INDUSTRY SPOTLIGHT

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How do you choose the right refrigerant for a commercial heat pump?

Written by Jason Allen, Commercial Product Manager for heat pumps, Ideal Commercial Heating.
Having worked in the HVAC industry for over 35 years, Jason has specialised in heat pumps for the past fifteen years, from sales through to business development, providing invaluable technical support internally and externally for customers.

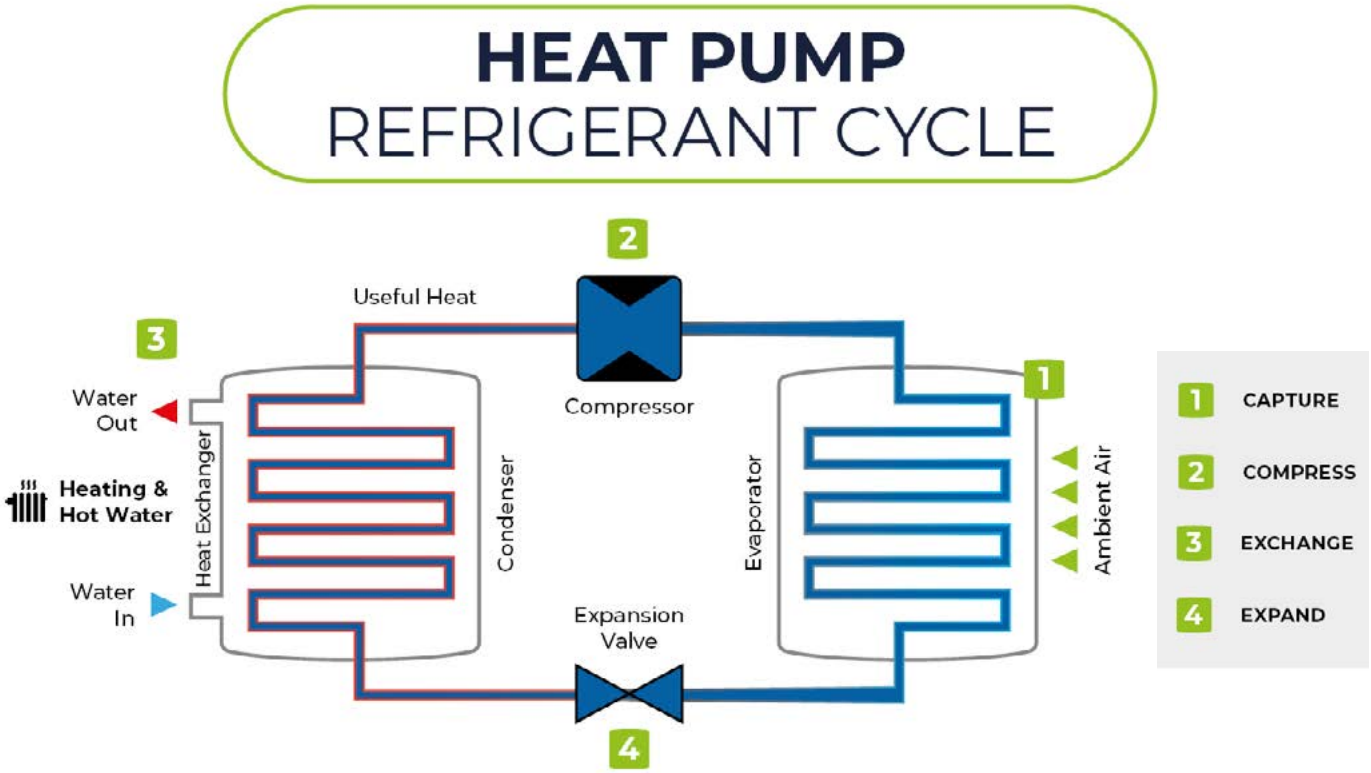
For those of us working to future-proof heating systems, the heat pump has become central to the journey towards low carbon buildings. But beneath every efficient heat pump system lies an unsung hero: the refrigerant.

It's not just about selecting a heat pump anymore – it's about choosing the right refrigerant for the right application. This is especially critical for heating professionals aiming to deliver sustainable, regulation-compliant solutions.

APRIL 2026

What is the role of the refrigerant?

At its core, a heat pump transfers heat from one place to another using a refrigerant cycle. It's the refrigerant that absorbs heat from the source (air, water, or ground) and releases it into the heating system. So, the performance, environmental impact, and even the cost of running the system can hinge on which refrigerant is chosen.



Historically, refrigerants like CFCs and HCFCs were widely used, but their high Ozone Depletion Potential (ODP) and Global Warming Potential (GWP) will lead to their phase-out in the future. This leaves us today with two main categories:

- **Natural Refrigerants** – such as R290 (Propane) and R744 (Carbon Dioxide / CO_2)
- **Synthetic Refrigerants** – such as R32 (Difluoromethane)

Each has advantages and drawbacks, which must be understood in context.

What is GWP and F-Gas legislation?

GWP is the benchmark for assessing a refrigerant's climate impact, comparing it to CO_2 over 100 years. The lower the GWP, the lower the contribution to climate change. The 2014 F-Gas Regulations – and more recently, the EU's Regulation 2024/573 – are pushing for a refrigerant phase-down, promoting the use of low-GWP alternatives.

Compliance with these regulations isn't optional. Even though some commitments, like TM44 assessments, remain underused or misunderstood, they should be considered best practice.

What are the natural refrigerants: R290 & R744?

Ecomod 290HT commercial heat pumps use R290 natural refrigerant

Natural refrigerants are attracting more attention, and for good reason. R290 and R744 boast ultra-low GWP values – just 3 for R290 and 1 for R744. This makes them highly attractive from a sustainability standpoint.

R290 can deliver temperatures up to 75°C, making it a strong candidate for domestic hot water production and high-demand commercial systems. However, safety considerations and risk assessments must be built into the design and installation process due to its flammability.

R744 heat pumps are especially efficient when operating in a 65–70°C flow / 30°C return temperature range. They're capable of accepting slightly higher return temperatures (up to 50°C temporarily), making them adaptable to more varied applications. However, CO_2 systems require precise design due to their high operating pressures and unique transcritical cycle.

What is the synthetic refrigerant option: R32?

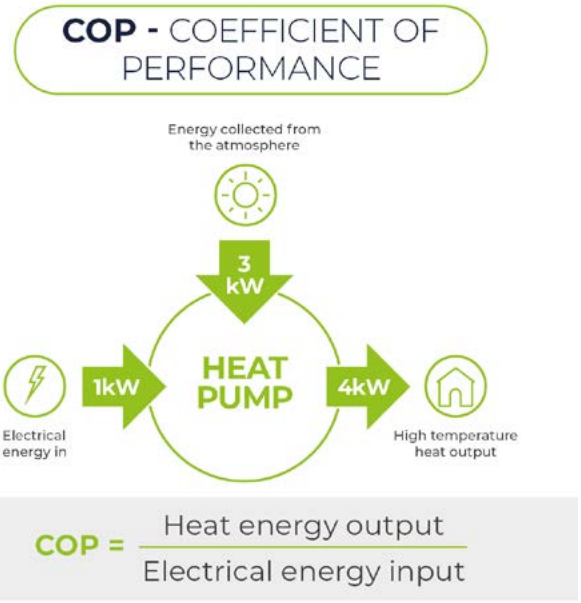
R32 is a popular choice for commercial air source heat pumps. With a GWP of 675, it's significantly lower than its predecessors. One of the common misconceptions we hear is that R32 can't produce high enough temperatures for UK heating demands. That's simply not true. Most R32 systems can reliably produce flow temperatures up to 55°C, making them ideally suitable for space heating, provided the system is well-designed.

Designing for R32 requires a narrow differential temperature (DT) approach and careful control of return water temperatures. But when these parameters are met, the result is a highly efficient and cost-effective system.

What is the difference between COP and SCOP?

Two key indicators of heat pump performance are the Coefficient of Performance (COP) and its seasonal variant, SCOP. COP is the ratio of heat output to electrical input at a specific condition, while SCOP accounts for temperature variations over an entire year.

Natural refrigerants like R744 or R290 can show high SCOP values in suitable applications, particularly in domestic hot water systems. However, achieving optimal SCOP means marrying refrigerant choice with building design, control strategy, and realistic expectations around flow temperatures.



How to design an efficient heat pump system?

No matter the refrigerant, successful heat pump design demands an integrated approach. This can include:

- Understanding the heating demand profile
- Designing with a lower flow temperature
- Implementing variable flow control strategies
- Educating the industry about realistic operating conditions

Contrary to popular belief, a heat pump doesn't need to match the flow temperature of a gas boiler, if correctly designed. Instead, the system should be optimised around what a heat pump can do efficiently. High-temperature outputs are possible – but not always necessary.

While refrigerant type can influence system cost, natural options like R290 and R744 are becoming increasingly viable as technology improves and demand grows. Still, system cost isn't just about the unit – it includes installation, building fabric upgrades, maintenance, training, and compliance with safety standards.

Final thoughts when choosing the right refrigerant for a commercial heat pump?

As installers, engineers, consultants and building owners, we all have a role in supporting the UK's decarbonisation goals. Understanding refrigerants isn't just a technical necessity – it's a professional responsibility. Whether you're specifying a new commercial plant room or retrofitting an older building, your choice of refrigerant can increase the system's performance, decrease the environmental impact, and improve the long-term viability.

With evolving regulations and growing emphasis on whole-system efficiency, now is the time to brush up on refrigerant knowledge and explore the full potential of heat pumps in commercial settings.