depend upon whether products of combustion are vented to a flue, whether they escape into the space to be conditioned, or whether appliances are hooded allowing part of the heat to escape through a stack. There are no generally accepted data available on the effects of venting and shielding heating appliances, but it is believed that, when they are properly hooded with a positive fan exhaust system through the hood, 50 per cent of the heat will be carried away and 50 per cent dissipated in the space to be conditioned. Where latent as well as sensible heat is given off, it is usually safe to assume that all latent heat will be removed by a properly designed and operated vent or hood.

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 cane 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, ½ 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*, Vol. 36, No. 4, April, 1939).

Moisture Through Walls

In some applications walls of the conditioned space may be in contact with other spaces which have in them a higher water vapor pressure than that in the conditioned space. It is known that water vapor will flow 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*[13]. The water vapor entering the conditioned space must be added to the latent cooling load.

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

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 presented in the foregoing text. Alternative procedures for calculating cooling loads have been devised by various writers. One of the most recent, intended particularly for residential installations, is given in Bulletin No. 18 of the *American Gas Association*.

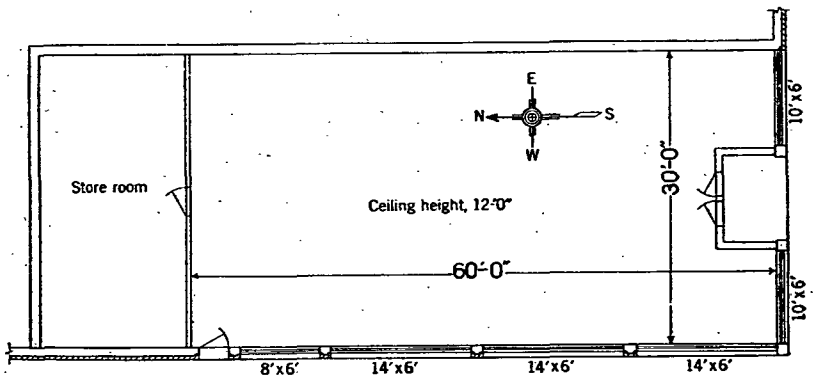

FIG. 4. PLAN DIAGRAM OF CLOTHING STORE

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-N).

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.