Lubrication Oil Filtration Systems for wind turbine gearboxes
Innovative functionality and reliability
– turn key gearbox filtration and lubrication systems

Efficient filtration technology and lubricating oil system cleanliness is essential in extending maintenance intervals and increasing equipment reliability. Parker’s combined gearbox lubrication filtration and cooling systems do just that.

Parker’s outstanding wind turbine experience and world leading technology in filtration solutions have convinced our customers of the system reliability. The integrated gearbox filtration and lubrication systems are available for wind turbines of capacity up to 7 megawatts.

Parker’s system-matched filtration solutions have proven to be effective to extend the life time of critical components such as bearings. Lightweight, compact designs and integrated fluid functionality reduce possible leakage points. Integrated system consists of decreased number of components and less connections with piping and fitting. Electric system solutions are connected to terminal boxes. High flow and low differential pressure provide class leading filtration performance also in extreme conditions. Systems are designed for easy installation and maintenance.

Pump-motor filter assembly
FMB Modular Filter Manifold Block
Early warning system

Energy efficiency and savings

New developments related to next generation media
• Includes new fibre compositions
• Focus on improved particle distribution for maintaining low constant pressure drop combined with extended life time
• Increased effective filtration media in similar space envelope
Safety and savings with condition monitoring
Parker’s innovative Condition Monitoring System integrates real-time accurate and low cost monitoring of the lubrication fluids condition. System condition monitoring and high quality filtration and cooling components extend gearbox life time and bring savings in maintenance and service costs.

Reliable partner for reliable systems
Parker provides turn key solutions with the full project responsibility – tailored design, selecting and sampling of components, time-saving kitting and pre-assembly, multiple test points and installation. Reliable functionality is assured with compatible, high quality Parker components.

Take a step to higher productivity. Parker’s advanced solutions are available world wide with support from centres of excellence in US, Europe and Asia.

Standard filtration and cooling solutions
- Gear pump with electrical 2-speed motor
- System pressure relief valve
- 5 or 10 micron filter
- Temperature control valve
- Oil cooler

Extensions of standard solutions
- Integrated manifold designs for higher power rates
- External or internal heating units
- Piping and connections
- Measuring devices for temperature, pressure and cleanliness of the oil
- Assembly on the customer site by Parker representatives
- Reservoir accessories
- Pre-connected low and high voltage cables
- Condition monitoring devices

Environmental Condition Variances
Cold climate condition requirements:
- External heating system (5/10/15 kW)
- Heating system in suction lines
- Trace heating for electrically driven pump

Hot climate condition requirements:
- Increased cooler capacity
## Standard solutions for wind turbine gearbox lubrication

<table>
<thead>
<tr>
<th>Turbine gearbox power</th>
<th>Main specification for lubricating and cooling system</th>
<th>Electrically driven pump</th>
<th>Mechanically driven pump</th>
<th>Integrated filter functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0 MW</strong></td>
<td>Heat loss 30kW</td>
<td>Cast iron pump: PG-P350A178ERAB0511</td>
<td>Bi-directional pump: KF32</td>
<td>Filter element length 1</td>
</tr>
<tr>
<td></td>
<td>Max pressure 15 bar</td>
<td>Volumetric displacement: 21cc</td>
<td>Volumetric displacement: 32cc</td>
<td>Number of filter housings 1</td>
</tr>
<tr>
<td></td>
<td>Cleanliness level -15/13 (ISO DIN 4406)</td>
<td>Motor power: 1.0kW/1.5kW, 2-speed IEC 100 LX 8-4</td>
<td>Nominal speed 1500rpm</td>
<td>Secondary element 50μm</td>
</tr>
<tr>
<td></td>
<td>Oil ISO VG320</td>
<td>Voltage: 400/690 VAC, 50/60Hz</td>
<td>Max speed 2000rpm</td>
<td>By pass valve opening 5 bar</td>
</tr>
<tr>
<td></td>
<td>ORDER CODE: LOFS10-S001</td>
<td>Viscosity: 5000cSt (0°C)</td>
<td>Viscosity: 20000cSt (0°C)</td>
<td>Δp indication at 3 bar</td>
</tr>
<tr>
<td><strong>1.5 MW</strong></td>
<td>Heat loss 45kW</td>
<td>Cast iron pump: PG-P350A178ERAB1011</td>
<td>Bi-directional pump KF50</td>
<td>Filter element length 1</td>
</tr>
<tr>
<td></td>
<td>Flow 125 l/min (pump ratio 40/60)</td>
<td>Volumetric displacement: 42cc</td>
<td>Volumetric displacement: 50.2cc</td>
<td>Number of filter housings 1</td>
</tr>
<tr>
<td></td>
<td>Max pressure 15 bar</td>
<td>Motor power: 2.2kW/3.3kW, 2-speed IEC 132 S 8-4</td>
<td>Nominal speed 1500rpm</td>
<td>Secondary element 50μm</td>
</tr>
<tr>
<td></td>
<td>Cleanliness level -15/13 (ISO DIN 4406)</td>
<td>Voltage: 400/690 VAC, 50/60Hz</td>
<td>Max speed 2000rpm</td>
<td>By pass valve opening 5 bar</td>
</tr>
<tr>
<td></td>
<td>Oil ISO VG320</td>
<td>Viscosity: 5000cSt (0°C)</td>
<td>Viscosity: 20000cSt (0°C)</td>
<td>Δp indication at 3 bar</td>
</tr>
<tr>
<td></td>
<td>ORDER CODE: LOFS15-S001</td>
<td>Max pressure 15 bar</td>
<td>System pressure valve 15 bar</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cleanliness level -/15/13 (ISO DIN 4406)</td>
<td>Temperature control valve opening 45°C</td>
<td>Order code: FMBC1H10QBBF3SSR32E4</td>
</tr>
<tr>
<td><strong>2.0 MW</strong></td>
<td>Heat loss 60kW</td>
<td>Cast iron pump: PG-P350A178ERAB1211</td>
<td>Bi-directional pump SS-20-200</td>
<td>Filter element length 1</td>
</tr>
<tr>
<td></td>
<td>Flow 160 l/min (pump ratio 40/60)</td>
<td>Volumetric displacement: 52cc</td>
<td>Volumetric displacement: 68cc</td>
<td>Number of filter housings 1</td>
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<tr>
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<td>Max pressure 15 bar</td>
<td>Motor power: 2.2kW/3.3kW, 2-speed IEC 132 M 8-4</td>
<td>Nominal speed 1500rpm</td>
<td>Secondary element 50μm</td>
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<td>Cleanliness level -15/13 (ISO DIN 4406)</td>
<td>Voltage: 400/690 VAC, 50/60Hz</td>
<td>Max speed 2000rpm</td>
<td>By pass valve opening 5 bar</td>
</tr>
<tr>
<td></td>
<td>Oil ISO VG320</td>
<td>Viscosity: 5000cSt (0°C)</td>
<td>Viscosity: 20000cSt (0°C)</td>
<td>Δp indication at 3 bar</td>
</tr>
<tr>
<td></td>
<td>ORDER CODE: LOFS20-S001</td>
<td>Max pressure 15 bar</td>
<td>System pressure valve 15 bar</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cleanliness level -/15/13 (ISO DIN 4406)</td>
<td>Temperature control valve opening 45°C</td>
<td>Order code: FMBC2H10QBBF3SSR32E4</td>
</tr>
<tr>
<td><strong>3.0 MW</strong></td>
<td>Heat loss 100kW</td>
<td>Cast iron pump: PG-P350A178ERAB1511</td>
<td>Bi-directional pump SS-20-250</td>
<td>Filter element length 1</td>
</tr>
<tr>
<td></td>
<td>Flow 220 l/min (pump ratio 40/60)</td>
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<td>Volumetric displacement: 83cc</td>
<td>Number of filter housings 1</td>
</tr>
<tr>
<td></td>
<td>Max pressure 15 bar</td>
<td>Motor power: 2.6kW/4.2kW, 2-speed IEC 132 M 8-4</td>
<td>Nominal speed 1500rpm</td>
<td>Secondary element 50μm</td>
</tr>
<tr>
<td></td>
<td>Cleanliness level -15/13 (ISO DIN 4406)</td>
<td>Voltage: 400/690 VAC, 50/60Hz</td>
<td>Max speed 2000rpm</td>
<td>By pass valve opening 5 bar</td>
</tr>
<tr>
<td></td>
<td>Oil ISO VG320</td>
<td>Viscosity: 5000cSt (0°C)</td>
<td>Viscosity: 20000cSt (0°C)</td>
<td>Δp indication at 3 bar</td>
</tr>
<tr>
<td></td>
<td>ORDER CODE: LOFS30-S001</td>
<td>Max pressure 15 bar</td>
<td>System pressure valve 15 bar</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cleanliness level -/15/13 (ISO DIN 4406)</td>
<td>Temperature control valve opening 45°C</td>
<td>Order code: FMBC1H10QBBF3SSR32E4</td>
</tr>
<tr>
<td><strong>3.6 MW</strong></td>
<td>Heat loss 120kW</td>
<td>Cast iron pump: PG-P350A178ERAB1611</td>
<td>Bi-directional pump SS-20-350</td>
<td>Filter element length 1</td>
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<tr>
<td></td>
<td>Flow 290 l/min (pump ratio 40/60)</td>
<td>Volumetric displacement: 84cc</td>
<td>Volumetric displacement: 116cc</td>
<td>Number of filter housings 2 in manifold</td>
</tr>
<tr>
<td></td>
<td>Max pressure 15 bar</td>
<td>Motor power: 4.0kW/6.0kW, 2-speed IEC 132 MX 8-4</td>
<td>Nominal speed 1500rpm</td>
<td>Main element 10μm</td>
</tr>
<tr>
<td></td>
<td>Cleanliness level -15/13 (ISO DIN 4406)</td>
<td>Voltage: 400/690 VAC, 50/60Hz</td>
<td>Max speed 2000rpm</td>
<td>Secondary element 50μm</td>
</tr>
<tr>
<td></td>
<td>Oil ISO VG320</td>
<td>Viscosity: 5000cSt (0°C)</td>
<td>Viscosity: 20000cSt (0°C)</td>
<td>Δp indication at 3 bar</td>
</tr>
<tr>
<td></td>
<td>ORDER CODE: LOFS36-S001</td>
<td>Max pressure 15 bar</td>
<td>System pressure valve 15 bar</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Cleanliness level -/15/13 (ISO DIN 4406)</td>
<td>Temperature control valve opening 45°C</td>
<td>Order code: FMBC2H10QBBF3SSR32E4</td>
</tr>
<tr>
<td><strong>5.0 MW</strong></td>
<td>Heat loss 180kW</td>
<td>Cast iron pump: PG-P365A178ERAB2111</td>
<td>Bi-directional pump SS-20-450</td>
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<tr>
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<td>Flow 390 l/min (pump ratio 40/60)</td>
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<td>Volumetric displacement: 149cc</td>
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<tr>
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<td>Max pressure 15 bar</td>
<td>Motor power: 5.0kW/7.8kW, 2-speed IEC160 M 8-4</td>
<td>Nominal speed 1500rpm</td>
<td>Main element 10μm</td>
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<td>Cleanliness level -15/13 (ISO DIN 4406)</td>
<td>Voltage: 400/690 VAC, 50/60Hz</td>
<td>Max speed 2000rpm</td>
<td>Secondary element 50μm</td>
</tr>
<tr>
<td></td>
<td>Oil ISO VG320</td>
<td>Viscosity: 5000cSt (0°C)</td>
<td>Viscosity: 20000cSt (0°C)</td>
<td>Δp indication at 3 bar</td>
</tr>
<tr>
<td></td>
<td>ORDER CODE: LOFS50-S001</td>
<td>Max pressure 15 bar</td>
<td>System pressure valve 15 bar</td>
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</tr>
<tr>
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<td>Cleanliness level -/15/13 (ISO DIN 4406)</td>
<td>Temperature control valve opening 45°C</td>
<td>Order code: FMBC3H10QBBF3SSR32E4</td>
</tr>
</tbody>
</table>
### Cation Oil Filtration and Cooling Systems

<table>
<thead>
<tr>
<th>Cooler (as examples)</th>
<th>Oil Reservoir as Part of Gearbox Casting</th>
<th>Oil Reservoir as Separate Tank</th>
<th>Example of Main Component Assemblies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type: oil/air</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of coolers: 1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Max working pressure: 20 bar</td>
<td>Typical oil volume: 260 litres</td>
<td>Typical oil volume: 260 litres</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>By pass setting: 5 bar</td>
<td>Necessary accessories:</td>
<td>Necessary accessories:</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Normal &amp; cold climate up to 35°C</td>
<td>- immersion heaters</td>
<td>- immersion heaters</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>LAC-033-4 (27.5kW)</td>
<td>- oil level sensor</td>
<td>- oil level sensor</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Hot climate up to 45°C</td>
<td>- temperature probe</td>
<td>- temperature probe</td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
<tr>
<td>LAC-058-6 (30kW)</td>
<td>- drain valve</td>
<td>- drain valve</td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td>- sight glass</td>
<td>- sight glass</td>
<td><img src="image7.png" alt="Image" /></td>
</tr>
<tr>
<td><strong>Type: oil/air</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of coolers: 1</td>
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<td></td>
<td></td>
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<td>Max working pressure: 20 bar</td>
<td>Typical oil volume: 440 litres</td>
<td>Typical oil volume: 440 litres</td>
<td><img src="image8.png" alt="Image" /></td>
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<td>By pass setting: 5 bar</td>
<td>Necessary accessories:</td>
<td>Necessary accessories:</td>
<td><img src="image9.png" alt="Image" /></td>
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<tr>
<td>Normal &amp; cold climate up to 35°C</td>
<td>- immersion heaters</td>
<td>- immersion heaters</td>
<td><img src="image10.png" alt="Image" /></td>
</tr>
<tr>
<td>LAC-078-6 (50kW)</td>
<td>- oil level sensor</td>
<td>- oil level sensor</td>
<td><img src="image11.png" alt="Image" /></td>
</tr>
<tr>
<td>Hot climate up to 45°C</td>
<td>- temperature probe</td>
<td>- temperature probe</td>
<td><img src="image12.png" alt="Image" /></td>
</tr>
<tr>
<td>LAC-098-6 (45kW)</td>
<td>- drain valve</td>
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<td>- sight glass</td>
<td>- sight glass</td>
<td><img src="image14.png" alt="Image" /></td>
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<tr>
<td></td>
<td>- compensator</td>
<td>- compensator</td>
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</tr>
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<td></td>
<td>- inspection covers</td>
<td>- inspection covers</td>
<td><img src="image16.png" alt="Image" /></td>
</tr>
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<td><strong>Type: oil/air</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of coolers: 2</td>
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<td></td>
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<tr>
<td>Max working pressure: 20 bar</td>
<td>Typical oil volume: 560 litres</td>
<td>Typical oil volume: 560 litres</td>
<td><img src="image17.png" alt="Image" /></td>
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<td>By pass setting: 5 bar</td>
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<td><img src="image18.png" alt="Image" /></td>
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<td>Normal &amp; cold climate up to 35°C</td>
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<td><img src="image19.png" alt="Image" /></td>
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<td>LAC-033-4 (27.5kW)</td>
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<td><img src="image20.png" alt="Image" /></td>
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<tr>
<td>Hot climate up to 45°C</td>
<td>- temperature probe</td>
<td>- temperature probe</td>
<td><img src="image21.png" alt="Image" /></td>
</tr>
<tr>
<td>LAC-058-6 (30kW)</td>
<td>- drain valve</td>
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<td><img src="image22.png" alt="Image" /></td>
</tr>
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<td>- sight glass</td>
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<td></td>
</tr>
<tr>
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<tr>
<td>Max working pressure: 20 bar</td>
<td>Typical oil volume: 770 litres</td>
<td>Typical oil volume: 770 litres</td>
<td><img src="image26.png" alt="Image" /></td>
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<td>Normal &amp; cold climate up to 35°C</td>
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<td>- immersion heaters</td>
<td><img src="image28.png" alt="Image" /></td>
</tr>
<tr>
<td>LAC-078-6 (50kW)</td>
<td>- oil level sensor</td>
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<td><img src="image29.png" alt="Image" /></td>
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<td>- temperature probe</td>
<td>- temperature probe</td>
<td><img src="image30.png" alt="Image" /></td>
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<tr>
<td>LAC-098-6 (45kW)</td>
<td>- drain valve</td>
<td>- drain valve</td>
<td><img src="image31.png" alt="Image" /></td>
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<td>- sight glass</td>
<td>- sight glass</td>
<td><img src="image32.png" alt="Image" /></td>
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<td>- compensator</td>
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<td>- inspection covers</td>
<td>- inspection covers</td>
<td><img src="image34.png" alt="Image" /></td>
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<tr>
<td><strong>Type: oil/water</strong></td>
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<tr>
<td>Number of coolers: 1</td>
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<tr>
<td>Max working pressure: 16 bar</td>
<td>Typical oil volume: 1000 litres</td>
<td>Typical oil volume: 1000 litres</td>
<td><img src="image35.png" alt="Image" /></td>
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<tr>
<td>By pass setting: 5 bar</td>
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<tr>
<td>Inlet water temp: 50°C (typical)</td>
<td>- immersion heaters</td>
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<td><img src="image37.png" alt="Image" /></td>
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<tr>
<td>GCD-016-M-5-P-111-151786</td>
<td>- oil level sensor</td>
<td>- oil level sensor</td>
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<td>(120kW)</td>
<td>- temperature probe</td>
<td>- temperature probe</td>
<td><img src="image39.png" alt="Image" /></td>
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<td>- drain valve</td>
<td>- drain valve</td>
<td><img src="image40.png" alt="Image" /></td>
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<td>- sight glass</td>
<td>- sight glass</td>
<td><img src="image41.png" alt="Image" /></td>
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<td>- compensator</td>
<td>- compensator</td>
<td><img src="image42.png" alt="Image" /></td>
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<td>- inspection covers</td>
<td>- inspection covers</td>
<td><img src="image43.png" alt="Image" /></td>
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<td><strong>Type: oil/water</strong></td>
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<td></td>
</tr>
<tr>
<td>Number of coolers: 2</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Max working pressure: 16 bar</td>
<td>Typical oil volume: 1400 litres</td>
<td>Typical oil volume: 1400 litres</td>
<td><img src="image44.png" alt="Image" /></td>
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<td>By pass setting: 5 bar</td>
<td>Necessary accessories:</td>
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</tr>
<tr>
<td>Inlet water temp: 50°C (typical)</td>
<td>- immersion heaters</td>
<td>- immersion heaters</td>
<td><img src="image46.png" alt="Image" /></td>
</tr>
<tr>
<td>GCD-016-M-5-P-111-151786</td>
<td>- oil level sensor</td>
<td>- oil level sensor</td>
<td><img src="image47.png" alt="Image" /></td>
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<tr>
<td>(120kW)</td>
<td>- temperature probe</td>
<td>- temperature probe</td>
<td><img src="image48.png" alt="Image" /></td>
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<tr>
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<td>- drain valve</td>
<td>- drain valve</td>
<td><img src="image49.png" alt="Image" /></td>
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<td>- sight glass</td>
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<tr>
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<td>- compensator</td>
<td>- compensator</td>
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<td>- inspection covers</td>
<td>- inspection covers</td>
<td><img src="image52.png" alt="Image" /></td>
</tr>
</tbody>
</table>
Turn key application solution

The system is designed and built using high quality Parker compatible components.

1. Hose fittings
   - Chrome 6-free fittings
   - Several elbow options
   - Available in several connection types
   - Together with Parker hoses ensure leakfree connections between components

2. Mechanically driven pump
   - External gear pump with cast iron housing
   - Direct drive from gearbox to secure oil delivery during idling
   - Excellent suction capabilities with high viscosity oils

3. Electrically driven oil pump
   - High performance gear pump with cast iron housing
   - Excellent suction capabilities with high viscosity oils
   - One or two speed electrical motors with heating for cold climate installations
   - Frequency drive as option for optimized flow control

4. Suction hoses
   - Specially designed for high viscosity applications
   - Low friction to avoid pressure losses

5. Filter manifold
   - 5 or 10 micron filtration with integrated bypass filtration with low pressure drop and high dirt holding capacity
   - Two different element lengths
   - Integrated differential pressure switch / sensor
   - Integrated pressure and temperature control valves
   - Modular construction
   - Optional offline filter module without additional pump-motor assembly
   - No tools required for element change

6. Flow and temperature control valves
   - Cartridge type valves designed for high viscosity fluids
   - Low pressure drop with minimized hysteresis
   - Surface or block mounted
   - LVDT sensors as option

7. Temperature controller
   - Available as tank mounted or online
   - Analogue 4...20 mA signal with local display
   - Programmable limit switches for alarm functions

8. Pressure hoses
   - Minimized bend radius
   - High abrasion resistance
   - World wide availability

9. Coolers
   - Air or water cooled heat exchangers
   - Corrosion resistant materials
   - Low pressure drop with high cooling capacity
   - Low noise levels
   - By pass valve as option

10. Ball valves
    - Available in several different sizes
    - Special seals for cold climate conditions

11. Oil level sight glasses
    - Rigid design for visual oil level monitoring
    - Available with integrated temperature indicator
    - Several heights ensures right monitoring levels

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16. Oil level sight glasses
    - Rigid design for visual oil level monitoring
    - Available with integrated temperature indicator
    - Several heights ensures right monitoring levels
Pressure sensors
- High linearity sensors
- Long term stability
- Excellent interference resistance
- Several pressure sensing levels
- Output with 4...20mA or 0...10V

Air Filters
- Highly efficient contaminant removal
- Changeable filter element
- Desiccant type moisture removal as option

Connectors and Fittings
- Leak free connections with soft seal arrangement without retightening
- High corrosion resistant
- Chrome 6 – free coating

Terminal boxes
- low and high voltage cables pre-connected in terminal box for easy access

External heater
- Highly efficient heating for cold climate applications
- 5, 10 and 15kW versions as standard
- High efficiency gear pump with excellent suction capabilities up to 20000 cSt
- Equipped with pressure sensor to ensure reliable operation

Oil tank
- Specially designed for customised needs including offshore requirements
- Optimised internal oil movement with highly efficient air removal function
- Including submersible heaters, level gauges and controllers, drain valves, manholes, flexible connections, etc

Level controller
- Reliable analogue measurement for reservoir oil level even for high viscosity fluids
- Local level display in millimetres, inches or as percent of set max level
- Analogue 4...20 mA signal for continuous measurement
- Analogue 4...20 mA signal with local display

Early Warning System
- Reliable online oil cleanliness measurement for high viscosity fluids
- Moisture sensor as option
- Measurement either from the tank or directly from the system

Parker provides a complete system solution and takes responsibility of design, functionality and reliability of the lubrication system. Furthermore, with project management, system condition monitoring and global after sales service, Parker provides the Total Health Management System, which frees our customers’ resources and helps ensure operation without downtime.

Parker solutions meet every need – from component supply to total health management.
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