R32 VRF Transition

Navigating the Refrigerant Shift: What It Means for VRF HVAC

Industry discussions about the A2L refrigerant transition in HVAC systems have intensified since the American Innovation and Manufacturing (AIM) Act was enacted in December 2020 to curtail the production and consumption of hydrofluorocarbons (HFCs). LG, a market leader in HVAC solutions, can help you navigate and take advantage of these changes for both new and existing equipment. In the following brief overview, we'll discuss what you need to know about the refrigerant transition and how it affects Variable Refrigerant Flow (VRF) systems.

Beginning January 1, 2026, updated regulations will require newly manufactured or imported Variable Refrigerant Flow (VRF) systems >65kBtu/h to employ refrigerant with Global Warming Potential (GWP) levels below 700. Separately, the U.S. Environmental Protection Agency (EPA) proposed a new rule that would allow new VRF systems using HFCs with a GWP over 700 to be installed until January 1, 2027, provided all components are manufactured or imported before January 1, 2026.

In alignment with these regulations, LG's next-generation VRF equipment will transition to R-32 instead of R-410A refrigerant. This shift, prompted by the EPA's phasedown of HFC refrigerants, allows LG to enhance its VRF technology across multiple performance parameters.

Naturally, this development has prompted designers and installers to voice their concerns such as cost implications, regulatory compliance, code applications, compatibility challenges, and other related matters. Let's examine why the transition of refrigerant should not be a cause for concern for those who are specifying VRF equipment.

A Quick Refresher: Why R32?

ASHRAE Standard 34 assigns R-32 and several other lower GWP (Global Warming Potential) refrigerants the A2L safety classification, which indicates lower toxicity and lower flammability. With a GWP of 675, R-32 offers reduced emissions compared to R-410A. As a result of evaluating the performance of the refrigerant in the low-pressure scroll compressor, R-32 increased the capacity by 4-8% and efficiency by 0-5% compared to R-410A systems. LG leverages this efficiency and thermal capacity to increase VRF compressor capability and reduce the required charge.

LG's VRF equipment is designed to effectively manage the higher discharge temperature of R-32 compared to R-410A by incorporating variable-speed inverter technology into its compressors. This means that LG can take advantage of the many benefits of R-32.

What's more, R-32 refrigerant offers enhanced performance by reducing indirect and total CO2 equivalent emissions. Compared to R-410A and R-454B, this efficiency leads to a lower Life Cycle Climate Performance (LCCP), underscoring its environmental benefits. This is preferable because R-32 provides greater capacity and efficiency with a smaller refrigerant charge.

Compared to conventional options, LG's VRF equipment preserves space with compact, lightweight units. R-32's thermodynamic properties enable LG to expand the equipment's flexibility and scalability by designing VRF solutions that can deliver capacity in a smaller footprint.

ASHRAE Standard 15 Updates for Safe Use of A2L Refrigerants

In December 2022, ASHRAE Standard 15, Safety Standard for Refrigeration Systems, underwent an update. This update supported the safe application of products using A2L refrigerants and helping mitigate risks to ensure safe application through factors like space size, ventilation, circulation, and release mitigation controls.

The updates to ASHRAE Standard 15 also expand the tools and safety measures available to designers when the calculated room volume is too small relative to the releasable refrigerant charge. Options include the following:

Ventilation

- **Natural ventilation:** Standard 15 includes location guidelines and calculations for sizing natural ventilation openings.
  - » **Connected spaces:** One option is to increase the calculated room volume by adding a permanent opening to an adjacent room. A properly sized permanent opening allows any refrigerant leak to disperse into the adjacent area(s) keeping the concentration lower.
- **Mechanical ventilation:** In this case, mechanical ventilation can be used to move refrigerant out of the space. By sizing to move air out of the bottom of the space to another space, this can help with the dilution.

Release mitigation controls: Introduced in Standard 15, the concept of releasable refrigerant charge refers to "a portion of the system refrigerant charge that can released into a space as a result of a single point of failure." This is compared to the Effective Dispersal Volume Charge (EDVC), which is based on the space's ability to safely disperse the refrigerant. Release mitigation controls like leak detectors paired with shutoff valves can limit the possible releasable charge to the space. Once sensors detect a refrigerant leak, the mitigation controls are triggered by the leak and work to keep refrigerant levels in the space sufficiently low, adding additional security and reassurance. Since mitigation controls limit the releasable charge to a branch of the system, designers may have more flexible design options with R-32 equipment than with previous equipment despite having a lower RCL (Refrigerant Concentration Limit, measured in lb/mcf).

Shafts and Alternative Designs

Although codes are continually evolving, current safety codes requiring fire-rated shafts that penetrate multiple floors are unchanged with lower-GWP refrigerant. However, if piping containing A2L refrigerants is run in a shaft, ventilation will be required for the shaft. Here are some design options for consideration:

- **Smaller systems:** Breaking larger systems up into smaller systems may reduce the system's total refrigerant volume.
- **External piping:** Piping can be run external to the building.
- **Horizontal layout:** Laying out systems in a horizontal orientation with the outdoor units on the floors they serve avoids vertical piping and can provide better heat recovery opportunities.

Charging Ahead

As we embrace the transition to R-32 refrigerant in VRF units, it's important to remember that LG has a successful history using R-32 with VRF products in Europe and has successfully integrated it into North American window air conditioners since 2015. We understand concerns about this shift, but the benefits are clear: improved performance and energy efficiency. This transition represents a positive step toward transforming HVAC designs in the built environment and LG's innovations and support help ensure you are ready to take the lead. Visit LGHVAC.com to learn more and get in touch.

References

1. https://www.epa.gov/climate-hfcs-reduction/frequent-questions-phasedown-hydrofluorocarbons
2. The EPA rule published in December 2023 provides a one-year grace period for installing R-410A split systems smaller than 65,000 BTU/h. Systems imported prior to the January 1, 2025 cutoff may be installed and charged prior to January 1, 2026. A proposed rule published by the EPA on June 26, 2024 suggests a similar approach for R-410A VRF systems greater than 65,000 BTU/h. In this proposal, the EPA would allow systems imported prior to the January 1, 2026 cutoff to be installed and charged prior to January 1, 2027. For details, see Federal Register: "Phasedown of Hydrofluorocarbons: Restrictions on the Use of HFCs Under the AIM Act in Variable Refrigerant Flow Air Conditioning Subsector," https://www.federalregister.gov/documents/2024/06/26/2024-13900/phasedown-of-hydrofluorocarbons-restrictions-on-the-use-of-hfcs-under-the-aim-act-in-variable
3. https://lghvac.com/why-r32/
4. The EPA rule published in December 2023 provides a one-year grace period for installing R-410A split systems smaller than 65,000 BTU/h. Systems imported prior to the January 1, 2025 cutoff may be installed and charged prior to January 1, 2026. A proposed rule published by the EPA on June 26, 2024 suggests a similar approach for R-410A VRF systems greater than 65,000 BTU/h. In this proposal, the EPA would allow systems imported prior to the January 1, 2026 cutoff to be installed and charged prior to January 1, 2027. For details, see Federal Register: "Phasedown of Hydrofluorocarbons: Restrictions on the Use of HFCs Under the AIM Act in Variable Refrigerant Flow Air Conditioning Subsector," https://www.federalregister.gov/documents/2024/06/26/2024-13900/phasedown-of-hydrofluorocarbons-restrictions-on-the-use-of-hfcs-under-the-aim-act-in-variable
5. LG Electronics (2016). Applicability Assessment of Alternative Refrigerant R-454B in Air Conditioning System. Korean Journal of Air-Conditioning and Refrigeration Engineering. Retrieved August 22, 2023.
6. R-32 has lower Life Cycle Climate Performance (LCCP) indicators than R-410A, meaning tests show R-32 has lower direct and indirect emissions from production through disposal. Direct emissions include refrigerant leakage and atmospheric refrigerant degradation while indirect emissions result from energy consumption, manufacturing and recycling. For details on LCCP guidelines, see International Institute for Refrigeration: "Guidelines for Life Cycle Climate Performance," https://iifir.org/en/news/iir-working-group-publishes-guidelines-for-life-cycle-climate-performance
7. ANSI/ASHRAE Standard 15-2022, Safety Standard for Refrigeration Systems
8. Section 713.4 of the 2024 International Building Code (IBC): Shaft enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more, and not less than 1 hour where connecting less than four stories. The number of stories connected by the shaft enclosure shall include any basements but not any mezzanines. Shaft enclosures shall have a fire-resistance rating not less than the floor assembly penetrated but need not exceed 2 hours. Shaft enclosures shall meet the requirements Section 703.2.1.1. https://codes.iccsafe.org/s/IBC2024P1/chapter-7-fire-and-smoke-protection-features/IBC2024P1-Ch07-Sec713.4#:~:text=713.4Fire%2Dresistance%20rating.,basements%20but%20not%20any%20mezzanines.
9. Section 1109.3 of the 2021 Uniform Mechanical Code (UMC): In addition to the requirements of Section 305.5, aluminum, copper and steel tube used for Group A2L and B2L refrigerants and located in concealed locations where tubing is installed in studs, joists, rafters or similar member spaces, and located less than 11/2 inches (38 mm) from the nearest edge of the member, shall be continuously protected by shield plates. Protective steel shield plates having a minimum thickness of 0.0575 inch (1.46 mm) (No. 16 gage) shall cover the area of the tube plus the area extending not less than 2 inches (51 mm) beyond both sides of the tube. https://codes.iccsafe.org/s/IMC2021P1/chapter-11-refrigeration/IMC2021P1-Ch11-Sec1109.3.1.

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