Mobile air conditioning lubricants
Shrieve has developed a strong presence in the refrigeration and air conditioning compressor lubricant markets, providing a complete range of technically advanced ZEROL® synthetic lubricants for application in mobile systems employing R134a refrigerant. We offer a full range of synthetic technologies for mobile applications, from OEM compliant products for existing HFC systems, through to lubricants for new systems employing primary alternate refrigerants such as HFO-1234yf and CO₂.

A combination of many performance attributes has led to a broad global acceptance and usage of synthetics such as polyalkylene glycol (PAG) and polyol ester (POE) for the lubrication of mobile air conditioning (MAC) compressors. PAG technology broadly predominates due to the excellent lubricity, stability, system compatibility and wide temperature operating range which are inherent features of this type of base fluid. Further to EU legislation requiring the adoption of less ozone depleting refrigerant technologies in MAC systems, PAG lubricants remain the preferred lubricants of choice for new refrigerant types, including both HFO-1234yf and CO₂.

For R134a refrigerant based systems:
**ZEROL® RFL-X**

ZEROL RFL-X ‘double end-capped’ or ‘di-capped’ PAGs have been designed specifically as an OEM approved product choice for application with R134a refrigerant in MAC systems. They are formulated for compressors that require a superior, high-performance lubricant with viscosity of 46-150mm²/s @ 40°C. They are fully compliant with the technical requirements for MAC double end-capped PAG lubricants specified by leading global compressor manufacturers and carry a number of OEM approvals:

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double end-capped PAG with optimised miscibility in R134a</td>
<td>Maximised oil return to the compressor ensuring highest system efficiency</td>
</tr>
<tr>
<td>Exceptional EP performance, primarily derived from the di-capped base fluid structure</td>
<td>Excellent hydrodynamic and boundary lubrication properties, resulting in minimised levels of wear</td>
</tr>
<tr>
<td>Lower water absorbing tendency compared to alternative PAG products</td>
<td>Improves system reliability and lifetime</td>
</tr>
<tr>
<td>Excellent thermal, chemical and hydrolytic stability</td>
<td>Reduces downtime and lowers maintenance costs</td>
</tr>
<tr>
<td>High flash point and low pour points</td>
<td>Ensures operation across the broadest temperature range</td>
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<tr>
<td>Excellent system component compatibility</td>
<td>Compatible with all metallic and elastomeric components commonly employed in MAC systems</td>
</tr>
<tr>
<td>High Viscosity Index</td>
<td>Ensures lubrication is not compromised at temperature extremes</td>
</tr>
</tbody>
</table>

The Shrieve ZEROL RFL-X range is available in the following grades to accommodate varying system designs:

- ZEROL RFL 46-X
- ZEROL RFL 100-X
- ZEROL RFL 150-X
For R134a refrigerant based systems:
**ZEROL® PAG**

Our standard ZEROL PAG range are fully formulated ‘single end-capped’ polyalkylene glycol lubricants designed specifically for application with R134a refrigerant in mobile air conditioning systems. These synthetic oils are the premium option for aftermarket applications where top-up of the existing lubricant is required during servicing:

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>Single end-capped PAG lubricant, formulated with wear prevention technology</td>
<td>Good hydrodynamic and boundary lubrication properties, resulting in minimised levels of wear</td>
</tr>
<tr>
<td>Specifically designed for R134a refrigerant in mobile air conditioning systems</td>
<td>Full miscibility with R134a across the full MAC operating temperature range</td>
</tr>
<tr>
<td>Good thermal, chemical and hydrolytic stability</td>
<td>Reduces downtime and lowers maintenance costs</td>
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<td>High Viscosity Index</td>
<td>Ensures lubrication is not compromised at temperature extremes</td>
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<td>Excellent seal compatibility</td>
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<td>High flash point and low pour points</td>
<td>Ensures operation across the broadest temperature range</td>
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</tbody>
</table>

**Our ZEROL PAG range is available in the following grades to accommodate varying system designs:**

- ZEROL PAG 46
- ZEROL PAG 56
- ZEROL PAG 100
- ZEROL PAG 150

For systems utilising ester lubricant technology:
**ZEROL® ESTER**

The ZEROL ESTER range is a complementary range of synthetic refrigeration/air conditioning lubricants based on polyol ester (POE) technology. Employed broadly in a range of compressor applications, ZEROL ESTERs are suitable for use in all HFC systems, both mobile R134a and stationary commercial/industrial applications.

ZEROL ESTERs are produced to the tightest moisture and acid value tolerances to meet the exacting standards for refrigeration and air conditioning applications with low moisture and TAN specifications. ZEROL ESTERs offer excellent miscibility and compatibility with HFC refrigerants, high thermal stability, together with good electrical insulating properties for hermetic systems.

**The ZEROL ESTER range is available in the following grades:**

- ZEROL ESTER 22
- ZEROL ESTER 32
- ZEROL ESTER 46
- ZEROL ESTER 68
- ZEROL ESTER 100
- ZEROL ESTER 170

For CO₂ refrigerant based systems:
**ZEROL® RFL-EP**

The mobile air conditioning industry has recently realised significant refrigerant selection changes due to EU legislation requiring the adoption of less ozone depleting technologies by the automotive industry. Primary refrigerants under consideration by the automotive industry include the natural refrigerant CO₂.
The ZEROL RFL-EP range are speciality double end-capped PAGs, engineered specifically to operate under the high pressure/temperature conditions of CO₂ compression. They provide highly efficient lubrication for R744 compressors, with optimised levels of refrigerant miscibility to ensure wear protection even under the highest levels of CO₂ dilution, where alternate lubricants may demonstrate loss in hydrodynamic and boundary lubrication:

### Features
- Double end-capped PAG for optimised CO₂ miscibility
- Exceptional load bearing (EP) properties
- Thermal, chemical and hydrolytic stability
- Reduced water absorbance tendency
- System component compatibility
- High Viscosity Index/Low pour point

### Benefits
- Maximises oil return to the compressor for system efficiency, without loss of hydrodynamic/boundary lubrication properties
- Lubrication properties are not compromised even under elevated pressure and temperature conditions
- Prolongs stable operating conditions, minimises sludge and deposit formation, reduces downtime and lowers maintenance costs
- Minimised water ingress compared to alternate R744 technologies
- Compatible with all metallic and elastomeric components commonly employed for maximised system stability and extended life
- Ensures high system efficiency and no compromise in lubrication at temperature extremes

Our ZEROL RFL-EP range is extensively OEM approved for established applications utilising R744 (e.g. commercial and industrial stationary systems) and is available in the following grades:

- ZEROL RFL 46-EP
- ZEROL RFL 68-EP
- ZEROL RFL 100-EP
- ZEROL RFL 150-EP

**For HFO-1234yf refrigerant based systems:**

**ZEROL® HD**

With increasing emphasis being placed on the use of more environmentally conscious refrigerants in the refrigeration and air conditioning industry, the mobile sector has pioneered the potential use of Hydro Fluoro Olefin (HFO) technology as a lower cost alternative to natural refrigerants such as CO₂. The mobile air conditioning industry is in the final stages of validating this refrigerant as the primary technology to replace R134a.

Shrieve has participated proactively throughout the industry during this period of refrigerant validation and developed the synthetic lubricant solutions specifically required to meet the performance parameters for mobile HFO-1234yf based applications.

The ZEROL HD range is based on double end-capped PAG technology optimised specifically to maximise performance in HFO-1234yf. These lubricants offer the highest levels of system efficiency and contain additisation technology specifically developed to ensure thermal, chemical and hydrolytic system stability is maintained in HFO-1234yf applications.
**ZEROL® HD (continued)**

Our ZEROL® HD range complies with the performance specifications being established by leading compressor OEMs for lubricants to be utilised with HFO-1234yf, and is available in the following grades:

- ZEROL HD46
- ZEROL HD100

*Further viscosity grades can be implemented as required.

**For hybrid/electrically driven R134a systems:**

**ZEROL® HYBRID**

An increasing industry trend towards hybrid and electrically driven vehicles has led to specific requirements for appropriate air conditioning lubricants. This requirement relates primarily to ensuring that electrical insulating properties of these lubricants are suitable for their application in electrically driven compressors where motor windings are in direct contact with the lubricant.

ZEROL HYBRID 46 is a polyalkylene glycol lubricant designed specifically for application in electrically driven mobile air conditioning compressors. It is manufactured to exacting standards that optimises the electrical properties of this lubricant for use in hybrid and electric systems.

**ZEROL HYBRID 46 advantages:**

- Compressor production plant complexity and dealership/workshop contamination issues can be avoided by the use of a single PAG type lubricant for both conventional belt driven and electrically driven MAC compressors. ZEROL HYBRID 46 is suitable for use in all belt driven systems and is compatible with all PAG technologies currently employed in belt driven compressors. The use of a single PAG technology therefore eliminates the safety hazard potentially posed by the contamination of a hybrid system with a lubricant not designed for application in a hybrid system.
- Suitable for use in R134a and R744 systems.
- Highly optimised product quality to ensure specification compliance with electrical property requirements for hybrid applications.
- Superior lubricity, viscosity index and chemical stability compared with non-PAG based technologies available for electrically driven systems.

POE lubricants have more typically been under adoption for hybrid/electric systems to date, since their usage has traditionally been associated with domestic hermetic systems where the possibility of current leakage from motor windings also exists. ZEROL ESTER 80H is a polyol ester based lubricant designed for use in hybrid and electric systems which require that only POE technology may be employed.

**ZEROL® lubricant technology application summary:**

<table>
<thead>
<tr>
<th>Lubricant required</th>
<th>Refrigerant</th>
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<tbody>
<tr>
<td></td>
<td>R134a belt driven</td>
</tr>
<tr>
<td>Premium PAG</td>
<td>ZEROL RFL-X</td>
</tr>
<tr>
<td>Standard PAG</td>
<td>ZEROL PAG</td>
</tr>
<tr>
<td>Polylol Ester (POE)</td>
<td>ZEROL ESTER</td>
</tr>
</tbody>
</table>
The ZEROL® product range can be offered in a variety of pack sizes to suit usage requirements.
For more information on our complete ZEROL lubricant range please contact us at any of the following regional locations:

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**Great Chemistry**

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