ics cool energy

REASONS WHY HFO REFRIGERANTS ARE A STRONG ALTERNATIVE TO NH3/AMMONIA

PILLAR 6 - PERFORMANCE

INTRODUCTION

When installing an industrial chiller in a food, beverage, or dairy setting, it is important to consider whether NH3 (Ammonia) is indeed the most appropriate refrigerant solution.

In food and beverage processes, it has been a traditional approach to have the cooling process applied by an "Industrial" cooling system, typically using ammonia as refrigerant. Some reasons are based on unconscious bias, some other reasons are the "natural" aspect of ammonia.

But now companies that need a mild freezing cooling system are increasingly turning to Hydrofluoroolefin refrigerants – known as HFOs – to improve sustainability, boost performance, and significantly reduce costs.

The ideal refrigerant for these sectors needs to be non-toxic, non-flammable, non-explosive, non-corrosive, not harmful to the environment, cheap and easy to produce / work with and have good thermodynamic properties. Luckily, HFOs meet this criterion. And simply put, HFO solutions are always lower cost versus NH3/ammonia.

HFO refrigerants are categorised as having zero ozone depletion (ODP) potential and low global warming potential (GWP) and R1234ze is a synthetic refrigerant, rather than a natural refrigerant like ammonia. Interestingly the GWP value of R1234ze is less than the GWP another natural refrigerant CO2 (being 1) and importantly R1234ze doesn't create TFA (trifluoroacetic acid and its salts).

Here we look at the aspect of performance.

GLOBAL INNOVATIONS

HFO chillers make use of the latest global innovations. These innovations include inverter driven compressors with a variable pressure ratio optimizing itself in all running conditions. Additionally, controllers are not only managing the brine temperature, but include continuous optimisation based on all forthcoming conditions, and even avoiding any nuisance failure by anticipating running trends and pro-actively asking service attention by mail when there would be a need.

Although ammonia systems can be very efficient at deep freezing systems, HFO cooling systems can outperform at mild freezing and cooling conditions. Beside of the innovative technologies, the use of copper and refrigerant cooled compressors adds significant efficiency to the system compared to ammonia systems. It is always important to consider the final energy customer energy meter including all auxiliary components such as cooling towers and pumps.

PERFORMANCE COMPARISON

The performance of ICS Cool Energy's HFO chillers are 3rd party certified and subject to R&D testing procedures. This means that before a chiller even lands at a food and beverage facility there are certain assurances. You can be sure how the system will behave, and how it's parts and components will react collectively and individually, from compressors to condensers.

Inversely, it's a lot harder to predict exactly how an ammonia chiller built to a bespoke specification will operate once it's in place. The forecasted performance will often be based on catalogue data, that is to say, how an ammonia chiller will work at certain design conditions, but not based on the very individual and differing conditions a food/beverage manufacturer may be facing. Will a set of components be able to cope with their temperatures? Will the components be able to offer optimum support under intense usage? One Process Engineer at a chocolate manufacture may envisage their cooling need for set of jacketed vessels only requiring chiller support for a couple of hours a day, 4 days per week. Whereas another Process Engineer at a brewery many need 16 hours of cooling per day 7 days a week to adequately chill their brewing tanks.

THERE IS NO ONCE SIZE FITS ALL WITH AMMONIA COOLING

Unfortunately, when selecting an ammonia system there are no testing capabilities per se ahead of installation. Therefore, it is often only after the chiller has been delivered to site, unloaded, shifted to its final position, connected to any new (and often expensive) pipework, turned on and set up for action / commissioned before one can really know how it will fare. This clearly is a disadvantage and poses certain financial and feasibility risks, especially if it were to underperform or need retrospective modifications.

So far, no ammonia systems have been certified by third-party organisations like Eurovent or the Air-Conditioning, Heating, and Refrigeration Institute (AHRI). This means that manufacturers can only see if it achieves the performance as promised after the entire ammonia system has been installed and is running.

AN EXAMPLE WHERE PERFORMANCE FORECAST WAS DECISIVE

A dairy customer based in the southwest of England with whom we worked with recently was encouraged to move away from ammonia cooling for a new 1200kW requirement for centralised cooling of their food production vessels and tanks.

The customer conducted an energy study as part of this major factory expansion project and found it difficult to predict how a new centralised ammonia system would work – data, figures and performance were hard to plot. Having looked further into their energy consumption of their current chillers to assess heat loads, we worked with them to put some baseline figures together for cooling demands for not only the current plant but more importantly and decisively what would be envisioned for the future for the total demand of our proposed HFO system. These figures were easy to provide, show and demonstrate and so it's with no surprise the customer felt a proven performance HFO chiller that would potentially save them money was a better choice than a hypothetical new ammonia system where data was woolly.

It can be safely said that HFO chillers can outperform ammonia chillers by up to 25% according to the energy efficiency ratio (EER).

To run a process chiller, 90% of its costs can be attributed to the electricity required to power it, so using HFO chillers using low GWP refrigerants to reduce energy usage, increase efficiency of performance and maintain a strong, sustainable and carbon reducing focus.

IN SUMMARY

Although ammonia has been used as a cost-efficient cooling medium for over 150 years in chillers and cooling applications at food, beverage, and dairy production sites, the science and modernisation behind other less toxic/safer/lower GWP refrigerants has developed hugely, not least in terms of the magnification and rise to prominence of HFO refrigerants in very recent times especially.

The door is firmly open for refrigerants like R1234ze to offer a perfect cooling alternative regardless of the process or application in question. Given that hydrofluorocarbons like R1234ze are environmentally friendly, non-toxic and with low GWP/ODP (Global Warming Potential / Ozone Depletion Potential), they make a great option for all process cooling requirements in all the aforementioned sectors and their associated industries.

Although service, maintenance and system care are important whatever type of chiller is used, with HFO plant there is not the same risk, worry, risk to health / life and need for emergency procedures should an accident occur.

7 REASONS TO CHOOSE AN ICS COOL ENERGY HFO CHILLER OVER AN AMMONIA CHILLER

- Cost effective solution
- Zero Toxicity
- Ease of maintenance and operation
- Low GWP
- Standardised range of products with fast customisation options
- Proven performance
- Compact footprint