



CLIMATE SOLUTIONS TREND WATCH

GLOBAL WARMING IS HAPPENING — LET'S FACE IT WITH SUSTAINABLE CLIMATE SOLUTIONS

Sustainable Refrigerants — New Demands on Electrical Components

The global drive for sustainability is real, and it is transforming the HVAC-R (heating, ventilation, air conditioning, and refrigeration) climate solutions industry. From refrigerant regulations to energy efficiency mandates, every aspect of system design is being reimagined to reduce environmental impact.

At the core of this transformation are technologies that:

- ▶ Lower energy consumption
- ▶ Enable cleaner, more efficient operation
- ▶ Support compliance with evolving global standards

Whether it's through smarter motor control, cleaner power, or more sustainable refrigerants, the path to the future runs through innovation — and the components that make it possible.

HOW THE SHIFT TO LOW-GWP REFRIGERANTS IS RESHAPING HVAC SYSTEM DESIGN

Why Refrigerants Are Changing — Fast

As the HVAC industry races to reduce its environmental footprint, refrigerants are under the spotlight. Governments worldwide are phasing out high-GWP (global warming potential) substances in favor of more climate-friendly alternatives. This effort is reshaping the market and the engineering behind it.



THE TRADE-OFF: LOWER EMISSIONS, HIGHER FLAMMABILITY

Low-GWP refrigerants like R-32, R-1234yf, and R-290 are becoming the new standard in air conditioners, heat pumps, chillers and commercial refrigeration equipment. However, many of these alternatives are flammable, classified as A2L (mildly flammable) or A3 (highly flammable). Regulations vary by country and equipment type, but the trend is clear: more sustainable refrigerants are becoming mandatory.

This shift creates a new risk landscape. Electrical components, such as relays and switches, can become ignition sources if not properly protected. The presence of flammable gases in or near control boards demands a new level of design rigor.

HOW REFRIGERANTS STACK UP

CLASSIFICATION	FLAMMABILITY	TYPICAL GWP RANGE	EXAMPLES
A1	No flame propagation	High R-410A ~2088	R-134a R-410A
A2	Lower flammability	Medium to Low R-152a ~124	R-152a
A2L	Mildly flammable <i>Lower burning velocity</i>	Low R-32 ~675 R-454B ~466	R-32 R-454B R-1234yf
A3	Higher flammability	Very Low R-290 ~3	R-290 <i>Propane</i> R-600a <i>Isobutane</i>

Table 1. Refrigerant Classification Table

Engineering for Safety in a Flammable Environment

To mitigate these risks, HVAC manufacturers are adopting several key strategies:

- ▶ **Sealed compartments to isolate electrical components from refrigerant zones**
- ▶ **Potting and encapsulation to prevent gas ingress and arcing**
- ▶ **Use of certified components that meet flammability and hazardous area standards**

For A2L refrigerants, UL certification (UL 60335-2-40) is often required. For A3 refrigerants like propane (R-290), components may need to meet ATEX (ATmosphères EXplosibles: French for "Explosive Atmospheres") or IECEx (International Electrotechnical Commission System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres) standards for hazardous environments.

HOW TE CONNECTIVITY HELPS YOU STAY AHEAD

TE Connectivity (TE) supports this transition with one of the industry's largest assortments of A2L qualified relays (UL 60335-2-40), rigorously tested to meet evolving safety standards. For systems using A3 refrigerants, TE offers relays designed for hazardous areas, helping customers meet both regulatory and performance demands.

Our components are engineered to perform reliably in the presence of flammable refrigerants — supporting innovation while maintaining safety.

LET'S BUILD SAFER, GREENER SYSTEMS TOGETHER

As HVAC systems evolve to meet climate goals, the need for safe, compliant, and sustainable components is more urgent than ever. TE is ready to help you navigate this transition.

Let's talk about how our solutions can support your next-generation HVAC designs.



Sustainability: The Core of Climate Solutions

TE Connectivity is proud to support industrial HVAC needs of today and tomorrow with a broad portfolio of solutions that help our customers build cleaner and more efficient systems. Together we are creating a safer, sustainable, productive and connected future.

Connect with an expert to learn more about TE Connectivity's Climate Solutions.

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