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Oil Coolers For Temperature Optimization In Hydraulic Systems

Catalog HY10-1700/Americas



ENGINEERING YOUR SUCCESS.



If you have questions about the products contained in this catalog, or their applications, please contact:



**Accumulator & Cooler
Division - Americas**
phone **815 636 4100**
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parker.com/accumulator

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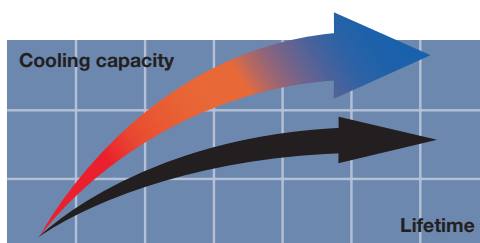
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Parker is a global player specializing in innovative, efficient system solutions for temperature optimization and energy storage. All over the world, our products are working in the most diverse environments and applications.

Oil Coolers

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.**



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.



*At 250 gpm and 70 °F ITD

More Cooling Per \$

with precise calculations and our engineers' support

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.

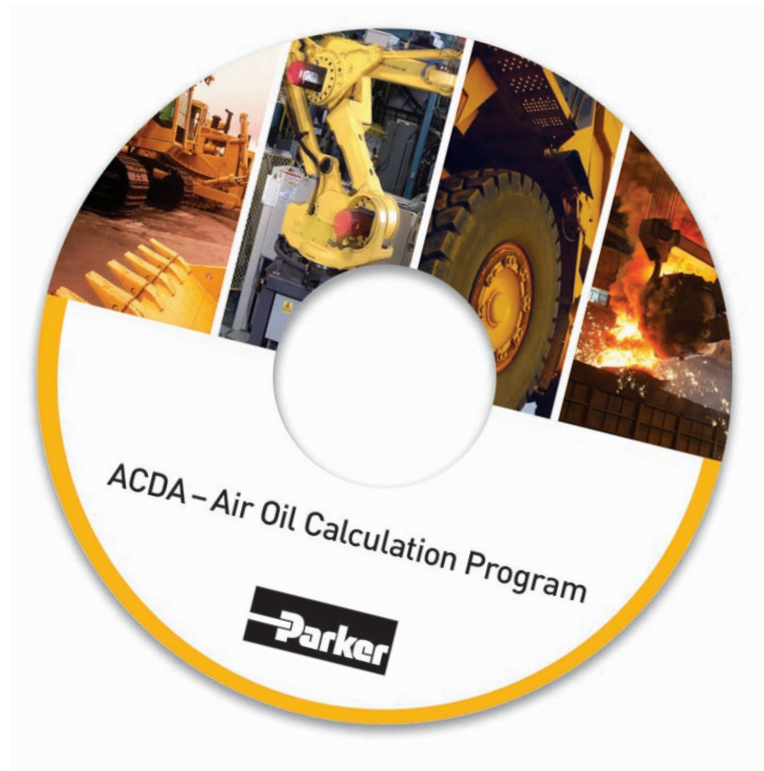
In-depth system review as an added value.

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.

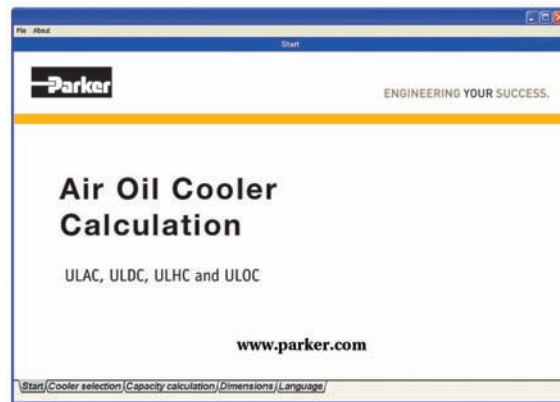
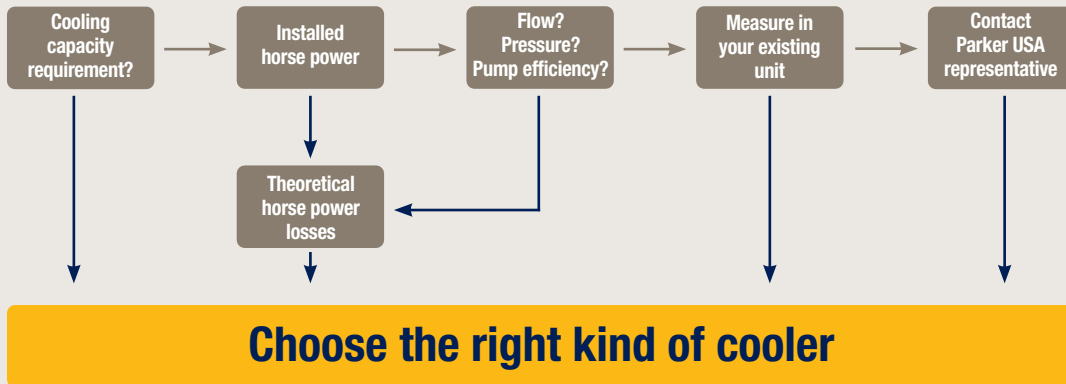
A continual desire for more cost efficient and environmentally friendly hydraulic systems requires continuous development. Areas where we are continuously seeking to improve performance include cooling capacity, noise level, pressure drop and fatigue.

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



Enter your values ...

ULDC 011

Input data:	
Refrigeration oil	100.00 gal
Oil flow	10.00 gal/min
Max. oil temperature	170 °F
Air temperature	100 °F
Altitude	6.20 ft
Max. oil viscosity	150.00 cP
Max. oil density	150.00 lb/ft ³
Max. oil specific heat	0.45 Btu/lb·°F
Max. oil thermal conductivity	0.10 Btu/ft·h·°F
Max. air density	0.075 lb/ft ³
Max. air specific heat	0.24 Btu/lb·°F
Max. air thermal conductivity	0.015 Btu/ft·h·°F

Calculated data:

Max. oil temperature	140.00 °F
Max. air temperature	100.00 °F
Max. air velocity	100.00 ft/min
Max. air density	0.075 lb/ft ³
Max. air specific heat	0.24 Btu/lb·°F
Max. air thermal conductivity	0.015 Btu/ft·h·°F
Max. oil density	150.00 lb/ft ³
Max. oil specific heat	0.45 Btu/lb·°F
Max. oil thermal conductivity	0.10 Btu/ft·h·°F

Technical data:

Max. oil temperature	140.00 °F
Max. air temperature	100.00 °F
Max. air velocity	100.00 ft/min
Max. air density	0.075 lb/ft ³
Max. air specific heat	0.24 Btu/lb·°F
Max. air thermal conductivity	0.015 Btu/ft·h·°F
Max. oil density	150.00 lb/ft ³
Max. oil specific heat	0.45 Btu/lb·°F
Max. oil thermal conductivity	0.10 Btu/ft·h·°F

... get suggested solution

OAW Water Oil Cooler

For mobile and industrial use



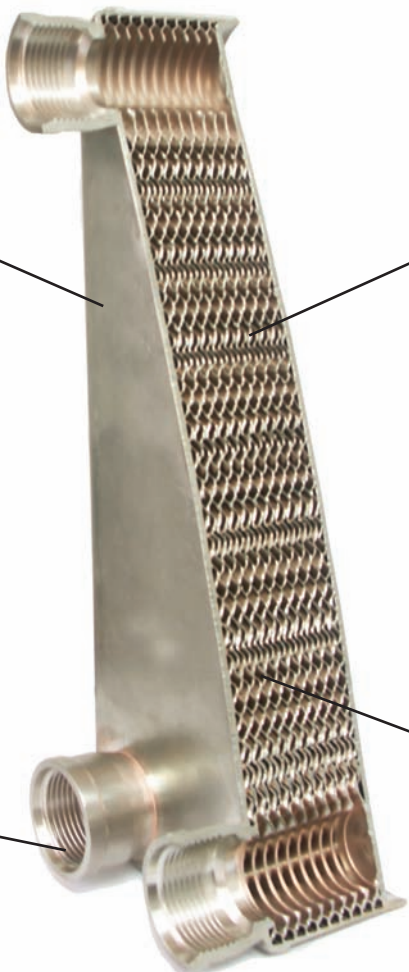
The OAW oil cooler is optimized for use in mobile and industrial sectors. Together with a wide range of accessories, the OAW cooler is suitable for installation in most applications and environments.

- **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.

LOW WATER CONSUMPTION. ECONOMICAL OPERATION COMPACT.

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

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

BROAD RANGE: SEVERAL MODELS IN-STOCK FOR IMMEDIATE DELIVERY.

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

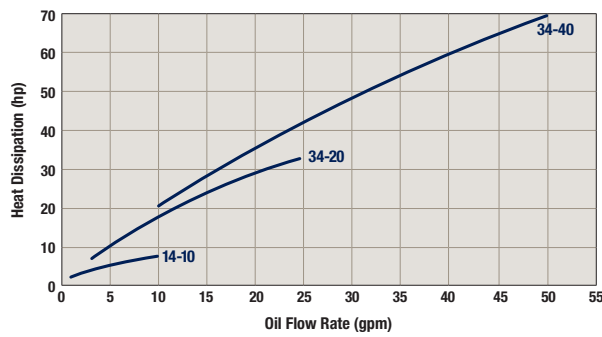
Maximum Efficiency:
Maximum material efficiency. No "Dead Zone" because there is no need for gaskets. Up to 25% more capacity utilization.

OAW 14 & OAW 34

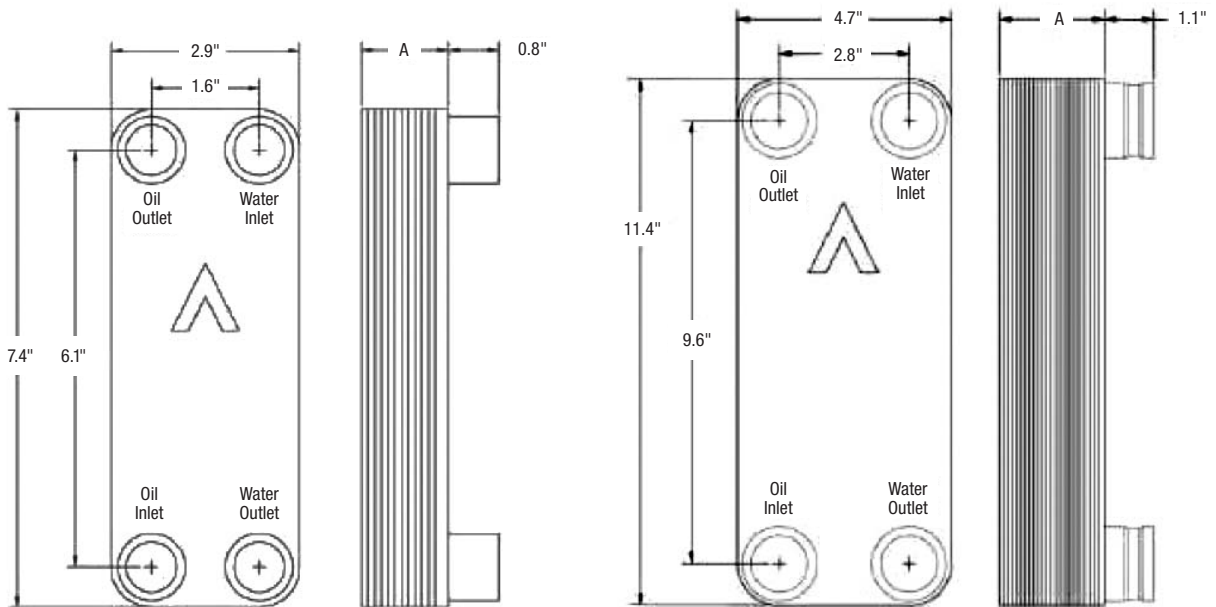
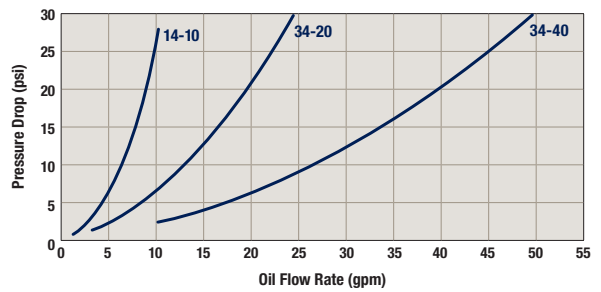
MODEL	Cooling Capacity (*hp)	Connection	A (inches)	Weight (lbs.)	Volume (in ³)
OAW 14-10-SG	2-7	5/8" SAE O-ring	1.4	1.4	15
OAW 34-20	6-33	1" SAE O-ring	2.3	9	74
OAW 34-40	20-69	1" SAE O-ring	4.1	15	149

*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 14 & 34 COOLING CAPACITY



OAW 14 & 34 PRESSURE DROP

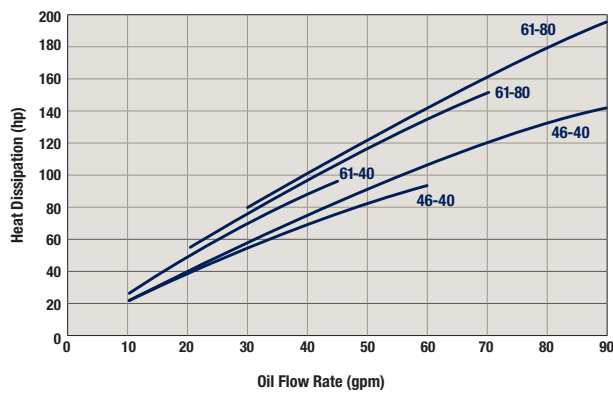


OAW 46 & OAW 61

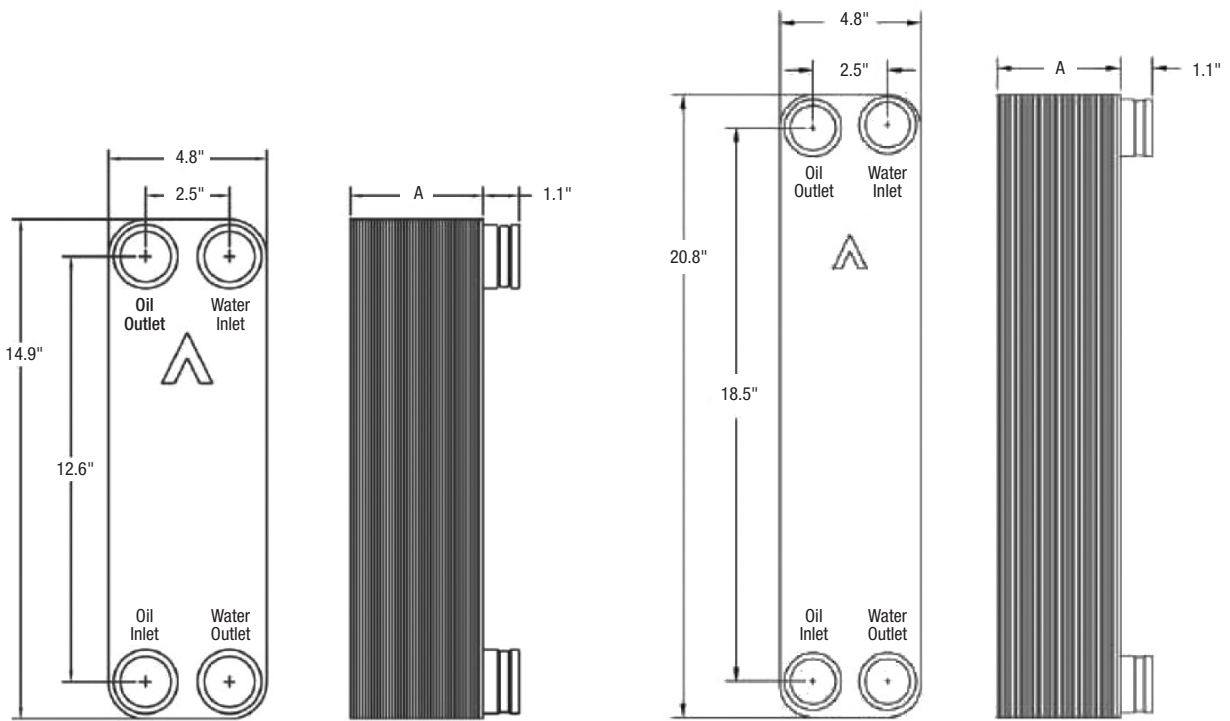
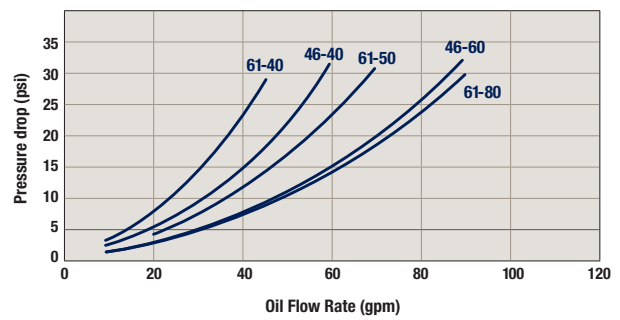
MODEL	Cooling Capacity (*hp)	Connection	A (inches)	Weight (lbs.)	Volume (in ³)
OAW 46-40	21-94	1¼" SAE O-ring	3.9	13	200
OAW 46-60	23-142	1¼" SAE O-ring	5.7	18	300
OAW 61-40	27-98	1¼" SAE O-ring	3.9	19	271
OAW 61-60	53-152	1¼" SAE O-ring	5.7	27	406
OAW 61-80	79-198	1¼" SAE O-ring	7.4	34	542

*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 & 61 COOLING CAPACITY



OAW 46 & 61 PRESSURE DROP

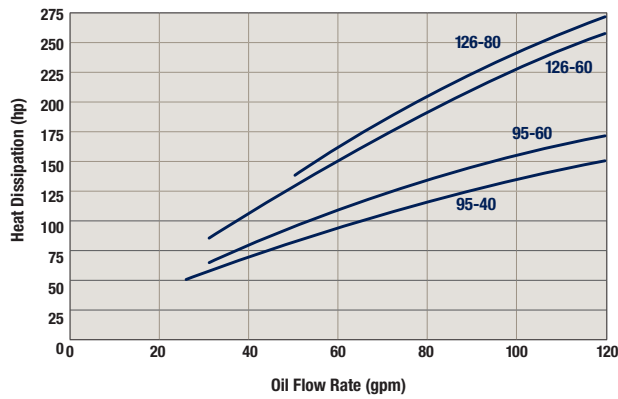


OAW 95 & OAW 126

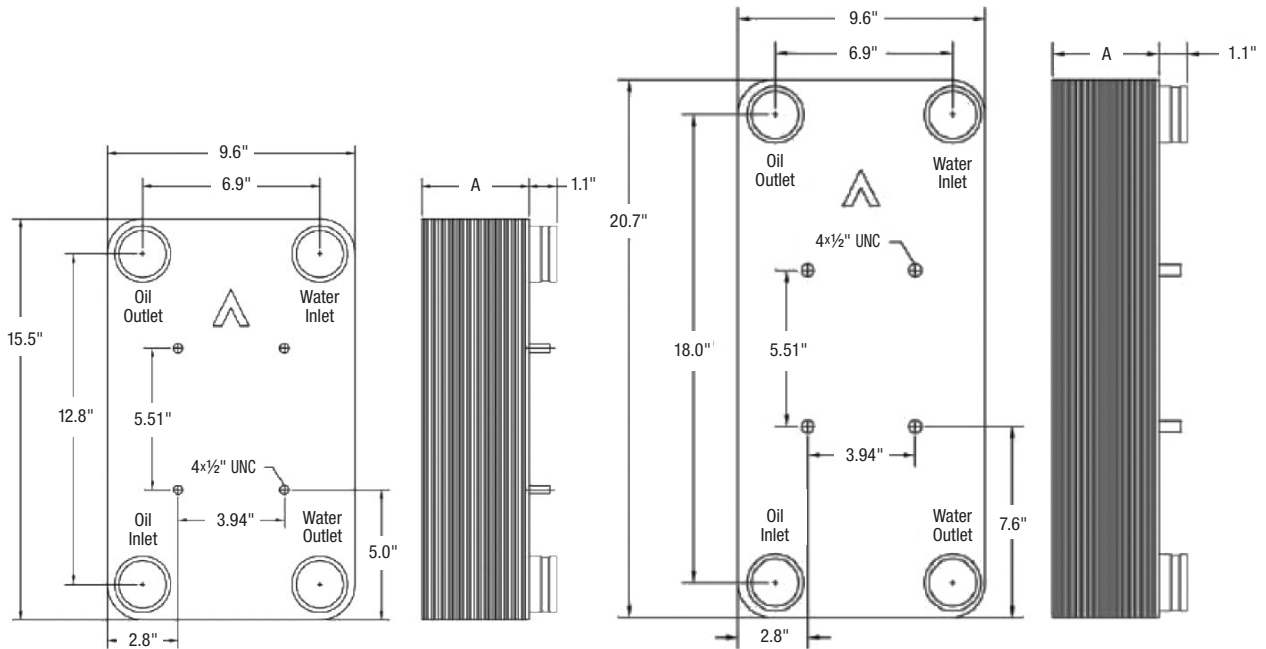
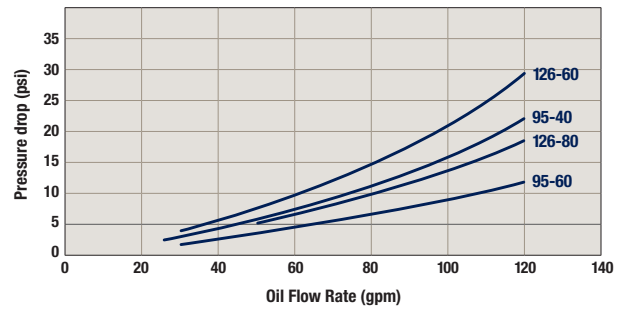
MODEL	Cooling Capacity (*hp)	Connection	A (inches)	Weight (lbs.)	Volume (in ³)
OAW 95-40	50-150	1½" SAE O-ring	4.1	44	427
OAW 95-60	63-171	1½" SAE O-ring	6.0	59	641
OAW 126-60	84-259	1½" SAE O-ring	6.1	79	856
OAW 126-80	138-274	1½" SAE O-ring	7.9	97	1142

*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



OAW 95 & 126 PRESSURE DROP

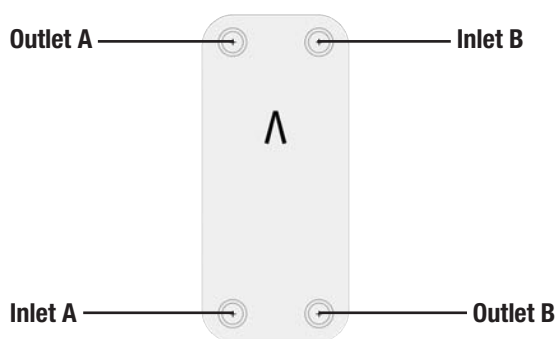


Installation

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.



Maximum cooling efficiency is achieved by cross flowing through the plates, the oil inlet and water inlet being located on a diagonal. Failure to have the cooler attached in this manner will lead to a decrease in efficiency.

The cooler may be mounted in any position. However, requirements for draining the circuits should be taken into consideration.

The OAW coolers must not be installed into a rigid frame. Use the Accumulator and Cooler Division purpose-made brackets (or "Armafex" equivalent) to provide a "soft, elastic installation." The OAW 95 and 126 series coolers come equipped with stud bolts to assist in mounting. However, these bolts alone should not be used to suspend the cooler. All tubing should be done in such a way as to minimize vibrations to the cooler. When installed on a return line, the cooler should be connected using flexible hoses.

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 on 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 Kv.

Oil Pressure Drop: Multiply the pressure drop with the correction factor Kp.

Viscosity Class	Cooling Capacity Factor, Kv	Pressure Drop Factor, Kp
ISO VG 22	0.95	0.9
ISO VG 32	1.0	1.0
ISO VG 46	1.05	1.3
ISO VG 68	1.2	1.7
ISO VG 100	1.35	2.2
ISO VG 150	1.6	3.0
ISO VG 220	1.9	4.3

Table 1

Correction Factors for Other Inlet Temperature Differences

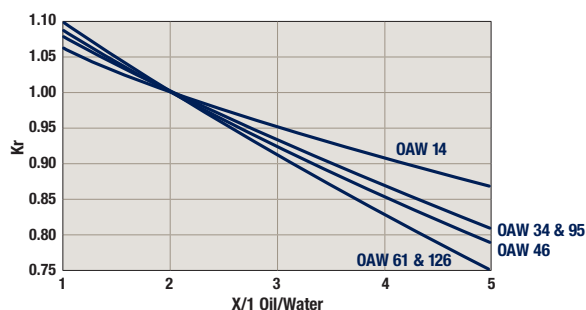
Cooling Capacity: For inlet temperature differences other than 60 °F, multiply the requested cooling capacity by the correction factor Kt.

ETD	30	40	50	60	70
Kt	1.87	1.43	1.17	1.0	0.88

Table 2

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 Kr obtained from the curves in Graph 3.



Graph 3

Sizing Example

Conditions:
 Oil type: ISO VG 68
 Oil Flow: 40 gpm
 Desired cooling capacity Qr 40 hp
 Oil temperature in To 140 °F
 Water temperature in Tw 100 °F
 Available water flow 10 gpm
 Maximum Pressure Drop 30 psi

$$ETD = T_o - T_w = 140^{\circ}\text{F} - 100^{\circ}\text{F} = 40^{\circ}\text{F}$$

The design cooling capacity (Qd) is the cooling capacity used when selecting a suitable cooler. Qd is calculated by multiplying Qr by the factors Kv and Kt (found in Tables 1 and 2 respectively) and then dividing by the Kr 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, Kp from Table 1.

$$DP_{oil} = p \times K_p = 23 \text{ psi} \times 1.7 = 39.1 \text{ psi.}$$

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:

$$DP_{oil} = p \times K_p = 12 \text{ psi} \times 1.7 = 20.4 \text{ psi.}$$

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

For assistance with calculations, please contact Accumulator and Cooler Division.

Take the next step

Choose the right accessories

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.



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.



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.



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.



Stone guard/Dust guard

Protects components and systems from tough conditions.



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.



Temperature-controlled 3-way valve *External*

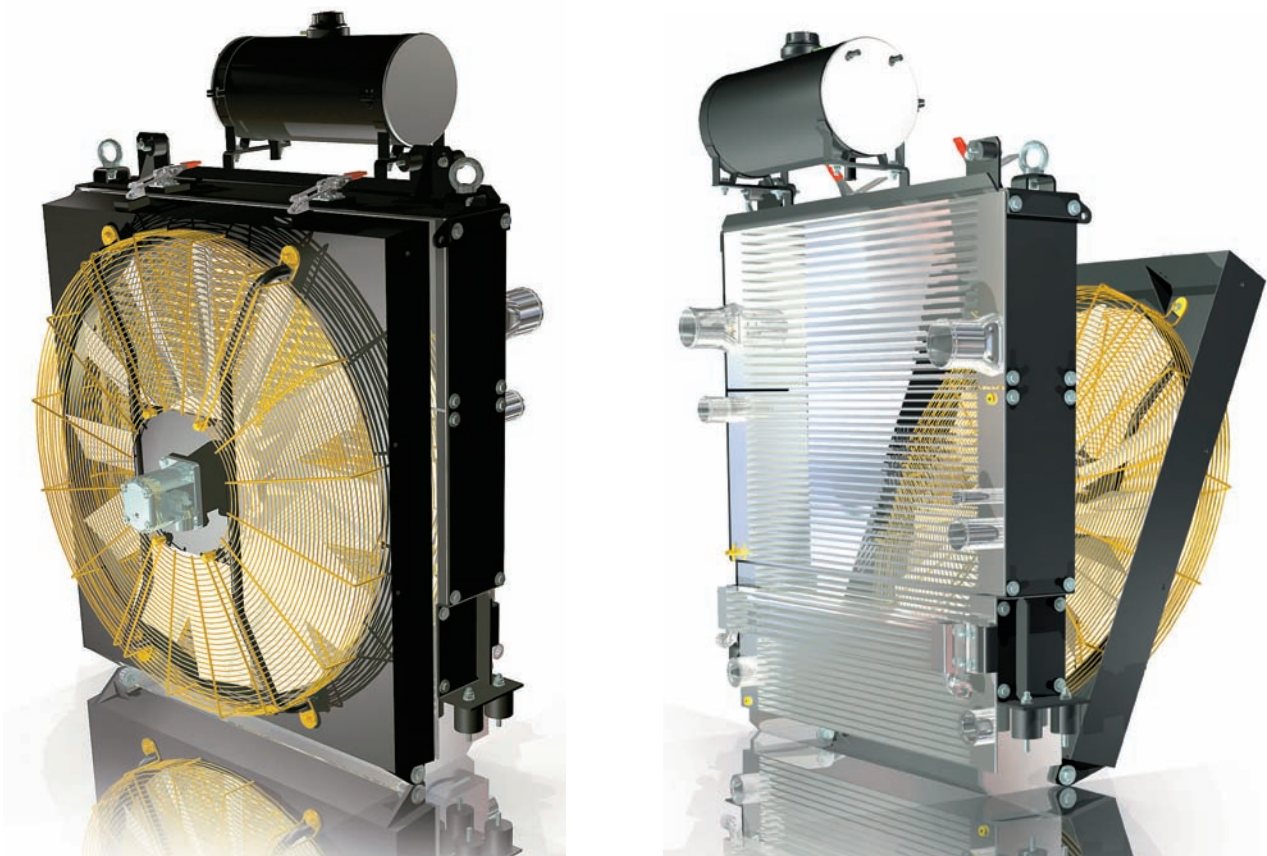
Same function as the temperature-controlled bypass valve, but positioned externally.

Note: *Must be ordered separately.*



Lifting eyes

For simple installation and relocation.



Professional competence, as well as advanced technology and extensive knowledge from the industry, allow us to provide many cooler combinations, which meet your unique needs.

Cooling Modules/ Combination Cooler

Providing optimal solutions

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.

Parker's Motion & Control Product Groups

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)



Aerospace

Key Markets

Aftermarket services
Commercial transports
Engines
General & business aviation
Helicopters
Launch vehicles
Military aircraft
Missiles
Power generation
Regional transports
Unmanned aerial vehicles

Key Products

Control systems & actuation products
Engine systems & components
Fluid conveyance systems & components
Fluid metering, delivery & atomization devices
Fuel systems & components
Fuel tank inerting systems
Hydraulic systems & components
Thermal management
Wheels & brakes



Automation

Key Markets

Renewable energy
Conveyor & material handling
Factory automation
Food & beverage
Life sciences & medical
Machine tools
Packaging machinery
Paper machinery
Plastics machinery
Primary metals
Safety & security
Semiconductor & electronics
Transportation & automotive

Key Products

AC/DC drives & systems
Air preparation
Electric actuators, gantry robots & slides
Human machine interfaces
Inverters
Manifolds
Miniature fluidics
Pneumatic actuators & grippers
Pneumatic valves & controls
Rotary actuators
Stepper motors, servo motors, drives & controls
Structural extrusions
Vacuum generators, cups & sensors



Climate & Industrial Controls

Key Markets

Agriculture
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 driers
Hand shut-off valves
Heat exchangers
Hose & fittings
Pressure regulating valves
Refrigerant distributors
Safety relief valves
Smart pumps
Solenoid valves
Thermal management systems
Thermostatic 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

Aerial lift
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

Aerial lift
Agriculture
Alternative energy
Construction machinery
Forestry
Industrial machinery
Machine tools
Marine
Material handling
Mining
Oil & gas
Power generation
Refuse vehicles
Renewable energy
Truck hydraulics
Turf equipment

Key Products

Accumulators
Cartridge valves
Electrohydraulic actuators
Human machine interfaces
Hybrid drives
Hydraulic cylinders
Hydraulic motors & pumps
Hydraulic systems
Hydraulic valves & controls
Hydrostatic steering
Integrated hydraulic circuits
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
Pulp & 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 & digital flow controllers
Industrial mass flow meters/controllers
Permanent no-weld tube fittings
Precision industrial regulators & flow controllers
Process control double block & bleeds
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
Elastomeric o-rings
Electro-medical instrument design & assembly
EMI shielding
Extruded & precision-cut, fabricated elastomeric seals
High temperature metal seals
Homogeneous & inserted elastomeric shapes
Medical device fabrication & assembly
Metal & plastic retained composite seals
Shielded optical windows
Silicone tubing & extrusions
Thermal management
Vibration dampening



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