### 06D/E COMPRESSORS WITH ALTERNATE REFRIGERANTS

Carlyle is proud to announce the addition of our new 06D/E HFC compatible compressors to our product line. We have been conducting extensive qualification tests with our compressors for the past several years to develop the application requirements for these compressors. This includes performance testing, material compatibility testing, and the selection and approval of the new POE lubricant required for operation with the HFC refrigerants. Carlyle is striving to offer one "universal compressor" that is compatible with the refrigerant of today and tomorrow. These new models offer many excellent benefits and enhancements for compressor systems regardless of the refrigerant.

The new features of the 06D/E HFC compatible models are:

- The compressors are shipped without oil: The new polyolester (POE) oils are much more hygroscopic than the mineral oils with which our industry is used to working. These POE oils attract and retain much higher quantities of moisture than mineral oils. For that reason, it may be desirable to add the oil to the compressor at the very end of the unit or system assembly. Supplying the compressor without oil allows the system manufacturer to work with these compressors at their facility and add oil after the unit has been completely assembled. Oil may also be added at the job site to reduce the potential for an open system to collect moisture. Shipping the compressors without oil also offers the OEM the flexibility to use either POE or mineral oil.
- New high flow oil pump: Our new rotary vane oil pump has increased the oil flow by over 50%. The 06D nominal oil pressure is now 15 to 25 psi and the 06E nominal oil pressure is now 25 to 35 psi. This increase in oil flow, results in the ability to quickly build oil pressure even under flooded start conditions. Because the new HFC's and POE's are more soluble than mineral oil and CFC's or HCFC's, this may result in an increased incidence of nuisance oil pressure switch tripping. The new Carlyle high flow oil pump has been designed to alleviate these difficulties.
- Crankcase venting: When refrigerant has accumulated in the oil sump, high pressures may occur in the crankcase during startup, as the refrigerant out-gasses. Our internal venting system allows any high pressure vapor to escape the crankcase and enter the compressor suction manifold, enhancing compressor life and reliability.

#### Oils

While the compressors are supplied without oil, they are factory run tested with a POE oil. The compressors, when used with HFC refrigerants such as HFC-134a, HFC-507, and HFC-404A, must be applied with customer supplied and Carlyle approved POE lubricants.

Carlyle Compressor recommends an ISO 68 cSt viscosity polyolester oil. Shown below are POE-68 oils which are approved for use in Carlyle compressors. Please note that the use of different oils affect the various code approvals. Currently only 2 of the lubricants have UL or CSA approval.

| MFG.      | BRAND NAME         | CODE       | ADDITIVE   |       |
|-----------|--------------------|------------|------------|-------|
|           |                    | UL         | CSA        | USED  |
| Mobil     | Arctic EAL 68      | Yes        | Yes        | No    |
| Castrol   | SW 68              | Yes        | Yes        | Yes * |
| ICI       | Emkarate RL68H     | In Process | In Process | No    |
| +Lubrizol | Lubrikuhl LS 2916S | In Process | In Process | Yes * |

\* Contains wear additives

+ Lubrizol ISO 68 also sold under Texaco Capella HFC 68NA brand

Carlyle has attempted to qualify its compressors with the option of using POE oils that do not contain additives. This allows our customers the maximum flexibility in component selection since it minimizes potential additive compatibility problems. Several POE options have also been selected that contain additives. Our testing indicates that even if these additives were removed (by system filters, for example), the remaining composition should meet our requirements for proper compressor lubrication.

#### **HFC Application Requirements**

Several additional system recommendations must also be followed with all HFC/POE systems:

1. All components used in systems must be compatible with the HFC refrigerant and ISO 68 POE oil being used. It is especially important that the filter dryers be compatible with the refrigerant and oil. Many system manufacturers have found 100% molecular sieve filter driers are the preferred filter drier alternative.

- 2. Care must be taken to minimize compressor flooded starts. When refrigeration migration occurs in the oil, the new HFC refrigerants and POE oils (which are more soluble) react differently than CFC's and mineral oil. Consequently, off-cycle refrigerant isolation is required. This can be accomplished by utilizing the standard Carlyle 180 watt crankcase heaters on 18 through 99 CFM models. The smaller 8 through 16 CFM can be applied with the current 50 watt external strap on crankcase heater. A refrigerant pump down/solenoid drop control should also be utilized on single compressor applications.
- 3. Normal application precautions and guidelines should be followed when using multiple compressors in a single circuit. As always, particular attention must be paid to oil management in multiplex systems. Carlyle recommends the use of an oil separator, oil reservoir, and float system to ensure good oil management. Other options should be reviewed with Carlyle Application Engineering.
- 4. In general, the same application guidelines apply to these 06D/E models with HFC-507 and HFC-404A as with CFC-502. The compressors will require the same overcurrent protection and have the same electrical specifications (same calibrated circuit breakers for 06E compressor models) as with CFC-502.
- 5. While the Carlyle compressors operate cooler with HFC-507 and HFC-404A than with CFC-502, cylinder head cooling fans *are required* for applications below -25°F saturated suction temperature.

#### 06D/E Compressors Applied With HCFC-22 and POE Oils

Many customers are also interested in applying refrigeration compressors today with POE lubricants and HCFC-22 to make a conversion to an HFC refrigerant easier in the future. It is important to note that HCFC-22 appears to react differently with POE lubricants than with mineral oil. Carlyle has noted some instances of unusual compressor wear when running the compressors at very high compression ratios and high discharge temperatures. For this reason, we recommend limiting the discharge temperature to 225°F if customers wish to apply our compressors with POE oils and HCFC-22. Carlyle Engineering is continuing to run extensive qualification tests with our compressors with HCFC-22 and a variety of POE oils. We will continue to keep you informed of the status of our testing.

Attached please find the new 06D/E HFC compatible compressor model number charts and peformance data for HFC-507 and HFC-404A. Carlyle's performance testing has shown both of these new refrigerants to be within approximately +/- 2% of each other for capacity and EER. Therefore, one set of performance tables has been generated representing both refrigerants.

## CHART I

# 06DR/DM MODELS

| EXISTING       | HFC/POE COMPATIBLE |                | APPROVED FOR USE |          |           |           |
|----------------|--------------------|----------------|------------------|----------|-----------|-----------|
| COMPRESSOR     | COMPRESSOR         | COMPRESSOR     | MED.TEMP         | AC       | LOW TEMP  | MED. TEMP |
| (NAMEPLATE #)  | (PKG #)            | (NAMEPLATE #)  | HFC-134a         | HFC-134a | HP62/AZ50 | HP62/AZ50 |
| 06DR1090GA3100 | 06DR1090GA315A     | 06DR1090GA3150 | YES              | YEŞ      | YES       | NÖ        |
| 06DR1090GA3200 | 06DR1090GA325A     | 06DR1090GA3250 | YE\$             | YES      | YES       | NÖ        |
| 06DR1090GA3600 | 06DR1090GA365A     | 06DR1090GA3650 | YES              | YES      | YES       | NO        |
| 06DR0130CA3100 | 06DR0130CA315A     | 06DR0130CA3150 | YES              | YE\$     | YES       | NO        |
| 06DR0130CA3200 | 06DR0130CA325A     | 06DR0130CA3250 | YES              | YES      | YES       | NO        |
| 06DR0130CA3600 | 06DR0130CA365A     | 06DR0130CA3650 | YES              | YES      | YES       | NO        |
| 06DR3160CA3100 | 06DR3160CA315A     | 06DR3160CA3150 | YES              | YES      | YES       | YE\$      |
| 06DR3160CA3200 | 06DR3160CA325A     | 06DR3160CA3250 | YES              | YES      | YES       | YES       |
| 06DR3160CA3600 | 06DR3160CA365A     | 06DR3160CA3650 | YES              | YES      | YES       | YES       |
| 06DR7180DA3100 | 06DR7180DA315A     | 06DR7180DA3150 | YES              | YES      | YES       | NO        |
| 06DR7180DA3200 | 06DR7180DA325A     | 060R7180DA3250 | YES              | YES      | YES       | NO        |
| 06DR7180DA3600 | 06DR7180DA365A     | 06DR7180DA3850 | YES              | YES      | YE\$      | NO        |
| 06DR8200DA3100 | 06DR8200DA315A     | 06DR8200DA3150 | YES              | YES      | YE\$      | YES       |
| 06DR8200DA3200 | 06DR8200DA325A     | 06DR8200DA3250 | YES              | YES      | YES       | YES       |
| 06DR8200DA3600 | 06DR8200DA365A     | 06DR8200DA3650 | YES              | YES      | YES       | YE\$      |
| 06DR7240DA3100 | 06DR7240DA315A     | 06DR7240DA3150 | YES              | YES      | YES       | YE\$      |
| 06DR7240DA3200 | 06DR7240DA325A     | 06DR7240DA3250 | YES              | YES      | YES       | YES       |
| 06DR7240DA3600 | 06DR7240DA365A     | 06DR7240DA3650 | YES              | YES      | YES       | YES       |
| 06DR2260DA3100 | 06DR2280DA315A     | 06DR2280DA3150 | YES              | YES      | YEŜ       | YES       |
| 06DR2260DA3200 | 06DR2280DA325A     | 06DR2260DA3250 | YES              | YES      | YES       | YES       |
| 06DR2260DA3600 | 06DR2280DA365A     | 06DR2260DA3650 | YES              | YES      | YES       | YES       |
| 06DR3370DA3100 | 06DR3370DA315A     | 06DR3370DA3150 | YES              | YES      | YES       | YES       |
| 06DR3370DA3200 | 06DR3370DA325A     | 06DR3370DA3250 | YES              | YES      | YES       | YES       |
| 06DR3370DA3600 | 06DR3370DA365A     | 06DR3370DA3650 | YES              | YES      | YES       | YES       |
| 06DM8080GA3100 | 06DM8080GA315A     | 06DM8080GA3150 | NO               | NO       | NO        | YES       |
| 06DM8080GA3200 | 06DM8080GA325A     | 06DM8080GA3250 | NO               | NO       | NO        | YES       |
| 06DM8080GA3600 | 06DM8080GA365A     | 06DM8080GA3650 | NO               | NO       | NO        | YES       |
| 06DM3130GA3100 | 06DM3130GA315A     | 06DM3130GA3150 | NO               | NO       | NO        | YES       |
| 06DM3130GA3200 | 06DM3130GA325A     | 06DM3130GA3250 | NO               | NO       | NO        | YES       |
| 06DM3130GA3600 | 06DM3130GA365A     | 06DM3130GA3650 | NO               | NO       | NÔ        | YES       |
| 06DM3370DA3100 | 06DM3370DA315A     | 06DM3370DA3150 | YES              | YES      | YES       | YES       |
| 06DM3370DA3200 | 06DM3370DA325A     | 06DM3370DA3250 | YES              | YES      | YES       | YES       |
| 06DM3370DA3600 | 06DM3370DA365A     | 06DM3370DA3650 | YES              | YES      | YES       | YES       |

## CHART II

### 06ER/06EM MODELS

| EXISTING      | HFC/POE COMPATIBLE |               | APPROVED FOR USE |          |           |
|---------------|--------------------|---------------|------------------|----------|-----------|
| COMPRESSOR    | COMPRESSOR         | COMPRESSOR    | MED.TEMP         | AC       | LOW TEMP  |
| (NAMEPLATE #) | (PKG #)            | (NAMEPLATE #) | HFC-134a         | HFC-134a | HP62/AZ50 |
| 06ER150100    | D8ER45010A         | 06ER450100    | NÔ               | NO       | YEŞ       |
| 06ER150300    | 06ER45030A         | 06ER450300    | NO               | NO       | YES       |
| 06ER150600    | 06ER45060A         | 06ER450600    | NO               | NO       | YES       |
| 06ER165100    | 06ER46510A         | 06ER465100    | NO               | NO       | YES       |
| 06ER165300    | 06ER46530A         | 06ER465300    | NO               | NO       | YES       |
| 06ER165600    | 08ER46560A         | 06ER465600    | NÔ               | NÓ       | YES       |
| 06ER175100    | 06ER47510A         | 06ER475100    | NÓ               | NÓ       | YES       |
| 06ER175300    | 06ER47530A         | 06ER475300    | NO               | NO       | YES       |
| 06ER175600    | 06ER47560A         | 06ER475600    | NO               | NO       | YES       |
| 06ER099100    | 06ER39910A         | 06ER399100    | NO               | NO       | YES       |
| 06ER099300    | 08ER39930A         | 06ER399300    | NO               | NO       | YE\$      |
| 06ER099600    | 06ER39960A         | 06ER399600    | NO               | NO       | YES       |
|               |                    |               |                  |          |           |
| 08EM150100    | 06EM45010A         | 08EM450100    | YES              | YES      | NO        |
| 06EM150300    | 06EM45030A         | 08EM450300    | YES              | YES      | NO        |
| 06EM150600    | 06EM45060A         | 06EM450600    | YES              | YES      | NO        |
| 06EM165100    | 06EM56510A         | 06EM565100    | YES              | YES      | NO        |
| 06EM165300    | 06EM56530A         | 08EM565300    | YES              | YES      | NO        |
| 06EM165600    | 06EM56560A         | 08EM565600    | YES              | YES      | NO        |
| 06EM175100    | 06EM47510A         | 08EM475100    | YES              | YES      | NO        |
| 06EM175300    | 06EM47530A         | 06EM475300    | YE\$             | YES      | NÔ        |
| 06EM175800    | 06EM47580A         | 06EM475600    | YE\$             | YES      | NÔ        |
| 06EM199100    | 06EM49910A         | 06EM499100    | YES              | YES      | NO        |
| 06EM199300    | 06EM49930A         | 06EM499300    | YES              | YE\$     | NO        |
| 06EM199600    | 06EM49960A         | 06EM499600    | YE\$             | YES      | NÔ        |