



## Achieving compliance is our top priority



The question we've been asked most often over the past year is this: "What is Emerson Climate Technologies doing to prepare for future regulations?" Between the Environmental Protection Agency's (EPA) multiple significant new alternatives policy (SNAP) rulings on refrigerants and the Department of Energy's (DOE) energy reduction mandates, complying with these regulations has been a primary concern for our customers.

Our answer as a company is unequivocal: nearly every internal development program we've undertaken in commercial refrigeration has been geared toward achieving compliance. From participating in the meetings on the Hill — where the scope of the rulings were debated — to making significant investments in research, development and testing, our approach has been all-encompassing.

Individually, the DOE's and the EPA's rulings present significant challenges. Combined, they become increasingly more difficult to address. Until the EPA announced its final delisting ruling in July, there was wide speculation about how aggressive the refrigerant ruling would be, and what its impact on the DOE's already-final

rule on energy reductions would be.

While the EPA's final refrigerant delisting ruling has slightly delayed their phase-down stance of hydrofluorocarbons (HFCs) R-404A, R-507A, R-407A and HFC-134a in various applications, compliance is still a near-term inevitability. Even though the DOE's energy reduction mandates on stand-alone commercial refrigeration equipment (such as reach-in and walk-in coolers and freezers, and automatic commercial ice makers) are still looming in the 2017–2018 time frame, we expect a fair amount of industry pushback to the DOE's timeline to continue. So, even though both rulings are final, there's still a real sense that the industry is waiting for the dust to settle.

### **Proactive Pursuit of Energy-Efficient, Eco-Friendly Technologies**

As a component manufacturer, we don't have the luxury of waiting to see what is going to happen next. And as a company, we strive to maintain a proactive posture by relentlessly pursuing a multitude of potential solutions. So our approach to this challenge has remained consistent throughout: to rigorously engineer and evaluate component performance against worst-case regulatory scenarios. As a

result, we can confidently say we are prepared to address both the EPA and DOE compliance challenges.

### ***EPA SNAP Rulings — Refrigerant Preparation***

#### ***New HFOs and Associated Blends***

The majority of our compressor platforms have been validated for use with the EPA's newly approved A1, hydrofluoroolefin (HFO) blends, such as R-448A, R-449A, R-450A and R-513A. This includes both our Copeland Scroll™ and Copeland Discus™ semi-hermetic compressor lines. We're also in the process of following up our validation efforts on these refrigerants in our Copeland™ hermetic compressor lines, which we'll be finalizing in 2016.

#### ***Natural Refrigerant Options***

Because of their extremely low global warming potential (GWP), the industry is taking an even closer look at CO<sub>2</sub> (R-744) and propane (R-290). While these natural options have their own challenges, they take original equipment manufacturers (OEMs) and operators to the finish line on EPA compliance. But, they also should be evaluated on their impact to system efficiencies and their viability in terms of meeting DOE energy regulations. CO<sub>2</sub>-based refrigeration

systems are increasing in popularity around the globe. And, in our R-290 performance testing, we've seen more than a 10 percent efficiency improvement. We've released several compressors that utilize these natural alternatives, including:

- Copeland semi-hermetic transcritical CO<sub>2</sub> compressors
- Copeland Scroll compressors for subcritical CO<sub>2</sub> applications
- Copeland hermetic compressors for R-290 to be used in small reach-in systems where the refrigerant charge is less than 150g

### **A2L Refrigerants**

We've also invested in compressor evaluations using A2L (mildly flammable) refrigerants like HFO-1234yf and HFO-1234ze. While A2Ls are not EPA SNAP-approved at this time, we are preparing for their likely introduction into commercial refrigeration applications. As a general rule, we typically make these investments with emerging refrigerants at least 2 to 3 years before compressors could potentially be moved into production.

It's important to note that from a refrigerant perspective, we're not changing our core technology to achieve compatibility. We are continually improving our designs to adapt to new refrigerant alternatives.

### **DOE — Walk-in and Reach-in Compressor Development**

With respect to the DOE's energy reduction requirements on walk-in and reach-in units, we've been pursuing major technology extensions to our compressor platforms.

First, we're expanding our Copeland Scroll line to include smaller displacements and capacities that are more applicable for walk-in (and potentially reach-in) applications — capitalizing on scroll's known efficiency benefits in these smaller displacements. Second, we're evaluating our existing vapor-injected scroll technology, specifically to address the challenging annual walk-in efficiency factor (AWEF) standard for low-temp, walk-in applications.

### **Medium-temperature Walk-ins and Reach-ins**

For medium-temperature, walk-in applications, we're extending the Copeland Scroll ZS\*KAE platform by reducing the horsepower (hp) range down to ¾ hp. At this reduced size, it may also be suitable for large reach-in units.

### **Low-temperature Walk-ins**

Low-temperature, walk-in applications represent the most challenging segment in which to achieve regulatory compliance. The reasons are two-fold: 1) the new class of approved refrigerants has a high

heat of compression, requiring discharge temperature monitoring and control in low-temperature applications, and 2) the AWEF standard for the DOE's requirements is especially a challenge to comply with.

To address these challenges, we're evaluating the use of the enhanced vapor injection capabilities of the Copeland Scroll ZF\*KVE line, a platform that has been successfully deployed in food retail in small, distributed systems.

### **Reach-in System Evaluation**

It's important to note that with the walk-in standard, the performances of condensing unit, unit cooler, panels and doors are able to be self-tested and self-qualified. However, on the reach-in applications, the system efficiency is evaluated as a whole, including: insulation, walls, doors, compressor, fans, etc. If you're an OEM and have begun the process of evaluating and making system changes to qualify with the DOE mandates, now is a good time to check with your Emerson Climate Technologies sales representative to determine how much efficiency can be gained from different compressor options. We can provide guidance on compressor technologies, and even do a complete system evaluation through our Design Services Network to alleviate your engineering load.

## **Expanded Testing Capabilities**

Emerson Climate Technologies has made significant investments to help us better evaluate the performance of new refrigerants and system technologies. We thoroughly test the heat transfer characteristics and thermodynamic properties of each refrigerant to predict system performance based on theoretical models of heat transfer across the evaporator and the condenser.

**Calorimeters** — test the performance of various refrigerants in the compressor at specified conditions. By knowing the application, we can combine our knowledge and test history of that application to run a selection of performance tests. We can then compile those results to predict how that refrigerant will perform across the entire year of running in that application and compare it to today's refrigerant options.

**Life-test stands** — test the reliability and robustness of compressors by simulating very harsh compressor conditions. With up to 2,000 hours of simulation, we have compiled a comprehensive database to predict and evaluate compressor wear.

**System simulations** — designed to evaluate compressor performance inside an entire system in real-time applications (walk-in, reach-in, supermarket rack or ice machine):

- A1, A2L and A3 refrigerants for reach-in and walk-ins
- A1 refrigerants in supermarket module in our Sidney, Ohio, lab
- CO<sub>2</sub> in a transcritical booster supermarket module to be housed at The Helix Innovation Center Emerson is opening later this year in Dayton, Ohio