

# White paper

## R32: get ready!

### Technological options for R32 compressors

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#### R32 Solutions

In air conditioning, R32 is generally considered as one of the best choices to replace R22. R32's ozone depletion potential (ODP) is 0 and its Global Warming Potential (GWP) is also less than one third of the GWP of R22. It is more efficient: the same compressor size with a lower refrigerant charge will provide a higher cooling capacity.

R32 presents some challenges which imply some technological choices for compressor manufacturers, OEMs and installers. Compressors using R32 have a higher discharge temperature. Additionally, the refrigerant is slightly flammable. As a result, implementing

R32 in a system leads to changes in the lubricant oil as well as in the compressor and refrigeration system design.

Several ways exist to manage the high discharge temperature in the compressors operating with R32.

**Vapour injection** can be used to increase system capacity and performance. It also has the function to decrease discharge temperature. However, this option requires a complex system installation and the operating map will be limited.

**Wet suction** can be one technology to decrease discharge temperature

by controlling the expansion valve and uses a special lubricant to reduce the suction gas dryness to lower the discharge temperature. But the risk is to make the compressor compress liquid or reduce the lubricant viscosity, or to have an oil back risk and limited operating map.

**Wet injection** controls also the dryness of injected refrigerant, but it's difficult to control. Due to the refrigerant's properties, the lubricant should be requalified to ensure miscibility and tropology.

Danfoss has opted for **liquid injection**.



# Danfoss and liquid injection: the best technological option for R32

Considering the cooling capacity, system performance, compressor operating map, system complexity, reliability and cost, Danfoss has opted for liquid injection for air conditioning and most of the heat pump applications when using R32. The R32 compressor using liquid injection keeps the same performance and it greatly enlarges the operating map so that it is suitable for more extreme conditions. The condensed fluid is injected into the scroll through an electronic injection valve, which will absorb the heat of intermediate compressed gas to vaporize. Thus the discharge temperature can be lowered effectively and the injected mass flow rate can be easily modulated by injection valve.

## Comparison of performance by compressor technology

	Liquid Injection	Vapour Injection	Wet Injection	Wet Suction
Cooling capacity	Similar	Slightly Increased	Slightly Increased	Reduced
Performance	Moderate	Slightly Increased	Moderate	Moderate
Operating Map	Large	Small	Large	Moderate
Complexity	Low	High	High	Low
Reliability	OK	OK	OK	Low
System Cost	Low	High	High	Low

## Additional benefits of R32 compressors with liquid injection

Liquid injection is a simple, economic, reliable and efficient option

### Easy and cost effective implementation

The R32 compressor with liquid injection is simple to assemble in the system. The unit requires fewer modifications than one equipped with a compressor using another technology. From the compressor perspective, there is an additional injection valve to inject liquid. Injection is controlled by an electronic panel (OCS) which can monitor the discharge temperature (Fig. 1). From the system perspective, only a tube is needed from the liquid line to the compressor injection valve (Fig. 2).

### Versatile compressor suiting lots of applications

The R32 compressor with liquid injection technology offers a larger operating envelope (Fig.3). With 68°C saturated condensing temperature, the compressor allows safe hot sanitary water production and comfortable space heating. In parallel, the compressor can be used in very cold regions and ensure the safety and reliability of the system operating process thanks to evaporating temperatures going down to -30°C.

### Efficient solution to reduce the energy bill

The R32 refrigerant offers a higher cooling capacity thanks to its thermodynamic properties. The cooling capacity of R32 compressors is increased by more than 10% compared to compressors using R22. R32 compressors also show a better performance in cooling efficiency and provide a significant higher COP than R22 compressors at the same cooling capacity.

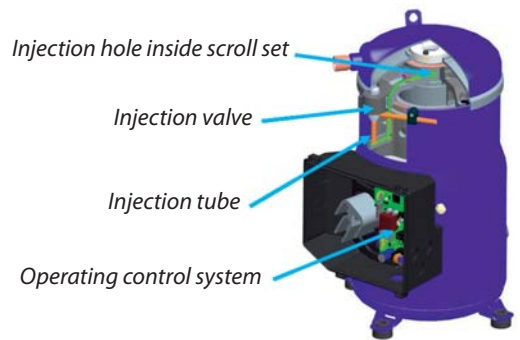


Fig. 1: Danfoss R32 compressor with liquid injection

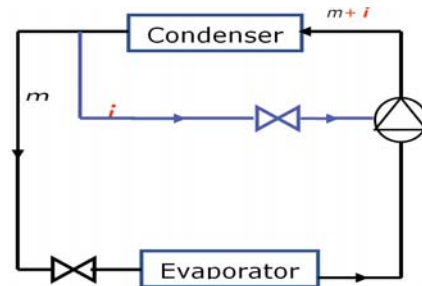


Fig. 2: R32 compressor with liquid injection in refrigeration circuit

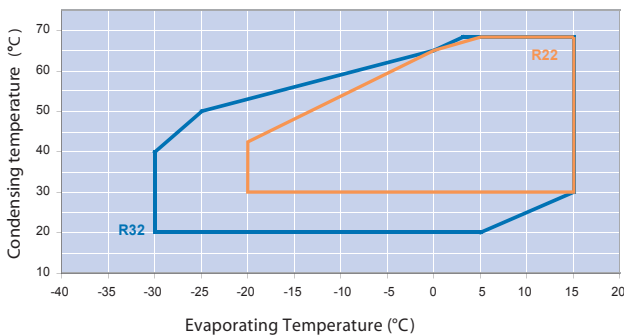


Fig. 3: Operating envelopes: comparison between R32 with liquid injection and R22 compressors

## Conclusion

Danfoss is successfully developing a compressor for R32, which is suitable for light commercial air cooled units like water heat chillers and split air-conditioning system applications. With the liquid injection technology, the Danfoss R32 compressor provides the simplest system design with the lowest applied costs. Through proven energy efficient and reliable products and effective processes, Danfoss helps its customers reduce the total value chain costs.

## Performance Data

Model	50 Hz	
	Cooling capacity	
	W	Btu/h
SG147	37 200	126 800

Preliminary data

For details, please contact your local sale offices.

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