

Copeland Scroll™ compressor for subcritical R-744 (CO₂)



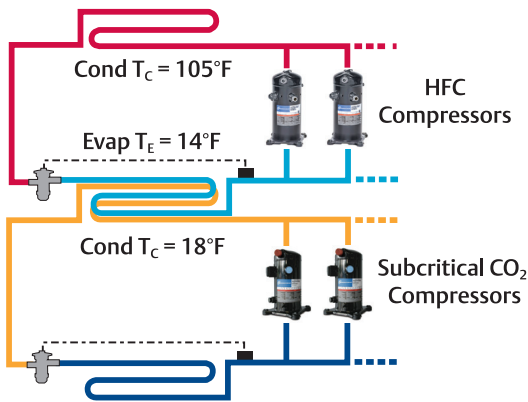
CO₂ low temperature refrigeration

Emerson Climate Technologies has been a critical resource in past refrigerant transitions. As the market leader with the broadest compressor line up, our experience with refrigerants and products to fit the industry needs make us uniquely qualified to provide a compressor solution for CO₂.

Increasing environmental concerns about the potential direct emissions from HFC-based refrigeration systems into the atmosphere have led system designers to revisit refrigerant R-744 (CO₂). In comparison with HFC refrigerants, the specific properties of CO₂ require changes in the design of the refrigeration system. The ZO range of Copeland Scroll compressors has been designed to exploit the characteristics of CO₂ refrigeration systems. The efficiency, reliability and liquid handling advantages of Copeland Scroll technology make it ideal for these applications.

Low temperature cascade systems

The comparably high pressure level and thermodynamic properties of the refrigerant CO₂ have driven system designers towards cascade systems, where CO₂ is used as a direct expanding fluid in the low temperature stage. In these subcritical cascade applications, the CO₂ compressor in the low temperature stage is still exposed to pressure levels higher than in standard HFC-based systems. However, they are limited to pressure levels similar to those already known from air-conditioning applications with refrigerant R-410A. An HFC refrigerant is typically used in the medium temperature stage of the cascade system.



Illustrative purposes only

Safeguarding your product and our environment

Environmental concerns must address potential direct refrigerant emissions as well as those arising from the energy consumption of the refrigeration system. The use of the refrigerant CO₂ has the potential to reduce direct emissions. However, refrigerant leakage is still undesirable as it jeopardizes system reliability. With its hermetic design, Copeland Scroll technology eliminates any compressor-related leakage, contributing to reliable system operation and thus safeguarding your refrigerated product.

Additionally, the ZO range of scroll compressors transfers the high efficiency inherent in the Copeland Scroll design to subcritical CO₂ refrigeration systems.

The extended operating envelope of the ZO compressors can further boost overall system efficiency when taking advantage of low load night time operation.

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Optimized design for CO₂ applications

The challenges for CO₂ compressors compared to HFC compressors lie in the high pressure levels, the higher mass flow for a given displacement, and designing for proper lubrication.

In terms of mechanical strength, ZO scroll compressors benefit from many years of experience with R-410A air-conditioning compressors, which operate at similar pressure levels as subcritical CO₂ compressors. For piston compressors, particular attention has to be paid to redesigning the suction and discharge valves for the higher mass flow. Copeland Scroll compressors eliminate this problem up-front by not utilizing suction and discharge valves to control the compression process.

Lubrication is always of particular concern during the design stage of new compressors and has to be proven during reliability and field testing. The effort has resulted in the development of a dedicated polyolester oil (POE). Moreover, ZO compressors feature internal design details which ensure higher bearing durability and lubrication to all critical parts at any time during run-time and system start-up. This includes the use of polymer bearings.

Copeland Scroll™ ZO model summary

Model	Nominal Horsepower	Displacement	Capacity	EER
ZO21K3E	1.0	112 CFH	20,800 btuh	15.4
ZO34K3E*	2.0	172 CFH	32,000 btuh	15.4
ZO45K3E	2.5	228 CFH	44,000 btuh	16.5
ZO58K3E	3.5	291 CFH	57,000 btuh	16.7
ZO88K3E	5.0	431 CFH	85,300 btuh	16.3
ZO104K3E*	6.0	498 CFH	98,500 btuh	16.3

*Digital model available

*Capacity with R-744 at -31°F evap, 14°F cascade cond, 5°F RG, 14°F liquid

