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DAIKIN R-407C Retrofit Information

Introduction

HCFC-22 has been used as a refrigerant in Refrigeration, Air Conditioning and commercial HVAC systems for many years. Under the Montreal Protocol the use of HCFC's, including HCFC-22, is scheduled for phase out. Daikin supports international efforts to reduce the environmental impact of refrigerants such as the commitments and further discussions under the Montreal Protocol and other international climate negotiations.

Systems designed for use with HCFC-22 will require an alternative refrigerant to perform well into the future as HCFC's become no longer available. Daikin America is proud to provide R-407C as a replacement for HCFC-22 in residential, positive displacement air conditioner and heat pump applications. Not suitable for flooded evaporators or refrigeration applications.

Compared to all other HCFC-22 substitutes R-407C provides the closest match in pressure, cooling capacity and efficiency. Substitutes such as R-438A, R-427A and R-422D can have up to a 18% capacity reduction and a 7% performance reduction as compared to HCFC-22.*

Ensuring that the retrofitted systems perform well, and for many years requires following original equipment and compressor manufacturer guidelines, as well as the guidelines provided here by Daikin America.

*Cycle Analysis at 105°F Ambient; 25°F Evaporating; 10°F Superheat and Subcooling.

Property	R-407C	HCFC-22
Ozone Depletion Potential (ODP)	0	0.05
Global Warming Potential (GWP) [1]	1624	1760
Boiling Point at 1atm [2]	-46.5°F (-43.6°C)	-41.5°F (-40.8°C)
Vapor Pressure Saturated at 77°F (25°C) [2]	157.8 psig	136.7 psig
Molecular Weight	86.2	86.5
ASHRAE 34 Classification	A1	A1

[1] IPCC Fifth Assessment Report [2] Refprop 9.1

When to Retrofit?

There is no perfect set of requirements for a retrofit. The steps involved in properly retrofitting with R-407C, outlined further, require an investment of time, diligence and components.

For newer installed HCFC-22 equipment recovering from a refrigerant leak, an R-407C retrofit would provide excellent performance and the security of knowing refrigerant will be available many years into the future.

For HVAC systems towards the end of their life cycle, the lowest cost option could be replacement of the condenser, evaporator and line sets with proven and reliable Goodman components.

In certain cases, a replacement of the compressor, containing the appropriate Polyol Ester Oil (POE), in addition to the R-407C could be the best cost alternative.

It is up to the qualified service technician, and the requirements of the customer to identify the right option going forward.

Quick Tips and Safety

Always follow requirements under EPA regulations Section 608 of the Clean Air Act EPA 608 requirements.

Follow best industry safety practices; lock out/tag out when working on equipment. Never perform brazing or cutting on pressurized refrigerant circuits.

Never leak test a system with air, oxygen, or a mixture of air and oxygen with refrigerants

Never "Top-Off" a system with a different refrigerant. Mixing refrigerants can lead to system failure. If unknown refrigerant is present in the system the full charge needs to be recovered, or a sample taken for test before proceeding.

Never mix refrigerants in the recovery cylinder.

Guidelines

This retrofit guideline applies to Residential Heat Pumps and Air Conditioners. Refer to original equipment or compressor manufacturer retrofit guidelines if available.

1. Retrofit with R-407C will require the following hardware: New Filter Drier, New Elastomeric seals such as o-rings for the schrader seals, solenoid valves and caps, and Polyol Ester Lubricant. In case of hermetic or semi-hermetic compressors, check if the wire coating is compatible with POE oils and R407C.

2. Prior to making any changes, compare current system operating data with normal operating data. Record Temperature and Pressure at the evaporator, compressor suction, compressor discharge, expansion device and at the condenser. These values will be necessary when adjusting for the performance of R-407C.

3. Fully recover HCFC-22 from the equipment.

   If the refrigerant charge amount is not listed on the equipment, record the weight of the recovered refrigerant.

4. Lubricant Identification and Replacement

   a. If the system is currently charged with Mineral Oil (MO) or Alkyl Benzene (AB) it will need to be replaced with Polyol Ester Lubricant (POE). Check with the compressor manufacturer for the recommended viscosity and type of POE oil.

   b. Compressors without an oil drain need to be removed, and the lubricant can be drained via the suction line.

   c. Larger systems might require lubricant drainage from the low point of the evaporator

   d. If an oil separator is present, lubricant entrained in it should be removed as well.

   e. Measure the amount of lubricant removed to make sure 95% or more of the original lubricant has been removed.

   f. If the amount of lubricant recovered is not sufficient, the compressor should be filled with POE lubricant and drained up to three times to make sure the least amount of residual MO or AB in the system.

5. Replace the Filter/Drier with one qualified for use with R-407C

6. Proceed to reconnect the system and leak check per normal service practices.

7. Charge the system with R-407C

   a. It is best practice to remove the refrigerant from the cylinder and charge the system as a liquid.

   b. The system will require 90-95% by weight as compared to original HCFC-22 Charge.

   c. Charge optimization should be done per standard industry practice, and depends on the size of the system components and the lengths of the tubing runs: Charge the system to 85% of the total desired R-407C weight. First, with the compressor not running, charge to the high pressure side. As the pressure in the system equilibrates with the pressure in the cylinder, the remainder of the refrigerant can be charged to the suction side of the system while the compressor is running. Liquid should never be allowed to enter the suction side.

   d. Start the system and adjust the charge. After the system stabilizes add refrigerant charge as necessary to adjust for the discharge pressure/temperature. It may be necessary to adjust the expansion valve to avoid refrigerant slugging. Note: refer to the pressure/temperature chart as R-407C will have a lower discharge temperature and higher pressure with respect to HCFC-22

8. For future service, label the system and the components to identify the refrigerant charge amount, oil type and charge and refrigerant type.

Pressure Temperature Chart*

*Calculated with Refprop 9.1

Temperature		Pressure		
		HCFC-22	R-407C	
			Vapor	Liquid
°F	°C	PSIG	PSIG	PSIG
-40	-40.0	0.6	-2.3	2.7
-35	-37.2	2.6	-0.4	5.1
-30	-34.4	4.9	1.6	7.7
-25	-31.7	7.4	3.9	10.6
-20	-28.9	10.2	6.5	13.7
-15	-26.1	13.2	9.3	17.2
-10	-23.3	16.5	12.3	20.9
-5	-20.6	20.1	15.7	25.0
0	-17.8	24.0	19.4	29.5
5	-15.0	28.3	23.5	34.3
10	-12.2	32.8	27.9	39.5
15	-9.4	37.8	32.7	45.2
20	-6.7	43.1	37.9	51.2
25	-3.9	48.8	43.5	57.7
30	-1.1	55.0	49.6	64.7
35	1.7	61.5	56.1	72.2
40	4.4	68.6	63.2	80.2
45	7.2	76.1	70.7	88.8
50	10.0	84.1	78.8	97.9
55	12.8	92.6	87.5	107.6
60	15.6	101.6	96.8	117.9
65	18.3	111.2	106.7	128.9
70	21.1	121.4	117.3	140.5
75	23.9	132.2	128.5	152.8
80	26.7	143.6	140.5	165.8
85	29.4	155.7	153.2	179.6
90	32.2	168.4	166.7	194.1
95	35.0	181.8	181.0	209.4
100	37.8	195.9	196.1	225.5
105	40.6	210.8	212.1	242.4
110	43.3	226.4	229.0	260.3
115	46.1	242.8	246.9	279.0
120	48.9	260.0	265.8	298.6
125	51.7	278.0	285.7	319.2
130	54.4	296.9	306.6	340.7
135	57.2	316.7	328.8	363.3
140	60.0	337.4	352.1	387.0