

# Hydraulic Power Units

D, H, V-Pak and Custom Power Units

HY28-2600-550-M1USA May 2017



ENGINEERING YOUR SUCCESS.

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## **WARNING - USER RESPONSIBILITY**

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

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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 distributor. This offer and its acceptance are governed by the provisions stated in the detailed "Offer of Sale" elsewhere in this document.



## Introduction

This manual provides descriptive operation and maintenance instructions for standard Hydraulic Power Units manufactured by the Hydraulic Pump and Power Systems Division of Parker Hannifin Corporation. Any additional information may be obtained from Parker by referencing the unit's model number and serial number stamped on the Reservoir Nameplate, or by contacting your local authorized Parker Distributor.

Some of the information in this manual may not apply to your power unit. Your power unit may include non-cataloged equipment or contain additional components that were added after factory shipment from Parker, in which case this manual will not include information and possible required warnings regarding this additional equipment.

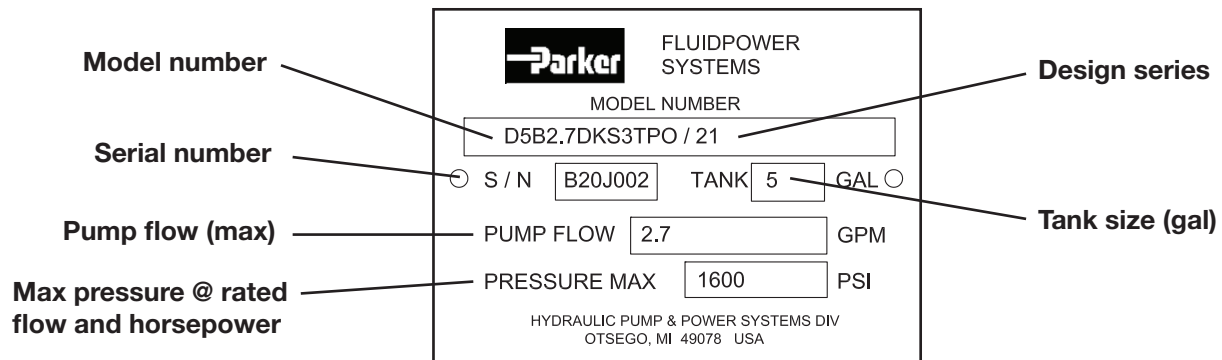
### WARNING:

**It is imperative that personnel involved in the installation, service and operation of the power unit be familiar with how the equipment is to be used. They should be aware of the limitations of the system and its component parts, and have knowledge of good hydraulic practices in terms of safety, installation and maintenance.**

## Description

Parker's standard power units feature a vertical design, with the pump/motor assembly vertically mounted to the reservoir's top plate. This minimizes the required floor space and keeps the pump's inlet flooded or nearly flooded with oil, preventing cavitation. **Make sure to match the design series of your unit with the design series numbers in this manual. If your design series doesn't match the design series numbers shown later in this manual, consult the factory to verify form, fit and function of replacement parts.** In the example below, the design series is "21".

D-Paks and H-Paks use fixed volume gear pumps. V-Paks use variable volume piston pumps and are available with several standard pressure compensation options, load sense and horsepower limiting options. See catalog HY28-2661-CD/US for more information on Parker's standard power units. Parker also makes modifications to the cataloged units, and these units have X numbered suffixes. Most of the information contained in this document will apply to those units as well.



## Preparation for Use

### Unpacking and Checking

The power unit is mounted on skids and carefully packed for shipment. Do not remove it from the skid until it has been carefully checked for damage that may have occurred in transit. Report all damage immediately to the carrier and send a copy to the vendor. All open ports on the power unit are plugged at the factory to prevent the entry of contamination. These plugs must not be removed until just before piping connections are made to the unit.

### Storage

If the power unit is not going to be installed immediately, it should be stored indoors, covered with a waterproof sheet, and have all open ports plugged. If long-term storage is expected (6 months or more), we recommend filling the reservoir completely with clean hydraulic fluid to prevent the entry of moisture.

### Removing from Shipping Skids

Vertical power units should be removed from the skid by wrapping a heavy-duty nylon strap around the base of the motor mounting feet or by the lift eyes that may be on the unit. This strap should be firmly secured to the lifting device when unit is lifted. The power unit may have lag bolts securing it to the shipping pallet, so be sure to remove these bolts before lifting.

**Do not use the lift eye in the motor. It is designed to lift only the electric motor, not the entire power unit.**

**Do not lift a unit that is full of oil.**

## Installation

### Locating Power Unit

The unit should be installed indoors, and preferably in a clean, dry environment with an ambient temperature of 60 to 100° F (15 to 38° C). The unit can be installed outdoors if the reservoir was provided with optional weatherproof construction, and provisions were made for extreme temperature conditions. The reservoir can be secured to the floor or base using the four mounting holes located on the reservoir legs or reservoir base plate.

The power unit should be located close to the point of use. It is strongly recommended that any directional valves controlling the actuators be located as close as possible to those actuators. This means that if the power unit is installed away from the actuators, the directional valves should be remote from the power unit and as close as possible to the actuators. System shock, response time and noise are greatly reduced by minimizing the distance between the actuators and the valves.

### Condensation/Rust

Frequent temperature changes can lead to rust developing inside the reservoir. As air moves in and out of the reservoir with fluid level changes, warm humid air can condense when temperatures drop, creating rust on the underside of the top plate and exposed tank sides. Moisture also can turn the oil acidic, leading to varnish and pitting of components. Keeping the oil level as high as possible without overfilling is recommended, but remember oil will expand when hot so do not over fill. Maintaining reservoir temperature with an auxiliary heater can minimize these effects. Optional desiccant breathers and/or stainless tanks are available for extreme conditions.

## Electrical Service Connections

### Water

**If water cooled heat exchanger has been provided:**

Connect the water supply to the inlet of the heat exchanger with a shut-off valve and strainer (if not supplied by Parker). If a temperature control valve (Model WTC\*\*) has been provided, it also should be installed on the inlet side. The outlet of the heat exchanger should be connected directly to the facility drain system. On single pass heat exchangers, the water connections should be installed as shown below to maximize heat transfer. On multi-pass heat exchangers, the water flow direction is not important unless otherwise instructed by the heat exchanger manufacturer. (See *Figure 1*)

### Electrical

**Non-inverter units:** Verify that the available voltage is the same as the voltage identified on the motor nameplate. **Most motors have dual voltage ratings (230/460), so verify that the leads in the motor conduit box have been connected together as**

**defined on the motor nameplate to match the facility power source available.** Connect the pump motor to the power source following the good practices as outlined in the National Electric Code and any local codes that may apply. If solenoid valves, pressure/temperature switches or oil immersion heaters have been provided on the power unit, refer to the component name tag or other service information in this manual for operating voltage and ratings.

**DCP, or units with inverter:** Verify that the available voltage is the same as the voltage rating of the inverter. Connect the drive to a power source following the good practices as outlined in the National Electric Code and any local codes that may apply. The Parker DCP units have a local disconnect to isolate the drive from incoming power. This disconnect turns power off to the drive and allows the motor connections to be checked. **Even when the motor is not running, there is high voltage present on the motor leads if power to the drive is present unless the disconnect is in the “OFF” position.**

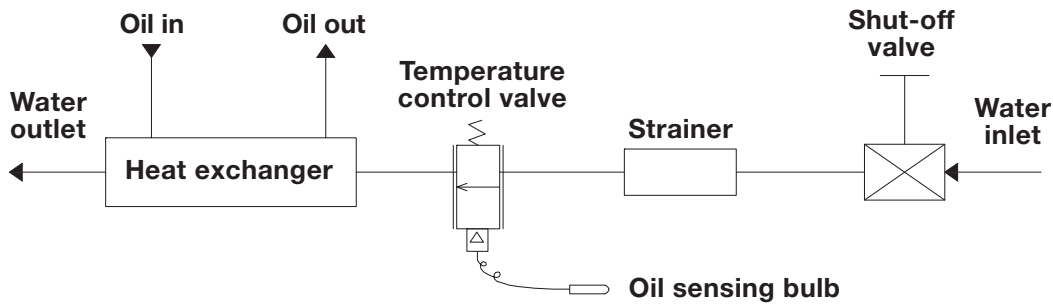


Figure 1

**WARNING:**

DCPs, or units with the AC10 inverter, must have branch circuit protection with a maximum rating of 5KVA.

Disconnect

Factory-installed shielded cable from the drive to the electric motor



### Inverter (DCP) Wiring Information

This section covers main power wiring. Control wiring is application/model code specific. For more information regarding control wiring, see Catalog HY28-2661-CD/US Mar 31, 2016 or later.

The electric motor has been factory-wired to the drive using shielded cable. The cord grips on this cable are designed to connect the cable's shield to the drive's frame. Proper grounding of the drive is important for user safety and the ability to minimize electrical noise.

Connect the proper voltage 3 phase power to the back of AC10's disconnect switch (220VAC +/-15% or 480VAC +10/-15% depending on the drive selected).



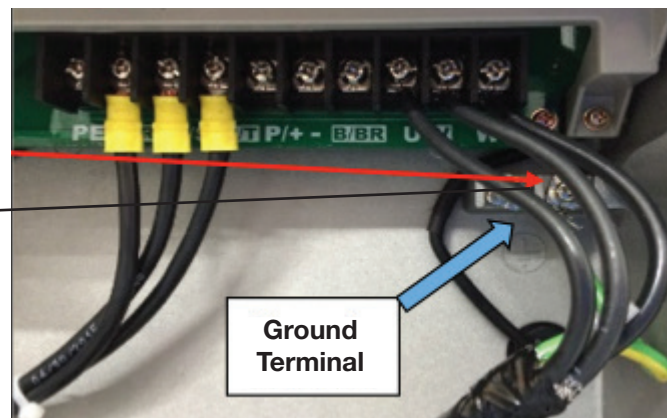
Remove the drive's cover by removing the Phillips screws around the front of the unit

Install an appropriate cord grip through one of the knock-outs in the bottom steel plate for the incoming power connection



Connect incoming power here

Ground connection: This connection must be made to a suitable ground (PE)



**Note About Motor Wiring:**

- In general, the actual incoming voltage can be +/-10% of the motor nameplate voltage rating, as long as the frequency is correct.
- The ampacity of the wires feeding the electric motor or inverter drive must be properly sized to handle the F.L.A. rating of the motor.
- Make sure the connections inside the motor's terminal box are secure and cannot come loose with vibration. **Lethal shock, arc flash and or electrical fire can result if these connections come loose.**
- When a motor is connected to an across-the-line starter, its rotation can be changed by swapping any two of the three leads. If the rotation is incorrect on a system with an inverter, two of the three leads between the drive and motor must be swapped. **Do not swap the power connection leads to the drive as this will have no effect on rotation.** Factory installed drives are tested to verify correct rotation.
- 60 Hz motors rated for 230/460 volts can be operated on 50Hz at 190/380 volts, but the available power of the motor is reduced approximately 15%. Dual rated 50/60Hz motors are optionally available. However, their service factor is reduced from 1.15 to 1.0 at 50Hz.\* All dual rated motors have a CSA and CE stamp. In the case of using the DCP, incoming frequency **to the drive** does NOT affect motor speed, however incoming voltage affects motor torque. If this voltage is less than nameplate voltage, the motor will need to be de-rated.

\*The 2Hp and 3Hp motors have a 1.15SF at 60 Hz and 50Hz.

**Temp/Level Switch**

The standard temp/level switch is a discrete device with no adjustment. The R1 is normally closed held OPEN (no connection) when oil level is OK and temperature is below 150° F (66° C).

The R2 version is normally open held CLOSED (connection) when the oil level is OK and the temperature is below 150° F (66° C). R2 is preferable because the logic of the monitoring device will detect a fault even if there is no connection to the temp/level switch.

**Wiring Info**

Common= Black

Float Level = Yellow

Temperature = Red & White

**Float Switch**

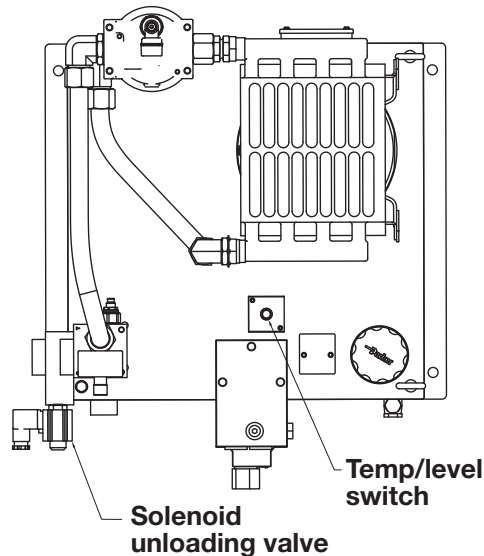
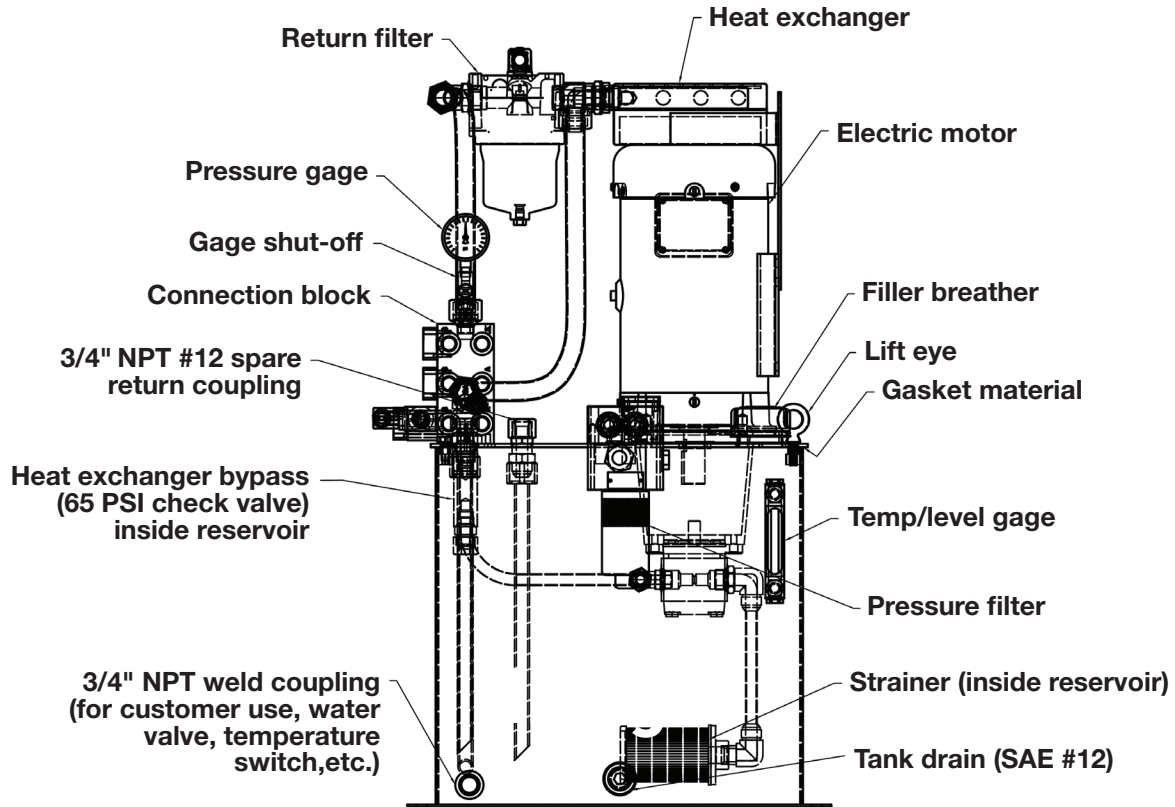
1.5 Amps (50 va) max, 1 mv to 260 VAC or 200 VDC max

**Temp Switch**

8 Amps (800 va) max @ 110 VAC, 1 mv to 240 VAC or 36 VDC max Changes state at 150°F (66°C)

**Component Location (Typical)**

This shows the typical component location for a **20-gallon H-Pak**. Exact configuration depends on options selected.







## Supply and Return Connections

Complete all necessary interconnecting piping between the power unit and hydraulic actuators. The line sizes should be determined based on oil flow, operating pressure, viscosity and allowable pressure drop between the power unit and point of use. The exact connection details will depend on how the power unit was ordered. If the unit was ordered with a PT block, the top plate will have a block with a “P” and a “T” stamped on it. The “P” is the pressure connection, and the “T” is the tank or return connection. If the unit was ordered with a manifold option, there will be ports labeled “A” and “B.” These are connections that normally go directly to the customer’s actuator ports. The actuator is controlled by valves mounted on the manifold. These valves could be supplied from the factory or added by a third party or the customer.

### WARNING:

**Check to ensure that the proper rated hose or pipe is used on pressure lines. It is the customer’s responsibility to select the proper hose or tube style to ensure safe and reliable performance. Improper selection of the interconnecting plumbing can cause serious injury or death. Make sure you fully understand the requirements for a safe installation or contact professional assistance.**

**Make sure vibration and thermal expansion are considered. Straight tube runs should include bends to accommodate thermal expansion and contraction. If the power unit is mounted on a separate base from the rest of the installation, flexible hose may be required to absorb possible relative movement.**

### Important:

One of the key ingredients for good service and long life from a hydraulic system is cleanliness. Since most dirt infiltrates a hydraulic system during installation, Parker recommends the following:

1. All open ports on the power unit, cylinders, etc. must remain plugged with tape or plastic plugs until just before the hydraulic connections are made.
2. All interconnecting tubing, pipe or hose should be clean and free of rust, scale and dirt. The ends of all connectors should be plugged until just before they are to be installed in the system.
3. All openings in the reservoir such as the filler breather or access end cover holes must remain closed during installation.
4. If Teflon tape or pipe dope is used, be sure it doesn’t extend beyond the first thread of the pipe fitting.

## Reservoir Filling

The reservoir must be filled with clean fluid through the filler cap on the reservoir. The type of fluid must be compatible with the seals used on the power unit, and must comply with the recommendations of the manufacturers of the component parts. Refer to the component manufacturer’s catalog for fluid requirements.

**The cleanliness of the fluid going into the reservoir is very important**, and in most cases, even new oil out of the drum is not adequate. We recommend that any fluid being transferred into the reservoir be done with a transfer pump with a 10-micron filter installed. Various Parker oil transfer pumps are available for this purpose. Additionally, Parker sells pre-cleaned fluid called DuraClean™. This fluid is clean from the drum and has additives that resist moisture buildup, reducing varnish and oxidation.

### Cautions About Filling

Power units should be filled while they are not running, especially if there is an accumulator in the system. If a system has an accumulator and the oil level is “FULL” when running, the oil level will likely overflow when the system is turned off.

After the initial fill, re-check the oil level after the system has been in operation for a few cycles. In some installations, the actuators and plumbing will “consume” enough oil that the system will need another fill to prevent it from running low during the machine cycle.

## Start-Up Procedure

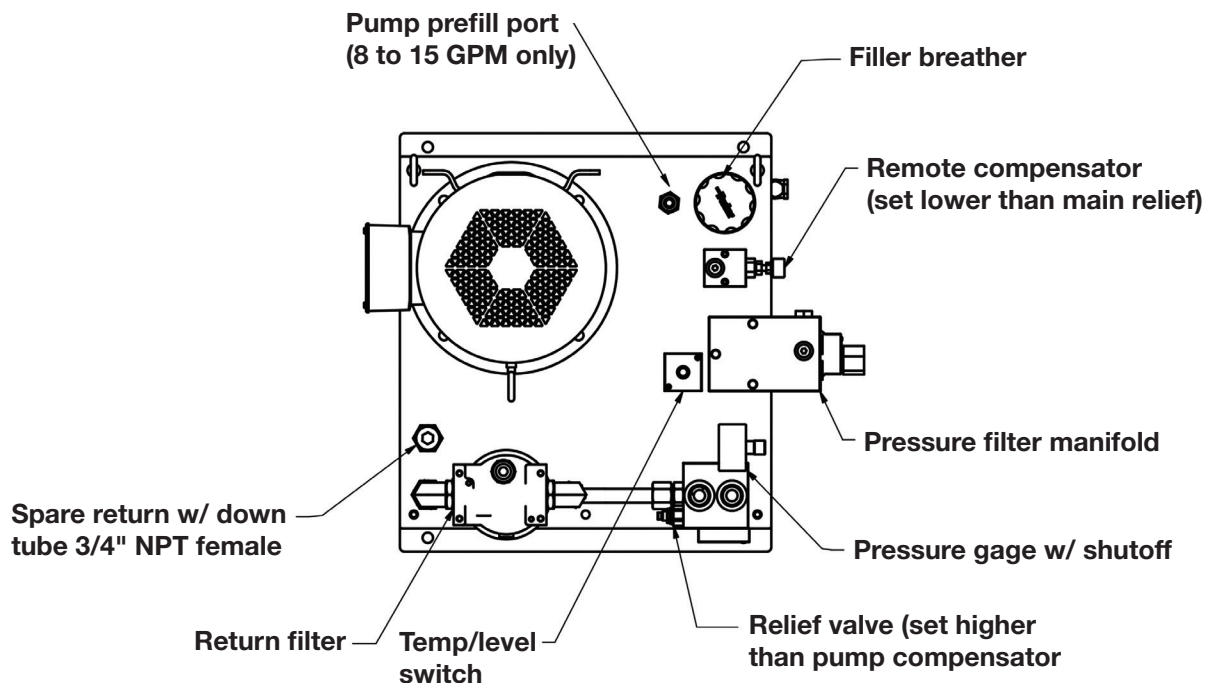
### NOTE:

If the power unit has been provided with a variable displacement pump (V-Pak), the pump case should be filled with clean oil prior to priming. Located on the power unit's top plate, there is a port labeled "Pump Case." Remove the plug from this port, fill it with oil and then replace the plug. See right:

**Before proceeding to the rest of the start-up procedure, wear proper personal protective equipment. Safety glasses and gloves are the minimum required items to avoid exposure and injury from unexpected high-pressure oil leaks.**

1. If the system has a standard solenoid controlled unloading valve, it should be turned off to allow the system to start up at minimum pressure. A few special systems have a normally closed unloading valve, in which case it should be energized to get low pressure.
2. If the system has been provided with an open center directional valve, the oil during start-up will flow directly back to tank when neither solenoid is energized. This should allow the system to prime very quickly.

3. Fixed volume systems (D and H Paks) will have a P to T open path if it is equipped with an unloading option. On V Paks, the unloading option unloads the pump compensator, not the main pressure line, therefore additional work to prime the system may be required.
4. Turn the main relief valve all the way down (counter clockwise).
5. Jog the pump motor once, and verify that the pump is rotating in the same direction as the arrow tag on the motor fan cover. If the direction is incorrect, reverse any two (2) of the three (3) motor leads, and re-check the rotation. Most units are right hand rotation, or clockwise looking down at the motor fan. If the unit has a rear mount heat exchanger, you may need to use a small piece of thin wire or zip tie to "feel" which direction the motor's fan is turning.
6. Jog the pump/motor three (3) to six (6) times to prime the pump and then allow the pump to run for several minutes at minimum pressure. Check the piping for any leaks and correct immediately. (Leaks in fittings and tubing can be the result of vibration during shipping.)



- If the system has not primed, the pressure line may need to be bled. Do not use ports with O-ring seals for bleeding, as the oil will cut the O-ring. One suggestion for bleeding is to close the needle valve at the base of the pressure gage, remove the pressure gage, then run a small hose from the needle valve back to the tank breather opening. With the needle valve just slightly open (1/2-1 turn), jog the pump until oil comes out of the hose. Replace the pressure gage, close the breather and resume startup.
- Begin adjusting the relief valve and/or pump compensator to increase the pressure gradually.

**NOTE:**

On systems with open-center directional valves, it will be necessary to actuate the valve in order to build pressure.

- Continue increasing pressure and checking connections until normal operating pressure is obtained. Lock adjustment screws in place.

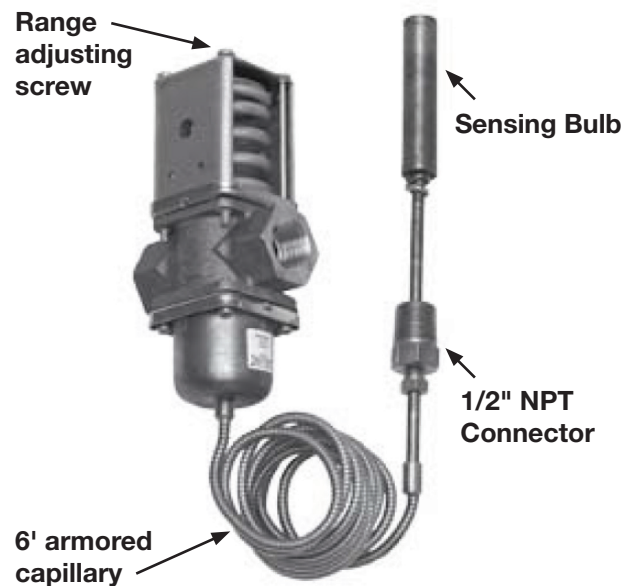
**NOTE:**

If the system has been provided with a pressure compensated pump and a relief valve, adjust the relief valve approximately 200 psi higher than the compensator so that excessive heat is not generated by the relief valve. If the relief and the compensator are set too close to each other, the system pressure will oscillate or hunt. The pump compensator should be the device that limits system pressure, while the main relief is a redundant pressure limiter that reduces pressure spikes the pump can't respond to.

- During the start-up sequence, all filters should be monitored closely. Replace any filter elements as soon as they begin to go into by-pass as indicated on the visual indicator.
- After the entire system has been wetted with fluid, refill the reservoir to the normal operating level.

**Water Control Valve (if Equipped)**

Units that have a heat exchanger and water control valve may require adjustment. The valves are adjustable between 75 to 135° F (24 to 58° C). Turning the adjustment screw clockwise decreases the valve's opening temperature. The maximum recommended oil temperature for most hydraulic systems is 120° F (49° C). Running above this temperature increases the chance for causing burns and accelerates oxidation of the oil, which creates deposits and varnish in the system.



## General Maintenance

**Electric Motors** – Lubricate as recommended by the motor vendor.

**Filters** – Change filter elements when indicated by the filter's mechanical or electrical indicator. New power unit installs will typically have short element life until the oil is cleaned by repeated passes through the filter(s). When using electrical indicators, a short time delay in the logic that reads the indicator is advisable to prevent false alarms (0.1 – 0.25 seconds is typical).

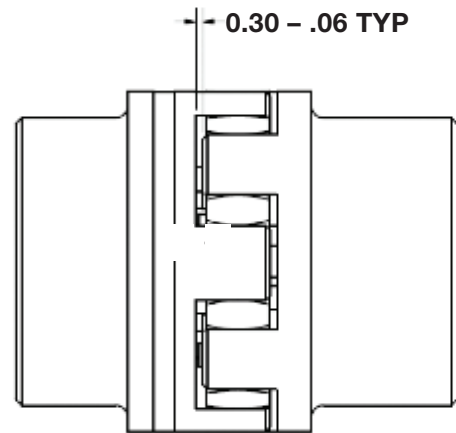
**Suction Strainers** – Strainers should be cleaned anytime it is suspected that the pump is starving for oil. When the suction strainer is the only filter in the system, it will clog much sooner than if there are additional filters present. Modern systems with proper filtration rarely have their suction strainers clog; however heavy varnish, a failed return filter element or other similar event could cause a rapid clogging of the strainer.

The exact filter and strainer part numbers are model code dependent. Contact your local distributor or Parker's Hydraulic Pump and Power Systems Division Tech Support for replacement part number information.

**Pump/Motor Coupling** – Under normal conditions the pump/motor coupling will last many years. Heavy cycling, fluid compatibility or the loss of solid attachment to the pump or motor shaft can cause the coupling or its insert to fail. Whenever the top plate is raised for inspection inside the tank, inspect the pump/motor coupling for signs of wear. If the coupling is replaced, make sure there is a small gap (approx. 1/32 – 3/32 of an inch) between the two coupling halves to prevent axial loading when the pump and motor get warm.

**Reservoirs** – Maintain proper oil level at all times. The oil should be sampled and checked after the first 100 hours of operation to verify that cleanliness and moisture are in acceptable ranges. Occasional sampling after that point is recommended. A robust sampling program can help ensure the oil is properly maintained and can assist in root cause analysis if there is a component failure.

**Paint** – Parker's standard paint for these units is Sherwin Williams quick dry enamel, F77A3 Machine Tool Grey.





## Maintenance Suggestions

1. Set up a filter maintenance schedule and follow it diligently.
2. Inspect filter elements that have been removed from the system for signs of failure which may indicate that the service interval should be shortened, the oils viscosity is too high or too cold, or that the filter is undersized.
3. Never return to the system any fluid that has leaked out.
4. Always keep the supply of fresh fluid covered tightly.
5. Use clean containers, hoses and funnels when filling the reservoir. Use of a filter cart when adding oil is highly recommended.
6. Use common sense precautions to prevent entry of dirt into components that have been temporarily removed from the circuit.
7. Make sure that all clean-out holes, filter caps and breather cap filters on the reservoir are properly fastened.
8. Do not run the system unless all normally provided filtration devices are in place.
9. Make certain that the fluid used in the system is of a type recommended by the manufacturers of the system or components.
10. Before changing from one type of fluid to another (e.g., from petroleum base oil to a fire resistant fluid), consult component and filter manufacturers in the selection of the fluid and filters that should be used. Also consult the publication "Recommended Practice for the Use of Fire Resistant Fluids for Fluid Power Systems" published by the National Fluid Power Association.
11. Parker offers an oil sampling kit, which can be used to ascertain the condition of the system fluid.

## Maintaining Proper Oil Temperature

Hot oil in your equipment's hydraulic system is one of the primary causes of poor operation, component failure and downtime. Here are some pointers on maintaining proper oil temperature. The oil in your hydraulic system was designed for operation within a specified temperature range. You may be able to run it at hotter temperatures for short periods of time, intermittently, without adverse effects. If you run continuously with oil that's too hot, your equipment will operate poorly causing key component failure and machine downtime.

"Hot oil" is a relative term. In most cases, 120° F (49° C) at the reservoir is considered an ideal operating temperature. Always take an oil temperature reading at the reservoir, not at a component or any of the piping. Some hydraulic systems are designed to operate at 130° F (54° C) or higher. If you don't know the maximum operating temperature for your equipment, check your component manual for temperature and viscosity limitations.

### How Can You Keep Your Equipment's Hydraulic System From Running Too Hot?

1. Set up a regular schedule for checking the oil temperature, appearance, smell and feel. Change oil as recommended by the equipment manufacturer.
2. If relief or flow-control valves are running hot, check and adjust their settings. Follow your equipment owner's manual.
3. Consider adding an unloading circuit to reduce system pressure between machine cycles.
4. Consider using a VFD for motor control. Most machine cycles require maximum motor speed for only a brief part of the cycle. Heat, noise and power reductions can be substantial when using a VFD. Contact Parker or your local Parker distributor for information regarding our Drive Controlled Pump (DCP).

**Maintenance**

5. Keep your equipment clean. A thick layer of dirt acts as insulation. It will prevent the hydraulic system from getting rid of heat.
6. Proper heat exchanger selection is crucial. If a variable system (V-Pak) runs compensated most of the time, a return line heat exchanger won't be as effective as a case drain cooler. An oversized cooler will be less efficient than a smaller cooler at low flows. Some systems, especially ones that run continuously above 1500 psi may require offline (kidney loop) cooling.
7. On a variable volume system (V-Pak), make sure the main relief is set HIGHER than the pump compensator. If the pump compensator is set higher than the main relief, oil will flow continuously across the relief creating noise and a lot of heat. Electrical power consumption will also increase.

**NOTE:**

When using high water content fluids, high temperatures are very detrimental to the entire system. The balance of water to additives is quickly disrupted, causing the fluid to lose its proper characteristics.



**D-Pak Parts List**

The D-Pak parts list is for standard units, design series 21, with directional valve information excluded. If your unit is a different **design series**, the form, fit and function of replacement parts may not match your parts.

Gear pumps, filters and valves should be purchased from their respective source Parker Divisions. Parts unique to the power unit (variable piston pumps, gaskets, special manifolds, etc.) should be purchased from Parker's Hydraulic Pump and Power Systems Division.

D-Pak (D5) Parts List – Design Series 21		
Universal Parts	Part Number	
5" level gage	875033-05	
Suction strainer	875035-03	
Filler breather	875034	
Gasket (manifold)	875576-04	
Pressure gage	875053-****	**** = Max pressure on gage
U-shaped tank edge rubber	875041-48	48" Long, trim to fit
Needle valve (gage)	N400S	

Unloader Options			
Option	Block	2-Way Valve	Coil
Omit	876377 Cover plate		N/A
B	BD03-PT-A	DSL101NRM	CAP115D
J			CAP024D

D-Pak Pump Part Numbers	
Pump Flow	Pump
0.9	331-9110-267
1.3	331-9110-011
1.8	331-9110-010
2.7	331-9110-101

D-Pak Motor Part Numbers		
Option (HP)	Voltage/Frequency Ratings	Motor Part Number
U1 (1/2)	115/208-230 1Ph 60Hz	875054-02
T1 (1)	115/230-230 1Ph 60Hz	875054-07
T3 (1)	208-230/460 3Ph 60Hz	875054-14
DG (2)	208-230/460 3Ph 60Hz 190/380 50Hz	133-60021-0
DK (3)	208-230/460 3Ph 60Hz 190/380 50Hz	133-60022-0

D-Pak Bell Housing Gasket and Coupling Part Numbers					
Flow/HP Combinations	HP	Gasket Number	Motor Coupling	Pump Coupling	Insert
	U1, T1, T3, DG	875577-01	L-075 5/8X3/16	L-075 1/2X1/8	L-075U
	DK	875577-02	68514411518	876975	68514411499

**Parts List**

<b>D-Pak Accessories Parts List</b>			
<b>Option</b>	<b>Description</b>	<b>Part Number</b>	<b>Filter Element</b>
B1	Rear mt heat ex	RM-08-2-2	
	Bracket	875225 (2 pc)	
H	Pressure filter (STD aluminum)	15P110QBRSKX1	932612Q
	Pressure filter (steel head)	15P110QB16690	
	Manifold	876526 (aluminum)	
		876526-S (steel)	
Gasket	875576-16		
K	Check valve	DT-370-MOMF-05	
L	Check valve	C1020S65	
O	Return filter	12AT10CN15MMH	921999
R1	Switch housing w/ cover	876620	
	Float switch	876782-01	
	Gasket	875576-14 (2 pc required)	
R2	Switch housing w/ cover	876620	
	Float switch	876782-02	
	Gasket	875576-14 (2 pc required)	

The pressure filter is a standard aluminum 15P filter. For high pressure/high fatigue applications (above 2000 psi), an optional steel manifold and special 15P with a steel head is available.

**H-Pak Parts List**

The H-Pak parts list is for standard units, design series 14, with directional valve information excluded. If your unit is a different **design series**, the form, fit and function of replacement parts may not match your parts.

Gear pumps, filters and valves should be purchased from their respective source Parker Divisions. Parts unique to the power unit (variable piston pumps, gaskets, special manifolds, etc.) should be purchased from Parker's Hydraulic Pump and Power Systems Division.

H-Pak (H1-H4) Parts List – Design Series 14		
Description	Part Number	Notes
5" Level gage	875033-05	
10" Level gage	875033-10	
Filler breather	875034	
Pressure gage	875053-****	**** = Max pressure on gage
U-shaped tank edge rubber	875041-72	10 Gal tank, 72" long, trim to fit
U-shaped tank edge rubber	875041-78	20-40 Gal tank, 78" long, trim to fit
Needle valve (gage)	N400S	

Unloader Options			
Option	Block	2-Way Valve	Coil
Omit	876377 Cover plate	N/A	875576-13
B, J	See pump/strainer/unloading valve/gasket information		

H-Pak Pump/Strainer/Unloading Valve/Gasket Information						
Pump Flow	Pump	Suction Strainer	2-Way Valve & Solenoid	Pressure/Tank Connections	Remote Body or Cartpak	Unloading Valve Gasket
0.9	331-9110-267	875035-03	DSL101NRM CAP115D (AC) CAP024D (DC)	O, S5, M5* => 875970 (aluminum) S3, M3* => BD03-PT-A		875576-13
1.3	331-9110-011					
1.8	331-9110-010					
2.7	331-9110-101					
3.2	334-9111-069	875035-10	DSH161NRM CAP115D (AC) CAP024D (DC)	ALL => 878483 (aluminum)		875576-17
4.5	334-9111-068					
5.1	334-9111-067					
6.3	334-9111-048					
8.1	334-9111-065					
9.6	334-9111-049					

<b>H Pak Motor Chart</b>		
<b>Option (HP)</b>	<b>Voltage/Frequency Ratings</b>	<b>Motor Part Number</b>
U1 (1/2)	115/208-230 1Ph 60Hz	875054-02
T1 (1)	115/230-230 1Ph 60Hz	875054-07
T3 (1)	208-230/460 3Ph 60Hz	875054-14
DG (2)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60021-0
DK (3)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60022-0
L (5)	208-230/460 3Ph 60Hz	875054-21
DL (5)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60023-0
M (7.5)	208-230/460 3Ph 60Hz	875054-22
DM (7.5)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60024-0
N (10)	208-230/460 3Ph 60Hz	875054-23
DN (10)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60025-0
P (15)	208-230/460 3Ph 60Hz	875054-24
DP (15)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60026-0
S (20)	208-230/460 3Ph 60Hz	875054-25
DS (20)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60027-0

<b>H-Pak Bell Housing Gasket &amp; Coupling Part Numbers</b>						
<b>Flow/HP Combinations</b>	<b>HP*</b>	<b>Flow</b>	<b>Gasket Number</b>	<b>Motor Coupling</b>	<b>Pump Coupling</b>	<b>Insert</b>
	U, T, DG	0.9 to 2.7	875577-01	L-075 5/8X3/16	L-075 1/2X1/8	L-075U
		3.2 to 9.6		L-100 5/8X3/16	L-100 5/8X5/32	L-100
	DK, L, DL	0.9 to 2.7	875577-02	68514411518	876975	68514411499
		3.2 to 9.6		L-100 1-1/8X1/4	L-100 5/8X5/32	L-100
	M, DM, N, DN	3.2 to 9.6	L-100 1-3/8X5/16	L-100 5/8X5/32	L-100U	
P, DP, S, DS	4.5 to 9.6	M300 1-5/8X3/8	M300 5/8X5/32	370N		

\*STD or dual rated motors are the same frame size

<b>H-Pak Pressure Tank Connections</b>			
<b>Option</b>	<b>Subplate/Manufacturer ID Number</b>	<b>Relief Valve</b>	<b>Gasket</b>
O	876305 (aluminum)	See relief valve chart	875576-05
	876305-S (steel)		
S3	876378 (aluminum)		875576-04
	876378-S (steel)		
S5	876305 (aluminum)		875576-05
	876305-S (steel)		
M33	AD03P032S/C		875576-04
M35	AD03P052S/C		
M53	AD05P032S/C	875576-05	
M55	AD05P052S/C		



**Parts List**

H-Pak Relief Valve Part Numbers		
Flow	HP Option*	Relief Valve
0.9 to 3.2	U, T	RAH101S20
	DG, DK, L, M	RAH101S30
4.5 to 9.6	U, T, DG, DK	RAH101S20
	L, M, N, P, S	RAH101S30

\*STD or dual rated.

H-Pak Accessories Parts List			
Option	Description	Part Number	Filter Element
A	Rear mt heat ex	RM-08-4-2	
	Bracket	875225 (2 pc)	
B1	Rear mt heat ex	RM-08-1-2	
	Bracket	875225 (2 pc)	
B2	Rear mt heat ex	RM-19-94171	
	Bracket	875225 (2 pc)	
C	Water/oil heat exch	BS-401-A4-O-BR	
D	Water/oil heat exch	BS-701-B6-F-BR	
E	Water valve	65253	
H	Pressure filter (aluminum head)	15P110QBRSKX1	
	Pressure filter (steel head)	15P110QB16690	
	Manifold	876526 (aluminum)	
		876526-S (steel)	
Gasket	875576-16		
J	Weld coupling	NA	
K (10 GAL)	Check valve	C1020S	
K (20 THRU 40 GAL)	Check valve	DT-750-MOMF-05	
L	Check valve	C1220S65	
N	Return filter	40CN110QEBM2KS164	936708Q
O	Return filter	12AT10CN15MMH	921999
	Gage, filter	876544	
R1	Switch housing w/ cover	876620	
	Float switch	876782-01	
	Gasket	875576-14 (2 pc required)	
R2	Switch housing w/ cover	876620	
	Float switch	876782-02	
	Gasket	875576-14 (2 pc required)	

The pressure filter is a standard aluminum 15P filter. For high pressure/high fatigue applications (above 2000 psi), an optional steel manifold and special 15P with a steel head is available.



**V-Pak Parts List**

V-Pak parts list is for standard units, design series 11, with directional valve information excluded. If your unit is a different **design series**, the form, fit and function of replacement parts may not match your parts.

Gear pumps, filters and valves should be purchased from their respective source Parker Divisions. Parts unique to the power unit (variable piston pumps, gaskets, special manifolds, etc.) should be purchased from Parker’s Hydraulic Pump and Power Systems Division.

V-Pak (V1-V4) Parts List – Design Series 11		
Description	Part Number	Notes
5" Level gage	875033-05	10 & 20 Gal
10" Level gage	875033-10	30 & 40 Gal
Filler breather	875034	
Pressure gage	875053-****	**** = Max pressure on gage
U-shaped tank edge rubr	875041-72	10 Gal tank, 72" long, trim to fit
U-shaped tank edge rubr	875041-78	20-40 Gal tank, 78" long, trim to fit
Needle valve (gage)	N400S	

Compensator Options						
Option	Block	Relief	Gasket	2-Way Valve	Coil	P08-2
Omit	876488 (aluminum)	(1 pc) 205745N-25	875576-13	N/A	N/A	No
	876488-S (steel)					
B, BJ	876549 (aluminum)	(1 pc) 205745N-25	875576-15	(1 pc) DSL081NRM	(B) CCP115D	Yes
	876549-S (steel)				(BJ) CCP024D	
C, CJ	876549 (aluminum)	(2 pc) 205745N-25	875576-15	(1 pc) DSL081NRM	(C) CCP115D	Yes
	876549-S (steel)				(CJ) CCP024D	
D, DJ	876549 (aluminum)	(2 pc) 205745N-25	875576-15	(2 pc) DSL081NRM	(D) CCP115D	No
	876549-S (steel)				(DJ) CCP024D	
F	876377 Cover plate		875576-13			N/A

V-Pak Pump And Suction Strainer Part Numbers			
Pump Flow	Option	Pump	Suction Strainer
Up to 7GPM*	-	PVP1630R2VM12*	875035-10
Up to 7GPM*	A	PVP1630R2VA12*	
Up to 7GPM	H	See motor chart	
8 to 15 GPM*	-	PVP3336R2VM21*	875035-20
8 to 15 GPM*	A	PVP3336R2VA21*	
8 to 15 GPM	H	See motor chart	

\* **Important:** Specify flow rate to match original power unit model code. "V" compensator has no local pressure setting.

Example: Power unit V3A13Mm

Replacement pump = **"PVP3336R2VA21 set at 13 GPM @ 1800 RPM"**

The remote compensator on the tank top controls the pump’s pressure after it is installed in the power unit and the compensator control line is reconnected to the remote block.



Parts List

V-Pak Motor/Pump HP Chart							
Option (HP)	Motor Part Number	7 GPM Pump with H Option (HP Limiting)		1.5 GPM Pump with H Option (HP Limiting)			
		hvPump Number ^	Pressure Set (PSI)	Pump Number ^	Pressure Set (PSI)		
DG (2)	133-60021-0	PVP1630R2VH12 ^	1600	N/A			
DK (3)	133-60022-0		2200				
L (5)	875054-21		3000 PSI			PVP3336R2VH21 ^	3000
DL (5)	133-60023-0						
M (7.5)	875054-22						
DM (7.5)	133-60024-0						
N (10)	875054-23						
DN (10)	133-60025-0						
P (15)	875054-24						
DP (15)	133-60026-0						
S (20)	875054-25						
DS (20)	133-60027-0						

**^Important:** specify the hp setting, rpm and pressure setting shown above to match your system. In most cases hp limited pumps are set at max volume.

**Example:** Power unit: V2H7DK Replacement pump = "PVP1630R2VH12 Set for 3 HP @ 1800 RPM, minimum pressure 2200 PSI. 2200 PSI is NOT the compensator setting, the remote block on the power unit top plate will be the limiting pressure device.

**The 3 HP motor is no longer available in a 56C frame. It is an 182TC frame design series 11 and beyond.**

**\* See H-Pak motor chart for voltage ratings.**

V-Pak Bell Housing Gasket & Coupling Part Numbers						
Flow/HP Combinations	HP	Flow	Gasket Number	Motor Coupling	Pump Coupling	Insert
	2 (DG)		2-7 GPM	875577-01	L-075 5/8X3/16	L-075 3/4X3/16
		8-15 GPM	NA	N/A		
3 (DK)		2-7 GPM	875577-02	L-100 1-1/8X1/4	L-100 3/4X3/16	L-100
		8-15 GPM	C820004	L-100 1-1/8X1/4	L-100 7/8X1/4	L-100
5 (L)		2-7 GPM	875577-02	L-100 1-1/8X1/4	L-100 3/4X3/16	L-100
		8-15 GPM	C820004	L-100 1-1/8X1/4	L-100 7/8X1/4	L-100
7.5 (M)		2-7 GPM	875577-02	L-100 1-3/8X5/16	L-100 3/4X3/16	L-100
		8-15 GPM	C820004	M300 1-3/8X5/16	M300 7/8X1/4	370N
10 (N)		2-7 GPM	875577-02	L-100 1-3/8X5/16	L-100 3/4X3/16	L-100
		8-15 GPM	C820004	M300 1-3/8X5/16	M300 7/8X1/4	370N
15 (P)		2-7 GPM	875577-02	M300 1-5/8X3/8	M300 3/4X3/16	370N
		8-15 GPM	C820004	M400 1-5/8X3/8	M400 7/8X1/4	470N
20 (S)		2-7 GPM	875577-02	M300 1-5/8X3/8	M300 3/4X3/16	370N
		8-15 GPM	C820004	M400 1-5/8X3/8	M400 7/8X1/4	470N



Parts List

V-Pak Pressure Tank Connections			
Option	Subplate/Manufacturer ID Number	Relief Valve	Gasket
O	876305 (aluminum)	RAH101S50	875576-05
	876305-S (steel)		
S3	876378 (aluminum)		875576-04
S5	876305 (aluminum)		875576-05
	876305-S (steel)		
M33	AD03P032S/C		875576-04
M35	AD03P052S/C		
M53	AD05P033S/C		875576-05
M55	AD05P053S/C		

V-Pak Accessories Parts List			
Option	Description	Part Number	Filter Element
A	Rear mt heat exch	RM-08-4-2	
	Bracket	875225 (2 pc)	
B1	Rear mt heat exch	RM-08-1-2	
	Bracket	875225 (2 pc)	
B2	Rear mt heat exch	RM-19-94171	
	Bracket	875225 (2 PCS)	
C	Water/oil heat exch	BS-401-A4-O-BR	
D	Water/oil heat exch	BS-701-B6-F-BR	
E	Water valve	65253	
H	Pressure filter (aluminum head)	15P110QBRKX1	
	Pressure filter (steel head)	15P110QB16690	
	Manifold	876526 (aluminum)	
		876526-S (steel)	
Gasket	875576-16		
J	Weld coupling	NA	
K (10 GAL)	Check valve	C1020S	
K (20 THRU 40 GAL)	Check valve	DT-750-MOMF-05	
N	Check valve	C1220S65	
L	Return filter	40CN110QEBM2KS164	
O	Return filter	12AT10CN15MMH	936708Q
	Gage, filter	876544	921999
R1	Switch housing w/cover	876620	
	Float switch	876782-01	
	Gasket	875576-14 (2 pc required)	
R2	Switch housing w/cover	876620	
	Float switch	876782-02	
	Gasket	875576-14 (2 pc required)	

The pressure filter is a standard aluminum 15P filter. For high pressure/high fatigue applications (above 2000 psi), an optional steel manifold and special 15P with a steel head is available.





Parts List

V-8 (Low Profile) Parts List

V-8 (low profile) parts list is for standard units, design series 13, with directional valve information excluded. If your unit is a different **design series**, the form, fit and function of replacement parts may not match your parts.

Gear pumps, filters and valves should be purchased from their respective source Parker Divisions. Parts unique to the power unit (variable piston pumps, gaskets, special manifolds, etc.) should be purchased from Parker's Hydraulic Pump and Power Systems Division.

V-8 Low Profile Parts List – Design Series 13		
Universal Parts	Part Number	
10" level gage	875033-10	
Filler breather	875034	
Pressure gage	875053-****	**** - Max pressure on gage
Needle valve (gage)	N400S	
Clean-out cover	5087	
Gasket, temp/level	875576-14	
U-shaped tank edge rubber	875041-100	100" long, trim to fit
Remote comp hose	F381-0606040404-35"	

Compensator Options					
Option	Block	Relief	Gasket	2-Way Valve	Coil
Omit	876488 (aluminum)	(1 pc) 205745N-25	875576-13	N/A	N/A
B, BJ	876549 (aluminum)	(1 pc) 205745N-25	875576-15	(1 pc) DSL081NRM	(B) CCP115D (BJ) CCP024D
C, CJ	876549 (aluminum)	(2 pc) 205745N-25		(1 pc) DSL081NRM	(C) CCP115D (CJ) CCP024D
D, DJ	876549 (aluminum)	(2 pc) 205745N-25		(2 pcs) DSL081NRM	(D) CCP115D (DJ) CCP024D
E	876377 Cover plate	N/A		875576-13	N/A

V8 Low Profile Pump Part Number Chart				
Pump Flow	Pump Control	Pump (If no air cooling option A, B or C)	Pump (If air cooling option A, B or C)	Suction Strainer
9 to 15 GPM*	-	PVP33363R2M21*	PVP33363R26A4M21*	875035-20
9 to 15 GPM*	A	PVP33363R2A21*	PVP33363R26A4A21*	
9 to 15 GPM	H	Consult factory	Consult factory	
16 to 23 GPM*	-	PVP48363R2M11*	PVP48363R26A4M11*	875035-30
16 to 23 GPM*	A	PVP48363R2A11*	PVP48363R26A4A11*	
16 to 23 GPM	H	Consult factory	Consult factory	
23 to 36 GPM*	-	P2075RXXC5C25PA00N00S1A1U^	P2075RXXC5C25PA00N00A1A1U^	875035-50
23 to 36 GPM*	A	P2075RXXC5C25LA10N00S1A1U^	P2075RXXC5C25LA10N00A1A1U^	
23 to 36 GPM	H	Consult factory	Consult factory	

\***Important:** specify flow rate & rpm to match original power unit model code. For example: power unit = V820PM53 The replacement pump would be PVP48363R2M11, specify the volume stop be set at 20 gpm @ 1800 rpm, pressure compensator set at 3600 PSI.

^**Important:** the P2's flow rate is called out in the model code of the pump as a percentage of full flow (36 gpm). For example: Power unit = V827RM82 27/36 = 75%, so the replacement pump model code is P2075R75C5C25PA00N00S1A1U.



<b>V8 Low Profile Bell Housing Gasket and Coupling Part Numbers</b>					
<b>HP</b>	<b>Flow</b>	<b>Gasket Number</b>	<b>Motor Coupling</b>	<b>Pump Coupling</b>	<b>Insert</b>
7.5 (M) 10(N)	9-23 GPM	C820004	M300 1-3/8X5/16	M300 7/8X1/4	370U
	24-36 GPM	C820004	M400 1-3/8X5/16	M400 1-1/4X5/16	470N
15 (P) 20 (S)	9-23 GPM	C820004	M400 1-5/8X3/8	M400 7/8X1/4	470N
	24-36 GPM	C820004	M400 1-5/8X3/8	M400 1-1/4X5/16	
25 (Q)	9-23 GPM	N/A	M400 1-7/8X1/2	M400 7/8X1/4	470N
	24-36 GPM		M400 1-7/8X1/2	M400 1-1/4X5/16	
30 (R)	9-23 GPM		M400 1-7/8X1/2	M400 7/8X1/4	470U
	24-36 GPM		M400 1-7/8X1/2	M400 1-1/4X5/16	
40 (V)	9-23 GPM		M500 2-1/8X1/2	M500 7/8X1/4	570N
	24-36 GPM		M500 2-1/8X1/2	M500 1-1/4X5/16	

<b>V8 Low Profile Subplate/Manifold, Relief Valve/Gasket Numbers</b>			
<b>Option</b>	<b>Subplate/Manifold Number</b>	<b>Relief Valve</b>	<b>Gasket</b>
OMIT	877544	RAH161S50	875576-09
S5	876305 (AI)	RAH101S50	875576-05
M53	AD05P033S/C		875576-05
M55	AD05P053S/C		
M82	AD08P025S/C		875576-12

<b>V-8 Low Profile Motor Part Numbers</b>		
<b>Option (HP)</b>	<b>Voltage/Frequency Ratings</b>	<b>Motor Part Number</b>
M (7.5)	208-230/460 3Ph 60Hz	875054-22
DM (7.5)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60024-0
N (10)	208-230/460 3Ph 60Hz	875054-23
DN (10)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60025-0
P (15)	208-230/460 3Ph 60Hz	875054-24
DP (15)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60026-0
S (20)	208-230/460 3Ph 60Hz	875054-25
DS (20)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60027-0
Q (25)	208-230/460 3Ph 60Hz	875054-26
DQ (25)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60028-0
R (30)	208-230/460 3Ph 60Hz	875054-27
DR (30)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60029-0
V (40)	208-230/460 3Ph 60Hz	875054-28
DV (40)	208-230/460 3Ph 60Hz   190/380 50Hz	133-60030-0



V8 Low Profile Accessories Parts List			
Option	Description	Part Number	Filter Element
A	Rear mt heat ex	RM-08-2-2	
	Bracket	875225 (2 pc)	
	Suction strainer	875035-10	
	Gear pump	334-9111-061	
B	Rear mt heat exch	RM-19-2-2	
	Bracket	875225 (2 pc)	
	Suction strainer	875035-10	
	Gear pump	334-9111-061	
C	Heat exchanger	AOC-22-2-1PH	
	Gear pump	334-9111-058	
	Suction strainer	875035-10	
	Filter	40CN205QEBM2GS244	936711Q
E	Water/oil heat exch	EKS-708-T	
F	Water valve	65253	
H	Pressure filter	30P210QBM2KS161	932630Q
J	Weld coupling	N/A	
K	Check valve	493-1601-2	
L	Check valve	C2020S65	
N	Return filter	40CN210QEBM2KS244	936601Q
R1	Switch housing w/cover	876620	
	Float switch	876782-01	
	Gasket	875576-14 (2 pc required)	
R2	Switch housing w/cover	876620	
	Float switch	876782-02	
	Gasket	875576-14 (2 pc required)	

## Troubleshooting

### System Fails to Generate Flow/Pressure

1. Add oil to the unit, fill until the oil is at the top of the level gage glass. Use a petroleum base fluid per HF-0 or HF-1. The fluid should have anti-rust, anti-foam properties and be designed for operating under high pressure.
2. Motor rotation incorrect, verify and change if necessary.
3. Pump hasn't primed. Bleed the system and retry.
4. No resistance to flow. **Pumps generate flow not pressure.** Pressure is generated by the resistance to flow. If there is an open center directional valve or other path that connects the pressure line to tank, there will be no pressure.
5. Unloading valve not activated. Verify voltage to the solenoid, preferably with the solenoid connected. An undersized power supply can appear to be OK but then droop when loaded by the solenoid.
6. Failed or incorrectly adjusted relief valve. Contamination can plug the internal pilot pressure of a relief valve, causing it to fail in the open position.
7. Pump/motor coupling loose or broken. Normally the motor will stop within a second or two of losing power. If it winds down over several seconds it is not connected to the pump shaft.
8. Loose or disconnected inlet line.
9. Failed pump. In the case of a variable volume pump, additionally the remote compensator and main compensator should be inspected. Contamination can cause the pump to de-stroke at minimum pressure. Checking the remote compensator should be done first because it is mounted on the power unit top plate (easy access).

### System Flow and/or Pressure Inadequate or Erratic

1. Loose inlet connection or dirty inlet strainer.
2. Incorrectly adjusted relief valve. Pump hasn't primed. Bleed the system and retry.
3. If a variable pump is being used, make sure the main relief and pump compensator are not set too closely together. A minimum separation of 250 psi is recommended.
4. If flow and pressure are steady but weak, verify the motor is properly wired to match the incoming voltage and that all three phases have power. Running on two phases or being wired for the wrong voltage will cause the motor to run slow and will result in motor damage.

## DCP (Inverter) Specific Troubleshooting Items

### Motor Fails to Start When Drive Is Commanded to Do So

1. 24 VDC signal not present at required pin(s). The exact control option determines which inputs cause the drive to run the motor. In most cases, at least one input (DIN1) needs to be held high to enable the drive. As of March 2017, all drives shipped with factory-installed software require DIN1 and DIN2 to be held high to function. DIN1 is a master enable; DIN2 could be tied to the temp/level switch (if equipped) or a NC stop button that opens when pressed. In addition to these two discrete inputs, there are analog inputs that are used for the “V” and “I” options.access).
2. Make sure the DC common of the remote 24 VDC signal source is tied to the “(CM) 0VDC” terminal of the AC10. This is necessary so both devices have the same zero-volt reference.

### Excessive Electrical Interference or EMI

1. Broken or improper shield connection of the cable between the motor and the drive. Loose or missing ground connection at power connection.

### Motor Slows Down Unexpectedly or Stalls

1. This is a sign the drive is undersized. The AC10 can handle 150% of its rating for a few seconds. Starting torque can often be more than this, especially with variable volume pumps. If the drive has trouble starting, an unloading valve or decrease in pressure may be required until the motor is up to speed.
2. Ampacity of the wires feeding the drive is too low. Make sure the wires are properly sized. The longer the run, the bigger the wire needs to be for a given amp rating to avoid voltage droop. If the voltage to the drive droops too much, current rise and motor slip will lead to a complete breakdown of motor speed.

## Power Unit Weights

Since there are so many combinations of options, listing an exact weight for every model code is not practical. The following chart will provide estimates based on tank size and horsepower. Combine the tank size and motor horsepower to come up with an average total weight, without oil.

Tank Size	Approximate Weight Less Motor
5 Gallon	70 lbs.
10 Gallon	106 lbs.
20 Gallon	122 lbs.
30 Gallon	126 lbs.
40 Gallon	130 lbs.
55 Gallon	260 lbs.
75 Gallon	313 lbs.
95 Gallon	365 lbs.
Motor HP	Approximate Weight
1/4	20 lbs.
1/2	20 lbs.
3/4	40 lbs.
1	40 lbs.
2	40 lbs.
3	65 lbs.
5	75 lbs.
7-1/2	100 lbs.
10	120 lbs.
15	170 lbs.
20	200 lbs.
25	370 lbs.
30	440 lbs.
40	505 lbs.







**Offer of Sale**

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods, services or work described will be referred to as "Products".

1. **Terms and Conditions.** Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found on-line at [www.parker.com/sale/terms/](http://www.parker.com/sale/terms/). Seller objects to any contrary or additional terms or conditions of Buyer's order or any other document issued by Buyer.
2. **Price Adjustments; Payments.** Prices stated on Seller's quote or other documentation offered by Seller are valid for 30 days, and do not include any sales, use, or other taxes unless specifically stated. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and is due 30 days from the date of invoice or such other term as required by Seller's Credit Department, after which Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.
3. **Delivery Dates; Title and Risk; Shipment.** All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon placement of the products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.
4. **Warranty.** Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of eighteen months from the date of shipment from the Company. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**
5. **Claims; Commencement of Actions.** Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for an amount due on any invoice) must be commenced within 12 months from the date of the breach without regard to the date breach is discovered.
6. **LIMITATION OF LIABILITY.** UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. **IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.**
7. **User Responsibility.** The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.
8. **Loss to Buyer's Property.** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, will be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.
9. **Special Tooling.** A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.
10. **Buyer's Obligation; Rights of Seller.** To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.
11. **Improper use and Indemnity.** Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including

- attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.
12. **Cancellations and Changes.** Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.
13. **Limitation on Assignment.** Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.
14. **Force Majeure.** Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.
15. **Waiver and Severability.** Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.
16. **Termination.** Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appoints a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) dissolves or liquidates all or a majority of its assets.
17. **Governing Law.** This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.
18. **Indemnity for Infringement of Intellectual Property Rights.** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.
19. **Entire Agreement.** This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.
20. **Compliance with Law, U. K. Bribery Act and U.S. Foreign Corrupt Practices Act.** Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or countries of the Territory in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that they are familiar with the provisions of the U. K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller. 04/2014

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