

Press release

Many reasons for small quantities of refrigerant

Advantages (and challenges) of low charge ammonia systems

Frankfurt (Main), 05 February 2018. Ammonia is an environmentally benign, cost efficient and future proof refrigerant. It has been traditionally used in industrial applications for cooling capacities of several megawatts using tonnes of refrigerant charge. However, the flammability and toxicity of ammonia impose comparatively high safety requirements in terms of system design when compared to synthetic refrigerants, and traditionally has not always been suitable for every application. System and component development has resulted in the wider adoption of low-charge ammonia systems as an attractive alternative to conventional systems, across an increase range of applications. Ammonia is non-harmful to the environment and isn't included in the F-Gases Regulation and pending phase-down programme. Smaller charges reduce safety risks and the regulatory stipulations that have to be heeded when devising the system. With a combination of low Total Cost of Ownership (TCO) and low operating costs, low charge systems are often the best solution for the long term, in both economic and ecological terms.

Traditional, pump based ammonia refrigeration systems typically contain a charge of 2 to 3 kg per kW cooling capacity. By contrast, low-charge systems contain far less ammonia, typically less than 1.3 kg per kW, and applications are even possible with just 0.06 kg per kW. These small quantities reduce health and safety risks in the event of a leak, and simplify the official approval procedures, as systems with smaller charges have to heed far fewer requirements and regulations. The planning, operation and maintenance of some low charge system designs is also easier as there are fewer components and many systems are manufactured as a single factory built package. In many cases there will be no need for pumps to move the refrigerant around the system and both pipework and vessels are smaller.

Systems with 95% less ammonia charge

Low charge systems can achieve the same capacity levels as conventional pump-based systems but with a fraction of the refrigerant inventory. Traditional refrigeration systems circulate more liquid than is required for extracting heat in the evaporators. The overfeed rate i.e. the ratio of liquid to gaseous ammonia is typically 2:1 to 8:1 depending on the

application. In other words, only one of the two to eight kilograms of refrigerant pumped through the system is actually evaporated into the gas phase. In low charge systems, the ratio is usually less than 1.2:1. "Suitable system designs can reduce the ammonia charge in the overall system by 75% and even 95% in the evaporator, with no appreciable drop in capacity", explains Rob Lamb, Marketing Director at eurammon member Star Refrigeration Ltd.

These low circulation rates are possible through recent developments in evaporator design for temperature controlled storage applications using aluminium piping. Traditional air coolers use stainless or galvanised steel pipe which require 4:1 recirculation rates to achieve the design cooling capacity. Aluminium pipe has twice the thermal conductivity of galvanised steel and 12.6 times the conductivity of stainless steel (304L). The result is improved heat transfer between the room air and the refrigerant without the need for liquid pumps, leading to more efficient operation than pumped recirculation for the same operating conditions.

Prerequisites – precise calculation and clean working

When design low charge systems, attention is needed in terms of charging and installation cleanliness. "Optimum efficiency and permanently safe operation depends crucially on accurate calculation of the required ammonia charge. It must be large enough to permit stable, efficient operation across the entire operating range of the system, and also take account of changing ambient temperatures and system loads", says Lamb. If the charge is too small, it will jeopardise the long-term performance capability and reliability of the overall system, for example if a leak causes small quantities of refrigerant to escape which would reduce the cooling capacity and efficiency of the system. Cleanliness during the installation process is also important. "The small circulation rates required for low charge systems means that small orifice expansion devices can easily clog due to remnants of dirt from the installation process." On the other hand, the refrigeration systems are simple in design, reducing requirements for ongoing maintenance which makes them cheaper to operate.

New applications – from process cooling to HVAC

Low charge technology with its high system capacity opens up new applications where classic ammonia systems or refrigeration plants with synthetic refrigerants have been used. This includes refrigeration plants for deep-freeze and cold storage facilities as well as the food industry, process cooling, data centre cooling systems and the HVAC sector. The new refrigeration system installed for the British food and frozen food specialist Farmfoods is a good example for the efficiency and flexibility of low charge systems. The company has

around 300 food stores throughout the UK and was looking for an energy efficient refrigeration system with natural refrigerants for its new distribution centre in Bristol to supply the company's stores in the south of England. Farmfoods opted for two Azanefreezers by Star Refrigeration Ltd. with ammonia as refrigerant. These operate with a total cooling capacity of 530 kW to keep temperatures permanently and reliably at -22°C in the freezer rooms. The chilled areas are cooled to +2°C by an Azanechiller which uses ammonia to cool a secondary glycol circuit and has a capacity of 120 kW. The intelligent system design reduced the ammonia charge in both systems to 0.25 kg per kW and 0.1 kg per kW, respectively. The new systems are not just far more efficient than standard HFC refrigeration systems. Use of the natural refrigerant ammonia also reduces the company's carbon footprint – something that final consumers find increasingly important.

For eurammon member Rob Lamb from Star Refrigeration Ltd., the project clearly demonstrates the potential and growing significance of low charge refrigeration systems. "It combines high efficiency with a comparatively simple system design, relatively minimum regulatory requirements and high environmental compatibility that makes low-charge ammonia systems an attractive alternative in almost every application segment, also including the high capacity range", says Lamb.

Pictures:



Caption: eurammon member Rob Lamb, Marketing Director at Star Refrigeration Ltd.



Caption: Thanks to the intelligent system design of the Azanefreezer by Star Refrigeration Ltd., it was possible to reduce the ammonia charge at Farmfoods to 0.1 kg per kW.

About eurammon

eurammon is a joint initiative of companies, institutions and individuals who advocate an increased use of natural refrigerants. As a knowledge pool for the use of natural refrigerants in refrigeration engineering, the initiative sees as its mandate the creation of a platform for information sharing and the promotion of public awareness and acceptance of natural refrigerants. The objective is to promote the use of natural refrigerants in the interest of a healthy environment, and thereby encourage a sustainable approach in refrigeration engineering. eurammon provides comprehensive information about all aspects of natural refrigerants to experts, politicians and the public at large. It serves as a qualified contact for anyone interested in the subject. Users and designers of refrigeration projects can turn to eurammon for specific project experience and extensive information, as well as for advice on all matters of planning, licensing and operating refrigeration plants. The initiative was set up in 1996 and is open to companies and institutions with a vested interest in natural refrigerants, as well as to individuals e.g. scientists and researchers.

Internet URL: www.eurammon.com

Kontakt

eurammon contact

eurammon
Dr. Karin Jahn
Lyoner Straße 18
D-60528 Frankfurt
Tel.: +49 (0)69 6603-1277
Fax: +49 (0)69 6603-2276
Mail: karin.jahn@eurammon.com

Press contact

FAKTOR 3 AG
Katharina Seher
Kattunbleiche 35
D-22041 Hamburg
Tel.: +49 (0)40 679446-6322
Fax: +49 (0)40 679446-11
Mail: eurammon@faktor3.de

In case of a publication, we are glad to receive a sample copy at the address of the press contact.