

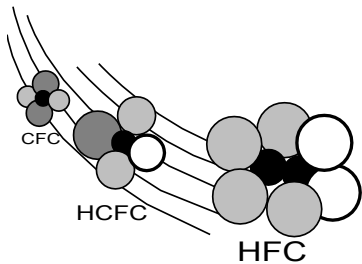
Refrigerant Changeover Guidelines

HCFC R-22 to HFC R-404A/R-507

Leading the Industry with Environmentally
Responsible Refrigerant Solutions

COPELAND[™]


EMERSON[™]



Emerson does not advocate the wholesale changeover of HCFCs 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 system. However, once the decision has been made to make the change from HCFC R-22 to HFC R-404A or R-507, 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.2170-2172). Emerson does not recommend retrofitting Copeland Discus™ compressors prior to the release of the Delta Reed design of the suction valve. For the 3D models, the design change took place in 1999 and for the 4D and 6D model compressors, in 2003. The combination of HFC refrigerants and POE oil may cause increased wear in the older Floating Reed design.

2. An Emerson approved Polyol Ester (POE) lubricant should be used with R-404A/R-507. For a complete list of all lubricants approved by Emerson refer to Form 93-11.

These lubricants are available from all Authorized Copeland™ Wholesalers. The use of other POE lubricants may void the compressor warranty. Because mineral oils are not miscible with R-404A/R-507, they may log in the evaporator resulting in system capacity loss. It is for this reason that the flushing process must be done with the R-22 in the system. Emerson recommends flushing to a maximum of no more than 5% residual mineral oil in the system for effective system performance. System design plays a significant role in oil return and logging. In some systems, it may be possible to achieve adequate system performance even with residual mineral oil up to 10%. As long as system performance is not compromised, residual mineral oil in the range of 5 to 10% is acceptable.

3. Compressor capacity will be comparable to R-22 in medium temperature applications. However, there

can be a significant increase in compressor capacity for low temperature applications. This could result in the condenser being undersized.

4. R-404A/R-507 can be used in either low or medium temperature systems. **R-404A/R-507 should not be mixed with any other refrigerant!**
5. The expansion valves will probably need to be changed. New power heads and larger orifices will likely be required. The valve manufacturers should be consulted for the exact details.
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 ADK are compatible with either R-22 or R-404A/R-507.
 - b. Compacted bead type driers that use XH6 or XH9 molecular sieve material such as found in the Emerson EK or EKH series are also compatible.
 - c. If a loose fill type drier is to be used, XH9 molecular sieve material is required.
7. Pressure regulators such as EPR valves may have to be reset. Contact the EPR manufacturer for the correct settings.
8. R-404A/R-507 exhibits higher pressures than R-22 at normal condensing temperatures. This may require that the high pressure safety controls be reset in order to operate as intended.
9. The higher pressure characteristics exhibited by R-404A/R-507 will in some cases exceed the industry accepted safety factors on the compressor crankcase (low side). This will require the addition of a pressure relief valve on the compressor crankcase, set at a maximum of 375 psig to adequately protect the compressor from the possibility of excessive pressure. Pressure relief valves can be purchased from your Authorized Copeland Wholesaler as part number 998-0051-02. Copeland™ semi-hermetic compressors that require this additional valve are:
 - * Copeland Discus 3D, 4D, 9D and MD
 - * All Other Semi-Hermetic (Non-Discus™ Models)

WARNING: IT IS POSSIBLE THAT EXCESS PRESSURE BUILD-UP ON MODELS INDICATED COULD RESULT IN THE COMPRESSOR BURSTING UNLESS THE PRESSURE RELIEF VALVE SPECIFIED HAS BEEN PROPERLY INSTALLED ON THE ORIGINALLY BUILT COPELAND™ COMPRESSOR.
10. Systems that use a low pressure controller to maintain space temperature may need to have the cut in and cut out points changed. Although R-404A/R-507 does exhibit "glide", the average evaporator or condenser

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

temperature is within 0.5°F of the saturated vapor temperature; therefore no correction is required.

11. Systems using R-404A/R-507 should have approximately the same system pressure drop as 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.

NOTE:

1. **R-404A/R-507 is not compatible with the seal material used in the R-22 Moduload Unloading System of 3D Compressors. If your system has Moduload, the valve plate assembly MUST be changed.**
2. **For low temperature ZF Scroll compressors, the liquid injection requirements are different and the proper cap tube or DTC valve must be used.**

Consult your Authorized Copeland™ Wholesaler for the proper part numbers.

Many other system seals and gaskets may be affected by the change over from R-22 to R-404A/R-507. The part manufacturer should be contacted for their recommendations as to whether the seals need to be changed or replaced.

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

1. Safety glasses
2. Gloves
3. Refrigerant service gauges
4. Electronic thermometer
5. Vacuum pump capable of pulling 250 microns
6. Thermocouple micron gauge
7. Leak detector
8. Refrigerant recovery unit including refrigerant cylinder
9. Proper container for removed lubricant
10. New liquid control device
11. Replacement liquid line filter-drier(s)
12. New POE lubricant
13. R-404A/R-507 pressure temperature chart
14. R-404A/R-507 refrigerant

CHANGEOVER PROCEDURE

1. The system should be thoroughly leak tested with the R-22 refrigerant still in the system. All leaks should be repaired before the R-404A/R-507 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-404A/R-507.

3. It is necessary to thoroughly remove the existing mineral oil lubricant from the system before the refrigerant is changed. No more than 10% residual mineral oil may be left in the system when it is recharged with R-404A/R-507 for proper compressor operation. No more than 1 to 2% residual mineral oil may be required to assure no loss of heat transfer if enhanced tube heat exchangers are used in the system.

I. Systems with service valves

- a. Disconnect electrical power to system.
- b. Front seat the service valves to isolate the compressor.
- c. Properly remove the R-22 from the compressor.
- d. Remove the mineral oil lubricant from the compressor. Hermetic compressors will have to be removed from the system and tipped up to drain the lubricant out through the suction/process fitting.
- e. Those systems that have oil separators, oil reservoirs, oil floats and suction line accumulators must have the mineral oil drained from them. Add POE lubricant to the oil separator and to the oil reservoir.
- f. Replace the liquid line filter-drier with one that is compatible with R-404A/R-507.
- g. Fill the compressor with the proper amount of POE lubricant. The oil charge is on the label of the compressors. If the lubricant charge is unknown, an Authorized Copeland Wholesaler can provide the technician with the information.
- h. Reinstall the compressor in the system. Evacuate it to 250 microns. A vacuum decay test is suggested to assure the system is dry and leak free.
- i. Recharge the system with R-22.
- j. Operate the compressor in the system for a minimum of 24 hours. On large systems with long piping runs, experience indicates operating for several days to allow for thorough mixing of the remaining mineral oil and POE will minimize the number of flushes.
- k. Repeat steps 3.I.a through j until the residual mineral oil is less than desired. This may require two flushes of the system's lubricant.
- l. In most cases, two complete flushes of the lubricant lowers the mineral oil to 10% or less and three complete flushes of the lubricant lowers the mineral oil content down to 5% or less in the system. To be sure of the mineral oil content between flushes and to be sure that the system ultimately has 5% or less mineral oil, test kits are available from Virginia KMP or Nu Calgon. A Refractometer may also be used to determine the residual mineral oil in the system. The

Refractometer (p/n 998-RMET-00) is available from your Authorized Copeland™ Wholesaler.

- m. Properly dispose of the lubricant removed from the system after each flush.

II. Systems without service valves

- a. Disconnect electrical power to system.
- b. Properly remove the R-22 from the system.
- c. Remove the mineral oil lubricant from the compressor. Hermetic compressors will have to be removed from the system and tipped up to drain the lubricant out through the suction/process fitting.
- d. It may be advisable to add service valves at the compressor suction and discharge connections. The compressor will have to have its lubricant changed generally three times.
- e. Those systems that have oil separators, oil reservoirs, oil floats and suction line accumulators must have the mineral oil drained from them. Add POE lubricant to the oil separator and to the oil reservoir.
- f. Replace the liquid line filter-drier with one that is compatible with R-404A/R-507.
- g. Fill the compressor with the proper amount of POE lubricant. The oil charge is on the label of the compressors. If the lubricant charge is unknown, an Authorized Copeland Wholesaler can provide the technician with the information.
- h. Reinstall the compressor in the system. Evacuate it to 250 microns. A vacuum decay test is suggested to assure the system is dry and leak free.
- i. Recharge the system with R-22.
- j. Operate the compressor in the system for a minimum of 24 hours. On large systems with long piping runs, experience indicates operating for several days to allow for thorough mixing of the remaining mineral oil and POE will minimize the number of flushes.
- k. Repeat steps 3.II.a through j until the residual mineral oil is less than 10%.
- l. To date, two complete flushes of the lubricant lowers the mineral oil to 10% or less and three complete flushes of the lubricant has shown to lower the mineral oil content down to 5% or less in the system. To be sure of the mineral oil content between flushes and to be sure that the system ultimately has 5% or less mineral oil, test kits are available from Virginia KMP or Nu Calgon.

A Refractometer may also be used to determine the residual mineral oil in the system. The Refractometer (p/n 998-RMET-00) is available from the Authorized Copeland Wholesaler.


- m. Properly dispose of the lubricant after each flush.
4. With the proper amount of polyol ester in the system, the R-22 can now be removed. Measure and note the amount removed.
 5. Before the final flush, be sure all leaks are repaired, liquid control devices and any other system components are changed. Install the correct liquid line filter-drier. Driers must be compatible with the refrigerant and lubricant.
 6. Be advised that 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.
 7. Once the compressor is installed and the system is closed, the system must be evacuated to and hold 250 microns or lower.
 8. Charge the system with the R-404A/R-507. Charge to 90% of the refrigerant removed in item 4. R-404A/R-507 must leave the charging cylinder in the liquid phase. It is suggested that a sight glass be connected between the charging hose and compressor suction service valve. This will permit adjustment of the cylinder valve to assure the refrigerant enters the compressor in the vapor state.
 9. Operate the system. Record the data and compare to the data taken in item 2. Check and adjust the TEV superheat setting if necessary. Make adjustments to other controls as needed. Additional R-404A/R-507 may have to be added to obtain optimum system performance.
 10. Properly label the components. Tag the compressor with the refrigerant used (R-404A/R-507) and the lubricant used. The proper color code for R-404A is Pantone Orange PMS (Paint Matching System) 021C; for R-507, Teal, PMS 326.
 11. 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.

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 the control of Emerson, we can assume no liability for results obtained or damages incurred through the application of the data presented.

CAUTION: *These guidelines are intended for use with R-404A and/or R-507 only. 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.*

ADDENDUM

The contents of this publication are presented for informational purposes only and are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. Emerson Climate Technologies, Inc. and/or its affiliates (collectively "Emerson"), as applicable, reserve the right to modify the design or specifications of such products at any time without notice. Emerson does not assume responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use and maintenance of any Emerson product remains solely with the purchaser or end user.

 **CAUTION** POE must be handled carefully and the proper protective equipment (gloves, eye protection, etc.) must be used when handling POE lubricant. POE must not come into contact with any surface or material that might be harmed by POE, including without limitation, certain polymers (e.g. PVC/CPVC and polycarbonate).

R-404A/507 Temperature/Pressure Chart

Vapor Pressure PSIG	Vapor Temp. °F R-404A	Vapor Temp. °F R-507	Vapor Pressure PSIG	Vapor Temp. °F R-404A	Vapor Temp. °F R-507	Vapor Pressure PSIG	Vapor Temp. °F R-404A	Vapor Temp. °F R-507
0	-50	-52.1	60	23	20.9			
1	-48	-49.7	61	24	21.6	110	53	50.7
2	-46	-47.3	62	25	22.3	115	56	53.2
3	-43.5	-46	63	25.5	23.1	120	58	55.6
4	-41	-43	64	26	23.8	125	60	57.9
5	-39	-41	65	27	24.5	130	63	60.1
6	-37	-39	66	28	25.2	135	65	62.3
7	-35	-37	67	28.5	25.8	140	67	64.4
8	-33	-35.3	68	29	26.5	145	69	66.5
9	-31.5	-33.5	69	29.5	27.2	150	71	68.6
10	-30	-31.8	70	30	27.9	155	73	70.6
11	-28	-30.2	71	31	28.5	160	75	72.5
12	-26	-28.6	72	32	29.2	165	77	74.4
13	-24.5	-27	73	32.5	29.8	170	79	76.3
14	-23	-25.5	74	33	30.5	175	81	78.1
15	-21.5	-24	75	33.5	31.1	180	82	79.9
16	-20	-22.6	76	34	31.7	185	84	81.7
17	-19	-21.2	77	34.5	32.4	190	86	83.4
18	-18	-19.8	78	35	33	195	88	85.1
19	-16.5	-18.4	79	36	33.6	200	89	86.7
20	-15	-17.1	80	37	34.2	205	90.5	88.3
21	-13.5	-15.8	81	37.6	34.8	210	92	89.9
22	-12	-14.6	82	38.2	35.4	215	94	91.5
23	-11	-13.4	83	38.8	36	220	96	93.1
24	-10	-12.2	84	39.4	36.6	225	97.5	94.6
25	-8.5	-11	85	40	37.2	230	99	96.1
26	-7	-9.8	86	40.6	37.8	235	100.5	97.5
27	-6	-8.7	87	41.2	38.4	240	102	99
28	-5	-7.5	88	41.8	39	245	103	100.4
29	-4	-6.4	89	42.4	39.5	250	104	101.8
30	-3	-5.4	90	43	40.1	255	105.5	103.2
31	-2	-4.3	91	43.4	40.7	260	107	104.6
32	-1	-3.3	92	43.8	41.2	265	108.5	105.9
33	0	-2.2	93	44.2	41.8	270	110	107.2
34	1	-1.2	94	44.6	42.4	275	111.5	108.6
35	2	-0.2	95	45	42.9	280	113	109.8
36	3	0.8	96	45.6	43.4	285	114	111.1
37	4	1.7	97	46.2	44	290	115	112.4
38	5	2.7	98	46.8	44.5	295	116.5	113.6
39	6	3.6	99	47.4	45.1	300	118	114.8
40	7	4.6	100	48	45.6	305	119	116
41	8	5.5	101	48.6	46.1	310	120	117.2
42	9	6.4	102	49.2	46.7	315	121	118.4
43	10	7.3	103	49.8	47.2	320	122	119.6
44	11	8.2	104	50.4	47.7	325	123.5	120.7
45	11.5	9	105	51	48.2	330	125	121.8
46	12	9.9	106	51.4	48.7	335	126	123
47	13	10.7	107	51.8	49.2	340	127	124.1
48	14	11.6	108	52.2	49.7	345	128	125.2
49	15	12.3	109	52.6	50.2	350	129	126.3
50	16	13.2				355	130.5	127.3
51	16.5	14				360	132	128.4
52	17	14.8				365	133	129.4
53	18	15.6				370	134	130.5
54	19	16.4				375	135	131.5
55	19.5	17.2				380	136	132.5
56	20	17.9				385	137	133.5
57	21	18.7				390	138	134.5
58	22	19.4				395	139	135.5
59	22.5	20.2				400	140	136.4

Note: Saturated Vapor Temperatures are shown. The average evaporator or condenser temperature is within .5° F of the saturated vapor temperature; therefore, no correction is required.