Δt = 16 F. Subtracting 16 deg from 55 deg gives a required refrigerant temperature of 39 F. (4) In Fig. 12, assume an air velocity of 2000 lb per hour and obtain a coil efficiency of 0.8. (5) Solving for Q in Equation 12, a capacity of 17,400 Btu per hour is obtained, which is not the required capacity. It is necessary to try a higher air velocity until a balanced condition is found at an air velocity of 2080 pounds per hour. (6) By assuming a coil depth of 6 rows and repeating the same procedure, another solution can be obtained at a refrigerant temperature of 43.5 F and an air velocity of 1760.

The foregoing cut-and-try calculations can be eliminated by the use of the type of graph shown in Fig. 16, which may be constructed as outlined herewith:

1. The three axes of the nomogram on the left side of the chart are drawn in such a manner that the C axis represents the differences in total heat content between the air at wet-bulb temperature along B axis and air at wet-bulb temperature along A axis. Thus, the C axis represents the total heat (Btu per pound of air, sensible and latent) which could be removed from the air at some inlet wet-bulb temperature on B axis if

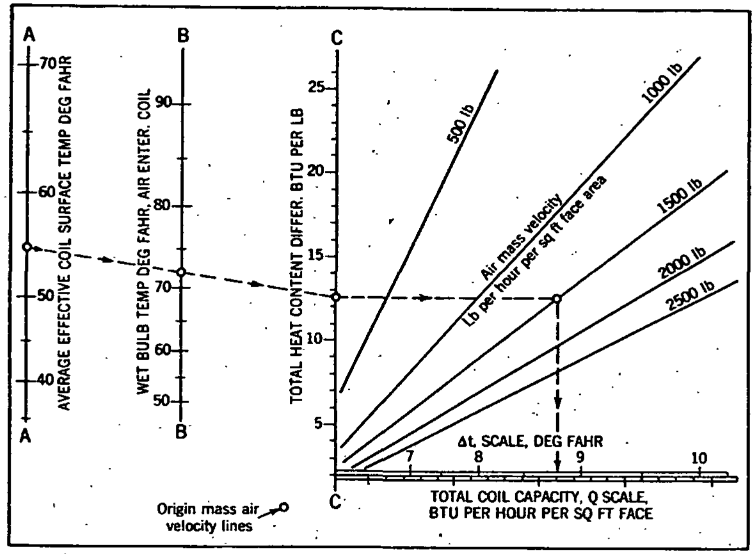

Fig. 16. Typical Coil Performance Chart

the coil heat transfer efficiency were 100 per cent and the wet-bulb temperature of the air could be reduced to some average (effective) external coil temperature on A axis. For example if a straight line is drawn through 72 F wet-bulb temperature of entering air on axis B and the 55 F average effective coil (external surface) temperature on axis B, then this straight line will intersect the C axis at 12.6, which figure represents the difference in total heat content of air between 72 and 55 F wet-bulb temperature.

2. Next scale Q is drawn to cover the range of the likely practical loading for the given coil in Btu per hour per square foot coil face area.

3. Lastly, the diagonal mass air velocity lines are drawn in at the intersection of various values on C axis and the corresponding values on the Q scale. The values on the Q scale corresponding to various values on C axis are obtained by multiplying the values on C axis by mass air velocity and coil efficiency. In this way the calculations required by Equation 12 are performed.

4. Parallel to the Q scale is drawn the Δt scale, so that the difference between average surface temperature and refrigerant temperature can be read directly, eliminating the use of Equation 16.

For coils using water as a cooling medium, the chart shown in Fig. 17 can be used for the purpose of eliminating calculations. Such a chart can embrace all sizes of coils of a particular design, but requires an index which gives the *coil design factor* for each size. The coil design factor is the number of square feet of internal tube surface of the entire coil. The curves shown in the lower right hand quarter of the chart perform the calculations of Equation 17, by using an average water temperature and the actual tube diameter.

Performance of Coils and Refrigeration Compressor

Practically all data published by various makers of direct expansion cooling coils are based upon maintaining a predetermined refrigerant

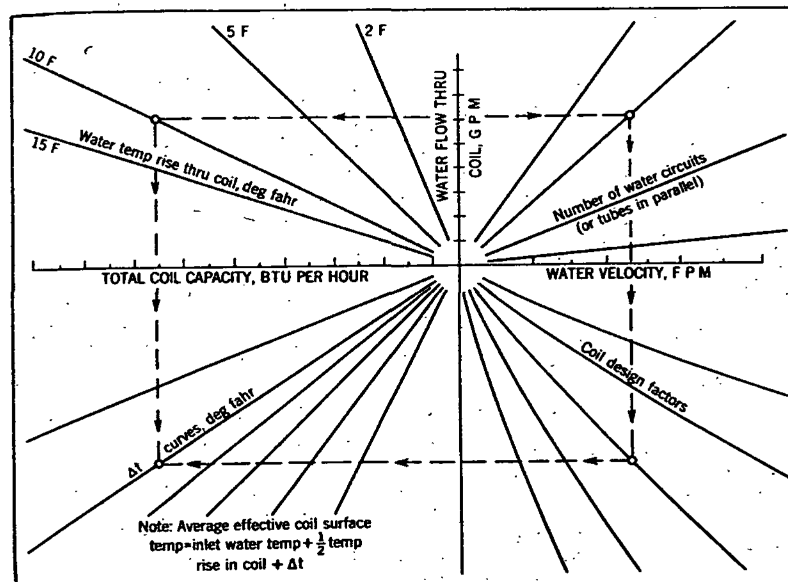

Fig. 17. Water Coil Performance Chart

temperature within the coils. While it is often possible to maintain a definite refrigerant temperature within a given cooling coil, for the greater part it is either impossible or impractical. This is due to the fact that the capacity of standard refrigeration compressors is usually fixed and in matching a given cooling coil with a standard compressor the capacity of the latter is often somewhat smaller or greater than that of the former. Consequently, very often the refrigerant temperature resulting within a cooling coil and correspondingly the capacity of the coil-compressor combination are not what they were originally calculated to be.

In order to determine the actual performance of a given coil-compressor combination under varying conditions of operation, a graphical solution of the balance point is highly desirable. A typical method of graphical