different from those in factories, since there must be a considerable volume of air circulated in order to provide ventilation and cooling.

COOLING LOAD

The cooling load may be divided into the following parts:

1. Transmission of heat through walls, roof, glass, etc., with allowances for sun-exposed surfaces and heat capacity.
2. Transmission of solar radiation through glass and absorption by interior furnishings.
3. Heat and moisture from infiltration and from outside air introduced.
4. Heat and moisture from occupants and heat from lights, machinery and other sources.

Transmission With No Sun Effect

The transmission load *for surfaces not exposed to the sun* is calculated in a manner similar to that described in Chapter 7, by means of the following formula:

$$H_t = A\,U\,(t_o - t) \qquad (1)$$

where

H_t = heat transmitted through the material of the wall, glass, roof, or floor in Btu per hour.
A = net inside area of wall, glass, roof, or floor in square feet.
t = inside temperature, degrees Fahrenheit.
t_o = outside temperature, degrees Fahrenheit.
U = coefficient of transmission of wall, floor, roof, or glass in Btu per hour per square foot per degree Fahrenheit difference in temperature. (Tables 8 to 18, Chapter 5).

Temperatures

The maximum cooling load in summer may be calculated for an outside dry-bulb temperature not to exceed 95 F and a wet-bulb temperature not to exceed 80 F. While higher outside dry-bulb temperatures are frequently observed they are either of short duration or accompanied by low relative humidities. Weather Bureau reports are frequently misleading in this respect as they report the maximum temperature for the day with the relative humidity which occurs during a different period and which usually is much higher than the relative humidity occurring at the maximum temperature. Any statement of weather condition which gives a wet-bulb temperature higher than 80 F in the United States is questionable.

Summer dry-bulb and wet-bulb temperatures for various cities are given in Table 1. It will be noted that the wet-bulb temperatures are not the maximums but the design temperatures which should be used in air-conditioning calculations. The maximum outside wet-bulb temperatures as given in Weather Bureau reports usually occur only from 1 per cent to 4 per cent of the time, and they are therefore of such short duration that it is not practical to design a cooling system covering this range.

Sun Effect

Solar radiation is an important factor in the mechanism of heat flow into buildings. Research conducted at the A.S.H.V.E. Research Labora-

TABLE 1. AVERAGE MAXIMUM DESIGN DRY-BULB TEMPERATURES, DESIGN WET-BULB TEMPERATURES, WIND VELOCITIES, AND WIND DIRECTIONS FOR JUNE, JULY, AUGUST, AND SEPTEMBER

State	City	Average Maximum Design Dry-Bulb	Design Wet-Bulb	Summer Wind Velocity MPH	Prevailing Summer Wind Direction
Ala.	Birmingham	93	77	5.2	S
	Mobile	94	78	8.6	SW
Ariz.	Phoenix	110	77	6.0	W
Ark.	Little Rock	95	77	7.0	NE
Calif.	Los Angeles	88	70	6.0	SW
	San Francisco	85	68	11.0	SW
Colo.	Denver	90	64	6.8	S
Conn.	New Haven	88	74	7.3	S
D. C.	Washington	93	76	6.2	S
Fla.	Jacksonville	94	78	8.7	SW
	Tampa	94	79	7.0	E
Ga.	Atlanta	91	75	7.3	NW
	Savannah	95	79	7.8	SW
Idaho	Boise	95	65	5.8	NW
Ill.	Chicago	88	73	10.2	NE
	Peoria	91	75	8.2	S
Ind.	Indianapolis	90	73	9.0	SW
Iowa	Des Moines	92	74	6.6	SW
Ky.	Louisville	94	75	8.0	SW
La.	New Orleans	94	79	7.0	SW
Maine	Portland	85	71	7.3	S
Md.	Baltimore	93	76	6.9	SW
Mass.	Boston	88	73	9.2	SW
Mich.	Detroit	88	72	10.3	SW
Minn.	Minneapolis	84	72	8.4	SE
Miss.	Vicksburg	95	78	6.2	SW
Mo.	Kansas City	92	75	9.5	S
	St. Louis	93	76	9.4	SW
Mont.	Helena	87	63	7.3	SW
Nebr.	Lincoln	93	74	9.3	S
Nev.	Reno	93	64	7.4	W
N. J.	Trenton	93	75	10.0	SW
N. Y.	Albany	90	74	7.1	S
	Buffalo	83	72	12.2	SW
	New York	91	75	12.9	SW
N. M.	Santa Fe	87	63	6.5	SE
N. C.	Asheville	87	72	5.6	SE
	Wilmington	93	79	7.8	SW
N. D.	Bismarck	88	69	8.8	NW
Ohio	Cleveland	87	72	9.9	S
	Cincinnati	93	75	6.6	SW
Okla.	Oklahoma City	96	76	10.1	S
Ore.	Portland	83	65	6.6	NW
Pa.	Philadelphia	93	76	9.7	SW
	Pittsburgh	91	73	9.0	NW
R. I.	Providence	85	73	10.0	NW
S. C.	Charleston	94	80	9.9	SW
	Greenville	93	76	6.8	NE
Tenn.	Chattanooga	94	76	6.5	SW
	Memphis	93	77	7.5	SW