Oil Coolers For Temperature Optimization In Hydraulic Systems

Catalog HY10-1700/Americas
WARNING

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## Table of Contents

Oil Coolers ........................................................................................................ 4

More Cooling Per $........................................................................................................... 6

**ULAC With AC Motor** ....................................................................................... 9
  - Cooling Performance ......................................................................................... 10
  - Pressure Drop .................................................................................................. 11
  - Dimensions ...................................................................................................... 12
  - Order Key and Technical Specifications ..................................................... 14

**ULOC Cooling System** .................................................................................... 15
  - Cooling Performance ......................................................................................... 16
  - Dimensions ...................................................................................................... 17
  - Order Key and Technical Specifications ..................................................... 18

**ULDC With DC Motor** ................................................................................... 19
  - Cooling Performance ......................................................................................... 20
  - Pressure Drop .................................................................................................. 20
  - Dimensions ...................................................................................................... 21
  - Order Key and Technical Specifications ..................................................... 22

**ULHC With Hydraulic Motor** .......................................................................... 23
  - Cooling Performance ......................................................................................... 24
  - Pressure Drop .................................................................................................. 25
  - Dimensions ...................................................................................................... 26
  - Order Key and Technical Specifications ..................................................... 28

**OAW Cooling System** .................................................................................... 29
  - General ............................................................................................................ 30
  - Cooling Performance, Pressure Drop, Dimensions ...................................... 31
  - Installation ........................................................................................................ 34

**Accessories** ............................................................................................................. 37

**Cooling Modules/Combination Cooler** ......................................................... 38

**Product Groups** .................................................................................................. 39
Choosing the right cooler requires precise system sizing. The most reliable way to size a cooler is with the aid of our calculation program. This program, together with precise evaluations from our experienced, skilled engineers, gives you the opportunity for more cooling per $ invested.

**Overheating – an expensive problem**
An underestimated cooling capacity produces a temperature that is too high. The consequences are poor lubricating properties, higher internal leakage, a higher risk of cavitation, damaged components, etc. Overheating leads to a significant drop in efficiency which can be detrimental to our environment.

**Temperature optimization – a basic prerequisite for cost-efficient operation**
Temperature balance in a hydraulic system occurs when the cooler can cool down the energy input that the system does not consume – the system’s lost energy ($P_{loss} = P_{cool} = P_{in} - P_{used}$).

Temperature optimization occurs at the temperature at which the oil viscosity is maintained at recommended values. The correct working temperature produces a number of economic and environmental benefits:

- The hydraulic system’s useful life is extended.
- The oil’s useful life is extended.
- The hydraulic system’s availability increases – more operating time and fewer shutdowns.
- Service and repair costs are reduced.
- High efficiency level maintained in continuous operation – the system’s efficiency falls if the temperature exceeds the ideal working temperature.

Oil Coolers

Parker is a global player specializing in innovative, efficient system solutions for temperature optimization and energy storage. All over the world, our products are working in the most diverse environments and applications.
### ULAC with AC Motor
For industrial use – maximum cooling capacity 400 HP*

- Optimized design with the right choice of materials and components ensures reliable and long lasting cooling with low service and maintenance costs.
- Compact design results in a lighter weight unit with higher cooling capacity and lower pressure drop.
- Easy to maintain and easy to retrofit into many applications.
- Quiet fan design due to optimization of material and blade.
- AC motor – NEMA three phase motors are standard. A wide range of operating voltages and frequencies available.
- Cooler core with low pressure drop and high cooling capacity.

### ULOC Cooling System
For industrial use – maximum cooling capacity 60 HP

- Optimized design and the right choice of materials and components produce a long useful life, high availability and low service and maintenance costs.
- Integrated circulation pump produces an even flow with low pressure pulsations.
- Easy to maintain and easy to retrofit in many applications.
- Compact design and low weight.
- Quiet fan and pump.
- Cooler core with low pressure drop and high cooling capacity.

### ULDC with DC Motor
For mobile use – maximum cooling capacity 40 HP

- Optimized design with the right choice of materials and components ensures reliable and long lasting cooling with low service and maintenance costs.
- Compact design results in a lighter weight unit with higher cooling capacity and lower pressure drop.
- Easy to maintain and easy to retrofit into many applications.
- DC motor 12V/24V
- Quiet fan and fan motor.

### ULHC with Hydraulic Motor
For mobile and industrial use – maximum cooling capacity 215 HP

- Optimized design and the right choice of materials and components produce a long useful life, high availability and low service and maintenance costs.
- Compact design results in a lighter weight unit with higher cooling capacity and lower pressure drop.
- Easy to maintain and easy to retrofit into many applications.
- Hydraulic motor with displacement from 8.4 cc/rev to 25.2 cc/rev.
- Collar bearing for fan motor on larger models provides longer operating life.
- Quiet fan design due to optimization of material and blade.
- Cooler core with low pressure drop and high cooling capacity.

### OAW Cooling System
For mobile and industrial use – maximum cooling capacity 274 HP

- Optimized design and the right choice of materials and components ensures reliable and long lasting cooling with low service and maintenance costs.
- Compact design for easy installation.
- Turbulent water flow prevents clogging and reduces maintenance.
- Low water consumption for economical operation.
- SAE O-ring connections for ease of assembly and leak-proof operation.
- Maximum material efficiency with no “Dead Zone” outside gaskets.

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*At 250 gpm and 70 °F ITD
Optimal sizing produces efficient cooling.
Correct sizing requires knowledge and experience. Our calculation program, combined with our engineers’ support, gives you access to this very knowledge and experience. The result is more cooling per $ invested.

In-depth system review as an added value.
A more wide-ranging review of the hydraulic system is often a natural element of cooling calculations. Other potential system improvements can then be discussed – e.g. filtering, offline or online cooling, etc. Contact us for further guidance and information.

Parker’s quality and performance guarantee assures you of maximum system performance and reliability.
A continual desire for more cost efficient and environmentally friendly hydraulic systems requires continuous development.
Areas where we are continuously seeking to improve performance include cooling capacity, noise level, pressure drop and fatigue.

Meticulous quality and performance tests are conducted in our laboratory. All tests and measurements take place in accordance with standardized methods – cooling capacity in accordance with EN1048, noise level ISO 3743, pressure drop EN 1048 and fatigue ISO 10771-1.
For more information about our standardized tests, ask for “Parker’s blue book – a manual for more reliable cooler purchasing.”
Calculate the cooling capacity requirement

Cooling capacity requirement? → Installed horse power → Flow? Pressure? Pump efficiency? → Measure in your existing unit → Contact Parker USA representative

Theoretical horse power losses

Choose the right kind of cooler

Air Oil Cooler Calculation
ULAC, ULDC, ULHC and ULOC

www.parker.com

Enter your values ...

... get suggested solution
The ULAC oil cooler with AC motor is optimized for use in the industrial sector. Together with a wide range of accessories, the ULAC cooler is suitable for installation in most applications and environments.

- Optimized design with right choice of materials and components ensures a reliable and long lasting cooler with low service and maintenance costs.
- Compact design resulting in lighter weight unit yet with higher cooling capacity and lower pressure drop.
- Easy to maintain and easy to retrofit into many applications.
- Quiet fan design due to optimization of material and blade design.
- AC motor – NEMA three phase motors are standard. Wide range of operating voltages and frequencies available.
- Cooler core with low pressure drop and high cooling capacity.
ULAC Cooling Performance

The cooling capacity curves are based on an ETD (Entering Temperature Difference) of 1 °F. For example, oil temperature of 140 °F and air temperature of 70 °F yields a temperature difference of 70 °F. Multiply the number from the cooling graphs corresponding to the specific flow rate by the ETD for the particular application to get the total heat duty.

Cooling capacity tolerance ± 10%. 

COOLING PERFORMANCE  ULAC 007 - ULAC 023

COOLING PERFORMANCE  ULAC 033 - ULAC 112
Cooling performance & pressure drop ULAC 200 K

Cooling capacity tolerance ± 10%.

Pressure drop at 150 SSU (psi) vs Oil Flow Rate (gpm)

Pressure drop at 150 SSU (psi) vs Oil Flow Rate (gpm)

Pressure Drop Correction Factor* for other viscosities.

* Pressure Drop Correction Factor for other viscosities.
<table>
<thead>
<tr>
<th>TYPE</th>
<th>Acoustic Pressure Level LpA dB(A) 3 Ft.*</th>
<th>No. Of Poles/ Capacity HP*</th>
<th>Weight Lbs. (Approx.)</th>
<th>P SAE O-Ring</th>
<th>Q SAE O-Ring Boss</th>
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</thead>
<tbody>
<tr>
<td>ULAC 007B</td>
<td>69</td>
<td>4/0.5</td>
<td>33</td>
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<td>1&quot; (#16)</td>
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<tr>
<td>ULAC 011B</td>
<td>71</td>
<td>4/0.5</td>
<td>44</td>
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<td>1&quot; (#16)</td>
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<td>1&quot; (#16)</td>
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<tr>
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<td>4/1</td>
<td>79</td>
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<td>1&quot; (#16)</td>
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<tr>
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<td>4/1</td>
<td>115</td>
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<td>1½&quot; (#20)</td>
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<td>1½&quot; (#20)</td>
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<tr>
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<td>1½&quot; (#20)</td>
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<tr>
<td>ULAC 078G</td>
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<td>¾&quot; (#12)</td>
<td>1½&quot; (#24)</td>
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<td>ULAC 112H</td>
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<td>542</td>
<td>¾&quot; (#12)</td>
<td>1½&quot; (#24)</td>
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<tr>
<td>ULAC 200K</td>
<td>93</td>
<td>6/15</td>
<td>1,030</td>
<td>NA</td>
<td>CODE 61 SAE 2&quot; FLANGE</td>
</tr>
</tbody>
</table>

*Noise level tolerance ± 3 dB(A).
All dimensions listed above are in inches.
### Technical Specifications

#### FLUID COMBINATIONS
- Mineral oil
- Oil/water emulsion
- Water glycol
- Phosphate ester

#### MATERIAL
- Cooler core: Aluminum
- Fan blades/hub: Glass fiber reinforced polypropylene/Aluminum
- Fan housing: Steel
- Fan guard: Steel
- Other parts: Steel
- Surface treatment: Electrostatically powder-coated

#### COOLER CORE
- Maximum static working pressure: 300 psi
- Dynamic working pressure: 200 psi*
- Heat transfer tolerance: ± 6 %
- Maximum oil inlet temperature: 250 °F
  *(Tested in accordance with ISO/DIS 10771-1)

#### COOLING CAPACITY CURVES
Cooling capacity curves are based on testing in accordance with EN1048 with ISO VG 46.

#### CONTACT PARKER FOR ADVICE ON
- Oil temperatures > 250 °F
- Oil viscosity > 100 cSt / 500 SSU
- Aggressive environments
- Environments with heavy airborne particulates
- High-altitude locations

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**Order Key for ULAC Oil Coolers**

All positions must be filled in when ordering.

<table>
<thead>
<tr>
<th>EXAMPLE:</th>
<th>ULAC</th>
<th>007B</th>
<th>- M</th>
<th>- 100</th>
<th>- SA</th>
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<tbody>
<tr>
<td>Series</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

1. **OIL COOLER SERIES WITH AC MOTOR; ULAC**

2. **MOTOR TYPE**
   - No motor = W
   - Three-phase 190/380V 50 Hz, 208-230/460V 60 Hz = M
   - Three-phase 208-230/460V 60 Hz = N
   - Three-phase 230/460V 60 Hz = P
   - Three-phase 575V 60 Hz = Q
   - Single-phase 115/230V 60 Hz = R
   - Single-phase 230 V 60 Hz = S

3. **THERMOSWITCH**
   - No thermoswitch = 000
   - 100 °F = 100
   - 120 °F = 120
   - 140 °F = 140
   - 160 °F = 160
   - 175 °F = 175
   - 195 °F = 195

4. **CORE BYPASS**
   - No Bypass = SW
   - 20 psi External Hose Bypass (standard option) = SA
   - 65 psi External Hose Bypass (standard option) = SB
   - 30 psi External Tube Bypass = SG
   - 75 psi External Tube Bypass = SH
   - 120 psi External Tube Bypass = SJ
   - 120 °F External Thermo-Bypass = SM
   - 140 °F External Thermo-Bypass = SN
   - 160 °F External Thermo-Bypass = SP
   - 195 °F External Thermo-Bypass = SQ
   - Full Flow External Bypass = SF

*The standard cores are single pass. Two pass cores and other options available upon request, please consult Accumulator and Cooler Division.

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The information in this brochure is subject to change without prior notice.
ULOC Cooling System
For industrial use – cooling capacity up to 60 HP

The ULOC cooling system with three-phase AC motor is optimized for use in the industrial sector. The system is supplied ready for installation. An integrated circulation pump makes it possible to cool and treat the oil in a separate circuit – offline cooling. Together with a wide range of accessories, the ULOC cooling system is suitable for installation in most applications and environments.

- Optimized design with right choice of materials and components ensures a reliable and long lasting cooler with low service and maintenance costs.

- Integrated circulation pump produces an even flow with low pressure pulsations.

- Easy to maintain and easy to retrofit in many applications.

- Compact design and low weight.

- Quiet fan and fan motor.

- Cooler core with low pressure drop and high cooling capacity.
<table>
<thead>
<tr>
<th>TYPE</th>
<th>Nom. Oil Flow Rate (gpm)</th>
<th>Cooling Capacity at 50 °F ETD (Btu/hr)</th>
<th>Cooling Capacity Btu/hr/°F</th>
<th>Acoustic Pressure Level LpA dB(A) 3 ft. *</th>
<th>Motor Capacity / No. Of Poles HP</th>
<th>Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULOC 007D</td>
<td>A</td>
<td>6.3</td>
<td>15,500</td>
<td>310</td>
<td>71</td>
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<td>ULOC 007D</td>
<td>B</td>
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<td>19,000</td>
<td>380</td>
<td>71</td>
<td>1/4</td>
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<td>72</td>
<td>2/4</td>
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<td>ULOC 007E</td>
<td>D</td>
<td>25.4</td>
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<td>72</td>
<td>2/4</td>
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<td>74</td>
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<td>570</td>
<td>74</td>
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<td>640</td>
<td>74</td>
<td>2/4</td>
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<td>940</td>
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<td>1,600</td>
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<td>5/4</td>
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<td>25.4</td>
<td>105,000</td>
<td>2,100</td>
<td>88</td>
<td>5/4</td>
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</tbody>
</table>

Electric motors specified are calculated for max. Working pressure 90 psi at 125 cSt and 50 Hz, 60 psi at 125 cSt and 60 Hz.
If you require higher pressure, please contact us for a choice of motors with a higher output.

* Noise level tolerance ± 3 dB(A).
<table>
<thead>
<tr>
<th>TYPE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L0</th>
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<td>26.6</td>
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<td>0.35</td>
<td>1&quot; (#16)</td>
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<td>ULOC 007E - C</td>
<td>5.2</td>
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<td>15.6</td>
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<td>8.5</td>
<td>27.1</td>
<td>8.9</td>
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<td>1&quot; (#16)</td>
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<tr>
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<tr>
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<td>12.4</td>
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<td>24.0</td>
<td>17.4</td>
<td>33.9</td>
<td>13.5</td>
<td>0.55</td>
<td>1¼&quot; (#20)</td>
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</table>

* Port on the inlet side of the pump is 1½" (#24) SAE O-ring Boss for all models.
All dimensions listed above are in inches.
Order Key for ULOC Cooling Systems

All positions must be filled in when ordering.

**EXAMPLE:**

<table>
<thead>
<tr>
<th>ULOC</th>
<th>-</th>
<th>007D</th>
<th>-</th>
<th>M</th>
<th>-</th>
<th>A</th>
<th>-</th>
<th>SA</th>
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<tr>
<td>Series</td>
<td>Model</td>
<td>Motor Type</td>
<td>Pump Flow Rate</td>
<td>Core Bypass</td>
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<td></td>
<td></td>
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<td>1</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
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</table>

1. **OIL COOLER SERIES OFFLINE, WITH PUMP; ULOC**

2. **COOLER SIZE/MODEL**

   007D, 007E, 011D, 011E, 016E, 023F, 033G, 044G

3. **MOTOR TYPE**

   - No motor = W
   - Three phase, 190/380V 50 Hz, 208-230/460V 60Hz = M
   - Three phase, 575V 60Hz = Q
   - Not listed, consult Accumulator and Cooler Division = Z

   Performance at 50 Hz will be reduced by approximately 10%.

4. **PUMP FLOW RATE (GPM)**

   - 6 = A
   - 12 = B
   - 19 = C
   - 25 = D

5. **CORE BYPASS**

   - No Bypass = SW
   - 20 psi External Hose Bypass (standard option) = SA
   - 65 psi External Hose Bypass (standard option) = SB
   - 30 psi External Tube Bypass = SG
   - 75 psi External Tube Bypass = SH
   - 120 psi External Tube Bypass = SJ
   - 120 °F External Thermo-Bypass = SM
   - 140 °F External Thermo-Bypass = SN
   - 160 °F External Thermo-Bypass = SP
   - 195 °F External Thermo-Bypass = SQ

   *The standard cores are single pass. Two pass cores and other options available upon request, please consult Accumulator and Cooler Division.

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**Technical Specifications**

**COOLER CORE**

- Maximum static working pressure: 300 psi
- Dynamic working pressure: 200 psi*
- Heat transfer tolerance: ± 6 %
- Maximum oil inlet temperature: 250 °F

* Tested in accordance with ISO/DIS 10771-1

- ULOC is designed primarily for synthetic oils, vegetable oils and mineral oil type HL/HLP in accordance with DIN 51524. Maximum oil temperature 210 °F.
- Maximum negative pressure in the inlet line is 6 psi with an oil-filled pump. Maximum pressure on the pump’s suction side is 8 psi.
- Maximum working pressure for the pump is 150 psi.

Heat transfer tolerance: ± 6 %

**MATERIAL**

- Cooler core: Aluminum
- Fan blades/hub: Glass fiber reinforced polypropylene/Aluminum
- Fan housing: Steel
- Fan guard: Steel
- Pump housing: Aluminum
- Other parts: Steel
- Surface treatment: Electrostatically powder-coated

**CONTACT PARKER FOR ADVICE ON**

- Oil temperatures > 250 °F
- Oil viscosity > 100 cSt / 500 SSU
- Aggressive environments
- Environments with heavy airborne particulates
- High-altitude locations

---

The information in this brochure is subject to change without prior notice.
The ULDC oil cooler with 12 or 24V DC motor is optimized for use in the mobile industry. Together with a wide range of accessories, the ULDC cooler is suitable for installation in most applications and environments.

- Optimized design with right choice of materials and components ensures a reliable and long lasting cooler with low service and maintenance costs.

- Compact design resulting in lighter weight unit yet with higher cooling capacity and lower pressure drop.

- Easy to maintain and easy to retrofit into many applications.

- DC motor 12V/24V.

- Quiet fan and fan motor.
ULDC Cooling Performance

The cooling capacity curves are based on an ETD (Entering Temperature Difference) of 1 °F. For example, oil temperature of 140 °F and air temperature of 70 °F yields a temperature difference of 70 °F. Multiply the number from the cooling graphs corresponding to the specific flow rate by the ETD for the particular application to get the total heat duty.

**COOLING PERFORMANCE ULDC 003 - ULDC 033**

![Cooling performance graph](image)

Cooling capacity tolerance ± 10%.

**PRESSURE DROP**

![Pressure drop graph](image)

*Pressure Drop Correction Factor for other viscosities.*
<table>
<thead>
<tr>
<th>TYPE</th>
<th>Weight</th>
<th>Acoustic Pressure</th>
<th>Max. Current (Amps.)</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lbs (Approx.)</td>
<td>LpA dB(A) 3 Ft.*</td>
<td>12 Volts</td>
<td>24 Volts</td>
</tr>
<tr>
<td>ULDC 003</td>
<td>11</td>
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</tr>
<tr>
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<td>12</td>
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<tr>
<td>ULDC 020</td>
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<td>82</td>
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<tr>
<td>ULDC 033</td>
<td>66</td>
<td>75</td>
<td>20</td>
<td>12</td>
</tr>
</tbody>
</table>

All dimensions listed above are in inches.

* Noise level tolerance ± 3 dB(A).
** ULDC-023 & ULDC-033 Cooler assemblies come with two fans each. The indicated max. current is for one fan only.
Order Key for ULDC Oil Coolers
All positions must be filled in when ordering.

**Example:**

ULDC - 007 - A - 000 - SA

1. **OIL COOLER SERIES WITH DC MOTOR; ULDC**
2. **COOLER SIZE/MODEL**
   003, 004, 007, 011, 016, 020, 023, 033
3. **MOTOR VOLTAGE**
   12 V = A
   24 V = B
4. **THERMOSWITCH**
   No thermoswitch = 000
   100 °F = 100
   120 °F = 120
   140 °F = 140
   160 °F = 160
   175 °F = 175
   195 °F = 195
   Not listed, consult Accumulator and Cooler Division = ZZZ
5. **CORE BYPASS**
   No Bypass = SW
   20 psi External Hose Bypass (standard option) = SA
   65 psi External Hose Bypass (standard option) = SB
   30 psi External Tube Bypass = SG
   75 psi External Tube Bypass = SH
   120 psi External Tube Bypass = SJ
   120 °F External Thermo-Bypass = SM
   140 °F External Thermo-Bypass = SN
   160 °F External Thermo-Bypass = SP
   195 °F External Thermo-Bypass = SQ
   Full Flow External Bypass = SF

*The standard cores are single pass. Two pass cores and other options available upon request, please consult Accumulator and Cooler Division.

**Technical Specifications**

<table>
<thead>
<tr>
<th>FLUID COMBINATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral oil</td>
</tr>
<tr>
<td>Oil/water emulsion</td>
</tr>
<tr>
<td>Water glycol</td>
</tr>
<tr>
<td>Phosphate ester</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooler core</td>
</tr>
<tr>
<td>Fan blades/guard</td>
</tr>
<tr>
<td>Fan housing</td>
</tr>
<tr>
<td>Other parts</td>
</tr>
<tr>
<td>Surface treatment</td>
</tr>
<tr>
<td>Aluminum</td>
</tr>
<tr>
<td>Glass fiber reinforced polypropylene</td>
</tr>
<tr>
<td>Steel</td>
</tr>
<tr>
<td>Steel</td>
</tr>
<tr>
<td>Electrostatically powder-coated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COOLER CORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum static working pressure</td>
</tr>
<tr>
<td>Dynamic working pressure</td>
</tr>
<tr>
<td>Heat transfer tolerance</td>
</tr>
<tr>
<td>Maximum oil inlet temperature</td>
</tr>
</tbody>
</table>

*Tested in accordance with ISO/DIS 10771-1

<table>
<thead>
<tr>
<th>COOLING CAPACITY CURVES</th>
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</thead>
<tbody>
<tr>
<td>The cooling capacity curves in this catalogue are created using oil type ISO VG 46 at 250 °F.</td>
</tr>
</tbody>
</table>

**CONTACT PARKER FOR ADVICE ON**

- Oil temperatures > 250 °F
- Oil viscosity > 100 cSt / 500 SSU
- Aggressive environments
- Environments with heavy airborne particulates
- High-altitude locations

The information in this brochure is subject to change without prior notice.
ULHC With Hydraulic Motor
For mobile and industrial use – maximum cooling capacity 215 HP

The ULHC oil cooler with hydraulic motor is optimized for use in the mobile and industrial sector. Together with a wide range of accessories, the ULHC cooler is suitable for installation in most applications and environments.

- Optimized design with right choice of materials and components ensures a reliable and long lasting cooler with low service and maintenance costs.
- Compact design resulting in lighter weight unit yet with higher cooling capacity and lower pressure drop.
- Easy to maintain and easy to retrofit into many applications.
- Hydraulic motor with displacement from 8.4 cc/rev to 25.2 cc/rev.
- Collar bearing for fan motor on larger models provides longer operating life.
- Quiet fan design due to optimization of material and blade design.
- Cooler core with low pressure drop and high cooling capacity.
ULHC Cooling Performance

The cooling capacity curves are based on an ETD (Entering Temperature Difference) of 1 °F. For example, oil temperature of 140 °F and air temperature of 70 °F yields a temperature difference of 70 °F. Multiply the number from the cooling graphs corresponding to the specific flow rate by the ETD for the particular application to get the total heat duty.
Pressure drop at 150 SSU (psi)

Oil Flow Rate (gpm)

* Pressure Drop Correction Factor for other viscosities.
<table>
<thead>
<tr>
<th>TYPE</th>
<th>Fan Speed rpm</th>
<th>Fan Power HP</th>
<th>Weight lbs. (Approx.)</th>
<th>Max Speed rpm</th>
<th>Acoustic Pressure Level LpA dB(A) 3 Ft*</th>
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<td>22</td>
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<tr>
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*Noise level tolerance ± 3 dB(A).*

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<tr>
<th>MOTOR</th>
<th>Displacement cm³/r</th>
<th>N ULHC 007 - ULHC 023</th>
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<th>Max. Working Pressure psi</th>
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<td>B</td>
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### Motor Selection Table

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<th>D</th>
<th>E</th>
<th>F</th>
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<td>19.5</td>
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<td>11.6</td>
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<td>ULHC 078</td>
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<td>32.3</td>
<td>3.9</td>
<td>26.8</td>
<td>-</td>
<td>38.9</td>
<td>41.4</td>
<td>20.4</td>
<td>40.2</td>
<td>24.0</td>
<td>20.7</td>
</tr>
<tr>
<td>ULHC 112</td>
<td>5.1</td>
<td>38.8</td>
<td>3.9</td>
<td>31.1</td>
<td>0.2</td>
<td>45.4</td>
<td>47.8</td>
<td>23.6</td>
<td>46.7</td>
<td>24.0</td>
<td>23.9</td>
</tr>
</tbody>
</table>

All dimensions listed above are in inches.

---

### Motor Selection

<table>
<thead>
<tr>
<th>Type</th>
<th>L (Max)</th>
<th>M</th>
<th>P SAE O-ring</th>
<th>Q SAE O-ring Boss</th>
<th>Motor Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULHC 007</td>
<td>14.4</td>
<td>8.9</td>
<td>½&quot; (#8)</td>
<td>1&quot; (#16)</td>
<td>A - F</td>
</tr>
<tr>
<td>ULHC 011</td>
<td>15.3</td>
<td>9.8</td>
<td>½&quot; (#8)</td>
<td>1&quot; (#16)</td>
<td>A - F</td>
</tr>
<tr>
<td>ULHC 016</td>
<td>16.3</td>
<td>10.8</td>
<td>½&quot; (#8)</td>
<td>1&quot; (#16)</td>
<td>A - F</td>
</tr>
<tr>
<td>ULHC 023</td>
<td>16.6</td>
<td>11.1</td>
<td>½&quot; (#8)</td>
<td>1&quot; (#16)</td>
<td>A - F</td>
</tr>
<tr>
<td>ULHC 033</td>
<td>19.7</td>
<td>12.5</td>
<td>½&quot; (#8)</td>
<td>1¼&quot; (#20)</td>
<td>A - F</td>
</tr>
<tr>
<td>ULHC 044</td>
<td>20.7</td>
<td>13.5</td>
<td>½&quot; (#8)</td>
<td>1¼&quot; (#20)</td>
<td>A - F</td>
</tr>
<tr>
<td>ULHC 058</td>
<td>22.4</td>
<td>15.3</td>
<td>¾&quot; (#12)</td>
<td>1½&quot; (#24)</td>
<td>A - F</td>
</tr>
<tr>
<td>ULHC 078</td>
<td>21.4</td>
<td>16.3</td>
<td>¾&quot; (#12)</td>
<td>1½&quot; (#24)</td>
<td>B - F</td>
</tr>
<tr>
<td>ULHC 112</td>
<td>24.4</td>
<td>17.2</td>
<td>¾&quot; (#12)</td>
<td>1½&quot; (#24)</td>
<td>D - F</td>
</tr>
</tbody>
</table>
## Order Key for ULHC Oil Coolers

All positions must be filled in when ordering.

### EXAMPLE:

<table>
<thead>
<tr>
<th>ULHC</th>
<th>007</th>
<th>- A</th>
<th>120</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>Model</td>
<td>Hydraulic motor displacement</td>
<td>Thermoswitch</td>
<td>Core Bypass</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

### 1. OIL COOLER SERIES WITH HYDRAULIC MOTOR; ULHC

#### 2. COOLER SIZE/MODEL

007, 011, 016, 023, 033, 044, 058, 078 and 112.

### 3. HYDRAULIC MOTOR, DISPLACEMENT

- No hydraulic motor = W
- Displacement 8.4 cm³/rev. = A
- Displacement 10.8 cm³/rev. = B
- Displacement 14.4 cm³/rev. = C
- Displacement 16.8 cm³/rev. = D
- Displacement 19.2 cm³/rev. = E
- Displacement 25.2 cm³/rev. = F
- Not listed, consult Accumulator and Cooler Division = Z

### 4. THERMO CONTACT

- No thermoswitch = 000
- 100 °F = 100
- 120 °F = 120
- 140 °F = 140
- 160 °F = 160
- 175 °F = 175
- 195 °F = 195
- Not listed, consult Accumulator and Cooler Division = ZZZ

### 5. CORE BYPASS*

- No Bypass = SW
- 20 psi External Hose Bypass (standard option) = SA
- 65 psi External Hose Bypass (standard option) = SB
- 30 psi External Tube Bypass = SG
- 75 psi External Tube Bypass = SH
- 120 psi External Tube Bypass = SJ
- 120 °F External Thermo-Bypass = SM
- 140 °F External Thermo-Bypass = SN
- 160 °F External Thermo-Bypass = SP
- 195 °F External Thermo-Bypass = SQ
- Full Flow External Bypass = SF

*The standard cores are single pass. Two pass cores and other options available upon request, please consult Accumulator and Cooler Division.

---

## Technical Specifications

### FLUID COMBINATIONS

- Mineral oil
- Oil/water emulsion
- Water glycol
- Phosphate ester

### MATERIAL

- Cooler core: Aluminum
- Fan blades/Housing: Glass fiber reinforced polypropylene/Aluminum
- Fan housing: Steel
- Fan guard: Steel
- Other parts: Steel
- Surface treatment: Electrostatically powder-coated

### COOLER CORE

- Maximum static operating pressure: 300 psi
- Dynamic operating pressure: 200 psi*
- Heat transfer tolerance: ± 6 %
- Maximum oil inlet temperature: 250 °F

* Tested in accordance with ISO/DIS 10771-1

### COOLING CAPACITY CURVES

The cooling capacity curves in this catalog are being created using oil type ISO VG 46 at 140 °F.

### CONTACT PARKER FOR ADVICE ON

- Oil temperatures > 250 °F
- Oil viscosity > 100 cSt / 500 SSU
- Aggressive environments
- Environments with heavy airborne particulates
- High-altitude locations

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The information in this brochure is subject to change without prior notice.
OAW Water Oil Cooler
For mobile and industrial use

The OAW oil cooler is optimized for use in mobile and industrial sectors. Together with a wide range of accessories, the OAW cooler is suitable for installation in most applications and environments.

- Optimized design and the right choice of materials and components ensure reliable and long-lasting cooling with low service and maintenance costs.
- Compact design for easy installation.
- Turbulent water flow prevents clogging and reduces maintenance.
- Low water consumption for economical operation.
- SAE O-ring connections for ease of assembly and leak-proof operation.
- Maximum material efficiency with no “Dead Zone.”
General

Our OAW coolers are designed for a maximum working pressure of 450 psi. The most standard application for the OAW cooler involves a cold water circuit and a hot oil circuit. Fluids are not limited to oil and water however; see the Fluid Compatibility section in the OAW product literature for more information. Inlets and outlets are clearly identified by the Accumulator and Cooler Division sticker affixed to the front of the unit. When in doubt, pour a liquid in one of the connections and note which connection it comes out of. This will be the inlet and outlet for one circuit (either oil or water). The other inlet should be located on the diagonal from the first inlet. Maximum cooling efficiency is achieved by cross flowing through the plates, the oil inlet and water inlet being located on a diagonal.

OAW to the max.

- **Extremely Compact:**
  85-90% Reduction in volume and weight of a shell-and-tube heat exchanger of the same capacity.

- **Corrugated:**
  Plates made of 316 stainless steel brazed with pure copper.

- **SAE O-Ring Connections:**
  Good for ease of assembly and leak proof operation.

- **LOW WATER CONSUMPTION. ECONOMICAL OPERATION COMPACT.**

- **BROAD RANGE:**
  Several models in-stock for immediate delivery.

- **TURBULENT WATER FLOW PREVENTS CLOGGING AND REDUCES MAINTENANCE. SMALLER SIZE MAKES IT EASY TO INSTALL.**

- **Maximum Efficiency:**
  Maximum material efficiency. No “Dead Zone” because there is no need for gaskets. Up to 25% more capacity utilization.
OAW 14 & OAW 34

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Cooling Capacity (*hp)</th>
<th>Connection</th>
<th>A (inches)</th>
<th>Weight (lbs.)</th>
<th>Volume (in³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAW 14-10-SG</td>
<td>2-7</td>
<td>5/8&quot; SAE O-ring</td>
<td>1.4</td>
<td>1.4</td>
<td>15</td>
</tr>
<tr>
<td>OAW 34-20</td>
<td>6-33</td>
<td>1&quot; SAE O-ring</td>
<td>2.3</td>
<td>9</td>
<td>74</td>
</tr>
<tr>
<td>OAW 34-40</td>
<td>20-89</td>
<td>1&quot; SAE O-ring</td>
<td>4.1</td>
<td>15</td>
<td>149</td>
</tr>
</tbody>
</table>

*Cooling capacity is calculated with the following conditions. For other flow conditions, type of fluids or temperatures, please see page 35 or consult Accumulator and Cooler Division. Oil type – ISO VG 32 – Oil/water flow ratio – 2:1 – Oil inlet temperature – 140°F – Water inlet temperature – 80°F.
OAW 46 & OAW 61

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Cooling Capacity (*hp)</th>
<th>Connection</th>
<th>A (inches)</th>
<th>Weight (lbs.)</th>
<th>Volume (in³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAW 46-40</td>
<td>21-94</td>
<td>1¼” SAE O-ring</td>
<td>3.9</td>
<td>13</td>
<td>200</td>
</tr>
<tr>
<td>OAW 46-60</td>
<td>23-142</td>
<td>1¼” SAE O-ring</td>
<td>5.7</td>
<td>18</td>
<td>300</td>
</tr>
<tr>
<td>OAW 61-40</td>
<td>27-98</td>
<td>1¼” SAE O-ring</td>
<td>3.9</td>
<td>19</td>
<td>271</td>
</tr>
<tr>
<td>OAW 61-60</td>
<td>53-152</td>
<td>1¼” SAE O-ring</td>
<td>5.7</td>
<td>27</td>
<td>406</td>
</tr>
<tr>
<td>OAW 61-80</td>
<td>79-198</td>
<td>1¼” SAE O-ring</td>
<td>7.4</td>
<td>34</td>
<td>542</td>
</tr>
</tbody>
</table>

*Cooling capacity is calculated with the following conditions. For other flow conditions, type of fluids or temperatures, please see page 35 or consult Accumulator and Cooler Division. Oil type – ISO VG 32 – Oil/water flow ratio – 2:1 – Oil inlet temperature – 140°F – Water inlet temperature – 80°F
## OAW 95 & OAW 126

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Cooling Capacity (*hp)</th>
<th>Connection</th>
<th>A (inches)</th>
<th>Weight (lbs.)</th>
<th>Volume (in³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAW 95-40</td>
<td>50-150</td>
<td>1½” SAE O-ring</td>
<td>4.1</td>
<td>44</td>
<td>427</td>
</tr>
<tr>
<td>OAW 95-60</td>
<td>63-171</td>
<td>1½” SAE O-ring</td>
<td>6.0</td>
<td>59</td>
<td>641</td>
</tr>
<tr>
<td>OAW 126-60</td>
<td>84-259</td>
<td>1½” SAE O-ring</td>
<td>6.1</td>
<td>79</td>
<td>856</td>
</tr>
<tr>
<td>OAW 126-80</td>
<td>138-274</td>
<td>1½” SAE O-ring</td>
<td>7.9</td>
<td>97</td>
<td>1142</td>
</tr>
</tbody>
</table>

*Cooling capacity is calculated with the following conditions. For other flow conditions, type of fluids or temperatures, please see page 35 or consult Accumulator and Cooler Division. Oil type – ISO VG 32 – Oil/water flow ratio – 2:1 – Oil inlet temperature – 140°F – Water inlet temperature – 80°F*

### OAW 95 & 126 COOLING CAPACITY

![Cooling Capacity Graph](graph1.png)

### OAW 95 & 126 PRESSURE DROP

![Pressure Drop Graph](graph2.png)
Installation

Installation Instructions for OAW Coolers

The OAW coolers are designed for a maximum working pressure of 450 psi. The most standard application for the OAW cooler involves a cold water circuit and a hot oil circuit. Fluids are not limited to oil and water however; for other types of fluid, please contact the factory.

Inlets and outlets are clearly identified by the Accumulator and Cooler Division sticker affixed to the front of the unit. When in doubt, pour a liquid in one of the connections and note which connection it comes out of. This will be the inlet and outlet for one circuit (either oil or water). The other inlet should be located on the diagonal from the first inlet.

When to Clean

Fouling occurs mainly on the water side of the cooler. Fouling can be detected by monitoring the inlet and outlet temperatures and/or the pressure drop across the cooler. Fouling will result in decreased heat transfer, producing temperature differences lower than specified.

Fouling also restricts the passages and thus causes an increase in velocity. This will produce an increase in the pressure drop across the cooler. When either the temperature difference or the pressure drop is significantly different from specified values, cleaning should be performed.

Methods of Cleaning

If cleaning the cooler is required, backflushing with water will remove most of the soft deposits. If fouling appears in the form of hard deposits, circulate a weak acid through the cooler in reverse direction to normal water flow. Use 5% phosphoric acid for infrequent cleanings. For more frequent cleaning, use 5% oxalic acid or similar weak organic acid. Afterwards flush with a large quantity of water to remove all acid from the cooler before starting up the system again. Never wait until the cooler is completely clogged before cleaning!

Filters or Strainers

When there are particles in the fluid that could clog the cooler, filters or strainers should be used. Particles up to 1mm diameter will not cause any problems.

Fluid Compatibility

On the oil side, most synthetic and petroleum based fluids may be used. For aggressive oils, please contact Accumulator and Cooler Division for compatibility. On the water side, de-mineralized and untreated water may be used without concern. When water is chemically treated please contact Accumulator and Cooler Division for suitability. Sea water cannot be used in OAW coolers. For sea water applications, please contact Accumulator and Cooler Division for information on titanium coolers. Do not use ammonia in the OAW coolers.
Correction Factors for Other Oil Types, Temperatures and Flow Rates

All of the cooling curves are based on very specific conditions. These include using an ISO VG 32 oil, having an oil/water ratio of 2:1, and having an oil/water inlet difference of 60 °F. For other conditions, the following correction factors should be used.

Correction Factors for Other Oil Types

*Cooling Capacity:* Multiply the requested cooling capacity with the correction factor $K_v$.

*Oil Pressure Drop:* Multiply the pressure drop with the correction factor $K_p$.

Correction Factors for Other Inlet Temperature Differences

*Cooling Capacity:* For inlet temperature differences other than 60 °F, multiply the requested cooling capacity by the correction factor $K_t$.

Correction Curves for Other Oil/Water Flow Ratios

*Cooling Capacity:* For all other oil/water flow ratios other than 2:1, divide the requested cooling capacity by the factor $K_r$ obtained from the curves in Graph 3.

### Table 1

<table>
<thead>
<tr>
<th>Viscosity Class</th>
<th>Cooling Capacity Factor, $K_v$</th>
<th>Pressure Drop Factor, $K_p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO VG 22</td>
<td>0.95</td>
<td>0.9</td>
</tr>
<tr>
<td>ISO VG 32</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>ISO VG 46</td>
<td>1.05</td>
<td>1.3</td>
</tr>
<tr>
<td>ISO VG 68</td>
<td>1.2</td>
<td>1.7</td>
</tr>
<tr>
<td>ISO VG 100</td>
<td>1.35</td>
<td>2.2</td>
</tr>
<tr>
<td>ISO VG 150</td>
<td>1.6</td>
<td>3.0</td>
</tr>
<tr>
<td>ISO VG 220</td>
<td>1.9</td>
<td>4.3</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>ETD</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>$K_t$</td>
<td>1.87</td>
<td>1.43</td>
<td>1.17</td>
<td>1.0</td>
<td>0.88</td>
</tr>
</tbody>
</table>

### Table 3

<table>
<thead>
<tr>
<th>$X/1$ Oil/Water</th>
<th>$K_r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.10</td>
</tr>
<tr>
<td>2</td>
<td>1.00</td>
</tr>
<tr>
<td>3</td>
<td>0.90</td>
</tr>
<tr>
<td>4</td>
<td>0.80</td>
</tr>
<tr>
<td>5</td>
<td>0.70</td>
</tr>
</tbody>
</table>

### Graph 3

**Sizing Example**

**Conditions:**
- Oil type: ISO VG 68
- Oil Flow: 40 gpm
- Desired cooling capacity $Q_r$: 40 hp
- Oil temperature in $T_o$: 140 °F
- Water temperature in $T_w$: 100 °F
- Available water flow: 10 gpm
- Maximum Pressure Drop: 30 psi

**ETD = To - Tw = 140°F - 100°F = 40°F**

The design cooling capacity ($Q_d$) is the cooling capacity used when selecting a suitable cooler. $Q_d$ is calculated by multiplying $Q_r$ by the factors $K_v$ and $K_t$ (found in Tables 1 and 2 respectively) and then dividing by the $K_r$ factor found from Graph 3.

$$Q_d = \frac{Q_r \times K_v \times K_t}{K_r} = \frac{40 \text{ hp} \times 1.2 \times 1.43}{0.82} = 83 \text{ hp}$$

**According to the cooling capacity curves on page 32, the minimum size cooler for these conditions is an OAW 61-40.**

The oil pressure drop can be found from the pressure drop curve. It should be multiplied by the Pressure Drop Factor, $K_p$ from Table 7.

$$D_{Poil} = p \times K_p = 23 \text{ psi} \times 1.7 = 39.1 \text{ psi}.$$  

In this case the pressure drop exceeds the maximum allowable. The next size cooler would be an: OAW 61-60.

The pressure drop for this cooler would be:

$$D_{Poil} = p \times K_p = 12 \text{ psi} \times 1.7 = 20.4 \text{ psi}.$$  

Therefore the correct size cooler would be the OAW 61-60.

For assistance with calculations, please contact Accumulator and Cooler Division.
Supplementing a hydraulic system with a cooler and proper accessories or an accumulator gives you increased system up time and a longer expected life as well as lower service and repair costs. All applications and operating environments are unique. A well-planned choice of the following accessories can thus further improve your hydraulic system. Please contact Accumulator and Cooler Division for guidance and information.

**Take the next step**

**Choose the right accessories**

- **Pressure-controlled bypass valve** *Integrated*
  - Allows the oil to bypass the cooler core if the pressure drop is too high. Reduces the risk of the cooler bursting, e.g. in connection with cold starts and temporary peaks in pressure or flow. Available for single-pass or two-pass core design.

- **Temperature-controlled bypass valve** *Integrated*
  - Same function as the pressure-controlled by-pass valve, but with a temperature-controlled opening pressure – the hotter the oil, the higher the opening pressure. Available for single-pass or two-pass core design.

- **Thermo contact**
  - Sensor with fixed set point for temperature warnings and cost efficient operation with automatic switching on and off of the fan motor thereby reducing the energy usage.

- **Smart DC Drive speed regulation**
  - For cost-efficient operation and better environmental consideration through speed regulated fan control – the higher the temperature, the higher the fan speed.

- **Stone guard/Dust guard**
  - Protects components and systems from tough conditions.

- **Temperature-controlled 3-way valve** *External*
  - Same function as the temperature-controlled bypass valve, but positioned externally.
  
  **Note:** Must be ordered separately.

- **Lifting eyes**
  - For simple installation and relocation.
A close collaboration between our application engineers, designers and you as the customer during the whole project will result in a high-quality product. The final product will be a tailor-made cooler, which always meets your unique needs.

**Extensive choices**
Long-term experience from the mobile field has provided us with a unique ability to deliver the ideal combination cooler solution. Depending on the conditions, the cooler fan can be operated by the diesel engine on the machine or by a hydraulic motor or a DC motor. We can also supply many different cooler combination options. A frequent combination is the “side-by-side”-cooler, where the coolers are placed side-by-side, no matter the media, such as a water cooler, an oil cooler and an intercooler. Another solution is the “sandwich”-cooler, where the coolers are placed in front of each other. The solution could also be a combination of these two. No matter which combination will be used, the pressure drop and the heat dissipation across the core will always be optimal.
At Parker, we’re guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further info call 1 800 C-Parker (1 800 272 7537)

**Parker’s Motion & Control Product Groups**

**Aerospace**
**Key Markets**
- Aftermarket services
- Commercial transports
- Engines
- General & business aviation
- Helicopters
- Launch vehicles
- Military aircraft

**Key Products**
- Control systems & actuators
- Fluid connectors
- Fluid power systems & components
- Fluid tank mounting systems
- Hydraulic systems & components
- Thermal management
- Wheels & brakes

**Automation**
**Key Markets**
- Renewable energy
- Conveyer & material handling
- Factory automation
- Food & beverage
- Life sciences & medical
- Machine tools
- Machine vision
- Paper machinery
- Paper products
- Plastic molding
- Primary metals
- Safety & security
- Semiconductors & electronics
- Transportation & automotive

**Key Products**
- AC/DC drives & systems
- Air preparation
- Electric actuators,FC
- Industrial robots & skids
- Human machine interfaces
- Inverters
- Manipulators
- Miniature fluidics
- Pneumatic actuators & air paddles
- Pneumatic valves & controls
- Rotary actuators
- Step motors, servo motors, drives & controls
- Structural extrusions
- Vacuum generators, cups & sensors

**Climate & Industrial Controls**
**Key Markets**
- Air conditioning
- Construction Machinery
- Food & beverage
- Industrial machinery
- Life sciences
- Oil & gas
- Power generation
- Process
- Refrigeration
- Transportation

**Key Products**
- Accumulators
- Advanced actuators
- CO2 controls
- Electronic controllers
- Filter design
- Hand hole valves
- Heat exchangers
- Hose & fittings
- Pressure regulating valves
- Refrigerant distributors
- Safety relief valves
- Smart pumps
- Solenoid valves
- Thermal management systems
- Thermoelastic expansion valves

**Filtration**
**Key Markets**
- Aerospace
- Food & beverage
- Industrial plant & equipment
- Life sciences
- Marine
- Mobile equipment
- Oil & gas
- Power generation
- Process
- Transportation
- Water Purification

**Key Products**
- Analytical gas generators
- Compressed air filters & dryers
- Engine air, coolant, fuel & oil filtration systems
- Fluid condition monitoring systems
- Hydraulic & lubrication filters
- Hydrogen, nitrogen & zero air generators
- Instrumentation filters
- Membrane & fiber filters
- Microfiltration
- Sterile air filtration
- Water desalination & purification filters & systems

**Fluid Connectors**
**Key Markets**
- Aircraft
- Agriculture
- Bulk chemical handling
- Construction machinery
- Food & beverage
- Fuel & gas delivery
- Industrial machinery
- Life sciences
- Marine
- Mining
- Mobile
- Oil & gas
- Renewable energy
- Transportation

**Key Products**
- Check valves
- Connectors for low pressure fluid conveyance
- Deep sea umbilicals
- Diagnostic equipment
- Hose couplings
- Industrial hose
- Mooring systems & power cables
- PTFE hose & tubing
- Quick couplings
- Rubber & thermoplastic hose
- Tube fittings & adapters
- Tubing & plastic fittings

**Hydraulics**
**Key Markets**
- Aircraft
- Agriculture
- Alternative energy
- Construction machinery
- Forestry
- Industrial machinery
- Machine tools
- Marine
- Material handling
- Mining
- Oil & gas
- Power generation
- Refuse vehicles
- Renewable energy
- Truck hydraulics
- Trench equipment

**Key Products**
- Accumulators
- Cartridge valves
- Electrohydraulic actuators
- Human machine interfaces
- Hybrid drives
- Hydraulic cylinders
- Hydraulic motors & pumps
- Hydraulic systems
- Hydraulic valves & controls
- Hydraulic steering
- Integrated hydraulic systems
- Power take-offs
- Power units
- Rotary actuators
- Sensors

**Instrumentation**
**Key Markets**
- Alternative fuels
- Biopharmaceuticals
- Chemical & refining
- Food & beverage
- Marine & shipbuilding
- Medical & dental
- Microelectronics
- Nuclear Power
- Offshore oil exploration
- Oil & gas
- Pharmaceuticals
- Power generation
- Pumps & paper
- Steel
- Water/Wastewater

**Key Products**
- Analytical instruments
- Analytical sample conditioning products & systems
- Chemical injection fittings & valves
- Fluoropolymer chemical delivery fittings, valves & pumps
- High purity gas delivery fittings, valves, regulators & pumps
- Industrial mass flow meters/controls
- Permanent magnet water take fittings
- Precision industrial regulators & flow controllers
- Process control double block & bleed
- Process control fittings, valves, regulators & manifold valves

**Seal**
**Key Markets**
- Aerospace
- Chemical processing
- Consumer
- Fluid power
- General industrial
- Information technology
- Life sciences
- Microelectronics
- Military
- Oil & gas
- Power generation
- Renewable energy
- Telecommunications
- Transportation

**Key Products**
- Dynamic seals
- Elastomer o-rings
- Electro-medical instrument design & assembly
- EMI shielding
- Exhaust & precision cut, fabricated elastomer seals
- High temperature metal seals
- Homogeneous & inserted elastomeric shapes
- Medical device fabrication & assembly
- Metal & plastic retained composite seals
- Shiel<f>ed optical windows
- Silicone tubing & extrusions
- Thermoset management
- Vibration dampening