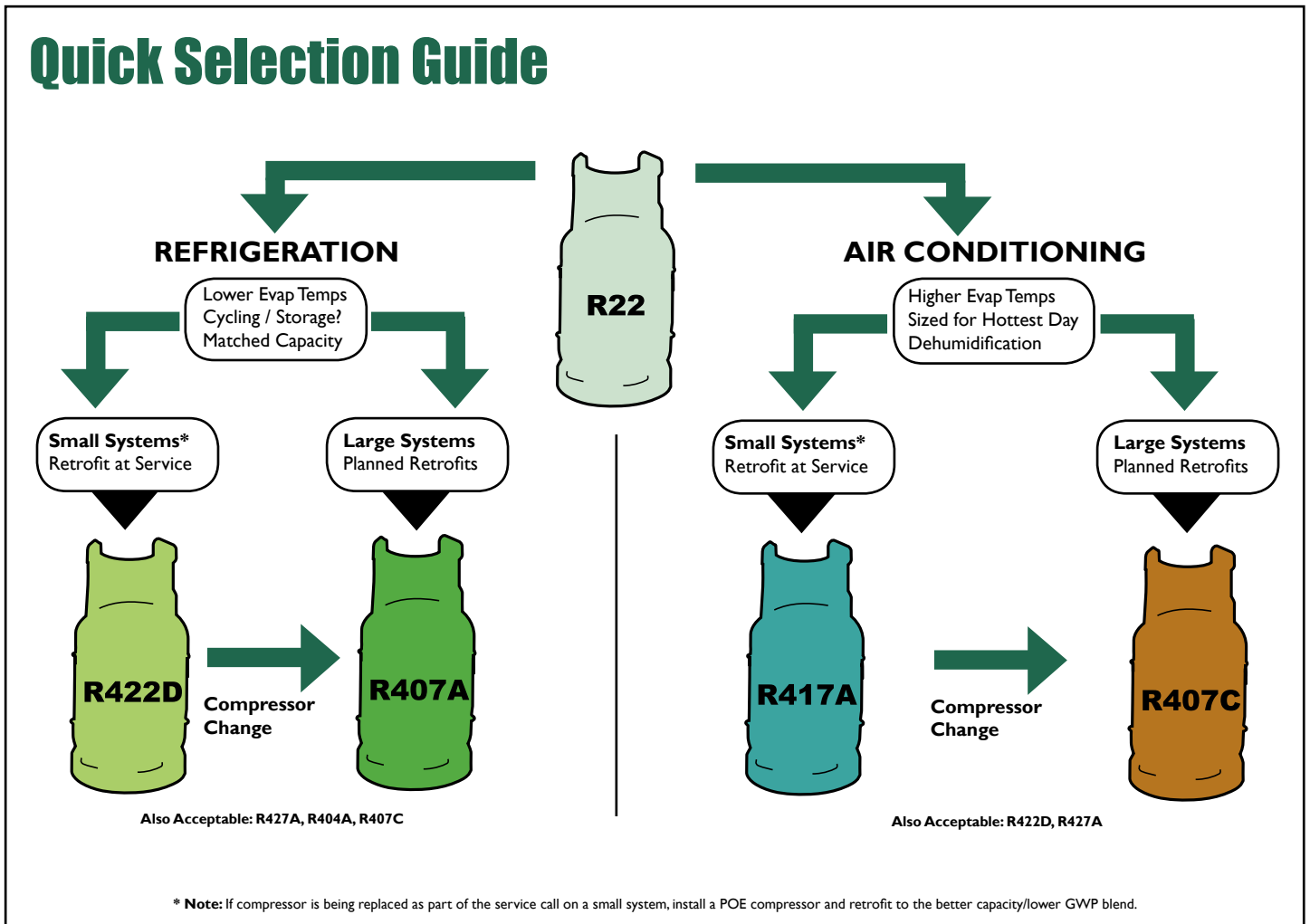


NATIONAL REFRIGERANTS

R22 Alternative Options Guide

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Quick Selection Guide



Recommendations enclosed are based on application, including:

Differences in Air Conditioning and Refrigeration

Equipment Design • Evaporator Temperature

System Size (Small/Large)

Ease of Retrofit • Quantity and Complexity of Components

Product Availability and Characteristics

Environmental Impact • System Performance • Ease of Retrofit

Lubricant Issues

Hydrocarbons not Adequate • Partial POE Retrofits

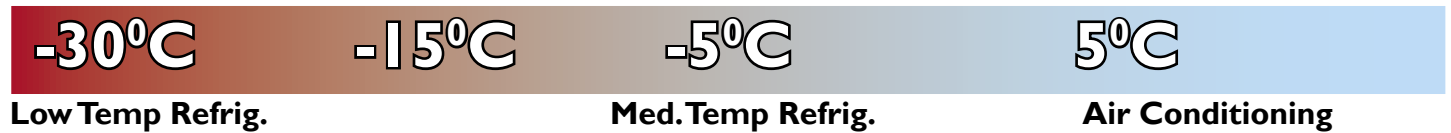
Application Differences:

Which blend is the closest match to R-22?

That depends...

Refrigeration or Air Conditioning?

The biggest difference is evaporator temperature. Some blends will match R-22 properties in AC and others will be better suited for lower temperature operation.



Storage/Cycling or Full-run Cooling?

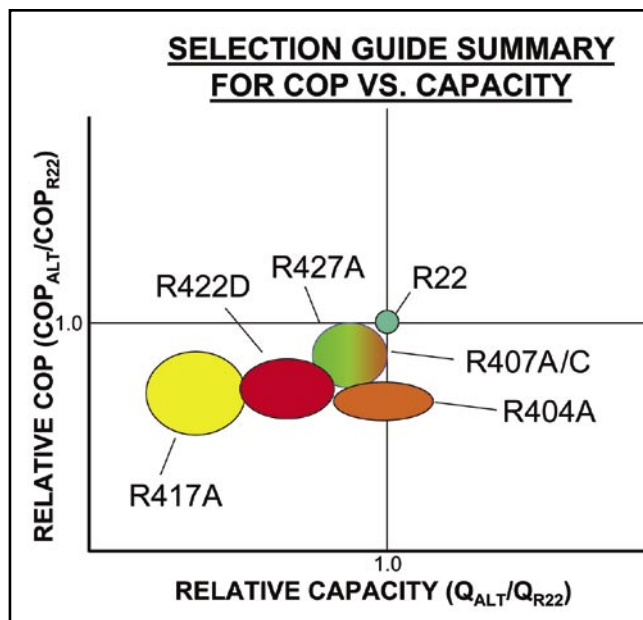
A/C Units are sized for the hottest days of the year, but most of the time they will cycle. “Storage” applications in refrigeration are also sized to run 18 to 20 hours a day. Using a blend with lower capacity will result primarily in slightly longer run times for these systems. Applications where the capacity of the system is matched to the load, or the system seems to be running all the time, will need to use blends that match the capacity of R-22 more closely.

Small or Large?

A “small” system is not necessarily physically small, but it is uncomplicated, self-contained, and probably difficult to change parts or change oil. The refrigerant will not be retrofitted as a special project, but rather replaced during a service call for another problem. Examples are reach-in coolers, ice machines, residential or light commercial air conditioners. Ease of retrofit becomes the most important factor in choosing a retrofit blend.

A “large” system, by contrast, has a lot of components, has easier access for part replacement or an oil change, and generally involves regular or more complicated maintenance. Retrofit projects will be planned ahead of time and involve more work. Examples are supermarket refrigeration, chemical process chillers, or engineered air conditioning systems. For large systems, factors such as performance match to R-22 and environmental issues are more important.

Note: if replacing a compressor during a service call, the system can be recharged with any of the new blends if the new compressor contains POE. Regardless of the size of a system, this is an opportunity to pick the best environmental or performance option since most of the work required to retrofit is already being done for the compressor change.



Summary of Performance

It is difficult to provide an exact table of performance data for retrofit blends compared to R-22. The conditions of test (evaporator and condenser temps, superheat and subcooling values, etc.), type of equipment tested, or computer model parameters used will offer a wide variety of results.

This chart is intended to show relative performance of blends over a range of test conditions. In general, the test results presented to date show that R-407A / C together with R-427A have the closest match to R-22 capacity and efficiency, followed by R-422D and then finally R-417A. R-404A maintains capacity at a cost of valve change.

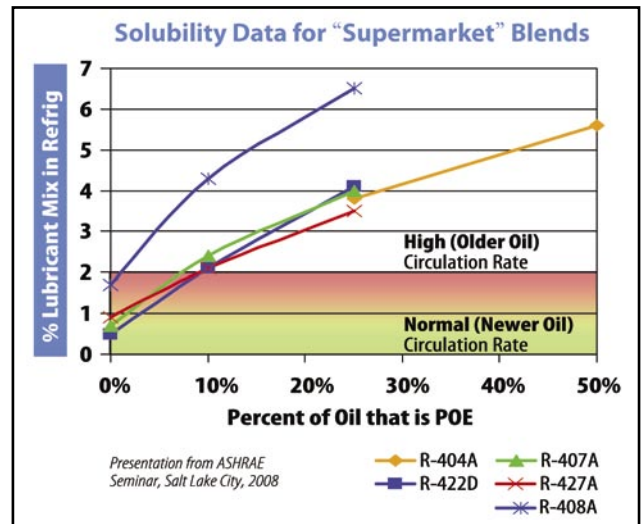
Will the blends work with mineral oil?

HFC Refrigerants with Mineral Oil

- They don't mix so the mineral oil will form a separate layer in the receiver or other high-side liquid hold up.
- Mineral Oil will remain thick on the low side and not be returned back to the compressor.

Hydrocarbons (HC) in Blends

- HC soaks into mineral oil and thins it so it will circulate easily around the system.
- The thinned mineral oil will move easily on the low side.
- The mineral oil/HC mixture will still not mix with liquid HFC on the high side of the system. A layer of oil will still form in the receiver or other liquid hold-up.



Partial POE Retrofit

- Some amount of mineral oil is replaced with POE (does not require 3 flushes or less than 5% mineral oil).
- The POE mixes well with the mineral oil, and the resulting mixture dissolves somewhat into liquid HFC. The oil mixture will be carried by the liquid HFC out of the receiver.
- National Refrigerants testing has shown that as little as 10% POE in mineral oil will circulate as much as an older compressor will pump out into a system.
- These tests have also shown that there is very little difference in oil solubility with all of the blends on the market, regardless of the hydrocarbon content in the blend. Partial POE works with all of the blends, but hydrocarbons do not appear to help with liquid solubility of mineral oil with HFCs.

Other Ease of Retrofit Concerns

TXVs

- Valve selection does not depend entirely on pressure/temperature match (needed to keep the same bulb/charge head), but also on properties that affect flow and pressure drop (viscosity, density). Some blends match R22 well, others may require a larger valve orifice.

Liquid Lines

- Flow properties will also affect pressure drop, particularly in liquid lines. Some blends may require replacement of lines that are sized too small, or the blends may experience performance problems (loss of capacity) if the lines are left in place.

Pressure Controls

- Some blends will show higher head pressure, even though the suction side pressures are the same. This can affect pressure control settings for some systems.

Glide/Fractionation

- All of the retrofit blends have some degree of temperature glide. System operation can be affected (superheat settings, other controls) and fractionation must be considered for systems that may leak while not running for long periods (air conditioners).

Product Selection Guide:

		R-407A	R-407C	R-422D	R-427A	R-417A	R-404A
Refrigeration	Small	0 / +	0	+	0	-	0
	Large	+	0	0	0	-	0
Air Conditioning	Small	-	0 / +	0	0	+	-
	Large	-	+	0	0	0	-
Performance		+	+	0	+	0	+
Environmental		+	+	0	+	0	-
Ease of Retrofit		A	A	B	A	B	C
GWP (Co2 Equivalent)		2110	1770	2730	2140	2350	3920
Temperature Glide (F)		8	10	5	13	5	1.5

- + Preferred.
- Acceptable.
- Not recommended.
- A. Partial POE replacement of mineral oil; no component changes.
- B. Possible POE addition/replacement; possible component changes.
- C. Partial POE replacement of mineral oil; component changes



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