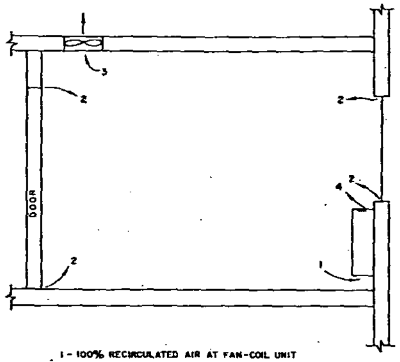


1 - 100% RECIRCULATED AIR AT FAN-COIL UNIT
2 - INFILTRATION AROUND WINDOWS AND DOORS
3 - POWER EXHAUST
4 - CONDITIONED AIR FROM FAN-COIL UNIT

Fig. 43 .... Ventilation by Wall Aperture

2. Baffles to prevent wind driven rain from being blown into the building.
3. A rain dam and weep holes to permit rain entrained in the assembly to drain back to the outdoors.
4. An insect screen which is desirable, but should not be incorporated in the through-the-wall assembly if it will be inaccessible for cleaning from within the building. The fan-coil conditioner filter should screen out insects as it filters the outdoor air.

Fan-coil conditioners applied with wall apertures should have a damper assembly for adjusting the quantity of outdoor air drawn into the building, as well as provisions for closing the damper tightly, when necessary during winter operation. All the outdoor air should pass through the filter and mix with recirculated room air before entering the fan and coil sections. It is important that direct blow-through into the room be eliminated, because it may result in uncomfortable drafts.

When this method is used with existing buildings, it has been found to be practicable for reasons of economy of installation to provide the through-the-wall aperture by using a core drill to make a 4 in. diameter hole through the exterior wall in which is installed an assembly having a 4 in. cross-section. In new building construction, a rectangular cross-section through-the-wall assemblies is generally used, with the assembly designed to be sealed with mortar into the opening in the exterior wall. In curtain wall construction it is frequently necessary to draw the air vertically through a grille installed in the lintel of the window below, with the wall panel being specifically designed to accomplish this function.

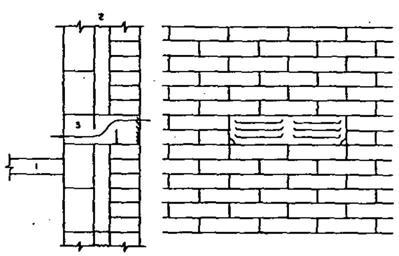
It is not possible to achieve positive ventilation and pressurization using this method for the following three reasons:

1. Whenever the occupant turns the fan switch of the room-fan-coil conditioner to the *off* position, the fans stop and, therefore, no air is drawn into the space from the outdoors.
2. Wind pressure on the outside of the building wall can create pressures which are higher or lower than those within the conditioned space. The pressures will be higher on the windward side of the building thus creating over ventilation and possible draft. It will be lower on the leeward side of the building and can lead to exfiltration and under-ventilation. The combined effect can result in an actual migration of air within the building from the windward side to the leeward side.
3. The chimney or stack effect of tall buildings produces a negative pressure and an inward flow of air at the lower floors and a positive pressure with an outward flow of air at the higher floors. A neutral zone where there is no pressure differential between the indoor and outdoor air generally exists at the middle floors. Thus, ventilation balance of even the most carefully engineered aperture system is easily upset by three factors over which the designer has no real control.

The use of wall apertures should be restricted to low buildings where the location of the building is such that it is shielded from wind by adjacent buildings, walls, or natural barriers.

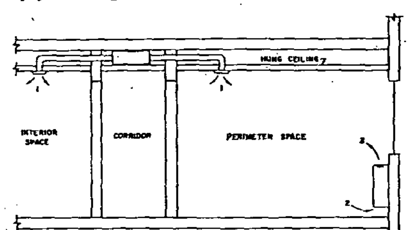
Ventilation From Interior Space System

Where a building has interior spaces as well as perimeter spaces, a practical method of supplying a constant quantity of dehumidified ventilation air to the perimeter spaces is to size the duct system serving the interior zone with enough air handling and cooling capacity to also supply perimeter ventilation (Fig. 45). Branch ducts from the trunk ducts serving the interior spaces discharge this dehumidified ventilation air into the perimeter space through ceiling or sidewall grilles if vertical fan-coil conditioners are installed along the exterior wall. Where horizontal models are ceiling mounted, this air can be conducted to the fan plenum where it mixes with the recirculated room air before being discharged by the fan-coil conditioner into the room. The added cost is not great compared to the positive results realized, since a relatively small amount of additional ductwork is generally required and larger, rather than additional, air handling and dehumidifier equipment will generally be adequate.



1 - SLAB 2 - CAVITY WALL
3 - APERTURE SHOWING RAIN LOUVERS, RAIN BAFFLES AND CORNER DRAIN HOLES

Fig. 44 .... Typical Wall Apertures



1 - CONDITIONED AIR FROM INTERIOR SYSTEM
2 - RECIRCULATED AIR
3 - CONDITIONED AIR FROM FAN-COIL UNIT

Fig. 45 .... Ventilation from Interior Space System

The designer has the choice of supplying only enough of this air to satisfy the ventilation requirements of the perimeter spaces, taking what dehumidification is available, or supplying sufficient air to satisfy the entire dehumidification requirement of the perimeter space as well as the ventilation requirement.

An adequate supply of this air is capable of providing the same control of humidity in the perimeter spaces as is maintained for the interior spaces. This air should be at a relatively constant temperature year round, approximately 60 F. It is normally lower than room temperature since the interior spaces, when lighted or occupied, require year round cooling to counteract internal loads. This ventilation air is therefore a constant cooling source that decreases the amount of cooling required of the fan-coil conditioners in summer and increases the amount of heating required of them in the winter. These factors must, therefore, be considered when sizing the fan-coil conditioners.

Ventilation From Separate Duct System

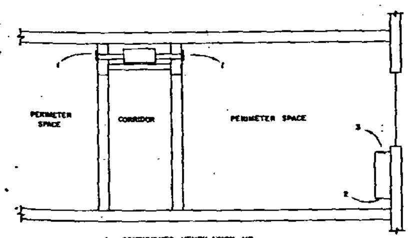
There are several variations of this method, all of which provide positive ventilation and dehumidification to the perimeter spaces while making it possible to add a second source of heating or cooling to the space. This approach (Fig. 46) is commonly employed where system performance is of more concern than first cost and the building is composed of only perimeter spaces, thus precluding the use of branch takeoffs from an interior zone system. The quantity of this ventilation air will rarely exceed 20 percent of that required by an *all-air* system. Thus the central fan and duct system itself will require considerably less space and investment than would be required for an all-air system. This makes the overall performance of the fan-coil system comparable to that of an induction unit system. However, the initial cost increases to the point where the designer may also want to evaluate the application of an induction unit system as a means of lowering first cost.

There are four variations of perimeter duct systems:

1. Vertical risers with vertical fan-coil conditioners
2. Vertical risers with horizontal fan-coil conditioners
3. Corridor duct with vertical fan-coil conditioners
4. Corridor duct with horizontal fan-coil conditioners.

With any of these variations, central station air handling equipment is used to filter, preheat (in winter), and dehumidify (in summer) the incoming outdoor air prior to delivery of the air to the duct system. Frequently reheaters are used, as in an induction unit system, to reheat the ventilation air during the intermediate seasons when the ambient outdoor temperature is below room design. Thus the ventilation-air system counteracts transmission losses and heats the unoccupied and shaded rooms while the thermostatically controlled water valves on the fan-coil conditioners modulate the flow of chilled water to counteract the load from people, lights, and sun. This method can eliminate expensive zoning of the water system and the need for the operating engineer to switch frequently from hot water to chilled water, and vice versa, during the intermediate seasons. In winter months, when the perimeter spaces require mostly heating, hot water can be modulated at the room fan-coil unit coils and the preheated ventilation air can be supplied to the space at about 48 F, thereby providing a small amount of cooling capacity.

In all four variations, the air must be distributed to the spaces or to the fan-coil conditioner at low sound levels since the units are not equipped to attenuate sound. Sound attenuaters must, therefore, be designed into the duct system if the ventilation air is to be introduced at other than low pressure.



1 - CONDITIONED VENTILATION AIR
2 - RECIRCULATED AIR
3 - CONDITIONED AIR FROM FAN-COIL UNIT

Fig. 46 .... Ventilation from Separate Duct System

WATER SYSTEMS

Room fan-coil conditioners are selected to provide sufficient heating and cooling capacity based on a certain delivery of hot water and chilled water. The design of the water system must assure that each room fan-coil conditioner can receive its maximum design flow rate, otherwise design conditions within the space will not be maintained when peak heating or peak cooling loads exist.

Layout and Balancing

Where room fan-coil conditioners are applied without manual or automatic water control valves, the fan-coil conditioner receives a constant water flow year-round regardless of the load within the space. Control of room conditions is obtained by manual or thermostatic variation of fan speed. Since it is impossible to balance the flow of water accurately to each fan-coil conditioner after the water system has been installed, the piping must be sized carefully with reversed return where possible. Where a reversed return is not adaptable to the building layout, a flow control fitting should be installed in series with each fan-coil conditioner. This fitting should be sized to handle the unit maximum design flow to prevent excessive flow to units installed closest to the pumps while units farthest from the pumps receive too little water.

These same design considerations apply when manual water control valves are installed at each fan-coil unit. However, it cannot be assumed that the occupant will control the fan-coil conditioner output by throttling the manual control valve. The occupant may well choose to reduce the unit fan speed manually. In such case, the unit will require the maximum design flow rate. Manual water control valves are not generally recommended for this reason.

Where the room fan-coil conditioners are applied with thermostatically controlled water valves for capacity control, the layout and balancing of the water circuit is less critical because all units will generally not require this maximum flow simultaneously. When some control valves operate at throttled condition, additional water becomes available to those that are not throttled. It is good practice to use the reversed return principle in laying out the risers, but the headers supplying the risers can be installed for direct return.

Insulation, Condensate Lines, Service Valves

Chilled water and return water lines should be insulated to prevent sweating. In new building construction in particular, vertical and horizontal pipe chases should be sealed at points where the piping comes through the floor or wall. This can be