MECHANICAL HOME VENTILATION SYSTEMS

There has been a big growth recently in the installation of mechanical home ventilation supply systems. We are told they can solve many of our indoor environmental problems, but sometimes basic issues need tackling first.

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Ventilation is required to meet the requirements of the New Zealand Building Code Clause G4 *Ventilation*. Passive ventilation is the typical first choice solution and under G4/AS1 is met by a minimum openable area of no less than 5% of the space's floor area. Mechanical ventilation is required where this cannot be met, and can also be useful even if the minimum openable area is present, because the control of passive ventilation airflow can sometimes be limited.

The advantages of mechanical ventilation systems (either extract or supply) include:

- air can be supplied or removed at specific flow rates and for specific periods of time
- excess ventilation can be minimised, lowering the amount of extra space heating required
- polluted or moist air can be extracted directly from where it is produced
- the removal of polluted indoor air to the outside is guaranteed
- outside air can be sourced from a location where the air is fresher, cleaner, drier or warmer
- outside air can be heated or cooled before entering the space
- sufficient ventilation and air movement can be provided in hard-to-reach spaces (often in apartment buildings) or in airtight houses
- airflow into and out of a house (that is airtight) is less affected by outside air temperature, wind velocity and direction
- higher building security than opening windows.

However, when compared to passive ventilation, mechanical ventilation does have some potential drawbacks, such as using energy, causing noise, requiring extra penetrations in the envelope, being visually unattractive, being expensive to buy and install and needing ongoing maintenance.

Proprietary mechanical ventilation supply systems force outside air into spaces like passageways or living rooms, replacing room air with air that is fresher and should have lower moisture levels.

Improving air quality?

Just having fresh air enter a room improves air quality. Supply systems also filter particulates from the incoming air adding some extra benefit. An EU4 or G4 grade filter is the minimum recommended

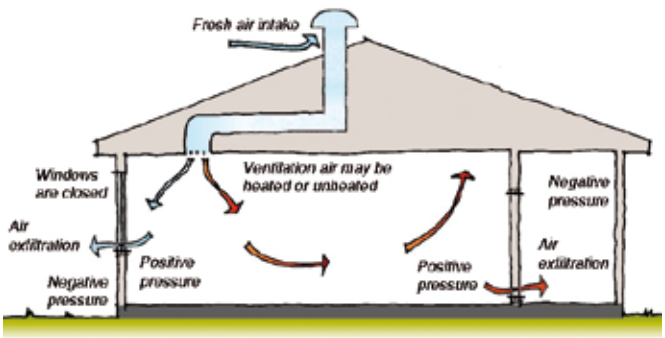

Figure 1: Positive pressure with a supply air ventilation system.

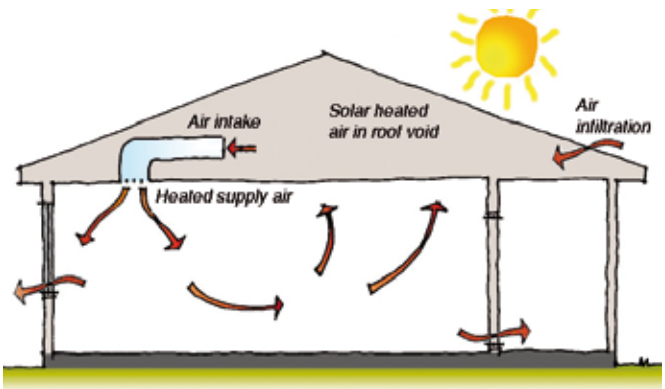

Figure 2: Domestic ventilation supply system using heat from the ceiling space.

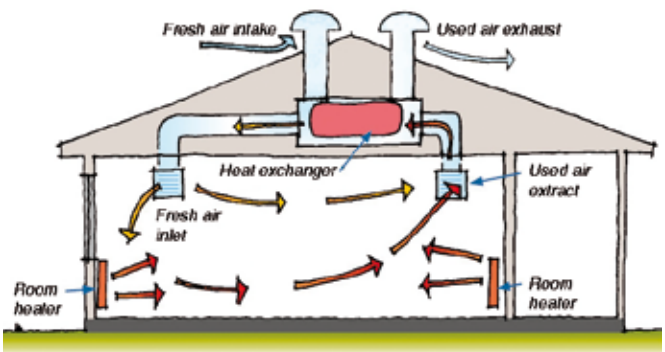

Figure 3: Domestic ventilation heat recovery system.

and will remove 80–95% of particles down to 10 microns. They require replacement from time to time, though some types are washable (at least once a year).

Some supply systems also claim to provide positive pressurisation of the building space (see Figure 1). This means that the ventilated space is at a higher pressure than its surroundings, so air leakage will generally be directed outward through the room envelope. This limits uncontrolled entry of cold or polluted air from outside, and drives out stale room air. However, the levels of positive pressure required to be effective will not be achieved if there is insufficient pressure provided by the fan, the building is not sufficiently airtight, or there is high wind exposure.

Help reduce condensation

Excess moisture is a key concern in houses. This should be managed by providing three things – adequate ventilation (passive or mechanical), heating and insulation. A ventilation supply system alone may not resolve dampness or condensation problems unless other issues have been addressed, such as: insufficient space heating; lack of insulation; draughts; and/or a mechanical extract system to remove moisture-laden air when and where it is produced in kitchens, bathrooms or laundries.

Space heating of sorts

When outside air is cold, the ventilation air supply must be heated before it enters the room. Generally, supply systems have an in-line (supplementary) heater in the ventilation airflow to take the chill off.

The energy efficiency of domestic ventilation systems is improved by capturing any available 'free' (or cheap) heating, meaning they can act as a space heater. The most common supply systems use air from the roof space above the ceiling, which has been passively heated by the sun shining on the roof above. This warm air is then moved into the space to be ventilated (see Figure 2). The viability and effectiveness of these systems require:

- adequate sunshine to raise the air temperature, which limits use at night, early in the day, when there is significant cloud cover or on sites with shading
- ambient temperatures that are not too low, for example more supplementary heating may be required in Invercargill than in Auckland
- sufficient ceiling space to give heat storage capacity and meet the air change rate needed in the occupied space
- limited air movement through the ceiling space to reduce heat losses, for example concrete tile roofs may have too much air infiltration
- limited moist air penetration from the spaces below (especially kitchens and bathrooms) otherwise the system will recirculate moisture around the building.

Domestic ventilation supply systems that use heat when available from the ceiling space are sometimes called heat recovery systems, but this name is more appropriate for systems incorporating a heat exchanger to recover heat from the living space. In these systems, warm (and often moist) room air is extracted, and passed through the heat exchanger before being discharged to the outside. Heat is absorbed by the heat exchanger and transferred into the fresh airflow supplied to the room (see Figure 3). There is no mixing of the two air streams, ensuring no moisture is transferred into the air supply. This system is not only an effective solution where a suitable roof void is not available, such as in apartments, but also removes moist air while reducing the amount of heating energy lost from a room when ventilation is provided. However, it does need the room air to be warmer than the outside air.

Most installations optional

Extract systems generally provide effective removal of moist air from bathrooms, kitchens and other wet spaces. Supply systems can also offer some benefits, but their effectiveness in a house (taking account of the already mentioned issues) needs to be assessed by the system supplier before purchase.

Most of the commonly available supply systems are installed for reasons of personal choice – they are rarely installed to meet Building Code requirements for mechanical supply ventilation. If they are, there may be issues with meeting G4/AS1, given the level of positive pressurisation required, and with using roof space air which may be deemed technically not to be 'fresh outside' air.