Industrial and Mobile Coolers

Catalog MSG10-1700/US

ENGINEERING YOUR SUCCESS.

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

Accumulator & Cooler Division
phone **815 636 4100**
fax **815 636 4111**
parker.com/acd

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Offer of Sale

The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions in the **"Offer of Sale."**

NOTE: Failure or improper selection or improper use of coolers or related items can cause death, personal injury and property damage. Parker Hannifin shall not be liable for any incidental, consequential or special damages that result from use of the information contained in this publication.

⚠WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having expertise. It is important that you analyze all aspects of your application, including consequences of any failure and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its related companies at any time without notice.

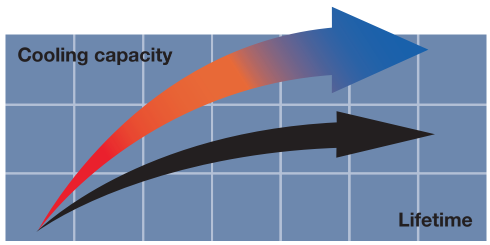
Table of Contents




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.

$$\text{Power}_{loss} = \text{Power}_{cool} = \text{Power}_{in} - \text{Power}_{used}$$

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.**

Air-Oil Coolers

Industrial Coolers

ULAC Series Cooler

- Single or Three-phase AC Fan Motor
  - NEMA 56C through 284T
  - ½ through 15 HP
- Cooling up to 425 HP @ Δ70°F @ 250 gpm
- Optional Integrated Oil Filter

ULOC Series Cooler

- Three-phase AC Pump & Fan Motor
  - 50/60 hz
  - 1 through 5 HP
- Flow rates up to 25 gpm
- Cooling up to 60HP @ Δ70°F @ 25 gpm
- Integrated Optional Oil Filter

Mobile Coolers

Combination Coolers

- Capable of cooling multiple fluids with the same fan source
- Custom mounting options allow for easy installation in engine cooling applications
- Custom designs are optimized to meet customer specific cooling needs

ULDC Series Cooler

- 12V or 24V DC Motor (SPAL)
- Cooling up to 40 HP @ Δ70°F @ 80 gpm
- Optional integrated partial bypass
- Optional integrated thermoswitch

ULHC Series Cooler

- Hydraulic motor displacement ranges from 8cc to 28cc
- Cooling up to 185 HP @ Δ70°F @ 120 gpm @ 1000 rpm
- Optional integrated partial bypass valve
- Optional integrated thermoswitch

Water-Oil Coolers

OAW Brazed Plate Cooler Series

- Cooling up to 275 hp @ 120 gpm @ Δ60°F
  - higher cooling capacities available upon request
- Optional mounting clamps available
- SAE O-ring connections come standard

Air-Oil Cooler Accessories

Integrated Pressure-controlled Bypass Valve

Allows the oil to **partially** 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.

Stone guard/Dust guard

Protects components and systems from tough conditions.

External Temperature/Pressure-controlled 3-way Bypass Valve

Allows the oil to **fully** bypass the cooler core if the pressure is too high or the oil temperature is too low. Reduces the risk of the cooler bursting, e.g. in connection with cold starts and temporary peaks in pressure or flow.

Air Filter

Durable bolt-on air filter is constructed using a fiberglass filter element that can help maintain cooler performance.

ThermoSwitch

Temperature sensor with a fixed set point that automatically switches the fan motor on and off, thereby reducing the energy usage.

Oil Filter

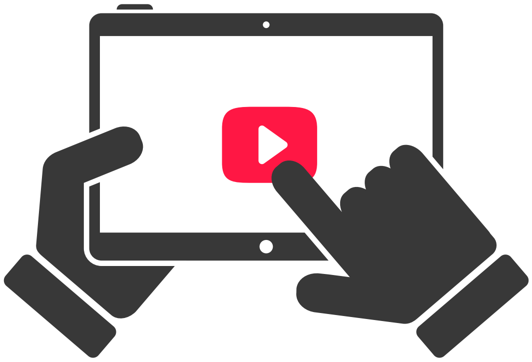
Durable 10 micron oil filter comes in 2 sizes to fit most ULAC and ULOC cooler models.*

Note: This filter comes with a bracket and fasteners to mount to cooler housing. Please visit www.Parker.com/distributors to find the nearest Parker distributor to purchase hose and fittings from.

UL Series: Air-Oil Cooler Configurator
http://www.parker.com/air-oil-coolers

UL Series: Air-Oil Cooler Sizing Software (.exe)
http://www.parker.com/ULsizing

All the Latest Information



Be sure to keep up with all the latest product updates and up to date information by calling the division to find out new cooler promotions and educational webinars.

Accumulator & Cooler Division
phone **815 636 4100**
parker.com/acd

Cooler Sizing Form

Essential Cooler Sizing Parameters

Please read carefully and complete the following. the items in BOLD are the minimum requirments to properly size a cooler for your application. Fill out and email the form to acd_cct@support.parker.com or fax to 815-636-411.

Name		Company	
Title		Location	
Phone #		E-mail	

Required Heat Dissipation (hp)* ________ **Max Ambient Temperature (◦F)** ________

Oil Flow Rate (gpm) ________ **Max Inlet Oil Temperature (◦F)** ________

Oil Type and Viscosity ____________________

Max Oil Pressure Drop (psi) ________ Max Noise Decibel Level ________

Air Oil Coolers Only

Fan Motor (AC, DC, Hydraulic) ____________________
Include details on voltage, frequency, etc.

Options: Bypass (20/65psi) ________ Thermoswitch(100/120/140/160/175◦F) ________

Water Oil Coolers Only

Water Type (ie. Water-Glycol) ____________________

Water Flow Rate (gpm) ________ **Max Inlet Water Temperature (◦F)** ________

Max Water Pressure Drop (psi) ________

Special Requirements/Features ____________________
(ie. Explosion proof, Marine grade, Oil Filter, Air Filter, etc.)

* If Required Heat Dissipation is unknown then it can either be estimated by assuming 20-30% of the installed horsepower will be converted to heat load. However, the most accurate measure would be to calculate the heat load by recording the time the oil takes to get up to temperature with no cooler in the system. In order to calculate, the following info. is needed:

Initial Oil Temperature (◦F) ________ Final Oil Temperature (◦F) ________

Time Interval (minutes) ________ Total Oil Volume in System (gal) ________

Competitive Cross Reference Tool
crossref.parker.com

Cooler Sizing Form
http://www.parker.com/coolersizingform

ULAC with AC Motor

For industrial use – cooling capacity up to 425 HP

Product Features:

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.**
- **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.**

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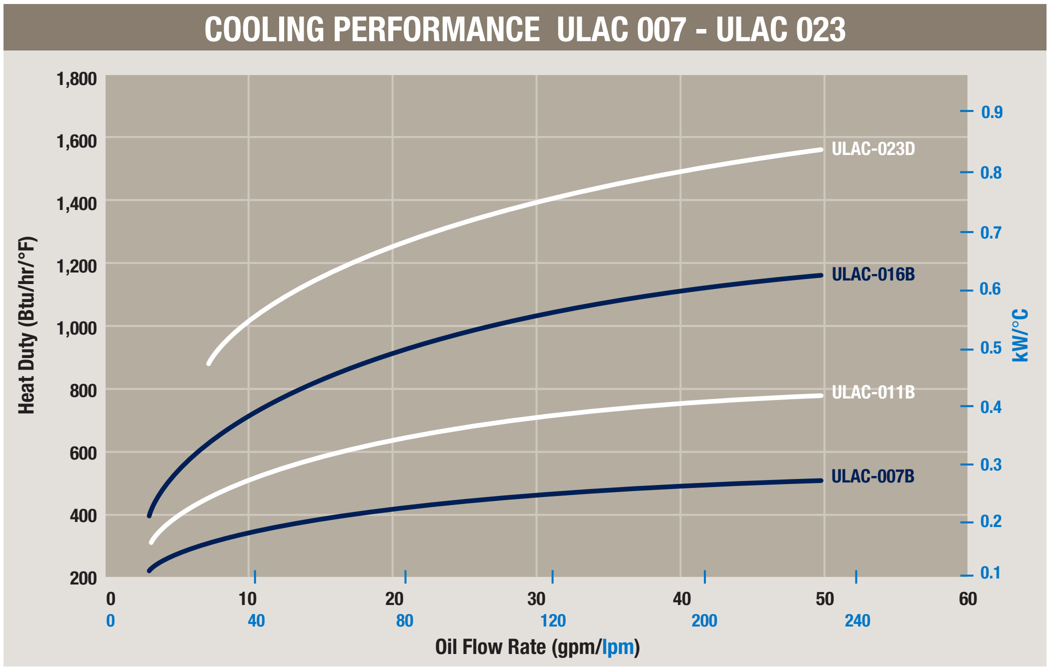
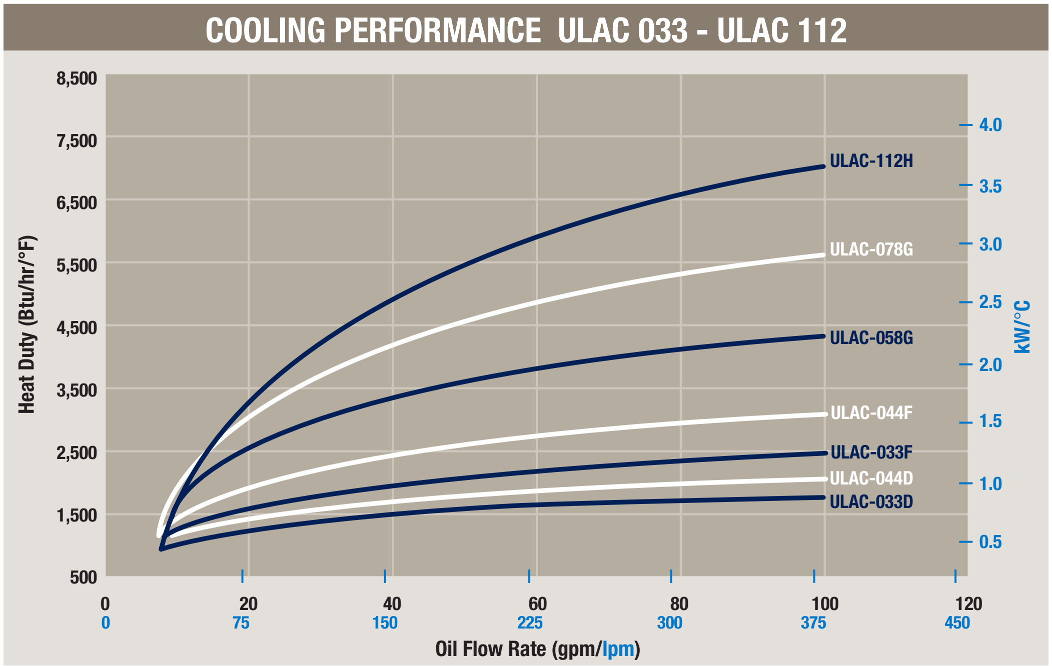
ULAC Cooling Performance

The cooling capacity curves are based on an ETD (Entering Temperature Difference) of 1 °F. For example, inlet oil temperature of 140 °F and ambient 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.



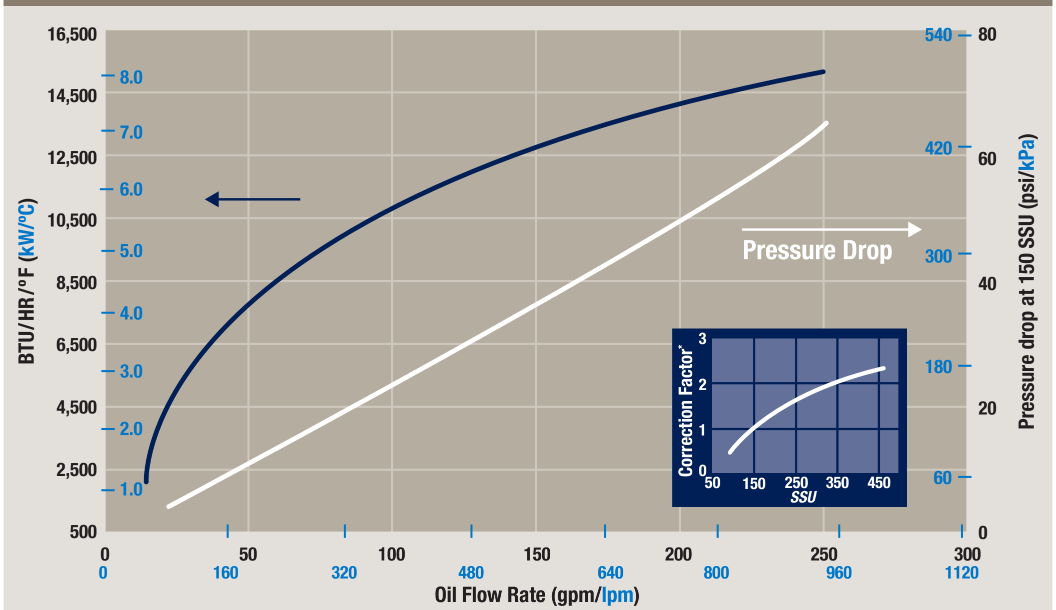
Cooling capacity tolerance ± 10%.



Cooling capacity tolerance ± 10%.

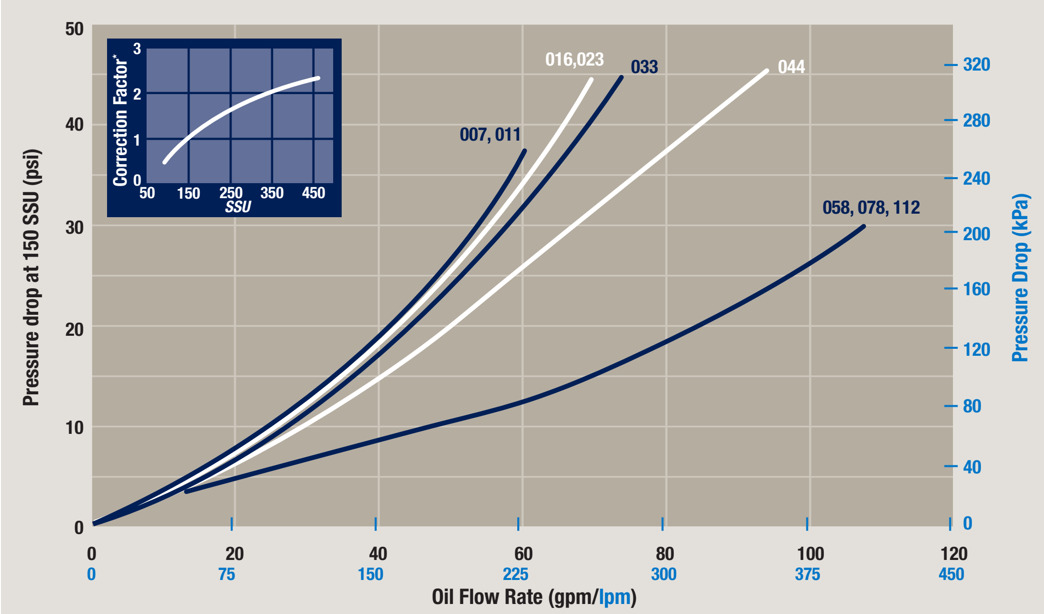
Helpful Equations
Unit Conversion: ____ [HP/(Max Oil Inlet Temp °F - Ambient Air Temp °F)] x 2547 = _____BTU/hr/°F
_____kW/°C x 1897 = _____BTU/hr/°F
_____GPM x 3.79 = _____ LPM
_____PSI x 6.894 = _____ kPa

COOLING PERFORMANCE & PRESSURE DROP - ULAC 200 K



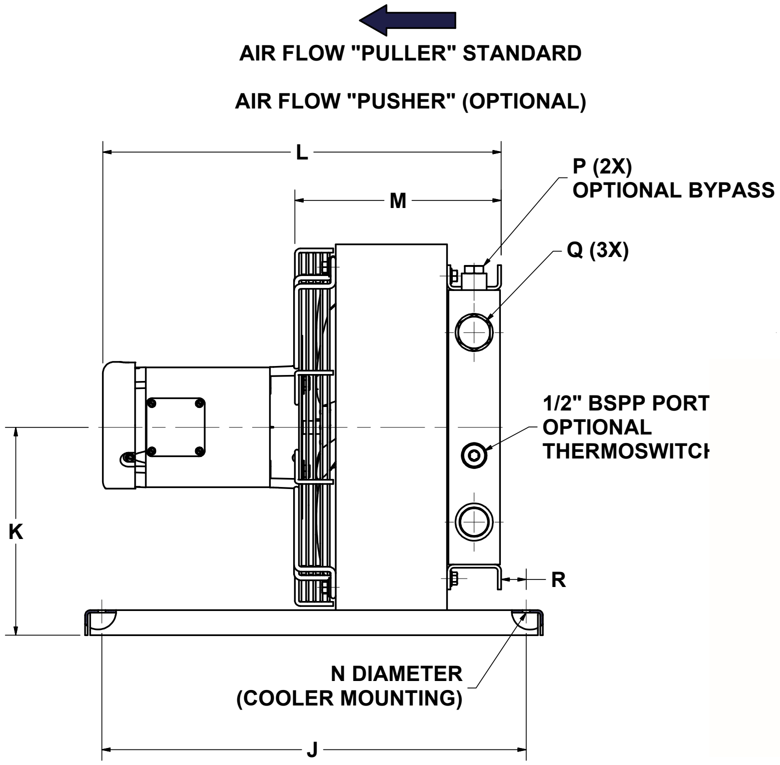
Cooling capacity tolerance ± 10%.

PRESSURE DROP ULAC 007-ULAC 112



* Pressure Drop Correction Factor for other viscosities.

Helpful Equations
Unit Conversion: ____ [HP/(Max Oil Inlet Temp °F - Ambient Air Temp °F)] x 2547 = _____BTU/hr/°F
_____kW/°C x 1897 = _____BTU/hr/°F
_____GPM x 3.79 = _____ LPM
_____PSI x 6.894 = _____ kPa



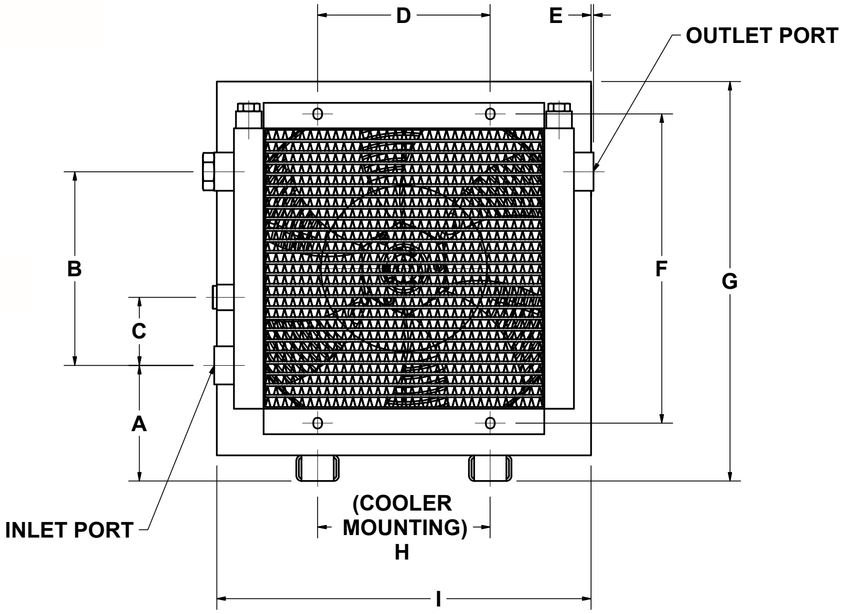
ULAC with Standard Removable Mounting Feet

ULAC Engineering Specifications

TYPE	Acoustic Pressure Level LpA dB(A) 3 Ft.*	No. Of Poles/ Capacity HP	Weight Lbs. (Approx.)	P SAE O-Ring	Q SAE O-Ring Boss	NEMA Motor Frame Size
ULAC 007B	69	4/0.5	33	½" (#8)	1" (#16)	56C
ULAC 011B	71	4/0.5	44	½" (#8)	1" (#16)	56C
ULAC 016B	74	4/0.5	53	½" (#8)	1" (#16)	56C
ULAC 023D	81	4/1	79	½" (#8)	1" (#16)	56C
ULAC 033D	82	4/1	115	½" (#8)	1¼" (#20)	56C
ULAC 033F	86	4/3	170	½" (#8)	1¼" (#20)	182T
ULAC 044D	83	4/1	143	½" (#8)	1¼" (#20)	56C
ULAC 044F	87	4/3	197	½" (#8)	1¼" (#20)	182T
ULAC 058G	90	4/5	264	¾" (#12)	1½" (#24)	184T
ULAC 078G	92	4/5	434	¾" (#12)	1½" (#24)	184T
ULAC 112H	96	4/7.5	542	¾" (#12)	1½" (#24)	213T
ULAC 200K	93	6/15	1,030	NA	CODE 61 SAE 2" FLANGE	284T

* Noise level tolerance ± 3 dB(A).

Note: Optional Oil Filter available upon request. For flow rates 0-15 gpm, use 12CSFILTER. For flow rates 15-50 gpm, use 50CSFILTER. For flowrates >50 gpm, consult factory.



ULAC with Standard Removable Mounting Feet

ULAC Dimensions

TYPE	A	B	C	D	E	F	G	H	I	J	K	L	M	Nø	R
ULAC 007B	5.2	6.3	3.2	8.0	0.24	11.7	15.6	8.0	14.4	20.1	8.4	19.8	8.8	0.35	1.18
ULAC 011B	5.4	9.0	3.2	8.0	0.12	14.3	18.5	8.0	17.3	20.1	9.8	20.8	9.8	0.35	1.18
ULAC 016B	5.2	11.7	3.2	8.0	0.28	17.0	20.7	8.0	19.5	20.1	10.9	21.6	10.7	0.35	1.18
ULAC 023D	5.2	14.9	3.2	14.0	0.20	20.2	24.0	14.0	22.8	20.1	12.6	22.2	11.3	0.35	1.18
ULAC 033D	5.2	19.1	3.2	14.0	NA	24.5	28.4	14.0	27.2	20.1	14.8	23.1	12.5	0.35	1.18
ULAC 033F	5.2	19.1	3.2	14.0	NA	24.5	28.4	14.0	27.2	24.0	14.8	25.6	12.5	0.55	1.34
ULAC 044D	4.6	26.1	3.2	14.0	NA	31.5	34.1	14.0	27.2	20.1	17.6	24.1	13.3	0.35	1.18
ULAC 044F	4.6	26.1	3.2	14.0	NA	31.5	34.1	14.0	27.2	24.0	18.3	26.6	13.5	0.55	1.34
ULAC 058G	5.2	26.1	3.2	20.0	NA	31.5	35.4	20.0	34.2	24.0	18.3	29.9	15.2	0.55	0.40
ULAC 078G	5.2	32.3	3.9	26.8	NA	38.9	41.4	20.4	40.2	35.4	21.1	30.9	16.2	0.55	3.88
ULAC 112H	5.1	38.8	3.9	31.1	0.14	45.4	47.8	23.6	46.7	35.4	24.4	31.9	17.2	0.55	3.22
ULAC 200K	7.2	50.9	5.0	49.6	1.2	61.0	64.2	55.9	59.4	35.4	32.7	41.5	18.7	0.71	0.67

All dimensions listed above are in inches.

ULAC Motor Specifications

MOTOR HP	USED ON	MOTOR TYPE	Standard WEG Motor M	575V 60 Hz WEG Motor Q
1/2	ULAC-007B ULAC-011B ULAC-016B	Part Number	SM-.5-4-56C-DFM	SM-.5-4-56C-575V
		Specification	.5018ES3E56C-S	.5018ES3H56C-S
		Voltage Frequency	190-220/380-415V 50 Hz//208-230/460 V 60 Hz	575 V 60 Hz
		Full Load Amps	1.90-181/0.950-0.962 //1.91-1.72/0.862	0.69
1	ULAC-023D ULAC-033D ULAC-044D	Part Number	SM-1-4-56C-DFM	SM-1-4-56C-575V
		Specification	00118ET3E56C-S	00118ET3H56C-S
		Voltage Frequency	190-220/380-415V 50 Hz//208-230/460 V 60 Hz	575 V 60 Hz
		Full Load Amps	3.40-306/1.70-1.62 //3.25-2.94/1.47	1.18
3	ULAC-033F ULAC-044F	Part Number	EM-3-4-182T	ACM-3-4-182T-575V
		Specification	00318ET3E182T-S	00318ET3H182T-S
		Voltage Frequency	190-220/380-415 V 50 Hz//208-230/460 V 60 Hz	576 60Hz
		Full Load Amps	9.08-8.15/4.54-4.32//8.43-7.62/3.81	3.00
5	ULAC-058G ULAC-078G	Part Number	EM-5-4-184T	ACM-5-4-184T-575V
		Specification	00518ET3E184T-S	00518ET3H184T-S
		Voltage Frequency	190-220/380-415V 50 Hz//208-230/460 V 60 Hz	575 V 60 Hz
		Full Load Amps	15.8-14.1/7.88-7.4//14.4-13.0/6.49	5.19
7-1/2	ULAC-112H	Part Number	ACM-7.5-4-213T-DFM	ACM-7.5-4-213T-575V
		Specification	00718ET3E213T-S	00718ET3H213T-S
		Voltage Frequency	380, 400, 415 V 50 Hz//208-230/460 V 60 Hz	576 60Hz
		Full Load Amps	11.0, 10.6, 10.3//20.1-18.1/9.07	7.30
15	ULAC-200K	Part Number	EM-15-6-284TC	EM-15-6-284TC-575V
		Specification	01512ET3E284TC-W22	015ET3H284TC-W22
		Voltage Frequency	380, 400, 415 V 60 Hz//208-230/460 V 60 Hz	576 60Hz
		Full Load Amps	22.0, 20.9, 20.2//39.6-35.8/17.9	14.3

For any motor other than WEG, please consult factory.

Order Key for ULAC Oil Coolers

All positions must be filled in when ordering.

Series (1)	Model (2)	Motor (3)	Thermoswitch (4)	Core Bypass (5)	Integrated Filter (6)
ULAC	- 007B	- M	000	SA	- FIL

EXAMPLE: ULAC-007B-M000SA-FIL

1. OIL COOLER SERIES WITH AC MOTOR; ULAC	
2. COOLER SIZE/MODEL	
007B, 011B, 016B, 023D, 033F, 033D, 044F, 044D, 058G, 078G, 112H and 200K.	
3. MOTOR TYPE	
No motor	= W
Three-phase 380V 50 Hz, 208-230/460V 60 Hz	= M*
Three-phase 575V 60 Hz	= Q
Single-phase 115/230V 60 Hz	= R
Explosion proof, Division 1, Class 1 Group D, Class II Group F & G, T3C	= X**
Not listed, consult Accumulator and Cooler Division	= Z
*M-motor is standard.The performance at 50 HZ will be reduced by approximately 10%. P and N motor types were replaced by M motor type ** Thermal switch not available with explosion proof motor option cooler.	
4. THERMOSWITCH	
No thermoswitch	= 000
100 °F (38 °C)	= 100
120 °F (49 °C)	= 120
140 °F (60 °C)	= 140
160 °F (71 °C)	= 160
175 °F (79 °C)	= 175
5. CORE BYPASS	
No Bypass	= SW
20 psi External Hose Bypass (standard option)	= SA
65 psi External Hose Bypass (standard option)	= SB
6. FILTER	
No Integrated Filter	=
Integrated Filter	= FIL

Integrated filter kits on coolers, -FIL, come with filter mounted and all necessary hose/tube components. For for non-integrated filter kits bought as an accessory, the kit will come with the Filter, Bracket to mount to housing, and Fasteners. It will not include any hose/tube assemblies. For hose/tube assemblies, please buy from a Parker Distributor. You can find the nearest distributor at www.Parker.com/distributors.

Technical Specifications

FLUID COMBINATIONS	
Mineral oil	
Oil/water emulsion	
Water glycol	
Phosphate ester	
COOLER CORE*	
Maximum static working pressure	300 psi
Dynamic working pressure	200 psi**
Heat transfer tolerance	± 6 %
Maximum oil inlet temperature	250 °F
*Standard cores are single pass. Two pass cores and other options available upon request, please consult Accumulator and Cooler Division. ** Tested in accordance with ISO/DIS 10771-1	
MATERIAL	
Cooler core	Aluminum
Fan blades/hub	Glass fiber reinforced polypropylene/Aluminum
Fan housing	Steel
Fan Guard	Steel
Other parts	Steel
COOLING CAPACITY CURVES	
The cooling capacity curves in this catalogue are created using oil type ISO VG 46 oil.	
CONTACT PARKER FOR ADVICE ON	
Oil temperatures > 250 °F Oil viscosity > 100 cSt / 500 SSU @ 100 °C * Aggressive environments Environments with heavy airborne particulates High-altitude locations *See Viscosity Conversion Chart on page 45.	
ADDITIONAL OPTIONS INCLUDE (SEE ACCESSORIES, PAGE 38)	
Separately Mounted Full Flow Thermal/Pressure Bypass Valve, Stone Guard, Dust Guard, Air Filter, Oil Filter, Thermal Switch	

Learn more online:

UL Series: Air-Oil Cooler Configurator
Parker.com/air-oil-coolers
Competitive Cross Reference Tool
crossref.parker.com
UL Series: Air-Oil Cooler Sizing Software (.exe)
http://www.parker.com/ULsizing

The information in this brochure is subject to change without prior notice.

ULOC Cooling System

For industrial use – cooling capacity up to 60 HP

Product Features:

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, this 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.**
- **Cooler core with low pressure drop and high cooling capacity.**

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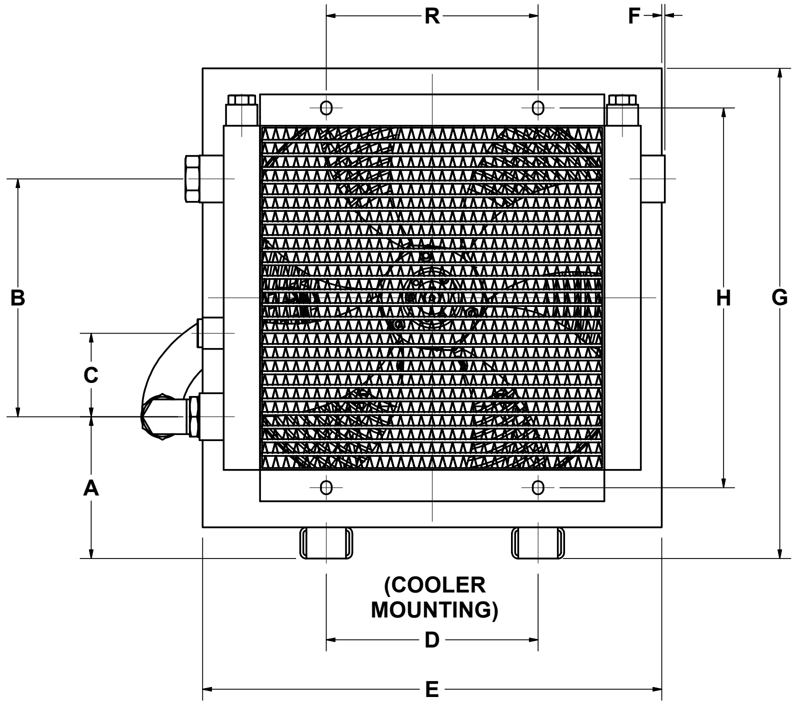
ULOC Cooling Performance



TYPE	Nom. Oil Flow Rate (gpm)	Cooling Capacity at 50 °F ETD (Btu/hr)	Cooling Capacity Btu/hr/°F	Acoustic Pressure Level LpA dB(A) 3 Ft.*	Motor HP / No. Of Poles	Motor	Optional Oil Filter Kit◊†
ULOC 007D - A	6.3	15,500	310	71	1/4	1-4-143TC	12CSFILTER**
ULOC 007D - B	12.7	19,000	380	71	1/4	1-4-143TC	12CSFILTER**
ULOC 007E - C	19.0	21,000	420	72	2/4	2-4-145TC	50CSFILTER***
ULOC 007E - D	25.4	22,500	450	72	2/4	2-4-145TC	50CSFILTER***
ULOC 011D - A	6.3	24,000	480	74	1/4	1-4-143TC	12CSFILTER
ULOC 011D - B	12.7	28,500	570	74	1/4	1-4-143TC	12CSFILTER
ULOC 011E - C	19.0	32,000	640	74	2/4	2-4-145TC	50CSFILTER
ULOC 011E - D	25.4	34,500	690	74	2/4	2-4-145TC	
ULOC 016E - A	6.3	33,500	670	78	2/4	2-4-145TC	
ULOC 016E - B	12.7	41,000	820	78	2/4	2-4-145TC	
ULOC 016E - C	19.0	47,000	940	78	2/4	2-4-145TC	
ULOC 016E - D	25.4	50,000	1,000	78	2/4	2-4-145TC	
ULOC 023F - B	12.7	60,000	1,200	82	3/4	3-4-182TC	
ULOC 023F - C	19.0	65,000	1,300	82	3/4	3-4-182TC	
ULOC 023F - D	25.4	70,000	1,400	82	3/4	3-4-182TC	
ULOC 033G - C	19.0	80,000	1,600	87	5/4	5-4-184TC	
ULOC 033G - D	25.4	90,000	1,800	87	5/4	5-4-184TC	
ULOC 044G - C	19.0	95,000	1,900	88	5/4	5-4-182TC	
ULOC 044G - D	25.4	105,000	2,100	88	5/4	5-4-182TC	

Electric motors specified are calculated for maximum 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.

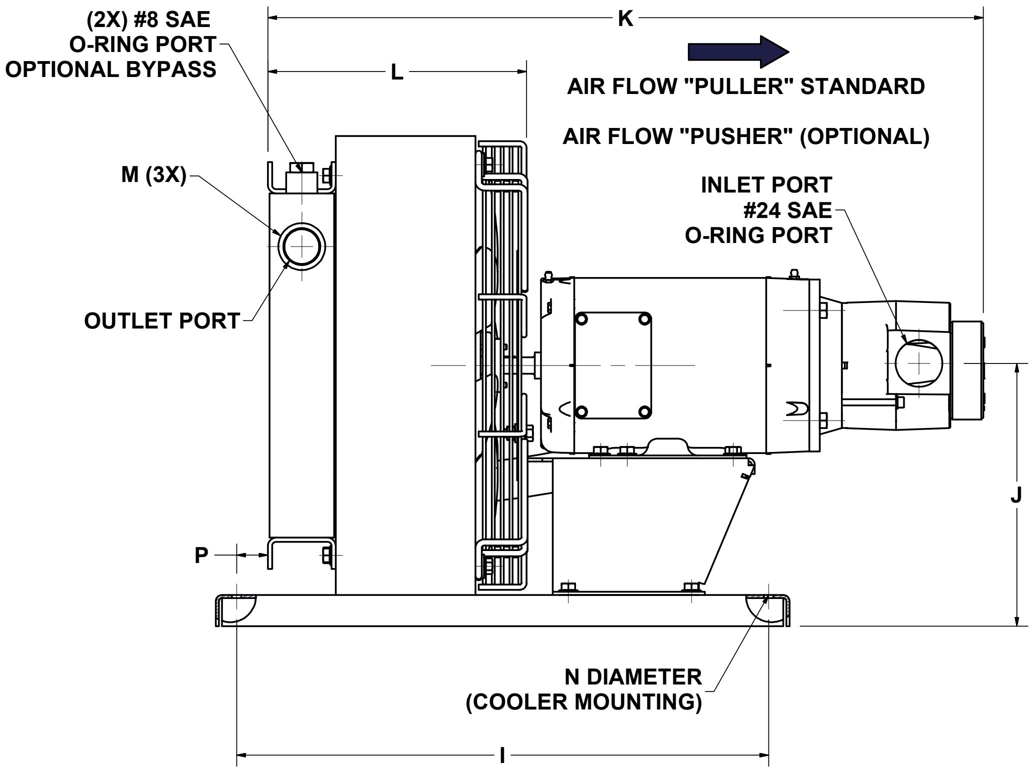
* Noise level tolerance ± 3 dB(A).

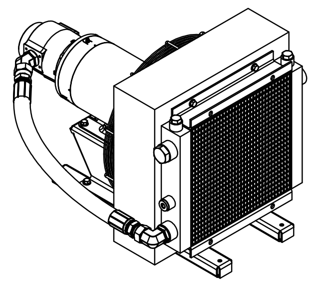
** Customer must also order 7DFILTERPIPE

*** Customer must also order 7EFILTERPIPE

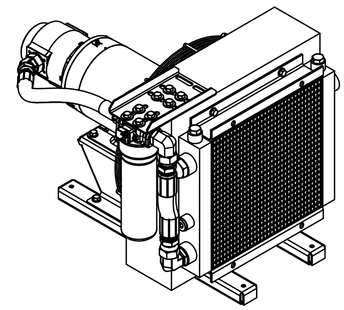
◊ For flow rates 0-15 gpm, use 12CSFILTER. For flow rates 15-50 gpm, use 50CSFILTER.

† Integrated filter kits on coolers, -FIL, come with filter mounted and all necessary hose/tube components. For for non-integrated filter kits bought as an accessory, the kit will come with the Filter, Bracket to mount to housing, and Fasteners. It will not include any hose/tube assemblies. For hose/tube assemblies, please buy from a Parker Distributor. You can find the nearest distributor at www.Parker.com/distributors.





ULOC



Oil Filter options

TYPE	A	B	C	D	E	F	G	H	I	J	K	L	M	N HOLE DIAMETER	P	R
ULOC 007D - A	5.2	6.3	3.1	8.0	14.4	0.2	15.6	11.7	20.1	8.4	26.1	8.8	1" (#16 SAE)	0.35	1.2	8.0
ULOC 007D - B	5.2	6.3	3.1	8.0	14.4	0.2	15.6	11.7	20.1	8.4	26.6	8.8	1" (#16 SAE)	0.35	1.2	8.0
ULOC 007E - C	5.2	6.3	3.1	8.0	14.4	0.2	15.6	11.7	20.1	8.4	27.1	8.8	1" (#16 SAE)	0.35	1.2	8.0
ULOC 007E - D	5.2	6.3	3.1	8.0	14.4	0.2	15.6	11.7	20.1	8.4	27.6	8.8	1" (#16 SAE)	0.35	1.2	8.0
ULOC 011D - A	5.4	9.0	3.1	8.0	17.3	0.1	18.5	14.3	20.1	9.9	27.0	9.8	1" (#16 SAE)	0.35	1.2	8.0
ULOC 011D - B	5.4	9.0	3.1	8.0	17.3	0.1	18.5	14.3	20.1	9.9	27.4	9.8	1" (#16 SAE)	0.35	1.2	8.0
ULOC 011E - C	5.4	9.0	3.1	8.0	17.3	0.1	18.5	14.3	20.1	9.9	28.0	9.8	1" (#16 SAE)	0.35	1.2	8.0
ULOC 011E - D	5.4	9.0	3.1	8.0	17.3	0.1	18.5	14.3	20.1	9.9	28.5	9.8	1" (#16 SAE)	0.35	1.2	8.0
ULOC 016E - A	5.1	11.7	3.1	8.0	19.5	0.3	20.7	17.0	20.1	11.0	27.7	10.6	1" (#16 SAE)	0.35	1.2	8.0
ULOC 016E - B	5.1	11.7	3.1	8.0	19.5	0.3	20.7	17.0	20.1	11.0	28.2	10.6	1" (#16 SAE)	0.35	1.2	8.0
ULOC 016E - C	5.1	11.7	3.1	8.0	19.5	0.3	20.7	17.0	20.1	11.0	28.8	10.6	1" (#16 SAE)	0.35	1.2	8.0
ULOC 016E - D	5.1	11.7	3.1	8.0	19.5	0.3	20.7	17.0	20.1	10.7	29.3	10.6	1" (#16 SAE)	0.35	1.2	8.0
ULOC 023F - B	5.2	14.9	3.1	14.0	22.8	0.2	24.0	20.2	24.0	12.4	30.7	11.2	1" (#16 SAE)	0.55	1.2	14.0
ULOC 023F - C	5.2	14.9	3.1	14.0	22.8	0.2	24.0	20.2	24.0	12.4	31.2	11.2	1" (#16 SAE)	0.55	1.2	14.0
ULOC 023F - D	5.2	14.9	3.1	14.0	22.8	0.2	24.0	20.2	24.0	12.4	31.7	11.2	1" (#16 SAE)	0.55	1.2	14.0
ULOC 033G - C	5.2	19.1	3.1	14.0	27.2	-	28.4	24.5	24.0	14.6	32.7	12.5	1¼" (#20 SAE)	0.55	1.3	14.0
ULOC 033G - D	5.2	19.1	3.1	14.0	27.2	-	28.4	24.5	24.0	14.9	33.2	12.5	1¼" (#20 SAE)	0.55	1.3	14.0
ULOC 044G - C	4.6	26.1	3.1	14.0	27.2	-	34.1	31.5	24.0	17.4	33.7	13.5	1¼" (#20 SAE)	0.55	1.3	14.0
ULOC 044G - D	4.6	26.1	3.1	14.0	27.2	-	34.1	31.5	24.0	17.4	33.9	13.5	1¼" (#20 SAE)	0.55	1.3	14.0

*** 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 Oil Coolers

All positions must be filled in when ordering.

Series (1)	Model (2)	Motor (3)	Pump Flow Rate (4)	Core Bypass (5)	Integrated Filter (6)
ULOC	- 007D	- M	- A	- SA	- FIL

EXAMPLE: ULOC-007D-M-A-SA-FIL

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, 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 15%

4. PUMP FLOW RATE (GPM)

60 HZ	50 HZ	
6	5	= A
12	10	= B
19	15.8	= C
25	20.8	= D

5. CORE BYPASS*

No Bypass	= SW
20 psi External Hose Bypass (standard option)	= SA
65 psi External Hose Bypass (standard option)	= SB

6. FILTER

No Integrated Filter	=
Integrated Filter	= FIL

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

Learn more online:

UL Series: Air-Oil Cooler Sizing Software (.exe)
http://www.parker.com/ULsizing

Technical Specifications

COOLER CORE

Maximum static working pressure	300 psi
Dynamic working pressure	200 psi*
Heat transfer tolerance	± 6 %
Maximum oil inlet temperature	210 °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 5 inches Hg 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

CONTACT PARKER FOR ADVICE ON

Water-glycol that is < 60% glycol, Oil temperatures > 210 °F, Oil viscosity > 100 cSt /500 SSU*, Aggressive environments, Environments with heavy airborne particulates, High-altitude locations
*See page 45 for Viscosity Conversion Chart

ADDITIONAL OPTIONS INCLUDE

Separately Mounted Full Flow Thermal/Pressure Bypass Valve, Stone Guard, Dust Guard, Air Filter, Oil Filter

Available options to include separately mounted full flow thermal/pressure bypass valve, thermal switch (see Accessories, page 38). **Note:** Thermal switch (sold separately) if used, should be installed in the hydraulic reservoir and not the cooler.

CALIFORNIA PROP 65: WARNING:

This product can expose you to chemicals including lead which is known to the State of California to cause cancer and birth defects, or other reproductive harm.

For more information go to www.P65Warnings.ca.gov

ULOC Motor Specifications

MOTOR HP	USED ON	MOTOR TYPE	Standard Baldor Motor M	575V 60 Hz Q
1	ULOC-007D ULOC-011D	Part Number	ACD-1-4-143TC	ACD-1-4-143TC-575V
		Specification	35Q869-0087G3	35Q154-0292G2
		Voltage Frequency	190/380 50 Hz//208-230/460 60Hz	575 60Hz
		Full Load Amps	3.4/1.7//3.6-3.4/1.7	1.4
2	ULOC-007E ULOC-011E ULOC-016E	Part Number	ACD-2-4-145TC	ACD-2-4-145TC-575V
		Specification	35Q869-0872G1	35Q154-3282G1
		Voltage Frequency	190/380 50 Hz//208-230/460 60Hz	575 60Hz
		Full Load Amps	5.6/2.8//6.5-6.2/3.1	2.5
3	ULOC-023F	Part Number	ACD-3-4-182TC	ACD-3-4-182TC-575V
		Specification	35Q155Y334G1	36J109S582G1
		Voltage Frequency	190/380 50 Hz//208-230/460 60Hz	575 60Hz
		Full Load Amps	7.2/3.6//8.5-8.2/4.1	3.3
5	ULOC-033G ULOC-044G	Part Number	ACD-5-4-184TC	ACD-5-4-184TC-575V
		Specification	36H929W415G1	36L793W423G2
		Voltage Frequency	190/380 50 Hz//208-230/460 60Hz	575 60Hz
		Full Load Amps	10.4/5.2//15-13.2/6.6	5.3

The information in this brochure is subject to change without prior notice.

ULDC with DC Motor

For mobile use – cooling capacity up to 40 HP

Product Features:

The ULDC oil cooler with 12V 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 or 24V.**

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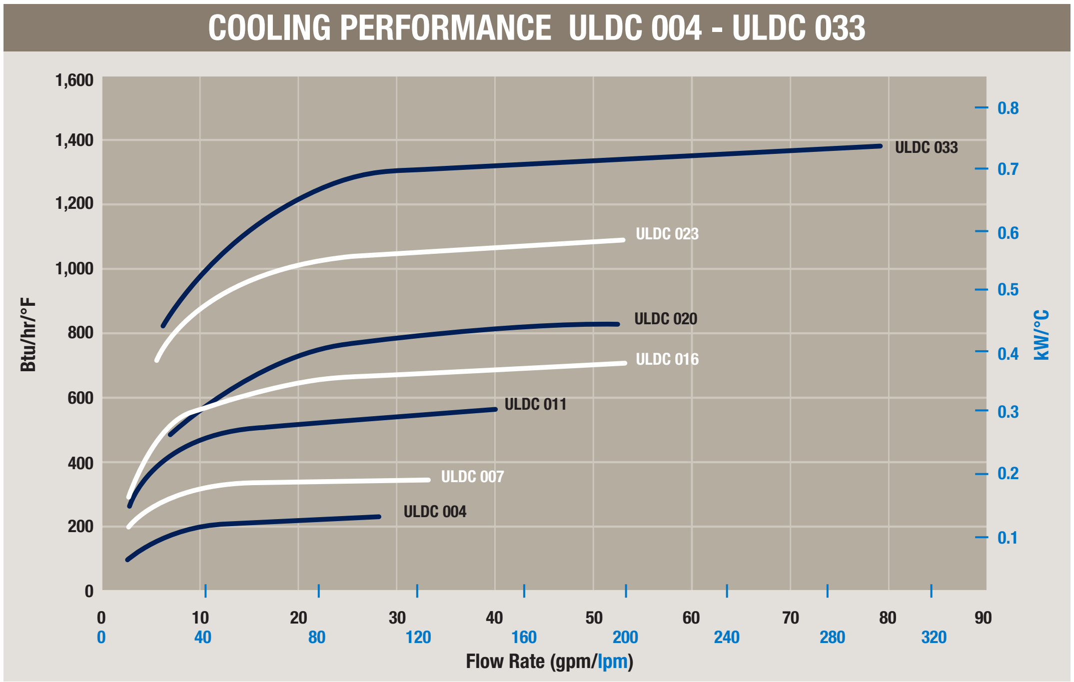
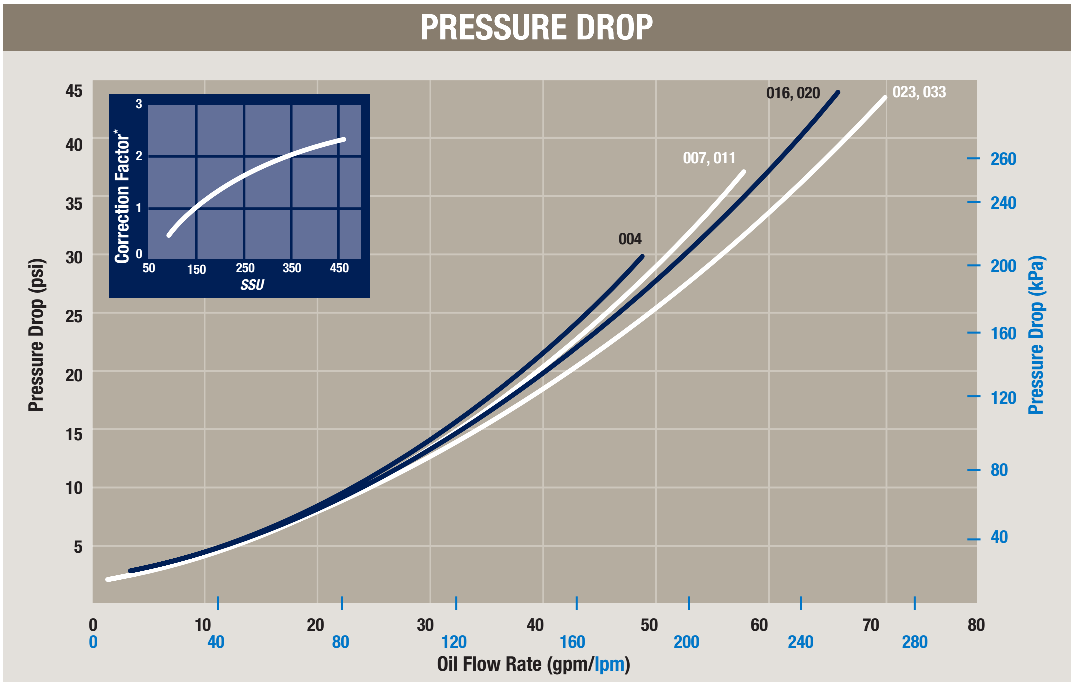
ULDC Cooling Performance

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 capacity tolerance ± 10%.



* Pressure Drop Correction Factor for other viscosities.

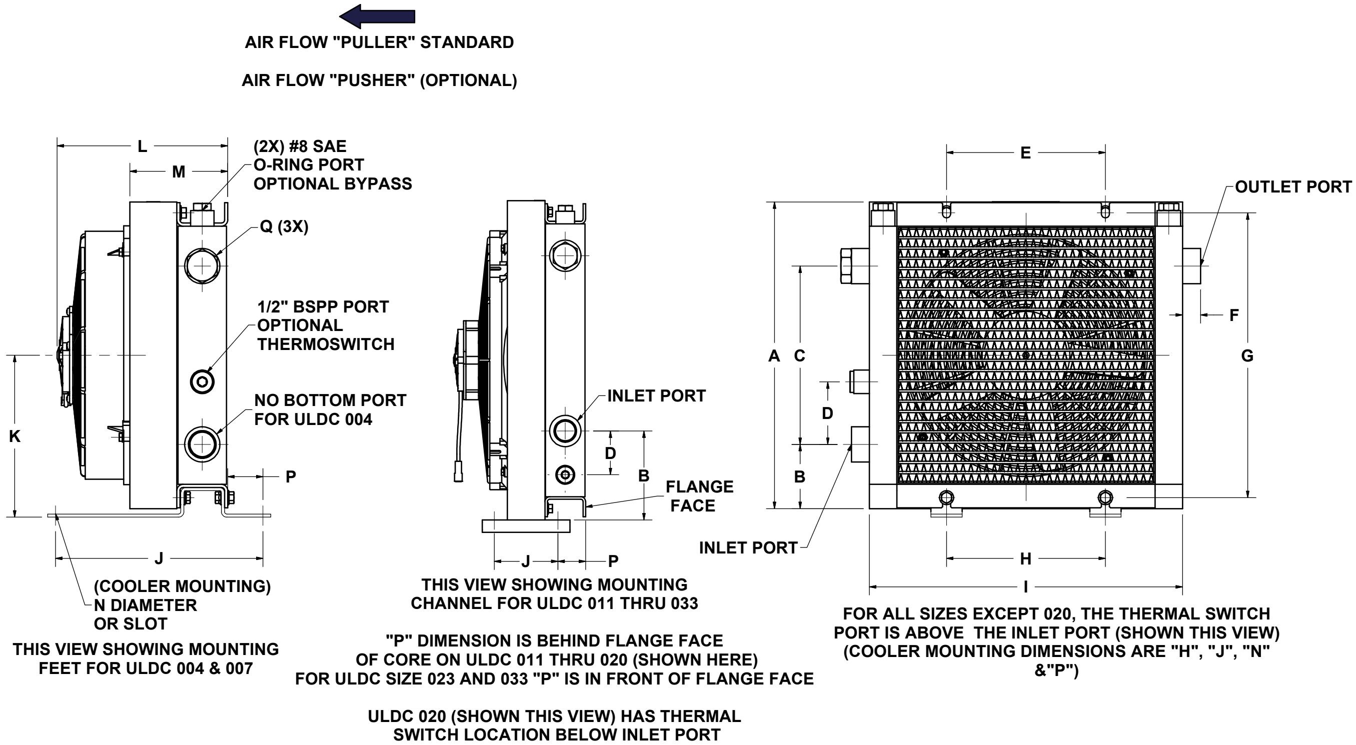
Helpful Equations

Unit Conversion: ____ [HP/(Max Oil Inlet Temp °F - Ambient Air Temp °F)] x 2547 = _____BTU/hr/°F

_____kW/°C x 1897 = _____BTU/hr/°F

_____GPM x 3.79 = _____ LPM

_____PSI x 6.894 = _____ kPa



ULDC Cooler

Type	Weight lbs (Approx.)	Acoustic Pressure LpA dB(A) 3 Ft.*	Running Current (Amps.)**		Q SAE O-Ring Boss	Recommended Fuse	
			12 Volts	24 Volts		12V	24V
ULDC 004	13	68	7	4	1" (#16)	15	10
ULDC 007	20	71	13	6	1" (#16)	30	15
ULDC 011	26	75	20	12	1" (#16)	40	30
ULDC 016	33	75	20	12	1" (#16)	40	30
ULDC 020	40	82	20	10	1" (#16)	50	30
ULDC 023	55	75	20	12	1" (#16)	40	30
ULDC 033	66	75	20	12	1¼" (#20)	40	30

* Noise level tolerance ± 3 dB(A).
** ULDC-023 & ULDC-033 Cooler assemblies come with two fans each. The indicated running current is for one fan only.

Type	A	B	C	D	E	F	G	H	I	J	K	L	M	N Ø Hole Diameter or Slot Size	P	Q
ULDC 004	9.6	-	-	-	6.0	0.9	9.0	5.3	10.5	5.8	5.2	6.0	4.1	.35 x 0.55	0.6	1" (#16 SAE)
ULDC 007	13.0	3.3	6.3	3.1	8.0	0.9	11.7	8.0	13.0	10.4	6.8	6.7	4.1	0.35	1.8	1" (#16 SAE)
ULDC 011	15.4	3.2	9.0	3.1	8.0	0.9	14.3	14.2	15.7	4.0	8.5	8.6	4.9	0.35 x .79	1.8	1" (#16 SAE)
ULDC 016	18.2	3.3	11.7	3.1	8.0	0.9	17.0	16.4	18.3	4.0	9.9	8.6	4.9	0.35 x .79	1.8	1" (#16 SAE)
ULDC 020	20.1	5.6	11.0	-2.8*	8.0	0.9	18.7	18.5	20.1	4.0	10.8	8.3	4.9	0.35 x .79	1.8	1" (#16 SAE)
ULDC 023	24.2	4.7	14.9	3.1	14.0	0.9	20.2	14.0	24.2	11.4	7.9/17.9	8.6	4.9	.50	1.4	1" (#16 SAE)
ULDC 033	25.9	3.4	19.1	3.1	14.0	1.0	24.5	14.0	25.0	11.4	8.8/18.8	10.2	6.5	.50	1.4	1¼" (#20 SAE)

All dimensions listed above are in inches.
* Thermoswitch port is below inlet port.

Order Key for ULDC Oil Coolers

All positions must be filled in when ordering.

Series (1)	Model (2)	Motor (3)	Thermoswitch (4)	Core Bypass (5)
ULDC	- 004	- A	- 000	SW

EXAMPLE: ULDC-004-A-000SW

1. OIL COOLER SERIES WITH DC MOTOR; ULDC	
2. COOLER SIZE/MODEL	
004, 007, 011, 016, 020, 023, 033	
3. MOTOR VOLTAGE	
12 V Puller (Standard)	= A
12 V Pusher (Optional)	= AP
24V Puller (Standard)	= B
24V Pusher (Optional)	= BP
4. THERMOSWITCH	
No thermoswitch	= 000
100 °F (38°C)	= 100
120 °F (49°C)	= 120
140 °F (60°C)	= 140
160 °F (71°C)	= 160
175 °F (79°C)	= 175
5. CORE BYPASS*	
No Bypass	= SW
20 psi External Hose Bypass	= SA
65 psi External Hose Bypass	= SB

* The standard cores are single pass. Two pass cores and other options available upon request, please consult Accumulator and Cooler Division.
Core bypass not available for size -004 coolers. Available on sizes -007 and above.

Learn more online:

UL Series: Air-Oil Cooler Configurator
Parker.com/air-oil-coolers
Competitive Cross Reference Tool
crossref.parker.com
UL Series: Air-Oil Cooler Sizing Software (.exe)
http://www.parker.com/ULsizing

Technical Specifications

FLUID COMBINATIONS	
Mineral oil	
Oil/water emulsion	
Water glycol	
Phosphate ester	
MATERIAL	
Cooler core	Aluminum
Fan blades/guard	Glass fiber reinforced polypropylene
Fan housing	Steel
Other parts	Steel
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	
The cooling capacity curves in this catalogue are created using oil type ISO VG 46 oil.	
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	
*See Viscosity Converion Chart on page 45	

FAN MOTOR CONNECTION

AMP	**180908-0**	**CONNECTOR**
AMP	**42460**	**TERMINAL**

MATING CONNECTOR

AMP	**180907**	**CONNECTOR**
AMP	**42281**	**TERMINAL**

Red = (+) Black = (-)

ADDITIONAL OPTIONS INCLUDE

Separately Mounted Full Flow Thermal/Pressure Bypass Valve, Stone Guard, Dust Guard, Air Filter, Oil Filter

Available options to include separately mounted full flow thermal/pressure bypass valve (see Accessories, page 38)

CALIFORNIA PROP 65: WARNING:

This product can expose you to chemicals including carbon black, which is known to the State of California to cause cancer and birth defects, or other reproductive harm.

For more information go to www.P65Warnings.ca.gov

The information in this brochure is subject to change without prior notice.

ULHC with Hydraulic Motor

For mobile and industrial use – maximum cooling capacity 185 HP

Product Features:

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 cc/rev to 28 cc/rev.**
- **Collar bearing for fan motor on larger models provides longer operating life.**
- **Cooler core with low pressure drop and high cooling capacity.**

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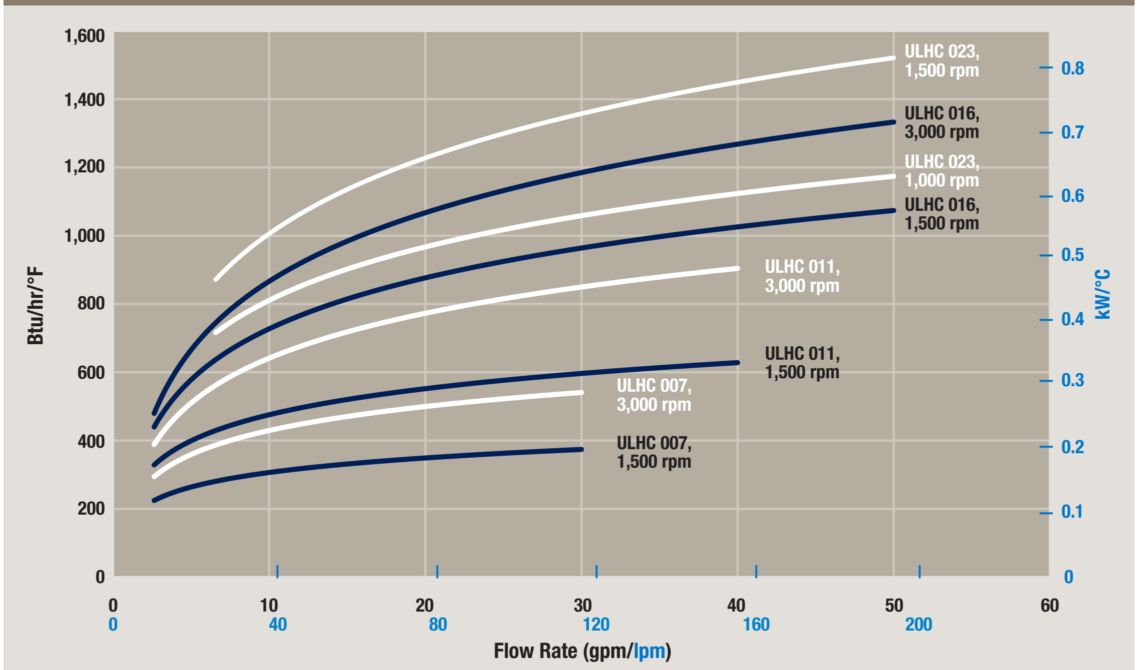
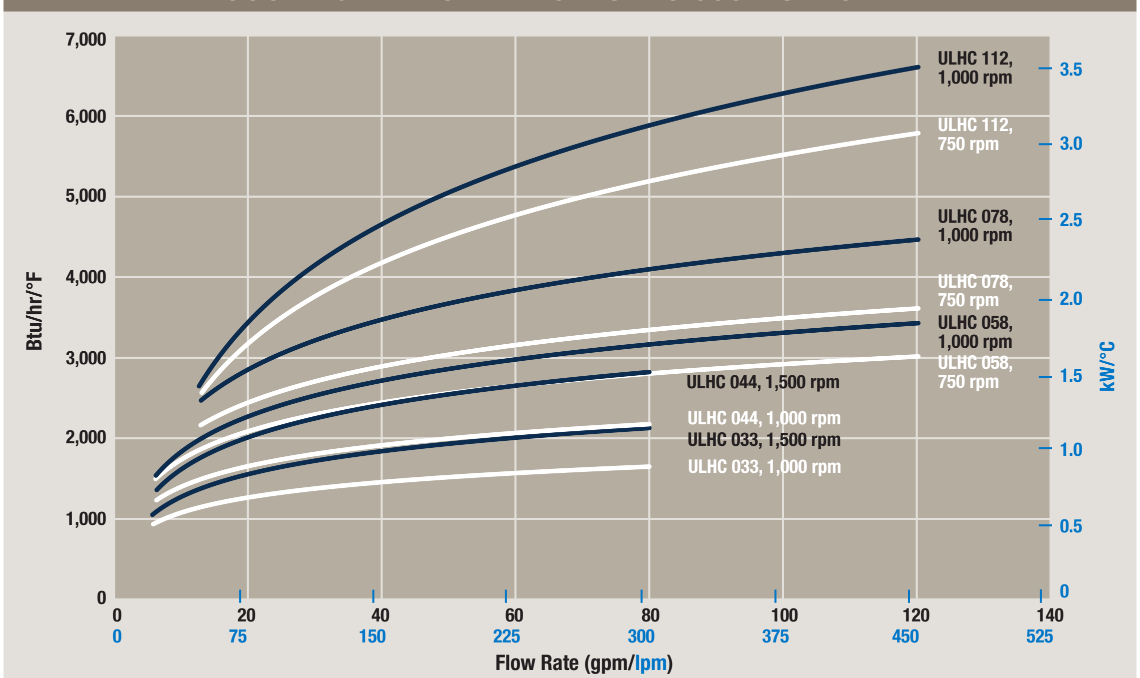
ULHC Cooling Performance

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.

COOLING PERFORMANCE ULHC 007 - ULHC 023



COOLING PERFORMANCE ULHC 033 - ULHC 112



Helpful Equations

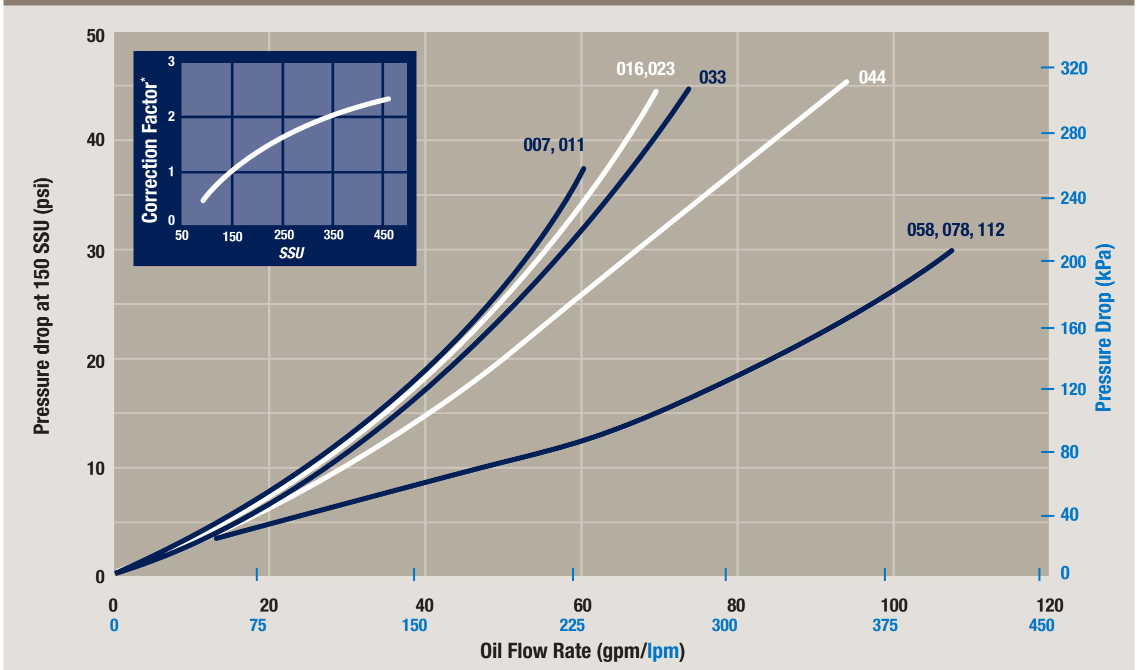
Unit Conversion: ____ [HP/(Max Oil Inlet Temp °F - Ambient Air Temp °F)] x 2547 = _____BTU/hr/°F

_____kW/°C x 1897 = _____BTU/hr/°F

_____GPM x 3.79 = _____ LPM

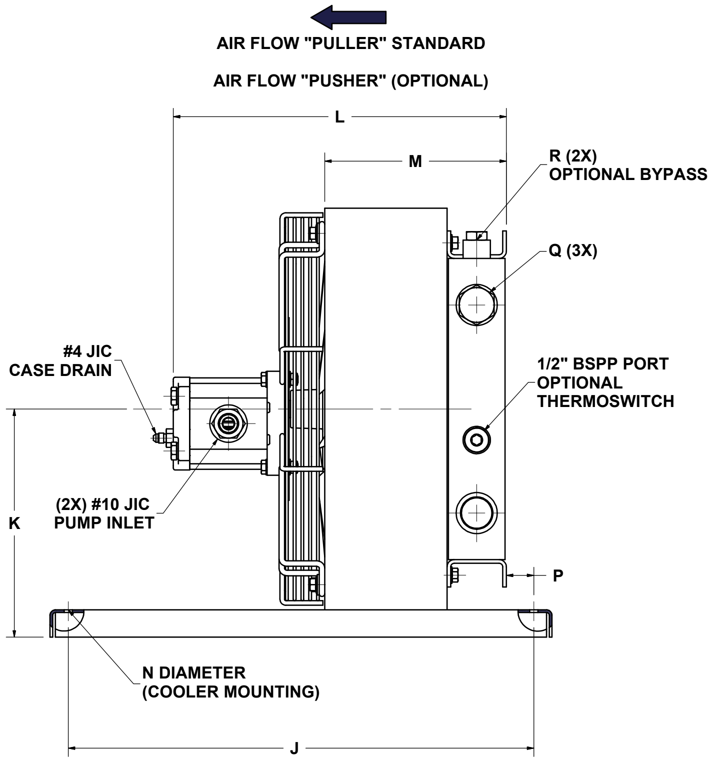
_____PSI x 6.894 = _____ kPa

PRESSURE DROP



*** Pressure Drop Correction Factor for other viscosities.**

Helpful Equations
Unit Conversion: ____ [HP/(Max Oil Inlet Temp °F - Ambient Air Temp °F)] x 2547 = _____BTU/hr/°F
_____kW/°C x 1897 = _____BTU/hr/°F
_____GPM x 3.79 = _____ LPM
_____PSI x 6.894 = _____ kPa

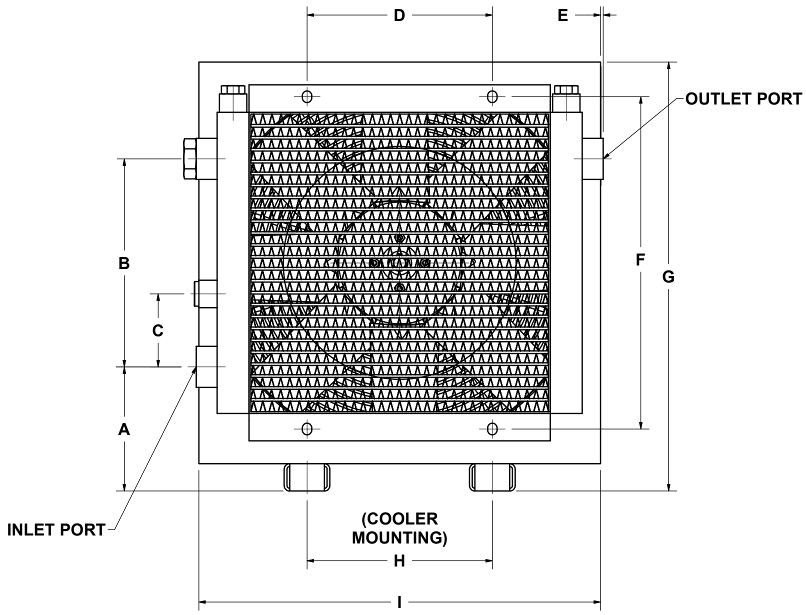


Type	Fan Speed rpm	Fan Power HP	Weight lbs. (Approx.)	Acoustic Pressure Level LpA dB(A) 3 Ft*	Max Allowable Fan Speed rpm
ULHC 007	1,500	0.13	22	62	3,500
	3,000	0.87	22	79	3,500
ULHC 011	1,500	0.27	33	67	3,500
	3,000	2.01	33	82	3,500
ULHC 016	1,500	0.13	40	60	3,500
	3,000	0.47	40	70	3,500
ULHC 023	1,000	0.20	66	64	2,840
	1,500	0.67	66	76	2,840
ULHC 033	1,000	0.87	88	75	2,350
	1,500	2.68	88	85	2,350
ULHC 044	1,000	0.94	123	77	2,350
	1,500	2.68	123	86	2,350
ULHC 058	750	1.01	170	75	1,850
	1,000	2.41	170	83	1,850
ULHC 078	750	0.94	245	81	1,690
	1,000	2.15	245	88	1,690
ULHC 112	750	2.28	276	86	1,440
	1,000	5.36	276	92	1,440

* Noise level tolerance ± 3 dB(A).

Motor	Displacement cc/rev	Max. Working Pressure psi
A	8	3,000
B	11	3,000
C	14	3,000
D	17	3,000
E	19	3,000
F	28	2,330

All dimensions listed above are in inches.



Type	A	B	C	D	E	F	G	H	I	J	K	L	M	P
ULHC 007	5.2	6.3	3.1	8.0	0.2	11.7	15.6	8.0	14.4	20.1	7.8	13.4	8.8	1.2
ULHC 011	5.4	9.0	3.1	8.0	0.1	14.3	11.7	18.5	17.3	20.1	9.2	14.4	9.8	1.2
ULHC 016	5.1	11.7	3.1	8.0	0.3	17.0	20.7	8.0	19.5	20.1	10.3	15.2	10.6	1.2
ULHC 023	5.2	14.9	3.1	14.0	0.2	20.2	24.0	14.0	22.8	20.1	12.0	15.8	11.2	1.2
ULHC 033	5.2	19.1	3.1	14.0	-	24.5	28.4	14.0	27.2	20.1	14.2	18.7	12.5	1.2
ULHC 044	4.6	26.1	3.1	14.0	-	31.5	34.1	14.0	27.2	20.1	17.0	19.7	13.5	1.2
ULHC 058	5.2	26.1	3.1	20.0	-	31.5	35.4	20.0	34.2	20.1	17.6	21.5	15.3	1.2
ULHC 078	5.1	32.3	3.9	26.8	-	38.9	41.4	20.4	40.2	24.0	20.7	22.5	16.2	0.8
ULHC 112	5.1	38.8	3.9	31.1	0.1	45.4	47.8	23.6	46.7	24.0	23.9	23.4	17.2	0.8

All dimensions listed above are in inches.

Type	N Hole Diameter	Q O-ring Boss	R O-ring	Motor Selection
ULHC 007	0.35	1" (#16 SAE)	½" (#8 SAE)	A - F
ULHC 011	0.35	1" (#16 SAE)	½" (#8 SAE)	A - F
ULHC 016	0.35	1" (#16 SAE)	½" (#8 SAE)	A - F
ULHC 023	0.35	1" (#16 SAE)	½" (#8 SAE)	A - F
ULHC 033	0.35	1¼" (#20 SAE)	½" (#8 SAE)	A - F
ULHC 044	0.35	1¼" (#20 SAE)	½" (#8 SAE)	A - F
ULHC 058	0.35	1½" (#24 SAE)	¾" (#12 SAE)	A - F
ULHC 078	0.55	1½" (#24 SAE)	¾" (#12 SAE)	B - F
ULHC 112	0.55	1½" (#24 SAE)	¾" (#12 SAE)	D - F

All dimensions listed above are in inches.

Order Key for ULHC Oil Coolers

All positions must be filled in when ordering.

Series (1)	Model (2)	Motor (3)	Thermoswitch (4)	Core Bypass (5)
ULHC	- 023	- A	- 000	SA

EXAMPLE: ULHC-023-A-000SA

1. OIL COOLER SERIES WITH HC 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 cc/rev.	= A
Displacement 11 cc/rev.	= B
Displacement 14 cc/rev.	= C
Displacement 17 cc/rev.	= D
Displacement 19 cc/rev.	= E
Displacement 28 cc/rev.	= F
4. THERMO CONTACT	
No thermoswitch	= 000
100 °F (38°C)	= 100
120 °F (49°C)	= 120
140 °F (60°C)	= 140
160 °F (71°C)	= 160
175 °F (79°C)	= 175
5. CORE BYPASS*	
No Bypass	= SW
20 psi External Hose Bypass (standard option)	= SA
65 psi External Hose Bypass (standard option)	= SB

* M is 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
COOLER CORE	
Maximum static working 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 catalogue are created using oil type ISO VG 46 oil.	
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	
*See Viscosity Conversion Chart on page 45.	
ADDITIONAL OPTIONS INCLUDE	
Separately Mounted Full Flow Thermal/Pressure Bypass Valve, Stone Guard, Dust Guard, Air Filter, Oil Filter	

Available options to include separately mounted full flow thermal/pressure bypass valve (see Accessories, page 38)

Learn more online:

UL Series: Air-Oil Cooler Configurator
Parker.com/air-oil-coolers
Competitive Cross Reference Tool
crossref.parker.com
UL Series: Air-Oil Cooler Sizing Software (.exe)
http://www.parker.com/ULsizing

CALIFORNIA PROP 65: WARNING:
This product can expose you to chemicals including lead which is known to the State of California to cause cancer and birth defects, or other reproductive harm.
For more information go to www.P65Warnings.ca.gov

The information in this brochure is subject to change without prior notice.

OAW Water-Oil Cooler

For industrial use

Product Features:

The OAW oil cooler is optimized for use in mobile and industrial markets. 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.**
- **For BSPP Ports (ISO-9) see PWO Cooler Catalog**
- **Maximum material efficiency with no “Dead Zone.”**

General

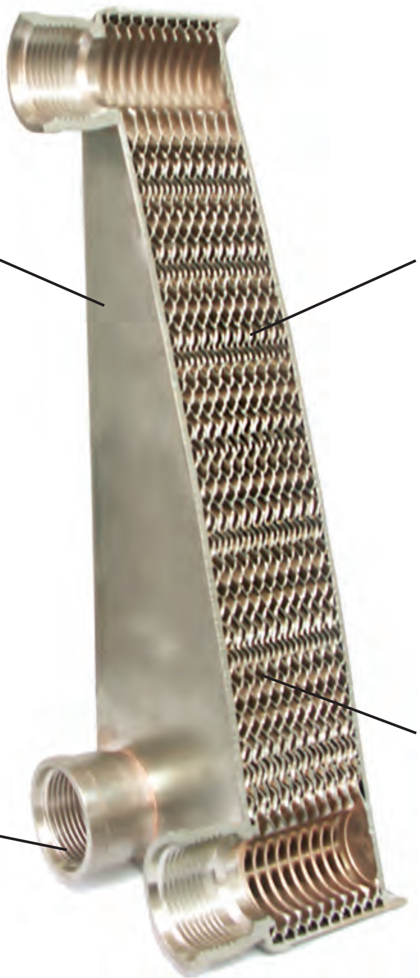
OAW Water-Oil Coolers

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.

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:

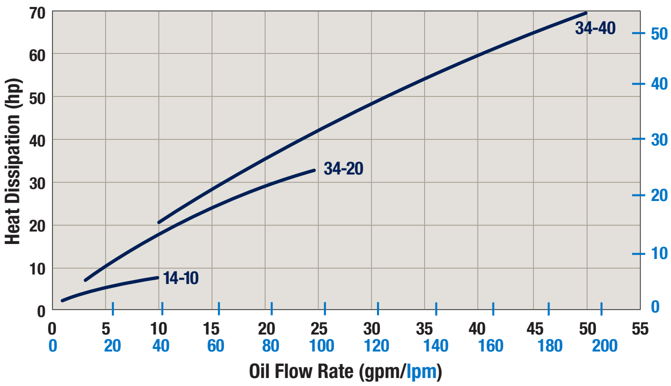
Maximum material efficiency. No “Dead Zone” because there is no need for gaskets.

OAW 14 & OAW 34

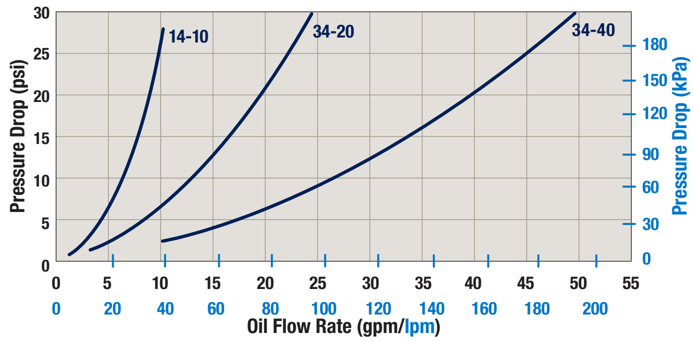
MODEL	Cooling Capacity (*hp)	Connection	A (inches)	Weight (lbs.)	Volume (in³)
OAW 14-10-SG	2-7	5/8" SAE O-ring	-	1.4	15
OAW 34-20	6-33	1" SAE O-ring	2.3	9	74
OAW 34-40	20-69	1" SAE O-ring	4.1	15	149

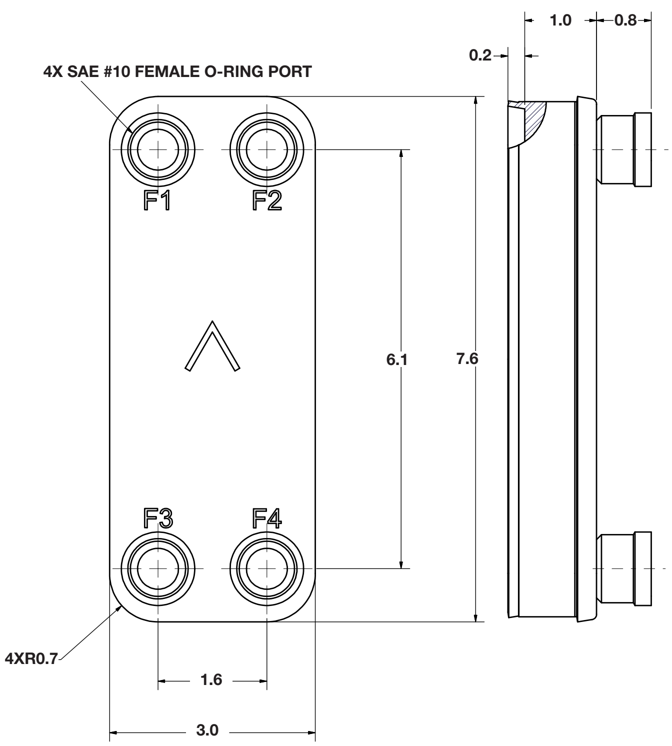
*Cooling capacity is calculated with the following conditions. For other flow conditions, type of fluids or temperatures, please see page 35 or consult Accumulator and Cooler Division. Oil type – ISO VG 32 – Oil/water flow ratio – 2:1 – Oil inlet temperature – 140°F – Water inlet temperature – 80°F. See page 45 for Viscosoty Conversion chart.

OAW 14 & 34 COOLING CAPACITY

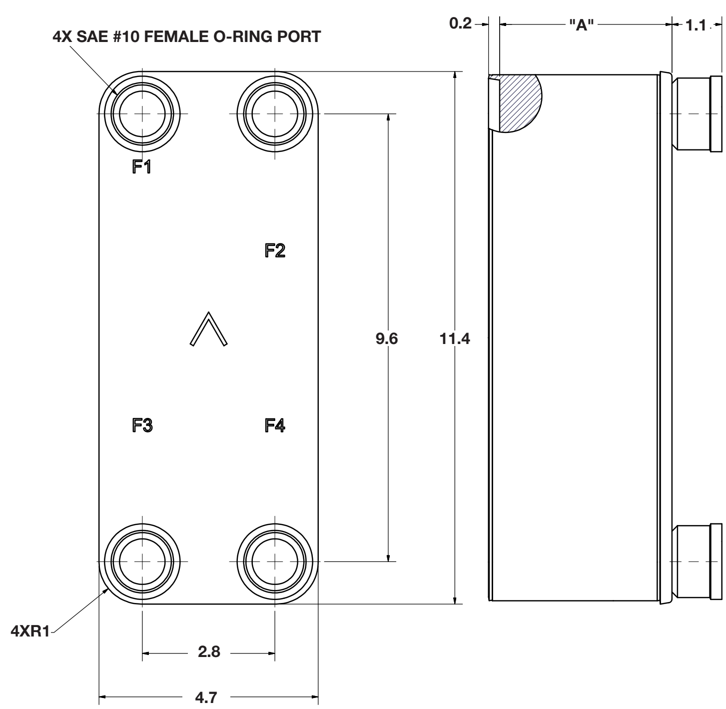


OAW 14 & 34 PRESSURE DROP





OAW 14



OAW 34

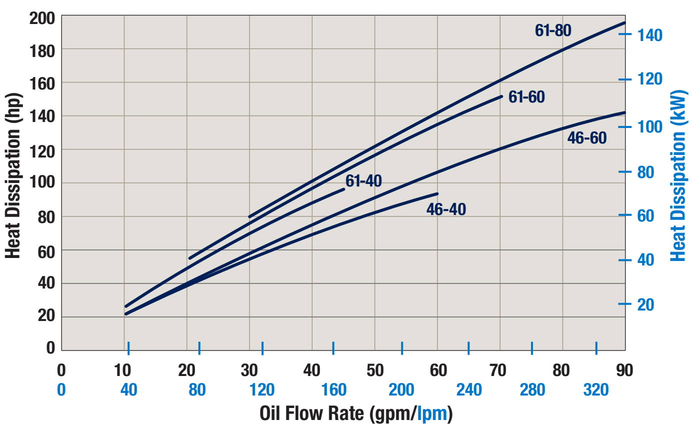
Helpful Equations
Horsepower equation: ____HP x 0.7457 = _____ kW
GPM to LPM equation: _____ GPM x 3.79 = _____ LPM
PSI to kPa equation: _____PSI x 6.894 = ______ kPa

OAW 46 & OAW 61

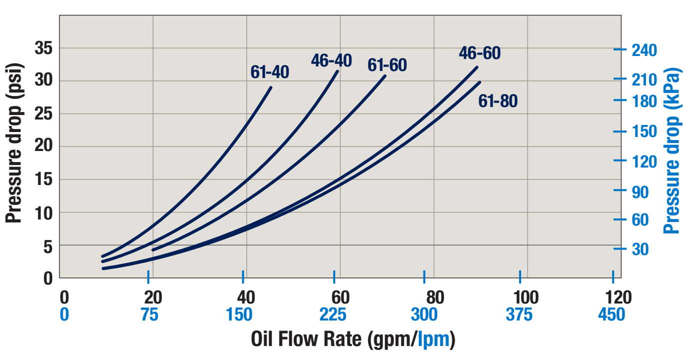
MODEL	Cooling Capacity (*hp)	Connection	A (inches)	Weight (lbs.)	Volume (in³)
OAW 46-40	21-94	1¼" SAE O-ring	3.9	13	200
OAW 46-60	23-142	1¼" SAE O-ring	5.7	18	300
OAW 61-40	27-98	1¼" SAE O-ring	3.9	19	271
OAW 61-60	53-152	1¼" SAE O-ring	5.7	27	406
OAW 61-80	79-198	1¼" SAE O-ring	7.4	34	542

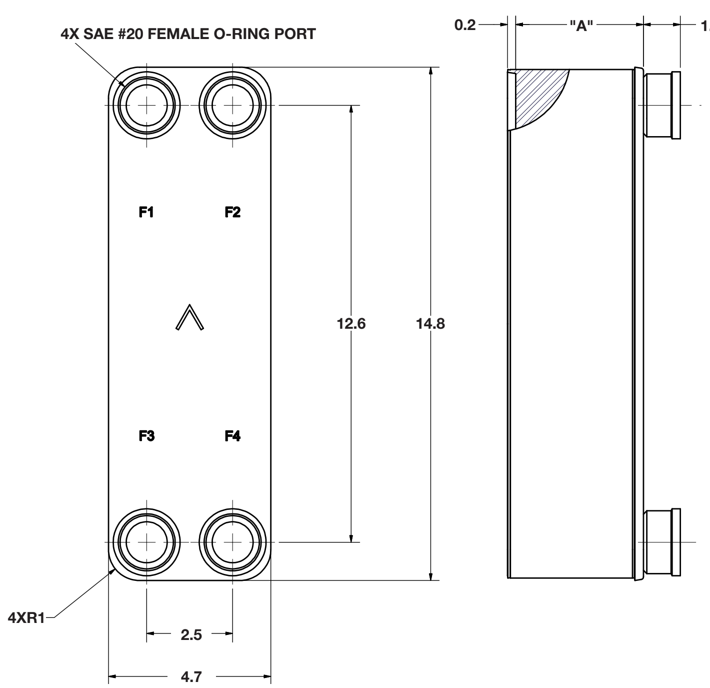
*Cooling capacity is calculated with the following conditions. For other flow conditions, type of fluids or temperatures, please see page 35 or consult Accumulator and Cooler Division. Oil type – ISO VG 32 – Oil/water flow ratio – 2:1 – Oil inlet temperature – 140°F – Water inlet temperature – 80°F See page 45 for Viscosoty Conversion chart.

OAW 46 & 61 COOLING CAPACITY

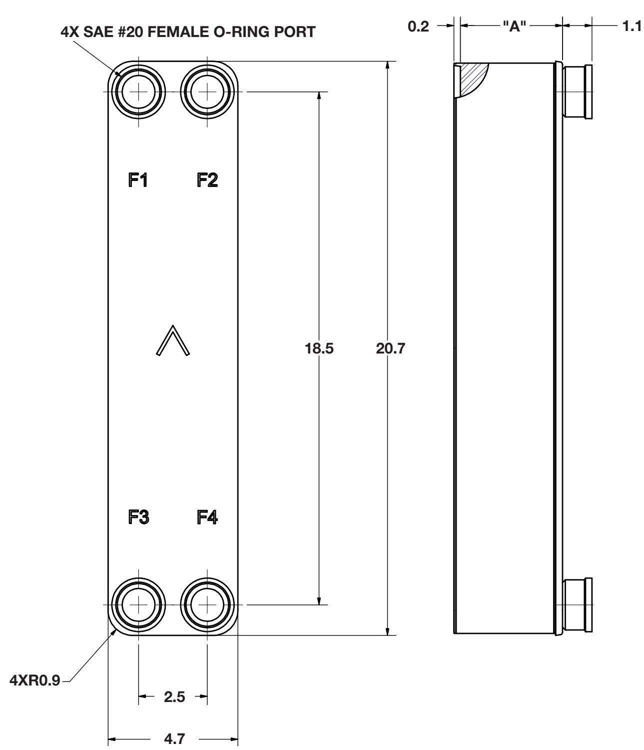


OAW 46 & 61 PRESSURE DROP





OAW 46



OAW 61

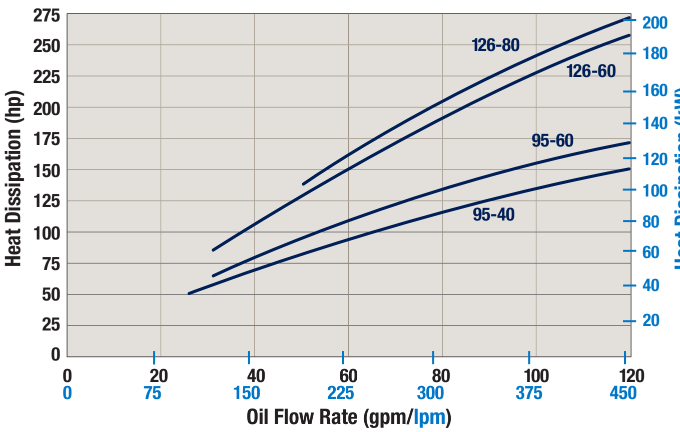
Helpful Equations
Horsepower equation: ____HP x 0.7457 = _____ kW
GPM to LPM equation: _____ GPM x 3.79 = _____ LPM
PSI to kPa equation: _____PSI x 6.894 = _____ kPa

OAW 95 & OAW 126

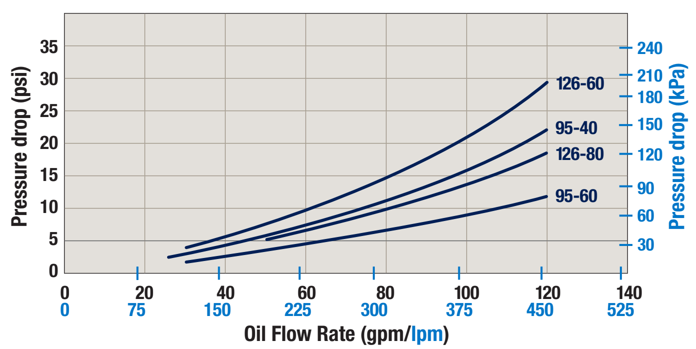
MODEL	Cooling Capacity (*hp)	Connection	A (inches)	Weight (lbs.)	Volume (in³)
OAW 95-40	50-150	1½" SAE O-ring	4.1	44	427
OAW 95-60	63-171	1½" SAE O-ring	6.0	59	641
OAW 126-60	84-259	1½" SAE O-ring	6.1	79	856
OAW 126-80	138-274	1½" SAE O-ring	7.9	97	1142

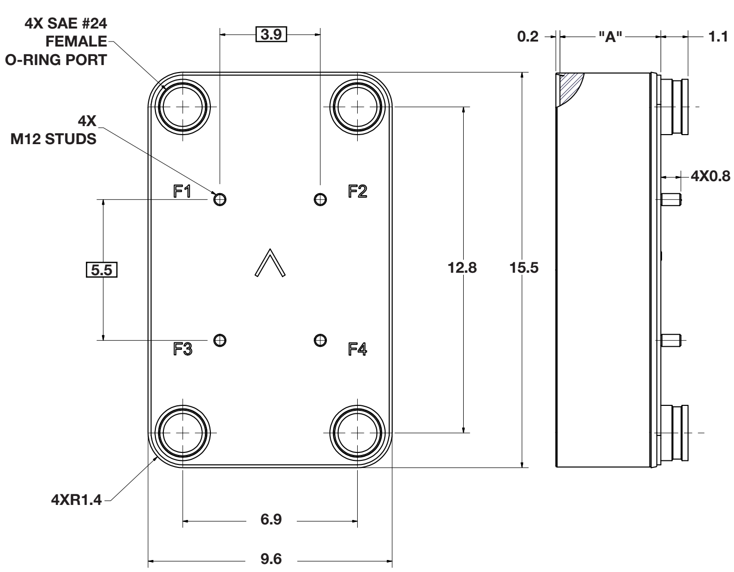
*Cooling capacity is calculated with the following conditions. For other flow conditions, type of fluids or temperatures, please see page 35 or consult Accumulator and Cooler Division. Oil type – ISO VG 32 – Oil/water flow ratio – 2:1 – Oil inlet temperature – 140°F – Water inlet temperature – 80°F See page 45 for Viscosoty Conversion chart.

OAW 95 & 126 COOLING CAPACITY

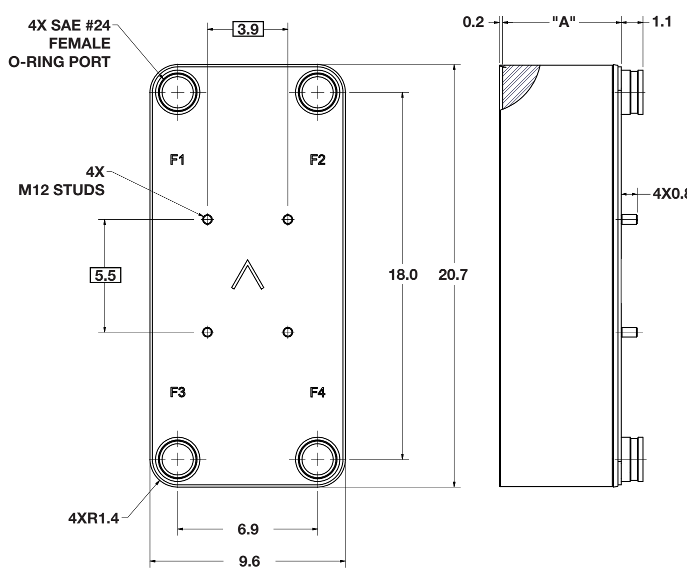


OAW 95 & 126 PRESSURE DROP





OAW 95



OAW 126

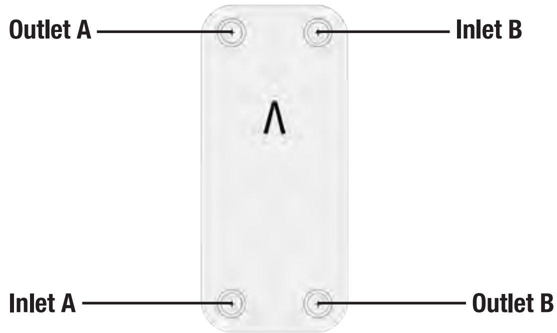
Helpful Equations
Horsepower equation: ____HP x 0.7457 = _____ kW
GPM to LPM equation: _____ GPM x 3.79 = _____ LPM
PSI to kPa equation: _____PSI x 6.894 = _____ kPa

OAW Installation Guide

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 "Armaflex" 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.

Viscocity 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

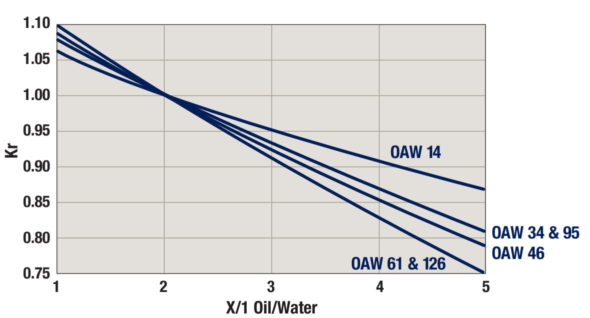
Cooling Capacity: For inlet temperature differences other than 60 °F, multiply the requested cooling capacity by the correction factor Kt.

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 = To - Tw = 140°F - 100°F = 40°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*.

$$Qd = \frac{Qr \times Kv \times Kt}{Kr} = \frac{40\ hp \times 1.2 \times 1.43}{0.82} = 83\ hp$$

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*.

DPoil = p x Kp = 23 psi x 1.7 = 39.1 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:

DPoil = p x Kp = 12 psi x 1.7 = 20.4 psi.

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

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

Learn more online:

OAW Series: Brazed Plate Cooler Configurator
Parker.com/oaw-coolers
Competitive Cross Reference Tool
crossref.parker.com
OAW Sizing (web app)
www.parker.com/OAWsizing

Accessories

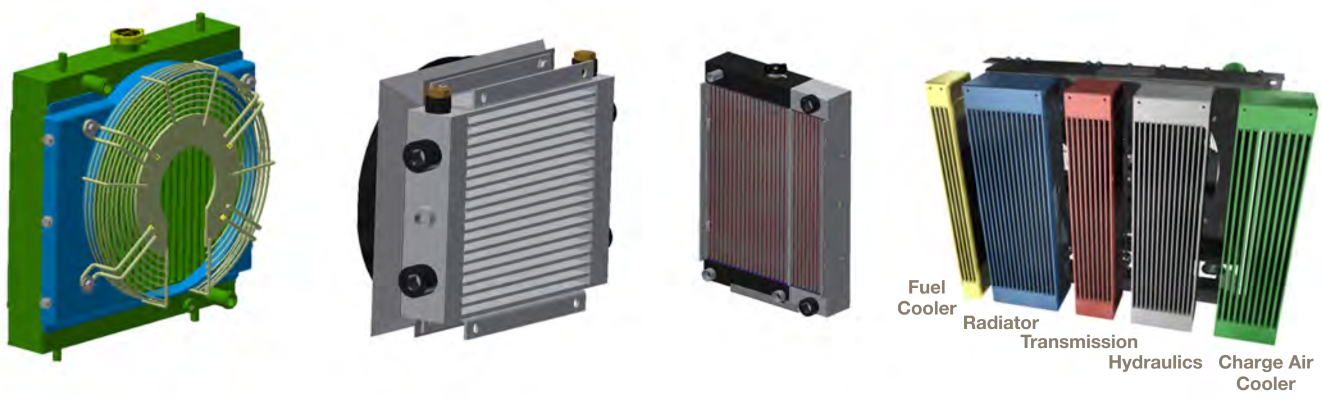
Clamps for OAW and PWO Brazed Plate Coolers

Part Number	Description
A2130002	Clamp for OAW 14, PWO B5
A2130022	Clamp for OAW 34, PWO B10 and B12
A2130052	Clamp for OAW 46, PWO B16
A2130062	Clamp for OAW 61, PWO B25
A2130082	Clamp for OAW 95, PWO B35
A2130102	Clamp for OAW 126, PWO B45*

* Two clamps are required for OAW 126 & PWO B45

Custom Cooling Modules & Combination Coolers

Providing optimal solutions



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.

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 driven by the engine or by a hydraulic motor, AC or 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.

Learn more online:

UL Series: Air-Oil Cooler Configurator
Parker.com/air-oil-coolers
Competitive Cross Reference Tool
crossref.parker.com
UL Series: Air-Oil Cooler Sizing Software (.exe)
http://www.parker.com/ULsizing

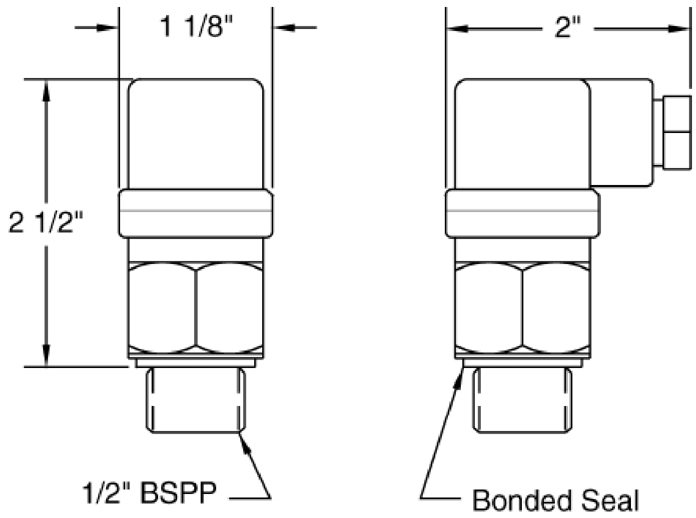
CALIFORNIA PROP 65: WARNING:

This product can expose you to chemicals including carbon black and lead, which are known to the State of California to cause cancer, and lead, which is known to the State of California to cause birth defects or other reproductive harm.

For more information go to www.P65Warnings.ca.gov

Accessories

ThermoSwitch



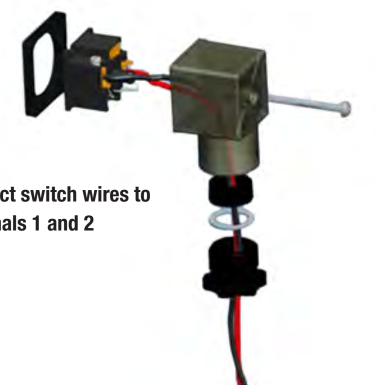
To ensure the best possible temperature control and working conditions of a hydraulic system, a thermoswitch should be installed to control the motor (AC or DC) on an air-oil cooler. The thermoswitches can also be used to give alarm signals for excessive fluid temperatures.

Part Number	Closing Temperature	Opening Temperature
ATS-GF-C100	100°F ± 9°F	80°F ± 9°F
ATS-GF-C120	117°F ± 9°F	97°F ± 9°F
ATS-GF-C140	140°F ± 9°F	120°F ± 9°F
ATS-GF-C160	158°F ± 9°F	138°F ± 9°F
ATS-GF-C175	176°F ± 9°F	156°F ± 9°F

Thermoswitches are normally open (NO)
IP65 protection; PG09 Plug Connector

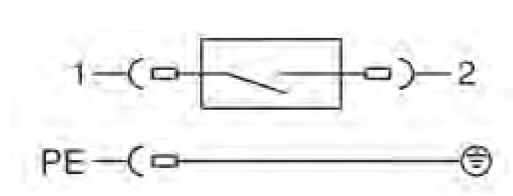
Voltage	12V DC	24V DC	240V AC
Amps (Max.)	10A	5A	10A

Wire connection diagram to DIN connector



Connect switch wires to terminals 1 and 2

Electrical Circuit



CALIFORNIA PROP 65: WARNING:

This product can expose you to chemicals including lead which is known to the State of California to cause cancer and birth defects, or other reproductive harm.

For more information go to www.P65Warnings.ca.gov

NOTE: Thermoswitch must be installed in the hydraulic reservoir when used with a ULOC cooler.

Accessories

Thermal Bypass Valves - TH Series

Maintain Optimum Fluid Temperature

Parker's thermal bypass valve will modulate fluid temperature by shifting return line flow through the cooler, or bypassing it directly to the reservoir.

Additionally, an integral pressure relief function automatically releases excess pressure to the reservoir if the cooler becomes restricted, and the inlet pressure becomes excessive. Relief crack pressure settings range from 5 to 85 PSI.

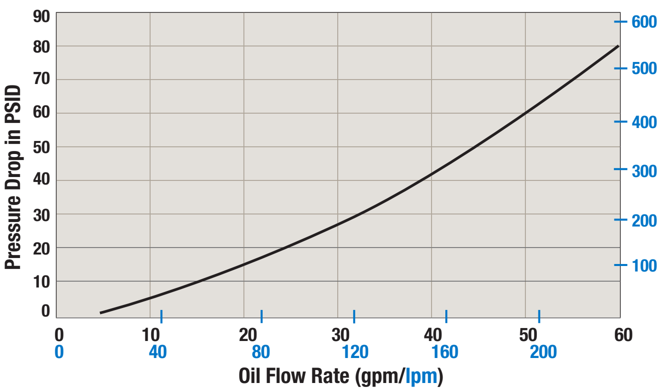
These lightweight, aluminum valves are ideal for hydrostatic drive circuits requiring fast warm-up, controlled fluid temperatures, and low return line back pressure.

Features

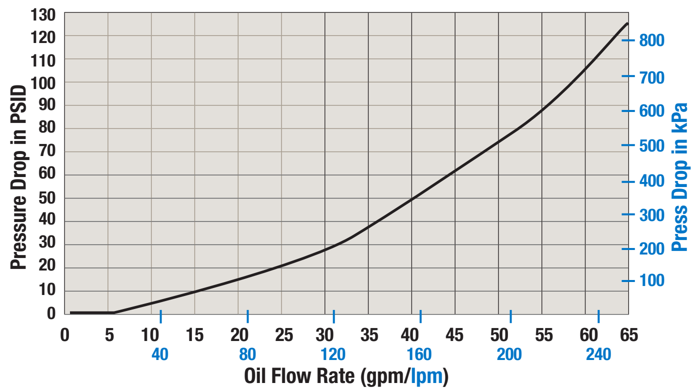
- Lightweight, corrosion-resistant aluminum housing.
- Available in five shift temperatures.
- Integral relief valve to dump excessive inlet pressures to the reservoir.
- 250 PSI maximum operating pressure.
- Up to 60 GPM flow rates.

Flow Data **Pressure Drop (Mobil DTE 26 oil)**

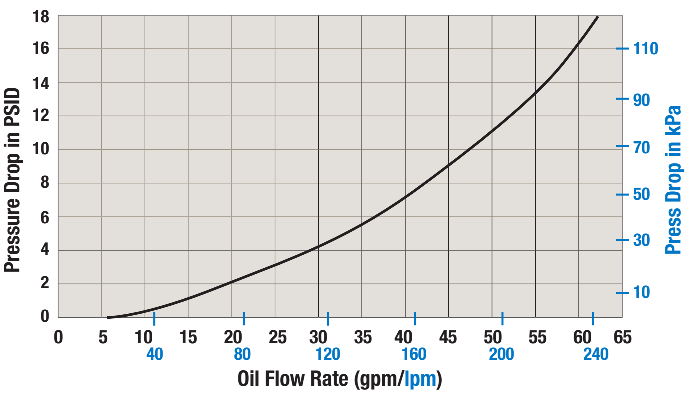
Inlet Port through Tank Port @ 100 °F (300 SUS)



Inlet Port over Integral Relief Port @ 170 °F (78 SUS Oil)



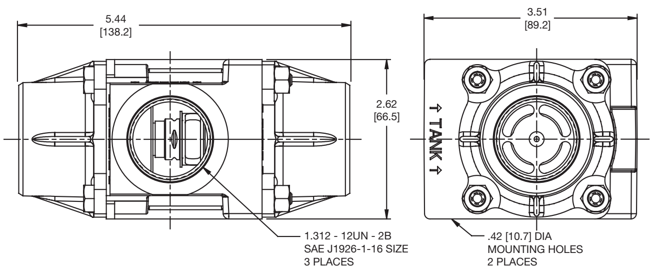
Inlet Port through Cooler Port @ 145 °F (110 SUS Oil)

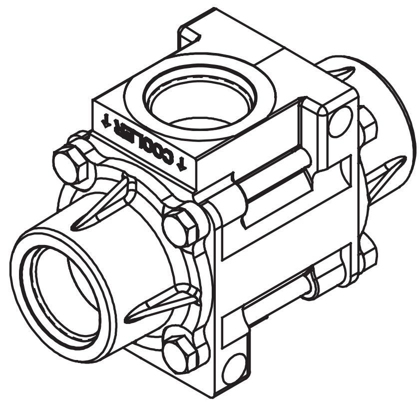


Helpful Equations
GPM to LPM equation: _____ GPM x 3.79 = _____ LPM
PSI to kPa equation: _____PSI x 6.894 = _____ kPa

TH Series Specifications	
Size	1 inch
Weight	2.00 lbs
Std Shift Temperatures	100 °F (38 °C), 120 °F (49 °C), 140 °F (60 °C), 160 °F (71 °C), 180 °F (82 °C)
Full Shift Temperature (cooler port open)	Shift Temperature plus 25 °F
Proof Pressure	300 PSI (21 bar)
Minimum Burst Pressure	Up to full shift temperature: 325 PSI (22 bar) Above full shift temperature: 600 PSI (41 bar)
Operating Temperature	Min: -30 °F Max: Shift temperature plus 75 °F
Max Flow Rate	60 GPM (227 l/m)

Dimensions





Ordering Information

T H - 1 0 0 0 - 1 6 F O - __

VALVE SERIES: Thermal Bypass

VALVE SIZE: **1000** = 1 inch

PORT SIZE & STYLE: **16FO** = 1 inch SAE O-Ring Boss (1.312 -12UN-2B thread)

CRACK PRESSURE/TEMPERATURE CODE: (see table)

Shift Temperature	Crack Pressure PSI																
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85
100 °F (38 °C)	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
120 °F (49 °C)	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
140 °F (60 °C)	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
160 °F (71 °C)	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
180 °F (82 °C)	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97

FAQ

What is a thermoswitch and how does it work?
A thermoswitch is a temperature sensor that can be installed into a cooling circuit. This can be either in the cooler core or upstream of the cooler core inlet. The thermoswitch senses the fluid temperature and at a preset temperature, sends a electrical signal to the fan-motor controller or relay. This signal then is used to turn the motor on and off.

What are the benefits of having a thermoswitch in a cooler?
The thermoswitch can reduce power consumed by the fan motor, thus making the cooling circuit more energy efficient.

What is an Integrated Pressure-controlled Bypass Valve and how does it work?
This is a pressure bypass valve that senses the pressure difference between the inlet and outlet ports of the core. When the pressure differential reaches the valve setting, it opens, allowing a portion of the inlet flow to bypass the core. This is a spring operated poppet valve.

What are the benefits of having an Integrated Pressure-controlled Bypass Valve ?
When the fluid media is at a low temperature, it can be highly viscous and cause increased pressure in the system. Having a bypass valve installed will reduce the pressure by allowing the media to heat up quicker and prevent damage. This is extremely important during cold weather machine startups.

What is the difference between an external (TH Series) Bypass Valve and the Pressure Bypass Valve that is installed on the cooler?
The Integrated Pressure-controlled Bypass Valve only diverts **some of the flow** around the cooler core and is activated by **pressure differential only**. The External Temperature-controlled 3-way Bypass Valve (TH Series) diverts **full flow** away from the core and can be activated by both **temperature and pressure**. The External Temperature-controlled 3-way Bypass Valve (TH Series) is typically installed upstream of the core inlet and can divert all flow away from the core.

What are the advantages of a bar & plate over a tube & fin core design?
The Bar & Plate is a more robust design and provides better protection against tube damage by external objects.

What is a turbulator (hot fin)?
This is an internal fin that helps to mix the cooling media which improves heat transfer.

When do I use a Brazed Plate Cooler vs a Shell & Tube?
You must consider flow rates of each fluid being used, envelope restrictions, maximum pressure drop allowance, cost, and material capatibility when determining which water-oil cooler is right for you. You can fill out the cooler sizing form @ parker.com/coolersizingform, submit it, and Parker ACD can size each type for you.

What is the minimum clearance when mounting an air-oil cooler?
The minimum clearance when mounting an air-oil cooler is 1/2 the fan diameter both in front and back of the cooler.

What is Heat Load?
Heat Load is the amount of energy a system creates. Cooling Capacity is the amount of energy that can be removed from the system by the cooler.

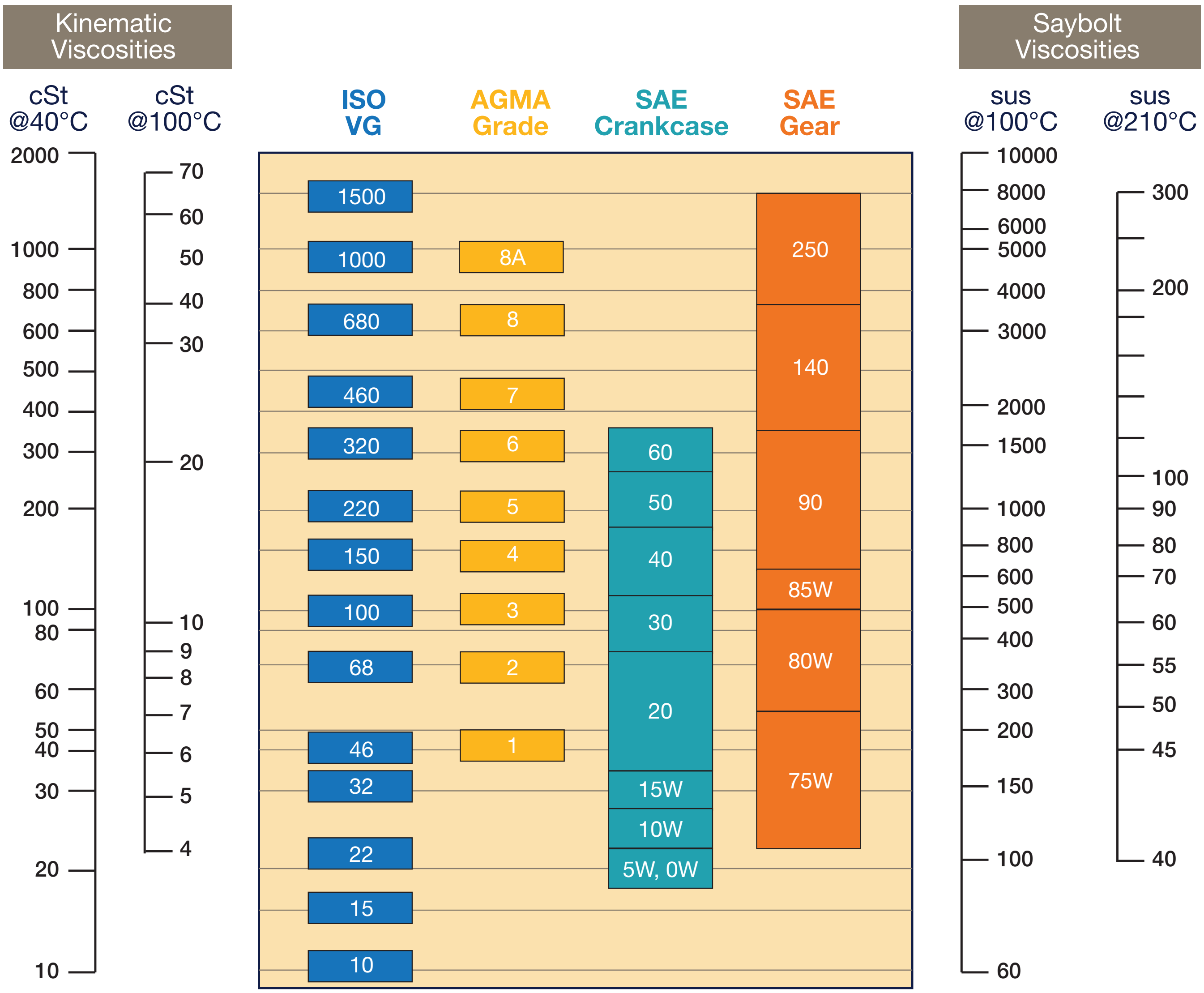
Why is heat load important?
If the Heat Load exceeds the cooling capacity of the cooler, then the system will overheat.

What is the difference between temperature and heat load?
Temperature is measured in °F and Heat Load (HP, kW, BTU/Hr) is measured by power.

How do I plumb my cooler?
Follow the installation instructions found here: Parker.com/ACD

What is a 2-pass (dual pass) cooler and when should I use it? What are the advantages and disadvantages to using a 2-pass cooler?
A 2-pass cooler has a core that makes the fluid being cooled pass through the core twice, instead of just once. This will increase the velocity of the fluid being cooled is in the core, thus increasing the cooling capacity of the cooler. When the fluid goes through the core twice, the speed of the fluid being cooled increases thus increasing the pressure drop across the core by four times that of a 1-pass (single pass) cooler. So you get more cooling capacity but at the cost of higher pressure drop.

Viscosity Conversion Chart



Basic Hydraulic Formulas

Torque and Horsepower Relationships:

Torque (ft lbs) = horsepower (hp) x 5,252 / speed (rpm)

Horsepower (hp) = torque (ft lbs) x speed (rpm) / 5,252

Speed (rpm) = horsepower (hp) x 5,252 / torque (ft lbs)

Piston Cylinder Area (in^2) = diameter squared x .7854
(Can also use 3.1416 x radius squared (ins))

Piston Rod End (annulus end) Area (in^2) = piston cylinder area (in^2) - rod area (in^2)

Cylinder Force (lbs) = pressure (psi) x area (in^2)

Cylinder Speed (ft/min) = 19.25 x flow rate (gpm) / area (in^2)
(Divide by 60 to convert speed to ft/sec)

Cylinder Speed (in/min) = flow rate (cu ins/min) / area (in^2)
(Note that 1 US gallon = 231 cu ins)

Cylinder Time (secs) = area (in^2) x cylinder stroke (ins) x .26 / flow rate (gpm)

Cylinder Flow Rate (gpm) = 12 x 60 x cylinder speed (ft/sec) x area (in^2) / 231

Cylinder Volume Capacity (gals) = cylinder area (in^2) x cylinder stroke (ins) / 231

Basic Hydraulic Motor Calculations:

Motor Torque (in lbs) = pressure (psi) x motor displacement (cu ins/rev) / 6.28
(Can also use horsepower (hp) x 63,025 / speed (rpm))

Motor Speed (rpm) = 231 x flow rate (gpm) / motor displacement (cu ins/rev)

Motor Horsepower (hp) = torque (in lbs) x motor speed (rpm) / 63,025

Motor Flow Rate (gpm) = motor speed (rpm) x motor displacement (cu ins/rev) / 231

Motor Displacement (cu ins/rev) = torque (in lbs) x 6.28 / pressure (psi)

Basic Pump Calculations:

Pump Outlet Flow (gpm) = pump speed (rpm) x pump displacement (cu ins/rev) / 231

Pump Speed (rpm) = 231 x pump flow rate (gpm) / pump displacement (cu ins/rev)

Pump Horsepower (hp) = flow rate (gpm) x pressure (psi) / 1,714 x pump efficiency factor (Can also use horsepower (hp) = torque (in lbs) x pump speed (rpm) / 63,025)

Pump Torque (in lbs) = pressure (psi) x pump displacement (cu ins/rev) / 6.28
(Can also use horsepower (hp) x 63,025 / pump displacement (cu ins/rev)

Heat Generation Formulas: Converting heat into other units

1 hp = 2,545 BTU/hr = 42.4 BTU/min = 33,000 ft. lbs./min = 746 watts

Horsepower (hp) = pressure (psi) x flow (gpm) / 1714 -or- BTU/hr = 1½ x psi x gpm

1 BTU/hr = .0167 BTU/min = .00039 hp

Example: 10 gpm flow across a pressure reducing valve with a 300 psi drop = 1.75 hp of heat generated

1.75 hp of heat = 4,453 BTU/hr = 105 BTU/min = 57,750 ft. lbs./min = 1,305 watts

- Most of this heat will be carried back to the reservoir.

Pressure, Force and Horsepower Relationships:

Pressure (psi) = force (lbs) / area (in^2)
Force (lbs) = area (in^2) x pressure (psi)
Area (in^2) = force (lbs) / pressure (psi)

Fluid Power Horsepower:

Fluid Power Horsepower (hp) = pressure (psi) x pump flow (gpm) / 1,714

General cooling capacity of a steel reservoir:

HP (heat) = .001 x TD x A

- TD = temperature difference of the oil in the reservoir and the surrounding ambient air
- A = entire surface area of the reservoir in square feet (including the bottom if elevated)

Commonly Used Fluid Power Equivalents:

One US gallon equals:

231 cubic inches
3.785 liters (1 liter = .2642 US gals)
4 quarts or 8 pints
128 ounces liquid
133.37 ounces weight
8.3356 pounds weight

One horsepower equals:

33,000 ft lbs per minute
550 ft lbs per sec
42.4 BTU per min
2,545 BTU per hour
746 watts
0.746 kw

One psi equals:

.0689 bar (1 bar = 14.504 psi)
6.895 kilopascal
2.0416 hg (inches of mercury)
27.71" water

One atmosphere equals:

14.696 psi
1.013 bar
29.921 hg (inches of mercury)

General Information and “Rules of Thumb”:

Estimating pump drive horsepower: 1 hp of input drive for each
1 gpm at 1,500 psi pump output

Horsepower when idling a pump: an idle and unloaded pump will require about 5% of its full rate hp

Reservoir capacity (GALS) = length (IN) x width (IN) x height (IN) / 231

Oil compressibility: 1/2 % approximate volume reduction for every 1,000 psi of pressure

Water compressibility: 1/3 % approximate volume reduction for every 1,000 psi of pressure

Wattage to heat hydraulic oil: each .74 watt will raise the temperature of 1 gallon of oil by 1°F per hour

Guidelines for Flow Velocity in Hydraulic Lines:

2 to 4 ft/sec = suction lines

10 to 15 ft/sec = pressure lines up to 500 psi

15 to 20 ft/sec = pressure lines 500 – 3,000 psi

25 ft/sec = pressure lines over 3,000 psi

4 ft/sec = any oil lines in air-over-oil systems

Velocity of Oil Flow in a Pipe: velocity (ft/sec) = flow (gpm) x .3208 / inside area of the pipe (sq in)

Area (sq in) = π x r^2 where π (pi) = 3.1416 and r = radius in inches squared

Area (sq in) = π x d^2 / 4 where π (pi) = 3.1416 and d = diameter in inches

Circumference (in) = 2 x π x r where π (pi) = 3.1416 and r is radius in inches

Circumference (in) = π x d where π (pi) = 3.1416 and d = diameter in inches

Gas Laws for Accumulator Sizing

Where “P” = psia (absolute) = psig (gauge pressure) + 14.7 psi

Pressure or Volume: original pressure x original volume = final pressure x final volume

$P_1V_1 = P_2V_2$ (Isothermic) (with constant “T” temperature)

Pressure or Temperature: original pressure x final temperature = final pressure x original temperature

$P_1T_2 = P_2 T_1$ (Isochoric) (with constant “V” volume)

Volume or Temperature: original volume x final temperature = final volume x original temperature

$V_1T_2 = V_2T_1$ (Isobaric) (with constant “P” volume)

Pressure or Volume with Temperature Change Due to Heat of Compression:

Original pressure x original volume^n = final pressure x final volume^n

$P_1 V_1^n = P_2V_2^n$

For Nitrogen the Exponent

"n" = 1.4 For full adiabotic conditions i.e., the "Full Heating" theoretical condition

"n" = 1.3 For rapid cycling (most heating normally experienced)

"n" = 1.1 For "normal" cycling

"n" = 1.0 Where gas time to return normal temp. before discharge or recharge

Note: This information is provided as a quick reference resource and is not intended to serve as a substitute for qualified engineering assistance. While every effort has been made to ensure the accuracy of this information, errors can occur. As such, neither Parker Hannifin, any of its affiliated companies nor its employees will assume any liability for damage, injury or misapplication as result of using this information.

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