A centralised HRV system consists of:

- **An HRV unit.**
  This has two fans, one for the fresh supply air and one for the stale exhaust air. And it has a heat exchanger, where the exhaust air warms up the supply air. (In hot weather, the exhaust air may sometimes be used to cool down the supply air.)

- **Air valves in every room**
  Supply air valves are fitted in the ceiling (or possibly on a wall) of each habitable room.
  Extract air valves are fitted in each ‘wet’ room (including the kitchen).

- **Ducting**
  Rigid or semi-rigid ducting conveys the air between the HRV unit and the air valves. Rigid ducting is used for conveying the air between the HRV unit and the outside.

The Approved Document F1, 'Means of ventilation', refers to a supplementary publication, the Domestic ventilation compliance guide, which gives guidance on installing and commissioning ventilation systems. (See Further Info.)

**Designing a system**

HRV components are often supplied direct from the manufacturer (or UK importer). Most suppliers offer to design a system from your architectural drawings. Or you may want to pay for a design. (See, for example, 'Green Building Store' in Further Info.)

The design (and installation) should comply with Approved Document F1 of the building regulations. That stipulates the minimum supply rate, according to the floor area of the house or the number of bedrooms. The supply airflows to inhabited rooms are usually set to be in proportion to room volumes. The Approved Document also sets minimum extract rates for the different types of wet room: kitchen, utility room, bathroom, or WC. Their sum gives the minimum total extract rate that is required – the Boost setting of the HRV unit must be capable of achieving this. (For details, see the Footnote.)

HRV units are available in different sizes with differing maximum flow rates. With the flow rates calculated for the Normal supply and the Boost extract, and the air resistance of the ducting also calculated perhaps, a suitable sized HRV unit can be selected – it should be considerably oversized if noise is to be minimised. As a rough rule of thumb, the maximum airflow of the unit should be about 50% greater than the maximum airflow that is actually required.

Attention should be given to sound levels, and where necessary silencers should be included in the ductwork. (In their installation designs, the Green Building Store ensure that noise levels are very low: below 30 dB(A) at extract valves in wet rooms, and below 25 dB(A) at supply valves. See my earlier article, 'HRV Units', for the significance of dB(A).)

**Installation**

The building regulations require an HRV system to be certified by a competent person, eg, a person who is qualified under a BPEC scheme (or similar). So what does this new
acronym stand for? I searched in vain on the BEPC website for the answer to that. An email to them elicited the answer: British Plumbing Employers Council. Nowadays they are involved in a wide range of training, for Gas, Plumbing, Renewables, Oil, and Electrical. And a similar scheme for certifying ventilation installers is now operated by the well respected NICEIC (National Inspection Council for Electrical Installation Contracting).

Anyway, various ventilation companies around the country put on training schemes for installers – presumably focussing mostly on their own products.

Although an HRV system needs to be designed at the beginning by an expert, and commissioned at the end by an expert, its installation may not require great skill, and your handy site workers may be able to install the HRV system as the build progresses. It's desirable to get the ducting in place before the plumber and electrician install their pipes and cables – but discuss their requirements with them beforehand.

Some installation companies offer a 'buddy' service. They give you practical guidance at the start, assume over-sight of the installation, and commission it at the end. But your workers do most of the hands-on work – thereby keeping down costs.

Be warned: Reports of ventilation systems on new estates have shown poorly installed systems, indicating a lack of competence by the installers/builders. (Eg, *Ventilation in New Homes* – See Further Info.)

The design and installation of an HRV system might go something like this:

1. You send your house plans to an HRV supplier.
2. The company makes an initial proposal.
3. They produce a detailed design of the system.
4. Optional site visit by the company.
5. Revisions, if any, to the initial plan.
7. Components supplied.
8. System installed, either by the company, or by you or your workers.
9. Airflows regulated, and the system commissioned by the company, or by some other competent person.
10. Certificate passed on to you.

Dust abounds on building sites – care should be taken during installation to keep dust out of the ventilation system.

**Commissioning the system**

Once the HRV system has been installed, it should be inspected, tested and commissioned by a ventilation installer who has been certified, for example, by BPEC or NICEIC. (It can be a good idea to get the HRV design, supply of components, and commissioning all from the same company.)

As mentioned last month, the airflow at each air valve needs to be set to match the design figure. This is achieved by adjusting each air valve and locking it in position. An alternative method is available with semi-rigid ducting: a restrictor ring with the appropriate aperture is placed in its port in the manifold (or 'distribution box').

The overall supply and extract flow rates should be approximately equal (say, with a difference of less than 10%). The supply and extract ducts will have different air resistances, so equalising the flow rates through them is done by adjusting the relative speeds of the two fans of the HRV unit. (This is done for the 'Normal' speed setting.) Note that some fan units are now 'self-balancing', and that simplifies commissioning –
or it can even help to make up for poor commissioning. Constant volume flow is another useful attribute of some HRV units – the fans run faster to overcome extra resistance as filters become clogged.

Once successfully commissioned, you should receive a commissioning certificate in three parts:

- Part 1: System details.
- Part 2: (a) Installation details, and (b) Inspection of installation.
- Part 3: Air flow measurement test details.

A copy of Part 3 is required by Building Control. This should show that the measured airflows at all the valves are at least as great as the designed airflows.

And you, as the householder, should receive an 'Operation and maintenance manual' with lots of useful information on how to use and maintain the system.

**Control**

The controller of an HRV unit gives the householder basic control over the operation of the unit. In particular, it allows the householder to select the speed of the fan unit, with usually a choice of three speeds:

- Low – eg, when occupants are away on holiday.
- Normal.
- Boost – eg, when a wet room is used.

The controller also allows many other sophisticated adjustments to be made, but many of these are best set at the outset by the installer.

The controller may be part of the fan unit, or it may be separate so that it can be positioned in a convenient location, not necessarily by the unit. Connection to the fan unit can be wired or wireless. Do you want a simple controller, or a sophisticated one? For example, some controllers show when filters need to be changed.

Switches of various types can be connected to the controller, by wire or wirelessly – eg, switches for detecting humidity (called humidistats), movement (PIR), or CO2. These switches might be installed in individual rooms, and when activated set the airflow to 'Boost', for example, for a pre-set time, typically 30 minutes.

An alternative is an HRV unit which incorporates its own a humidistat. This is activated when humid air is extracted from any wet room, and so there is no need to have any humidistats in the wet rooms. (Optionally, the automatic 'Boost' control can be supplemented by manual 'boost' switches in wet rooms.) In a WC, fit a PIR switch or a manual switch rather than a humidistat.

**Room for improvement**

A lot is being written nowadays about how 'smart' our homes are going to be, aided by digital technology. One of the nice things about the Passive House method is that the house doesn't need to be 'smart' to remain comfortable. However, there is an aspect of it, namely the HRV system, where I do see a need for more smartness.

For example, consider this:

- Someone takes a bath. The humidity in the bathroom rises and the HRV system is smart enough to recognise that more extraction is required. So the HRV unit
switches to 'Boost' mode. But that extracts more air from all the wet rooms, not just the bathroom. That is not smart enough.

Or another scenario:

- During commissioning, the air supply to your guest bedroom is adjusted as for any other habitable room. But for most of the year, it is unoccupied, and unfortunately the HRV system is not smart enough to give this individual room only a trickle supply of fresh air while it is out of use.

In short, there needs to be more control over the ventilation rates for individual rooms. I speculate that possibly this will be achievable in the future by using controllable apertures in the air valves or the ductwork.

But with the present state of the technology, the only controls are on the fan unit: the Low, Normal, and Boost settings change the speed of the fans, and thus the ventilation rate for the whole house. The situation may change. I note that the Scottish 'Supporting Guidance, Domestic Ventilation' (2015 edition) state:

'It is preferable for a boost facility to target individual rooms rather than increase the overall extraction rate from the dwelling.'

Individualised 'Demand Controlled Ventilation' is coming to commercial buildings, but it is not readily available for houses. No matter. Install a not-so-smart HRV system now, and it may be possible to upgrade it with smarter controls at a later date.

Air transfer path

To allow air to move around the house, internal doorways should not be airtight. The standard recommendation is to undercut a door to leave a 1 cm gap between the door and the finished floor surface. But who knows what the floor covering will be, now and into the future? My suggestion is that it should become standard practice to fit a timber threshold strip (or 'threshold plate') at every doorway. The 1 cm gap between the threshold strip and door would remain, whatever floor coverings are fitted either side. (Arguably, the under-door gap could be somewhat less than 1 cm, especially for a small room. In fact, the Scottish Standards recommend 5 – 8 mm.)

When no floor covering has been fitted (and there is no threshold strip), the Domestic Ventilation Compliance Guide suggest that the undercut should be 2 cm.

The gap under the door reduces sound resistance, of course.

There are two other possible methods of providing an air transfer path:

- Adapt the architrave at the head of a doorway to allow for an air gap which is hidden from sight. (See 'The Passivhaus Handbook'.)
- Fit an Air Transfer Grill into the door or internal wall. (Some types reduce noise transfer.)

Reminder

Especially for web searchers: In the UK, 'Heat Recovery Ventilation', HRV, is often called 'Mechanical Ventilation with Heat Recovery', MVHR.
FOOTNOTE: **Minimum ventilation rates required by Part F**

An HRV system is 'System 4' of the Approved Document F. This shows how to calculate the minimum ventilation rates:

**Step 1:**
Determine the minimum supply rate for the whole dwelling (on the Normal fan setting):

\[
\text{Minimum supply rate} = 0.3 \text{ litre/sec per m}^2 \text{ of floor area.}
\]

(The other requirement according to the number of bedrooms is almost certainly met by the floor area requirement.)

As an example, for a house with a floor area of 150 m\(^2\):

\[
\text{Minimum supply rate} = 45 \text{ litres/sec.}
\]

**Step 2:**
Determine the minimum extract rate for the whole dwelling (usually on the High fan setting, ie, Boost):

Minimum Boost extract rate = Sum of the minimum Boost extract rates for each wet room:

<table>
<thead>
<tr>
<th>Room</th>
<th>Minimum Boost rate (litres/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitchen</td>
<td>13</td>
</tr>
<tr>
<td>Utility</td>
<td>8</td>
</tr>
<tr>
<td>Bathroom</td>
<td>8</td>
</tr>
<tr>
<td>WC</td>
<td>6</td>
</tr>
</tbody>
</table>

**Extract ventilation – Minimum Boost rates**

Our example house might have a kitchen, a utility room, two bathrooms and two WC's. So:

\[
\text{Minimum boost extract rate} = 13 + 8 + 2 \times 8 + 2 \times 6
\]

\[
= 49 \text{ litres/sec.}
\]

**Step 3:**
The Normal ventilation rate should be at least as great as the minimum supply rate of Step 1.

The Boost rate should be at least the higher of the Step 1 and Step 2 rates. (Usually the Step 2 rate is higher than the Step 1 rate, but not always.)

So for the example house, the Normal ventilation rate should be at least 45 litres/sec, and the Boost rate at least 49 litres/sec. (Most HRV units have three speeds: Boost, Normal, Low (or Holiday).)
In practice, to reduce steam in bathrooms or smells in WC's, you may well wish to have the Boost rate set to well above the minimum Boost rate. (See next month's article, 'Some Sundry Aspects of Heat Recovery Ventilation'.)

The ventilation rates of HRV units are usually expressed in cubic metres per hour. For comparison, the minimum supply rate above of 45 litres/sec would be expressed as 162 m³/h. (162 = 45 x 3.6.)

FURTHER INFO:

*Ventilation in New Homes*
– *A report of site visit findings.*
Published by the Zero Carbon Hub, 2015.
(But only one of the six sites visited had MVHR systems.)
Most of the ventilation systems on these commercial developments had been poorly installed.
Government funding for the Zero Carbon Hub was ended in 2016, and its website closed.
The report can be downloaded from the Government Web Archive: www.nationalarchives.gov.uk/webarchive.

*NHBC Standards Plus:*
*Chapter 3.2: Mechanical ventilation with heat recovery.*
Nowadays, NHBC Standards are available to download, free to all: www.nhbc.co.uk.

*Space Heating Through Heat Recovery Ventilation*
– *GHA Technical Briefing Paper 01,*
And
*MVHR Installation – Onsite guidance*
– *GHA Technical Briefing Paper 03.*
Both published 2015 by the Good Homes Alliance.
Download the 3-page pdf's from: www.goodhomes.org.uk.

*Approved Document F: Ventilation*

*Domestic ventilation compliance guide*
Published by the Department for Communities and Local Government, 2010.
63 pages, free pdf: www.planningportal.gov.uk.

*Continuous mechanical ventilation in dwellings*
– *Design, installation and operation.*
Though published many years ago, most of the information is still relevant. Except that nowadays, it is considered undesirable for the extract valve in the kitchen to be over the cooker.

*BPEC*
They certify ventilation installers.
They publish: *Domestic Ventilation Systems Manual – £45.*

DESIGN AND INSTALLATION OF AN HRV SYSTEM 6 (JANUARY 2018.)
NICEIC
They certify ventilation installers.

Video: MVHR Good Practice
30 minute Youtube video by Peter Warm of WARM Low Energy Building Consultancy.
www.youtube.com.

Green Building Store
They offer a MVHR design service (for about £400.). A quote is free.
www.greenbuildingstore.co.uk.

MES Building Solutions
Nationwide consultants who commission MVHR systems. (They also do airtightness testing, and much else.)
www.mesbuildingsolutions.co.uk.

Waterloo
Air transfer grills and diffusers.
www.waterloo.co.uk.

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