

TECHNICAL BOOK

KIMSUL

REG. U.S. & CAN. PAT. OFF.

INSULATION

A.I.A.
FILE NO. **37B**

THERMAL EFFICIENCY
page 7

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page 9

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page 12

KIMSUL expands to 5 times its packaged length



A Section of a roll of KIMSUL unexpanded, as packaged to facilitate handling, storage and shipment.



Same piece expanded 5 times its packaged length, ready to be installed.

Drawing below, reproduced from an actual photograph, shows the 150-foot continuous length of 16-inch KIMSUL that is packaged in one easily handled roll of KIMSUL.



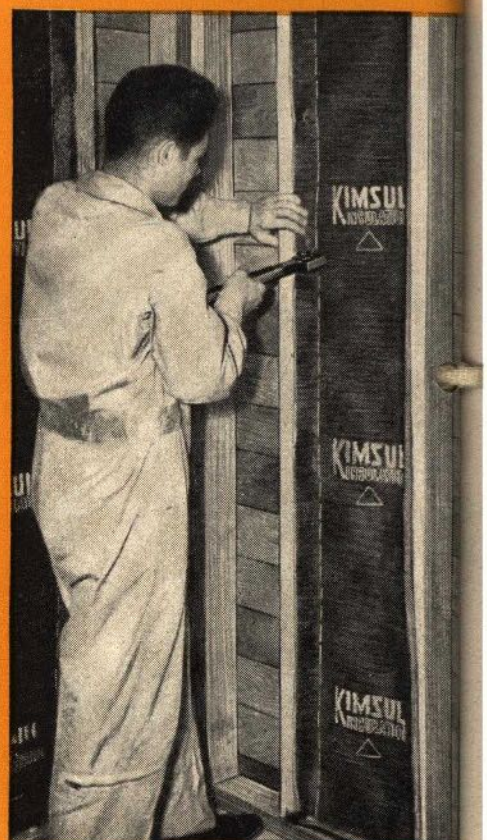
Step 1—Attach with fiber strip at top.



Step 2—Place another strip on other end.



Step 3—Expand blanket until stitching is taut and nail or staple through strip at bottom.



Step 4—Extra-wide blanket permits fastening along edges. Use same procedure for floors and ceilings.



150 FEET

KIMSUL*

is basically
different

KIMSUL* is unique among building insulations and acoustical materials because it is made of many individual plies—each one a continuous separate layer of soft, clean, creped, asphalt-treated cellulose fibers. Each ply is controlled carefully in manufacture both as to thickness and crepe. The result is a flexible blanket, inherently uniform in thickness—an important factor in a thermal or sound insulating material.

The KIMSUL plies and the creped PYROGARD* cover are held together with rows of strong stitching. The entire assembly is permanently resistant to fire, vermin and mold.

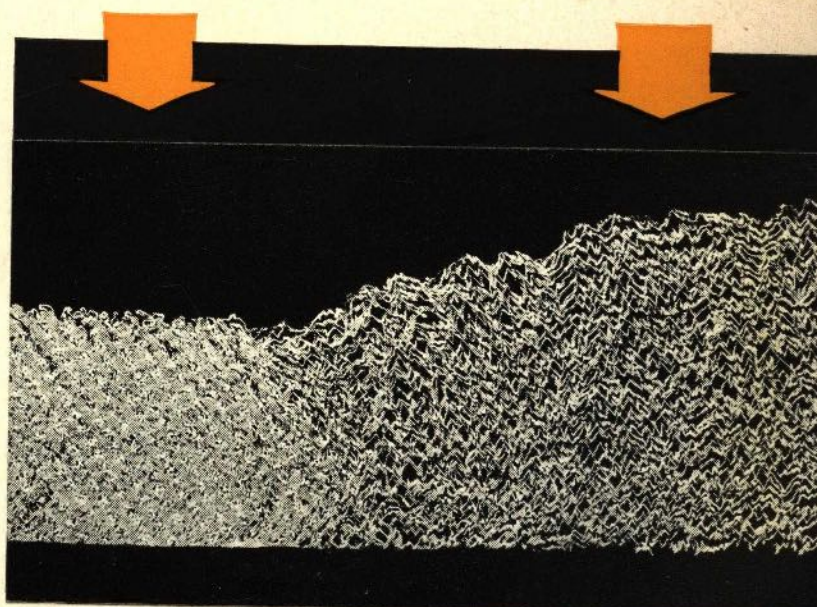
To overcome the disadvantages of extreme bulk and liability to damage, common to insulating materials, KIMSUL is reduced to 1/5th its installed volume for shipment and storage. Small, high-density rolls are easy to handle and resist damage. On the job, the KIMSUL blanket is expanded in installation. The stitching controls the expansion to the density of maximum efficiency.

UNEXPANDED

KIMSUL is packaged compressed in this form for easier shipment, handling and storage—an exclusive advantage.

EXPANDED

Note how the multi-ply construction provides high insulating value when the blanket is expanded for installation.



Edge view (actual size)
Double-Thick KIMSUL insulation



Scientific control



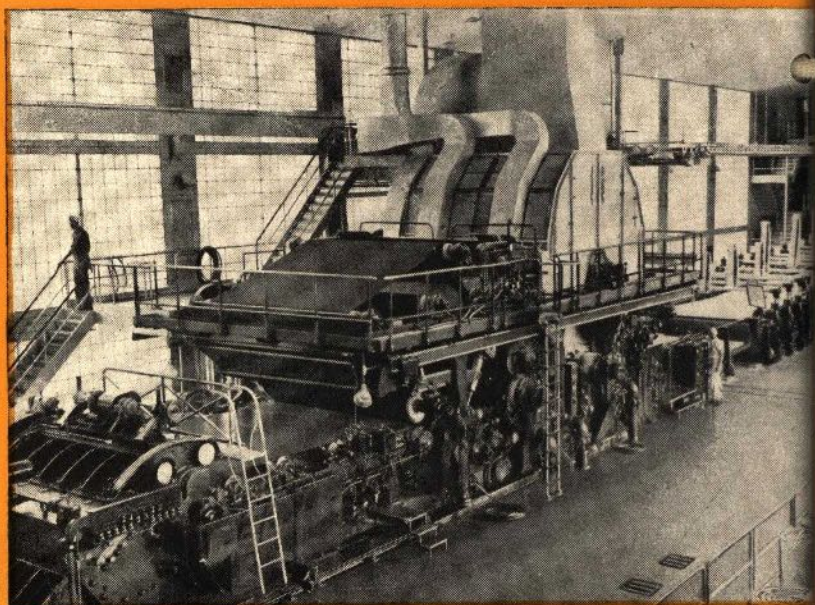
Research and Development — Equal to the best facilities in existence, the equipment in these buildings makes possible exact determination of KIMSUL performance as well as the investigation of new and improved methods and materials. Extensive physical, chemical and experimental laboratories are housed in a separate building at Neenah, Wisconsin, and employ the services of a large staff of scientists and technicians.

Manufacture — Engineering and operating skill plus precision equipment constitute the completely integrated Kimberly-Clark manufacturing operation that transfers tested scientific design from laboratory to high production machines. (See right). This modern equipment transforms cellulose fibers into asphalt-treated plies of uniform substance, thickness and crepe. Thus the completed blanket, composed of many individual plies, is precisely controlled to meet predetermined scientific standards for effective insulation.

Customer Acceptance Laboratory — Completely independent of the manufacturing mills, this laboratory takes many samples each day for critical test and examination from the customer's viewpoint. These Customer Acceptance examinations include tests of reaction to temperature, humidity, fire, mold, and age; installation tests; and checks on dimensions, appearance, packaging, and other factors. These tests are entirely separate from the many routine mill laboratory tests used to control production.



Research and Development Laboratories employ 150 scientists and technicians.



Manufacture of KIMSUL requires operating skill and high speed precision machines.



Customer Acceptance Laboratory assures the customer of uniformly high quality at all times.

Insulate for comfort

Engineering Reasons

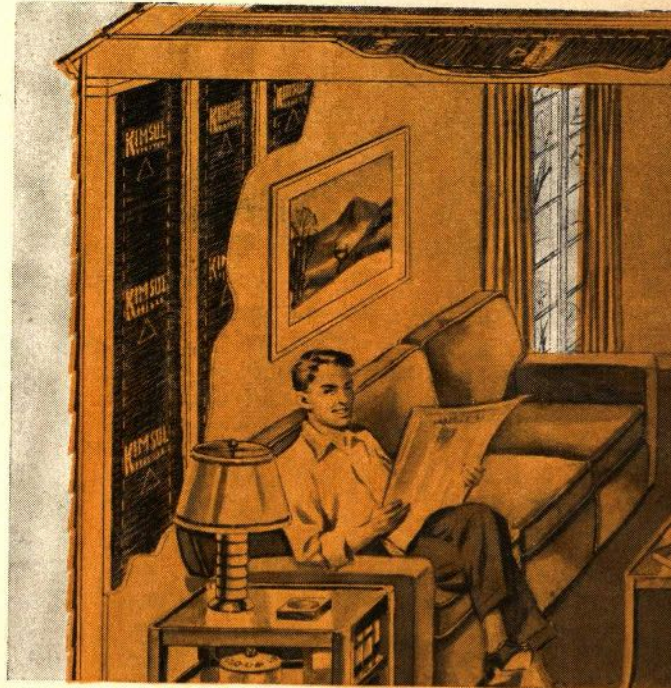
Radiant Heat Loss is governed by surface temperatures. In a room heated by radiant panels or by any other means, low wall surface temperatures drain radiant heat energy from the body. This causes a feeling of coolness and uneven heat, and is especially noticeable in close proximity to cool walls or windows. In addition to insulating all exposed walls, ceilings and floors, the windows should be double glazed. Heating control is improved by complete insulation.

Air Stratification and Drafts—Cold ceilings, walls, and floors cool the room air which touches these surfaces. This cooled air, as it settles down toward the floor, is a draft. As a cool layer of air forms on the floor, the warmer air is forced upward, and the room suffers from stratification. A cold floor (with no heat below) will stay cold and uncomfortable without insulation.

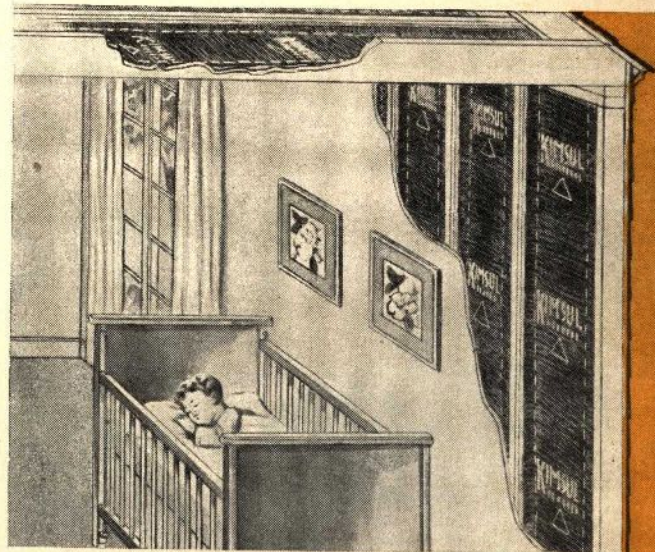
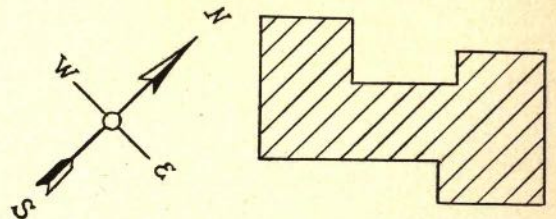
Variable Exposure—Heating systems are designed to take account of average anticipated exposure to cold winds and other extremes. This can only approximate satisfactory comfort unless the exposed walls, ceilings and floors are insulated to minimize the effects of variable exposure, changing weather.

Coolness Balance—In hot weather the achievement of comfortable conditions within a structure, without using refrigeration, requires that the coolness of the night be retained through the following day, or at least that the interior be protected from the heat of the day. For maximum results, all the following measures must be utilized: (1) low density insulation of not too great thickness, (2) wall insulation, (3) attic ventilation night and day, (4) increased ventilation of the building interior at night, and (5) window protection from the sun's heat.

"Radiant Coolness" is governed by surface temperatures. Just as cool walls and ceilings radiate unwanted coolness in the winter, warm walls "radiate" unwanted warmth in the summer. When air temperatures within a room are already at a maximum for comfort, the radiant heat added by warm surrounding surfaces (uninsulated walls and ceilings) causes discomfort by raising the effective temperature above the limits of the comfort zone.



WINTER CONDITIONS



SUMMER CONDITIONS

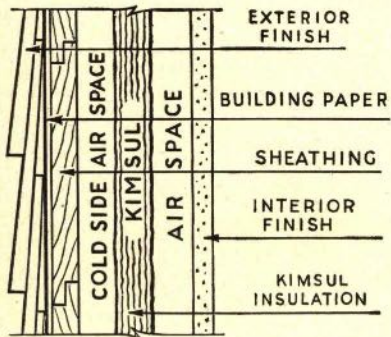
Correct Design Avoids Trouble

Problems

Heat Lag in hot weather may nullify the benefits of insulating by carrying over, within the structure of a house, the heat of the preceding day. In other words, such construction cannot make full use of lower night temperatures to "pre-cool" for the following day.

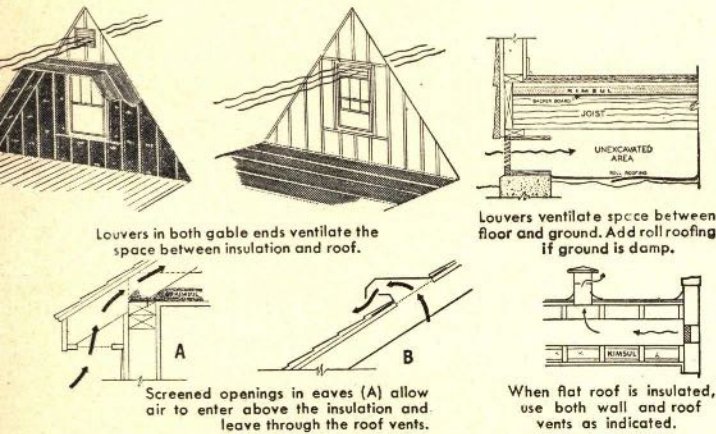
Major causes are: (1) insulation too thick and of too great weight per cubic foot, and (2) lack of ventilation between insulation and roof. Whenever possible the interior of buildings should be ventilated by positive means at night.

Condensation may occur in walls and under roofs during prolonged cold weather, resulting in paint failures, rot, etc. It is invited by: (1) excessive humidity within the building, (2) tight construction with reduced heat losses, (3) use of vapor seals as exterior building paper, and (4) lack of breathing spaces in walls and absence of ventilation in attics. Condensation is but moisture condensing out of the air and occurs on the first surface available which is cold enough to be below the dew point of this air. A general rule is to make the vapor resistance of the warm (interior) side of the wall three times greater than the cold (exterior) side.



Solutions

Air Spaces in Walls—Although there are few cases of severe condensation, the air space for ventilation is at all times desirable. The provision of this air space is a prime requisite for correct insulation design, and will reduce, if not eliminate, all but serious condensation troubles. Care should be taken to use a vapor-permeable building paper—not a vapor seal—under the exterior finish. For Vapor Seal uses, see paragraph below.



Ventilation in Attics and Floors—Ventilation should never be omitted whenever insulation is installed. In hot weather, it avoids excessively high temperatures. In cold weather, it allows water vapor to escape, thereby reducing the possibility of condensation. Use approximately one square foot of louver area per 300 square feet of ceiling area, distributed in at least two louvers.

Water Vapor originates by evaporation within the building and generally causes trouble by condensing on windows and within walls and roof construction when natural air change does not carry it off. Relief may be obtained by: (1) increasing the ventilation where water vapor originates, as in cooking, washing, clothes drying, bathing, and (2) ventilating with outside air the spaces in the construction where condensation can occur, or (3) by use of vapor seal.

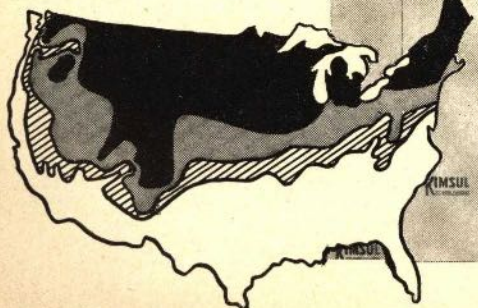
Vapor seal should be used with Commercial Thick KIMSUL in black area only; with Standard Thick KIMSUL in black and gray areas; and with Double Thick KIMSUL in black, gray, and lined areas.



Vapor Seal—In addition to ventilation described above, in colder climates or where high humidity is present within the building, a vapor seal should be used to reduce the flow of water vapor through the walls and unventilated ceilings. It must be installed on the warm side of the insulation—i.e., between the insulation and the inside of the building.

Photograph at left shows KIMSUL Vapor Seal Paper 50 inches wide being installed over framing members, directly beneath plaster base or wallboard. Joints occur only at framing. Two coat lead and oil, enamel, rubber base, asphalt, or aluminum paints, also metal foil backed lath, are good vapor seals.

A vapor seal (vapor barrier) should have a water vapor permeability not exceeding one grain per square foot per hour per inch of mercury, difference in vapor pressure.



Walls, ceilings, floors—all need insulation

Where the Heat Goes

- Walls . . . 38%
- Ceilings, Roof . 25%
- Glass, Doors, etc. 21%
- Air infiltration . 14%
- Floors . . . 2%

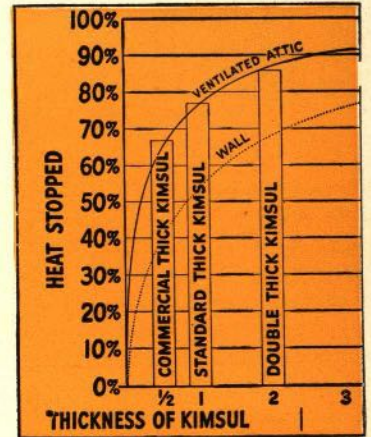
Heat loss distribution, 2-story uninsulated house with storm sash, heated basement—A. S. H. & V. E. 1948 Guide, Page 252.

Where to Insulate

All the heat from the furnace gets out somewhere. Usual construction allows heat to flow through roof faster than walls. But because the wall area is greater than the ceiling area, the greatest heat loss, without insulation, is actually through the walls (38%). Insulate all exterior walls, also all floors, ceilings, or walls which are exposed to unheated areas.

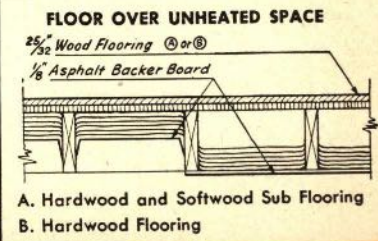
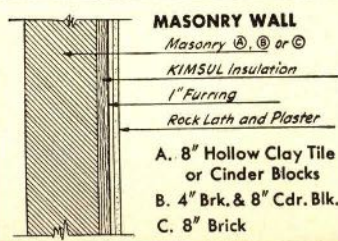
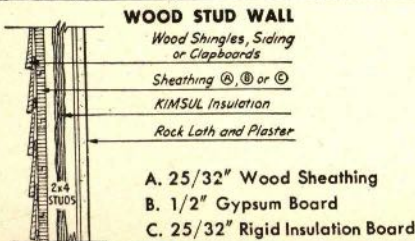
1/2", 1", 2" thicknesses—plus air spaces

Insulation slows the flow of heat but does not stop it entirely. Curves at right indicate that thicknesses greater than Double Thick KIMSUL probably exceed the economic thickness. Little additional reduction will result from greater thickness. The first increment of insulation does the most work and pays for itself quickest.



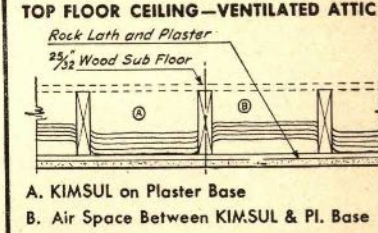
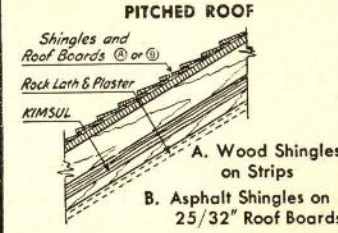
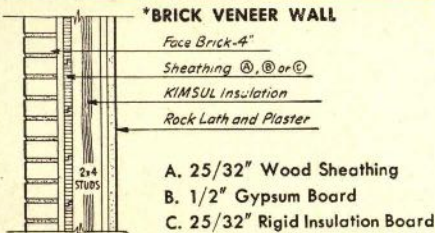
"U" FACTORS — HEAT FLOW THROUGH GIVEN CONSTRUCTIONS

KIMSUL FACTORS
 $k = 0.27$
 $C'' =$
 Commercial Thick 0.540
 Standard Thick . 0.270
 Double Thick . 0.135
 * Authority J. C. Peebles, Armour Institute.



KIMSUL THICKNESS SPECIFICATION (APPROX. DIMENSIONS)	KIMSUL BETWEEN STUDS			KIMSUL OVER STUDS			KIMSUL OVER OR BETWEEN FURRING			NO AIR SPACE		AIR SPACE	
	A	B	C	A	B	C	A	B	C	A	B	A	B
	U %	U %	U %	U %	U %	U %	U %	U %	U %	U %	U %	U %	U %
NO INSULATION	.25	.31	.19	.25	.31	.19	.27	.24	.30	.30	.43	.30	.43
COMMERCIAL THICK 1/2"	.15	.40	.17	.17	.32	.14	.18	.33	.17	.19	.37	.19	.37
STANDARD THICK 1"	.12	.52	.13	.13	.48	.11	.15	.44	.14	.14	.53	.16	.63
DOUBLE THICK 2"	.08	.68	.09	.07	.63	—	—	—	—	.09	.70	.10	.77

Foot Notes:
 * Small air space and mortar between paper and brick veneer neglected.
 ** Based on two air spaces.



KIMSUL THICKNESS SPECIFICATION (APPROX. DIMENSIONS)	KIMSUL BETWEEN STUDS			KIMSUL OVER STUDS			NO PLASTER		**ROCK LATH AND PLASTER		NO SUB FLOOR		SUB FLOOR	
	A	B	C	A	B	C	A	B	A	B	A	B	A	B
	U %	U %	U %	U %	U %	U %	U %	U %	U %	U %	U %	U %	U %	U %
NO INSULATION	.27	.35	.21	.27	.35	.21	.46	.56	.29	.32	.75	.75	.32	.32
COMMERCIAL THICK 1/2"	.15	.44	.18	.18	.33	.15	.20	.57	.16	.45	.31	.59	.20	.38
STANDARD THICK 1"	.12	.56	.13	.13	.52	.12	.15	.67	.12	.59	.20	.73	.15	.53
DOUBLE THICK 2"	.08	.70	.09	.08	.62	—	.10	.78	.08	.72	.11	.85	.10	.69

DEFINITIONS:
U—Overall coefficient of heat transmission (thermal transmittance) in Btu/hr./sq. ft. of assembled structural section per/°F. diff. in the temperature on exposed faces.

"k"—Thermal conductivity of homogeneous material in Btu/hr./sq. ft./in./°F diff.
%—Percent of heat transfer stopped=
 $\frac{U \text{ (not insulated)} - (U \text{ insulated})}{U \text{ (not insulated)}} \times 100$

NOTES: All calculations carried to second decimal only. All calculations are based on recommended conductivities for computing heat transmission coefficients as published in the A.S.H.V.E. Guide for 1947. Coefficients may be used with sufficient accuracy for plaster on wood or metal lath.

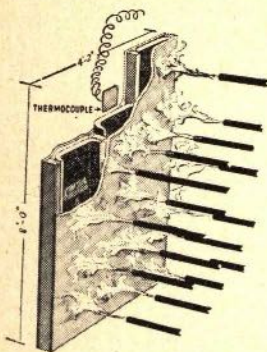


Flexible—fits into corners, tucks behind pipes, electrical wiring and other "tight spots". No areas unprotected.

Clean—no sharp particles to irritate, nothing to sift; stitched ply construction prevents settling or sagging.

Caulkable—one ply or many plies may be compressed to high density in narrow or wide joints, sealing out cold air and sound. KIMSUL asphalt-treated wood fiber does not break up during caulking or tamping operation.

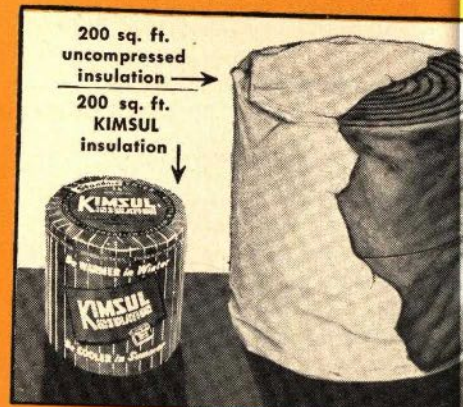
Continuous, no joints—workmanship determines the effective efficiency of an insulation job. Positive end attachment, no intermediate joints, uniform ply construction, and extra blanket width—assure a good job.



**UNDERWRITERS
A. S. T. M.
FIRE TEST**

Flames in a gas fired furnace play directly on surface of test panel, reaching temperatures as high as 1700° F.

	TONS OF COAL USED PER SEASON	TONS SAVED PER SEASON
No Insulation	12.1	—
Commercial Thick	8.0	4.1
Standard Thick	7.1	5.0
Double Thick	6.4	5.7
KIMSUL in Walls and Ceilings		
Commercial Thick in Walls	7.5	4.6
Standard Thick in Ceilings	7.0	5.1
Commercial Thick in Walls	6.7	5.4
Double Thick in Ceilings	6.7	5.4
KIMSUL in Ceilings only		
Commercial Thick	9.1	3.0
Standard Thick	8.5	3.6
Double Thick	8.1	4.0



Fire-Resistant—Special permanent chemical treatment makes KIMSUL resist fire. No insulating material can make a wood frame building fire-proof, but insulation should never increase the hazard of fire.

Objective: Comfort—in winter, due to warmer surrounding surfaces of walls, ceilings and floors; in summer, due to protection from excessive heat.

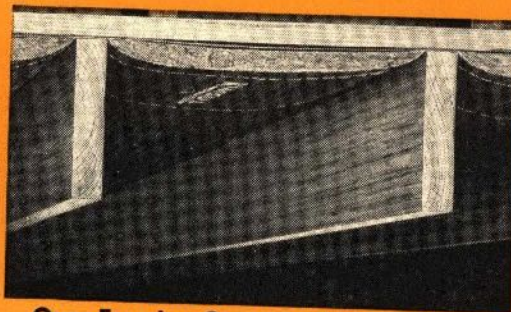
Attendant Benefit: Fuel Saving—as shown above for a one-story Chicago residence.

Small Storage Space—Easy Handling
KIMSUL shipping package is small, tough—1/5th installed volume.

Other packages are necessarily bulky, hard to carry and store, easily damaged.



Insulated Fastening Edge—KIMSUL blankets are extra wide to provide fully insulated fastening edges, and to insure completely filling spaces where framing may be slightly off center.



Over-Framing Compressibility—KIMSUL insulation, in Standard and Commercial Thicknesses, may be easily compressed over framing members. Especially valuable for 48" wide KIMSUL—suitable for mass or prefabricated construction.



PYROGARD fire-resistant cover—(exclusive KIMSUL feature) prevents flame-spread. Insulation covers and wrappers customarily used are highly flammable and constitute a hazard, regardless of the material used for insulation.



Many-Layer, Stitched—Each ply is continuous and separate; all are held together at the density of maximum efficiency by strong stitching. No heat leaking thin spots, no money-wasting thick spots in the KIMSUL blanket.

LIGHT WEIGHT—1.4 lb. per cubic foot. Standard Thick KIMSUL weighs only 115 lbs. per 1000 square feet.

MOISTURE-RESISTANT—Asphalt treatment of each ply sheds water.

RESISTS MOLD, ROT, VERMIN—The materials of which KIMSUL is made offer no subsistence to vermin or insects. Special chemical treatment resists mold and fungus.

ACOUSTICAL USES—See pages 10-11.

"k" FACTOR—0.27 Btu/sq.ft./hr./°F.



Any Width, Any Length—It's easy to cut exact lengths or narrow widths. Avoids muss and fuss. Workmen do a fast, neat job—with KIMSUL.

Specifications

Typical Architectural Specifications

THERMAL

KIMSUL insulation is acceptable under U. S. Government Federal Specification HH-1-571a.

Insulation: All exterior walls and all ceilings, floors, and walls exposed to the roof, overhangs, unexcavated spaces or to other unheated areas shall be insulated with (Commercial Thick—Standard Thick—Double Thick) KIMSUL blanket insulation as manufactured by Kimberly-Clark Corporation, Neenah, Wisconsin. Insulation shall be installed in accordance with the manufacturer's instructions. All spaces around window and door openings in the exterior walls are to be tightly caulked with KIMSUL.

Vapor Seal (when required): Exterior walls, and walls, floors and ceilings exposed to unheated and unventilated areas shall be vapor sealed to prevent condensation. Vapor seal shall be applied to warm side of the construction, using a vapor seal paper consisting of not less than a 50-lb. continuous asphalt film faced on both sides with not less than a 30-lb. Kraft paper, or using other vapor seal, such as paint or special lath with a minimum permeability of one grain per square foot per hour per inch of mercury difference in vapor pressure. All joints should occur at framing members and be overlapped 2" and the vapor seal paper installed so joints run parallel to and over the framing members. The vapor seal paper shall run out onto the floor and ceiling 6" to 8".

Ventilation: All attic spaces and crawl spaces shall be ventilated with two or more louvers arranged to provide cross ventilation with free area of at least one square foot for every 300 square feet of exposed interior surface.

COLD-STORAGE CONSTRUCTION. For details see Application Data Sheet No. 11, published by Kimberly-Clark Corp.

ACOUSTICAL

(See pages 10-11)

Sound Deadening: All sound resisting partitions, floors, and ceilings shall be of the (independent support-cushioned support) type exactly as indicated in the drawings with (Commercial Thick—Standard Thick) KIMSUL blanket insulation as manufactured by the Kimberly-Clark Corporation, Neenah, Wisconsin. Insulation shall be installed in accordance with the manufacturer's instructions.

Care shall be taken to avoid all unnecessary contact between one face of the wall and the other. All joints and cracks shall be tightly filled with compressed KIMSUL, either by caulking after construction or by insertion of strips of KIMSUL during construction.

Sound Absorption: All sound absorbing areas shall be constructed as shown on the plans, using KIMSUL blanket insulation (Double Thick—Standard Thick—Commercial Thick) as the sound absorbing element. Care shall be taken that the spacing between the KIMSUL insulation and the backing surface be as indicated, and that the KIMSUL blanket be installed with the cover, if any, facing away from the source of sound.

NOTE: Architects, builders and others may obtain schematic drawings showing KIMSUL acoustical applications by writing to Kimberly-Clark Corporation, Neenah, Wisconsin.

KIMSUL BUILDING INSULATION

THICKNESSES	THERMAL RESISTANCE "R"	SOUND ABSORPTION (AV.)	SQUARE FEET PER ROLL STANDARD WIDTHS		APPROXIMATE NET WEIGHT PER 1000 SQ. FT.	APPROXIMATE SHIPPING WEIGHT PER 1000 SQ. FT.
			16, 20, 24 INCHES	48 INCHES		
COMMERCIAL THICK (Approx. 0.5 In.)	1.85	.40	200	500	68 Lbs.	75 Lbs.
STANDARD THICK (Approx. 1.0)	3.70	.55	200	500	120	126
DOUBLE THICK (Approx. 2.0)	7.40	.70	100	250	225	236

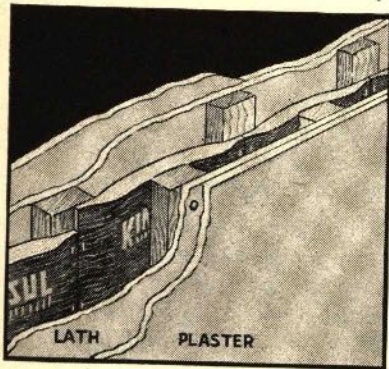
Commercial Thick rolls contain two blankets (100 sq. ft. each). Standard Thick and Double Thick rolls contain one 100 sq. ft. blanket.

KIMSUL VAPOR SEAL PAPER

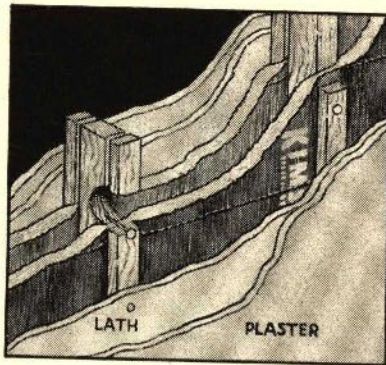
A duplex Kraft and asphalt sheet (30-55-30). Available in 50-inch width rolls to cover three conventional stud spaces with lap. Vapor permeability (maximum): one grain/sq. ft./hour/inch of mercury difference in vapor pressure. Weight: 1000 sq. ft. roll—40 lbs.

Sound Deadening

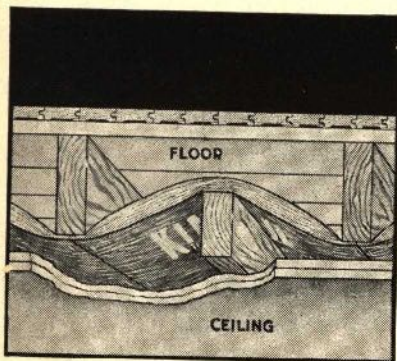
(one room to another)



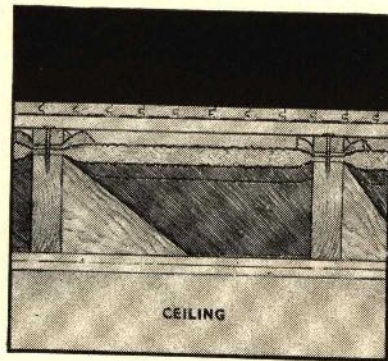
INDEPENDENT SUPPORT



CUSHIONED SUPPORT

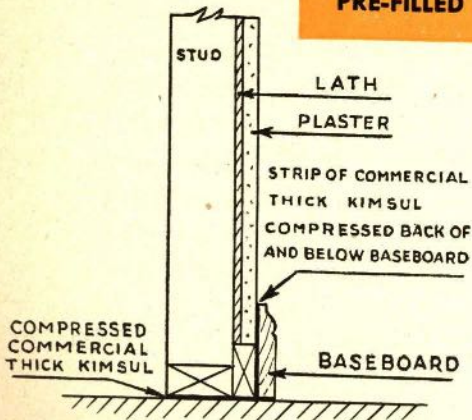


INDEPENDENT SUPPORT



CUSHIONED SUPPORT

PRE-FILLED JOINTS



Cracks and joints in conventional construction allow air borne sound to leak through. Method at left shows KIMSUL inserted during construction to caulk these joints. Extreme compressibility allows KIMSUL to conform to space back of baseboards, window and door frames, and under plates, etc.

KIMSUL insulation performs four functions in sound deadening construction:

- 1) Absorbs sound originated by diaphragmatic action.
- 2) Absorbs sound which leaks through joints and cracks, present initially or opening with drying or age. Thus KIMSUL helps insure against serious deterioration of the construction's sound resistance.
- 3) Cushions furring strip type of construction.
- 4) Prevents accidental bridging or short circuiting of sound-resisting construction during erection.

The four sound resisting constructions shown provide at least 45 decibels of sound reduction from either side to the other. This is regarded as excellent performance. Commercial Thick or Standard Thick KIMSUL is usually sufficient. KIMSUL wrapped around noisy water and soil pipes helps reduce the sound nuisance where pipes are not bonded to the structure. Strips of KIMSUL compressed or caulked tightly into joints in any type of construction stop sound leakage through such joints.

WARNING—Care must be exercised in all sound control work in specifying and in supervision on the job.

Write Kimberly-Clark Corporation, Nee-nah, Wisconsin, concerning applications of KIMSUL in any case you have under consideration.

Sound Absorption

(within a room)

Acoustical Treatment

KIMSUL insulation, due to its *many-layer* construction and porous nature, is a good sound absorbing element in constructions designed to control sound by absorption. Sound absorption may be varied over the frequency range by judicious spacing of KIMSUL away from a reflective surface and by varying the type of covering. Average coefficients of sound absorption as determined by Electrical Research Products, Inc. are:

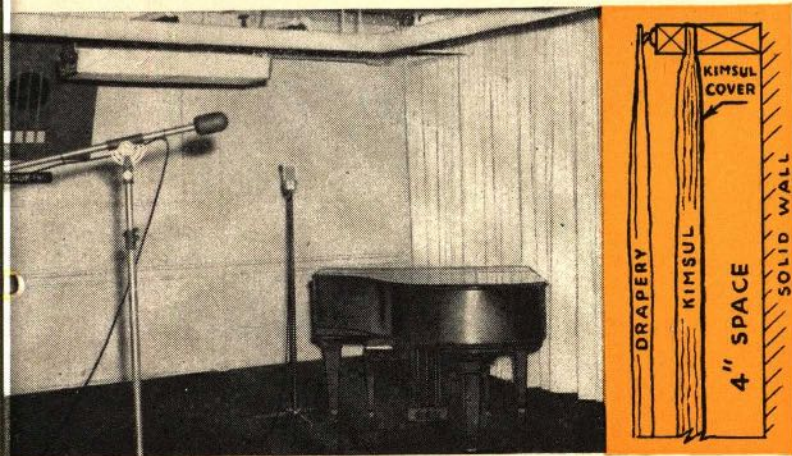
- Double Thick 70%
- Standard Thick 55%
- Commercial Thick 40%

The multi-ply stitched blanket construction of KIMSUL provides a self-contained sound absorbing element, not requiring wrapping to restrain loose fibers. This explains the low comparative cost of KIMSUL for acoustical purposes.

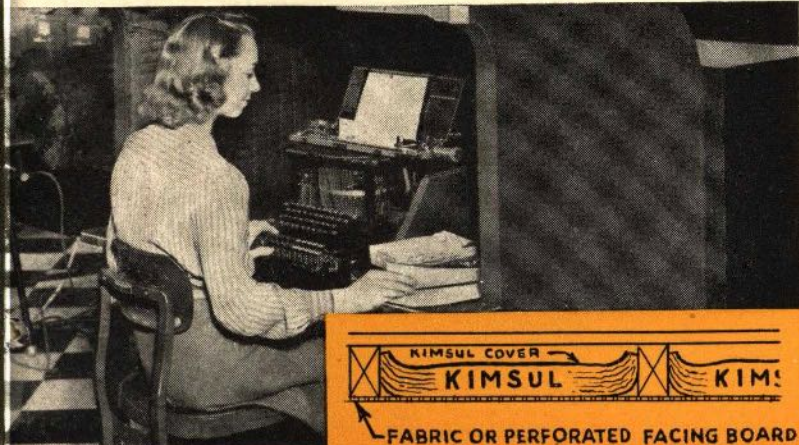
Except in special cases where unusual sound absorption over the frequency range is desired, KIMSUL should be installed with the cover side facing away from the source of sound. In general, it is desirable to space the sound absorber away from the reflecting —backing— surface from one to six inches, because in this way greater sound absorption at the lower frequencies is obtained. As indicated in sketches at the left various coverings may be used.



Acoustical Ceilings, Walls



Sound Studio Panels

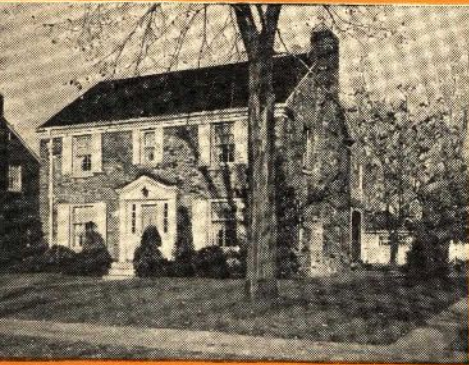


Machine Noise Reduction

Thermal and Acoustical Blanket for every type of insulation Job



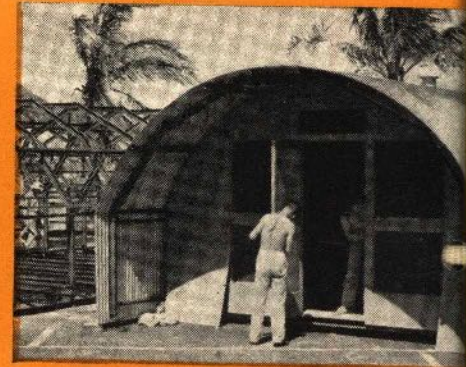
Beneath the Northern Lights — In the most frigid outposts of our security, Navy men find their famous Quonset huts made more comfortable with KIMSUL.



Year 'Round Home Comfort — Thousands of private homes — of all classes, in all climates — enjoy greater all-season comfort with KIMSUL. KIMSUL is specified for government mass housing projects, too.



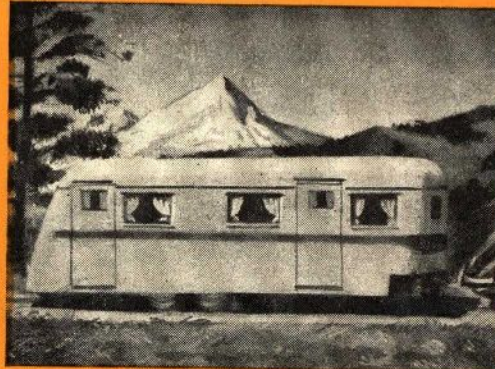
Atom Bomb Cities — Los Alamos, Oak Ridge, and Richland have more than 7,000,000 square feet of KIMSUL insulation in their homes, schools, churches, plants and commercial buildings.



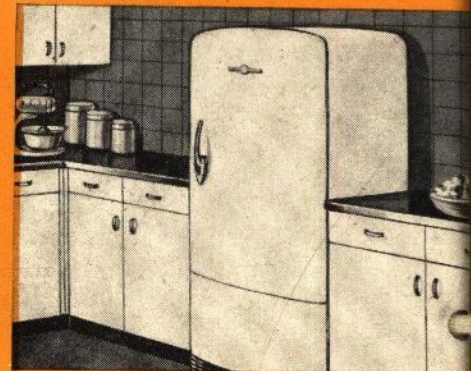
Under Tropic Sun — KIMSUL keeps Quonsets appreciably cooler in island and desert installations. Makes life more pleasant for their Armed Forces garrisons.



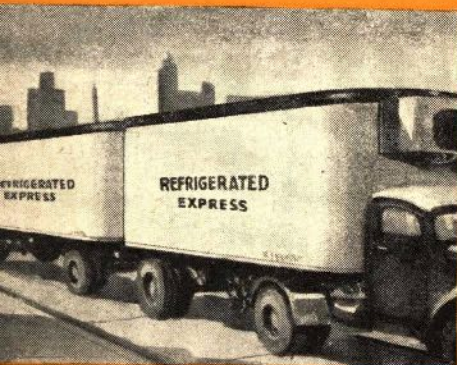
Thermal and Acoustical insulation with KIMSUL makes many of today's finest passenger cars warmer and quieter. The choice of leading manufacturers.



House Trailers use more KIMSUL than any other brand of insulation. Efficiency, ease of handling, compressibility under framing members, and permanence of installation are the main reasons why.



Quiets Noise — Non-settling KIMSUL increases the efficiency of domestic refrigerators and acts as an acoustical treatment to silence motor vibrations.



Refrigerated Cargoes are well protected in trucks insulated with KIMSUL, a favorite with body designers because of its efficiency and many physical advantages.

KIMBERLY-CLARK CORPORATION

Kimsul Division • Neenah, Wisconsin

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