

Fig. 6 Arrangement for Face Control

transfer surface. In air-cooling coils, the air usually flows at right angles to the tubes. In a coil having only one row in the direction of air flow, the relative directions of flow would all be at right angles. In coils having more than one row in the direction of air flow, the media in the tubes may be variously circuited as illustrated for water coils in Fig. 8. It is the usual practice to designate a coil that is circuited and employed as in Fig. 8A, as a *parallel-flow* coil. Figs. 8B and 8C show the general arrangements that are termed *counter-flow* and *cross-flow* respectively. Cross flow is common in steam heating coils, the temperature within the tubes being substantially uniform, and the mean temperature difference the same whatever the direction of flow, relative to the air. The parallel and counter-flow arrangements as illustrated in Figs. 8A and 8B are common in brine or water

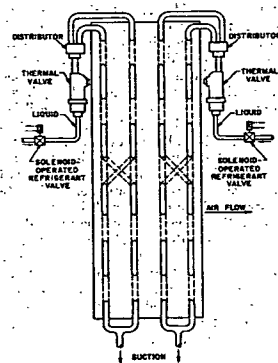


Fig. 7 Arrangement for Depth Control

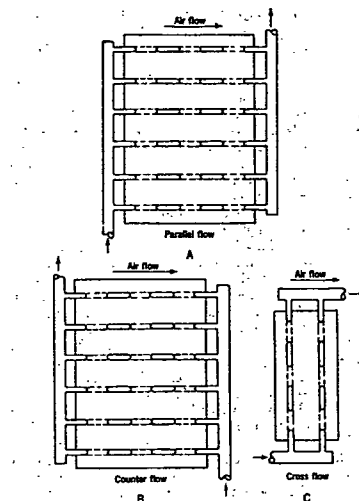


Fig. 8 Flow of Media in Tubes in Relation to Air Flow

coils, with the counter-flow arrangement being the preferred arrangement to secure the advantage of highest possible mean temperature difference. Most direct-expansion coils also follow the general scheme of counter flow but the circulating requirements for proper loading sometimes result in a combination of the other flow arrangements with counter flow in the same coil. Cross flow is more difficult to control in the volatile refrigerant coils because of the problem of equalizing loading of the parallel circuits.

Applications

A typical arrangement of coils is shown in Fig. 9. All of the air should be filtered to prevent dirt, insects, and foreign matter from accumulating on the coils. The cooling coil and humidifier (when used) must be provided with a drip pan to catch the condensate formed during the cooling cycle and the excess water from the humidifier. The drain connection should be on the downstream side of the coils, made of ample size (not less than 1/4-in. pipe), provided with accessible clean-outs, a deep-seal trap, and discharge to an indirect waste or storm sewer, so that there will be no possibility that sewer gas may enter the system. Precautions against freezing must be taken with the humidifier piping and drain connections as well as with steam or water coils. Sufficient insulation should be provided on such components as the drip pan, unit casing, water piping, etc., to prevent sweating.

Face-and-bypass dampers have proven to be satisfactory means of capacity reduction for cooling coils using non-volatile refrigerants. The use of such face and bypass damper arrangements on volatile refrigerant coils poses difficult refrigerant control problems which are most severe when a change of setting at the thermostat imposes a rapid change in position of the dampers. On many installations, the coil

Air-Cooling and Dehumidifying Coils

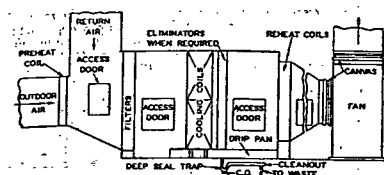


Fig. 9 Typical Arrangement of Cooling Coils in a Built-up Central System

bank is divided into 2, 3, or 4 sections and each section is connected to an individual compressor or to a modulating compressor or compressors which will adjust to the load as each succeeding coil section is cut out by the thermostat.

The design features of the coil (fin spacing, tube spacing, type of fins), determine at which air velocity condensed moisture will be blown off the coil. Water blows off some coils below 400 fpm face velocity, while this does not occur on others at face velocities in excess of 500 fpm. The carryover of water, blown off the coils into air duct work external to the air-conditioning unit, is always undesirable and should be avoided. However, water blow-off from the coils is not in itself necessarily harmful, provided arrangements are included in the unit design to catch and dispose of the condensate. Where there is a likelihood of water being carried over from the air-conditioning unit into external air duct work, eliminator plates should be installed on the down-stream side of the coils if no other means for condensate disposal are included. Usually, in a central station type air-handling unit or a factory-assembled self-contained air conditioner, eliminator plates are not used; other means for condensate disposal are included in the unit design to cover the maximum rated air quantity. When a number of coil sections are stacked one above another, there is a tendency for the condensate to be carried out into the air stream as it drips from one coil to the next. In such cases, drip troughs, as shown in Fig. 10, are used to collect the water and conduct it to the drain pan.

The enclosure around a coil or filter bank should be corrosion resistant and should have adequate access doors to provide for changing of air filters, cleaning of coils, adjusting expansion valves, oiling motors, etc.

Sometimes cooling and dehumidifying coils are sprayed with water to increase the rate of heat transfer and to provide outlet air approaching saturation. This arrangement requires a collecting tank and recirculating pump to maintain water circulation whenever the apparatus is in operation. Fig. 11 illustrates this arrangement with a bypass around the coil. This bypass is often used to facilitate thermostatic control. It is advantageous to direct only return air through the bypass, rather than a mixture of return and outdoor air, in order to hold the humidity ratio under thermostatic control.

It is considered good practice to support stacked coils individually in an angle iron frame to facilitate their removal for repair or replacement. The piping arrangement must be made to allow for such removal.

COIL SELECTION

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

1. The duty required: cooling, dehumidifying, and the capacity required to maintain balance with other system compo-

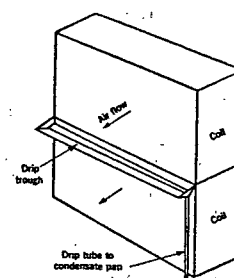


Fig. 10 Coil Arranged with Drip Trough

nents such as compressor equipment in the case of direct expansion coils.

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 cooling media and operating temperatures.
4. Space and dimensional limitations.
5. Air quantity limitations.
6. Allowable frictional resistances in air circuit (including coils).
7. Allowable frictional resistances in cooling media piping system (including coils).
8. Characteristics of individual coil designs.
9. Individual installation requirements, such as, for example, the type of automatic control to be used, corrosive atmospheres, etc.
10. Coil air face velocity.

The duties required may be determined from information in Chapter 24, 25, 26, and 27. There may, or may not, be a choice of cooling media, as well as operating temperatures 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 handled may be limited by the use of installed ventilating ducts for air distribution or may be determined by requirements for 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 because of sound-level requirements. The allowable friction through the water or brine circuit may be dictated by the head available from a given size of pump and pump motor. Selection of

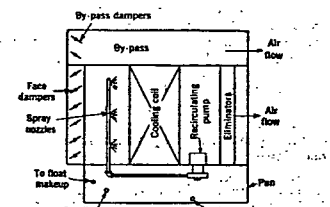


Fig. 11 Recirculating Spray System for Cleaning Coils