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## **Retrofitting HCI Reciprocating Compressors from CFC Refrigerants to HFC Refrigerants**

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**SUBJECT: Alternative Refrigerants**

**Retrofitting from CFC to HFC Refrigerants**

*i.e. R-12 to R-134a, R502 to R404A or R-507 and R-22 (HCFC) to R-407C (HFC)*

**APPLICATION: All HCI Reciprocating Compressors including RHC (D-B Metic), Big 4 and Belt Driven**

### **DISCLAIMER**

Hartford Compressors offers these recommendations and instructions to qualified/certified Refrigeration Service Technicians. In doing so, we assume no liability for misapplications or system capacity losses.

The instructions contained herein are based on technical information provided to us by various refrigerant and oil manufacturers. All information contained herein is based on the most up to date information supplied to us at the time of publication. Information contained in this Service Bulletin relates to compressors manufactured by Hartford Compressors or Dunham-Bush Inc. or remanufactured by its authorized remanufacturer. Any compressors remanufactured by personnel other than our authorized remanufacturers may not conform to our standards and may require additional changes.

- Before undertaking the changeover from one refrigerant to another, we recommend that this entire instruction be reviewed. Consult with HCI Application Engineering Department if you have any questions.
- These instructions relate to the compressor only. We have made some recommendations with regard to the system but you must consult with the equipment/system manufacturer on any matters not directly related to the compressor.
- **Hartford Compressors Inc.** does not recommend changing CFC refrigerants to HCFC or HFC refrigerants unless there is no other alternative. If there are no leaks to atmosphere and the system is functioning properly, there should be no reason to replace the refrigerant. It is possible that by changing the refrigerant, the UL listing of the equipment may be voided.
- Once the decision is made to replace the refrigerant, it is recommended that the CFC refrigerant be replaced with an HFC refrigerant. These instructions are for changing CFC refrigerants to HFC refrigerants only. They should not be used for changing "similar" refrigerants.
- When changing to an HFC refrigerant, it will also be necessary to change the lubricant from mineral oil to Polyol Ester (POE) lubricant.

## COMPRESSOR CONSIDERATIONS

- Before the final decision is made to change out the refrigerant, the compressor must be checked to see if it is compatible with the new refrigerants and lubricants.
- **MOTORS:** Semi-hermetic compressors manufactured before **1974** do not have motors that are suitable for conversion. The motor insulation in semi-hermetic compressors manufactured before 1974 is not compatible with the new refrigerants and oils and conversion will violate the U. L. Standard for Field Conversion/retrofit of Alternate Refrigerants in Air Conditioning and Refrigeration Equipment. (UL 2154)
- **GASKETS:** On compressors manufactured before **1992** the gaskets are not compatible with POE lubricants and HFC refrigerants. If the compressor is manufactured before 1992, the gaskets must be changed.
- **TERMINAL SEALS:** On semi hermetic compressors manufactured before **1994** the terminal seals are not compatible with the HFC refrigerants and POE lubricants. If the compressor is manufactured before 1994, the terminal seals must be changed.
- **COMPRESSOR SERIAL #:** For compressors manufactured before April 1997, the first two digits of the serial number designate the year of manufacture. Serial numbers after April 1997 use letters to designate the year. (i.e., for serial # 95D0337D, the year of manufacture is 1995 / ABB-A1234-10 = typical serial number for compressor manufactured after April 1997)

## SYSTEM CONSIDERATIONS

- **LUBRICATING OIL:** When using HFC, the compressor mineral oil must be changed to Polyol Ester (POE) lubricant. There can be no more than 5% mineral oil left in the system when the refrigerant is changed. See the section on "Changeover Procedure" for more detailed information.
- If changing over to R-134a it should not be used in any applications that operate at -10oF or below.
- HFC refrigerants cannot be mixed with other refrigerants.
- Although HFC refrigerants have similar capacity their CFC counterparts, all refrigerant metering devices such as TXV's, head pressure controls etc. must be examined and readjusted or replaced as necessary. If necessary, consult the TXV manufacturer for the proper valve and size.
- Because of the slight pressure/temperature differences between the two refrigerants, all pressure switches should be checked and recalibrated as necessary.

- **FILTERS & FILTER DRIERS:** System filters and filter driers must be changed. Solid core driers such as ALCO ADK or SPORLAN Type C cores are recommended. Consult the filter manufacturer's recommendations before purchasing.
- HFC refrigerants will have a slightly different system pressure drop than CFC's. Check with the manufacturer of any pressure regulators or pilot operated valves to be sure that they will operate at the higher pressure drops.

## CHANGEOVER PROCEDURES

### IMPORTANT

The oil in the system must be changed before the refrigerant is changed. If the refrigerant is changed first, mineral oil will log in the system and could foul heat transfer surfaces. This will have an insulating effect in the evaporator and will substantially reduce system capacity.

## PREREQUISITES

1. The system should be thoroughly leak-checked before conversion can begin. All leaks must be repaired before the new refrigerant is added to the system.
2. A complete set of operating conditions including temperature and pressure readings must be taken before system conversion begins. This will give the technician guidelines to refer to when the system is recharged with the new refrigerant.

### A. CHANGE SYSTEM OIL

RECOMMENDED OILS	
APPLICATION RANGE	APPROVED OILS
* -10 <sup>o</sup> F - +25 <sup>o</sup> F SST	CPI Solest-35 ICI RL35H Castrol SW35 Mobil EAL Arctic 35
+25 <sup>o</sup> F - +55 <sup>o</sup> F SST	CPI Solest-68 ICI RL68H Castrol SW68 Mobil EAL Arctic 368

1. For refrigeration systems with a defrost cycle, run the system in defrost to maximize the return of the mineral oil to the compressor.

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2. Shut off electrical power to the compressor and tag out the system to prevent accidental starting of the compressor. Back seat (open) the service valves for the compressor.
3. Using current recovery procedures, remove the CFC refrigerant from the system and hold in a storage container for return to the system. (See step 9.).
4. Drain all mineral oil from the compressor crankcase. Measure the amount of oil removed.

The system should be allowed to warm up to facilitate the removal of mineral oil. The time it takes to change filters and drain oil should be enough to warm the oil and allow it to drain quicker.

5. On systems with oil separators, oil reservoirs or suction line accumulators, all mineral oil must be removed directly from the component if possible.

*Do not rush this step. The time spent warming the system and draining the mineral oil will pay off by time saved later in the procedure.*

6. Replace all filters and filter driers in the system with replacements that are compatible with the HFC's.
7. Add POE lubricant to the compressor until it is  $\frac{1}{2}$  to  $\frac{3}{4}$  in the sight glass. You should add an oil charge equivalent to the amount of oil removed from the compressor in step 4. Also, add oil to the components that oil was removed from in step 5.

**NOTE:** POE lubricants are extremely hygroscopic and will very quickly absorb moisture from the air as soon as the container is opened. Once the POE lubricant has been added to the system, it should be sealed as soon as possible. For this reason, all leaks should be repaired and all filters and filter driers should be installed before adding the POE lubricant.

8. Add additional POE lubricant (Equal to  $\frac{1}{2}$  the oil removed from the compressor crankcase) to the liquid line after condenser and the receiver (if there is one).
9. Evacuate the system to at least 500 microns. It is suggested that the vacuum be left on the system to use the pressure rise as a further check for leaks. Break the vacuum by adding refrigerant to the system. Use the refrigerant reclaimed in step 3
10. Reset the power that was shut down in step 2 and restart the compressor. You will have approximately 50% extra lubricant in the system. This additional lubricant will sweep through the system allowing for more efficient removal of the remaining mineral oil in the system.
11. Monitor the crankcase oil level. As the level fills the sight glass, drain the crankcase to about  $\frac{1}{2}$  in the sight glass. It should take 30 to 60 minutes to remove the extra lubricant including much of the residual mineral oil left in the system.

12. When no more excess oil returns from the system, shut the compressor off and sample the oil in the crankcase.
13. Using a mineral oil test kit (available at most HVAC parts distributors) test the sample to see what percent of mineral oil is in the system. On the first test, you should not expect the residual mineral oil to reach the target of 5% or less.
14. If the mineral oil content is more than 5%, isolate the compressor and using current recovery procedures, remove the refrigerant from the compressor and hold in a storage container for return to the system.
15. Drain the lubricant from the crankcase and charge with an equal volume of POE lubricant.
16. Change the filter dryers.
17. Open the service valves and restart the compressor. Run it for a minimum of 24 hours. If necessary, add refrigerant removed from compressor in step 14.
18. Shut down the compressor and retest the sample as in step 13.
  - a. If the mineral oil is still above 5%, repeat steps 14 through 17.
  - b. If the mineral oil is below 5%, go to next section "Change refrigerant".
19. Two to three flushes of the lubrication system are enough to lower the mineral oil content down below 5%.

## **B. CHANGE REFRIGERANT**

1. With the proper amount of POE lubricant in the system, remove by recovering the CFC from the system. Weigh and record the amount removed.
2. Once the CFC has been removed, evacuate the entire system to 500 microns.
3. Charge the system with the appropriate HFC refrigerant. Charge the system to 90% (by weight) of the refrigerant removed in item B.1.

NOTE: The refrigeration system may require less HFC (by weight) than the CFC refrigerant that was removed.
4. Start the compressor and record the temperatures and pressures and compare to the readings taken in item 2 of the prerequisites.
5. Adjust the TXV and any other controls necessary to balance the system. It may be necessary to add additional HFC to complete the overall balance of the system.
6. Label all components in a prominent location with tags showing the type of refrigerant in the system as well as the brand name and type of lubricant in the system.

**C. CLEANUP**

1. It is essential that all used components be disposed of in accordance with current local and state laws regarding the disposal of refrigerants, lubricants and other system components.
2. Used refrigerants must be reclaimed and recycled in accordance with current EPA guidelines.
3. In many cases, used refrigerant oils cannot be disposed of like used motor oils. Check with your local jurisdiction for correct disposal guidelines for the refrigerant and oil.