

Johns-Manville
Home Insulation

Advantages, Application and Specifications

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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 retarding heat flow through walls, ceilings and floors of frame houses. Its purpose is to keep the buildings warm in winter and cool in summer, thereby providing greater comfort with lower fuel bills. Home Insulation is permanent, fireproof, non-conductive of electricity, and will not support vermin.

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. This factor is often overlooked when heating systems are being planned.

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 percent could have been saved by insulation and the 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 plants for such bungalows.

Applying this survey information to the entire United States would reveal a possible annual fuel saving of $100,000,000, or more.

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 50 percent is lost because of imperfect combustion, etc. The remaining 50 percent goes to heat the house. It is from this 50 percent remaining that most of the saving can be accomplished.

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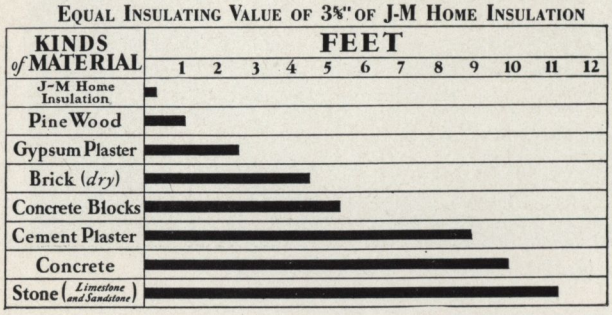
The term "dead air space" is commonly used in building construction as applying to the space between the walls, and the popular impression is that this has a certain insulation value because it acts like the walls in a thermos bottle. It has been conclusively shown, however, that this notion is fallacious 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



The roof or attic floor of any home can be insulated, as can also the walls of any house of frame construction, whether stucco, clapboard, brick veneer or shingles. Insulation is not ordinarily recommended where it makes direct contact with solid masonry walls because moisture gathers on the masonry. If such specification is required, the masonry wall must be thoroughly waterproofed wherever there is contact with the insulation and lath.

The Advantages of Insulation

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

General Home Comfort:

(a) Warmer in winter. No rooms "hard to heat" are found where an adequate heating system is installed in an insulated house.

(b) Cooler in summer. The upper floor rooms can be kept at a temperature close to that of the lower floors. Indoor temperatures will run as much as 15 deg. F. lower than outside temperature.

(c) Waste attic space, used for storage, can be made into extra bedrooms, play rooms, etc.

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.

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 helps to eliminate disturbing outside noises. The same is true of noises from bathrooms, kitchens or adjacent apartments or stores.

Aids in Preventing Fires:

The average frame house, due to its construction, is a fire hazard. Filling the walls and ceilings with a fireproof insulating material lessens the possibility of the house catching fire from overheated flues because furnace "forcing" then becomes unnecessary. Furthermore, the insulation will prevent the passage of flame between the walls, if a fire occurs.

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 uniformly maintaining comfortable temperatures.

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 20 to 35 percent of the fuel bill may be expected. These figures may safely be taken as a fair average, although numerous examples of greater savings have been recorded.

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J-M Type A Home Insulation



Blowing machines housed in trucks or trailers install Home Insulation pneumatically

J-M Type A Home Insulation, used for insulating the walls and finished attics of existing homes, is nodulated rock wool, which, when blown into the walls and attic spaces with compressed air, fills every space with heat resistant material. This method is the only practical way of insulating houses already constructed.

Proper application is just as important in insulating existing homes as is the material itself. For this reason, Approved Home Insulation Contractors who have the necessary equipment have been selected in convenient localities by Johns-Manville as qualifying in experience and business integrity to carry the J-M franchise. These companies are equipped to furnish and install Home Insulation to meet the high standard required by their franchise.

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 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.

Home Insulation is blown only at low pressures, usually 2 lb. per sq. in. or less. The pressure accomplishes two desired effects: It gives a dense, even pack (approximately 7 to 8 lbs. per cu. ft.) which insures maximum thermal efficiency; and it puts the material under an initial compression so that any subsequent vibration or building movement will not cause the insulation to settle, but, rather, to expand and thus retain its full insulating value. The U. S. Bureau of Standards conductivity figure for Rock Wool is given as 0.27 B.t.u. at a density of 10 lb. per cu. ft. At 7 to 8-lb. density, this figure is conservative, since, within certain limits, conductivity is reduced by lighter density. As furnished, Type A Home Insulation weighs 30 lb. per paper bag containing 2½ cu. ft.

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. Before the work of blowing starts, soundings are made with a plumb bob to insure that all spaces will be filled.

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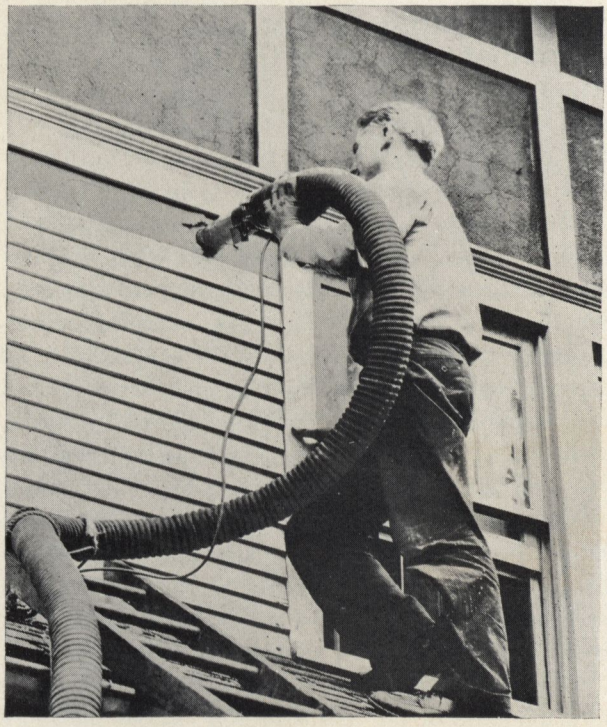
Filling in between the joists of an unfloored attic with J-M Home Insulation, insures warm rooms below

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.

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.



Blowing J-M Home Insulation into the walls of a frame house. The work is done from the outside, avoiding any dust or disturbance in the interior

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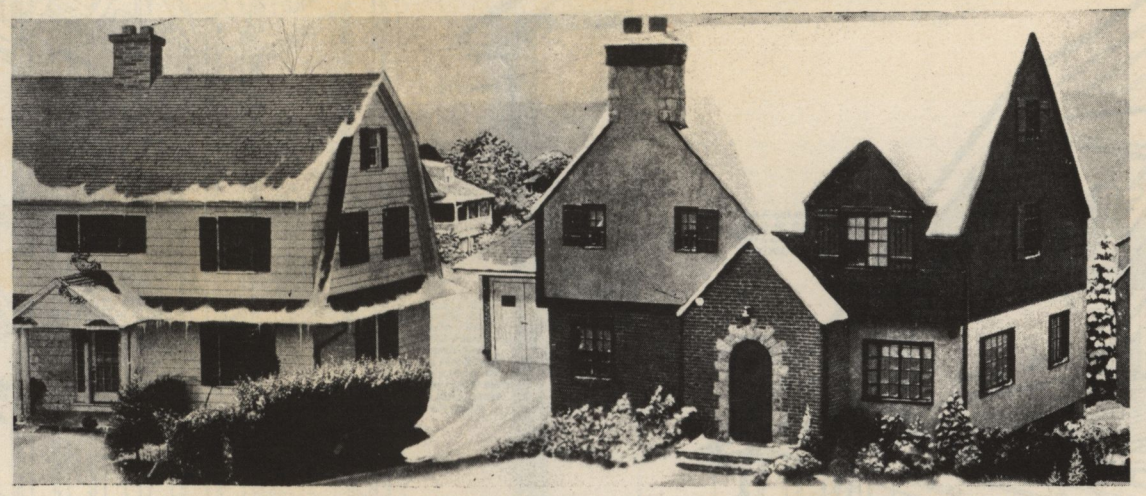
J-M HOME INSULATION FOR NEW CONSTRUCTION



A striking contrast between insulated and uninsulated houses. The melting snow on the house at the left indicates how heat leaks through uninsulated construction

TYPE B HOME INSULATION:

Type B Home Insulation, designed for new houses under construction, is felted rock wool formed into bats of convenient size which facilitate the economical and rapid coverage of large areas.

The Type B bats are made in the following types and sizes: Ful-Thik is furnished 15" x 23" in full wall-stud thickness, packed in cartons containing 8 bats with a surface measure of 19.2 sq. ft. Semi-Thik is furnished 15" x 23" by 2" thick, packed 12 bats, 28.8 sq. ft., per carton. Each bat is uniform in thickness and density.

These bats can readily be pressed between studs, ceiling beams or roof rafters and can easily be sawed, cut with a knife or even torn with the hands to fit around odd shapes such as windows, pipes, plumbing stacks and outlet boxes. When installed, Type B Home Insulation forms a homogeneous mass of solid insulation, sealing itself against air infiltration by the interlacing of fibres.

TYPE C HOME INSULATION:

Type C, also designed for homes under construction, is an improved form of loose rock wool formed without binder into pieces measuring 8" x 15" x 3".

These pieces are packed in paper bags containing 18 per bag. The net contents of each bag is 15 sq. ft. which is designed to cover 16 sq. ft. of gross wall area to full wall-stud thickness.

Since the type C pieces are made without a binder they do not have the rigidity of the Type B bat and cannot be placed as easily although the pieces are far superior to ordinary loose wool in ease of handling. However, if crushed thin or out of shape in transit, they can easily be fluffed-back to normal thickness by a gentle shake.

TYPE L HOME INSULATION:

Type L is loose rock wool shipped in bulk in paper bags containing approximately 35 lb. This type of Home Insulation must be packed by hand and cannot produce the same quality job possible with Type B and Type C.

JOHNS-MANVILLE Building Materials, Miscellaneous

DATE September, 1936

J-M Home Insulation for New Construction

(Cancelling sheet dated November, 1935)

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4-I-12-B (BMM-3)

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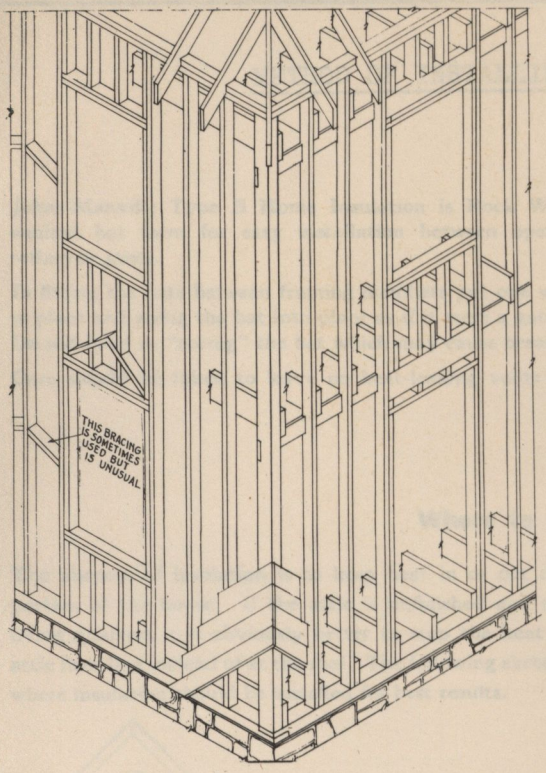
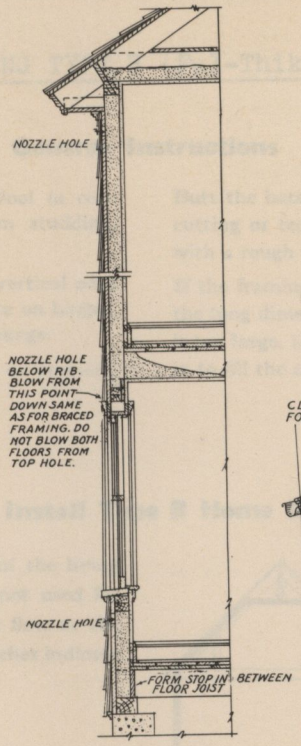


BALLOON FRAMING



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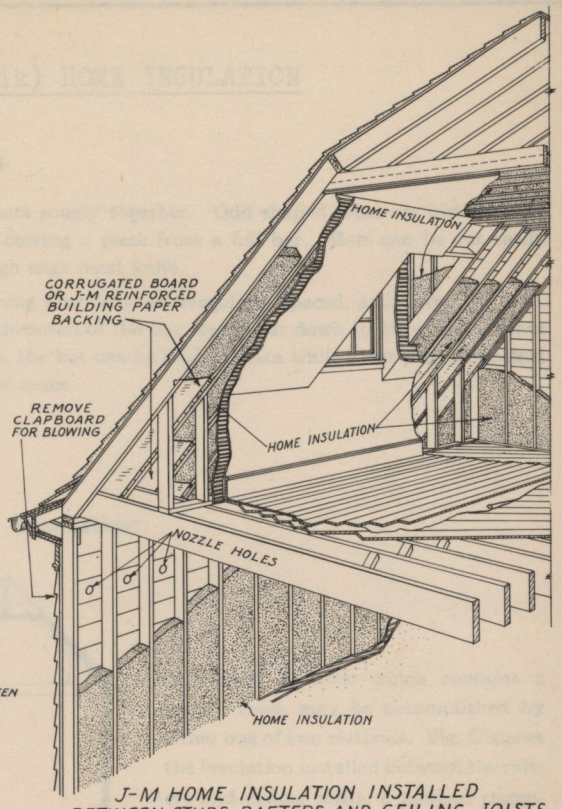
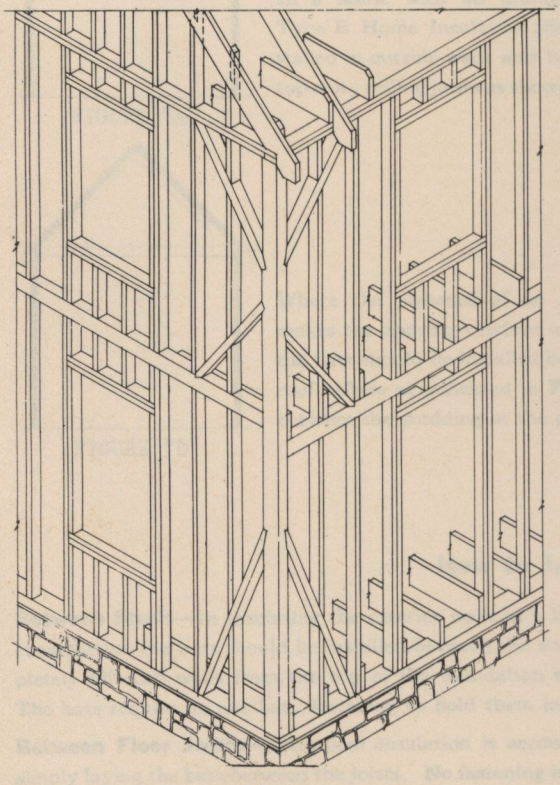


J-M HOME INSULATION INSTALLED BETWEEN STUDS, RAFTERS AND CEILING JOISTS.



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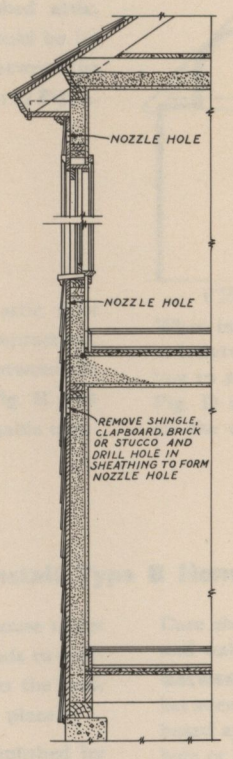

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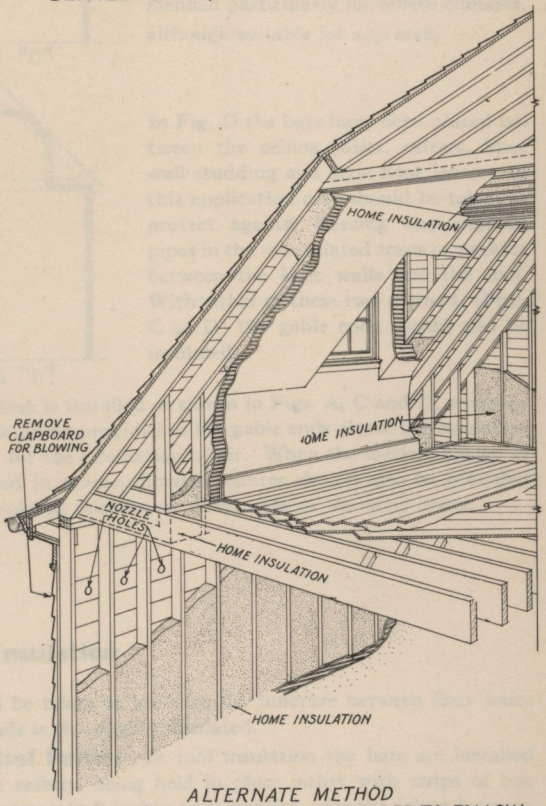

ALTERNATE METHOD
J-M HOME INSULATION INSTALLED TO FOLLOW THE OUTLINE OF THE OCCUPIED AREAS

BALLOON FRAMING CONSTRUCTION.

JOHNS-MANVILLE Building Materials, Miscellaneous

J-M Home Insulation: Frame Construction and Method of Insulating with Blowing Equipment

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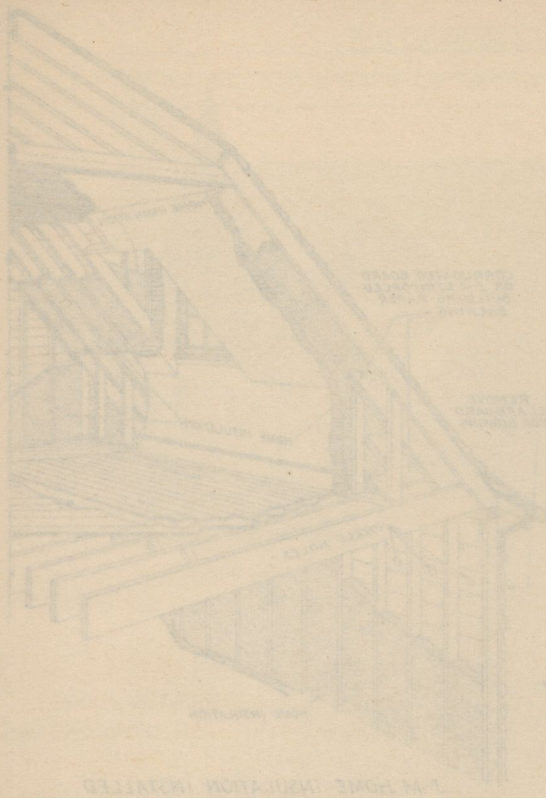

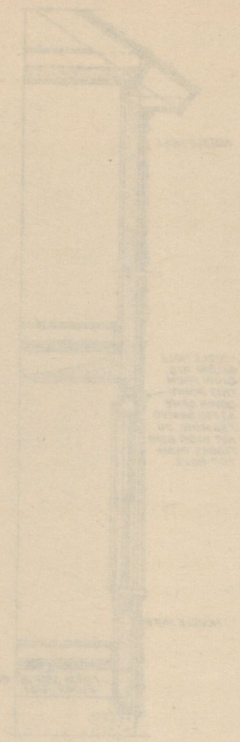

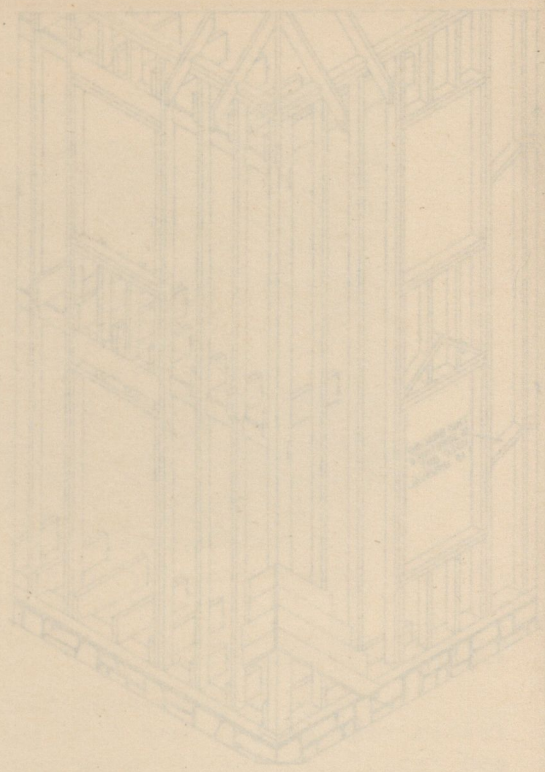

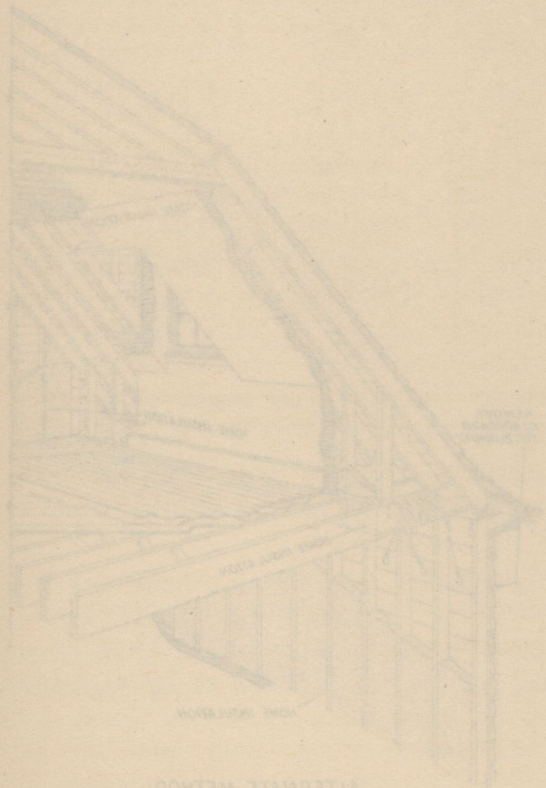

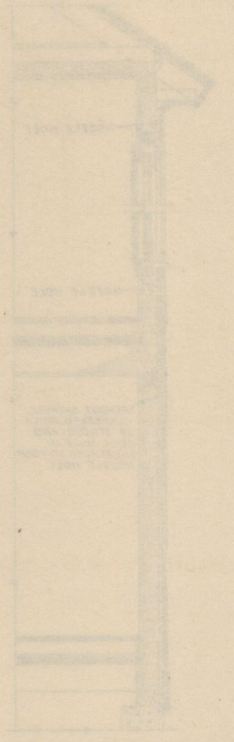



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METHOD OF INSTALLING TYPE B (Ful-Thik) HOME INSULATION

General Instructions

Johns-Manville Type B Home Insulation is Rock Wool in convenient bat form for easy installation between open studding, rafters or joists.

In fitting the bats between framing members put one vertical edge in place and swing the bat into place as if it were a gate on hinges. Do not bend or "spring" the bat which may cause breakage.

Care should be taken to leave no heat-leaking voids or crevices. Butt the bats snugly together. Odd shaped areas are insulated by cutting or tearing a piece from a full bat. Bats can be cut easily with a rough edge meat knife.

If the framing members are irregularly spaced, as is often the case, the long dimension of the bat can be cut down to fit or, if the space is too large, the bat can be held in place while a cut piece is packed in to fill the space.

Where to Install Type B Home Insulation

The purpose of insulation is to keep heat in or out of the living portion of the house. If the attic is unfinished and not used for living quarters it is obviously better to stop the heat flow at the attic floor line instead of at the roof. The following sketches indicate where insulation should be installed for best results.

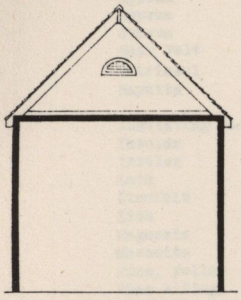

FIGURE "A"

In a house with an unfinished attic, Type B Home Insulation should be installed in outside walls and between the top story ceiling joists as shown in Fig. A.

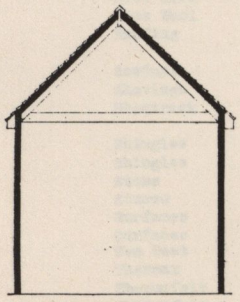

FIGURE "B"

Where the presence of an attic floor makes the above procedure impractical, the bats should be installed between the roof rafters as indicated in Fig. B, and between the studding in the gable ends.

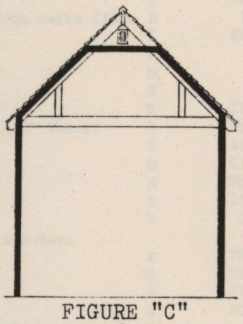

FIGURE "C"

Insulating an attic which contains a heated room may be accomplished by either one of two methods. Fig. C shows the insulation installed between the rafters and ceiling joists, a method recommended particularly for severe climates, although suitable for any area.

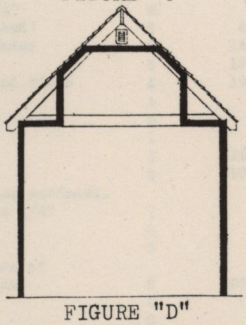

FIGURE "D"

In Fig. D the bats have been placed between the ceiling joists, rafters, knee wall studding and attic floor joists. In this application care should be taken to protect against freezing any exposed pipes in the uninsulated zones or pockets between the knee walls and the roof. With either of these two methods (Figs. C or D) the gable ends should also be insulated.

When insulation is installed as shown in Figs. A, C and D, windows or louvres should be provided in the gable ends above the insulation line to allow for the circulation of air. When the method shown in Fig. D is used in severe climates louvres should also be provided for the uninsulated pockets on either side of the attic room.

How to Install Type B Home Insulation

Between Studs—In insulating the exterior walls of a house under construction the bats should be installed between the studs to completely fill such walls from the top of the foundation to the roof. The bats require no auxiliary fastening to hold them in place.

Between Floor Joists—Attic floor insulation is accomplished by simply laying the bats between the joists. No fastening is necessary. Care should be taken to see that the juncture between floor joists and wall studs is thoroughly insulated.

Between Roof Rafters—In roof insulation the bats are installed between the rafters, being held in place either with strips of box board approximately 9 inches wide applied over the joints between bats or with sheets of box board completely covering the bats. The cartons in which the bats are received can be used in either method.

JOHNS-MANVILLE Building Materials, Miscellaneous

Method of Installing Type B Home Insulation

APPROVED: E. Bew.

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PRINTED IN U. S. A.

DISCLOSURE WOULD MIGHT BE DETRIMENTAL TO THE INTEREST OF THE COMPANY.

CONDUCTIVITIES AND CONDUCTANCES OF BUILDING MATERIALS AND INSULATIONS

Material	Description	Authority	Density lb. per cu. ft.	Mean Temperature deg. F.	Conductivity or Conductance (see note a)
Aerocrete	Cellular concrete	A	40.0	75	1.06
Aerocrete	Cellular concrete	A	70.0	75	2.18
Air Space	(as between wall materials) assumed 3-5/8" wide	G	-	-	1.10*
Asbestos	Sheet	I	48.3	110	0.29
Asbestos	Corrugated board	I	20.4	110	0.48
Asbestos Millboard	Pressed asbestos	S	60.5	86	0.84
Asbestos Shingles	Asbestos and cement compressed	A	65.0	75	6.00*
Asbestos Wood	Asbestos and cement compressed	S	123.0	86	2.70
Balsa Wood	Across grain	S	8.8	90	0.38
Balsam Wool	Chemically treated wood fibre between layers of paper (not compressed)	S	2.2	90	0.27
Beaverboard	Rigid insulation made from sugar cane fibre	A	13.8	75	0.33
Brickwork	Mortar bond	I	132.0	100	4.00 to 5.00
Cabots Quilt	Eel grass between Kraft paper (not compressed)	S	3.4	90	0.25
Celotex	Rigid insulation made from sugar cane fibre	S	13.2	90	0.34
Concrete	Stone, 1-2-4 mix	I	140.0	110	8.30
Concrete	Cinder	A	110.0	75	5.20
Cork	Regranulated, about 3/16" particles	S	8.1	90	0.31
Corkboard	Pure, no added binder	S	7.0	90	0.27
Corkboard	Pure, no added binder	S	14.0	90	0.34
Dry Zero Blanket	Pliable slab form of insulation made from ceiba fibre	A	1.6	75	0.24
Fir	Across grain (one surface finished)	I	33.4	-	1.00
Fir Sheathing	With building paper	M	-	30	0.71*
Fir Sheathing	Building paper and pine lap siding	M	-	20	0.50*
Fir Sheathing	Building paper and stucco	M	-	20	0.82*
Flaxlinum	Flax fibre	S	13.0	90	0.31
Gyplap	Gypsum between layers of heavy paper (1/2" thick)	S	53.5	90	2.60*
Gypsum	Plaster	S	46.2	86	2.32
Gypsum	Solid tile	M	51.8	70	1.66
Gypsum	Solid tile	M	75.6	76	2.96
Hair Felt	Felted cattle hair	S	13.0	90	0.26
Hairinsul	75% hair; 25% jute	S	6.3	90	0.27
Haydite	Heat-treated clay aggregate concrete, standard blocks, 8" x 8" x 16"	A	73.0	-	1.62
Insulating Board	Rigid insulation made from wood fibre	S	18.0	90	0.34
Insulex	Cellular gypsum, dry	S	12.0	90	0.44
Insulex	Cellular gypsum, dry	S	30.0	90	1.00
Lath	With 3/8" plaster. Total thickness 3/4"	M	-	70	2.50*
Linofelt	Flax fibres between paper (not compressed)	S	4.9	90	0.28
Lith	Rock wool, flax and straw pulp with binder	S	14.3	90	0.40
Magnesia	85% Magnesia; 15% asbestos. Rigid	S	19.3	86	0.51
Masonite	Rigid insulation made from exploded wood fibre	A	19.6	75	0.33
Pine, yellow	Across grain	A	-	-	1.00
Pine siding	Lap siding 4" wide, and building paper	M	-	16	0.85*
Plaster	Cement	I	-	-	8.00
Rock Cork	Rock wool block with binders	S	14.5	77	0.33
Rock Wool	Fibrous material made from rock	S	10.0	90	0.27
Roofing	Built-up bitumen and felt gravel or slag surfaced. Assumed total thickness 1/4"	I	-	-	1.325*
Sawdust	Ordinary	S	-	86	1.04
Shavings	Ordinary	S	-	86	0.71
Sheetrock	Gypsum mixed with sawdust between layers of heavy paper (0.39" thick)	S	60.7	90	3.60*
Shingles	Slate	G	-	-	10.37
Shingles	Wood	G	-	-	1.28*
Stone	Building	G	-	-	12.50
Stucco		I	-	-	8.00
Surfaces	(Moving air - 15 mph)	G	-	-	6.00*
Surfaces	(Still air)	G	-	-	1.65*
Ten Test	Rigid insulation made from wood fibre	T	-	52	0.33
Thermax	Made from shredded wood and cement	A	24.2	72	0.46
Thermofelt	Hair and asbestos fibres, felted	S	7.8	90	0.28
Thermofelt	Jute and asbestos fibres, felted	S	10.0	90	0.37
Thermofill	Dry, fluffy, flaked gypsum	S	19.8	90	0.35
Thermofill	Dry, fluffy, flaked gypsum	S	34.0	90	0.60
Tile	Encaustic or Terrazzo	G	-	-	12.00
Tile	2" hollow clay, 1/2" plaster both sides	I	120.0	110	1.00*
Tile	4" hollow clay, 1/2" plaster both sides	I	127.0	100	0.60
Tile	6" hollow clay, 1/2" plaster both sides	I	124.3	105	0.47*
Torfoleum	Peat moss compressed into sheet form	S	10.2	92	0.29

Authorities:

- A Armour Institute of Technology - Tests by J. C. Peebles
- G A.S.H.V.E. Guide, 1934
- I University of Illinois - Tests by A. C. Willard, L. C. Lichty and L. A. Harding
- M University of Minnesota - Tests by F. B. Rowley
- S U. S. Bureau of Standards
- T University of Toronto - Tests by E. A. Allcut

(a) Conductivities expressed in B. t. u. per hour per square foot per degree Fahrenheit per inch of thickness.

*Conductances, indicated by an asterisk opposite the figures, expressed in B.t.u. per hour per square foot per degree Fahrenheit for thickness stated or used in building construction, not per 1 in. thickness.

JOHNS-MANVILLE Building Materials, Miscellaneous

Conductivities and Conductances of Building Materials and Insulations

APPROVED:

DATE March, 1935

(Cancelling sheet 4-I-13-X-1, dated October 2, 1929)

4-I-13-X-1 (BMM-60)

PRINTED IN U. S. A.

CONDUCTIVITIES AND CONDUCTANCES OF BUILDING MATERIALS AND INSULATIONS

Material	Description	Authority	Density lb. per cu. ft.	Mean Temperature or Overall Temperature Deg. F.	Conductivity or Conductance (See Note a)
Asbestos	Cellular concrete	A	40.0	75	1.06
Asbestos	Cellular concrete	A	70.0	75	1.19
Air Space	(As between wall materials) assumed 3-4/8" wide	D	-	-	1.20*
Asbestos	Sheet	I	48.8	110	0.99
Asbestos	Corrugated board	I	30.4	110	0.49
Asbestos MILLBOARD	Pressed asbestos	I	48.2	86	0.84
Asbestos Shingles	Asbestos and cement compressed	A	120.0	75	3.00*
Asbestos Wood	Asbestos and cement compressed	I	115.4	86	1.70
Balsa Wood	Across grain	I	8.8	90	0.38
Balsa Wood	Chemically treated wood fibre between layers of paper (not compressed)	I	5.3	80	0.27
Basesboard	Slight insulation made from paper cane fibre	A	12.8	75	0.32
Bitumen	Mopbar board	I	152.0	100	4.00 to 6.00
Cabots Quilt	(As) press between Kraft paper (not compressed)	S	5.4	90	0.25
Celotex	Slight insulation made from sugar cane fibre	S	12.2	90	0.34
Concrete	Stone, 1-2-4 mix	I	140.0	110	5.20
Concrete	Cinder	A	110.0	75	2.20
Cork	Compressed, about 1/2" particles	S	8.2	90	0.31
Cornboard	Pure, no added binder	S	7.0	90	0.27
Cornboard	Pure, no added binder	S	14.0	90	0.54
Dry Pure Kindred	Multiple slab form of insulating mats from cane fibre	A	1.2	75	0.14
Fir	Across grain (pure unless finished)	I	32.4	-	1.00
Fir Insulating	Multiple insulating paper	M	-	90	0.17*
Fir Sheathing	Building paper and pine lap siding	M	-	90	0.82*
Fir Flooring	Building paper and stocco	M	-	90	0.82*
Flooring	Pine floor	S	32.0	90	0.71
Gypsum	Opposed between layers of heavy paper (1/8" thick)	S	52.8	90	2.80*
Gypsum	Plaster	S	46.8	86	2.22
Gypsum	Solid tile	M	51.8	90	1.64
Gypsum	Solid tile	M	49.2	75	2.22
Hair Felt	Felted cattle hair	S	12.0	90	0.36
Hardboard	Oil hairy pine pine	S	8.8	90	0.27
Impregn	Fiber-treated clay aggregate concrete, standard blocks, 8" x 8" x 12"	A	75.0	-	1.28
Insulating Board	Slight insulation made from wood fibre	S	12.0	90	0.34
Insulex	Cellular cypress, dry	I	12.0	90	0.44
Insulex	Cellular cypress, dry	S	20.0	90	1.06
Lath	Pine fibres between paper (not compressed)	S	4.3	90	0.22
Lath	Rock wool, flax and straw pulp with binder	I	14.2	90	0.40
Masonite	Hot Impregnated (not extruded, Slight	S	18.0	86	0.51
Masonite	Slight insulation made from extruded wood fibre	S	16.0	75	0.35
Pine, yellow	Across grain	A	-	-	1.00
Pine sliding	Lap siding 6" wide, not building paper	M	-	75	0.85*
Plaster	Cement	I	-	-	5.56
Rock Cork	Rock wool block with binders	S	14.3	77	0.35
Rock Wool	Fibrous material made from rock	S	10.0	90	0.27
Roofing	Built-up bitumen and felt gravel or slag surfaced. Assumed total thickness 1/4"	I	-	-	1.20*
Sheathing	Ordinary	S	-	86	1.04
Shingles	Ordinary	I	-	86	0.77
Sisalkraft	Crepe wood with reenter between layers of heavy paper (0.25" thick)	S	60.0	90	2.80*
Shingles	Slate	S	-	-	12.50
Shingles	Wood	S	-	-	1.25*
Stucco	Building	S	-	-	12.50
Terrazzo		I	-	-	8.00
Terrazzo	Marble - 12 cpd)	S	-	-	8.00*
Trelabor	Felted slag	I	-	-	1.45*
Tan Yank	Slight insulation made from wood fibre	I	-	86	0.38
Tentest	Made from shredded wood and cement	A	25.0	75	0.64
Thermofelt	Hair and asbestos fibres, felted	S	7.0	90	0.28
Thermofelt	Jute and asbestos fibres, felted	S	10.0	90	0.37
Thermofill	Dry, fluffy, flaked cypress	S	12.8	90	0.38
Thermofill	Dry, fluffy, flaked cypress	S	24.0	90	0.60
Tile	Terrazzo or Terrapave	S	-	-	12.00
Tile	1" hollow clay, 1/2" plaster both sides	I	120.0	110	1.00*
Tile	8" hollow clay, 1/2" plaster both sides	I	121.0	100	0.80
Tile	8" hollow clay, 1/2" plaster both sides	I	122.8	102	0.47*
Torfolaum	Peat moss compressed into sheet form	S	32.8	92	0.39

Authorities:

1. Bureau Institute of Technology - Specs by L. C. Beckins
2. A.S.H.V.E. Guide, 1934
3. University of Illinois - Tests by A. B. Willard, L. C. Kirby and L. A. Harding
4. University of Minnesota - Tests by F. B. Haley
5. U. S. Bureau of Standards
6. University of Toronto - Tests by E. A. Allcut

(a) Conductivities expressed in B. t. u. per hour per square foot per degree Fahrenheit per inch of thickness.

"Conductance" indicated by an asterisk signifies the figures, expressed in B.t.u. per hour per square foot per degree Fahrenheit for thickness stated or used in building construction, not per 1 in. thickness.

JOHNS-MANVILLE Building Materials, Miscellaneous

Conductivities and Conductances of Building Materials and Insulations

APPROVED:

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4-I-13-X-j (BMM-60)

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UNDERWRITERS' LABORATORIES REPORT ON
J-M HOME INSULATION

J-M Home Insulation, Type A, was subjected to tests by the Underwriters' Laboratories, New York City, and reported on October 23, 1929. This material was shown to be non-corrosive, non-abrasive, non-combustible, chemically neutral, low in absorption, a non-conductor of electricity, and a good heat insulator.

J-M Home Insulation, Type A, has been approved and listed by them as suitable for use in the hollow spaces of walls and floors wired by either of the general wiring methods described in the National Electrical Code.

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EXTRACTS FROM UNDERWRITERS' LABORATORIES REPORT ON INSULATING MATERIAL

Elec. No. E-7948; App. No. 29N335 New York City, October 23, 1929

DESCRIPTION

This material, known as "Home Insulation, Type A", is composed practically entirely of calcium-magnesium-alumino silicates. It is designed and intended to be placed within the hollow spaces of walls and ceilings to reduce heat transfer. Type A is specially processed and refined to produce a material relatively free from shot, and foreign matter. The construction of this material makes it adaptable for blowing by a blowing machine. It weighs approximately 12 lb. per cu. ft.

CHEMICAL TESTS

Chemical Analysis and Examination:

The material used was submitted by the manufacturer and was representative of the commercial output. The material was analyzed qualitatively and a determination made of the constituents found. The analysis showed that the water soluble matter was composed practically entirely of calcium carbonate. The product showed a very slight basic reaction.

Combustibility Matter:

The amount of volatile matter, including combustibility, was determined using a two-gram sample in an open crucible over a Bunsen flame. The percent loss in weight on ignition was 0.06. The outward appearance was not apparently changed.

Hygroscopicity Tests:

The sample, which had been carefully weighed, was exposed in large closed jars to atmospheres of 100%, 70% and 50% relative humidity. Temperature conditions were those of an ordinary room in summer. The sample was reweighed after 50 hours, 100 hours and 200 hours, and the percent gained in weight calculated and recorded after

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each weighing. The following table gives the results of this test:

	Relative Humidity		
	100%	70%	50%
Per Cent Gain in Wt. - 50 hours	0.19	0.03	0.002
" " " " " 100 "	0.36	0.03	0.024
" " " " " 200 "	0.77	0.06	0.028

ELECTRICAL TESTS

Insulation:

A box representing the space between studs was filled and wired with No. 14 B&S gauge rubber covered wire. This box was then filled, by pouring, with Home Insulation. The material was then removed and condition of wiring noted.

It was noted after removing the material from the box that the wires had not been disarranged and were securely held under the knobs. It was concluded from this test that this material can be installed with concealed knob and tube work without injury to the wiring.

Burnout:

Using the same box described above and with No. 14 wires knobbed on the inside, the space was again filled with the insulating material and the wire allowed to carry a current of 90 amperes until burnout occurred. This test was also repeated with the box wired with No. 12 B&S gauge rubber covered wire, and it was allowed to carry 100 amperes for 20 minutes to get a prolonged heating effect, after which the current was raised to 145 amperes which fused the wires. The method of wiring was what is known as concealed knob and tube work with the wires spaced 5" apart and supported at 4' 6" intervals.

It was noted that the wires merely burned in two and no short circuit resulted. This was true of both the No. 14 and No. 12 B&S gauge wires. Upon removing the material it was found that it had become quite hot where it surrounded the wires. Some of the material was discolored in spots.

Loose Connection:

For this test a box constructed of soft pine wood, 10" long, 7" wide and 4" deep, was used. One wire of a 250 volt D. C. circuit was wired inside the box. No. 8 B&S gauge rubber covered wire was used for the reason that rigidity was required. The wire was cut in two in the box and the insulation removed for approximately 3/4". One end of the wire was secured to the side of the box 1" off the surface. The other wire was pushed through a hollow tube, secured to the end of the box until it touched the fixed wire. The wires in this position formed electrodes, and while carrying current, the removable wire could be slid back in the tube sustaining an arc between the two wires. The box at different times was filled with the material and then covered. The current at different times in the circuit was adjusted to 7.5, 20, 50 and 100 amperes, and with these current values the wires were pulled apart, causing an arc.

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each weighing. The following table gives the results of this test:

		Relative Humidity		
		100%	70%	50%
Per Cent Gain in Wt. -	80 hours	0.19	0.03	0.002
" " " "	100 "	0.86	0.03	0.024
" " " "	200 "	0.77	0.06	0.038

ELECTRICAL TESTS

Insulation:

A box representing the space between studs was filled and wired with No. 14 B&S gauge rubber covered wire. This box was then filled, by pouring, with Home Insulation. The material was then removed and condition of wiring noted.

It was noted after removing the material from the box that the wires had not been disarranged and were securely held under the knobs. It was concluded from this test that this material can be installed with concealed knob and tube work without injury to the wiring.

Burnout:

Using the same box described above and with No. 14 wires knobed on the inside, the space was again filled with the insulating material and the wire allowed to carry a current of 30 amperes until burnout occurred. This test was also repeated with the box wired with No. 12 B&S gauge rubber covered wire, and it was allowed to carry 100 amperes for 20 minutes to get a prolonged heating effect, after which the current was raised to 185 amperes which fused the wires. The method of wiring was what is known as concealed knob and tube work with the wires spaced 5" apart and supported at 4' c" intervals.

It was noted that the wires merely burned in two and no short circuit resulted. This was true of both the No. 14 and No. 12 B&S gauge wires. Upon removing the material it was found that it had become quite hot where it surrounded the wires. Some of the material was discolored in spots.

Loose Connection:

For this test a box constructed of soft pine wood, 10" long, 7" wide and 4" deep, was used. One wire of a 550 volt D. C. circuit was wired inside the box. No. 8 B&S gauge rubber covered wire was used for the reason that rigidity was required. The wire was cut in two in the box and the insulation removed for approximately 3½". One end of the wire was secured to the side of the box 1" off the surface. The other wire was pushed through a hollow tube, secured to the end of the box until it touched the fixed wire. The wires in this position formed electrodes, and while carrying current, the removable wire could be slid back in the tube sustaining an arc between the two wires. The box at different times was filled with the material and then covered. The current at different times in the circuit was adjusted to 7.5, 20, 30 and 100 amperes, and with these current values the wires were pulled apart, causing an arc.

JOHNS-MANVILLE Building Materials, Miscellaneous	DATE October, 1931
Home Insulation Underwriters' Laboratories Test	
APPROVED:	

4-I-15-X-5-A (BMM-Y)

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In all cases it was found the material had dropped between the arc, extinguishing it. It was necessary to pull the wires apart approximately 3/4" to form the arc. It was further noted that the Home Insulation covered the wood surface and acted as a heat insulator from both the arc and the flame. It was noted that the wood was not discolored.

Dielectric:

A wooden trough, 2-1/2" long, 8" wide and 3" deep, was constructed for this test. No. 14 B&S gauge rubber covered wire was installed on knob and tube work on the bottom of this trough. Wires were spaced 5" apart which is the minimum spacing allowed by the National Electrical Code for concealed knob and tube work. A dielectric test was conducted between the two wires through the air, and also with the trough filled with dry "Home Insulation". Tests were also conducted when the material contained the percent of moisture it was found it would absorb in the Hygroscopicity Test.

The voltages necessary to cause break-down between the two wires through air are as follows: Sample No. 1 - 97,000 v.; No. 2 - 99,000 v.; No. 3 - 93,000 v. The voltage required to cause a break-down between the material when dry was approximately 107,000 volts.

The following table shows the voltage required for break-down with the material at the various moisture contents determined in the Hygroscopicity Test:

Per Cent Relative Humidity	Exposure in Hours	Per Cent Moisture Content	Voltage
50	50	0.002	61,000
50	100	0.024	57,000
50	200	0.028	56,000
70	50	0.030	68,000
70	100	0.030	67,000
70	200	0.060	63,000
100	50	0.190	61,000
100	100	0.360	59,000
100	200	0.770	46,000

CONCLUSION

The Home Insulation covered by this report has been found to comply with present requirements covering the class, and is judged to be acceptable for listing as standard under the Laboratories Reexamination Service.

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ESTIMATING HEAT LOSSES AND SAVINGS RESULTING FROM USE OF J-M HOME INSULATION

It is frequently necessary to prepare detailed estimates showing the practical value of J-M Home Insulation. In this connection the following calculations are typical and illustrate the method used for this work.

In preparing the data, all conductivities and other constants have been taken either from tables published by the U. S. Bureau of Standards or from the Guide of the American Society of Heating and Ventilating Engineers. The resistance method of computing coefficients of heat transmission has been followed and the results are directly comparable to the published tables in the A.S.H. & V.E. Guide, 1933.

Definition of Terms - Symbols Used:

k = Thermal conductivity, the amount of heat expressed in B.t.u. transmitted in 1 hour through 1 sq. ft. of homogeneous material 1" thick for a difference in temperature of 1 deg. F. between the two surfaces of the material.

C = Thermal conductance, the amount of heat expressed in B.t.u. transmitted in 1 hour through 1 sq. ft. of a body of the thickness and type specified for a difference in temperature of 1 deg. F. between the two surfaces.

U = Thermal transmittance or over-all coefficient of heat transfer, the amount of heat expressed in B.t.u. transmitted in 1 hour through 1 sq. ft. of wall (or roof, etc.) for a difference in temperature of 1 deg. F. between the air on the inside and outside of the wall (or roof, etc.)

R = Resistivity or resistance is the reciprocal of conductivity, conductance or transmittance. (1/k = internal resistivity, 1/C = internal resistance, 1/U = over-all resistance).

Conductance of outer surfaces is based on a wind velocity of 15 miles per hour.

Conductance of inner surfaces is based on still air conditions.

Building: Residence, 40' long x 25' wide x 20' high to the eaves. The third floor has attic heated, with peak of roof 8.33' above the eaves.

Location: St. Joseph, Mo.

Lowest Outside Temperature: -24 deg. F., from U. S. Weather Bureau report for preceding ten years.

Base Temperature: (-24 deg. F. + 15 deg. F.) = -9 deg. F. Base temperature to be assumed must not be more than 15 degrees above the lowest recorded by the U. S. Weather Bureau during the preceding ten years. This base temperature is used only for the design of the heating system.

Average Outside Temperature: 40 deg. F., from U. S. Weather Bureau average during the period from October 1 to May 1. This temperature is used in computing the average heat losses:

Inside Temperature: 70 deg. F.

Average Temperature Difference: (70 deg. F - 40 deg. F.) = 30 deg. F.

Prevailing Wind Direction: Northwest, from U. S. Weather Bureau report for months of December, January and February. Used only for purposes of heating system design.

Average Wind Velocity: 9.1 miles per hour, from U. S. Weather Bureau report for months of December, January and February. In the following computations, coefficients from the A.S.H. & V.E. Guide are mostly based on a wind velocity of 15 miles per hour. However, where windage has a special importance, as in filtration, the more accurate figure of 9.1 is used.

Heating Period: Taken to be 210 days, 17 hours per day, or 3570 hours per year.

Heating System: Low pressure steam.

Fuels: Calculations are made for three fuels - coal, oil and gas. The efficiencies of the heating systems are taken as follows - coal 50%, oil 65%, gas 75%. These efficiencies take care of losses in the entire system, including the boiler, and are comparable to figures used in the A.S.H. & V.E. Guide. Probably they are as close as can be obtained without knowing the details of the system, the exact fuels to be used, etc. The available heating capacity of these fuels is therefore taken to be:

Coal -	14,000,000 B.t.u. per ton	(0.50 efficiency x 14,000 B.t.u. per lb. x 2,000 lb. per ton)
Oil -	93,600 B.t.u. per gallon	(0.65 efficiency x 144,000 B.t.u. per gallon)
Gas -	401 B.t.u. per cu. ft.	(0.75 efficiency x 535 B.t.u. per cu. ft.)

CONSTRUCTION DETAILS AND CALCULATION OF HEAT LOSS COEFFICIENTS

Walls:

The following shows the derivation of (U) for the walls. (Item 50-A, page 31, A.S.H. & V.E. Guide, 1933).

			Uninsulated	Insulated
	C	K	R	R
Outer surface	6.00		0.167	0.167
4" brick veneer		9.20	0.435	0.435
Wood sheathing	0.82		1.220	1.220
3-5/8" air space	1.10		0.908	
3-5/8" J-M Home Insulation		0.27		13.420
Plaster on wood lath	2.50		0.400	0.400
Inner surface	1.65		0.606	0.606
over-all resistance (R)			3.736	16.248
heat transfer coefficient (U)			0.27	0.062

Note: If plans of the house are available, the following data is secured from them. In this case, a sketch was made of the assumed building. Windows and doors were placed in accordance with conventional design.

Total wall area	2808 sq. ft.
Chimney area	100
Wall area less chimney area	2708 sq. ft.
Windows and doors	428
Net area to be insulated	2280 sq. ft.

Heat Loss Through Walls:

Uninsulated 2280 x 0.27 x 30 = 18,468 B.t.u. per hr.
Insulated 2280 x 0.062 x 30 = 4,241 " " "

Windows and Doors: Assumed, 1 wood panel and 3 glazed outside doors, total area 146 sq. ft. Assumed, 26 windows, double hung, single glass, total area, 282 sq. ft.

The heat transfer coefficient (U) for windows and doors is taken as 1.13 (Table 18-A, page 39, A.S.H. & V.E. Guide, 1933).

Heat Loss Through Windows and Doors:

Windows 282 x 1.13 x 30 = 9560 B.t.u. per hr.
Doors 146 x 1.13 x 30 = 4949
Total 14509 B.t.u. per hr.

Roof:

The following shows the derivation of (U) for the roof. (See Item 6-D, Page 38, A.S.H. & V.E. Guide, 1933*)

			Uninsulated	Insulated
	C	k	R	R
Outer surface	6.00		0.167	0.167
Rigid asbestos shingles	6.00		0.167*	0.167
Wood sheathing	1.28		0.781	0.781
3-5/8" air space	1.10		0.908	
3-5/8" J-M Home Insulation		0.27		13.420
Plaster on wood lath	2.50		0.400	0.400
Inner surfaces	1.65		0.606	0.606
over-all resistance (R)			3.029	15.541
heat transfer coefficient (U)			0.33*	0.064

Total area to be insulated, 1,202 sq. ft.

Heat Loss Through Roof:

Uninsulated 1202 x 0.33 x 30 = 11,900 B.t.u. per hr.
Insulated 1202 x 0.064 x 30 = 2,308 " " "

*Guide coefficients here slightly modified to apply more accurately to rigid asbestos shingles.

Floor Over Basement:

The following shows the derivation of (U) for the floor over the basement. (Item 1-D, Page 33, A.S.H. & V.E. Guide, 1933).

	C	k	R
Upper surface	1.65		0.606
13/16" oak top flooring		1.15	0.707
25/32" yellow pine sub-flooring		0.80	0.977
Lower surface	1.65		0.606
over-all resistance(R)			2.896
heat transfer coefficient(U)			0.34

Total area of floor over basement (40' x 25') = 1,000 sq. ft.

Note: The upper and lower surface conductance (C) is the same on both sides of the floor due to the fact that both sides of the construction are protected against ouside exposure.

Heat Loss Through Floors:

Over basement 1,000 x 0.34 x 15 = 5,100 B.t.u. per hr.

Note: Basement temperature assumed as 50 deg. F. and air temperature at floor assumed as 65 deg. F. Temperature difference (65 - 50) = 15 deg. F.

Air Infiltration:

The leakage per foot of crack for average window, not weatherstripped, including frame leakage is 18.9 cu. ft. of air per hour for a 9.1 mile per hour wind velocity (Table 2, page 44, A.S.H. & V.E. Guide, 1933.) The heat equivalent is (18.9 x 0.075 x 0.24) = 0.34 B.t.u. per ft. of crack per hour per deg. F. temperature difference. The total amount of window crack from plans is 380 linear feet.

Note: 0.075 = density of air, 0.24 = specific heat of air.

Assume infiltration loss through door crack to be double that of windows, or (2 x 0.34) = 0.68 B.t.u. per ft. of crack per hour per deg. F. temperature difference.) Total amount of door crack from assumed plans is 155 linear feet.

Infiltration Losses:

Windows	380 x 0.34 x 30 =	3,876 B.t.u. per hr.
Doors	155 x 0.68 x 30 =	3,162
Total		7,038 B.t.u. per hr.

Summary:

Losses not Influenced by Insulation:

Floor	5,100 B.t.u. per hr.
Window and door	14,509
Infiltration	7,038
Total	26,647 B.t.u. per hr.

Losses Influenced by Insulation:

	Uninsulated	Insulated
Walls	18,468	4,241
Roof	11,900	2,308
	30,368	6,549 B.t.u. per hr.

Total Loss:

Uninsulated: 30,368 + 26,647 = 57,015 B.t.u. per hour
Insulated: 6,549 + 26,647 = 33,196 B.t.u. per hour

Savings due to J-M Home Insulation:

B.t.u. 57,015 - 33,196 = 23,819 B.t.u. per hr.

Coal $\frac{23,819 \times 3,570}{14,000,000}$ = 6.08 tons per yr.

Oil $\frac{23,819 \times 3,570}{93,600}$ = 908 gals. per yr.

Gas $\frac{23,819 \times 3,570}{401}$ = 212,000 cu. ft. per yr.

or $\frac{23,819 \times 100}{57,015}$ = 41.8% saving in annual fuel costs.

COMPARISON OF DIFFERENT TYPES OF HOUSE INSULATION

Insulation type & thickness	Thermal conductivity of insulation (k)	Total resistance to heat flow		Coefficient of transmission (U)		Annual heating requirement, B.t.u.	Saving per year, B.t.u.	Saving per year, %	Efficiency of insulation, %
		Wall	Roof	Wall	Roof				
None	---	3.736	3.029	0.27	0.033	203,650,000	---	---	---
3-5/8" J-M Home Insulation	0.27	16.248	15.547	0.062	0.064	118,630,000	85,020,000	41.8	78.4
3-5/8" other filling insulation	0.48	10.378	9.671	0.096	0.10	131,600,000	72,050,000	35.4	66.4
1/2" rigid insulation	0.33	5.005	4.298	0.20	0.23	173,750,000	29,900,000	14.7	27.6
1" rigid insulation	0.33	6.520	5.813	0.15	0.17	153,850,000	49,800,000	24.5	45.9
1/2" flexible insulation	0.27	5.413	5.791	0.18	0.17	161,050,000	42,600,000	20.9	39.3
1" flexible insulation	0.27	7.263	7.641	0.14	0.13	146,100,000	57,550,000	28.3	53.1

Note: All resistances shown above are based on conductivity values as listed in Table 2, page 96, A.S.H. & V.E. Guide, 1935.

Summary:

Losses not Influenced by Insulation:

Floor	6,100 B.t.u. per hr.
Window and door	14,509
Infiltration	7,038
Total	28,647 B.t.u. per hr.

Losses Influenced by Insulation:

	Uninsulated	Insulated
Walls	18,468	4,241
Roof	11,900	2,308
	30,368	6,549 B.t.u. per hr.

Total Loss:

Uninsulated: 30,368 + 28,647 = 57,018 B.t.u. per hour
Insulated: 6,549 + 28,647 = 33,196 B.t.u. per hour

Savings due to J-M Home Insulation:

B.t.u. 57,018 - 33,196 = 23,819 B.t.u. per hr.

Coal $\frac{23,819 \times 3,570}{14,000,000} = 6.08$ tons per yr.

Oil $\frac{23,819 \times 3,570}{35,600} = 908$ gals. per yr.

Gas $\frac{23,819 \times 3,570}{401} = 212,000$ cu. ft. per yr.

or $\frac{23,819 \times 100}{57,018} = 41.8\%$ saving in annual fuel costs.

COMPARISON OF DIFFERENT TYPES OF HOUSE INSULATION

Insulation Type & Thickness	Thermal conductivity of insulation (k)	Total resistance to heat flow (R) Ins.	Total	Coefficient of transmission (U) Ins.	Uninsulated	Annual heating requirements, B.t.u.	Saving per year, B.t.u.	Saving per year, %	Efficiency of insulation, %
None	—	6.756	1.029	0.27	0.852	803,440,000	—	—	—
3-5/8" J-M Home Insulation	0.27	16.296	12.569	0.062	0.083	118,400,000	86,020,000	41.8	78.4
3-5/8" rock wool filling insulation	0.28	15.978	12.271	0.082	0.35	121,500,000	72,940,000	38.4	66.4
1/2" rigid insulation	0.25	8.006	4.186	0.20	0.23	172,750,000	30,690,000	16.7	27.6
1" rigid insulation	0.25	8.256	6.436	0.16	0.17	165,600,000	37,840,000	22.5	46.9
1/2" flexible insulation	0.27	8.212	5.987	0.18	0.17	161,000,000	42,600,000	30.9	85.2
1" flexible insulation	0.27	7.956	7.041	0.14	0.12	140,100,000	87,840,000	25.8	85.1

Note: All resistances shown above are based on conductivity values as listed in Table 2, page 36, A.S.H.V. & A.E. Guide, 1938.

JOHNS-MANVILLE Building Materials, Miscellaneous

J-M Home Insulation

Estimating Heat Losses and Savings

DATE March, 1938

(Cancelling sheet dated August, 1932)

4-I-15-X-12 (300-38)

APPROVED.

RADIATION REQUIREMENTS OF AN INSULATED AND UNINSULATED HOUSE

For the purpose of comparing radiation requirements, using various insulation materials, the same house is employed in the following computations as that assumed for "Estimating Heat Losses and Savings Resulting From Use of J-M Home Insulation", which appears in other data sheets. The dimensions of the house are 40' long x 25' wide x 20' high to the eaves. The annual saving in fuel by utilizing J-M Home Insulation is computed in the above estimate to be 6.08 tons of coal, 908 gal. of oil or 212,000 cu. ft. of gas.

The radiation required is figured on the basis of 240 B.t.u. emitted per square foot of radiator surface per hour, with steam at 215 deg. F. and a maintained room temperature of 70 deg. F. While these figures will vary, the proportionate radiation requirements will remain the same.

During the heating season the total heat loss for the uninsulated house at St. Joseph, Mo., was determined in the above data sheets to be 57,015 B.t.u. per hour. This was based on an average outside temperature for the heating season of 40 deg. F. and a temperature difference of 30 deg. F.

In calculating total radiation requirements, however, a base temperature not more than 15 deg. above the lowest recorded temperature for the locality in question is required. In accordance with this established practice, a base temperature of -9 deg. F. is here used, making the temperature difference 79 deg. F.

RADIATION SAVINGS

Insulation type & thickness	Heat loss in B.t.u. per hour	Total radiation required, sq. ft.	Possible saving in radiation due to insulation	
			sq. ft.	percent
None	150,000	625	--	--
3-5/8" J-M Home Insulation	87,250	364	261	41.8
3-5/8" other filling insulation	96,300	403	222	35.5
1/2" rigid insulation	128,000	533	92	14.7
1" rigid insulation	113,300	472	153	24.5
1/2" flexible insulation	118,600	494	131	21.0
1" flexible insulation	107,600	448	177	28.4

The installed cost of J-M Home Insulation necessarily varies, depending on type of construction, location, labor conditions, etc. In computing the following data, the total installed cost for the assumed house is taken to be $645.

A unit cost of $1.25 per square foot of radiation installed is used in figuring the savings shown below. This assumed unit cost is based on the total cost of installed radiators and piping. Due to the fact that in practically all cases it will be necessary to use the same size boiler whether or not the building is insulated, no saving in reduced size of boiler is considered. A standard boiler not smaller in size than required to accomodate the estimated maximum rate of heat delivery must be selected in any case to take care of rapid heating, etc. The cost of the boiler and placing it in the heating system is therefore not included in the above unit cost ($1.25) for radiation.

YEARLY RETURN ON NET COST OF HOME INSULATION

Gross cost of Home Insulation	$645.00
Saving in radiation (261 sq. ft. x $1.25)	326.00
Net cost of investment	$319.00

Annual charges on net cost of insulation:

Depreciation, based on 25-year life $319.00 x .04 = $12.75

Average annual interest at 6% on net cost of insulation $319.00 x $\frac{.06}{2} \times \frac{26}{25}$ = 9.95

Total annual charges $22.70

Coal cost per ton	$8.00	$12.00	$15.00
Annual saving in fuel cost (6.08 tons per yr.)	48.65	73.00	91.20
Total annual charges	22.70	22.70	22.70
Net annual saving	25.95	50.30	68.50
Net annual return on net cost of insulation	8.1%	15.8%	21.5%

Oil cost per gallon	$0.05	$0.075	$0.10
Annual saving in fuel cost (908 gal. per year)	45.40	68.10	90.80
Total annual charges	22.70	22.70	22.70
Net annual saving	22.70	45.40	68.10
Net annual return on net cost of insulation	7.1%	14.2%	21.4%

Gas cost per 1000 cu. ft.	$0.50	$0.75	$1.00
Annual saving in fuel cost (212,000 cu. ft. per year)	106.00	159.00	212.00
Total annual charges	22.70	22.70	22.70
Net annual saving	83.30	136.30	189.30
Net annual return on net cost of insulation	26.1%	42.8%	59.3%

A unit cost of $1.25 per square foot of radiation installed is used in figuring the savings shown below. This assumed unit cost is based on the total cost of installed radiators and piping. Due to the fact that in practically all cases it will be necessary to use the same size boiler whether or not the building is insulated, no saving in reduced size of boiler is considered. A standard boiler not smaller in size than required to accomodate the estimated maximum rate of heat delivery must be selected in any case to take care of rapid heating, etc. The cost of the boiler and placing it in the heating system is therefore not included in the above unit cost ($1.25) for radiation.

YEARLY RETURN ON NET COST OF HOME INSULATION

Gross cost of Home Insulation	$845.00
Saving in radiation (281 sq. ft. x $1.25)	336.00
Net cost of investment	$509.00

Annual charges on net cost of insulation:
Depreciation, based on 25-year life $509.00 x .04 = $12.76
Average annual interest at 8% on
net cost of insulation $509.00 x .08 x 26/52 = 8.05

Total annual charges $20.81

	Coal cost per ton	$8.00	$12.00	$16.00
	Annual saving in fuel cost (5.08 tons per yr.)	$8.85	$13.00	$17.20
	Total annual charges	$20.81	$20.81	$20.81
	Net annual saving	$12.05	$7.81	$3.61
	Net annual return on net cost of insulation	2.4%	1.5%	.7%

	Oil cost per gallon	$0.05	$0.075	$0.10
	Annual saving in fuel cost (908 gal. per year)	$45.40	$68.10	$90.80
	Total annual charges	$20.81	$20.81	$20.81
	Net annual saving	$24.59	$47.29	$69.99
	Net annual return on net cost of insulation	4.8%	9.3%	13.8%

	Gas cost per 1000 cu. ft.	$0.50	$0.75	$1.00
	Annual saving in fuel cost (212,000 cu. ft. per year)	$106.00	$159.00	$212.00
	Total annual charges	$20.81	$20.81	$20.81
	Net annual saving	$85.19	$138.19	$191.19
	Net annual return on net cost of insulation	16.7%	27.1%	37.6%

HEAT LOSSES THROUGH VARIOUS BUILDING WALL, CEILING AND ROOF CONSTRUCTIONS

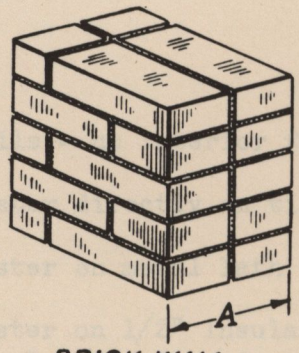
The heat losses for various types of construction given in the following tables are presented as values of (U). This coefficient is termed thermal transmittance and is the amount of heat expressed in B.t.u. transmitted in one hour per square foot of the construction for a difference in temperature of 1 deg. F. between the air on the two sides, based on outside wind velocity of 15 miles per hour.

The figures are taken from published values given in the A.S.H. & V.E. Guide, 1933, excepting those specifying Home Insulation. The transmittances here given for Home Insulation (Rock Wool) are based on a density of 10 lb. per cubic foot (this being the approximate density at which the material is installed), whereas the figures given in the Guide are based on a density of approximately 21 lb. per cubic foot.

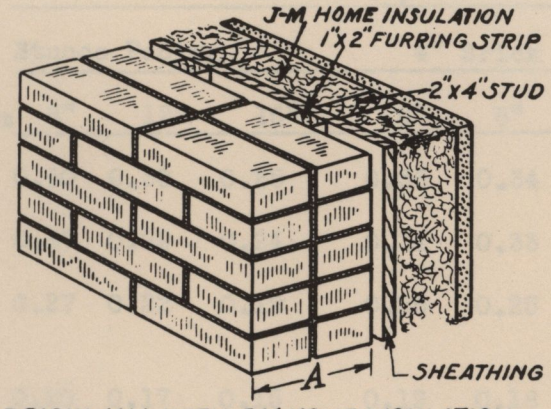
Still air conditions will cause a somewhat lower loss through uninsulated constructions. However, due to the relatively small ratio of the value of the outside surface resistance to the over-all resistance, this factor is of negligible importance in the case of insulated constructions.

The following unit heat losses may be used as the basis of heat loss estimates such as appear in other Home Insulation Data Sheets.

Brick Walls:



BRICK WALL



BRICK WALL WITH J-M HOME INSULATION

A = thickness of brickwork

	Heat Losses (U)		
A =	8"	12"	16"
Plain Walls - no finish	0.50	0.36	0.28
1/2" Plaster on brick	0.46	0.34	0.27
3/4" Plaster on metal lath - furred	0.32	0.25	0.21
1/2" Plaster on Insulating Board 1/2" thick - over furring	0.22	0.19	0.16
1/2" Plaster on Insulating Board 1" thick over furring	0.16	0.14	0.13
3/4" Plaster on metal lath - furred nominally 2" and filled with 1-5/8" of Home Insulation	0.109	0.100	0.093
3/4" Plaster on metal lath - furred nominally 4" and filled with 3-5/8" Home Insulation	0.060	0.058	0.055

JOHNS-MANVILLE Building Materials, Miscellaneous

Home Insulation
Heat Losses Through Various Building Constructions

APPROVED:

DATE August, 1933

(Cancelling sheets 4-I-13-X-15 to 15-C, dated Sept., 1, 1930)

4-I-13-X-15 (BMM-87)

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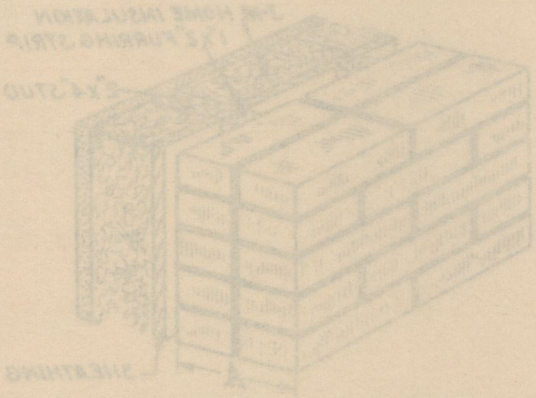

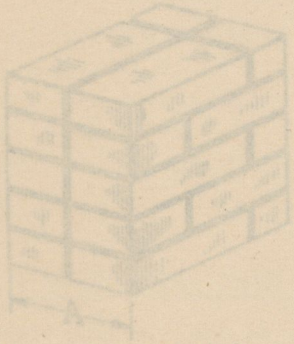

A = Thickness of brickwork

A = 8"	Heat losses (U) 12"	16"
0.60	0.38	0.28
0.46	0.34	0.27
0.32	0.28	0.21
0.22	0.18	0.16
0.18	0.14	0.13
0.109	0.100	0.095
0.080	0.068	0.056

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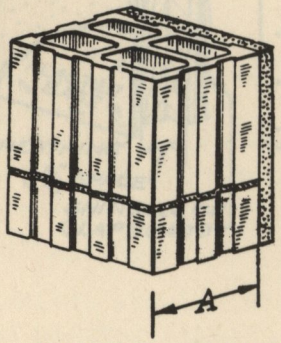
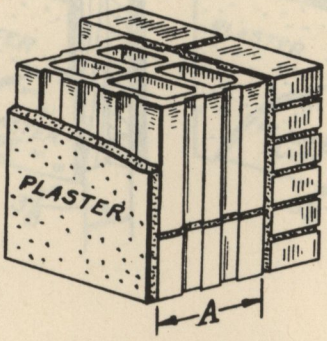
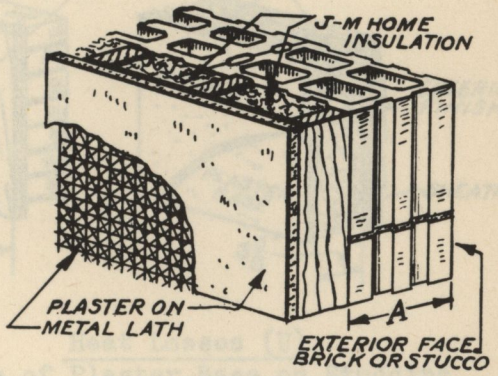
HOLLOW TILE WALLS:



STUCCO FACING



BRICK FACING



WITH J-M HOME INSULATION

A = Thickness of Hollow Tile

	Heat Losses (U)					
	Stucco Facing			4" Brick Facing		
A =	8"	12"	16"	6"	8"	10"
Plain Walls - no interior finish	0.40	0.30	0.25	0.36	0.34	0.34
1/2" Plaster directly on tile	0.37	0.29	0.24	0.34	0.33	0.32
3/4" Plaster on metal lath - furred	0.27	0.22	0.19	0.25	0.25	0.24
1/2" Plaster on 1/2" Insulating Board - furred	0.20	0.17	0.15	0.19	0.18	0.18
1/2" Plaster on 1" Insulating Board - furred	0.15	0.13	0.12	0.16	0.14	0.14
3/4" Plaster on metal lath - furred nominally 2" and filled with 1-5/8" Home Insulation	0.114	0.104	0.097	0.110	0.109	0.109
3/4" Plaster on metal lath - furred nominally 4" and filled with 3-5/8" Home Insulation	0.062	0.059	0.056	0.061	0.060	0.060

JOHNS-MANVILLE Building Materials, Miscellaneous

DATE August, 1933

Home Insulation
Heat Losses Through Various Building Constructions

APPROVED:

4-I-13-X-16 (BMM-88)

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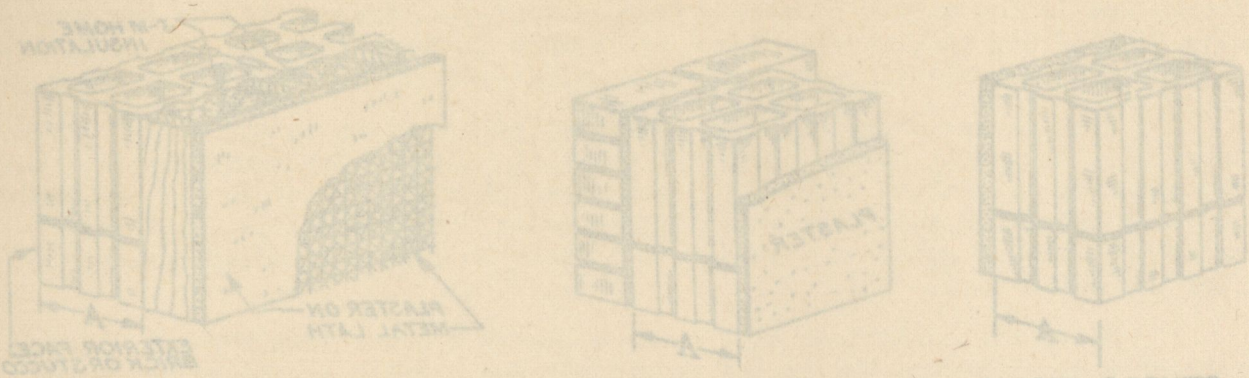
HOLLOW TILE WALLS:

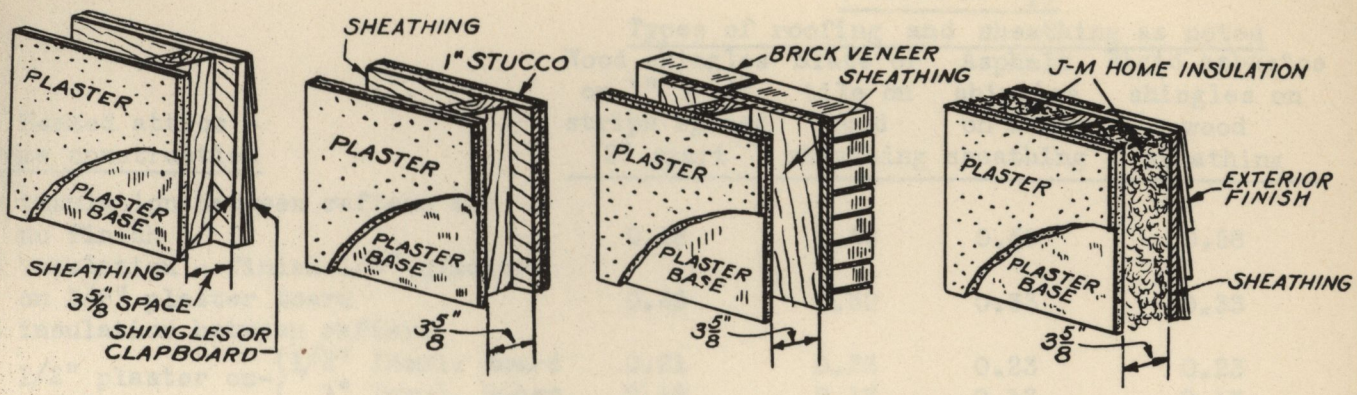


A = Thickness of Hollow Tile

Heat Losses (U)

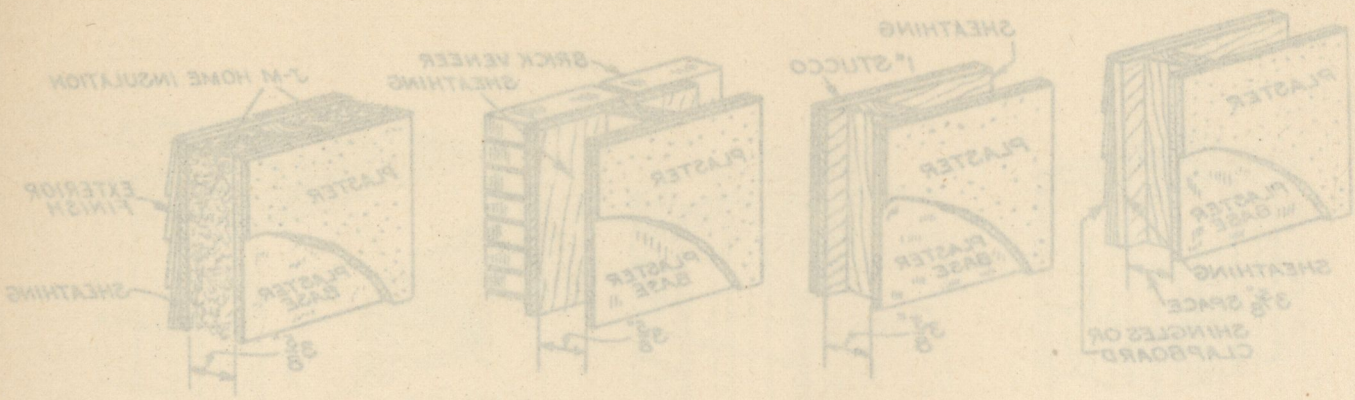
A =	Stucco Facing 8"	12"	16"	4" Brick Facing 8"	10"
Plain Walls - no interior finish	0.40	0.30	0.25	0.36	0.34	0.34
1/2" Plaster directly on tile	0.37	0.29	0.24	0.34	0.33	0.32
3/4" Plaster on metal lath - furred	0.27	0.22	0.19	0.26	0.25	0.24
1/2" Plaster on 1/2" Insulating Board - furred	0.20	0.17	0.15	0.19	0.18	0.18
1/2" Plaster on 1" Insulating Board - furred	0.18	0.15	0.13	0.16	0.14	0.14
3/4" Plaster on metal lath - furred nominally 3" and filled with 1-5/8" Home Insulation	0.114	0.104	0.097	0.110	0.109	0.109
3/4" Plaster on metal lath - furred nominally 4" and filled with 3-5/8" Home Insulation	0.082	0.079	0.068	0.081	0.080	0.080

FRAME WALLS:



Interior finish assumed to be gypsum plaster in all cases	Heat Losses (U) Type of Plaster Base on Studding: Wood Lath	Metal Lath	Plaster Board	Insulating Board 1/2"	1"
FRAME WALLS WITH WOOD SHINGLES OR CLAPBOARD FACING (1" WOOD SHEATHING)					
Construction as noted and shown with no other insulation	0.25	0.26	0.25	0.19	0.15
With 1" blanket type insulation "tucked in"	0.128	0.131	0.128	0.111	0.095
With other filling insulations (k=0.48)	0.093	0.095	0.093	0.083	0.074
With 3-5/8" Home Insulation fill	0.060	0.061	0.060	0.056	0.052
FRAME WALLS WITH 1" STUCCO FACING (1" WOOD SHEATHING)					
Construction as noted and shown with no other insulation	0.30	0.31	0.30	0.22	0.16
With 1" blanket type insulation "tucked in"	0.141	0.145	0.141	0.120	0.102
With other filling insulations (k=0.48)	0.100	0.102	0.100	0.089	0.078
With 3-5/8" Home Insulation fill	0.063	0.063	0.063	0.058	0.054
FRAME WALLS WITH 4" BRICK FACING (1" WOOD SHEATHING)					
Construction as noted and shown with no other insulation	0.27	0.28	0.27	0.20	0.15
With 1" blanket type insulation "tucked in"	0.135	0.138	0.135	0.115	0.098
With other filling insulations (k=0.48)	0.096	0.098	0.096	0.086	0.076
With 3-5/8" Home Insulation fill	0.062	0.062	0.062	0.057	0.053

FRAME WALLS:



Interior finish assumed to be Gypsum plaster in all cases	Heat Losses (U) Type of Plaster Base on Studding			
	Wood Lath	Metal Lath	Plaster Board	Insulating Board 1/2" 1"
FRAME WALLS WITH WOOD SHINGLES OR CLAPBOARD FACING (1" WOOD SHEATHING)				
Construction as noted and shown with no other insulation	0.26	0.26	0.25	0.19 0.15
With 1" blanket type insulation "tucked in"	0.128	0.131	0.128	0.111 0.095
With other filling insulations (K=0.48)	0.093	0.096	0.093	0.085 0.074
With 3-5/8" Home Insulation fill	0.080	0.081	0.080	0.076 0.062
FRAME WALLS WITH 1" STUCCO FACING (1" WOOD SHEATHING)				
Construction as noted and shown with no other insulation	0.30	0.31	0.30	0.22 0.16
With 1" blanket type insulation "tucked in"	0.141	0.145	0.141	0.120 0.102
With other filling insulations (K=0.48)	0.100	0.102	0.100	0.089 0.078
With 3-5/8" Home Insulation fill	0.085	0.085	0.085	0.078 0.064
FRAME WALLS WITH 4" BRICK FACING (1" WOOD SHEATHING)				
Construction as noted and shown with no other insulation	0.27	0.28	0.27	0.20 0.16
With 1" blanket type insulation "tucked in"	0.138	0.138	0.135	0.115 0.098
With other filling insulations (K=0.48)	0.096	0.098	0.096	0.086 0.076
With 3-5/8" Home Insulation fill	0.082	0.082	0.082	0.057 0.058

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ROOF CONSTRUCTIONS:

Heated attics - Frame construction	(Values of U_r) Types of roofing and sheathing as noted: Wood shingles on 1" x 4" strips spaced 2" apart	Slate or tile on wood sheathing	Asphalt shingles on wood sheathing	Rigid asbestos shingles on wood sheathing
No insulation between rafters and no finish	0.48	0.56	0.59	0.58
No insulation - finish 1/2" plaster on 3/8" plaster board	0.29	0.32	0.33	0.33
No insulation between rafters 1/2" plaster on- (1/2" Insul. Board	0.21	0.23	0.23	0.23
(1" Insul. Board	0.16	0.17	0.17	0.17
1" flexible insulation, metal lath and plaster finish	0.13	0.13	0.13	0.14
3-5/8" other filling insulation (k=0.48) between rafters, metal lath and plaster finish	0.097	0.100	0.105	0.105
3-5/8" Home Insulation fill - metal lath and plaster finish	0.064	0.065	0.065	0.065

NOTE: In the above table the last two columns are specially computed to apply more accurately to asphalt and asbestos shingles.

When the attic is unheated, the overall loss from heated top story through ceiling construction and the roof may be found by using the following equation - $U = \frac{U_r \times U_c}{nU_r + U_c}$. (Page 27, A.S.H. & V.E. Guide, 1933) Where U is the overall heat transmission coefficient per hour per deg. F. temperature difference between air under ceiling and air on outside of roof per square foot of roof area; U_r = the coefficient of heat loss through the roof; and U_c = coefficient through the ceiling. $n = \frac{\text{area of roof}}{\text{area of ceiling}}$ This equation may be derived from equations stating that the heat loss through roof equals loss through ceiling and either one equals the overall loss.

FRAME CEILINGS:

Type of Ceiling	(Value of U_c) Flooring over Ceiling Joists: No flooring	Yellow Pine	Maple or Oak over Yellow Pine
No ceiling finish	----	0.46	0.34
Metal lath and 3/4" plaster	0.69	0.30	0.25
Wood lath and plaster	0.62	0.28	0.24
3/8" plaster board and 1/2" plaster	0.61	0.28	0.24
1/2" insulating board and 1/2" plaster	0.35	0.21	0.18
1" insulating board and 1/2" plaster	0.23	0.16	0.14
1" flexible insulation* - lath and plaster	0.16	0.12	0.11
4" other filling insulations* (k=0.48) - lath and plaster	0.101	0.085	0.080
4" Home Insulation fill* - lath and plaster	0.061	0.055	0.053

* Where lath and plaster does not comprise the larger part of the resistance to heat flow, the difference between wood lath and plaster and metal lath and plaster is negligible.

JOHNS-MANVILLE Building Materials, Miscellaneous

DATE August, 1933

Home Insulation
Heat Losses Through Various Building Constructions

APPROVED:

4-I-13-X-18 (BMM-90)

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Johns-Manville

Executive Offices: 22 East 40th Street, New York

