness of Insulation		Thickness of Insulation		Thickness of Insulation	
Pipe size, inches	Superex, inches	Asbesto-Sponge Felted* or 85% Magnesia, inches	Superex, inches	Asbesto-Sponge Felted, or 85% Magnesia, inches	Superex, inches	Asbesto-Sponge Felted, or 85% Magnesia, inches
1½ and smaller	Single layer only of Superex, 2″ thick.					
2	1¼	1½	1¼	2	1⁹⁄₁₆	1½
2½	1⁵⁄₁₆	1½	1⁵⁄₁₆	2	1¹³⁄₁₆	1½
3	1⁹⁄₁₆	1½	1⁹⁄₁₆	2	2¹⁄₁₆	1½
3½	1⁵⁄₁₆	1½	1⁵⁄₁₆	2	1¹³⁄₁₆	1½
4	1⁹⁄₁₆	1½	1⁹⁄₁₆	2	2¹⁄₁₆	1½
4½	1⁵⁄₁₆	2	1⁵⁄₁₆	2½	1¹³⁄₁₆	2
5 and larger, approx.	1½	2	1½	2½	2	2

*In this temperature range, Asbesto-Sponge Felted may be used alone, instead of Superex Combination Insulation. For thickness, see Asbesto-Sponge Felted Insulation Specification on another data sheet.

(2) *Outdoors:*

All piping located outdoors or exposed to the weather shall be insulated to thicknesses not less than ½″ greater than those given in the foregoing table for piping located indoors.

(b) *Fittings, Valves and Flanges:*

See other data sheets.

APPLICATION

(a) *Piping:*

All insulation shall be applied in two layers as specified above.

The first layer with all joints tightly butted shall be securely wired to the pipe with not less than three loops of 16-gauge annealed iron wire, on pipes up to and including 6″, and not less than four loops on larger pipes.

The second layer shall be applied over the first so that both circumferential and horizontal joints are broken, and shall be held in place on pipes up to and including 6″ with not less than three loops of 16-gauge annealed iron wire.

On 8″ and larger piping, the second layer shall be

*Asbesto-Sponge Felted may be substituted for 85% Magnesia.

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held in place by not less than four loops of 16-gauge annealed iron wire. The ends of these wire loops shall be tightly twisted together and shall be bent over and hammered into the insulation so as to leave no projection.

Segmental block insulation and that on bends shall be given a thin finishing coat of hard finish Asbestos Cement to present a smooth, even surface.

Canvas shall in all cases be omitted from the inner layer of insulation where the insulation is applied in two layers.

All of the above insulation shall be stopped off a sufficient distance from all flanges to permit the easy removal of the bolts, when the end of the insulation is beveled back from the pipe to the outside of the insulation, at an angle of 45 degrees with the axis of the pipe.

(b) ***Fittings, Valves and Flanges:***
See other data sheets.

FINISH

(a) ***Piping:***

(1) ***Indoors:***

All insulation on piping located indoors shall be enclosed in an extra jacket of 8-oz. canvas sewed on over rosin-sized paper. All seams shall be located where least visible and the stitches shall be not less than three to the inch.

Where re-canvasing is not desired the light canvas jacket regularly furnished with the insulation shall be neatly pasted down over all laps.

All cement surfaces shall be finally finished with a jacket of 8-oz. canvas neatly and securely pasted on.

(2) ***Outdoors:***

All insulation on piping located outdoors or exposed to the weather shall be finished with a Double Coated Flexstone weatherproof jacket. All joints in the jacket shall be lapped at least 3″ and sealed with Lap Cement.* The jacket shall be securely wired in place by means of loops of No. 16 B. & S. gauge Copperweld wire placed on not greater than 4″ centers.

On horizontal pipes the seams of the weatherproof jacket shall be placed at the side of the pipe with the lap turned down in order to shed the water.

Piping located close to the ground or where there is danger of the jacket being subjected to mechanical injury, shall be protected by means of a suitable metal jacket.

(b) ***Fittings, Valves and Flanges:***
See other data sheets.

PAINTING

All insulation finished with a jacket of 8-oz. canvas shall be painted with one coat of glue sizing and then not less than two coats of first quality lead and oil paint, of color selected by the purchaser.

All of the above insulation shall be applied by the manufacturer of the materials used, or his approved contractor.

Superex Combination Insulation on piping at Cahokia Station of the Union Electric Light and Power Co., St. Louis, Mo.

*A liquid asphalt cement, furnished in 1, 5, 25 and 50-gal. containers.

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Superex Combination Insulation (with 85% Magnesia) Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiency expressed as a percentage of bare pipe losses.

Thickness of Superex insulation, inches	Pipe size of 85% Magnesia, inches	Thickness of 85% Magnesia, inches	Total thickness of insulation, inches		Temperature of pipe—deg. Fahr. 500 / Temperature difference, pipe to air—deg. Fahr. 425	600 / 525	700 / 625	800 / 725
Nominal pipe size ½″								
1½	No outer layer		1½	Heat Loss, B.t.u.	.804	.824	.844	.864
				Efficiency %	81.05	84.00	86.15	87.72
2	No outer layer		2	Heat Loss, B.t.u.	.723	.738	.755	.772
				Efficiency %	82.96	85.66	87.60	89.02
Nominal pipe size ¾″								
1½	No outer layer		1½	Heat Loss, B.t.u.	.718	.738	.758	.778
				Efficiency %	83.12	85.66	87.55	88.94
2	No outer layer		2	Heat Loss, B.t.u.	.639	.654	.670	.687
				Efficiency %	84.95	87.30	89.00	90.22
Nominal pipe size 1″								
1½	No outer layer		1½	Heat Loss, B.t.u.	.648	.665	.682	.700
				Efficiency %	84.75	87.09	88.80	90.06
2	No outer layer		2	Heat Loss, B.t.u.	.571	.583	.596	.610
				Efficiency %	86.55	88.68	90.20	91.34
Nominal pipe size 1¼″								
1½	No outer layer		1½	Heat Loss, B.t.u.	.587	.602	.618	.636
				Efficiency %	86.16	88.30	89.85	90.96
2	No outer layer		2	Heat Loss, B.t.u.	.511	.523	.536	.550
				Efficiency %	87.97	89.84	91.20	92.18
Nominal pipe size 1½″								
1½	No outer layer		1½	Heat Loss, B.t.u.	.558	.572	.587	.602
				Efficiency %	86.85	88.90	90.36	91.44
2	No outer layer		2	Heat Loss, B.t.u.	.484	.495	.507	.520
				Efficiency %	88.60	90.38	91.68	92.60
Nominal pipe size 2″								
1¼	4½	1½	2¾	Heat Loss, B.t.u.	.358	.366	.375	.385
				Efficiency %	91.57	92.90	93.84	94.52
		2	3¼	Heat Loss, B.t.u.	.327	.335	.343	.352
				Efficiency %	92.30	93.50	94.36	95.00
		Dbl. Std.	3½	Heat Loss, B.t.u.	.314	.322	.330	.338
				Efficiency %	92.61	93.75	94.58	95.20
		2½	3¾	Heat Loss, B.t.u.	.303	.311	.319	.327
				Efficiency %	92.86	93.96	94.76	95.35
		3	4¼	Heat Loss, B.t.u.	.286	.293	.300	.303
				Efficiency %	93.26	94.31	95.07	95.62

June, 1931 (Cancelling 9-B-4-X-3 to 3-B and 9-B-4-X-5 and 6, dated in 1928 to 1930)

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SUPEREX COMBINATION INSULATION (WITH 85% MAGNESIA)
HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.
Efficiency expressed as a percentage of bare pipe losses.

Thickness of Superex insulation, inches	Pipe size of 85% Magnesia, inches	Thickness of 85% Magnesia, inches	Total thickness of insulation, inches		Temperature of pipe—deg. Fahr. 500 / Temperature difference, pipe to air—deg. Fahr. 425	600 / 525	700 / 625	800 / 725
Nominal pipe size 2½″								
1 5/16	5	1½	2 13/16	Heat Loss, B.t.u.	.327	.335	.343	.352
				Efficiency %	92.30	93.50	94.36	95.00
		2	3 5/16	Heat Loss, B.t.u.	.297	.304	.312	.321
				Efficiency %	93.01	94.10	94.87	95.43
		Dbl. Std.	3 9/16	Heat Loss, B.t.u.	.286	.293	.300	.308
				Efficiency %	93.26	94.31	95.07	95.62
		2½	3 13/16	Heat Loss, B.t.u.	.276	.282	.289	.297
				Efficiency %	93.50	94.52	95.25	95.78
		3	4 5/16	Heat Loss, B.t.u.	.259	.265	.272	.280
				Efficiency %	93.90	94.86	95.53	96.02
Nominal pipe size 3″								
1 9/16	6	1½	3 1/16	Heat Loss, B.t.u.	.289	.296	.303	.311
				Efficiency %	93.20	94.26	95.01	95.56
		2	3 9/16	Heat Loss, B.t.u.	.264	.270	.277	.285
				Efficiency %	93.78	94.76	95.45	95.94
		Dbl. Std.	3 13/16	Heat Loss, B.t.u.	.254	.260	.267	.275
				Efficiency %	94.02	94.96	95.61	96.09
		2½	4 1/16	Heat Loss, B.t.u.	.244	.250	.257	.265
				Efficiency %	94.26	95.15	95.77	96.24
		3	4 9/16	Heat Loss, B.t.u.	.229	.235	.241	.248
				Efficiency %	94.61	95.44	96.04	96.48
Nominal pipe size 3½″								
1 5/16	6	1½	2 13/16	Heat Loss, B.t.u.	.287	.294	.301	.309
				Efficiency %	93.24	94.30	95.05	95.60
		2	3 5/16	Heat Loss, B.t.u.	.259	.265	.272	.280
				Efficiency %	93.90	94.86	95.53	96.02
		Dbl. Std.	3 9/16	Heat Loss, B.t.u.	.249	.255	.261	.268
				Efficiency %	94.14	95.05	95.71	96.19
		2½	3 13/16	Heat Loss, B.t.u.	.238	.244	.250	.257
				Efficiency %	94.40	95.27	95.90	96.35
		3	4 5/16	Heat Loss, B.t.u.	.223	.228	.234	.241
				Efficiency %	94.74	95.58	96.16	96.58
Nominal pipe size 4″								
1 9/16	7	1½	3 1/16	Heat Loss, B.t.u.	.263	.269	.276	.284
				Efficiency %	93.81	94.78	95.47	95.96
		2	3 9/16	Heat Loss, B.t.u.	.240	.245	.251	.258
				Efficiency %	94.35	95.25	95.88	96.33
		2½	4 1/16	Heat Loss, B.t.u.	.221	.226	.232	.239
				Efficiency %	94.80	95.62	96.19	96.60
		3	4 9/16	Heat Loss, B.t.u.	.206	.211	.217	.223
				Efficiency %	95.15	95.90	96.43	96.83

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SUPEREX COMBINATION INSULATION (WITH 85% MAGNESIA)
HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.
Efficiency expressed as a percentage of bare pipe losses.

Thickness of Superex insulation, inches	Pipe size of 85% Magnesia, inches	Thickness of 85% Magnesia, inches	Total thickness of insulation, inches		Temperature of pipe—deg. Fahr. 500 / Temperature difference, pipe to air—deg. Fahr. 425	600 / 525	700 / 625	800 / 725
Nominal pipe size 4½"								
1 5/16	7	2	3 5/16	Heat Loss, B.t.u.	.239	.245	.252	.259
				Efficiency %	94.38	95.25	95.86	96.31
		2½	3 13/16	Heat Loss, B.t.u.	.218	.224	.230	.237
				Efficiency %	94.87	95.65	96.23	96.64
		3	4 5/16	Heat Loss, B.t.u.	.204	.208	.213	.219
				Efficiency %	95.20	95.96	96.50	96.89
Nominal pipe size 5"								
1½	8	2	3½	Heat Loss, B.t.u.	.223	.229	.235	.242
				Efficiency %	94.74	95.56	96.14	96.57
		2½	4	Heat Loss, B.t.u.	.205	.210	.215	.222
				Efficiency %	95.17	95.92	96.47	96.84
		3	4½	Heat Loss, B.t.u.	.190	.195	.200	.206
				Efficiency %	95.52	96.22	96.72	97.07
Nominal pipe size 6"								
1½	9	2	3½	Heat Loss, B.t.u.	.211	.217	.223	.230
				Efficiency %	95.03	95.79	96.34	96.73
		2½	4	Heat Loss, B.t.u.	.194	.199	.204	.210
				Efficiency %	95.43	96.14	96.64	97.01
		3	4½	Heat Loss, B.t.u.	.179	.184	.189	.195
				Efficiency %	95.79	96.43	96.90	97.23
Nominal pipe size 7"								
1½	10	2	3½	Heat Loss, B.t.u.	.203	.208	.213	.219
				Efficiency %	95.22	95.96	96.50	96.89
		2½	4	Heat Loss, B.t.u.	.185	.190	.195	.201
				Efficiency %	95.64	96.31	96.80	97.14
		3	4½	Heat Loss, B.t.u.	.171	.175	.180	.185
				Efficiency %	95.97	96.60	97.04	97.37
Nominal pipe size 8"								
1½	11	2	3½	Heat Loss, B.t.u.	.196	.201	.206	.212
				Efficiency %	95.39	96.10	96.62	96.99
		2½	4	Heat Loss, B.t.u.	.178	.183	.188	.193
				Efficiency %	95.81	96.45	96.91	97.29
		3	4½	Heat Loss, B.t.u.	.165	.169	.173	.178
				Efficiency %	96.11	96.72	97.16	97.47
Nominal pipe size 9"								
1½	12	2	3½	Heat Loss, B.t.u.	.190	.195	.200	.206
				Efficiency %	95.52	96.22	96.72	97.07
		2½	4	Heat Loss, B.t.u.	.173	.177	.182	.187
				Efficiency %	95.93	96.57	97.00	97.34
		3	4½	Heat Loss, B.t.u.	.160	.164	.168	.173
				Efficiency %	96.24	96.82	97.24	97.54
Nominal pipe size 10"								
1 9/16	14	2	3 9/16	Heat Loss, B.t.u.	.182	.187	.192	.198
				Efficiency %	95.72	96.37	96.84	97.19
		2½	4 1/16	Heat Loss, B.t.u.	.166	.170	.175	.180
				Efficiency %	96.09	96.70	97.12	97.45
		3	4 9/16	Heat Loss, B.t.u.	.153	.157	.162	.167
				Efficiency %	96.40	96.95	97.34	97.63

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SUPEREX COMBINATION INSULATION (WITH 85% MAGNESIA)
HEAT LOSSES AND EFFICIENCIES *(Continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiency expressed as a percentage of bare pipe losses.

Thickness of Superex insulation, inches	Pipe size of 85% Magnesia, inches	Thickness of 85% Magnesia, inches	Total thickness of insulation, inches		Temperature of pipe—deg. Fahr. 500 / Temperature difference, pipe to air—deg. Fahr. 425	600 / 525	700 / 625	800 / 725
Nominal pipe size 12″								
1 9/16	16	2	3 9/16	Heat Loss, B.t.u.	.176	.181	.186	.191
				Efficiency %	95.85	96.49	96.95	97.28
		2½	4 1/16	Heat Loss, B.t.u.	.159	.163	.168	.173
				Efficiency %	96.26	96.84	97.24	97.54
		3	4 9/16	Heat Loss, B.t.u.	.146	.150	.155	.160
				Efficiency %	96.56	97.09	97.45	97.72
Nominal pipe size 14″								
1½	17	2	3½	Heat Loss, B.t.u.	.176	.180	.185	.190
				Efficiency %	95.85	96.51	96.97	97.30
		2½	4	Heat Loss, B.t.u.	.158	.162	.167	.172
				Efficiency %	96.28	96.86	97.26	97.55
		3	4½	Heat Loss, B.t.u.	.144	.148	.152	.156
				Efficiency %	96.62	97.13	97.50	97.78
Nominal pipe size 16″								
1½	19	2	3½	Heat Loss, B.t.u.	.172	.176	.181	.186
				Efficiency %	95.95	96.59	97.02	97.36
		2½	4	Heat Loss, B.t.u.	.154	.158	.163	.168
				Efficiency %	96.37	96.93	97.32	97.61
		3	4½	Heat Loss, B.t.u.	.141	.145	.149	.153
				Efficiency %	96.68	97.19	97.56	97.83
Nominal pipe size 18″								
1½	21	2	3½	Heat Loss, B.t.u.	.168	.172	.177	.182
				Efficiency %	96.04	96.66	97.10	97.42
		2½	4	Heat Loss, B.t.u.	.150	.154	.158	.163
				Efficiency %	96.47	97.01	97.41	97.68
		3	4½	Heat Loss, B.t.u.	.137	.140	.144	.148
				Efficiency %	96.77	97.28	97.64	97.90
Nominal pipe size 20″								
1½	23	2	3½	Heat Loss, B.t.u.	.166	.170	.175	.180
				Efficiency %	96.09	96.70	97.12	97.45
		2½	4	Heat Loss, B.t.u.	.148	.152	.156	.160
				Efficiency %	96.51	97.05	97.43	97.72
		3	4½	Heat Loss, B.t.u.	.135	.138	.142	.146
				Efficiency %	96.82	97.32	97.68	97.93
Nominal pipe size 24″								
1½	27	2	3½	Heat Loss, B.t.u.	.162	.166	.170	.174
				Efficiency %	96.18	96.78	97.22	97.53
		2½	4	Heat Loss, B.t.u.	.144	.148	.152	.156
				Efficiency %	96.62	97.13	97.50	97.78
		3	4½	Heat Loss, B.t.u.	.131	.134	.137	.141
				Efficiency %	96.91	97.40	97.75	98.00
Nominal pipe size 30″								
1½	33	2	3½	Heat Loss, B.t.u.	.158	.162	.166	.170
				Efficiency %	96.28	96.86	97.27	97.58
		2½	4	Heat Loss, B.t.u.	.140	.143	.147	.151
				Efficiency %	96.71	97.23	97.58	97.85
		3	4½	Heat Loss, B.t.u.	.127	.130	.133	.137
				Efficiency %	97.01	97.48	97.82	98.05

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Superex Combination Insulation (with Asbesto-Sponge Felted) Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiencies expressed as a percentage of bare pipe losses.

Thickness of Superex insulation, inches	Pipe size of Asbesto-Sponge Felted, inches	Thickness of Asbesto-Sponge Felted, inches	Total thickness of insulation, inches		Temperature of pipe—deg. Fahr. 500 Temperature difference, pipe to air—deg. Fahr. 425	600 525	700 625	800 725
Nominal pipe size ½"								
1½	No outer layer		1½	Heat Loss, B.t.u. Efficiency %	.804 81.05	.824 84.00	.844 86.15	.864 87.72
2	No outer layer		2	Heat Loss, B.t.u. Efficiency %	.723 82.96	.738 85.66	.755 87.60	.772 89.02
Nominal pipe size ¾"								
1½	No outer layer		1½	Heat Loss, B.t.u. Efficiency %	.718 83.10	.738 85.66	.758 87.55	.778 88.94
2	No outer layer		2	Heat Loss, B.t.u. Efficiency %	.639 84.95	.654 87.30	.670 89.00	.687 90.22
Nominal pipe size 1"								
1½	No outer layer		1½	Heat Loss, B.t.u. Efficiency %	.648 84.75	.665 87.09	.682 88.80	.700 90.06
2	No outer layer		2	Heat Loss, B.t.u. Efficiency %	.571 86.55	.583 88.68	.596 90.20	.610 91.34
Nominal pipe size 1¼"								
1½	No outer layer		1½	Heat Loss, B.t.u. Efficiency %	.587 86.16	.602 88.30	.618 89.85	.636 90.96
2	No outer layer		2	Heat Loss, B.t.u. Efficiency %	.511 87.97	.523 89.84	.536 91.20	.550 92.18
Nominal pipe size 1½"								
1½	No outer layer		1½	Heat Loss, B.t.u. Efficiency %	.558 86.85	.572 88.90	.587 90.46	.602 91.44
2	No outer layer		2	Heat Loss, B.t.u. Efficiency %	.484 88.60	.495 90.38	.507 91.68	.520 92.60
Nominal pipe size 2"								
1¼	4½	1	2¼	Heat Loss, B.t.u. Efficiency %	.379 91.07	.390 92.43	.402 93.40	.414 94.12
		1½	2¾	Heat Loss, B.t.u. Efficiency %	.343 91.92	.353 93.15	.364 94.02	.376 94.66
		2	3¼	Heat Loss, B.t.u. Efficiency %	.312 92.66	.322 93.75	.332 94.55	.343 95.12
		2½	3¾	Heat Loss, B.t.u. Efficiency %	.289 93.20	.298 94.22	.308 94.94	.318 95.48
		3	4¼	Heat Loss, B.t.u. Efficiency %	.272 93.59	.280 94.57	.289 95.25	.299 95.75

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SUPEREX COMBINATION INSULATION (WITH ASBESTO-SPONGE FELTED) HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiencies expressed as a percentage of bare pipe losses.

Thickness of Superex insulation, inches	Pipe size of Asbesto-Sponge Felted, inches	Thickness of Asbesto-Sponge Felted, inches	Total thickness of insulation, inches		Temperature of pipe—deg. Fahr. 500 / Temperature difference, pipe to air—deg. Fahr. 425	600 / 525	700 / 625	800 / 725
Nominal pipe size 2½"								
1 5/16	5	1	2 5/16	Heat Loss, B.t.u.	.348	.356	.365	.375
				Efficiency %	91.80	93.09	94.00	94.67
		1½	2 13/16	Heat Loss, B.t.u.	.313	.321	.330	.339
				Efficiency %	92.63	93.77	94.58	95.18
		2	3 5/16	Heat Loss, B.t.u.	.284	.292	.300	.309
				Efficiency %	93.31	94.33	95.07	95.61
		2½	3 13/16	Heat Loss, B.t.u.	.262	.270	.278	.287
				Efficiency %	93.83	94.76	95.43	95.92
		3	4 5/16	Heat Loss, B.t.u.	.245	.253	.261	.269
				Efficiency %	94.23	95.09	95.72	96.18
Nominal pipe size 3"								
1 9/16	6	1	2 9/16	Heat Loss, B.t.u.	.308	.315	.324	.333
				Efficiency %	92.75	93.88	94.68	95.26
		1½	3 1/16	Heat Loss, B.t.u.	.278	.286	.294	.303
				Efficiency %	93.45	94.45	95.17	95.70
		2	3 9/16	Heat Loss, B.t.u.	.253	.261	.269	.278
				Efficiency %	94.04	94.94	95.58	96.05
		2½	4 1/16	Heat Loss, B.t.u.	.234	.242	.250	.259
				Efficiency %	94.49	95.31	95.89	96.32
		3	4 9/16	Heat Loss, B.t.u.	.219	.227	.235	.243
				Efficiency %	94.84	95.60	96.14	96.55
Nominal pipe size 3½"								
1 5/16	6	1	2 5/16	Heat Loss, B.t.u.	.309	.318	.327	.337
				Efficiency %	92.72	93.83	94.63	95.20
		1½	2 13/16	Heat Loss, B.t.u.	.275	.284	.293	.302
				Efficiency %	93.53	94.49	95.19	95.71
		2	3 5/16	Heat Loss, B.t.u.	.247	.255	.264	.273
				Efficiency %	94.18	95.05	95.66	96.12
		2½	3 13/16	Heat Loss, B.t.u.	.227	.235	.243	.252
				Efficiency %	94.66	95.44	96.01	96.42
		3	4 5/16	Heat Loss, B.t.u.	.211	.219	.227	.235
				Efficiency %	95.03	95.75	96.27	96.66
Nominal pipe size 4"								
1 9/16	7	1	2 9/16	Heat Loss, B.t.u.	.280	.288	.296	.304
				Efficiency %	93.40	94.41	95.14	95.68
		1½	3 1/16	Heat Loss, B.t.u.	.253	.261	.269	.277
				Efficiency %	94.04	94.94	95.58	96.06
		2	3 9/16	Heat Loss, B.t.u.	.229	.236	.243	.251
				Efficiency %	94.61	95.42	96.01	96.43
		2½	4 1/16	Heat Loss, B.t.u.	.211	.218	.225	.232
				Efficiency %	95.03	95.77	96.30	96.71
		3	4 9/16	Heat Loss, B.t.u.	.197	.203	.210	.217
				Efficiency %	95.36	96.06	96.55	96.92

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SUPEREX COMBINATION INSULATION (WITH ASBESTO-SPONGE FELTED) HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.
Efficiencies expressed as a percentage of bare pipe losses.

Thickness of Superex insulation, inches	Pipe size of Asbesto-Sponge Felted, inches	Thickness of Asbesto-Sponge Felted, inches	Total thickness of insulation, inches		Temperature of pipe—deg. Fahr. 500 / Temperature difference, pipe to air—deg. Fahr. 425	600 / 525	700 / 625	800 / 725
Nominal pipe size 4½"								
1 5/16	7	2	3 5/16	Heat Loss, B.t.u.	.228	.235	.243	.251
				Efficiency %	94.63	95.44	96.01	96.43
		2½	3 13/16	Heat Loss, B.t.u.	.208	.215	.222	.230
				Efficiency %	95.10	95.83	96.35	96.73
		3	4 5/16	Heat Loss, B.t.u.	.192	.199	.206	.213
				Efficiency %	95.48	96.14	96.62	96.97
Nominal pipe size 5"								
1½	8	2	3½	Heat Loss, B.t.u.	.212	.219	.226	.234
				Efficiency %	95.01	95.75	96.47	96.67
		2½	4	Heat Loss, B.t.u.	.194	.201	.208	.215
				Efficiency %	95.43	96.10	96.58	96.94
		3	4½	Heat Loss, B.t.u.	.181	.187	.194	.201
				Efficiency %	95.74	96.37	96.81	97.14
Nominal pipe size 6"								
1½	9	2	3½	Heat Loss, B.t.u.	.202	.208	.215	.222
				Efficiency %	95.24	95.96	96.60	96.84
		2½	4	Heat Loss, B.t.u.	.184	.190	.196	.203
				Efficiency %	95.66	96.31	96.78	97.11
		3	4½	Heat Loss, B.t.u.	.170	.176	.182	.188
				Efficiency %	95.99	96.59	97.01	97.33
Nominal pipe size 7"								
1½	10	2	3½	Heat Loss, B.t.u.	.194	.200	.207	.214
				Efficiency %	95.43	96.12	96.72	96.96
		2½	4	Heat Loss, B.t.u.	.176	.182	.188	.195
				Efficiency %	95.85	96.47	96.91	97.23
		3	4½	Heat Loss, B.t.u.	.162	.168	.174	.180
				Efficiency %	96.18	96.74	97.14	97.44
Nominal pipe size 8"								
1½	11	2	3½	Heat Loss, B.t.u.	.188	.194	.200	.207
				Efficiency %	95.57	96.23	96.81	97.06
		2½	4	Heat Loss, B.t.u.	.169	.175	.181	.187
				Efficiency %	96.02	96.60	97.03	97.34
		3	4½	Heat Loss, B.t.u.	.156	.161	.167	.173
				Efficiency %	96.33	96.88	97.26	97.54
Nominal pipe size 9"								
1½	12	2	3½	Heat Loss, B.t.u.	.182	.188	.194	.200
				Efficiency %	95.72	96.35	96.93	97.16
		2½	4	Heat Loss, B.t.u.	.164	.169	.175	.181
				Efficiency %	96.14	96.72	97.12	97.43
		3	4½	Heat Loss, B.t.u.	.151	.156	.161	.167
				Efficiency %	96.44	96.97	97.36	97.63
Nominal pipe size 10"								
1 9/16	14	2	3 9/16	Heat Loss, B.t.u.	.175	.181	.187	.194
				Efficiency %	95.88	96.48	97.03	97.24
		2½	4 1/16	Heat Loss, B.t.u.	.158	.164	.170	.176
				Efficiency %	96.28	96.82	97.21	97.50
		3	4 9/16	Heat Loss, B.t.u.	.145	.150	.156	.162
				Efficiency %	96.58	97.09	97.44	97.70

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SUPEREX COMBINATION INSULATION (WITH ASBESTO-SPONGE FELTED) HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour. Efficiencies expressed as a percentage of bare pipe losses.

Thickness of Superex insulation, inches	Pipe size of Asbesto-Sponge Felted, inches	Thickness of Asbesto-Sponge Felted, inches	Total thickness of insulation, inches		Temperature of pipe—deg. Fahr. 500; Temperature difference, pipe to air—deg. Fahr. 425	600; 525	700; 625	800; 725
Nominal pipe size 12"								
1 9/16	16	2	3 9/16	Heat Loss, B.t.u.	.169	.175	.181	.187
				Efficiency %	96.02	96.60	97.06	97.34
		2½	4 1/16	Heat Loss, B.t.u.	.152	.157	.163	.169
				Efficiency %	96.42	96.95	97.32	97.60
		3	4 9/16	Heat Loss, B.t.u.	.139	.144	.149	.155
				Efficiency %	96.73	97.21	97.55	97.80
Nominal pipe size 14"								
1½	17	2	3½	Heat Loss, B.t.u.	.167	.173	.179	.186
				Efficiency %	96.07	96.64	97.14	97.36
		2½	4	Heat Loss, B.t.u.	.149	.155	.161	.167
				Efficiency %	96.49	96.99	97.36	97.63
		3	4½	Heat Loss, B.t.u.	.137	.142	.148	.154
				Efficiency %	96.77	97.24	97.57	97.81
Nominal pipe size 16"								
1½	19	2	3½	Heat Loss, B.t.u.	.163	.168	.174	.180
				Efficiency %	96.16	96.74	97.19	97.44
		2½	4	Heat Loss, B.t.u.	.145	.150	.155	.161
				Efficiency %	96.58	97.09	97.45	97.71
		3	4½	Heat Loss, B.t.u.	.133	.138	.143	.148
				Efficiency %	96.87	97.32	97.65	97.90
Nominal pipe size 18"								
1½	21	2	3½	Heat Loss, B.t.u.	.160	.165	.171	.177
				Efficiency %	96.23	96.80	97.19	97.48
		2½	4	Heat Loss, B.t.u.	.143	.148	.153	.158
				Efficiency %	96.63	97.13	97.49	97.75
		3	4½	Heat Loss, B.t.u.	.130	.135	.140	.145
				Efficiency %	96.94	97.38	97.70	97.94
Nominal pipe size 20"								
1½	23	2	3½	Heat Loss, B.t.u.	.157	.162	.167	.173
				Efficiency %	96.30	96.86	97.26	97.54
		2½	4	Heat Loss, B.t.u.	.140	.145	.150	.155
				Efficiency %	96.70	97.19	97.54	97.80
		3	4½	Heat Loss, B.t.u.	.128	.132	.137	.142
				Efficiency %	96.99	97.44	97.75	97.98
Nominal pipe size 24"								
1½	27	2	3½	Heat Loss, B.t.u.	.154	.159	.164	.169
				Efficiency %	96.37	96.91	97.31	97.60
		2½	4	Heat Loss, B.t.u.	.137	.141	.146	.151
				Efficiency %	96.77	97.26	97.60	97.85
		3	4½	Heat Loss, B.t.u.	.125	.129	.133	.138
				Efficiency %	97.06	97.50	97.81	98.04
Nominal pipe size 30"								
1½	33	2	3½	Heat Loss, B.t.u.	.150	.154	.159	.164
				Efficiency %	96.47	97.01	97.39	97.67
		2½	4	Heat Loss, B.t.u.	.133	.137	.141	.146
				Efficiency %	96.87	97.34	97.68	97.93
		3	4½	Heat Loss, B.t.u.	.121	.125	.129	.133
				Efficiency %	97.15	97.57	97.88	98.11

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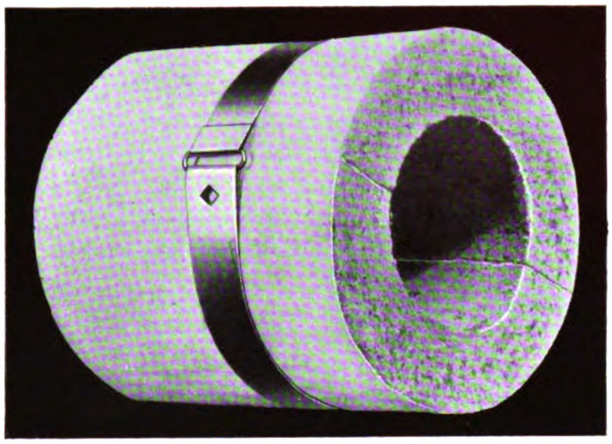
Asbestos Fire-Felt Pipe Insulation

For temperatures to 1000 deg. F.



Asbestos Fire-Felt pipe insulation, suitable for temperatures up to 1000 deg. F., is composed of asbestos fibre felted and moulded into sections of the required size.

The process of manufacture produces a strong, resilient material unaffected by vibration, expansion and contraction and many other severe conditions common to railroad and industrial plant service.

Asbestos Fire-Felt is particularly adapted for use on hot oil lines, gas engine exhaust lines, etc., where temperatures are high and where conditions of vibration or mechanical abuse would cause other moulded insulations to deteriorate rapidly.

Asbestos Fire-Felt is furnished in 3-foot sections, in thicknesses of 1″ to 3″, with canvas jacket and brass lacquered bands, to fit standard sizes of pipe.

Also furnished in sheet and block forms as described on another data sheet.

Weight in pounds per standard 3-foot section, uncrated

Thickness, inches	Nominal pipe sizes, inches																	
	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
1	4.8	5.06	5.35	6.0	6.4	7.08	7.88	8.8	9.53	10.3	11.1	12.0	13.6	15.2	16.8	18.2	19.9	23.0
1½	9.7	10.10	10.60	11.4	12.0	12.90	14.00	15.4	16.40	17.5	18.5	19.8	22.0	24.2	26.3	28.4	30.7	35.0
2	13.0	13.60	14.30	15.6	16.4	17.80	19.30	21.3	22.80	24.4	26.0	27.8	31.1	34.3	37.5	40.7	44.2	50.6
3	23.0	23.80	24.90	27.0	28.2	30.40	32.80	35.9	38.40	40.8	43.4	46.1	51.3	56.2	61.0	66.1	71.4	81.4

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(BMW)
WATERPROOFING &
MISC. ASPH. PROD.

TRANSITE
PRODUCTS

(BMS)
SOUND
CONTROL

ROOFING &
SHINGLES

(IN)
INSULATION

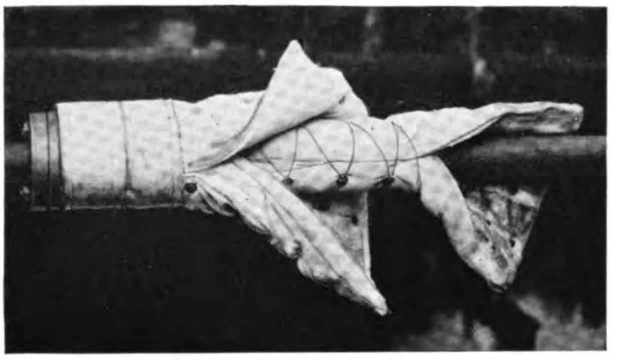
(FR)
FRICTION
MATERIALS

(FI)
FILTER-AIDS &
MINERAL FILLERS

(EL)
ELECTRICAL
MATERIALS

J-M Asbestos Pipe Blankets

For temperatures to 800 deg. F.



For pipes where inspection is made frequently and necessitates the removal of the insulation, a blanket form of insulation is far more economical than moulded insulation, due to the ease of application and the elimination of breakage and its resultant loss. An example of such service is found in oil refineries where hot oil vapor lines, particularly those which connect the cracking coil with the soaking drum in cracking processes, must be inspected at frequent intervals.

J-M Asbestos Pipe Blankets are made of asbestos cloth filled with brown asbestos fibre and quilted on approximate 9″ centers. Temperature limit, 800 deg. F.

All edges are beveled for a lap joint and sewed with 5-ply asbestos sewing twine in a special lock stitch. Monel metal hooks for lacing are secured to all longitudinal edges, on approximate 5″ centers, with monel metal wire and copper discs.

For single layer blankets the thickness is 2″ or 3″, and for the double layer blankets, 1½″ and 2″, the second layer fitting snugly over the first. Pipe blankets are made in sections 3 ft. long, with 1 ft. sections for breaking joints on two layer construction, and special lengths as required for the particular job. The proper thickness, depending upon conditions, will be recommended by Johns-Manville, upon application.

Standard straight blankets are used on pipe bends, but where the radius of the bends is small, the end edges of the blankets are mitered, to make the joints at right angles to the pipe.

Measurements

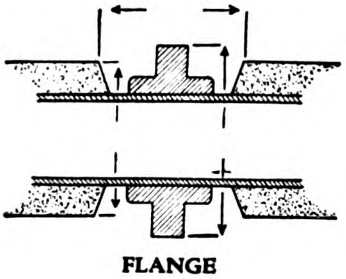
For blankets on ells, crosses, tees and valves, the fittings must be measured exactly as they are shown in the accompanying sketches.

In addition to the measurements, it is desirable to state the class and specification of valves and fittings. For valves, it is desirable, also, to give the name of the manufacturer.

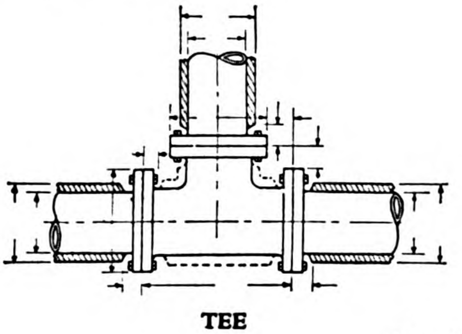
The blankets are laced on the pipe or fitting with monel metal wire furnished with the blanket.

For waterproofing pipe blankets, the use of an Asbestos Firetard Jacket, cut to fit and wired on, is recommended.

Measurements to be taken for Pipe Blankets



FLANGE



TEE

(See other side)

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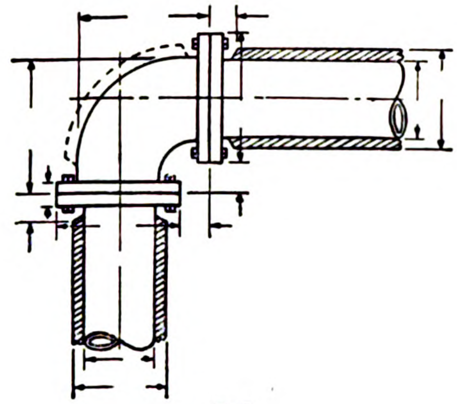
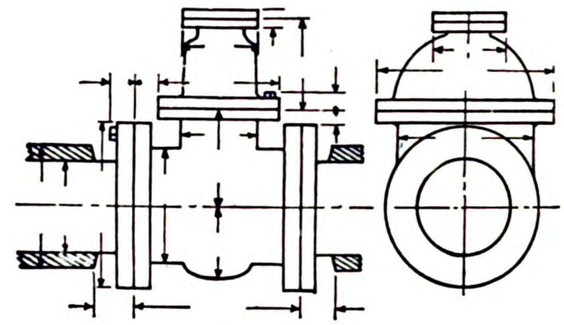
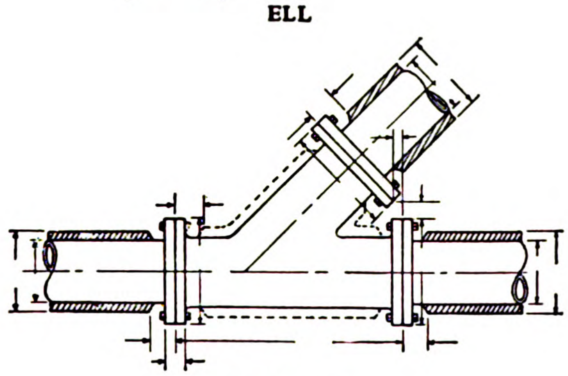
Measurements required on fittings, valves, flanges, etc.



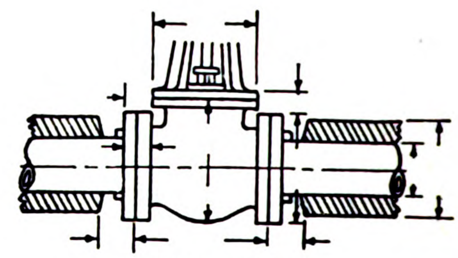
ELL



GATE VALVE

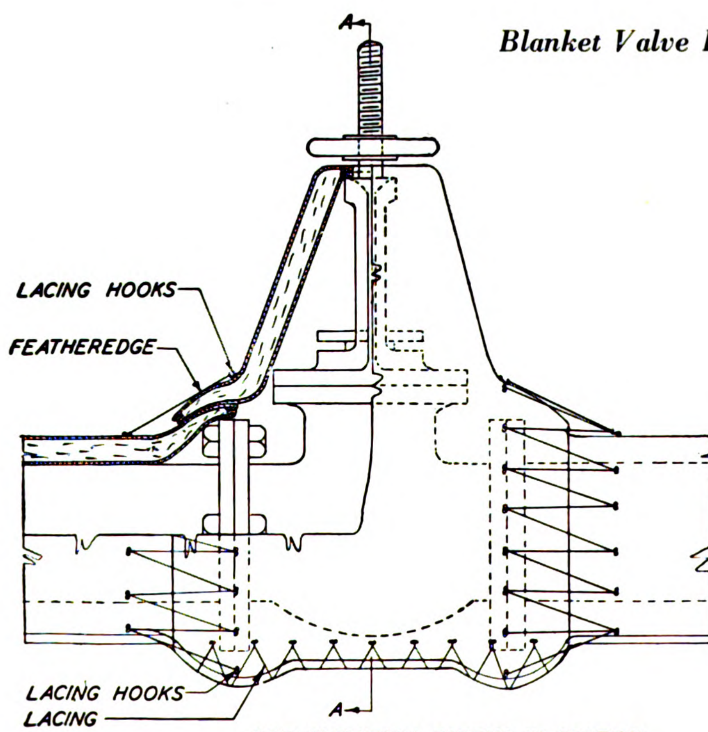


LATERAL

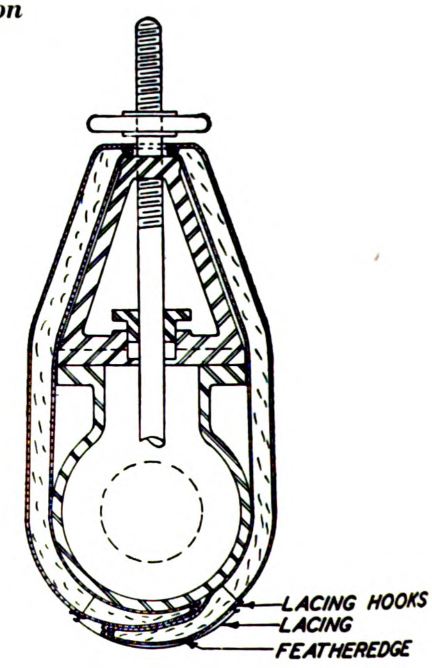


GLOBE VALVE

Blanket Valve Insulation



SIDE ELEVATION PARTLY IN SECTION TO SHOW



SECTION A-A

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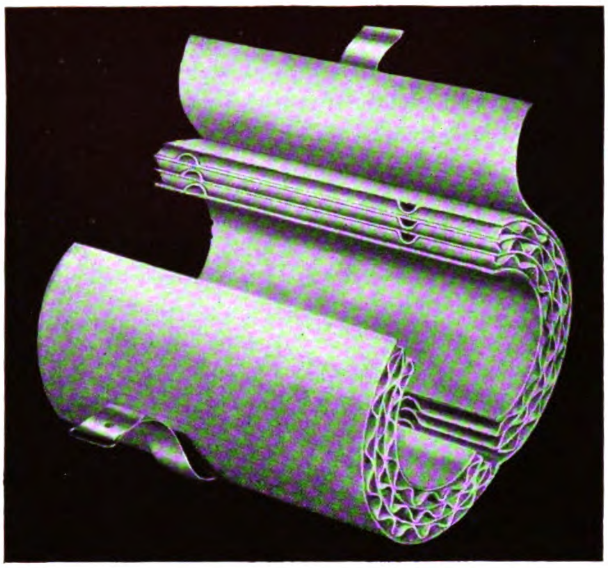
(EL) ELECTRICAL MATERIALS
(FI) FILTER-AIDS & MINERAL FILLERS
(FR) FRICTION MATERIALS
(IN) INSULATION
ROOFING & SHINGLES
(BMS) SOUND CONTROL
(TP) TRANSITE PRODUCTS
(BMW) WATERPROOFING & MISC. ASPH. PROD.

Improved Asbestocel Pipe Insulation

For temperatures to 300 deg. F.

Improved Asbestocel is used for insulating pipes conveying steam at medium or low pressures, or hot water. Temperature limit, 300 deg. F.



Improved Asbestocel is a cellular type of insulation made up of alternate layers of plain and corrugated asbestos felts, with the longitudinal corrugations crossed at right angles by other corrugations which form a barrier to the free circulation of air along the pipe section and increase its ability to withstand vibration and wear.

For identification, Improved Asbestocel is marked with a red band on the inside of each end of every section.

The standard type of Improved Asbestocel is furnished in standard thicknesses of 2, 3 and 4 plies, each ply approximately ¼″ thick. Greater thicknesses can also be furnished. It is made in 3-ft. sections with canvas jacket and brass-lacquered bands, to fit standard sizes of pipe.

Improved Asbestocel is also supplied six plies to the inch, known as Fine Corrugated Improved Asbestocel. The smaller corrugations provide greater strength and efficiency. Standard thicknesses are 4 and 6 plies, each ply approximately 1/6″ thick. Greater thicknesses can also be furnished.

Both types are also furnished in sheet and block form as described on another data sheet.

Number of feet and sections and gross weight per standard carton

Nominal Pipe Size, inches	2-Ply			3-Ply			4-Ply		
	Lin. ft. of Insulation	No. of 3-ft. Sections	Gross Weight, lb.	Lin. ft. of Insulation	No. of 3-ft. Sections	Gross Weight, lb.	Lin. ft. of Insulation	No. of 3-ft. Sections	Gross Weight, lb.
½	171	57	62	108	36	60	84	28	55
¾	135	45	60	96	32	50	72	24	55
1	108	36	55	72	24	45	54	18	45
1¼	84	28	45	60	20	40	45	15	45
1½	72	24	40	54	18	42	39	13	40
2	54	18	35	45	15	40	33	11	40
2½	42	14	32	36	12	35	27	9	35
3	33	11	30	24	8	30	21	7	35
3½	24	8	25	21	7	30	18	6	30
4	33	11	35	27	9	30	21	7	43
4½	30	10	40	21	7	35	15	5	35
5	21	7	30	18	6	30	15	5	35
6	18	6	30	15	5	30	12	4	30

Weight in pounds per standard 3-foot section, uncrated

Thickness	Nominal pipe sizes, inches																	
	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
2 ply	0.90	1.04	1.18	1.37	1.49	1.74	2.02	2.37	2.64	2.92	3.19	3.48	4.05	4.60	5.14	5.68	6.26	7.34
3 ply	1.27	1.42	1.60	1.86	2.01	2.37	2.71	3.15	3.50	3.87	4.20	4.60	5.37	6.04	6.75	7.47	8.25	9.65
4 ply	2.00	2.19	2.40	2.69	2.90	3.30	3.74	4.25	4.67	5.09	5.51	6.00	6.89	7.72	8.56	9.41	10.35	12.00

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Improved Asbestocel Insulation Specification for low pressure steam or hot water piping

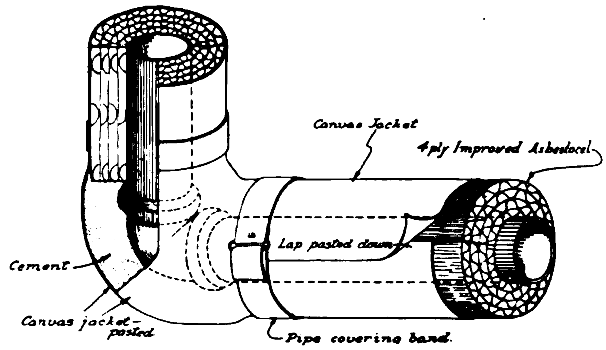
All pipes conveying hot water or low pressure steam at pressures below 25 lb. or 267 deg. F., except heating returns, runouts and concealed radiator branches, shall be insulated with Johns-Manville 4-ply Improved Asbestocel Insulation.

All heating returns, runouts and concealed radiator branches shall be insulated with Johns-Manville 3-ply Improved Asbestocel Insulation.

All fittings and valves shall be insulated with Johns-Manville Insulating Cement, applied to a thickness equal to the adjacent pipe insulation. All flanges shall be insulated by Method A or B, depending upon whether flange insulation is to be removable and replaceable (Method A), or non-replaceable (Method B).

Method A: Use size of J-M Improved Asbestocel sectional insulation suitable to encircle flanges completely, and a length sufficient to overlap the adjoining pipe insulation at least 2″ on each side of the flange. Secure this flange covering with wire and fill space between pipe and flange insulation with J-M Insulating Cement. Apply a thin coat of Insulating Cement over entire outside surface of the flange cover.

Method B: First prime flange surface with a thin coat of J-M Insulating Cement, applied to leave a rough surface. When dry, follow with successive one-half inch coats of J-M Insulating Cement to a final thickness equal to that of the adjacent pipe insulation.



Each coat of the cement should be allowed to dry before the next coat is applied, and each coat should have a rough surface, except the final coat, which should be troweled down to a smooth finish.

All of the above insulation, including fittings, valves and flanges, located indoors and exposed to view, shall be finally finished and additionally protected with 8-oz. canvas, neatly sewed on over rosin-sized paper placed over the canvas jacket furnished with the insulation. The canvas shall then be painted with either fireproof paint, or lead and oil paint, of the color desired. If insulation is not covered with the sewed and painted canvas, lacquered bands furnished with the insulation shall be applied, at 18″ intervals, on all sectional insulation.

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Improved Asbestocel (sectional) Heat Losses and Efficiencies

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.
Efficiency expressed in percent of bare pipe losses.

Insulation thickness		Temperature of pipe—deg. Fahr. 125	175	225	275	325	375
		Temperature difference between pipe and air—deg. Fahr. 50	100	150	200	250	300
	Nominal pipe size ½″						
2-ply	Heat Loss, B.t.u.	1.020	1.082	1.147	1.215	1.287	1.363
	Efficiency %	47.72	49.73	52.22	54.42	56.39	58.19
3-ply	Heat Loss, B.t.u.	.914	.966	1.020	1.076	1.134	1.194
	Efficiency %	53.13	55.11	57.51	59.63	61.57	63.37
4-ply	Heat Loss, B.t.u.	.847	.894	.943	.994	1.047	1.102
	Efficiency %	56.58	58.45	60.71	62.70	64.52	66.19
	Nominal pipe size ¾″						
2-ply	Heat Loss, B.t.u.	.927	.984	1.044	1.107	1.173	1.242
	Efficiency %	52.48	54.28	56.49	58.47	60.29	61.89
3-ply	Heat Loss, B.t.u.	.824	.873	.923	.975	1.028	1.082
	Efficiency %	57.75	59.43	61.54	63.42	65.17	66.81
4-ply	Heat Loss, B.t.u.	.755	.799	.844	.890	.937	.985
	Efficiency %	61.29	62.86	64.83	66.60	68.25	69.78
	Nominal pipe size 1″						
2-ply	Heat Loss, B.t.u.	.853	.908	.965	1.024	1.085	1.148
	Efficiency %	56.27	57.81	59.80	61.58	63.23	64.77
3-ply	Heat Loss, B.t.u.	.755	.799	.844	.890	.938	.988
	Efficiency %	61.29	62.86	64.83	66.60	68.22	69.69
4-ply	Heat Loss, B.t.u.	.684	.724	.765	.807	.850	.894
	Efficiency %	64.93	66.35	68.12	69.72	71.20	72.58
	Nominal pipe size 1¼″						
2-ply	Heat Loss, B.t.u.	.794	.845	.898	.953	1.010	1.070
	Efficiency %	59.29	60.73	62.59	64.24	65.78	67.18
3-ply	Heat Loss, B.t.u.	.692	.733	.775	.818	.862	.908
	Efficiency %	64.52	65.93	67.70	69.31	70.79	72.13
4-ply	Heat Loss, B.t.u.	.623	.660	.698	.736	.775	.814
	Efficiency %	68.05	69.33	70.91	72.38	73.73	75.02
	Nominal pipe size 1½″						
2-ply	Heat Loss, B.t.u.	.764	.813	.864	.917	.972	1.030
	Efficiency %	60.83	62.22	64.00	65.60	67.07	68.39
3-ply	Heat Loss, B.t.u.	.660	.699	.739	.780	.822	.866
	Efficiency %	66.16	67.52	69.21	70.73	72.15	73.43
4-ply	Heat Loss, B.t.u.	.592	.627	.663	.699	.736	.774
	Efficiency %	69.64	70.85	72.37	73.78	75.05	76.24
	Nominal pipe size 2″						
2-ply	Heat Loss, B.t.u.	.717	.764	.813	.864	.918	.975
	Efficiency %	63.23	64.49	66.12	67.58	68.89	70.10
3-ply	Heat Loss, B.t.u.	.615	.652	.690	.729	.769	.811
	Efficiency %	68.47	69.71	71.25	72.64	73.93	75.12
4-ply	Heat Loss, B.t.u.	.547	.580	.613	.647	.682	.717
	Efficiency %	71.95	73.04	74.45	75.72	76.89	78.00

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IMPROVED ASBESTOCEL, SECTIONAL: HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.
Efficiency expressed in percent of bare pipe losses.

Insulation thickness		Temperature of pipe—deg. Fahr. 125	175	225	275	325	375
		Temperature difference between pipe and air—deg. Fahr. 50	100	150	200	250	300
	Nominal pipe size 2½″						
2-ply	Heat Loss, B.t.u.	.686	.732	.780	.830	.882	.936
	Efficiency %	64.82	65.97	67.50	68.86	70.11	71.29
3-ply	Heat Loss, B.t.u.	.586	.619	.654	.691	.730	.771
	Efficiency %	69.95	71.23	72.74	74.07	75.27	76.35
4-ply	Heat Loss, B.t.u.	.517	.547	.578	.610	.643	.677
	Efficiency %	73.49	74.57	75.91	77.11	78.22	79.23
	Nominal pipe size 3″						
2-ply	Heat Loss, B.t.u.	.662	.706	.752	.800	.850	.902
	Efficiency %	66.05	67.19	68.67	69.99	71.20	72.33
3-ply	Heat Loss, B.t.u.	.557	.589	.623	.659	.697	.737
	Efficiency %	71.43	72.62	74.03	75.28	76.38	77.39
4-ply	Heat Loss, B.t.u.	.489	.518	.548	.578	.609	.641
	Efficiency %	74.93	75.92	77.17	78.31	79.37	80.33
	Nominal pipe size 3½″						
2-ply	Heat Loss, B.t.u.	.645	.688	.733	.780	.829	.881
	Efficiency %	66.93	68.03	69.45	70.73	71.91	72.82
3-ply	Heat Loss, B.t.u.	.540	.573	.607	.642	.678	.715
	Efficiency %	72.31	73.38	74.70	75.91	77.03	78.07
4-ply	Heat Loss, B.t.u.	.471	.500	.529	.559	.589	.620
	Efficiency %	75.85	76.75	77.96	79.02	80.04	80.98
	Nominal pipe size 4″						
2-ply	Heat Loss, B.t.u.	.633	.675	.719	.765	.814	.866
	Efficiency %	67.53	68.62	70.03	71.29	72.42	73.43
3-ply	Heat Loss, B.t.u.	.528	.560	.593	.627	.662	.698
	Efficiency %	72.92	73.96	75.29	76.47	77.57	78.58
4-ply	Heat Loss, B.t.u.	.458	.486	.515	.544	.574	.604
	Efficiency %	76.52	77.41	78.54	79.58	80.55	81.47
	Nominal pipe size 4½″						
2-ply	Heat Loss, B.t.u.	.622	.664	.708	.754	.802	.852
	Efficiency %	68.11	69.13	70.49	71.70	72.82	73.87
3-ply	Heat Loss, B.t.u.	.517	.549	.582	.616	.651	.687
	Efficiency %	73.49	74.48	75.74	76.88	77.94	78.93
4-ply	Heat Loss, B.t.u.	.449	.476	.504	.532	.561	.590
	Efficiency %	76.97	77.87	79.00	80.03	80.99	81.90
	Nominal pipe size 5″						
2-ply	Heat Loss, B.t.u.	.615	.656	.699	.744	.791	.841
	Efficiency %	68.47	69.51	70.88	72.08	73.19	74.20
3-ply	Heat Loss, B.t.u.	.508	.539	.571	.604	.638	.674
	Efficiency %	73.94	74.94	76.21	77.33	78.38	79.33
4-ply	Heat Loss, B.t.u.	.438	.465	.493	.521	.549	.578
	Efficiency %	77.54	78.38	79.45	80.45	81.40	82.27

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IMPROVED ASBESTOCEL, SECTIONAL: HEAT LOSSES AND EFFICIENCIES *(continued)*

Heat losses expressed in B.t.u. per square foot of pipe surface, per degree temperature difference, per hour.
Efficiency expressed in percent of bare pipe losses.

Insulation thickness		Temperature of pipe—deg. Fahr. 125	175	225	275	325	375
		Temperature difference between pipe and air—deg. Fahr. 50	100	150	200	250	300
Nominal pipe size 6"							
2-ply	Heat Loss, B.t.u.	.605	.615	.687	.731	.777	.826
	Efficiency %	68.98	70.02	71.38	72.57	73.68	74.66
3-ply	Heat Loss, B.t.u.	.495	.525	.556	.588	.621	.656
	Efficiency %	74.62	75.59	76.83	77.93	78.96	79.87
4-ply	Heat Loss, B.t.u.	.425	.451	.477	.504	.532	.560
	Efficiency %	78.21	79.03	80.12	81.08	81.97	82.82
Nominal pipe size 7"							
2-ply	Heat Loss, B.t.u.	.592	.632	.674	.718	.764	.812
	Efficiency %	69.64	70.63	71.91	73.05	74.11	75.09
3-ply	Heat Loss, B.t.u.	.484	.514	.545	.577	.610	.644
	Efficiency %	75.18	76.11	77.29	78.34	79.33	80.24
4-ply	Heat Loss, B.t.u.	.415	.441	.467	.493	.520	.548
	Efficiency %	78.72	79.51	80.53	81.49	82.38	83.19
Nominal pipe size 8"							
2-ply	Heat Loss, B.t.u.	.585	.625	.667	.711	.757	.805
	Efficiency %	70.00	70.96	72.20	73.32	74.35	75.31
3-ply	Heat Loss, B.t.u.	.479	.508	.538	.569	.601	.635
	Efficiency %	75.43	76.39	77.58	78.64	79.63	80.52
4-ply	Heat Loss, B.t.u.	.409	.434	.459	.485	.512	.539
	Efficiency %	79.03	79.83	80.87	81.80	82.65	83.47
Nominal pipe size 9"							
2-ply	Heat Loss, B.t.u.	.580	.621	.663	.706	.751	.798
	Efficiency %	70.24	71.14	72.37	73.50	74.55	75.52
3-ply	Heat Loss, B.t.u.	.470	.499	.529	.560	.592	.625
	Efficiency %	75.89	76.81	77.96	78.97	79.93	80.83
4-ply	Heat Loss, B.t.u.	.401	.426	.451	.477	.503	.530
	Efficiency %	79.43	80.21	81.21	82.10	82.95	83.74
Nominal pipe size 10"							
2-ply	Heat Loss, B.t.u.	.575	.615	.656	.699	.744	.791
	Efficiency %	70.51	71.41	72.66	73.78	74.79	75.73
3-ply	Heat Loss, B.t.u.	.465	.494	.524	.555	.587	.620
	Efficiency %	76.14	77.04	78.17	79.17	80.11	80.98
4-ply	Heat Loss, B.t.u.	.398	.421	.445	.470	.496	.523
	Efficiency %	79.58	80.43	81.46	82.36	83.19	83.95
Nominal pipe size 12"							
2-ply	Heat Loss, B.t.u.	.565	.604	.645	.688	.733	.780
	Efficiency %	71.02	71.93	73.11	74.18	75.16	76.07
3-ply	Heat Loss, B.t.u.	.457	.486	.516	.547	.579	.612
	Efficiency %	76.56	77.41	78.49	79.47	80.37	81.22
4-ply	Heat Loss, B.t.u.	.390	.414	.438	.463	.488	.514
	Efficiency %	80.00	80.76	81.75	82.62	83.16	84.23

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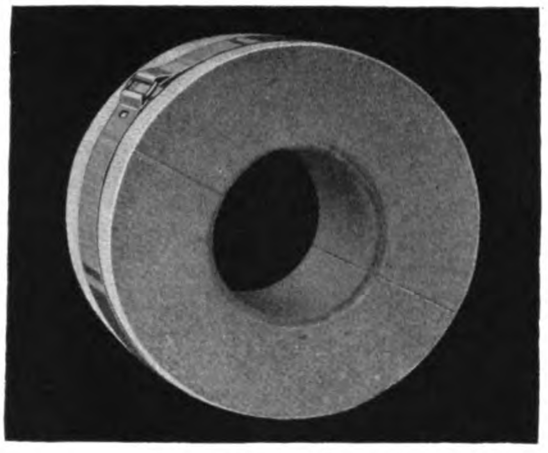
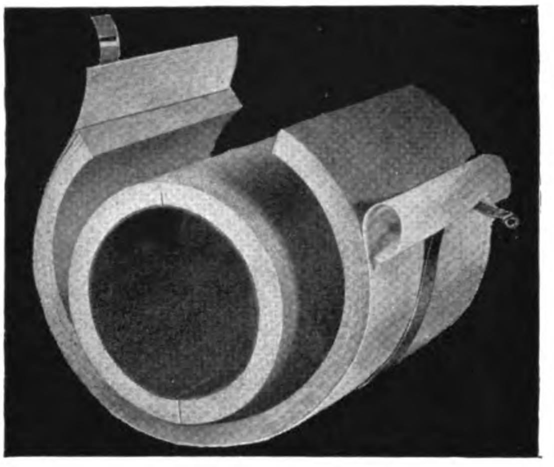
J-M Wool Felt Pipe Insulation



Single layer Wool Felt



Double layer Wool Felt

J-M Wool Felt pipe insulation is recommended for use where a low-priced material is required to insulate hot or cold water piping. It is of slightly differing construction for various conditions of service.

All Wool Felt sectional pipe insulation is furnished in sections 3 ft. long, in thicknesses of ½″, ¾″, and 1″ with canvas cover and brass lacquered bands. Solid Hot Water and Cold Water Wool Felt can also be furnished Double ½″ and Double ¾″.

J-M Wool Felt on lines in walking tunnel. United Aircraft & Transport Corp., East Hartford, Conn.

The double layer construction is advantageous because in application the outer layer may be turned and slipped along the inner layer, thus breaking all joints.

For hot water service:

Corrugated Hot Water Wool Felt is made from alternate layers of plain and corrugated wool felt, lined with asbestos paper.

Solid Hot Water Wool Felt is made from laminations of plain wool felt, lined with asbestos paper.

For cold water service:

Cold Water Wool Felt is made from laminations of plain wool felt, lined with waterproof felt.

Weight in pounds per 3-foot section, uncrated

Thickness, inches	Nominal pipe size, inches				
	½	¾	1	1¼	1½
½	1.40	1.60	1.82	2.08	2.28
¾	2.35	2.60	2.90	3.23	3.50
1	3.10	3.63	4.20	4.75	5.30
	Nominal pipe size, inches				
	2	2½	3	3½	4
½	2.70	3.15	3.60	4.00	4.50
¾	4.10	4.70	5.30	5.90	6.50
1	6.40	7.50	8.54	9.63	10.70

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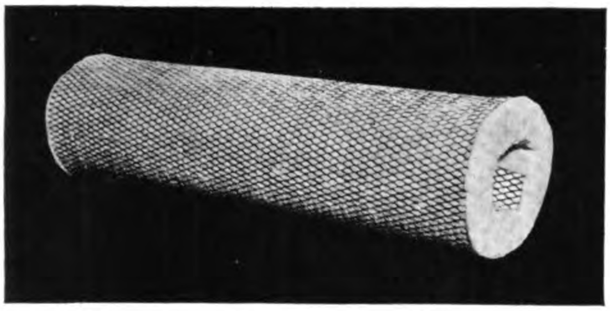
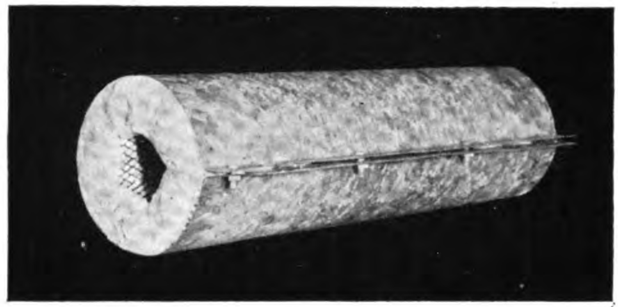
Banroc Pipe Insulation

For temperatures to 1000 deg. F.



Style No. 25



Style No. 65

Banroc Pipe Insulation is made in different forms for use at temperatures up to 1000 deg. F. It consists of specially annealed rock wool fibre, felted and secured between metal fabrics of various types.

Style No. 25:

Banroc Pipe Insulation Style No. 25 is made by securing the Banroc between two layers of copper-bearing metal lath by No. 20 galvanized tie wires. Because of its great flexibility, it is crated and shipped flat. It is installed by wrapping around the pipe and lacing the metal lath together with No. 20 galvanized wire. For outdoor work it must be covered with one of the weather-proof or fire-retardant jackets described in another data sheet, or with a coat of Insulkote, troweled over a 1/4" of insulating cement, consisting of two parts by weight of asbestos cement and one part portland cement. For interior work, the insulation may be coated with asbestos cement and finished with an 8-oz. canvas jacket, sized and painted if desired.

Style No. 25 is furnished in sections 2 ft. long, in thicknesses of 1" to 4", for pipe sizes 2" in diameter and larger.

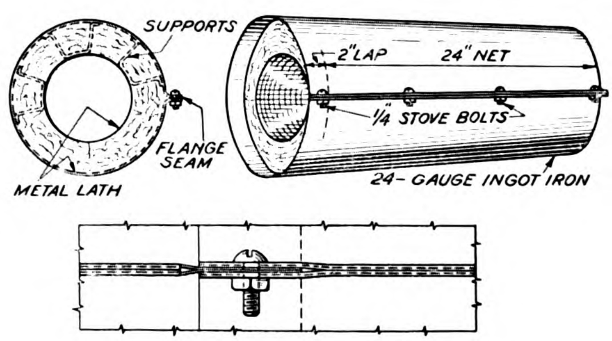
Style No. 65:

Banroc Pipe Insulation Style No. 65 is made with a 24-gauge rust-resisting iron outer casing, to which copper-bearing metal lath, covering the Banroc, is attached by a patented flange and rivet construction. The interior surface is the same type metal lath, stapled to the outer surface, and supported from it with suitable staples and wire arch supports. These patented supports are designed to resist compression and hold the inner and outer surfaces concentric. The insulation is composed of Banroc in segmental form. In applying, it is spread and slipped around the pipe, and then bolted together by means of 1/4" galvanized stove bolts.

Style No. 65 is especially suited for pipe lines in refineries and process plants where an insulation with a waterproof and fireproof metal jacket is desired. It is also particularly adapted for use where the insulation must be frequently removed for repairs or changes.

Style No. 65 is furnished in sections 24" long with 2" extra casing length for end laps, in thicknesses of 1" to 4", for pipe sizes 2" in diameter and larger.

Special styles of Banroc Pipe Insulation can be furnished on order.



Construction details of Style No. 65

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Circumferences of Banroc Pipe Insulation and Crated Weights per linear foot of Style No. 25

Insulation thickness	1"		1½"		2"		2½"		3"		4"	
Pipe Size Inches	Circum. Inches	Wgt. Crated lbs.-ft.	Circum. Inches	Wgt. Crated lbs.-ft.	Circum. Inches	Wgt. Crated lbs.-ft.	Circum. Inches	Wgt. Crated lbs.-ft.	Circum. Inches	Wgt. Crated lbs.-ft.	Circum. Inches	Wgt. Crated lbs.-ft.
2	13.75	3.4	16.88	4.5	20.03	6.9	23.17	9.4	26.31	12.8	32.60	15.6
2½	15.32	3.4	18.46	4.5	21.60	7.6	24.74	9.4	27.88	12.8	34.17	15.6
3	17.28	3.4	20.42	4.5	23.56	8.0	26.71	9.4	29.85	12.8	36.14	15.6
3½	18.85	3.5	21.99	4.6	25.14	8.6	28.28	9.4	31.42	12.8	37.71	15.6
4	20.42	3.7	23.56	4.8	26.71	8.8	29.85	9.4	32.99	12.8	39.28	15.7
4½	21.99	3.9	25.13	5.2	28.28	9.0	31.42	9.6	34.56	13.5	40.85	17.6
5	23.75	4.2	26.89	5.5	30.05	9.4	33.19	9.8	36.33	14.2	42.62	18.2
6	27.10	4.8	30.24	6.1	33.38	9.6	36.53	10.7	39.67	14.7	45.96	19.6
7	30.24	5.1	33.38	6.8	36.52	9.7	39.67	11.5	42.81	15.0	49.10	20.5
8	33.38	5.6	36.52	7.3	39.67	10.1	42.81	12.4	45.95	15.5	52.24	21.4
9	36.52	6.2	39.67	7.8	42.81	11.1	45.95	13.3	49.09	16.1	55.38	22.3
10	40.06	7.0	43.20	8.2	46.34	11.5	49.48	14.7	52.62	16.8	58.91	23.1
12	46.34	7.8	49.48	9.7	52.63	11.7	55.77	15.8	58.91	17.7	65.20	25.2
14	50.26	8.6	53.41	10.2	56.55	12.2	59.69	16.3	62.83	18.5	69.12	26.5
16	56.56	9.6	59.69	11.0	62.83	13.4	65.98	17.1	69.12	20.0	75.40	29.0
18	62.83	10.4	65.98	12.1	69.12	14.8	72.26	18.5	75.40	22.0	81.68	31.4
20	69.12	10.6	72.26	13.2	75.40	16.0	78.54	20.2	81.60	23.8	87.97	33.8
24	81.68	12.6	84.82	15.6	87.97	18.7	91.11	23.5	94.25	27.5	100.53	38.6
30	100.53	16.3	103.68	19.0	106.82	22.6	109.96	28.4	113.10	33.0	119.38	45.8

Style No. 65—Crated Weights, pounds per linear foot

Pipe Size, Inches	Insulation Thickness, Inches						
	1	1½	2	2½	3	3½	4
2	4.2	5.90	7.90	10.50	13.25	.....	.....
2½	4.6	6.50	8.45	11.05	13.80	.....	.....
3	4.9	7.16	9.18	11.90	14.75	17.00	.....
3½	5.6	7.50	9.76	12.58	15.50	18.85	.....
4	6.3	8.20	10.35	13.25	16.26	19.28	23.20
6	8.6	10.40	12.83	16.10	19.50	22.77	27.10
8	10.2	12.50	15.28	18.83	22.50	26.04	31.00
10	12.7	14.68	17.65	21.70	25.68	29.52	34.60
12	14.6	16.76	20.00	24.42	28.75	33.00	38.00

Notes:

Sections of No. 25 Banroc Pipe Insulation are always crated to avoid damage in transit. Sections of No. 65 Banroc Pipe Insulation for curved pipe or bends are also always crated, but sections of No. 65 for straight pipe are crated only on less carload shipments.

List Prices of Banroc Pipe Insulation per linear foot, crated

Thickness	Pipe Size, inches					
	2	2½	3	3½	4	4½
1"	$ .70	$ .75	$ .85	$ .95	$1.05	$1.15
1½"	.90	1.00	1.10	1.20	1.30	1.40
2"	1.30	1.40	1.50	1.60	1.70	1.85
2½"	1.65	1.75	1.85	1.95	2.05	2.20
3"	2.20	2.30	2.45	2.60	2.75	2.90
4"	3.10	3.25	3.40	3.55	3.70	3.85

Thickness	Pipe Size, inches					
	5	6	7	8	9	10
1"	$1.25	$1.35	$1.50	$1.65	$1.80	$2.00
1½"	1.50	1.65	1.80	1.95	2.15	2.35
2"	2.00	2.15	2.30	2.50	2.75	3.00
2½"	2.35	2.50	2.70	2.95	3.20	3.50
3"	3.05	3.30	3.55	3.80	4.10	4.40
4"	4.00	4.20	4.50	4.80	5.10	5.50

Thickness	Pipe Size, inches					
	12	14	16	18	20	24
1"	$2.20	$2.50	$2.80	$3.10	$3.40	$4.00
1½"	2.70	3.00	3.30	3.60	3.90	4.60
2"	3.20	3.60	4.00	4.40	4.80	5.60
2½"	3.80	4.20	4.60	5.00	5.50	6.40
3"	4.80	5.20	5.80	6.30	6.90	7.90
4"	6.00	6.50	7.10	7.60	8.20	9.50

J-M Engineers' Insulating Tape*

For temperatures to 1000 deg. F.

J-M Engineers' Insulating Tape is designed for insulating small steam pipes with curves or bends which make the application of sectional pipe covering impractical. The material is a combination of Ceilinite and Asbestos Listing, stitched together down the center, with a marginal overlap of the Listing approximately ¼" on each side, which serves to seal the joint. The material may be used up to 1000 deg. F.

Engineers' Insulating Tape is applied spirally in the same manner as ordinary Listing. It is made in only one size, which is suitable for all sizes of pipe from ¼" up to and including 2" pipe. It is applied with the Ceilinite against the pipe, and the Listing forms the exposed side. The Ceilinite is 2" wide and the Listing 2½" wide, the tape having an effective width of 2¼". The thickness is a full ¼" or slightly more. This material is furnished in 25-ft. rolls.

Application:

Before starting to apply the material, cut off enough Ceilinite from the end of the roll so that the remaining strip of Listing will go once around the pipe. Dip the entire roll in a bucket of water for about five seconds to saturate partially the material. Wrap the free end of the roll around the pipe and secure it with two turns of No. 16 gauge annealed copper or iron wire. Then wrap the tape on spirally, overlapping each preceding turn by the ¼" margin of Listing.

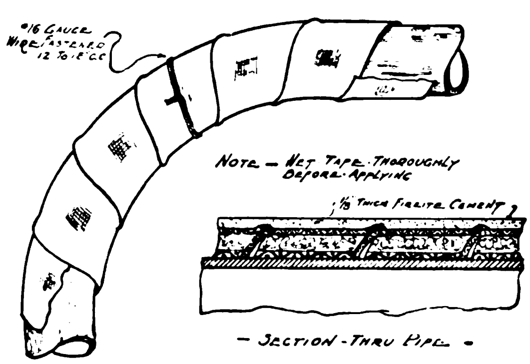
When wrapping bends, lap the material sufficiently on the short radius so that on the long radius the tape will have the same overlap as on straight pipe.

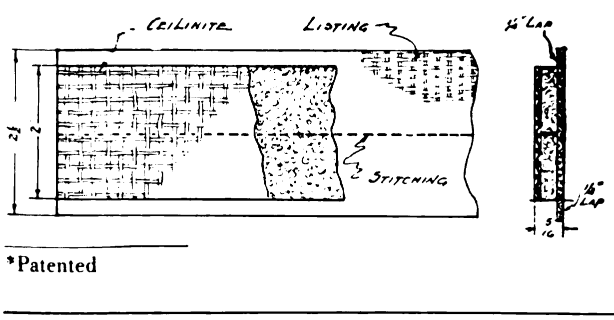
To finish the wrapping, cut off sufficient Ceilinite to allow a full turn of Listing at the end, which may be doubled back over the covering and secured with wire. Intermediate fasteners of wire should be used on 12" or 18" centers as required.

When the application is completed, go back over the job, and where there are bumps or double thicknesses, smooth them out with a mallet and the finished application will be perfectly smooth with no joints. If a white finish is desired, leave the application as it is. If it is to be painted, allow it to dry and paint the desired color, using waterproof paint.

If a cement finish is desired, Fireite Asbestos Furnace Cement can be troweled on approximately ⅛" thick and makes a very satisfactory appearance.

Engineers' Insulating Tape is intended more as a protection against burns than as a highly efficient insulating material. If greater efficiency is required than will be secured with one wrapping, the pipe should first be wrapped with a strip of 2" wide ¼" thick Ceilinite and then Engineers' Insulating Tape applied over this in the regular manner.





Material required per 100 lin. ft. of pipe

Nominal pipe size, inches	Actual outside diameter, inches	Tape required, ft.
¼	.540	147
½	.840	187
¾	1.050	218
1	1.315	254
1¼	1.660	302
1½	1.900	338
2	2.375	400

*Patented

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J-M Asbestos Combination Spiral Pipe Insulation

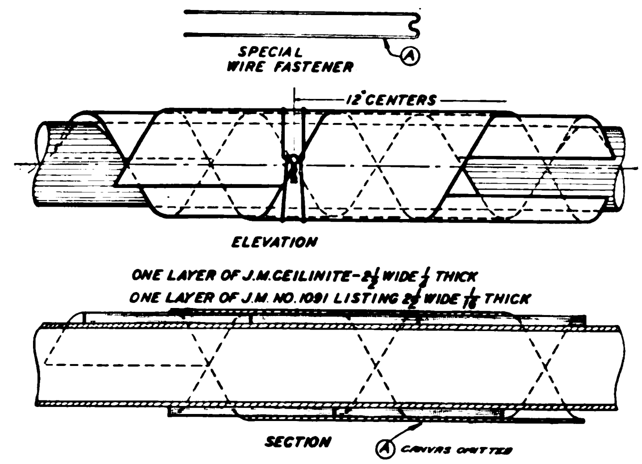
For temperatures to 1000 deg. F.

J-M Asbestos Combination Spiral Pipe Insulation was developed as an insulation for steam pipes on locomotives where clearance conditions would not allow the application of standard thicknesses of moulded insulation. The temperature limit is 1000 deg. F.

The primary object of this insulation is to guard against injury or damage likely to result from leaving a highly heated surface unprotected. However, it also effects a considerable reduction in heat loss, especially where the pipes are exposed to moving air.

Asbestos Combination Spiral Insulation consists of one layer of Ceilinite 2½" wide by ¼" thick, over which is wrapped a layer of J-M Asbestos Listing of the same width and 1/16" thick. Wire-inserted Asbestos Listing is stronger, can be pulled somewhat tighter, and is preferred in some cases.

Asbestos Combination Spiral Insulation lends itself readily to application on irregular runs of pipe as well as where considerable vibration is encountered, such as in railroad and automotive service. In automotive service, where the above mentioned conditions are encountered, this particularly applies to exhaust pipes located near woodwork or under floor boards.



SCHEME "A"-LISTING WITHOUT WIRE INSERTION
SCHEME "B"-LISTING WITH WIRE INSERTION

Application:

The Ceilinite is wrapped spirally with butt joints on the pipe and secured on 12" centers by special wire fasteners, as shown on the drawing, or by two turns of 16-gauge annealed iron wire, fastened by twisting the ends together. The wire fasteners are not, as a rule, furnished with the insulation.

A layer of Asbestos Listing is then wound spirally with butt joints over the Ceilinite, in the reverse direction to the Ceilinite, and secured in place by wires or fasteners on 12" centers as described previously.

The insulation may be left with the Listing as a finish or a brush coat of J-M Fireite Asbestos Furnace Cement may be applied over the Listing.

Material required per 100 lin. ft. of pipe

Size of pipe, inches		½	¾	1	1¼	1½	2	2½	3
Outside diameter of pipe, inches		.840	1.050	1.3 5	1.660	1.900	2.375	2.875	3.500
Ceilinite ¼" thick—quantity in feet		137	164	197	240	271	330	393	472
No. 1091 Asbestos Listing 1/16" thick—quantity in feet		177	203	236	280	310	370	432	511
Lb. of No. 1091 Listing	With wire	13.62	15.62	18.15	21.54	23.85	28.46	33.23	39.31
	Without wire	10.11	11.94	13.88	16.47	18.24	21.77	25.41	30.06

Note—Approximately 17 ft. No. 1091 Listing per lb.; wire-inserted No. 1091 Listing, 13 ft. per lb.

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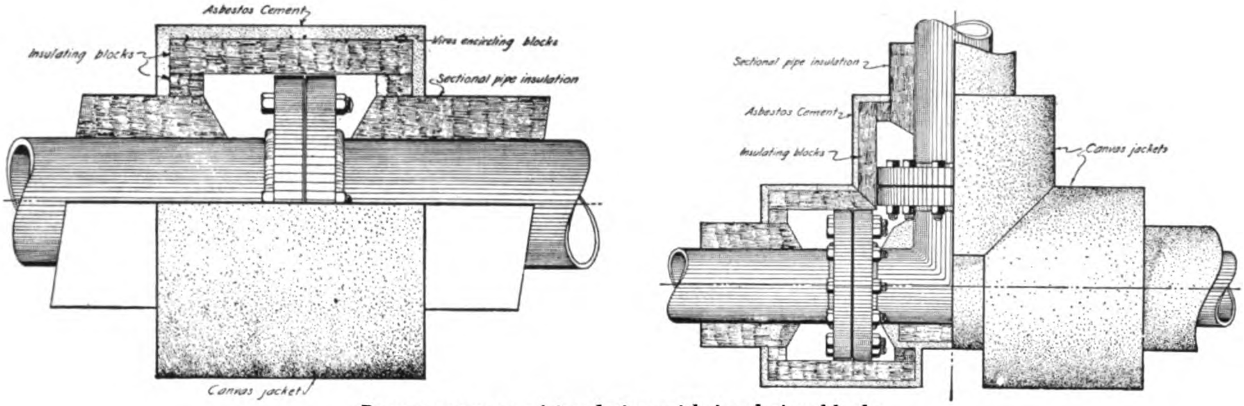
Insulation Specifications for Flanges, Fittings and Valves



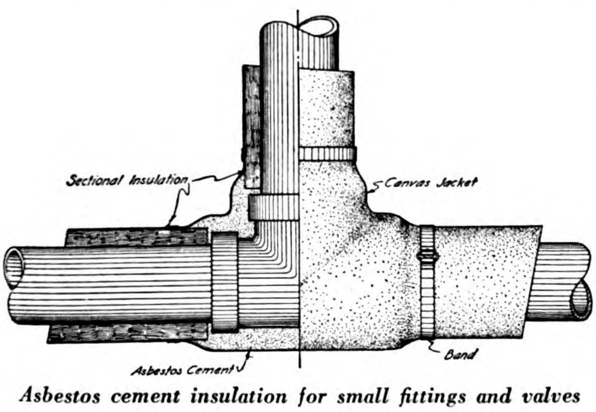
Permanent type of insulation with insulating blocks

Insulation:

All flanges, fittings and valves shall be insulated with the same materials as the adjacent piping.

On piping 4″ and larger, the bodies of flanged fittings and valves, the entire surface of screwed fittings, the entire surface up to the bonnet of screwed valves, and flanges of all pipe sizes where flange insulation is to be of the permanent type, shall be insulated with block insulation to a thickness ½″ thinner than the insulation on the adjacent piping. Hard finish Asbestos Cement shall then be applied to make the total thickness of insulation on the valve or fitting equal to that on the adjacent piping. Pipe insulation should be stopped short of all flanges, and beveled off to permit removal of flange bolts when necessary.

In the case of flanges the insulation of which is to be of the removable and replaceable type, all flanges shall be insulated with sectional pipe insulation to a thickness equal to that of the insulation on the adjacent piping or with block insulation to a thickness ½″ thinner than the insulation on the adjacent piping, covered with ½″ hard finish Asbestos Cement. Removable flange insulation is applied as described on the next page.



Asbestos cement insulation for small fittings and valves

On piping 3½″ and smaller, in place of blocks and cement as mentioned above, the entire insulation of flanged and screwed fittings and valves shall consist of hard finish Asbestos Cement to a total thickness equal to that of the adjacent pipe insulation.

Application—Permanent Type:

The block insulation on the body of 4″ or larger fittings and valves and on all flanges to be insulated with permanent type insulation, shall be securely wired in place with No. 16 gauge annealed iron wire. On flanges the insulation shall be of such length as to extend not less than 2″ over the adjacent pipe insulation on each side of the flange and the space between filled and thoroughly sealed with hard finish Asbestos Cement. Hard finish Asbestos Cement shall then be applied in two coats to bring the total thickness of the insulation up to that on the adjacent piping. The first coat of cement shall be allowed to dry thoroughly before the second is applied and the second coat shall be troweled to a smooth, hard finish.

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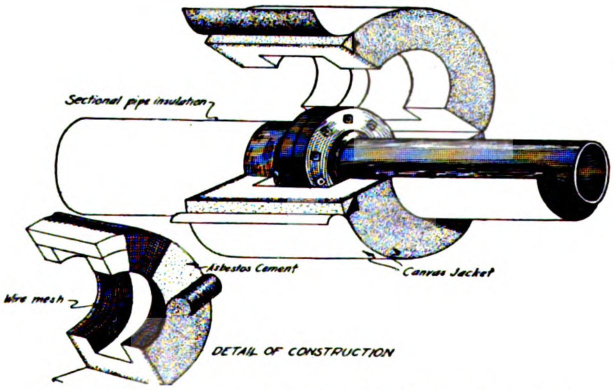
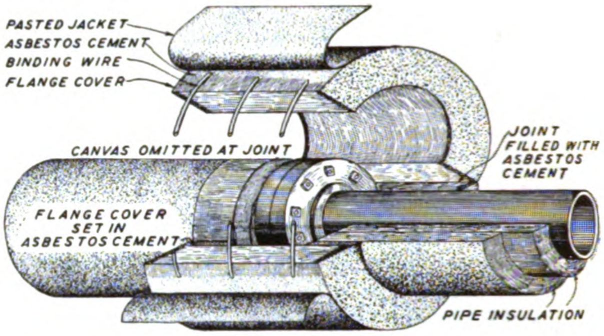
Application—Removable and Replaceable Type:

On all flanges which are to be insulated with a removable and replaceable type of insulation, where the flange insulation consists of sectional covering, it shall be of suitable size to encircle the flange and of such length that it will, when applied, overlap the adjacent pipe insulation on each end, not less than 2″. This sectional covering shall be securely wired in place on the flange and the annular space, if any, between the flange insulation and the insulation on the pipe, shall be filled and thoroughly sealed with hard finish Asbestos Cement. A thin layer of hard finish Asbestos Cement shall then be applied over the entire surface of the flange covering to present a smooth, even finish.

On all flanges which are to be insulated with a removable and replaceable type of insulation, where the flange insulation consists of blocks, they shall be securely wired to a frame made of ½″ square mesh, 19-gauge galvanized wire cloth. This frame shall be made in two parts and of such size and shape, as to encircle and enclose the blocks on the outside. At the ends of the blocks the wire mesh shall be split and bent down to enclose the hard finish Asbestos Cement used to fill up the annular space between the block insulation and the pipe insulation. The wire frame, with its attached blocks and cement, shall then be wired in place on the flange and the entire cover finished with ½″ of hard finish Asbestos Cement. The cement shall be applied in two coats, the first of which shall be allowed to dry thoroughly before the second is applied. The second layer shall be troweled to a smooth, even finish.



Removable and replaceable block type of insulation



Removable and replaceable sectional type insulation

Application on Fittings 3½″ or Smaller:

On 3½″ or smaller valves and fittings, hard finish Asbestos Cement shall be applied to the surface, in layers not thicker than ½″, to equal the total thickness of insulation on adjacent piping. Each layer of cement shall be allowed to dry thoroughly before the succeeding layer is applied and the final layer shall be troweled to a smooth, hard finish.

Finish:

Indoors: The surfaces of all flanges, fittings and valves located indoors shall be finished with 8-oz. canvas stretched tightly over the surface of the fitting and held in place by paste throughout its entire surface. The canvas shall be so cut and stretched that it covers the entire surface of the fitting and presents a smooth, even surface.

Outdoors: All flanges, fittings and valves located outdoors shall be finally finished with J-M Insulkote, applied to a thickness of ¼″ over the first coat and in place of the second coat of hard finish Asbestos Cement. The Insulkote shall be troweled to a smooth, even finish.

Painting:

All flanges, fittings and valves, finished with a jacket of 8-oz. canvas, shall be finally painted with first one coat of glue sizing and then not less than two coats of first quality lead and oil paint, of a color selected by the purchaser.

All of the above insulation shall be applied by the manufacturer of the materials used, or by his approved contractor.

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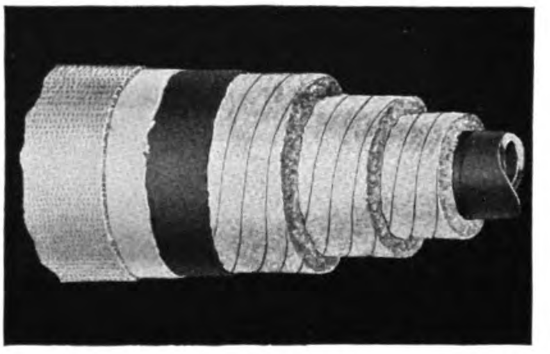
J-M Built-up Brine and Ammonia Insulation

J-M Built-up Brine and Ammonia Insulation is efficient in maintaining the extremely low temperatures required in pipe lines conveying brine, ammonia or other cold liquids or gases. It consists of several layers of insulating felts carefully applied and sealed around pipes to be insulated.

The effective method of sealing eliminates the possibility of moisture accumulating between pipe and insulation and then freezing and bursting the insulation.

J-M Built-up Brine and Ammonia Insulation is not only highly efficient as an insulator, but will withstand contraction and expansion without cracking or breaking open.

Each layer of insulating felt, before application, is approximately 1″ thick. Insulation should be of a suitable thickness, based on temperatures contained in piping or apparatus. The ordinary range of temperatures require the following thicknesses:



Plus 15°F. to plus 50°F.—2 layer insulation
Minus 10°F. to plus 15°F.—3 layer insulation
Minus 20°F. to minus 10°F.—4 layer insulation

This type of built-up insulation to be satisfactory should be applied only by mechanics specially trained in low temperature work.

For any conditions where temperatures are below minus 20 deg. F., recommendations will be furnished by Johns-Manville.

Rates of heat transmission

The rates of heat transmission given below are expressed in B.t.u. per square foot (and also per linear foot) of pipe surface, per hour, per degree temperature difference between fluid in the pipe and air surrounding the pipe. The thickness of 2-layer has been taken as 2″, of 3-layer as 3″ and 4-layer as 4″. Sometimes the thicknesses after application are less than these nominal thicknesses and for such cases the figures in the table should be modified accordingly.

Pipe size, inches	Two-layer		Three-layer		Four-layer	
	B.t.u. per lin. ft. of pipe	B.t.u. per sq. ft. of pipe	B.t.u. per lin. ft. of pipe	B.t.u. per sq. ft. of pipe	B.t.u. per lin. ft. of pipe	B.t.u. per sq. ft. of pipe
½	.086	.390	.074	.331	.065	.295
¾	.095	.345	.079	.288	.070	.255
1	.107	.310	.088	.257	.078	.227
1¼	.124	.285	.102	.235	.090	.206
1½	.132	.265	.109	.218	.095	.190
2	.149	.240	.120	.193	.104	.167
2½	.167	.222	.133	.177	.114	.151
3	.192	.210	.151	.165	.128	.140
3½	.211	.201	.165	.157	.138	.132
4	.228	.194	.176	.150	.148	.126
4½	.247	.188	.190	.145	.158	.121
5	.268	.184	.205	.141	.170	.117
6	.307	.177	.233	.134	.191	.111
7	.343	.172	.257	.129	.212	.106
8	.380	.168	.282	.125	.232	.102
9	.415	.165	.307	.122	.242	.099
10	.455	.162	.335	.119	.279	.097
12	.528	.158	.387	.116	.310	.093

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Built-up Brine and Ammonia Insulation Specification

All pipe lines, including fittings and flanges and other apparatus containing brine or ammonia, or other cold liquids or gases, shall be insulated with Johns-Manville Built-up Brine and Ammonia Insulation of the proper thickness as indicated on other side of this sheet.

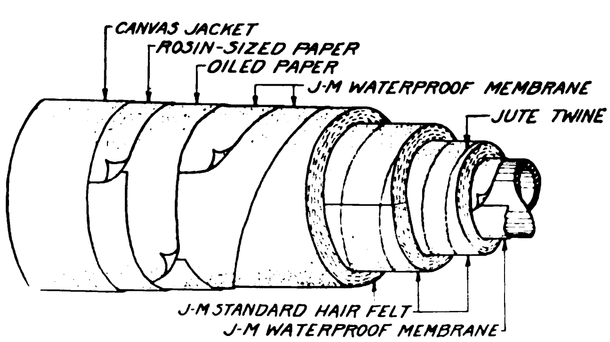
All piping and other surfaces to be insulated shall be so located that there will be uninterrupted clearance around the finished insulation of at least 3″ in all directions. The insulated piping shall not be located closely adjacent to any heated surface nor located in the same pipe chase or shaft with heated pipes.

Pipes:

All surfaces to be insulated shall be thoroughly cleaned and dried before insulation is applied and the system shall not be put in operation until the insulation work is completed.

Whenever it is desired to seal the end of the insulation, as at fittings, valves, flanges, etc., the bare pipe for a distance of about 1 linear foot is wrapped with Waterproof Membrane. All pipes shall then be wrapped with a layer of 1″ Hair Felt, cut to proper length, so that all longitudinal and abutting joints shall fit closely together. The Hair Felt shall be secured to the pipe by 2-ply wrapping twine, wound spirally on approximate 1″ centers. Then additional layers of 1″ Hair Felt shall be applied, to the thickness specified, and these outer layers shall be applied so that all longitudinal and abutting joints shall be broken.

When the proper number of layers have been applied, Waterproof Membrane shall be wrapped on spirally so that at no place shall it be less than 2-ply thick. Two coats of Waterproof Sealing Compound* shall be applied to the surface of the outside waterproof membrane, allowing the first coat to set before applying the second.



A sealing cap of Waterproof Membrane shall enclose the end of the felt insulation wherever it is interrupted by fittings, hangers, etc. These sealing caps shall be at least 2-ply in thickness and shall extend over the felt and under the outside sealing membrane and shall be coated with Waterproof Sealing Compound the same as the outside membrane on the pipe.

Fittings:

All fittings shall be insulated separately from the adjacent piping, the insulation being of the same thickness, and applied and sealed in the same manner, as on the pipe.

The insulation on each fitting or nest of fittings shall be thoroughly sealed with a sealing membrane not less than 2-ply thick, and joined to the adjacent pipe insulation in such manner that there will be no interruption of insulation of pipes and fittings.

Hangers:

Each hanger shall be insulated separately, the same as the fittings, running the insulation along the rod of the hanger for some distance beyond the adjacent pipe insulation.

Accumulators, Tanks, etc.:

Surfaces of accumulators, tanks, etc., shall be insulated in the same manner as specified above for pipe lines, except that *extra thicknesses* of insulation felts may be required on account of lower temperatures. All exposed ends shall be sealed with sealing caps.

Finish of Insulation:

All of the above insulation exposed to view shall be finished with a jacket of 8-oz. canvas, sewed on over a layer of oiled paper and a layer of rosin-sized sheathing paper. This canvas jacket shall be thoroughly sized, and painted with not less than two coats of a first quality lead and oil paint, of a color selected by the purchaser.

All of the above insulation shall be furnished and applied by the manufacturer of the materials used, or by his approved contractor.

*A liquid asphaltic compound furnished in 1, 2, 3, 5, 25 and 50-gal. containers.

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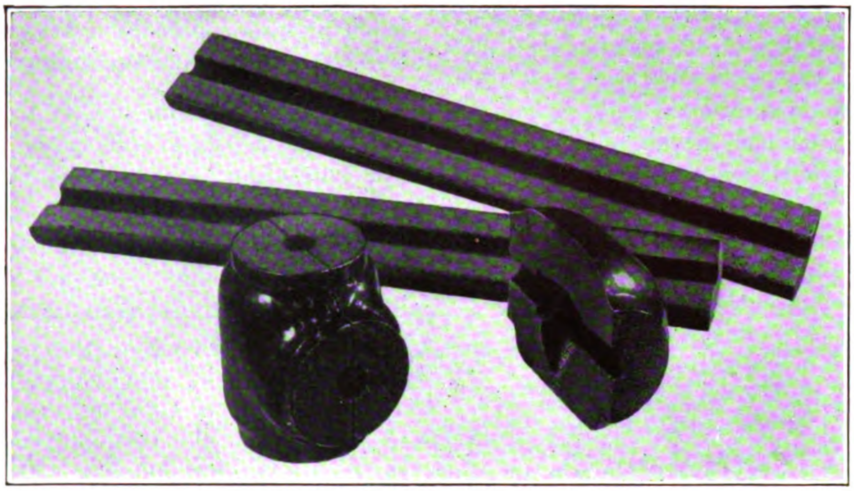
J-M Cork Pipe Insulation



J-M Cork Pipe Insulation is used for piping containing brine and ammonia, ice water, cold water and other cold liquids. It is manufactured from pure granulated cork, moulded, compressed and baked into the required form. Because it possesses such an enormous quantity of minute air cells, cork is one of the most efficient insulating materials known.

Cork does not possess capillarity—it is inherently moisture resisting. The baking process dries out the moisture in the sap and surrounds each particle of granulated cork with a waterproof gum, forming an additional barrier to the entrance of moisture.

The mineral rubber finish, with which the finished product is coated inside and out when manufactured, acts as an added protection against moisture absorption. In applying the material, all joints are sealed with waterproof cement.

J-M Cork Pipe Insulation is furnished in single-layer, semi-cylindrical sections, 3 ft. long, to fit standard pipe sizes. It is supplied in a definite thickness for each size of pipe according to the service. Cork jackets are furnished to fit all sizes of screwed and flanged fittings and are made in two half-sections for small sizes and in assembled form for large sizes. The "assembled" insulation is made up of carefully mitred pieces, and is hardly distinguishable from the moulded insulation.

Ice Water Thickness, used for water, liquid ammonia or cold lines above 25 deg. F., varies from approximately 1½″ to 2″, increasing in thickness with pipe size. Furnished in two half-sections, or jackets, for sizes to 10″ and in assembled form above 10″.

Brine Thickness, used for lines conveying brine and ammonia gas and other refrigerants between 0 and 25 deg. F., varies from approximately 2″ to 3″, increasing in thickness with pipe size. It is furnished in two half-sections, or jackets, for pipe sizes up to 8″ and in assembled form above 8″.

Heavy Brine Thickness, for brine lines at temperatures below 0 deg. F., varies from approximately 3″ to 4″, increasing in thickness with pipe size. It is furnished in two half-sections for pipe sizes up to 6″ and in assembled form for pipes above 6″.

Space Required for Applying Cork to Pipes

Insulation	Space between parallel pipes	Space between pipe and wall
Ice Water Thickness		
Up to 6″ pipe—screwed fittings	6″	4″
Larger than 8″ pipe—screwed fittings	10″	5″
All pipe sizes—flanged fittings	10″	5″
Standard Brine Thickness		
Up to 6″ pipe—screwed fittings	8″	6″
Larger than 6″ pipe—screwed fittings	14″	8″
All pipe sizes—flanged fittings	14″	8″
Heavy Brine Thickness		
Up to 3″ pipe—screwed fittings	10″	8″
Larger than 3″ pipe—screwed fittings	18″	12″
All pipe sizes—flanged fittings	18″	12″

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(EL) ELECTRICAL MATERIALS
(FI) FILTER-AIDS & MINERAL FILLERS
(FR) FRICTION MATERIALS
(IN) INSULATION
ROOFING & SHINGLES
(BMS) SOUND CONTROL
(BMT) TRANSITE PRODUCTS
(BMW) WATERPROOFING & MISC. ASPH. PROD.

Supplementing the thicknesses given above, for extremely low temperatures it is generally advisable, in order to prevent condensation on the surface of the insulation, to use lags over Heavy Brine Thickness Cork. Between —25 and —40 deg. F., 1½″ thick lags are recommended; below —40 deg. F., 2″ thick lags. The lags are waterproofed with asphalt. If extreme humidity conditions prevail (over 80% relative humidity), a special recommendation should be obtained from the nearest Johns-Manville office.

Where finished with a coat of asphalt paint over the original mineral rubber finish, the cork pipe insulation presents a pleasing appearance, making it unnecessary to apply canvas or other material.

Where there is objection to the dark finish, the surface can be painted with special enamel or covered with canvas and painted the desired color.

Heat transmission through J-M Cork Pipe Insulation

Nominal pipe size, inches	Ice Water Thickness			Brine Thickness			Heavy Brine Thickness		
	Thickness, inches	Heat transmission*		Thickness, inches	Heat transmission*		Thickness, inches	Heat transmission*	
		Square foot	Lin. foot		Square foot	Lin. foot		Square foot	Lin. foot
¼	1.45	.642	.091	1.98	.571	.081	2.97	.494	.070
⅜	1.40	.576	.102	1.91	.511	.091	2.90	.436	.077
½	1.35	.525	.116	1.83	.460	.101	2.82	.385	.085
¾	1.47	.454	.125	1.97	.396	.109	2.72	.345	.095
1	1.59	.394	.135	2.09	.345	.119	2.84	.299	.103
1¼	1.42	.378	.164	2.42	.289	.126	3.16	.254	.111
1½	1.52	.348	.174	2.55	.264	.132	3.05	.241	.120
2	1.55	.317	.197	2.31	.253	.157	3.31	.208	.129
2½	1.31	.330	.248	2.56	.221	.165	3.06	.200	.151
3	1.50	.287	.263	2.75	.197	.181	3.24	.179	.164
3½	1.50	.278	.292	3.00	.179	.187	3.50	.163	.171
4	1.75	.244	.286	2.75	.182	.214	3.25	.163	.192
4½	2.00	.216	.284	3.00	.166	.218	4.25	.133	.174
5	1.72	.231	.336	2.72	.170	.248	3.97	.133	.193
6	1.68	.227	.393	2.94	.154	.267	3.92	.127	.220
7	1.69	.223	.445	2.94	.149	.298	4.00	.121	.242
8	1.94	.197	.444	2.94	.144	.324	4.00	.117	.264
9	1.94	.194	.488	3.19	.133	.335	4.00	.113	.284
10	1.87	.195	.549	3.12	.133	.375	4.00	.110	.310
12	1.62	.213	.709	3.12	.127	.423	4.00	.106	.348
14	....	....	....	3.12	.125	.460	4.00	.103	.378
16	....	....	....	3.12	.123	.515	4.00	.101	.422

*B.t.u. per square foot of pipe surface, and per linear foot of pipe, per degree temperature difference, per hour.

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J-M Cork Pipe Insulation Specification

Brine Thickness Cork—0 to 25 deg. F.:

All brine and ammonia lines operating between 0 and 25 deg. F., after they have been tested, cleaned and approved, are insulated with Brine Thickness J-M Cork Insulation.

J-M Sectional Cork Insulation is used on all pipe lines to and including 8″ nominal pipe size. On larger sizes, J-M Assembled Cork Insulation is used. All joints are made tight with Waterproof Cement, all end joints being broken by making one half of the first section 18″ long and the other half the full length of 36″. All longitudinal joints are made on top and bottom. The insulation is fastened in place with Copperweld steel wire, not less than 6 wires per section. Wires are drawn tight all around the insulation, not merely at the point of twist.

J-M Cork Fitting Jackets are used on all screwed and flanged fittings up to and including 6″. On all larger sizes, J-M Assembled Cork Insulation is used. All joints are made tight with Waterproof Cement and the jacket securely wired with Copperweld steel wire, applying not less than 6 wires per fitting. On flanged fittings, all spaces between the Cork and the pipe are filled with molten paraffin and granulated cork particles, mixed in equal volumes and so applied as to leave no void spaces behind the insulation. Brine Putty is used on screwed fittings.

After the insulation is thus applied, all seams and broken edges are filled with Seam Filler, to leave a smooth, workmanlike surface. The entire exposed surface of the insulation is painted with one good coat of asphalt paint, or finished as otherwise specified.

All insulated lines are carried on hangers fitted to the outside of the insulation, which should be protected by a 6″ wide sheet iron shield, shaped to fit the insulation and extending halfway up the sides of the insulation.

Heavy Brine Thickness Cork—below 0 deg. F.:

On brine and ammonia lines operating below 0 deg. F., the specifications given for Brine Thickness Cork should be followed with these exceptions:

(a) "Heavy Brine" is substituted for "Brine" thickness.

(b) J-M Sectional Cork Insulation is used on all pipe lines to and including 6″ nominal pipe size, and J-M Assembled Cork Insulation on larger sizes.

(c) J-M Cork Fitting Jackets are used on all screwed fittings up to and including 5″, and on all flanged fittings up to and including 4″. On all larger sizes, J-M Assembled Cork Insulation is used.

Ice Water Thickness Cork—above 25 deg. F.:

On ice water and cold lines operating above 25 deg. F., the specifications given for Brine Thickness Cork should be followed, with these exceptions:

(a) "Ice Water" is substituted for "Brine" thickness.

(b) J-M Sectional Cork Insulation is used on all pipe lines up to and including 10″ nominal pipe size, and J-M Assembled Cork Insulation on larger sizes.

Sundry Materials:

In order that J-M Cork Pipe Insulation and Cork Fitting Jackets may be properly applied, the following sundry materials are supplied without extra charge:

(a) Waterproof Cement, for cementing the joints.

(b) Brine Putty, for filling all spaces inside the insulation over screwed fittings.

(c) Paraffin and granulated cork, for filling spaces inside the insulation over flanged fittings.

(d) Copperweld steel wire, for holding the insulation in place.

(e) Seam Filler, for finishing seams and broken edges.

(f) Asphalt paint, for painting the outside surface of the insulation to give it a neat and finished appearance.

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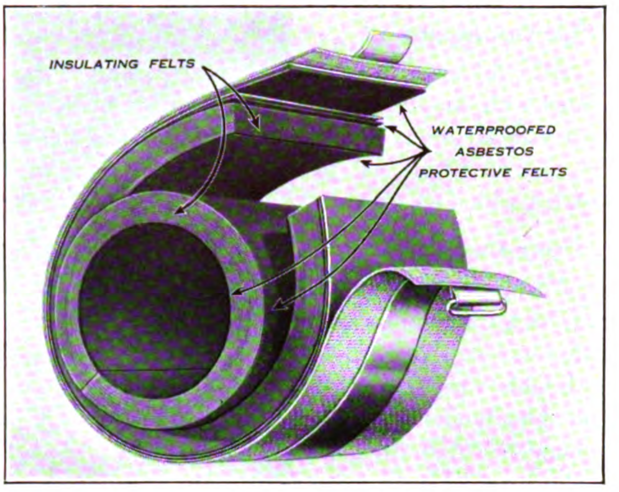
Anti-Sweat Pipe Insulation

Anti-Sweat Insulation is a combination of insulating and waterproofing felts for use on cold water pipes to keep pipes cold and to prevent condensation and damage from dripping. It costs less to keep water cold than to re-cool it.



The special broken joint construction, used on thicknesses 1″ and over, eliminates through joints. When Anti-Sweat is applied, the outer layer is turned and slipped along, so that all joints are staggered. The longitudinal laps of Anti-Sweat should be sealed with Lap Cement, applied directly over the cut, using just enough to prevent its squeezing out.

Anti-Sweat is made in 3-ft. sections in thicknesses of ½″ and ¾″ solid construction, and in 1″, 1½″ and 2″ broken joint construction, to fit standard pipe sizes.

Weight in pounds per standard 3-foot section, uncrated

Thickness, Inches	Nominal pipe sizes, inches																	
	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
¾	3.35	3.70	4.07	4.60	4.98	5.70	6.55	7.50	8.30	9.10	9.87	10.75	12.47	14.00	15.60	17.25	19.00	22.15
1	4.10	4.50	5.00	5.60	6.10	7.00	7.93	9.12	10.07	11.00	11.95	13.00	15.05	16.93	18.85	20.70	22.80	26.60
1½	7.90	8.40	9.07	9.95	10.58	11.80	13.10	14.70	16.00	17.30	18.60	20.00	22.80	25.27	27.95	30.60	33.40	38.60

Rates of Heat Transmission

B.t.u. per hour, per degree temperature difference, per linear foot and per square foot of pipe surface.

Insulation	½″ thick		¾″ thick		1″ thick		1½″ thick		2″ thick	
Pipe size, inches	B.t.u. per lin. ft.	B.t.u. per sq. ft.	B.t.u. per lin. ft.	B.t.u. per sq. ft.	B.t.u. per lin. ft.	B.t.u. per sq. ft.	B.t.u. per lin. ft.	B.t.u. per sq. ft.	B.t.u. per lin. ft.	B.t.u. per sq. ft.
½	.212	.963	.185	.841	.167	.758	.143	.649	.128	.581
¾	.245	.891	.212	.770	.189	.687	.160	.581	.142	.515
1	.286	.830	.243	.706	.215	.625	.180	.523	.158	.460
1¼	.338	.777	.284	.653	.249	.572	.206	.473	.180	.413
1½	.374	.751	.312	.627	.272	.546	.223	.448	.194	.389
2	.443	.713	.367	.591	.318	.512	.257	.413	.221	.356
2½	.518	.688	.425	.564	.364	.484	.292	.388	.249	.331
3	.611	.666	.497	.542	.423	.462	.337	.367	.284	.310
3½	.685	.655	.553	.528	.468	.447	.369	.353	.311	.297
4	.757	.643	.611	.518	.515	.437	.404	.343	.338	.287

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Anti-Sweat Insulation Specification for cold water and ice water piping

Pipe Insulation:

All cold water and ice water piping shall be insulated with Anti-Sweat Insulation, applied in two layers with all joints broken, tightly drawn together and stapled in place. All joints in both layers shall be sealed with Lap Cement.*

Fitting Insulation:

All fittings shall be insulated with Hair Felt, cut to fit the fitting and secured in place with a close wrapping of heavy jute twine. Over this Hair Felt, apply a double wrapping of Waterproof Membrane wound on spirally and sealed with Waterproof Sealing Compound.** A finish of 1/4" Asbestos Cement may be substituted on cold water lines.

Insulation Thickness:

The thickness of all insulation shall be in accord with the following table:

Air temperature under 100 deg. F.

Pipe Temperature, deg. F.	Humidity Range, %	Thickness of Anti-Sweat on Pipes	Thickness of Hair Felt on Fittings
Over 50	Under 75	1"	3/4"
Over 50	75 to 80	1 1/2"	1 1/2"
32 to 50	Under 75	1 1/2"	1 1/2"

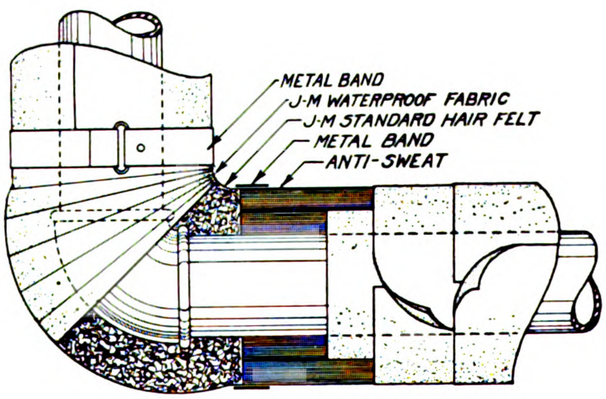
Finish:

All pipe and fitting insulation exposed to view shall be enclosed in an extra jacket of 8-oz. canvas, sewed on over a lining of heavy rosin-sized paper. Where Sealing Compound is used on fittings, they shall be wrapped with oiled paper before rosin-sized paper is applied. Seams in canvas shall be located where least visible. On outdoor piping the canvas shall be omitted, and in its place shall be used a waterproof jacket of Double Coated Flexstone Roofing.

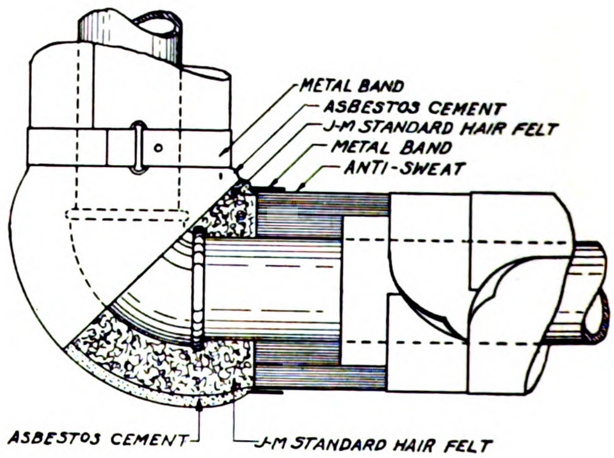
Painting:

All insulation with a canvas finish exposed to view shall be painted with, first, a heavy coat of glue sizing to fill the canvas and then with two coats of first quality white lead and linseed oil paint, of a color selected by the purchaser.

All of the above insulation shall be furnished and applied by the manufacturer of the materials used, or by his approved contractor.



Fitting Insulation on ice water line



Fitting Insulation on cold water line

*J-M Lap Cement, a liquid asphalt cement furnished in 1, 5, 25 and 50-gal. containers.
**J-M Waterproof Sealing Compound, a liquid asphaltic compound furnished in 1, 2, 3, 5, 25 and 50 gal. containers.

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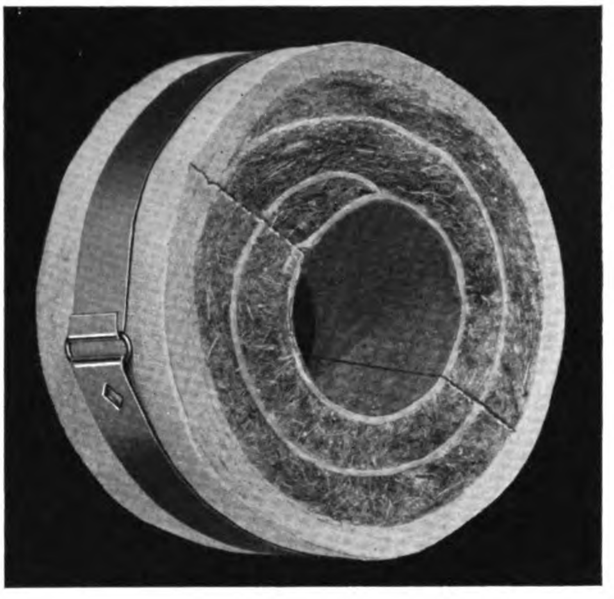
Zero Pipe Insulation



Zero Pipe Insulation is used to prevent cold water pipes from freezing under *ordinary* conditions.

It is constructed of layers of hair felt surrounded by several layers of wool felt, with a layer of saturated wool felt inside the hair felt to prevent the hair from coming in direct contact with the pipe.

Hair felt, one of the best of insulating materials, greatly retards the flow of heat from the water in the pipe to the colder surrounding air, and the wool felt jacket and the inner layer of saturated felt provide efficient protection for the hair felt lining to assure its durability.

Zero Pipe Insulation is designed for insulating cold water pipes that are exposed to moderate rather than extremely low temperatures, or where the time that the surrounding air would be below freezing point is of short duration.

When this material is applied to pipes running out-of-doors, special provision should be made for weatherproofing and protecting the insulation.

For extremely low temperatures or for temperatures below the freezing point that are of long duration, a built-up hair felt construction is recommended, applied according to specifications based on the particular conditions.

Zero Pipe Insulation is furnished in 3-foot lengths, split for ready application, covered with canvas and equipped with brass lacquered bands. Made for all pipe sizes from ½″ up, and in *one* thickness, approximately 1¼″.

Weight in pounds per standard 3-foot section

Nominal pipe sizes, inches				
½	¾	1	1¼	1½
4.00	4.43	4.88	5.30	5.72

Nominal pipe sizes, inches				
2	2½	3	3½	4
6.67	7.60	8.50	9.40	10.30

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J-M Built-up Hair Felt Pipe Insulation for water pipes exposed to freezing

J-M Built-up Hair Felt Insulation is designed to protect water pipes from freezing where the pipes are subjected to severe conditions. This insulation consists of a suitable number of layers of 1″ J-M Standard Hair Felt securely bound in place on the pipe by means of heavy jute twine and finished on the outside with a waterproof jacket.

It is not possible to give a definite recommendation as to thickness which would suitably protect pipes under all conditions. No insulation, no matter how thick or efficient it may be, will prevent water in pipes from freezing where there is no circulation or only a small amount of circulation in the pipes, if the outside temperature remains sufficiently low for a sufficient length of time.

Insulation will retard freezing of water in pipes, and if there is a certain amount of circulation or, even without circulation, if the air remains at a low temperature for a short enough period, freezing may be prevented.

Still water in pipes may also be prevented from freezing by running small steam lines of proper size next to the cold water pipes and inside the insulation surrounding them.

To make a specific recommendation, the following information is required:

1. Minimum temperature to which pipe will be exposed.
2. Duration of this extreme temperature.
3. Temperature of water entering the pipe.
4. Size of pipe.
5. Length of exposed section of pipe.
6. Rate of flow of water through pipe.
7. Duration of periods, if any, when there will be no flow in the pipe.

Following are the rates of heat transmission through 2-layer, 3-layer and 4-layer Built-up Hair Felt Insulation on pipes from ½″ to 12″ in diameter.

Also, to assist in quick estimates as to results which may be accomplished, figures are given showing the length of time required for the water in a pipe to be cooled 10 deg., from 42 to 32 deg. F., with a difference in temperature between water and air of 60 deg. F., which would correspond to an air temperature of about 20 deg. F. below zero.

Water should not be allowed to remain stationary for longer than one-half the time mentioned.

Data on Freezing of Water in Pipes

Pipe size, inches	Insulation, No. of layers each 1 in. thick	B. t. u. per deg. temp. diff., per hour per lin. ft.	Hours to cool to freezing point	Lb. water flow per hr. per lin. ft. to prevent freezing
½	2	.0895	.417	.537
	3	.0747	.500	.448
	4	.0660	.565	.396
1	2	.1125	.825	.675
	3	.0911	1.02	.548
	4	.0798	1.16	.480
1½	2	.1400	1.40	.840
	3	.1126	1.74	.676
	4	.0972	2.02	.583
2	2	.1586	1.94	.952
	3	.1244	2.48	.747
	4	.1063	2.90	.638
3	2	.2062	3.25	1.237
	3	.1572	4.27	.913
	4	.1322	5.08	.793
4	2	.2450	4.55	1.470
	3	.1850	6.02	1.110
	4	.1548	7.20	.929
5	2	.2887	5.92	1.733
	3	.2146	7.96	1.289
	4	.1764	9.69	1.059
6	2	.3302	7.35	1.981
	3	.2434	9.88	1.460
	4	.1984	12.20	1.191
8	2	.4100	10.05	2.460
	3	.2960	13.90	1.776
	4	.2390	17.25	1.434
10	2	.4930	13.00	2.960
	3	.3536	18.10	2.122
	4	.2830	22.70	1.698
12	2	.5720	15.80	3.432
	3	.4090	22.20	2.454
	4	.3222	28.10	1.933

The last column indicates the minimum amount of water which should be supplied per hour at 42 deg. F. for each linear foot of pipe, in order to prevent the temperature of the water from being lowered to the

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freezing point. The weight in this column should be multiplied by the length of the pipe in feet. In order to provide against temporary reduction of flow due to lower pressure, etc., the rate of flow should be at least double that given in table. The figures on time and flow apply only to the conditions given.

If the water enters the pipe at 52 deg. F., instead of 42 deg. F., it will take double the time given in order to cool it to the freezing point, or only half the amount of water need be circulated to prevent freezing.

On the other hand, if it enters at 34 deg. F., it will be cooled to 32 deg. F. in one-fifth of the time given in the table or five times as much water would have to be circulated to prevent freezing.

If the minimum temperature is about 40 deg. F. below zero (temperature difference equals 80 deg. F.), instead of 20 deg. F., the time required to cool water to the freezing point will be 60/80 times that given in the table, or the amount of flow required will be 80/60 times that given in the table.

In the above figures, the effect of varying temperature difference due to cooling of the water has been ignored, as this is an unnecessary refinement where large factors of safety are required. The only effect of not considering this varying temperature difference is to increase the factor of safety.

Where water must remain stationary longer than the safe length of time previously indicated, the only sure way of protecting the line is to provide a small steam or hot water line alongside the water line and then place insulation entirely around both lines. In this case 2-layer insulation is satisfactory and sufficient, as the heating line is the protection against freezing and the purpose of the insulation is to prevent excessive loss, and to keep the heat where it is wanted.

The time shown in the table is the time to lower the water to the freezing point. Much longer time would be required actually to freeze all of the water in the pipes, but once it starts to freeze, the danger point has been reached. If the water were to freeze at only one point, flow would be stopped and the whole line would be in danger.

Insulation Specification for Water Pipes Exposed to Freezing

Insulation:

All cold water, compressed air, soil and waste piping and fittings that are exposed to freezing temperatures, shall be insulated with J-M Built-Up Hair Felt Insulation of the required number of layers. Each layer of J-M Standard Hair Felt shall be 1″ thick and secured to the pipe with a wrapping of heavy jute twine on 2″ centers, and over each layer shall be applied a layer of 15-lb. Asphalt Felt, secured in place with a wrapping of jute twine.

If no weather-proof or canvas jacket is to be applied, the Asphalt Felt at the outside of the insulation shall be sealed at both circumferential and longitudinal joints with Waterproof Sealing Compound (a liquid asphaltic material, furnished in 1, 2, 3, 5, 25 and 50-gal. containers).

Finish:

All pipe and fitting insulation exposed to view shall be enclosed in a jacket of 8-oz. canvas, sewed over linings of oiled paper and of heavy rosin-sized paper. Seams shall be located where least visible.

Painting:

All insulation with a canvas finish exposed to view shall be painted with first a heavy coat of glue sizing and then with two coats of first quality white lead and linseed oil paint, of a color selected by the purchaser.

Weather-proof Jacket:

If piping is exposed to the weather, the canvas shall be omitted and in its place the insulation shall be protected by a Double Coated Flexstone Weather-proof Jacket.

All of the above insulation is to be furnished and applied by the manufacturer of the materials used, or by his approved contractor.

J-M System of Underground Insulation

The savings effected by the centralization of heating and power plants in large institutions, such as colleges and hospitals, have been further increased by the installation of the J-M System of Underground Insulation, which provides a permanent, efficient, and economical means of placing underground, and insulating, pipes conveying steam, hot water, or other hot liquids.

The J-M System is complete. It provides insulation for the pipes, enclosure for the insulation, supports for the pipes and complete drainage by means of drain-tile and broken stone around the conduit. It is not necessary to furnish any enclosure, insulation, or other means of support than that provided by the system. The J-M System includes:

1. J-M Waterproof Asbestos Conduit Filling, consisting of high grade, especially waterproofed asbestos fibre, which is used to fill completely the space between the pipes and the outside protective and containing member.

2. Vitrified tile conduit for the protection and enclosure of the insulation and piping. The tile is split longitudinally on the job and carefully fitted together and sealed at the longitudinal and circumferential joints with portland cement mortar, properly waterproofed.

3. Roll frames and rollers to provide for the support and expansion of the piping are securely embedded in portland cement mortar placed in the bottom half of the tile at proper intervals and at the required elevation from overhead batter board lines, so that there shall be no stress or strain on the couplings or joints of the piping, due to misalignment.

4. Underdrain for drainage of the earth surrounding the system, consisting of a bell and spigot drain tile with open joints, placed in a small trench below the center of the conduit tile in such a manner as to drain the water properly from the surrounding earth.

5. Shutters to seal the end of the conduit runs where they terminate in buildings or manholes, consisting of a brick or cement wall in the end of the tile enclosing the space between the piping and tile.

6. Anchor pits to control expansion and for changes in direction or elevation of the system, usually consisting of a waterproofed concrete box around the conduit into the sides of which are secured a channel iron or I-beam, to which the piping is fastened by means of U-bolts. This box is filled with the same insulation as used in the conduit and is completely sealed with a poured concrete cover.

In the J-M System the conduit is completely filled with asbestos fibre, and adequate drainage provided by bell and spigot pipe in broken stone

7. Broken stone or clean gravel of suitable size for supporting lower halves of the tile and for furnishing a medium through which water in the surrounding ground may properly flow to the underdrain.

8. Manholes, including covers. These are of the usual concrete form with circular J-M specification cast iron cover, providing adequate space for attention to piping and fittings enclosed.

These various parts are combined into the complete J-M System, assembled and installed by J-M Approved Contractors according to methods adopted after long experience in furnishing layouts and in installing this system of insulation. In many instances a preliminary conference with a J-M Approved Contractor before the plans are drawn will result in valuable information regarding the layout and location of conduit lines, so that a considerable saving may be made over other contemplated layouts.

The principal function of an underground system of insulation is to provide for the distribution of steam, hot water, oil, or other hot liquids with the

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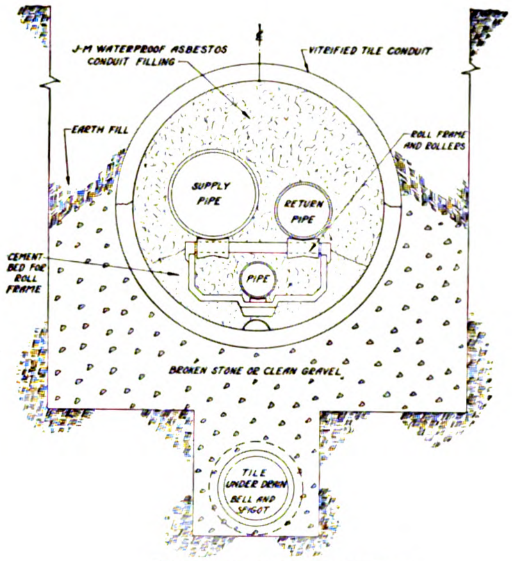


TYPICAL CROSS-SECTION OF J-M SYSTEM OF UNDERGROUND INSULATION

The J-M System provides a permanent, efficient and economical means for sub-surface conveyance of steam and hot water

minimum heat loss. The J-M System possesses the three qualifications of a practical underground insulation system, which are necessary to accomplish this result. These three qualifications are:

1. High Efficiency: Efficiencies of 90% or more are obtainable when the installation is made according to J-M specifications by J-M Approved Contractors, or under their supervision. J-M Waterproof Asbestos Conduit Filling is high in insulating value and, when properly installed, effectively reduces heat loss.

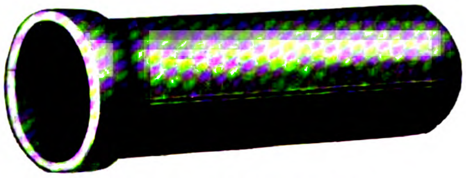
2. Permanency: Only the most durable materials are used in the J-M System—stone, tile, iron, and asbestos. Because of the high moisture-resisting property of the filling material and its resilient nature, it will not settle and will always maintain its high initial insulating efficiency.

3. Economy: In the J-M System a number of pipes may be grouped in a single conduit with the insulating material entirely surrounding them, thereby making possible the use of a smaller conduit than would be necessary to obtain the same efficiency with sectional covering on each pipe. Moreover, the pipe when covered with sectional insulation must be left bare at the rollers with a consequent heat loss at that point. In general, therefore, this system will cost less than a system of the same efficiency which employs sectional insulation.

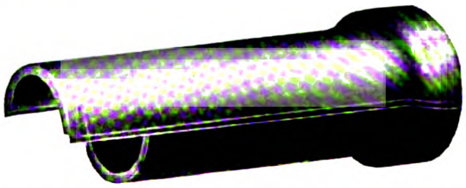
Less efficient and less durable systems of underground insulation can be installed at a lower first cost than the J-M System. It should be remembered, however, that an underground line is inaccessible and therefore should be installed with the most permanent and efficient type of construction possible.

Only one other underground method, that of running the lines in a walking tunnel, is more accessible and has equal permanence. The cost of this method is several times that of the J-M System, and frequently lack of room, or natural topography, makes the walking tunnel a practical impossibility.

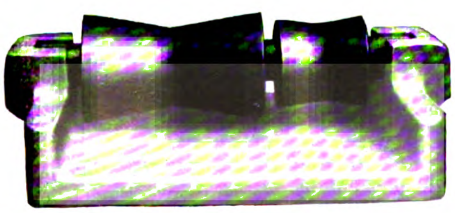
The J-M System of Underground Insulation, therefore, offers the best method for efficiently, permanently and economically insulating pipes carried underground.



Straight conduit section



Supporting section used with four-pipe roll frame



Two-pipe internal support

Three-pipe internal support

Four-pipe roll frame

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J-M Insulating Cements

J-M Insulating Cements are well known for their excellent coverage, good finish and insulating properties. There is a cement for every purpose.

Asbestos insulating cements are generally used as a surface finish over block or sheet forms of insulation to seal all joints between the blocks and to provide a smooth, attractive finish or a surface to which canvas may be applied if desired.

J-M Insulating Cements are also especially suitable for insulating irregular surfaces such as valves, flanges and other pipe fittings, heating furnaces, kettles, etc., where it would be impracticable to apply sectional insulation, sheets or blocks.

No. 302 Insulating Cement
(For temperatures to 1000 deg. F.)

No. 302 Cement is made of asbestos fibre and binding materials. It is a high-grade insulating cement, easy to mix and apply, and sticks readily to hot surfaces.

It is an excellent finishing cement, producing a hard, durable and attractive surface which does not crack, break or peel off.

Packed in 100-lb. bags. Covering capacity 25 sq. ft., 1″ thick, per bag.

No. 450 Insulating Cement
(For temperatures to 1200 deg. F.)

No. 450 Cement has a high covering capacity, is light in weight, a good insulator and is recommended where a high grade cement has to be used instead of insulation in sheet or block form.

It adheres readily to both hot and cold surfaces. It has little shrinkage on drying, therefore the tendency toward cracking is minimized. When dried, No. 450 Cement presents a firm surface but, because of its high porosity, is not a finishing cement.

In order to reclaim No. 450 Cement for re-use, all that is necessary is to mix reclaimed cement with water.

Packed in 60-lb. bags. Covering capacity 24 sq. ft., 1″ thick, per bag; or 40 sq. ft., 1″ thick, per 100 lb.

No. 352 Insulating Cement
(For temperatures to 1000 deg. F.)

No. 352 Cement is an inexpensive cement used in large quantities by the steamfitting and plumbing trade for insulating heating boilers and pipe fittings.

Packed in 100-lb. bags. Covering capacity 19 sq. ft., 1″ thick, per bag.

No. 340 Insulating Cement
(For temperatures to 1000 deg. F.)

No. 340 Cement is a high grade material, comparing favorably with No. 302 Cement but having a somewhat smaller covering capacity and lower cost.

Packed in 100-lb. bags. Covering capacity 18 sq. ft., 1″ thick, per bag.

No. 304 Hot Blast Cement
(For temperatures to 1200 deg. F.)

No. 304 Hot Blast Cement is a semi-refractory insulating cement which provides an excellent finish and is frequently used for fireproofing structural steel.

Packed in 100-lb. bags. Covering capacity 18 sq. ft., 1″ thick, per bag.

No. 364 Insulating Cement
(For temperatures to 1000 deg. F.)

No. 364 Cement is an excellent medium grade cement frequently used by the steamfitting trade. It adheres well and gives a very good finish.

Packed in 100-lb. bags. Covering capacity 18 sq. ft., 1″ thick, per bag.

Printed in U.S.A.

J-M 85% Magnesia Cement

(For temperatures to 600 deg. F.)

This material is similar to J-M 85% Magnesia sectional and block insulation except that it is in powdered or cement form.

Compared with other cements, its efficiency is high but it is not ordinarily recommended as a finishing cement.

Packed in 60-lb. bags. Covering capacity 35 sq. ft., 1″ thick, per bag; or 58 sq. ft., 1″ thick, per 100 lb.

No. 319 Semi-Refractory Cement

(For temperatures to 1600 deg. F.)

No. 319 is a combined insulating and refractory cement, ideal for use as a protective coating over insulation linings of breechings, flues, etc., exposed to the erosive action of moving gases.

Packed in 50-lb. bags. Covering capacity 7½ sq. ft., 1″ thick, per bag; or 15 sq. ft., 1″ thick, per 100 lb.

Superex Insulating Cement

(For temperatures to 1600 deg. F.)

Superex Insulating Cement is Superex Insulation in powdered or cement form for use on irregular or small surfaces where the application of blocks or sectional pipe covering is impractical.

Packed in 75-lb. bags. Covering capacity 30 sq. ft., 1″ thick, per bag; or 40 sq. ft., 1″ thick, per 100 lb.

J-M Fibrous Adhesive

In the application of sheet, block or brick insulation to flat surfaces, as well as to curved surfaces of large diameters, it is necessary, in a majority of cases, that the insulation be temporarily held in place until the application of the outer binding support and final finish.

J-M Fibrous Adhesive successfully takes the place of other temporary binding methods, being applied easily and rapidly and yet furnishing a moderately strong and effective support for the insulation until the permanent panel or finish is applied which secures the insulation in place.

Fibrous Adhesive is recommended for use where insulation is applied to brick, concrete, metal or other surfaces, and is also a satisfactory adhesive for binding insulating blocks together in multiple layer construction

Where temperatures do not exceed 500 deg. F., Fibrous Adhesive may be used as the principal means of attachment of insulation directly to the surface of ducts, flues, etc. In such cases, however, a secondary support should always be provided, such as cables or mesh wire, tightly laced over the outer surface of the blocks

Fibrous Adhesive is applied to the face of the insulating material, which is then pressed in place against the surface to be insulated. It is not necessary to coat the entire face of the insulation if only temporary support is required, as spotting of the adhesive is usually sufficient.

Only a sufficient thickness of the adhesive to obtain a thin film for bonding need be used; however, the thickness required depends largely upon the smoothness of the surface. Bare metal surfaces require less adhesive than is necessary for application of insulation to brick or concrete or to other insulation.

All paint *must* be removed before insulation can be applied by Fibrous Adhesive, or the insulation will loosen after the adhesive dries out.

In estimating requirements, the following covering capacities may be used: For sticking insulation to metal surfaces, 50 lb. of Fibrous Adhesive will cover approximately 100 sq. ft. of surface. For sticking insulation to brick, concrete or other insulation, 75 lb. of Fibrous Adhesive will cover approximately 100 sq. ft. of surface.

Fibrous Adhesive is supplied ready for use, in 75-lb. kegs, and in 175-lb., 350-lb., and 600-lb. barrels.

June, 1931 (Cancelling 9-G-1-A-1 and 9-D-35-A-1, dated in 1928 and 1929)

Printed in U.S.A.

J-M Insulating Fillers

Sil-O-Cel C-3

For temperatures to 2000 deg. F.

Sil-O-Cel C-3, a semi-refractory insulating product, is made from the mineral Celite, calcined in order that it may withstand temperatures as high as 2000 deg. F.

Sil-O-Cel C-3 is a coarsely ground, granular material with a sufficient proportion of fines to insure a uniform mass without large voids. It may be used alone as a granular filling material, or in combination with portland cement to form Sil-O-Cel C-3 Concrete as described on another data sheet. Sil-O-Cel C-3 will not shrink and, for a material which can be used at so high a temperature, is a remarkably efficient insulator.

Sil-O-Cel C-3 is used for insulating tops and for filling walls of heated equipment operating at extremely high temperatures or in equipment where lack of space prohibits the use of any but relatively thin fire brick linings and where the insulation is therefore subjected to very high temperatures. A typical application of this material in dry form is in the bases of oil-fired marine boilers.

Sil-O-Cel C-3, loose, weighs about 28 lb. per cu. ft. When rammed into place moist, without the addition of any bonding material, it weighs approximately 31 lb. per cu ft. Packed in bags of about 100 lb.

Sil-O-Cel Insulating Powder

For temperatures to 1600 deg. F.

Sil-O-Cel Insulating Powder is manufactured from the pure mineral Celite, milled to a high degree of fineness. Milling is very carefully done in specially designed equipment to preserve the natural cellular structure of the material. Sil-O-Cel Powder is furnished in bags of approximately 100 lb.

This material has an exceptionally high insulating value. It can be used where it will be subjected to temperatures as high as 1600 deg. F. without shrinking or deteriorating in any way. When loosely poured, Sil-O-Cel Insulating Powder weighs about 12 lb. per cu. ft., and when packed in place to the proper density (15 to 17 lb. per cu. ft.) will retain its effectiveness indefinitely.

The high insulating efficiency of Sil-O-Cel Insulating Powder makes it ideally adapted for use where structural strength and rigidity are not required of the

Installing Sil-O-Cel Coarse Grade in wall of Harrop Tunnel Kiln at A. P. Green Fire Brick Co., Mexico, Mo. Sil-O-Cel Coarse Grade is also used on the top.

insulation. When used to cover the tops of furnaces, tunnel kilns and similar equipment, the material should be lightly tamped to a density of about 15 lb. per cu. ft. Tamping is facilitated by moistening. A convenient method of moistening is to sprinkle the material in the bags the day before it is to be used.

To prevent dusting when Sil-O-Cel Insulating Powder is used over the top of heated equipment, a lime or cement slurry is often used to form a top crust.

For packing in walls of ovens, furnaces, kilns, etc., it should be tamped to about 17 lb. per cu. ft.

Sil-O-Cel Coarse Grade

For temperatures to 1600 deg. F.

Sil-O-Cel Coarse Grade is a material very similar to Sil-O-Cel Powder, excepting that, as its name implies, it is not milled to such fineness as the powder. Shipped in bags of approximately 100 lb. It should be packed to a density of about 22 lb. per cu. ft.

Sil-O-Cel Coarse Grade is particularly adapted for insulating the walls of such equipment as lime kilns, vertical boilers, etc. Due to its coarser nature, it is easier to pack than Sil-O-Cel Powder.

June, 1931 (Cancelling 9-G-1-A-2, 9-G-15-A-1, 9-G-16-A-1 and 9-G-23-A-1, dated in 1928 and 1929.)

Printed in U.S.A.

Fil-Insul

For temperatures to 1000 deg. F.

Fil-Insul is used as an insulating filler in irregular spaces where insulation in block or brick form is not practical and where a resilient high-grade filler is needed. It will permit considerable expansion and contraction because of its fibrous nature which also serves to prevent any settling or sifting through cracks. Fil-Insul weighs approximately 17 lb. per cu. ft. when packed to proper density for service.

Fibro-Cel

For temperatures to 1800 deg. F.

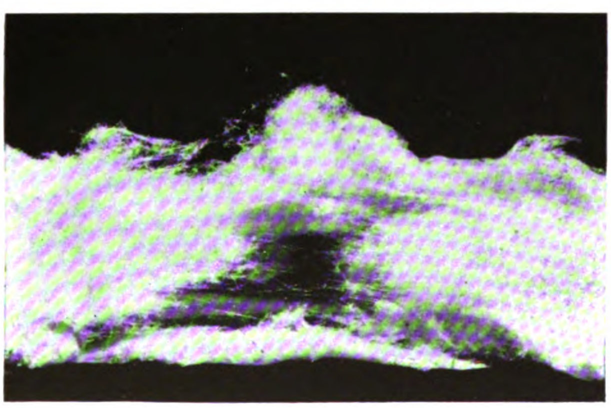
Fibro-Cel is a mixture of diatomaceous silica and long fibre asbestos. The asbestos fibre gives the material distinctly different characteristics from ordinary powdered filling materials because the presence of the fibre has a highly beneficial effect in offsetting any tendency toward settling or filtering through cracks, which makes it well adapted for use as a filling material on gas generator sets, etc.

Fibro-Cel weighs approximately 18 lb. per cu. ft. when packed in place. Furnished in 80-lb. bags.

Banroc Wool

For temperatures to 1000 deg. F.

Banroc (rock wool) is a lightweight, effective insulating material produced from high silica limestone. Safe temperature limit, 1000 deg. F.



Banroc is made by melting the limestone and fiberizing by steam jets. Unlike products from unblended rock or slag, this material has a high degree of stability. Being non-combustible, it is an effective fire retardant.

In addition to the types of wool listed below, Banroc is used in making J-M Rock Cork, Banroc Blankets, and Banroc Pipe Insulation.

Banroc Loose:

This material is used as an insulating filler in hollow oven walls, fireless cookers, electric ranges and for other purposes where a loose bulk insulation is required. It may be packed to various densities but usually 12 lb. per cu. ft. is recommended. Shipped in burlap bags containing 50 lb.

Banroc Loose—Regular: Very lightly oil-treated (sometimes called Annealed). Adaptable for many conditions requiring an economical loose insulation. This grade is furnished on all orders, unless otherwise specified.

Banroc Loose—Medium Treated: Because of its heavier oil treatment, this material has a somewhat greater cohesion than the regular grade, making it desirable for handling in large quantities. It is also more moisture-resistant.

Banroc Loose—Heavily Treated: Very heavily annealed and more moisture-resistant than other grades, but should not be considered waterproof.

Banroc Granulated:

Banroc Granulated is made from Banroc Loose—Regular. Recommended for hand-packing. All forms are shipped in 50-lb. bags.

Banroc Granulated—Single Processed: Consists of granules averaging 3/8", with practically none over 3/4".

Banroc Granulated—Double Processed: Consists of granules averaging 5/16", with practically none over 1/2". Especially suited for pouring.

Special Banroc Wools:

A wide range of other types of Banroc Wool, including special white and special light density wools, can be furnished on order.

Granulated Rock Cork

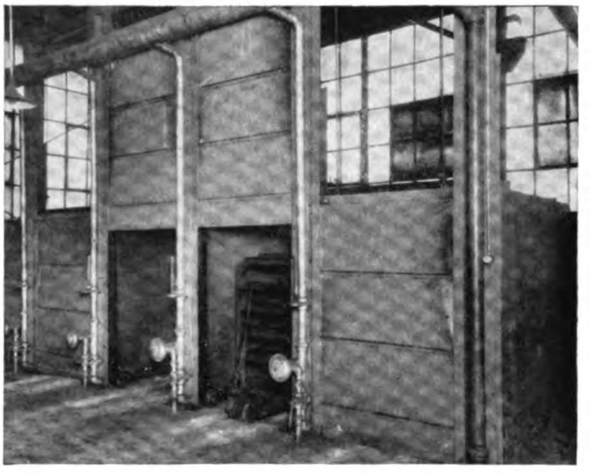
For temperatures below 100 deg. F.

Granulated Rock Cork, a rock wool product treated with a bituminous binder, is used wherever a loose, moisture-resisting filler is required for low temperature service. Granulated Rock Cork weighs approximately 14 lb. per cu. ft. when packed to the proper density. Shipped in 50-lb. bags.

Sil-O-Cel C-3 Insulating Concrete

For temperatures to 1800 deg. F.

Large japanning ovens at the Durand Steel Locker Co., Chicago Heights, Ill., built entirely of Sil-O-Cel C-3 Concrete with 9" thick walls and tops. Size of ovens 9 ft. wide, 22 ft. high, 50 ft. long



Battery of four monolithic gas-fired core ovens, constructed throughout of Sil-O-Cel C-3 Concrete with 12" thick walls and tops. The doors were built of Sil-O-Cel C-3 Concrete 9" thick

Sil-O-Cel C-3 in the form of insulating concrete, can be cast into any shape desired. This has made it possible to utilize insulation where previously it had been impossible to do so for structural reasons. Sil-O-Cel C-3 can be easily cast in monolithic form for the construction of doors, baffles, dampers, etc., and, when suitably reinforced, may be moulded into large units for such purposes.

Sil-O-Cel C-3 Insulating Concrete is made by mixing four parts of Sil-O-Cel C-3 and one part of portland cement, by *volume*, with sufficient water to form a plastic, coherent mass. Care should be taken to avoid excess water. (The making of insulating concrete in this way is covered by U. S. patent.) For this purpose approximately 28 lb. of Sil-O-Cel C-3 are required per cu. ft., when rammed into place and dried.

Sil-O-Cel C-3 Concrete can be applied very satisfactorily to steel surfaces, such as stacks, by means of a cement gun. It can also be applied with a cement gun to the brick walls of existing equipment, such as open-hearth regenerators

Sil-O-Cel C-3 Concrete is over three times as effective as fire brick in preventing heat penetration. Made in accordance with specifications, the material sets up into a strong, durable concrete weighing approximately 60 lb. per cu. ft. and with a crushing strength of about 1,000 lb. per sq. in. (72 tons per sq. ft.). It has a high degree of refractoriness for an insulating material and can be used without other refractory protection where it may be subjected to direct heat as high as 1800 deg. F.

For monolithic construction of ovens, etc.:

Such equipment as japanning and enameling ovens, core ovens, etc., where the heating operation is carried on at a comparatively low temperature, are in many cases now being constructed entirely of Sil-O-Cel C-3 Concrete.

Ovens of this type can be constructed and operated at very great savings over the ordinary type of masonry construction. Due to the insulating properties of Sil-O-Cel C-3 Concrete and the fact that all masonry joints are eliminated, fuel consumption is surprisingly low. This construction can be satisfactorily employed for many types of equipment.

For foundations and bases:

Sil-O-Cel C-3 Concrete is an ideal material for insulating the bases of heated equipment. In fact, the practice of insulating bases can be said to have originated with the introduction of this material. It

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is used for base insulation in various types of heat-treating furnaces, kilns, oil still furnaces, hot blast stoves, open-hearth furnace regenerators and flues, and in many other types of high temperature equipment.

Insulation of the bases of such equipment is now recognized as being essential, not only because of the fuel saving, but also because it insures more uniform heat distribution within the equipment and protects the foundations from excessive heat.

Sil-O-Cel C-3 Concrete doors:

Sil-O-Cel C-3 Concrete is the principal material in use today for furnace door construction. Fire brick doors, as formerly used, are highly conductive of heat. Such heat waste is costly, reduces the output of the furnace, disturbs temperature uniformity, makes close control impossible, and causes unsatisfactory conditions for the operators. Since fire brick weigh about 130 lb. per cu. ft., fire brick doors also have the disadvantage of great weight, which makes them hard to handle, and elaborate counterbalancing devices are often required. Sil-O-Cel C-3 Concrete weighs less than half as much as fire brick, conducts less than one-third as much heat and costs less per door installed.

Other uses:

Sil-O-Cel C-3 Concrete is an excellent material for making up special shapes such as baffles, dampers, etc. It is also cast into covers for wheel annealing pits; used as an insulating lining for hot metal cars in steel mills; for the construction of fire screens to protect workmen operating in front of open furnace doors; and for a great variety of other uses. In many cases Sil-O-Cel C-3 Concrete is particularly adapted for insulating on the outside of walls of equipment previously constructed without insulation.

Sil-O-Cel C-3 Concrete is ideally adapted to the construction of monolithic furnace doors. The C-3 Concrete doors on this battery of malleable annealing ovens are 9" thick

Insulkote

Insulkote is a durable, easily applied, weather-proof coating for insulated surfaces. It is black when applied and turns to a dark gray in service.

It is particularly applicable for the protection of insulation on large tanks and vessels, and for insulated equipment, such as smoke breechings, exposed ducts and large outdoor pipes.

The advantages of Insulkote over other forms of weather-proofing are:

1. Great durability under extreme weather conditions.
2. Elasticity which prevents its cracking under changes in temperature.
3. Smooth surface finish.
4. Easy application.
5. Reasonably low cost.
6. Furnished ready for application.

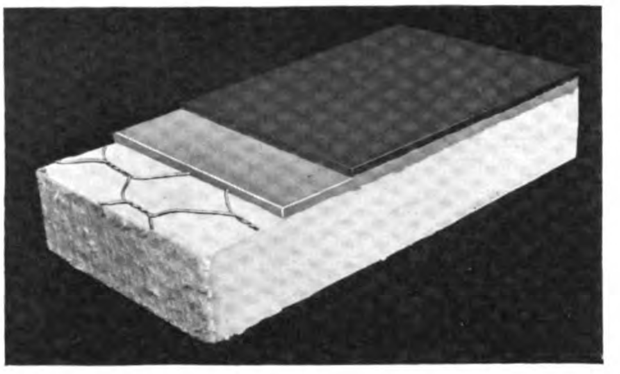
Insulkote is furnished in ready-mixed, plastic form and of suitable consistency to apply with a trowel. When temperatures during application may be below 45 deg. F., Winter Insulkote should be used.

Insulkote, applied in one coat 1/4" thick, will cover approximately 45 sq. ft. per 100 lb. Furnished in 50-lb. pails, and in 150, 300 and 500-lb. drums.

Application

Insulkote should be applied as follows: Stretch the necessary reinforcing hexagonal mesh wire netting over the insulation. Then apply a 1/4" coat of insulating cement consisting of two parts by weight of J-M No. 302 Insulating Cement and one part portland cement. This coat should be scored and allowed to dry before applying the Insulkote.

Over the cement apply Insulkote approximately 1/4" thick in one layer, troweled to a smooth finish.



After drying, the thickness of the Insulkote, applied 1/4" thick, will be approximately 1/8" thick. Lesser thickness should not be used. This shrinkage is due to dehydration, which imparts the desirable features to the Insulkote.

While J-M No. 302 and portland cement provides the best base for Insulkote, other hard finish asbestos cements may be used if mixed, two to one by weight, with portland cement.

Insulkote Primer

Insulkote can be used on ordinary concrete or brick walls, Sil-O-Cel C-22 brick or J-M Insulating Board, by the application of a coat of Insulkote Primer to these materials before the application of Insulkote. The covering capacity of Insulkote Primer in square feet per gallon over certain materials is as follows:

Over Concrete	95
Red brick	120
Sil-O-Cel C-22 Brick	65
J-M Insulating Board	180

Insulkote Primer is furnished in 5 and 15-gal. pails and 30 and 55-gal. drums.

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Aertite Coating

Aertite is a tough, rubbery asphaltic-asbestos coating in plastic form which is sometimes used instead of Insulkote, for waterproofing insulation on tanks, pipe line flanges and similar surfaces exposed to the weather. Temperature limit, 250 deg. F.

It is applied over insulation in a thin troweled coat to approximately 1/8" thickness. If the material has partially dried in the container, it can be brought to the proper consistency by adding a small amount of gasoline. When applying, a rag saturated with kerosene is handy for keeping the trowel clean.

Aertite is black in color but can be painted with aluminum paint. If some other color is wanted, the Aertite should first be painted with aluminum paint and the other color then applied.

Aertite is furnished in 25, 50, 150, 300 and 500-lb. containers. The covering capacity depends somewhat upon the character of the surface. For a 1/8" coating, from 50 to 80 lb. per 100 sq. ft. of surface area, will be required.

Soft or dusty surfaces should be primed with J-M Concrete Primer before the Aertite is applied.

In addition to its use as a weather protection for insulation, Aertite Coating is quite generally applied to the outside of boiler walls, to eliminate air infiltration. It provides a tough, rubbery, air-tight blanket over the entire boiler setting which remains tight because of its adhesive and ductile qualities and prevents imperfect combustion due to air leakage through the setting. For details of this application of Aertite, see the "Waterproofing and Miscellaneous Asphalt Products" Section.

Application of Aluminum Paint over Insulkote or Aertite

Preparation of Surface to be painted:

Insulkote shall be allowed to dry thoroughly before application.

Aertite shall be subjected to service conditions for about ten days before applying paint, to allow excess solvent to dry out.

Preparation of Paint:

The aluminum paint shall consist of 2 lb. of the Aluminum Company of America's extra Brilliant Varnish Powder and one gallon of DuPont Company's No. 129 Aluminum Mixing Varnish.

The paint shall be mixed immediately before using and in no case shall more paint be made up than can be used the same day.

Application:

The paint shall be applied in two coats, the first of which shall be allowed to stand not less than 24 hours or longer as required to dry thoroughly, before the second coat is applied.

The paint can be applied by brushing, but a spray will give a quicker, and possibly slightly smoother, job.

June, 1931 (Cancelling 9-G-12-A-1, dated March 1, 1929)

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Specifications for weather-proof and fire-retardant jackets for outdoor pipe insulation

Specification A:

All outdoor pipe insulation shall be protected from the weather by means of a weather-proof jacket of Double Coated Flexstone. (This material is furnished in rolls of 108 sq. ft., 32″ wide, and weighing approximately 55 lb.)

All joints shall be lapped at least 3″, and all horizontal laps shall be located on the side of the pipe with the laps turned downward in order to shed water from the surface.

The jacket shall be secured in place by means of rings of No. 16 B. & S. gauge Copperweld wire applied on not greater than 4″ centers.

Specification B:

All outdoor pipe insulation shall be protected from the weather by means of a weather-proof jacket of Medium Pilot Roofing. (This material is furnished in rolls of 108 sq. ft., 36″ wide, and weighing approximately 45 lb.)

All joints shall be lapped at least 3″, and all horizontal laps shall be located on the side of the pipe with the laps turned downward in order to shed water from the surface.

The jacket shall be secured in place by means of rings of No. 16 B. & S. gauge Copperweld wire applied on not greater than 4″ centers.

Specification C:

Where the weather-proof jacket is furnished as an integral part of the insulation, the lap shall be turned downward in order to shed water from the surface, and shall be sealed with Lap Cement (a liquid asphaltic material, furnished in 1, 5, 25 and 50-gal. containers).

A strip of waterproofing felt 7″ wide, as furnished with the insulation, shall be applied over each butt joint and shall be sealed to the jacket by means of Lap Cement.

The lap in this circumferential strip shall be placed on the opposite side of the pipe from the jacket lap and shall be turned downward in order to shed water.

The jacket shall be secured in place by means of rings of No. 16 B. & S. gauge Copperweld wire applied on not greater than 4″ centers.

Specification D:

In exceptional cases where the jacket would be subjected to mechanical injury from excessively rough usage, a suitable metal jacket shall be substituted for the weather-proof jacket specified above.

Specification E:

Where fire hazard must be considered and the application of roofing jackets (as in A and B) is prohibited, due to the fact that flame may be carried along exposed piping when a fire occurs adjacent to lines so protected, a J-M Asbestos Firetard Jacket shall be applied as described in Specification A.

The J-M Asbestos Firetard Jacket consists of one sheet of asphalt-saturated asbestos felt, over which has been cemented an unsaturated felt for an outer surface. This material will not drip asphalt, carry flame or support combustion. It is furnished in rolls of 108 sq. ft., 32″ wide, and weighing approximately 50 lb.

Application of Aluminum Paint over Roofing Felts

Preparation of Paint:

The aluminum paint shall consist of 2 lb. of the Aluminum Company of America's extra Brilliant Varnish Powder and one gallon of DuPont Company's No. 129 Aluminum Mixing Varnish.

The paint shall be mixed immediately before using and in no case shall more paint be made up than can be used the same day.

Application:

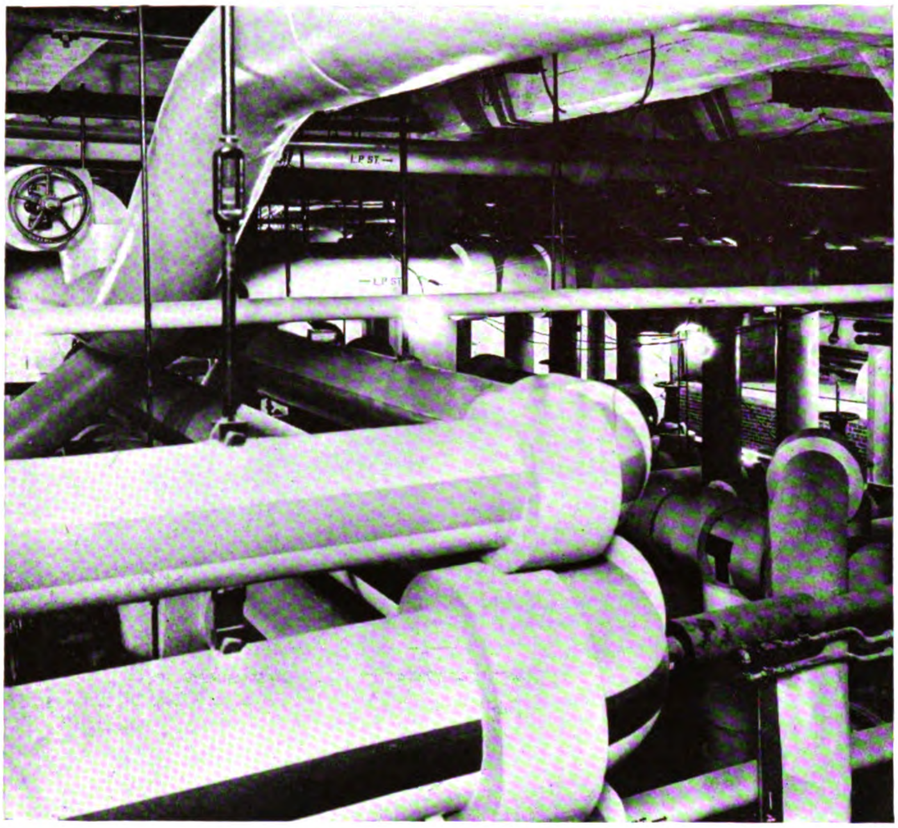
The paint shall be applied in two coats, the first of which shall be allowed to stand not less than 24 hours or longer as required to dry thoroughly, before the second coat is applied.

The paint can be applied by brushing, but a spray will give a quicker, and possibly slightly smoother, job.

June, 1931 (Cancelling 9-A-1-B-1, 9-B-1-B-1 and 9-B-16-A-1, dated in 1928)

Printed in U.S.A.

Insulation of Power Plant Equipment



Steam headers and heating mains insulated with J-M 85% Magnesia Pipe Insulation in the power sub-station of the New York Central Railroad under the Grand Central Terminal, New York City

Johns-Manville furnishes a wide variety of power plant materials for improving performance, increasing capacity and reducing operating costs. Fuel cost is one of the principal items of expense wherever heat is generated, and the problem of fuel conservation is a matter of major consequence. Insulation, therefore, is particularly important in insuring economical operation. A complete line of insulating materials in all forms is available to save heat otherwise dissipated from boiler settings and drums, economizers, breechings and stacks, turbines, pumps, feed-water heaters, and piping.

Pipe Insulation

The insulation of bare metal surfaces where steam or hot water is in contact with the metal is even more important than insulation over brickwork. Asbesto-Sponge Felted in sheets or pipe sections is recommended up to 700 deg. F. where the insulating material will be subjected to rough usage. Moulded blocks or pipe sections of J-M 85% Magnesia are also highly efficient in the temperature range below 600 deg. F. At higher temperatures, Superex or Superex Combination Insulation should be used.

The term Superex Combination refers to the use of Asbesto-Sponge Felted or J-M 85% Magnesia outside of Superex, which is placed next to the heated surface. This construction is slightly more efficient than Superex used alone, and, in the case of Asbesto-Sponge Felted, more resistant to hard usage. Other materials for special conditions are available to meet every requirement.

The tables of thicknesses which follow represent standardized practice in general use on heated lines.

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Exceptional conditions may make necessary thicker insulation. Where piping is located outdoors, it is customary to use insulation ½″ thicker than that used on the lines indoors.

Magnesia or Asbesto-Sponge Felted for temperatures to 600 deg. F.

Thickness of insulation, J-M 85% Magnesia			Temp., deg. F.	Thickness of insulation, Asbesto-Sponge Felted		
Pipes larger than 4″	Pipes 2″ to 4″	Pipes smaller than 2″		Pipes larger than 4″	Pipes 2″ to 4″	Pipes smaller than 2″
Std.	Std.	Std.	Below 212	1″	1″	1″
Std.	Std.	Std.	212 to 266	1″	1″	1″
1½″	Std.	Std.	267 to 337	1½″	1″	1″
2″	1½″	Std.	338 to 387	2″	1½″	1″
Dbl. Std.	2″	1½″	388 to 499	2½″	2″	1½″
3″	Dbl. Std.	2″	500 to 599	3″	2½″	2″
			600 to 700	3½″	3″	2″

Superex Combination Insulation for temperatures above 600 deg. F.

	600-699 deg. F.		700-799 deg. F.		800-1000 deg. F.	
	Thickness of insulation		Thickness of insulation		Thickness of insulation	
Pipe size, inches	Superex, in.	85% Magnesia, in.	Superex, in.	Asbesto-Sponge Felted, or 85% Magnesia, in.	Superex, in.	Asbesto-Sponge Felted, or 85% Magnesia, in.
1½ or less	2	....	2	....	2	....
2	1¼	1½	1¼	2	1[illegible]/16	1½
2½	1 5/16	1½	1 5/16	2	1 13/16	1½
3	1 9/16	1½	1 9/16	2	2 1/16	1½
3½	1 5/16	1½	1 5/16	2	1 13/16	1½
4	1 9/16	1½	1 9/16	2	2 1/16	1½
4½	1 5/16	2	1 5/16	2½	1 13/16	2
5 or more, approx.	1½	2	1½	2½	2	2

Pipe insulation is securely fastened in place with not less than three loops of 16-gauge annealed iron wire on pipes up to and including 6″, and with not less than four loops on larger sizes. In double layer work both longitudinal and circumferential joints are staggered and each layer is wired separately. Inside piping is finished with 8-oz. canvas sewed over a layer of asbestos paper or rosin-sized paper. Where similar pipes run close together they may be insulated as a unit, using block insulation and half sections of pipe insulation, finished with canvas the same as a single pipe.

Fittings and valves are insulated with blocks and J-M No. 302 Insulating Cement to a thickness equivalent to the adjacent pipe insulation. No. 302 Cement is often used alone on screwed fittings or over the bodies of small flanged fittings or where the total

Large steam lines being insulated with J-M 85% Magnesia, Double Standard Thick

thickness of insulation is less than 1½″. In any case the customary finish is 8-oz. canvas, pasted smoothly to the surface of the cement.

Pipe insulation is stopped at a sufficient distance from a flange or flanged fitting to allow free removal of the bolts, and blocks are wired around the flange to extend not less than 2″ over the adjacent pipe insulation. The cement finish is applied in two coats to a total thickness of ½″, the first or rough coat being allowed to dry before application of the smooth finish coat.

Instead of blocks around a flange, it is frequently convenient to use short sections of pipe insulation of a size which just fits snugly against the periphery. These flange covers are wired in position and finished the same as in the other method, except that the cement may be applied in a thinner coat.

On outdoor lines protection of the insulation from the weather is afforded by a flexible waterproof jacket, carefully sealed to shed the rain and held in position by non-corroding wire on 4″ centers.

Outdoor valves and fittings are weather-proofed by replacing the final ¼″ coat of cement with Insulkote,

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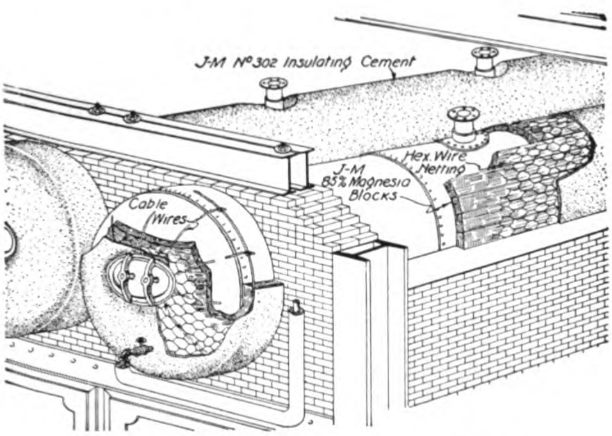
care being taken effectively to seal the joints between the pipe insulation jacket and the Insulkote over the valve or fitting. Where lines are subject to mechanical injury a sheet metal casing will provide the necessary protection.

Boiler Shells and Drums, Turbines, etc.

In power plant work the exposed steam and water surfaces of boilers, feed-water heaters, steam pumps and turbines are insulated with blocks of the proper thickness depending on temperature. H.R.T., fire-box type and cast-iron sectional boilers and the drums of water-tube boilers are insulated with J-M 85% Magnesia Blocks, 1" thick, for steam pressures up to 25 lb.; 1½" thick for pressures up to 100 lb.; 2" thick for pressures up to 200 lb.; and 2½" thick for pressures over 200 lb. Steam turbines at temperatures below 300 deg. F. are insulated with J-M 85% Magnesia Blocks 1½" thick; at temperatures from 300 to 400 deg. F., 2" thick; and at temperatures from 400 to 600 deg. F., 3" thick. Turbines at temperatures over 600 deg. F. are insulated with 1½" Superex Blocks and 1½" J-M 85% Magnesia Blocks. Feed-water heaters are insulated with 1½" J-M 85% Magnesia Blocks. On pump cylinders and chests, 2" Magnesia Blocks are used.



Method of insulating drums and drum-heads

Two coats of J-M No. 302 Insulating Cement of a total thickness of ½", reinforced with hexagonal mesh wire, are applied over the blocks, the first coat being left to dry with a rough surface and the second troweled smooth and hard. A suitable iron jacket is provided where the insulation is likely to be damaged, as on a steam pump or turbine.

Brickset Boiler Insulation and Casing

Insulation over boiler brickwork saves fuel, provides closer temperature control, reduces air infiltration and assures better working conditions. Added to this is the decrease of internal strains and reduction in spalling because of the smaller temperature differential between the inside and outside of the refractory. Insulation placed over exterior brickwork promotes heat flow along the walls, and the back passes are raised to a higher temperature. Wall cracks, caused by uneven expansion and contraction, are fewer and smaller.

A veneer layer of Superex or Magnesia Insulation or Superex-Magnesia Combination Insulation of a thickness depending on the design of the boiler is applied over the brick and, preferably, finished with flat Transite. The insulation may be applied behind or between the buckstays. If brick shapes are preferred, Sil-O-Cel Brick are laid up, either bonded or unbonded, on the exterior of the fire brick. In "core wall" construction, Sil-O-Cel Brick are built in as a core between the fire brick and an outer wall of red brick.

Block Insulation Recommendations for typical water-tube boilers

Type of boiler	Front Wall	Side Walls		Rear Wall	Top
		From front wall to bridge wall	To rear of bridge wall		
B & W	3" Superex-Magnesia Combination	3" Superex-Magnesia Combination	1¼" Magnesia (1 layer)	None	2½" Magnesia (1 layer)
Stirling	3" Superex-Magnesia Combination	3" Superex-Magnesia Combination	3" Magnesia (2 layers)	1½" Magnesia (1 layer)	3" Superex-Magnesia Combination
Springfield	None	3" Superex (2 layers)		3" Superex (2 layers)	3" Superex-Magnesia Combination

If block insulation is placed between buckstays, light angles may be clipped or spot-welded to the buckstays and punched so that insulation may be secured in place by lacing wires. These angles also serve as support for the Transite casing. Transite has a much lower conductivity than most casing materials, is lighter in weight and makes a better appearance. It is light gray in color, very resistant to corrosion, and when put up in panel type construction with steel battens over the joints is easily removed and replaced.

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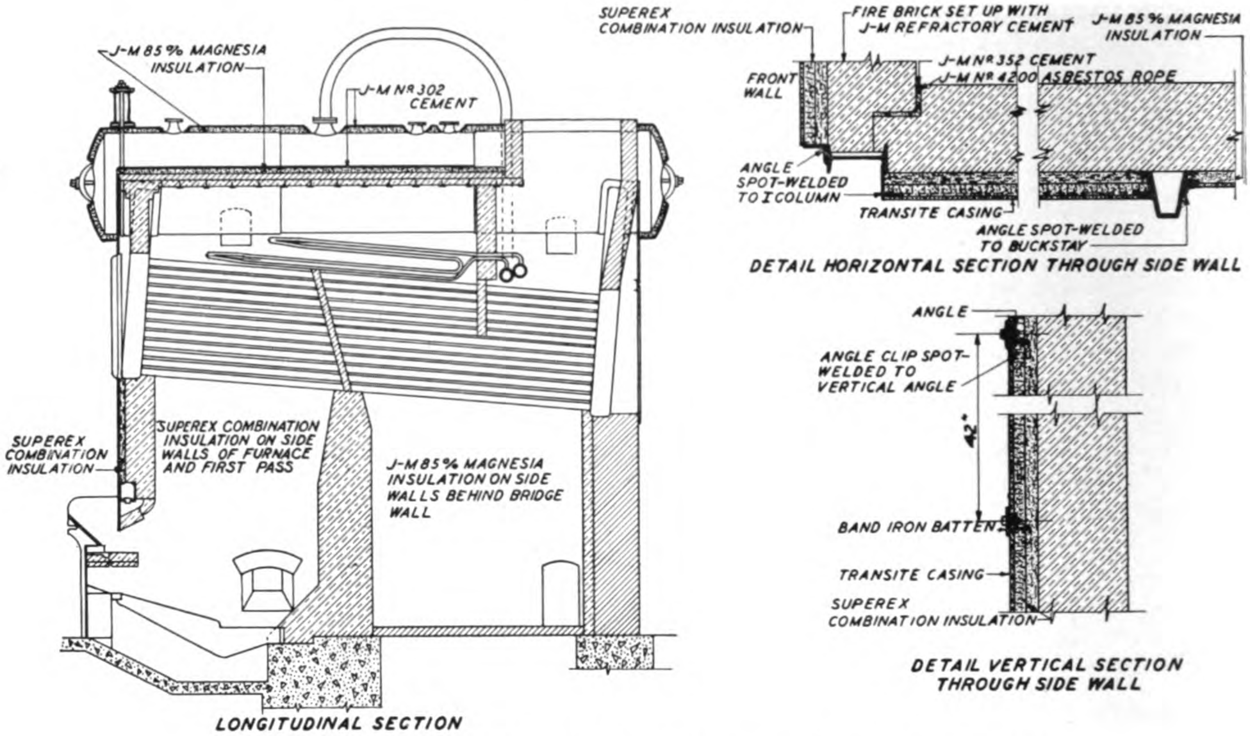
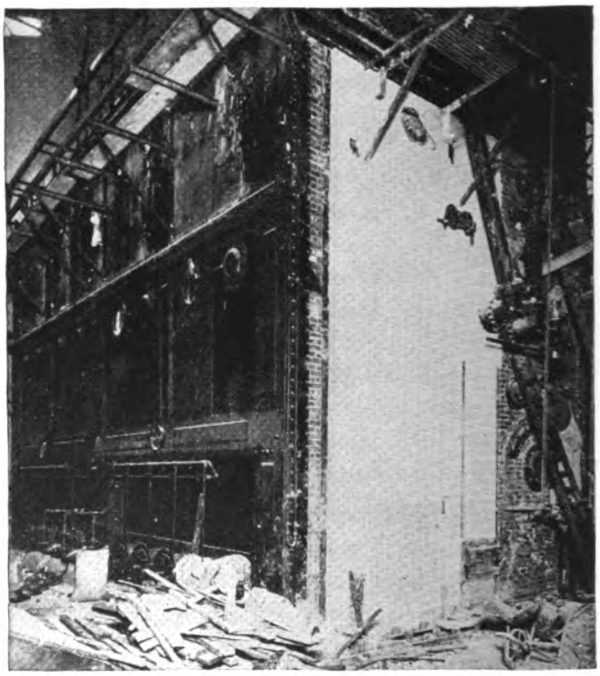


Typical block insulation and Transite casing on horizontal, longitudinal drum boiler (Erie City boiler with Elesco superheater)

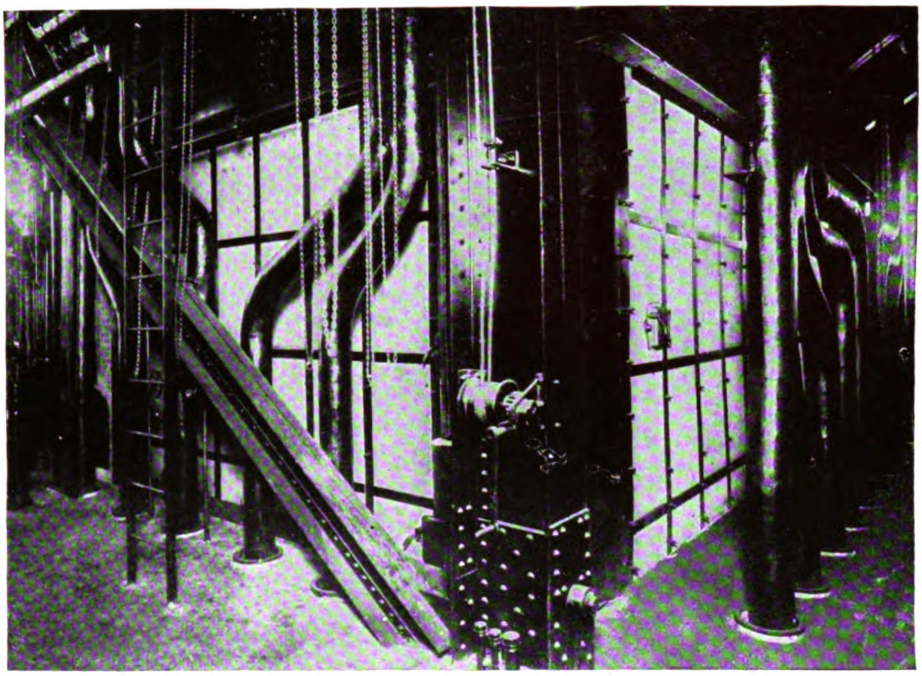
A reinforced asbestos cement finish may be used over those portions of the insulation not subject to mechanical damage, but the Transite affords better protection and will present a good appearance after years of usage.

On new settings a veneer of 4½″ Sil-O-Cel C-22 Brick may be bonded into the outside of the fire brick every fifth course vertically. On old settings, spikes or expansion bolts with wires attached may be driven into mortar joints on 2-ft. centers and 4½″ Sil-O-Cel Natural Brick laced to the brickwork without bond of any kind. The C-22 Brick present an attractive and durable surface as laid but if desired they may be coated with Insulkote Primer and Insulkote to prevent air infiltration. The Natural Brick are finished with two ¼″ coats of cement, reinforced with wire netting.

On new settings of H.R.T. boilers and small water-tube boilers, a "core wall" of 4½″ Sil-O-Cel Natural Brick is often laid between fire brick and red brick and bonded every fifth course vertically. Opposite the furnace and first pass of water-tube boilers Sil-O-Cel C-22 Brick are used.



Sil-O-Cel Natural Brick veneer on existing wall of water-tube boiler



Bailey water-wall insulation with Transite casing

Water-Wall Insulation and Casing

Boiler water walls are insulated with about 4″ of J-M 85% Magnesia Blocks, or, if the temperature is high, with Superex or Superex Combination Insulation. The insulation is cased with 3/8″ Transite panels, battened with steel strips, which makes a neat removable and replaceable casing of great durability. The heat saving amounts to more than 90% of the uninsulated loss.

If the exterior of the wall surface is uneven, a filler coat of J-M No. 450 Insulating Cement is first well pressed onto the surface in a thickness just sufficient to provide a flat surface. Then two layers of insulating blocks are applied with the lengths of the blocks running vertically and with all joints broken. The outside layer is pointed up with J-M No. 302 Insulating Cement and all joints are closely butted.

Casing bolts or studs protrude through the insulation and serve to support flat Transite panels which are usually fitted against the wall in vertical rows between the bolts, beginning at the bottom. Each panel has a flat steel batten bolted to its top edge, behind which the next higher panel is slipped in the course of erection. The panels are secured against the wall by continuous steel battens pressed firmly over their vertical edges and held in place by the wall bolts or studs. Pliable gaskets of J-M Asbestos Roll Fire-Felt may be used under all battens to seal the casing against air infiltration.

No cables or mesh are used with the panel type casing and the construction permits access to the tubes without disturbing the insulation anywhere on the wall except that portion which it is desired to remove. Because of weight, it has been found advisable to support steel casings, where used, independently of the water wall. Cables and lacing wire must then be employed to hold the insulation, which cannot thereby be secured as snugly against the wall as with an integral casing. Flue effect between separate casing and insulation increases loss but creates a false impression of efficiency because the casing is cooled by the air flow. Transite casings have none of these disadvantages.

If reinforced hard finish cement is used instead of Transite, the disadvantages of wire and mesh are present but there are better possibilities of an air seal than with an independently supported steel casing. The cement finish should not be used where it will be subjected to hard wear.

Sometimes No. 450 Insulating Cement is used not merely to level the surface to be insulated but is made thicker to serve as complete insulation either by itself or with a hard reinforced cement finish. The plastic insulation is less efficient than the blocks and the construction in general is less desirable.

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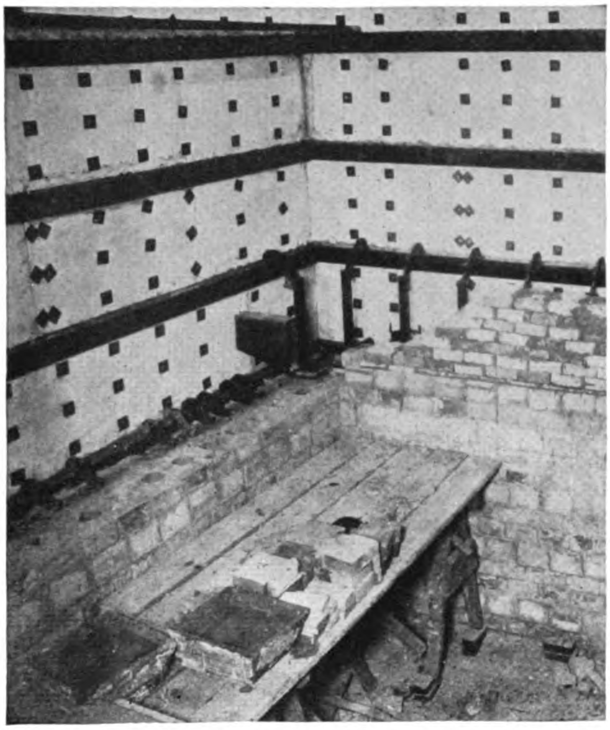


Interior of insulated Transite casing erected outside air-cooled furnace walls. Brickwork is laid after the casing is completed

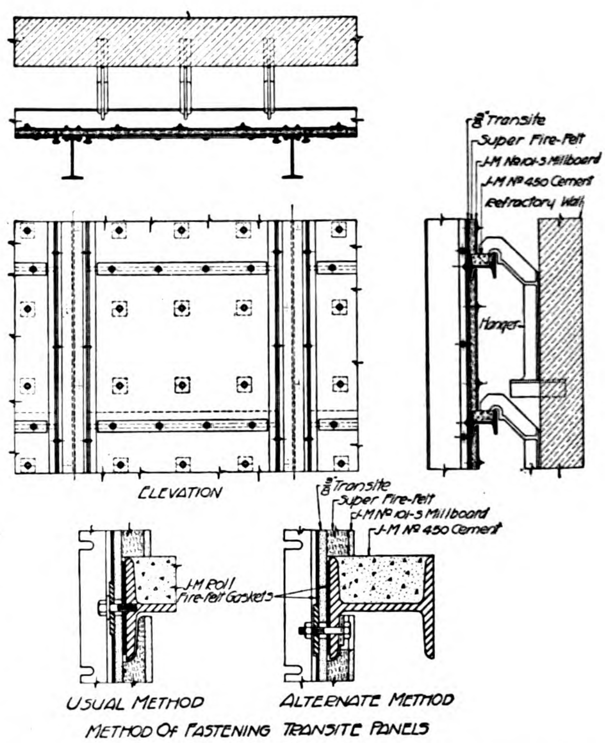
Air-Cooled Wall Insulation and Casing

In all designs of ventilated boiler walls air is drawn over exterior brick surfaces (suspended or otherwise) either by fans, by natural draft or by burner induction. The circulation varies in the different designs, but in all designs the function of the casing over the air passages is to retain the heat recovered by the air, furnish a suitable clearance for air travel so that adequate scrubbing action is combined with the elimination of undue friction loss, and prevent leakage of air which would interrupt the flow over surfaces to be cooled. The construction should be fireproof and able successfully to withstand abrasion, ordinary mechanical impact and high temperature.

The best casing is made of ⅜″ flat Transite, lined with Super Fire-Felt Sheets (usually 1″ thick). A protective surface, next to the air space, is provided by J-M No. 101-S Asbestos Sheet Millboard. This casing, erected between the buckstays, gives superior insulation with minimum thickness. The panel construction is tight, sectionally removable and replaceable, and economical of floor space.

The materials which go to make up the panels are fabricated as units by means of through bolts with nuts on the inside, bearing on large washers pressed against the furnace surface of the millboard. Behind each buckstay the insulation and millboard are held in place by bolts passing through the flange of the buckstay. Before erecting the casing, the horizontal H-beams are filled with J-M No. 450 Insulating Cement from the web to a point level with the top of the flange.

The usual practice is to complete the application of insulation and casing prior to the erection of the brick furnace walls. In one method of application the panels are maintained in position by steel battens fastened to horizontal H-beams. Vertical joints are sealed by light angles, slotted for bolting to the channel backing of the buckstay and pressed firmly against the panels as the final operation. All joints subject to air leakage are gasketed during erection with ⅛″ J-M Asbestos Roll Fire-Felt.



Insulation recommendation for air-cooled furnace walls

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Boiler Bases

The bases of boilers should ordinarily be insulated under fire brick with at least 4″ of Sil-O-Cel C-3 Concrete. Sil-O-Cel Brick of the proper type to withstand the temperature may be applied where the use of brick shapes is advantageous.

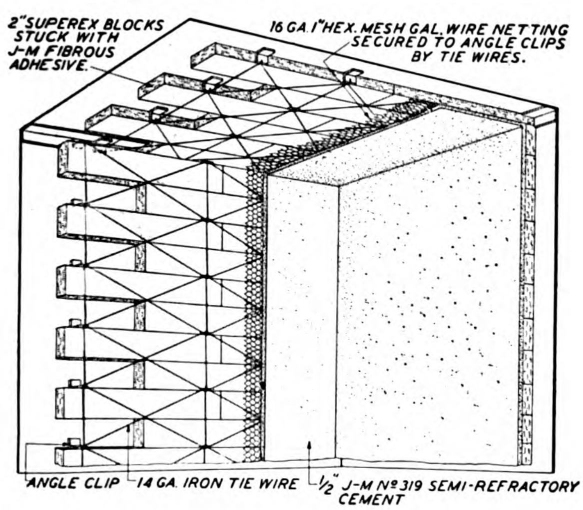
Expansion joints in the brickwork of the base are perhaps even more essential than in the walls, if a satisfactory life is to be obtained. Where improper joints are provided the fire brick will arch and expose the insulation.

In some cases where inadequate insulation is used over a cinder fill, heat has been known to work down into the foundation and ignite the cinders if they are not burned out properly. Where boilers are set over wood piling or in other places where fire hazards are present, particular care is essential in insulating the bases.

Boiler Tube Doors

Boiler tube doors should be thoroughly insulated to protect the steam surfaces immediately behind. These doors are insulated with 2″ Super Fire-Felt Sheets, protected on the surface with 1/4″ J-M No. 101-S Asbestos Sheet Millboard, the whole being held in place by bolts and plate washers. All joints between the sheets and around the edges are pointed up with J-M No. 319 Semi-Refractory Cement.

If the doors are insulated before they are hung, they may be laid flat and filled with Sil-O-Cel C-3 Concrete rammed in between reinforcing bolts which extend through the door.



Breeching lined with Superex Blocks

Boiler breeching lined with 2½″ Sil-O-Cel Natural Brick and Semi-Refractory Cement

Breechings and Stacks

No one doubts the advisability of insulating smoke flues and breechings but there is some difference of opinion as to whether the insulation should be external or internal. Often the size and location of the flue will eliminate one possibility, as where a man cannot work inside and the insulation is necessarily placed outside. Outdoor ducts, on the other hand, should be insulated inside if in any way possible. The special circumstances of the individual installation usually indicate the better kind of construction.

In applying interior insulation, drilled angle clips or other suitable fasteners are spot-welded to the interior of the breeching on convenient centers. Tie wires are twisted through the hole in each clip and the insulation (2½″ Sil-O-Cel Natural Brick or 2″ Superex Blocks) stuck against the shell with J-M Fibrous Adhesive. The insulation is securely laced in position and reinforcing mesh tied tightly over the surface. J-M No. 319 Semi-Refractory Cement is worked well into the reinforcing mesh, and after the first application is dry, the second coat is troweled smooth and hard. This finish is very effective in protecting the insulation from abrasion.

In erecting outside insulation, J-M 85% Magnesia or Superex Blocks may be stuck to the shell, wired in position, and finished with No. 302 Insulating Cement reinforced with wire mesh. In a Connery breeching this construction has the disadvantage of leaving the expansion stiffeners uninsulated.

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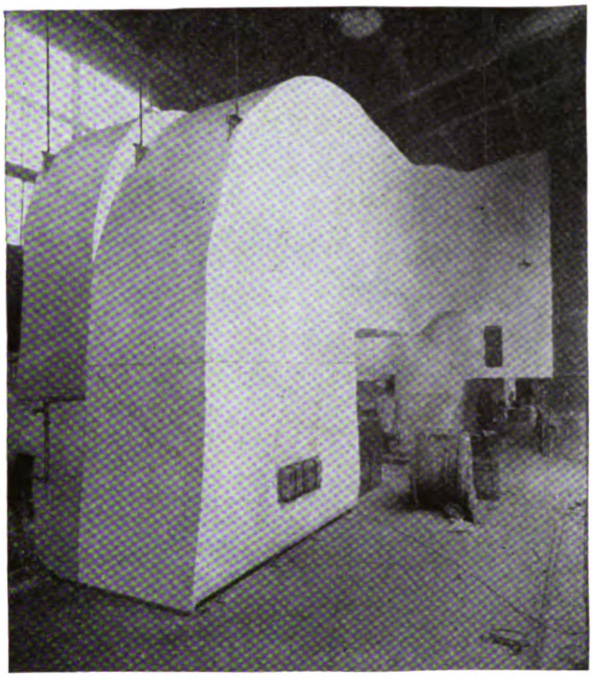
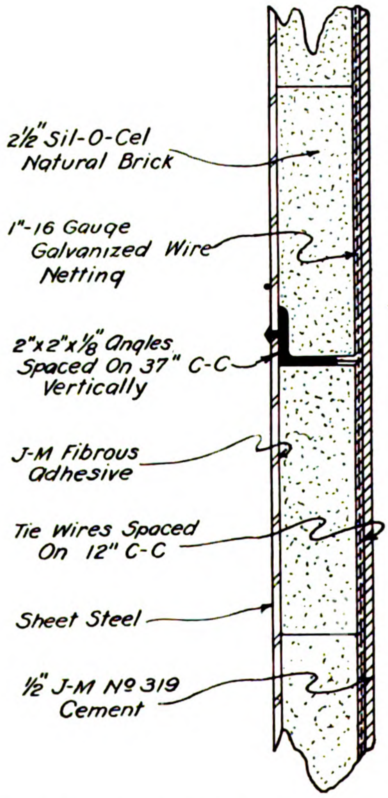


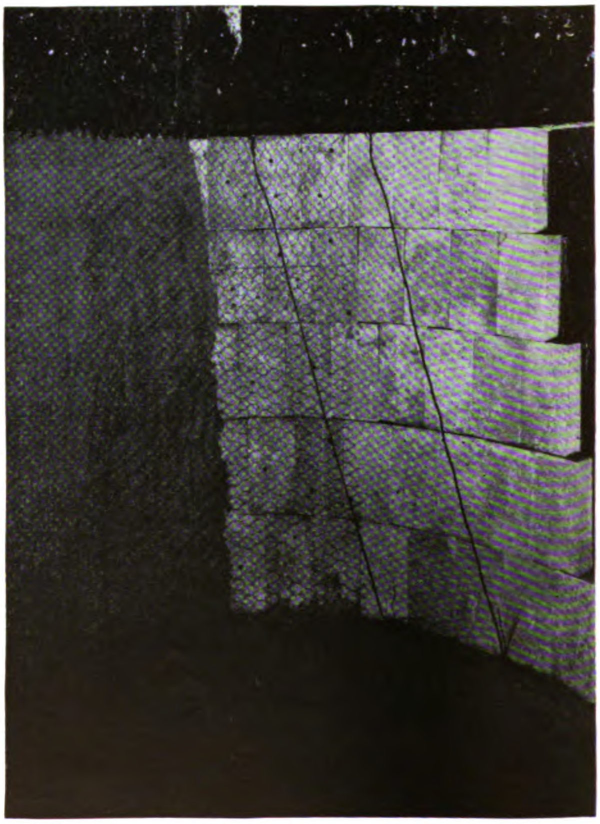
Connery flue insulated with Superex Blocks with cement finish

Another method for outside work is to apply 6" square mesh 6-gauge wire fabric over the stiffener angles or V-ribs. On Connery flues it is spot-welded to the V-ribs and on other flues it is securely laced to the stiffening angles. The insulating blocks are laced firmly to the fabric with wire and cables, and reinforced No. 302 Cement applied. Where stiffening angles are widely spaced or where there are no projecting stiffeners, V-rib lath with 1" ribs may be used to form the air space over which block insulation may be applied.

Stacks are insulated in much the same way as the interior of breechings. Circumferential angles 2" x 2" x 1/8" are placed on 37" vertical centers with 1/4" holes for lacing punched on 12" centers in the outstanding leg. Sil-O-Cel Natural Brick are then applied in identical construction to that used on breeching interiors. Sil-O-Cel C-22 Brick are used instead of Natural Brick where stack temperatures are unusually high. Vitribestos Sheets, 2" thick and curved to fit, are designed for stack insulation where temperatures do not exceed 700 deg. F.



Stack lining with Sil-O-Cel Natural Brick



Sil-O-Cel C-22 Brick stack lining

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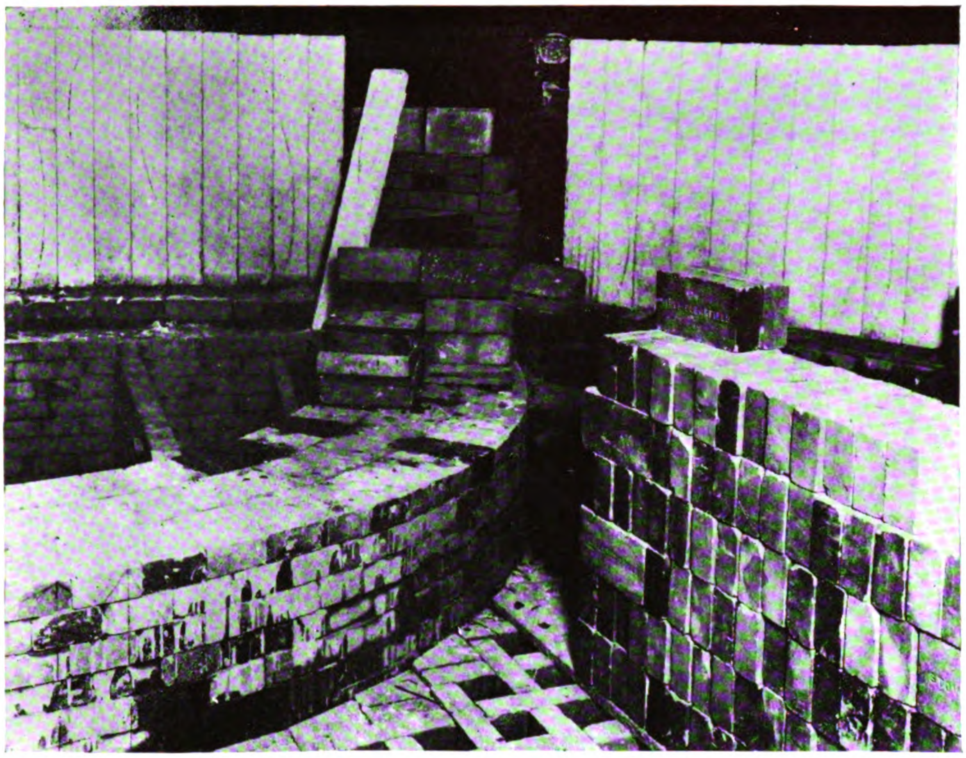
Insulation of Steel Making Equipment



J-M insulation being applied behind refractory in a side combustion hot blast stove

Many J-M insulating products find wide application in steel mill equipment for improving performance, increasing production and lowering operating costs. The more important of such applications are discussed in the following pages.

Blast Furnace Stack

The blast furnace stack is insulated with 2½″ to 4″ of Sil-O-Cel Coarse Grade, extending from the mantel to the bottom of the wearing plates. The coarse powder is densely packed between the shell and the in-walls as the laying of the brickwork progresses. Because of the more uniform temperature gradient, vapors of zinc or other impurities in the ore are prevented from chilling and condensing in the lining, but instead are carried through into the insulation, where condensation takes place in the highly porous Sil-O-Cel. The insulation also protects the shell against excessive temperatures, cushions the brick expansion, and lessens cracking and spalling.

Hot Blast Stoves

The approved insulation for hot blast stoves consists of 2½″ of Superex Blocks next to the shell, with 4½″ of the fire brick lining, immediately inside the Superex, replaced by 4½″ of Sil-O-Cel C-22 Brick. Domes are insulated with 4½″ of C-22 Brick and 2″ of Superex Blocks. Older practice made use of Superex only, but replacing 4½″ of fire brick with C-22 Brick has proved amply justified by the excellent return on the investment. The insulation pays for itself in a few months' operation, stove capacity is increased and checkerwork lasts longer. Base insulation consists of a minimum of 4″ of Sil-O-Cel C-3 Concrete.

Hot Blast Mains

The generally recommended insulation for hot blast mains and bustle pipes is a 4½″ course of Sil-O-Cel C-22 Brick behind a 4½″ course of fire brick. This construction reduces radiation loss 60 to 70 per cent compared to that from an uninsulated 9″ fire brick

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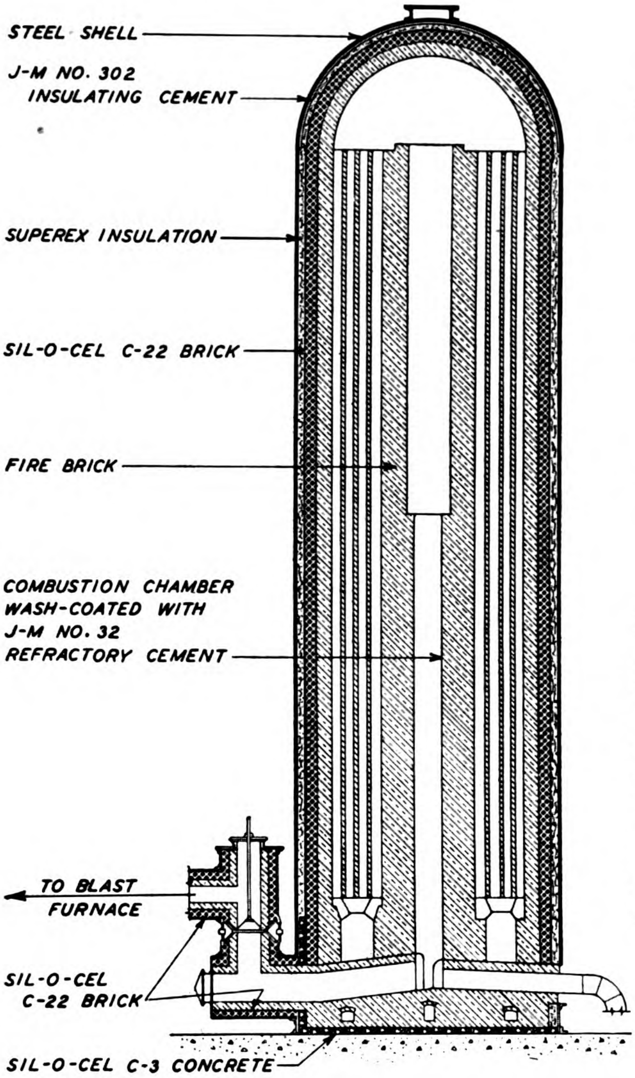
lining. Alternate specifications make use of C-22 Brick laid 2½" thick, or Superex Blocks 2" thick, protected by at least 6" of fire brick.



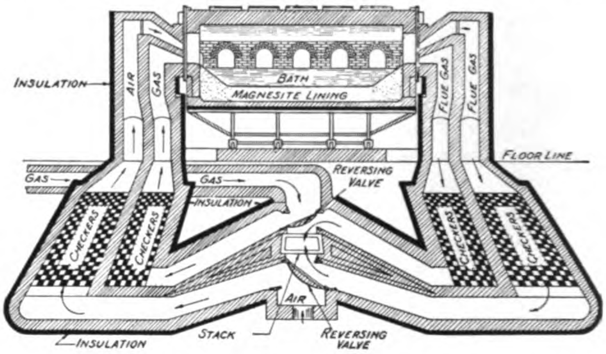
Method of insulating hot blast stoves and mains

Open Hearth Furnace Hearths

The entire hearth and sloping back wall of the open hearth furnace is insulated with 5" of Sil-O-Cel C-3 Concrete, making proper provision for expansion. Immediately above the supporting steel work in the pan of the hearth, the C-3 Concrete is placed in monolithic construction. Sil-O-Cel C-3 Concrete is made in the usual way and tamped into place after thorough mixing. The usual brick hearth construction proceeds after the C-3 Concrete has set. In certain instances it may be preferable to use 5" of Sil-O-Cel C-22 or Super Brick instead of the Sil-O-Cel C-3 Concrete.

Open Hearth Regenerators

The walls of new open hearth regenerators are insulated with 4" of Superex Blocks or 4½" of Sil-O-Cel Natural Brick, inside the steel casing. Roofs are



Perspective cross-section of the open hearth system, showing location of insulation

insulated with 2" of Superex or 2½" of Sil-O-Cel Natural Brick. Sections below ground are insulated with 4" of Sil-O-Cel C-3 Concrete. Existing regenerator walls are also insulated with 4" of Sil-O-Cel C-3 Concrete, and Sil-O-Cel C-3 (granular) is spread 2½" thick on the roof surface. It is not unusual for insulation on regenerators to repay its cost in a year's time through heat saving accomplished, not to mention improved operation through minimized air infiltration.

Fan-tails, Slag Pockets and Flues

The bases of fan-tails and slag pockets are insulated with a minimum of 4" of Sil-O-Cel C-3 Concrete. Walls are insulated with Sil-O-Cel C-22 Brick, or C-3 (granular), 4½" thick. Fan-tail roofs are insulated with the same materials 2½" thick.

Open hearth flues are completely insulated in base, sides and over the top with at least 4" of Sil-O-Cel C-3 Concrete, outside the fire brick lining.

Soaking Pits

Soaking pits are insulated in much the same manner employed for open hearth regenerators. Three approved methods of insulating involve the use of Superex Blocks, Sil-O-Cel Natural Brick, and Sil-O-Cel C-3 Concrete.

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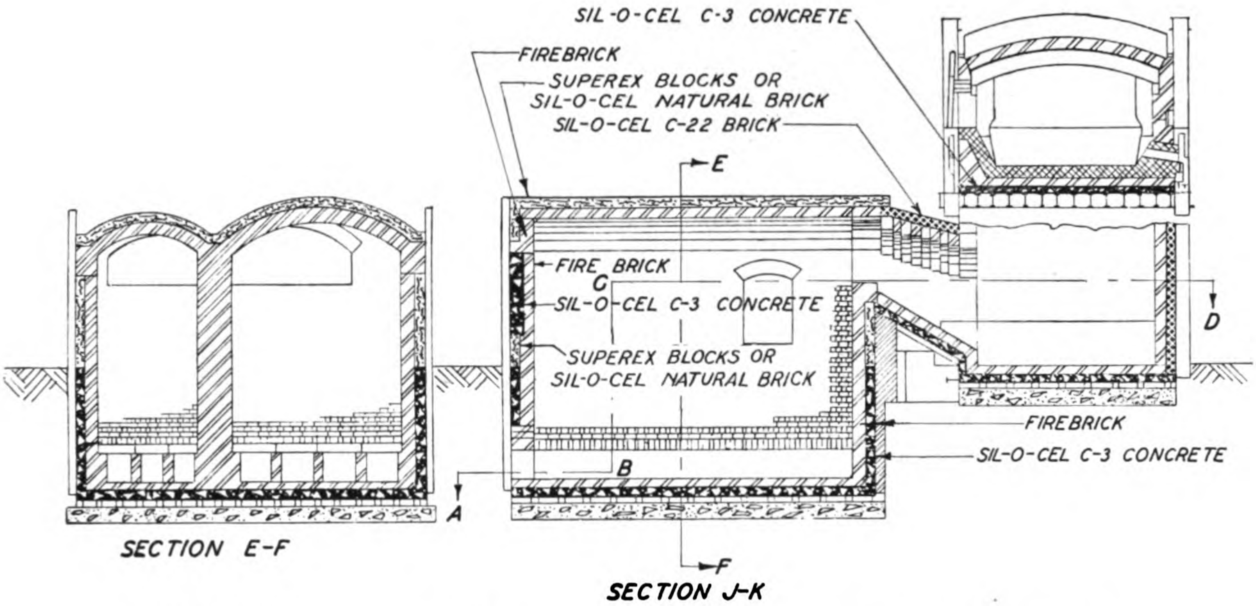
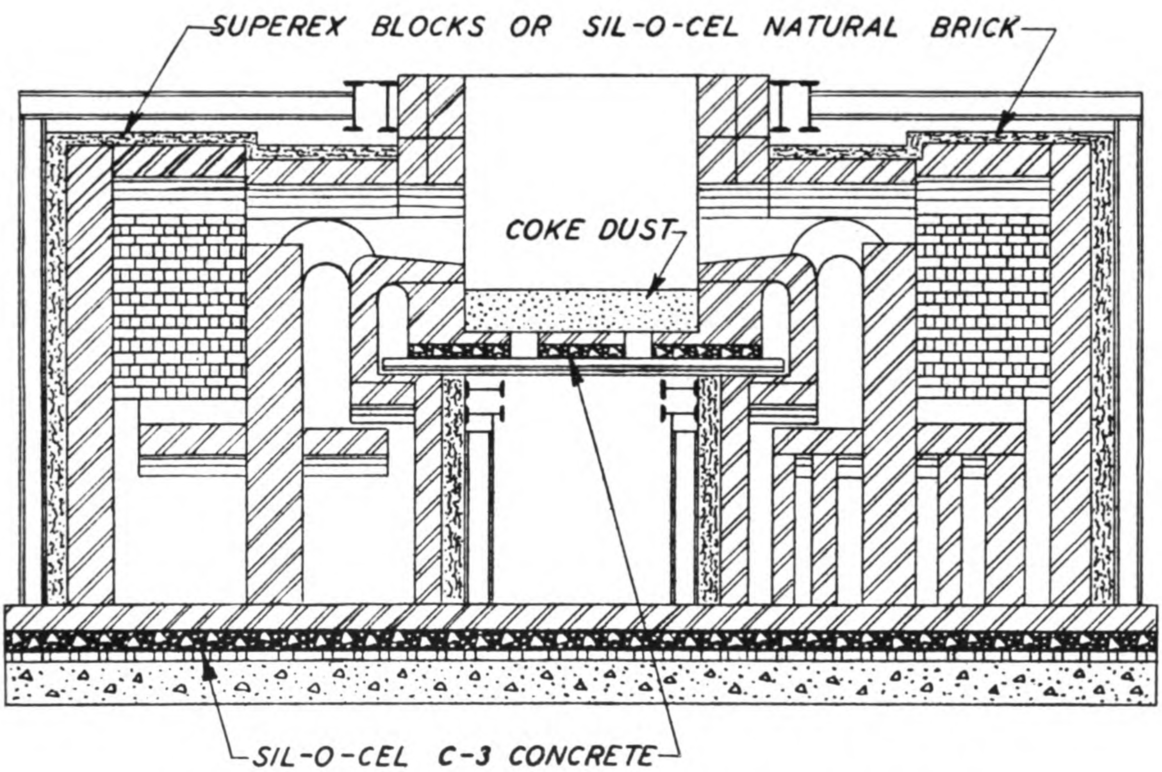


J-M insulation recommendation for new open hearth construction. Fan-tail and slag pocket walls are insulated with Sil-O-Cel C-22 Brick or C-3 (granular). Flues are insulated, base, walls and top, with Sil-O-Cel C-3 Concrete outside the refractory



J-M insulation recommendation for new soaking pit construction. Existing pits are completely insulated with Sil-O-Cel C-3 Concrete applied on the outside of the walls and C-3 (granular) over the top

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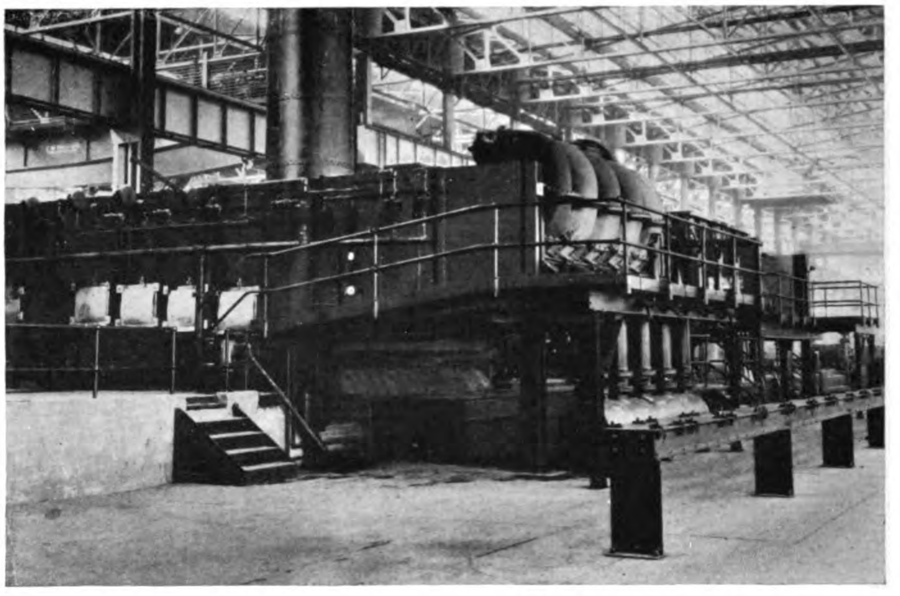

Morgan continuous billet heating furnace (oil-fired) with side walls insulated with Superex Blocks

Heating and Treating Furnaces

Insulation on heating and treating furnaces saves fuel, provides closer temperature control, reduces air infiltration and assures better working conditions. Added to this is the decrease of internal strains and reduction in spalling because of the smaller temperature differential between the inside and outside of the refractory. Wall cracks, caused by uneven expansion and contraction, are fewer and smaller.

Superex Blocks, Superex-Magnesia Combination Insulation or Sil-O-Cel Brick are usually applied between or behind the buckstays, next to the refractory lining, to the required thickness. At places of unusual thrust, such as opposite a sprung arch, or where castings and steel work are hung into the brickwork, the fire brick is carried through the insulation to the outside of the furnace. The thickness applied may vary from 2″ on billet heating furnaces to 20″ or more on electric oven furnaces. Furnace bases should be insulated under the refractory with a minimum of 4″ of Sil-O-Cel C-3 Concrete.

Sil-O-Cel as a Combination Insulation and Refractory

While in most cases Sil-O-Cel is used as an insulating material behind fire brick linings, its use as a combination refractory and insulation in certain types of equipment has been attended by great success.

Sil-O-Cel C-22 Brick and Sil-O-Cel Super Brick, because they have been calcined at high temperatures, are semi-refractory and serve very well without fire brick protection when not subjected to erosion or abrasion. The great advantage of such construction lies not only in excellent insulating qualities but also in marked reduction in heat stored in the furnace lining and time required to reach operating temperatures.

Ovens and furnaces operated at moderate temperature are in many cases now being constructed of Sil-O-Cel C-3 Concrete. Fuel consumption is surprisingly low, due to the insulating properties of C-3 and the fact that all masonry joints are eliminated. This insulating concrete is over three times as effective as fire brick in preventing heat penetration. Made in accordance with specifications, the material sets up into a strong durable concrete with a crushing strength of about 1000 lb. per sq. in.

Producer Gas Mains

Producer gas mains are insulated between refractory lining and steel shell with 2½″ to 4″ of Superex Blocks. Sil-O-Cel Natural Brick are similarly used in 2½″ or 4½″ thickness. Such insulation reduces tar deposition, keeps the gas of higher heat value and makes fewer burnouts necessary. Superex Blocks, 2½″ thick, save in heat over four times their cost in a year of operation, assuming 1400 deg. F. gas, and sensible heat worth $0.25 per million B.t.u.

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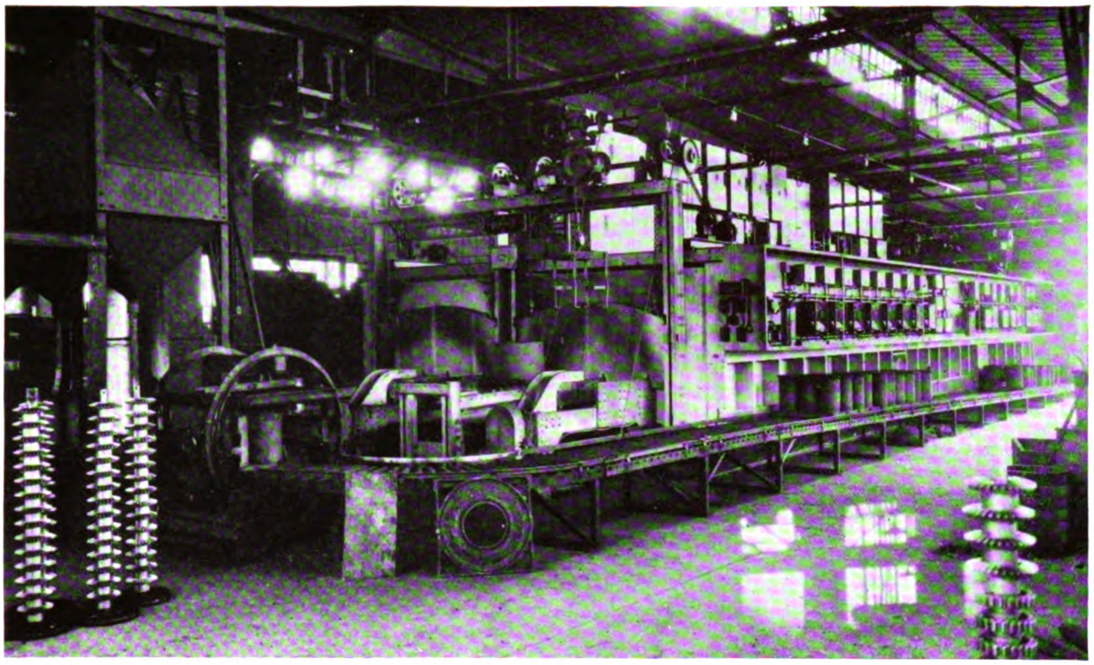
Insulation of Industrial Furnaces



Pusher-type industrial furnace, heavily insulated with J-M Materials. Hevi Duty Electric Co., Milwaukee, Wis. (For insulation, see reverse side of Data Sheet IN-1001)

In the operation of industrial furnaces, insulation saves fuel, improves the quality of the product, provides closer temperature control, reduces air infiltration and assures better working conditions. There is also the decrease of internal strains in the brickwork and reduction in spalling because of smaller temperature differential between the inside and outside of the refractory. The effect of insulation is to promote heat flow along the walls, and cooler portions are raised to a higher temperature. Wall cracks, caused by uneven expansion and contraction, are fewer and smaller. Lower temperatures may be used in the heating zone, yet adequate temperatures still be maintained throughout the furnace, which saves fuel and further prevents rapid deterioration of the refractories.

Superex Blocks, Superex-Magnesia Combination Insulation or Sil-O-Cel Brick are usually applied between or behind the buckstays, next to the refractory lining, to the required thickness. The thickness of Superex and the thickness and type of Sil-O-Cel Brick used will vary with the temperature, type of heating employed, and temperature control required.

For furnaces operating at temperatures between 1500 and 2300 deg. F., 4″ is the minimum advisable thickness of insulation. For electrically heated equipment, much heavier insulation is always necessary. Where the temperature to be applied on the insulation is not more than 1600 deg. F., either Superex Blocks or Sil-O-Cel Natural Brick are used; at higher temperatures Sil-O-Cel C-22 Brick or Sil-O-Cel Super Brick.

Superex Blocks are furnished 6″ x 36″ and applied in two or more layers, broken-joint construction, with joints closely butted and pointed up with J-M No. 302 Insulating Cement. Sil-O-Cel Brick are furnished in standard fire brick size and laid in a mortar of the same material as the brick, with thin rubbed joints.

Suitable openings are provided through the insulation for doors, burners, etc. Around these openings the fire brick are carried through to the outside.

Where insulation is applied after the brickwork is laid, a cement finish is recommended. The insulation is secured by lacing it with soft annealed iron wire to cables run through holes in the buckstays or

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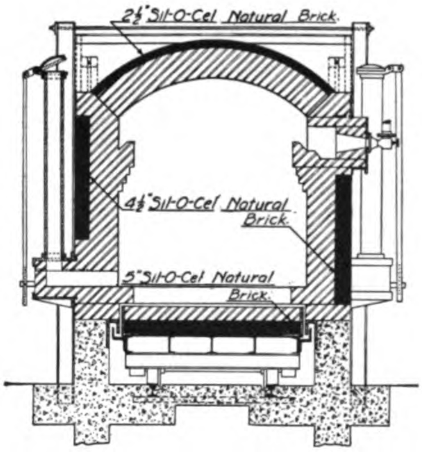
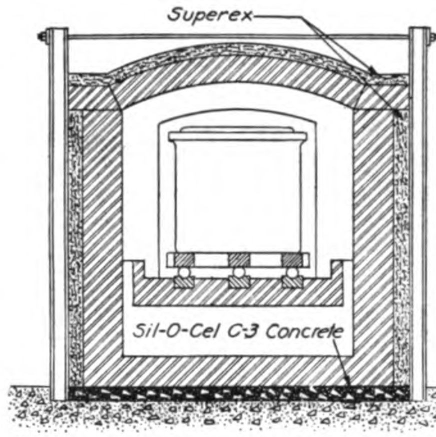
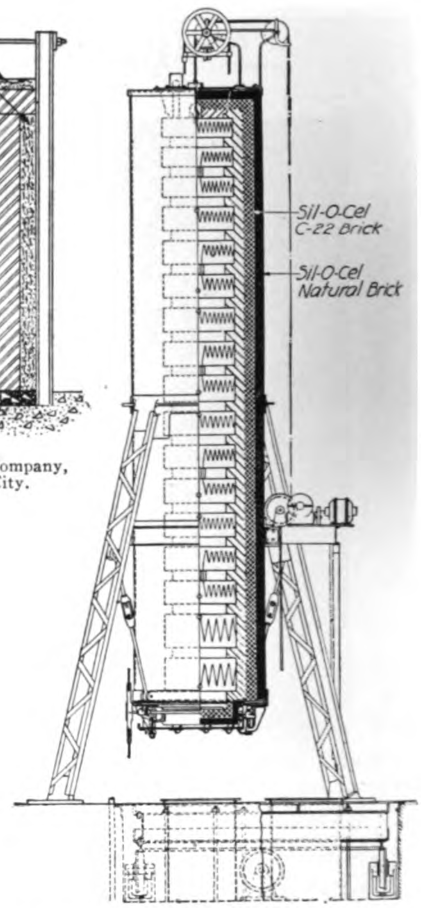


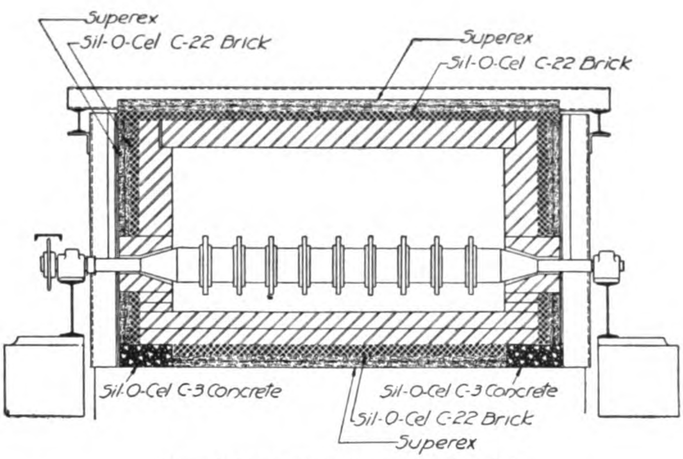
Direct over-fired recuperative car-type furnace, designed and built by Denver Fire Clay Co., Denver.



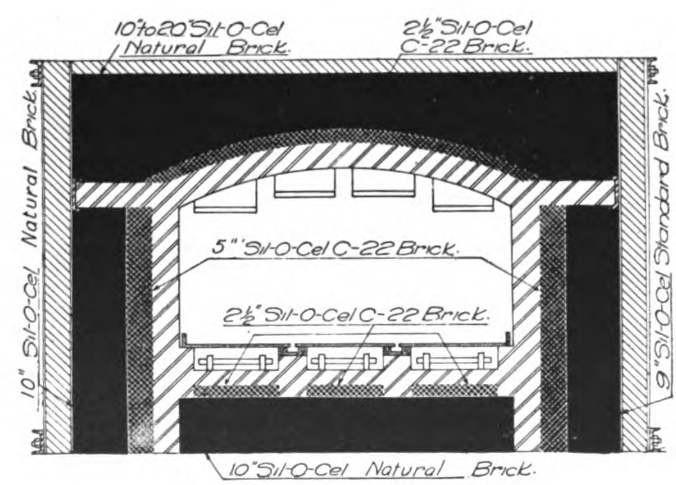
Car and roll furnace. W. S. Rockwell Company, designers and builders, New York City.



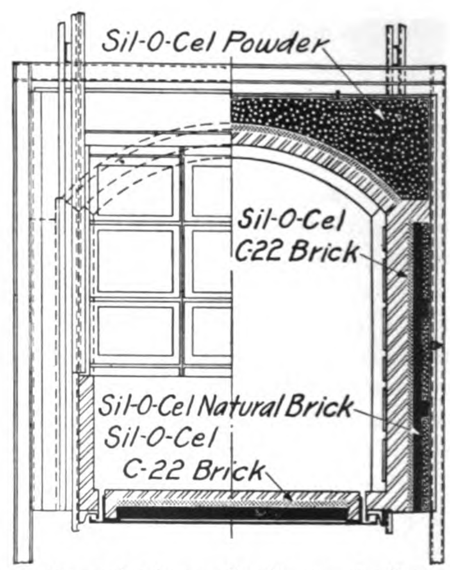
Duralumin heat-treating furnace, designed and built by Strong, Carlisle & Hammond Co., Cleveland, Ohio.



Normalizing furnace designed and built by Swindell-Dressler Corp., Pittsburgh, Pa.



Thorough insulation recommended by General Electric Co. in this electric box-type heat-treating furnace.



Large electric annealing furnace. Loading clearance 12 ft. wide x 12 ft. high x 68 ft. deep. Built by the Electric Furnace Co., Salem, Ohio.

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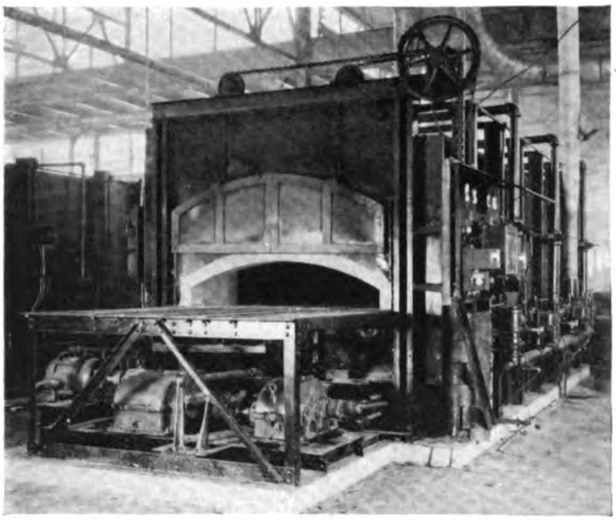

Conveyor hearth furnace insulated with Sil-O-Cel C-22 Brick, Superex Blocks and J-M 85% Magnesia Blocks

to drilled angle clips spot-welded or bolted to the buckstays. All supporting steel work is left sufficiently exposed to prevent its reaching undue temperatures.

Over the insulation, 1½" hexagonal mesh galvanized wire netting is stretched tightly and fastened securely to the cables. Two ¼" coats of J-M No. 302 Insulating Cement are then applied, the first coat being left to dry with a rough surface before applying the smooth finishing coat. For an exceptionally hard finish, the second coat may be mixed with 1/3 to ½ portland cement by weight, the amount depending on the degree of hardness required.

Transite forms a much more durable surface than cement, and may be held in place over the insulation by flat steel battens secured to suitable angles or angle clips, spot-welded or bolted to the buckstays.

In building new furnaces, the casing may be erected first, then insulation laid up between the fire brick and casing. In places where arch thrust or other exceptional stress is transmitted to the buckstays, the insulation is omitted and the brickwork carried through to the supporting steel.

Furnace roofs are insulated with the same insulation used on the sides, of proper thickness. A cement finish is used, or, in the case of Sil-O-Cel Brick, a slurry of the mortar used for setting.

Furnace hearths, flues and car floors, where the insulation is protected by 5" or more of solid fire brick, are insulated with a minimum of 4" thick Sil-O-Cel C-3 Concrete, made by mixing Sil-O-Cel C-3 and portland cement in the proportion of four parts of C-3 to one part of portland cement by volume. An excess of water should be avoided.

Where the maximum furnace operating temperature is 1800 deg. F. or less, the furnace door lining is best constructed entirely of Sil-O-Cel C-3 Concrete from 6" to 9" thick, depending upon conditions. For higher operating temperatures, Sil-O-Cel C-3 Concrete of the required thickness should be faced with fire brick. In cast iron doors, reinforcing bolts projecting from the door face and sides should extend part way through the insulation. In channel iron frame doors, similar bolts are installed in the sides, bottom and top and suitable reinforcing wire used to tie the projecting bolts together.

The Sil-O-Cel C-3 Concrete is mixed in the usual manner and tamped into the door laid horizontally. It is best practice to saturate the C-3 with water and allow it to stand over night, adding the portland cement, and additional water if necessary, immediately before mixing. The top surface should be covered with a damp cloth and kept wet for 48 hours.

Sil-O-Cel Used Without Fire Brick Protection

In recent years, furnace designers and builders have often adopted the use of Sil-O-Cel C-22 Brick or Sil-O-Cel Super Brick without fire brick protection in cases where the brick will not be subjected to erosion and abrasion. These calcined Sil-O-Cel Brick are semi-refractory and, when used alone, combine excellent insulating qualities with a marked reduction in heat storage capacity and time required to reach operating temperatures.

Sil-O-Cel C-3 Concrete for Monolithic Furnaces

Furnaces operated at moderate temperatures are in many cases now constructed entirely of Sil-O-Cel C-3 Concrete without fire brick linings. Walls, tops, bases and doors are poured into forms and the material thoroughly tamped into place, proper provision being made where necessary for reinforcing and for expansion joints.

This type of construction may be utilized at a great saving over ordinary masonry. Due to the insulating properties of Sil-O-Cel C-3 Concrete and the fact that all masonry joints are eliminated, fuel consumption is surprisingly low. Furnace operation is much improved, time cycles are shortened, and uniformity of performance assured.

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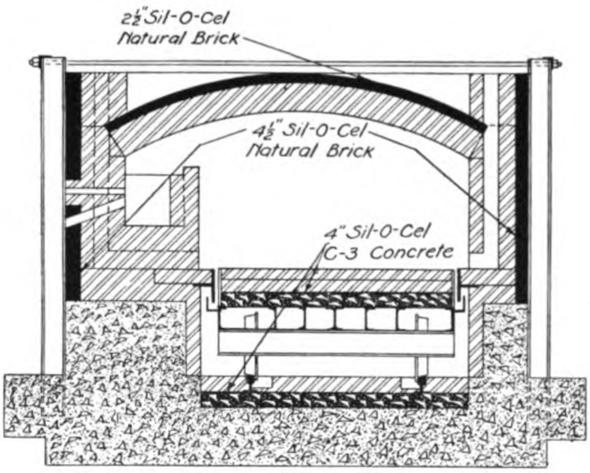
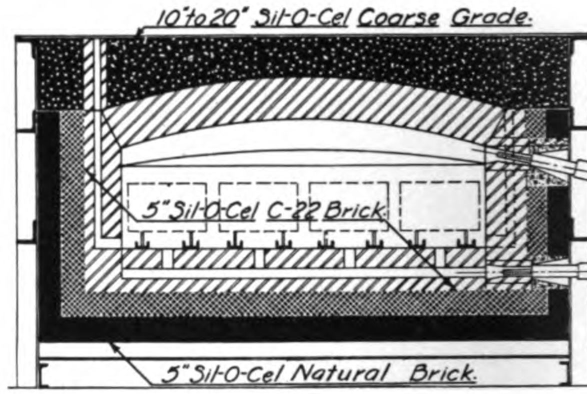
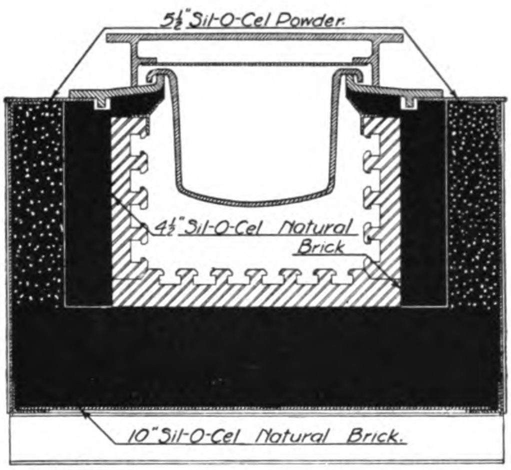


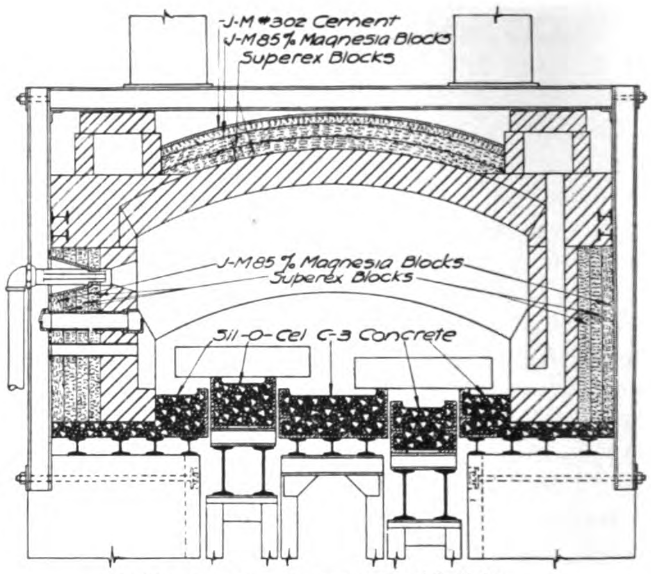
Single car-type annealing furnace. Method of insulating recommended by Costello Engineering Co., Pittsburgh, Pa.



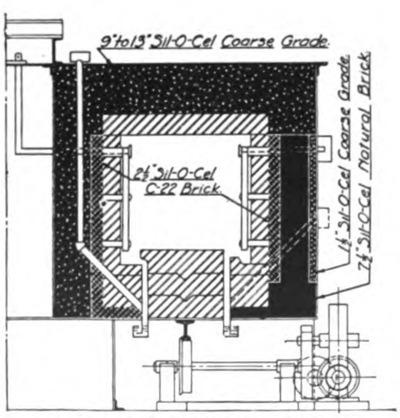
Gas-fired carbonizing furnace. Holcroft & Co., Detroit, designers and builders.



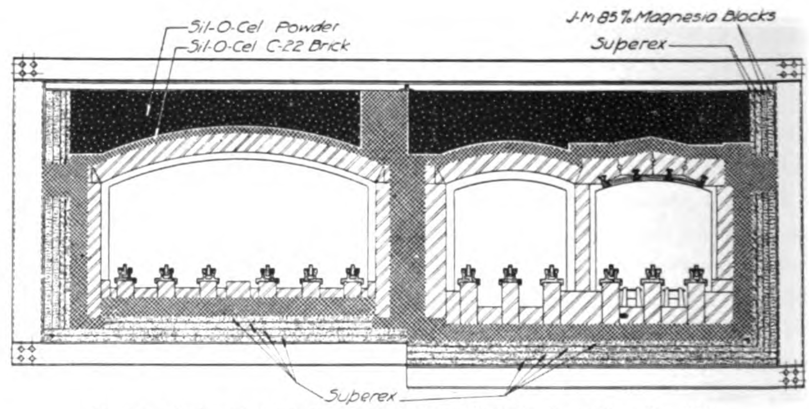
Lead pot designed and built by Hoskins Manufacturing Co., Detroit.



Walking beam furnace, designed and built by Ryan, Scully & Co., Philadelphia, Pa.



Method of insulating Westinghouse Electric & Manufacturing Co. rotary hearth electric furnace.



Furnace designed and built by Hevi Duty Electric Co., Milwaukee, Wis. An exterior view of this furnace appears on Data Sheet IN-1000.

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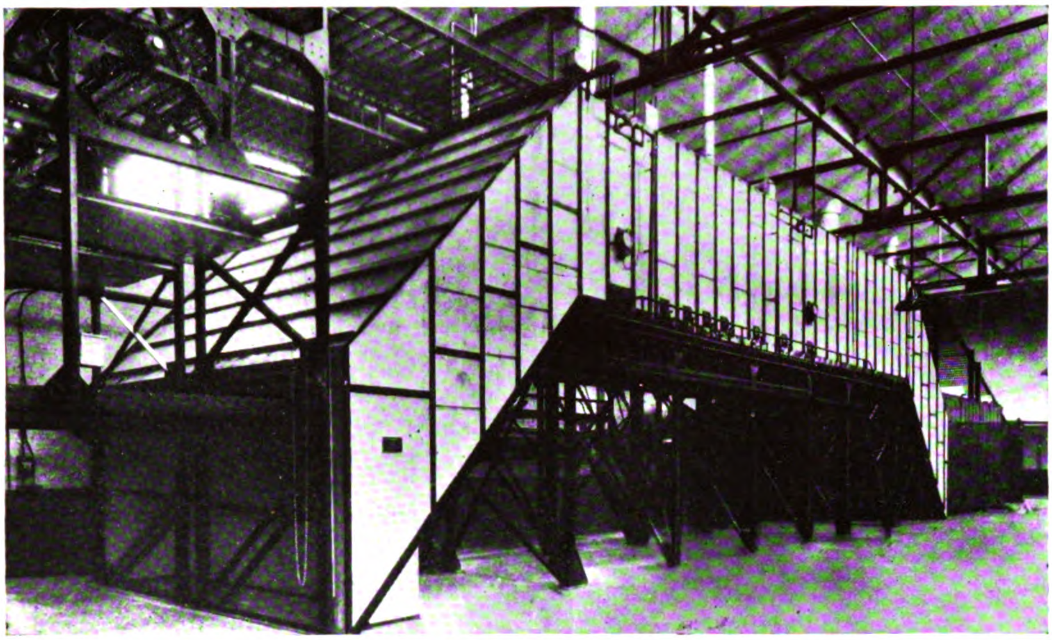
Insulation of Industrial Ovens



Continuous conveyor oven of American Stove Co., Clark-Jewel plant, insulated inside the casing with J-M 85% Magnesia Blocks

Industrial ovens operate through a wide temperature range for heating, baking and drying, but in every case the use of adequate insulation is recognized as essential to economical operation. Performance is also much improved by incorporating insulation in the design.

Brickwork blanketed by insulation maintains the more uniform soaking heat which is so much desired by operators. Insulating bricks or blocks are recommended for use on sides and tops of brick ovens, while Sil-O-Cel C-3 Concrete, applied at least 4″ thick, is generally used for insulating the bases of such equipment.

Continuous ovens in the medium temperature range are often constructed of steel and insulation, no refractory being used. Insulation in the form of sheets or blocks is well adapted to such work. The same is true of discontinuous steel and insulation ovens, such, for example, as the equipment which operates in cycle under full temperature for 8 hours and then is shut down for 16 hours.

The thickness of insulation used on ovens is ordinarily much greater than that which would be economical from the standpoint of fuel saving. Room or oven temperature control is usually of more importance than the cost of wasted heat.

Electrically heated "V" type fender and sheet metal ovens, such as are used in the automobile industry, have been insulated with two layers of J-M 85% Magnesia Blocks applied broken-joint method on sides, bottom and top. The thickness varies from a total of 6″ at the vertex to 4″ at the lower legs of the oven. Hy-rib lath is laced over the outside layer of insulation where it is exposed to the air and over it J-M No. 302 Insulating Cement is troweled in two or more coats to a smooth finish. Eight-ounce canvas is smoothly pasted on the cement and the whole exterior surface is given two coats of lead and oil paint. Field-built body, chassis, frame and wheel ovens are similarly insulated and finished, the thickness of the insulation being varied in accordance with oven temperature and fuel cost. The painted surface can be washed when it gets dirty and, for all ordinary usage, the insulation is still in perfect condition when the oven is worn out and ready to be replaced.

A manufacturer of traveling bread ovens, for reasons of fuel economy, more uniform conditions of soaking heat, close temperature control, and in sym-

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pathy with the demand for cool bakeries, has standardized on J-M 85% Magnesia Blocks around the body of the oven to a total thickness of 7″, applied in three broken-joint layers. On top, a cement finish is specified similar to that described above, and the sides are cased with 3/8″ flat Transite applied in panel construction with all joints tightly battened. This Transite casing is especially durable and lasting, and its appearance is a distinct asset to a bakery which emphasizes the sanitary aspects of its business. Flat Transite sheets are furnished 36″ x 48″, 42″ x 48″, and 42″ x 96″, and in thicknesses from 1/8″ to 4″.

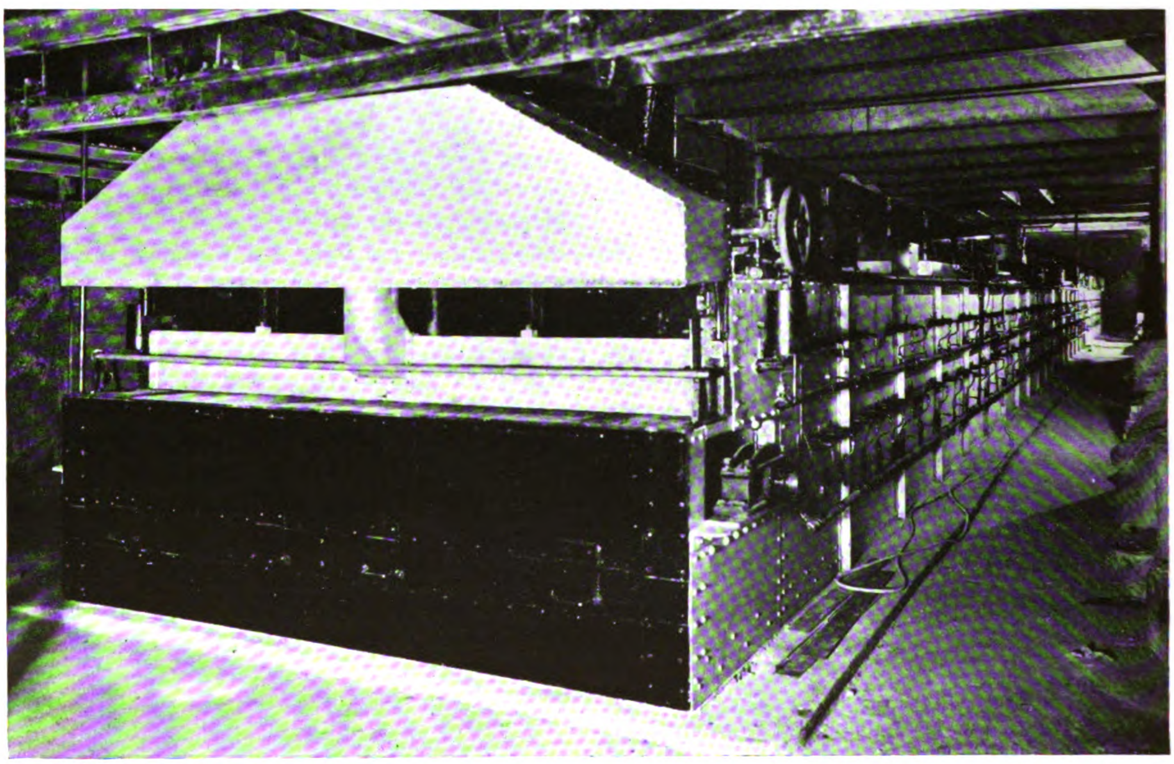
Brick core ovens are insulated on the inside with 2½″ thick Magnesia Blocks, protected on the oven side with panels of ¼″ flat Transite which are secured at the edges by steel battens fastened into the brickwork with expansion bolts. In applying insulation under the arches, it is convenient to erect 6″ square mesh 6-gauge wire fabric as a flat membrane to which insulating blocks may be laced and a cement finish applied. For temperatures below 400 deg. F., a 2″ thickness is used, and above 600 deg. F., 3″ thick Superex-Magnesia Combination insulation is specified. On ovens at these higher temperatures the finish consists of J-M No. 319 Semi-Refractory Cement, reinforced with hexagonal mesh wire. On such high temperature ovens, insulation is often placed over the top of the arch instead of inside. The advantage of interior insulation lies in reducing heat stored in the brickwork, but on ovens which operate night and day this factor is inconsequential and insulation is applied outside of the brickwork in accord with usual practice.

Core oven door insulation is usually placed between steel plates, bolted through the insulation. Angles, suitably fastened, protect the insulation at the edges.

The use of Sil-O-Cel C-3 Insulating Concrete is often of advantage in constructing monolithic core ovens, as is described in subsequent paragraphs.

Block Insulation

Probably the most universally applicable insulating material for ovens in the medium temperature range is J-M 85% Magnesia. Asbesto-Sponge Felted, however, is much to be preferred where the insulation itself will be required to endure wear and rough usage. Where the need is for a block insulation to



Comstock oven, 130 ft. long, at Freihofer Baking Co., Philadelphia, Pa., heavily insulated with J-M Materials

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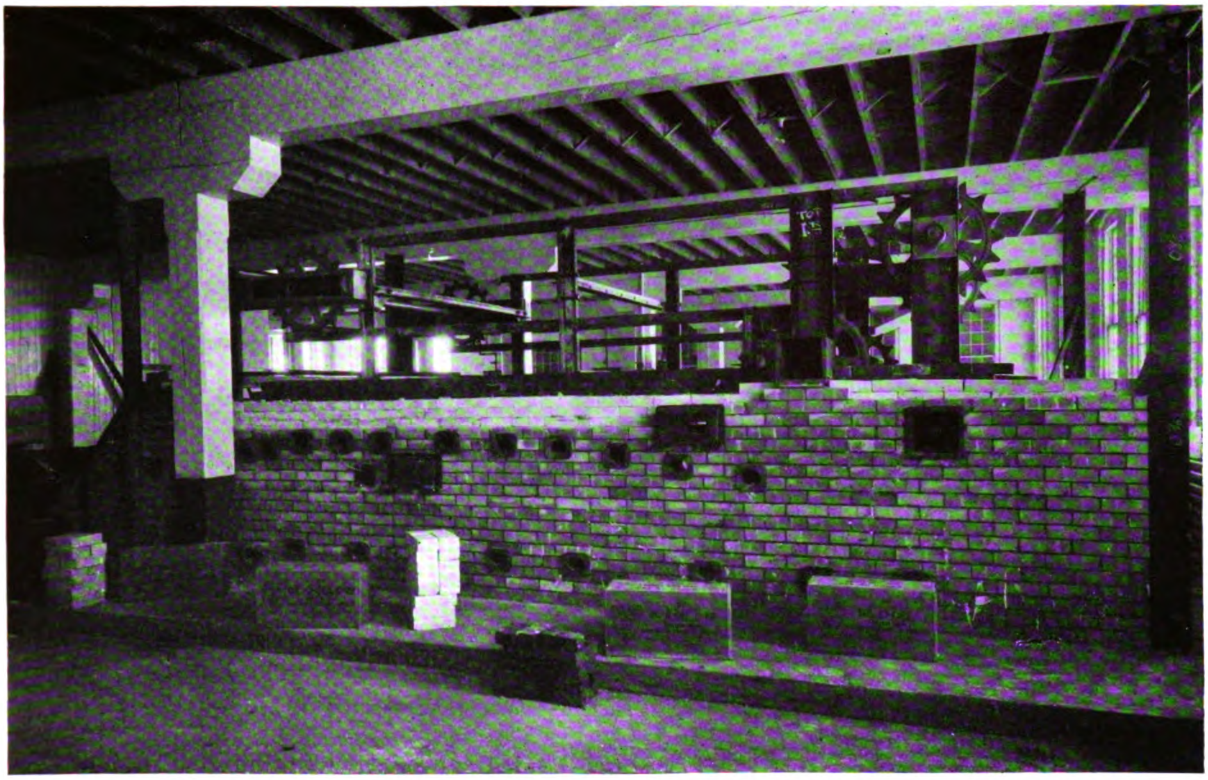

Baker-Perkins traveling tray oven at Hamilton Bakery Ltd., Hamilton, Ont. Faced with 4½" of Sil-O-Cel C-22 Brick outside 9" of Sil-O-Cel Natural Brick

withstand temperatures above 600 deg. F., Superex is the proper material. The size of blocks is 6" x 36" (or 3" x 18") and thicknesses may be had up to 4". Asbesto-Sponge Felted is also furnished in sheets 24" x 36".

One or more layers of 85% Magnesia or Asbesto-Sponge Felted are often used outside of Superex, this construction being termed Superex Combination Insulation. Such combination results in greater insulating efficiency and heat resistance for a given insulation thickness. The Superex is always used next to the hot surface as a protection for the other insulation, which, though high in insulation value, is comparatively low in heat resistance. The proper combination and thickness depends on the maximum operating temperature, average operating temperature, cost of heat, and degree of temperature control required.

Brick Insulation

Sil-O-Cel Natural Brick, furnished in standard fire brick sizes, are especially adapted to the insulation of brick ovens, the thickness used depending on conditions. Sil-O-Cel C-22 Brick (calcined) are ordinarily used for the insulation of high temperature furnaces. Because of their attractive appearance, however, they have often been used on such equipment as bread baking ovens as a combination face brick and insulation.

Rigid, Self-Supporting Sheets

For constructing dry rooms, japanning ovens and similar heated enclosures, the use of rigid, self-supporting sheets of Pan-O-Cel is convenient. Type A Pan-O-Cel has a temperature limit of 500 deg. F., and Type B (more moisture-resistant) has a limit of 250 deg. F. Standard size sheets are 36" x 36", 36" x 72" and 36" x 84", in thicknesses from 1" to 4". Special sizes may be had up to 68" x 100".

Another J-M product, Transite-Encased Insulating Board, combines the desirable properties of Transite as a casing material and J-M Insulating Board as a structural insulation. This material is ideally adapted to the construction of many types of housings which

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are required to withstand moderate temperatures, where extreme humidity conditions do not exist. The hard, durable surface on each side and the efficient insulating core unite qualities not to be found to a like degree in any other material. Standard size sheets are 42″ x 96″, with 1/8″ Transite on each side and a core of either 1/2″ or 1″ J-M Insulating Board. Temperature limit 230 deg. F.

Insulating Fillers

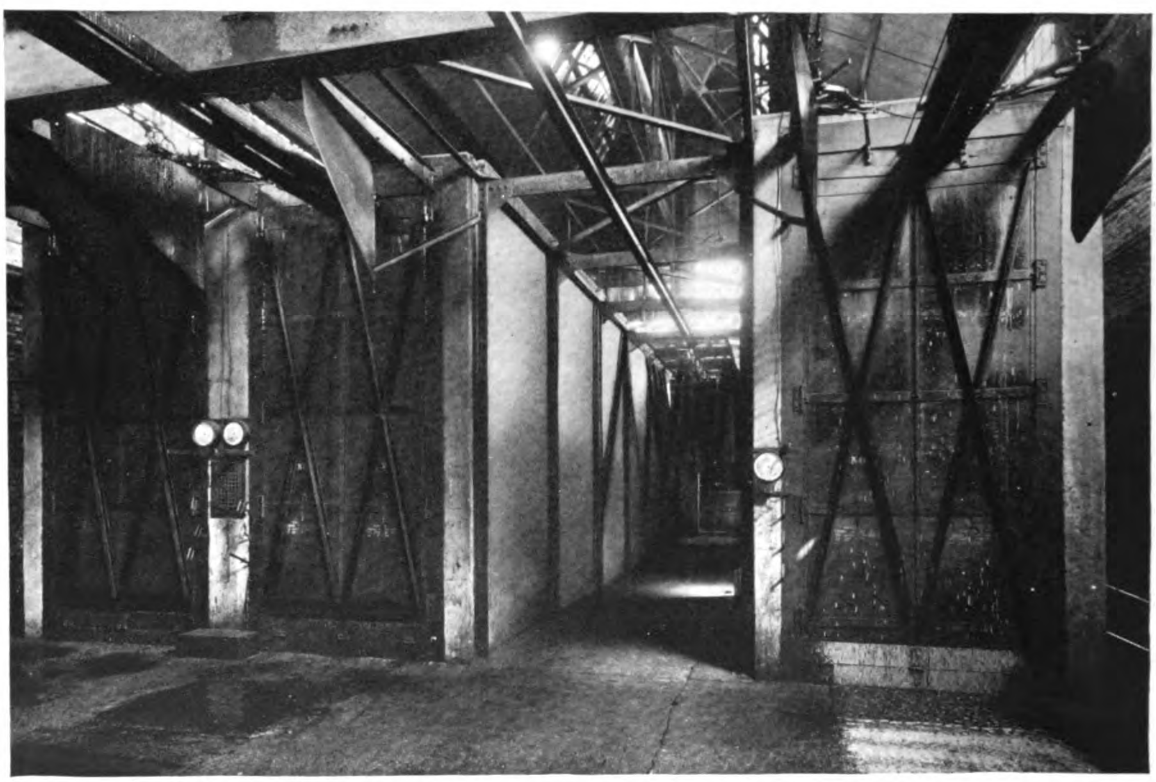
It is ordinarily preferable to insulate ovens with block or sheet materials. In some instances, however, conditions render impracticable the use of solid insulation and then insulating fillers are adapted to serve the purpose. Well-known J-M filling materials, one of which will be found suitable for such a condition, include Sil-O-Cel C-3, Sil-O-Cel Powder, Sil-O-Cel Coarse Grade, Fibro-Cel, Fil-Insul, Banroc (rock wool) and Banroc Granulated. (Banroc may also be obtained in blanket form, felted between various metal fabrics, such as galvanized wire netting, metal lath and rib lath. Thicknesses 1″ to 6″ may be obtained in sizes 24″ x 48″ and 24″ x 96″.)

Insulating Cements

Ordinarily the proper use of insulating cements is limited to finishing purposes for the protection of the insulation. J-M No. 302 Insulating Cement is the best example of this usage. Special kinds of cement may be used alone where block insulation cannot be applied. J-M No. 450 Insulating Cement is the material usually recommended for such purposes.

Insulating Concrete

Sil-O-Cel C-3 Insulating Concrete has found excellent application in oven construction because it may be cast into any desired form, and poured in place to make monolithic ovens for use over a widely varying range of temperature. Sil-O-Cel C-3 Concrete is made by mixing four parts, by volume, of Sil-O-Cel C-3 and one part of portland cement, with only sufficient water to form a plastic mixture. This insulating concrete is over three times as effective as fire brick in resisting heat penetration. It has a crushing strength of about 1000 lb. per sq. in., and can be used where it will be subjected to direct heat at a temperature as high as 1800 deg. F.



Japanning ovens at the Durand Steel Locker Co., Chicago Heights, Ill., built entirely of Sil-O-Cel C-3 Concrete, 9″ thick in walls and tops

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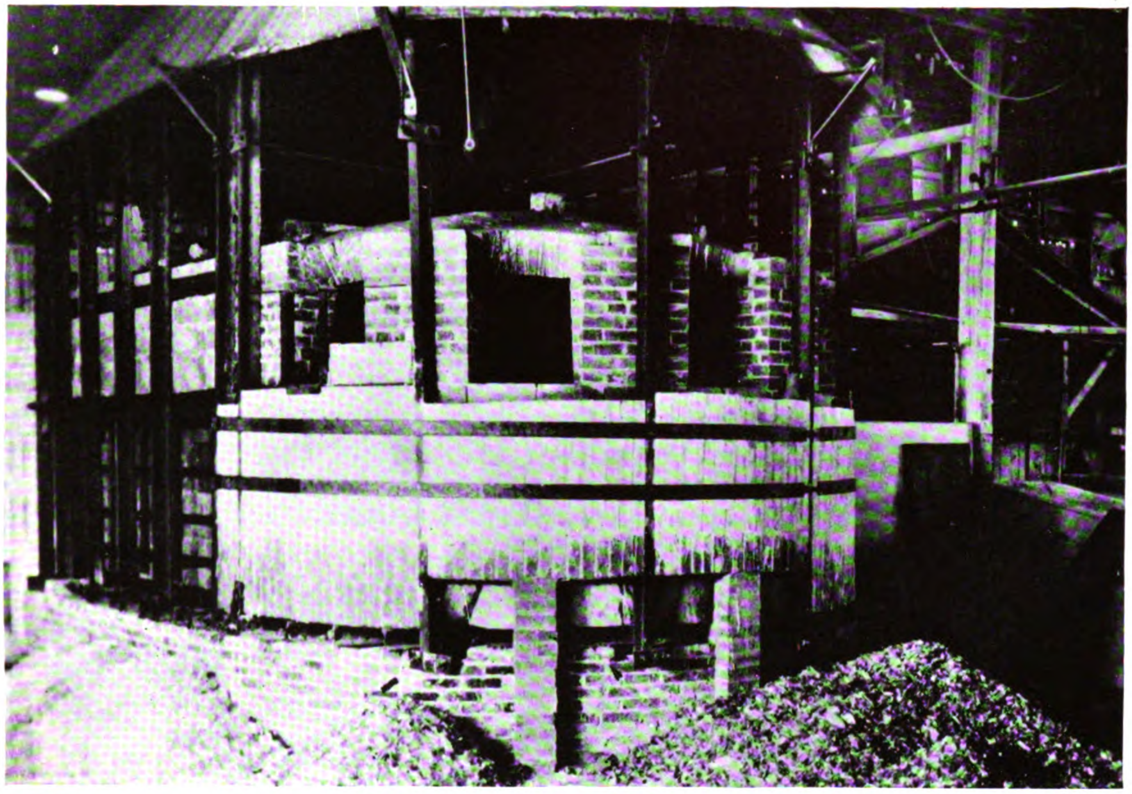
Insulation of Glass Making Equipment



Sil-O-Cel C-22 Brick as a veneer course on the nose of a continuous tank

The application of insulation to continuous glass tank furnaces and pot furnaces offers such attractive possibilities of heat saving that much attention has been given in recent years to its potential use under the hearths and on walls and crowns. A special study of the particular refractory conditions in the individual furnace is the only method of evolving insulation recommendations for this type of equipment. However, insulation has been utilized on the refining chamber of continuous tanks for a number of years with very satisfactory results.

Day Tanks

In day tanks also, insulation has been used with uniformly beneficial results. Melting time has been shortened, fuel consumption reduced, troubles due to devitrified or cordy glass minimized, and the life of the flux blocks increased. Insulation has usually consisted of a 4½" course of Sil-O-Cel C-22 Brick outside the flux blocks on the sides, and a 2½" course of C-22 Brick over the silica brick crown. In the bottom, 2½" Sil-O-Cel Natural or C-22 Brick are laid, covered with one or two layers of fire brick and the regular bottom blocks.

Regenerators

Standard insulation specifications have long been used for regenerators and up-takes. The heat conserved by reducing radiation losses may be evidenced by a direct saving in fuel, by increased production or by greater speed in making the heats. Losses incidental to shut-downs are decreased, and improved conditions result from the reduced leakage through insulated regenerator walls. Refractory loads are lightened, more uniform temperatures exist throughout the checkers, and maintenance charges are smaller. Through fuel saving alone the expense of insulating is returned well within the first year.

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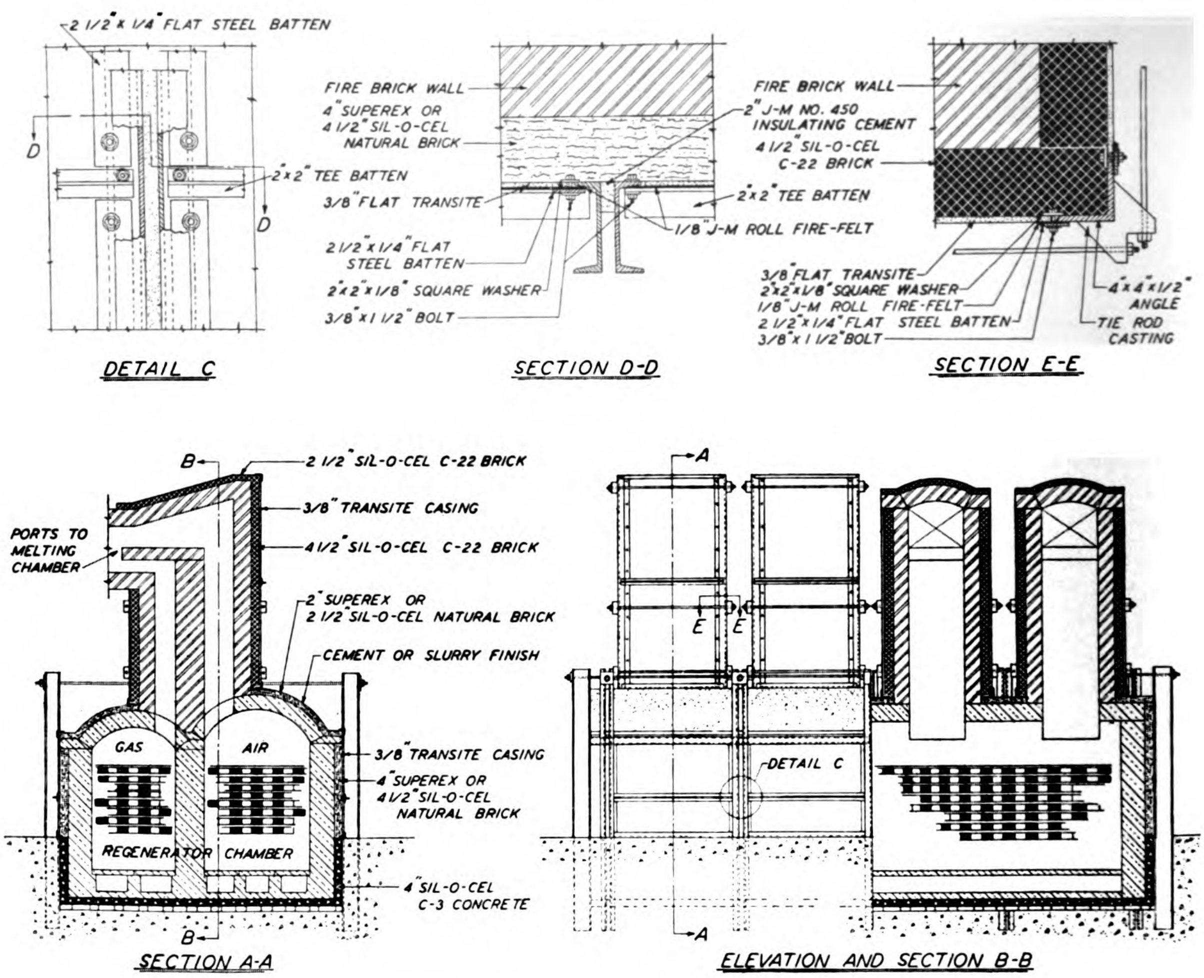
On new regenerators, with solid fire brick walls not less than 13½″ thick, all exterior brickwork in the sides above ground is insulated with 4″ Superex Blocks or 4½″ Sil-O-Cel Natural Brick, placed behind the brickwork, and preferably finished with a Transite casing. At the arches, the fire brick is carried through to the supporting steel members. Regenerator roofs, consisting of fire brick at least 9″ thick, are insulated with 2″ Superex Blocks or 2½″ Sil-O-Cel Natural Brick. A cement finish is troweled over the surface of the Superex, and the Sil-O-Cel Brick are finished with a slurry of Sil-O-Cel Mortar.

Wall sections of new regenerators below ground are insulated with a minimum of 4″ of Sil-O-Cel C-3 Concrete, tamped into forms outside of the brickwork. The base is insulated with 4″ of Sil-O-Cel C-3 Concrete covered with two 2½″ courses of fire brick.

Wall sections of existing regenerators above ground are insulated with a minimum of 4″ of Sil-O-Cel C-3 Concrete, applied to the clean regenerator wall and suitably reinforced. This application may be accomplished either by the use of a cement gun or by suitable forms. The roofs of such regenerators are insulated with Sil-O-Cel C-3 (granular) spread over the roof surface to an even thickness of 2½″.

Flues and Up-takes

The walls of the tank furnace flues and up-takes, consisting of solid silica brick not less than 9″ thick, are insulated with Sil-O-Cel C-22 Brick, 4½″ thick, cased with Transite. The crowns of ports and up-takes are insulated with Sil-O-Cel C-22 Brick laid over the roof in a single layer, 2½″ thick and finished with a slurry of Sil-O-Cel Mortar.



J-M insulation recommendation for glass tank furnace regenerators and up-takes

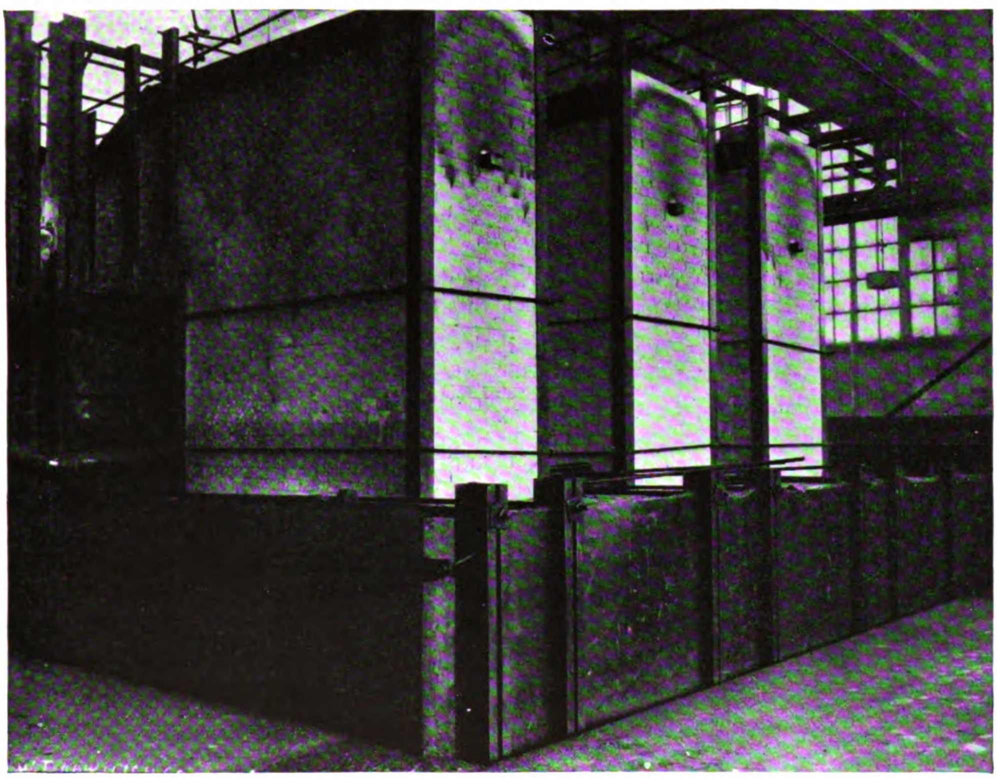
Lehr being insulated with 4½" Sil-O-Cel Natural Brick in core wall construction at the plant of the Mississippi Glass Co., St. Louis, Mo.

Annealing Furnaces and Lehrs

The insulation of lehrs does not readily lend itself to a standard specification, chiefly because of variations in design, fuel costs, hours of operation, and the degree of temperature uniformity and control necessary. As thickness of insulation is increased the cost of heat lost per year is decreased, but the cost per year of insulation (first cost multiplied by per cent fixed charges) is increased. The thickness at which the sum of these two costs is a minimum, is obviously the most economical.

The annealing of glass is a delicate operation requiring close control of the temperature gradient through the lehr, which is difficult to obtain with a cycle of decreasing temperatures. Thorough insulation is not only necessary from the standpoint of economical operation but also is a great factor in insuring accurate temperature control, uniform heat distribution and a perfectly annealed product.

For a cheap fuel, lehr exteriors may be economically insulated with 4" of Superex or 4½" of Sil-O-Cel Natural Brick. In an electrically heated lehr,



Upper portion of regenerators above floor level, insulated with Superex Blocks. W. T. Rawleigh Co., Freeport, Ill.

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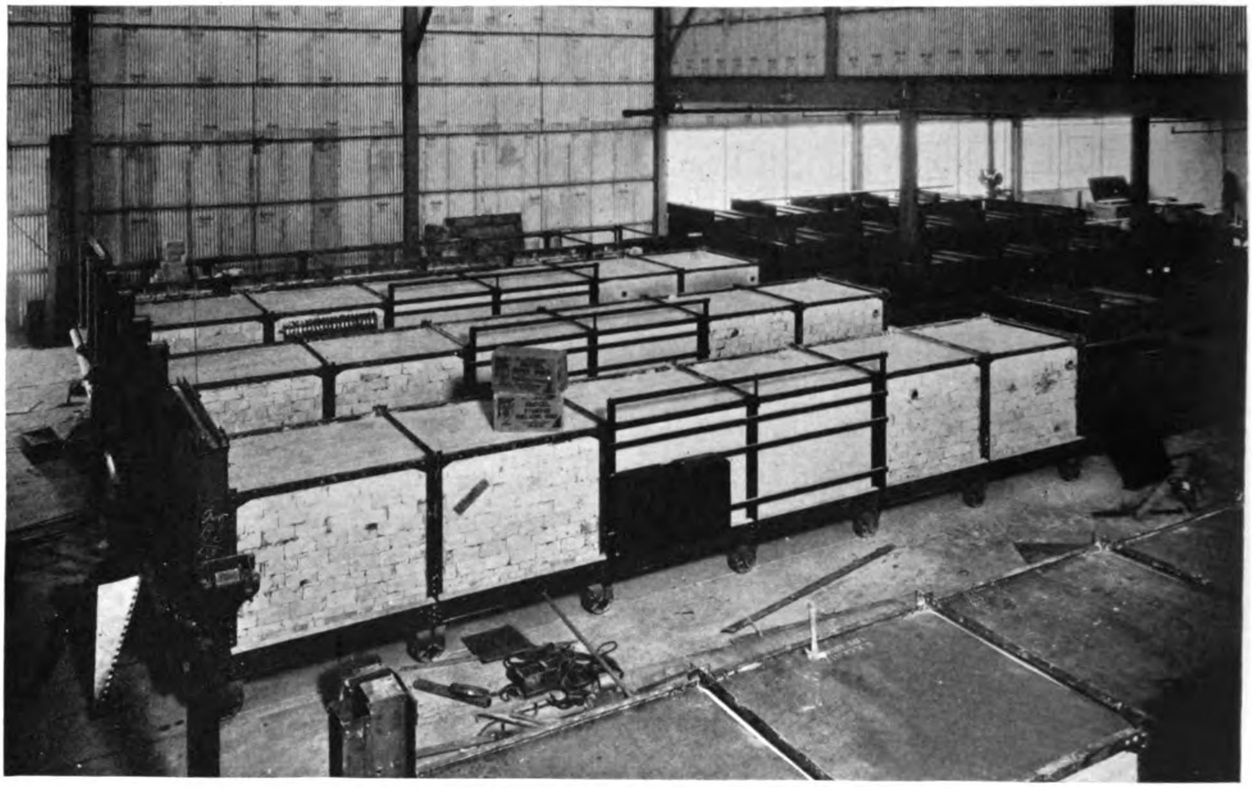

Electrically heated lehrs under construction at the Illinois-Pacific Glass Co., Los Angeles, Calif. Sil-O-Cel Super Brick used as combination refractory and insulation inside of Sil-O-Cel Natural Brick

the economical thickness of insulation may amount to 18″ or 20″ or more. Frequently the necessity of close temperature control will occasion the use of much thicker insulation than considerations of heat saving would justify.

The development of Sil-O-Cel C-22 Brick and Sil-O-Cel Super Brick during the past few years has made possible, in many cases, the elimination of fire brick linings. These brick are now being successfully used as combination insulating and refractory linings in many large electrically heated lehrs. Such application not only saves construction costs but also cuts down heat storage capacity, which conserves heat during shut-downs and permits the equipment to be brought up to temperature again in a very short time with minimum expense.

One installation of the type mentioned was made at the Los Angeles plant of the Illinois-Pacific Glass Company where six electrically heated lehrs were constructed with 4½″ of Sil-O-Cel Super Brick as an inside lining on sides and top, backed up with 5″ of Sil-O-Cel Natural Brick. The bases were insulated with 7½″ of Sil-O-Cel Natural Brick, above which was placed 2½″ of Sil-O-Cel Super Brick.

Pot Arches

Insulation of pot arches is an excellent investment not only from the standpoint of fuel saving, but also because of the more uniform heating of the pots with elimination of trouble due to cracking or breaking.

Bases are insulated with 4″ to 6″ of Sil-O-Cel C-3 Concrete protected by two 2½″ layers of fire brick. Side and end walls are usually insulated with 4½″ of Sil-O-Cel Natural Brick between the fire brick and a red brick outer wall. Superex Blocks, 4″ thick, may also be used behind the fire brick, with a Transite casing, or a cement finish. Tops are insulated either with two 2½″ layers of Sil-O-Cel Natural Brick or with two 2″ layers of Superex Blocks.

Insulated doors, which further assist in improving heat distribution, can be made by lining the door frame with Sil-O-Cel C-3 Concrete from 6″ to 9″ thick. Such doors weigh only half as much as fire brick and conduct only one-third as much heat.

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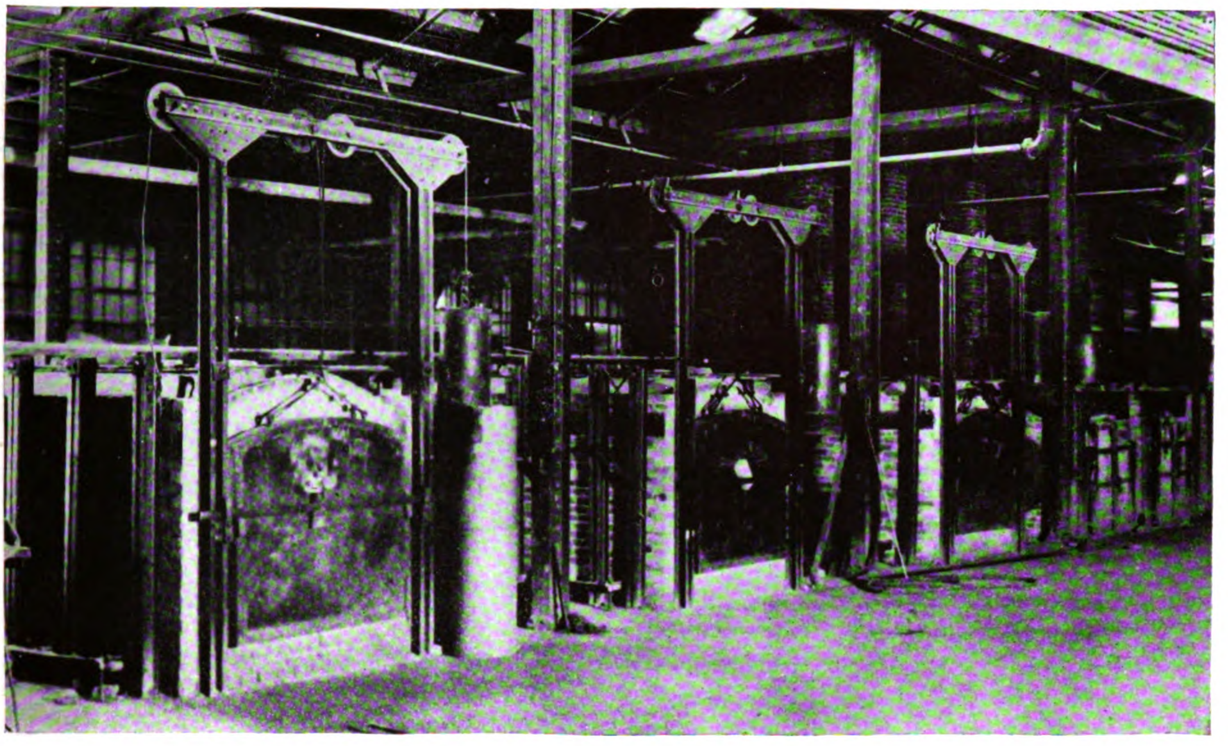
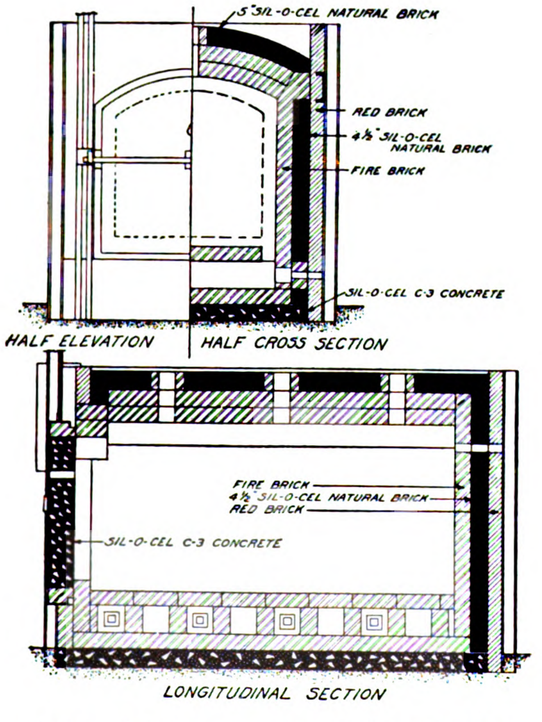


Pot arches insulated with Sil-O-Cel Natural Brick and Sil-O-Cel C-3 Concrete. Bausch & Lomb Optical Co., Rochester, N. Y.



J-M insulation recommendation for pot arches

Flattening Ovens

Flattening ovens operate much more efficiently when properly insulated. The usual construction consists of 4½" of Sil-O-Cel Natural Brick between the fire brick and red brick on the sides. Superex Blocks, 4" thick, with a Transite casing, or a cement finish, may also be used to advantage for this purpose. Tops should be insulated either with two 2½" layers of Sil-O-Cel Natural Brick finished with a slurry of Sil-O-Cel Mortar, or with two 2" layers of Superex Blocks finished with cement.

Fourcault Squeeze Rolls

Development over several years is responsible for the present Fourcault rolls made of special J-M Asbestos Sheet Millboard. In the Fourcault process the rolls actually pull the glass from the drawing canals and the speed and setting of the rolls determines the thickness of the glass. These millboard rolls will not polish or slip, and have a certain resiliency which permits a small pebble or other foreign substance picked up with the glass to press into

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the surface of the roll rather than shadow the glass.

In making one type of roll, 5½″ dia. discs of 3/16″ millboard with a 1¾″ square hole in the center are densely pressed together about 20 at a time over a square shaft. After the length of the shaft has been covered, the discs are secured in place, the rolls turned down to 5¼″ dia. and finished with sand paper and fine files. A 54″ roll requires from 340 to 360 such discs. It is possible after using the rolls for a time to turn them down further and use them for a second run.

The casings which enclose the rolls are variously insulated with Asbesto-Sponge Felted, Super Fire-Felt, or Asbestos Sheet Millboard.

Fourcault Canals

It is important to insulate drawing canals in order to obtain uniform temperature conditions in the glass bath. Temperature control within a narrow range is absolutely essential to assure the delivery of glass in proper condition for drawing. This is accomplished by the use of adequate insulation outside the refractory.

The canals are heavily insulated in accord with individual requirements in the bottom, side walls, and over the crown. Extensive studies of operating requirements have resulted in the accumulation of a great amount of data on this subject. Recommendations are made separately for each particular installation.

Producer Gas Mains

Producer gas mains are insulated between refractory lining and steel shell with 2½″ to 4″ of Superex Blocks. Sil-O-Cel Brick are similarly used in 2½″ or 4½″ thicknesses. Such insulation reduces tar deposition, keeps the gas of higher heat value and extends the periods between necessary burnouts. As an example of sensible heat saving: Superex Blocks, 2½″ thick, save in heat over four times their cost in a year of operation, assuming 1400 deg. F. gas, and sensible heat worth $0.25 per million B.t.u.

Producer gas main being insulated with Sil-O-Cel Natural Brick

Transfer Tables and Conveyors

The surfaces of roll table or transfer table tops are often made of flat Transite, 1½″, 1¾″ or 2″ thick. Oftentimes small holes about 1/16″ dia. are drilled over the entire surface on approximate 4″ centers both ways. Without such holes, bubbles may form under the glass due to expansion of air confined as a result of small elevations on the surface of the glass. Conveyor plates of Transite are drilled in much the same manner.

Unit-type lehr walls and tops are often lined inside with ½″ flat Transite, except at muffle heating zones. Insulation is placed between inner and outer casings. At the top of the cool end, it is not unusual to omit the insulation and use loose Transite sheets which can be moved as dampers to control the cooling rate of the glass.

For conveying moulded glass containers, J-M No. 121 Woven Asbestos Gasketing Tape of commercial or 95% grade finds excellent application.

J-M Asbestos Fibres 201-A and 209 are used to protect glassware and prevent contact with hard, cold surfaces.

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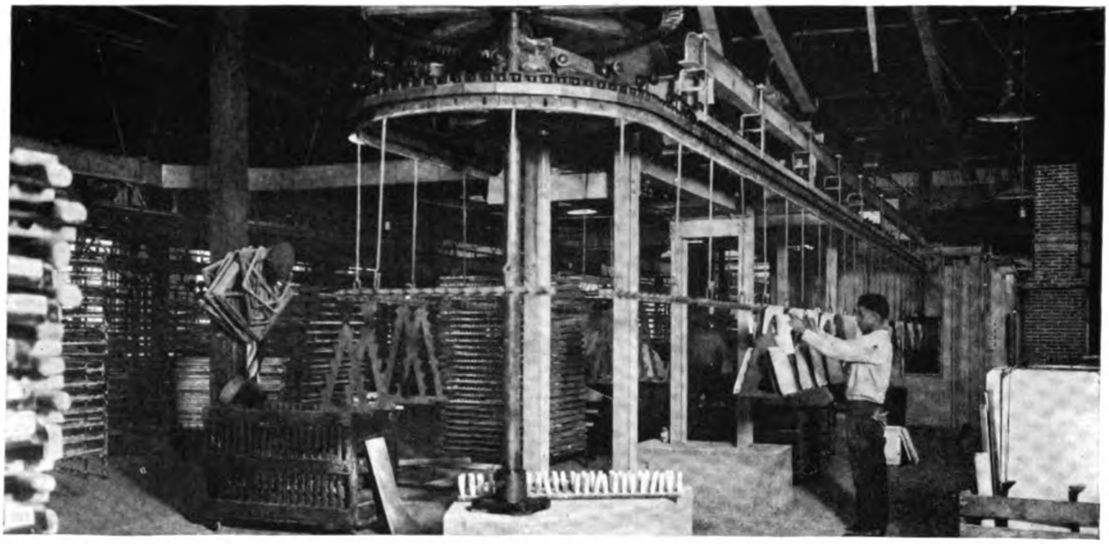
Insulation of Vitreous Enameling Furnaces



Beemack enameling furnace, designed and built by the Surface Combustion Corporation. Insulated with Sil-O-Cel Natural Brick and C-3 Concrete

All modern furnaces for vitreous enameling are insulated to reduce fuel costs, facilitate temperature control and improve working conditions.

Methods of insulating continuous furnaces are the same as those employed in the case of tunnel kilns for firing other ceramic products.

The in-and-out type of furnace is insulated in the same general way as heat-treating furnaces of similar design. The thickness of insulation varies with the method of heating. A minimum of 4″ of insulating material should be used in any case, while in electrically heated furnaces, a thickness of 12″ or more is economical. In the bases, under one or two layers of fire brick, Sil-O-Cel C-3 Concrete, 4″ or more in thickness, is used. Walls are insulated either with Sil-O-Cel Natural Brick between the fire brick and red brick in "core-wall" construction, or with Sil-O-Cel Natural Brick or Superex Blocks behind the refractory, and covered with a Transite casing or with a cement finish. Tops are usually insulated with the same materials used on the sides.

By lining the doors of in-and-out furnaces with Sil-O-Cel C-3 Insulating Concrete faced with Firecrete, working conditions are improved in front of the furnaces and more uniform temperatures can be maintained. Sil-O-Cel C-3 Concrete is made by mixing four parts of Sil-O-Cel C-3 and one part of portland cement by volume with only sufficient water to form a plastic mass. The C-3 Concrete is tamped into the door frame to a level approximately 1½″ below that desired for the finished lining. While the concrete is still fresh, ½″ of Firecrete is applied and rodded sufficiently to obtain a mixing of the Firecrete and C-3 for a depth of an inch or more below the surface of the mixture. Immediately thereafter, before the concrete has set, an additional 1″ of Firecrete is applied without rodding, and troweled to a smooth finish. Such a door lining is inexpensive, relatively light in weight and about three times as effective as fire brick in retarding heat flow. The Firecrete refractory facing prevents dusting.

Frit Furnaces

Most of the recent installations of furnaces for enamel smelting have been insulated. One large oil-fired furnace was insulated with 10″ of Sil-O-Cel Natural Brick in the bottom, covered with 7½″ of fire brick and 6″ of hearth tile. Sil-O-Cel Natural Brick, 9″ thick, were used on the sides behind 9″ of fire brick and 6″ of hearth tile. The 9″ crown was grouted with a relatively thin layer of Sil-O-Cel C-3 Concrete because of the high operating temperature involved (2600 deg. F.). The charging door was lined with 6″ of Sil-O-Cel C-3 Concrete and faced with a 3″ clay slab. This furnace operated at 35% efficiency compared to 10% for the old uninsulated furnaces.

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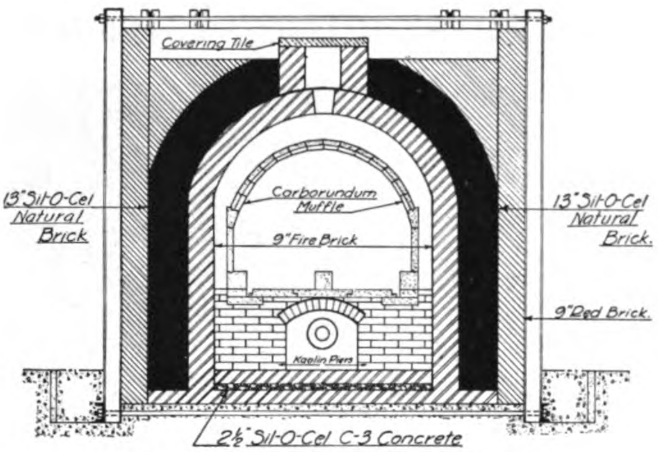
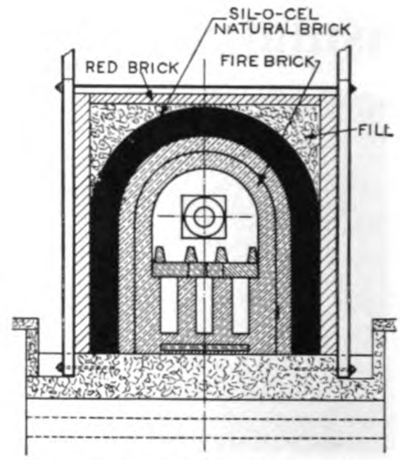
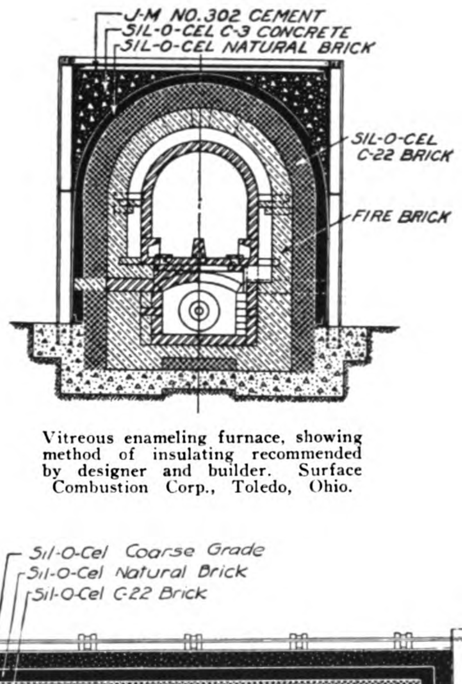


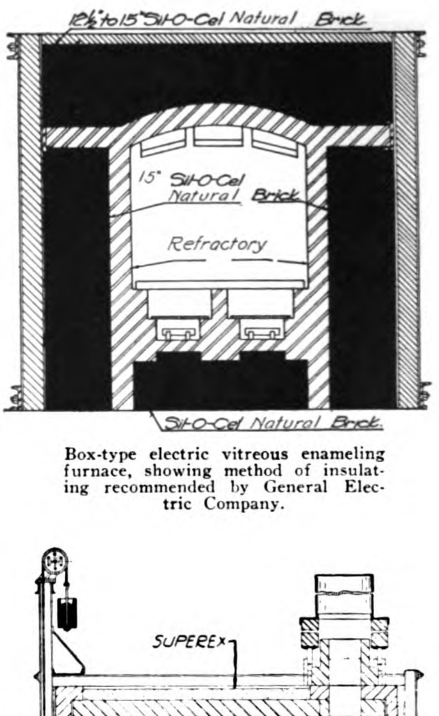
Method of insulating oil-fired enameling furnace recommended by Porcelain Enamel & Manufacturing Co., Baltimore, Md.



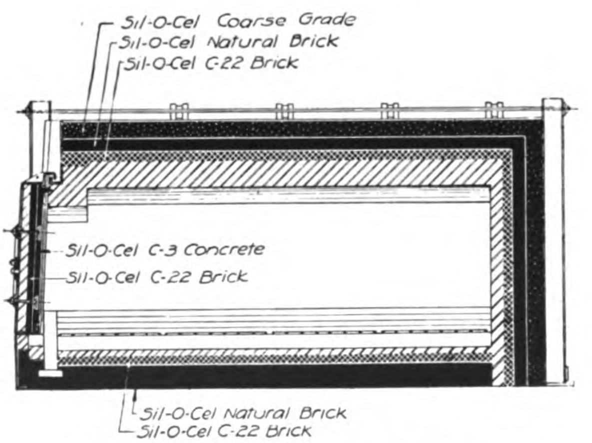
"H & H" enameling furnace, designed and built by C. A. Hoppin & Co., Peoria, Ill.



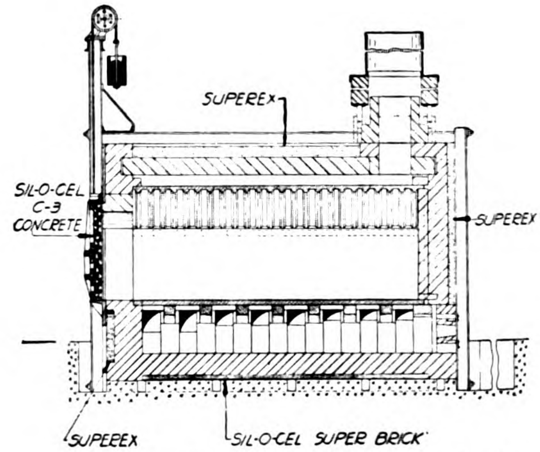
Vitreous enameling furnace, showing method of insulating recommended by designer and builder. Surface Combustion Corp., Toledo, Ohio.



Box-type electric vitreous enameling furnace, showing method of insulating recommended by General Electric Company.



Electric enameling furnace, designed and built by Gas Equipment Engineering Corporation, Philadelpiha, Pa.



Muffle furnace for vitreous enameling, designed and built by the Carborundum Co.

Vitreous enameling furnaces insulated with J-M Materials

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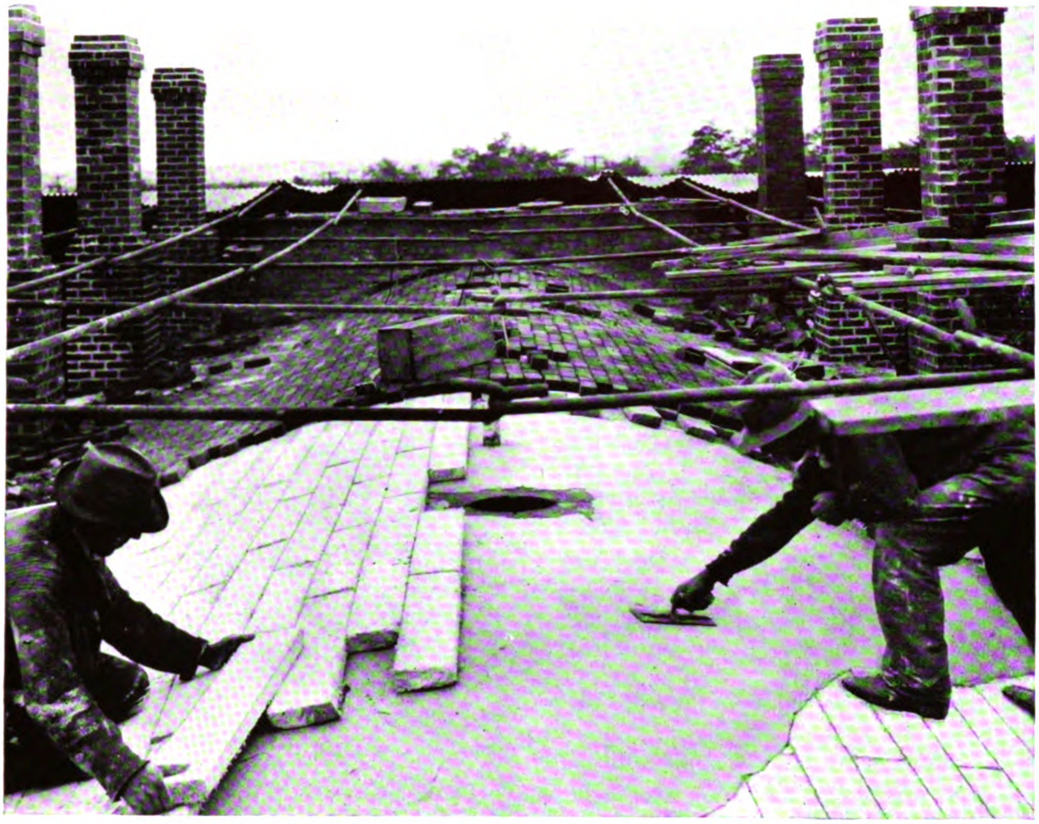
Insulation of Ceramic Kilns



Applying Superex Blocks to top of rectangular down-draft kiln at Hazelton Brick Co., Hazelton, Pa.

High temperatures are so intimately associated with the manufacture of ceramic products that adequate insulation is recognized as an essential in the design and construction of efficient equipment. On all kilns of the permanent type, whether continuous or periodic, insulation effects marked savings in production cost. In the continuous tunnel kiln, heavy insulation has always been used. On periodic kilns, crown insulation alone effects savings of 10% to 13% in fuel costs, while kilns insulated throughout, in bases, walls and crowns, operate with 17% to 20% less fuel than similar uninsulated kilns. Proper insulation also improves the quality of the ware, a logical result of the more uniform temperatures maintained through the blanketing effect of the insulation.

Insulated kilns can be brought up to heat and held at the desired temperature much more easily. The result is more rapid kiln turn-over with consequent lower labor costs. Furthermore, temperatures can be more accurately controlled in bad weather, an advantage particularly important in climates where wide ranges or sudden fluctuations in temperature are encountered.

Periodic Kilns

Usual methods of insulating round down-draft kilns and bottle-neck up-draft kilns are shown in the drawings. Rectangular down-draft kilns are insulated in the same general manner as round down-draft kilns.

Crowns:

Insulation of the crown is particularly important because of its relatively thin construction. In addition to reducing radiation losses approximately 75%, insulation more nearly equalizes the temperature

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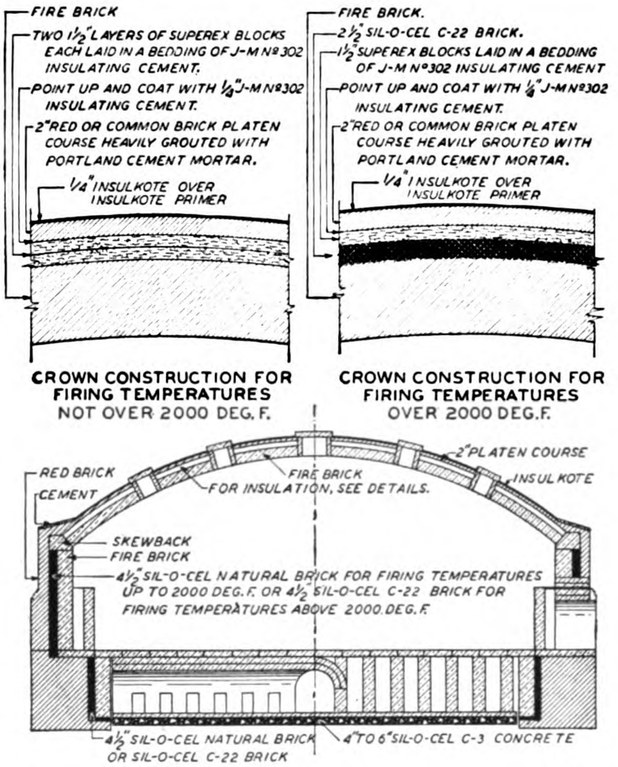


J-M insulation recommendation for round down-draft kiln

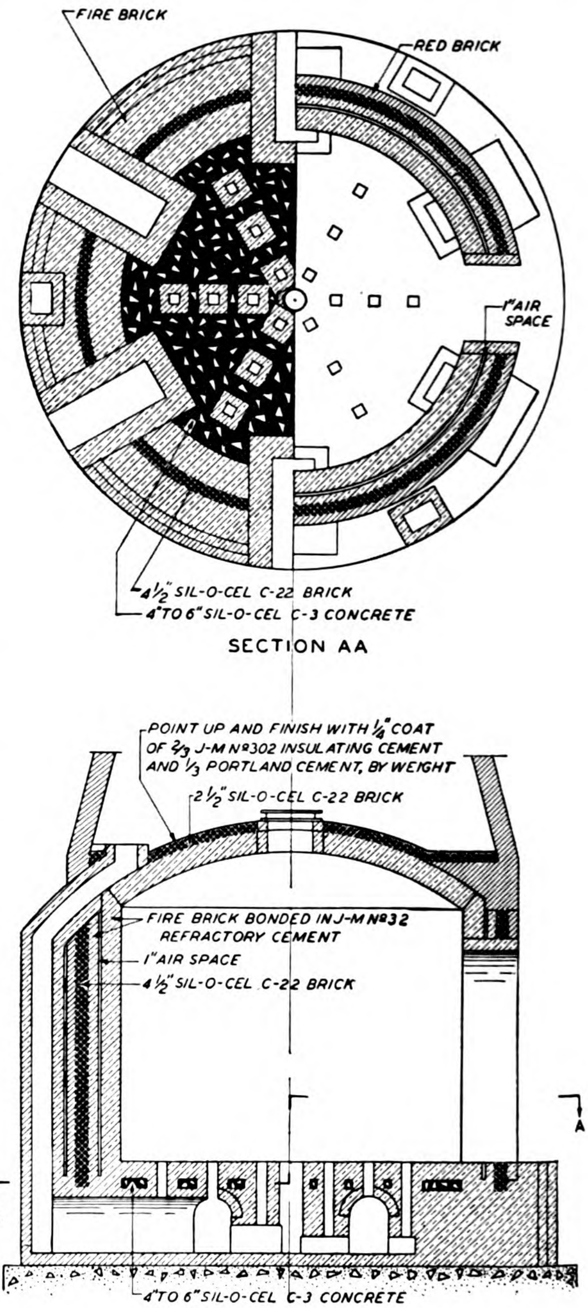
through the fire brick, preventing stresses which are the usual cause of cracking. Insulation also reduces the exterior temperature sufficiently to permit the use of asphaltic waterproofing treatment.

For best results, the insulation, platen course and Insulkote waterproofing on the crown should be applied while the kiln is hot, to prevent subsequent cracking due to expansion under heat. The crowns of new kilns should be left uninsulated for one or two burns to allow settling to take place.

Superex Blocks, whether used directly over the fire brick (operating temperatures not more than 2000 deg. F.), or over an intermediate layer of Sil-O-Cel C-22 Brick (operating temperatures exceeding 2000 deg. F.), should be laid in a bedding of J-M No. 302 Insulating Cement and should be pointed up and coated with ¼" of the same material. The platen course of red brick or common brick is heavily grouted with a slurry of portland cement and sand, after which the surface is primed and Insulkote applied.

The crowns of bottle-neck kilns, because of being enclosed in the stack with consequent lower radiation loss than if exposed, ordinarily require insulation with 2½" Sil-O-Cel C-22 Brick only.

Existing Crowns: Old kilns can be made to operate more economically and, in many instances, quality can be improved and output increased, by insulating the crown alone. Such crowns should be of good quality fire brick and in good condition. The



J-M insulation recommendation for bottle-neck kiln existing platen course, if any, may be removed if weight must be considered, and replaced after the insulation is applied. Insulation, because of its light weight, does not add appreciably to the load on the crown. Application is made in the same manner as shown for new kilns.

Walls:

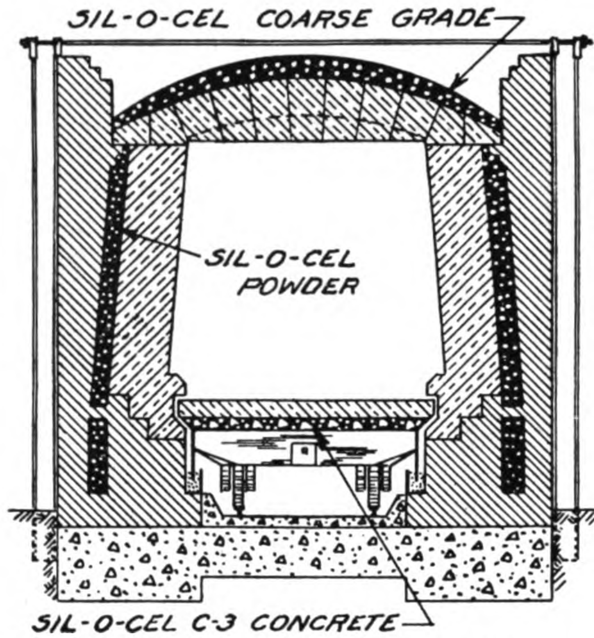
Kiln walls are insulated with 4½″ of Sil-O-Cel Natural Brick for operating temperatures up to 2000 deg. F., or with 4½″ of Sil-O-Cel C-22 Brick for temperatures above 2000 deg. F. Insulation permits the use of relatively thin walls without sacrificing efficiency because of undue radiation losses. A 4½″ course of Sil-O-Cel Brick will reduce heat losses at least 60% compared with those through uninsulated walls of the same total thickness.

Bases:

The earth on which a kiln stands will absorb a large amount of heat. This constant source of loss not only often interferes with the draft but also makes it difficult to maintain temperatures in the bottom of the kiln. In many instances this results either in under-firing the ware in the bottom, or over-burning the top ware in an effort to bring bottom temperatures to the desired point. Insulating the base with from 4″ to 6″ of Sil-O-Cel C-3 Concrete is a most effective means of insuring uniform temperatures throughout all parts of the kiln.

Continuous Kilns

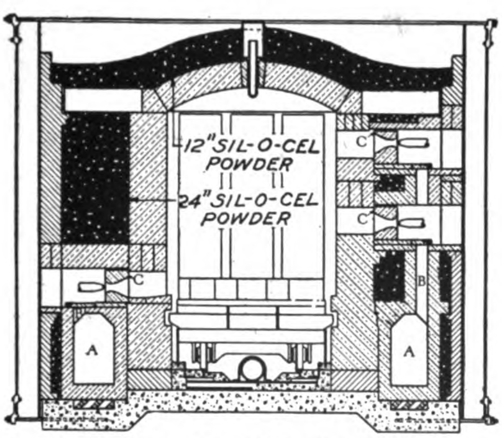
Continuous tunnel kilns, because of the great areas exposed to radiation, would be very wasteful of heat unless thoroughly insulated. Sil-O-Cel materials have been used in practically every tunnel kiln built during the past fifteen years.



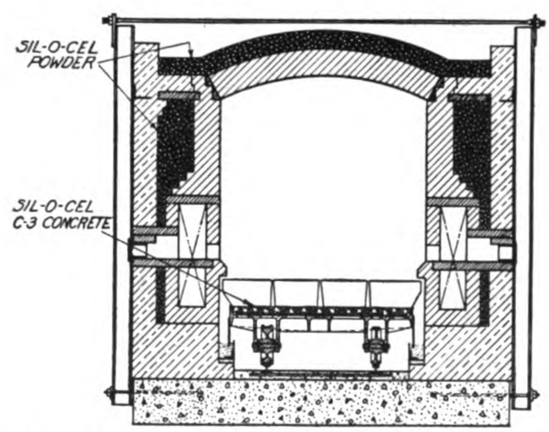
Method of insulating Harrop tunnel kiln

Cross sections of tunnel kilns show typical methods of insulation in general use. Sil-O-Cel Powder, or Sil-O-Cel Coarse Grade, is usually employed for this purpose and is highly effective in minimizing heat loss.

One illustration shows a tunnel kiln used for decorated china-ware, in which walls and top, as well as the decks of the tunnel kiln cars, are composed entirely of Sil-O-Cel insulating materials. At this tem-



Swindell-Dressler tunnel kiln of recent design. Car decks also insulated with Sil-O-Cel C-3 Concrete



Russell direct-fired tunnel kiln, showing insulation of walls, top and car deck

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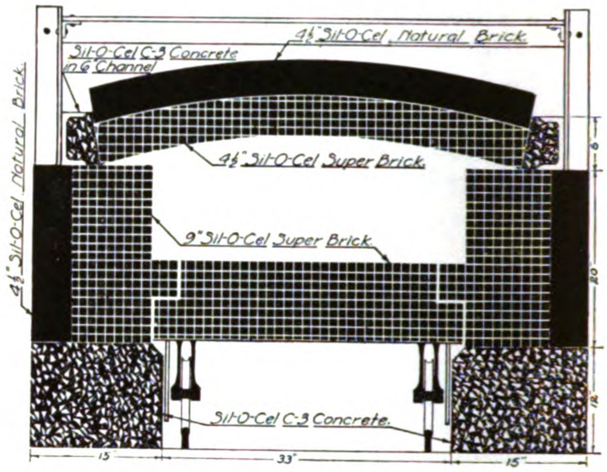
perature, 1400 deg. F., with electric heat (where there are no combustion gases) Sil-O-Cel C-22 or Super Brick can be used with great success as a combination insulation and refractory. Due to reduction in the heat storage capacity of the masonry, the equipment can be brought up to temperature rapidly with considerable saving in power costs.

In continuous kilns, where the hot gases and heat from cooling ware is transmitted to other compartments containing green ware or ware at a lower temperature, insulation greatly increases efficiency by retaining the heat within the system. General methods of insulating are the same as for periodic kilns.

Where periodic kilns are connected by underground flues for operation as a continuous system, the waste heat flues, as well as the kilns, should be insulated. Sil-O-Cel C-3 Concrete, from 4″ to 6″ thick, is ideally suited for underground flue insulation.



Section through hot zone of electrically heated china decorating kiln. Sil-O-Cel Materials used as combination refractory and insulation. Buffalo Pottery Co., Buffalo, N. Y.

Swindell-Dressler tunnel kiln nearing completion. Insulated with 4″ to 12″ of Sil-O-Cel Coarse Grade

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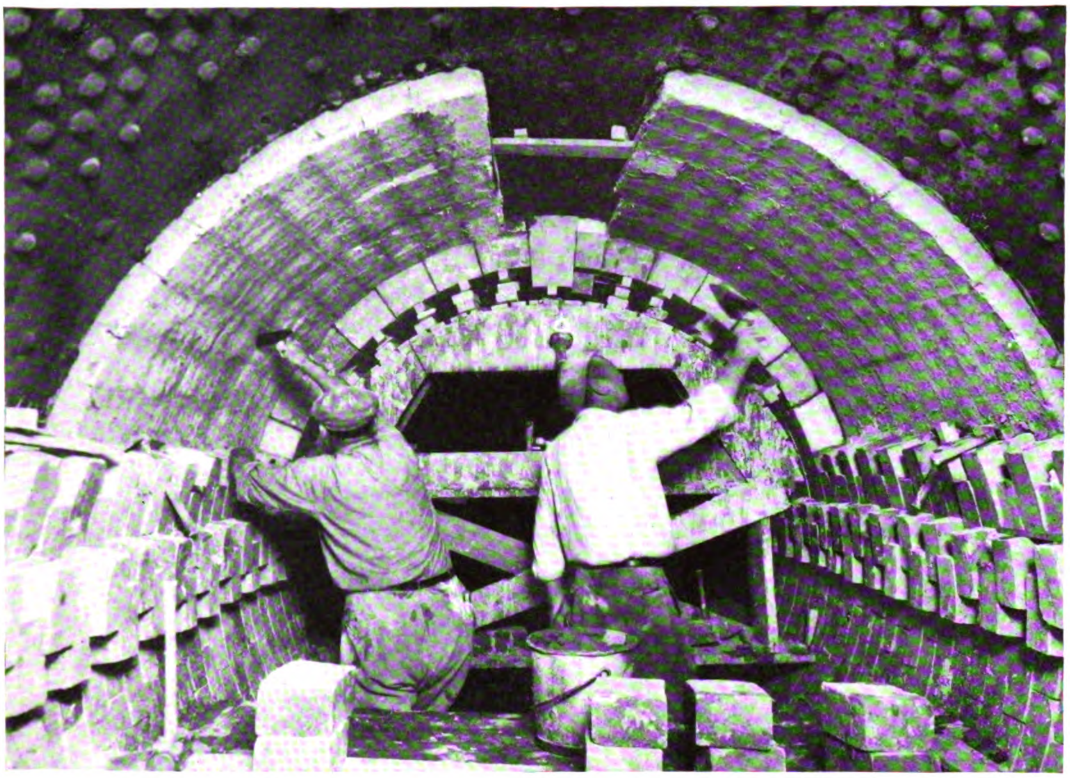
Insulation of Lime and Cement Kilns



Superex Insulation in rotary kiln, showing completion of the lining by the arch-form method

Rotary Kilns

High temperature rotary kilns, such as are used for burning cement and lime, offer an interesting example of economy resulting from the use of Superex Insulation. There is no apparatus operating under temperature conditions similar to those encountered in the rotary cement kiln in which the materials used in the lining are subjected to such severe service. In addition to high temperature, there is rotation, vibration, abrasion, expansion and contraction of the fire brick lining and the continued impact of the heavy mass of clinker throughout the kiln. In wet process kilns there is also the effect of water in the slurry.

Taking into account these factors, and the fact that shut-down due to a hot spot means a loss of several thousand dollars per kiln every 24 hours, it was only natural that for many years authorities were doubtful of the advisability of insulating to reduce excessive heat waste. In the Spring of 1924, J-M Superex Block Insulation was subjected to its first severe trial in a cement kiln. Since then this kiln has operated almost continuously with only the necessary periodical shut-downs for renewing fire brick at the hot zone where insulation is not installed. On such occasions, an inspection of the Superex revealed it to be in perfect condition.

Since 1924, as the excellent record of the first kiln became generally known, a great many kilns have been insulated in accordance with specifications similar to those followed in the first installation, and without a single failure. These kilns are insulated between the steel shell and the refractory lining with 2½" thick Superex Blocks, set up in J-M No. 319 Semi-Refractory Cement.

In both dry and wet process kilns, insulation is omitted at the hot end for a distance equal to 25% of the kiln length, or a minimum of 45 ft. The insulation is terminated flush with the upper end, except in wet process kilns where filters are not used, in which case the insulation is omitted for a distance of 20 ft.

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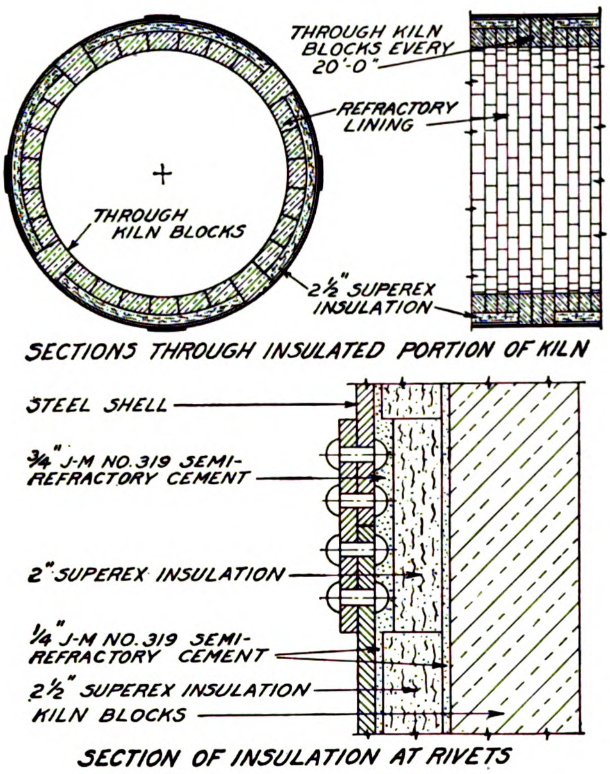

J-M insulation recommendation for rotary kilns

at the wet end. The refractory lining over the insulated section consists of 6" kiln blocks, bonded to the steel shell with 9" kiln blocks on each quadrant longitudinally and at approximate 20-ft. intervals circumferentially, to insure that the lining shall be wedged tightly in place.

The successful insulation of a rotary kiln depends not only on the use of the right material but also on proper installation of the lining to prevent circumferential slippage and to localize longitudinal movement. J-M installations made since 1924 have accomplished this result.

The advantages of insulating rotary kilns may be summarized under the headings of fuel conservation, increased flue gas temperature, more uniform heat distribution and protection of the kiln shell.

Fuel Conservation: The heat lost by radiation from a 10-ft. x 200-ft. uninsulated kiln, is equivalent to approximately 9,500,000 B.t.u. per hr. Using pulverized coal with available heat of 10,000 B.t.u. per pound and coal costing $5.00 per ton, the annual loss equals $17,000. By insulating the upper portion of the kiln for a distance of 150 feet, it is possible to save about 50% of this loss or $8,500 per year.

Increased Flue Gas Temperature: In plants where waste heat boilers are used, insulation in the kilns and waste heat flues will increase the temperature of the gases 150 to 250 deg. F. Where waste heat boilers are not installed, it is possible through insulation to reduce coal consumption from 30 to 60 lb. per ton of clinker.

Uniform Heat Distribution: There is considerably less variation in temperatures throughout the length of the insulated kiln and the kiln is less susceptible to outside temperature changes. Air currents also have less effect in increasing heat loss on insulated kilns.

Protection of the Kiln Shell: Insulation materially reduces the temperature on the kiln shell, overcoming to a large degree the expansion stress on the steel plates, the loosening of rivets and the bulges that sometimes occur in an unprotected shell. In a test on rotary kilns having an average inside temperature in the intermediate zone of 1550 deg. F. in an uninsulated kiln, and 1750 deg. F. in an insulated kiln, the average external surface temperatures were 640 and 280 deg. F., respectively.

Superex insulation in rotary kiln, showing longitudinal timber and cross-jack method of installation

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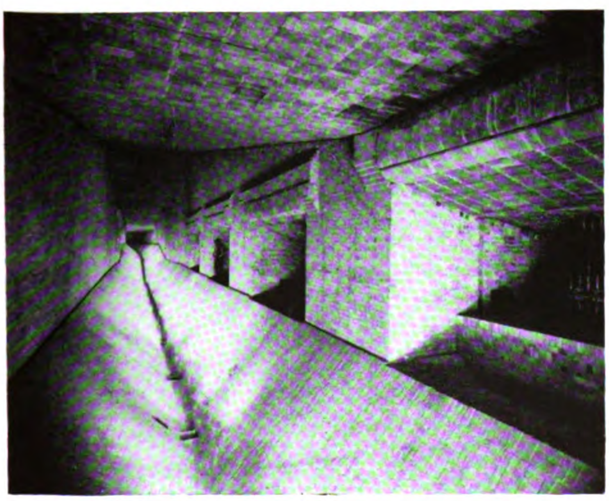
Settling Chambers, Waste Heat Flues and Boilers

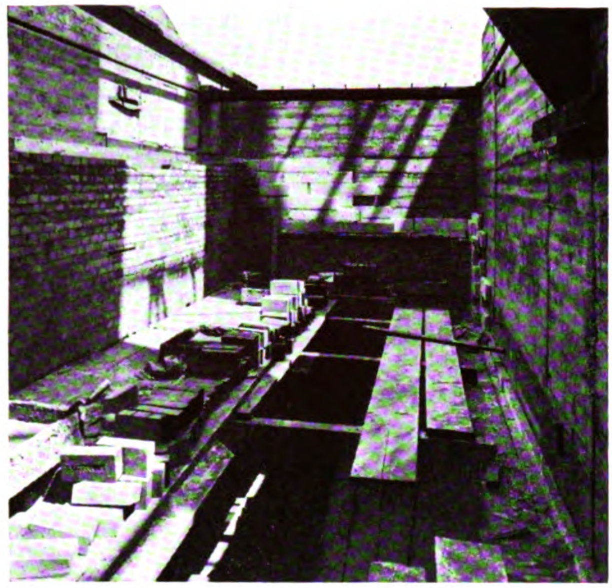
When exit gases from the kilns are utilized in waste heat boilers, insulation of the entire system, including settling chambers, waste heat flues and boilers, is particularly important.

Settling chambers are usually insulated with 4½″ of Sil-O-Cel Natural Brick, or with two 2″ layers of Superex Blocks, between a 9″ fire brick lining and an outer wall of concrete. The top is insulated over the fire brick with two 2½″ layers of Sil-O-Cel Natural Brick or with two 2″ layers of Superex Blocks. In the base, Sil-O-Cel C-3 Concrete, 4″ thick, is applied over the regular portland cement concrete and covered with one or two layers of fire brick. Sil-O-Cel C-3 Concrete is made by mixing four parts of Sil-O-Cel C-3 with one part of portland cement by volume, with only sufficient water to make a plastic mass. This concrete is strong, durable and more than three times as effective as fire brick in resistance to heat flow.

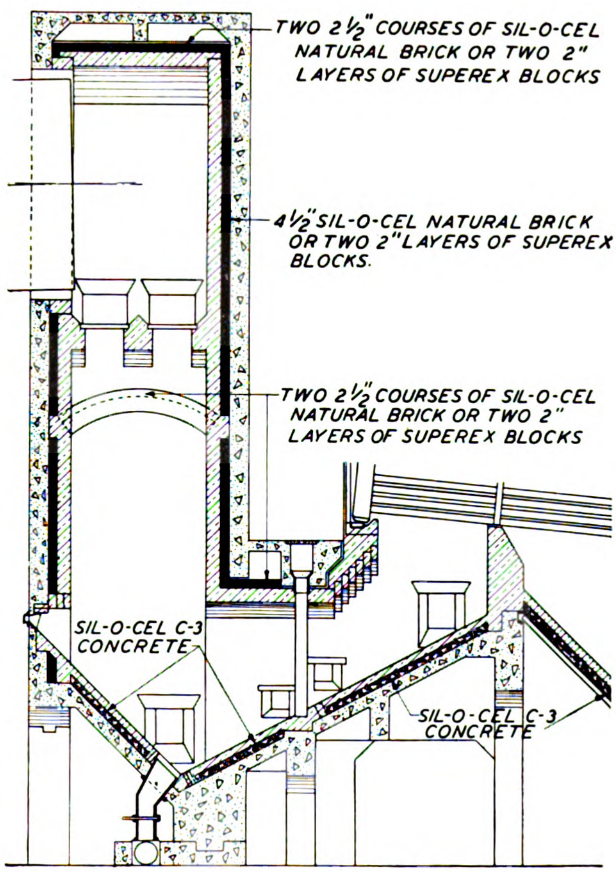
Sil-O-Cel Natural Brick and Superex Blocks have been used for insulating flues and boilers in practically every waste heat installation in the Cement Industry. A number of methods of insulating have been employed, the thickness of insulation varying from 3″ to 5″. The usual construction has been 4½″ (or 5″) of Sil-O-Cel Natural Brick, or two 2″ layers of Superex Blocks, on sides and top. Sil-O-Cel C-3 Concrete, 4″ thick, is recommended for insulating the bases. Waste heat boilers are insulated by the same methods used for direct-fired boilers, described in other data sheets.



Waste heat flue in cement mill. Sil-O-Cel Natural Brick in bottom and over arch; Sil-O-Cel Coarse Grade on sides



Cement mill waste heat flue being insulated with two 2″ layers of Superex Blocks



Waste heat flue insulation recommendation

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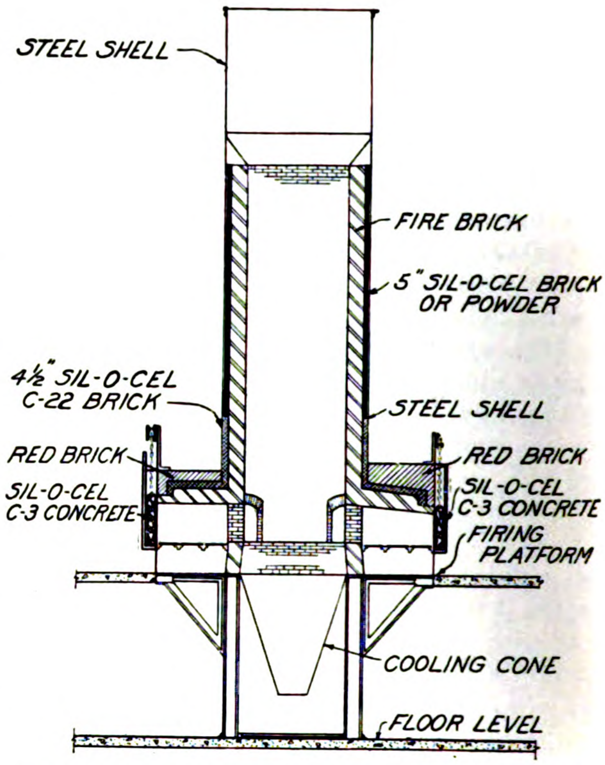
Vertical Lime Kilns

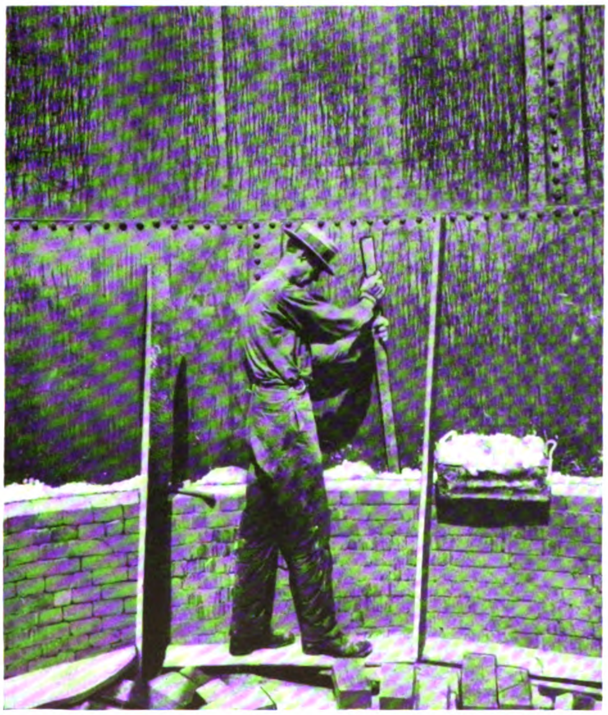
Insulation of vertical lime kilns not only quickly pays for itself in fuel saving but also assists in the production of clean, white lime with no "core" or unslakable lumps. Lime, especially if the stone contains impurities, is exceedingly sensitive to over-burning and temperatures must be controlled within a relatively small range. Insulated kilns are blanketed against fluctuations in atmospheric conditions which interfere with temperature control.

In the fire-box of vertical lime kilns, 4½" of Sil-O-Cel C-22 Brick are used behind 18" of fire brick. The balance of the lined portion of the kiln is insulated, behind 13½" of fire brick, with two 2½" layers of Sil-O-Cel Natural Brick or with from 4" to 5" of Sil-O-Cel Coarse Grade. Superex Blocks, in two 2" layers, may also be used. Brick or block insulation is preferred in most instances. When Sil-O-Cel Coarse Grade is used care should be taken to pack it carefully so the space between the lining and shell will be completely filled.

The above constructions have the advantages of high insulating value, a "cushioned" shell protected from excessive heat, and a thin wall which gives maximum volume within the kiln.



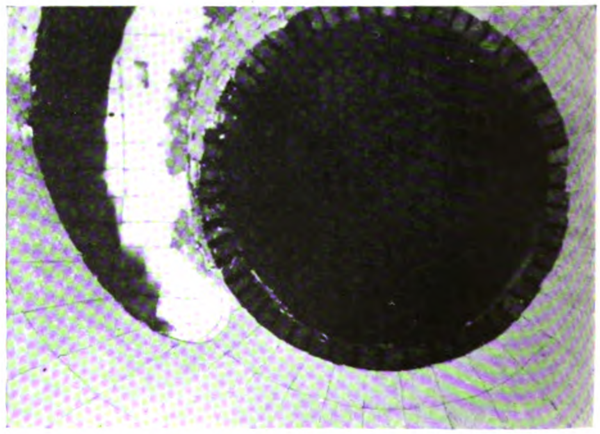
J-M insulation recommendation for vertical lime kiln



Installing Sil-O-Cel Coarse Grade in wall of vertical lime kiln

Producer Gas Mains

Producer gas mains are insulated between the refractory lining and steel shell with Superex Blocks 2½" to 4" thick, or with Sil-O-Cel Natural Brick 2½" or 4½" thick. Insulation pays for itself in a few months of operation by minimizing heat loss. Tar deposition is also reduced, necessitating fewer burn-outs.



Main being insulated with Superex Blocks between steel shell and refractory lining

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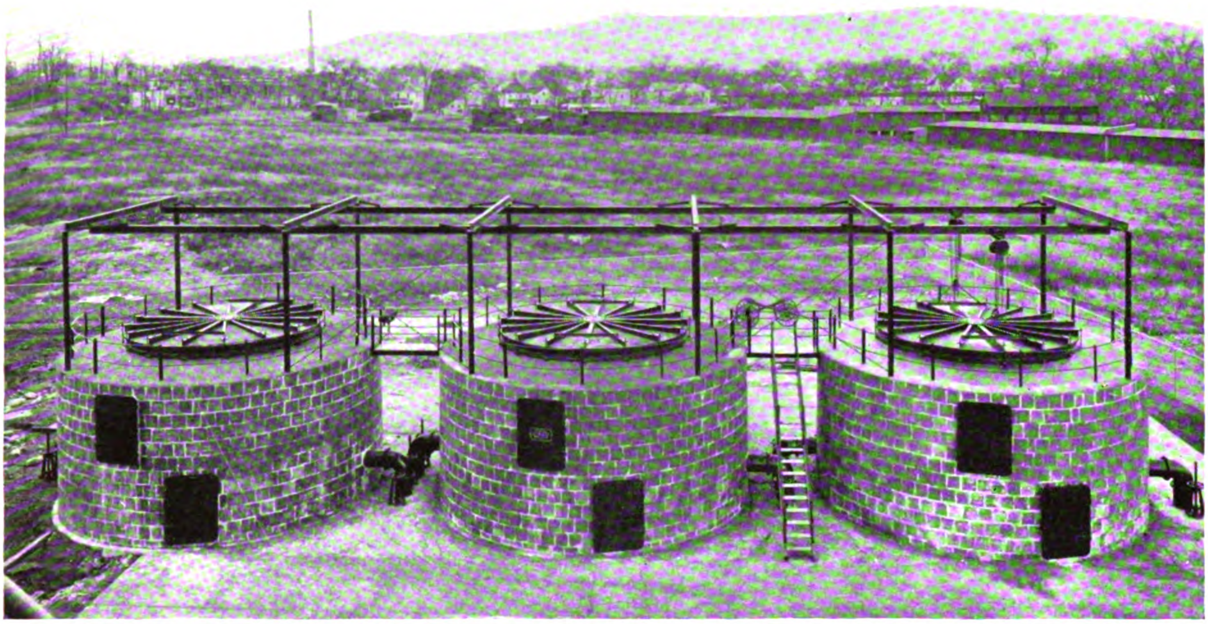
Insulation of Gas Making Equipment



Cruse-Kemper purifiers at Pittsfield Coal Gas Co., Pittsfield, Mass., insulated with 2½" of Sil-O-Cel Powder on the sides and 2½" of Sil-O-Cel C-3 Concrete on tops and covers

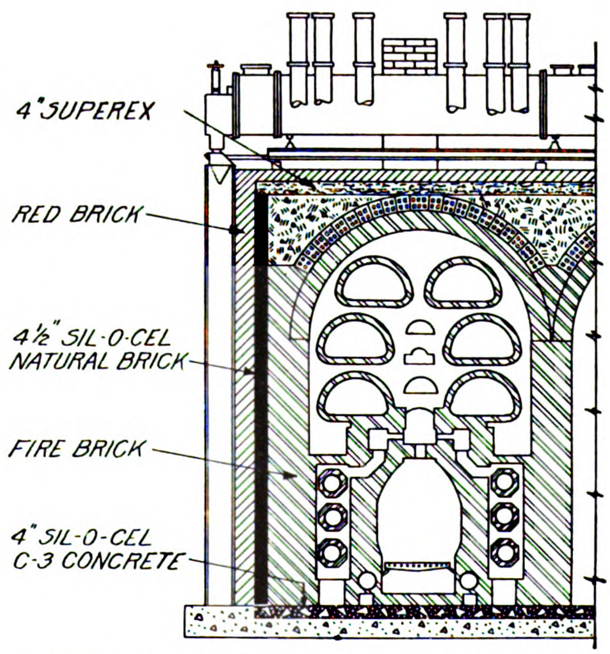
Coal Gas Apparatus

Maintaining a uniform effective temperature in the carbonization chambers of a coal gas bench as well as efficient operation of the producer are important factors in successful bench operation. Insulation of benches and of producer take-offs and mains assists greatly in securing proper control of these factors and in reducing operating costs.

Coal Gas Retorts:

Horizontal and inclined retort benches are insulated in the exterior walls with 4½" of Sil-O-Cel Natural Brick, usually outside 9" of fire brick. The tops are insulated most satisfactorily with 4" of Superex applied in two 2" layers with staggered joints, closely butted and pointed up with J-M No. 302 Cement. Bases are insulated with a minimum of 4" of Sil-O-Cel C-3 Concrete, protected by 5" of fire brick over the insulation.

The wall insulation of vertical retort benches is the same as in the horizontal retorts, consisting of 4½" of Sil-O-Cel Natural Brick.



J-M insulation recommendation for horizontal coal gas retort bench

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Water Gas Apparatus

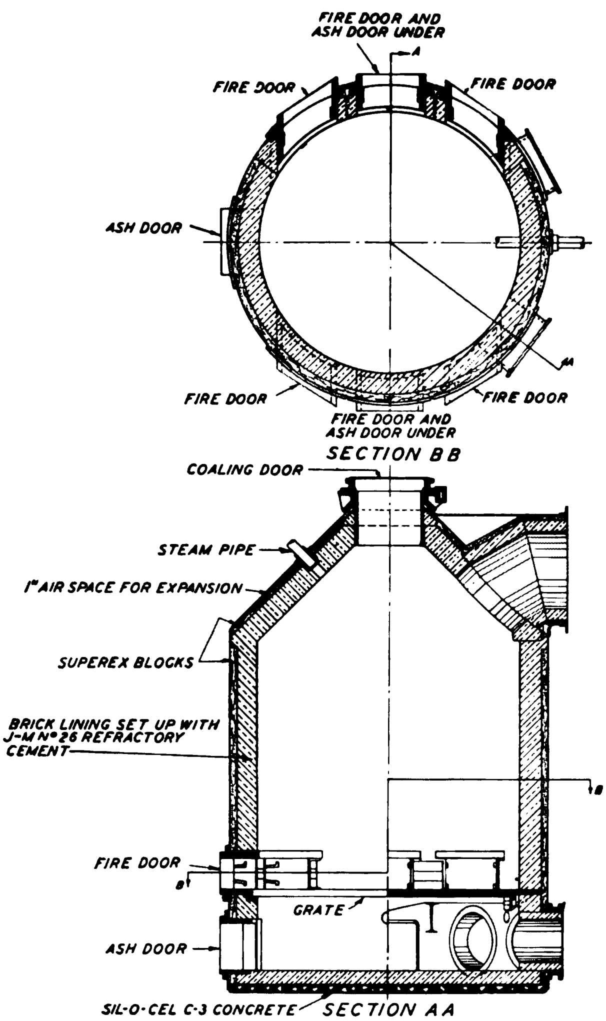
Modern manufacture of carburetted water gas has been developed to a highly efficient process in which insulation naturally plays an important part. In every piece of apparatus in the modern water gas plant where heat is to be controlled or conserved, from generator base to the steam lines of the storage holder cups, J-M insulation contributes to satisfactory and economical operation.

Water Gas Sets:

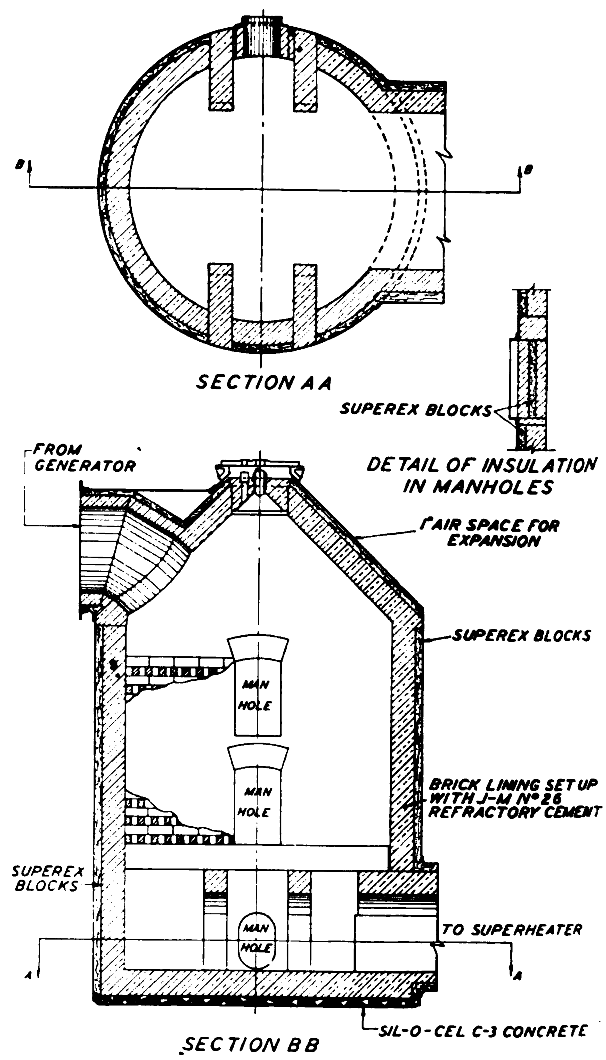
In the modern cone-top steel-cased set, consisting of generator, carburetter and superheater, the side walls, cone tops and connections are insulated with 3" of Superex Blocks behind at least 9" of refractory. In the cone tops, 1" air space is allowed between the insulation and the steel casing for expansion of the brickwork.

Before the application of any insulation, the entire inside surface of the steel shell is coated with J-M Resisto Primer and then painted with J-M Resisto Paint for protection against acid and moisture conditions. The Superex is then applied in two 1½" layers between the fire brick and the shell, as the brickwork progresses. All joints in the insulation should be staggered, closely butted and pointed up with J-M No. 302 Cement.

Bases of generator, carburetter and superheater are insulated with 4" of Sil-O-Cel C-3 Concrete with 5" or more of fire brick over the insulation.



Method of insulating water gas generator



Typical water gas carburetter insulation

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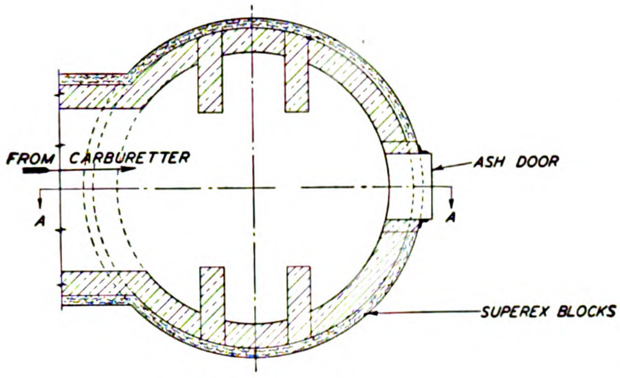
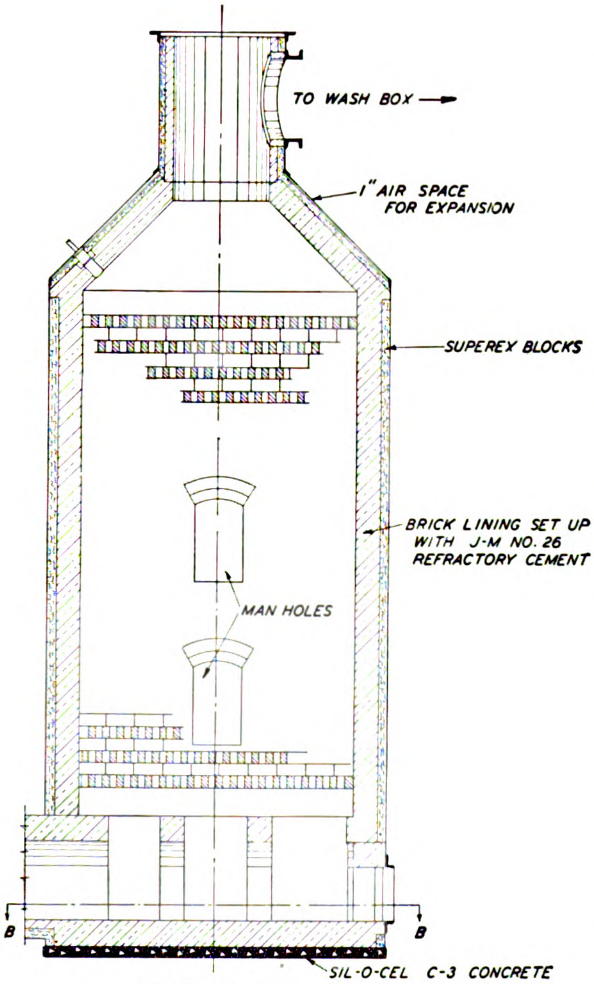


SECTION B-B



SECTION A-A

Water gas superheater insulated in sides and over cone top with Superex Blocks, Sil-O-Cel C-3 Concrete used in base

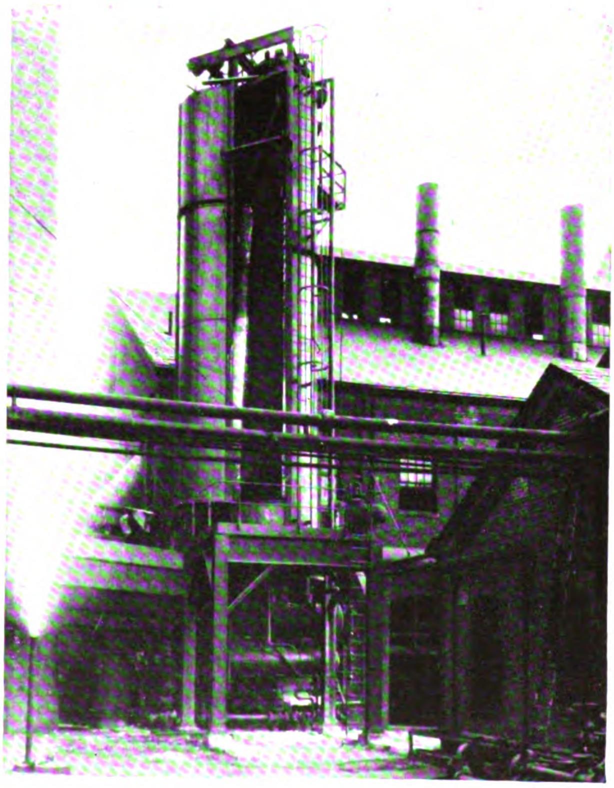
Power Plant Equipment

The insulation of steam pipes, direct-fired boilers, breechings and other power plant equipment is fully treated in other data sheets.

Waste-heat Boilers:

Horizontal or inclined waste-heat boilers of the fire-tube type are insulated with 2″ thick J-M 85% Magnesia Blocks, applied longitudinally, with all joints closely butted. Insulation blocks are securely wired to the boiler with two turns to each course of blocks, followed by 1½″ hexagonal mesh galvanized wire netting, tightly stretched over the insulation and fastened. Over the wire netting two ¼″ coats of J-M No. 302 Cement are applied, the first coat being left to dry with a rough surface before the application of the smooth finishing coat.

In vertical waste-heat boilers of the LaMont type, the steam pot and water pump body are insulated with 2″ thick J-M 85% Magnesia Blocks, wired on and finished with J-M No. 302 Cement, similarly to the horizontal type previously described. Vertical waste-heat boilers of the Wickes type are insulated with 2½″ of Sil-O-Cel C-22 Brick over the arch; 2″



LaMont waste heat boiler insulated with J-M Materials

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to 3″ of Sil-O-Cel Coarse Grade tamped in place between the fire brick side wall and the steel casing; and 2½″ of Sil-O-Cel Natural Brick over the top.

Other waste-heat boilers of the various water-tube types are insulated in the same manner as employed in direct-fired boilers, discussed on other data sheets.

Producer Gas Mains

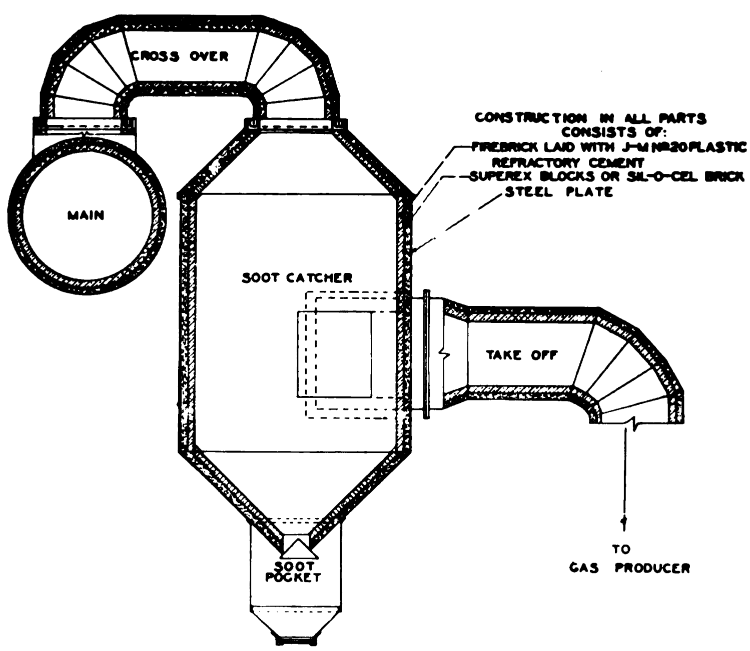
Since producer efficiency is greater, by 20% or more, where the gas is used hot, the take-off, soot-catcher and main should always be insulated. Insulated linings in producer gas mains also effect operating economies entirely apart from savings in sensible heat. By maintaining a high temperature in the gas, insulation inhibits the condensation of the tarry vapors resulting from the breaking down of unstable hydrocarbons, which subsequently deposit on the fire brick lining and, as a corollary effect, the length of time between shut-downs for burnout is materially increased. In addition, these vapors, by remaining in suspension, increase the calorific value of the gas at the furnaces.

The economy attained through the proper use of insulation appears in producer mains as elsewhere. Heat loss through an uninsulated main lined with 4½″ of fire brick with a gas temperature of 1400 deg. F., approximates 1569 B.t.u. per sq. ft. per hour. Insulated with 2½″ of Superex Blocks, this loss is reduced to 286 B.t.u. On the basis of heat worth 25 cents per million B.t.u. and continuous operation, the saving corresponds to $2.82 per sq. ft. per year on an outlay of less than 45 cents per sq. ft. for insulating materials.

Producer gas mains are insulated, either when old mains are being re-lined or when new mains are being installed, with 2½″ to 4″ of Superex Blocks or 2½″ or 4½″ of Sil-O-Cel Natural Brick between the fire brick lining and the steel shell.

Purifier Boxes and Covers

Where purifier boxes are located in the yard, they are protected from variations of temperature by insulating the sides with 2½″ of Sil-O-Cel Powder, tamped to a density of 15 to 17 lb. per cu. ft. and the tops and covers with 2½″ of Sil-O-Cel C-3 Concrete. In some instances, the boxes are merely protected by a housing made of ½″ thick J-M Insulating Board nailed to a framework of wood studs, with an outer finish, over the Insulating Board, of ¼″ of J-M Insulkote, troweled smooth.



Producer gas take-off, soot-catcher and main insulation

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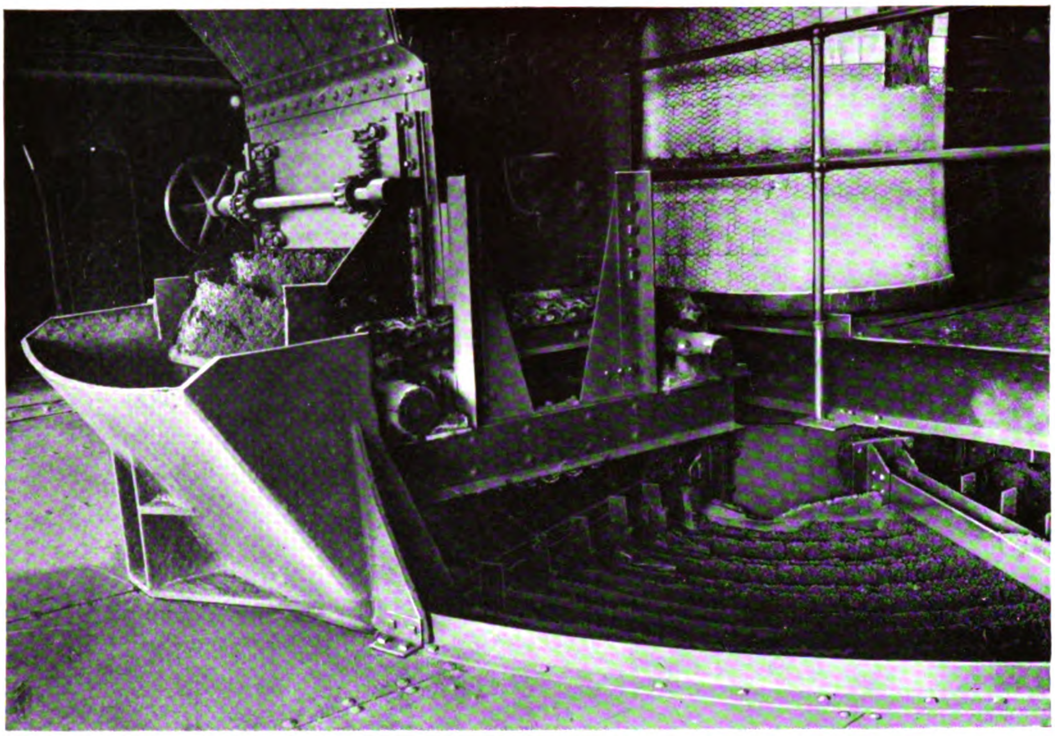
Insulation of Non-Ferrous Metallurgical Equipment



Upper hearth of J-M insulated roaster. Up-take insulated with 2½" Sil-O-Cel Natural Brick to be finished with cement

Heat is such an essential in metallurgy that its control or conservation is naturally one of the major factors in the design of any reduction or refining equipment. With non-ferrous metals, the intricacies of the reduction processes, the refractoriness of many of the ores and the close margin between profit and loss in operating, all demand exhaustive consideration of proper heat insulation. Typical examples of how J-M products serve are briefly discussed here.

Roasting Equipment

In the reduction of non-ferrous ores, as a general rule the products of milling and concentrating require treatment preliminary to smelting and refining. This may be either drying, calcining, nodulizing, roasting or sintering, or, more usually, a combination of two or more of these, depending on the characteristics of the particular ore. In much of this preliminary treatment temperature control is of paramount importance rather than fuel saving, although in some instances conserving the heat of the reaction is a distinct economy, reflected in lower operating costs.

Kilns:

Drying, and calcining which differs only in the higher temperatures used, are usually accomplished in rotary kilns, which are partly or wholly lined and, when used for calcining (or for the nodulizing of flotation concentrates), insulated between the kiln blocks and the steel shell. Both wet and dry process kilns are uninsulated at the hot end for a distance equal to 25% of the kiln length. Wet process kilns are usually uninsulated for a distance of approximately 20 ft. at the wet end.

The insulation consists of 2½" thick Superex Blocks, 6" x 36", next to the steel shell, laid in and coated with J-M No. 319 Semi-Refractory Cement. The refractory lining over the insulated portion is

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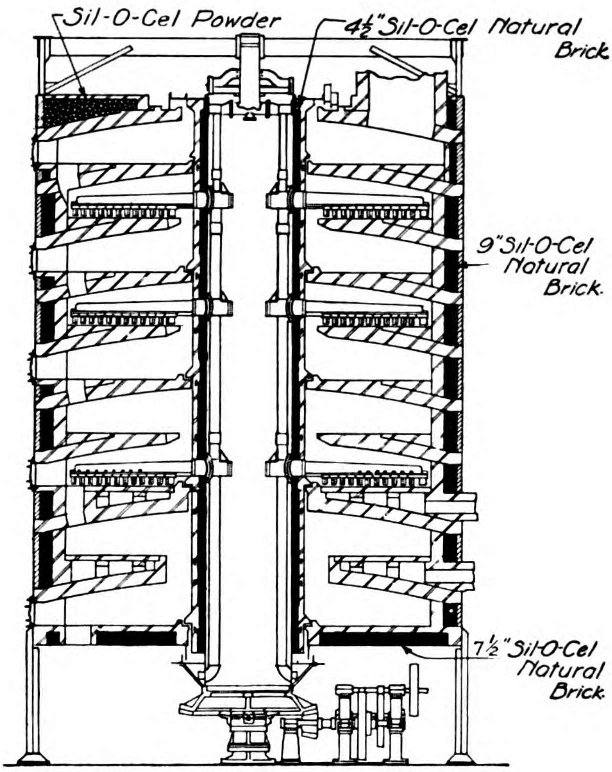
bonded to the shell with through kiln blocks on each quadrant longitudinally and at 20-ft. intervals circumferentially, to prevent slipping.

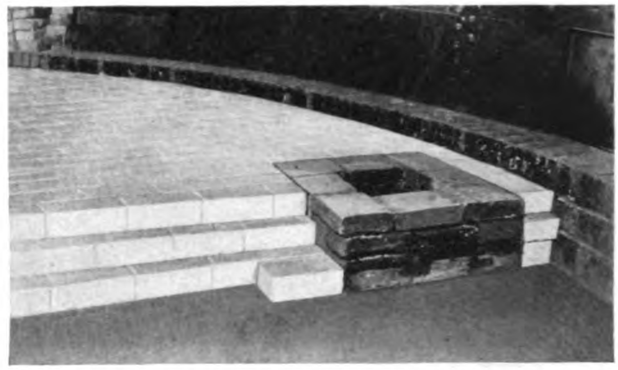
Roasters:

Single hearth reverberatory furnaces, when used for rough roasting at temperatures from 500 to 1300 deg. F., are economically insulated in side wall, base and roof. Sil-O-Cel Natural or C-22 Brick, 4½″ thick, are used behind 13½″ of fire brick in the side walls, and 2½″ or 5″ thick on the roof. The base is insulated with 4″ to 6″ of Sil-O-Cel C-3 Concrete overlaid with one or two layers of fire brick.



J-M insulation recommendation for Wedge roaster

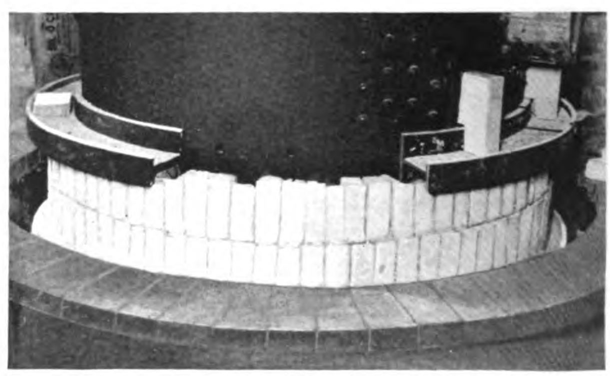
The Wedge multiple hearth roaster is insulated on the sides with 9″ and on the bottom hearth with 7½″ of Sil-O-Cel Natural Brick between the fire brick and the steel shell. The central rotating shaft is insulated with 4½″ of Sil-O-Cel Natural Brick protected by a course of fire brick. The top of the roaster, above the first or drying hearth, is insulated with 8″ to 12″ of Sil-O-Cel Powder, tamped to a density of 15 to 17 lb. per cu. ft.



Three courses of Sil-O-Cel Natural Brick in bottom of Wedge roaster

The Nichols-Herreshoff type of roaster is similar to the Wedge with the exception of the central shaft which, serving as a passage for cooling air to the rabble arms, is smaller and not insulated. Insulating brick are applied on the walls and bottom hearth as in the Wedge type. When the heated cooling air is used for combustion purposes on the hearths, the housing and steel distributing pipes are insulated with J-M 85% Magnesia or Superex Combination Insulation.

In the Queen-type roaster, designed for one of the most modern copper smelters, the upper three hearths are used to dry the concentrates, with no combustion occurring on them. These drying hearths are insulated with 4½″ of Sil-O-Cel Natural Brick overlaid with 3″ of re-pressed red brick. The lower eight hearths, where the roasting takes place, are insulated with 7½″ of Sil-O-Cel Natural Brick, laid in three 2½″ courses and protected by a 3″ re-pressed red brick lining. In the base of the roaster, three courses



Installing Sil-O-Cel Natural Brick 4½″ thick around central rotating shaft of Wedge roaster

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of 2½" Sil-O-Cel Natural Brick are used beneath a 4" course of re-pressed red brick.

Burner Boxes: Where exterior burner boxes are used, they are insulated between the refractory and the steel shell in the same manner as the roaster wall.

Roaster Up-takes: Roaster up-takes are insulated with 2½" of Superex Blocks or Sil-O-Cel Natural Brick, wired on and followed by 1½" hexagonal galvanized wire netting over which is applied ½" of J-M No. 302 Insulating Cement in two ¼" coats, the first coat allowed to dry with a rough surface and the second troweled to a smooth finish.

Calcine Pipes and Hoppers:

The hot calcine pipes between the roaster bottom hearth and the calcine hoppers are insulated with 2½" of Superex Blocks or Sil-O-Cel Natural Brick, finished over hexagonal wire mesh with ½" of cement in the same manner as the roaster up-take. As a further protection, the calcine pipes are usually encased with a steel sleeve.

Hot calcine pipes between roasters and calcine hoppers, insulated with J-M Materials

The calcine hoppers, generally mounted above the reverberatories, are insulated in the sides and bottom with two 2½" courses of Sil-O-Cel Natural Brick behind one 2½" course of fire brick. The crowns of the hoppers are insulated with one 2½" course of the insulating brick above the 9" fire brick crown.

Ignition Stove for Straight-line Machine:

On the Dwight-Lloyd straight-line machine, which is used for giving a finishing roast, as well as for sintering, the ignition stove is insulated.

One efficient installation is the insulated coke-burning stove designed and used on the Dwight-Lloyd machines at the Midvale plant of the U. S. Smelting, Refining and Mining Co., Midvale, Utah. The shell is of sheet steel, open at the top, within which a fire brick lining is built up with 3" of Sil-O-Cel Powder tamped between the lining and the shell. The roof is a fire brick arch covered with 1" of rock wool (Banroc) over which is applied a ½" layer of insulating cement reinforced with wire mesh.

Dust Collecting Equipment

J-M insulation being applied to large flue at zinc smelter

Flues:

Flues are insulated to protect the material of which the flue is made, as well as to maintain the temperature of the gases, necessary to the process in many instances. Temperatures must be held above the condensation point of sulphur gases or a steel flue quickly deteriorates from corrosion, occasioning replacement costs far in excess of the price of original insulation.

Because of the varying temperatures due to the widely differing process demands, each installation of flue insulation becomes a problem of the particular plant and depends largely on local conditions.

Comparatively short internal flues and gas passages are usually insulated either externally with Sil-O-Cel Brick or Superex Combination Insulation, similarly to the apparatus which they connect, or internally with the insulating brick or blocks bonded to the steel with J-M Fibrous Adhesive and wired in place

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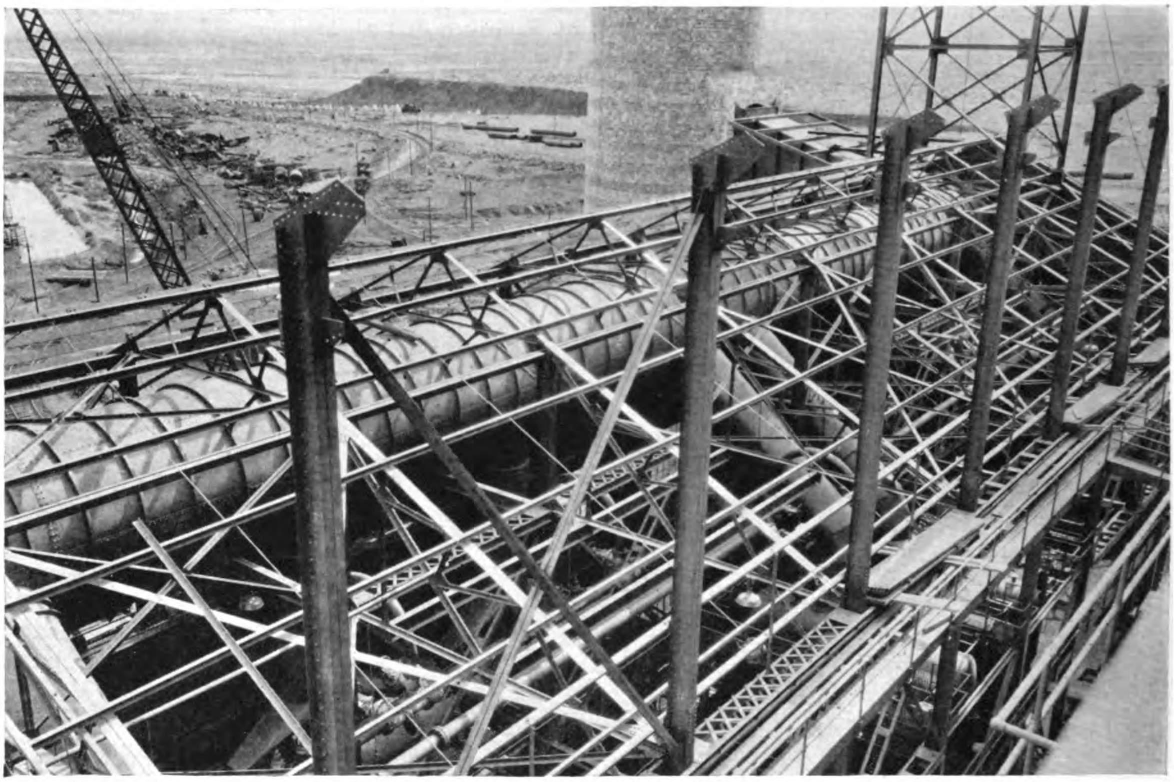

Boiler up-takes and flue to stack at large copper smelter, insulated with Sil-O-Cel Natural Brick and Sil-O-Cel Coarse Grade

to spot-welded lugs. The insulation is protected from erosion by the hot moving gases with ½″ or more of J-M No. 319 Semi-Refractory Cement, applied in ¼″ coats and reinforced with suitable wire mesh.

Long out-door flues call even more for adequate insulation because of the additional exposure to temperature changes. Sometimes the insulation is applied internally, as at the Consolidated Mining and Smelting Co., at Trail, B. C. Here the steel flue is insulated with 5″ thick Superex Combination Insulation (2″ of J-M 85% Magnesia overlaid with 3″ Superex) secured to the interior steel surface by 1½″ x 1/16″ band iron attached to lugs welded at 18″ intervals and protected by 1″ of J-M No. 319 Semi-Refractory Cement reinforced with 16-gauge galvanized wire netting. The results have been entirely satisfactory.

Equally successful is the externally insulated flue at the International Nickel Co. plant at Copper Cliff, Ontario. This flue was insulated on the outside with 1½″ thick Superex Blocks wired on with circumferential tie wires and covered with ½″ of J-M No. 302 Insulating Cement reinforced with wire mesh and applied in two coats in the usual manner. The insulation was then waterproofed with a roofing jacket, the laps sealed with Lap Cement and the sheets additionally secured by circumferential tie wires. The roofing jacket was finally painted with J-M Regal Roof Coating.

Balloon flues have been jacketed for a 3″ fill of Sil-O-Cel Coarse Grade.

Cottrell Precipitators:

In the larger, modern plants, Cottrell apparatus is widely used for the electrical precipitation of dust in the flue gas stream. Such precipitators handle flue gas at temperatures to 1200 deg. F. with a drop through them of only 100 deg., thus solving at one time the double problem of gas-cleaning and heat conservation.

The steel housings of Cottrell precipitators are usually jacketed and filled with 3″ to 4″ of Sil-O-Cel Coarse Grade, with 2½″ or 5″ of Sil-O-Cel Natural Brick or with 2½″ to 4″ of Superex Blocks, over

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Cottrells insulated on sides with 3" Sil-O-Cel Coarse Grade. Tops are insulated with 2½" of Sil-O-Cel Natural Brick

the tops. Inspection doors are also insulated, using Sil-O-Cel C-3 Concrete to fill the entire frame of the door, and not less than 4" thick, the total thickness depending on the temperatures encountered. Sil-O-Cel C-3 Concrete is made by mixing Sil-O-Cel C-3 and portland cement in the proportion of four parts of C-3 to one part of portland cement by volume, with only sufficient water to make a plastic mixture.

Cottrell Dust Hoppers: The dust hoppers into which the hot dust from the gas stream is precipitated by the Cottrell apparatus are insulated on the inside with a 2½" course of Sil-O-Cel Natural Brick protected by a course of fire brick.

Cottrell Discharge Pipes: With the comparatively slight temperature drop through the Cottrell apparatus, the discharge pipes require practically the same insulation as the flue system. They are usually insulated on the outside with a 2½" course of Sil-O-Cel Natural Brick or Superex Blocks, wired in place and covered with ½" of insulating cement, reinforced with mesh wire.

Smelting Equipment

In non-ferrous ore reduction, where blast furnaces are used, as a general rule they are water-jacketed, not insulated. Reverberatories are often run at too high temperatures to permit insulation. In specific instances small reverberatories have been successfully insulated with a 4½" course of Sil-O-Cel C-22 Brick behind 13½" of refractory in the side walls. Roofs, even though the source of 80% of the heat loss, are not insulated, owing to the necessity for free radiation over the arch. When insulation can be used without shortening the life of the refractory, great savings in fuel are obtained.

Waste Heat Boilers:

Waste heat boilers are insulated similarly to other types of boilers of the same class, discussed in detail in other data sheets. The dust hoppers beneath the boilers are insulated with a 2½" course of Sil-O-Cel Natural Brick beneath a layer of fire brick. The breechings are insulated outside with 2½" of Superex

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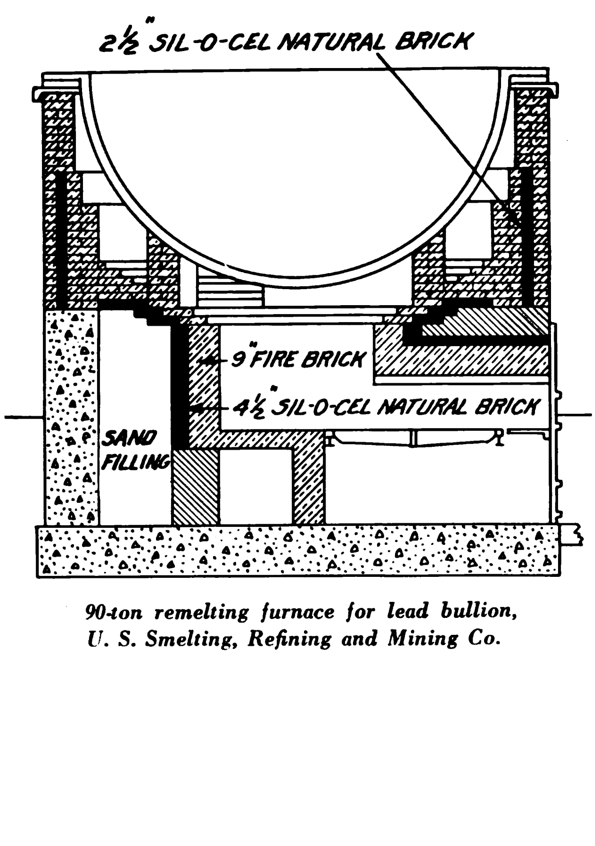
Blocks or Sil-O-Cel Natural Brick, wired in place and covered with ½″ of J-M No. 302 Cement, reinforced with wire mesh.

Refining Equipment

Certain of the non-ferrous metals are reduced in equipment peculiar to the individual process. Some of such appliances, to the economical or efficient operation of which adequate insulation is essential, are discussed in the following paragraphs.

Lead Drossing Kettle:

A noteworthy example of the effectiveness of insulation to achieve economical operation is the 90-ton remelting furnace for lead bullion designed and constructed at the Midvale smelter of the U. S. Smelting, Refining and Mining Co. Daily use over a long period necessitated no repairs and, owing to the efficiency of the insulation, this furnace consumes no more coal in melting 90 tons of lead than do the uninsulated furnaces in melting 30 tons.



90-ton remelting furnace for lead bullion, U. S. Smelting, Refining and Mining Co.

Above the concrete foundation to the cast steel ring which supports the kettle, the circular wall is insulated with 2½″ of Sil-O-Cel Natural Brick laid in "core wall" construction between fire brick and red brick. The fire box is also insulated with Sil-O-Cel Natural Brick, with the space between the insulating brick and the concrete wall filled with granulated slag. In spite of the greatly increased melting capacity, the grate area of this furnace is identically the same as that of the 30-ton uninsulated furnaces.

Aluminum Reducing Furnace:

The electrolytic cell in which molten aluminum is precipitated from a fused bath at a temperature of about 1650 deg. F., is insulated between the refractory lining and the steel shell with one or more courses of Sil-O-Cel Natural Brick or Superex Blocks.

The furnaces used in remelting the metal from the reduction cell are insulated in the side walls and over the top with two 2½″ courses of Sil-O-Cel Natural Brick or with two 2″ layers of Superex Blocks. The base is insulated with 4″ to 6″ of Sil-O-Cel C-3 Concrete, protected by one or two layers of fire brick.

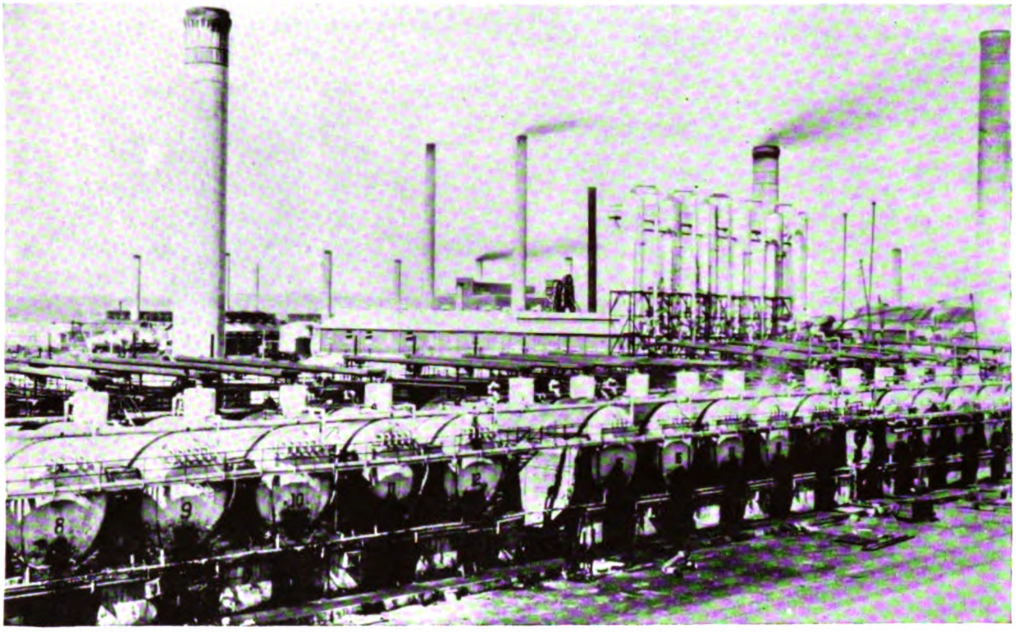
Zinc Distillation Furnace Regenerators:

It is estimated that the use of a regenerative system saves 50% of the coal required when producer gas is used in the distillation furnace. Regenerator insulation consists of Sil-O-Cel Natural Brick or Superex Blocks behind the refractory on sides and top. Bases are insulated with Sil-O-Cel C-3 Concrete overlaid with fire brick.

Remelting and Heat Treating Furnaces

The insulation of industrial furnaces similar to those used in the fabrication of non-ferrous metals is discussed in other data sheets.

Insulation of Oil Stills, Towers and Drums



Battery of continuous shell stills, insulated with J-M Materials

The proper kind and thickness of insulation for the metal surfaces of oil stills, towers and other fractionating equipment is ordinarily determined by considering the following factors:

(1) The maximum operating temperature, in order to select an insulating material, the temperature limit of which will not be exceeded.

(2) The average operating temperature, to determine the economical thickness of the insulation.

(3) The degree of temperature control required, so that sufficient insulation may be applied to maintain the necessary operating temperature in the coldest weather.

The use of J-M 85% Magnesia, Asbesto-Sponge Felted, or Superex-Magnesia Combination Insulation is usually recommended. Thicknesses are as indicated in the following table, except where special conditions require the minimizing of temperature drop or the conserving of unusually expensive heat.

J-M Block Insulation on Metal Surfaces

Maximum temperature on insulation, deg. F.	Thickness of Superex, inches	Thickness of Asbesto-Sponge Felted or 85% Magnesia, inches	Total thickness of block insulation, inches	Heat transmission, B.t.u. per sq. ft. per hr., at stated temperature: With 85% Magnesia	Heat transmission, B.t.u. per sq. ft. per hr., at stated temperature: With Asbesto-Sponge Felted	Insulation efficiency, with 85% Magnesia, per cent	Insulation efficiency, with Asbesto-Sponge Felted, per cent
300	...	2	2	50.7	46.4	93.13	93.71
400	...	2½	2½	60.5	56.2	95.23	95.57
500	...	3	3	68.2	64.6	96.60	96.78
600	...	3½	3½	74.6	71.6	97.47	97.58
750	1½	2½	4	89.8	87.4	98.11	98.17
900	2	2	4	114.2	111.5	98.37	98.40
1000	2½	2	4½	118.1	116.2	98.64	98.67
1200	3½	1½	5	138.0	137.2	98.91	98.92

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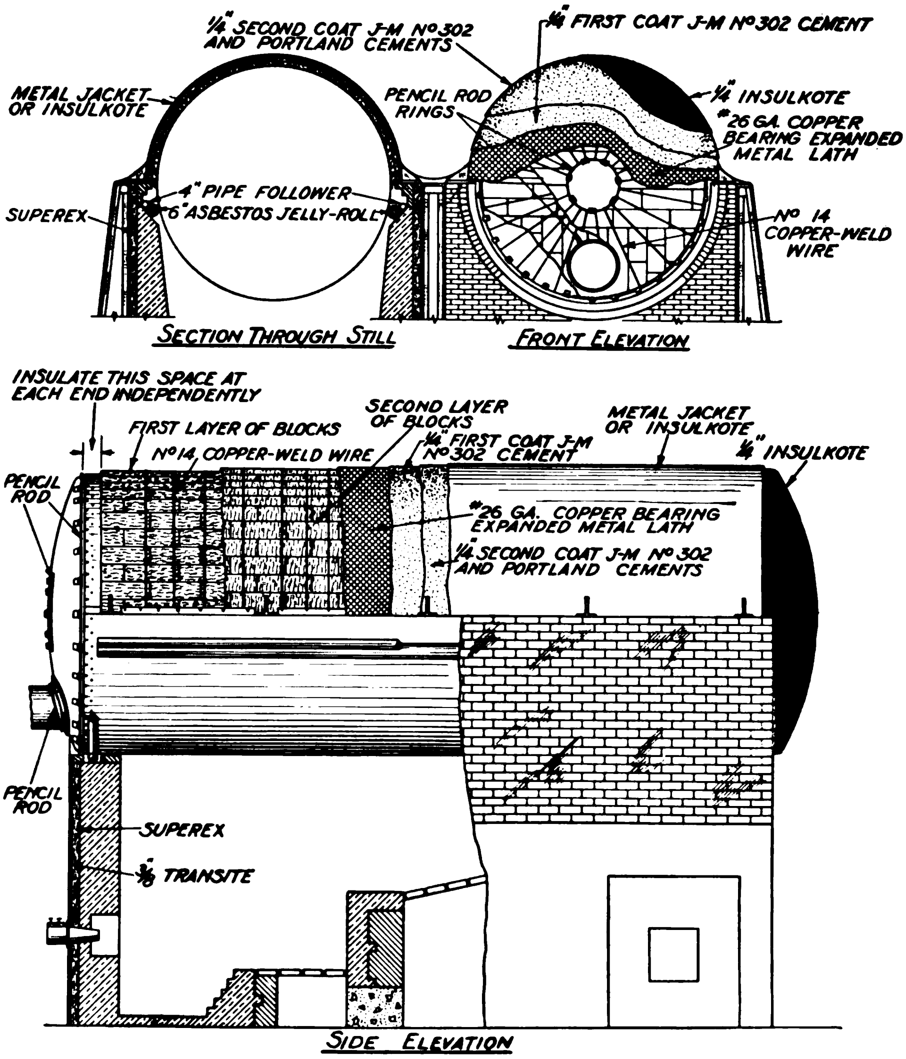
Fired Shell Stills

Fired shell stills have longitudinal angles supported along the sides where insulation is to terminate, and on the heads suitable clips are spot-welded near the outer rims. Similar clips are spot-welded in a circle near the center of the front head. Rings of 3/8" pencil rod iron are securely wired to the outside of rim and center clips, and the manhole neck is similarly treated.

Insulating blocks are then wired in place with No. 14 Copperweld annealed wire through holes in the longitudinal angles and to the pencil rod rings or other projections. Joints and cracks are well filled with J-M No. 302 Insulating Cement, and No. 26 copper-bearing expanded metal lath stretched tightly over the blocks. Two 1/4" coats of J-M No. 302 Insulating Cement are applied over the metal lath, the first coat being allowed to dry with a rough surface and the second, mixed with one-third portland cement by weight, troweled smooth. The weather-proofing consists of a 1/4" application of J-M Insulkote, troweled over the cement.

It is well to attach hairpin wires for securing a sheet iron side flashing to the expanded metal lath before applying cement. Insulkote is troweled on after all other work, including the installation of the flashing, is completed. The work can be expedited and cracking of insulation largely prevented if heat is provided in the still during application of the cement coatings.



Methods of insulating and sealing fired shell stills

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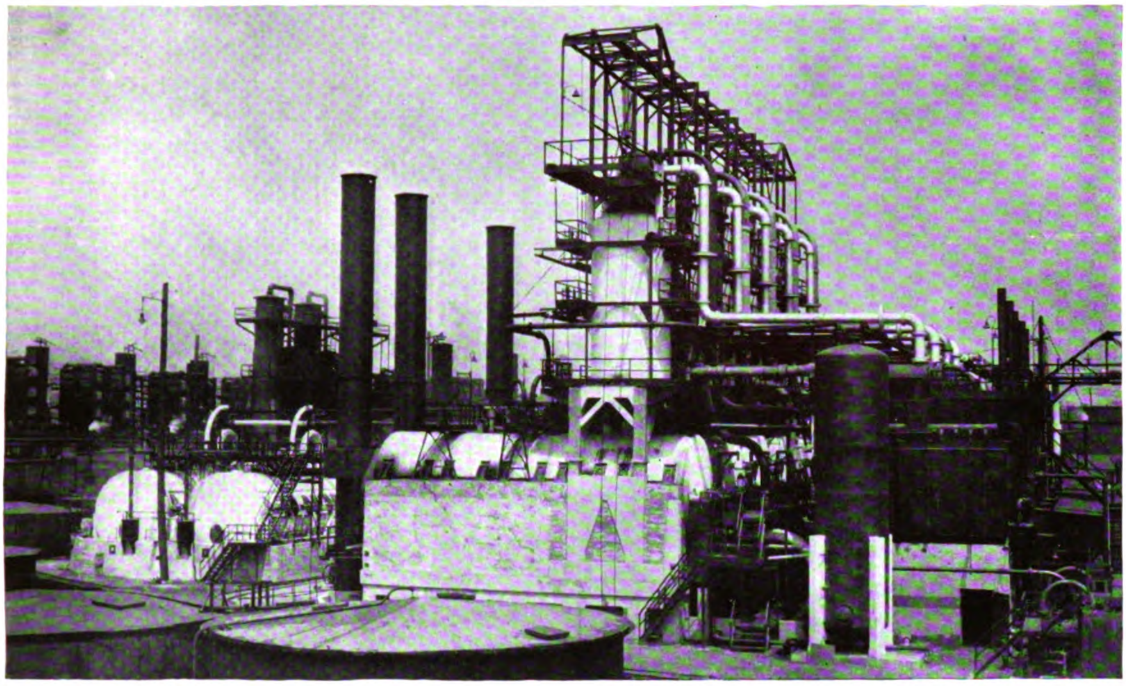


J-M insulation on fire tube shell stills at the Tidewater Oil Company

Steam Shell Stills

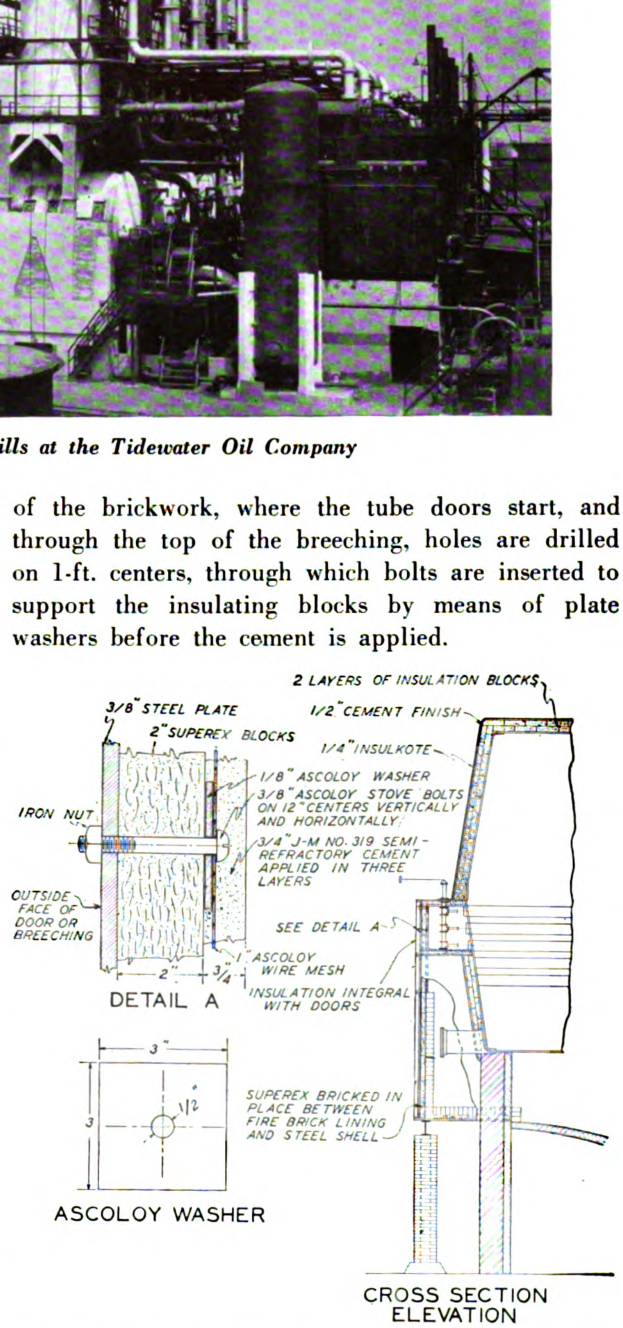
Insulation is applied on the heads and upper half of the shell of steam shell stills in the manner described for fired shell stills. On the lower half of the shell the insulating blocks are secured by means of ¾″ x .020″ Signode straps, spaced two per block, applied over the outer layer, fastened to longitudinal angle irons, drawn tight with the stretching tool and sealed.

The insulation is usually finished as described for fired shell stills, but the Insulkote may be omitted and in its place may be applied an 8-oz. canvas jacket, neatly sewed, sized and painted with two coats of lead and oil paint.

Fire Tube Shell Stills

On fire tube shell stills the upper half of the shell and that part of the heads not enclosed by the breeching are insulated in the manner indicated for fired shell stills.

The rear breeching is insulated on the inside with 2″ Superex Blocks, coated on the exposed surface with ¾″ J-M No. 319 Semi-Refractory Cement reinforced with Ascoloy wire mesh, or with Ascoloy or Nichrome wire laced diamond pattern. Where the brickwork is used in the bottom of the breeching, no support for the insulation is needed. Above the top of the brickwork, where the tube doors start, and through the top of the breeching, holes are drilled on 1-ft. centers, through which bolts are inserted to support the insulating blocks by means of plate washers before the cement is applied.



Insulation of doors and breeching on fire tube shell still

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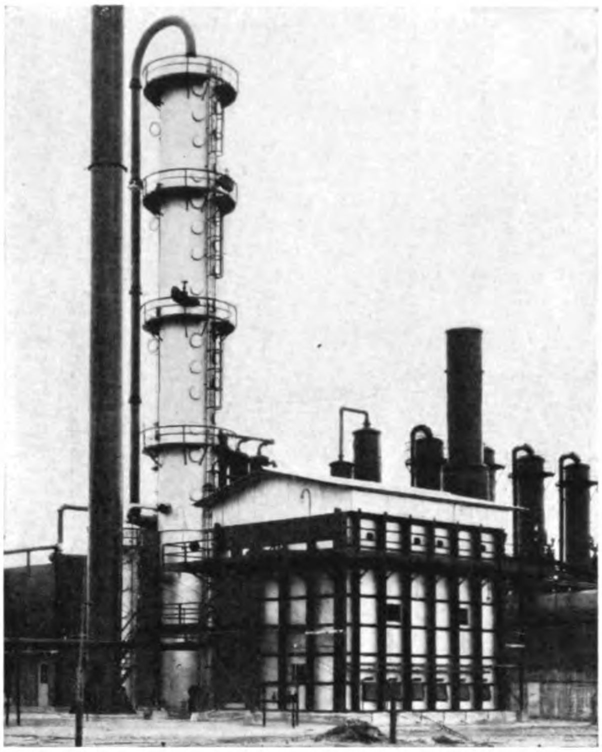


Tube still and tower insulated with J-M Materials. Still cased with flat Transite and shielded with a corrugated Transite roof and apron

Towers and Drums

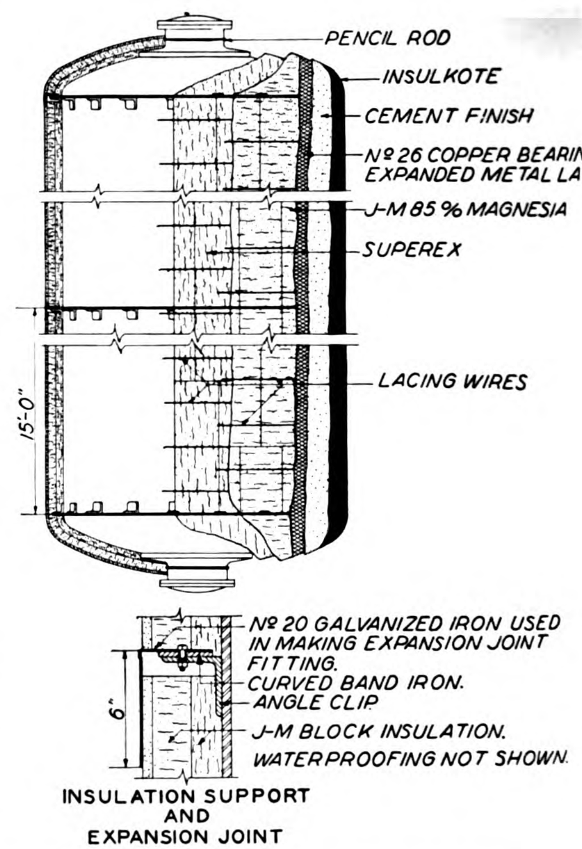
Every heated surface where some useful purpose will be served by preventing heat dissipation should be properly insulated. While it is necessary, for maximum thermal efficiency in the use of fractionating columns, to introduce on the top plate all the reflux required to obtain the desired separation, any condensation of vapors at other points in the tower, resulting from heat loss through the shell, will form liquid which is relatively ineffective and which merely increases the heat necessary for the given separation.

It is often true that temperature control is the important factor, rather than heat saving. To meet particular conditions, care is necessary in selecting and applying insulation. The standard materials are Superex and Magnesia or Superex and Asbesto-Sponge Felted, which are adaptable to almost any condition and entirely stable and reliable in service. Banroc blankets have also been used. Thicknesses are given in the foregoing table.

The general method of applying the block insulating materials, such as Superex and Magnesia, to vertical towers and drums involves the use of angle clips, spot-welded circumferentially around the bottom head, to which a curved band iron is bolted. This band iron serves as an anchor for lacing wires maintaining the insulating blocks on the head and as a support for the insulation on the shell above it. Similar circumferential band iron supports and suitable expansion joints are located at intervals of not more than 15 ft. on the height of the tower.

A band iron anchor for lacing wires is also located circumferentially around the top head. Bent angle iron rings welded directly to the shell may be used instead of clips and band iron. Pencil rod rings around manheads may serve as additional supports for lacing wires.

Insulating blocks are secured on the shell by circumferential lacing wires on 12″ centers. Signode straps find excellent application in some of this work, and stranded wire cable is also frequently used. A cement finish, waterproofed with a 1/4″ application of Insulkote, is ordinarily applied over the insulation.



Method of insulating soaking drums

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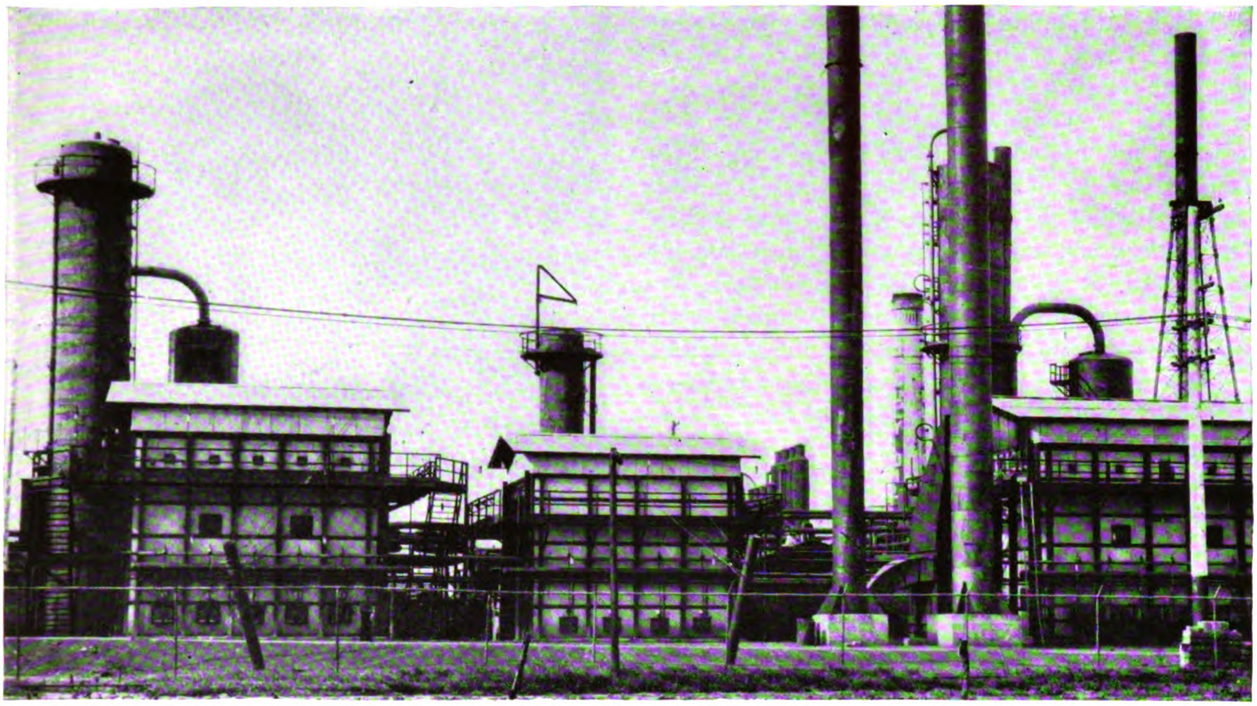
Insulation of Oil Refinery Furnaces



Flat Transite casing over J-M insulation on Winkler-Koch tube stills, with corrugated Transite roofs and aprons

The primary function of insulation on furnace settings is to limit heat flow from hot interiors, thereby reducing fuel cost. Temperature differential between the inside and outside of brickwork is decreased, which lessens internal strains and reduces spalling. Wall cracks, caused by uneven expansion and contraction, are fewer and smaller. The insulation itself, if properly applied, tends to seal cracks and make the setting tight. Insulation also promotes heat flow along the walls, and cooler portions of the furnace are raised to a higher temperature. Sharp temperature changes are obviated and brickwork protected against widely varying rates of expansion.

Where temperatures up to 2500 deg. F. will be imposed on the insulation, Sil-O-Cel Super Brick are recommended. In the range immediately below 2000 deg. F., Sil-O-Cel C-22 Brick are generally utilized. Both of these are calcined semi-refractory insulating brick, manufactured from diatomaceous silica in standard fire brick sizes.

Between 600 and 1600 deg. F., Sil-O-Cel Natural Brick are used where insulation in brick form is desired. Superex and Superex Combination Insulation are the proper block insulating materials in this range where the use of shapes 6″ x 36″ or 3″ x 18″ is advantageous.

Furnace Casings

Flat Transite sheets, 3/8″ thick, have been adopted by many of the leading designers of refinery furnaces throughout the country as the ideal casing over insulation on refinery furnaces. The sheets weigh but 4 lb. per sq. ft. and are furnished 36″ x 48″, 42″ x 48″ and 42″ x 96″.

Although Transite is not considered a heat insulator, it has a relatively low conductivity (approximately 1/50 that of steel) and its natural gray color makes it a poor radiator of heat. It is fireproof, resistant to acid and alkali vapors, requires no painting and will last indefinitely.

Brick Settings

Superex and Magnesia Blocks and Sil-O-Cel Bricks may be applied between refractory and buckstays with complete satisfaction, except at places of unusual thrust, such as opposite a sprung arch or where cast-

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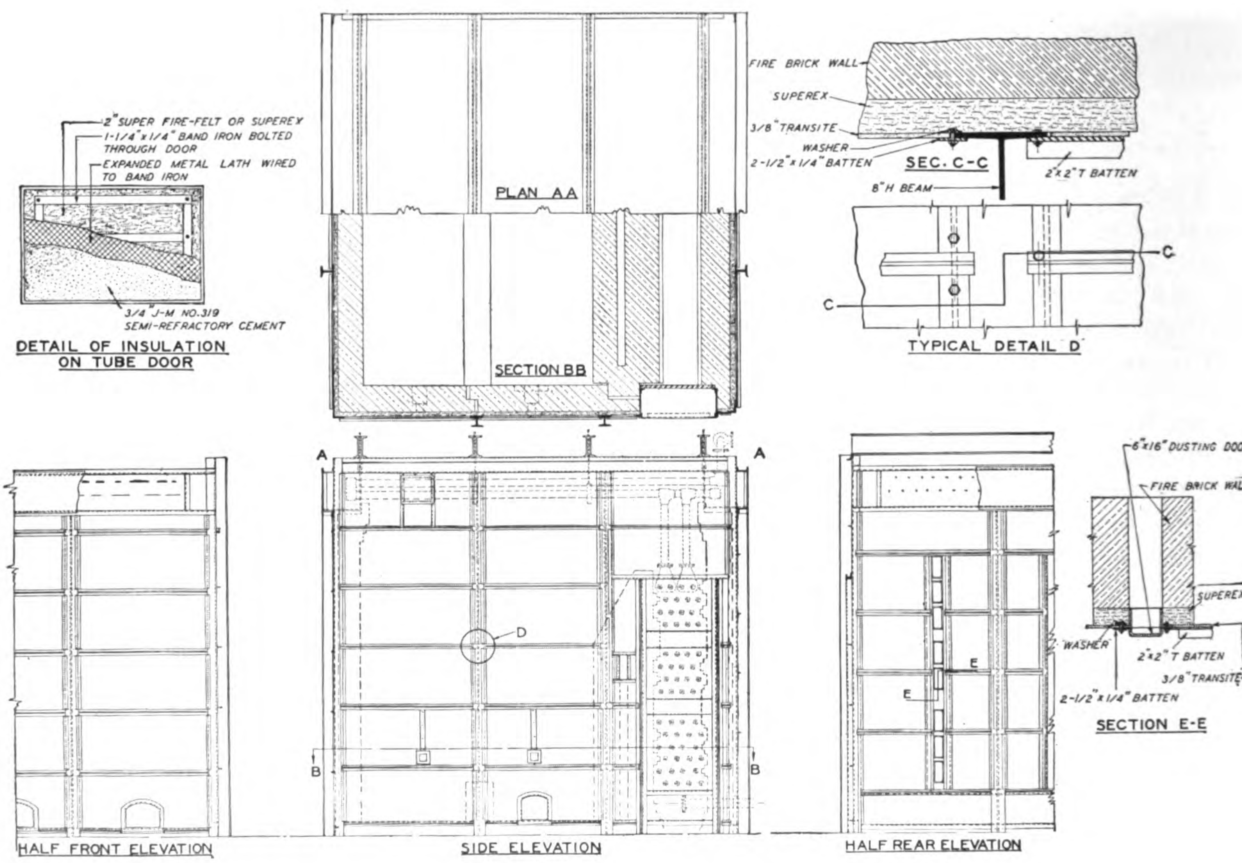
ings are hung into the brickwork. In such locations the fire brick is carried through to the outside.

The insulation is placed between or behind the buckstays, next to the refractory lining, to the required thickness. Where furnace brickwork is erected flush with the back of the buckstays, light angles may be clipped or spot-welded to the buckstays to assist in lacing the insulation in place and to support the Transite casing. When the Transite casing is flush with the back of the buckstays, it may be secured by steel battens and toggle bolts or by other suitable means. In oil refinery practice, the casing is frequently erected first, then insulation is applied inside and brickwork laid up snugly against the insulation.

"Core wall" construction, used in some furnaces, consists of 4½" of Sil-O-Cel C-22 Brick laid between fire brick and red brick with bonds at every fifth course vertically. Opposite the cooler portions of the furnace Sil-O-Cel Natural Brick may be used instead of Sil-O-Cel C-22.

Superex Combination Insulation, 3½" thick, between Transite casing and fire brick lining of Gyro tube still



Superex insulation with Transite casing applied to tubular oil heater

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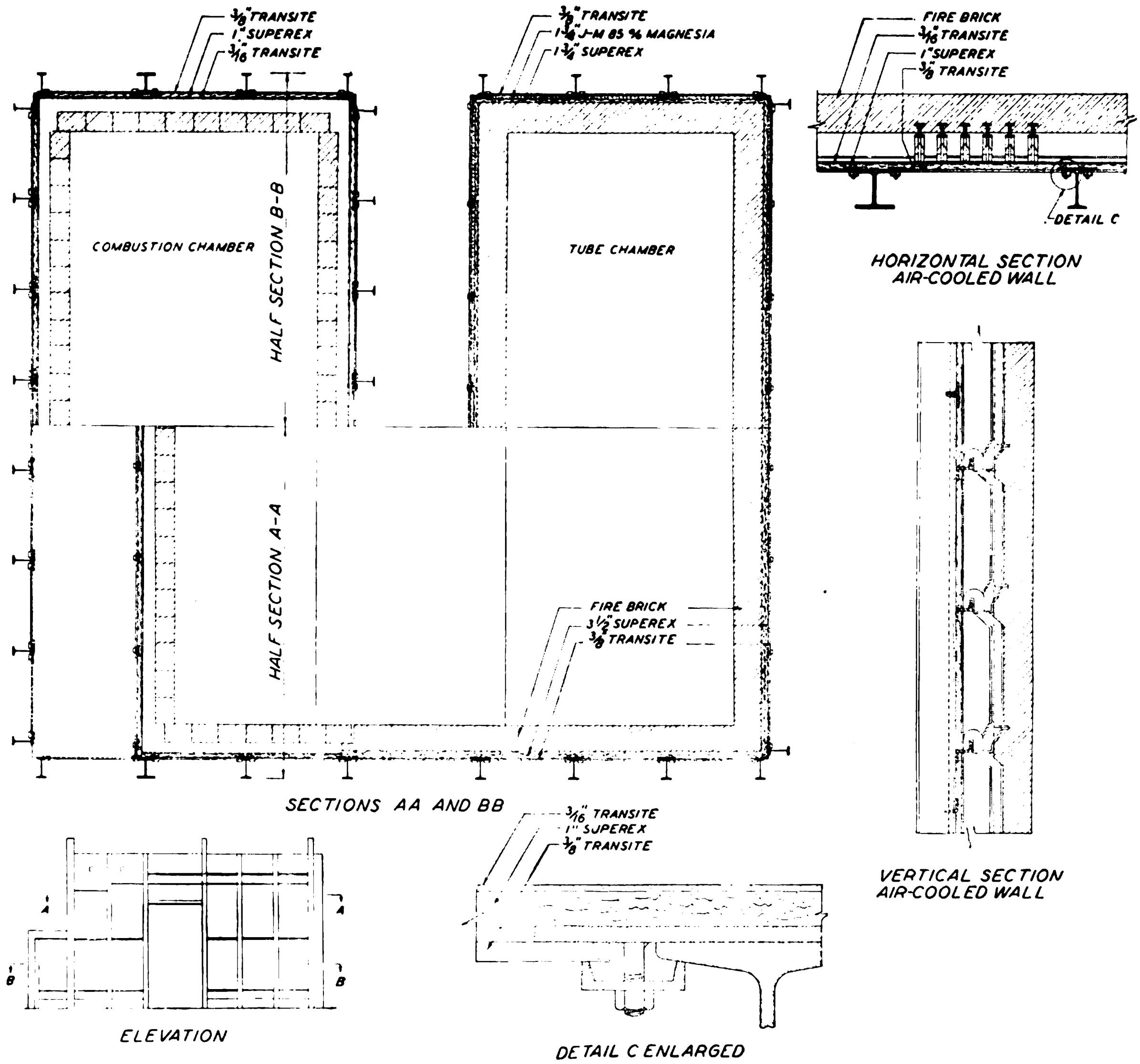
Air-Cooled Walls

Where air-cooled walls are employed on refinery furnaces, it is usual first to erect the exterior casing, then apply insulating blocks on the inside with J-M Fibrous Adhesive and, finally, bolt the inner casing through the insulation to the outer casing. The construction which best meets Oil Industry requirements is made up of 3/8″ flat Transite sheets, 1″ Superex Blocks, and inside panels of 3/16″ flat Transite sheets.

This construction offers superior insulating qualities with minimum thickness. Proper clearance is provided for air travel, with resultant elimination of friction losses and corresponding reduction in power to fans. The Transite casing may be made impervious to air leakage, is fireproof, and will withstand temperatures higher than are ever required of it in practice.



Insulated Transite panels form the casing over airways on the ventilated portions of a setting. On the brick-set portions, the customary Transite-insulation-firebrick construction is used

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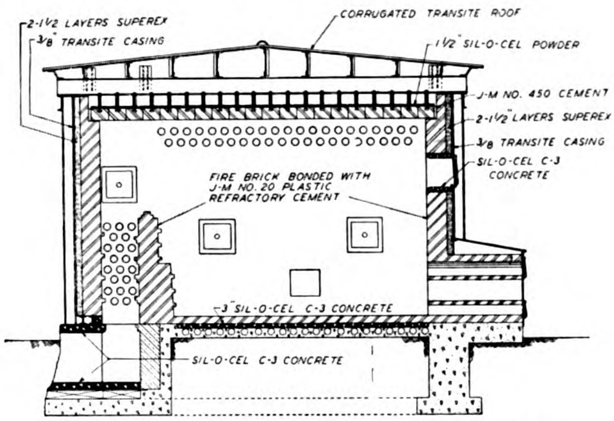
Foundations and Bases

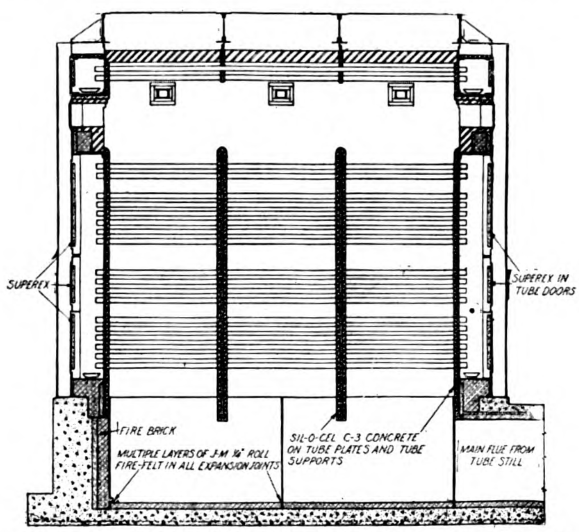
For foundations and bases, Sil-O-Cel C-3 Insulating Concrete has proved highly effective. In all furnace construction, the concrete foundations should be top-surfaced with at least 4″ of C-3 Concrete, covered by one or more layers of fire brick. This insulating material is over three times as effective as fire brick in resisting the passage of heat. It will withstand 1800 deg. F., and has a crushing strength of about 1000 lb. per sq. in.



J-M Materials in Dubbs Process Brick-Set Radiant Heat Furnace

Tube Plates, Supports and Doors

Sil-O-Cel C-3 Concrete is often used to protect metal work on tube plates and tube supports and for the insulation of tube doors. Super Fire-Felt Sheets, 2″ thick, may also be used to insulate tube doors, and are secured in place by plate washers which are fastened by bolts running through the insulation and the door. The exposed surface of the Super Fire-Felt is protected by ¼″ J-M No. 101-S Asbestos Sheet Millboard, or by ¾″ J-M No. 319 Semi-Refractory Cement. Superex Blocks, 2″ thick, are often used instead of Super Fire-Felt and are held in place by band iron and finished with ¾″ J-M No. 319 Semi-Refractory Cement.



Section through tube bank of Winkler-Koch tube still, showing use of Sil-O-Cel C-3 Concrete in tube plates and supports

Underground flue insulated with two 1½″ layers of Superex between 9″ of fire brick and concrete outer wall

Furnace Expansion Joints

All expansion joints are made twice as wide as the maximum expected amount of expansion. The joints are packed either with J-M No. 4200 Asbestos Rope or J-M Asbestos Jelly-Rolls, using No. 4200 Rope to 1″ in diameter and Jelly-Rolls for larger spaces. On the furnace side of the expansion joint, it is usual to force J-M No. 352 Insulating Cement into the crevices over the packing material.

The use of J-M RX Fibre is often convenient to fill the interstices between or beside Jelly-Rolls with a resilient material.

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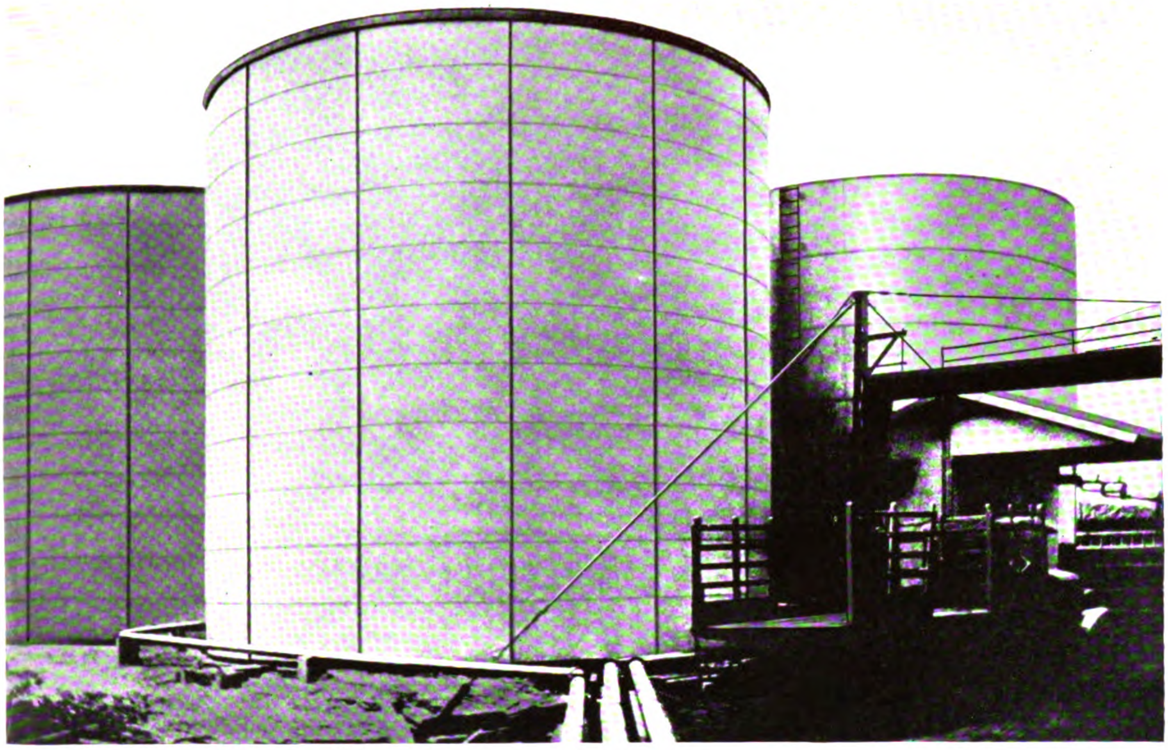
Insulation of Hot Tanks



Hot tanks, J-M insulated and cased with flat Transite

Vertical steel tanks, operating at temperatures between 100 and 600 deg. F., are insulated with J-M 85% Magnesia Blocks on the roof, and Magnesia Blocks or Banroc Blankets on the side walls.

The proper thickness of insulation to use on tank sides varies according to the maximum temperature. The following thicknesses are recommended for ordinary conditions:

Temperature, deg. F.	Shell Insulation, Thickness
100 to 300	2 inches
300 to 400	2½ "
400 to 500	3 "
500 to 600	*3½ "

*When Banroc Blankets are used for temperatures from 500 to 600 deg. F., the insulation on the side wall should be 4″ thick (a standard thickness), while the Magnesia on the roof should be 3″ thick.

Roof insulation thickness is ordinarily ½″ less than that on the shell.

Before any insulation is applied, the tank should be prepared for insulating, and the curb cleaned and then flooded with hot J-M Standard Roofing Asphalt 225.

During erection, care should be taken to prevent damage to the insulation by weather, before it is protected by the waterproofing or casing.

Side Wall Insulation

Magnesia Blocks:

J-M 85% Magnesia Blocks are applied vertically, attached to the tank side with J-M Fibrous Adhesive, and each course further secured by two circumferential turns of ¾″ x .020″ Signode straps. Horizontal joints of 85% Magnesia Blocks are staggered and all open joints, cracks, etc., sealed with J-M No. 302 Insulating Cement. All blocks should be closely butted, except where a Transite casing is to be used, when a space between blocks is left at 48¼″ intervals to receive angle irons, to every alternate one of which the Transite casing is later attached.

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When a Transite casing is used, the Signode straps which hold the blocks are applied after the angles are erected. One ply of J-M 15-lb. Asbestos Waterproofing Felt is applied vertically over the insulation and temporarily fastened with double-pointed tacks, all laps being at least 3″ and sealed with J-M Lap Cement. One turn of Signode strap drawn tight around the top, one around the middle, and one around the bottom of the tank side furnish additional support for the felt.

To alternate angle iron studs, Transite sheets, 42″ x 96″, are then secured by battens to bolts previously spot-welded in place on the angles. The Transite sheets are laid horizontally and fastened to each other by clamps previously bolted onto the top of each course of sheets. The vertical battens consist of galvanized or painted channel irons. The junction of the casing and the curb is pointed up with J-M Aertite Coating or J-M Ready-Mixed Asbestile.

As an alternate side wall finish, J-M No. 302 Insulating Cement mixed with one-third portland cement by weight, may be applied over 1½″ hexagonal mesh galvanized wire netting, and the whole then waterproofed with a ¼″ application of Insulkote. On indoor tanks the cement is applied in two coats and Insulkote may be omitted. Insulkote may be painted with aluminum paint if desired.

Banroc Blankets:

J-M No. 102-R Banroc Blankets, furnished with a heavy waterproof felt under the wire mesh on one side, are used where an Insulkote finish is desired. When a Transite casing is to be erected, J-M No. 102 Banroc Blankets, without the waterproof felt, are used. The blankets are furnished 24″ x 96″ and are applied vertically to the side walls by hoisting them into position on a temporary ⅜″ cable stretched around the tank. Each course is permanently held in place by four circumferential turns of ¾″ x .020″ Signode straps.

No. 102-R Banroc Blankets (with felt surface exposed) are tightly butted, the joints covered with 6″ strips of J-M Medium Pilot Roofing and securely laced. The finish consists of J-M No. 302 Insulating Cement mixed with one-third portland cement by weight, and waterproofed with Insulkote, applied ¼″ thick.

No. 102 Banroc Blankets are applied with vertical spaces left between alternate rows of blankets, in which spaces are placed angle iron studs, with necessary bolts spot-welded on proper centers. Other joints are tightly butted and laced. The exterior casing of Transite is erected as described for Magnesia Block Insulation.

Roof Insulation

J-M 85% Magnesia Blocks are applied to the tank roof with Fibrous Adhesive. Two coats of J-M No. 302 Insulating Cement, mixed with one-third portland cement by weight, are then applied over the roof and extended to a point on the side wall at least 9″ below the eave angle. When the cement is dry it is coated with J-M Concrete Primer. Two layers of J-M Asphalt-Saturated Fabric are cemented with hot asphalt over the eaves, over-lapping roof and side wall at least 9″ in each direction. J-M 15-lb. Asbestos Waterproofing Felt is then applied over the entire roof, lapped 17″ to form a 2-ply protection and laid in J-M Standard Roofing Asphalt 225.

J-M Salamander White Top Roofing is solidly hot-mopped over the entire roof as a finish. All joints should be closely butted and sealed with J-M Aertite Coating applied over J-M Concrete Primer. It is preferable to carry the black felts over the eaves and secure them in place on the side walls with one turn of Signode straps. Around the rim of the eaves and around projections, Aertite is troweled to a smooth finish. All felts are neatly fitted and flashed around manhole neck and vent pipe.

If a black finish is desired, three plies of J-M 15-lb. Asbestos Waterproofing Felt (instead of two) may be used with a top coating of asphalt, the Salamander being omitted.

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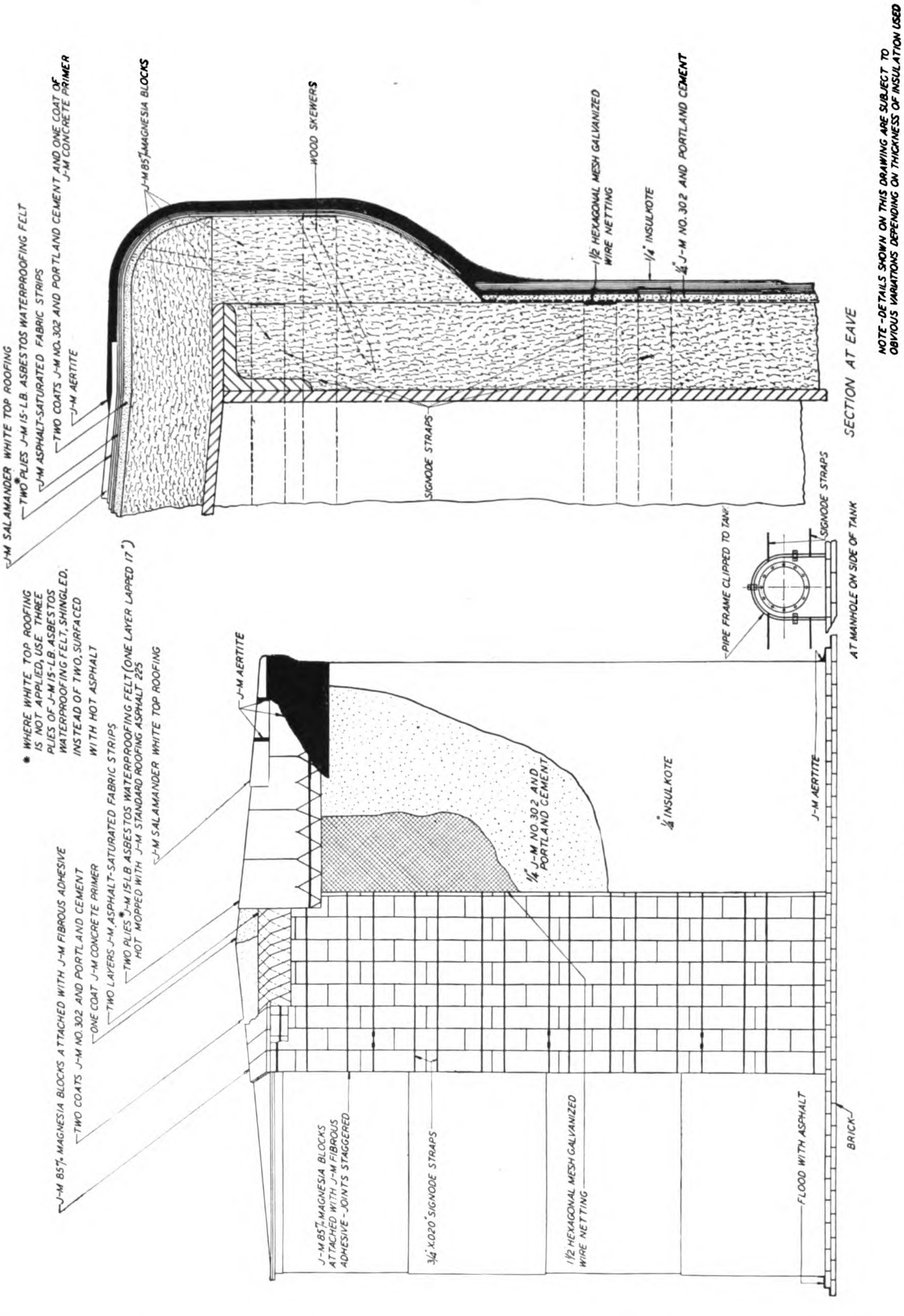

J-M 85% Magnesia with Insulkote finish on vertical steel tank

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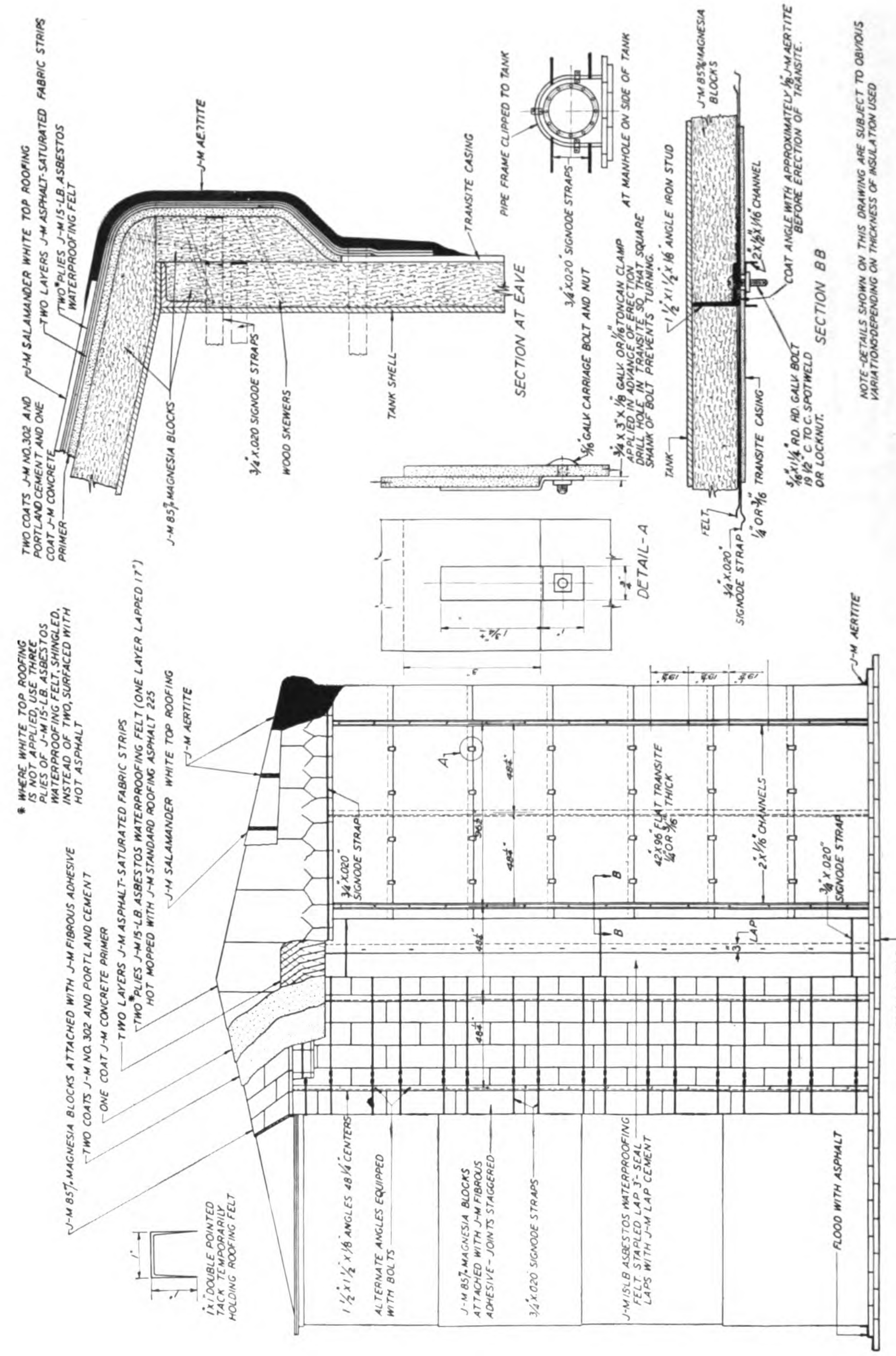

J-M 85% Magnesia with Transite casing on vertical steel tank

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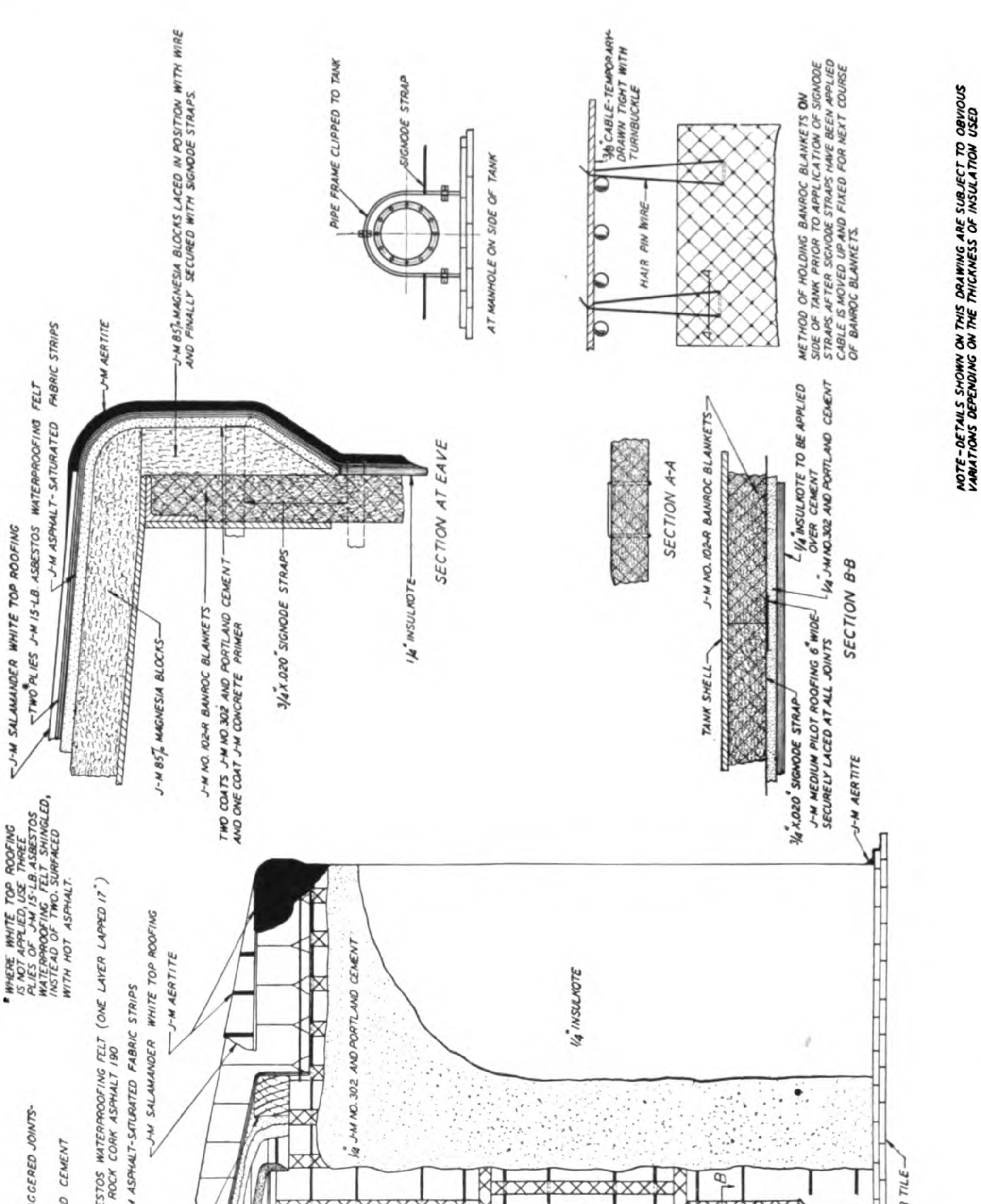

J-M No. 102-R Banroc Blankets with Insulkote finish on vertical steel tank

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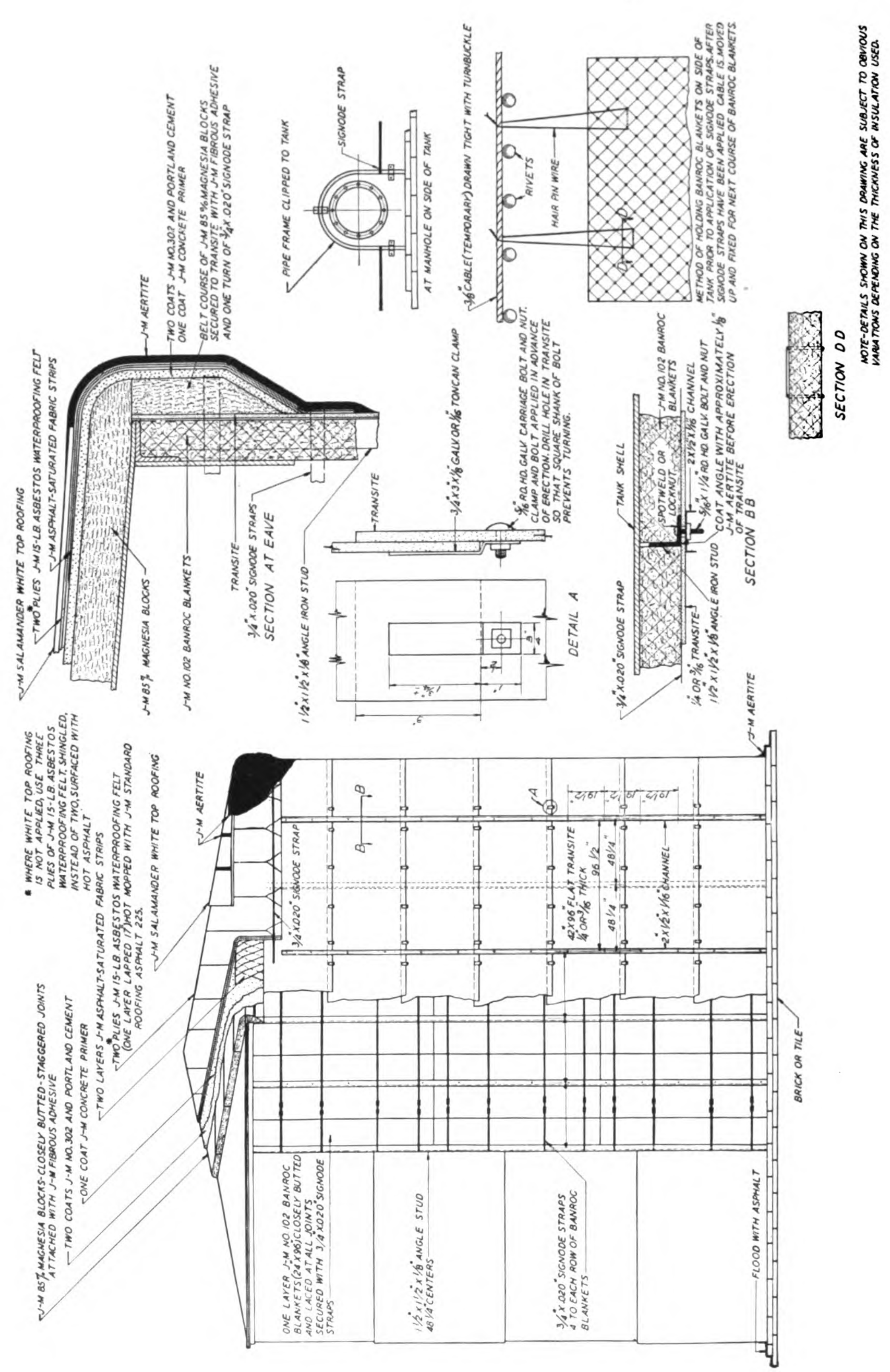

J-M No. 102 Banroc Blankets with Transite casing on vertical steel tank

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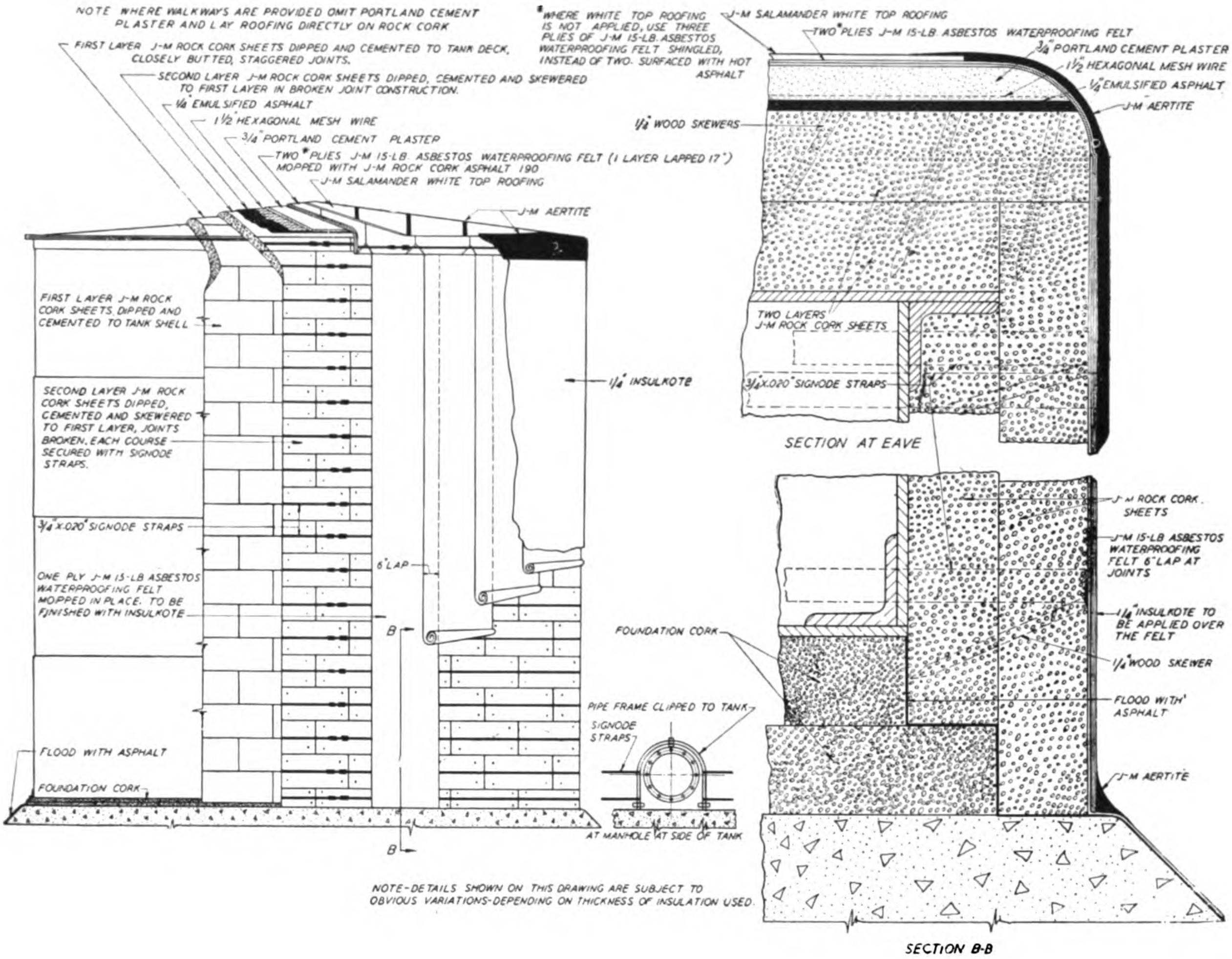
Insulation of Cold Tanks



J-M Rock Cork Sheets with Insulkote finish on vertical steel tank 20 ft., or larger, in diameter

Vertical steel tanks operating at temperatures between minus 60 and plus 100 deg. F. are insulated with J-M Rock Cork insulation on side walls and roofs in the following thicknesses:

Temperature, deg. F.	Insulation Thickness
—60 to —40	12″ in 3 layers
—40 to —25	10″ in 3 "
—25 to —15	8″ in 2 "
—15 to 0	7″ in 2 "
0 to 15	6″ in 2 "
15 to 25	5″ in 2 "
25 to 40	4″ in 1 layer
40 to 50	3″ in 1 "
Above 50	2″ in 1 "

Roof insulation on cold tanks is usually the same thickness as that on the shell.

Before any insulation is applied, the tank should be prepared for insulating, and the curb cleaned and then flooded with hot J-M Rock Cork Asphalt 190.

During erection, care should be taken to prevent damage to the insulation by weather, before it is protected by the waterproofing or casing.

Side Wall Insulation

Tanks at temperatures down to minus 60 deg. F. are insulated with J-M Rock Cork Sheets with either an Insulkote finish or Transite casing. If the tank is less than 20 ft. in diameter, J-M Rock Cork Lags are used, with a finish of Insulkote.

J-M Rock Cork Sheets are applied horizontally to the side wall of the tank after dipping one face of the

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sheets in hot J-M Rock Cork Asphalt 190, and are further secured by one circumferential turn of ¾″ x .020″ Signode strap to each course of sheets. When the tank is less than 20 ft. in diameter and Rock Cork Lags are used, the lags are applied vertically with two circumferential turns of Signode straps on each course of lags.

If more than one layer of sheets is required, the second, and each subsequent layer, is secured to the previous layer by wood skewers, four to a sheet, driven at an angle, in addition to cementing with hot asphalt. When two or more layers are used, the Signode straps are applied over the outer layer of Rock Cork Sheets only.

At the base of the tank, the side wall insulation sheets are cemented to the foundation cork with hot J-M Rock Cork Asphalt 190, in broken joint construction.

Over the Rock Cork Sheets and Signode straps, one ply of J-M 15-lb. Asbestos Waterproofing Felt, lapped 6″, is solidly hot-mopped with J-M Rock Cork Asphalt 190, the felt being carried down over the curb.

Insulkote Finish: For a finish, ¼″ of J-M Insulkote is applied and troweled over the felt to a smooth surface. The junction of the Insulkote and the curb should be coated with J-M Aertite Coating or J-M Ready-Mixed Asbestile. The Insulkote may be painted with aluminum paint if desired.

Transite Casing: When a Transite casing is to be used, over the completed side wall insulation is erected a skeleton wood frame of ⅞″ x 3″ wood studs on 48¼″ centers. Signode straps will prove convenient in maintaining the studs in position while the framework is being completed. Horizontal wood furring strips and vertical filler strips, each ⅞″ x 6″, are nailed to the studding. The lower part of all framework should be hot-mopped before erection with J-M Rock Cork Asphalt 190 to a point as high as the top of the base course of Transite sheets.

To this frame is secured a housing of 42″ x 96″ Transite sheets. The bottom course is coated on the inner side with J-M Rock Cork Asphalt 190, embedded in J-M Aertite Coating or J-M Ready-Mixed Asbestile at the junction with the curb, and screwed to the base furring strip. Succeeding courses of Transite sheets are attached to the frame at 6″ intervals by galvanized hook nails with the hooks projecting onto the sheets, and the sheets further secured to each other by clamps bolted to the top edge of each course before erection. The vertical joints are covered by galvanized or painted channel irons, screwed to the studs.

Roof Insulation

The roofs of tanks at temperatures down to minus 60 deg. F. are insulated with J-M Rock Cork Sheets, usually to the same thickness as that on the side wall. The sheets are dipped on one face in hot J-M Rock Cork Asphalt 190 in the same manner as on the side wall; and the second, and each succeeding layer, additionally secured to the preceding layer with wood skewers. All joints should be closely butted and staggered. Each layer should extend over the eaves, to join with the side wall insulation.

Unless walkways are provided, the Rock Cork is coated with emulsified asphalt, over which is stretched 1½″ hexagonal mesh galvanized wire netting, covered by ¾″ portland cement plaster of 1:3 mix. Where walkways are provided, the emulsified asphalt, wire netting and portland cement plaster are omitted.

Over the portland cement plaster or directly on the Rock Cork Sheets, as the case may be, J-M 15-lb Asbestos Waterproofing Felt is solidly hot-mopped with J-M Rock Cork Asphalt 190, lapped 17″ to provide a two-ply protection. The felts should be carried over the eave, lapping 6″ or more over the side wall construction, and be secured around the tank below the eave angle with one circumferential turn of ¾″ x .020″ Signode strap over the outer ply.

Over the 15-lb. felt, one layer of J-M Salamander White Top Roofing is hot-mopped in J-M Rock Cork Asphalt 190, with all edges closely butted and extending to within 3″ of the rim of the tank roof.

On all joints of the Salamander White Top Roofing, and around manhole neck and other projections, J-M Concrete Primer is applied, followed by J-M Aertite Coating. The exposed 15-lb. felt at the eaves is thickly coated with Aertite.

If a black finish is desired, the Salamander White Top Roofing is omitted and three plies of J-M 15-lb. Asbestos Waterproofing Felt (one layer, shingled with 22″ lap) are used instead of the two plies called for above. The top surface is given a mopping of hot J-M Rock Cork Asphalt 190.

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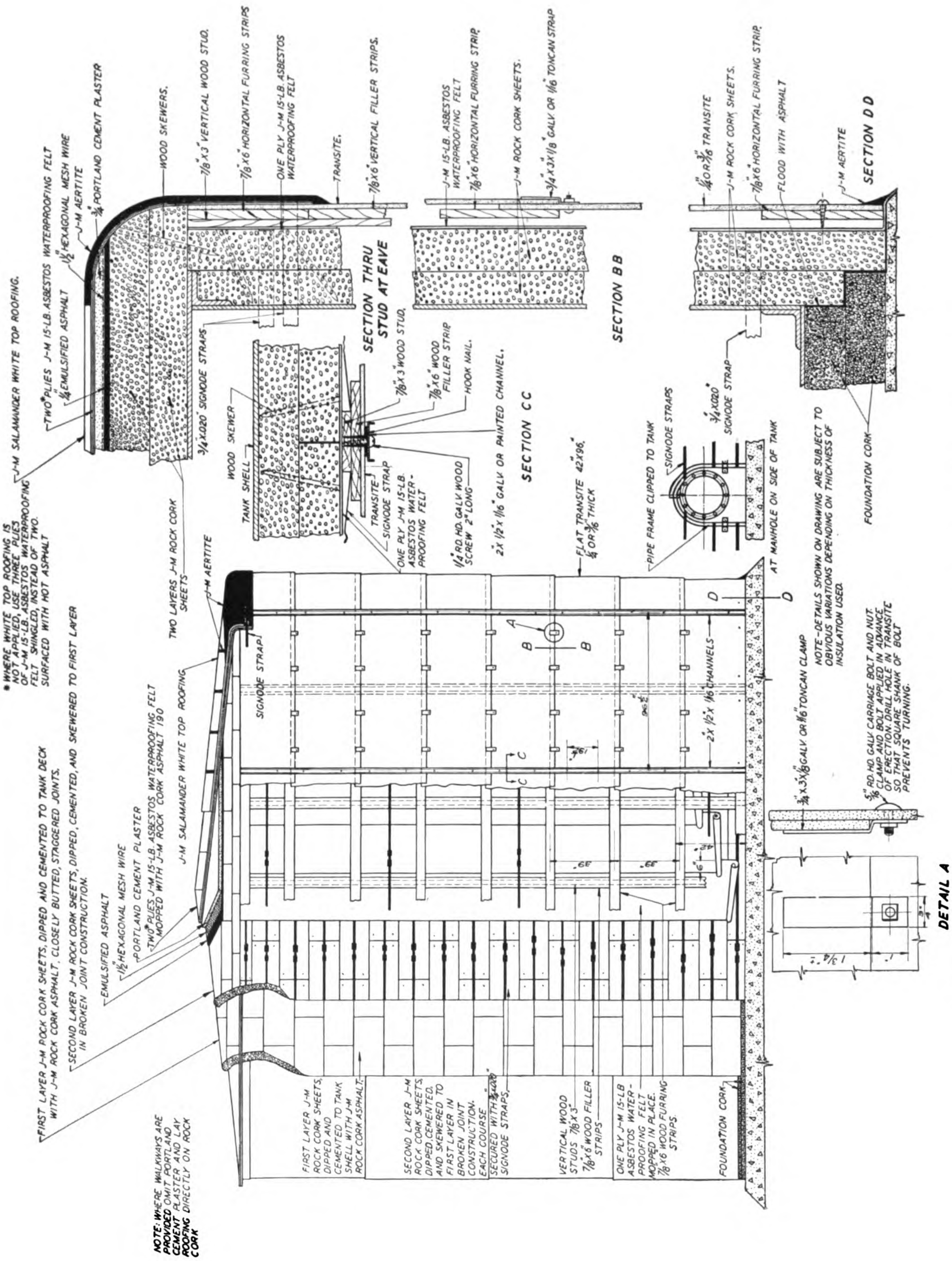

J-M Rock Cork Sheets with Transite casing on vertical steel tank 20 ft., or larger, in diameter

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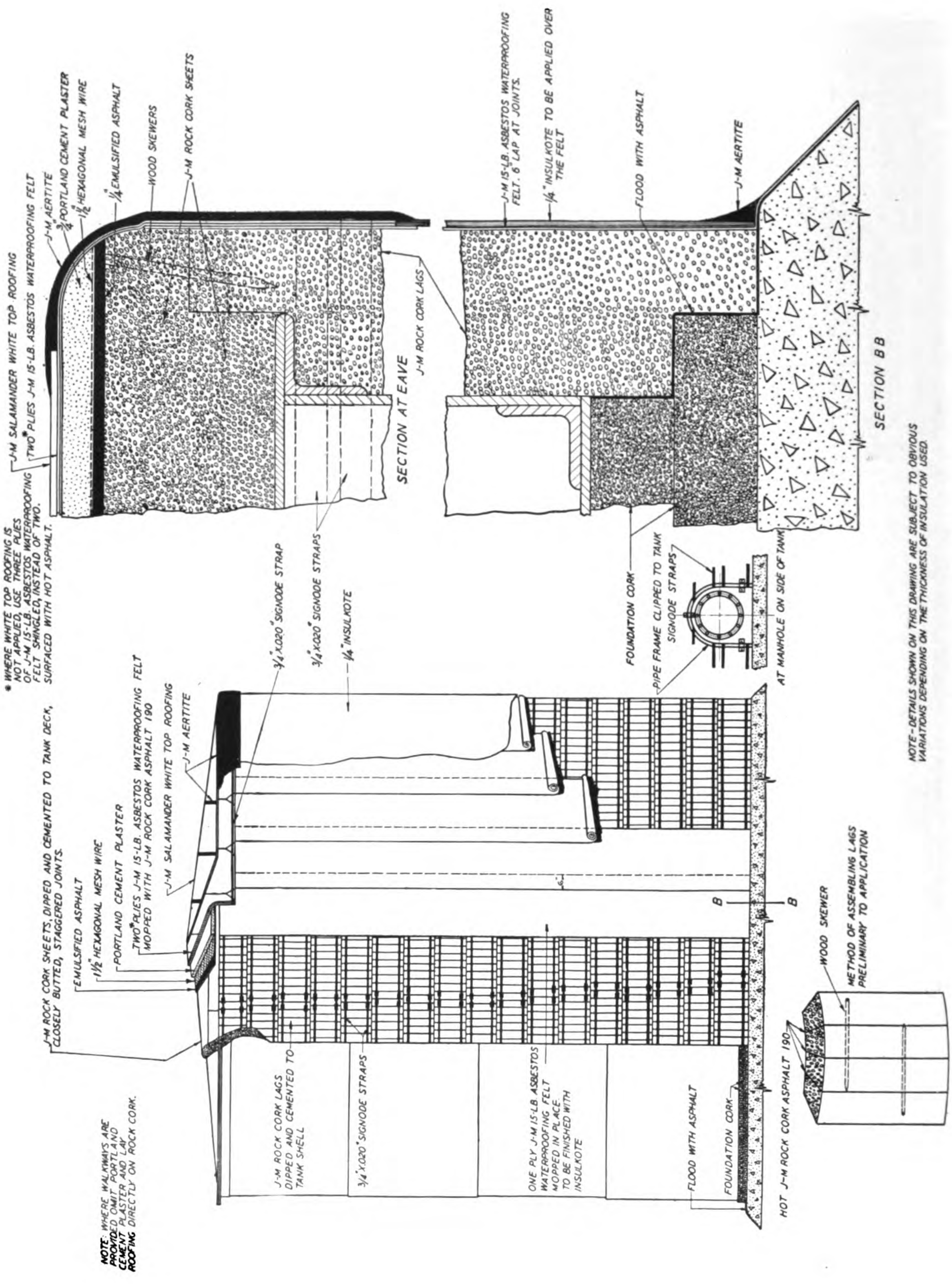

J-M Rock Cork Lags with Insulkote finish on vertical steel tank less than 20 ft. in diameter

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Efficiency of Insulation

The efficiency of an insulation is obtained by subtracting the heat loss through the insulation from the heat loss of the uninsulated surface and dividing the difference by the heat loss of the uninsulated surface.

The common unit of heat is the B.t.u. (British thermal unit), which is the quantity of heat required to raise the temperature of one pound of water 1 deg. F., or, to be more exact, a B.t.u. is 1/180 of the heat required to raise the temperature of a pound of pure water from 32 deg. F. to 212 deg. F.

Heat Transmission:

Heat transmission is usually expressed in B.t.u. per square foot, or per linear foot, per degree temperature difference, per hour. The term "conductivity" is often used erroneously where "heat transmission" or "heat loss" is meant.

Conductivity:

Conductivity, like density, is a specific property of a material. Conductivity is usually expressed in B.t.u. per square foot, per 1″ of thickness, per degree temperature difference between surfaces, per hour. However, it is not necessary to have exactly 1″ thick material in order to express its conductivity per inch thick.

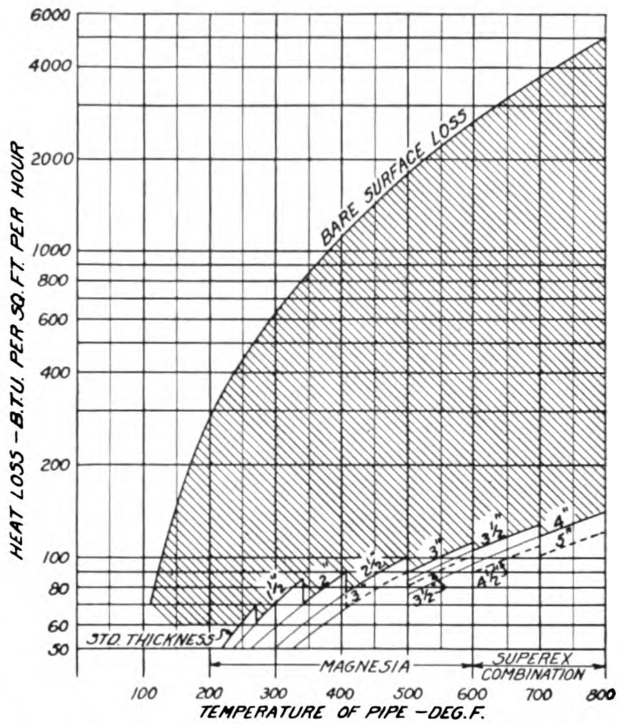
The *rate of heat transmission* is much *less* for a thick layer of a material than it is for a thin layer of the same material, but the *conductivity* is the *same*. This illustrates why the terms "conductivity" and "heat transmission" can not be used interchangeably.

Condensation in Steam Pipes:

Loss of heat from a pipe containing saturated steam does not result in a change in temperature, but causes the condensation of a portion of the steam. In order to determine the amount of condensation it is necessary to divide the total heat loss by the latent heat of evaporation (found in the steam tables).

For example, it will be noted from the steam tables that at 100-lb. gauge pressure the latent heat of evaporation is 879.9 B.t.u. This means, at 100-lb. steam pressure, 1 lb. of condensation for each 879.9 B.t.u. lost.

In case of superheated steam, the loss of heat results in a lowering of the temperature or loss of superheat. Condensation, in the case of superheated



Heat losses through Magnesia and through Superex Combination Insulation, on 8″ pipe, compared with bare pipe losses

steam lines, will not take place until all of the superheat has been dissipated.

Effect of Wind Velocity:

With a 10-mile per hour wind velocity the heat loss from bare pipe will be over twice as great as in still air. Higher velocities increase the loss still further.

On pipes covered with efficient insulation, the maximum increase in heat loss due to a wind velocity of 10 miles per hour is about 30% for 1″ thick insulation, 20% for 2″ thick insulation and 10% for 3″ thick insulation. At lower velocities there would be a correspondingly lesser effect.

The heat losses and efficiencies shown in data sheet tables are based on still air conditions. The increase in loss from an insulated pipe due to wind velocity is very small compared to the increase in loss from bare pipes, and the thicker the insulation the less the effect of wind in increasing the loss. But, if joints are open or insulation is cracked, so air can circulate, the increase in losses may be many times as great.

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Efficiency Tables

The efficiencies of pipe insulations vary with the size of the pipe insulated and with the temperature difference between the pipe and air surrounding the pipe.

The efficiencies furnish a means of comparing the savings effected by insulation, with bare pipe losses.

Also the relative values of different insulations may be determined by comparing either their efficiencies or their heat losses. A small difference in efficiency may represent a really large difference in heat losses. The following example will explain further:

The efficiency of 2″ thick Asbesto-Sponge Felted sheet insulation at 500 deg. temperature difference is 95.29% and of the same insulation 3″ thick, 96.75%. The difference in efficiencies is only 1.46%, which seems small and might lead one to believe that it would not pay to use the extra inch of thickness.

However, the loss through the 95.29% efficient insulation is 4.71% of the bare surface loss and the loss through the 96.75% efficient insulation is only 3.25% of the bare surface loss. The difference is 4.71% — 3.25% = 1.46%. Therefore, the loss through the 2″ thickness is 1.46 ÷ 3.25=44.9% greater than the loss through the 3″ thick insulation.

Tables of efficiencies of the different insulations on various sized pipes and on flat surfaces at various temperature differences are given in the data sheets on the respective insulations. Such efficiency tables are used as follows:

Example 1:

What is the *efficiency* of J-M Asbesto-Sponge Felted pipe insulation, 2″ thick, on a 6″ pipe conveying steam at 200 lb. gauge pressure through a room where temperature is 70 deg. F.?

To determine the difference between the temperature of steam in the pipe and the temperature of air surrounding the pipe, refer to the steam tables, where the temperature of steam at 200-lb. pressure is found to be 388 deg. F. The temperature of air around the pipe is the room temperature given, 70 deg. F. Therefore, the temperature difference is 318 deg. F.

Next refer to table of efficiencies for 2″ thick Asbesto-Sponge Felted Pipe Insulation. Opposite 6″ pipe size, the efficiency for 350 deg. F. difference is found to be 92.56% and for 300 deg. F. difference, 91.93%. The difference for 50 deg. F. is therefore, .63%.

If difference for 50 deg. F. = 0.63%, then for 1 deg., the difference is .63 ÷ 50 = .0126%. The temperature difference (318 deg.) is 18 deg. more than 300 deg.; so 18 x .0126 = .227%, which, added to 91.93% (efficiency for 300 deg.) = 92.16%, the required efficiency.

Example 2:

To find exactly *how much heat is saved* by applying this 2″ insulation, proceed as follows:

By referring to table giving total heat loss in B.t.u. per linear foot of bare pipe, opposite 6″ pipe size and under 300 deg. difference, the heat loss is found to be 1694.9 B.t.u. per hour. Under 350 deg. difference the loss is 2198.7 B.t.u. The difference in loss for the 50 deg. in temperature difference is 2198.7 — 1694.9=503.8 B.t.u. So, for 1 deg. difference, it is 503.8 ÷ 50 = 10.08 B.t.u.

The temperature difference (318 deg.) is 18 deg. more than 300 deg., so 18 x 10.08 = 181.4 B.t.u., which, added to 1694.9 (heat loss at 300 deg. difference) = 1876.3 B.t.u., the required total heat loss from 1 lin. ft. of 6″ bare pipe, per hour.

Having obtained the loss for bare pipe, the saving effected by the 2″ Asbesto-Sponge Felted Insulation is obtained by multiplying the total loss, 1876.3 B.t.u., by the efficiency of the insulation, previously found according to Example 1, as 92.16%, or 92.16% x 1876.3 = 1729.2 B.t.u. saved, per lin. ft. per hour, by the insulation.

This result may be compared with the quantities of heat saved by other types or thicknesses of pipe insulation, which quantities may be obtained in similar manner to the above.

Example 3:

If the *heat loss* through this 2″ thick insulation is to be determined, proceed as follows:

Find the efficiency, as outlined in Example 1, which is 92.16%. If the insulation is 92.16% efficient, the per cent bare surface loss which is still lost through insulation is 100 — 92.16 = 7.84%.

Find the bare surface loss, as outlined in Example 2, which is 1876.3 B.t.u. per lin. ft., per hour.

Then the loss through the insulation is 7.84% of 1876.3 B.t.u. = 147.1 B.t.u., per lin. ft., per hour.

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Heat loss from bare surfaces

Temperature differences 50 to 400 deg. F. See other side for higher temperatures.

Losses given in B.t.u. per hour, per linear foot of bare pipe and per square foot of bare flat surface, at various temperature differences.

(For finding losses at temperatures between those shown, the B.t.u. differences per degree are given in light-face type between the main columns)

Temperature difference, deg. Fahr. — Heat loss in B.t.u. per linear ft. per hour

Nominal pipe size, inches	Area of pipe surface per lin. ft., sq. ft.	50°		100°		150°		200°		250°		300°		350°		400°	
½	.220	**21.5**	.52	**47.3**	.64	**79.2**	.76	**117.3**	.90	**162.3**	1.06	**215.2**	1.28	**279.1**	1.52	**355.1**	1.73
¾	.275	**26.8**	.64	**59.0**	.79	**98.6**	.96	**146.8**	1.11	**202.1**	1.33	**268.5**	1.58	**347.6**	1.89	**442.2**	2.20
1	.344	**33.6**	.81	**74.0**	1.00	**123.8**	1.19	**183.4**	1.41	**253.7**	1.67	**336.4**	1.98	**436.5**	2.37	**555.2**	2.71
1¼	.435	**42.5**	1.01	**93.6**	1.26	**156.6**	1.51	**231.9**	1.78	**320.8**	2.09	**425.4**	2.53	**551.9**	3.00	**702.1**	3.42
1½	.498	**48.7**	1.17	**107.2**	1.44	**179.3**	1.72	**265.4**	2.04	**367.3**	2.39	**487.0**	2.90	**631.8**	3.44	**803.8**	3.92
2	.622	**60.9**	1.46	**133.9**	1.80	**223.9**	2.15	**331.5**	*2.54	**458.7**	2.99	**608.3**	3.62	**789.2**	4.29	**1003.9**	4.90
2½	.753	**73.4**	1.76	**161.6**	2.18	**270.4**	2.60	**400.3**	3.07	**553.9**	3.61	**734.5**	4.37	**952.8**	5.19	**1212.1**	5.99
3	.917	**89.6**	2.15	**197.3**	2.66	**330.1**	3.17	**488.8**	3.75	**676.3**	4.41	**896.8**	5.33	**1163.4**	6.33	**1480.0**	7.22
3½	1.047	**102.3**	2.46	**225.3**	3.03	**376.9**	3.62	**558.1**	4.28	**772.2**	5.04	**1024.0**	6.09	**1328.4**	7.23	**1689.9**	8.24
4	1.178	**115.1**	2.77	**253.5**	3.41	**424.2**	4.07	**627.9**	4.82	**868.8**	5.67	**1152.1**	6.85	**1494.6**	8.13	**1901.3**	9.27
4½	1.309	**127.9**	3.07	**281.5**	3.79	**470.9**	4.53	**697.2**	5.35	**964.7**	6.29	**1279.2**	7.61	**1659.5**	9.03	**2111.1**	10.33
5	1.456	**142.2**	3.42	**313.1**	4.21	**523.8**	5.03	**775.5**	5.95	**1073.0**	7.00	**1423.0**	8.46	**1846.0**	10.00	**2348.4**	11.49
6	1.734	**169.4**	4.05	**371.9**	5.04	**623.9**	6.00	**923.7**	7.09	**1278.1**	8.34	**1694.9**	10.10	**2198.7**	12.00	**2797.1**	13.68
7	1.996	**195.0**	4.71	**430.4**	5.79	**720.0**	6.92	**1066.0**	8.19	**1475.6**	9.61	**1956.0**	11.66	**2539.0**	13.78	**3228.0**	15.58
8	2.257	**220.6**	5.30	**485.7**	6.54	**812.5**	7.81	**1203.0**	9.23	**1664.5**	10.80	**2207.3**	13.10	**2863.6**	15.60	**3642.8**	17.76
9	2.519	**246.0**	5.92	**542.0**	7.30	**907.0**	8.72	**1343.0**	10.34	**1860.0**	12.10	**2465.0**	14.70	**3200.0**	17.40	**4070.0**	19.73
10	2.817	**275.4**	6.62	**606.2**	8.16	**1014.1**	9.75	**1501.5**	11.50	**2077.5**	13.60	**2755.0**	16.40	**3574.1**	19.50	**4546.6**	22.17
11	3.073	**300.0**	7.26	**663.0**	8.92	**1109.0**	10.66	**1642.0**	12.60	**2272.0**	14.76	**3010.0**	17.90	**3905.0**	21.30	**4972.0**	23.94
12	3.338	**326.0**	7.86	**719.0**	9.68	**1203.0**	11.54	**1780.0**	13.70	**2465.0**	16.02	**3266.0**	19.40	**4235.0**	23.10	**5390.0**	26.22
14 o.d.	3.663	**357.0**	8.59	**786.0**	10.64	**1318.0**	12.64	**1950.0**	15.00	**2700.0**	17.06	**3580.0**	21.30	**4645.0**	25.20	**5905.0**	28.96
16 o.d.	4.188	**408.0**	9.84	**901.0**	12.20	**1510.0**	14.50	**2233.0**	17.20	**3095.0**	20.10	**4100.0**	24.40	**5320.0**	28.90	**6765.0**	32.84
Flat, curved, or cylindrical surfaces — Heat loss in B.t.u. per sq. ft. per hour		**97.5**	2.35	**215.2**	2.90	**360.0**	3.16	**533.0**	4.10	**737.8**	4.80	**978.0**	5.83	**1269.4**	6.89	**1614.0**	7.87
Heat loss in B.t.u. per sq. ft. per degree temperature difference per hour		**1.950**		**2.152**		**2.400**		**2.665**		**2.951**		**3.260**		**3.627**		**4.035**	

*Example: 2″ pipe, 235° temperature difference; 235° — 200° = 35°; 35° × 2.54 (B.t.u. per degree) = 88.9 B.t.u. 331.5 + 88.9 = 420.4 B.t.u. loss at 235° temperature difference.

See other side for temperature differences from 450 to 800 deg. F.

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HEAT LOSS FROM BARE SURFACES

Temperature differences 450 to 800 deg. F. See other side for lower temperatures.

Losses given in B.t.u. per hour, per linear foot of bare pipe and per square foot of bare flat surface, at various temperature differences.

(For finding losses at temperatures between those shown, the B.t.u. differences per degree are given in light-face type between the main columns)

Nominal pipe size, inches	Area of pipe surface per lin. ft., sq. ft.	450°		500°		550°		600°		650°		700°		750°		800°
		Heat loss in B.t.u. per linear ft. per hour														
½	.220	441.6	1.99	541.2	2.16	650	2.44	772	2.64	904	2.86	1047	3.04	1199	3.30	1364
¾	.275	552.1	2.49	676.5	2.71	812	3.08	966	3.28	1130	3.58	1309	3.82	1500	4.10	1705
1	.344	690.6	3.11	846.2	3.39	1016	3.82	1207	4.12	1413	4.48	1637	4.76	1875	5.14	2132
1¼	.435	873.2	3.94	1070.1	4.30	1285	4.82	1526	5.20	1786	5.72	2071	6.02	2372	6.50	2697
1½	.498	999.7	4.51	1225.1	4.89	1470	5.54	1747	5.94	2044	6.52	2370	6.92	2716	7.38	3085
2	.622	1248.6	5.63	1530.1	6.12	1836	6.92	2182	7.42	2553	8.16	2961	8.58	3390	9.30	3855
2½	.753	1511.6	6.82	1852.4	7.83	2224	8.38	2643	8.98	3092	9.82	3583	10.56	4106	11.24	4668
3	.917	1840.8	8.30	2255.8	9.04	2708	10.20	3218	10.94	3765	11.96	4363	12.74	5000	13.84	5692
3½	1.047	2101.8	9.47	2575.6	10.33	3092	11.64	3674	12.52	4300	13.70	4985	14.50	5710	15.74	6497
4	1.178	2364.8	10.66	2897.9	11.64	3480	13.10	4135	14.10	4840	15.40	5610	16.28	6424	17.72	7310
4½	1.309	2627.8	11.85	3220.1	12.92	3866	14.58	4595	15.70	5380	17.00	6230	18.20	7140	19.60	8120
5	1.456	2922.9	13.18	3581.8	14.36	4300	16.20	5110	17.40	5980	19.00	6930	20.20	7940	21.80	9030
6	1.734	3480.9	15.69	4265.6	17.12	5122	19.20	6082	20.76	7120	22.68	8254	24.02	9455	25.90	10750
7	1.996	4006.9	18.07	4910.2	19.69	5895	22.20	7005	23.90	8200	26.00	9500	27.80	10890	29.70	12375
8	2.257	4530.8	20.43	5552.2	22.29	6667	25.06	7920	27.00	9270	29.60	10740	31.00	12300	33.80	13990
9	2.519	5056.8	22.79	6196.7	26.86	7440	28.00	8840	30.00	10340	33.00	11990	34.80	13730	37.80	15620
10	2.817	5655.0	25.49	6929.8	27.80	8320	31.40	9890	33.40	11560	37.00	13410	38.80	15350	42.20	17460
11	3.073	6168.9	27.81	7559.6	30.41	9080	34.20	10790	36.60	12620	40.20	14630	42.40	16750	46.00	19050
12	3.338	6700.9	30.21	8211.5	32.97	9860	37.00	11710	40.00	13710	43.60	15890	46.20	18200	49.80	20690
14 o. d.	3.663	7353.3	33.15	9011.0	36.18	10820	40.60	12850	43.80	15040	47.80	17430	50.40	19950	55.00	22700
16 o. d.	4.188	8407.2	37.91	10302.5	41.15	12360	46.60	14690	50.20	17200	54.80	19940	57.60	22820	62.80	25960
Flat, curved, or cylindrical surfaces	Heat loss in B.t.u. per sq. ft. per hour	2007.5	9.05	2460.0	9.87	2953.5	11.2	3510.0	11.96	4108.0	13.04	4760.0	13.85	5452.5	14.95	6200.0
	Heat loss in B.t.u. per sq. ft. per degree temperature difference per hour	4.461		4.920		5.370		5.850		6.320		6.800		7.270		7.750

See other side for temperature differences from 50 to 400 deg. F.

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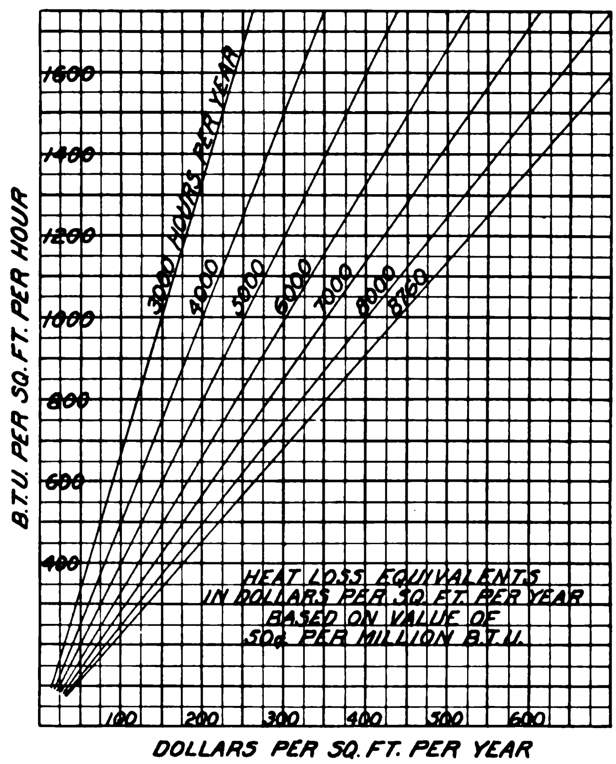
Coal waste due to heat loss from uninsulated surfaces

Steam pressure	Temperature (deg. F.)	Temp. Diff. (deg. F.)	B.t.u. Loss per sq. ft. per hour	Coal Wasted, lb. per sq. ft. per year	Area in sq. ft. wasting 1 ton coal in 1 year
0	100	30	56.6	49.6	40.3
0	120	50	97.5	85.4	23.4
0	140	70	112	124.3	16.1
0	160	90	190	166.3	12.03
0	180	110	242	212	9.44
0	200	130	298.5	261.5	7.65
0	212	142	334	293	6.82
10	240	170	425	372	5.38
25	267	197	522.5	458	4.37
50	298	228	644	564	3.55
75	320	250	737.5	646	3.10
100	338	268	820	718	2.79
150	366	296	960	840	2.38
200	388	318	1,079	945	2.12
250	406	336	1,184	1,036	1.93

Above figures involving waste of coal are based on 10,000 B.t.u. available per pound of coal, equivalent to a boiler efficiency of 70% using coal with an assumed heat value of about 14,000 B.t.u. per pound.

These figures are very conservative, as both the boiler efficiency and the heat value of the coal are high—a lesser boiler efficiency or inferior grade of coal would show even greater waste of fuel.

The figures are based also on continuous service, 24 hours per day, 365 days per year. The temperature of surrounding air is assumed to be 70 deg. F.



Cost of heat loss per sq. ft., per year

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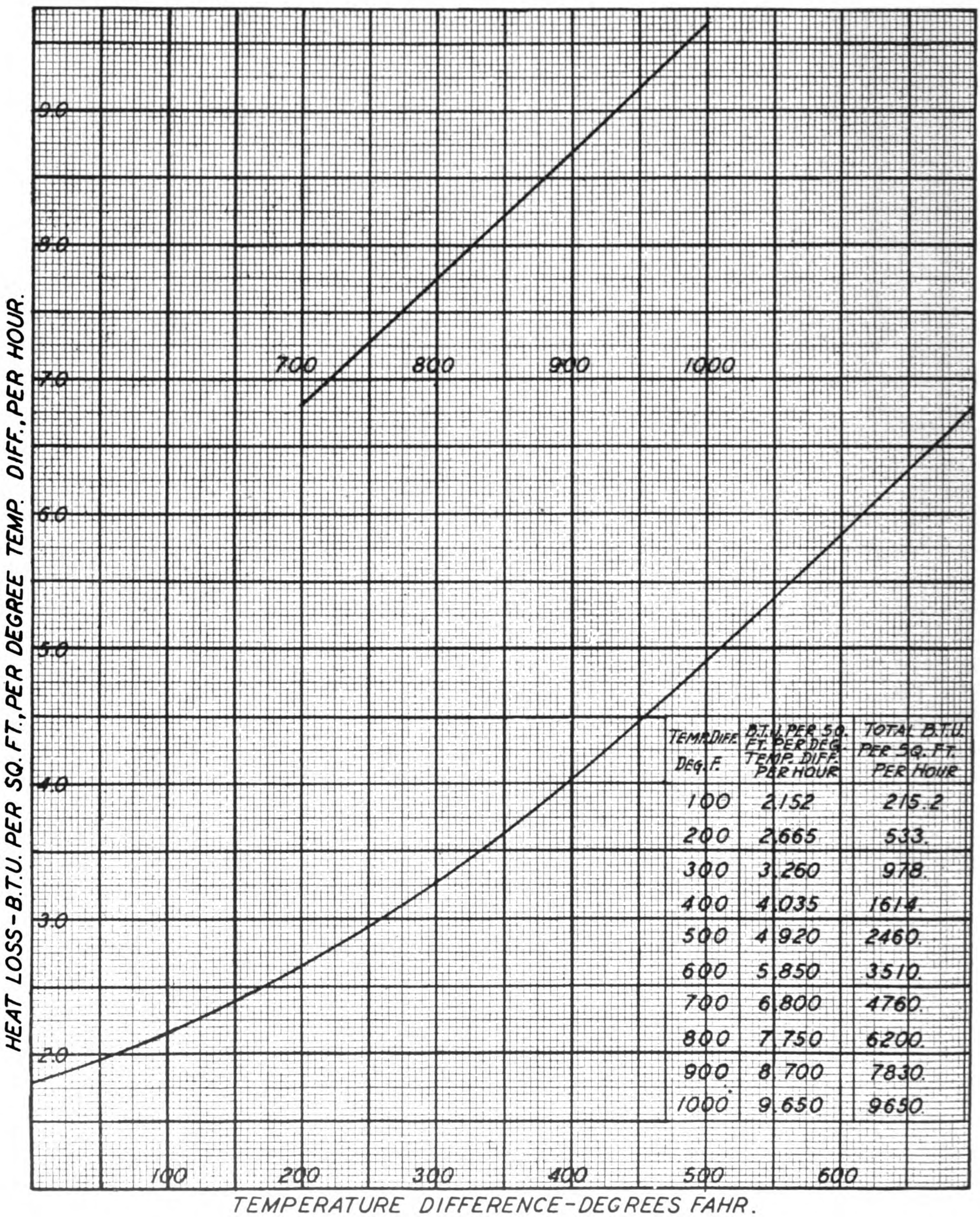
Bare surface losses in still air



TEMP. DIFF. DEG. F.	B.T.U. PER SQ. FT. PER DEG. TEMP. DIFF. PER HOUR	TOTAL B.T.U. PER SQ. FT. PER HOUR
100	2.152	215.2
200	2.665	533.
300	3.260	978.
400	4.035	1614.
500	4.920	2460.
600	5.850	3510.
700	6.800	4760.
800	7.750	6200.
900	8.700	7830.
1000	9.650	9650.

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Johns-Manville Packing Recommendations

Johns-Manville Packings have been developed to meet, with dependability and economy, all types of industrial packing service.

Among the J-M packings which have become standard through their widespread use are Sea Rings, an automatic packing for reciprocating rods, with a record for durability under severe service, Kearsarge for steam, Semi-Metallic for a more resilent metallic packing, Centripac for centrifugals, Mogul for small packing space and valve stems, Service Sheet for any flange, J-M Flax for hydraulic equipment. Every packing requirement is met by some J-M Packing designed for that purpose.

Coupled with the mechanical excellence of the packing is the service afforded by over 400 convenient distribution points.

Recommendations for specific applications of the various J-M Packings are given below.

NOTE: First material listed for each given condition is best recommendation for that service. For special or unusual conditions consult Johns-Manville.

SERVICE	*Rod, Outside-Packed Plunger and Valve Stem Packing*			
	Reciprocating Rods and Plungers		*Centrifugal and Oscillating Rods*	*Valve Stems*
	Large Packing Space	*Small Packing Space*		
Steam Over 500° F.	#5 High Temperature #6 Rajah #789 Thermo, lubricated and graphited	#5 High Temperature #6 or #2 Rajah #789 Thermo, lubricated and graphited	#5 High Temperature #6 Rajah #789 Thermo, lubricated and graphited	#5 High Temperature #2 or #6 Rajah #789 Thermo, lubricated and graphited
Steam 350° to 500° F.	#166 Kearsarge #32 Universal Rod #6 Rajah #90 K. U.	#6 or #2 Rajah #223 or #222 Mogul	#7 or #11 Centripac #350 Semi-Metallic #223 or #222 Mogul #166 Kearsarge (oscillating only)	#2 or #6 Rajah #222 or #223 Mogul #193 Mogul
Steam Under 350° F.	#166 Kearsarge #32 Universal Rod #6 Rajah #10 Jewett #90 K. U. #223 or #222 Mogul #183 High Pressure Diagonal #184 Low Pressure Diagonal #271 Cross Diagonal #171 Duro	#223 or #222 Mogul #6 or #2 Rajah #10 Jewett	#7 or #11 Centripac #350 Semi-Metallic #223 or #222 Mogul #10 Jewett #166 Kearsarge (oscillating only)	#222 or #223 Mogul #2 or #6 Rajah #10 Jewett #193 Mogul
Water—Hot	#271 Cross Diagonal #32 Universal Rod #10 Jewett #90 K. U. Combinations of above	#6 or #2 Rajah #10 Jewett #223 or #222 Mogul	#7 or #11 Centripac #350 Semi-Metallic #223 or #222 Mogul #10 Jewett	#222 or #223 Mogul #10 Jewett #193 Mogul
Water—Cold Over 500 lb. pressure	#240 or #181 W. P. H. Flax #188 or #189 Flax (with #295 Light Weight Hydraulic end rings) #370 Armorflax	#240 or #181 W. P. H. Flax #188 or #189 Flax (with #295 Light Weight Hydraulic End Rings) #10 Jewett	#11 Centripac #350 Semi-Metallic #10 Jewett #210 or #181 W. P. H. Flax #188 or #189 Flax	#10 Jewett #223 Mogul
Water—Cold 100–500 lb. pressure	#188 or #189 Flax #240 or #181 W. P. H. Flax #370 Armorflax #32 Universal Rod #10 Jewett	#188 or #189 Flax #240 or #181 W. P. H. Flax #10 Jewett #223 or #222 Mogul	#7 or #11 Centripac #350 Semi-Metallic #223 or #222 Mogul #10 Jewett #188 or #189 Flax #240 or #181 W. P. H. Flax	#222 or #223 Mogul #10 Jewett

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Recommendations for the use of Johns-Manville Packings—*continued*

SERVICE	*Rod, Outside-Packed Plunger and Valve Stem Packing*			
	Reciprocating Rods and Plungers		*Centrifugal and Oscillating Rods*	*Valve Stems*
	Large Packing Space	*Small Packing Space*		
Water—Cold Fresh or Salt Under 100 lb. pressure	#189 Flax #2000 Flax #370 Armorflax #32 Universal Rod #10 Jewett	#223 or #222 Mogul #189 Flax #2000 Flax #10 Jewett	#7 or #11 Centripac #350 Semi-Metallic #223 or #222 Mogul #10 Jewett #189 Flax #2000 Flax	#222 or #223 Mogul #193 Mogul
Brine	#240 or #181 W. P. H. Flax (Medium) #188 or #189 Flax	#240 or #181 W. P. H. Flax (Medium) #188 or #189 Flax	#7 or #11 Centripac #350 Semi-Metallic #240 or #181 W. P. H. Flax (Medium)	#222 or #223 Mogul #193 Mogul
Ammonia	#172 Besta-Monia #172 D. C. and #172-S. C. Besta-Monia Combination Rings #271 Cross Diagonal	#172 Besta-Monia #271 Cross Diagonal	#7 Centripac #350 Semi-Metallic #223 or #222 Mogul	#222 or #223 Mogul #193 Mogul
Air N. Y. & Westinghouse Air Pumps	#15-55 Combination Rings			
Air Compressors or Air Vacuum Pumps	#15 Kearsarge #166 Kearsarge #55 Air Packing #7 Centripac	#222 or #223 Mogul #10 Jewett		
Air Compressors, "two-stage"	Sea Rings, with #789 Thermo (lubricated and graphited) for header and follower rings Combination, #789 Thermo (lubricated and graphited) and #10 Jewett			
Acid—(Strong)	#2017 Acid	#2017 Acid	#2018 Acid	#2017 Acid
Note: Best results can be secured by advising all conditions of service.				
Acid—(Weak)	#2019 Braided Wool #223 or #222 Mogul #6 Rajah	#2019 Braided Wool #223 or #222 Mogul #6 or #2 Rajah	#2019 Braided Wool #7 Centripac #350 Semi-Metallic #223 or #222 Mogul	#2019 Braided Wool #222 or #223 Mogul #193 Mogul #2 or #6 Rajah
Note: Best results can be secured by advising all conditions of service.				
Caustic Soda	#73 Caustic	#73 Caustic	#74 Caustic	#73 Caustic
Vegetable Oil	#223 or #222 Mogul #10 Jewett	#223 or #222 Mogul #10 Jewett	#7 or #11 Centripac #350 Semi-Metallic #223 or #222 Mogul #10 Jewett	#222 or #223 Mogul #193 Mogul #10 Jewett
Natural Gas Over 500 lb. pressure	Sea Rings, with #789 Thermo (lubricated and graphited) for header and follower rings Combination, #789 Thermo (lubricated and graphited) and #10 Jewett			
Natural Gas Under 500 lb. pressure	#15 Kearsarge #223 or #222 Mogul #10 Jewett	#223 or #222 Mogul #10 Jewett		

Recommendations for the use of Johns-Manville Packings—*continued*

SERVICE	*Rod, Outside-Packed Plunger and Valve Stem Packing*			
	Reciprocating Rods and Plungers		*Centrifugal and Oscillating Rods*	*Valve Stems*
	Large Packing Space	*Small Packing Space*		
Crude Oil 350° to 1000° F.	#789 Thermo #6 Rajah #5 High Temperature #871 Hot Oil #731 Hot Oil	#789 Thermo #6 or #2 Rajah #5 High Temperature #871 Hot Oil #731 Hot Oil	#789 Thermo #5 High Temperature #871 Hot Oil #731 Hot Oil	#789 Thermo #2 or #6 Rajah #5 High Temperature #871 Hot Oil #731 Hot Oil
Crude Oil 100° to 350° F.	#6 Rajah #871 Hot Oil #731 Hot Oil #223 or #222 Mogul #10 Jewett #370 Armorflax	#6 or #2 Rajah #871 Hot Oil #731 Hot Oil #223 or #222 Mogul #10 Jewett	#7 Centripac #350 Semi-Metallic #871 Hot Oil #731 Hot Oil #223 or #222 Mogul #10 Jewett #6 Rajah	#2 or #6 Rajah #871 Hot Oil #731 Hot Oil #222 or #223 Mogul #10 Jewett
Crude Oil Under 100° F.	#323 or #322 Gasoline Rod #210 or #181 W. P. H. Flax (Medium) #370 Armorflax	#323 or #322 Gasoline Rod #210 or #181 W. P. H. Flax (Medium) #370 Armorflax	#18 Centripac #351 Semi-Metallic #323 or #322 Gasoline Rod	#322 or #323 Gasoline Rod #293 Gasoline Rod
Gasoline Distillate Light Oils Mineral Seal Oil	#323 or #322 Gasoline Rod #271 Cross Diagonal	#323 or #322 Gasoline Rod #271 Cross Diagonal	#18 Centripac #351 Semi-Metallic #323 or #322 Gasoline Rod #271 Cross Diagonal	#322 or #323 Gasoline Rod #293 Gasoline Rod
Asphaltic and Heavy Oils Over 350° F.	#789 Thermo #871 Hot Oil #731 Hot Oil #6 Rajah	#789 Thermo #871 Hot Oil #731 Hot Oil #6 Rajah		
Asphaltic and Heavy Oils Under 350° F.	#10 Jewett #6 Rajah	#10 Jewett #6 Rajah		

SERVICE	*Inside-Packed Piston Packing*
Hot Water	#33 Universal; #295 Light Weight Hydraulic; #182 Aqua
Cold Water	#33 Universal; #295 Light Weight Hydraulic; #182 Aqua; #290 Square Hydraulic
Crude Oil	#33 Universal; #295 Light Weight Hydraulic; #290 Square Hydraulic; #182 Aqua
Gasoline Under 100° F.	#33 Universal; #295 Light Weight Hydraulic; #290 Square Hydraulic; #182 Aqua
Mineral Seal Oil	#33 Universal; #295 Light Weight Hydraulic; #290 Square Hydraulic; #132 Aqua
Slush Pump	#178 Slush Pump Sleeves

SERVICE	*Sheet Packing*
All Conditions	#60 Service
Hot Oils	#70 Asbestos
Cold Oil or Gasoline	#711 Seigelite
Low Pressure Water, Steam, Air	#107 Liberty
	Note: Use #100 Kearsarge or #101 Mobilene for rough or uneven flanges

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Recommendations for the use of Johns-Manville Packings—*continued*

SERVICE	*Gaskets*
All conditions	#61 Service Gaskets
Hot oil	#61 or #71 Asbestos Gaskets
Cold Crude Oil or Gasoline	#712 Seigelite Gaskets
Boiler handhole or nanhole	#116 Kearsarge
Boiler tube plate:	
B. & W., Heine, Edge Moor	#118 Kearsarge Jointless or #116 Kearsarge
All other tube plates	#116 Kearsarge
Emergency manhole or handhole or round cross-section	#124 Kearsarge Tubular Gasketing
Surfaces too uneven or rough for #61 Service	#116 Kearsarge or #126 Kearsarge
Odd or irregular gaskets	#120 Kearsarge Gasketing Tape

SERVICE	*Pump Valves*
Hot Water—Maximum 300 lb. pressure, 300° F.	#124
Cold Water—Pressure up to 200 lb.	#416
Cold Water—200-400 lb. pressure	#415
Condenser	#420
Oil, Ammonia, Syrups, etc.—Maximum 300 lb. pressure; 300° F.	#430
Hot or cold oil, gasoline, naphtha, etc., paraffin, hot or cold water, weak acids and weak alkalis. Limit 300° F., all pressures	#300
Slush Pump	#209 All Duck or #207 All Compound
	Note: Other styles of pump valves furnished for special conditions.

SERVICE	*Oil Field Special Packing Recommendations*
Swivel	#184 Low Pressure Diagonal Ring, or, alternate, #166 Kearsarge and #32 Universal Rod; with #33 Universal Piston end rings for the wash pipe and #10 Jewett for top and bottom oil boxes
Polish Rod Stuffing Box	#373 Polish Rod Ring
Slush Pump	Fluid End:
	#474 Compound Slush Pump Ring
	#184 Low Pressure Diagonal Ring
	#476 Combination Slush Pump Set (Two #474 rings and one #184 ring)
	Steam End:
	#166 Kearsarge
	#156 Oil Field Spiral
	#271 Cross Diagonal

SERVICE	*Pipe Line Station Special Packing Recommendations*
Reciprocating Pipe Line Pumps	Sea Rings—special for pipe line work
	#370 Armorflax
	#240 or #181 W. P. H. Flax with alternate #140 Rubber Ring
Centrifugal Pipe Line Pumps	#18 Centripac or #351 Semi-Metallic
Cooling Pumps	#271 Cross Diagonal
Suction Pumps	#295 Light Weight Hydraulic; #33 Universal

SERVICE	*Oil Refinery Special Packing Recommendations*
Bubble Towers	#733 or #873 Braided Rope
Scraper Rod	#128 Kearsarge Lute Coil; #90 K. U.; #166 Kearsarge or #731 Hot Oil
Tank Car Dome Gaskets	#116 Kearsarge or #61 Service
Tank Car Outlet Cap Gaskets	#61 Service or #712 Seigelite
Fire, Steam or Pressure Stills	#61 Service; #219 Felted Asbestos
Filterhead (percolating filters)	#787 Braided Asbestos Rope

SERVICE	*Steel Mill Special Packing Recommendations*
Hot Blast Stove cleanout doors, Boiler explosion doors, etc.	#790 Groove Packing
Converter bottoms	#177 Groove Packing
Butterfly valves	#872 Groove Packing
Benzol,Tar,Wash Oil, Ammonia Liquo.	Sea Rings
Service Water (Sheet packing)	#60 Service or #107 Liberty

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Recommendations for the use of Johns-Manville Packings—*continued*

SERVICE	*Gas Manufacturing Special Packing Recommendations*
Crude Oil, Fuel Oil, Gas Oil, Gas Tar Oil and Tar, Oil and Tar Drips, Tar Water	Reciprocating Rods #10 Jewett Rotating Rods: #10 Jewett; #350 Semi-Metallic; #7 Centripac
Gas and Tar, Gas, Naphthalene	Valve Stems: #222 or #223 Mogul; #193 Mogul
Exhauster shafts	#223 or #222 Mogul
Ammonia, Water and Ammonia, Tar and Ammonia	Reciprocating Rods—#172 Besta-Monia or #271 Cross Diagonal Rotating Rods: #7 Centripac; #350 Semi-Metallic; #223 or #222 Mogul Valve Stems: #222 or #223 Mogul; #193 Mogul
Purifier Box cover and door seals	#128 or #129 Kearsarge Lute Coil Packing
Hot Valves—generator to carburetter	#223 or #222 Mogul
Generator ash and clinker doors	#216 Generator Door Packing #566 or #787 Braided Asbestos Rope

SERVICE	*Pulp and Paper Special Packing Recommendations*
White Water or Stock Pumps	Reciprocating Rods—Sea Rings; #32 Universal; #271 Cross Diagonal; #390 Hollow Core; #173 Victor or combinations of #32, #390, #271, or #173. Specify lubricated but not graphited on #32, #271, #390 and #173. Rotating Rods—#350 Semi-Metallic; #10 Jewett. Specify lubricated but not graphited. Note: Flax and other fibrous packings are likely to get through into the pumps and spoil the stock. For those who prefer flax, use #240 or #181 W. P. H. without graphite finish, as there will be the least tendency for this type of flax to cause trouble.
Water Pumps	See standard recommendations for water.
Vacuum Pumps	See standard recommendations for air
Acid and Caustic Pumps	See standard recommendations for acid and caustic
Dryer journal boxes	#166 Kearsarge or #223 Mogul
Grinders	Rods—See standard recommendations for water Pistons—#33 Universal or #182 Aqua

SERVICE	*Lumber Special Packing Recommendations*
Shot Guns Feed Engines Kickers Niggers Donkey Engines Log Turners Loaders	Top and bottom rings of #280 Braided Copper together with #15 Kearsarge; #32 Universal or #271 Cross Diagonal; or combinations of #15, #32, or #271

SERVICE	*Miscellaneous Special Packing Recommendations*
Steam Hammers	Rods—#32 Universal; #271 Cross Diagonal; #166 Kearsarge or combinations of #32, #271 or #166 Pistons—#182 Aqua or #33 Universal
Accumulators	Alternate #33 Universal and #240 W. P. H. Flax; or Top and Bottom Rings #33 Universal and #240 W. P. H. Flax Alternate #90 K. U. and #240 W. P. H. Flax
Milk Homogenizers	Sea Rings #32 Universal
Oxygen	#873 Pure Braided Asbestos Rope
Ceramic Slip Pumps Tunnel Kiln Pushers	 Sea Rings Sea Rings

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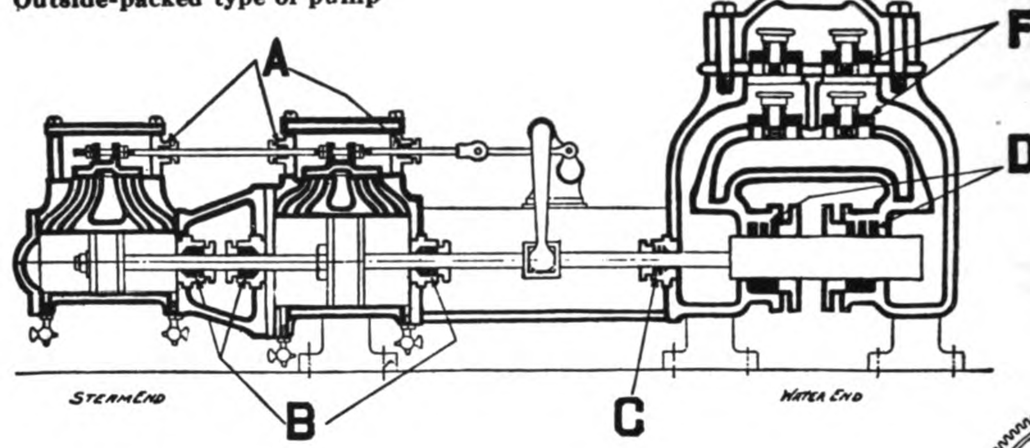
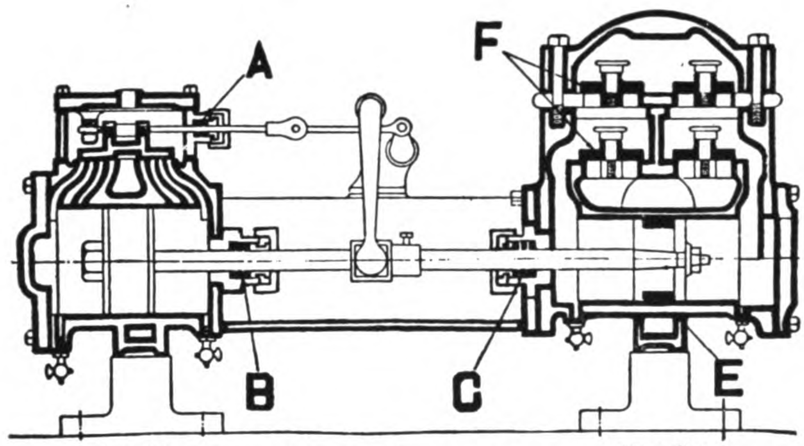
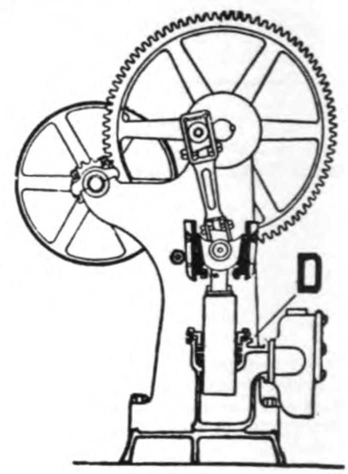
J-M Pump Packing Recommendations

Outside-packed type of pump





Inside-packed type of pump



Vertical outside-packed type of pump

For best results, pumps should be packed as follows:

A, B, C, D — Sea Rings—except where rod or plunger is under ¾″ diameter, or space between rod and stuffing box is less than 5/16″, in which case use Mogul, No. C-222 or No. C-223.

or

A, B — Kearsarge, No. S-166.

C—Hot water: Cross Diagonal, No. S-271

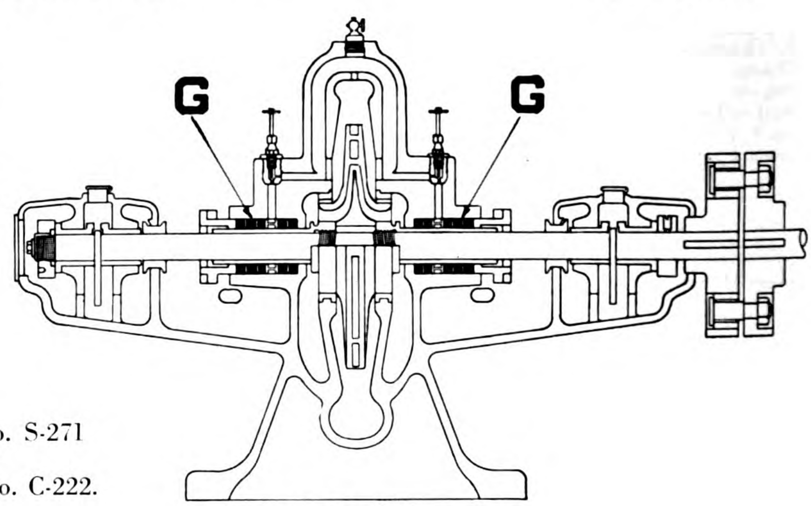
D—Cold water: J-M Flax No. 189

For small packing space, Mogul, No. C-222.

E—Universal Piston, No. S-33

F—J-M Pump Valves

G—Centripac, No. C-7 or C-11 or Semi-Metallic, No. C-350.



Centrifugal pump

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J-M Sea Rings

J-M Sea Rings are designed for service against steam, hot or cold water, air, brine, vegetable oils and some mineral oils and other fluids and chemicals, in use on reciprocating rods and plungers in good condition where rod is not less than 3/4″ diameter nor more than 16″, and packing space is not less than 5/16″ nor more than 1 1/4″.

Depending upon the nature of the service, Sea Rings are made of asbestos fabric, or duck, or of a combination of the two, impregnated with heat and oil-resisting materials selected to meet the particular conditions.

The flexible lip is held tightly to the rod on the work stroke by the pressure of the fluid, but releases on the return. Hence, because unnecessary friction is eliminated, Sea Rings reduce wear on the rod, minimize the amount of power required, and by their longer life, obviate frequent replacements with attendant shut-down of the equipment.

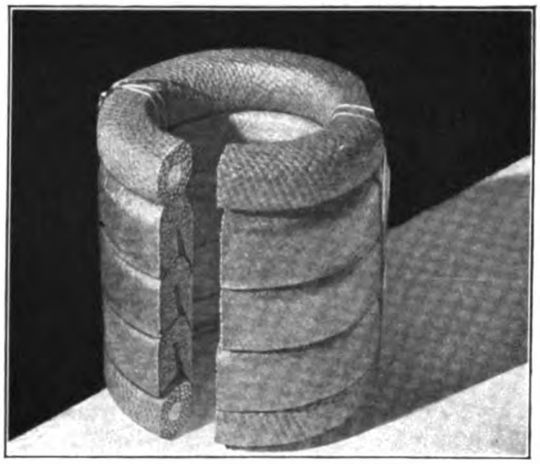
Sea Rings are furnished in sets only, usually one header ring, two or more Sea Rings, and one follower ring, packed one or more sets to a box, depending upon their size, and properly marked for identification. In ordering Sea Rings, full information should be given as outlined on the Sea Ring Packing Data Sheet (see other side of this sheet), in order that the proper set to fit the conditions of service may be furnished.

Metallic Filler Rings for Sea Rings used on the oil ends of oil pumps:

When Sea Rings are used for packing rods or plungers against oil, (not recommended for refined oils such as benzine, gasoline, naphtha, kerosene, etc., which have no lubricating value) best results are generally obtained by using not more than three Sea Rings, one header and one follower ring.

If the depth of the stuffing-box and length of the gland are such that this number of rings will fill it and allow 1/2-inch space for gland adjustment or "take up," no extra ring need be used. However, if the stuffing-box is so long, or the gland so short, that there is space left to be filled, a metallic filler ring may be used, in place of a fourth Sea Ring, placed in the bottom of the stuffing-box before the Sea Ring set is installed.

This metallic filler ring is constructed of babbitt metal, machined to fit stuffing-box and rod, and cut in halves so that it may be easily installed without disconnecting the piston rod.



Minimum depth of stuffing-box for one set, 2 Sea Rings, 1 header ring and 1 follower ring, and extra depth required for each added Sea Ring*

Width of packing space, inches	Depth of stuffing box, inches	Added depth needed for each added Sea Ring, inches
5/16	1-1/2	3/8
11/32	1-11/16	13/32
3/8	1-13/16	7/16
13/32	1-7/8	15/32
7/16	1-15/16	15/32
15/32	2-1/16	1/2
1/2	2-1/4	17/32
17/32	2-9/16	19/32
9/16	2-3/4	21/32
19/32	2-13/16	23/32
5/8	2-15/16	3/4
21/32	3-1/4	13/16
11/16	3-5/16	27/32
23/32	3-3/8	7/8
3/4	3-1/2	15/16
25/32	3-7/8	31/32
13/16	4	1
27/32	4-1/8	1-1/32
7/8	4-1/4	1-1/16
29/32	4-3/8	1-3/32
15/16	4-1/2	1-1/8
31/32	4-3/4	1-3/16
1	4-7/8	1-1/4
1-1/32	5-3/16	1-9/32
1-1/16	5-3/16	1-5/16
1-3/32	5-1/4	1-11/32
1-1/8	5-1/2	1-7/16
1-5/32	5-5/8	1-15/32
1-3/16	5-3/4	1-1/2
1-7/32	6	1-1/2
1-1/4	6-1/8	1-9/16

*Note: Where depth of stuffing-box is not sufficient to accommodate a set (2 Sea Rings, 1 header and 1 follower ring), deduct 1/2 of the *width* of packing space from minimum *depth* of box to determine the minimum *depth* required to accommodate 2 Sea Rings and 1 header ring. For example, if *width* of packing space is 3/4″, deduct 3/8″ from the minimum depth given, to allow for not using a follower ring.

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Johns-Manville Sea Ring Packings

The following information is required on all orders for Sea Rings.

FILL OUT VERY CAREFULLY

This form must *accompany* all orders

1. **Service for which Rings are to be used**..

....

State whether it is steam, hot water, cold water, air, oil, etc. Do not state, for instance: "Hot Water Pump", because this does not indicate whether the rings are intended for the steam end of the pump or the water end.

2. **Machine on which Rings are to be used**.................{ Reciprocating / Rotating ....

....

State briefly whether it is a high speed engine, low speed engine, hot water pump, cold water pump, air compressor, plunger elevator, etc. If possible, state name of manufacturer. It is not necessary to give any manufacturer's serial number or sizes of cylinder, etc.

3. **Condition of Rod**..

State definitely if in good condition and runs true or if scored and runs out of true. If the latter, state how bad it is.

4. **How is rod lubricated?** ....

5. **Pressure to come on Packing in Lbs. per sq. in.** ....

Such as steam pressure at the engine, hydraulic pressure, per sq. in. etc.

6. **Temperature of liquid or gas (in case of pump or compressor)**.............................

7. **Does Packing work under Vacuum or Suction, and how much?**..........................

....

If used on pumps that lift or engines running condensing the packing may be subject to vacuum part of the time.

8. **Diameter of Rod** ....

If rod is worn or has been turned down, be sure that measurement is correct for all that portion which moves through the stuffing box.

9. **Inside Diameter of Stuffing Box**...

Get this accurately. Do not give the outside diameter of gland follower, or calculate the diameter by adding the nominal size of packing to be used to the diameter of rod.

10. **Shortest Depth of Box**...

This means if bottom of box is concaved, take measurement along the wall of the box and not along the rod. If it is not possible to measure this, have the customer give you the approximate depth and so enter it on the signed order. In case Gland Follower Ring is used, make allowance for its entrance into Box.

11. **Bottom of Box—Flat or concaved?**...

12. **Gland Follower—Flat or concaved?** ....

13. **Length of Part of Gland entering stuffing box** ....

This means distances from stuffing box end of gland to inside face or shoulder of gland.

14. **No. sets to be furnished according to this data sheet.**

15. **Any Remarks?**....................**If so, use other side of sheet.**

A Sea Ring Packing Data Sheet. Copies may be obtained from any Johns-Manville salesman or packing distributor

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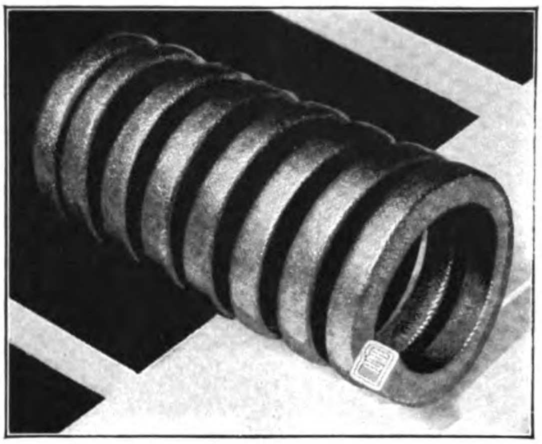
J-M Kearsarge Rod Packing

Styles No. 15 and No. 166



Style No. S-166

Kearsarge Rod Packing is designed for service against steam, air, and gas up to 500 deg. F., in use on reciprocating rods and plungers where the packing space is 3/8″ or more. (For smaller space, use J-M Mogul).

Made with a folded center block, which contains no rubber friction, and a non-hardening rubber cushion, over both of which is wrapped a double wearing surface of asbestos cloth woven from tightly twisted asbestos yarn.

In sizes 9/16″ and under, a core of asbestos rope replaces the folded block, since the use of a block in the smaller sizes is not practical.

Style No. 15 is furnished without the rubber expansion cushion in spiral form, Style No. S-15, coil form, Style No. C-15, and ring form, Style No. R-15.

Style No. 166 (with rubber expansion cushion) is usually furnished in spiral form, Style No. S-166, finished with a heat-resisting lubricant and graphited. Also available in ring form, Style No. R-166, and in coil form, Style No. C-166, which is furnished either plain or with lubricant and graphite finish as specified. In coil form it is generally used as a groove packing and furnished plain.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds								
Style No. S-166	6	8	12	20	30	42	56	70
C-166 (plain)	4	6	9	16	24	36	48	56
S-15	6	8	10½	16	28	36	51	62
C-15 (plain)	4	6	8	15	20	32	40	52

Spirals and coils are furnished in 12½-ft. lengths; spirals packed one length per box; coils packed in boxes weighing as follows: Sizes 1/4″ to 1/2″, 5 to 6 pounds; 5/8″ to 3/4″, 8 to 10 pounds; 7/8″ to 1″, 10 to 14 pounds. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

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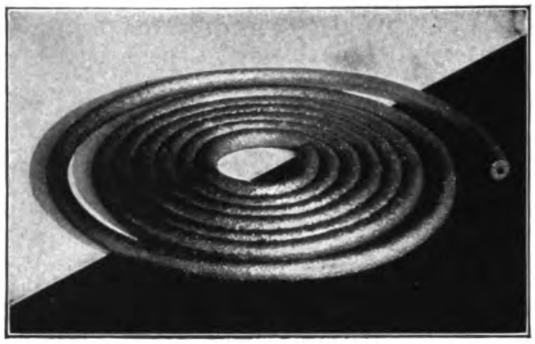
J-M Universal Rod Packing

Style No. 32



Style No. C-32

Universal Rod Packing is designed for service against steam, especially steam carrying high condensation, hot or cold water, varying hot and cold water conditions, and air, in use on reciprocating rods and plungers, especially where there is considerable vibration or where rods are worn or out of alignment.

Made of asbestos and cotton fabrics, frictioned together with a resilient heat-resisting rubber compound and wrapped around a non-hardening rubber core. This combination of materials produces a tough packing of great pliability and resiliency, adapted to a variety of general service conditions.

Furnished in spiral form, Style No. S-32, coil form, Style No. C-32, and ring form, Style No. R-32, which is also used in sets as locomotive throttle packing.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	5	8	10	16	22	34	44	53

Spirals and coils are furnished in 12½-ft. lengths; spirals packed one length to a box; coils packed in boxes weighing as follows: ¼″ to ⅜″, 5 to 6 pounds; ½″ to ¾″, 8 to 10 pounds; ⅞″ to 1″, 12 to 14 pounds. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Printed in U.S.A.

J-M Air Pump Packing Sets

Style No. R-15-55

Style No. R-15-55

J-M Air-Pump Packing Set, Style No. R-15-55, is a combination set of ring packing, Kearsarge Style No. R-15 (see Kearsarge Rod Packing) and Air Packing Style No. R-55, for use on air-compressors, No. R-15 on the steam end and No. R-55 on the air end. It should be ordered by specifying the make and size of the air pump on which it is to be used. A complete set consists of sufficient packing for all of the stuffing-boxes on one pump, but the packing for each stuffing-box is put up in a separate carton properly labeled "Steam End" or "Air End."

Number of cartons per complete set for each size of Westinghouse and New York Air Pumps:

Kind and Size of Pump	No. of Cartons Style No. R-15 for Steam End	No. of Cartons Style No. R-55 for Air End	No. of Cartons in complete set
Westinghouse			
6″	1	1	2
8″	1	1	2
8½″	2	2	4
9½″	1	1	2
10½″	2	2	4
11″	1	1	2
New York			
No. 2	2	2	4
" 5	2	2	4
" 6	2	2	4
8″	1	1	2
8½″	2	2	4
9½″	1	1	2
11″	1	1	2

J-M Air Packing

Style No. 55

J-M Air Packing is designed for service against air, particularly on the air end of compressed-air pumps.

Made in square cross-section, braid over braid, from selected long fibre asbestos yarn reinforced with fine copper wire, thoroughly impregnated with a special heat-resisting lubricant, and graphited.

Will withstand the high temperatures and pressures of air service without becoming hard or brittle.

Furnished in coil form, Style No. C-55 and ring form, Style No. R-55, the latter being used in combination with Kearsarge, Style No. R-15, for air compressor packing sets as described above.

Coils are furnished in continuous lengths, on 10, 25 and 50 pound reels. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Style No. R-55

Approximate weight of 100 linear feet

Size, inch	¼	5/16	⅜	½	⅝	¾	⅞	1
Weight, pounds	5	8	12	21	33	48	65	85

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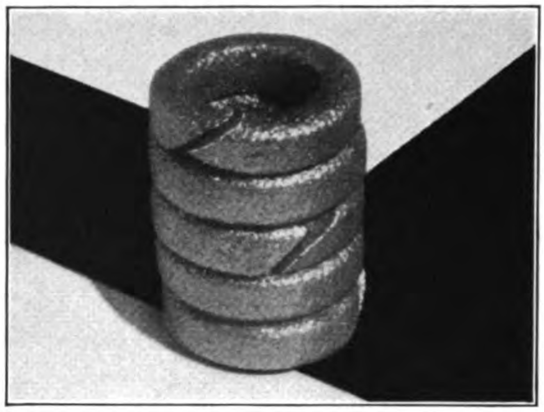
J-M Locomotive Throttle Sets

Styles No. R-15, No. R-32 and No. R-65



Style No. R-15

J-M Throttle Sets are designed primarily for packing locomotive steam throttles. Made in three types for different service conditions.

Throttle packings are furnished in ring form only, and shipped in individual sets sufficient to pack one stuffing-box. In ordering, exact diameter of rod and inside diameter and depth of stuffing-box should be specified.

Locomotive Throttle Set, Style No. R-15: J-M Locomotive Throttle Set, Style No. R-15, is designed primarily for use on throttles operating under saturated or super-heated steam, and located in the back head above the water-line, or in the steam dome. (See Kearsarge, Style No. R-15.)

Locomotive Throttle Set, Style No. R-32: J-M Locomotive Throttle Set, Style No. R-32, is designed primarily for use on throttles situated in the back head and below the water-line of the boiler. (See Universal, Style No. R-32.)

Locomotive Throttle Set, Style No. R-65: J-M Throttle Set, Style No. R-65, is designed primarily for use on super-heated steam throttles located in the front end or in the smoke box. (See Thermo, Style No. R-789.)

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J-M Thermo Rod Packing

Style No. 789

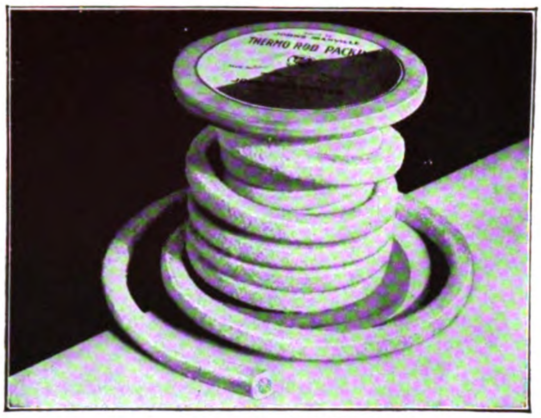
Thermo Rod Packing is designed especially for service against high-temperature oils and gases, in use on reciprocating or rotating rods. *It is not intended to be used under ordinary conditions.*

Depending upon the size, it is constructed by braiding one or two jackets of pure asbestos yarn over a center core of twisted pure asbestos containing annealed iron wire. Under each jacket there is a small amount of special heat-resisting compound to seal the pores of the packing.

Furnished in coil form, Style No. C-789, and ring form, Style No. R-789, either square or round, with or without lubricant and graphite finish. Unless otherwise specified, it will be furnished square, without lubricant or graphite finish. For steam service, it should be ordered lubricated. Used in sets for locomotive throttle packing, it is known as Style No. R-65.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	3½	7	11	16½	25	33	44	57



Style No. C-789

Coils are furnished in continuous lengths, on 5, 10, 25 and 50 pound reels. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

J-M High Temperature Packing

Style No. 5

Style No. C-5

J-M High Temperature Packing is designed for service against super-heated steam and hot oils, in use on reciprocating and rotating rods.

Made of plaited pure asbestos with copper wire insertion, and specially treated for high-temperature service.

Furnished in coil form, Style No. C-5, and ring form, Style No. R-5.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	3¾	6	8½	15	21	30	41	54

Coils are furnished in continuous lengths, on 5, 10, 25 and 50 pound reels. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

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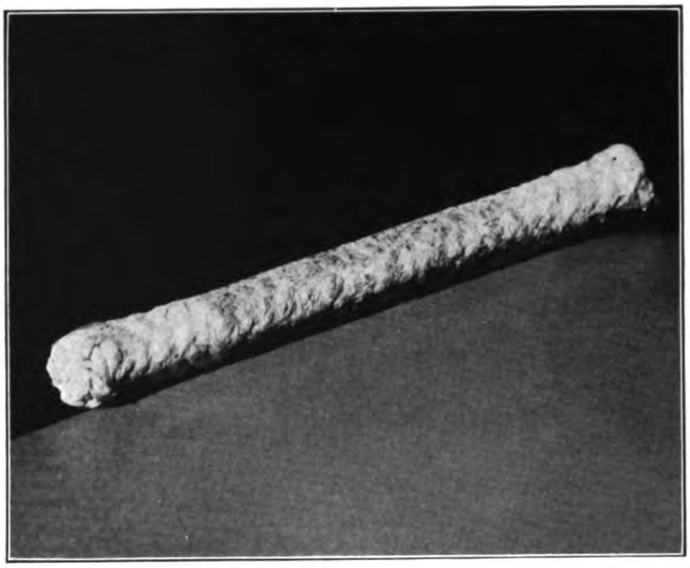
J-M Hot Oil Packing

Styles No. 731 and No. 871



Style No. C-871

J-M Hot Oil Packing is designed to give good results when used on equipment handling hot oils, though Thermo Rod Packing, Style No. 789, is the preferred recommendation for this service. J-M Hot Oil Packings are furnished without lubricant or graphite finish, unless otherwise ordered, and in coil form with square cross-section, Styles No. C-871 and No. C-731. On special order, they can be furnished in ring form, Styles No. R-871 and No. R-731.

Styles No. C-871 and No. R-871 are made braid over braid of pure asbestos yarn, with a special sealing compound between the jackets.

Styles No. C-731 and No. R-731 are made in a similar manner except that commercially pure asbestos yarn is used.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds								
Style No. C-871	3 1/4	7 3/4	12 1/2	17	25	34	50	66
C-731	3	5	9	14	20	25	34	50

Coils are furnished in continuous lengths, on 5, 10, 25, and 50 pound reels. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

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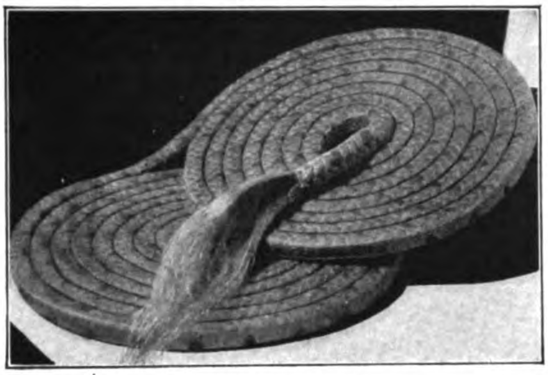
J-M Flax Packings

Styles No. 181 (W.P.H.), No. 188, No. 189, No. 240 (W.P.H.) and No. C-2000



Style No. C-189

J-M Flax, Style No. 181 (W.P.H.), is designed for moderately severe hydraulic service where a W.P.H. flax is required. Braided solid from pure flax roving with an average comb of 12″, lubricated with pure Japan wax, and graphited. Can be furnished without graphite, if desired.

Furnished in coil form, Style No. C-181, spiral form, Style No. S-181, and ring form, Style No. R-181. In all these forms it is available in three densities: hard (-H), medium (-M), or soft (-S), but is furnished in medium density unless otherwise ordered.

J-M Flax, Style No. 188, is recommended for service against cold water, either fresh or salt, and brine. It is the finest regularly lubricated flax packing that it is possible to make, braided solid, without center or corners, from flax roving with an average comb of 20″, and lubricated with special lubricant.

Furnished in coil form, Style No. C-188, and ring form, Style No. R-188. Can be furnished graphited throughout when required.

J-M Flax, Style No. 189, is recommended for service against cold water, either fresh or salt, and brine and all general service where a regularly lubricated flax packing is required. Braided solid from pure flax roving with an average comb of 12″, and lubricated with special lubricant. Marked with red diamond-shaped spots for identification.

Furnished in coil form, Style No. C-189, and ring form, Style No. R-189. Can be furnished graphited throughout when required.

J-M Flax, Style No. 240 (W.P.H.), is designed especially for severe high pressure or high friction service, where a W.P.H. flax is required. It is the highest quality W.P.H. flax packing that can be made, braided solid, without center or corners, from pure flax roving with an average comb of 20″, lubricated with pure Japan wax, and graphited. Marked for identification by a small groove which runs along two opposite sides.

Furnished in coil form, Style No. C-240, spiral form, Style No. S-240, and ring form, Style No. R-240. In all these forms it is available in three densities: hard (-H), medium (-M), or soft (-S), but is furnished in medium density unless otherwise ordered.

For service where a graphite finish is objectionable, such as in use on paper stock pumps, white water pumps, etc., Style No. 240 can be furnished without graphite finish.

J-M Flax, Style No. C-2000, is a special lubricated flax packing for general industrial use such as in steel mills, etc. Furnished in coil form only.

(For sizes, weights and packages, see other side of this sheet)

Printed in U.S.A.

J-M Jute Packings

Styles No. C-4181 (W.P.H.) and No. C-4191

J-M Jute Packing, Style No. C-4191, is braided from first quality jute, with center and corners of the same material, and lubricated. Furnished in coil form only.

J-M Jute Packing, Style No. C-4181 (W.P.H.), is similar to Style No. C-4191, except that it is treated with a W.P.H. compound and graphited.

SIZES, WEIGHTS AND PACKAGES OF J-M FLAX AND JUTE PACKINGS

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Style No. 188, 189, C-2000	3 1/4	6	8	13	20 1/4	30	37	47
181, 240, 4191	3 3/8	6 1/2	8 1/2	14	22	31	39	48 1/4
4181	2 3/4	5	7	10 1/2	19	29	35 1/2	45

All flax and jute packings in coil form are packed in boxes weighing 10 to 12 pounds net for sizes from 1/4″ to 1″—larger sizes in proportion—or on reels of 50 pounds or more.

Spiral Styles No. S-181 and No. S-240 are furnished in lengths of 12 1/2 feet, packed one length to a box.

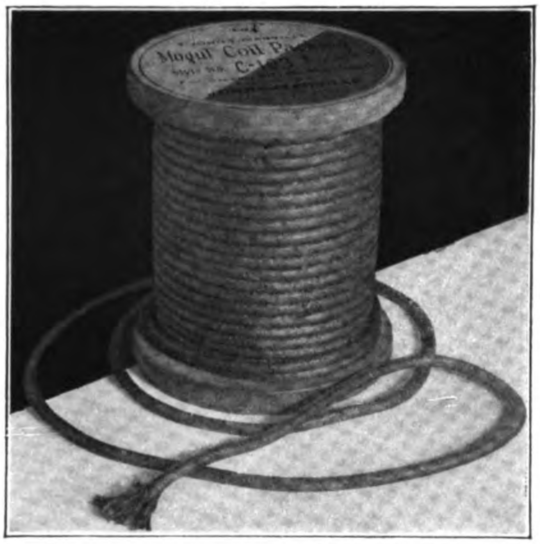
Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Printed in U.S.A.

J-M Mogul Packing

Styles No. C-193, No. C-222 and No. 223



Style No. C-193

J-M Mogul Packing is designed for service against steam, air, water, ammonia, oil and chemicals and general conditions where a packing without rubber is required, in use on valve stems, reciprocating rods with small packing spaces, and centrifugal pumps.

Made of long-fibre asbestos yarn, twisted or braided into coil form, lubricated, and graphited. The asbestos yarn and lubricating compound used in its manufacture insure its remaining soft and resilient.

J-M Twisted Mogul, Style No. C-193 is the handiest packing for general conditions. By untwisting the strands, packing of whatever size is desired may be obtained, a great convenience for small rods, valve stems, etc. Furnished in coil form only.

J-M Braided Mogul, Styles No. C-222 and No. 223, is especially adapted for use on reciprocating rods where the packing space is small. It has the body required for such service, as well as ample high-grade lubrication to keep it soft and pliable, and to prevent wearing and scoring the rod.

Furnished in coil form, Style No. C-222 (round cross-section), and Style No. C-223 (square cross-section). When ordered in large quantities for equipment, can be furnished in ring form, Style No. R-223 (square cross-section).

Furnished in continuous lengths, on reels weighing 5, 10, 25 and 50 pounds. Also furnished in sizes 1/8″ to 1/2″, on 1 pound spools.

Approximate weight of 100 linear feet

Size, inch	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds										
Style No. C-193	1	2½	3¾	5½	8	13	22	28	36	50
C-222	1	2	3½	5¼	7	12½	20	28	40	53
C-223			5¼	7	12½	20	28	40	53	67

J-M Gasoline Rod Packing

Styles No. C-293, No. C-322 and No. C-323

J-M Gasoline Rod Packing is designed for service against cold gasoline and other cold mineral oils, in use on rods and valve stems.

Made from selected long-fibre asbestos yarn, treated with a special lubricating compound and twisted or braided into coil form. The lubricating compound is such that it seals the pores of the packing and effectively prevents seepage of gasoline or oil. It will not wash out, neither will it discolor the liquid.

J-M Gasoline Rod Packing has proved successful on filling-station pumps and other apparatus handling gasoline and other cold mineral oils, where other packings have failed.

Furnished in coil form only, Styles No. C-293, twisted; No. C-322, braided round; and No. C-323, braided square.

Approximate weight of 100 linear feet

Size, inch	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds										
Style No. C-293	1	2½	3¾	5½	8	13	22	28	36	50
C-322	1	2	3½	5¼	7	12½	20	28	40	53
C-323			5¼	7	12½	20	28	40	53	67

Coils are furnished in continuous lengths, on 5, 10, 25 and 50 pound reels. Sizes 1/8″ to 1/2″ are also furnished on 1-pound spools.

Printed in U.S.A.

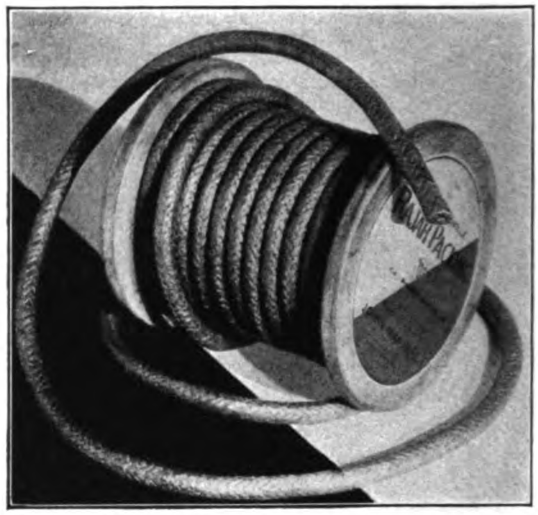
J-M Rajah Packing

Styles No. C-2 and No. 6

J-M Rajah Packing is designed for service against superheated steam, hot or cold oil or water and other high temperature conditions. Used on valve stems and reciprocating rods and plungers. Heat resistance and impenetrability are its two major characteristics which insure long and efficient service.

Made of long-fibre asbestos yarn, braided solid, surface-treated with a heat-resisting compound, and graphited.

Furnished in coil form, Style No. C-2, round cross-section, and Style No. C-6, square cross-section; and, when ordered in large quantities for equipment, can be furnished in ring form with square cross-section, Style No. R-6.



Style No. C-2

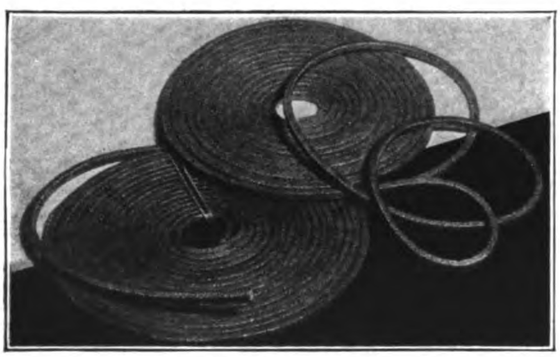
Approximate weight of 100 linear feet

Size, inch		1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds											
Style No.	C-2	1	1¾	3	5	7	12½	20	25	34	50
	C-6			5	7	12½	20	25	34	50	70

Coils are furnished in continuous lengths, on 5, 10, 25 and 50 pound reels. Sizes $1/8''$ to $1/2''$ are also furnished on 1-pound spools.

J-M Jewett Packing

Style No. 10



Style No. C-10

J-M Jewett Packing is designed for service against steam, either fresh or salt hot or cold water, air, gas, crude and heavy oils, and some chemicals requiring a packing free from rubber. Used on valve stems, reciprocating rods and plungers and rotating rods.

Made of several jackets of long-fibre asbestos yarn, with fine copper wire inserted, braided over a thin lead-ribbon core, treated with a special heat-resisting lubricant and graphited. The material is then pressed in steel dies to exact shape and size, which insures not only efficient and dependable service, but also unusually rapid assembly.

Furnished in coil form, Style No. C-10, square cross-section; and, when ordered in large quantities for equipment use, in ring form, Style No. R-10.

To meet particular requirements, in quantity lots, Jewett Rings can also be furnished made of other materials than those mentioned.

Approximate weight of 100 linear feet

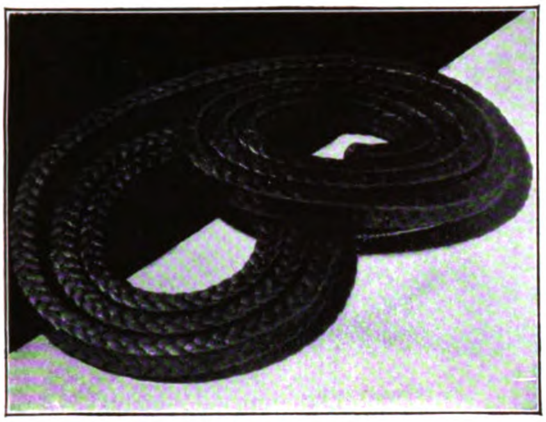
Size, inch	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	2½	4	5	8	11	16	24	34	52	64

Furnished in 12½-ft. lengths, packed in boxes weighing as follows: Size $1/4''$ to $1/2''$, 5 to 6 pounds; $1/2''$ to $3/4''$, 8 to 10 pounds; $3/4''$ to $1''$, 12 to 16 pounds. Also in continuous lengths, on 5, 10, 25 and 50 pound reels.

Printed in U.S.A.

J-M Centripac Packing

Styles No. 7, No. 11 and No. 18



Style No. C-7

J-M Centripac Packing is constructed and lubricated particularly for service against either fresh or salt hot or cold water, steam, oil, ammonia, brine, and some weak acids, in use on centrifugal pumps or other rotating or oscillating rods.

Made of strands of long-fibre asbestos yarn, with or without wire in each strand, plaited square and then thoroughly lubricated and graphited.

The materials and method of manufacture insure minimum friction, long packing life and, an important advantage in centrifugal service, no wear on the rod.

Furnished without wire, in coil form, Style No. C-7 and ring form, Style No. R-7, and with wire inserted, in coil form, Style No. C-11 and ring form, Style No. R-11.

Also furnished without wire and with a special lubricant for service against gasoline and other cold mineral oils, in coil form, Style No. C-18, and ring form, Style No. R-18.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds								
Style No. C-7	4	7	10	14	22	40	50	68
C-11	6	9	12	16½	25½	43	55½	74
C-18	4	7	10	14	22	40	50	68

Coils are furnished in continuous lengths, on 5, 10, 25 and 50 pound reels. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

J-M Semi-Metallic Packing

Styles No. 350 and No. 351

J-M Semi-Metallic Packing is designed for service against steam, air, water, oil, etc., in use on centrifugal rods, in either high or low pressure service, with temperatures up to 500 deg. F. On vacuum pumps it is generally advisable to use front and end rings of a soft packing such as J-M Mogul or Centripac. J-M Semi-Metallic Packing can also be used on reciprocating rods and plungers, either alone or in combination with other rod packings.

Plaited square from a combination of non-abrasive metal and asbestos fibre, and thoroughly lubricated and graphited. Being practically frictionless, it does not wear or score the rod. It has considerable resiliency, a feature lacking in most semi-metallic packings.

Style No. C-350

Style No. 350, for service against steam, air, water, oil, etc., is furnished in coil form, Style No. C-350, and ring form, Style No. R-350.

Printed in U.S.A.

Style No. 351, designed and lubricated particularly for use against gasoline and other cold mineral oils, is furnished in coil form, Style No. C-351, and ring form, Style No. R-351.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	16½	18	26½	45	58	80	114	135

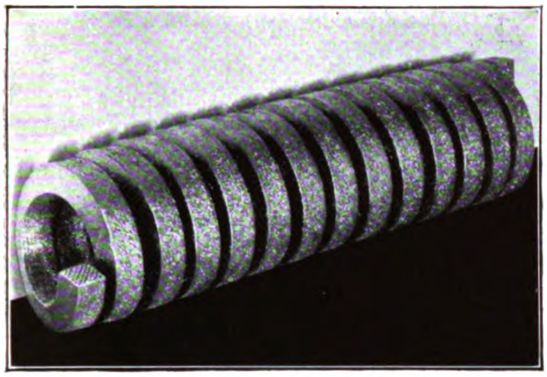
Coils are furnished in continuous lengths, on reels weighing 5, 10, 25 and 50 pounds. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Printed in U.S.A.

J-M Cross Diagonal Rod Packing

Style No. 271



Style No. S-271

J-M Cross Diagonal Rod Packing, Style No. 271 is designed for service against hot and cold water, low-pressure steam, ammonia, light oils, and mineral seal oil, in use on reciprocating rods and plungers where the packing space is 1/4" or more. (For smaller space, use J-M Mogul).

Made of plies of first-quality duck, laid diagonally, frictioned with a high-grade rubber compound and graphited. The diagonal construction allows for the unusual expansion incident to hot-water and ammonia service. It will also give exceptional service on worn rods and plungers.

Furnished in spiral form, Style No. S-271, coil form, Style No. C-271, and ring form, Style No. R-271.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	4	6	8 3/4	15	24	32	46	58

Spirals and coils are furnished in 12 1/2-ft. lengths, spirals packed one length to a box, coils packed in boxes of 10 to 12 pounds net for sizes from 1/4" to 1"—larger sizes in proportion. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

J-M Besta-Monia Rod Packing

Style No. 172

J-M Low Pressure Diagonal Rod Packing is designed for service against ammonia, in use on reciprocating rods and plungers where the packing space is 1/4" or more. (For smaller space, use J-M Mogul.)

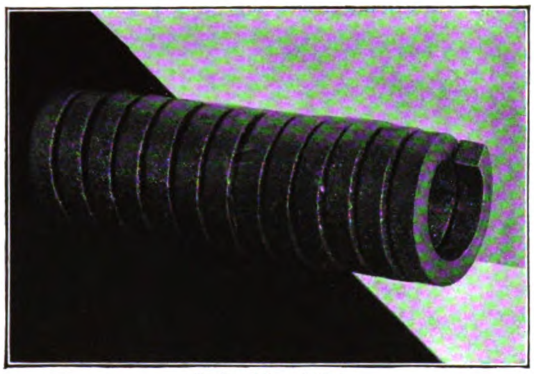
Made of plies of first-quality duck, frictioned with a special ammonia-resisting rubber compound, lubricated and graphited.

Furnished in spiral form, Style No. S-172, and Style No. S-172-X (stitched); coil form, Style No. C-172 and No. C-172-X (stitched); ring form, Style No. R-172, Style No. R-172-X (stitched), Style No. R-172-S.C. (sectional cut), and Style No. R-172-D.C. (diagonal cut).

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	5	7 1/2	11	19 1/2	30 1/2	43 1/2	59	77

Spirals and coils are furnished in 12 1/2-ft. lengths, spirals packed one length to a box, coils packed in



Style No. S-172

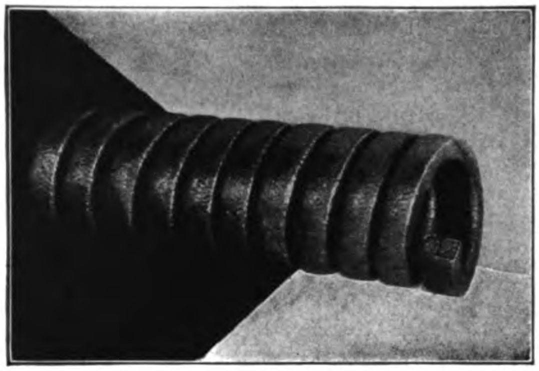
boxes weighing 10 to 12 pounds net for sizes from 1/4" to 1"—larger sizes in proportion. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Printed in U.S.A.

J-M High Pressure Diagonal Rod Packing

Style No. 183



Style No. S-183

J-M High Pressure Diagonal Rod Packing is designed particularly for service against medium or low-pressure steam, in use on rods which are scored, worn, or out of alignment.

Made of a round cushion of rubber and duck, combined with diagonally cut wedges of first-grade laminated duck frictioned with rubber, all thoroughly lubricated and held in place with a braided cotton jacket. (*The muslin wrapping, which is used for protection in shipping, should be removed before the packing is used*).

Made in sizes 3/8″ and up, in coil form, Style No. C-183, spiral form, Style No. S-183, and ring form, Style No. R-183.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	6	9 1/4	13	24	37	49	73	95

Coils are furnished in continuous lengths for sizes up to 3/4″, and in 20-ft. lengths for sizes 3/4″ and over, packed in boxes weighing 10 to 12 pounds net for sizes from 1/4″ to 1″—larger sizes in proportion. Spirals are packed in 12-ft. lengths per box for sizes up to 11/16″; and in 10-ft. lengths per box for sizes 3/4″ and over. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

J-M Low Pressure Diagonal Rod Packing

Style No. 184

J-M Low Pressure Diagonal Rod Packing is designed for service against low-pressure steam and cold water, especially in use on rods which are scored, worn, or out of alignment. The construction is the same as that of High Pressure Diagonal, except that the round cushion is made of braided jute, instead of rubber and duck. (*The muslin wrapping, which is used for protection in shipping, should be removed before the packing is used*).

Furnished in coil form, Style No. C-184, spiral form, Style No. S-184 and ring form, Style No. R-184.

Coils are furnished in continuous lengths for sizes under 3/4″ and in 20-ft. lengths for sizes 3/4″ and over, packed in boxes weighing 10 to 12 pounds net for sizes from 1/4″ to 1″—larger sizes in proportion. Spirals are packed in 12-ft. lengths per box, for sizes up to 11/16″; and in 10-ft. lengths per box for sizes 3/4″ and over. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	5 3/4	9	12 1/2	23	36	47	70	92

Printed in U.S.A.

J-M K. U. Rod Packing

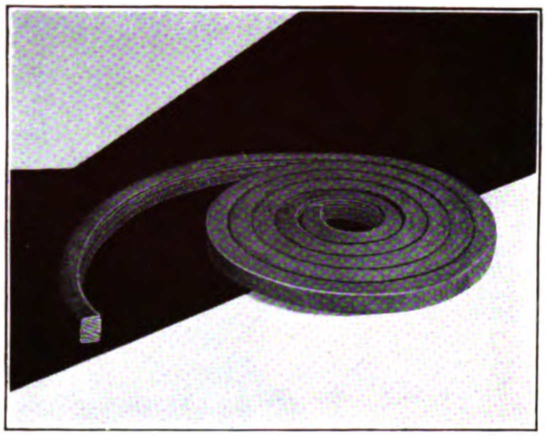
Style No. 90

J-M K. U. Rod Packing is designed primarily for service against steam in use on reciprocating rods and plungers, but will give good results against air and hot or cold water, and has proved very satisfactory as a boiler feed-water pump packing.

Made of wire-inserted asbestos fabric, frictioned with a rubber compound and folded accordion-fashion to make a square core, which is covered on three sides with a jacket of the same fabric, thoroughly bonded to the center block.

Resilient and flexible as K. U. packing is, it is still tough enough not to be destroyed by gland pressure nor to be disintegrated and forced out through the stuffing-box.

Furnished in spiral form, Style No. S-90, coil form, Style No. C-90, and ring form, Style No. R-90.



Style No. S-90

Approximate weight of 100 linear feet

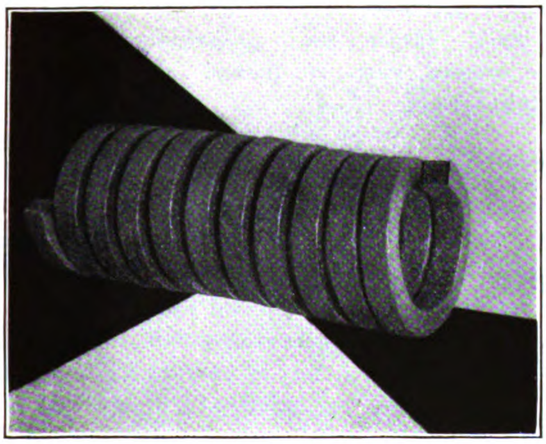
Size, inch	½	⅝	¾	⅞	1
Weight, pounds	20	26	38	44	56

Spirals and coils are furnished in 12½-ft. lengths, spirals packed one length to a box, coils packed in boxes weighing as follows: ½″ to ⅞″, 10 to 12 pounds; 1″, 14 to 15 pounds. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	10	15	20

J-M Duro Rod Packing

Style No. 171



Style No. S-171

J-M Duro Rod Packing is designed for service against steam or water where temperatures or pressures are not excessive, in use on reciprocating rods and plungers.

Made in laminated form from heavy duck, cemented together with a non-hardening rubber friction, lubricated and graphited.

Furnished in sizes ¼″ and up, in spiral form, Style No. S-171 and Style No. S-171-X (stitched); coil form, Style No. C-171 and Style No. C-171-X (stitched); and in ring form. Style No. R-171, Style No. R-171-X (stitched), Style Nc. R-171-S.C. (sectional cut) and Style No. R-171-D.C. (diagonal cut).

Approximate weight of 100 linear feet

Size, inch	¼	5⁄16	⅜	½	⅝	¾	⅞	1
Weight, pounds	4	6	8¾	15	24	32	46	58

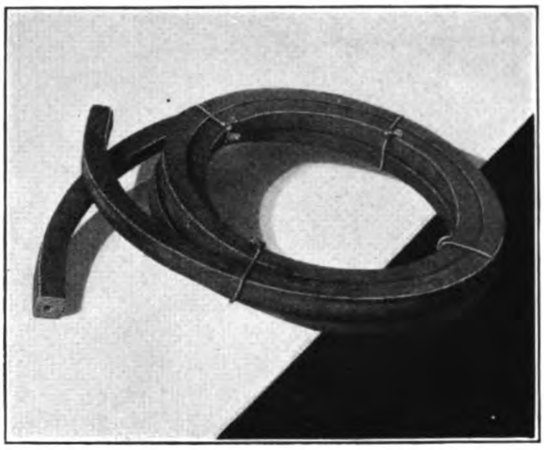
Spirals and coils are furnished in 12½-ft. lengths, spirals packed one length to a box, coils packed in boxes weighing 10 to 12 pounds net for sizes from ¼″ to 1″—larger sizes in proportion. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Printed in U.S.A.

J-M Hollow Core Rod Packing

Style No. 390



Style No. S-390

J-M Hollow Core Rod Packing is designed for general low-pressure steam and water service, in use on rods and plungers particularly where extreme resilience is needed.

Made of first-quality, rubber-frictioned duck wrapped with a hollow core or center, in square cross-section, lubricated and graphited. The hollow core compensates for expansion and contraction, and makes the packing very resilient and adaptable to temperature changes.

Furnished in coil form, Style No. C-390, spiral form, Style No. S-390, and ring form, Style No. R-390.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	3 1/2	5 1/2	8	14	22	26	35	48

Coils and spirals are furnished in 12 1/2-ft. lengths; spirals packed one length to a box; coils packed in boxes weighing 10 to 12 pounds net for sizes from 1/4" to 1"—larger sizes in proportion. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

J-M Victor Rod Packing

Style No. 173

J-M Victor Rod Packing is designed for medium and low-pressure steam, and hydraulic service. Made in round cross-section, of selected duck frictioned and wound around a rubber core, lubricated and graphited.

Furnished in spiral form, Style No. S-173, coil form, Style No. C-173, and ring form, Style No. R-173.

Spirals and coils are furnished in 12 1/2-ft. lengths, spirals packed one length to a box, coils packed in boxes weighing 10 to 12 pounds net for sizes from 1/4" to 1"—larger sizes in proportion. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

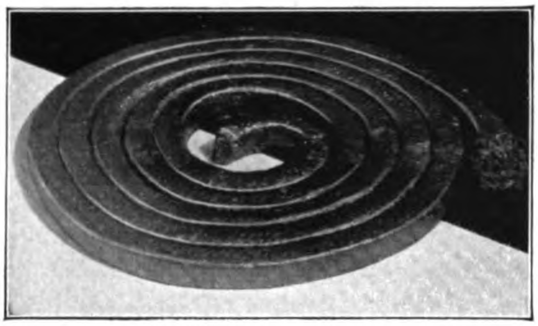
Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	3 3/4	6	8 1/2	15	24	34	46	60

Printed in U.S.A.

J-M Acid-Resisting Packing

Styles No. 2017 and No. 2018



Style No. C-2017

J-M Acid-Resisting Packing is designed for service against various acids, in use on reciprocating or rotating rods and plungers, and valve stems. Made in square cross-section.

Style No. 2017: Made from blue African asbestos, which is particularly adapted to acid work, braided jacket over jacket and treated with a special acid-resisting lubricant. Furnished in coil form, Style No. C-2017, and ring form, Style No. R-2017.

Style No. 2018: Made of the same quality asbestos and the same acid-resisting lubricant as Style No. 2017, but plaited solid for centrifugal service. Furnished in coil form, Style No. C-2018, and ring form, Style No. R-2018.

Approximate weight of 100 linear feet

Size, inch	¼	5/16	⅜	½	⅝	¾	⅞	1
Weight, pounds	6	8	13	20	28	40	52	72

Coils are furnished in continuous lengths, packed in boxes weighing 10 to 12 pounds net, for sizes from ¼″ to 1″—larger sizes in proportion; or on reels of approximately 50 pounds. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

J-M Braided Wool Packing

Style No. C-2019

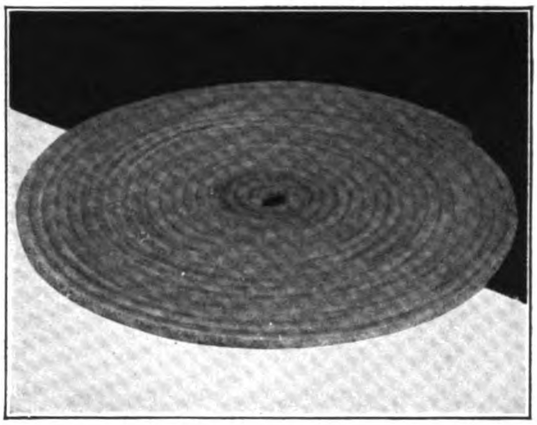
J-M Braided Wool Packing is designed for service against weak acids, in use on rods, plungers and valve stems. Particularly adapted to the requirements of the paper industry.

Made from first-quality long-fibre wool, plaited like flax and furnished in coil form only, Style No. C-2019, either dry or impregnated as ordered.

Approximate weight of 100 linear feet

Size, inch	¼	5/16	⅜	½	⅝	¾	⅞	1
Weight, pounds	3¼	5	7¼	13	20	30	39	51

Furnished in continuous lengths, packed in boxes weighing 10 to 12 pounds net for sizes from ¼″ to 1″ —larger sizes in proportion; or on reels of approximately 50 pounds.



Style No. C-2019

Printed in U.S.A.

J-M Caustic Packing

Styles No. 73 and No. 74

J-M Caustic Packing is designed especially for service against caustic soda and other similar corrosive chemicals, in use on reciprocating rods and plungers, and valve stems.

Style No. 73: Made of blue African asbestos, braided jacket over jacket in square cross-section to the required size and impregnated with a special compound for caustic service.

Furnished in coil form, Style No. C-73, and ring form, Style No. R-73.

Style No. 74: Made of the same quality asbestos and the same compound as Style No. C-73, but plaited solid for centrifugal service. Furnished in coil form, Style No. C-74, and ring form, Style No. R-74.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	6	8	13	20	28	40	52	72

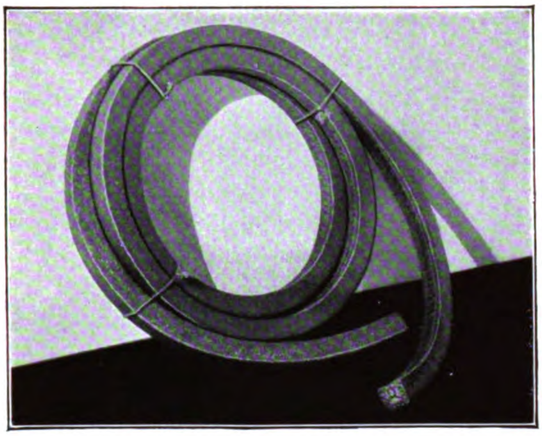
Coils are furnished in continuous lengths, packed in boxes weighing 10 to 12 pounds net for sizes from 1/4" to 1"—larger sizes in proportion; or on reels of approximately 50 pounds. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Printed in U.S.A.

J-M Armorflax Rod Packing

Style No. 370



Style No. C-370

J-M Armorflax Rod Packing is designed for hydraulic service, either fresh or salt water, and also against crude oil, in use on reciprocating rods and plungers.

Made of square braided flax, covered on three sides with several plies of heavy duck. In service, the uncovered side of the packing is placed next to the rod to give a wearing surface of both flax and duck. The duck protects the flax from direct pressure and also holds it in place.

Furnished in coil form Style No. C-370, spiral form, Style No. S-370, and ring form, Style No. R-370.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	3 3/8	6 1/4	8 1/2	14	22	31	39	48

Coils and spirals furnished in lengths of 12½ and 25 ft.; spirals packed one length to a box; coils packed in boxes weighing 10 to 12 pounds net for sizes from ¼″ to 1″—larger sizes in proportion. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

J-M Square Braided Cotton Packing

Styles No. C-262, No. C-263, No. C-264 and No. C-265

J-M Square Braided Cotton Packing is designed for use on the liquid end of pumps in service against various cold liquids where a packing with a cotton base is particularly desired.

Made of long-staple cotton, braided or plaited to suit conditions and furnished in coil form only.

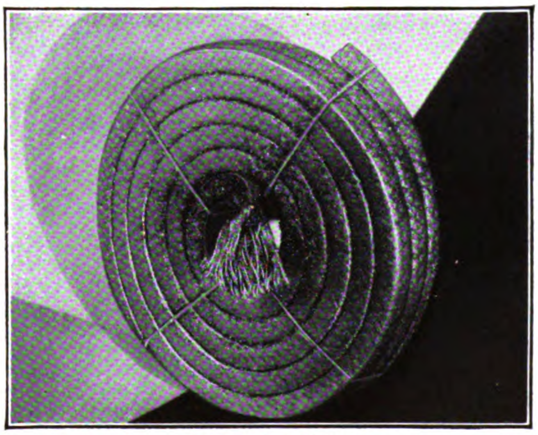
Style No. C-262, braid over braid, lubricated with oil, and graphited.

Style No. C-263, constructed in the same manner as Style No. C-262, but lubricated with wax.

Style No. C-264, for centrifugal service, plaited to the size required, lubricated with oil, and graphited.

Style No. C-265, constructed in the same manner as Style No. C-264, but lubricated with wax.

Coils are furnished in continuous lengths, packed in boxes weighing 10 to 12 pounds net for sizes from ¼″ to 1″—larger sizes in proportion; or on reels of approximately 50 pounds.



Style No. C-264

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	3 1/4	5	7 1/4	13	20	30	39	51

Printed in U.S.A.

J-M Flax-Copper Combination Packing

Style No. 278

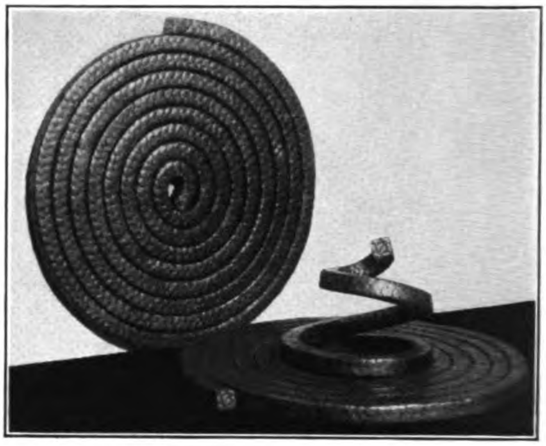
J-M Flax-Copper Combination Packing is designed for use as end rings on severe hydraulic service. Made of flax fibre and copper wire, plaited, lubricated and graphited. Furnished in coil form, Style No. C-278, and ring form, Style No. R-278.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	7 3/4	12	17 1/2	31	48	70	95	123

Coils are furnished in continuous lengths, packed in boxes weighing 10 to 12 pounds net for sizes from 1/4" to 1"—larger sizes in proportion; or on reels of 50 pounds or more. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

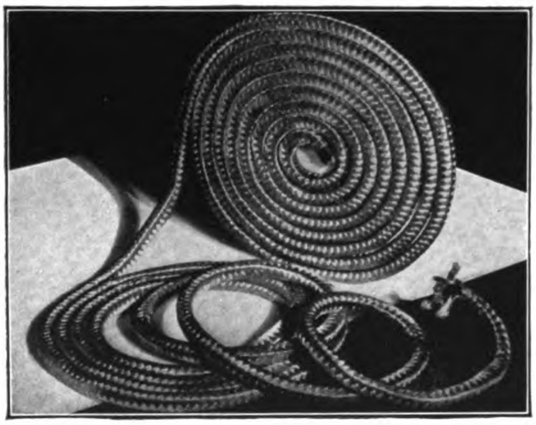


Style No. C-278

J-M Square Braided Copper Packing

Style No. 280

J-M Square Braided Copper Packing is designed for use as header rings on high-pressure service to take the brunt of the pressure; as end rings when packing heavy horizontal plungers, to hold the weight of the plunger; or as bushing rings where there is a large space between the wall of the stuffing-box and the rod.



Style No. C-280

Made entirely of pure copper wire, plaited in square cross-section, in sizes 1/4" and up, in coil form, Style No. C-280, and ring form, Style No. R-280.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	14	25	34	56	88	124	156	192

Coils are furnished in continuous lengths, on reels weighing 50 pounds or more. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Printed in U.S.A.

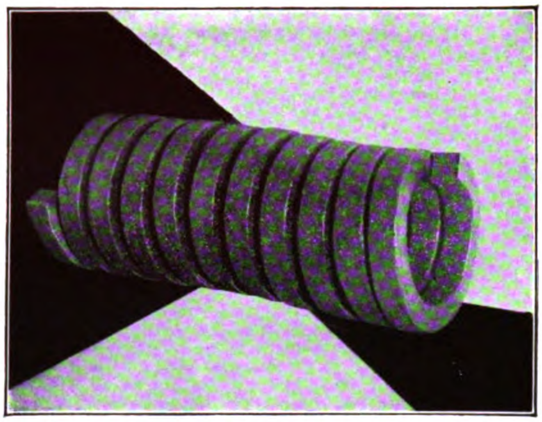
J-M Special Oil Field Packings

Styles No. R-140, No. S-156, No. 207, No. 209, No. R-373, No. R-474, No. R-476 and No. 478

J-M Rubber Rings, Style No. R-140, are designed for use between rings of W.P.H. Flax, Styles No. 240 or No. 181 on reciprocating pipe-line pumps. Made of a special rubber compound, selected for the service, and furnished in 1/4" thickness, in boxes in the quantities specified. Can be furnished in other thicknesses when required.

J-M Oil Field Spiral Packing, Style No. S-156, is designed for use on reciprocating rods at the steam end of slush pumps, and for general service conditions in the oil fields.

Made of high-grade duck, frictioned with best quality rubber, and thoroughly lubricated and graphited. Furnished in spiral form only, in sizes 1/4" and up.



Oil Field Spiral, Style No. S-156

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	4	6	8 3/4	15	24	32	46	58

Furnished in 12 1/2-ft. lengths, packed one length to a box.

Slush Pump Valve Inserts are designed for use on slush pump valves in deep-well drilling equipment, and are constructed to stand up under the severe service conditions and at the same time properly protect the valve seat. In ordering valve inserts, exact size must be given.

Style No. 207, an all-rubber compound valve insert designed especially to withstand the cutting action of sand and grit.

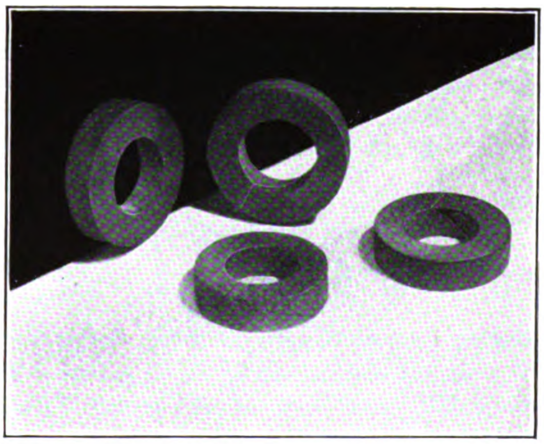
Style No. 209, designed particularly for use in drilling deep wells where shale and high-pressure conditions are encountered. Made of layers of a tough cotton fabric cemented together with a selected rubber compound. Tougher than Style No. 207, but not so resistant to the cutting action of sand and grit.

Polish Rod Ring Packing, Style No. R-373, made of a special rubber and graphite compound. Furnished in ring form only, in boxes, in the quantities specified.

Slush Pump Rings, Style No. R-474, are designed for use on the mud end of slush pumps. Made of a special rubber and graphite compound and furnished in ring form only, in boxes, in the quantities specified.

Slush Pump Combination Sets, Style No. R-476, which consists of two Slush Pump Rings, Style No. R-474, and one Low Pressure Diagonal Ring, Style No. R-184. In ordering sets, exact size must be given.

Slush Pump Sleeves, Style No. 478, made of rubber, treated to withstand the severe service requirements. In ordering sleeves, exact dimensions must be given. Furnished in boxes, in quantities specified.



Polish Rod Ring Packing, Style No. R-373

Printed in U.S.A.

J-M Universal Piston Packing

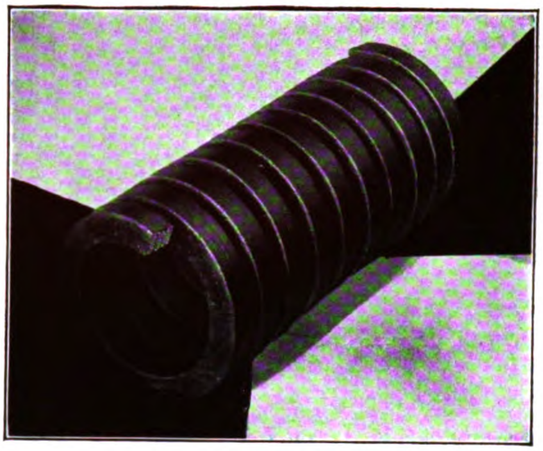
Style No. 33

J-M Universal Piston Packing is designed for service against hot water, cold water, brine, air, and oils, in use on inside-packed pumps where the packing space is 3/8" or over.

Made of layers of asbestos and duck, frictioned together, and folded back and forth into the cross-section construction illustrated.

The wearing surface formed of rigid shoulders of asbestos and duck gives greater flexibility and resiliency, longer life, and hence greater economy.

Furnished in spiral form, Style No. S-33, coil form, Style No. C-33 and ring form, Style No. R-33.



Style No. S-33

Approximate weight of 100 linear feet

Size, inch	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	10	18	24	36	42	56

Spirals and coils are furnished in 12-ft. lengths; spirals packed one length per box; coils packed in boxes weighing as follows: 3/8", 5 to 6 pounds; 1/2" to 7/8", 9 to 11 pounds; 1", 14 pounds. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

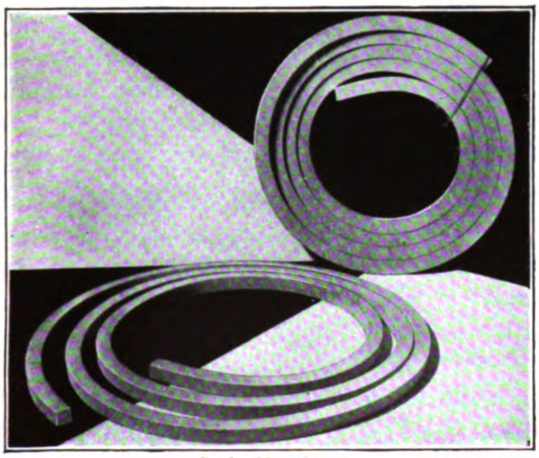
Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

J-M Aqua Hydraulic Piston Packing

Style No. 182

J-M Aqua Hydraulic Piston Packing is used for hot or cold water and oil, on inside-packed pistons.

Made of specially selected duck, cross laminated with high-grade white rubber friction. Furnished rock-hard when for use with extremely hot water.



Style No. C-182

Furnished in coil form, Style No. C-182 (regular cure), Style No. C-182-R.H. (rock-hard), Style No. C-182-X (regular cure, stitched), or Style No. C-182-X.R.H. (rock-hard, stitched). Also furnished in ring form, either step joint or solid—step joint unless otherwise ordered—Style No. R-182 (regular cure), Style No. R-182-R.H. (rock-hard), Style No. R-182-X (regular cure, stitched), and Style No. R-182-X.R.H. (rock-hard, stitched).

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	4½	6¾	9½	17	27	38	51	67

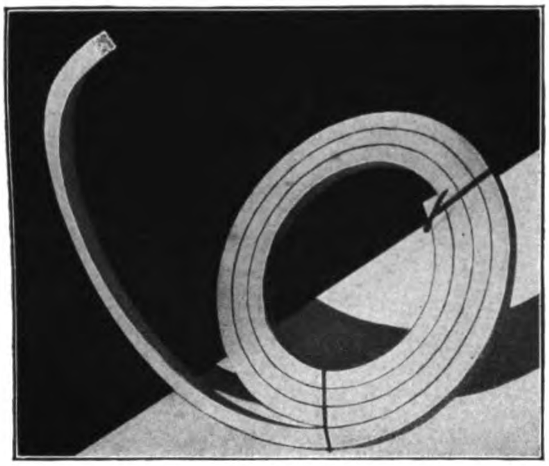
Coils are furnished in 12½-ft. lengths, packed in boxes weighing 10 to 12 pounds net for sizes from 1/4" to 1"—larger sizes in proportion. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Printed in U.S.A.

J-M Light Weight Hydraulic Rod Packing

Style No. 295



Style No. C-295

J-M Light Weight Hydraulic Rod Packing is designed for service against crude oil, gasoline, benzine, naphtha, mineral seal oil, and hot or cold water, in use on rods and plungers. Also used as end rings in hydraulic sets on outside-packed rods or plungers in service against water or oil.

Made in laminated form from exceptionally high-quality coarse duck and light rubber friction and particularly adapted to oil and gasoline service because its tendency to swell is less than that of similar packings. Furnished in coil form, Style No. C-295, and ring form, Style No. R-295.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	3 5/8	5 3/4	8 1/4	14 3/4	23	33	45	59

Coils are furnished in 12½-ft. lengths, packed in boxes weighing 10 to 12 pounds net for sizes from ¼" to 1"—larger sizes in proportion. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

J-M Square Hydraulic Piston Packing

Style No. 290

J-M Square Hydraulic Piston Packing is a medium-quality hydraulic packing for service against hot or cold water, and cold oil, in use on inside-packed pistons.

Made of good quality duck, laminated, with rubber friction, and furnished in sizes ¼" and up, in coil form, Style No. C-290, and ring form, Style No. R-290, either step joint or solid. Step joint rings are furnished unless otherwise ordered.

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	5	8	12	19½	31½	46	59	77

Coils are furnished in 12½-ft. lengths, packed in boxes weighing 10 to 12 pounds net for sizes from ¼" to 1"—larger sizes in proportion. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

J-M Tucks Piston Packing

Style No. 186

J-M Tucks Piston Packing is designed primarily for medium-pressure cold-water service on inside-packed pistons.

Made from heavy duck and high-grade black rubber friction.

Furnished in coil form, Style No. C-186, and ring form, Style No. R-186.

Coils are furnished in 12½-ft. lengths, packed in boxes weighing 10 to 12 pounds net for sizes from ¼" to 1"—larger sizes in proportion. Unless otherwise ordered, rings are packed in boxes, weighing as follows:

Diameter of rod, inches	To 1	1 to 2	2 to 3	3 to 4	Over 4
Pounds per box, net	3	5	10	15	20

Approximate weight of 100 linear feet

Size, inch	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds	3 3/8	6 1/4	8½	14	22	31	39	48

J-M Groove Packings

Styles No. C-17, No. C-176, No. C-177, No. C-216, No. C-790 and No. C-872

J-M Groove Packings are furnished in six standard styles, all of which are made in coil form only.

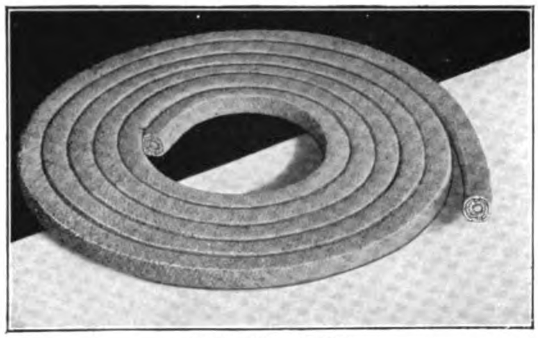
Style No. C-17 (Furnace Door Packing), square cross-section, designed for use on furnace doors, etc., where the packing is subject to great wear, particularly in cases where the door must be opened frequently. Made of a twisted asbestos core, over which are braided jackets of asbestos yarn, wire-inserted, and finished with an open mesh copper wire braided jacket. Furnished in sizes 3/8″ and up.

Style No. C-176, square cross-section, designed primarily for packing converter bottoms and the like. Made of frictioned asbestos cloth, wound around a core of asbestos rope. Furnished in sizes 1/4″ and up.

Style No. C-177, square cross-section, made like Style No. C-176, except that the cloth used as a wrapping is wire-inserted asbestos. Furnished in sizes 1/4″ and up.

Style No. C-216 (Water Gas Generator Door Packing), designed particularly for use on water gas generator doors. Made by braiding, over a core of asbestos rope, successive jackets of asbestos yarn slightly impregnated with a heat-resisting compound, and finished with graphite. Extremely tough, and most economical, since it will withstand repeated opening and sealing of the clinkering and ash-pit doors. Furnished in square cross-section. Can also be furnished in rectangular cross-section, the width of which is not less than one-half the length. The minimum width—the thickness of the packing—is 3/8″.

Style No. C-790, designed particularly for use on hot blast stove clean-out doors, boiler explosion doors, and the like. Made braid over braid from wire-inserted asbestos yarn and furnished either in square or round cross-section, in sizes 3/8″ and up.



Style No. C-176

Style No. C-872, square cross-section, designed especially for butterfly valves and similar apparatus. Made of pure asbestos yarn, wire-inserted, braided into jackets, one over another, in sizes 3/8″ and up.

Approximate weight of 100 linear feet

Size, inch		1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Weight, pounds									
Style No.	C-17			11	17	21	28	41	55
	C-176	4	6	8	14	22	32	44	52
	C-177	6	7	9	16	24	34	48	56
	C-216			11	19	30	40	48	78
	C-790	4	9	14	19	30	40	60	80
	C-872	4	9	14	19	30	40	60	80

Styles No. C-176 and No. C-177 are furnished in 12½-ft. lengths, packed in boxes, weighing as follows: 1/4″ to 1/2″, 5 to 6 pounds; 5/8″ to 3/4″, 8 to 10 pounds; 7/8″ to 1″, 12 to 14 pounds.

Styles No. C-17, No. C-216, No. C-790 and No. C-872, are furnished in continuous lengths, on 10, 25 and 50-pound reels.

Several other packings of the Johns-Manville line, though not designed as distinctly groove packings, are often used as such. Among these are some of the Braided or Twisted Rope Packings, some of the Asbestos Wick Packings, Kearsarge Packing, Style No. C-166, and Kearsarge Tubular Gasketing, Style No. **124.**

Printed in U.S.A.

J-M Asbestos Wick Packing

Styles No. 195, No. 199, No. 202, No. 4195, No. 4199 and No. 4202

Style No. 4202

J-M Asbestos Wick Packing is made in six standard styles, for the many service conditions which call for the use of asbestos wick.

Style No. 195, several strands of commercially pure asbestos roving twisted together.

Style No. 199, a single twisted strand of pure asbestos roving.

Style No. 202, several strands of pure asbestos roving twisted together.

Style No. 4195, a single twisted strand of commercially pure asbestos roving.

Style No. 4199, a single twisted strand of pure felted asbestos with a small cotton yarn in the center.

Style No. 4202, several strands of pure felted asbestos, twisted together, each strand of which has a small cotton yarn through the center. The cotton yarn gives the wick additional strength, and makes it less liable to breakage in handling.

J-M Asbestos Wick Packing is made in one size only, approximately 1/4" diameter. Furnished in continuous lengths, in 1/4 pound, 1/2 pound, and 1 pound balls, and also on paper tubes in rolls of 25 and 50 pounds net.

Number of feet per pound

Style No. 195	60 ft.	Style No. 4195	60 ft.
199	65 ft.	4199	50 ft.
202	63 ft.	4202	40 ft.

J-M Rope Packings

Twisted: Styles No. 196, No. 200, No. 203, No. 4196 and No. 4200
Braided: Styles No, 566, No. 580, No. 581, No. 702, No. 733, No. 787, No. 788, No. 857, No. 869 and No. 873

J-M Twisted Asbestos Rope Packing is made in five standard styles:

Style No. 196, twisted strands of commercially pure asbestos roving. Same as Style No. 4196, but of a higher quality.

Style No. 200, twisted strands of pure asbestos roving, and therefore suitable for higher temperatures.

Style No. 203, similar to Style No. 200 except the strands of pure asbestos roving are in themselves composed of a number of smaller strands.

Style No. 4196, made in the same manner as Style No. 4200, but from commercially pure asbestos roving, and suitable for ordinary service.

Style No. 4200, pure asbestos rope made by twisting tightly together a number of strands of twisted felted asbestos, the center strands bonded with a suitable compound.

Style No. 4200

J-M Twisted Asbestos Rope Packing is furnished in sizes 3/8" diameter and up, in continuous lengths, in 10, 25 and 50 pound coils.

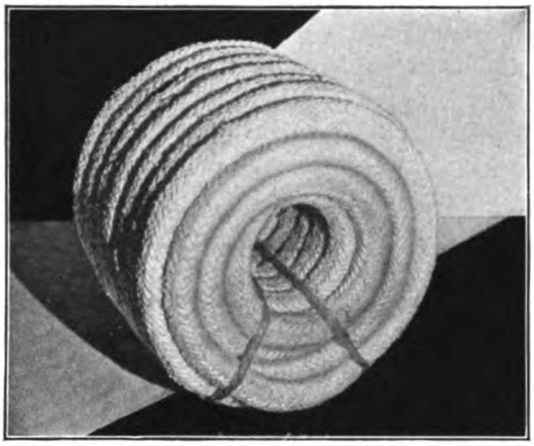
(continued)

Printed in U.S.A

Twisted Asbestos Rope

Approximate weight of 100 linear feet

Size, inch	⅜	½	⅝	¾	⅞	1
Weight, pounds						
Style No. 196	5	10	14	20	25	34
200	6	11	17	25	30	40
203	6	11	17	25	30	40
4196	5	10	14	20	25	34
4200	5	10	14	20	25	34



Style No. 566

J-M Braided Asbestos Rope Packing is made in ten standard styles:

Styles No. 566 (round) and No. 787 (square), made by braiding one or two jackets, depending upon the size, of commercially pure asbestos over a core of asbestos twisted rope. Furnished in sizes ¼″ to ¾″ inclusive with one braided jacket, and in sizes ⅞″ and over with two braided jackets.

Style No. 580 (plain) and No. 581 (wire-inserted), made by plaiting commercially pure asbestos yarn into square cross-section. Furnished in sizes ¼″ and up.

Style No. 702 (round) and No. 733 (square), made of commercially pure asbestos yarn, braided into jackets, one over the other, in sizes ¼″ and up.

Style No. 788 (round) and No. 873 (square), made of jackets of pure asbestos yarn, braided one over the other, in sizes ¼″ and up.

Style No. 857 (round) and No. 869 (square), made by braiding one or two jackets, depending upon the size, of pure asbestos over a pure asbestos twisted rope core. Furnished in sizes ¼″ to ¾″ inclusive with one braided jacket, and in sizes ⅞″ and over with two braided jackets.

Braided Asbestos Rope Packing is furnished in continuous lengths, as follows: Styles No. 566, No. 702, No. 788 and No. 857 in 10, 25 and 50 pound coils; Styles No. 580, No. 581, No. 733, No. 787, No. 869 and No. 873 on 10, 25 and 50 pound reels.

Braided Asbestos Rope

Approximate weight of 100 linear feet

Size, inch	¼	5/16	⅜	½	⅝	¾	⅞	1
Weight, pounds								
Style No. 566	2	3	5	7	14	16	25	34
580	3	5	7½	10½	16½	30	37	51
581	4½	6½	9	12½	19	33	42	56
702	2	3	5	9	14	20	25	34
733	3	5	9	14	20	25	34	50
787	3	5	7	14	16	25	34	40
788	2¼	3¼	7¾	12½	16¾	25	34	50
857	2	3	6	8	15	19	27	36
869	3	6	8	15	19	27	36	50
873	3¼	7¾	12½	16¾	25	34	50	66

J-M Twisted Asbestos Cord

Styles No. 274 and No. 285

J-M Twisted Asbestos Cord is especially serviceable in glass and chemical works, and for suspending metals, retorts, and crucibles in contact with flame or heat. Also used as a packing for small valve stems.

Made of strands of strong 1, 2, or 3-ply asbestos yarn twisted together into a cord of the required diameter and treated with a suitable dressing to give a smooth, hard finish.

Furnished in two grades, Style No. 274, and Style No. 285, the latter being the higher grade and made of finer yarn, in continuous lengths, on 1, 5, 10 or 25 pound spools, or in ¼, ½ and 1 pound balls.

Number of feet per pound

Size, inch		1/16	3/32	⅛	5/32	3/16	¼
Feet per pound							
Style No.	274	500	300	140	110	65	40
	285	425	225	125	95	55	35

Printed in U.S.A.

J-M Service Sheet Packing

Style No. 60

J-M Service Sheet Packing, Style No. 60, is designed for use on flanges and other parallel surfaces against superheated or saturated steam, gas, air, water, ammonia and some acids, alkalies and other chemicals.

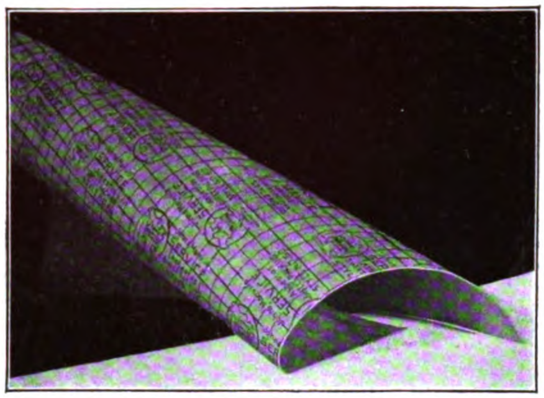
Made of selected long-fibre asbestos and special heat-resisting compounds bonded under pressure into a sheet that is pliable and resilient, and adaptable to all general sheet packing purposes.

Graphited on one side only; the other surface is ruled in one-inch squares to facilitate cutting.

The density of Service Sheet is such that it can be used successfully in thicknesses one-half as great as rubber. It does not deteriorate with age and can be carried in stock almost indefinitely.

Approximate weight per square yard

Thickness, inch	1/64	1/32	1/16	1/8
Weight, pounds	1.34	2.67	5.33	10.67



Style No. 60

Furnished in sheets 54″ x 63″, 36″ x 126″ and 54″ x 126″—all thicknesses. and in sheets 108″ x 126″—thicknesses 1/32″ and up.

J-M Asbestos Sheet Packing

Style No. 70

J-M Asbestos Sheet Packing, Style No. 70, is designed primarily for use against hot oil.

Made of asbestos and special compounds selected to meet the severe requirements of such service.

Furnished in sheets 40″ x 40″, in thicknesses of 1/64″ and up.

Approximate weight per square yard

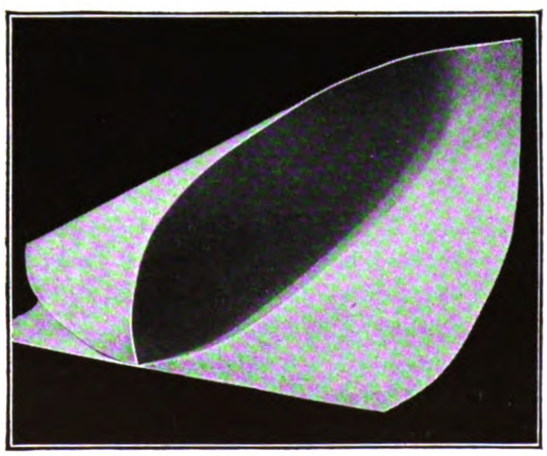
Thickness, inch	1/64	1/32	1/16	1/8
Weight, pounds	1.34	2.67	5.33	10.67

J-M Felted Asbestos Sheet Packing

Style No. 219

J-M Felted Asbestos Sheet Packing, Style No. 219, is a felted asbestos sheet designed primarily for use at high temperatures. Because of the long-fibre asbestos, the special binder which is used, and the method of manufacturing this sheet, it is stronger than ordinary felted asbestos. No rubber compound is used in it.

Furnished in sheets 40″ x 40″ in thicknesses of 1/16″ and 1/8″. Approximate weight per square yard: 1/16″, 3½ pounds; 1/8″, 7 pounds.

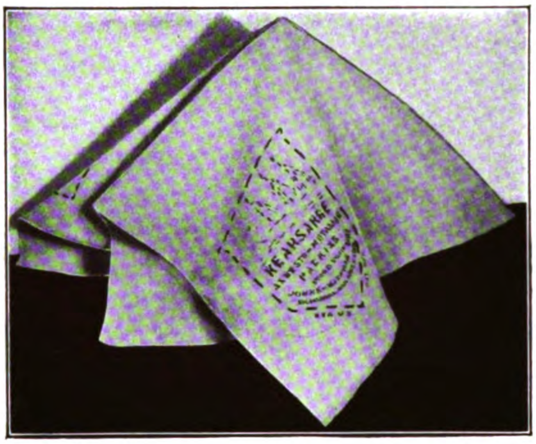


Style No. 219

Printed in U.S.A.

J-M Kearsarge Sheet Packing

Style No. 100



Style No. 100

J-M Kearsarge Sheet Packing, Style No. 100, is particularly designed for use on rough flanges against low, medium or high pressure steam, water and air. Also recommended where a narrow flange gasket is necessary, or where many ports and bolt holes must be used.

Made of tightly twisted asbestos yarn spun with brass wire for additional strength, woven into Asbesto-Metallic cloth and impregnated with a special heat-resisting compound.

Furnished in 48″ wide rolls weighing approximately 250 pounds net per roll, and shipped one roll per case.

Approximate weight per square yard: 1/32″, 4½ pounds; 1/16″, 5½ pounds; ⅛″, 10½ pounds.

J-M Mobilene Sheet Packing

Style No. 101

J-M Mobilene Sheet Packing, Style No. 101, is in frequent demand for packing cylinder-head joints and various parts of gas and gasoline engines.

Made of a strong asbestos fabric, interwoven with fine brass wire, and impregnated with a special compound to withstand high temperature and pressure. Coated with a red compound on one side and graphite on the other, so that a joint may easily be taken apart without destroying the gasket.

Furnished 1/32″ and 1/16″ thick, in 48″ rolls weighing approximately 250 pounds net, and shipped one roll per case.

Approximate weight per square yard: 1/32″, 4½ pounds; 1/16″, 5½ pounds.

J-M Seigelite Sheet Packing

Style No. 711

J-M Seigelite Sheet Packing, Style No. 711, is designed for use on parallel surfaces and flanges against gasoline, benzine, oil and greases, and hot or cold water. Not recommended where temperatures exceed 250 deg. F., or for alternate wet and dry conditions. Approved by the Underwriters' Laboratories, Inc., for use against hazardous liquids.

Made of plant fibre, thoroughly impregnated with a special compound as a binder and to preserve the sheet. Contains no rubber or rubber substitutes.

Has extremely high tensile strength, and when immersed in liquids, becomes extremely tough, resembling rawhide. Because of its tensile strength, it is more desirable for hydraulic service than either rubber, or rubber cloth inserted (C.I.) sheets. Because of its density and resiliency, it can be used in thickness one-half that of a rubber sheet.

In thicknesses up to 1/16″, it is furnished in 36″ and 48″ wide rolls containing 25 or 50 square yards, and shipped one roll per crate. In ⅛″ thickness it is furnished in sheets, 36″ x 48″.

Approximate weight per square yard

Thickness, inch	1/64	1/32	1/16	1/8
Weight, pounds	0.8	1.7	3.7	7

Printed in U.S.A.

J-M Rubber Sheet Packing

Styles No. 107, No. 108, No. 109, No. 110, No. 111, No. 112, and No. 115

Liberty Red Rubber Sheet Packing, Style No. 107, is designed for medium or low-pressure steam and hydraulic service. Made from a special heat-resisting rubber compound of the highest quality, is comparatively light in weight and will not deteriorate rapidly.

Liberty Red Rubber Sheet Packing, Style No. 108, same as Style No. 107, but wire-inserted.

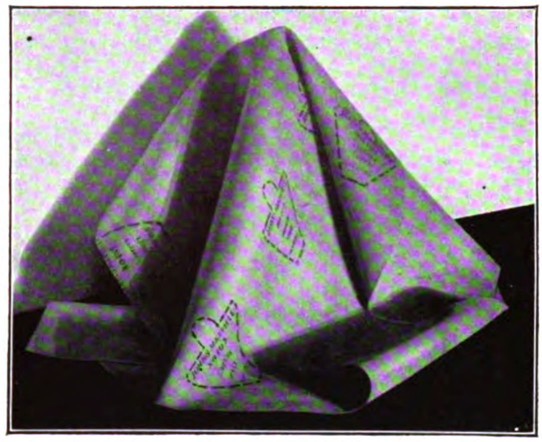
Hydraulic Sheet Packing, Style No. 109, a cloth inserted (C.I.) sheet, designed for low-pressure cold-water service.

Hydraulic Sheet Packing, Style No. 110, similar to Style No. 109, except that it has cloth on one side (C.O.S.).

Hydraulic Sheet Packing, Style No. 111, similar to Style No. 109, but with cloth on both sides. (C.B.S.)

Black Oil-Proof Sheet Packing, Style No. 112, is particularly designed for packing against oil. Made of a special black rubber compound which will satisfactorily withstand the action of oils. Comparatively light in weight, and will not deteriorate as rapidly as similar sheet packings.

Diaphragm Rubber Sheet Packing, Style No. 115, a high-grade duck inserted rubber sheet packing, designed for making diaphragms on damper regulators, reducing valves, etc.



Style No. 107

All styles of J-M Rubber Sheet Packings are furnished in 36″ wide rolls, weighing approximately 250 pounds each and wrapped in burlap.

Weight per square yard

Thickness, inch		1/32	1/16	1/8
Weight, pounds				
Style No.	107	3¼	6½	12½
	108		8	14
	109		4¾	9½
	110		4¾	9½
	111		4¾	9½
	112	3	6	12
	115		4¾	9½

Printed in U.S.A.

J-M Cut Gaskets

Styles No. 61, No. 71, No. 126, No. 141, No. 142, No. 220 and No. 712

J-M Service Gaskets, Style No. 61, are cut from Service Sheet Packing. They have all the pliability, resiliency, and adaptability of Service Sheet, and can be used for the same great variety of conditions. Furnished in thicknesses of 1/64", 1/32", and 1/16", to the dimensions required.

J-M Seigelite Gaskets, Style No. 712, are cut from Seigelite Sheet Packing and have the same properties. Furnished in thicknesses of 1/64", 1/32", 1/16", and 1/8", to the dimensions required.

J-M Kearsarge Cut Gaskets, Style No. 126, are cut from Kearsarge Sheet Packing and are therefore particularly adapted for use on rough flanges. Can be furnished in any odd or irregular shape.

J-M Felted Asbestos Gaskets, Style No. 220, are cut from J-M Felted Asbestos Sheet and have all its qualities. Furnished in thicknesses of 1/16" and 1/8", to the dimensions required.

J-M Mobilene Gaskets, Style No. 141, are cut from Mobilene Sheet Packing and have all the properties of that sheet. Furnished in thicknesses of 1/32" and 1/16", to the dimensions required.

J-M Asbestos Gaskets, Style No. 71, are cut from Asbestos Sheet Packing and have the same properties. Furnished in thicknesses of 1/64", 1/32", 1/16" and 1/8", to the dimensions required.

J-M Liberty Red Rubber Gaskets, Style No. 142, are cut from Liberty Red Rubber Sheet Packing. Furnished in thicknesses 1/32", 1/16" and 1/8", to the dimensions required.

In addition to Liberty Red Rubber Gaskets, Style No. 142, Johns-Manville can furnish, on order, gaskets of any size and shape required which can be cut from other J-M rubber sheet packings.

The standard sizes for flange gaskets are given in the table in opposite column and on the other side of this sheet.

FLANGE GASKET DIMENSIONS (in inches)

(A. S. M. E. Standard)

Extra heavy and medium flanges

Nominal	*Ring Gaskets*		*Full Face Gaskets*	
Pipe Size	*I. D.*	*O. D.*	*I. D.*	*O. D.*
1	1	2¾	1	4½
1¼	1¼	3¼	1¼	5
1½	1½	3⅞	1½	6
2	2	4⅜	2	6½
2½	2½	5⅛	2½	7½
3	3	5⅞	3	8¼
3½	3½	6½	3½	9
4	4	7⅛	4	10
4½	4½	7¾	4½	10½
5	5	8½	5	11
6	6	9⅞	6	12½
7	7	11	7	14
8	8	12⅛	8	15
9	9	13	9	16¼
10	10	14¼	10	17½
12	12	16⅝	12	20½
14	14	19⅛	14	23
15	15	20¼	15	24½
16	16	21¼	16	25½
18	18	23½	18	28
20	20	25⅝	20	30½
22	22	27¾	22	33
24	24	30⅜	24	36
26	26	32⅞	26	38¼
28	28	35⅜	28	40¾
30	30	37½	30	43
32	32	39⅝	32	45¼
34	34	41⅝	34	47½
36	36	44⅛	36	50
38	38	46⅛	38	52¼
40	40	48⅜	40	54½
42	42	50⅞	42	57
44	44	53	44	59¼
46	46	55¼	46	61½
48	48	58¾	48	65

NOTE: Cut gaskets can also be furnished, on order, cut from asbestos paper, asbestos millboard, felt paper, manila tag paper, manila rope paper, straw board, chipboard, fish paper, blotting paper and varnished cloth.

Printed in U.S.A.

FLANGE GASKET DIMENSIONS (in inches)
(A. S. M. E. Standard)

Standard and low pressure flanges

Nominal	*Ring Gaskets*		*Full Face Gaskets*		*Nominal*	*Ring Gaskets*		*Full Face Gaskets*	
Pipe Size	*I. D.*	*O. D.*	*I. D.*	*O. D.*	*Pipe Size*	*I. D.*	*O. D.*	*I. D.*	*O. D.*
¾	¾	2⅛	¾	3½	40	40	45⅝	40	50¾
1	1	2 9/16	1	4	42	42	47⅞	42	53
1¼	1¼	2 15/16	1¼	4½	44	44	50⅛	44	55¼
1½	1½	3⅜	1½	5	46	46	52⅛	46	57¼
2	2	4⅛	2	6	48	48	54⅜	48	59½
2½	2½	4⅞	2½	7	50	50	56½	50	61¾
3	3	5⅜	3	7½	52	52	58¾	52	64
3½	3½	6⅜	3½	8½	54	54	61	54	66¼
4	4	6⅞	4	9	56	56	63¼	56	68¾
4½	4½	7	4½	9¼	58	58	65½	58	71
5	5	7¾	5	10	60	60	67½	60	73
6	6	8¾	6	11	62	62	69⅞	62	75¾
7	7	10	7	12½	64	64	72⅛	64	78
8	8	11	8	13½	66	66	74⅛	66	80
9	9	12½	9	15	68	68	76⅜	68	82¼
10	10	13⅜	10	16	70	70	78⅝	70	84½
12	12	16⅛	12	19	72	72	80⅝	72	86½
14	14	17¾	14	21	74	74	82⅝	74	88½
15	15	19	15	22¼	76	76	84⅝	76	90¾
16	16	20¼	16	23½	78	78	86¾	78	93
18	18	21⅝	18	25	80	80	89	80	95¼
20	20	23⅞	20	27½	82	82	91¼	82	97½
22	22	26	22	29½	84	84	93½	84	99¾
24	24	28¼	24	32	86	86	95¾	86	102
26	26	30½	26	34¼	88	88	98	88	104¼
28	28	32¾	28	36½	90	90	100⅛	90	106½
30	30	34⅝	30	38¾	92	92	102⅜	92	108¾
32	32	38	32	41¾	94	94	104⅛	94	111
34	34	39	34	43¾	96	96	106¼	96	113¼
36	36	41¼	36	46	98	98	108½	98	115½
38	38	43⅝	38	48¾	100	100	110¾	100	117¾

Printed in U.S.A.

J-M Kearsarge Gaskets

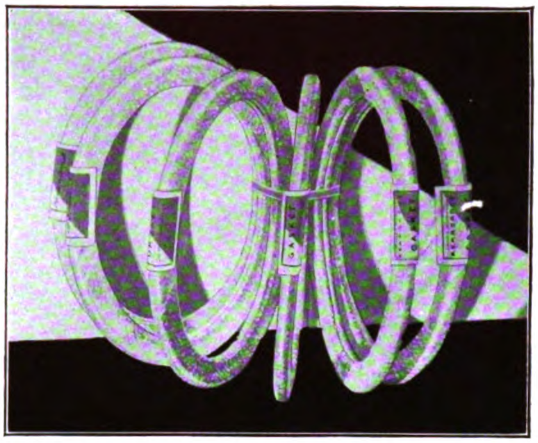
Boiler Handhole and Manhole, Style No. 116 and Jointless Tube Plate, Style No. 118

J-M Kearsarge Boiler Handhole and Manhole Gaskets, Style No. 116, are made by folding to the proper size and shape several plies of Asbesto-Metallic cloth, made from tightly twisted asbestos yarn with fine copper wire insertion, which has been treated with a special heat-resisting compound. The finished gaskets are so formed that the edges of the folds are on the inner side, while on the outer side, where the gasket is exposed to pressure, there is an unbroken, rounded shoulder. They may be used repeatedly, if they are properly applied.

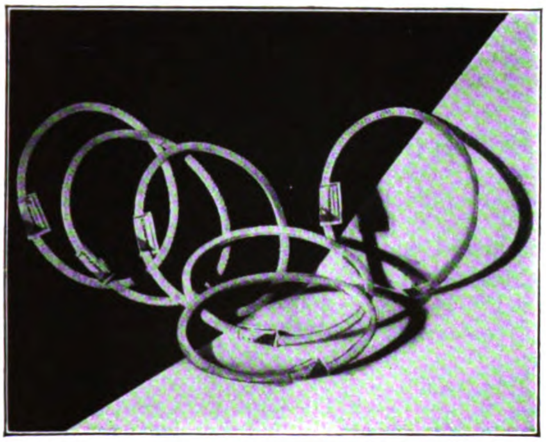
Furnished in oval form to fit the plate for which they are intended. Handhole gaskets have an average inside diameter between 3″ and 6″; manhole gaskets have an average inside diameter of 6″ or over. Shapes other than oval can be furnished on order.

The minimum flange width is 3/8″. The thickness varies according to the number of plies of fabric, each ply being approximately 1/16″ thick. Best results are generally obtained through the use of gaskets three or four plies thick. Gaskets thicker than four-ply are unnecessary, because the thicker the gasket the greater the tendency to blow out. A two-ply gasket is usually not efficient.

In ordering Kearsarge gaskets, specify the two inside diameters, the width of the flange, and the number of plies desired in the gasket. Where gaskets are ordered 1/8″ thick and are not specified as two-ply, they will be furnished three-ply from fabric approximately 1/32″ thick.



Style No. 116



Style No. 118

J-M Kearsarge Jointless Tube Plate Gaskets, Style No. 118, are recommended for tube plate work. Their advantage lies in the fact that there are no taped joints to interfere with perfect seating, so necessary when gaskets with a very narrow flange are used.

Made seamless and without a joint, from Asbesto-Metallic yarn woven into tubular ring form, properly folded and treated with the same heat-resisting compound used in the J-M Kearsarge Boiler Gaskets. Made in the following sizes only:

For B. & W. boilers Size, inches	Thickness	Approximate weight per 100 gaskets, lb.
4 15/32 x 5 13/32 x 1/4 (oval)	3-ply	4 3/8
4 15/32 x 5 13/32 x 1/4 (oval)	4-ply	5 1/2
4 25/32 x 4 31/32 x 1/4 (square)	3-ply	5 3/4
4 25/32 x 4 31/32 x 1/4 (square)	4-ply	6 3/4
For Heine boilers Size, inches		
3 1/2 i. d. x 3/8 flange (round)	3-ply	4
3 1/2 i. d. x 3/8 flange (round)	4-ply	5 1/2
3 1/2 x 4 1/2 i. d. x 3/8 flange (oval)	3-ply	5
3 1/2 x 4 1/2 i. d. x 3/8 flange (oval)	4-ply	5 7/8

In ordering, specify the size desired, and the make of boiler upon which the gaskets are to be used.

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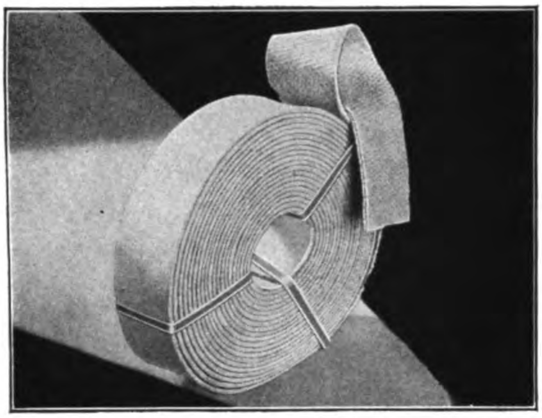
J-M Kearsarge Gasketing Tape

Style No. 120



Style No. 120

J-M Kearsarge Gasketing Tape, Style No. 120, is designed for service against steam, air, water, ammonia, and various chemicals, both acids and alkalies, not only on rough or irregular shaped surfaces where a gasket softer than one cut from Service Sheet is required, but also wherever a tape gasket is needed.

Made of Asbesto-Metallic fabric, treated with a resilient heat-resisting compound, and folded into the required sizes.

Furnished in widths ½″ and up, in thicknesses of 1/16″, ⅛″, 3/16″ and ¼″ in continuous lengths; thicknesses 1/16″ and ⅛″ in 200-ft. coils; thicknesses 3/16″ and ¼″ in 100-ft. coils.

Approximate Weight of 100 Linear Feet

Thickness, inch	1/16	⅛	3/16	¼
Weight, pounds				
Width ½″	2¼	5	7½	10
1″	4½	10	15	20
2″	9	20	30	40
3″	13½	30	45	60

J-M Kearsarge Lute Coil Gasketing

Styles No. 128 and No. 129

J-M Kearsarge Lute Coil Gasketing is designed to meet the exacting requirements of a packing for gas purifier boxes and the like, which must be free from material affected by the gas, and yet be rugged enough to resist the weight of the cover and the force exerted in tightening the hold-down screws.

Made of asbestos cloth, plain, Style No. 128, and wire-inserted, Style No. 129, folded back and forth into the required size and covered with a jacket of the same material. Heat-resisting compound is used on the center block but the covering jacket is untreated.

In ordering, specify width and thickness desired and indicate on which side of gasket the cover will rest.

J-M Woven Asbestos Gasketing Tape

Styles No. 121 and No. 122

J-M Woven Asbestos Gasketing Tape is designed for use under high temperature conditions where exceptional strength is a requirement. Not impregnated.

Style No. 121, made of wire-inserted asbestos yarn woven to the thickness and width required.

Style No. 122, made of plain asbestos yarn woven to the required width and thickness. Slightly softer than Style No. 121.

Furnished in continuous lengths in coils of approximately 50 ft.

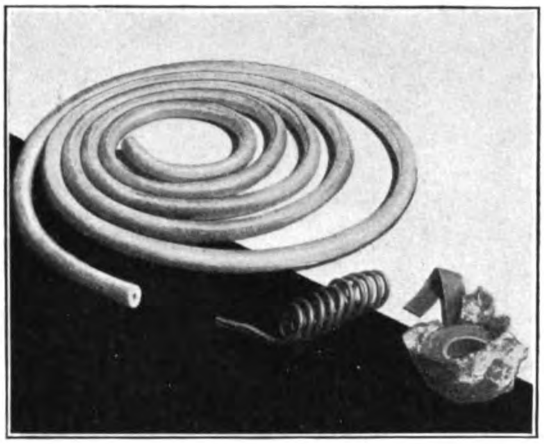
Approximate Weight of 100 Linear Feet

Thickness, inch	⅛	3/16	¼	5/16
Weight, pounds				
Style No. 121				
Width 1″	9	10	16	20
2″	17	21	27	32
3″	26	28	43	48
Style No. 122				
Width 1″	8	8¾	14	17½
2″	15	18¾	23⅝	28
3″	22¾	24½	37½	42

Printed in U.S.A.

J-M Kearsarge Tubular Gasketing

Style No. 124



Style No. 124

J-M Kearsarge Tubular Gasketing, Style No. 124, is designed primarily for use as emergency gasketing. Also extensively used for making odd or irregular-shaped gaskets; for packing joints where grooves are provided; and wherever a gasket of round cross-section is desired.

Made of Asbesto-Metallic fabric, treated with a special heat-resisting compound, and rolled into a coil of round cross-section with a hollow center. Has none of the disadvantages of rubber gasketing, and can be used for a greater number of service conditions. If properly handled, can be used repeatedly.

Furnished in sizes from 3/8″ up, packed in boxes weighing approximately 5 or 10 pounds net, containing one or more 12½-ft. lengths of the gasketing, together with the necessary friction tape and lead.

Approximate Weight of 100 Linear Feet

Thickness, inch	3/8	½	5/8	¾	7/8	1
Weight, pounds	8	14	24	40	52	64

J-M Liberty Red Rubber Tubular Gasketing

Style No. 125

J-M Liberty Red Rubber Tubular Gasketing is designed for use on medium and low-pressure steam and in hydraulic service.

Made of red rubber, cloth-inserted sheet, in round cross-section, with a hollow center.

Sizes from ¼″ to 1″ packed in continuous lengths, in boxes weighing from 10 to 12 pounds net, including the necessary friction tape and lead.

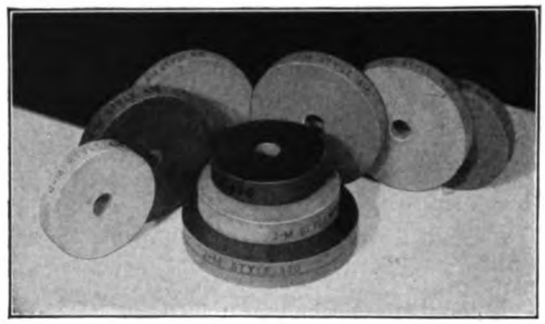
Approximate Weight of 100 Linear Feet

Size, inch	¼	5/16	3/8	½	5/8	¾	7/8	1
Weight, pounds	4	6	8¾	15	24	32	46	58

Printed in U.S.A.

J-M Pump Valves

Styles No. 300, No. 415, No. 416, No. 420, No. 424 and No. 430



J-M Pump Valves are made from various rubber compounds especially selected for the particular type of service for which the valve is recommended.

Style No. 300, an exceptionally strong, hard valve, made of duck impregnated with rosin gums, designed for service against hot or cold water, oils, naphtha, benzine, paraffin, weak acids, and alkalies, on pressures up to 300 pounds and temperatures up to 300 deg. F.

Style No. 415,a hard valve, recommended for high-pressure cold-water service on pressures from 200 to 400 pounds.

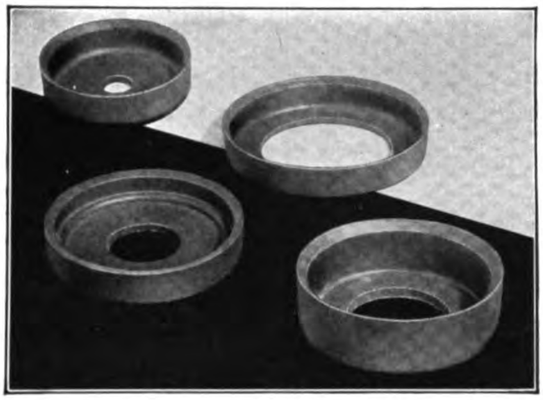
Style No. 416, a medium hard valve, designed for cold-water service on pressures up to 200 pounds. Recommended for use against fresh, salt, or alkali water and for general industrial service.

Style No. 420, a soft, tough valve, designed and recommended for lake, marine, and other severe condenser service.

Style No. 424, a hard valve of the highest quality, designed for all hot-water service conditions. Recommended for pressures up to 300 pounds and for temperatures up to 300 deg. F.

Style No. 430, a hard valve, designed to give exceptional service against oil, acids, ammonia, syrups, etc., on pressures up to 300 pounds and temperatures up to 300 deg. F.

J-M Moulded Packing Cups



J-M Moulded Packing Cups are especially designed and moulded to the exact size and shape required, and give long and efficient service against steam, air, water, oil, etc.

Recommended for use on steam brake cylinders, air hoists, pneumatic chucks, hydraulic presses, valves, etc., and are particularly adapted to slow-moving pistons having a relatively short travel, steam and air rams for setting clutches and brakes, steam-operating cylinders on vulcanizers, and air cylinders on foundry moulding equipment.

Depending upon the nature of the service, J-M Moulded Packing Cups are made of asbestos, duck, or other fabrics, impregnated with heat and oil-resisting compounds selected to meet the particular conditions and temperatures to which they will be subjected.

Since they are made from specially selected materials, and are moulded to the exact shape and size, they have many advantages over leather. Their composition can be varied to suit requirements and they will retain their shape in service.

J-M Moulded Packing Cups are furnished in a variety of shapes, including regular shaped cups, such as types A, B and P, also U-shape and "Hat" shape. Dimensions and list prices are given in the following pages.

In ordering J-M Moulded Packing Cups, full information as outlined on the Packing Cup Data Sheet must be given in order that the proper cups for the particular conditions may be furnished.

Johns-Manville Moulded Packing Cups

JOHNS-MANVILLE CORP. .... Division

Customer's Name ....

Address ....

The following information is required on all orders for packing cups.

FILL OUT VERY CAREFULLY

This form must *accompany* all orders.

1. **Service for which cups are to be used** ....

....
(State whether steam, hot water, cold water, air, oil, etc.).

2. **Machine on which cups are to be used** ....

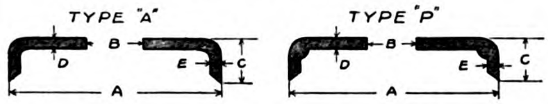
....
(State briefly whether it is a brake, press, accumulator, pump, plunger elevator, etc. If possible state name of manufacturer. It is not necessary to give manufacturer's serial number or sizes of cylinder, etc.)

3. **How are cups lubricated?** ....

....

4. **Pressure to come on packing in lbs. per sq. in.** ....
5. **Temperature of liquid or gas** ....
6. **What does our cup replace?** ....
7. **If any remarks, use other side and check here** ....
8. **Diameter of cylinder in which cup operates** ....
9. **Is cylinder perfectly round and smooth?** ....
10. **If not give particulars** ....
11. **Type of cup required** ....

(State whether Type A, Type P or Special)



12. **Dimensions "A"** .... **"B"** .... **"C"** .... **"D"** .... **"E"** ....
(If variation is permissible in above dimensions, indicate in spaces above as "C", 1" to 2").
13. **Give mould number of suitable cup if possible** ....

SPECIAL TYPES

14. **Make dimensioned sketch on back of this sheet to show all packing conditions and add remarks necessary to make them clear.**

Facsimile of the Moulded Packing Cup Data Sheet

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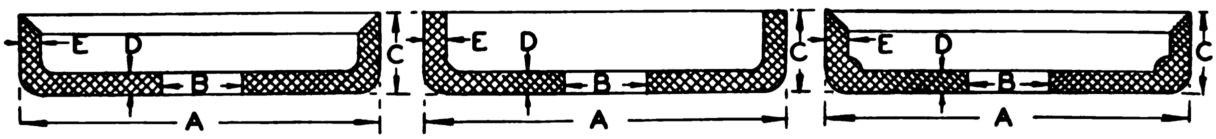
J-M Moulded Packing Cup Dimensions



TYPE A TYPE B TYPE P

MOULD NO.	A	B	C	D	E	TYPE	LIST PRICE F.O.B. MANVILLE, N.J.
	Dimensions in Inches						
973	1/2	None	3/16	3/64	3/64	A	$ .50
161	3/4	3/8	11/16	3/16	5/32	B	.75
154	7/8	3/8	1/4	3/32	5/32	A	.88
624	31/32	1/2	15/32	1/8	1/8	A	.97
901	1	1/4	1/2	1/8	1/8	A	1.00
734	1	5/16	3/16	3/32	3/32	B	1.00
268	1	3/8	7/16	7/64	7/64	B	1.00
243	1	1/2	7/16	1/8	1/8	A	1.00
938	1	17/32	11/16	1/8	1/8	A	1.00
487	1-1/8	none	5/16	1/8	1/8	B	1.13
564	1-1/8	1/4	7/16	1/8	1/8	A	1.13
484	1-1/8	7/8	5/16	1/16	1/16	B	1.13
871	1-3/16	3/8	3/8	3/32	3/32	A	1.19
105	1-1/4	3/8	1	1/8	1/8	A	1.25
141	1-1/4	21/32	5/16	1/8	1/8	A	1.25
361	1-1/4	3/16	3/8	1/16	1/16	A	1.25
674	1-1/4	9/16	7/16	3/32	3/32	A	1.25
235	1-11/32	1/4	5/8	5/32	5/32	A	1.34
505	1-3/8	11/16	1/2	5/32	5/32	B	1.38
144	1-3/8	1/4	1/2	1/8	1/8	A	1.38
261	1-3/8	5/16	7/16	1/8	1/8	A	1.38
390	1-3/8	11/16	3/8	1/8	1/8	A	1.38
512	1-3/8	11/16	1/2	1/8	1/8	A	1.38
274	1-3/8	5/8	9/16	1/8	1/8	A	1.38
794	1-7/16	9/16	3/8	3/32	3/32	A	1.44
874	1-15/32	21/32	9/16	3/32	3/32	B	1.47
136	1-15/32	17/32	5/8	1/8	1/8	A	1.48
128	1-15/32	13/16	1/2	3/32	3/32	A	1.48
146	1-15/32	11/16	5/8	1/8	1/8	B	1.48
101	1-1/2	1/2	1/2	1/8	1/8	A	1.50
162	1-1/2	3/4	1/2	1/8	1/8	A	1.50
247	1-1/2	3/4	3/8	1/8	1/8	A	1.50
131	1-1/2	1-1/8	1/2	1/8	1/8	A	1.50
462	1-1/2	7/16	1/2	3/16	3/16	A	1.50
591	1-1/2	none	3/8	1/8	1/8	A	1.50
524	1-1/2	none	3/4	3/16	3/16	A	1.50
147	1-1/2	3/8	3/8	1/8	1/8	A	1.50
906	1-1/2	1/2	5/8	1/8	1/8	A	1.50
971	1-1/2	9/16	3/4	3/16	3/16	P	1.50
993	1-1/2	1	3/4	1/8	1/8	A	1.50
951	1-9/16	9/16	9/32	1/16	1/16	A	1.30
885	1-35/64	17/32	11/16	5/32	5/32	A	1.55
894	1-35/64	17/32	3/8	5/32	5/32	A	1.55
106	1-5/8	none	1/2	1/8	1/8	B	1.63
102	1-5/8	none	1/2	1/8	1/8	A	1.63
276	1-3/4	1	1/2	1/8	1/8	A	1.75
671	1-3/4	21/32	7/16	3/32	3/32	A	1.75
621	1-3/4	1/2	7/16	1/8	1/8	A	1.75
464	1-3/4	15/16	1/2	3/16	3/16	A	1.75
167	1-3/4	1-3/16	3/4	1/8	1/8	A	1.75
314	1-3/4	1-3/16	11/16	5/32	5/32	B	1.75
991	1-3/4	3/4	3/4	1/8	1/8	A	1.75
169	1-25/32	none	25/32	5/32	5/32	A	1.78
857	1-25/32	1-3/16	3/4	11/64	11/64	A	1.78
928	1-25/32	1-1/4	3/4	1/8	1/8	A	1.78
508	1-13/16	1	3/8	1/8	1/8	A	1.82
166	1-7/8	1/2	3/4	3/32	3/32	A	1.88
577	1-7/8	1/2	3/8	1/16	1/16	A	1.88
959	1-7/8	5/8	1/2	1/8	1/8	A	1.86
275	1-31/32	1-1/4	9/16	1/8	1/8	A	1.97
463	1-31/32	1-1/8	11/16	3/16	3/16	B	1.97
377	1-31/32	3/4	7/16	1/8	1/8	B	1.97
502	1-63/64	1-5/16	7/8	3/16	1/8	A	1.99
108	2	7/8	3/8	1/8	1/8	B	2.00
277	2	1	9/16	1/8	1/8	A	2.00
658	2	1	1/2	1/8	1/8	A	2.00
470	2	9/16	9/32	1/16	1/16	A	2.00
686	2	3/4	1/2	3/16	3/16	A	2.00
156	2	3/8	1/2	1/8	1/8	A	2.00
269	2	3/4	1/2	3/16	3/16	A	2.00
246	2	1	3/8	3/16	3/16	A	2.00
469	2	1-5/16	7/8	1/8	3/16	A	2.00
449	2	1/2	9/16	3/16	3/16	A	2.00
870	2	5/8	9/16	3/16	3/16	A	2.00
905	2	5/8	7/8	5/32	5/32	A	2.00
992	2	15/16	3/4	1/8	1/8	A	2.00
151	2-1/32	13/16	1-1/2	1/2	3/8	B	3.25
373	2-1/16	5/16	7/16	1/8	1/8	A	2.07
494	2-1/8	25/32	3/8	1/8	1/8	A	2.13
148	2-3/16	3/4	1/2	1/8	1/8	A	2.19
278	2-7/32	1-1/4	9/16	1/8	1/8	A	2.22
592	2-1/4	1/2	3/8	1/16	1/16	A	2.25
279	2-1/4	1-1/4	9/16	1/8	1/8	A	2.25
978	2-1/4	1	1/2	3/32	3/32	A	2.25
1000	2-1/4	1-1/4	7/16	1/16	1/16	A	2.25

MOULD NO.	A	B	C	D	E	TYPE	LIST PRICE F.O.B. MANVILLE, N.J.
	Dimensions in Inches						
280	2-1/4	1/2	1/2	5/32	5/32	A	$ 2.25
174	2-5/16	1-3/16	13/16	3/16	3/16	A	2.32
107	2-3/8	1-1/8	1/2	3/32	3/32	A	2.38
457	2-3/8	9/16	9/32	1/16	1/16	A	2.38
145	2-13/32	27/32	19/32	5/32	5/32	A	2.41
281	2-1/2	15/16	1/2	1/8	1/8	A	2.50
152	2-1/2	1-1/8	17/32	5/32	5/32	A	2.50
160	2-1/2	1-1/8	1/2	1/8	1/8	A	2.50
134	2-1/2	1-3/4	1/2	1/8	1/8	A	2.50
104	2-1/2	5/8	3/8	1/8	1/8	A	2.50
150	2-1/2	1-1/8	1/2	1/8	1/8	A	2.50
245	2-1/2	1-1/4	3/8	3/16	3/16	A	2.50
649	2-1/2	1-1/8	1/2	1/8	1/8	A	2.50
445	2-9/16	5/16	1/2	1/8	1/8	A	2.57
942	2.575	1-3/4	1/2	1/8	1/8	A	2.57
272	2-5/8	1/4	1	7/32	7/32	A	2.63
138	2-5/8	3/8	9/16	5/32	5/32	A	2.63
282	2-5/8	1/2	9/16	1/8	1/8	A	2.63
636	2-3/4	1	9/16	1/8	1/8	A	2.75
632	2-3/4	15/16	9/16	1/8	1/8	A	2.75
283	2-3/4	1/2	9/16	1/8	1/8	A	2.75
324	2-3/4	2	9/16	9/64	9/64	A	2.75
234	2-3/4	1-1/2	1-1/4	3/16	3/16	A	3.85
133	2-3/4	2-1/32	3/4	3/16	3/16	A	2.75
299	2-3/4	1	5/8	5/32	5/32	B	2.75
425	2-13/16	1-1/3	1/2	1/8	1/16	B	2.82
424	2-13/16	1-1/8	1/2	1/8	1/16	B	2.82
507	2-7/8	2-3/8	3/8	1/16	1/16	A	2.88
250	2-7/8	1-1/8	7/8	3/16	3/16	B	2.88
832	2-7/8	1-7/8	1/2	1/8	1/8	A	2.88
957	2-7/8	1	3/4	3/16	3/16	A	2.86
929	2-15/16	none	7/8	1/8	1/8	A	2.94
240	3	25/32	3/4	3/16	3/16	A	3.00
447	3	25/32	3/4	3/16	3/16	A	3.00
284	3	5/8	11/16	1/8	1/8	A	3.00
285	3	1	9/16	1/8	1/8	A	3.00
648	3	1-1/8	9/16	1/8	1/8	A	3.00
615	3	1/2	5/8	3/16	3/16	A	3.00
495	3	1-1/8	1	1/4	1/4	A	3.60
494	3	25/32	3/8	1/8	1/8	A	3.00
460	3	5/8	5/8	3/32	3/32	A	3.00
267	3	3/8	7/16	1/8	1/8	A	3.00
109	3	none	5/8	1/8	1/8	A	3.00
123	3	none	1-5/16	3/16	3/16	A	3.00
220	3	1-3/4	5/8	1/4	1/4	A	3.60
171	3	1-1/4	11/16	1/4	1/4	A	3.60
226	3	1-1/4	3/4	1/4	1/4	A	3.60
374	3	5/16	7/16	1/8	1/8	A	3.00
400	3	1-1/8	1/2	1/8	1/8	A	3.00
416	3	1-5/8	1/2	1/8	1/8	A	3.00
111	3	1-3/4	3/8	1/16	1/16	A	3.00
746	3	1-1/4	9/16	1/8	1/8	A	3.00
688	3	5/8	9/16	1/8	1/8	A	3.00
885	3	none	1	3/16	3/16	A	3.00
236	3.002	1-17/64	1	1/4	1/4	A	3.60
943	3.062	2-1/4	5/8	1/8	1/8	A	3.06
237	3-1/16	5/8	5/8	3/16	3/16	A	3.07
485	3-1/16	1/4	3/4	1/4	1/4	A	3.68
132	3-1/8	1-1/4	5/8	1/8	1/8	A	3.13
721	3-3/16	1-25/32	1/2	3/32	3/32	A	3.19
113	3-1/4	7/16	1/2	1/8	1/8	A	3.25
112	3-1/4	1-1/4	5/8	1/8	1/8	A	3.25
960	3-1/4	1-1/16	5/8	1/8	1/8	A	3.25
110	3-3/8	none	5/8	1/8	1/8	A	3.38
723	3-1/2	1-1/2	5/8	3/16	3/16	A	3.50
783	3-1/2	3/4	1	3/16	3/16	A	3.50
313	3-1/2	5/8	9/16	1/8	1/8	A	3.50
683	3-1/2	1-1/8	21/32	1/8	1/8	A	3.50
647	3-1/2	1-1/8	9/16	1/8	1/8	A	3.50
130	3-1/2	1-1/8	1/2	1/8	1/8	A	3.50
129	3-1/2	1-1/8	1/2	1/8	1/8	A	3.50
239	3-1/2	25/32	3/4	3/16	3/16	A	3.50
845	3-1/2	3/4	9/16	1/8	1/8	A	3.50
934	3-35/64	1-13/16	5/8	1/8	1/8	A	3.55
297	3-9/16	2-1/2	1/2	1/16	1/16	B	3.57
657	3-5/8	2-1/8	5/8	1/8	1/8	P	3.63
392	3-5/8	2-1/2	7/8	3/16	3/16	A	3.63
678	3-3/4	2-5/8	1/2	1/8	1/8	A	3.75
153	3-3/4	2-7/8	5/8	1/8	1/8	A	3.75
356	3-3/4	1-1/4	3/4	3/16	3/16	A	3.75
121	3-3/4	1-1/2	3/4	3/16	3/16	B	3.75
748	3-3/4	1-1/8	21/32	1/8	1/8	A	3.75
828	3-3/4	2-9/16	3/4	3/16	3/16	A	3.75
230	3-13/16	2	1-1/4	3/16	3/16	A	5.35

January, 1931 (Cancelling 2-B-3-A-5 to 20, dated July 1, 1930)

Printed in U.S.A.

J-M Moulded Packing Cup Dimensions (continued)

MOULD NO.	A	B	C	D	E	TYPE	LIST PRICE F.O.B. MANVILLE, N.J.
	Dimensions in Inches						
872	3-13/16	1	1	3/16	3/16	A	$ 3.82
853	3-7/8	2-3/8	3/4	3/16	5/16		3.88
749	4	1-13/16	3/4	3/16	3/16	P	4.00
300	4	3	3/4	5/32	5/32	B	4.00
312	4	1	7/8	1/8	1/8	B	4.00
446	4	1-3/4	15/32	1/8	1/16	B	4.00
286	4	1-3/4	15/32	1/8	1/8	A	4.00
613	4	1-1/2	1	1/8	1/8	A	4.00
635	4	3/4	1	3/16	3/16	A	4.00
639	4	1-1/8	1	1/4	1/4	A	4.00
612	4	2-3/4	3/4	3/16	3/16	P	4.00
260	4	15/16	21/32	3/16	3/16	A	4.00
177	4	1-1/2	1/2	3/16	3/16	A	4.00
126	4	1/2	5/8	3/16	3/16	A	4.00
142	4	1	1	3/16	3/16	A	4.00
173	4	1-1/8	5/8	3/16	3/16	A	4.00
362	4	1-1/2	3/4	3/16	3/16	P	4.00
924	4.045	1	3/4	1/8	1/8	A	4.05
257	4-1/8	1	1-3/8	5/32	5/32	A	5.78
116	4-1/4	2-1/8	3/4	3/16	3/16	A	4.25
727	4-5/16	3	5/8	1/8	1/8	B	4.32
231	4-1/2	1-1/4	1	3/16	3/16	A	4.50
185	4-1/2	2-7/8	13/16	1/8	1/8	A	4.50
241	4-1/2	5/8	1	3/16	3/16	A	4.50
252	4-1/2	2	3/4	3/16	3/16	P	4.50
652	4-1/2	1	3/4	5/32	5/32	A	4.50
287	4-1/2	1-7/8	3/4	5/32	5/32	A	4.50
931	4-1/2	2-1/2	13/16	1/8	1/8	A	4.50
936	4-1/2	1-1/16	1-1/8	1/4	1/4	A	7.20
944	4-1/2	3-5/8	5/8	1/8	1/8	A	4.50
124	4-3/4	3-1/2	5/8	1/8	1/8	A	4.75
625	4-3/4	2-1/4	1-3/16	3/16	3/16	A	6.65
951	4-15/16	1-1/32	7/8	3/16	3/16	A	4.94
825	5	3-1/2	3/4	3/16	3/16	P	5.00
814	5	3/4	1	3/16	3/16	A	5.00
659	5	1-1/4	3/4	1/4	1/4	A	6.00
233	5	3/4	1	1/4	1/4	A	6.00
251	5	2	3/4	9/64	9/64	A	5.00
253	5	2-1/2	3/4	3/16	3/16	P	5.00
176	5	2-1/8	2-1/4	3/16	3/16	B	7.00
713	5	3	3/4	3/16	3/16	P	5.00
836	5	1-1/16	3/4	3/16	3/16	P	5.00
933	5	1-1/2	1-1/4	5/16	5/16	A	8.00
987	5	4-3/16	5/8	1/8	1/8	A	5.00
288	5-3/32	3-1/4	3/4	3/16	3/16	B	5.10
117	5-1/8	3/4	7/8	1/4	1/4	A	6.15
118	5-1/8	3/4	1	1/4	1/4	A	6.15
119	5-1/4	none	3/4	3/16	3/16	A	5.25
988	5.460	4-5/8	5/8	1/8	1/8	A	5.46
503	5-1/2	1-9/16	3/4	1/8	1/8	B	5.50
289	5-1/2	2-7/8	3/4	5/32	5/32	B	5.50
120	5-1/2	2-1/8	3/4	3/16	3/16	A	5.50
206	5-1/2	4	13/16	1/8	1/8	A	5.50
367	5-1/2	3	3/4	3/16	3/16	P	5.50
891	5-1/2	4-1/8	5/8	3/32	3/32	A	5.50
483	5-1/2	1-1/4	3/4	3/16	3/16	A	5.50
675	5-9/16	1-1/2	3/4	3/16	3/16	A	5.57
229	5-3/4	4-7/8	13/16	1/8	1/8	A	5.75
932	5-3/4	3-3/4	3/4	3/16	3/16	P	5.75
999	5-3/4	3/4	1-1/4	1/4	1/4	A	9.20
319	6	3-3/8	3/4	5/32	5/32	B	6.00
290	6	2-7/8	3/4	5/32	5/32	B	6.00
681	6	2	1-1/2	5/16	5/16	B	9.60
242	6	none	1	1/4	1/4	A	7.20
255	6	3-1/2	3/4	3/16	3/16	P	6.00
188	6	2-1/4	1-1/16	3/8	3/8	A	9.60
216	6	2-1/32	1-5/16	1/4	1/4	A	9.60
227	6	1	1-5/16	1/4	1/4	A	9.60
258	6	1	1	5/32	5/32	A	6.00
619	6	2	1-3/16	1/4	1/4	A	9.60
301	6	2-7/8	1-1/4	3/16	3/16	A	8.40
448	6	3-1/2	3/4	3/16	3/16	A	6.00
745	6	4-7/32	1-3/16	3/16	3/16	A	8.40
757	6	7/8	1	1/4	1/4	A	7.20
897	6	2-1/2	21/32	5/32	5/32	A	6.00
907	6	3-1/2	1-1/8	3/16	3/16	P	8.40
833	6	1-1/16	3/4	3/16	3/16	P	6.00
784	6-1/8	3	1	3/16	3/16	A	6.13
618	6-1/4	none	1	3/16	3/16	A	6.25
189	6-1/4	2-1/8	1	3/16	3/16	A	6.25
232	6-1/2	1-3/8	1-5/8	1/4	1/4	A	10.40
254	6-1/2	4	3/4	3/16	3/16	P	6.50
426	6-1/2	4-15/16	13/16	3/16	3/16	A	6.50
311	6-1/2	3-7/8	3/4	5/32	5/32	B	6.50
859	6-3/4	4-1/2	3/4	3/16	3/16	A	6.75
821	6-3/4	4-13/16	1-1/8	3/16	3/16	A	9.45
840	6-3/4	4-1/2	3/4	3/16	3/16	A	6.75
796	7	3-3/8	3/4	5/32	5/32	B	7.00
315	7	4-5/8	1	3/16	3/16	A	7.00
210	7	4	1-3/16	3/16	3/16	A	9.80
249	7	4	1-1/4	1/4	1/4	A	11.20
190	7	5	1	3/16	3/16	A	7.00
183	7	4-1/4	1	1/4	1/4	A	8.40
409	7	2-3/4	1	3/16	3/16	A	7.00
366	7	4-1/2	3/4	3/16	3/16	P	7.00
207	7	2-3/4	1-7/16	1/4	1/4	A	11.20
302	7	4-3/8	3/4	5/32	5/32	B	7.00
223	7	none	1-1/2	1/4	1/4	A	11.20
758	7	1	1	1/4	1/4	A	8.40
948	7-1/16	6-1/4	5/8	1/8	1/8	A	7.07
995	7-1/16	2-3/4	1	3/16	7/32	A	8.47
407	7-1/8	2-3/4	1	3/16	3/16	A	7.13
892	7-3/16	5-1/2	5/8	1/8	1/8	A	7.19
917	7-1/4	2-3/4	1	5/16	3/16	A	8.70
218	7-1/2	none	1-1/4	3/16	3/16	A	10.50
575	7-1/2	4-3/4	15/16	5/32	5/32	A	7.50
180	7-1/2	5-1/2	5/8	1/8	1/8	A	7.50
626	7-3/4	1-17/64	3/4	3/16	3/16	P	7.75

MOULD NO.	A	B	C	D	E	TYPE	LIST PRICE F.O.B. MANVILLE, N.J.
	Dimensions in Inches						
501	8	5	7/8	1/4	1/4	A	$ 9.60
654	8	5-15/16	13/16	3/16	3/16	A	9.60
298	8	5-3/8	3/4	1/4	1/4	A	9.60
363	8	5-1/2	3/4	3/16	3/16	P	8.00
415	8	5-1/2	1-1/4	3/16	3/16	A	11.20
203	8	4	1	3/16	3/16	A	8.00
215	8	4-1/32	1-5/16	1/4	1/4	A	12.80
137	8	3	1	1/4	1/4	A	9.60
222	8	none	1-1/4	1/4	1/4	A	12.80
248	8	2-3/4	3/4	3/16	3/16	A	8.00
209	8	6-1/4	1-5/16	1/8	1/8	B	11.20
184	8	6	1	3/16	3/16	B	8.00
303	8	5-3/8	3/4	5/32	5/32	B	8.00
759	8	1	1	1/4	1/4	A	9.60
864	8	1-5/8	3/4	1/8	1/8	A	8.00
869	8	1-1/8	1	3/16	3/16	A	8.00
913	8	5-3/8	3/4	3/16	3/16	A	8.00
947	8-1/16	7-1/4	5/8	1/8	1/8		8.06
212	8-1/8	2-1/2	1-1/2	1/4	1/4		13.00
902	8-1/8	5-1/2	3/4	3/16	3/16	A	8.13
291	8-1/4	4-5/8	3/4	5/32	5/32	B	8.25
510	8-1/4	5-1/2	3/4	3/16	3/16	P	8.25
937	8.256	5-3/4	3/4	3/16	3/16	P	8.25
722	8-1/2	5-1/2	3/4	3/16	3/16	P	8.50
292	9	6-3/8	3/4	5/32	5/32	B	9.00
213	9	7	15/16	3/16	3/16	A	9.00
197	9	none	1-5/8	1/4	1/4	A	14.40
432	9	2-3/4	1	3/16	3/16	A	9.00
433	9	5-1/2	1	3/16	3/16	A	9.00
438	9	1-1/2	1-1/2	3/16	3/16	A	12.60
587	9	4-11/16	1	3/16	3/16	A	9.00
316	9	6-1/4	1	3/16	3/16	A	9.00
751	9	4	1	3/16	3/16	A	9.00
873	9	1-1/8	1	3/16	3/16	A	9.00
1002	9-1/16	5-1/2	1	3/16	7/32	A	10.87
966	9-1/16	2-3/4	1	3/16	7/32	A	10.87
221	9-1/8	2-3/4	1	3/16	1/4	A	10.95
586	9-1/8	4-11/16	1	3/16	1/4	A	10.95
676	9-1/8	5-1/2	1	3/16	1/4	A	10.95
496	9-1/8	4	1	3/16	1/4	A	10.95
813	9-1/4	5-1/2	1	3/16	5/16	A	11.10
890	9-1/4	2-3/4	1	3/16	5/16	A	11.10
305	9-1/2	7	3/4	5/32	5/32	B	9.50
551	9-1/2	1-1/2	1-1/16	3/16	3/16	B	13.30
480	9-3/4	8-1/2	1	3/16	3/16	P	9.75
204	9-15/16	8-1/4	5/8	1/8	1/8	A	9.94
419	10	6	1	3/16	3/16	A	10.00
225	10	2-3/4	1	3/16	3/16	A	10.00
244	10	none	1-1/4	1/4	1/4	A	16.00
195	10	6	1-3/4	3/16	3/16	A	14.00
214	10	5-1/2	1-5/16	1/4	1/4	A	16.00
245	10	7-1/2	3/4	3/16	3/16	P	10.00
427	10	7-3/4	7/8	3/16	3/16	A	10.00
306	10	1-1/4	15/16	5/32	5/32	B	10.00
322	10	7-3/8	3/4	5/32	5/32	B	10.00
651	10	5-3/8	1	5/16	5/16	A	12.00
499	10	5-3/8	1	3/16	3/16	A	10.00
456	10-1/16	1	7/8	3/8	3/8	A	12.08
916	10-1/16	6	1	3/16	7/32	A	12.08
588	10-1/8	5-3/8	1	3/16	1/4	A	12.15
401	10-1/8	6	1	3/16	1/4	A	12.15
673	10-3/16	5-1/2	1	3/16	3/16	A	10.19
293	10-1/4	5-5/8	1	5/32	5/32	B	10.25
956	10-1/4	6	1	3/16	5/16	A	12.40
199	10-3/4	2-3/4	1-1/2	1/4	1/4	A	17.20
920	11	8-5/16	13/16	5/32	5/32	P	11.00
323	12	9-3/8	3/4	5/32	5/32	B	12.00
224	12	none	2-1/4	1/4	1/4	A	19.20
201	12	5-1/2	1-5/16	1/4	1/4	A	19.20
473	12	9-7/8	5/8	3/16	3/16	A	12.00
504	12	8	7/8	1/4	1/4	A	14.40
848	12	8	1	3/16	3/16	A	12.00
946	12	9-5/16	13/16	5/32	5/32	P	12.00
785	12-1/8	9-5/16	13/16	7/32	7/32	A	14.55
295	12-1/4	7-3/8	15/16	5/32	5/32	B	12.25
304	13	10-3/8	3/4	5/32	5/32	B	13.00
309	13	11	1-1/4	5/32	5/32	B	18.20
310	13	11	3/4	5/32	5/32	B	13.00
264	13	2	1-1/4	1/4	1/4	A	20.80
835	13	9-9/16	7/8	3/16	3/16	P	13.00
877	13	6	1-3/4	1/4	1/4	A	20.80
308	13-1/4	10-3/8	15/16	5/32	5/32	B	13.25
368	13-13/16	6	1	3/16	3/16	A	13.82
378	14	6	1	3/16	3/16	A	14.00
569	14	11-3/8	3/4	3/16	3/16	P	14.00
307	14	11-3/8	3/4	5/32	5/32	B	14.00
307	14	11-3/8	3/4	5/32	5/32	P	14.00
689	14	12	1	1/4	1/4	P	14.00
844	14-1/8	11-1/2	3/4	3/16	3/16	B	14.13
695	14-1/4	9-1/4	1-3/4	1/4	1/4	P	22.80
694	14-13/16	9-9/32	1-3/4	1/4	1/4	P	23.70
693	15	3	1	1/4	1/4	P	18.00
691	15-17/32	9-1/4	1-3/4	1/4	1/4	P	24.85
715	16	none	1-1/4	7/32	7/32	A	25.60
320	16	13-3/8	13/16	5/32	5/32	B	16.00
755	16-1/16	13-3/8	13/16	5/32	5/32	P	16.07
753	16-1/8	13-5/16	13/16	5/32	5/32	P	16.13
263	16-1/2	14-1/2	13/16	5/32	5/32	A	16.50
491	18	15	1-3/8	3/16	3/16	A	25.20
321	18	15-3/8	13/16	5/32	5/32	A	18.00
781	19	16-5/16	1	5/32	5/32	P	19.00
754	19-1/4	16-5/16	1	5/32	5/32	P	19.25
317	20	17-3/8	13/16	5/32	5/32	P	20.00
317	20	15-1/2	1	1/4	1/4	A	24.00
926	21	18-5/16	1	5/32	5/32	P	21.00
318	22	19-3/8	13/16	5/32	5/32	B	22.00
514	28	22-9/16	1-9/16	3/16	3/16	B	39.20
712	30	none	1-3/4	1/4	1/4	A	48.00

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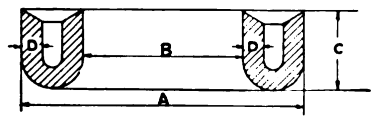
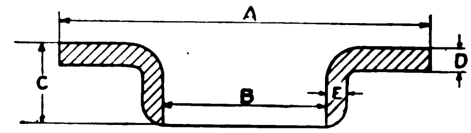
J-M Moulded Packing Cup Dimensions (continued)



U-Shape Type



Hat-Shape Type

U-Shape Type — Dimensions in Inches

Mould No.	A	B	C	D	List Price - Each F.O.B. Manville, New Jersey
459	1-7/32	57/64	1/4	7/128	$ 1.22
139	1-1/4	5/8	5/16	1/8	1.25
155	2	1-1/4	3/8	5/32	2.00
525	2	1-1/8	1/2	3/16	2.00
149	2-1/16	1-5/16	3/8	3/16	2.06
898	2-1/2	1-1/4	3/8	1/8	2.50
679	2-1/2	1-1/2	3/4	1/8	2.50
795	2-29/64	1-3/8	5/8	1/8	2.45
728	2-9/16	1-7/16	5/8	1/8	2.57
980	2.575	1.825	7/16	3/32	2.58
614	2-5/8	1-5/8	3/4	1/16	2.63
883	2-5/8	2-1/8	3/8	3/32	2.63
731	2-3/4	1-3/4	3/4	1/8	2.75
193	2-3/4	1-1/2	5/8	1/4	2.75
265	2-7/8	2-7/32	1/2	1/8	2.88
725	2-7/8	1-3/4	5/8	1/8	2.88
158	3	2	1/2	1/8	3.00
549	3	2-5/16	3/4	1/8	3.00
990	3	2-1/16	1/2	1/8	3.00
945	3.062	2.312	7/16	3/32	3.06
1001	3-1/16	2-9/16	5/16	7/64	3.06
964	3-5/16	2-1/16	5/8	1/8	3.31
818	3-3/8	2-3/8	3/4	5/32	3.38
823	3-3/8	1-1/4	9/16	1/8	3.38
979	3.544	2.79	7/16	3/32	3.54
976	3-9/16	2-5/16	5/8	1/8	3.56
997	3.687	2.937	7/16	7/32	3.69
939	3-7/8	2-1/4	7/8	3/16	3.88
981	4.044	3.294	7/16	3/32	4.04
644	4-1/8	2	13/16	5/32	4.13
798	4-17/64	3-1/8	5/8	1/8	4.27
797	4-17/64	3-3/16	5/8	1/8	4.27
756	4-17/64	3-1/4	5/8	1/8	4.27
927	4-1/2	3-1/2	1/2	5/32	4.50
983	4-1/2	3-3/4	7/16	5/32	4.50
535	4-5/8	3-5/8	3/4	1/8	4.63
982	5	4-1/4	7/16	3/32	5.00
940	5-1/8	3-3/4	3/4	1/9	5.13
985	5.460	4.710	7/16	3/32	5.46
623	6	5	7/8	7/32	6.00
729	6	5	3/4	1/8	6.00
735	6-1/8	5-1/8	3/4	1/8	6.13
179	6-1/4	4-1/4	13/16	3/16	6.25
515	6-1/4	5-1/4	1	1/8	6.25
357	6-1/2	5	1	3/16	6.50
918	6-7/8	5-7/8	3/4	1/8	6.88
984	7-1/16	6-5/16	7/16	3/32	7.06
326	7-1/2	6	1	5/32	7.50
856	7-3/4	5	1	3/16	7.75
273	9	7-1/2	1	3/16	9.00
534	9	8	3/4	1/8	9.00
900	9-1/2	8	1-1/2	3/16	14.25
899	10-3/4	9	1-1/2	1/4	16.13
325	11-1/2	10	7/8	7/32	11.50
724	11-15/16	10-1/16	1	3/16	11.94
879	11-5/8	9-15/16	1-1/8	1/4	13.08
889	12.576	10.236	1-1/4	1/4	15.73
952	13	12	1-1/4	1/8	16.25
533	13-1/4	12	1	5/32	13.25
271	13-1/2	12	1-1/4	3/16	16.88
327	13-3/4	12	1-1/4	3/16	17.19
393	14	12	1-1/4	1/4	17.50
641	15-1/2	14	1	3/16	15.50
423	15-5/8	13-15/16	1	13/64	15.63
451	16	14	1	1/4	16.00
266	17-1/4	16	1-5/8	7/32	28.03
682	17-3/4	16	1-1/4	7/32	22.19
745	17-1/2	16	1-5/8	1/4	28.44
745	17-1/2	16	2-1/8	1/4	37.19
238	19	18	3/4	3/16	19.00
633	24-1/4	22-3/4	1	3/16	24.25

Hat-Shape Type — Dimensions in Inches

Mould No.	A	B	C	D	E	List Price - Each F.O.B. Manville, N. J.
793	1-3/16	3/4	13/32	5/64	5/64	$ 1.19
421	1-1/4	1/2	3/8	3/32	3/32	1.25
986	1-19/64	9/16	5/16	3/32	3/32	1.30
986	1-19/64	47/64	5/16	3/32	3/32	1.30
422	1-1/2	3/4	1/2	3/32	3/32	1.50
399	1-1/2	5/8	1/2	1/8	1/8	1.50
403	1-1/2	17/32	1/2	1/8	1/8	1.50
404	1-1/2	3/8	1/2	1/8	1/8	1.50
719	1-5/8	1	1/2	1/8	1/8	1.63
941	1-13/16	15/16	5/8	1/8	1/8	1.81
192	2-1/8	1	7/8	3/16	3/16	2.13
157	2-5/32	3/4	3/8	1/8	1/8	2.16
168	2-1/4	1-1/8	7/8	1/4	1/4	2.70
642	2-1/2	1-1/2	1/2	3/16	3/16	2.50
135	2-21/32	1-23/32	7/8	1/4	1/4	3.19
178	2-25/32	1-11/16	27/32	3/16	3/16	2.78
125	3-3/8	2-1/8	7/8	3/16	3/16	3.38
270	3-1/2	2-1/2	3/4	1/8	1/8	3.50
191	3-11/16	2-1/4	3/4	3/16	3/16	3.69
817	3-3/4	2-1/2	5/8	1/8	1/8	3.75
645	3-15/16	2	13/16	5/32	5/32	3.94
182	4-3/8	2-1/2	7/8	1/8	1/8	4.38
143	5-1/2	4-1/4	7/8	3/16	3/16	5.50
471	6-3/4	2-1/2	1	1/4	5/16	8.10
431	10-7/8	8-3/4	5/8	3/16	3/16	10.88
574	15-3/4	10-5/8	1-3/4	1/4	1/4	25.20
963	24-5/8	20	2	1/4	1/8	39.40

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Furnace Expansion Joints

The major types of expansion joints used in various types of boilers and furnaces as a means of preventing failure of structures are shown in Figs. 1 and 2. These are applicable, in a general way, to almost all boiler and furnace walls. Expansion joints not shown on these drawings and found in practice lend themselves to the same manner of packing as those of the same class, illustrated. The location of expansion joints and the class of boiler settings in which they are found are as follows:

Water-tube Boilers
Stirling, Heine, Casey Hedges, Connelly, Badenhausen, Kidwell, Ladd, Erie City, etc.

Location of Expansion Joint	Drawing References
1. Furnace roof and side walls	Fig. 1, Detail A
2. Rear wall and side wall	Fig. 1, Detail H
3. Side walls (vertical joints)	Fig. 1, Detail C
4. Side and end wall	Fig. 1, Detail B
5. Relieving arch	Fig. 1, Detail G
6. Bridge wall	Fig. 2
7. Combustion arch, side and end walls	Fig. 2
8. Steam drum and brick setting	Fig. 2

B & W, Springfield, Edge Moor, Wickes, Erie City, Walsh and Weidner, etc.

1. Furnace roof and side walls	Fig. 1, Detail A
2. Rear wall and side walls	Fig. 1, Detail H
3. Side walls (vertical joints)	Fig. 1, Detail C
4. Side and end wall	Fig. 1, Detail B
5. Relieving arch	Fig. 1, Detail G
6. Water-tube header	Fig. 1, Detail E
7. Front water-tube header and setting	Fig. 1, Detail D
8. Rear water-tube header and setting	Fig. 1, Detail F
9. Bridge wall	Fig. 2
10. Combustion arch, side and end walls	Fig. 2
11. Steam drum and brick setting	Fig. 2

Fire-tube Boilers

1. Boiler shell and brick settings	Fig. 2
2. Side walls (vertical joints)	Fig. 1, Detail C
3. Union of side and end walls	Fig. 1, Detail B
4. Combustion or deflection arch and side walls	Fig. 2
5. Deflection arch and end walls	Fig. 2
6. Bridge wall	Fig. 2

All expansion joints in the boiler setting proper or between parts of the boiler and setting should be so made that the joint is twice as great as the maximum amount of expansion taking place between the adjacent expanding members.

Expansion joint materials are installed while the wall is being constructed, except where joints are accessible and can be conveniently packed after the wall is complete. All material is firmly packed into the joint so that there are no voids.

Where movement of the expanding members is likely to work the packing out of the joint, the expansion joint material is held in place by a spring steel plate or by other suitable means.

Expansion Joint Materials

All expansion joints in the boiler setting proper or between parts of the boiler and the setting are packed with either J-M No. 4200 Asbestos Rope or J-M Asbestos Jelly-Rolls. The size of the expansion joint is the determining factor in choosing between the No. 4200 Asbestos Rope and Jelly-Rolls. J-M No. 4200 Asbestos Rope is used for joints up to 1″ in width. When larger diameter packing is required, standard Asbestos Jelly-Rolls should be used.

J-M No. 4200 Asbestos Rope is made in sizes from 3/8″ to 1″, increasing by increments of 1/8″, but can be furnished when necessary as large as 2″. J-M Asbestos Jelly-Rolls are made in standard sizes of 1″, 1 1/4″, 1 1/2″, 1 3/4″, 2″, 2 1/2″, 3″, 3 1/2″, 4″, 4 1/2″, 5″, 5 1/2″, and 6″ in diameter, in lengths of 5′ 9″.

In expansion joints such as Details D and F, Fig. 1, and the boiler drum-setting expansion joint shown in Fig. 2, the Asbestos Jelly-Rolls are packed in J-M RX Asbestos Fibre. This is used to fill the interstices between the Jelly-Rolls with a resilient material. The water-tube headers, as shown in Fig. 1, Detail E, can be advantageously packed with strips of J-M Asbestos Roll Fire-Felt.

Wall expansion joints should have the openings facing into the combustion chamber sealed with J-M No. 352 Asbestos Cement after the packing is in place. If there is no J-M No. 352 Cement on the job, either J-M No. 302 or No. 400 Asbestos Cement can be used satisfactorily. These cements are described in the "Insulation" Section.

January, 1931 (Cancelling 2-B-5-A-1 to 4, dated in 1927 and 1930)

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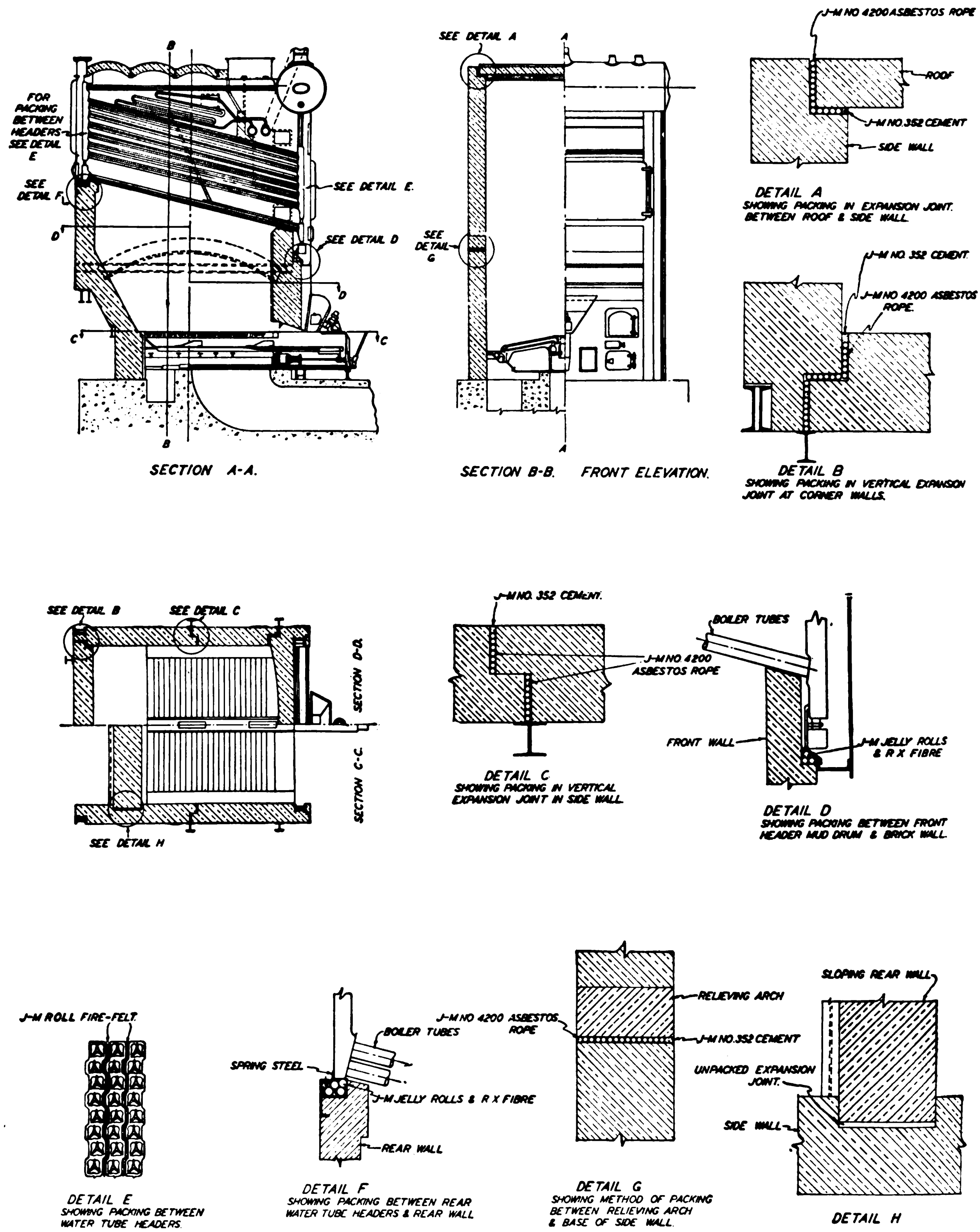

Fig. 1. Boiler Wall Expansion Joint Locations and Details

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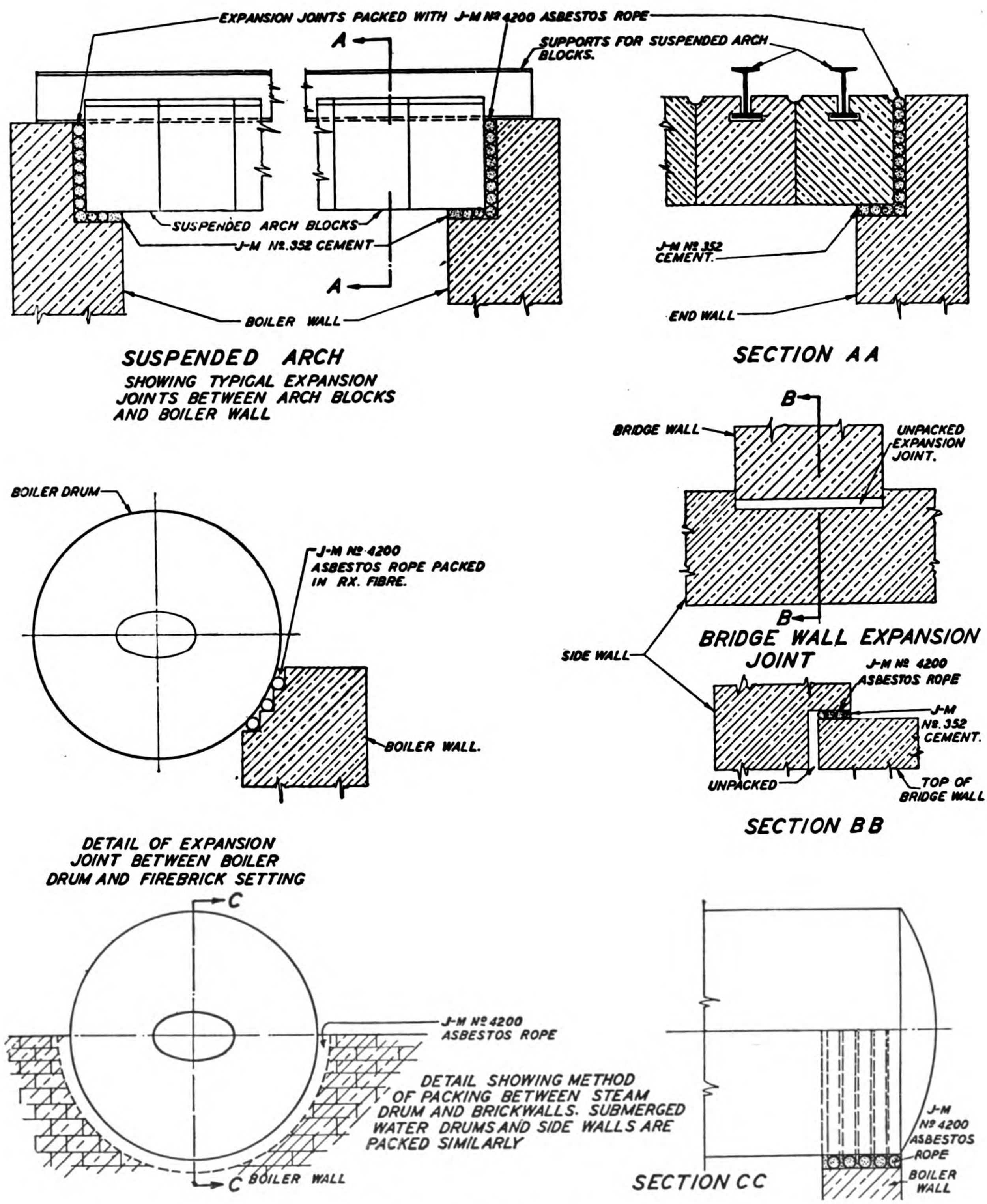

Fig 2. Expansion Joints at Suspended Arch, Bridge Wall and Steam Drum

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INDEX

Refractory Cements

(For complete list of data sheets, see other side of this page.)

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Refractory Cements

Complete List of Data Sheets Available

Brochures, etc.

J-M Refractory Cements (description and application), 24 pp. 8½"x11", form RC-1A
Refractory Cements for Oil Burners, 8 pp. 3½" x 6", form RC-3A

★Catalog pages

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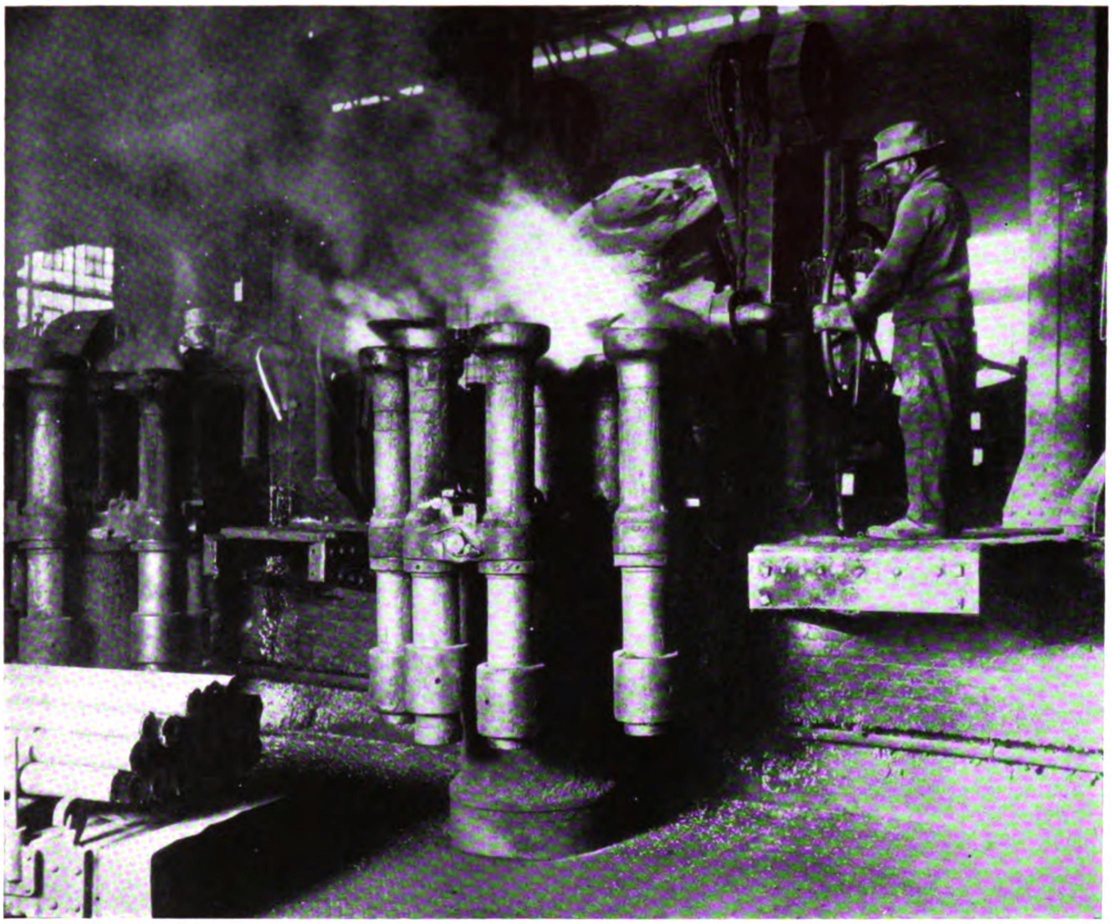
J-M Refractory Cements



An Ajax-Wyatt electric induction furnace with a monolithic lining of No. 34 Refractory Cement

J-M Refractory Cements are used for setting or bonding fire brick in various types of boilers and industrial furnaces, as protective coatings to furnace settings, for patching furnace settings and in some cases as monolithic linings. These cements are scientifically compounded to resist temperature, disintegration and spalling under furnace conditions. They do not break the bond by shrinking or swelling or by reaction with furnace ash, slags or gases.

In best furnace practice, J-M Refractory Cements are used to bond and protect the fire brick. Exposing the edges of brick to the action of flame and molten ash is the commonest cause of rapid deterioration of a setting. Fire clay is merely a filler and has practically no bonding strength. It shrinks badly, crumbles away and blows out of the joints, exposing the edges of the brick. In practice, fire clay is being rapidly replaced by refractory cement.

By using the proper J-M Refractory Cement, heat losses are cut down because open joints between the brick are eliminated; the tight construction protects the insulation from furnace gases and vapors; and air which might otherwise be drawn in through the walls, with negative pressure in the furnace, is excluded.

Fire brick generally soften at temperatures at least 500 deg. F. below their melting point and when fire clay or inferior refractory cement is used, softening of the brickwork is hastened by open joints or cracks in the setting. Brickwork well-protected with J-M Refractory Cement will stand higher temperatures

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because the softening heat does not have access to the fire brick except at one face. Spalling, too, is decreased by this construction, because there is a more uniform temperature gradient through the brick.

Where there is a tendency toward clinkering, the formation of such deposits on the setting may be retarded by making surfaces as smooth as possible with a wash-coating of the right J-M Refractory Cement. Open joints give the clinker a good hold and in removing it the bricks of the setting are often pulled out unless they are strongly bonded together with refractory cement.

The erosive action of oil flame and the slagging of brick by low fusion ash are mitigated in a setting with tightly sealed joints and brick pores filled by wash-coating. This form of protection also tends to prevent brick disintegration by the action of furnace gases. A correctly applied plaster coating will greatly retard further deterioration of refractories which are spalling or melting away from any of these causes.

If the brickwork has failed locally, instead of replacing the destroyed brick, it is frequently economical to take out the old brick and pound in J-M Plastic Fire Brick Material. Pit fires, metal ladles, induction furnaces and domestic oil burning furnaces may be effectively lined with the proper J-M Refractory Cement rammed or poured in to form a monolithic refractory interior.

Refractory cements cost more than fire clay, yet their cost amounts to only 5% or 6% of the total cost of the installation. It takes only a week or two longer life to pay for this difference and, as a matter of fact, the increased life generally runs into many months.

Data on Johns-Manville Refractory Cements

	No. 20	No. 26	No. 30	No. 31	No. 32	No. 33	No. 34	No. 35	P.F.B.M. (Plastic Fire Brick Material)
Character of base	Silica	Aluminum silicate	Silicon carbide	Aluminum silicate	Aluminum silicate	Aluminum silicate / Processed kaolin	Chrome	Processed alumina	Aluminum silicate
Lowest working temperature or low point vitrification, °F.	*	† 900	1850	1450	1250	1000	1000	1200	1500
Highest working temperature, °F.	2700	2600	3000	3100	3100	3300	3400	3500	3000
Specific gravity	1.95	1.68	1.85	1.76	1.77	1.65	2.4	1.6	2.0
Approx. capacity, lb. required for setting 1,000 brick	×				‡	††	×	×××	
With 1/8-3/16" bond joint	500-600	600-700	800-900	600-700	**	750-850	....	750-850	‡‡
With brick to brick joint	400-500	....	....	....	400-500	....	600-700	....	....
Form in which furnished	Plastic	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Plastic
Containers	5, 10, 25, 50, 100, 250, 500, 850 lb. cans or drums	100-lb. bags	100-lb. bags	100-lb. bags	100-lb. bags	100-lb. bags	100-lb. bags	100-lb. bags	100 250 and 500-lb. drums

* Sets hard when air dried.

× For wash-coating an average of about 150 lb. of No. 20 (thinned) will cover 100 sq. ft.

† Medium air set.

‡ Quantity of No. 32 cement required for coating varies a great deal depending upon the porosity of the brick. Based on average conditions, and when cement and water are used in equal quantities, *i.e.*, 100 lb. cement and 100 lb. water, 90 lb. of cement are required per 100 sq. ft. of surface.

** Use only in brick to brick joint—not bond joint.

†† For plaster coating—average 1/4 in. thick, 400 lb. per 100 sq. ft.

×× For monolithic linings of No. 34, about 200 lb. are required for one cu. ft.

××× For patching, about 130 lb. of No. 35 are required per cu. ft. of finished work.

‡‡ For patching, figure approx. 125-130 lb. per cu. ft.

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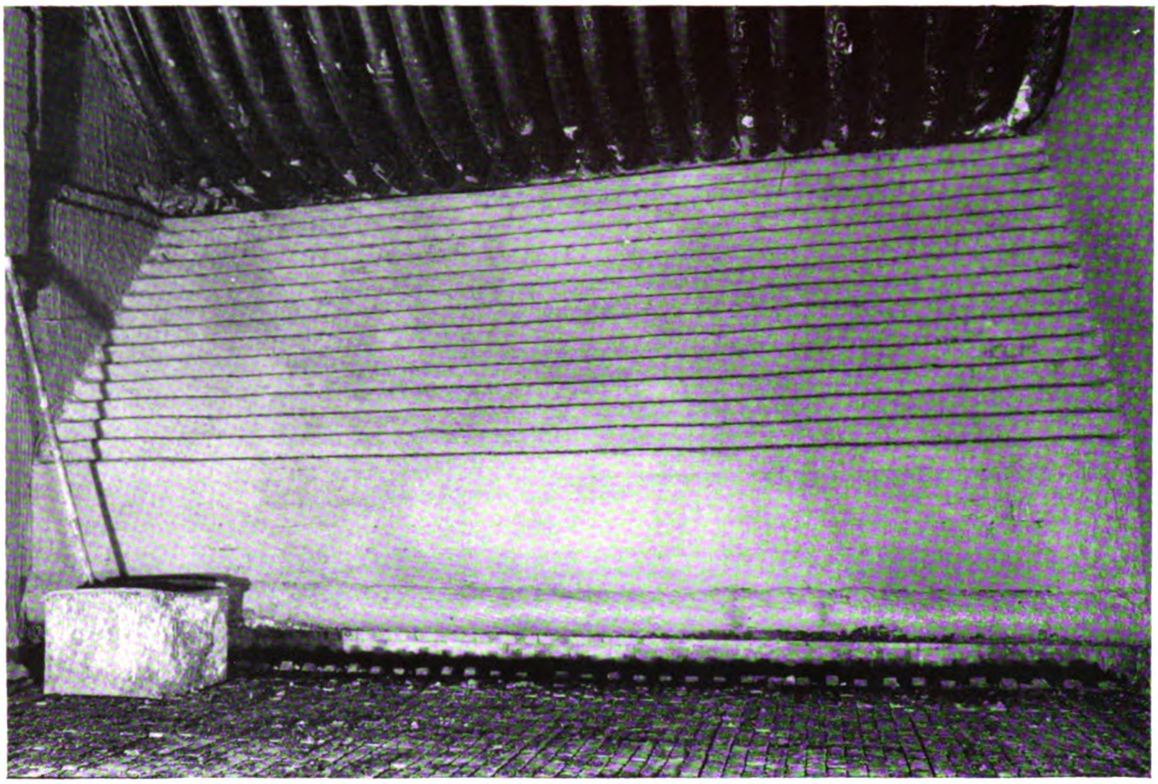
Refractory Cements for General Industrial Work



J-M Refractory Cements, for bonding and wash-coating, lengthen the life of boiler walls

A good refractory cement should have approximately the same base as the refractory used. It should have a temperature resistance equal to or better than the brick. The bonding strength and other properties should be such that the cement will not separate from the fire brick due to movement in the setting. It should be chemically inert to the action of the furnace and the shrinkage of the cement should be low.

The great variety of industrial furnace conditions precludes the possibility of using one type of refractory cement to meet all requirements.

From a complete line of refractory cements, developed to serve specialized purposes, Johns-Manville recommends the following cements for general work:

For a brick-to-brick, or dipped, joint and for wash-coating:

J-M No. 32 Refractory Cement where a dry cement is wanted;

J-M No. 20 Plastic Refractory Cement (thinned) where a plastic cement is wanted.

For a bond joint ($\frac{1}{8}''$ to $\frac{3}{16}''$):

J-M No. 31 Refractory Cement where a dry cement is wanted;

J-M No. 20 Plastic Refractory Cement where a plastic cement is wanted.

For plaster coating: J-M No. 33 Super-Refractory Cement.

For patching: J-M Plastic Fire Brick Material.

Power Stations and Industrial Plants

A Bureau of Mines survey has shown that the chief causes of boiler setting failure today include slag adhesion, erosion, spalling and failure of furnace structure. The relative importance of the individual causes varies with the type of fuel.

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The greater percentage of the "outage" hours of present-day boilers is due to brickwork repairs, and this ratio is increasing, due to the modern tendency toward larger units pushed at high ratings. A serious investigation of ways and means of minimizing refractory maintenance in boiler furnaces indicates that the use of a high grade refractory cement is as important as the selection of the right fire brick or the method of design and construction of the furnace.

Slag Adhesion:

The building up of high viscosity slags produced by eastern bituminous coals can be retarded by a smooth setting with tight joints such as is secured with J-M No. 31, No. 32, or No. 20 and a wash coat of J-M No. 32. The strongly bonded wall obtained through the use of these cements resists destruction of the brickwork when removing the slag accumulations.

Erosion:

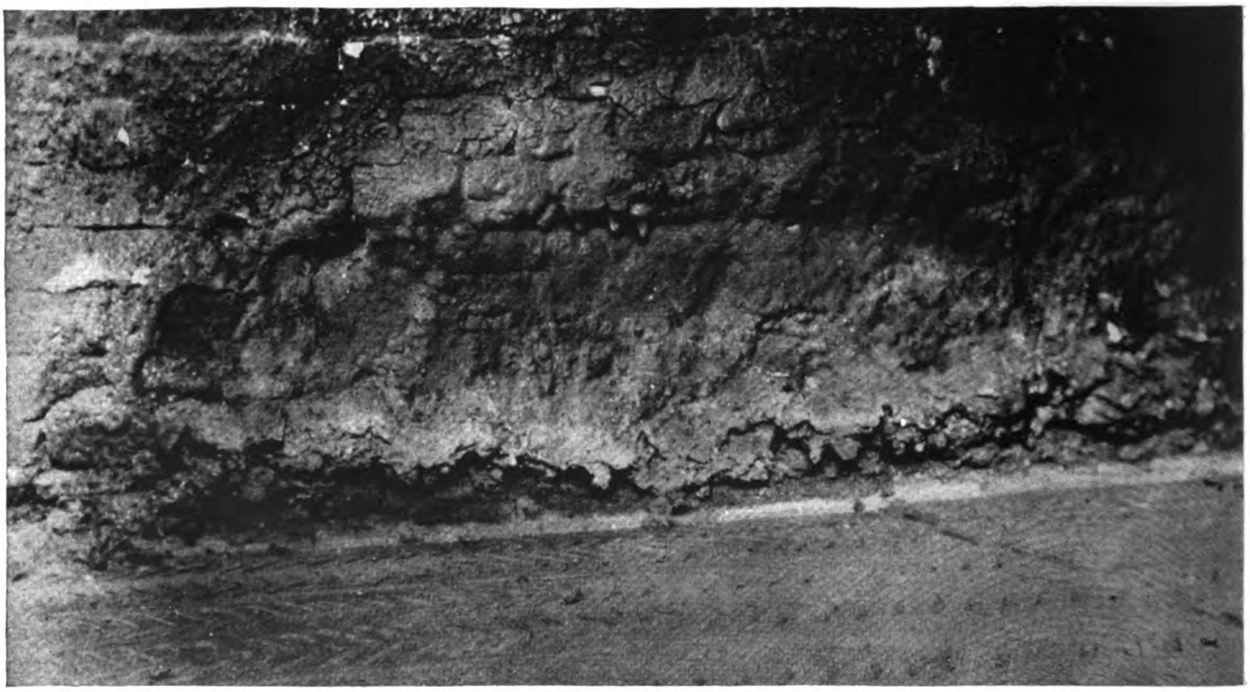
Erosion is particularly troublesome with mid-western bituminous coal due to its low-viscosity chemical slag which eats into the brickwork. The problem is similar in plants burning bagasse and hog fuel. Strong, tight joints obtained with J-M No. 31 or No. 32 prevent slag penetration in the joints of the setting and in this manner retard destruction by the slag.

If the slag is sufficiently fluid, it will not only flow down the face of the wall, but will be drawn into the pores of the brick, depending upon its texture. The surface of a relatively porous brick can be made dense by working a wash coating of J-M No. 32 Refractory Cement into the pores of the brick, and in this manner, retarding the slag penetration.

Spalling:

Spalling is not only the main cause of trouble in oil burning boilers, but also threatens coal burning boilers, especially when there are quick changes in load. Open joints exposing the sides of the fire brick, as well as the face, to changes in temperatures, will increase spalling.

A setting bonded with J-M No. 31, No. 32 or No. 20, protects the vulnerable edges and corners, and effects a gradual, even temperature gradient through the brickwork, which to a large degree eliminates temperature strains and spalling.



Slagging along the fire line. Open joints due to the use of a fire clay have helped this condition to start. A plaster-coating of No. 33 Super-Refractory Cement will save this setting from failure

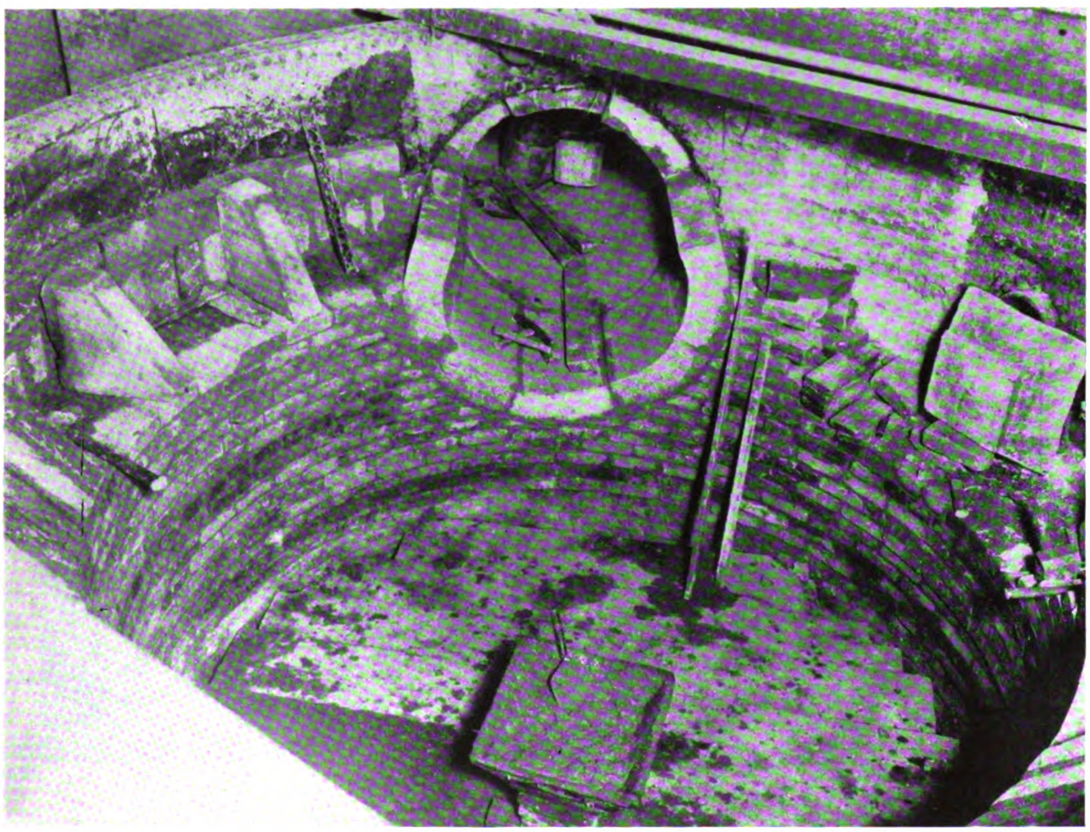
J-M Refractory Cements in the Gas Industry

The modern gas practice of pushing gas generating apparatus to the limit of its capacity is responsible for the need of greater care in the study and selecting of the materials used. J-M Refractory Cement protection is being used in hundreds of gas plants throughout the country to keep pace with bad fuel conditions, higher temperatures, higher blast pressures and mechanically operated clinker bars.

Water Gas Apparatus:

Setting the fire brick or tile lining of the generator, carburetter and superheater with J-M No. 26, No. 32 or No. 20 Refractory Cement provides a strong wall that is particularly desirable in the generator to withstand the alternate raising and lowering of temperature occasioned by the blow and run, the destructive action of the clinker bar, the erosive action of the blast and the mechanical abrasion of the charge. Spalling is prevented and insulation is protected from the deteriorating action of steam by the same means. Take-offs, hot valves and connections are all subjected to severe service, but stand up for a much longer time if bonded and sealed with No. 26, No. 32 or No. 20.

No. 20, used for either hot or cold patching, effectively restores cracked or damaged brickwork around generator door openings, generator crowns, blast and steam connections, hot valve take-offs, etc. For large patches in generators near the grate bars, Plastic Fire Brick Material has proved to be economical. Some operators have found gun patching with No. 26 to be of considerable help in maintaining the generators.



Interior of a water gas generator set up with No. 26 Refractory Cement. This insures a strong lining which will withstand the destructive effects of the clinker bar, the alternate raising and lowering of the temperature, and the abrasion of the charge

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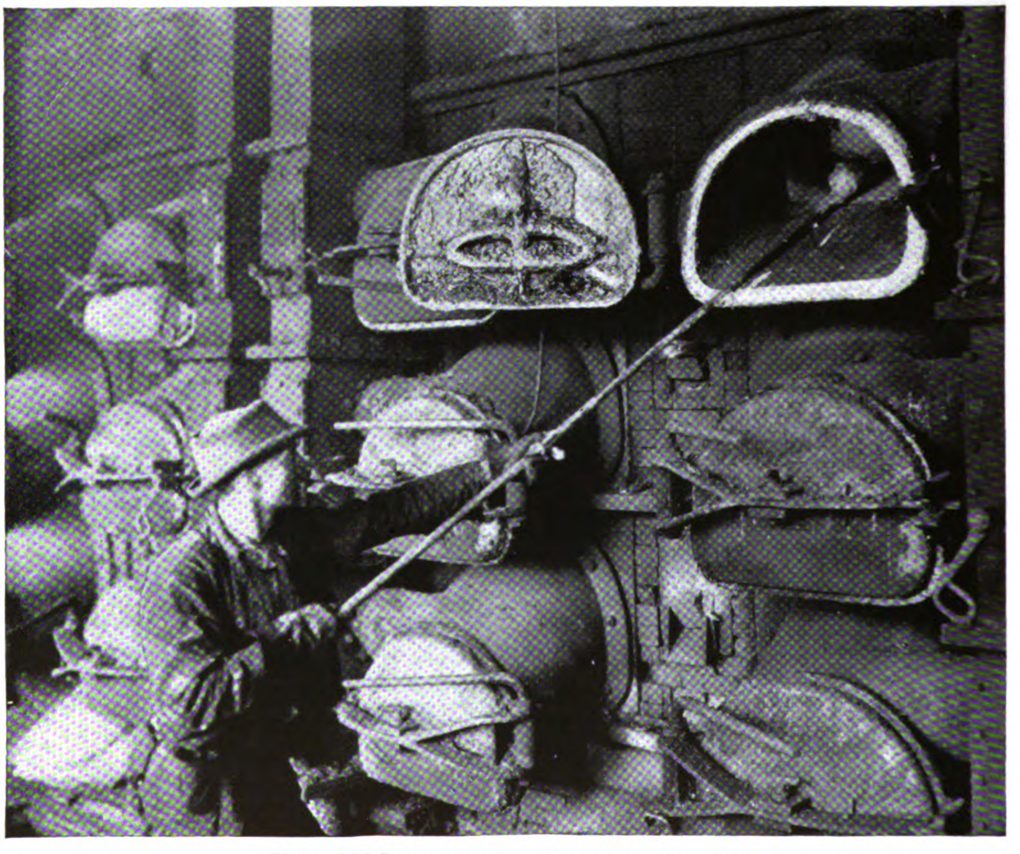
Coal Gas Apparatus:

The economical operation of coal gas benches depends to a great extent on maintaining leak-proof recuperator walls, long-lived producers and minimum maintenance to retorts. Bench producers, recuperator settings, arches and front and rear filling walls bonded with J-M No. 31, No. 32 or No. 20 Refractory Cement offer the greatest resistance to trouble from expansion and contraction, which is the cause of leaks in recuperator partitions. If leaks do occur in waste gas flues they can be effectively controlled and sealed with No. 26 or No. 20 which are particularly adaptable for this type of work.

For producer brickwork to stand up under the erosion of the charge and the destructive action of the clinker removal, it should be protected with No. 31, No. 32 or No. 20. Patching of the producer can be accomplished economically with J-M Plastic Fire Brick Material.

By-Product Gas Apparatus:

Solid, air-tight walls are of great importance in by-product coke ovens to prevent short circuiting of the gases. The right refractory cements protect the brickwork during charging and pushing, and from the erosive action of the gases. No. 26 or No. 20 makes a strong bond in the combustion chamber. No. 26 is unexcelled for use in pointing up jambs, up-take pipes, charging hole brick and for sealing gas leaks wherever they occur about the ovens. It is also adapted to use in cement gun mixtures.



Using J-M Refractory Cement as a patching material to minimize retort troubles in a gas plant

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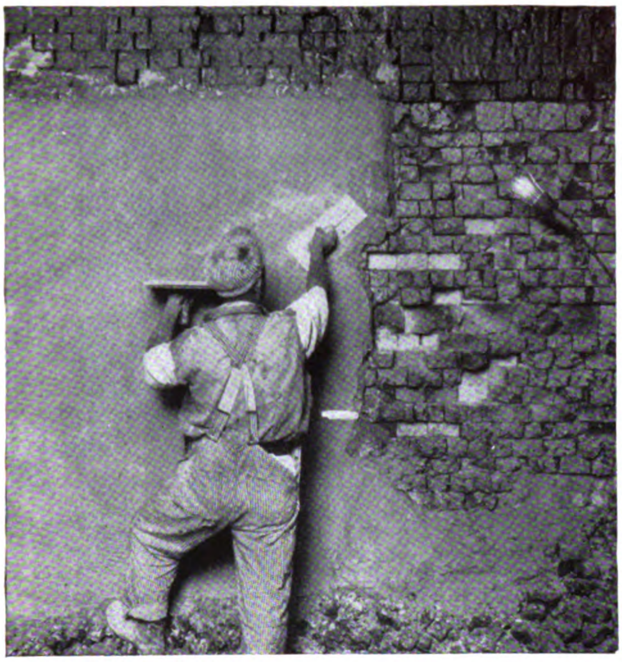
Applying J-M Refractory Cements



An old wall being plaster-coated with No. 33 Super-Refractory Cement

Setting Fire Brick with Nos. 26, 30, 31, 33 and 35 Refractory Cements:

When preparing J-M Refractory Cements Nos. 26, 30, 31, 33 and 35, for use as a bond joint between fire brick, water is mixed with the cement to provide the proper consistency. The amount of water required depends upon the porosity of the brick and can best be found by trial. Porous brick will require a thinner mixture than those less porous.

A batch of refractory cement mortar may have a good appearance and yet, if a few handfuls of the batch are taken and rubbed together, some cement is found that is dry. The mortar should be thoroughly mixed and free from lumps. It is just as important than an excess of water be avoided.

The cement is "buttered" or troweled on the brick already placed. Then a brick is laid on top and tapped until the joint between the brick is from 1/8" to 3/16" thick and cement squeezes out between the edges of the brick. The cement is then troweled back over the face of the joint and brick so that it protects the edges of the brick, making a "T" joint.

Setting Fire Brick with Nos. 20 and 32 Refractory Cement:

For brick-to-brick, or dipped, joints, No. 20 or No. 32 is thoroughly mixed with water to a soup consistency. The brick is wet and all faces which will come in contact with the brickwork already in place, are dipped in the mixture. Full directions are supplied with each shipment of refractory cement from the factory.

For a bond joint, J-M No. 20 Plastic Refractory should usually be used as furnished in the container, but it may be necessary to add a slight amount of water to bring it to the proper working consistency. The cement is worked with a trowel or hoe to make it smooth and is then applied the same as Nos. 26, 30, 31, 33 and 35.

Wash-coating with Nos. 20 and 32 Refractory Cement:

The setting is thoroughly cleaned and the cement mixed with sufficient water to bring it to a thin grout consistency. The mixture is thinly applied to the face of the brickwork with a stiff brush or broom, working it well into the cracks and pores in the brick.

Wash-coating with J-M Refractory Cement

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Plaster-coating with No. 33 Super-Refractory Cement:

No. 33 is extremely resistive to the cutting action of oil flame and slag. It should be used only on old furnace walls that have been thoroughly cleansed of slag or cinder incrustation. Any glazed or smooth surface must be chipped away and well scarified.

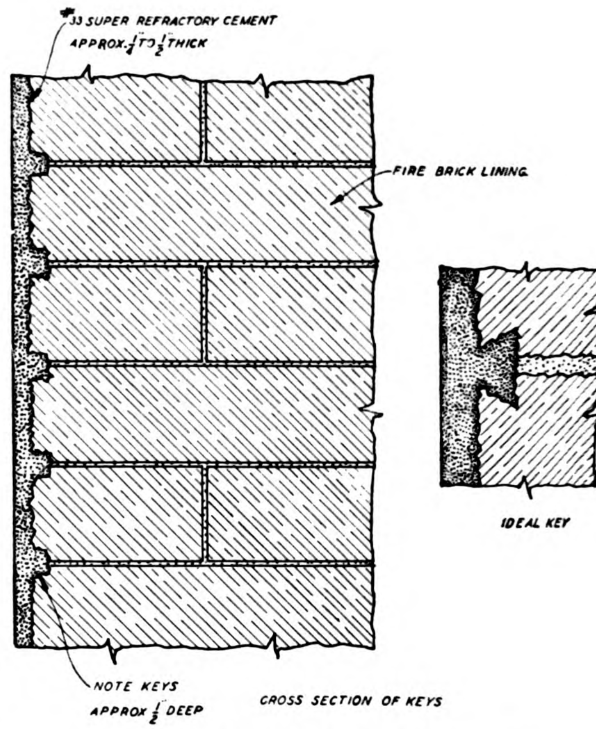
No. 33 should be thoroughly mixed with water to a dense mortar consistency and the mixture tempered by standing over-night, covered by wet rags. Keys should be cut into the brickwork at each course, in order to hold the plaster-coating in place. The cement should be applied with a trowel to a thickness of from ¼″ to ½″ depending upon the condition of the wall.

Patching with J-M Plastic Fire Brick Material or No. 20 Refractory Cement:

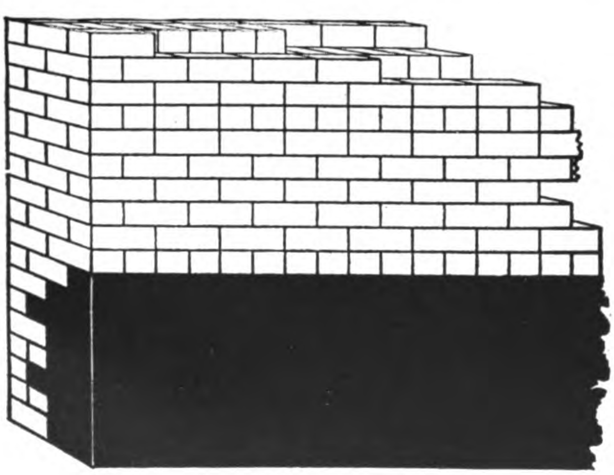
Plastic Fire Brick Material should be used in a very stiff plastic condition. It is shipped in the right consistency for use and if only a portion of the contents of a drum is used, it can be kept in the right condition by covering with wet rags.

If the material is too wet, it will not permit of proper pounding into place and shrinkage will increase. If it is too dry, it will lose some of its adhesiveness and proper vitrification is prevented. If the material has dried out, it can be brought back to the right consistency by the addition of a small amount of water.

The old brick is torn out so that the thickness of the material will be at least 4″. All loose pieces of brick and mortar are removed and the part to be patched is washed down with water. Chunks of Plastic Fire Brick Material are then pounded into the patch with a wooden mallet. If material has become frozen, it should thoroughly thaw out before using.



Keyways are important in plaster-coating with No. 33 Super-Refractory Cement



P.F.B.M. patches should be at least 4″ thick

Except on large patches no drying out period is required. For large patches, a slow fire is started to drive off the moisture gradually and then without a let-up, the furnace is brought up to operating temperature.

When it is desired to use up old fire brick as a patching material J-M No. 20 Plastic Refractory is mixed with water to a soup consistency and crushed fire brick added. The fire brick should pass through a No. 4 screen (4 openings per linear inch). Both the fine and coarse particles should be mixed thoroughly with the cement to quite a stiff consistency. The best proportion is 35% of No. 20 and 65% of crushed fire brick. The application is similar to that of Plastic Fire Brick Material. Small patches may be made with No. 20 as supplied.

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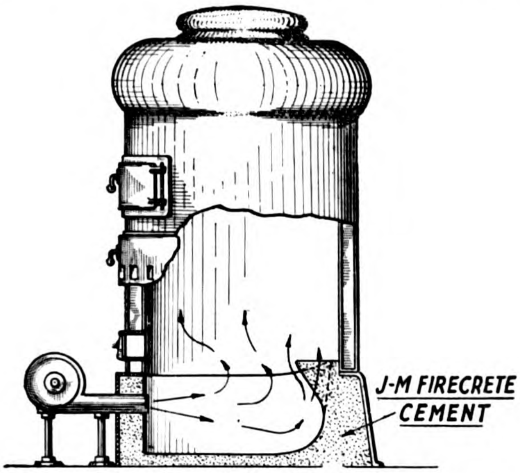
J-M Refractory Cements for Oil Burners

For domestic oil burning furnaces and boilers, Johns-Manville manufactures refractory cements that make an efficient combustion chamber. Whether fire brick shapes or poured or rammed linings are used, these cements are economically adapted to the requirements of the burner and of the appliance.

Servicing is one of the largest items of expense in the sale of oil burners, and a large portion of this expense is occasioned by refractory troubles. Clean, thorough combustion of oil can be accomplished only by the presence of high temperature in the combustion chamber which necessitates a proper refractory setting or lining, to act as a reflector and to increase the temperature of the atomized oil. More heat units result from such combustion, and heat absorbing surfaces are made more effective by the elimination of soot and carbon.

The refractory must withstand high heat, as well as the severe strain of expansion and contraction. It

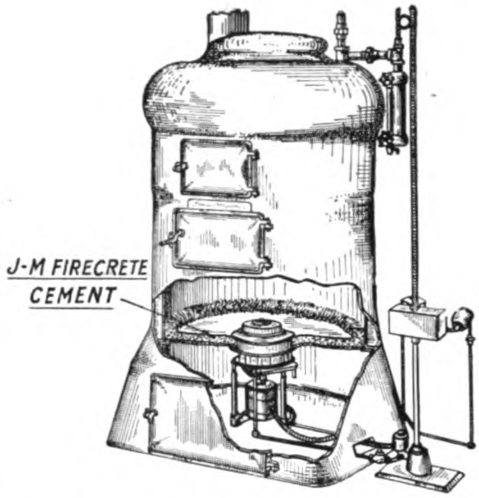


Firecrete setting for round boiler combustion chamber

must also hold and reflect the heat, and serve as a protection for uncooled metal parts. All of these qualities are combined in Firecrete.

Firecrete:

J-M Firecrete is a dry refractory cement used for either poured or tamped linings and is also adapted to the pre-moulding of special refractory shapes. It is easily troweled and may be poured like concrete or can be cast in any desired form, regardless of the type of burner or the size of combustion chamber.

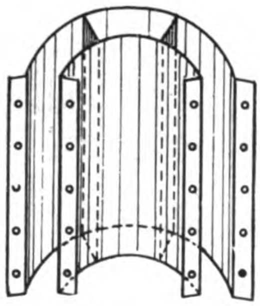


A rotating plate burner with lining of Firecrete

Firecrete saves many hours of difficult and tedious fire brick construction. It is truly economical and any unmixed cement left over from one job can be used on the next. It air-sets without the application of heat, resists oil penetration, does not shrink and successfully resists temperatures in excess of 2600 deg. F.

For the rotary type of burner which is installed inside the boiler, such as Silent Automatic, Timken, A.B.C., Torridheat and Nokol, Firecrete is applied to the hearth or horizontal burner plate. In other types, the combustion chamber is lined with a monolithic refractory.

For poured linings, 10 quarts (approximately 20 lb.) of water are added per 100 lb. of Firecrete. Suitable forms can be made of either wood or sheet metal,



Half-section of typical sheet metal form used for poured linings. Can be easily made and dismantled. Fill in between boiler and Firecrete with sand

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to hold the cement in place until it develops an initial set. Firecrete begins to set within 15 minutes, so water is not added until the job is ready for application of the material. Where the refractory is to be placed at grate level, the grates are not removed from the boiler before application, as the Firecrete is poured on top of heavy cardboard, placed over the grates.

For tamped linings, 8 quarts (approximately 16 lb.) of clean, fresh water is added and mixed thoroughly. The cement is then tamped firmly into place.

Firecrete can be fired at any time after the initial set takes place, but it is preferable to allow it to cure at least over night.

Firecrete is shipped in 100-lb. bags, each bag containing sufficient material for 0.8 cu. ft. of finished refractory construction.

No. 20 Plastic Refractory Cement:

When fire brick or fire tile is to be used in the combustion chamber, J-M No. 20 Plastic Refractory Cement for bonding and wash-coating makes a strong setting with permanent, tight joints. It is a plastic cement, finely ground, which gains full strength without the application of heat and will not crumble or disintegrate on heating and cooling. This cement is also well adapted for patching holes and cracks in old linings.

When laying brick, not more than 2 quarts of water are added per 100 lb. of cement and mixed thoroughly. This gives a batter of a heavy cream consistency. Nothing except water should ever be added. Each brick should be dipped in the mixture and then tapped firmly in place, so that a thin brick-to-brick joint will be obtained. The cement that squeezes out from the joints between the brick should be troweled or "buttered" back over the joints. After the brickwork is set up, wash-coating with a stiff brush or broom dipped in the cement mixture will fill the pores of the brick and increase resistance to furnace gases.

For patching small areas in old linings, No. 20 is used as it is shipped. For large patches, No. 20 is mixed with fire brick crushed to pass through a No. 4 screen (four openings per linear inch), using both the fine and the coarse particles. The best proportion is 35% of No. 20 and 65% of crushed fire brick. The mixture should be quite stiff to obtain best results. It is pounded firmly into the part of the lining to be patched.

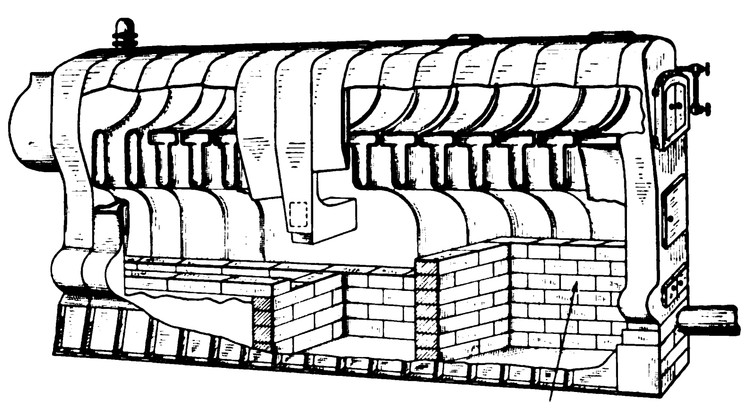
For setting 1,000 brick, from 400 to 500 lb. of No. 20 are required. It is furnished ready-mixed in 5, 10, 25, 50, 100, 250, 500 and 850-lb. cans or drums.

No. 26 Refractory Cement:

No. 26 is a dry cement for setting up fire brick shapes. It takes a medium air-set and is supplied where a dry cement is desired. Because of the nature of the material it is customarily used in a 1/8" to 3/16" bond joint, which takes 600 to 700 lb. per 1,000 brick. Furnished in 100-lb. bags.

Plastic Fire Brick Material:

J-M Plastic Fire Brick Material is a plastic, putty-like cement, which meets the requirements of a monolithic rammed-in lining and is also used for patching. The weight is about 125 to 130 lb. per cu. ft. This material reaches its vitrification point at 1500 deg. F. Shipped plastic, ready for use, in 100, 250 and 500-lb. drums.



Combustion chamber of a smokeless boiler with fire brick set with J-M No. 20 Plastic Refractory Cement

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Fireite Asbestos Furnace Cement

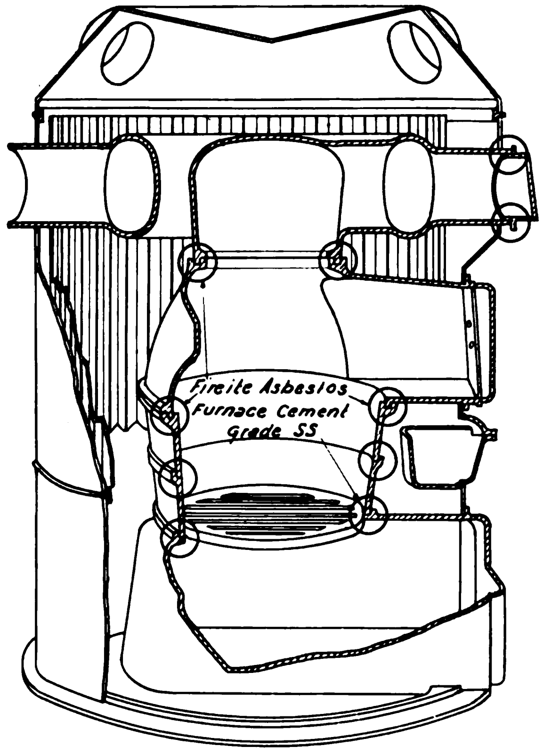
Fireite Asbestos Furnace Cement, in two grades, is used for setting up and repairing joints in furnaces, ranges, heaters and stoves. Making gas-tight the joints between sections in warm air heaters as shown in the circles on the illustration, represents one important application of this product. Grade SS (slow setting) is used for setting ash-pits, fire-pots, doors, dampers, or other sections where heat is to be applied soon after application. Grade FS (fast setting) is used for sealing sections of steel radiators. Grade SS is furnished unless FS is specified.

Fireite is prepared ready for use as a smooth, buttery paste. It is conveniently plastic, readily workable, odorless, and adheres firmly to castings and sheet metal. When subjected to heat, it vitrifies without shrinkage and forms a permanent air-tight joint which prevents the escape of smoke, soot and gases. For completely setting up the average warm air furnace, from 8 to 13 lb. of Fireite are required.

Before applying Fireite care should be taken to be sure the metal is clean of paint, iron rust, grease spots, etc. Iron rust or paint is cleaned off with a stiff wire brush and the grease spots with gasoline. After cleaning, dirt and foreign matter should be brushed out of crevices.

A small quantity of Fireite is diluted with water to a consistency of paint and applied to all the metal of the joint by means of a brush or wet cloth. This fills any slight defects such as are found in most castings. The heavy cement is then applied directly from the container preferably by means of a spatula or putty knife or sometimes is rolled by hand and forced into place. In all cases the cement must be firmly pressed against the metal.

In assembling heaters or stoves the entire joint is filled with Fireite and the section allowed to settle of its own weight into the cement. It should not be twisted or jammed into place or the cement will be pulled out of its proper location. The cement that squeezes out when the section settles in place should be neatly smoothed off. The Fireite is allowed to harden at least 24 hours before starting a fire. A slow fire should be carried at first so that the cement will cure uniformly. Quick initial firing will cause a weak joint with any cement.



Proper locations for Fireite are indicated by circles

Sizes

Both grades of Fireite Asbestos Furnace Cement are furnished in the following size containers: 1-lb., 100 per case; 2-lb., 50 per case; 3-lb., 32 per case; 5-lb., 24 per case; 10-lb., 18 per case; 25-lb.; 50-lb.; 100-lb.; 250-lb.; 500-lb. and 850-lb.

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J-M Refractory Cement Recommendations

Boilers

Type of Furnace	Part	Recommendations	Remarks
Water Tube Boilers. Horizontal Return Tubular (H.R.T.) Boilers.	Furnace walls, bridge walls and arches.	#31, #32 or #20 for bonding. #32 for wash-coating. #33 for plaster-coating. (Walls only.) P. F. B. M. for patching. (Walls only.)	#31 should be used where a dry cement is wanted for a bond joint; #32 where a dry cement is wanted for a brick to brick or rubbed joint; or #20 where a plastic cement is wanted for a brick to brick or rubbed joint. When wash coating with #32, apply thinly and work the cement into the cracks and pores of the brick. When plaster coating with #33, instructions should be closely followed. The proper preparation of keyways is important.
Waste Heat Boilers.	Entire setting.	#20 for bonding and wash coating fire brick.	#20 will prevent or retard erosion of the brickwork.
Water Tube Boilers.	Vertical baffles.	#26 for coating baffles.	Baffles are cleaned and wet down, and #26, mixed thick, applied with cement gun.
Chimneys.	Complete lining.	#20 for bonding and wash-coating brick.	#20 gives excellent results for setting-up chimney brick, due to its combined temperature and acid fume resisting qualities.

Oil Industry

Shell Stills. Tube Stills. Cracking Coils.	Furnace walls.	#20, #32 or #26 for bonding. #32 or #20 for wash-coating. #33 for plaster-coating. P. F. B. M. for patching.	Oil stills must be kept in good condition at all times for purposes of temperature regulation. Gouging or erosion can be remedied by a plaster-coat of #33.

Gas Industry

Water Gas Apparatus. Generators.	Lining and crown.	#26, #32 or #20 for bonding. P. F. B. M. for patching. #26 or #20 for patching with cement gun.	Refractory cements materially help the fire brick linings to withstand the destructive action of the clinker bar, the alternate raising and lowering of temperature and the erosive action of the blast and charge. They also protect generator shell insulation by preventing steam penetration through the brickwork.
Carburetters.	Lining and crown.	#26, #32 or #20 for bonding.	
Superheaters.	Lining and crown.	#26, #32 or #20 for bonding.	
Take-offs, hot valves and connections.	Lining.	#26, #32 or #20 for bonding. #20 for patching.	
Coal Gas Apparatus. Coal Gas Benches.	Bench producers, recuperators, arches and filling walls. Waste gas flues.	#31, #32 or #20 for bonding. P. F. B. M. for patching bench producer. #26 or #20 for sealing.	Solid air-tight walls are extremely important in coal gas benches. Leakage of air from recuperators into waste gas flues means incomplete combustion of producer gas and combustion in waste gas flue.
By-Product Coke Ovens.	Combustion and coking chambers, regenerator walls and arches. Flues. Door jambs.	#26 or #20 for bonding brick and sealing chambers. #26, or #20 for patching. #26 for patching.	Solid, air-tight walls are also important in by-product coke ovens to prevent short-circuiting of gases. Refractory cements protect the brickwork during charging and pushing, and from the erosive action of the gas.
Producer Gas Generators.	Entire lining. Mains, take-offs and dust catchers	#26, #32 or #20 for bonding. P. F. B. M. for patching. #20 for bonding and wash-coating.	Refractory cements help the linings of producer and blue gas generators to withstand the clinker bar, the change in temperature and the erosion of the charge. It also prevents the coal tar from penetrating the brickwork and thereby protects the insulation.
Blue Gas Generators.	Entire lining. Mains and take-offs.	#26, #32 or #20 for bonding. P. F. B. M. for patching. #20 for bonding and wash-coating.	

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Steel Industry

Type of Furnace	Part	Recommendations	Remarks
Blast Furnaces.	Bottom blocks, hearth, bosh, and inwall brick to approx. 30′ above mantle. Top, including area around wearing plates, down to approx. 30′ above mantle.	#30 for bonding brick. #20 for bonding brick.	#30 is particularly resistive to the action of blast furnace slag and the erosive action of materials passing through the furnace in the blast. In the bottom blocks, it prevents metal penetration and cuts down labor costs, for when using #30 it is not necessary to chip off the blocks to level each course. #20 strongly bonds the metal wearing plates to the brick and resists the cutting action of the ore, limestone and coke fed into the furnace.
Hot Blast Stoves.	Combustion chamber, including arches. Hot blast main connections.	#32 for bonding brick. #32 for wash-coating. #20 for patching.	The vulnerable parts of hot blast stoves are the combustion chamber, arches and take-off connections. Refractory cements offer particular saving at these points.
Open Hearth Furnaces.	Checker chamber walls and arches.	#20 or #26 for bonding brick.	Walls strongly bonded with #20 or #26 practically eliminate air infiltration.
Heating and Reheating Furnaces.	Walls and roof. Flues.	#31, #32 or #20 for bonding. P. F. B. M. for patching. #20 for bonding.	In heating and reheating furnaces, refractory cements to a great extent prevent trouble from spalling, reaction from oxide slags, and erosion in the flues.
Soaking Pits.	Side walls, checker chamber walls and arches, soaking pit covers.	#20 or #26 for bonding brick.	When the ingots are lowered into the soaking pits they often knock against the sides. Walls strongly bonded with refractory cement will better withstand this destructive action as well as the flame impingement and slagging action encountered.
Forging Furnaces.	Walls and roof. Flues.	#31, #32 or #20 for bonding. P. F. B. M. for patching. #26 or #20 for bonding.	See Heating and Reheating Furnaces above.
Annealing and Heat-Treating Furnaces.	Walls, arches and roof. Flues.	#31 or #26 for bonding. #33 for plaster-coating. (Hearth and walls only.) #26 or #20 for bonding.	See Heating and Reheating Furnaces above. For electric annealing furnaces, use #20. It is sulphur free and will not affect resistor elements.
Case Hardening.	Machine parts.	#20 for selective case hardening.	#20 is applied over those portions of the work which it is desired not to harden.
Inlet and Outlet connections.	In furnaces, stoves, etc.	#20 for bonding brick in arches and inner courses of walls.	Refractory cement protects the brick from hot blast abrasion.
Stacks.	Brick linings.	#20 for bonding brick.	Waste gases contain sulphur. In contact with atmospheric moisture, acid is formed. #20 prevents this acid from penetrating the brickwork and attacking the steel shell.

Lime and Cement Kilns

Vertical Lime Kilns.	Fire box. Burning zone. Top.	#31, #32 or #20 for bonding. #31 or #32 for bonding. #20 for bonding.	Refractory cements greatly assist the brick in withstanding the abrasion from the charge of limestone and coke or coal, and the varying temperature.
Rotary Lime Kilns.	Clinkering zone. Balance of kiln. Flue.	#32 for bonding brick. #20 for bonding brick. #20 for bonding brick.	In rotary lime kilns, there is not only abrasion but also vibration and enormous expansion stresses. Refractory cement gives a strong lining which will prevent premature failure.
Rotary Cement Kilns.	Clinkering zone. Balance of kiln. Flue.	#33 or #32 for bonding brick. #20 for bonding brick. #20 for bonding and wash-coating brick.	Service conditions in rotary cement kilns are more severe than in rotary lime kilns and the need for refractory cements is correspondingly greater.

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Iron Foundries

Type of Furnace	Part	Recommendations	Remarks
Cupolas.	Lining to 10′ above tuyeres. Top down to 10′ above tuyeres. Run-out spout.	#30 for bonding brick. #20 for bonding brick. #30 for patching.	#30 cement is resistant to the molten iron and gives a strong lining to withstand the destructive abrasive action of the charge passing through the cupola.
Core Ovens.	Combustion chambers. Heating chambers.	#31, #26 or #20 for bonding brick. P. F. B. M. for patching. #20 for bonding and wash-coating brickwork.	The proper refractory cement increases the life of the refractories and prevents air infiltration.
Malleable Iron Furnaces.	Combustion chambers. Walls of melting zone. Roofs (bungs). Flues.	#31 or #33 for bonding brick. #33 for plaster-coating. P. F. B. M. for patching. #33 for bonding brick. #33 for bonding brick. #31, #32 or #20 for bonding brick. #33 for plaster-coating.	#33 offers exceptional resistance to the oxidizing action of the flame and also helps to prevent spalling of the brickwork, both of which actions are severe in malleable iron furnaces. It bonds the brickwork of the bungs solidly together and makes a structurally strong roof. The draft in a malleable iron furnace is high, and refractory cements protect the flues from the erosive action of the ash particles and draft.

Non-Ferrous Metal Industry

Brass, copper, german-silver, bronze, chrome-nickel, monel metal, aluminum. Crucible Furnaces. Stationary or Tilting. (Pit fires.)	Entire lining.	P. F. B. M. for monolithic lining. #31, #32 or #20 for bonding brick. #32 for wash-coating brick. #33 for plaster-coating. P. F. B. M. for patching.	Plastic Fire Brick Material eliminates the necessity of special shapes. In crucible furnaces much trouble is experienced with slag erosion which is retarded by refractory cement.
Induction Furnaces. (Without crucible.) Ajax-Wyatt.	Entire lining including ducts and chambers.	#34 as a monolithic rammed-in lining for alloys with *not* more than 90% copper.	#34 gives exceptional results as a monolithic lining. Detailed instruction for use is given on special data sheets.
Indirect Arc Tilting Furnaces (Without crucibles.) Detroit, Booth.	Entire lining.	#33 or #35 for bonding brick. #33 or #35 for patching.	For patching, #33 or #35 are mixed with water to dry moulding sand consistency, tempered 12 hours, remixed and applied to a clean, scarified surface, previously washed with the cement. The mix is then tamped into place and the furnace heated bright red before charging.
Indirect Arc Stationary Furnaces (Without crucibles.) Reunerfelt, Re-Pel-Arc, Stassano	Roof. Sidewalls. Hearth.	#33 for bonding brick. #33 for bonding brick. #35 for bonding brick. #35 for patching.	#33 offers protection from excessive heat penetration into the brickwork through open joints. #35 rammed-in, or as a bond to fire brick, gives a long-wearing hearth.
Direct Arc Furnaces. (Without crucibles.) Heroult, Snyder, Greaves-Etchell, Bennet.	Roof. Sidewalls. Hearth.	#33 for bonding brick. #33 for bonding brick. #35 for bonding brick. #35 for patching.	The severe service conditions imposed on refractories mean a very limited life unless the proper refractory cements are used.
Resistor Furnaces. (Without crucibles.) Bailey, General Electric, Reunerfelt.	Roof. Sidewalls. Resistor piers. Hearth.	#33 for bonding brick. #31 for bonding brick. #31 for bonding brick. #34 as a monolithic rammed-in hearth.	Surprising economies can be effected by the careful application of these refractory cements.
Reverberatory Furnaces.	Combustion chamber. Flues.	#31, #32 or #20 for bonding. #32 for wash-coating. #33 for plaster-coating. P. F. B. M. for patching. #20 for bonding and wash-coating.	Refractory cements protect the brick from the many deteriorating influences, such as spalling, erosion, etc.
Electrically Heated Annealing Furnaces.	Walls and roof.	#20 for bonding brick.	#20 is sulphur-free and will not affect resistor elements.

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Glass Industry

Type of Furnace	Part	Recommendations	Remarks
Pot Furnaces. (Regenerative.)	Crown. Furnace walls. Flues and ports. Regenerator walls and arches.	#31 or #32 for bonding. #31, #32 or #20 for bonding. #32 for wash-coating. #33 for plaster-coating. P. F. B. M. for patching. #20 for bonding and wash-coating.	Refractory cements are particularly useful in protecting the brickwork from spalling when the ports are opened and the pots removed. It is highly important to use #20 on regenerators.
Tank Furnaces. (Regenerative.)	Crowns and furnace walls above glass melting zone. Flues and ports. Regenerator walls and arches.	#31 or #32 for bonding brick. #20 for bonding and wash-coating brick. #20 for bonding brick.	Refractory cements to a great extent prevent heat and flux vapor penetration into the brickwork, but are not recommended in parts of furnaces actually coming in contact with molten glass, due to the possibility of alumina absorption by the glass. It is highly important to use #20 on regenerators.
Lehrs or Annealing Ovens.	Combustion chamber.	#31, #32 or #20 for bonding. #32 for wash-coating. #33 for plaster-coating. P. F. B. M. for patching.	Uniformly graduating temperatures can best be controlled in a tight setting, free from cracks.
Glory Hole.	Entire lining.	#20 for bonding brick and for patching.	Patching is difficult and very necessary to glory holes. #20 is particularly effective for this work.
Pot Arches.	Roof, bridge walls, side walls, hearth and doors.	#31, #32 or #20 for bonding brick.	Due to the construction of the hearth and the load of the pots, the strength obtained with refractory cements is an important factor. The large doors also last longer when strongly bonded with refractory cement.

Ceramic Kilns

Periodic Kilns.	Walls and crown. Fire eyes. Waste gas flue.	#26, #32 or #20 for bonding. #31, #32 or #20 for bonding. P. F. B. M. for patching. #20 for bonding.	The fire eyes of kilns are subjected to the same deteriorating influences as boiler fire boxes. In up-draft kilns the floor is another weak spot because of the high temperature of the understructure.
Tunnel Kilns.	Furnace. Preheating, firing and cooling zones.	#31, #32 or #20 for bonding. P. F. B. M. for patching. #20 for bonding and wash-coating brick.	Refractories in the firing zone of modern tunnel kilns are subjected to exceptionally harsh conditions. Refractory cements assure long life and continuous operation.
Patching Saggers.		#20	#20 is particularly adapted to this service.

Incinerators

	Furnace.	#26, #32 or #20 for bonding brick.	There is considerable trouble from spalling in incinerators. Refractory cement will protect the brick.

Domestic Oil Burning Installations

	Furnace.	Firecrete for poured or tamped linings. #20 for bonding fire brick shapes and patching small areas. #26 for bonding fire brick shapes where a dry cement is desired. Plastic Fire Brick Material for rammed-in linings and for patching.	Stocks of refractory cements are carried all over the country. Complete directions for use are given in J-M pamphlet RC-3A.

Expansion Joints

Much fire brick trouble may be avoided in boilers and industrial furnaces by the use of suitable expansion joints properly designed and located. J-M Expansion Joints are described in other data sheets.

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Textiles, Papers and Fibres

(Asbestos)

(For complete list of data sheets, see other side of this page)

Printed in U.S.A.

Textiles, Papers and Fibres (Asbestos)

Complete List of Data Sheets Available

★ Catalog pages

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J-M Asbestos Textiles, Papers and Fibres

The types of asbestos of principal interest are found as veins in serpentine rock, an igneous formation millions of years old. Asbestos usually occurs as cross fibres, the length of the fibre being the width of the vein. Its composition always includes a large percentage of silica, but magnesia, soda, alumina, ferrous oxide, lime and water also enter into the chemical combination of the different varieties in varying quantities. The fibres are perfectly smooth and nontubular and in these respects are different from all animal and vegetable fibres.

Asbestos is found in various parts of the world, but an unusually pure quality is mined by Johns-Manville in extensive deposits in the Province of Quebec, Canada and at Chrysotile, Arizona. From the standpoint of use, the commercially valuable varieties can be placed in three groups—the most commonly used type as represented by Canadian, Russian and some kinds of African, the iron free type as represented by fibre from Arizona and Australia, and the acid-resisting type represented by blue African.

Asbestos mining is really a quarrying operation in most cases, as blasting is resorted to in order to loosen masses of the rock in open pits, after which the fibre is removed from rock in the ratio of about one ton of fibre from twenty tons of blasted material. The J-M Canadian mines are open pits while the J-M Arizona mines are underground. After being mechanically treated, the fibres extracted from the rock can be carded into roving, spun, woven, felted, moulded and otherwise manufactured into many useful articles.

J-M Asbestos Fibre

Asbestos fibre is first classified into two main divisions, crude and mill fibre. The crude fibre is obtained by collecting the larger pieces of fibre shaken loose by the blast and removing by hand the rock still clinging to them, after which it is shipped to the factory. All the rest of the blasted material is put through the mill at the mine, the rock crushed off, the fibre worked into a soft matted mass, screened, graded and packed for shipment. It is extremely difficult to grade and evaluate asbestos fibre, since with the exception of the crude, it is almost impossible to measure the length of fibre. Further, the length of fibre does not tell all that must be known.

Crude asbestos rock

Crude fibre is divided into two grades, No. 1 and No. 2, determined by its average length. Mill fibre is divided into many grades by a system of screen test measurements. The mines have adopted a standard screen consisting of a pan, a 1/8" mesh screen, a 1/4" mesh screen and a 1/2" mesh screen, reading from bottom to top. A pound of fibre is placed on the top 1/2" screen and shaken for two minutes by a cam having 300 revolutions per minute. The amounts of fibre remaining on each screen are then weighed and the results given in ounces on each screen based on a total of 16 oz. or 1 lb. Thus, 2-8-4-2 means 2 oz. on the 1/2" screen, 8 oz. on the 1/4" screen, 4 oz. on the 1/8" screen, and 2 oz. in the pan. While the results obtained show considerable variation, it is a roughly accurate method of valuing the less expensive grades, and it also indicates the cleanness. In the higher grades, this method takes no account of that quality of asbestos which is extremely important in textiles, packings, filter fibres and some high grade papers and insulations, namely, the natural life and resiliency of the fibre itself. Therefore, when the screen test is applied in the selection of fibre, it is necessary to take into account the use to which the fibre will be put and also to compare it with a sample of fibre which has been satisfactory for the purpose intended.

In general, the two grades of crude, and the two highest grades of mill fibres are used in yarns, cloth, brake linings, packings, high grade filter fibres,

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Carded asbestos fibre

papers and some insulation. The lower grades are used in paper, roofing, cements, shingles, insulation, gear compounds and paints.

J-M Asbestos Fibre is manufactured in various grades which differ greatly in character, depending upon the purpose for which they are intended. The particular fibre best suited for any process may be determined by its length and cleanness as well as its natural physical characteristics. The following are some of the fibres in most common use:

Amosite Asbestos Fibre. Brown African fibre, waterproofed for use as underground conduit insulation filling.

Asbestos Fibre No. A-36. Canadian fibre, used for filtering fruit juices, wines, drugs and sweet oils.

Asbestos Fibre No. A-47. Arizona fibre, practically iron free. Used for filtering chemicals, drugs, fruit juices, wines, extracts, lubricants and water.

Asbestos Fibre No. 99-A. Arizona fibre, practically iron free. Used for filtering and platinizing.

Asbestos Fibre No. 101. Canadian willowed fibre, coarser in texture than 101-A. Used for filtering.

Asbestos Fibre No. 101-A. Carded No. 101 used for filtering purposes.

Asbestos Fibre No. 201. Canadian fibre, coarser in texture than 201-A.

Asbestos Fibre No. 201-A. Carded No. 201 used in making filter films and pads, facing gas burner logs and in the glass industry to protect glassware.

Asbestos Fibre No. 208. Canadian willowed fibre used for wire wiping; caulking sulphuric acid pickling vats; filtering chemicals, drugs, fruit juices, wines, extracts, lubricants and water; grate-backs; and compounding lubricating greases.

Asbestos Fibre No. 208-1. Similar to No. 208 but slightly superior in quality.

Asbestos Fibre No. 209. Canadian fibre, used for wire wiping and compounding lubricating greases. It also finds extensive application in the glass industry to protect glassware.

Asbestos Fibre No. 211. Canadian willowed fibre used in furnace expansion joints and in compounding rubber.

Asbestos Fibre No. 219. Canadian fibre used for filtering and for caulking boiler settings. Can also be used for wire wiping.

Asbestos Fibre No. 232. Canadian fibre, suitable for filtering purposes and wire wiping.

Asbestos Fibre No. 249. Canadian fibre, used as a filtering agent.

Asbestos Fibre No. 255. Canadian fibre, suitable for wire wiping and compounding lubricating greases.

Asbestos Fibre No. 261. Canadian fibre, used for filtering purposes in the electro-chemical industry.

Asbestos Fibre No. 296. Canadian willowed fibre, used as packing to keep the wires apart in bases of electric light bulbs; also used in compounding roof putties, rubber, dry cell sealing caps and in the manufacture of stucco. This is the fibre used in forge shops to lessen the rate of cooling steel or iron parts.

Asbestos Fibre No. 305-F. Canadian fibre used in the manufacture of molded insulation.

Asbestos Fibre No. 323 and 323-S. Canadian fibre known as "Finish Asbestic" and "Floats." Used in asbestos gear greases. The S grade is the cleaner.

Asbestos Fibre No. L-412. Canadian fibre known as "Shorts." This is the short fibre Johns-Manville usually furnishes. The next longer is No. 296 and the next shorter are No. 323 and No. 323-S, which are known as "Floats," not fibres.

RX Asbestos Fibre. Brown African fibre especially suited for expansion joint work in brick furnace or boiler settings.

January, 1931 (Cancelling 2-F-1-A-2 to 2-F-7-A-1, dated in 1929 and 1930)

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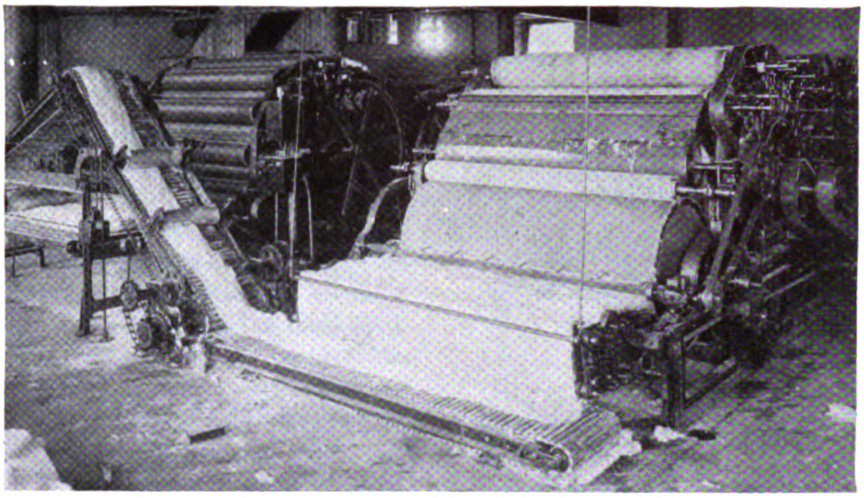
J-M Asbestos Roving and Yarn



Asbestos "web" being conveyed between carding machines

Asbestos fibre is mechanically treated, carded, formed into roving, and spun into yarn which serves many purposes requiring resistance to heat and chemicals.

The common or commercial grade of asbestos yarn is spun from commercially pure roving, containing approximately 80% asbestos. The vegetable fibre usually mixed with the asbestos is cotton, which is used to increase the strength of the yarn, and to facilitate spinning and weaving. Sometimes the purity is put in terms of carbon content. Where only cotton is mixed with the asbestos, the percentage carbon divided by 0.44 gives the approximate cotton content in per cent.

Commercial yarn and roving is not guaranteed to meet Underwriters' specifications. Instead, there is manufactured a grade known as Underwriters' Yarn and Roving which complies with Underwriters' specifications requiring a maximum carbon content of 10% at any one spot. Yarns known as 90%, 95%, and 98-99%, are supplied as containing these minimum percentages of asbestos. Dust contamination makes it impossible to produce a 100% asbestos yarn.

The term "cut," or "count," with respect to yarn and roving, means the number of 100 yds. per lb. of single or 1-ply yarn or roving. Thus, a 10-cut or 10's yarn or roving will average 1,000 yds. per lb. With a few exceptions, the count jumps 200 yds. at a time, as from 8 to 10 and 10 to 12. The material is recognized as varying in count by plus or minus 100 yds., and it would be difficult to distinguish between an 11's and a 12's.

The yardage of a 2-ply yarn will be slightly less than one-half the yardage of the single ply, because of the twist. For example, 10-cut, 2-ply (10/2) will run about 460 yds. per lb. Asbestos yarns are wound on tubes with one, two, or three ends. The traverse runs from 2″ to 6″ and the overall diameter of tube and yarn from 1⅞″ to 5″. The measured weight of the yarn includes the weight of the spools or tubes.

In specifying a yarn, the grade should be mentioned first, as Commercial, Underwriters', 90%, 95%, or 98-99%. Next, the number of cuts should be mentioned, as 8, 10, 12, 14 or 16. Lastly, the number of plies of asbestos are mentioned, as 1, 2, 3, or 4; and the number of strands of .008″ brass wire, if any, which it is desired to have twisted with the yarn, is indicated. Specifications as to strength can be met where required. Diameter and twist is not used as a means of specifying asbestos yarn except in special cases.

Asbestos roving is usually supplied either in the Commercial or Underwriters' grade. This material is the soft, cylindrical strand of asbestos fibre that comes from the carding machine. It has no twist and very little strength. The chief use of asbestos roving, other than for spinning yarn, is for the insulation of electric heater cords, where it produces a soft, bulky, flexible cord. Asbestos roving is furnished wound on cones or cheeses, in 7, 8 or 10 cuts.

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The following are a few uses for asbestos yarn:

- Manufacture of asbestos cloth
- Sewing asbestos cloth
- Braiding insulation over wire
- Incandescent gas mantles
- Core for electric resistance wires
- Wrapping for electric resistance wires
- Wire wiping in galvanizing plants
- Spark plug packing
- Packing for flexible metal hose or tubing
- Packing for small spaces, as on blow torches
- Fireproofing electrical cables

J-M Asbestos Cord, Wick and Rope

The principal use for asbestos cord, wick and rope is as packing. Asbestos wick is also used for wire wiping. Sometimes asbestos rope is wound spirally around exhaust pipes as insulation. Fire and chemical-resisting asbestos cord is very useful in glass and chemical works, and finds excellent application in suspending hot retorts, etc. Information on these products will be found in the "Packings and Furnace Expansion Joints" Section.

J-M Braided Asbestos Tubing

Braided asbestos tubing

J-M Braided Asbestos Tubing is made of commercially pure asbestos yarn (approximately 80% asbestos), braided into flexible tubing of various sizes. Its principal use is as a covering for wires to protect them against heat or chemicals. It is also used for many other purposes, such as in the glass industry for covering the tines or prongs of forks and other implements with which hot glass is carried, to prevent injury to the glass.

Braided tubings are flexible and the diameters given are for tubings expanded to normal size. In tubing Nos. 1529, 1530, 1531 and 1532, the width given can be varied as much as 1/4" wider or narrower by stretching the tubing out or pushing it in, due to its extreme flexibility in these sizes.

Sizes and Weights of Braided Asbestos Tubing

Style No.	Inside diameter, inches	For use over wire No.	Outside diameter, inches	Approximate flat width, inches	Approximate ft. per lb.
1516	1/64	17 B and S	1/8	Furnished Round	175
1517	1/32	10 B and S	5/32	Furnished Round	100
1518	1/16	8 B and S	3/16	Furnished Round	85
1519	1/8	5 B and S	1/4	5/16	65
1520	3/16	4 B and S	5/16	3/8	50
1521	1/4	2 B and S	3/8	1/2	45
1522	3/8	0 B and S	1/2	5/8	23
1523	1/2		5/8	3/4	20
1524	9/16		11/16	7/8	16
1528	5/8		3/4	1	15
1529	3/4		7/8	1 1/8	14
1530	7/8		1	1 1/4	12
1531	1 1/8		1 1/4	1 1/2	10
1532	1 3/8		1 1/2	1 3/4	9

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J-M Asbestos Listings

J.-M Asbestos Listings are fireproof, flexible, woven tapes, suitable for wrapping all forms of electrical wires and coils. They are also used for insulating hot pipes, especially pipe of small diameter and sharp bends; and as light conveyor belts and lead-in tapes where temperatures are higher than is safe for cotton fabrics.

Asbestos Listings are made in widths from ½″ to 3″ and in thicknesses of .025″ (No. 1064); 1/32″ (No. 1073); 3/64″ (No. 1082); and 1/16″ (Nos. 1091 and 1096). No. 1091 (1/16″ thick) can be furnished wire-inserted if desired. J-M Listings are all closely woven and have a smooth surface with the exception of Style No. 1064 which is a more open weave than the other styles as in this case a more exact thickness must be maintained. Other thicknesses are given in approximate figures. Style No. 1096, is more closely woven and much stronger than No. 1091.

All of the above listings are commercially pure (approximately 80% asbestos). Special listings of various asbestos contents up to 98-99% can also be furnished.

Footages per Pound

Width Inches	No. 1096 1/16″ thick Feet per lb.	No. 1091 1/16″ thick Feet per lb.	No. 1091 Wire-inserted 1/16″ thick Feet per lb.	No. 1082 3/64″ thick Feet per lb.	No. 1073 1/32″ thick Feet per lb.	No. 1064 .025″ thick Feet per lb.
½	76	86	68	128	122	166
⅝	60	69	54	102	98	133
¾	50	57	45	85	81	110
⅞	43	49	39	73	70	95
1	39	42	34	64	57	80
1¼	30	34	27	51	49	66
1½	25	28	22	42	40	55
1¾	21	24	19	36	35	47
2	19	21	17	32	28	41
2¼	16	19	15	28	27	36
2½	15	17	13	25	24	33
3	13	14	11	21	19	27

Nos. 1096 and 1091 come 150 ft. per roll, all widths; Nos. 1082, 1073 and 1064, 1″ wide or over, come 150 ft. per roll; widths under 1″ come in 1 lb. rolls.

J-M Asbestos Cloth

Asbestos yarn, woven into fabric, forms a soft flexible textile—a mineral cloth which resists heat and chemicals. Commercially pure cloth is ordinarily used, but there is frequent demand for cloth woven from each of the other standard grades of yarn, except Underwriters'. It is impossible to produce a 100% asbestos cloth as dust contamination of the fibre in process cannot be prevented, and this foreign matter shows up in subsequent chemical analysis.

Asbestos cloth is supplied on a square yard basis, woven of various plies of yarn of any standard cut (8, 10, 12, 14 or 16), to weigh a certain approximate amount per sq. yd. Standard widths are 36″ or 40″ and standard rolls contain 50 linear yards.

In construction and weight, cloths vary widely from a ⅞-lb. open cloth to a 4½-lb. tightly-woven plain cloth and a 12-lb. conveyor belting. The customary weave is plain, with warp threads passing alternately over and under the filling picks, but there are some twill weaves used where it is desired to make a very closely-woven, tight, heavy cloth. Wire-inserted cloths are used mostly in gasketing or friction materials as the wire adds materially to the strength and wear-resisting qualities of the cloth for this purpose.

Specifications for cloth of asbestos content, weave, texture, weight, thickness and tensile strength can be met in suitable combination, but it would be difficult to meet all these specifications in one particular piece of cloth unless rather wide variations were allowed, as asbestos fibre and yarn are variable products and exact uniformity cannot be expected. Weights of cloths normally vary plus or minus 5%.

The length of time during which the fibre in asbestos cloth is subjected to a given temperature has very little effect, the temperature itself being the important factor. As a rule, asbestos cloths and yarns will stand the following temperatures safely:

Commercial and Underwriters'..350 deg. F.
90% Asbestos ....600 deg. F.
95% Asbestos ....850 deg. F.
98-99% Asbestos ....950 deg. F.

Data on Johns-Manville standard cloths will be found on the following page.

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Commercial Asbestos Cloth (Approximately 80% Asbestos)
(No wire insertion)

Style No.	Weight, lb. per sq. yd.	Warp yarn	Filler yarn	Warp ends per inch	Filler ends per inch
444	2.25	10-cut, 2-ply	10-cut, 2-ply	18 to 19	10
1067-1/16″	2.50	10-cut, 2-ply	10-cut, 2-ply	20 to 21	10
1067-1/32″	1.87	14-cut, 2-ply	14-cut, 2-ply	20 to 21	10
FE-4911	2.5	14-cut, 2-ply	14-cut, 2-ply	27 to 28	14
DE-808	1.5	10-cut, 2-ply	10-cut, 2-ply	8 to 9	8
710	2.11	10-cut, 2-ply	10-cut, 2-ply	16 to 17	10
6190	1.87	10-cut, 2-ply	10-cut, 1 ply	16 to 17	10

Underwriters' Asbestos Cloth (Not over 10% carbon)
(No wire insertion)

GE-3210	2.0	16-cut, 2-ply	16-cut, 2-ply	24 to 25	10

90% Asbestos Cloth (No wire insertion)

OE-3010	1.87	14-cut, 2-ply	14-cut, 2-ply	20 to 21	10
ME-3010	2.5	10-cut, 2-ply	10-cut, 2-ply	20 to 21	10
PE-1215	1.35	16-cut, 2-ply	16-cut, 2-ply	12 to 13	15

95% Asbestos Cloth (No wire insertion)

912	2.5	12-cut, 2-ply	12-cut, 2-ply	20 to 21	12
WE-5011	3.0	12-cut, 2-ply	12-cut, 2-ply	30 to 31	10
WE-6912	3.33	12-cut, 2-ply	12-cut, 2-ply	36 to 37	12
VE-2808	2.13	10-cut, 2-ply	10-cut, 2-ply	16 to 17	8
UE-4807	3.5	8-cut, 2-ply	8-cut, 2-ply	24 to 25	7
WI-4809	3.89	12-cut, 3-ply	12-cut, 3-ply	24 to 25	9
1144	2.25	10-cut, 2-ply	10-cut, 2-ply	18 to 19	11

98-99% Asbestos Cloth (No wire insertion)

WE-5011 Spec.	3.0	12-cut, 2-ply	12-cut, 2-ply	30 to 31	10
WE-6912 Spec.	3.33	12-cut, 2-ply	12-cut, 2-ply	36 to 37	12

Commercial Asbestos Cloth (Approximately 80% Asbestos)
(Wire-inserted)

Style No.	Weight, lb. per sq. yd.	Warp yarn	Filler yarn	Warp ends per inch	Filler ends per inch	Wire
189	2.75	8-cut, 2-ply, 2-wire	8-cut, 1-ply, 1-wire	14 to 15	10	Brass
189-C	2.75	8-cut, 2-ply, 2-wire	8-cut, 1-ply, 1-wire	14 to 15	10	Copper
M-32	2.38	4-cut, 1-ply, 1-wire	8-cut, 1-ply, 1-wire	16 to 17	11	Brass
1414	1.87	8-cut, 1-ply, 1-wire	8-cut, 1-ply, 1-wire	14 to 15	14	Copper
DS-2807	3.0	10-cut, 2-ply, 2-wire	10-cut, 2-ply, 2-wire	16 to 17	7	Brass
CS-2807	3.45	8-cut, 2-ply, 2-wire	8-cut, 2-ply, 2-wire	16 to 17	7	Brass
ES-2807	2.5	12-cut, 2-ply, 2-wire	12-cut, 2-ply, 2-wire	16 to 17	7	Brass
CQ-2810	2.89	8-cut, 2-ply, 2-wire	8-cut, 1-ply, 1-wire	16 to 17	10	Brass
DR-3009	3.5	10-cut, 2-ply, 2-wire	10-cut, 2-ply, 1-wire	20 to 21	9	Brass

90% Asbestos Cloth (Wire-inserted)

MP-3010	3.25	10-cut, 2-ply, 1-wire	10-cut, 2-ply, 1-wire	20 to 21	10	Copper
OO-3010	2.75	14-cut, 2-ply, 1-wire	14-cut, 2-ply, 1-wire	20 to 21	10	Copper

95% Asbestos Cloth (Wire-inserted)

UQ-2711	2.75	8-cut, 2-ply, 2-wire	8-cut, 1-ply, 1-wire	14 to 15	11	Brass

Printed in U.S.A.

A Few Uses for Asbestos Cloth

Annealing blankets for covering large metal castings —No. 444
Belts for blue printing machines—No. 1067-1/16", No. 444
Clothing—No. 444, No. 1067-1/16", FE-4914, ME-3010
Covering fire felt or asbestos rope insulation on Diesel exhaust pipes—No. 444
Covers for insulating blankets—No. 444, No. 1067-1/16", No. 912
Curtains for dryers—No. 444, CQ-2810
Curtain shields for protecting workmen from heat or explosions such as occur at the stack valves of water gas sets—No. 444
Dust collection bags to withstand temperatures to 500 deg. F.—(Special Cloth)
Electrolytic cells—WE-5011, WE-6912, VE-2808, UE-4807
Filter cloths—WE-6912, WE-5011
Fireproof curtains for sectioning off warehouses, electric sub-stations, etc.—No. 444
Fireproof curtains or shields for welding—No. 444, No. 1067-1/16"
Fire protection shields for automatic closing of openings in buildings. Asbestos curtains can be rolled up and fastened with an inflammable cord so that when this burns the curtains will fall and close off openings—No. 444
Fire smothering blankets for oil refineries, fire departments, gasoline filling stations, dry cleaning establishments, varnish plants, etc.—No. 444
Foam fire extinguisher tubes and boots—(Special Cloth)
Heat retaining curtains in glass annealing lehrs—No. 444, No. 1067-1/16"
Hoods over forge furnaces—No. 444, CQ-2810
Insulating covers over glass conveying apparatus—No. 444, No. 912
Mill scale fenders to protect rolling mill adjusting apparatus from hot scale—No. 444
Portable moving picture booths—No. 444, No. 1067-1/16"
Special gaskets—No. 444, No. 1067-1/16", CQ-2810, WE-5011
Theatre curtains—No. 444, No. 1067-1/16", CQ-2810
Wrapping sheet glass conveyor rollers, etc., to prevent glass from touching metal—No. 444, No. 1067-1/16", CQ-2810

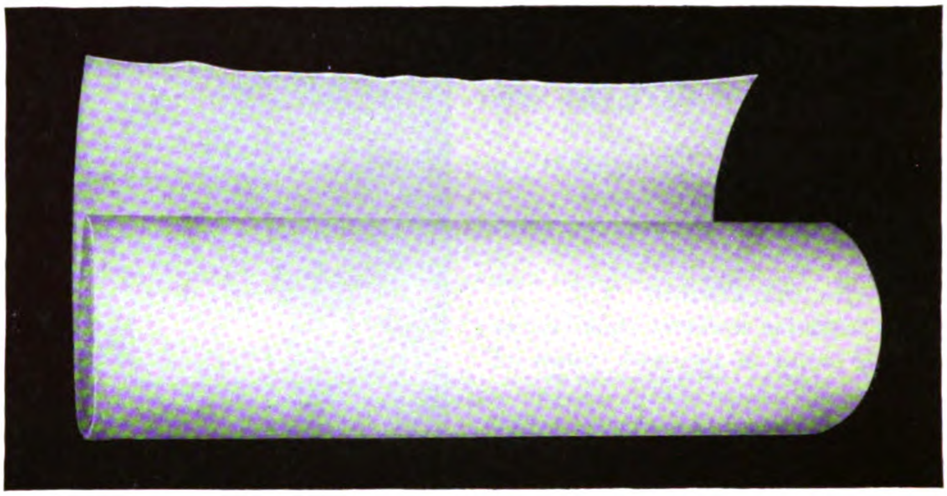
J-M Asbestos Clothing

The protection to workmen afforded by the peculiar qualities of asbestos and the ease with which it can be woven into fireproof cloth, which, while comparatively thick, is not too cumbersome, has made asbestos clothing a recognized essential equipment in many industries. Since the immediate requirements vary, such clothing naturally is made to order, to comply with the safety regulations of the particular plant.

The types of clothing most often manufactured include asbestos jumpers, overalls, aprons, helmets, hats, caps, shoes, arm protectors, mittens, and gloves of all kinds. Complete suits are also made to meet individual requirements.

Printed in U.S.A.

J-M Asbestos Paper and Roll Board



Asbestos fibre may be felted on paper machines to produce unburnable paper and roll board, which have a general and varied utility. One of the principal uses of these materials is as a liner and fire-retardant.

Special grades of J-M Asbestos Paper are also made for use in electrolytic chlorine cells, neon tube manufacture, electrical machine parts, etc.

Paper for electrolytic chlorine cells, for instance, is designed to operate on long cycles at reduced voltage with good throughput at satisfactory efficiencies. Its texture is such that it permits necessary handling without cracking.

All J-M papers are distinguished by the high quality of the fibre used in their manufacture and by the uniformity which characterizes consecutive mill lots.

J-M Asbestos Paper and Roll Board are furnished in standard rolls, 18″, 24″ and 36″ wide and in special widths to order. Approximate weights and thicknesses are as follows:

Asbestos Paper

Approx. thickness,* inches	Approx. weight* lb. per 100 sq. ft.
.015	6
.018	8
.020	10
.025	12
.028	14
1/32	16
1/16	35

Asbestos Roll Board

3/32	53
1/8	68

* The actual weights of Asbestos Paper, as ordinarily manufactured, may vary ± 10%. Actual thickness of Asbestos Roll Board, as ordinarily manufactured, may vary ± .02″.

Printed in U.S.A.