

accomplished by packing fiber glass or other insulation material around the pipes at the opening. Sealing prevents transmission of sound between adjoining spaces, and prevents moisture from the nonconditioned chases from reaching the fan-coil conditioner, some parts of which may be below the dew point of the air in the chases.

Where the fan-coil conditioner is to handle all or part of the latent heat load, a condensate return system must be installed to carry away the moisture removed from the air. Condensate lines should always be installed in hotel and apartment applications where it is difficult to predict accurately the moisture loads which will be imposed by such loads as showers and cooking.

Most room fan-coil conditioners are furnished with one or more condensate pans under the coil and control valves. A drain connection makes it possible to attach condensate lines of copper tubing, plastic tubing, or pipe. The horizontal condensate runout from the fan-coil conditioner to the condensate riser should be pitched in direction of flow and should be insulated. It is not necessary to insulate the condensate riser. When air conditioning is installed in existing buildings, the first cost can often be reduced by using the old water lines as part of the condensate system.

When the fan-coil conditioner is installed with its own decorative enclosure, the piping must be compactly installed to permit installation of the cabinet. With a furred-in type of installation, more space is available for the piping. In both instances, it is desirable to mount the control valves and the shut-off valves over the fan-coil conditioner condensate pan, thereby eliminating the expense of insulating them.

Shut-off valves should be installed on each riser so that it may be isolated from the remainder of the system. Being able to isolate the riser provides ease of maintenance and also permits part of the system to be put in operation before the remainder of the system is completed. Each riser should also be provided with a strainer.

Shut-off valves should be installed at each unit, or in the lines serving two or three units, so that individual units can be isolated for maintenance without shutting down and draining an entire riser. A bypass valve is frequently installed upstream from the unit-mounted water control valve. This permits the system to be flushed out after installation and prior to start-up, without the risk that construction dirt will foul the control valves.

Single-Supply Systems

As with the methods of supplying ventilation air, there are several types of systems for supplying water to the room fan-coil conditioners.

The single-supply system is the oldest and lowest first cost method. During cold weather, hot water is circulated to all fan-coil units. During hot weather, chilled water is circulated to all fan-coil units. The operating engineer decides when to supply hot water or chilled water.

This system works well during those periods when only cooling or only heating is required in all the perimeter spaces. Whenever some spaces require heating while others require cooling, the system fails. In most buildings this condition occurs when the outside ambient temperature falls much below 70 F. During these periods the unoccupied shaded exposures frequently require heating while the sunny exposure requires cooling. The problem is greatest in glass wall and curtain wall buildings where variations in solar and transmission loads are felt almost instantaneously in the perimeter spaces without benefit of the lag that would be due to heavy masonry construction.

In an effort to provide a degree of flexibility, the single-supply system is often zoned so that hot water can be sup-

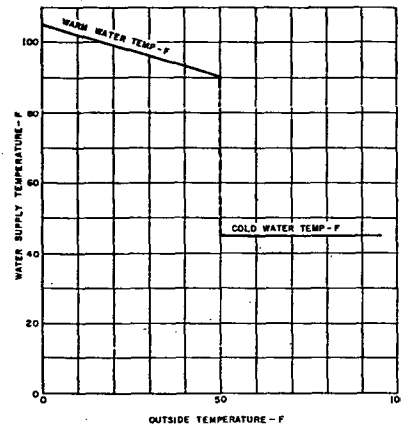


Fig. 47 Typical Water Temperatures for Single-Supply System

plied to units on one zone while chilled water is supplied to units on another zone (see Figs. 40 and 41). The more zones provided, the greater will be the flexibility to meet changing loads and to maintain design conditions in the perimeter spaces. Many times it is possible to zone the building according to exposure in 2 to 4 zones. Buildings in large cities frequently require vertical zoning so that fan-coil conditioners on the lower floors which are shaded by other buildings are on one zone while the conditioners serving the upper, sunny floors are on another. The number of zones required will vary from building to building. The final decision as to how many zones should be utilized will depend on first cost and space limitations.

All building layouts do not lend themselves to zoning. Generally buildings having a block plan are more easily zoned than those of irregular shape, because: (1) it is easier to group units having similar load requirements because exposures and the effect of shading by adjacent buildings are more easily defined, and (2) the place for additional zone pumps, water heaters, and extra piping may be more easily found. It is generally easier to zone new buildings than existing buildings because space is frequently lacking in the latter for installing the extra zone equipment.

Fig. 40 is typical of an application where the fan-coil units are selected to handle the latent load for the entire perimeter space. When a zone requires cooling, valve V1 is closed, valve V3 is open, and the zone pumps recirculate chilled water from the primary circuit through the zone and back to the primary circuit. When a zone requires heating, valve V1 is open, valve V3 is closed, and the zone pumps recirculate hot water from the zone heater through the zone and back to the heater. Valve V2 modulates to control the hot water temperature leaving the heater.

The chilled water temperature should be maintained at a constant temperature, typically 40 to 45 F even during periods of reduced cooling load to assure good humidity control. The maximum hot water temperature is generally established so that it is high enough to adequately heat the perimeter

spaces with the fan-coil conditioner fans operating at low speed. The hot water temperature should be varied by means of a master outdoor thermostat. This is necessary to prevent overheating during mild weather because overheating by gravity circulation can occur even when the occupant has turned the fan off. A typical water temperature schedule is shown in Fig. 47. At an outdoor temperature of 55 F, the zone represented would be changed from cooling to heating if the outdoor temperature were dropping, or from heating to cooling if the outdoor temperature were rising. This requires changeover of controls serving both the central system and the perimeter fan-coil conditioners. The larger the building and the greater the number of zones, the more this entails. A choice must therefore be made whether the changeover is to be a manual operation performed by the operating personnel, or an automatic operation which the control can perform pneumatically or electrically from the central control point.

Fig. 46 is typical of an application where the fan-coil units are selected to handle only the sensible cooling load of the perimeter space. A separate ventilation air system distributes air from the humidifier to each perimeter space in sufficient quantity to handle the entire perimeter space latent load. The dehumidifier coils receive the coldest water available for dehumidification direct from the chiller. Any zone requiring cooling receives a mixture of zone return water and chilled water. Mixing valve V4 is thermostatically modulated to maintain a chilled water temperature high enough to produce unit coil surface temperatures above the room dew-point temperature.

Dual-Supply Systems

With a single-supply system the ability to satisfy the constantly changing heating and cooling requirements of the

individual perimeter spaces increases with the number of zones provided. With a dual-supply water system, hot water and chilled water are available the year round at each room fan-coil unit. Thus each conditioner in effect is a separate zone. It functions independently of every other fan-coil conditioner in the building because its control valve selects either hot water or chilled water for the unit coil depending on whether the particular module it serves requires heating or cooling.

It is recommended that before a designer lays out a zoned single-supply system he consider one of the two types of currently used dual supply systems which are:

1. Dual-supply with Dual-return (Fig. 48). This is often termed a 4-pipe system.
2. Dual-supply with Single-return (Fig. 49). This is often termed a 3-pipe system.

Both types eliminate the need for zone water pumps, water heaters, valves, and controls which are required by a zoned single supply system. Also since dual-supply systems provide each room fan-coil conditioner with hot water and chilled water the year-round, it is unnecessary to use central station and fan-coil conditioner changeover controls such as are required in the single supply system.

Dual-Supply and Dual-Return Systems (Fig. 48) are commonly referred to as four-pipe systems and require two supply lines and two return lines for each fan-coil conditioner.

In one variation the fan-coil conditioner coil is divided into two rows connected to the chilled water supply and return lines and one row connected to the hot water supply and return lines. Separate control valves installed in each supply line can be of the pneumatic or electric type.

In another variation the fan-coil conditioner is furnished with one coil and two diverting valves, one at the coil inlet and one at the coil outlet. These valves, which can be either

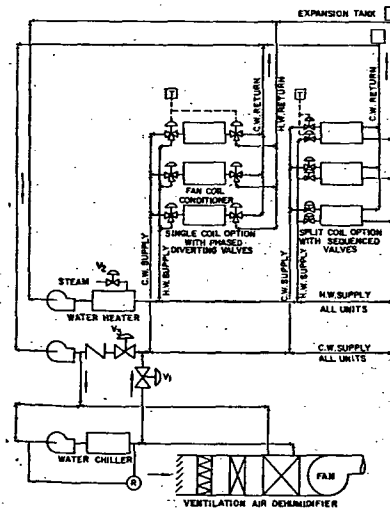


Fig. 48 Dual-Supply, Dual-Return System with Separate Ventilation

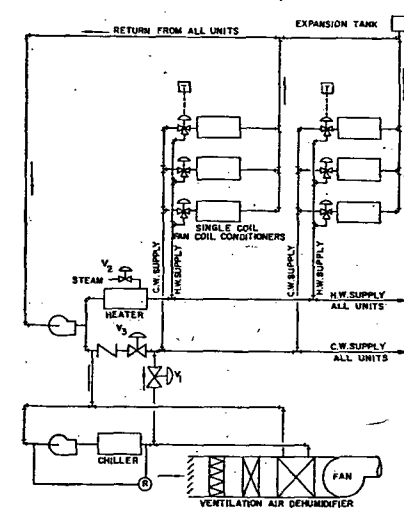


Fig. 49 Dual-Supply, Single-Return System with Separate Ventilation