

# BRITISH ENERGY REPLACES R22 WITH RS-45 (R434A) IN FLOODED CHILLER

British Energy PLC, the largest electricity generator in the UK by volume with its HQ at Gloucester, has successfully replaced R22 in a large flooded chiller. Performance of the chiller after conversion from R22 to RS-45 matches the original design parameters for the unit so that, in terms of a comparison with R22, in the key areas of capacity and energy usage the machine is working equally effective as it was on R22.



The HQ site at Barnwood, Gloucester operates the data centres for the eight nuclear power stations in the UK. As part of their environmental strategy, British Energy has already converted all of the site's systems from R22 to non ozone depleting replacements, but has until recently been unable to find a suitable alternative to R22 for their flooded chillers. This has been of considerable concern in view of the imminent phase-out of the use of virgin R22 for service work, and the fact that replacement of a chiller of this size would cost over £500,000.

British Energy has experimented with R22 alternatives, such as R422D, but found that the chiller could not achieve the temperature difference across the evaporator that is an essential requirement. Consequently, in May 2009, one of their flooded chillers was converted to RS-45 (from R422D) with details as follows:

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Dunham Bush Chiller Model PCX 700  
Condenser number SEPX790  
Dunham Bush Screw Compressor Model 2515DHFIL00  
Age 30 Years  
Flooded Evaporator  
Pilot Operated Thermostatic Expansion Valve + Partial Hand Expansion Valve  
Heat Recovery circuit on Condenser  
Recommended Charge 1,200 kgs R22  
Charged with 1,200 kgs RS-45  
Original oil Mineral Viscosity 170  
Charged with POE Viscosity 170

The control system operates compressor un-loader system based on a number of inputs which include but are not limited to chilled water leaving temperature, suction pressure, discharge pressure, motor loading percentage. The following readings were taken on 6 October:

Suction Pressure	74.32 psig
Discharge Pressure	188.30 psig
Motor amps	50 (Maximum setting 80, FLA 120)
Entering chilled water temperature	10.6°C
Leaving chilled water temperature	8.01°C (set point 8°C)
Suction Temperature	5.5°C
Evaporator Superheat	2.1°C
Motor load %	55.62 %
Outside air Temperature	17°C

Energy usage would appear to be lower with RS-45 with 5°C achieved at 65 amps, against design of 5.5°C at 108 amp. The system was operating up to 5.5° temperature difference on chilled water which was equal to design capacity. Before the initial conversion from R22 to R422D, the lubricant in the chiller had been changed from mineral oil to polyol ester.

The superheat was very consistent and did respond to adjustments to the expansion devices. Overall the customer is very happy with the performance of the chiller as it appears to be very similar to the R22 performance.

John Bravery of engineering contractor Balfour Beatty oversaw the conversion of the chiller to RS-45 with John Ormerod of refrigerant supplier A-Gas UK in attendance. The changeover process was quite straightforward, and no problems with this chiller have since been encountered since the machine has been achieving the duty previously obtained when operating on R22.

Geoff Benton, British Energy's Site Engineer, said:

"We have been planning to phase out R22 on this site before the cut-off date for using new R22 for service work kicks in at the end of 2009, but finding a refrigerant which can match the performance of R22 in the flooded chillers here had not been possible until the arrival of RS-45 (R434A). The fact that using RS-45 to replace R22 in one of our flooded chillers has resulted in an identical performance to using R22 in this unit means that we will be converting the remaining flooded chiller on site, and thereby achieving our overall objective to be free of ozone depleting substances prior to the phase out date in Europe. Overall, we are very pleased with the performance of RS-45 in what I understand is one of the most difficult applications for R22 replacements."

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