

SUBJECT: Carlyle R-22 to R-422D Retrofit RecommendationsDATE: September 26, 2007
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Product Name: 06D/E/CC Compressors

DESCRIPTION

Carlyle has received a number of requests for retrofit recommendations in converting R-22 applications to R-422D (also known as ISCEON® MO29, an HFC zeotropic blend). While Carlyle has limited performance data with R-422D, we have reviewed a number of field applications where the retrofit has performed successfully. If a customer wishes to retrofit existing R-22 low and medium temperature refrigeration systems with R-422D shown below are our recommendations for the Carlyle 06D/E/CC compressor models.

1. Review the system components (except for Carlyle compressors) for the presence of fluoro-elastomer components. Fluoro-elastomers (e.g. "Viton") swell at different rates when exposed to R22 versus R422D and other HFC refrigerants (i.e. R404A). The difference in swell can result in leaks after the system changeover which must be considered in retrofits. Unrestrained components (e.g. valve seats) are more susceptible and may require replacement with a neoprene compound suitable for R-422D duty. Highly restrained components (e.g. o-rings) may not need to be replaced. Suppliers of this refrigerant have also prepared technical bulletins and information on material compatibility of R-422D to common system materials. Compatibility information of elastomers and plastics with ISCEON® refrigerants can be found in the ISCEON® Refrigerants PUSH (Properties, Uses, Storage & Handling) bulletin K-10927. Find this at the DuPont's Refrigerant's website: www.refrigerants.dupont.com for this and other technical information.

Carlyle believes all components in 06D/E semi-hermetic compressors for the past 30 years are compatible with R-422D. Compressors built before 1973 may have used motor insulation systems that are different than that used today. The material compatibility of these compressors with the alternate refrigerants is unknown and conversions are not recommended for these very old compressors.

2. Refrigerant R-422D has a small amount of Isobutane (R600a) to assist in oil return if the original mineral oil is kept in the system. Field applications have indicated adequate oil return is

possible with the existing mineral oil left in the system. Carlyle still recommends a thorough review of the system piping to ensure adequate refrigerant velocities under minimum load conditions. This is especially true of single compressor systems with unloaders. In these cases the refrigerant velocity may become too low to properly allow adequate oil return. Field experience has reported that in cases of inadequate oil return, the addition of small quantities (5 to 10% of the oil charge) of an approved POE lubricant (see below) have assisted in improving oil return. Older applications, especially in R-22 low temperature systems, may have discolored oil. If that is the case, an oil change may be required.

If oil return problems are found or the end user would prefer POE lubricants the following are recommended ISO 68 cSt viscosity oils:

MFG.	BRAND NAME
Mobil*	EAL Artic 68*
Castrol*	SW 68*
ICI	Emkarate RL68H
Castrol	E 68
CPI	Solest 68

* - these lubricants not recommended for low temperature applications

3. Carlyle has not formally performance tested our compressors with R-422D. Based on reviewing the thermodynamics properties of the refrigerant and reviewing field experience, we believe the compressors will have slightly less capacity than with R-22. We believe the capacity reduction will be in the 5 to 10% range for medium temperature systems and the difference will depend on the application. For low temperature systems, the capacities may be closer due to the lower desuperheating requirements with R-422D (i.e. runs much cooler than R22 so less desuperheating is required). Many refrigeration systems may have the excess capacity available to allow this retrofit to meet the system requirements but each conversion should be carefully reviewed.

4. In 1994 Carlyle introduced a new, higher flow oil pump which allows the compressor to maintain sufficient oil pressure to avoid damage if refrigerant migration into the oil does occur. Carlyle 06D/E compressors built after serial number 1094J----- incorporate this new oil pump. Accessory 06D&E oil pump bearing head assemblies are available for older compressors and may be applied when making these R-422D conversions. This oil pump change is optional if mineral oil or A/B oils are used. They are strongly recommended if POE lubricants are used. The 06D/E oil pump bearing head assemblies service package P/N's:

06D & "D" body 06CC's: 06DA660126
 06E & "E" body 06CC's: 06EA660157

5. High side refrigerant pressures with R-422D are slightly higher than the R-22 it is replacing. Any pressure controls or settings should be reviewed to determine if adjustments are required. Carlyle recommends applying our 06D/E compressors with R-422D within published application limits shown for R-22. If using approved Carlyle motor protection, the RLA shown for R-22 should be the same for R-422D. Following table summarizes operating pressures for a few sample saturated temperatures.

Operating Pressure Comparison

Saturated Temp (F)	R422D² Press¹ (psig)	R22 Press¹ (psig)	R404A Press¹ (psig)
-25	5.4	7.4	12.7
15	35.3	37.8	49.0
110	230.5	226.4	270.4
130	305.8	296.9	353.5

1. Saturated vapor,
2. R422D has a glide 4F at 110 SDT vs 0.6F for R404A & 9F for R407C at 110F SDT.

6. R-422D has slightly higher mass flows than R-22 resulting in a higher loading of the expansion valves; however, field experience indicates that most expansion valves can be re-used with R-422D without replacement. R-422D suction pressures are similar to R-22, so existing TXV powerheads can also be re-used in most cases. An engineering review of the existing system is recommended before the retrofit as the increased valve loading will sometimes require replacement of expansion valves. Superheats should also be checked after the retrofit as well as the settings of all EPR and holdback valves and adjustments made as required. R-422D has a moderate glide (see note 2 on above table) and service personnel should be familiar with the effect of glide in setting TXV superheats and in determine the amount of subcooling in the liquid line.

7. Do not mix R-422D with R-22 or any other refrigerants. The effect on performance factors and other potential safety or reliability issues is unknown.

8. When ready for the retrofit – remove and recycle or reclaim the R-22 as required by all applicable regulations.

9. Evacuate the system. Triple evacuation is preferred to ensure moisture and system contaminants are removed.

10. Replace the filter drier with a molecular sieve type suitable for R-422D.

11. If the conversion has replaced all the original mineral or AB oil with POE oils then several filter drier changes may be required to remove additional moisture from the system. POE oils hold higher amounts of moisture than the mineral oils they are replacing and triple evacuation does not remove much moisture from POE oils.
12. If the conversion has replaced all the original mineral or AB oil with POE oils, Carlyle recommends the installation of crankcase heaters to the compressors. Carlyle flooded start abuse testing has found that maintaining proper lubrication is more difficult with alternate refrigerants and POE lubricants. Therefore, crankcase heaters are recommended on all applications with POE lubricants. To further minimize the potential for refrigerant absorption into the oil, pumpdown control cycles should be used whenever possible.
13. Label the system and change unit service literature appropriately to reflect the change to R-422D and lubricant. It is essential that operators and service personnel are aware of the change and do not use another refrigerant or oil when servicing the system.