As higher-GWP refrigerants continue to be phased out, the evaluation and approval of alternative refrigerants increase in importance.

The refrigeration industry’s primary concern is complying with new and upcoming regulations. At Emerson, our focus is unequivocal: nearly every internal development program we’ve undertaken in commercial refrigeration has been geared toward achieving this compliance. And one of the solutions we’ve researched, tested and implemented in our products is propane (R-290). While propane has met hesitation from some due to certain limitations and misconceptions, it is gaining momentum in the refrigeration industry and is a viable solution to complying with the refrigerant phase-down of hydrofluorocarbons (HFC).

Advantages

Because propane was introduced to the industry more than 100 years ago, its performance efficiencies and thermodynamic properties have been well vetted. It performs very similarly to or better than R-404A in terms of pressure, discharge temperature, volumetric capacity, capacity loss and coefficient of performance, but without the downside of ozone depletion due to leaks.

Propane’s many benefits include:
• Hydrocarbon-based, non-synthetic substance
• EPA-approved in commercial refrigeration applications
• Very low environmental impacts: GWP = 3, ODP = 0
• Relatively affordable
• High-efficiency, high-performance, reliable
• Safe when proper protocols and procedures are followed

From the standpoint of minimal effect on the environment, it is in an elite class of refrigerants and is very appealing for achieving regulatory compliance.

Product Offerings and Market Readiness

As the refrigeration industry continues to evolve, we continue working to enable our customers the most seamless means to evolve with it. As lower-GWP refrigerants continue to gain traction, we’ll continue to innovate our products for customers, allowing them to incorporate these refrigerants. Our approach to this challenge has remained consistent throughout: to rigorously engineer and evaluate component performance against worst-case regulatory scenarios.

Results from Emerson test labs comparing the EER of R-404A to R-290 in medium back pressure (MBP) show a significant improvement when using R-290.

At our test labs, we’ve found propane capable of high-performing, efficient operation. Compared to the refrigerants it will likely replace, it yields more capacity with lower wattage consumption. Overall, we’ve seen more than a 10 percent efficiency improvement in our propane performance testing.

We offer propane compressors and other system components ideally suited for low- and medium-temperature applications that address regulatory compliance challenges. We also continue to invest in facilities for testing needs to serve our customers, like our new lab expansion that will be A2L (YF, XE, R32 fluids) and A3 (propane, isobutene) capable as well as provide testing for compression.
Improved Efficiency With Natural Refrigerants

Emerson offers a new solution for operators looking for improved energy efficiency using natural refrigerants. The Copeland Scroll™ ZB*KAU compressor represents the latest innovation in compliant scroll technology for refrigeration equipment from 0.75 HP - 1.6 HP (8,400 - 13,450 BTU/hr at medium temperature ARI). It is more efficient than standard reciprocating compressors with 70% less moving parts for increased reliability.

The ZB*KAU models are intended for medium temperature refrigeration type duty and are ideally suited for applications such as self-contained display cases with multiple circuits, packaged condensing units for cold room applications, and refrigeration applications below the 150g R-290 refrigerant charge.

Copeland Scroll technology is an all-around superior refrigeration solution:

• Smooth scroll movement leads to low sound and vibration
• Smooth start and stop of a scroll means longer compressor life
• 70% fewer moving parts than a reciprocating compressor means better reliability
• Axial & radial scroll compliance provides improved liquid handling capability
• Hermetic design reduces leak potential

Applications and Special-Use Considerations

Propane is ideally suited to replace hydrofluorocarbons R-404A, R-507A, R-407A and HFC-134A in smaller commercial applications — such as beverage coolers, frozen drink machines, ice machines, small ice-cream freezers and small reach-in units — due to its extremely low global warming potential (GWP).

However, because of its small charge limit of 150g, large food retail applications are more limited. In some cases it has been used with special permission to allow for 300g of charge, although more compressors are needed to generate the capacity required to meet the refrigeration load.

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Emerson’s Complete R-290 Offering

In addition to the newly launched R-290 Copeland Scroll compressors, Emerson offers a complete range of fractional horse power compressors, condensing units, controllers, and other system components to serve the industry for their R-290 needs in various refrigeration applications.
M-Line Model Summary

<table>
<thead>
<tr>
<th>HP</th>
<th>Model</th>
<th>Electrical</th>
<th>BTUH 90/10</th>
<th>L</th>
<th>W</th>
<th>H</th>
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<td>1/2 MUPM-0048 CAA 2320</td>
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<tr>
<td>3/4 MUPM-0070 CAA 2800</td>
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</table>

M-Line R-290 Condensing Units

Copeland™ M-Line condensing units can help OEMs achieve regulatory compliance while giving end users optimal performance in low- and medium-temperature applications, with energy savings up to 30 percent.

- Latest generation of Copeland hermetic compressors
- Electronically commutated fan motors (an optional feature)
- Condenser coil tubing design that enables additional coil rows
- Available in Copevap base for condensation management

Designed with OEM and end user concerns in mind, Emerson offers A*E and R*T compressors rated for use with R-290 and available in fractional horsepower options to serve as the basis of Copeland M-Line condensing units.

- Minimal sound output for quiet operation
- Up to 30 percent energy-efficiency improvements compared to R-404A
- Little to no environmental impacts

Low temp application capacities: 1300-4200 Btu/h
Medium temp application capacities: 1800-7000 Btu/h

Dixell Controllers for R-290 Applications

Dixell controls are UL and CE listed and can be used in R-290 systems including, but not limited to, reach-in refrigerators and freezers, beverage coolers, and display cabinets.
Challenges

- Class A3 refrigerant that is flammable
- Globally mandated low charge limits of 150g restrict application range
- Requires special handling requirements certifications
- Lack of trained technicians

While there are challenges to the implementation of propane, for environmentally forward-leaning companies, it is an increasingly attractive option. While an uncertain regulatory environment may have cleared the way for wider R-290 adoption, the implementation of an industry-wide safety infrastructure will be necessary for propane to gain full adoption.

Propane is more combustible than hydrofluorocarbons and there are a number of special-use considerations for using it in refrigeration applications. Some examples include, but are not limited to:

- Sealed/gas-tight or fire-/explosion-proof electrical components (UL471/EN 60079-15)
- Spark-free fan motors (brushless)
- Ventilation and leak sensor safety measures
- Special charge and leak detection processes during manufacturing

It’s also important to note that while propane has tremendous potential in commercial refrigeration, it is not a “drop-in” refrigerant. Equipment and components must be specifically designed for use with propane, as it requires a different compressor that will not always directly match the capacity or cost of existing HFC models.

Please reference the REQUIREMENTS FOR REFRIGERATORS AND FREEZERS EMPLOYING A FLAMMABLE REFRIGERANT IN THE REFRIGERATING SYSTEM in the UL471 standard for commercial refrigerators and freezers for the detailed list of considerations.