

# EDF ENERGY Replaces R417A with RS-45 (R434A) in Flooded and DX Chillers at Barnwood Gloucester HQ site



Following the successful conversion of the two Dunham Bush PCX 700 flooded heat pumps at the Barnwood, Gloucester Site of EDF Energy, further retrofit works have been carried out to Star Refrigeration Thermo siphoning chillers which are also flooded.

These chillers were originally installed and commissioned in 1992 with R22 as the refrigerant, then in keeping with the whole site. A program of retrofits was carried out during the late 90's to remove Ozone Depleting Substances from the site and, with advice from Star Refrigeration, R417A was recommended and used until 2010.

A noticeable drop in performance of these machines was experienced which was unfortunately not documented, although the compressor running times were increased.

In 2010 EDF Energy committed to a program of cooling tower replacements for the Star Chillers and carried out compressor top end overhauls, and the replacement of the liquid line control valves and liquid level controls. During this time, it was decided also to replace R417A with RS-45 (R434A).

This work has proved to be extremely worthwhile, as not only has there been an efficiency improvement during mechanical cooling, but extremely good results have been experienced during the Thermo-siphoning cycle. During the winter months, the chillers have not run in mechanical cooling for up to 3 months.

In comparing the energy performance of the Star Refrigeration Chillers using RS-45 with the original commissioning sheets (for R22), performance is similar with an even higher energy efficiency.

Looking at the original commissioning sheets which were taken with the machines operating on R22, at similar ambient conditions, there has been a significant drop in Active power from 80.1kw to 67kw with the machine:

	R22	RS-45
Chilled water out temperature °C	14.8	12.8
Chilled water in temperature °C	17.9	15.3
Ambient dry bulb temperature °C	16.2	16.3
Discharge temperature °C	45.7	34.1
Active power kw	80.1	67.1



The Thermo-siphoning cycle is also performing well although we have been unable to make a comparison with the machine operating on R22. Looking at the design specification, the overall performance of the system measures up very well with its performance on R22. The machine details are as follows:-

There are three 400kw Star Refrigeration Ltd Chillers complete with evaporative cooling towers. The chillers are piped up in a series, with a high temperature chilled water flow design of 14°C. Each chiller has a Sabroe SMC108L compressor driven by a direct drive 75kw motor. The three chillers have a design  $\Delta t$  of 5.5°C, which is being achieved as each machine will produce in excess of a  $\Delta t$  of 2°C which will give a total  $\Delta t$  of 6-7°C.

These changes have been carried out by John Bravery and John Dudman of Balfour Beatty Workplace, with the support and investment of the EDF site engineer Geoff Benton who has made this project possible. The result has been to extend the life of the plant, which is still performing to as good or better than design, while providing energy savings to reduce the carbon footprint of the site.

A successful retrofit to a circuit of one of the Trane DX type CGMA211BR chillers with a shell and tube evaporator has been carried out. The chiller was designed to run with R22, but was subsequently retrofitted to R422D, which has now been replaced with RS-45 (R434A). Good results have been experienced with RS-45 demonstrating a better energy performance.

