HYDROCARBON REFRIGERANT CONVERSION REPORT FOR BOSCH SIEMENS HOME APPLIANCES CO CHUZHOU, CHINA.

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Initial Survey of Factory & Equipment.

The Fluid Chiller provides chilled water for the cooling of plastic injection moulding machines. There are 12 Chillers positioned throughout the factory, each with an approximate cooling capacity of 1000 kilowatts.

The Fluid Chiller, the subject of this report, is approximately 8 years old.

The Fluid Chiller technical details are as follows:

Make:	Climaveneta. (Italy)
Model:	CSRH 2702
Type:	Multi Screw Liquid Chiller
Capacity:	1049 kilowatts
Compressors:	2 x Climaveneta Hermetic Twin-Screw
Refrigerant:	R407c

PLANT ROOM MODIFICATIONS

Prior to HC's being utilized in this system various modifications to the plant room and surroundings had to be made.

The original plant room layout encompassed two Chillers, all the pumps, the controls and the main switchgear.

There was no suitable ventilation and the lighting was of the standard fluorescent type. The pressure release valves had never been piped to the exterior of the building.

To prepare for the conversion Engas separated the Chiller from the rest of the mechanical and electrical equipment with an industry standard two hour rated enclosed room. Two hour rated doors were fitted complete with fresh air intake vents.

The pressure release valves were piped to the outside of the building, with the piping correctly sized to ensure complete release with back pressure build up.

Eight HC leak detectors were mounted in the new ‘Chiller only’ plant room and these were wired into a purpose built control system that in the event of a leak the Chiller and main power supply was completely isolated. A manual shut off push switch was also fitted.

This system also incorporated warning lights and audible signals plus it was also connected to a purpose built extract system using a spark proof motor. The ducting for the extract system was run to an outside wall and supported at suitable centres, to allow discharge of the plant room air away from buildings and people.

The lighting and switches were changed over to sealed type, as were the power outlets in the area. Advice and warning signs were fixed to suitable highly visible positions.

CHILLER CONVERSION

The existing refrigerant was recovered into suitable cylinders and stored prior to returning to the building owner.

The liquid line filters were replaced with OEM replacements. The Chiller was then run on an extended vacuum, using the triple evacuation process. The oil/lubricant quality and levels were checked.

The Chiller was then charged with Engas M50 to approximately 35% of the original R407c charge. The circuit was then extensively leak tested.

The electrical control system was then switched on, and the system was started, whilst monitoring pressures, temperatures and current, small amounts of refrigerant were slowly added until optimal operating pressures were achieved.

The Chiller operation was then monitored for 24 hours.

Engas safety labels and stickers were attached to various locations on the Chiller indicating that Engas M50 was in use in the Chiller.

THE DATA

A Fluke 24 channel data logger was placed in the plant room with sensors located at all relevant positions.

Logging of the Chiller performance was undertaken for approximately 2 weeks at 15 min intervals.

From the data (chilled water flow and return temperatures) the Delta T was calculated. Averages were also calculated for each measurement point. These calculations were carried out for the pre and post data.

The Energy Savings (electricity consumption) at the point of conversion was 28%.

Environmental.

GWPs (Global Warming Potential) are used by, among others, policymakers to compare the impact on the climate system of emission of different greenhouse gases. The GWP index is relative to carbon dioxide (CO2), which is normalised at 1. As greenhouse gases differ in their atmospheric lifetimes, GWPs also have a time component. Time horizons of 20 years and 100 years are used to enable the proper evaluation on the environment.

Research has shown that for most Refrigeration or Air-conditioning systems the impact for Global Warming will be greater from energy consumption (Indirect Global Warming Impact) than from CO2 equivalent emission (release) of refrigerants. (Direct Global Warming Impact)

Therefore the Total Equivalent Global Warming Impact = leakage + energy consumption.

Leakage

The Climaveneta Chiller Model CSRH 2702 has a specified refrigerant charge of 109 KGs of HFC 407c. (R407c) Refrigerant R407c has a GWP of 3600 of CO2 equivalent per KG over 20 years.

Therefore **392,400.00** KGs of CO2 equivalent saved from the atmosphere.

Energy Consumption

The Climaveneta Chiller 1 at the BSH factory has a calculated electricity consumption of 2,079,693.91 kilowatt hours per year. (This is based on the Chiller compressors running 18 hours per day, 7 days per week, 52 weeks per year at 85% of full load amps, with a 25% saving after conversion to Engas M50) The estimated CO2 emission per kWh generated equals .7 (This is an Industry Standard figure).

Therefore 2,079,693.91 x .7 = 1,455,785.70 x 25% = 363,946.42 x 20 years =

7,278,928.40.

Total Equivalent Warming Impact

The total equivalent warming impact = 392,400.00 + 7,278,928.40 =

7,671,328.40 KGs.

Conclusion

The Energy saving based on the recorded data and taking into consideration actual power saving appears to be **28 %** at the point of the conversion.

The calculated environmental benefit is estimated at **7,671,328.40 KGs** of CO2 equivalent saved from the atmosphere over the next 20 years.