

Navigating the Transition to A2L Low GWP Refrigerants: Ensuring Safety with Certified Components in HVAC/R Equipment

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Introduction

The impending transition to low global warming potential (GWP) refrigerants marks a significant milestone in the HVAC/R industry’s ongoing efforts to mitigate climate change. With regulations set by the U.S. Environmental Protection Agency (EPA) requiring the phase-out of hydrofluorocarbons (HFCs) in new HVAC/R equipment by January 1, 2025, manufacturers and stakeholders face the challenge of adapting to new standards while maintaining safety and performance.

A2L refrigerants have emerged as a promising solution to meet the demand for low-GWP alternatives. Characterized by their reduced environmental impact, A2L refrigerants offer a viable pathway towards sustainability. However, their flammable nature presents unique safety considerations, particularly in HVAC/R systems where electrical switching components, such as definite purpose (DP) contactors and electromechanical relays, pose an ignition risk due to arcing when switching occurs. Other electrical components, such as transformers, may not require any special certifications as they do not pose an ignition risk for the refrigerant.

In this application note, we will explore the upcoming transition to A2L refrigerants, the challenges and opportunities they present, and the importance of ensuring safety through certified definite purpose contactors and electromechanical relays in HVAC/R equipment.

The Transition to A2L Refrigerants

The transition to A2L refrigerants signifies a change in thinking in the HVAC/R industry’s approach to environmental sustainability. Unlike their high-GWP counterparts, A2L refrigerants have significantly lower global warming potential, making them a preferred choice for reducing greenhouse gas emissions.

Driven by regulatory initiatives such as those by the EPA, the transition to A2L refrigerants reflects a broader global effort to phase out HFCs and transition towards more environmentally friendly alternatives. Countries and regions worldwide are implementing similar regulations and standards to address climate change and reduce reliance on high-GWP refrigerants.

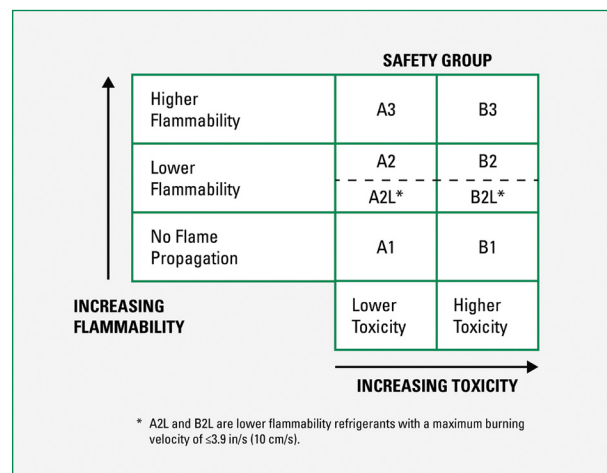


Figure 1: Safety Classifications of Refrigerants

Despite the environmental benefits they offer, A2L refrigerants pose unique challenges due to their flammability characteristics (Figure 1). While classified as mildly flammable, A2L refrigerants require careful handling and consideration to ensure safety in HVAC/R systems where potential sources of ignition are present.

Safety Considerations and HVAC/R Equipment

One of the key concerns surrounding the use of A2L refrigerants in HVAC/R systems is the potential risk of ignition. Electrical components, such as DP contactors and electromechanical relays, are integral to the operation of HVAC/R equipment and can pose a risk of ignition if not designed properly and certified for use with flammable refrigerants.

DP contactors and electromechanical relays play a critical role in controlling the flow of electricity within HVAC/R systems. Their function involves the opening and closing of electrical circuits to regulate the operation of compressors, fans, and other system components. In the presence of A2L refrigerants, DP contactors and electromechanical relays must be designed and tested to ensure they do not pose a risk of ignition or contribute to the propagation of flames during normal operation or in the event of a fault.

Certification Programs for A2L Compliance

To address safety concerns and ensure compliance with A2L refrigerants, organizations have developed certification programs to assess the compatibility and performance of electrical components in HVAC/R systems. UL Solutions, a leading provider of safety certification services, has introduced a specialized program tailored for A2L compliance.

The UL Solutions certification program for A2L compliance establishes rigorous testing and evaluation criteria to assess the safety and performance of DP contactors and other electrical components. Now, HVAC/R equipment manufacturers can more easily achieve safe designs and UL compliance by utilizing the list of certified components that now exists. And for suppliers, having your components included in the specialized certification category means HVAC/R equipment manufacturers will have confidence that the parts have met rigorous testing specifications, and will streamline the certification of their products.

The LZGH2/8 component category was developed for UL 60335-2-40, the Standard for Household and Similar Electrical Appliances – Safety – Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers. Nevertheless, manufacturers can leverage the component category under the adjacent IEC standards as well. Presented as part of a CB report, certificates and test reports of components according to LZGH2/8 enable customers to prove the absence of any ignition source inside the unit according to Clause 22, which enables UL to waive IEC 60335-2-40 ANNEX FF testing.

By achieving certification through programs such as those available from UL Solutions, HVAC/R manufacturers and OEMs can demonstrate compliance with regulatory requirements and provide assurance to customers regarding the safety and reliability of their equipment.

Conclusion

The transition to A2L low GWP refrigerants represents a significant milestone in the HVAC/R industry's journey towards environmental sustainability. While offering promising environmental benefits, the adoption of A2L refrigerants necessitates careful consideration of safety concerns, particularly regarding potential sources of ignition in HVAC/R equipment.

Certification programs, such as those offered by UL Solutions, play a critical role in ensuring the compatibility and safety of electrical components, such as DP contactors and electromechanical relays, in A2L-compliant HVAC/R systems. By adhering to rigorous testing and evaluation criteria, manufacturers

can mitigate risks and provide customers with confidence in the reliability and performance of their equipment.

As the industry continues to transition towards A2L refrigerants, collaboration between regulatory agencies, industry stakeholders, and certification bodies will be essential to facilitate a smooth and successful transition. Through collective efforts and adherence to safety standards, the HVAC/R industry can embrace the benefits of A2L refrigerants while ensuring the safety and reliability of equipment for years to come.

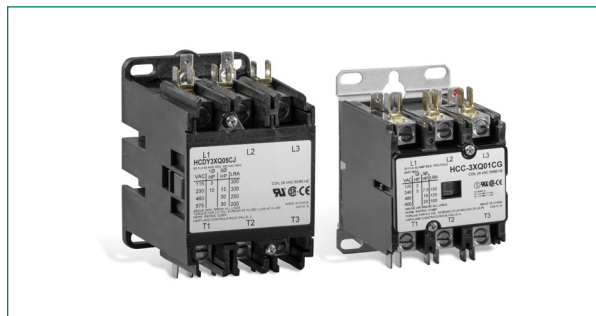


Figure 2: Littelfuse HCC and HCD Series Definite Purpose Contactors

Littelfuse Definite Purpose Contactors

Littelfuse Definite Purpose Contactors (Figure 2) are electromechanical switching devices designed and engineered for switching on and off heating, ventilation, air conditioning, and refrigeration (HVAC/R) applications. They are meant to switch high-current circuits for specialized inductive and resistive loads. These loads include, but are not limited to, compressors, pumps, and electric heating and lighting applications.

Littelfuse definite purpose contactors comply with the A2L refrigerant requirement of UL Category Control Number (CCN) LZGH2/8 for Annex JJ of UL 60335-2-40.

References:

[New Component Category Is the Smart and Simple Pathway to A2L Compliance: UL Solutions, July 2020](#)
[ASHRAE Standard 34: Safety Group Classifications, April 2023, ASHRAE](#)