

## Recovery is no burden for BOC's Beast ( August 2007)

*Said to be the world's fastest refrigerant recovery machine, the "Beast" can recover and clean refrigerant, removing water, oils, acids, sludge and particulates while the refrigeration system continues to operate. Officially called the ZugiBeast, there is just one of these units in the UK, and is in constant use as part of BOC's refrigerant recovery service.*



The Zugibeast separates contaminants from refrigerant, cleans and returns it while the refrigerant system is still operating

EVERY refrigeration system needs regular care and attention to ensure it runs within its design parameters, but even so, there comes a time when an overhaul is needed.

The ability to revitalise a system quickly and without the need for shutdown is keenly sought after by UK contractors and plant operators, and underpins BOC's refrigerant services business - a team of four engineers, headed by services manager, Colin McNicholl.

### Online deep-cleaning

At the core of BOC's business is the Zugibeast. Named after American inventor and chairman of Hudson Technologies Kevin Zugibe, the Zugibeast (or simply, the 'Beast') separates contaminants from refrigerant, cleans and returns it while the refrigeration system still operates - a critical factor for large chemical, petrochemical and food plants where plant shutdowns can be costly.

No bigger than a chest freezer the portable beast works next to the chiller or refrigeration machine processing two tonnes of refrigerant per hour (ten times faster than any other system in the UK) and works by using the plant's refrigerant charge to 'deep clean'.

Refrigerant is distilled so the cleaning action does not suffer from blocked filters encountered with filtration processes, which reduces cleaning rates and contaminant carry-over when filters have been consumed. The molecular sieve in the dryer vessel can be used to reduce moisture levels to less than 10ppm by weight. Oil and debris are also extracted.

BOC has been using the Zugibeast since 2003 and has since completed nearly 50 major jobs for a range of businesses: oil refining, poultry processing, confectionery manufacturing, and one Royal Navy aircraft carrier (HMS Illustrious).

In four years the beast has operated for over 1,300 hours, processed up to 400 tonnes of refrigerant and recovered five tonnes of oil. During that time McNicholl and his team have gathered valuable data about the Beast's performance in differing, sometimes difficult and even cramped circumstances.

"One of the trickier challenges was the flooding of a 6,000kg refrigeration system on board a fishing trawler where a condenser tube had leaked allowing a tonne of seawater into the fish freezing system charged with 6.5 tonnes of R22," said Colin McNicholl.

"In such circumstances dehydration is never easy. Moisture gets trapped in pockets throughout the system and each model of chiller presents its own, unique challenges.

"With the trawler, BOC's decontamination system was able to remove most of the moisture and get the system back up and running in four days rather than the six weeks it would otherwise have taken. Similarly, water had saturated the refrigeration system on HMS Illustrious, but with the Beast on board we were able to quickly pinpoint the cause of the problem recover and dry the refrigerant."

## **Moisture threatens**

Moisture ingress is a threat to any refrigeration system: at 50ppm, moisture can cause copper plating, which affects compressor reliability and shortens the life of the system. Too much moisture in the circuit can cause blocked expansion valves, leading ultimately to compressor nuisance trips and reduced plant reliability.

At a food storage plant in Wales where the refrigeration plant was failing to meet its design loads, BOC used a two-stage rectification process to remove moisture from the refrigeration system. Liquid dehydrant was pumped into the system and allowed to mix and circulate with the refrigerant for 24 hours. A BOC superdrier was then connected in series with the pumped liquid line.

"The additive acts as a carrier, picking up any moisture present and dropping it off for the desiccant to absorb. As the refrigerant charge was circulated, moisture was extracted through a series of desiccant change-outs inside the superdrier. The unit was quickly working at normal pressure and with fewer compressors on line, power consumption and fuel costs were reduced as was the need for maintenance," confirmed Colin McNicholl.

The end result for BOC's food customer was a 20% improvement in the operation of the refrigeration system.

## Oil by the barrel

Oil contamination is the other major problem for refrigeration. Logging in the evaporator of a large, low temperature refrigeration plant in the north east of England resulted in reduced capacity and efficiency. Here a three-stage, 12tonne chiller refrigeration system had been designed so that oil could be skimmed off the refrigerant surface in the evaporator.

"Because the skimmers were not working as they should, oil was building up in the refrigerant side of the evaporator with a resultant loss in capacity and efficiency. Using the Beast the BOC team pulled contaminated refrigerant from the evaporator and returned it clean. Regular sampling during the process showed that oil content in the refrigerant was reduced to less than 1% and in all, 820litres of oil was removed from the system."

The BOC Refrigerant Services team also cleaned an R22 refrigeration system at BP's oil refinery at Grangemouth, Scotland. Two hundred litres of oil was stripped from the refrigerant and particulates were flushed from the system evaporators. Now, the plant is chilling product down to -54°C having never previously got below -47°C.

Says McNicholl, "The Zugibeast has proved so efficient that any other form of refrigerant recovery could aptly be described as antiquated. When combined with other tools - refrigerant testing and system data analysis, the team has been able to solve those 'knotty' problems encountered by plant managers and put systems right quickly. Aside from minimising the rectification process and the costs associated with it, the Beast has allowed BOC to build a wealth of knowledge and expertise in this area, while helping UK customers meet some of their key environmental obligations."

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