

Displacement ventilation and chilled beams

In a partially centralised air conditioning system, a central air handling unit filters and then heats or cools incoming air. Adjustment of temperatures is then made with room-based equipment. Two of the key technologies used in partially centralised systems are:

- ▲ Chilled beams with displacement ventilation
- ▲ Fan coils

Displacement ventilation

A simple system that uses air brought into the building and either cooled or warmed to around 18°C. This air is brought into areas around the building at very low velocity, through floor terminals, or low-level wall terminals. Low velocities are needed to ensure that occupants don't feel a draught.

The cool supply air pools in a layer near the floor. Body heat from occupants, and heat from equipment such as PCs warms this pool of air which then rises. Fresh cool air is therefore drawn upwards, cooling the office and drawing out sources of pollution such as CO₂. The rising warm air is extracted at high level.

Due to the heavy heat loads found in today's offices, the displacement ventilation system is often teamed with chilled beams to enhance the cooling effect. The simplest of these is the passive chilled beam. These consist of an aluminium-finned copper coil mounted in a galvanised metal casing. The top and bottom of this casing are open to allow air to flow across the coil. Thus warm air rises, comes into contact with the coil and is cooled then falls back down to the occupied level of the room.

Passive chilled beams are a simple technology which is cheap to run. But there are a few challenges to overcome. Firstly, the chilled water in the coil should not fall below 14°C, or condensation can occur. Secondly if the cooled air falls away from the beam too quickly this can cause draughts for occupants sitting below the beam. Finally, passive beams only provide static cooling, so extra fresh air must be introduced to the occupied space to meet minimum requirements.

One way to deal with these issues is to use active chilled beams. This system does not use the displacement ventilation principle. Instead, air from the central air handling unit is fed into the beam at high velocity. This air leaves the supply ducting through slots or nozzles and drags (or induces) warm room air into the beam and across the cooling coil. The supply air and the cooled room air mix and enter the occupied space through the underside of the beam. This air is moving quickly enough to move horizontally into the space, so it does not create cold downward draughts.

An added advantage of active beams is that they can also be used for heating. With no fans or moving parts, chilled beam installations are efficient to run and very low maintenance.