air conditions are arbitrarily specified, the corresponding duty sometimes cannot be obtained at all without the use of reheat. As with heating and sensible cooling coils, there are combinations of face areas, depth, air velocity and refrigerant temperatures which will give the required performance. This is illustrated in Table 3.

It is possible as shown in Table 3 to perform approximately the same duty at a given refrigerant temperature with small face area and large thickness or vice versa. The large face area coil will give low air velocity and resistance but high air quantities per ton. The coil of small face area and great depth will require small air quantities per ton of refrigeration, high resistance and high air velocities. As shown also in Table 3 the same sensible, latent and total cooling capacity may be obtained with various refrigerant temperatures by proper choice of coil. This makes it possible

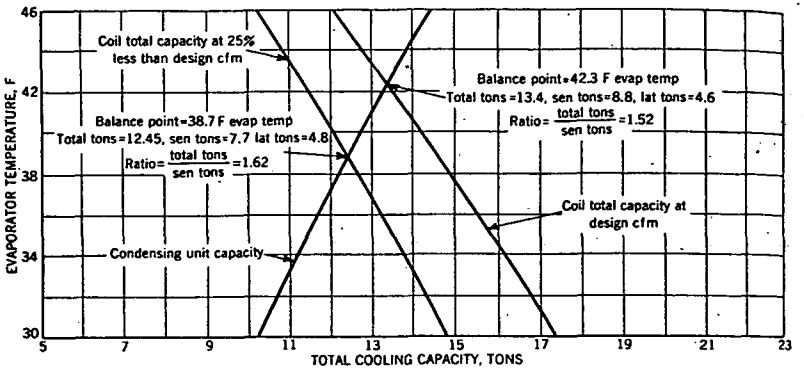


FIG. 16. BALANCE OF EVAPORATOR TEMPERATURE CONDITIONS WITH CONDENSING UNIT CAPACITY

to keep the evaporating temperature high enough to carry the load with a chosen size of condensing unit. High evaporating temperatures with correspondingly small compressor operating expense can be attained but at the expense of coil surface, air quantity or both. The choice will be determined by the necessities of individual installations.

For a given quantity and condition of entering air the evaporating temperature of a volatile refrigerant coil will be determined by a balance between the condensing unit and the coil. The total, sensible and latent cooling capacity can then be determined from the coil rating information. Fig. 16 shows typical balances. If the condensing unit and cooling coil have been properly balanced for the required load and, due to miscalculated duct resistance or improper choice of fan speed, the air quantity is reduced, the total cooling capacity will also be reduced. The decrease is generally in the sensible capacity. This is the effect also when the air by-pass or volume control is used.

It is necessary that not only the total capacity but also the sensible and latent cooling requirements both be met. The installation of an excess of coil will result in an increase in total capacity, but not a proportional gain

in latent heat capacity. On installations controlled from dry-bulb temperature the operating time will be shortened because of the added sensible cooling capacity. The result will be less moisture pick-up than calculated, and higher relative humidity. If an oversize condensing unit is installed the opposite situation will take place. The relative humidity will be lower than estimated. This is not generally a disadvantage except that it results in a greater load from outside air than calculated, as well as in increased power consumption. Balances to illustrate these cases appear in Fig. 17. If oversize equipment is furnished, a balance should be made to assure that the ratio of total to sensible capacity is the same as in the estimated load.

Sometimes arbitrary air quantities are specified for ventilation or other reasons independent of the selection of the cooling coil. As shown in

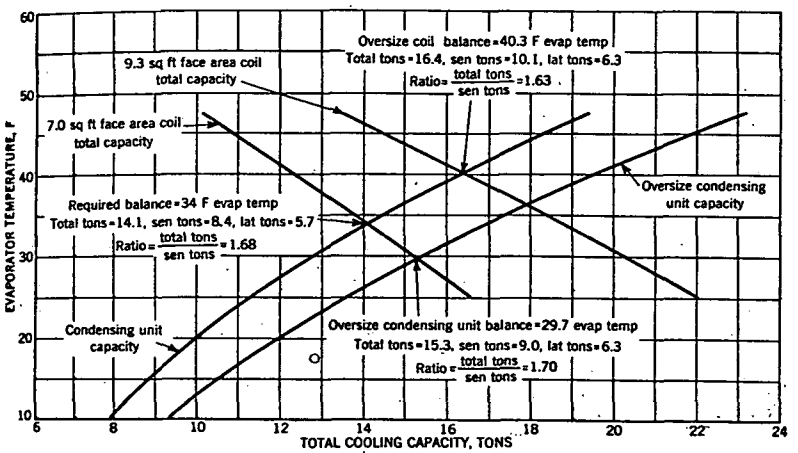


FIG. 17. BALANCING CONDITIONS FOR EXCESS COIL AND CONDENSING UNIT CAPACITIES

Table 3, the coil selection can be altered to take care of various air quantities for the same duty.

Where coil and condensing unit are selected for the peak load condition, and the sensible load partially disappears due to fall of outside temperature or other cause, the condensing unit and coil rebalance. This may result in more sensible capacity than required at the light load condition and less latent in proportion, with an increased relative humidity in the conditioned space. Such a condition, for a typical installation, is shown in Table 4. If approximately 40 per cent of the total air is by-passed, the condition will be improved as indicated. The situation could be entirely avoided by using reheat. With sufficient reheat, it is possible to handle any ratio of sensible and latent loads and maintain the design temperature and humidity.

Care should be taken to avoid freezing at light loads. In general, freezing occurs when the coil surface temperature falls to 32 F. With