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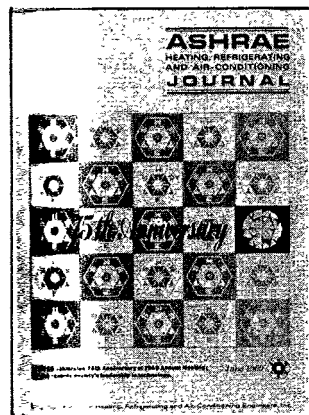
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Facts about THERMAL INSULATION

WILLIAM A. LOTZ
Member ASHRAE

In 1940, insulation materials such as rock wool, air cell, 85% magnesia, wool felt, hair felt, and cork were in common use. Today, these materials have been replaced by mineral wool, glass fiber, foam glass, calcium silicate, and styrene and urethane foams. This 30-year period has seen the insulation industry grow and resulted in savings for the insulation user. The demands upon insulation have become much more severe in terms of space, temperature, health hazards to the applicator, fire resistance of accessories, and last but not least, heat transfer. (See Figs. 1 and 2.)

ance. A few engineers and contractors realized the physics involved required vapor protection of the insulation. They relied upon asphalt for this protection. This resulted in the often false belief that anything black (like asphalt) was a vapor barrier. Others in the industry felt that cold insulation wore out and had to be replaced periodically.

Today the need for good vapor barriers is well documented in reference books such as ASHRAE GUIDE AND DATA BOOK.

Recommended vapor barrier performance specifica-

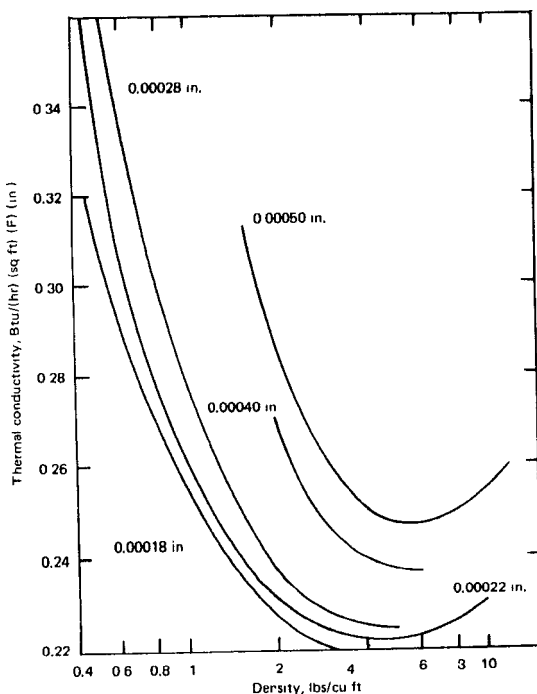


Fig. 1 Fibrous glass thermal conductivity vs fiber size and density at 75 F mean temperature (semilog)

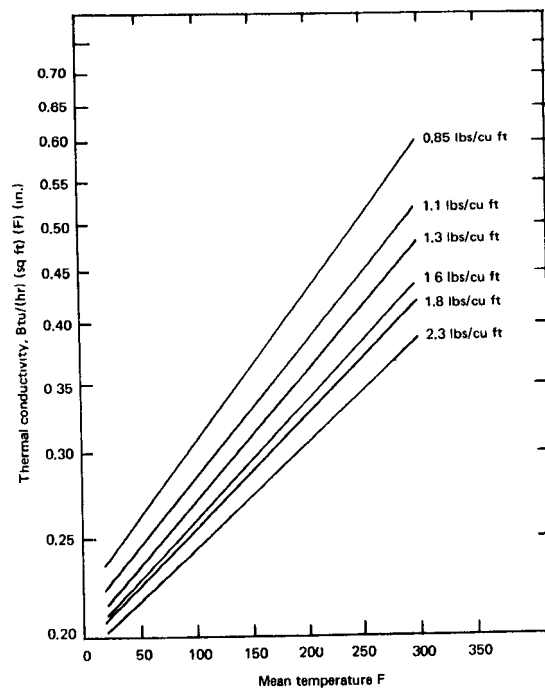


Fig. 2 Fibrous glass thermal conductivity vs mean temperature and density for 0.00025 fiber size (semilog)

It must be remembered that any cold insulation is only as good as its vapor barrier. Years ago, cold insulations relied upon the blotter principle; that is, the insulation absorbed moisture, and the result was "at least" a gain in heat transfer. "At least" because side effects, such as corrosion of the pipe or rotting of wood structure, usually went hand in hand with the decrease in thermal perform-

tions for straightforward insulation systems, such as chilled water or refrigeration piping, are:

Insulated piping		Perms, grains/hr sq ft in. Hg
Chilled water	45 to 55 F	0.3
Refrigeration	+ 45 to -30 F	0.05

Note that these values are for the vapor barrier system (including joints and all components) and are not just the pristine vapor barrier itself. They can also be applied to ducts, chillers, or other cold equipment. Cold storage warehouses require individual study.

Table I gives the water vapor transmission rate for a number of common materials. (Also see ASHRAE HANDBOOK OF FUNDAMENTALS, Chapter 18.)

W. A. Lotz, a member of ASHRAE TC 2.4—Insulation and Moisture Barriers, is senior associate facilities engineer, IBM Burlington, Essex Junction, Vt. This paper was presented at the Symposium on Thermal Insulation during ASHRAE's 1968 Semiannual Meeting, Columbus, Ohio, February 5-8, 1968.

PROBLEM AREAS

There are common problem areas in thermal insulation that are easy to avoid:

Do not staple vapor barriers. Of the hundred or so adhesives used in the field and tested in the laboratory, a few are capable of really sealing vapor barrier laps. With these few adhesives, stapling is not necessary; and, besides, stapling can increase the water vapor transmission rate through a vapor barrier system by a factor of 20!

Table 1. Water Vapor Transmission Rate*

Material	Perms grains/hr sq ft in. Hg
Plastic Films and Sheets	
Polyethylene, 8 mil	0.04
Polyethylene, 6 mil	0.06
Polyethylene, 4 mil	0.10
Polyester, glass fiber flake reinforced sheet, 74 mil	0.01
Acrylic, glass fiber reinforced sheet, 56 mil	0.12
Polyvinyl chloride, unplasticized, 2 mil	0.68
Polyvinyl chloride, plasticized, 4 mil	0.8 to 1.4
Polyethylene, fire retardant, white pigmented 3 mil	0.09
Coatings	
Styrene-butadiene latex paint 2 oz/sq ft	11.0
Synthetic latex coating 4 oz/sq ft	5.5
Asphalt emulsion 1.6 oz/sq ft	0.11
Asphalt cutback mastic 1/16 in. dry thickness	0.14
3/16 in. dry thickness	0.00
Chlorosulfonated polyethylene mastic coating 3.5 oz/sq ft	1.7
7.0 oz/sq ft	0.06
Hot melt asphalt 2.0 oz/sq ft	0.5
3.5 oz/sq ft	0.11
Foil and/or Kraft Laminates	
7/10 mil foil — flame-resistant adhesive-scrim-kraft as received	0.02
with 35 pinholes in foil/sq ft	0.04
with several larger holes in foil	0.08 to 0.16
with 1½ in. overlap joint (in 6 in. test pan)	0.05
1 staple through above joint	0.34
Brownskin, kraft — 1 mil foil-kraft (asphalt adhesive)	0.01
Paper masking tape	5.8
Duplex kraft 30-30-30 asphalt laminated	0.61 to 0.83
Reinforced duplex (heavy duty) asphalt laminated	0.38
1/3 mil foil - 2 mil polyethylene kraft	0.01
1/3 mil foil - latex adhesive - kraft	0.04
Asphalt saturated and coated kraft	0.07 to 0.15
1/3 mil foil-scrim-kraft (many holes in foil)	0.15
Miscellaneous**	
Asbestos transite board 0.2 in.	5.4
Plywood, 3/8 in. marine	1.8
Masonite, 1/8 in.	3.6
Insulations**	perm-in.
Urethane foam, refrigerant blown	0.4 - 1.6
Polystyrene foam, extruded	1.2
Polystyrene foam, bead	2.0 - 5.8
Cellular glass	.00
Unicellular flexible	
Synthetic rubber foam	0.02 - 0.30
Cork	7.0

* Except where noted, all tests were conducted at 90 F, 50% rh, dry cup following the procedure of ASTM E-96.

** Conducted at 73 F, 50% rh, dry cup.

Be careful to specify the proper accessories. Many times installations in which details like the failure of adhesives or coatings on fittings have resulted in considerable grief and cost and caused the insulation system to fail. For example: (1) in an upper New York State mental hospital, the refrigeration piping had a vapor barrier with a perm rate of 7.0, which resulted in an expensive failure, and (2) a vibrating liquid oxygen pipe in Butler, Pa. was completely devoid of insulation because the wire holding the insulation in place had cut through the rigid insulation.

Corrosion should be considered. Aluminum foil in 1 mil thickness is the heart of many vapor barrier systems. However, aluminum is rapidly perforated by chloride ions, iron, sodium hydroxide (in many insulation cements), or mercury compounds (used as mold inhibitors in paints, etc.). There are ducts and cold storage warehouses with flame-resistant salt-treated kraft-foil vapor barriers in which corrosion made lace out of the foil within two months of service.

Stress corrosion of stainless steel is of serious concern in the process industries. A few years ago, a 2-in. thick stainless steel autoclave split open on the first day of operation due to water soluble chlorides in the insulation coupled with a steam leak.

Watch out for health hazards. In 1964, an insulation worker in Ohio died of anthrax from hair felt insulation. A search of the medical journals reveals many reports of death caused by asbestosis. This condition is a result of many years of breathing asbestos dust and is similar in some respects to the results of cigarette smoking. Also, the dust from fibrous insulations has been the subject of many jokes over the years; but, nevertheless, it is a real problem to many people.

Ask the materials' manufacturers for the facts. Three brands of supposedly identical insulation were tested for water vapor transmission rate. It was found that brand A was 0.1 perms; brand B, 0.3 perms; and brand C, 0.06 perms. Visually, they could not be distinguished.

Will it burn under job conditions? In a few instances, boiler insulation has smoldered or burned from welder's sparks. These incidents leave questions in the engineer's mind because the material was rated "incombustible" by a variety of laboratory tests that did not take the most important factor into account—the job conditions. Will any component in the system burn: the adhesive, the canvas, or the paint? Remember the materials with varying degrees of resistance to flame are available with a minor cost increase.

SUMMARY

The insulation industry has gone through a dynamic change during the past 30 years. It has attempted to keep sensitive to the needs of the users, and to communicate the latest technology of the industry to the insulation user.

BIBLIOGRAPHY

1. Lotz, W. A., Heat and Air Transfer in Cold Storage Insulation, ASHRAE JOURNAL, April 1964, Vol. 6, No. 4, p. 53.
2. Lotz, W. A., Vapor Barrier Design, Neglected Key to Freezing Insulation Effectiveness, Quick Frozen Foods, November 1964.
3. Cold-Storage Facilities: A Guide to Design and Construction, Building Research Advisory Board, National Academy of Sciences, National Research Council, Washington, D. C., Publication 1098 (1963).
4. Lotz, W. A., Vapor Barrier Design for Cold Storage Applications, ASHRAE JOURNAL, December 1964, Vol. 6, No. 12, p. 46.

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For further information concerning manufacturers products please consult the 1969 edition of ASHRAE GUIDE AND DATA BOOK. Those company listings which represent manufacturers advertising in the 1969 edition are shown in parentheses.

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