RAF fights bitter weather at Saxa Vord

RAF Saxa Vord is situated at the north end of Unst,in the Shetlands.It is the most northerly island in the British Isles, only 390 miles from the Arctic Circle. The design standards office of the Property Services Agency was responsible for the design and the construction of six accommodation blocks to house airmen based at RAF Saxa Vord.

Using a multi-disciplinary coordinated approach to design by making an in-depth study into the conditions prevailing at Saxa Vord, the design standards office has been able to produce buildings which perform well within the energy targets set by the PSA. The estimated savings in energy costs are £4,300 a year and the projected total savings for the developed site is between £25,000 and £45,000 a year.

Accommodation blocks at RAF Saxa Vord.

SEVERE CLIMATE

A local description of the climate is three months winter and nine months bad weather. The driving rain index, based on wind speed and annual rainfall, is in the severe exposure category and the chill factor, based on wind speed and temperature, is in the very cold category. While winter temperatures are only marginally lower than the remainder of Britain, due to the influence of the Gulf Stream, the summer temperatures are significantly depressed and lead to an annual average temperature of 7°C. Rainfall is consistantly high throughout the year with an annual average of 1144 mm. Some of the highest wind speeds in the UK have been recorded on the island and 30 per cent of the time, winds are in excess of Force 4 on the Beaufort Scale. Being so far north, the hours of daylight are limited in winter and 'summer' days very long.

DESIGN

Six blocks have been built in a lineal development with a pedestrian link running between them, which enables personnel to move between the buildings without exposure to the elements and also reduces infiltration. The buildings have white rendered elevations, slate roofs at 45° pitch with the first floor within the the roof zone, storm porches, expressed gale walls, windows set in the roof — an echoing in effect of the Shetland's croft. Particular attention was given to insulation, fenestration and the reduction of infiltration.

Traditional materials capable of withstanding the severe weather conditions have been used in the construction. Walls are a double skin of dense concrete block incorporating a cavity with a 37 mm air gap and 33 mm of Celotex Double R isocyaranate. The roof structure comprises fibre cement slates fixed on battens and counter battens over plywood sarking and with an internal foilbacked plasterboard skin. It incorporates 100 mm of glass fibre insulation, as does the ventilated loft space in the upper section of the pitched roof. To reduce infiltration, openings are rebated with doors and windows draught-stripped. Fenestration has been reduced to the minimum, consistent with acceptable daylighting, which takes advantage of the long 'summer' hours of daylight.

A system of double windows has been used to provide good thermal insulation and reduced infiltration while facilitating cleaning and maintenance without exposing the interior to external elements. The outer leaf is manufactured in aluminium to reduce maintenance, while the inner leaf is of timber to reduce cold bridging. The rooflights are double-glazed 'Velux' windows. All external doors are hardwood framed, ledged, braced and battened are fitted with automatic door closers. In addition to weather stripping, infiltration is further reduced by storm porches and enclosed pedestrian links between buildings.

MECHANICAL AND ELECTRICAL SERVICES

Hot water for heating and the domestic hot water service is supplied from the Station's district heating main. The heat source is currently the waste heat boilers in the station's powerhouse but a mains electricity supply will shortly render the powerhouse redundant and heat is to be supplied by 3 No. 442 Kw oil-fired boilers, which are at present being installed. Heating within the accommodation blocks is provided by a lower temperature system feeding high output Hudevad radiators. The control system comprises a 3-port mixing valve controlled by a flow temperature thermostat and an external temperature compensator.

TRIPHOSPHOR LAMPS

Domestic hot water is provided from a 600-litre storage calorifier in each block. The primary heating element is sized for a two-hour recovery period in order to supply sufficient hot water for the shift working occupants. Natural ventilation for the washrooms and toilets was discounted because of the high wind speeds and lack of control. Mechanical ventilation is provided by independent wall-mounted extract fans which are controlled from the light switches for the area concerned. Make up air is taken from the corridor outside the washrooms. The level of lighting in the bedrooms is 50 lux, which is the level now recommended in the CIBS Code for Interior Lighting 1984. The luminaires are individually switched to allow a further reduction in level and the creation of some ambience within the room. The luminaires are fitted with low energy 2D fittings which further reduce the loading. Fluorescent lighting with higher output triphosphor lamps has been used in the corridors and for external lighting high efficacy MBFU lamps are used.

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Energy saving awards for armed forces

Four Ministry of Defence units each gained £500 for their welfare funds as winners of the British Gas—MOD energy efficiency awards.

The competition, now in its second year is open to all Ministry of Defence properties throughout the UK, ranging from airfields and barracks to research and development centres. Awards are made to each of the three services and to the procurement executive.

Judging was carried out by top management in the Ministry of Defence,and was by short-listing entries and then examining them in detail to select winners. Criteria included good housekeeping, targeting and monitoring arrangements, successful training and motivation programmes and the use of energy wardens.

Baroness Hooper, Parliamentary Under Secretary of State for Energy, presented the cheque, an illuminated certificate and an engraved glass bowl to the winning units.

Winners in the Royal Navy were Royal Marine Barracks, Stonehouse, Plymouth. In the Army the prize went to Headquarters Engineer Resource, Long Marston, West Midlands, and the RAF winners were RAF Wittering in Cambridgeshire. For the Procurement Executive, Directorate General of Defence, Quality Assurance, Woolwich, South East London carried off the honours.

Mr Colin Playle, HQ Director of Industrial and Commercial Gas, said that all who had taken part in the competition were winners in the sense that they had reduced their expenses and improved their energy efficiency by taking part.

The awards, he said, were a fine example of co-operation between the Ministry of Defence and British Gas.

'For our part we value this co-operation highly', he told *Energy Management*. 'The Ministry of Defence is among our most important and valued customers. Its establishments collectively purchase some 80 million therms of gas a year. In helping such a major customer to improve its energy efficiency, we have the added satisfaction of knowing that we are helping them to produce real benefits to the public purse and therefore to the taxpayers, whether they are corporate or individuals'.

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Prize-winners in the British Gas/Ministry of Defence energy efficiency awards. Left to right: Group Captain John Feesy,Col. Mike Crawshaw, Mr Roger Freeman, Armed Forces Minister, Lt. Col. Peter Lamb,Royal Marines,Mr John Scrivener, Baroness Hooper (who presented the prizes),Mr Christopher Chope, Minister with responsibility for the PSA, Mr Colin Playle, HQ Director of Industrial and Commercial Gas, British Gas.

(RAF fights Saxa Vord weather – continued)

Owing to the size of the existing development and changing conditions within the buildings supplied from the same heat source, it has not been possible to measure the savings directly attributable to the new accommodation. However, an estimate of the savings achieved has been made by comparison with energy targets. The targets used within PSA reflect the design conditions required by our clients and are, in fact, a little more stringent than those published by CIBS.

ENERGY SAVINGS

To illustrate the effect of the energy conservation measures incorporated into the Saxa Vord design, the energy demand for space heating was calculated for the cases listed below, using the CIBS Energy Code 2(a).

The accommodation as built is estimated to use 36 per cent less energy for space heating than if it were built to minimum Building Regulation standards, resulting in annual savings in the region of £4,300 (1984 prices). Whilst the design of the lighting system has produced some savings, these are not significant compared with the saving on space heating. Reduction of light use due to flexible switching is dependent on human behaviour and therefore difficult to quantify. The Net Present Value of the savings for the accommodation blocks over a 50-year period is calculated to be £117,600.

Accommodation situated in SE England built to minimum standards of the Building Regulations	15.4W/m^2
Accommodation situated at Saxa Vord built to minimum standards of the Building Regulations	21.3W/m^2
PSA Energy Target for space heating	18.0W/m^2
ACCOMMODATION AS BUILT	13.8W/m^2

COSTS AND PAYBACK

The cost of energy-saving features were not separately identified in the tender, however, the major features such as additional wall insulation, ground floor insulation, dual leaf/double-glazed windows and draught lobbies are estimated to account for some £26,000 (1981 prices) which is less than 2 per cent of the total capital expenditure. In the long term, the payback period of the features mentioned is forecast to be seven and a half years.

The RAF subsequently asked the design standards office to undertake a phased redevelopment of the whole site based on the same basic building form. This programme involves the construction of some 40 buildings at a value in the order of £17 millions. In addition, they have also requested that the Saxa Vord design be used in the construction of new accommodation blocks at RAF Benbecula,in the Outer Hebrides and the first of these is now under construction.

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