How to implement heat recovery in heating, air conditioning and ventilation systems

When you ventilate a building, cold air is drawn in to replace the warm air that's extracted. In winter, that means extra work for your heating systems.

The energy saving answer is to fit heat recovery devices. These use the heat from the outgoing air to pre-heat the incoming cold air.

The business case

The cost of installing HVAC heat recovery systems depends on the size and complexity of installation.

In an average installation, without any huge complications and where plant operates continuously, you could recoup the cost within two years. For plant that runs for just 40 hours a week, the payback period would be around five years.

The technology

Most HVAC heat recovery systems are based on a heat exchanger. The following table summarises the main advantages and disadvantages of the three most commonly used types.

Whatever type of heat recovery device you choose, you'll need automatic controls so that heat is recovered only when needed. Heat recovery plant should be isolated or bypassed in summer when the ventilation plant is using cold outside air to cool the building. Both the rotary wheel and runaround coils can simply be switched on and off by the automatic controller, but the plate heat exchanger needs a bypass damper.

Type	Advantages	Disadvantages
Plate heat exchanger	Simple, cheap and low maintenance.	Relatively low heat recovery efficiency, needs adjacent supply and extract ducts.
Runaround coil	Supply and extract ducts don't need to be adjacent.	Moderate maintenance requirements.
Rotary wheel	High recovery efficiency.	High maintenance, needs adjacent supply and extract ducts, leads to contamination between supply and extract streams.

Applications

Heat recovery can potentially be applied to any HVAC system that uses ductwork to supply and extract ventilation air. This could be for:

- offices.
- lecture theatres.
- hospital wards.
- swimming pool halls.
- manufacturing areas.

On most commercial and industrial sites, a plate heat exchanger would be used if the supply and extract ducts were adjacent; a runaround coil if not.

In theory, runaround coils can be used to link any supply and extract ducts. In practice, though, they tend to be economical only if the ducts are in the same plant room.

You wouldn't choose a rotary wheel for most applications, but they can be cost-effective in large, continuously operating systems where their higher efficiency outweighs their disadvantages. They can't, though, be used where cross-contamination between the supply and extract air streams is an issue – in medical and pharmaceutical environments, for example.

In general, heat recovery systems can't easily be applied to badly contaminated air streams, such as cooker hoods or some industrial extraction systems, because the heat exchanger gets fouled up.

When installing heat recovery in an existing HVAC system, you also need to consider the available space in the ductwork and whether your fan power is adequate.

Specification checklist

The following table outlines the points to discuss with your supplier when specifying a heat recovery system.

Considerations	Comments
Ductwork geometry	Adjacent or separate.
Duct sizes	For both the air supply and air extract systems.
Airflow rates	For both the air supply and air extract systems.
Air temperatures	Define the temperature (or range of temperatures) of both the supply and extract air streams as they enter the heat recovery device.
Maximum acceptable pressure drop	For both the supply and extract sides of the heat recovery device. Normally specified in pascals.

Commissioning procedure

- Measure and confirm the unit's heat recovery efficiency.
- Check all control systems operate correctly, for example:
  - that pumps or motors turn off when associated ventilation plant is turned off.
  - that any bypass dampers or on/off controls operate satisfactorily when heat recovery isn't needed or conditions aren't right.
- Make sure you have all the operating and maintenance documents.

Common problems

The most common problem at the design stage is failing to appreciate that any heat recovery device will create a pressure drop on the supply and extract fans.

Many fans will be able to cope with this without any major loss of performance. In other cases, though, ventilation may deteriorate unless you fit larger fan motors or increase fan speeds.

Apart from this, most problems with HVAC heat recovery systems are sorted out with good maintenance regimes that cover:

- blocked filters.
- dirty heat exchange surfaces.
- blocked condensate drains.
- damaged damper seals.
- seized damper actuators.
- poorly calibrated controls.

Finding a supplier

Air to air HVAC heat recovery systems come under the Government's Enhanced Capital Allowances scheme. You can see a list of ECA approved suppliers at www.eca.gov.uk

Heat recovery systems should always be fitted by a reputable heating contractor. You may already know of a good contractor; if not, try contacting a recognised trade association.

The Heating and Ventilating Contractors' Association (HVCA)
020 7313 4900
www.hvca.org.uk