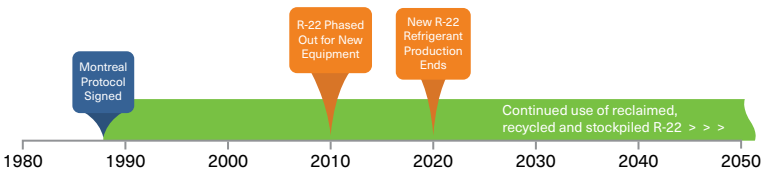
What You Need to Know About R-22

At Trane we understand how important it is for you to make the right decisions regarding installed HVAC systems in commercial, industrial or residential applications. Refrigerant regulations and phase-outs can be complex, which is why Trane is available to help you balance your decision and offer choices without compromising costs, safety, reliability and efficiency.

U.S. Environmental Protection Agency R-22 Phase-out Schedule

- Effective Jan 1, 2020 any remaining production and import of HCFC-22 ends.
- After 2020, the servicing of systems with R-22 will rely on reclaimed or stockpiled quantities. No published end dates.
- R-22 is available for service and will remain in use for years to come.
- Industry estimates hundreds of millions of pounds of R-22 is available for reuse in existing equipment.



Considerations for Transitioning from Systems Using R-22

By keeping these things in mind, you can help keep refrigerant emissions down and reduce the need to purchase additional R-22 for your systems.

- Schedule regular service of equipment that uses R-22 for optimal performance, maximizing efficiency and lowering the risk of refrigerant loss.
- Evaluate the cost of continuing maintenance for equipment that uses R-22 versus upgrading to new or converting equipment per manufacturer's recommendation.
- Some systems that are designed to use R-22 are very specialized, leading to the potential of significant risk in converting certain applications.

How Do You Decide When to Repair Equipment and When to Replace?

- Evaluate impact on occupants' comfort and overall maintenance cost.
- Consider the time and money spent on emergency repairs.
- Estimate the energy savings associated with new, more efficient equipment versus the existing system.
- Consider other customer requirements, such as environmental, budget, or building performance.

Trane Recommendations

- Equipment operates best with the refrigerant for which it was designed and optimized. Trane recommends staying with R-22 until the time is right for equipment replacement. High efficiency is key to reducing cost of ownership.
- When the time is right, consider replacing existing equipment with new Trane technology that brings efficiency and performance benefits to your building.
- Because **exact replacement alternatives do not exist**, Trane® Engineered Conversions® evaluate the hardware, lubrication, refrigerant, and controls to optimize the performance of equipment.
- Trane offers programs to help meet the requirements of Section 608 of the Clean Air Act through its Trane Supply stores. A reclamation program offers customers a cylinder swap or in-store credit, ensuring a sustainable supply of R-22.

Whether maintaining a system that runs on R-22, converting or replacing it with new equipment, make sure you understand the trade-offs of each option.

Trane-Approved Alternatives and Methods

Residential: For single compressor/single speed residential split and package systems, R-438A may be used as a replacement for R-22. A small amount of POE oil must be added to the system. R-407C may also be used as a replacement, but this requires a full replacement of the system oil with POE oil. Refer to Application Bulletin APP-APB011-EN for full details and instructions. Do not mix refrigerants; Do not use an alternative refrigerant to top off a system charged with R-22

Commercial: Taking a balanced approach to identify the best refrigerant for a specific application means considering safety, efficiency, and environmental impacts that will comply with future regulations. For these reasons, R-407C is the preferred refrigerant for use in select Trane Engineered Conversions. Contact your local Trane Commercial office for more information. No other refrigerant conversions are approved.

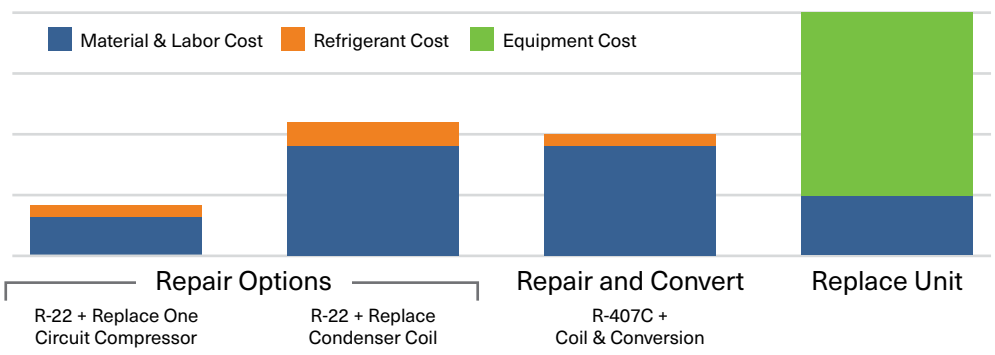
Warranty: Trane warranties do not apply if any refrigerant other than Trane design approved refrigerants are used in the product application.

Properly Recover R-22

Should you choose to convert your system to an approved R-22 alternative, properly recovering refrigerant is required. No intentional refrigerant venting is allowed under EPA regulations; technicians must recover refrigerants removed from HVAC equipment. Trane Commercial technicians follow robust procedures and prepare proper documentation for Engineered Conversions. For contractors, Trane Supply Stores will accept used R-22 refrigerant and send it to be processed for reclaim. Mixed refrigerants cannot be separated for reclaim, but our program can safely destroy them at no charge to you. Depending on the type of refrigerant, you may be eligible for credits and/or incentives. Contact your local Trane Supply Store for program details.

Cost Comparison

Repair, Convert or Replace (Light Commercial Unit)



Efficiency is the key to reducing cost of ownership. Systems designed for R-22 work best with R-22.

Key Terms Defined:

ASHRAE Standard 34 – describes a shorthand way of naming refrigerants and assigns safety classifications based on toxicity and flammability data.

A1 - ASHRAE Safety Group which indicates a lower toxicity, non-flammable refrigerant.

Azeotropes (R-500 series blends) – have components that boil and condense at same temperatures (i.e. have no temperature glide; acts as a single chemical).

Zeotropes (R-400 series blends) – have components that boil and condense at different temperatures (i.e. have some degree of temperature glide). Lower glide is typically preferred for HVAC applications.

Glide (Temperature Glide) – the absolute value of the difference between the starting and ending temperatures of a phase-change process by a refrigerant within a component of a refrigerating system, exclusive of any subcooling or superheating. This term usually describes condensation or evaporation of a zeotrope.

ODP – ozone depletion potential – degree to which a substance can degrade the ozone layer; all measurements relative to a similar mass of CFC-11, which is indexed to 1.0.

GWP – global warming potential – degree to which a greenhouse gas (GHG) traps heat in the atmosphere; all measurements are relative to a similar mass of carbon dioxide (CO_2), which is indexed at 1.0.

HFCs – hydrofluorocarbons (e.g. R-407C) – do not contain chlorine, but have high GWPs given their fluorine content, and are now being phased down globally under the Kigali Amendment to the Montreal Protocol.

HCFCs – hydrochlorofluorocarbons (e.g. R-22) - contain chlorine, but contribute less to ozone depletion and climate change than CFCs due to shorter atmospheric lives. Still in use globally, but have phase-out dates scheduled under the Montreal Protocol.

Counterfeit Refrigerant – an illegal refrigerant which may contain unknown ingredients which could decrease HVAC performance, damage the equipment, or cause a safety issue.

Drop In – an often-misleading term that indicates a replacement refrigerant may be used in existing equipment with no changes to the equipment and no detriment to performance. There are no true drop-in replacements for R-22.

POE (polyolester oil) – a synthetic lubricant used with HFCs and required for all R-22 replacements.

SNAP – Significant New Alternatives Policy – program of the U.S. EPA which evaluates refrigerants and classifies them as acceptable or unacceptable replacements based on their overall risk to human health and the environment.

Summary of Attributes for R-22 Alternatives

ASHRAE #	Trade Name	GWP (AR5)	Capacity Change	Refrigerant Components (% by Weight)									Manufacturer
				R-32	R-125	R-134a	R-143a	R-227ea	R-236fa	R-600	R-600a	R-601a	
R-22	-	1760	Baseline	-	-	-	-	-	-	-	-	-	-
R-407C	KLEA 407C, AC9000	1624	=	23%	25%	52%	-	-	-	-	-	-	Non-proprietary
R-421A	Choice R421A	2385	↓↓	-	58%	42%	-	-	-	-	-	-	RMS of Georgia, LLC
R-422B	ICOR XAC1	2290	↓↓	-	55%	42%	-	-	-	-	3%	-	ICOR International
R-422D	ISCEON MO29	2473	↓	-	65.1%	31.5%	-	-	-	-	3.4%	-	Chemours
R-422E	R-422E	2350	↓↓	-	58%	39.3%	-	-	-	-	2.7%	-	National Refrigerants, Inc.
R-424A	RS-44	2212	↓↓	-	50.5%	47.0%	-	-	-	1%	0.9%	0.6%	ComStar International, Inc.
R-427A	Forane 427A	2024	↓	15%	25%	50%	10%	-	-		-	-	Arkema
R-438A	KDD5, ISCEON MO99	2059	↓	8.5%	45%	44.2%	-	-	-	1.7%	-	0.6%	Chemours
R-453A	RS-44b	1636	↓	20%	20%	53.8%	-	5%	-	0.6%	-	0.6%	ComStar International, Inc.
R-458A	TdX 20	1522	↓↓	20.5%	4%	61.4%	-	13.5%	0.6%	-	-	-	Bluon Energy
-	alltemp®	1300	↓↓↓↓	-	-	100%	-	-	-	-	-	-	Proprietary

IPCC. 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Overview of R-22 Alternatives

R-407C (KLEA 407C or AC9000)
A **non-proprietary** blend that was developed in the early 1990s as the most optimal replacement for R-22. It has the best efficiency and capacity match with the fewest components. The table shows the capacity is comparable to R-22. R-407C was specifically designed with increased capacity to offset the impacts of temperature glide. R-407C is Trane-approved in limited commercial applications, but requires a change to POE oil.

***R-421A** (Choice R-421A); ***R-422B** (ICOR XAC1); ***R-422D** (ISCEON MO29); ***R-422E** (R-422E); ***R-424A** (RS-44)
These **proprietary** R-22 alternatives are all similar and are primarily blends of the same HFCs plus various refrigerant additives to promote mineral oil compatibility. Promoters of these alternatives claim that these additives eliminate the need to change the mineral oil used in the original compressor designed for R-22 to the POE oil required with HFCs. The hydrocarbon additives do allow for partial compatibility over narrow operating conditions, but long-term compressor reliability is at risk without the complete replacement of the mineral oil. These refrigerants are not recommended for use in R-22 equipment. All these refrigerants have much higher GWPs than R-22.

***R-427A** (Forane 427A)
A **proprietary** blend with a composition similar to R-407C. R-143a has been added to promote mineral oil solubility. This refrigerant is not recommended for use in equipment designed for R-22.

R-438A (KDDS or ISCEON MO99)
A **proprietary** blend that includes refrigerant additives. R-438A is Trane-approved in limited residential applications, but does require the addition of POE oil.

***R-453A** (RS-44b)
A **proprietary** blend that includes various refrigerant additives, one of which is R-227ea. Without the additives, it would have a composition very similar to R-407C. R-227ea is a refrigerant used in fire suppression and is not commonly used in air conditioning, so the material compatibility is unknown. Their additives add no value compared to using R-407C directly.

***R-458A** (TdX20 or Bluon)
A **proprietary** blend advertised as a replacement for R-22 and R-404A. It has zero ODP and a GWP that is lower than R-22, which is unusual for most alternatives on the market today. R-458A has a lower capacity compared to other blends which translates into measurable loss of capacity in the system.

***alltemp**
A **proprietary** refrigerant that consists primarily of R-134a. Promoters of this R-22 alternative claim power savings. This perceived efficiency boost results from the significantly reduced capacity compared to the original design for R-22. Because the unit cannot deliver the same capacity, the power draw is reduced.

Considerations When Using R-22 Alternatives

An exact replacement is not available: When making the decision to switch to an alternative refrigerant instead of the one that was designed by the manufacturer, it will require system changes. Significant impacts of failure may include loss of capacity and reliability of components.

Smaller Systems: Oil removal is difficult in residential systems.

- Lubrication is critical to the success of an alternative.
- Small systems do not have oil removal service valves.
- Therefore, refrigerant change is only practical when replacing the compressor.
- A new unit may be more cost effective than replacing the compressor and components.
- Due to increasing minimum energy standards, R-410A equipment is more energy efficient.

Price: Just looking for a lower price point on refrigerant without considering the impact on the environment, equipment performance and reliability or operational costs is not recommended.

Safety – System Tagging: Systems are not always tagged to indicate an alternate refrigerant has been installed, resulting in the following:

- Contaminated refrigerant leading to loss in the reclaim value.
- Equipment operational performance is compromised when service personnel cannot diagnose issues due to pressure variations.
- Equipment's reliability is put at risk.
- Service personnel are at risk when the type of installed refrigerant is unknown (i.e., use of flammable refrigerants).

Topping off: R-22 becomes contaminated when systems are topped off with any R-22 alternative, resulting in the total loss in value of the R-22 as well as cross contaminating recovery equipment. Topping off is never recommended.

*** The use of these alternatives are not endorsed by Trane and their use in Trane equipment will constitute an unapproved repair or alteration that will void all Trane warranties.**

Resources

1. U.S. Department of State. The Montreal Protocol on Substances that Deplete the Ozone Layer. Washington D.C., n.d. https://www.state.gov/e/oes/eqt/chemicalpollution/83007.htm

2. Environmental Protection Agency. Federal Register. 28 October 2014. https://www.federalregister.gov/documents/2014/10/28/2014-25374/protection-of-stratospheric-ozone-adjustments-to-the-allowance-system-for-controlling-hcfc. 3 April 2017

3. R-22 and Halon Critical Use Phase-out. n.d. http://www.epa.ie/air/airenforcement/ozone/r22andhaloncriticalusephase-out/. 3 April 2017

4. R-22 Phasedown https://www.epa.gov/ods-phaseout/commercial-refrigeration-and-air-conditioning-equipment-frequently-asked-questions

5. Ten Questions to Ask before You Purchase an Alternative Refrigerant - https://www.epa.gov/snap/ten-questions-ask-you-purchase-alternative-refrigerant

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