through the building materials in proportion to the vapor pressure difference on the two sides of the material. The total amount of water vapor transmitted is dependent on the permeability which is usually expressed in grains of moisture per square foot per hour per inch of mercury vapor pressure difference. The values for permeability in Table 11 are quoted from a publication of the *National Bureau of Standards*[12]. The water vapor entering the conditioned space must be added to the latent cooling load.

TABLE 11. PERMEABILITY OF VARIOUS MATERIALS TO WATER VAPOR

MATERIAL	PERMEABILITY GRAINS PER SQ FT PER HR PER INCH HG
	Group 1[a]
Plaster base and plaster, ¾ in.	14.7
Fir sheathing, ¾ in.	2.9
Waterproof paper	49.1
Pine lap siding	4.9
Paint film	3.4
Sugar can fiberboard, ¾ in.	12.5
Brick masonry, 4 in.	1.1
	Group 2[b]
Foil-surfaced reflective insulation, double-faced	0.08 to 0.13
Roll roofing—smooth, 40 to 65 lb/roll 108 sq ft	0.13 to 0.17
Duplex or laminated papers, 30-30-30	1.37 to 2.58
Plaster, wood lath	11.00
Plaster, 3 coats of lead and oil	3.68 to 3.84
Plaster, 2 coats of A1. paint	1.15
Plaster, fiberboard or gypsum lath	19.73 to 20.57
Plywood, ⅛ in., 5-ply Douglas fir	2.67 to 2.74
Insulating lath and sheathing, board type	25.68 to 34.27
Insulating sheathing, surface-coated	3.03 to 4.36
Insulating cork blocks, 1 in.	6.19
Mineral wool, unprotected, 4 in.	29.07

[a]Calculating Vapor and Heat Transfer Through Walls, by L. G. Miller (*Heating and Ventilating* 35, No. 11, 56 November, 1938).

[b]How to Overcome Condensation in Building Walls and Attics, by L. V. Teesdale (*Heating and Ventilating* 36, No. 4, 36 April, 1939).

Vapor barriers, to be effective in reducing entrance of moisture, must seal completely the walls, ceilings, and floors that are exposed to space having excessive vapor pressure and all doors must have gaskets applied to them to make the barrier effective.

ILLUSTRATION

From the foregoing discussion it is obvious that the determination of the maximum cooling load is rather complicated by reason of the variable nature of contributing load components. An illustrative example will explain the method.

[12]Moisture Condensation in Building Walls, by Harold W. Woolley (*U. S. Department of Commerce, National Bureau of Standards*, Building Materials and Structures Report BMS63).

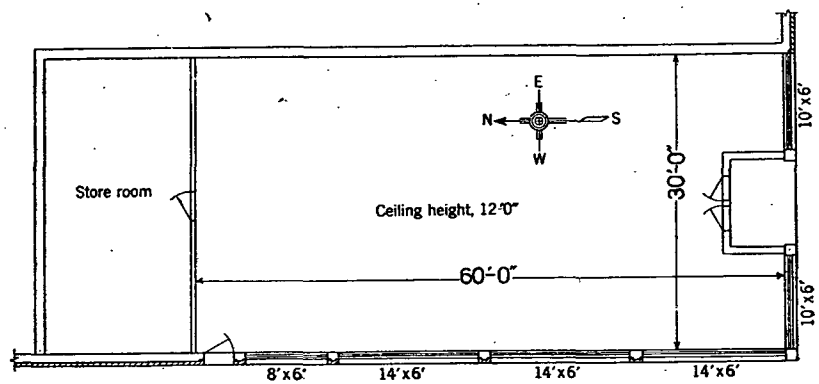

FIG. 4. PLAN DIAGRAM OF CLOTHING STORE

Example 1. Determine cooling load requirements for a clothing store illustrated in Fig. 4 and located in Pittsburgh, Pa., Latitude 40 deg. This is a one-story building located on a corner and it faces south and west. Assume building on east and north sides conditioned.

Wall construction, 8 in. concrete block, 4 in. brick veneer, plaster on walls, $U = 0.33$ (Table 7, Chapter 4, No. 93 B).

Roof construction, 2 in. concrete, ½ in. insulating board, metal lath and plaster ceiling, $U = 0.26$ (Table 14, Chapter 4, No. 14 B).

Floor, maple flooring on yellow pine, no ceiling below, $U = 0.34$ (Table 10, Chapter 4, No. 1-O).

Partition, wood lath and plaster on both sides of studding, $U = 0.34$ (Table 8, Chapter 4, No. 3 B).

Windows, provided with awnings.

Front doors, 2 ft 6 in. x 7 ft (glass paneled).

Side door, 3 ft x 7 ft (glass paneled), $U = 1.13$ (Table 17 A, Chapter 4).

Occupancy, 10 clerks, 40 patrons.

Lights, 4200 w.

Outside design conditions, dry-bulb 95 F; wet-bulb 75 F.

Inside design conditions, dry-bulb 80 F; wet-bulb 67 F.

Basement temperature, 85 F.

Store room temperature, 88 F.

Solution. It is obvious from the shape and exposure of this store and the large glass area on the west side that the maximum cooling load will occur during the afternoon when the sun is shining on the west wall. From Fig. 1, the peak load may be expected at 4:00 p.m.

The combined normal transmission and solar radiation transmission through the roof at 4:00 p. m. is obtained from Fig. 2. While none of the roofs in Fig. 2 is exactly like this one, roof *C* is similar. A heat flow of 11 Btu per square foot per hour was assumed, slightly less than for roof *C*. The combined normal transmission and solar radiation