DUCTING FOR HRV SYSTEMS
– The distribution of airflows

As we saw in my two previous articles, Heat Recovery Ventilation (HRV) gives healthy and comfortable ventilation whatever the weather. And in wintertime, it conserves most of the heat that is generally lost by natural ventilation. The HRV unit, with its two fans and heat exchanger, is at the heart of the system. Now we consider how the airflows to and from the HRV unit are distributed around the house.

Ductwork

The incoming, fresh supply air is distributed via ducting to inlets in the habitable rooms (living room, bedrooms, etc); exhaust air is taken from outlets in the 'wet' rooms (bathroom, WC, etc, and the kitchen).

Two types of layout for ducting are possible, branched or radial.

Branched layout – with rigid ducting

A branched layout has long been the standard layout, using rigid ducting made of either PVC or spiral wound, galvanized steel. For example, PVC channel is available with a circular cross-section (of diameter 100, 125 or 150 mm) in lengths of 2 m. These relatively short lengths result in numerous joints, which could possibly lead to some air leakage. Joints may be pushfit, with rubber seals, or else airtightness is obtained by the use of a non-hardening duct sealant and tape.

The size of the main ducts should match the spigots of the HRV unit. A smaller diameter may be used for branch ducts. The air velocities in the ductwork need to be considered when the system is designed. Obviously, the larger the diameter of a duct, the slower the airflow, and the easier it is for the fan – and the quieter. According to BRE Digest 398, the air velocity should be below 4 m/sec in normal (unboosted) operation. (Some say that less than 3 m/sec is desirable for better silence.)

Channel with a rectangular cross-section (eg, 204 x 60 mm) is an alternative which may be useful in restricted spaces, though its airflow is not so smooth and it is more difficult to clean. (Adapters enable round channel to be joined to rectangular.)
A T-piece allows a branch to be inserted, and a 90° bend is useful behind an air valve at a ceiling or wall. Also available are 45° bends.

Flexible ducting must only be used in short lengths of less than 30 cm. A short length, pulled taut, is often used to connect rigid ducting to the fan unit or to an air valve – it helps to reduce noise transfer. (Flexible ducting should not be used to form bends, though in practice there are plenty of bad examples of this.)

![Diagram of flexible ducting](image)

Using flexible ducting
(Source: NHBC Standards, modified.)

An exhaust duct to the outside that rises vertically should incorporate a condensate trap to prevent water running down into the fan unit.

Most HRV units are very quiet, but when some of them are working at top speed, on the 'Boost' setting, a hum may be heard. To reduce this, a silencer (or 'sound attenuator') can be incorporated into the ductwork close to the fan unit.

Radial Layout with semi-rigid ducting

A new method of installing ductwork is the use of a multitude of semi-rigid plastic ducts without any branches. Many ducts are connected to a single manifold – radial distribution. Every air valve has its own length of ducting that connects it directly to a manifold – either to a supply manifold or to an exhaust manifold. (The manifolds are usually best placed in a central location, with rigid ducting to the HRV unit. A manifold might also be called a 'plenum' or a 'distribution box'.)

The ducting is supplied in long coils for cutting to length. It is corrugated to give strength, but the inside bore is smooth for good airflow and cleanliness. The ducting can be bent into gentle curves.

No joints are required, giving benefits:

- Faster installation.
- Cleaner ducting – there are no joints where dirt might accumulate.
- Less chance of air leakage.

A variety of sizes are available to suit the required airflow, a common size having diameters of 75 mm outside and 63 mm inside. (As an alternative to increasing the diameter of ducting – for a larger airflow – a standard size can be doubled up, as in the diagram.)

[See schematic diagram on next page.]
Radial ducting – schematic diagram
(Source: Verplas)

Note:
The two white manifolds have some ports not in use – these have been closed with red caps.
Where extra airflow is required (eg, for the kitchen extract), two ducts have been laid together. Their airflows are combined at a green 'plenum' above an air valve. (The plenum has a 125mm outlet for the valve.)

A variation available from some suppliers is semi-rigid ducting with an oval cross section (eg, with typical outside dimensions of 51mm x 115mm). The flatter cross section may be useful in constricted spaces.
The cost of semi-rigid ducting is greater than that of rigid ducting, but it is quicker and easier to install.

Air valves

Air valves are fairly unobtrusive and are fitted in every room, either in the ceiling or possible high on a wall. They incorporate a means of constricting the orifice to reduce the airflow to that required. (They are sometimes called 'terminals', though possibly that word is probably best reserved for the intake and exhaust terminals in the open air outside. Other names are 'grille' and 'vent'.)

In general, an air valve should be located far from the room's doorway (and the air transfer path through it – see next month's article). This aids the replacement of all the stale air within the whole room. But the valve should not be positioned close to a wall, otherwise an unpleasant draft may descend down the wall.
Above a bath or shower are good locations for extract valves. In a kitchen/diner, it may be that both an outlet and an inlet air valve are fitted in the same room, far apart.

Air valves are designed to utilise what is called the 'Coanda' effect. The supply air from a valve in the ceiling keeps close to the ceiling as it moves away from the valve. It might travel as much as 6 metres just beneath the ceiling before moving downwards and mixing with the room air. So the fresh, supply air moves to all parts of the room.

It is not just ceiling-mounted air valves that use the Coanda effect. Wall-mounted air valves are also designed to 'throw' the air several metres, just below the ceiling.

Floor vents are available too. Their performance in replacing stale air is likely to be inferior to ceiling valves, but for some layouts installing the ducting to them can be much easier.

Fire and HRV

If you are concerned about the fire resistance of air valves, fit fire rated valves. One such design incorporates a hidden disc of intumescent material. If there is a fire, the material expands to fill the valve, and this should maintain the fire integrity of the ceiling for an hour.

Most domestic fires start in the kitchen, so fitting a fire rated valve here would be good. Or would it? Some say that in case of fire, a good thing is to extract the smoke – without fanning the fire. Others say that in case of fire, the HRV system should automatically be shut down. There seems to be no settled opinion about how a HRV system should react in case of fire.

Adjusting airflows

During the commissioning of an HRV system, the installer needs to set the airflow at each air valve.
Most types of air valve are adjustable, and can be locked in position to give the required airflow. (The airflow can be measured by an anemometer to which is fitted a hood – or 'cone' or 'funnel' – that fits over the air valve.)

A new technique that can be used with radial ducting is to fit non-adjustable air valves. The airflow is adjusted at the corresponding port of the manifold (or 'distribution box'). Here a restrictor ring is fitted at the port. (During the commissioning of the system, the size of the aperture in the ring can be changed to give the required airflow.)

Noise is generated where airflow is restricted, so restricting airflow at a manifold rather than at an air valve in a room is likely to result in better silence.

**Insulation of ductwork**

In wintertime, the air in both the intake and exhaust ducts will be cold. If these ducts are within the thermal envelope, they must be insulated both to conserve heat and to prevent condensation on the ductwork (which could result in water dripping onto the building fabric). The insulation should be vapour resistant, eg, 'Armaflex', or else it should be wrapped in a vapour barrier. Thicknesses of 25 – 100 mm are recommended. (Alternatively, pre-insulated ducting is available.)

It is recommended that the supply and extract ducts should be within the thermal envelope, but if they are outside they need thick insulation, say, 100 – 150 mm (or perhaps even more).

If the supply ducting carries heated supply air (for space heating), it too needs to be insulated: 50 mm may suffice if the ducts are within the heated envelope.

**Floor joists and HRV**

Yesteryear, floors were constructed with solid timber joists. Obviously, ducts can't run through these. For a centralised HRV system, deeper composite joists are advantageous. There are two types:

[See diagrams on next page.]
• **Metal web joists**

Provided the joists are deep enough, ducting and other services can easily be run through the open web. But remember: long rigid pipes can't be passed through once all the joists and walls are in place. These joists are made to order.

(Source: Crendon Timber Engineering)

• **I beams**

The web of these beams is usually OSB (Oriented Strand Board.) Holes can be made in the web to take ducting, as long as the size and position of the holes comply with the design guidelines for the I beam – consult the manufacturer. (Proprietary steel reinforcement may be required around large holes.) These joists are about 10% cheaper than metal web joists. And they are generally available from stock, to be cut to length.

(Source: James Jones & Sons Ltd)

For good airtightness at the walls, joists should be supported with steel joist hangers – not built into the walls.

Composite joists allow the ducting to the air valves in the ceiling of the ground storey to be easily installed. Composite joists can form the bottom chord of roof trusses. This allows the loft floor to be boarded (perhaps for storage purposes), whilst also giving plenty of space for deep insulation – and HRV ducting.

Another approach for the ducting of the upper storey is to fix counter battens at the upper storey ceiling, with channels for semi-rigid ducting – possibly oval ducting for a flatter profile.

Ductwork should not be in contact with plasterboard, which could amplify noise from the ducting.

If you intend to install an HRV system, then tell your architect at early stage in the design process. He/she can incorporate suitable joists into the design, and also allocate a suitable place for the HRV unit.

**FURTHER INFO:**

The suppliers of HRV units, listed last month, also supply ducting and other components.

**Ubbink**
Rigid and HB+ semi-rigid ducting
www.ubbink.co.uk.

**DUCTING FOR HRV SYSTEMS**

6 (MARCH 2018.)
Lindab
Swedish manufacturers of a large variety of components for ductwork (and also steel guttering).

Verplas
PVC ducting manufacturers.
Rigid, round or rectangular ducting; semi-rigid radial ducting; thermal ducting (ie, insulated).
www.verplas.co.uk.

Ductmaster Thermal
Pre-insulated ducting components.
www.nuaire.co.uk.

Astroflame
Fire-rated ceiling air valves.

Words 1968.

© Copyright article by Robert Matthews, January, 2018.