Some of the common methods of coil rating are based on the assumption that the load ratio line for a given coil under given operating conditions not only passes through points representing the entering and leaving air conditions, but also intersects the saturation curve at a temperature fictitiously referred to as the coil *surface temperature*, see Fig. 14. This *surface temperature* is higher than the refrigerant temperature by an amount proportional to the total cooling load, and determined by tests for each design of coil. For a selected coil, therefore, the load ratio line can be determined after such tests have been made. The chosen coil will not satisfy the required performance unless the coil load ratio line coincides with that of the required duty, a condition requiring a trial and error process. This entire method is not suitable when the proportion of latent heat load is high, because the true load ratio line fails to intersect the saturation curve.

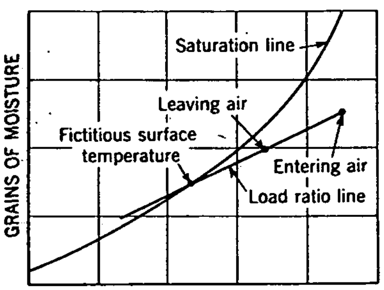

FIG. 14. LOAD RATIO LINE ON PSYCHROMETRIC CHART

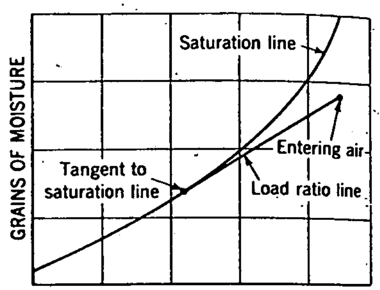

FIG. 15. APPROXIMATE MAXIMUM LOAD RATIO OR LATENT HEAT LOAD

Having selected a coil for which the load ratio line and total capacity meet the estimated load requirements, the condition of the leaving air can be located on the load ratio line by separately determining from rating tests and psychrometric information, any quantity which will give an intersection with the load ratio line, such as:

1. The dry-bulb temperature of exit air.
2. The wet-bulb temperature of exit air.
3. The dew-point temperature of exit air.
4. The relative humidity of exit air.
5. The wet-bulb depression of exit air.
6. The ratio: $\frac{\text{Length of line from inlet to exit conditions}}{\text{Length of line from inlet to saturation curve}}$

(This is frequently called the *ratio of heat removed to heat removable*).

As it is evidently impossible to dehumidify with a cooling coil, with no removal of sensible heat, there must be a limit to the possible ratio of total to sensible heat removal. A common approximation is to limit this ratio to that corresponding to a load ratio line drawn through the entering air condition and tangent either to the saturation curve or to an arbitrarily selected relative humidity line not far from saturation. (See Fig. 15).

The resistance to air flow for a given coil is usually greater for a wetted than for a dry coil, the difference being dependent upon the coil design and the facility with which the water of dehumidification is removed. The effect of water is greater with close than with wide fin spacing and for some designs is greater with upward vertical than with horizontal air flow. For typical coils, the air resistance of the wet coil is about 30 per cent greater than the resistance of the dry coil, although this depends also on the heat load ratio. Air resistance is usually taken as proportional to the square of the mass air velocity, although the 1.8 power is sometimes used instead of the square.

COIL PERFORMANCE AND SELECTION

In the selection of a coil it is necessary to consider several factors:

1. The duty required—heating, cooling, dehumidifying.
2. Temperature of entering air—dry-bulb only if there is no dehumidification, dry- and wet-bulb if moisture is to be removed.
3. Available heating and cooling media.
4. Space and dimensional limitations.
5. Air quantity limitations.
6. Allowable resistances in air circuit and through tubes.
7. Peculiarities of individual designs of coils.
8. Individual installation requirements, such, for example, as type of automatic control to be used.

The duties required may be determined from information in Chapters 5, 6, 7 and 8. There may or may not be a choice of cooling and heating media, as well as temperatures available, depending upon whether the installation is new or is in combination with present sources of heating or cooling. Space limitations are dictated by the requirements of individual cases. The air quantity is influenced by a number of considerations. The air quantity through heating coils is often made the same as that necessary to handle the summer cooling load. The air handled may be fixed by the use of old ventilating ducts as an air distribution system for new air conditioning apparatus, or may be dictated by requirements of satisfactory air distribution or ventilation. The resistance through the air circuit influences the fan horsepower and speed. This resistance may be limited to allow the use of a given size of fan motor, or to keep the operating expense low, or it may be limited by the maximum fan peripheral velocity which requirements of quietness may permit. The friction through the water or brine circuit may be dictated by the head available from a given size of pump and pump motor. As the fan and pump motor inputs represent a refrigerating load on cooling installations, it is economical to keep them low.

Proper performance of a surface heating or cooling coil depends upon correct choice of the original equipment and upon certain other factors. The usual coil ratings are based on a uniform face velocity or air. If the air is brought in at odd angles or if the fan is located so as to block part of the air flow, the performance as given in the Manufacturer's Ratings cannot usually be obtained. To obtain this performance it is necessary also that the air quantity be adjusted on the job to that used in determining the coil selection, and must also be kept at this value. The most common causes for a reduction of air quantity are the fouling of the filters