PLAINTIFF'S
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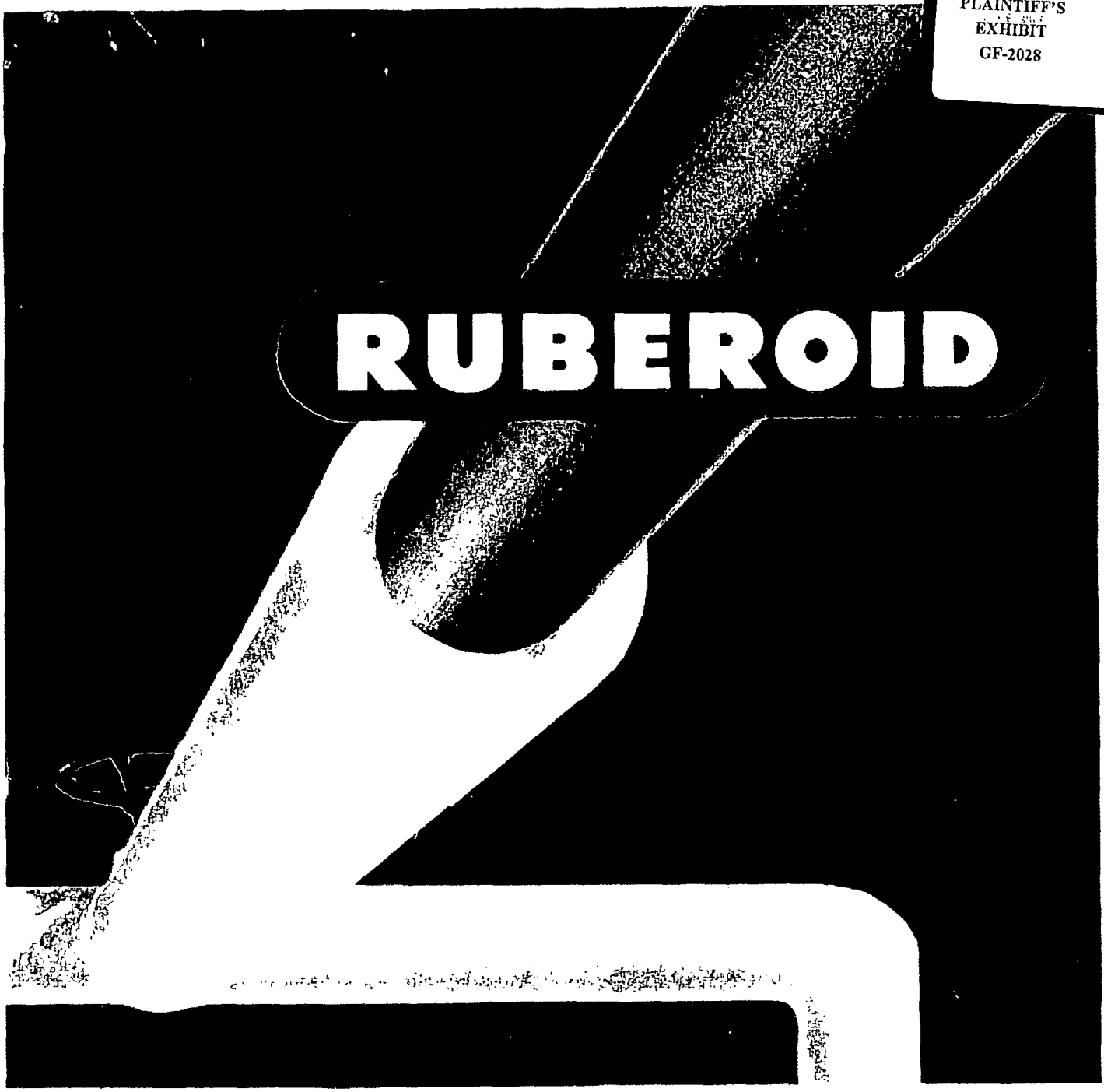

RUBEROID

INDUSTRIAL INSULATION CATALOG

1956

R-1007

A.I.A. File 37-B-6

The RUBEROID Co.

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INDUSTRIAL INSULATION SALES OFFICES

[illegible]
New York, 30, New York

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[illegible]

FACTORIES

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To provide proper installation and efficient use of Ruberoid materials a group of skilled applicators and distributors are located throughout the country. The name of the one nearest you will be sent upon request.

RUBEROID INDUSTRIAL INSULATION CATALOG

Foreword

HEATING and power equipment built at today's high cost of labor and materials must use every B.T.U. as efficiently as possible to derive the greatest benefits from huge capital investments.

With this in mind, The Ruberoid Co. has compiled this insulation catalog for architects, engineers and industrial consumers to save time and money in solving your heat and cold insulation problems. Here is a vast amount of practical information and useful charts and tables compressed for quick reading. You will want to keep these valuable facts at hand for immediate use and for future reference.

For more than half a century, the name "RUBEROID" has meant exceptional quality. Today, Ruberoid insulation materials for heating and power equipment are installed in hundreds of power plants, factories and commercial buildings giving maximum results at low cost.

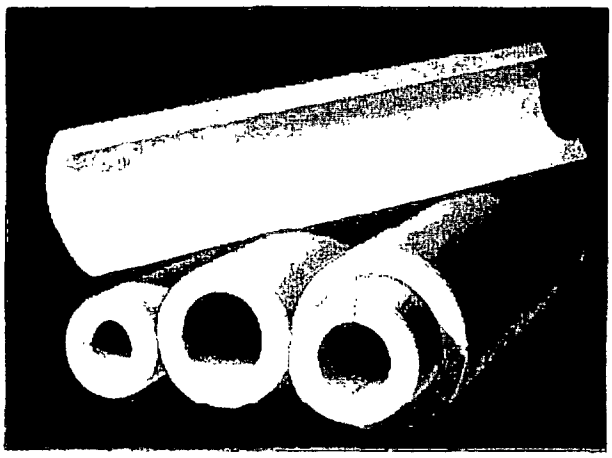
Ruberoid's industrial insulation products line is complete and of proven merit. It includes pipe coverings and blocks for use in temperatures from 350° to 1250°F.; wool felt pipe covering for domestic hot or cold water piping; asbestos papers for wrapping furnace pipes, protecting air conditioning; and high temperature cements, millboard and rollboard.

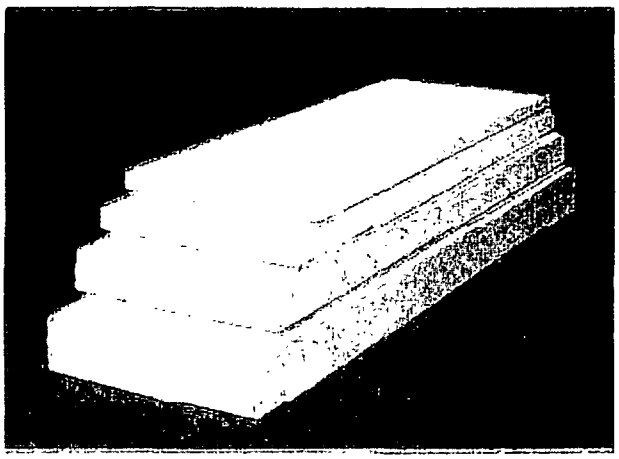
Throughout the country, Ruberoid has Approved Applicators, organizations known and recognized for their knowledge of insulation engineering and careful workmanship. These applicators are carefully selected and well-qualified to serve you. They are strategically located, ready to assist you in increasing the efficiency of your plant.

In addition to the wide selection of products and fine workmanship, Ruberoid offers you its own staff of fully trained, long experienced engineers to help with any insulation problems confronting you.

To get superior insulation performance on your next job, get the combined value of tested products applied by leading craftsmen skilled in the best methods of installation. If you require supplementary data, please write. Our sales and engineering staffs are at your disposal, ready to serve you with Ruberoid products specifically designed for every industrial insulation requirement.

Calsilite Insulation





Calsilite is a molded insulation designed for use on modern high pressure steam lines and equipment. It is a calcium silicate compound combined with asbestos fibres and other selected raw materials that, when carefully controlled, form a highly efficient insulating material. It is light in weight, yet can withstand a soaking heat of 1250°F. indefinitely with no appreciable efficiency loss.

It can be applied on pipe lines and equipment within its temperature range, in either single or double layer construction, in thicknesses which give maximum efficiency. It is unnecessary to use other types of high temperature insulation as an inner layer where this product is used. A constant co-efficient of conductivity is thus obtained which is more efficient than the usual dense high temperature insulations which may result in the use of lesser thicknesses to secure the required efficiency.

By using fewer layers in the installation of Calsilite, fewer sections are required for the job, application is speeded up and ultimate costs are reduced by eliminating the need for large stocks of different types of materials. This material is equally suitable for steam lines in commercial buildings as well as process and power steam lines carrying high pressures. This material is not soluble in water, normal acids nor alkalis, making it adaptable for piping in tunnels or plants where moisture conditions prevail.

Due to a unique manufacturing process and careful formulation, there is little breakage of Calsilite in transit, in the warehouse or on jobs where insulation is subjected to much physical abuse. Calsilite cuts and mitres simply and easily and presents a finished job that is neat in appearance.

STYLES AND FINISHES

Calsilite is made in various thicknesses of pipe covering and blocks.

Sectional pipe covering is furnished in 36" lengths composed of two semi-cylindrical pieces to fit pipes up to 6" in 1" nominal thickness; to 12" in 1½" and 2" nominal thickness; to 10" in 2½" and 3" nominal thickness—all in single layer. Double layer material is available in sectional and three segmental pieces in nominal thicknesses of 2", 3" and 4" as indicated on the charts opposite this page. Curved segmental blocks 6" wide are furnished for pipe sizes up to 33" in diameter.

All sectional covering up to 15¾" O.D. will be furnished with a standard cotton jacket. If desired, jackets of heavier canvas duck can be furnished.

Various type bands in ¾" and 1" widths can be furnished at slight additional cost.

If desired sectional covering can be furnished with asphalt saturated felt or 45 lb. asbestos roofing attached to the covering or separately cut to fit the pipe.

The schedule of standard thicknesses has been designed and is accurately maintained so that the outside diameter of any section of Calsilite is the same as the outside diameter of some cast iron or steel pipe. Any combination thickness may be built up from the single layers available, or any other type of pipe covering may be used as an outer layer over a Calsilite inner layer with the assurance of an accurate fit.

Calsilite flat blocks are made from 1" up to and including 4" thickness. These are available 3", 6" and 12" wide in pieces 18" and 36" long.

See page 5 for packaging information.

HIGH TEMPERATURE INSULATION PRODUCTS

PHYSICAL CHARACTERISTICS

Thermal Conductivity

at 200°F.	0.40	BTU/sq. ft/inch/hr/°F.
300°F.	0.45	"
400°F	0.50	"
500°F.	0.55	"
600°F.	0.60	"

Density—Average ..... 12.50 lbs/cu. ft.

Moisture Absorption (Volume)
After 6 hours exposure in atmosphere of 90% relative humidity at 120°F. dry bulb temperature 0.7%

Modulus of Rupture
Lbs/sq. in. min. ..... 3 × Density

Resistance to Abrasion
Loss in wt. 10 min. ..... 20 %
Loss in wt. 20 min. ..... 40 %

Change under Soaking Heat
Loss of Wt.
24 hrs. @ 1200° max. 9.9%
6 hrs. @ 1000° 9.0%

Linear Shrinkage
24 hrs. @ 1200° max. 1.4%
6 hrs. @ 1000° max. 0.9%

Compressive Strength
10% deformation min. ..... 125 lbs p.s.i.
10% deformation after immersion in water for 16 hours while wet min. ..... 65 lbs p.s.i.

CALSILITE PIPE COVERING THICKNESSES

SINGLE LAYER

Iron Pipe Size / Nominal Pipe Size	⅛"	¼"	⅜"	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	6"	7"	8"	9"	10"	11"	12"	14"	15"	16"	17"	18"	Up to and incl. 33"
Actual Pipe Size	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.000	4.500	5.000	5.563	6.625	7.625	8.625	9.625	10.750	11.750	12.750	14.000	15.000	16.000	17.000	18.000	....
Nominal 1" Thick Actual Thick. Inches	3/16"	3/8"	15/32"	5/8"	1"	1"	1"	29/32"	1 1/4"	1"	1 1/8"	31/32"	1 5/16"	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nominal 1½" Thick Act. Thick. Inches	1 13/16"	1 3/8"	1 31/32"	1 3/4"	1 1/16"	1 13/16"	1 15/16"	1 1/16"	1 1/16"	1 1/16"	1 1/16"	1 13/16"	1 5/16"	1 1/16"	1 1/16"	1 1/16"	1 3/16"	1 3/16"	1 3/16"	1 3/16"	1 3/16"	1 3/16"*	1 1/16"†	1 1/16"*†	1 1/16"†	1 1/16"*†	1 1/16"†
Nominal 2" Thick Act. Thick. Inches	2 5/32"	1 13/16"	2 1/64"	1 29/32"	2 3/16"	2 1/16"	2 5/16"	2"	2 1/16"	2"	1 3/4"	1 31/32"	2"	2"	2"	2 1/16"	2 1/16"	2 1/16"	2 1/16"	2 1/16"*	2 1/16"*	2"†	2"*†	2"†	2"*†	2"†
Nominal 2½" Thick Act. Thick. Inches	2 3/16"	2 3/4"	2 25/64"	2 5/16"	2 3/16"	2 5/16"	2 5/16"	2 1/2"	2 1/4"	2 1/2"	2 1/4"	2 1/16"	2 1/2"	2 1/2"	2 3/4"	2 3/4"	2 3/4"	2 3/4"	2 3/4"*	2 3/4"*†	2 1/2"*†	2 1/2"*†	2 1/2"*†	2 1/2"†	2 1/2"*†	2 1/2"*†
Nominal 3" Thick Act. Thick. Inches	2 25/32"	3 1/4"	3 7/64"	2 15/16"	2 13/16"	3 1/16"	2 13/16"	3"	2 3/4"	3 1/16"	2 13/16"	3 1/16"	3"	3 1/16"	3 1/16"	3 1/16"	3 7/64"	....	....	....	....	....	....	....	....	....

*Three segmental pieces
†6" wide segments
Tolerance on Wall Thickness ± 1/16"

TWO LAYER — NOMINAL 2" THICKNESS

IRON PIPE SIZE / Nominal Pipe Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"
INNER LAYER Pipe Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"
INNER LAYER Nom. Thick.	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
OUTER LAYER Pipe Size	2½"	2½"	3"	3"	3½"	4"	4½"	5"	6"	6"
OUTER LAYER Nom. Thick.	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
ACTUAL THICKNESS	1 15/16"	1 15/16"	2 1/64"	1 29/32"	2 1/16"	2"	2 1/16"	1 31/32"	2 1/16"	1 29/32"

COPPER TUBING

Nominal COPPER TUBING SIZE	⅛"	¼"	⅜"	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"
Actual O.D. of Tubing	⅜"	½"	⅝"	¾"	⅞"	1⅛"	1⅜"	1⅝"	2⅛"	2⅝"	3⅛"	3⅝"	4⅛"
Nominal 1" Thick Actual Thickness Inches	1 3/16"	1 1/16"	1 1/16"	1 1/16"	1 1/16"	1"	⅞"	⅞"	¾"	¾"	¾"	¾"	¾"

HIGH TEMPERATURE INSULATION PRODUCTS

TWO LAYER — NOMINAL 3" THICKNESS

Iron Pipe Size Nominal Pipe Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	6"	7"	8"	9"	10"	11"	12"	14"	15"	16"	17"	18"	Up to and incl. 33"
Inner Layer Pipe Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	6"	7"	8"	9"	10"	11"	12"	14"	15"	16"	17"	18"	
Inner Layer Nom. Thickness	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"	1½"†	1½"†	1½"†	1½"†	1½"†	1¼"†
Outer Layer Pipe Size	3¼"	3¼"	4"	4½"	4½"	5"	5"	6"	6"	7"	7"	8"	9"	10"	11"	12"	14"	15"	16"	17"	18"	19"	20"	21"	
Outer Layer Nom. Thickness	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1¼"	1½"	1½"	1½"†	1½"†	1½"†	1½"†	1½"†	1½"†	1½"†	1½"†	1½"†
Actual Thickness	2⅞"	2⅞"	3¼"	3⅛"	3⅛"	3"	3⅛"	3⅛"	3⅛"	3"	3⅛"	3⅛"	3⅛"	3⅛"	3⅛"	3⅛"	3⅛"	3⅛"	3⅛"	3"	3"	3"	3"	3"	3"

*Three segmental pieces
†6" wide segments
Tolerance of Wall Thickness ± 1/16"

TWO LAYER — NOMINAL 4" THICKNESS

Iron Pipe Size Nominal Pipe Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	6"	7"	8"	9"	10"	11"	12"	14"	15"	16"	17"	18"	Up to and incl. 33"
Inner Layer Pipe Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	6"	7"	8"	9"	10"	11"	12"	14"	15"	16"	17"	18"	
Inner Layer Nom. Thick.	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"†	2"†	2"†	2"†	2"†	2"†
Outer Layer Pipe Size	4½"	4½"	5"	5"	6"	6"	7"	7"	8"	8"	8"	9"	10"	11"	12"	14"	15"	16"	17"	18"	19"	20"	21"	22"	
Outer Layer Nom. Thick.	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"†	2"†	2"†	2"†	2"†	2"†	2"†	2"†	2"†
Actual Thickness	3⅞"	3⅞"	4⅛"	3⅞"	4⅛"	4⅛"	4"	4⅛"	4"	3⅞"	3⅞"	4⅛"	4⅛"	4"	4⅛"	4⅛"	4⅛"	4⅛"	4"	4"	4"	4"	4"	4"	4"

*Three segmental pieces
†6" wide segments
Tolerance of Wall Thickness ± 1/16"

RECOMMENDED NOMINAL THICKNESSES

NOMINAL PIPE SIZE	½ to 1"	1¼"	1½"	2"	2½"	3"	3½ to 4"	5 to 6"	7 to 8"	9 to 10"	11 to 12"	Up to 33" Incl.	BLOCKS
Temperature difference between pipe and surface 200°F	1	1	1	1	1	1	1	1½	1½	1½	1½	1½	1"
300°F	1	1	1	1	1	1	1	1½	1½	1½	1½	1½	1"
400°F	1	1	1	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½"
500°F	1½	1½	1½	1½	1½	1½	2	2	2	2	2	2	2"
600°F	1½	1½	1½	2	2	2	2	2	2	2	2½	2½	2½"
700°F	1½	2	2	2	2½	2½	2½	2½	2½	2½	3	3	3"
800°F	2	2	2½	2½	2½	2½	3	3	3	3	3	3	3"
900°F	2	2½	2½	2½	3	3	3	3	3½	3½	3½	3½	3½"
1000°F	2½	2½	3	3	3	3	3½	3½	3½	4	4	4	4"
1100°F	3	3	3	3	3	3½	4	4	4	4	4½	4½	4½"

MEDIUM PRESSURE INSULATION PRODUCTS

PACKAGING INFORMATION PIPE COVERING

SECTIONS PER CARTON

PIPE SIZE	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	6"	7"	8"	9"	10"	11"	12"	14"	16"	18"
Nominal 1" Th.	42b	42b	25b	25b	20b	18d	13b	10d	8d	8d	9c	9c	6c	—	—	—	—	—	—	—	—	—
Nominal 1½" Th.	20b	20b	18d	13b	13b	10d	10d	8d	8d	9c	9c	6c	3b	4c	3c	2d	1b	1b	1b	2a*	3c*	1a*
Nominal 2" Th.	13b	13b	10d	10d	8d	8d	9c	9c	6c	6c	6c	3b	4c	3c	2d	1b	1b	1b	1b	a*	1b*	1b*
Nominal 2½" Th.	10d	8d	8d	8d	8d	9c	9c	6c	6c	6c	3b	3b	3c	2d	b	1b	1b	1b	2c*	2c*	1a*	1a*
Nominal 3" Th.	8d	9c	9c	9c	9c	6c	6c	3b	3b	4c	4c	3c	2d	1b	b	1b	1b	—	—	—	—	—
GROSS WEIGHT PER CARTON (Pounds)																						
Nominal 1" Th.	68	63	57	52	55	57	44	41	48	42	65	53	42	—	—	—	—	—	—	—	—	—
Nominal 1½" Th.	66	64	71	58	55	54	49	54	48	73	65	63	34	51	44	32	20	21	23	46	77	30
Nominal 2" Th.	63	62	63	61	67	65	96	88	76	70	65	41	62	53	39	25	26	28	29	33	37	40
Nominal 2½" Th.	67	77	75	74	71	104	99	83	79	49	46	76	64	48	29	32	34	36	77	79	46	50
Nominal 3" Th.	77	113	112	110	108	92	88	55	53	85	81	73	55	33	36	39	41	—	—	—	—	—

PACKAGING INFORMATION BLOCKS

Thickness Per Carton	¾"	⅞"	1"	1¼"	1½"	2"	2½"	3"	4"
Sq. Ft.	72	60	54	42	36	27	21	18	13.5
Pcs.	48	40	36	28	24	18	14	12	9

Gross Weight of Carton 63 lbs.

All Blocks are packaged in "a" Cartons.

CURVED BLOCKS—SEGMENTS

1½" thick 24 per carton except 12", 19", 21"
2" thick 18 per carton
2½" thick 14 per carton except 12"

PACKAGING INFORMATION COPPER TUBING

SECTIONS PER CARTON

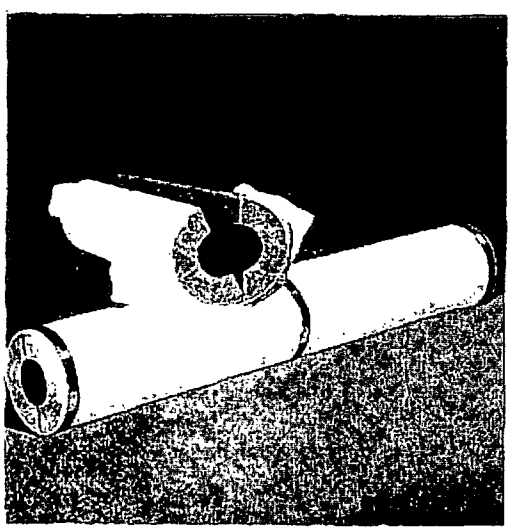
Pipe Size	¼"	⅜"	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"
Nominal 1" Thick	42b	42b	42b	42b	25b	25b	25b	20b	18d	13b	10d	8d
GROSS WEIGHT PER CARTON (Pounds)												
	73	74	71	68	60	57	53	50	53	44	40	48

Code Of Size Of Cartons

a—*Blocks and Three Segmental*—12½"x18½"x36¼"
b—*Pipe Covering and Segments*—18½"x18½"x36¼"
c—*Pipe Covering and Segments*—22¾"x23¾"x36¼"
d—*Pipe Covering and Segments*—13½"x26½"x36¼"
e—*Three Segmental*—16"x20½"x36¼"

*—*Covering Furnished Three Segmental Form*

Asbestos Sponge Felt Insulation



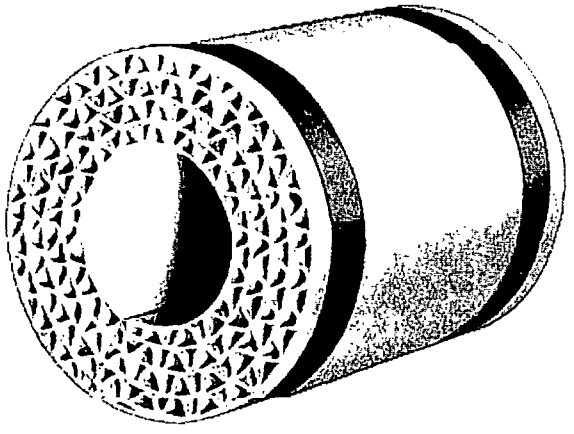
Asbestos sponge felt is recommended wherever high insulation efficiency, exceptional durability and toughness are required. This material is made up of 35 laminations to 1" thickness of specially processed asbestos felts cemented together to form thousands of minute air spaces. Both felts and adhesive will stand up indefinitely when applied to pipes and equipment operating at temperatures up to 700°F. Insulation efficiency is assured by the air spaces built into the product and the laminated construction contributes to its long life.

This material's toughness makes it ideal for use where there is shock or vibration or where rough usage or severe moisture conditions are expected. It has been employed in railroad and underground work for many years.

When specifically ordered, sheets and blocks with a certain amount of flexibility can be supplied for fitting to curved surfaces. Sheets and blocks are normally furnished in rigid form for use on equipment.

Pipe covering is furnished in 36" lengths, 1" to 3" thick for any commercial pipe use. Three inch thickness is furnished in double layer construction unless one layer is specified. Sheets or blocks are furnished 36" long, ½" to 4" thick, and 6, 12, 18, 24 and 36" wide.

Air Cell Products



RUBEROID AIR CELL

Air Cell products—pipe covering, jackets, sheets and corrugated paper—are designed for application over low pressure steam, hot water, and warm air pipes, ducts and other equipment. They are made of asbestos felts, each layer consisting of one corrugated and one flat felt, cemented together. In all Ruberoid Air Cells "Roman-arch" corrugations are employed, which together with the manufacturing methods used result in a stronger and more uniform product than would be otherwise produced. The pipe covering is concentric, and "offsets" in joints of both pipe covering and sheets are eliminated.

The asbestos used in the product is of a paper composition and processing such that shrinkage is at a minimum.

Pipe covering is furnished either with a canvas jacket or a smooth white paper finish. The latter finish results in a glossy, pure white, dust proof surface. It is easily cleaned and is ideal for work where appearance is a factor.

Sheets and blocks are made with alternating layers crossed so that corrugations run in both directions, giving exceptional strength and rigidity and resulting in increased efficiency. They can be furnished with smooth surface on both sides or smooth surface on one side and corrugated surface on the other.

Pipe covering sections are 36" length, ¾" (3 ply) and 1" (4 ply) thick for all standard pipe sizes. Sheets and blocks are 36" long, 6, 12, 18, 24, and 36" wide. Standard thicknesses are 2, 3 and 4 ply. Other thicknesses and sizes can be made.

PACKAGING INFORMATION
AIR CELL PIPE COVERING

SECTIONS PER CARTON

Pipe Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	6"	7"	8"
½" Thick	60	48	40	34	29	22	15	14	14	14	12	7	6	4	4
¾" Thick	45	36	28	23	21	16	13	12	10	8	8	7	6	3	3
1" Thick	28	27	22	20	16	13	11	9	9	6	6	6	5	3	3

WEIGHT PER CARTON (Pounds)

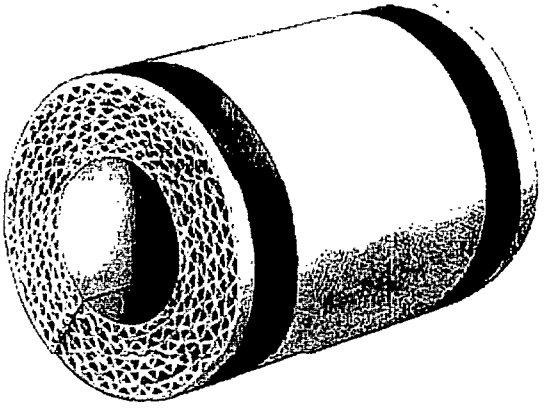
½" Thick	52	50	48	44	44	40	39	41	43	44	40	38	35	28	30
¾" Thick	46	49	44	41	41	37	35	37	38	37	37	32	31	19	22
1" Thick	48	51	48	49	43	41	40	37	41	39	42	35	34	24	26

Carton Size—20¾" x 14" x 36⅛"—6.07 cu. ft.

RUBEROID WATCOCELL

Watcocell is a type of asbestos cellular pipe covering constructed of corrugated asbestos paper in which the corrugations are considerably smaller than in Air Cell.

In 6 ply Watcocell, the flutes are approximately ⅛" high and 8 ply Watcocell uses a corrugated paper with flutes above 1/16" high.



This finer construction gives greater strength and rigidity and more durability than the regular four ply product. Insulation efficiency is increased by the greater number of air cells. These advantages of Watcocell encourages its use for insulation efficiency in pipelines operating at temperatures from 225°F. to 300°F., although its original cost is higher.

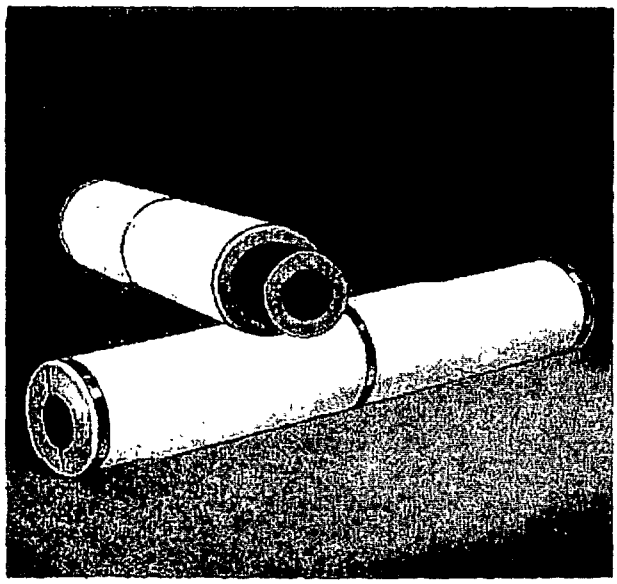
Watcocell is made in both pipe covering and block form. In the former, it can be supplied in thicknesses of ½", ¾", 1", 1½" up to 4". Sections are 36" long and furnished with either a cotton jacket or a white glossy paper finish. Bands are supplied to complete the installation.

Sheets and blocks are made for use on flat or curved surfaces. On curved surfaces the sheets are sufficiently flexible to be bent to some extent or can be scored and broken around the curvature. These are made in 36" length and in widths 6, 12, 18 and 36" wide. Thicknesses from ½" up are available.

Woolfelt Pipe Insulations

TWIN-PURPOSE WOOLFELT PIPE INSULATION

Because Woolfelt is lined with a special water-resistant material, it can be used to insulate either hot or cold water pipe.



The felt used for Ruberoid Woolfelt is processed to reduce thermal conductivity far below that of ordinary woolfelt. This processing, together with its excellent cutting and handling qualities makes it especially suitable for all around insulation use under 200°. The pipe covering is made in both single layer and broken joint construction, and is furnished with cotton jacket and bands unless otherwise specified.

Sections are 36" long. Thickness ½", ¾", 1" or greater as may be required in single or double layer.

PACKAGING INFORMATION
WOOLFELT PIPE COVERING

SECTIONS PER CARTON

Pipe Size	⅛"	¼"	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	6"	7"	8"
½" Thick	60	48	40	34	29	22	15	14	14	14	12	7	6	4	4
¾" Thick	45	36	28	23	21	16	13	12	10	8	8	7	6	3	3
1" Thick	28	27	22	20	16	13	11	9	9	6	6	6	5	3	3

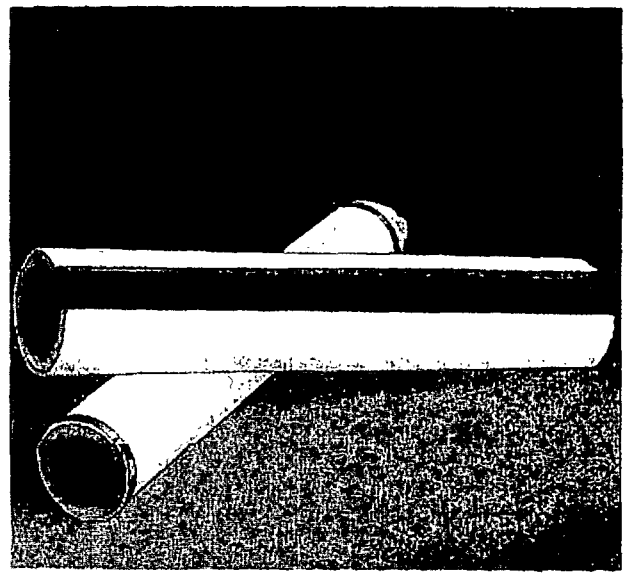
WEIGHT PER CARTON (Pounds)

½" Thick	92	89	72	68	68	62	61	64	66	68	63	60	52	48	40
¾" Thick	70	63	68	54	54	47	47	50	47	42	45	44	42	26	29
1" Thick	64	68	64	65	66	54	53	50	56	42	46	50	46	33	37

Carton Size—20¾" x 14" x 36½"—6.07 cu. ft.

FROST-PROOF PIPE INSULATION

Frost-proof pipe insulation is used on water pipes to keep them from freezing when exposed to low temperatures under ordinary conditions.

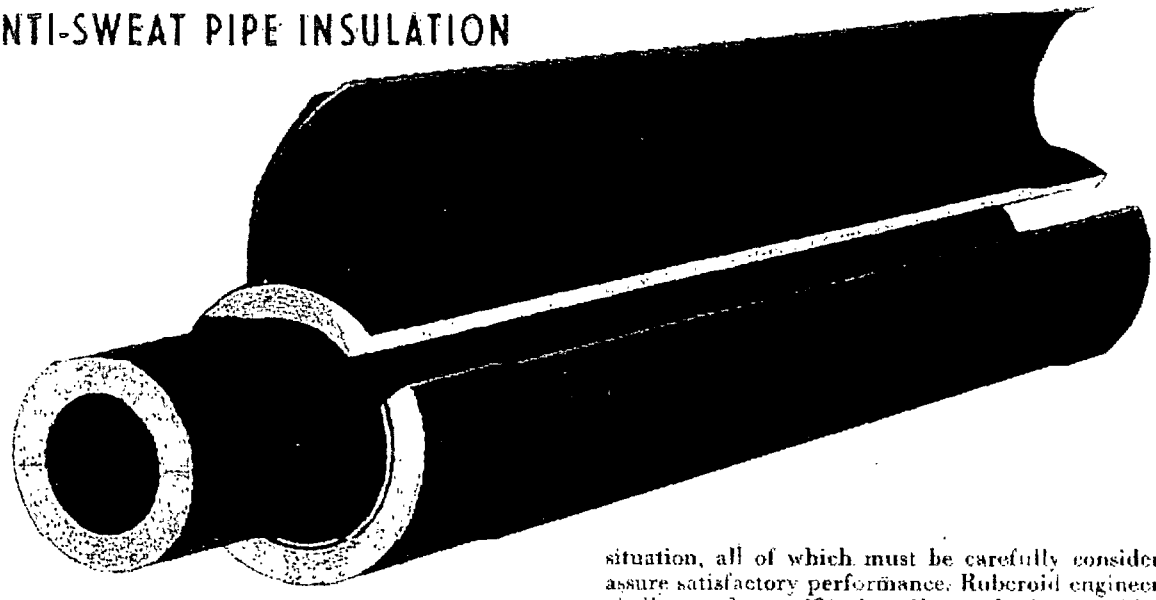


When extremely low temperatures are encountered, or where the temperatures are below the freezing point for any great length of time, provision may have to be made for adequate circulation of the water or for a greater thickness of insulation. In such cases it is advisable to consult Ruberoid engineers.

Frost-proof is composed of wrappings of asphalt saturated felts and pure cattle hair felt finished with an outer casing of woolfelt to a total of 1¼" thickness. In this manner a rugged construction, yet utilizing highly efficient hair felt, is made possible.

Furnished in 36" lengths for all pipe sizes and with either cotton jackets and brass lacquered bands or with waterproof jackets as required for the job.

ANTI-SWEAT PIPE INSULATION



Sweating occurs when warm, humid air contacts pipe surfaces whose temperature is lower than the dew point of the atmosphere. Anti-Sweat pipe insulation is designed to prevent this troublesome moisture condensation on cold pipes. Although water vapor easily penetrates materials used in ordinary pipe coverings, Ruberoid's Anti-Sweat is constructed of efficient felts and vapor barriers combined to stop damaging sweating in buildings.

At least four vapor barriers approved by engineers and test laboratories are incorporated in the body of Anti-Sweat. Experience has shown it gives satisfactory protection under conditions where ambient temperatures are under 100°F., water temperatures are not less than 42°F. and the average humidity is as much as from 75% to 80%. Proper thicknesses must be used and the application must be such that all seam openings and fittings are covered with vapor barriers equal to those used in the manufacture of Anti-Sweat. The following table indicates thicknesses that might be used for certain conditions. They are not recommendations, however, because many factors are involved that make each application a special situation, all of which must be carefully considered to assure satisfactory performance. Ruberoid engineers will gladly supply specifications if consulted as specific problems are encountered.

Air Temperatures under 100°F.

Pipe Temp. °F.	*Humidity Range %*	*Thickness of Anti-Sweat*
Over 50°	Under 75%	1"
Over 50°	75%-80%	1½"
40° to 50°	Under 75%	1½"

Anti-Sweat is made in sectional form for all pipe sizes. Thicknesses range from ½", ¾" and 1" up to any greater thickness required for the job. In ½", and ¾", pipe covering is supplied in solid thickness; 1" thick and greater, it is supplied with 2 layers one fitting over the other thus telescoping to assure all seams being closed.

Each length is 36" long and supplied with an outside vapor barrier providing a substantial lap over the seam to prevent infiltration of air. A cloth or weather-resistant jacket is supplied as may be specified.

PACKAGING INFORMATION
ANTI-SWEAT PIPE COVERING

SECTIONS PER CARTON

Pipe Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	6"	7"	8"
½" Thick	60	48	40	34	29	22	15	14	14	12	12	7	6	4	4
¾" Thick	45	39	28	23	21	15	13	11	8	8	5	5	3	2	2
1" Thick	28	27	27	20	16	13	11	8	6	6	3	4	3	2	4

WEIGHT PER CARTON (Pounds)

½" Thick	110	107	86	81	81	74	73	76	78	83	75	71	67	57	48
¾" Thick	83	75	77	63	64	59	57	57	46	61	47	43	51	25	27
1" Thick	88	91	90	97	79	75	72	60	51	54	40	44	36	29	32

Carton Size—20¼" x 14" x 36½" = 6.07 cu. ft.

HAIR FELT

Ruberoid Platen process Hair Felt Insulation is composed of 100% pure cattle hair, densely felted together. Punched hair felt is also manufactured either composed of pure hair or a mixture of hair and jute in varying proportions. Price and service regulates the type that may be desired.

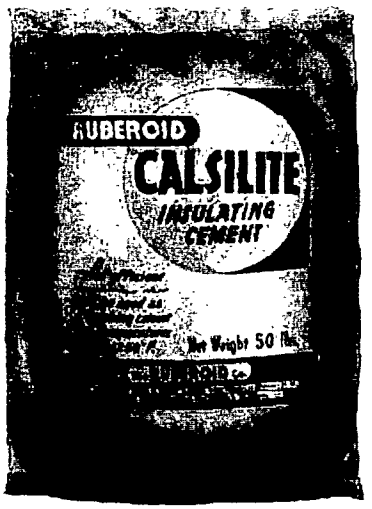
Hair Felt is generally used to insulate refrigerators, refrigerator cars and tanks, to prevent freezing of cold water pipes, and to insulate fittings where pipes are covered with Anti-Sweat or Frost-proof covering. It has excellent sound-deadening and acoustical properties.

Rolls are 6 feet wide by 50 feet long; 3 feet wide by 100 feet long; and 3 feet wide by 50 feet long. Can be cut any desired length or width on special order.

INSULATION CEMENTS

CALSILITE CEMENT

Calsilite cement combines the qualities of a good insulation and a satisfactory finishing material. Since it performs both functions, only one cement need be carried in stock and less labor is required because the number of coats necessary is reduced.



This cement has an excellent conductivity factor. It can be used on temperature up to 1250°F. and regardless of how long it has been in use, it can be reground, mixed with water and used again. It has a pleasing white finish which is smooth and hard enough for ordinary work.

The covering capacity of 50 bd. ft. per cwt. makes Calsilite cement reasonable in cost. When compared on a board foot applied basis with cheaper cements, it has proved to be the most economical.

When mixed in batches, it sets slowly so that it can be carried overnight and used the next day. It has a particularly low shrinkage and leaves no cracks when dried out.

GRADE 214 ASBESTOS CEMENT

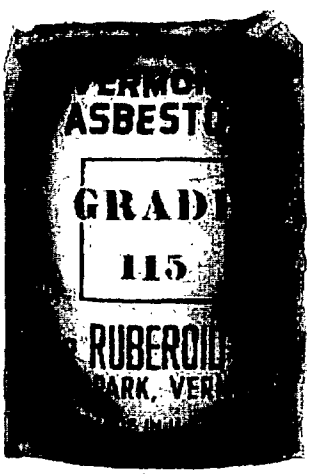
This is an excellent general utility Asbestos Cement frequently termed 7-K Mine Run. It is especially popular among steam fitters for use over boilers, tanks, fittings, etc. Covering capacity: 20 bd. ft. per 100 lbs. Furnished in 100 lb. bags. Temperature limit 1000°F.

HARD FINISH CEMENT

For a harder smoother finish on such cements as Grade 214, Grade 115 or Calsilite an addition of Portland cement may be used during the mixing of the batch. Approximately 20% will provide a desirable finish.

When so used, this hard finish should be applied only as a final coat in a ¼" thickness. It has little insulation value because of its high density due to the Portland cement. This finish coat lends itself to painting with either a water or lead and oil paint.

GRADE 115 ASBESTOS CEMENT



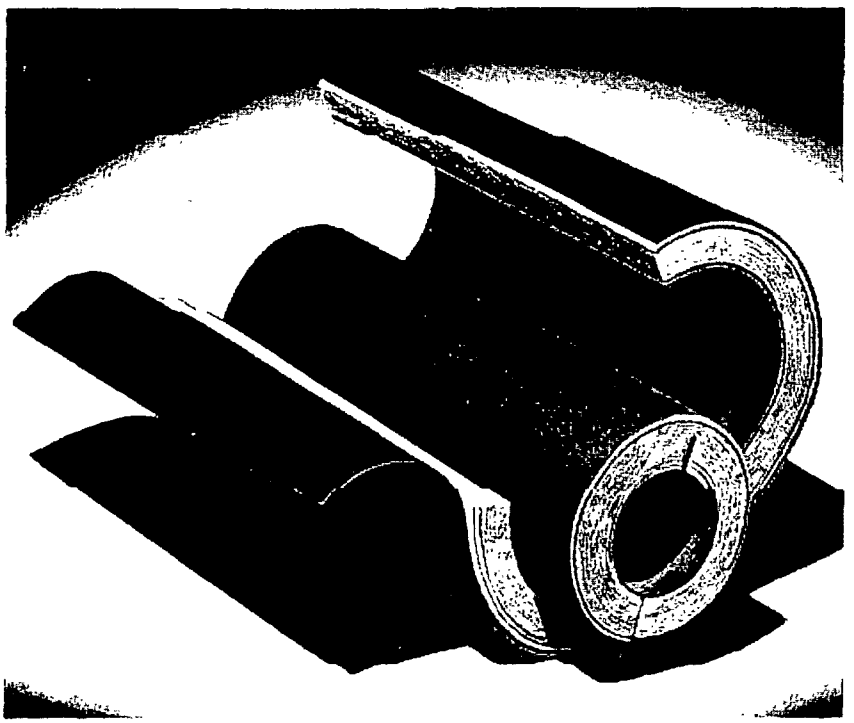
Standard 7-M Mine Run Asbestos Cement having shorter fibres and somewhat lower covering capacity than Grade 214 Cement. Good adhesion and very suitable where price is a factor. Covering capacity: 15 bd. ft. per 100 lbs., packed in 100 lb. bags. Temperature limit 1000°F.

FIBROUS ADHESIVE

Blocks and sheets generally require a temporary bonding of some sort pending the application of the additional bonding. Ruberoid Fibrous Adhesive furnishes an excellent support for insulation to any type of surface—brick, concrete, metal or other insulation. It may, in fact, be used as the primary means of support, provided a secondary means is also used.

Where Fibrous Adhesive is used only for temporary support it may be spotted in a few places on the face of the insulation. The insulating block in turn is then pressed against the surface to which it is to be applied. If, however, the Fibrous Adhesive is used as the principal means of support, it should be applied over the entire face of the insulation as a thin film—the thickness depending on whether the insulation is to be applied to a smooth or rough surface. Paint must of course be removed where Fibrous Adhesive is to be applied.

Covering capacity: to brick or concrete, 1⅓ sq. ft. per lb.; to metal, 2 sq. ft. per lb. Furnished in 100 lb. containers ready to use. Temperature limit 500°F.



WEATHERPROOF JACKETS

Where pipe covering is exposed to the weather several standard forms of jackets are available. Either one ply 30 lb. asphalt saturated asbestos felt or one ply 45 lb. asphalt saturated rag felt is employed, and furnished separate or attached, as specified. Accessories furnished include 6" wide strips for end laps, staples, copper wire and lap cement.

Jackets are made of a size sufficient to provide 4" side laps. When applying, the laps should be turned down to shed water, and sealed with RUBEROID Lap Cement. The 6" wide strips should be applied over end joints in a seal of Lap Cement, and the side lap turned down on the opposite side from the jacket lap. The wire furnished should be applied over the jackets on not more than 4" centers.

COVERKOTE

Ruberoid Coverkote is designed for the protection of insulation on outdoor equipment such as large tanks, vessels, breechings, ducts and on pipe fittings. It is a fibrated emulsion of high melting point asphalt.

Years of experience with Ruberoid Coverkote have demonstrated continued elasticity, resistance to cracking, durability under all sorts of weather and resistance to water penetration.

In service, Coverkote will change in color from black to gray without loss of its weatherproofing properties. As the emulsion forming water dries out Coverkote shrinks, so that a ¼" wet coat, the usual thickness to which it is applied, becomes approximately a ⅛" tough skin.

Thus applied, it has a covering capacity of approximately 45 sq. ft. per 100 lbs. (2.2 lbs. per sq. ft.). Orders shipped between October 1 and May 1 are filled with "winter grade" (Type C) Coverkote.

Coverkote is furnished in 10 lb. cans, 50 lb. pails and 150, 300 and 500 lb. drums.

AIR-VENT ASPHALT FELT

A perforated rag felt saturated with asphalt.

No. 15 lb., 36" wide, 432 sq. ft., 60 lbs. per roll.

BOILER WALL COATING

This material is sometimes used instead of Coverkote for waterproofing insulation exposed to the weather. It consists of Asbestos fibres and asphalt and is made in plastic form ready for trowelling.

Ruberoid Boiler Wall Coating is generally applied to brick boiler walls to eliminate air infiltration and thereby increase boiler efficiency.

When set it forms a tough elastic coat that is permanently impervious to air penetration.

The covering capacity depends on the nature of the surface and is generally about 50 to 80 lbs. per 100 sq. ft. Furnished in 25, 50, 150, 300 and 500 lb. containers.

CAP SHEET

A rag felt sheet saturated with asphalt, coated with asphalt on one side with finish especially adapted to promote adhesion. Primarily used as a cap sheet or top layer with built-up roofs which are not slagged in. Also used extensively where a cap repair job is wanted for re-roofing over old built-up roof.

No fixtures. Rolls are 43 lbs., 108 sq. ft., 36" wide.

MINERALIZED (HEAVY) ROLL ROOFING

This roll roofing is made of strong roofing felt saturated and coated with the best grade of asphalt, finished with minerals that are dependable for protection and appearance. It has a two inch bare marginal edge and is coated on the underside. Available in many attractive colors.

Zinc-coated large headed nails and lap-cement are included in each roll. Carries Underwriters' (Class C) label. Average approximate weight, 90 pounds per 108 sq. ft. roll, 36 in. wide.

SMOOTH SURFACED ROLL ROOFING

The original and still the best of smooth surfaced roll roofings. It comes in rolls containing 108 sq. ft. Each roll is 36" wide, and consists of a 36-ft. length of roofing sufficient to cover 100 sq. ft. of roof area, including the laps.

May be had in three weights: Medium, 45 pounds; Heavy, 55 pounds; Extra Heavy, 65 pounds.

The 65 and 55 pound weights carry the Class "C" label of the Board of Fire Underwriters, Inc.

ASPHALT FELTS

Rag felt saturated with pure asphalt, used in construction of both smooth and mineral surfaced roofs. The No. 15 lb. felt is also used as membrane in waterproofing walls, floors, etc.

Asphalt felts are furnished in 36" wide rolls in No. 15 and No. 30 lb. weights.

Numbers indicate weights per 100 sq. ft. Roll content varies from 432 to 216 sq. ft. Both weights carry Underwriters' label. Weights per roll are average; actual weights may be 5% more or less.

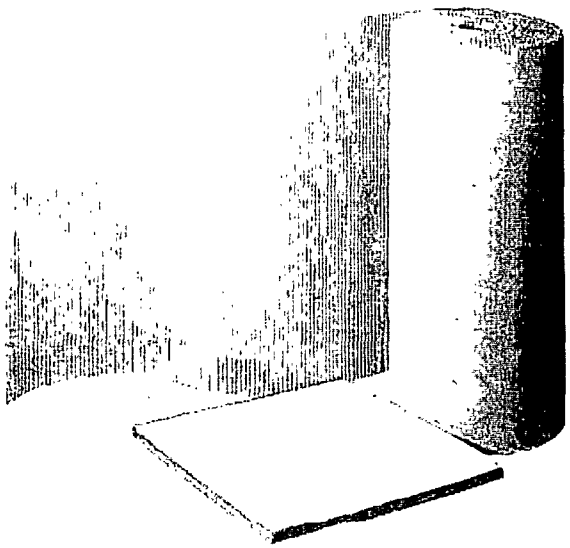
RUBEROID LAP CEMENT

This is an asphaltic plastic for application at ordinary temperatures. It sticks quickly and through its use the laps of waterproof jackets are quickly pressed into place. It may also be used as a coating. Sometimes when additional protection is desired in connection with waterproof jackets they are coated with RUBEROID Lap Cement.



Asbestos Papers

CORRUGATED ASBESTOS PAPER



In the Air Cell products described on page 6, the basic is a sheet of corrugated paper cemented to a flat sheet. Besides its use in manufacturing these products, it has a wide usage as a flexible insulation material. It is adapted for insulating warm air furnace pipes and casings and air conditioning ducts.

Furnished in rolls 37" wide, containing 250 sq. ft. Weight approximately 46 lbs. packed in cartons.

Watcocell fine corrugated asbestos paper with flutes ⅛ or 1/16 in. thick can be regularly furnished upon request.

ASBESTOS ROLLBOARD

Asbestos Rollboard is basically the same product as Ruberoid Asbestos Paper, except that it is made in thicknesses of 1/16" and 3/32". It is used for general fire proofing and heat resisting purposes. It will withstand temperatures up to 350°F.

Standard rolls are 18" and 36" wide, weighing 50 lbs. or 100 lbs. each. Rolls are tightly wound and attractively wrapped. Special width or cut sheets supplied on order.

ASBESTOS ROLL BOARD THICKNESS AND WEIGHT

Approximate Thickness	Approximate Weight per 100 Sq. Ft.	Average Sq. Ft. per 100 lbs.
3/32"	50 lbs.	200
1/8"	70 "	145

(Actual thickness Asbestos Roll Board may vary ± .02")

COMMERCIAL ROLLS

As a fire retardant with all the properties of a thin, pliable paper, Ruberoid Asbestos Paper finds a multitude of uses in residential and general building work and in industrial applications. It can be used to wrap furnace pipes, air-conditioning ducts, furnaces, jackets and the protection of wooden partitions exposed to heat. This product is ideal for any application where paper is desired and a degree of fireproofing is required.

It has a minimum of organic materials (not exceeding 5%) mixed with pure asbestos fibres to provide added strength to the sheet. Length of fibres and their orientation assures the physical characteristics that contribute to the quality desired in an asbestos paper regardless of the thickness that may be selected for general commercial uses. Special grades of asbestos paper can be supplied which will withstand higher temperatures. These were created for use by welders and glass sign manufacturers. Another grade is available for chemical filtration and for use in electrolytic processes.

ASBESTOS PAPER THICKNESS AND WEIGHT

Approximate Thickness	Approximate Weight per 100 Sq. Ft.	Average Sq. Ft. per 100 lbs.
.015"	6 lbs.	1725
.019"	8 "	1335
.022"	10 "	1065
.027"	13 "	864
.029"	14 "	720
.033"	16 "	639
1/16" (.0625")	32 "	330

(Actual weight of Asbestos Paper may vary ± 10%)

SMALL HANDY ROLLS

Ruberoid 10 lb. Asbestos Paper in attractive individual rolls weighing about 10 lbs. and containing 20 yards of 18" wide paper, are available to hardware dealers for sale to home owners. This neat handy package is ideal for small jobs around the house.

TAPE WIDTH ROLLS

Ruberoid Asbestos Paper in tape widths has been cut in convenient sized small rolls to make them easily handled in the furnace industry. This tape can be used for sealing joints in the application of cellular insulation on furnaces and pipes and air conditioning ducts. It also can be used by pasting directly on the seams of the ducts. Apply with a form of fireproof glue, such as silicate of soda, or immerse in a cold water paste solution.

Rolls contain approximately 83 lineal feet. 3" wide rolls are packed 12 rolls per package; 2" wide rolls, 18 per package. Carton weighs approximately 35 lbs.

ASBESTOS MILLBOARD

Ruberoid Asbestos Millboard is made of selected asbestos fibre combined with suitable binding materials to produce a densely compressed sheet of uniform size and thickness. To prevent warping, the sheet is carefully cured and dried. It can be obtained in several different styles with either a smooth or a pin-pointed, embossed finish.

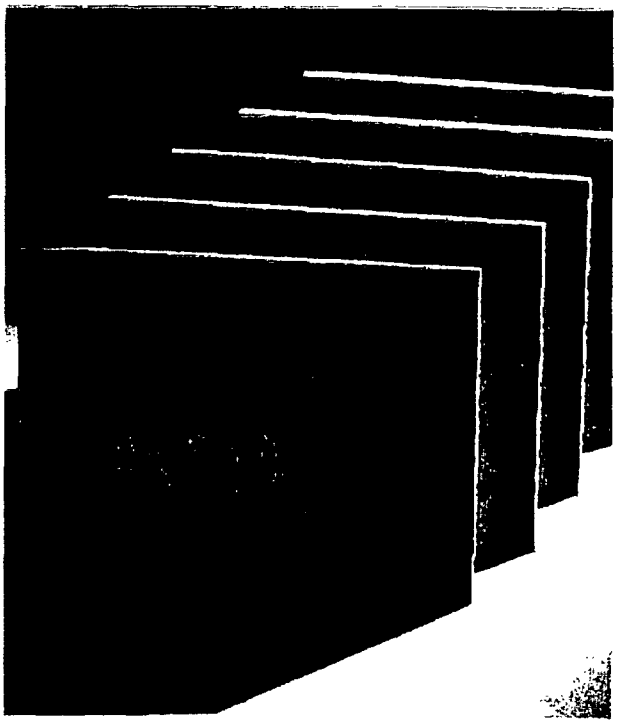
Asbestos Millboard is designed to be used wherever a light-weight, inexpensive fireproofing material is required. It is employed widely in insulating ovens and ranges and for lining grates, ceilings and walls. Its many residential and industrial uses are apparent when it is considered that the product is a fire retardant, is vermin proof and can be used as protection against acid fumes.

Commercial Quality. All Ruberoid millboard is of the "smokeless" type. Under heat it will not give off offensive, pungent gases or odors and while it may discolor slightly at higher temperatures, its strength is not materially impaired. It can safely be used with temperatures as high as 1000°F.

The soft, medium and hard grades are made to cover the wide uses to which millboard is put. While medium grade is standard and is furnished unless otherwise requested, soft quality satisfies the requirement when some flexibility is required. The hard quality is stiff and brittle. It is used when rigidity is a requirement.

Ruberoid Commercial Millboard, being of the "smokeless" type finds favor with the glass manufacturing industry, the glass sign manufacturers, the welders and many others because it is carried in standard stock by all distributors available immediately when requested.

Gasket Quality. The appearance of this board is the same on both sides, having a special embossed marking pressed upon the surface. It is very white in color. Special handling and pressing of each sheet gives the millboard an insured uniform density and accurate caliper of thickness. It has been put through a carefully controlled drying process that assures satisfaction on such accurate work as needed by the gasket industry. It will withstand temperatures of 1000°F. without smoking or giving off any odor. There are no organic binders used in the formula. Special thicknesses are made to satisfy requirements starting at .050". For such special runs we require a minimum of 300 standard size sheets.



Ruberoid Asbestos Millboard is furnished in one standard size, 42" x 48", but the material is suitable for cutting by saw or shears to any size desired. It is sufficiently soft to be fastened either with nails or screws. Other than standard sizes can also be furnished, cut to the required specification at the factory. The material is shipped either in cartons or crates. Crates contain approximately 350 lbs. net. Cartons contain about 100 lbs. each. Where a regular flow of shipment warrants, it is customary to use skids weighing approximately 2,500 lbs. each.

TYPES OF MILLBOARD AVAILABLE

Standard Finish	No. 100—soft
	No. 101—medium
	No. 102—extra hard
Embossed Finish	No. 200—soft
	No. 201—medium
	No. 202—extra hard
	No. 211—special gasket stock

Note:—All orders should definitely specify type of finish and grade desired.

ASBESTOS MILLBOARD, WEIGHTS AND CRATE CONTENTS

Thickness	Average Weight Per Sheet	Average Weight Per Sq. Ft.	Number Sheets Per Crate	Number Sheets Per Carton
1/16"	4.3 lbs.	.31 lbs.	80	24
1/8"	8.3 "	.59 "	40	12
3/16"	12.5 "	.90 "	28	8
1/4"	17.0 "	1.22 "	20	6
5/16"	20.3 "	1.45 "	16	5
3/8"	24.0 "	1.68 "	13	4
1/2"	31.0 "	2.20 "	10	3

(Actual weight of Millboard may vary ± 10%)
dimensions of carton 48¼"x42¼"x1⅝"
dimensions of crate 48½"x42½"x5¼"

SHEET & PANEL PRODUCTS

CORRUGATED ASBESTOS SHEETS



Ruberoid Corrugated Asbestos Sheets for roofs and sidewalls is a time-tested material. It provides a strong, permanent, absolutely incombustible covering for practically any type of building—in any climate.

Ruberoid Corrugated Asbestos is made of a combination of Portland cement and selected asbestos fibre which serves the dual purpose of aggregate and reinforcing. By its special manufacturing process Ruberoid controls the asbestos fibres so that they reinforce the corrugated sheets in much the same manner that steel reinforcing bars strengthen ordinary concrete. After the sheet is developed, it is subjected to high pressures. The result is a dense, waterproof, rock-like, corrugated sheet of great strength and durability, incombustible and practically indestructible.

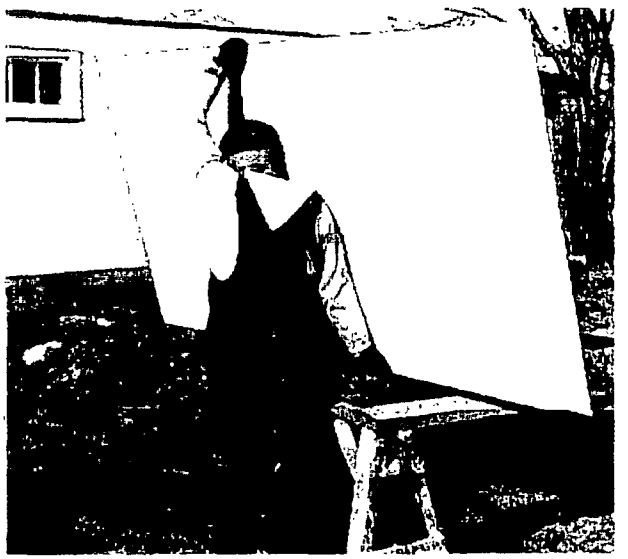
The use of Ruberoid Corrugated Asbestos Sheets is not limited to exterior use on industrial construction. Architects are quick to see its artistic value for interior use and decoration. Properly designed interiors and store fronts of Ruberoid Corrugated Asbestos Sheets are unusually striking and modern in appearance.

From every standpoint Ruberoid Corrugated Asbestos Sheets are economical.

The first cost is nominal because they can be applied directly to framing without sheathing.

Their economy is still more striking when measured by the length of maintenance-free service they will give.

STONEWALL BOARD



Old frame buildings... like barns and warehouses... can be made as good as new, or *better*... by re-siding with Ruberoid Stonewall Board. These big, 4' x 8' asbestos-cement sheets can be nailed and battened right over old siding. They strengthen the walls... never need painting. Equally adapted for new construction.

For interior walls, ceilings, partitions, Stonewall offers advantages no other building board can match. In barns, milk houses, poultry buildings it provides easy sanitation and protection against fire, rodents, termites. In industrial buildings where fumes, rust and rot are encountered, Stonewall Board is in a class by itself.

Stonewall is tough, durable, bendable. Much used for economy shelter over loading platforms, sheds, small farm buildings like brooders, hog houses, etc.

REFLECTIVE INSULATION & VAPOR BARRIER PAPER

This modern, lightweight, easy-to-handle vapor barrier material is composed of two layers of asphalt-saturated kraft paper adhered to either side of a sheet of aluminum foil with asphalt. It has been used successfully in a number of places where thicker materials are unsatisfactory.

Its efficiency results from the fact that the foil will reflect about 95% of the sun's rays while, at the same time, it is impervious to the passage of moisture in either liquid or vapor form. This material is available having a single layer of foil as well as a double layer. The rolls contain 250 sq. ft. and come in 25" and 36" widths.

TECHNICAL INFORMATION OR DATA

In order to understand the terminology referred to in this catalog and to more clearly comprehend the references which are often made to the scientific terms used in the study of heat, refrigeration and insulation, the following definitions and explanations will be helpful:

TRANSMISSION OF HEAT

Heat may be transmitted from one body to another by—

RADIATION which is the transfer of heat from one body to another as the result of the first body emitting radiant energy (wave motion like light waves), and the second body absorbing it, as experienced by a person standing in the sunlight and feeling the warmth of its radiated heat;

CONDUCTION which is the passing of heat from one part of a body to another part of the same body or to another body in contact with it, as can be observed in the handle of a frying pan, the bottom of the pan being heated by the gas flame;

CONVECTION which is the transfer of heat by means of circulating air or liquids, which may be explained by referring to the method of heating the average residence with so-called "radiators" where the air passes around the hot surface and is carried up and through the room by convection currents.

* * * * * * * * * *

EMISSIVITY is the ratio of the radiating power of a body to that of a "block" body at the same temperature.

ABSORPTIVITY of a non-block body is the fraction of the radiation impinging on it which it absorbs. For any body absorptivity is always equal to emissivity.

THERMAL CONDUCTIVITY is the quantity of heat transmitted through a unit thickness of material per unit of area in a unit of time. This term is expressed in B.T.U. per square foot, per inch of thickness, per degree temperature difference between surfaces, per hour. The conductivity of a material is a specific property of the material just the same as density or weight per cubic foot. Regardless of the size, shape or thickness of the material, the conductivity at a given temperature is always the same.

THERMAL CONDUCTANCE is the rate of heat flow through any material (which may be non-homogenous) expressed in the B.T.U. per hour, per sq. ft. per degree temperature difference between the surfaces.

THERMAL TRANSMITTANCE or over-all coefficient of heat transmission is the rate of heat flow through one sq. ft. per hour per degree temperature difference between the air (or gas) on one side and that on the other.

EFFICIENCY OF INSULATION is the ratio of the heat saved by the insulation to the heat which would be lost without insulation. Efficiency of insulation is usually figured on the basis of bare irons surface loss.

LATENT HEAT

LATENT HEAT is the quantity of heat absorbed (or given up) by a substance during a change of state, there being no change in temperature.

LATENT HEAT OF FUSION is the difference in total heat content between 1 lb. of saturated liquid and 1 lb. of saturated solid at the same temperature. For water the value is approximately 144 B.T.U. per lb.

LATENT HEAT OF VAPORIZATION is the difference in total heat content between 1 lb. of saturated vapor and 1 lb. of saturated liquid at the same temperature. For water the value at atmospheric pressure and 212°F. is 970.3 B.T.U. per lb. For other pressures and temperatures the values are found in steam tables.

HEAT CAPACITY AND SPECIFIC HEAT

SPECIFIC HEAT of a substance is the quantity of heat required to raise the temperature of a unit mass one degree under specified conditions of pressure, etc.

HEAT CAPACITY OF A BODY between two temperatures is the quantity of heat required to raise the temperature from the lower to the higher temperature.

UNITS OF HEAT

B.T.U. (the British Thermal Unit) is the quantity of heat required to raise 1 lb. of water from 62°F. to 63°F. For practical purposes this unit may be defined as 1/180 of the heat required to raise the temperature of 1 lb. of water from 32°F. to 212°F. The CALORIE (small calorie or gram-calorie), is the heat required to raise 1 gram of water from 14.5°C. to 15.5°C. 1 Calorie equals 0.003968 B.T.U.

1 Calorie per sq. centimeter per second per ° C. per centimeter thick equals 2902 B.T.U. per sq. ft., per hour per ° F. per inch thick.

HEAT EQUIVALENTS

ONE BOILER HORSEPOWER is the equivalent evaporation of 34.5 lbs. of water from and at 212°F. per hour. This amounts to 33,523 B.T.U. per hour.

ONE TON OF REFRIGERATION is the abstraction in 24 hours of a quantity of heat equal to the latent heat of fusion of 1 ton (2000 lbs.) of ice. The factor adopted by engineers is 200 B.T.U. per minute.

HEAT VALUE OF FUEL

The average calorific values which are generally used in making fuel saving computations for various fuels are as follows:

Coal—13,500 B.T.U. per lb.
Oil—18,500 B.T.U. per lb.
Oil—141,000 B.T.U. per gal.
Gas (Natural)—1000 B.T.U. per cu. ft.
Gas (Artificial)—535 B.T.U. per cu. ft.

THERMOMETERS

The "Fahrenheit" thermometer is generally used in English speaking countries and the "Centigrade" thermometer in countries that use the metric system.

The boiling point of water, 212°F. is 100° Centigrade.

The freezing point of water, 32°F. is 0° Centigrade.

1° Fahrenheit equals 0.555° Centigrade.

Fahrenheit temperature is 9/5 Centigrade temperature plus 32.

Centigrade temperature is 5/9 Fahrenheit temperature minus 32.

Heat Losses from Horizontal Bare Iron Pipes and Flat Surfaces

In B.T.U. per sq. ft. OF METAL SURFACE per hour per °F. temp. diff. between metal and air

Pipe Size Ins.	*Sq. Ft. per Lin. Ft.	Temperature Difference Between Pipe Surface and Surrounding Air in degrees F.																	
		50°	100°	150°	200°	250°	300°	350°	400°	450°	500°	550°	600°	650°	700°	750°	800°	900°	1000°	1100°	1200°
⅛	.220	2.48	2.70	2.95	3.21	3.51	3.84	4.20	4.57	4.97	5.41	5.86	6.31	6.78	7.25	7.73	8.22	9.23	10.20	11.20	12.20
¼	.275	2.36	2.57	2.80	3.07	3.36	3.68	4.04	4.42	4.81	5.25	5.70	6.15	6.62	7.09	7.57	8.06	9.07	10.04	11.04	12.04
⅜	.344	2.29	2.50	2.73	3.00	3.29	3.60	3.93	4.30	4.70	5.13	5.58	6.03	6.51	6.98	7.48	7.98	8.98	9.93	10.94	11.92
½	.435	2.24	2.45	2.68	2.94	3.23	3.54	3.89	4.28	4.67	5.09	5.54	5.98	6.44	6.91	7.39	7.88	8.89	9.86	10.87	11.86
¾	.498	2.20	2.41	2.64	2.90	3.19	3.50	3.85	4.23	4.61	5.03	5.48	5.92	6.39	6.86	7.34	7.83	8.84	9.81	10.82	11.81
1	.622	2.15	2.35	2.58	2.85	3.14	3.45	3.79	4.16	4.56	4.98	5.41	5.84	6.30	6.77	7.25	7.74	8.76	9.73	10.72	11.73
1¼	.753	2.09	2.29	2.52	2.78	3.06	3.37	3.71	4.09	4.49	4.91	5.32	5.78	6.24	6.71	7.19	7.68	8.71	9.69	10.68	11.69
1½	.917	2.05	2.25	2.47	2.73	3.00	3.31	3.65	4.03	4.43	4.85	5.26	5.71	6.19	6.65	7.14	7.63	8.66	9.63	10.62	11.63
2	1.047	2.02	2.22	2.43	2.69	2.97	3.27	3.61	3.98	4.38	4.80	5.22	5.67	6.15	6.62	7.10	7.59	8.62	9.59	10.58	11.59
2½	1.179	2.00	2.19	2.40	2.66	2.94	3.24	3.58	3.95	4.35	4.77	5.19	5.64	6.11	6.58	7.06	7.55	8.58	9.55	10.54	11.55
3	1.310	1.98	2.17	2.38	2.63	2.92	3.22	3.56	3.92	4.32	4.74	5.17	5.62	6.07	6.54	7.04	7.53	8.55	9.52	10.51	11.52
3½	1.456	1.97	2.15	2.36	2.61	2.90	3.20	3.54	3.90	4.30	4.71	5.15	5.60	6.05	6.52	7.00	7.49	8.52	9.49	10.48	11.49
4	1.736	1.95	2.13	2.34	2.59	2.88	3.18	3.52	3.89	4.28	4.69	5.12	5.57	6.02	6.49	6.97	7.46	8.49	9.46	10.45	11.46
5	2.000	1.93	2.11	2.32	2.57	2.86	3.16	3.50	3.87	4.26	4.67	5.10	5.55	6.00	6.47	6.95	7.44	8.47	9.44	10.43	11.44
6	2.262	1.91	2.09	2.31	2.56	2.84	3.14	3.49	3.86	4.25	4.66	5.09	5.53	5.99	6.46	6.94	7.43	8.45	9.42	10.41	11.42
7	2.525	1.90	2.08	2.30	2.55	2.83	3.13	3.48	3.85	4.24	4.65	5.08	5.51	5.98	6.45	6.93	7.42	8.43	9.40	10.39	11.40
8	2.817	1.89	2.07	2.29	2.54	2.82	3.12	3.47	3.84	4.23	4.64	5.07	5.50	5.97	6.44	6.92	7.41	8.41	9.38	10.37	11.38
10	3.344	1.87	2.05	2.27	2.52	2.80	3.10	3.45	3.81	4.20	4.61	5.05	5.48	5.94	6.41	6.89	7.38	8.39	9.36	10.35	11.36
12	3.663	1.86	2.04	2.25	2.50	2.78	3.08	3.43	3.79	4.18	4.59	5.03	5.46	5.92	6.39	6.87	7.36	8.37	9.34	10.33	11.34
14	4.184	1.85	2.03	2.23	2.48	2.76	3.06	3.41	3.77	4.16	4.57	4.99	5.44	5.90	6.37	6.85	7.34	8.35	9.32	10.31	11.32
16	4.717	1.84	2.02	2.22	2.47	2.75	3.05	3.39	3.75	4.14	4.55	4.98	5.42	5.88	6.35	6.83	7.32	8.33	9.30	10.29	11.30
Flat	.....	1.75	1.92	2.11	2.35	2.61	2.90	3.22	3.56	3.93	4.32	4.73	5.15	5.59	6.04	6.49	6.95	7.95	8.85	9.75	10.70

* To secure total losses per lineal foot, multiply sq. ft. losses in table by this factor, and by the temperature difference.
The figures in this column show the radiating surface per linear foot of pipe.
Above table by R. H. Heilman, page 299, Trans. A. S. M. E. 1922.

*Heat Loss from Horizontal Bare †BRIGHT Copper Pipe

Expressed in B.T.U. per hour PER LINEAR FOOT per degree Fahrenheit between the pipe and surrounding still air at 70° F.

Nominal Pipe Size (Inches)	Hot Water (Type K Copper Tube)				Steam (Standard Pipe Size Pipe)		
	120 F.	150 F.	180 F.	210 F.	227.1 F. (5 Lb.)	297.7 F. (50 Lb.)	337.9 F. (100 Lb.)
	TEMPERATURE DIFFERENCE						
	50 F.	80 F.	110 F.	140 F.	157.1 F.	227.7 F.	267.9 F.
⅛	0.180	0.210	0.218	0.229	0.299	0.338	0.355
¼	0.230	0.275	0.291	0.307	0.337	0.406	0.419
⅜	0.290	0.338	0.354	0.373	0.440	0.492	0.523
½	0.340	0.400	0.418	0.443	0.510	0.571	0.598
¾	0.390	0.463	0.471	0.507	0.598	0.671	0.710
1	0.490	0.525	0.600	0.628	0.719	0.813	0.851
1¼	0.580	0.675	0.709	0.750	0.840	0.953	1.008
1½	0.680	0.788	0.848	0.871	0.987	1.107	1.165
2	0.760	0.888	0.946	1.000	1.114	1.235	1.307
2½	0.940	1.000	1.045	1.107	1.210	1.361	1.456
3	.....	.....	.....	.....	1.333	1.495	1.488
3½	.....	.....	.....	.....	1.465	1.670	1.755
4	1.020	1.200	1.255	1.320	1.600	1.890	1.942
5	1.160	1.375	1.410	1.500	1.685	1.890	1.942
6	1.460	1.725	1.820	1.890	2.100	2.373	2.310

* ASH & VE Guide, 1942 Edition.
† Heat losses become greater with tarnishing.

Radiating Surface per Linear Foot of Copper Tubing

Outside diameter ⅛ in. greater than nominal size

Tube Size (Inches)	Surface Area (Sq. Ft.)	Tube Size (Inches)	Surface Area (Sq. Ft.)	Tube Size (Inches)	Surface Area (Sq. Ft.)
½	0.164	2	0.556	5	1.342
¾	0.229	2½	0.687	6	1.604
1	0.295	3	0.818	8	2.128
1¼	0.360	3½	0.949	..	.....
1½	0.426	4	1.080	..	.....

Dimensions of Wrought Iron and Steel Steam, Gas and Water Pipe

Diameter			Circumference		Length Pipe Per Square Foot External Surface	Length of Pipe Containing 1 Cu. Ft.	External Surface Area Per Lineal Foot
Nominal Internal	Actual External	Actual Internal	External	Internal			
Inches	Inches	Inches	Inches	Inches	Feet	Feet	Sq. Ft.
⅛	.405	.269	1.272	.845	9.431	2533.78	.106
¼	.540	.364	1.696	1.144	7.073	1383.79	.141
⅜	.675	.493	2.121	1.549	5.658	754.36	.177
½	.840	.622	2.639	1.954	4.547	473.91	.220
¾	1.050	.824	3.299	2.589	3.637	270.03	.275
1	1.315	1.049	4.131	3.296	2.904	166.62	.344
1¼	1.660	1.380	5.215	4.335	2.301	96.27	.435
1½	1.900	1.610	5.969	5.058	2.010	70.73	.498
2	2.375	2.067	7.461	6.494	1.608	42.91	.622
2½	2.875	2.469	9.032	7.757	1.328	30.07	.753
3	3.500	3.068	10.996	9.638	1.091	19.47	.917
3½	4.000	3.548	12.566	11.146	.954	14.37	1.047
4	4.500	4.026	14.137	12.648	.848	11.31	1.178
4½	5.000	4.506	15.708	14.156	.763	9.03	1.309
5	5.563	5.047	17.477	15.856	.686	7.19	1.456
6	6.625	6.065	20.813	19.054	.577	4.98	1.734
7	7.625	7.023	23.955	22.063	.501	3.72	1.996
8	8.625	7.981	27.096	25.073	.442	2.87	2.257
9	9.625	8.941	30.238	28.089	.396	2.29	2.519
10	10.750	10.020	33.772	31.479	.355	1.82	2.817
11	11.750	11.000	36.912	34.558	.325	1.51	3.077
12	12.750	12.000	40.055	37.700	.299	1.27	3.337
14	14.000	13.250	43.982	41.626	.273	1.04	3.663
16	16.000	15.250	50.266	47.909	.239	.79	4.188
18	18.000	17.182	56.549	53.979	.212	.62	4.716
20	20.000	19.182	62.832	60.262	.191	.49	5.235
22	22.000	21.250	69.115	66.759	.174	.40	5.747
24	24.000	23.250	75.398	73.042	.159	.33	6.286

Saturated Steam Table

Abstracted from "Thermodynamic Properties of Steam" by J. H. Keenan and F. G. Keyes, by permission of the publishers, John Wiley & Sons, Inc., and the authors.

†Gauge Pressure in Lbs./Sq. in.	Absolute Pressure in Lbs./Sq. In.	Temp. in Degrees Fahr.	Spec. Vol. of Sat. Vap. in Cu. Ft./Lb.	Latent Heat of Evap. in BTUs./Lb.	Total Heat of Steam in BTUs./Lb.	†Gauge Pressure in Lbs./Sq. In.	Absolute Pressure in Lbs./Sq. In.	Temp. in Degrees Fahr.	Spec. Vol. of Sat. Vap. in Cu. Ft./Lb.	Latent Heat of Evap. in BTUs./Lb.	Total Heat of Steam in BTUs./Lb.
	1	101.74	333.6	1036.3	1106.0	175.3	190	377.51	2.404	846.8	1197.6
	2	126.08	173.73	1022.2	1116.2	185.3	200	381.79	2.288	843.0	1198.4
	3	141.48	118.71	1013.2	1122.6	195.3	210	385.90	2.183	839.2	1197.6
	4	152.97	90.63	1006.4	1127.3	205.3	220	389.86	2.087	835.6	1199.6
	5	162.24	73.52	1001.0	1131.1	215.3	230	393.68	1.9992	832.0	1200.1
	6	170.06	61.98	996.2	1134.2	225.3	240	397.37	1.9183	828.5	1200.6
	7	176.85	53.64	992.1	1136.9	235.3	250	400.93	1.8438	825.1	1201.1
	8	182.86	47.34	988.5	1139.3	245.3	260	404.42	1.7748	821.8	1201.5
	9	188.28	42.40	985.2	1141.4	255.3	270	407.78	1.7107	818.5	1201.9
	10	193.21	38.42	982.1	1143.3	265.3	280	411.05	1.6511	815.3	1202.3
	12	201.96	32.40	976.6	1146.6	275.3	290	414.23	1.5954	812.1	1202.6
	14	209.56	28.04	971.9	1149.5	285.3	300	417.33	1.5433	809.0	1202.8
0	14.696	212.00	26.80	970.3	1150.4	295.3	310	420.35	1.4943	805.9	1203.1
3	15	213.03	26.29	969.7	1150.8	305.3	320	423.29	1.4483	802.9	1203.3
5.3	20	227.96	20.089	960.1	1156.3	315.3	330	426.17	1.4048	799.9	1203.5
10.3	25	240.07	16.303	952.1	1160.6	325.3	340	428.97	1.3645	797.1	1203.7
15.3	30	250.33	13.746	945.3	1164.1	335.3	350	431.70	1.3263	794.3	1203.9
20.3	35	259.28	11.898	939.2	1167.1	345.3	360	434.40	1.2895	791.4	1204.1
25.3	40	267.25	10.498	933.7	1169.7	355.3	370	437.03	1.2549	788.6	1204.2
30.3	45	274.44	9.401	928.6	1172.0	365.3	380	439.60	1.2222	785.8	1204.3
35.3	50	281.01	8.515	924.0	1174.1	375.3	390	442.12	1.1913	783.0	1204.4
40.3	55	287.07	7.787	919.6	1175.9	385.3	400	444.59	1.1618	780.5	1204.5
45.3	60	292.71	7.173	915.5	1177.6	395.3	410	447.01	1.1338	777.9	1204.6
50.3	65	297.97	6.655	911.6	1179.1	405.3	420	449.39	1.1071	775.2	1204.6
55.3	70	302.92	6.206	907.9	1180.6	415.3	430	451.72	1.0816	772.6	1204.6
60.3	75	307.60	5.816	904.3	1181.9	425.3	440	454.02	1.0556	770.0	1204.6
65.3	80	312.03	5.472	901.1	1183.1	435.3	450	456.28	1.0330	767.4	1204.6
70.3	85	316.25	5.168	897.8	1184.2	445.3	460	458.50	1.0094	764.9	1204.6
75.3	90	320.27	4.896	894.7	1185.3	455.3	470	460.69	0.9870	762.4	1204.6
80.3	95	324.12	4.652	891.7	1186.2	465.3	480	462.82	0.9670	759.9	1204.5
85.3	100	327.81	4.432	888.8	1187.2	475.3	490	464.93	0.9467	757.5	1204.4
90.3	105	331.36	4.232	886.0	1188.1	485.3	500	467.01	0.9278	755.0	1204.4
95.3	110	334.77	4.049	883.2	1188.9	495.3	510	469.05	0.9096	752.6	1204.3
100.3	115	338.07	3.882	880.6	1189.7	505.3	520	471.06	0.8921	750.2	1204.2
105.3	120	341.25	3.728	877.9	1190.4	515.3	530	473.04	0.8753	747.8	1204.1
110.3	125	344.33	3.587	875.4	1191.1	525.3	540	474.98	0.8592	745.4	1204.0
115.3	130	347.32	3.455	872.9	1191.7	535.3	550	476.90	0.8437	743.0	1203.8
120.3	135	350.21	3.333	870.6	1192.4	545.3	560	478.79	0.8288	740.6	1203.7
125.3	140	353.02	3.220	868.2	1193.0	555.3	570	480.65	0.8144	738.3	1203.5
130.3	145	355.76	3.114	865.8	1193.5	565.3	580	482.48	0.8005	736.0	1203.3
135.3	150	358.42	3.015	863.6	1194.1	575.3	590	484.29	0.7871	733.7	1203.1
145.3	160	363.53	2.834	859.2	1195.1	585.3	600	486.07	0.7741	731.4	1202.9
155.3	170	368.41	2.675	854.9	1196.0	595.3	610	487.83	0.7616	729.2	1202.7
165.3	180	373.06	2.532	850.8	1196.9	3191.5	3206.2	705.40	0.0503	0	902.7

† Gauge pressures indicated to nearest tenth corresponding to correct absolute pressure.

Areas of Flanged Fittings, Square Feet*

Nominal Pipe Size (Inches)	Flanged Coupling		90 Deg. Ell		Long Radius Ell		Tee		Cross	
	Standard	Extra Heavy	Standard	Extra Heavy	Standard	Extra Heavy	Standard	Extra Heavy	Standard	Extra Heavy
1	0.320	0.438	0.795	1.015	0.892	1.083	1.235	1.575	1.622	2.07
1¼	0.383	0.510	0.957	1.098	1.084	1.340	1.481	1.925	1.943	2.53
1½	0.477	0.727	1.174	1.332	1.337	1.876	1.815	2.68	2.38	3.54
2	0.672	0.848	1.65	2.01	1.84	2.16	2.54	3.09	3.32	4.06
2½	0.841	1.107	2.09	2.47	2.33	2.78	3.21	4.05	4.16	5.19
3	0.945	1.484	2.38	3.49	2.68	3.74	3.66	5.33	4.77	6.95
3½	1.122	1.644	2.98	3.96	3.28	4.28	4.48	6.04	5.83	7.89
4	1.344	1.914	3.53	4.64	3.98	4.99	5.41	7.07	7.03	9.24
4½	1.474	2.04	3.95	5.02	4.43	5.46	6.07	7.72	7.87	10.07
5	1.622	2.18	4.44	5.47	5.00	6.02	6.81	8.52	8.82	10.97
6	1.82	2.78	5.13	6.99	5.99	7.76	7.84	10.64	10.08	13.75
8	2.41	3.77	6.98	9.76	8.56	11.09	10.55	14.74	13.44	18.97
10	3.43	5.20	10.18	13.58	12.35	15.60	15.41	20.41	19.58	26.26
12	4.41	6.71	13.08	17.73	16.35	18.76	19.67	26.65	24.87	34.11

* Including areas of accompanying flanges bolted to the fitting.

For information regarding other Ruberoid Building Materials consult the nearest of your

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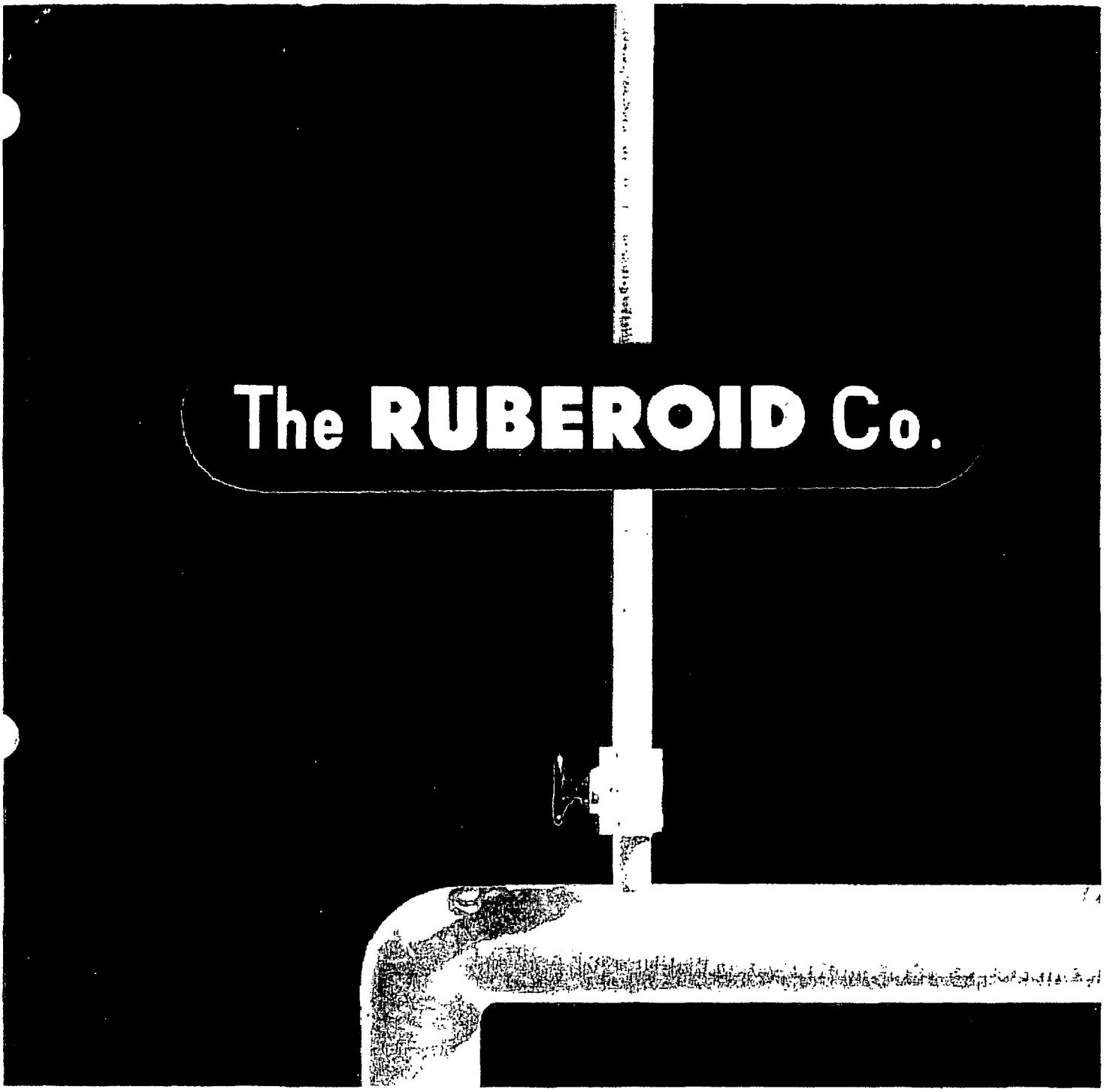

Form No. 1342 E-kn—Km.