

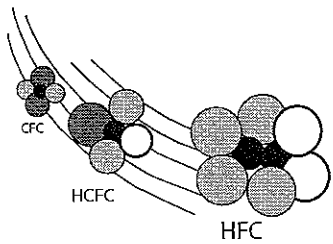
***Copeland***<sup>®</sup>

# Refrigerant Changeover Guidelines R-22 to R-407C

Leading the Industry with Environmentally  
Responsible Refrigerant Solutions



**EMERSON**<sup>™</sup>  
Climate Technologies



Copeland does not advocate the wholesale changeover of HCFC refrigerants to HFCs. If a system is not leaking refrigerant

to the atmosphere, and is operating properly, there is no technical reason to replace the HCFC refrigerant. In fact, changing the refrigerant may void the U.L. listing of the unit. However, once the decision has been made to make the change from R-22 to HFC R-407C, the following guidelines are recommended.

## CONSIDERATIONS

1. Retrofitting systems that employ compressors manufactured prior to 1973 is not recommended. This is due to the different materials used in motor insulation that have not been evaluated for compatibility with the new refrigerants and lubricants. Failure to heed this advice will violate the U.L. Standard For Field Conversion/Retrofit Of Alternate Refrigerants In Refrigeration And Air Conditioning Equipment (U.L. 2170).
2. Copeland's only approved lubricants for use with R-407C are Polyol ester lubricants. For a complete list of Copeland approved lubricants, refer to Form 93-11.
3. Compressor capacity will be comparable to R-22 in medium temperature applications.
4. R-407C should be used only in systems that currently use R-22. It should not be mixed with R-22 or any other refrigerant.
5. The capacity of the existing R-22 thermal expansion valve (TEV) will be approximately the same when using R-407C. However, the superheat setting must be checked and may have to be readjusted after the system is put back into operation. Consult with the TEV manufacturer for correct sizing and superheat settings.
6. Filter-driers must be changed at the time of conversion. This is proper air conditioning, refrigeration practice.
  - a. Solid core driers such as Emerson Climate

Technologies ADK are compatible with either R-22 or R-407C.

- b. Compacted bead type driers can use XH6 or XH9 molecular sieve material such as found in the Emerson Climate Technologies EK or EKH series.

- c. If a loose fill type drier is to be used, XH9 molecular sieve is required.

7. Because of glide, pressure regulators such as EPR valves may have to be reset. Contact the EPR manufacturer for the correct settings. Systems with receivers may experience some fractionation of the refrigerant in the receiver and have somewhat lower capacity.

8. R-407C exhibits higher pressures than R-22 at normal condensing temperatures. This may require adjusting the high pressure safety controls to operate as intended.

9. Systems that use a low pressure controller to maintain space temperature may need to have the cut in and cut out points changed. With R-407C, the pressure settings must reflect an average temperature of the refrigerant in the evaporator. Because of refrigerant glide, the refrigerant entering the evaporator for a specific suction pressure is approximately 10°F colder than the refrigerant vapor at the outlet of the evaporator (not considering superheat). Therefore, the average refrigerant temperature will be at a midpoint pressure/temperature equivalent.

Example: A 70°F air conditioned space usually requires that the refrigerant temperature in the evaporator be approximately 45°F. Using R-407C, the liquid entering the evaporator may be as cold as 40°F and the vapor temperature before superheat may be 50°F. Some pocket Pressure-Temperature charts give a midpoint evaporator temperature versus pressure. This may be used for the initial setting of the pressure activated room temperature controller. If the midpoint data is not available, subtract five degrees from the desired average evaporator temperature, (in this case 45°F - 5°F = 40°F) and set the initial pressure setting for the corresponding bubble point (liquid) pressure shown on the P/T chart (in this case 40°F = 79 psig).

**WARNING:** Use only Copeland approved refrigerants and lubricants in the manner prescribed by Copeland. In some circumstances, other refrigerants and lubricants may be dangerous and could cause fires, explosions or electrical shorting. Contact Copeland Corp., Sidney, Ohio for more information.

10. Due to refrigerant glide, it is important that when measuring and/or adjusting TEV superheat, the pressure and SATURATED VAPOR (Dew Point) TABLES be used. Example: The pressure measured at the TEV bulb is 79 psig. The Pressure/Temperature (P/T) chart shows that the saturated vapor temperature, at the dew point, of R-407C for 79 psig is = 51°F. If the actual refrigerant temperature is 60°F the superheat is 9°F.

To measure sub-cooling at the condenser outlet or at the TEV inlet to verify that a solid column of liquid is present, measure the pressure and the temperature at the location that the sub-cooling information is needed. Compare it to the SATURATED LIQUID (Bubble Point) TABLES. Example: A pressure of 250 psig is measured at the condenser outlet. From the R-407C chart, 250 psig is = 108°F saturated liquid temperature. If the actual refrigerant temperature is 98°F, the liquid is sub-cooled 10°F.

11. Systems using R-407C may have a higher system pressure drop than with R-22. Check with the manufacturer of any pressure regulators and pilot operated solenoid valves used in the system to be sure that they will operate properly.

12. Mineral oil lubricant, such as 3GS, cannot be used as the compressor lubricant. Copeland recommends the following lubricant choices: Polyol Ester (POE).

Before starting the changeover, it is suggested that at least the following items be ready:

- a. Safety glasses
- b. Gloves
- c. Refrigerant service gauges
- d. Electronic thermometer
- e. Vacuum pump capable of pulling 250 microns
- f). Thermocouple micron gauge
- g. Leak detector
- h. Refrigerant recovery unit including refrigerant cylinder
- i. Proper container for removed lubricant
- j. New liquid control device
- k. Replacement liquid line filter-driers(s)
- l. New (POE) lubricant Copeland approved Ultra 22CC or Mobil EAL Arctic 22CC or ICI Emkarate RL32CF

m. R-407C pressure temperature chart

n. R-407C refrigerant

## CHANGEOVER PROCEDURE

**NOTE: 1. R-407C is not compatible with the seal material used in the R-22 Moduload Unloading System. If your system has Moduload, the valve plate assembly MUST be changed.**

Consult your Copeland Wholesaler for the proper part numbers.

1. The system should be thoroughly leak tested with the R-22 still in the system. All leaks should be repaired before the R-407C refrigerant is added.

2. It is advisable that the system operating conditions be recorded with the R-22 still in the system. This will provide the base data for comparison when the system is put back into operation with the R-407C.

3. The system should be electrically shut off and the refrigerant properly removed from the system. Measure the quantity of refrigerant removed. This will provide a guide for recharging the system with R-407C (see item 9 this section).

4. The mineral oil must be removed from the compressor crankcase. Hermetic compressors will have to be removed from the piping and the lubricant drained out through the suction stub. It is advisable to do an acid test on the lubricant removed.

5. Measure the amount of lubricant removed. It should be within 4 to 6 ounces of the compressor's factory oil charge. The lubricant charge is indicated on the name plate of the compressors. If the lubricant charge is unknown, an authorized Copeland wholesaler can provide the technician with the information.

The use of a refractometer Copeland (P/N 998-RMET-00) is highly recommended to determine that the amount of mineral oil left in the system.

Those systems that have oil separators, oil reservoirs, oil floats and suction line accumulators must have the oil drained from them. If the liquid control device is going to be replaced, it is advisable that the suction line, liquid line, and evaporator coil be blown clean using properly regulated dry nitrogen.

**Note: Properly dispose of the lubricant.**

6. Before the new lubricant is installed into the compressor, be sure all leaks are repaired, and any system

components are changed if necessary. Install the correct liquid line filter-drier. Driers must be compatible with the refrigerant and lubricant.

7. POEs are very hygroscopic. They will very quickly absorb moisture from the air once the container is opened. Once the lubricant is added to the compressor, the compressor should be quickly installed. Like an open container, an open compressor with POE will absorb moisture. Add the correct amount of lubricant to the compressor. On systems using enhanced surfaces in the heat exchanger, excessive mineral oil can adversely effect the heat transfer due to logging. Therefore, it is desirable to have no more than one percent mineral oil in systems employing these types surfaces.

8. Once the compressor is installed and the system is closed, the system must be evacuated to 250 microns or lower.

9. REFRIGERANT CHARGING WITH "ZEOTROPES". R-407C is a zeotropic mixture. It is important that during initial charging or "topping" off a system that the refrigerant be removed from the charging cylinder in the liquid phase. Many of the cylinders for the newer refrigerants use a dip tube so that in the upright position liquid is drawn from the cylinder. DO NOT vapor charge out of a cylinder unless the entire cylinder is to be charged into the system. Refer to charging instructions provided by the refrigerant manufacturer.

With the system in a 250 micron or lower vacuum, liquid can be charged into the system "high side." The initial charge should be approximately 80 percent of the amount of refrigerant removed from the system.

10. Start the system and observe its operation. Additional refrigerant may have to be added to obtain optimum performance. Note: On systems with long liquid lines, the sight glass should be installed near the expansion valve to avoid erroneous flash gas indication caused by pressure drop or ambient temperature.

When adding refrigerant to an operating system, it may be necessary to add the refrigerant through the compressor suction service valve. Because the refrigerant leaving the refrigerant cylinder must be in liquid phase, care must be exercised to avoid damage to the compressor. It is suggested that a sight glass be connected between the charging hose and the compressor suction service valve. This will permit you to adjust the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

11. Operate the system and record the operating conditions. Compare this data to the data taken in item 2 this section. Check and adjust the TEV superheat setting if necessary. Make adjustments to other controls as needed.

12. Properly label the components, Tag the compressor with the refrigerant used (R-407C) and the lubricant used. The proper color code for R-407C is Burgundy PMS (Paint Matching System) 471.

13. Clean up and properly dispose of the removed lubricant. Check local and state laws regarding the disposal of refrigerant lubricants. Recycle or reclaim the removed refrigerant.

**CAUTION: These guidelines are intended for use with R-407C only, not for refrigerants which are similar to R-407C. Other refrigerants may not be compatible with the materials used in our compressors or the lubricants recommended in this bulletin resulting in unacceptable reliability and durability of the compressor.**

*The information contained herein is based on technical data and tests which we believe to be reliable and is intended for use by persons having technical skill, at their own discretion and risk. Since conditions of use are beyond Copeland's control, we can assume no liability for results obtained or damages incurred through the application of the data presented.*

**R407C SATURATED VAPOR/LIQUID  
TEMPERATURE/PRESSURE CHART**

<b>PRESSURE (PSIG)</b>	<b>LIQUID TEMP (°F)</b>	<b>VAPOR TEMP (°F)</b>	<b>PRESSURE (PSIG)</b>	<b>LIQUID TEMP (°F)</b>	<b>VAPOR TEMP (°F)</b>
20	-10.7	1.5	150	74.8	84.9
22	-8.2	4.0	155	76.8	86.8
24	-5.7	6.4	160	78.7	88.7
26	-3.4	8.7	165	80.6	90.5
28	-1.1	11.0	170	82.5	92.3
30	1.1	13.1	175	84.3	94.0
32	3.2	15.2	180	86.1	95.8
34	5.3	17.2	185	87.8	97.5
36	7.3	19.2	190	89.6	99.1
38	9.2	21.0	195	91.3	100.7
40	11.1	22.9	200	92.9	102.3
42	12.9	24.7	205	94.6	103.9
44	14.7	26.4	210	96.2	105.4
46	16.4	28.1	215	97.7	107.0
48	18.1	29.7	220	99.3	108.4
50	19.7	31.3	225	100.8	109.9
52	21.3	32.9	230	102.3	111.4
54	22.9	34.4	235	103.8	112.8
56	24.4	35.9	240	105.3	114.2
58	25.9	37.4	245	106.7	115.6
60	27.4	38.8	250	108.2	116.9
62	28.8	40.2	255	109.6	118.2
64	30.2	41.6	260	111.0	119.6
66	31.6	43.0	265	112.3	120.9
68	33.0	44.3	270	113.7	122.1
70	34.3	45.6	275	115.0	123.4
72	35.6	46.9	280	116.3	124.7
74	36.9	48.1	285	117.6	125.9
76	38.2	49.3	290	118.9	127.1
78	39.4	50.6	295	120.2	128.3
80	40.6	51.8	300	121.4	129.5
82	41.9	52.9	305	122.7	130.7
84	43.0	54.1	310	123.9	131.8
86	44.2	55.2	315	125.1	133.0
88	45.4	56.3	320	126.3	134.1
90	46.5	57.4	325	127.5	135.2
92	47.6	58.5	330	128.7	136.3
94	48.7	59.6	335	129.8	137.4
96	49.8	60.7	340	131.0	138.5
98	50.9	61.7	345	132.1	139.6
100	51.9	62.7	350	133.2	140.6
105	54.5	65.2	355	134.3	141.7
110	57.0	67.7	360	135.4	142.7
115	59.5	70.0	365	136.5	143.7
120	61.8	72.3	370	137.6	144.7
125	64.1	74.6	375	138.7	145.7
130	66.4	76.7	380	139.8	146.7
135	68.5	78.8	385	140.8	147.7
140	70.7	80.9	390	141.8	148.7
145	72.8	82.9	395	142.9	149.6

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