



Transitioning to a Greener Cooling Solution

Services: **Refrigerant Replacement: Retrofitting R404a with R448a**

Project Overview

A global provider of pharmaceutical products enlisted the help of Space Engineering Services to help protect their business from rising refrigerant costs and scarce availability of refrigerant R404a.

Their advanced production facility included large freeze drier units for freezing and drying pharmaceutical product operating at very low suction pressures using R404a, the market's standard refrigerant for freezers and blast chillers.

Due to its high global warming potential (GWP) of 3,943, R404a is one of the main refrigerants targeted for phase out in Europe under the F Gas regulations. Strict quotas have significantly reduced availability of this gas, causing the cost per kilo to dramatically increase, presenting a serious risk to businesses still using it. In the event of a leak, the customer would be exposed to extremely high costs for rectifying the system, with delays that would impact heavily on production.

Our customer therefore needed a refrigerant solution that would offer reduced maintenance costs, while ensuring the plant had no reduction in performance and remained compliant with F Gas regulations.

Our Solution

The customer opted to retrofit the existing plant with a new refrigerant which would offer a lower GWP than R404a. This is a cost-effective option for refrigerant users in the short term as it avoids the need to replace expensive plant.

R448a represents a greener alternative to R404a and is ideally suited for medium and low temperature applications. Its lower GWP of around 1300 means it's not currently affected by the HFC phase down, however it's likely to be targeted in the future.

Space Engineering Services has a wealth of experience in performing refrigerant conversion programmes, with a team of fully trained Commissioning Engineers. Our tried-and-tested approach includes conducting in-depth system analysis to fully understand all equipment and plant and the volume of refrigerant requiring replacement. This is combined with our coordinated approach of bringing the expertise of our plant manufacturing team together with our on-site teams.



Before commencing the project, we completed a full design review which included gathering data from equipment manufacturers and identifying the most suitable refrigerant replacement.

Given the need to maintain the same level of performance while minimising impact on operations during the conversion, we converted one small system first to R448a. Once completed, we undertook a series of tests including monitoring suction and discharge temperatures to ensure that they stayed within the manufacturers' limits and that there was no danger of damage to the components. Once satisfied with these results, our Commissioning Engineers optimised the system in line with the customer's requirements.



The customer had multiple systems of the same design, so the successful completion of the first system proved that our solution would be compatible. We then carried out conversions to the remaining systems, ensuring each one was fully optimised and running correctly before handing over the project.

Challenges

The freezer compressors were large Bitzer semi-hermetic internally compounded, and the packs were more than 20 years old. This made the project particularly challenging as very few refrigerant retrofits have been carried out on equipment of this age, and therefore there was no real comparative data available.

The customer's system was of a unique nature, as the freezer worked to temperatures as low as -70 degrees, making this a very unusual application. The system operates with internally compounded compressors with mechanical subcooling, so we

had to carefully select and adjust the components to ensure that the maximum permitted discharge temperatures were not exceeded.

The plant needed to maintain the same level of performance after the refrigerant conversion, so we adopted a phased approach to the project to ensure that performance would not be adversely impacted.

Key Benefits

Our customer's key requirements for this project were to ensure their systems remained legally compliant, and eliminate the financial risk that a catastrophic plant failure would present following a refrigerant leak.

By opting for R448a, the customer reduced their GWP from 3922 to 1387, well within the GWP limits set by the current F Gas regulations. R448a is a readily available, non-flammable and non-toxic refrigerant, making it a safe, greener and energy-efficient alternative to R404a. For our customer, this also meant they eliminated the potential difficulties in obtaining R404a and the costs associated. We successfully completed this refrigerant conversion project in line with all of our customer's technical requirements and their delivery schedule, and importantly they remained legally compliant.

While offering a cost-effective alternative to replacing plant, retrofitting doesn't provide a long-term solution to the HFC phase down, as R448a (an HFO blend) is at risk in the future from phase-outs. When a long-term solution is needed, natural and A2L refrigerants (for smaller refrigerant charges) offer future-proof cooling, and these are the most effective options to avoid escalating costs and interruption to business operations caused by the F- Gas Regulations. Our expertise in HFC/HFO blends and natural refrigerant solutions including CO₂ and ammonia perfectly position us to support our customers with identifying the right solution for them to mitigate significant future financial costs posed by F-Gas phase-downs.

