Home refreshment

Higher standards of insulation lead to an increased need for ventilation. * David Gane and Kenneth Davies put the case for mechanical ventilation and warm air heating

Controlled ventilation with the emphasis on control, is an effective way of ensuring comfort in the home, with good economy of fuel costs. If the heating system is already using movement of air to transport heat in the dwelling, it is logical to add the ventilation scheme to the heating system. This allows for the combination of various components, simplifying control and minimising space requirements.

The development of sophisticated systems during the last few years has followed an evolutionary path. This has allowed the use of tested and proven methods and has not required the re-education of installers to achieve results.

Heat requirements of a dwelling are governed by the insulating properties and the air-tightness of the materials used to build it, as well as the occupant's idea of a comfortable living temperature. Building Regulations control the minimum insulation properties and over the last 15 years these have called for an increasingly high standard of insulation in buildings. There have been several changes so far, and the latest stage in the raising of standards has just been published. In line with this improvement the proportion of the total heating load supplied to warm ventilating air has grown.

Improvements in the insulation properties of the materials of walls, roofs, floors, and the introduction of effective vapour barriers in timber frame houses, has a profound effect on the amount of air which is able to enter and leave a dwelling via the fabric and cracks. Stack effect and wind loading are able to cause far fewer air changes in a modern dwelling.

Stuffiness

Once the number of air changes falls below one per hour on average, three things will happen in the dwelling: moisture content of the air will rise, oxygen level fall and smells and 'stuffiness' will become noticeable. The only way to make such well-insulated, 'tight' houses comfortable and protect against rot is to install a ventilation and heating system.

We do not mean a window-fitted extract fan, although these can be effective in the room they serve.

Equally, a cooker hood extracting to outside can be a effective reducer of pollution in a kitchen, but it helps no other rooms and does not introduce fresh air.

One of the first methods of introducing fresh air into a dwelling without causing discomfort to the occupants involved the use of the air moving power of the circulating air fan of a warm air heater. A duct was run from the ventilated roof space to the return air plenum of the warm air system. Fresh air was drawn down into the circulating air stream whenever the fan ran. A simple regulating device controlled the amount of air drawn in so that it remained constant even when the fan speed varied. There was also some solar gain picked up as the air from the roof space was warmed by the sun.

One drawback with this arrangement is that the fresh air duct has to have a diameter of about 7 in, which gives an outside diameter of 9 in when the duct is insulated (to avoid condensation). This is sometimes too large to fit neatly into the spaces available. A smaller fresh air duct can be used if the air movement in it is induced by a separate fan. There is then no need for a regulating device, since the fresh air fan maintains a steady flow regardless of the speed of the circulating air fan. It is, however, necessary to provide a speed selector for the fresh air fan, so that it can be set up correctly during commissioning. It also needs to be cleaned as part of the annual maintenance work.

Discreet floor grilles can be used to distribute warm air.

The next stage in the development of a proper ventilating arrangement is the system in which fresh air is introduced into the dwelling, and foul air is extracted, independently of the heating system. This type of ventilation involves provision of fans and ducting systems for the distribution of fresh air to the living rooms and for the extraction of foul air from the bathroom, toilets and kitchen: an expensive undertaking. Some architects arrange for the fresh air to be collected from a conservatory, so as to benefit from solar pre-heating of the air.

Exchange ideas

If the house is designed to require this type of ventilation system, with inward and outward air flows, it becomes cost-effective to add a heat exchanger to transfer heat from the warm foul air to the cold fresh air. Heat exchangers can be fitted in the same casing as the fans driving the air in the extract and fresh air streams. This results in a small unit which can be housed in the roof space; accessible for annual cleaning.

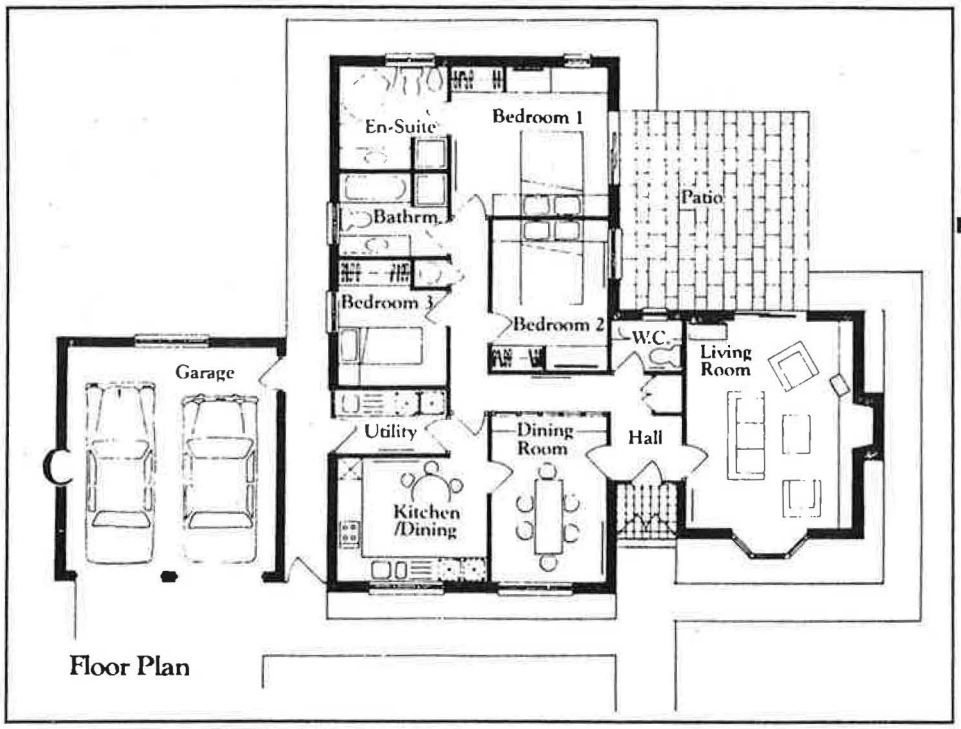
When heating is by warm air, the pre-heated fresh air can be fed into the recirculating return air stream of the heating, after which it passes through the heater and is distributed to all rooms through the warm air ducting and register system. Thus, the fresh air distribution does not cost any extra.

The Johnson and Starley HR 100 heat recovery unit is an example of the equipment which can be used in this arrangement.

The amount of air which needs to be extracted and supplied by these systems has been the subject of some discussion. The consensus seems to be that the least amount of ventilation which will ensure healthy, comfortable living is 1 air change per hour, related to the volume of the whole house. The average tightly built house has a natural air change rate of about 0.5 air changes per hour, and hence the mechanically operated ventilation system should supply and extract another 0.5 air changes per hour.

The draft Electricity Council Medallion 2000 specification for energy efficient homes calls for 0.5 ac/h extract and 0.45 ac/h supply as the normal rates, with provision for boosted operation under manual control.

The Scheme takes the necessary step of introducing measurement of the house ▶



Layout of the Barratt Sheridan Bungalow heated by a warm air system

leakage rate and the requirement to achieve less than a maximum rate to qualify for the Medallion. It also specifies a minimum efficiency for the heat recovery exchanger specified for the ventilation system.

The method of measurement of leakage is by pressurising the house to a pressure difference of 50 Pascals (0.2 in W.G.) between inside and out and then measuring that the air flow through the pressurising fan is the equivalent of no more than 7 ac/h at this differential.

A recent paper from British Gas Watson House Laboratories shows that, in a sample (200) of all types of houses surveyed, timber framed construction showed significantly lower leakage at this pressure differential compared with traditional construction. Data in the paper also show that less than 7 ac/h at 50 Pascals inside to outside differential pressure (Electricity Council proposed maximum) was not achieved by more than about 6 per cent of houses in the sample, with some of each type of construction among the qualifiers.

■ Cleanliness

To achieve the cleanliness required to conform to the highest levels of comfort as defined for the modern house, it is desirable to filter the circulating warm air as well as the incoming ventilation air. Effective electronic filters, able to collect pollens and smoke from the filtered air, are now available at lower cost than hitherto. In an installation consisting of warm air heating and proper ventilation, such a filter can be placed before the air heater so that both recirculating and incoming fresh air are filtered. Many countries in continental Europe have introduced regulations which make it compulsory to include powered, controlled ventilation in the designs for all new houses. Such regulations are not with us here yet, but they cannot be far away after the issue of the Building Regulations. Houses with low heat transmission will have low rates of adventitious ventilation, and will be uninhabitable without proper ventilation systems. The choice of controls for proper ventilation and heating systems is a matter for judgement. The ideal would be fully automatic, but householders expect to have control over ventilation rates. It will be necessary for a minimum rate to be set up and maintained during the hours when heating is enabled in order for the house structure not to suffer from excessive condensation. Occupants will therefore have to be limited to increasing the rate above this running minimum when they want to clear concentrations of pollution from, say, cooking, bathing or having a party.

A step increase in efficiency can be achieved by passing the products of combustion through a heat recovery exchanger in the foul air extract stream and recovering not only more of their sensible heat, but some of their latent heat of vaporisation as well. This is done simply by making the area of exchange adequate to lower the temperature of the combustion products and foul air below their dew point.

We see the high quality installation of the future as consisting of a warm air heater, with domestic water heating included in the same cabinet, combined with a proper exchanger included which is able to handle products of combustion from both appliances. □

*Based on a presentation given at the recent IBHE Conference by David Gane, sales director, and Kenneth Davies, technical director, Johnson and Starley Ltd.

Warm Scottish air

In the shadow of the two bridges spanning the River Forth, builders Barratt (Scotland) Ltd have created a riverside complex of upmarket showhouses.

For the first time Barratt are offering purchasers a choice of gas fired central heating systems—dry or wet. The decision to include warm air was based on Barratt's experience of using a Johnson & Starley system in their £200,000 showhouse at the Modern Homes Exhibition in Glasgow. Executives of the building company noted that the ventilation facility of the system kept the atmosphere clean and comfortable within the showhouse even when scores of people were inspecting the house.

As with most major organisations Barratt (Scotland) carry out regular market research and it was from one such operation that it became apparent that there was a demand for upmarket houses developing in Scotland. At Dalgety Bay the "Sheridan" bungalow and "Byron" 3-bed house have had Johnson & Starley warm air central heating systems installed which incorporate water heating and ventilation. System layouts for the other houses have been designed for purchasers stipulating warm air.

The heater used in each installation is a J55-65 MAF series 2 model located in a passageway cupboard. From this unit warm air is ducted to grilles and registers for distribution.

It is a downflow air heater with an output of 16-19kW (55,000 to 65,000 Btu/h) designed specifically for the larger type of house. Control is provided by the Modairflow electronic air handling device which matches heat input to heat loss to maintain stable room temperatures.

Ventilation requirements are met by drawing fresh air from the roof space or outside. This air is passed through a simple duct connection to the air heater where it is mixed with recirculation air, heated and distributed to rooms.

Heating system designers worked with Barratt on the project and reaction has been positive.

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