Refrigerant quality and its impact on refrigeration machinery

To ensure trouble-free and safe operation of refrigeration systems, refrigerants must comply with certain quality standards - just as compressors, the control systems, the piping and other essential components have to meet specific quality standards.

A major quality concern with regard to refrigerants is their purity. The moisture content in the refrigerant is of great importance: too much moisture can cause serious operational problems. A drop of water may look harmless enough, but to a refrigeration system moisture is “enemy number one”. Water can enter a system through sub-quality refrigerants during top-up.

Moisture in refrigeration systems

Excessive moisture in refrigeration systems may cause the following four major conditions:

Freeze ups

Freeze ups occur when moisture picked up by the refrigerant starts to freeze, building ice crystals that block the refrigerant passage in narrow passageways, for example in the expansion valve. This effect is called intermittent cooling, as the compressor stops after a while due to the blockage in the expansion valve and starts again when the ice crystals have melted and allow the refrigerant to pass through again. This is a periodical process of constant freezing and melting of the moisture inside the system, causing a periodical stop/start operation of the compressor.

Corrosion

Moisture can cause corrosion. However, moisture in combination with a HCFC (Hydrochlorofluorocarbon) refrigerant containing chlorine (like for example R-22 or R-409A)

creates much more serious corrosion, as the chlorine hydrolyses with the water to form hydrochloric acid (HCl) which is aggressive to most metals. Heat adds significantly to the problem by accelerating the acid-forming process.

For HFC refrigerants (like R-404A or R-407C), it is the polyolester oils that are very hygroscopic and may decompose at high temperatures forming hydrofluoric acid with the moisture which could be introduced to the system through a sub-standard refrigerant.

Sludge formation
Acid content inside a system can emulsify with the refrigeration oil to form an aggressive oil sludge that reduces lubrication properties. This can lead to serious compressor damage. Sludge can also cause a variety of other problems in a system such as blockages of strainers, expansion valves and other tiny passages.

Quality
The problems listed above do not happen over night, but normally build up over time if allowed to by incorrect refrigerant handling by the ship's crew.

A system breakdown is usually costly, the problem will be repaired and the system will get back in operations but the repair does not eliminate the cause of the problem. It is therefore vital that refrigerants comply with appropriate quality standards with regards to their purity.

In order to ensure trouble-free and safe operation of your onboard refrigeration machinery, all Unicool refrigerants supplied by Wilhelmsen Ships Service throughout the world comply with the stringent ARI 700-2006 standard that defines and benchmarks the purity of these substances and specifies a moisture content less than 10 ppm.

Wilhelmsen Ships Service supplies regulatory products and services, Unitor marine products, Nalfleet marine chemicals, maritime logistics and ships agency.

Wilhelmsen Ships Service has the world's largest maritime services network, with 4,600 marine professionals servicing 2 200 ports in 125 countries. Wilhelmsen Ships Service supplies regulatory products and services, Unitor marine products, Nalfleet marine chemicals, maritime logistics and ships agency to the maritime industry. Last year the company made 214 000 product deliveries to 23 000 vessels and handled 54 000 port calls.

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