



WHITE PAPER

Driving the Next Generation of Refrigerants



The heating, ventilation, and air conditioning (HVAC) industry is about to go through another refrigerant transition. The world has become more aware of the environmental impacts of refrigerants used in air conditioning, household appliances, and other applications. And that awareness has driven the industry to develop new refrigerants. Over the years, the industry has produced several offerings: chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) like R-22, and now hydrofluorocarbons (HFCs) like current industry standard R-410A. Recent international frameworks have spurred another transition. The market must now consider low global warming potential (GWP) alternative HFCs and hydrofluoroolefin (HFO) blends.

R-32 is one such solution—a single-component, low GWP HFC that is easy to work with. It is globally accepted and is already used in the United States in self-contained room air conditioning. Daikin, Goodman, and Amana brand HVAC systems—along with systems from more than 40 manufacturers worldwide—have selected this refrigerant as the next-generation solution for select residential, light commercial, and applied products. R-32 is a strong choice to address the international, national, state, and jurisdictional changes.

International

Montreal Protocol

The Montreal Protocol has guided the international transition of refrigerants, from CFCs to HCFCs to HFCs, and now, to low-GWP refrigerants.

It was first agreed to in 1987 to address the impact of ozone-depleting substances that created an “ozone hole” over the South Pole. In 2016, the international community updated the Montreal Protocol to address global warming by adopting the Kigali Amendment—named after the Rwandan capital where they met—and outlining a phasedown for the production and consumption of HFCs. The Amendment sets a clear schedule for reducing the amount of HFCs from baseline calculations over the next couple decades. As of July 2020, 100 countries have ratified the Kigali Amendment, although the United States has not.

As the markets in other countries that have ratified the Kigali Amendment have selected R-32 as the refrigerant of choice, that can provide confidence to the North American market to also make the change to R-32. To date, Daikin estimates over 23 million of its R-32 units have been installed, just part of the estimated 100 million units industry-wide across the globe.

Federal Level

American Innovation and Manufacturing (AIM) Act

With the understanding that the United States will likely need to move to a next-generation refrigerant, bipartisan legislation has been introduced in both the Senate and the House of Representatives: the American Innovation and Manufacturing (AIM) Act. This bill seeks to give the U.S. Environmental Protection Agency (EPA) the authority to regulate the transition, mirroring the Kigali Amendment phasedown. The Senate's analysis of the bill anticipates \$38.8 billion in economic benefits annually by 2027.¹

R-32 is a next-generation refrigerant that provides HVAC engineers the tools they need to design systems for low total cost of ownership: the low cost of the refrigerant per pound, coupled with the potential for lower charge size and easy handling for recharging when compared to non-azeotropic blends, can yield impressive savings.

EPA SNAP Program

The EPA's Significant New Alternative Policy (SNAP) Program identifies approved and disallowed refrigerants for various applications. Manufacturers, refrigerant producers, and users can submit a proposed substitute for consideration, and the Program evaluates overall risks to the environment and human health.

SNAP Rules 20 and 21 limited the use of high-GWP HFCs and HFC-containing blends in various applications. The EPA's authority was challenged, and the DC Circuit Court of Appeals held that the Clean Air Act only authorized the EPA to regulate replacements for ozone-depleting substances (ODSs) and could not regulate the general use of HFCs that were not substitutes for ODSs. Part of the AIM Act would address the Court's ruling, codifying that the EPA has the authority to help regulate the transition to low-GWP refrigerants.

SNAP Rule 19, which went into effect in 2015, listed R-32 as acceptable with use conditions for self-contained room air conditioning.² This summer, the EPA proposed its latest rule—SNAP 23—which lists several substances as acceptable or acceptable

¹ <https://www.epw.senate.gov/public/index.cfm/2019/11/carper-and-kennedy-introduce-bill-to-phasedown-use-of-hfcs>

² <https://www.govinfo.gov/content/pkg/FR-2015-04-10/pdf/2015-07895.pdf>

with conditions.³ R-32 has been proposed as acceptable subject to use conditions for residential and light commercial air conditioning and heat pumps.

State Level

States are taking actions to encourage the refrigerant transition. The US Climate Alliance—a bipartisan coalition of 24 states and Puerto Rico—was formed in 2017 to reduce greenhouse gas emissions in line with the goals of the 2015 Paris Agreement, from which the United States is set to withdraw later this year. As such, several of these states have begun addressing HFCs.

California

The state of California has taken a leadership position in drafting HFC phasedown regulations. The California Air Resources Board (CARB) is pursuing regulating based on the GWP level of a refrigerant.⁴ For unitary products, they are considering a 750 GWP limit beginning in 2023. CARB has held several stakeholder events on its draft language and is set to release its notice package this fall before the December Board meeting. Industry has expressed concerns that the COVID-19 pandemic and building code update delays will negatively impact the 2023 deadline.

R-32, with a GWP of 675, falls below the California working document limit. Additionally, with a lower GWP than R-410A and the potential for HVAC systems requiring less charge in certain applications, direct emissions from HVAC systems using R-32 can be up to 80% lower than similar R-410A systems.

Other US Climate Alliance States

While California has pursued regulations based on GWP level, other states are considering the EPA SNAP approach of listing acceptable uses. Washington⁵,

³ <https://www.epa.gov/snap/fact-sheet-proposed-rule-23-protection-stratospheric-ozone-listing-substitutes-under>

⁴ <https://ww2.arb.ca.gov/sites/default/files/2020-07/DRAFT%20CA%20SNAP%20Amendments-Reg%20Text.pdf>

⁵ <https://ecology.wa.gov/DOE/files/5e/5e8c70a6-52f7-4a08-9853-4499f0530be4.pdf>

Colorado⁶, Maryland⁷, Delaware⁸, Vermont⁹, and New York¹⁰ have draft or proposed language. These states are considering adopting SNAP 20 and 21, which would create restrictions for several end uses, including new centrifugal and positive displacement chillers. Currently, only California is considering an HFC phasedown for HVAC products beyond chillers. States are also considering additional requirements, like disclosure and reporting of substitutes and products. Others that have indicated they will begin pursuing similar phasedowns are Massachusetts, Oregon, Hawaii, and Virginia. Industry is working to ensure there is no patchwork of state regulations.

R-32 will help states achieve their greenhouse gas reduction goals. Since it has excellent thermodynamic properties, equipment can be designed with a lower charge and, in turn, smaller motors, smaller diameter piping, and smaller heat exchangers with the same capacity and efficiency as blended refrigerants. These design changes can lead to a smaller footprint. In addition to the energy savings seen from use, the fewer raw materials needed to make the equipment is a strong environmental benefit.

Safety Standards and Building Codes

As the transition occurs, safety standards and building codes must be updated. Many of the next-generation refrigerants are classified as “lower flammability”: in order to break up in the atmosphere and reduce global warming impacts, the bonds must be looser—which means an increased level of flammability compared to some of the common refrigerants today. These refrigerants were put into a new category “2L” (explained below) which falls between the no flame propagation and flammable refrigerant categories. Standards and codes create common practices for application, installation, and repair of equipment, as well as create a legal framework for compliance. Additionally, they provide a technological baseline that advances innovation.

⁶ <https://drive.google.com/drive/folders/1JJJ4Yiy5tpV1I52e-lolZVJoEMm3LR93>

⁷ <https://mde.maryland.gov/programs/Regulations/HB1124/Documents/Air/HFC-NPA-MD-Reg-Issue15-07-17-2020.pdf>

⁸ <http://www.dnrec.delaware.gov/Air/Documents/under-development/de-reg-1151-update-public-workshop-agenda-december-2019-edited.pdf>

⁹ https://dec.vermont.gov/sites/dec/files/aqc/laws-regs/documents/Vermont_HFC_Proposed%20Rule_DRAFT_19May2020_CLEAN.pdf

¹⁰ <https://www.dec.ny.gov/regulations/119032.html>

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) has created the Safe Transition Task Force to accelerate A2L adoption in the United States. Major stakeholders—including equipment, component, and refrigerant manufacturers; other industry associations representing contractors; safety groups; and energy advocates—all have a voice in the task force.

Safety Standards

Safety standards are created by technical committees and address technical issues. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 34 is the refrigerant classification standard, UL 60335-2-40 is the equipment standard, and ASHRAE 15 is the application standard. ASHRAE 34 classifies safety group for refrigerants: they are either A (lower toxicity) or B (higher toxicity), and 1 (no flame propagation), 2L (lower flammability), 2 (flammable), 3 (higher flammability). For example, R-410A is an A1 while R-290 (propane) is an A3. R-32, along with other next-generation solutions, is an A2L. These safety standards have been updated to address A2Ls.

Building Codes

Model building codes, meanwhile, are created by special trade groups and focus on practical aspects, adopting the safety standards. There are several model buildings codes—the International Building Code (IBC), the International Fire Code (IFC), the International Mechanical Code (IMC/UMC)—which operate on three-year update cycles. States and other jurisdictions can then adopt a model code, an updated version, or amend their building codes on their own. Industry has been working to update the model codes as well as the state codes.

R-32: The Right Alternative to R-410A

There are many moving parts driving the transition to next-generation refrigerants: international agreements phasing down the current generation of offerings, federal action deeming acceptable substitutes to use, states promoting greenhouse gas phasedowns, and safety standards and building codes creating the framework to adopt the new offerings. **As the industry goes through this process, Daikin, Goodman, and manufacturers of Amana-brand HVAC products are confident that R-32 is the best choice for the future for an R-410A alternative.**