Heatsavers – heating for low-energy housing

By Mike Trim

The trend in new housing in the UK is towards smaller, more compact, well insulated homes. This trend has been spearheaded partly by demographic changes – families are smaller and prefer independence at an earlier age than hitherto. Increasing building costs and the price of land have tended to crowd more homes on less space. In addition gradually improving thermal standards for buildings have reduced the design heat loss to the extent that the space heating requirement is comparable with that of the domestic hot water demand. As far as can be seen this trend is likely to continue as building regulation standards become more demanding.

Gas is by far the most popular domestic heating fuel, having about 70 per cent of the market share. But higher levels of insulation mean that electric storage heating can also be a viable option for the low-energy home. In order to remain competitive in this housing market, changes needed to be made to the range of conventional gas-fired heating appliances. With encouragement from British Gas, the appliance manufacturers have responded well to the challenge and this has led to the introduction of a new range of gas heating appliance – known generically as the Heatsaver. These appliances are intended for homes where the design heat loss is about 4kW. They are compact units – saving room space, generally easier to instal than conventional systems and produce savings in both energy and initial capital costs.

The Building Research Energy Conservation Support Unit (BRECSU) has assessed the performance in new housing of two heatsavers, manufactured by Baxi Heating and Gledhill Water Storage respectively, as a part of the Energy Efficiency Office's Demonstration Scheme. A further demonstration is in progress to examine heatsavers in refurbished housing.

The completed demonstrations involved houses in north London and Manchester. The buildings differ widely in architecture, but both sites have a similar design concept – a package of energy conserving features is installed which reduces the design heat loss of the building making the heating requirement low enough for a heatsaver.

Heatsavers are manufactured by various companies and different models are available for wet central heating, warm air heating and as modular systems for whole house heating. In general heatsavers take up less space than conventional heating appliances and combine energy saving advantages with reduced capital and installation costs.

Heatsavers – the concept

Gledhill manufacture the Cormorant for use with a conventional wet central heating system. The Cormorant consists of a thermal store which is heated by a small gas circulator, and is designed to provide both space and hot water heating from a single integrated appliance (see figure one). In principle the thermal store

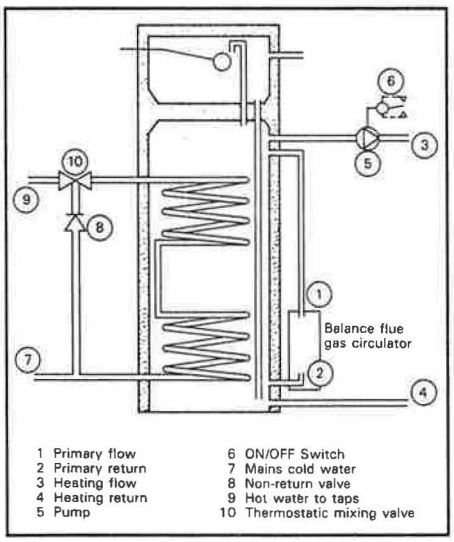

Figure 1 – Diagrammatic layout of 'Cormorant'

evens out peak load demand, allowing a smaller heat generator to be used than would be required to produce instantaneous hot water in a traditional system. Hot water is retained in a large integral and well insulated thermal store. When space heating is required water is pumped around the radiators in the conventional manner. When domestic hot water is required, mains water is drawn into a two-stage heating coil within the store, and heats very rapidly. A thermostatic valve mixes the hot water with cold mains water before allowing it to flow to the taps. The appliance can operate directly from the mains water supply, making it particularly useful for showers.

By contrast, the Baxi Brazilia is a gas-fired modular system designed for installation in the living room. The Brazilia is a dual purpose appliance comprising a convector for space heating (with a heat output of up to 2kW) and a circulator for domestic hot water (heat output up to 3kW). The circulator uses a conventional storage cylinder. The flues from both units are combined within the appliance into a single balanced flue outlet.

Other heatsavers for conventional radiator systems include: the Homewarm, Heatslave Junior and Andrews Heatsaver, and the SeWarm for warm-air heating systems. To enhance their output capacity some heatsavers can be used in conjunction with other appliances. For example, the Cormorant has a heat generator rated at 3kW. If used with the Brazilia the output can be boosted to 5kW.

Application experience

The Islington Housing Co-operative commissioned the design of 20 one and two bedroomed flats in Cromartie Road, north London [1]. The flats were designed on good low-energy principles. A package of energy efficient measures was incorporated into the design. The measures included:

- additional levels of insulation in the cavity walls, loft and ground floor slab, design U-values are shown in Table one

Table 1. Design U-values (W/m^2K)

	Building element			
	External walls	Roof	Ground floor	Windows
Cromartie Road, Islington	0.30	0.30	0.50	2.9
Collyhurst, Manchester	0.27	0.25	0.38	5.0

- the concentration of glazing on the southern aspect, with smaller windows on the north
- the avoidance of cold bridging over lintels etc
- double-glazed windows and

draught-stripped windows and doors
- controlled ventilation using extractor fans in the kitchens

Based on calculations using BRE Domestic Energy Model (BREDEM)[2], the measures reduced the design heat loss of the larger flats to 2.2kW, compared with an estimated 3.0kW for similar flats built to the current Building Regulation standards.

In terms of capital cost, the energy package added about 2.8 per cent to the overall building costs, or an average of £339 per flat. However, the tenants have been well pleased with their homes, even

Low-energy flats in Cromartie Road, North London.

though some were critical of the heating controls and exit temperature of the hot water. For the most part the design has performed to expectation, although the heating bills have been slightly higher than intended, at around £100 per annum. Comfort levels were very high during the heating season. Average maximum temperatures recorded were 24°C, and minumum temperatures 14°C, well within the recommended comfort level for this type of housing.

A different approach was adopted by Manchester City Council in their low-energy housing. The City Architect's Department designed 20 two-storey, three bedroomed houses on part of a major redevelopment site at Collyhurst, about a mile from the city centre[3].

A package of low-energy features were incorporated into the fabric of these houses, similar to the Cromartie Road development. But in this case the designers opted for a modular heating system, based on the Baxi Brazilia. Each house contained two heating appliances – a Brazilia in the living room and a second appliance in the hall. The domestic hot water was supplied by the Brazilia in the hall and stored in a conventional cylinder.

The houses were designed to distribute heat to the whole building from the two heating appliances. Heat circulated around the ground floor through transfer grilles in the walls and specially designed fan lights in the internal door frames. A wall fan situated in the downstairs w.c. and controlled by the room lighting, assured a modest level of air movement. The bedrooms were not directly heated. Warm air circulated upstairs through the natural 'stack' effect of the building. The performance of this group of houses was compared with identical houses in which a full wet central heating system was installed.

Monitoring results showed that similar comfort levels were attained in both groups of houses, indicating that the heatsaver system performed as well as a conventional central heating system. In addition the heatsaver houses showed an energy saving of about 13 per cent over the homes with wet central heating. The saving is worth £22 per annum at the gas price of £3.6 per GJ. But of greater importance, the simpler modular heating system produced a reduction in overall construction costs which is of direct benefit to the City Council. At current building costs the saving was £900 per house, compared with a similar house built to the requirements of the current Building Regulations, and about £990 compared with the Manchester low-energy house which was adopted as the standard for new housing following an earlier demonstration[4].

The saving on construction costs is dependent on several factors, such as the local cost of building materials, the use of direct labour etc. But future replicators should make savings of at least £400-£500 per house, if they adopt similar principles.

The monitoring programme confirmed that there were no problems of condensation and mould growth in either the heatsaver houses or the centrally heated houses.

Conclusions

The two demonstrations have shown that the performance of heatsavers is similar to that of traditional wet central heating systems in well insulated homes. In some cases the use of heatsavers can dramatically reduce the extra capital cost incurred in installing an energy efficient package of measures. Heatsavers also have a space saving advantage which can be beneficial in smaller housing units.

In the Cromartie Road development it is likely that additional energy savings could be made. The Cormorants at Cromartie Road were prototype models, because the production model was not available at the time of the construction. The production model which is now available is a considerable improvement over the early prototype. In addition, since concluding the monitoring programme shortcomings in the heating system design, such as the inaccessibility of on/off switches for the circulator and heating pump, have been rectified[5].

The heatsaver achieves its main objectives. It can, when installed in a well designed heating system, reduce fuel bills. Modular heatsavers, included as a part of a package of energy efficient measures incorporating high standards of fabric insulation, can reduce overall construction costs appreciably. In addition there are other advantages such as ease of installation, and less quantifiable advantages, such as space saving.

Monitoring is under way in the refurbishment scheme mentioned earlier which also uses the Gledhill Cormorant, and the results from this are eagerly awaited[6]

References

(1) *Heatsaver appliances in low-energy flats*, Energy Efficiency Office, PP280, October 1987.

(2) *BREDEM – BRE Domestic Energy Model: background, philosophy and description*, Building Research Establishment, 1985.

(3) *Low-energy local authority housing with reduced costs*, Energy Efficiency Office, EPP245, May 1989.

(4) *Low-energy houses in the City of Manchester*, Energy Efficiency Office, EPP89, July 1986.

(5) *Monitoring of Cromartie Road flats*, to be published by the Energy Efficiency Office as report no. ED/269/280, Autumn 1989.

(6) *The energy efficient refurbishment of smaller flats*, Energy Efficiency Office, PP327, September 1988.

Further information

Further information and project profiles can be obtained free of charge from the programme office, BRECSU, Building Research Establishment, Garston, Watford WD2 7JR, Tel No. 0923-664258. The BRE information paper will be available from BRE Publication Sales, Building Research Establishment, Garston, Watford WD2 7JR, Tel No. 0923-894040, price £1.00.