may not even produce comfort on cold days; if humidity is to be maintained at 50 percent, the lower temperatures will apply.

In rooms having large glass areas, when sun is not shining, or in rooms with walls having a high transmission coefficient, the lowered surface temperature will cause a feeling of coolness even though the air temperature in the room is at or above the temperatures indicated in the table. In rooms of this character, it is desirable to design for even higher temperatures than those listed, unless a compensating higher temperature surface is installed to offset the low temperature surfaces.

TABLE 2. WINTER INSIDE DRY-BULB TEMPERATURES USUALLY SPECIFIED[a]

Type of Building	Deg F	Type of Building	Deg F
		Theaters—	
Schools—		Seating space	68–72
Class rooms	70–72	Lounge rooms	68–72
Assembly rooms	68–72	Toilets	68
Gymnasiums	55–65		
Toilets and baths	70	Hotels—	
Wardrobe and locker rooms	65–68	Bedrooms and baths	70
Kitchens	66	Dining rooms	70
Dining and lunch rooms	65–70	Kitchens and laundries	66
Playrooms	60–65	Ballrooms	65–68
Natatoriums	75	Toilets and service rooms	68
Hospitals—		Homes	70–72
Private rooms	70–72	Stores	65–68
Private rooms (surgical)	70–80	Public buildings	68–72
Operating rooms	70–95	Warm air baths	120
Wards	68	Steam baths	110
Kitchens and laundries	66	Factories and machine shops	60–65
Toilets	68	Foundries and boiler shops	50–60
Bathrooms	70–80	Paint shops	80

[a] The most comfortable dry-bulb temperature to be maintained depends on the relative humidity and air motion. These three factors considered together constitute what is termed the *effective temperature*. (See Chapter 6.) When relative humidity is not controlled separately, optimum dry-bulb temperature for comfort will be slightly higher than shown in Table 2.

The inside temperatures specified in Table 2 may be used for panel heated spaces as well as for spaces heated by warm air, radiators or convectors. It is true that warm panel surfaces tend to produce a comfortable environment at a lower room air temperature than when warm panels are not present, but field experience in the United States has indicated that actual reductions in air temperature are slight in operation.

Temperature at Proper Level. In making the actual heat loss computations, however, for the various rooms in a building it is often necessary to modify the temperatures given in Table 2 so that the air temperature at the proper level will be used. By *air temperature at the proper level* is meant, in the case of walls, the air temperature at the mean height between floor and ceiling; in the case of glass, the air temperature at the mean height of the glass; in the case of roof or ceiling, the air temperature at the mean height of the roof or ceiling above the floor of the heated room; and in the case of floors, the air temperature at the floor level.

Temperature at Ceiling. The air temperature at the ceiling is generally higher than at the breathing level due to stratification of air resulting from the tendency of the warmer or less dense air to rise. An allowance for this fact should be made in calculating ceiling heat losses, particularly in the case of high ceilings. However, the exact allowance to be made may be somewhat difficult to determine as it depends on many factors, including (1) the type of heating system, (2) ceiling height, and (3) the inside-outside temperature differential. The type of heating system is particularly important, as the temperature gradient from floor to breathing-level to ceiling may depend to a large extent on whether direct radiation, unit heaters or warm air is used, and in the latter case, whether the air is moved mechanically or by gravity. The temperature of the heating medium is also a factor.

It is impracticable to establish rigid rules for determining the temperature difference to use in all cases. However, for residences and structures having ceiling heights under 10 ft, the comparatively small temperature differential between the breathing level and ceiling generally may be

TABLE 3. APPROXIMATE TEMPERATURE DIFFERENTIALS BETWEEN BREATHING LEVEL AND CEILING, APPLICABLE TO CERTAIN TYPES OF HEATING SYSTEMS[a]

Ceiling Height (Ft)	Breathing Level Temperature (5 ft Above Floor)									
	60	65	70	72	74	76	78	80	85	90
10	3.0	3.3	3.5	3.6	3.7	3.8	3.9	4.0	4.3	4.5
11	3.6	3.9	4.2	4.3	4.4	4.6	3.7	4.8	5.1	5.4
12	4.2	4.6	4.9	5.0	5.2	5.3	5.5	5.6	6.0	6.3
13	4.8	5.2	5.6	5.8	5.9	6.1	6.2	6.4	6.8	7.2
14	5.4	5.9	6.3	6.5	6.7	6.8	7.0	7.2	7.7	8.1
15	6.0	6.5	7.0	7.2	7.4	7.6	7.8	8.0	8.5	9.0
16	6.1	6.6	7.1	7.3	7.5	7.7	7.9	8.1	8.6	9.1
17	6.2	6.7	7.2	7.4	7.6	7.8	8.0	8.2	8.7	9.2
18	6.3	6.8	7.3	7.5	7.7	7.9	8.1	8.3	8.8	9.3
19	6.4	6.9	7.4	7.6	7.8	8.0	8.2	8.4	8.9	9.4
20	6.5	7.0	7.5	7.7	7.9	8.1	8.3	8.5	9.0	9.5
25	7.0	7.5	8.0	8.2	8.4	8.6	8.8	9.0	9.5	10.0
30	7.5	8.0	8.5	8.7	8.9	9.1	9.3	9.5	10.0	10.5
35	8.0	8.5	9.0	9.2	9.4	9.6	9.8	10.0	10.5	11.0
40	8.5	9.0	9.5	9.7	9.9	10.1	10.3	10.5	11.0	11.5
45	9.0	9.5	10.0	10.2	10.4	10.6	10.8	11.0	11.5	12.0
50	9.5	10.0	10.5	10.7	10.9	11.1	11.3	11.5	12.0	12.5

[a] The figures in this table are based on an increase of 1 percent per foot of height above the breathing level (5 ft) up to 15 ft and 1/10 of one degree for each foot above 5 ft. This table is generally applicable to forced air types of heating systems. For direct radiation or gravitywarm air, increase values 50 percent to 100 percent.

neglected without serious error. For higher ceilings, an allowance of approximately 1 percent per foot of height above the breathing level may be made for ceiling heights up to 15 ft and approximately $\frac{1}{10}$ of 1 deg per foot of height above this level. The values in Table 3 are calculated on this basis. For direct radiation and gravity warm air systems, the allowance should be increased from 50 percent to 100 percent over those given in Table 3. These rules should, however, be used with considerable discretion, and they do not apply to some types of heating systems such as those using panel and baseboard radiation, where very low temperature differences between the floor and the ceiling may exist.

Temperature at Floor Level. According to tests at the University of Illinois,[3, 4, 5, 6] the temperature at the floor level ranged from about 2 to 6 deg below that at the breathing level, or somewhat greater than the difference between the breathing level and ceiling temperatures. Tests at the University of Wisconsin[7] indicated a somewhat smaller differential between the floor and breathing level temperatures. As a general rule, if the breathing level to ceiling temperature differential is neglected (as with ceiling heights under 10 ft), the breathing level to floor differential may also be neglected, as the two are somewhat compensating, especially where both floor and ceiling losses are calculated for the same space. In other cases, the 10 ft temperature differentials in Table 3 may be used in arriving