

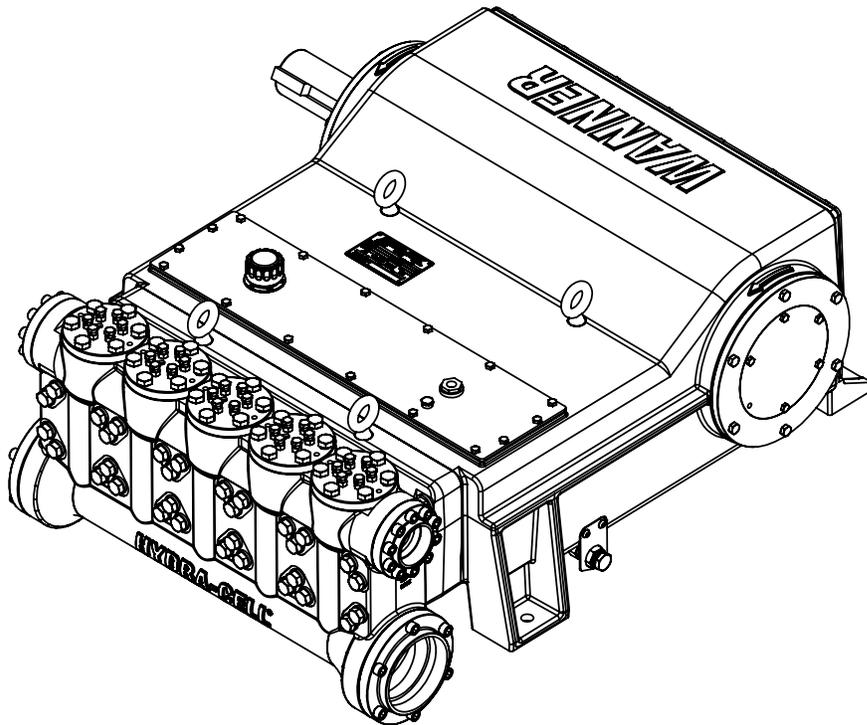
Installation, Operation & Maintenance
230-999 Rev A

Hydra-Cell[®]

Seal-less Pumps

Q330 Series Medium Pressure

Models: Q330K and Q330M



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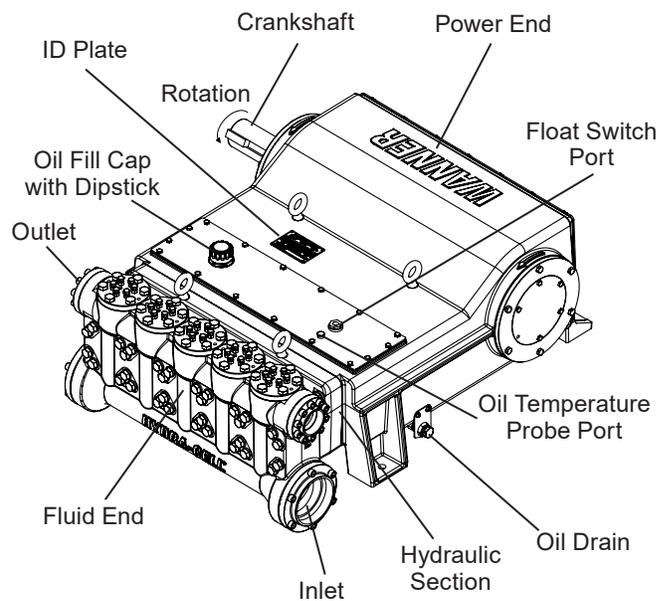
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Q330 Series Medium Pressure - Contents

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Component Identification



Q330 Series Medium Pressure - Specifications

Flow Capacities

Model	Pressure psi (bar)	rpm	gpm	l/min	BPD
Q330K	3000 (207)	400	153	579	5247
Q330M	3500 (241)	400	136	514	4664

Delivery

	Pressure psi (bar)	gal/rev	liters/rev
Q330K	500 (34)	0.413	1.563
	1500 (103)	0.400	1.515
	3000 (207)	0.383	1.450
Q330M	500 (34)	0.369	1.395
	1750 (121)	0.357	1.351
	3500 (241)	0.342	1.293

rpm

Maximum:	400
Maximum API 674:	310
Minimum:	40

(Consult factory for speeds less than 40 rpm.)

Maximum Discharge Pressure

Metallic Heads:	Q330K	3000 psi (207 bar)
	Q330M	3500 psi (241 bar)

Maximum Inlet Pressure 500 psi (34 bar)

Operating Temperature

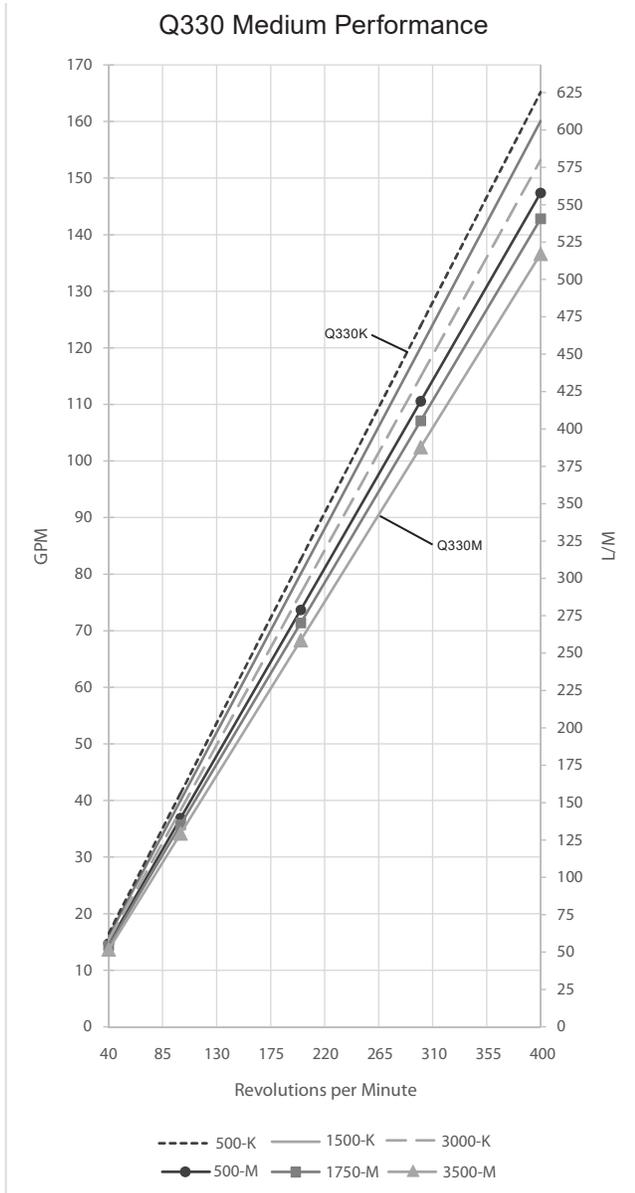
Maximum:	180°F (82.2°C)
Minimum:	40°F (4.4°C)

(consult factory for temperatures outside this range)

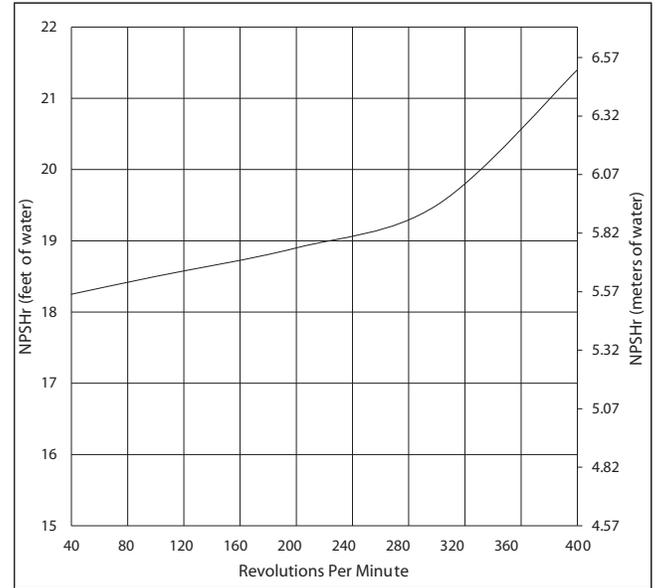
Maximum Solids Size	800 microns
Input Shaft	Left or Right Side
Inlet Ports	Weld-On, 6 inch / SCH. 40 6 inch NPT, 6 inch Class 300 RF ANSI
Discharge Ports	Weld-On, 3 inch / SCH. XXH 3 inch NPT, 3 inch Class 2500 RTJ ANSI
Plunger Stroke Length	5 inch (127 mm)
Shaft Diameter	4 inch (101.6 mm)
Shaft Rotation	Uni-directional (see rotation arrows)
Oil Capacity	110 US quarts (104.1 liters)
Weight	
Metallic Heads:	5000 lbs (2268 kg)
Fluid End Materials:	Nickel Aluminum Bronze (NAB)
Power End Materials:	Ductile Iron

Q330 Series Medium - Specifications (Cont'd)

Performance



Net Positive Suction Head – NPSHr



Calculating Required Horsepower (kW)*

$$\frac{\text{gpm} \times \text{psi}}{1,460} = \text{electric motor HP}^*$$

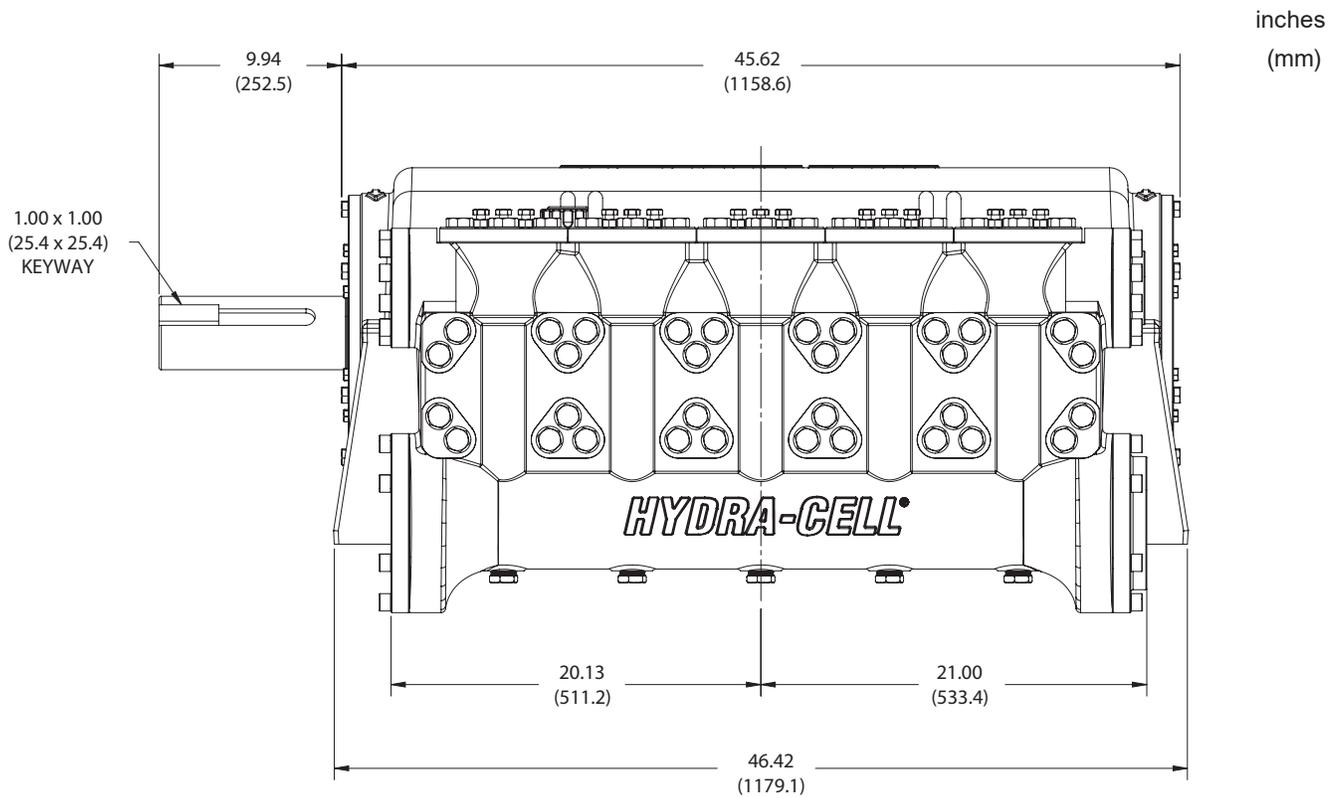
$$\frac{\text{l/min} \times \text{bar}}{511} = \text{electric motor kW}^*$$

* HP/kW is required application power.

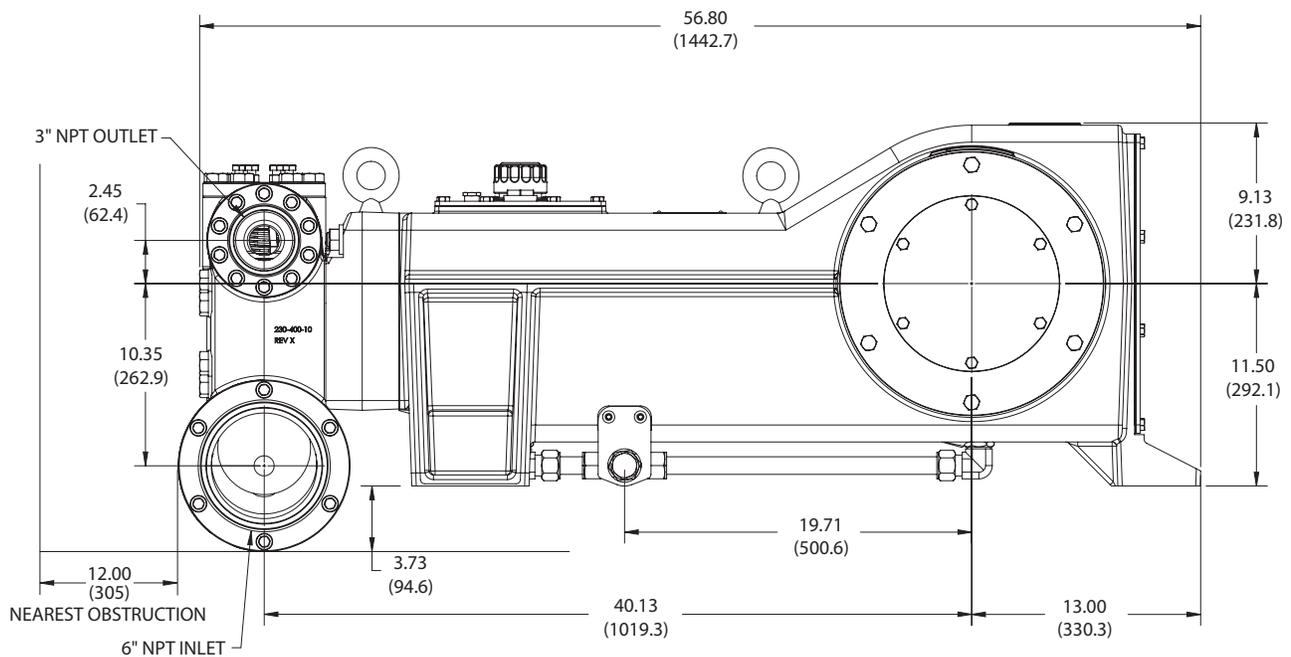
Attention!

When sizing motors with variable speed drives (VFDs), it is very important to select a motor and a VFD rated for constant torque inverter duty service and that the motor is rated to meet the torque requirements of the pump throughout desired speed range.

Q330 Medium Pressure - Representative Drawings



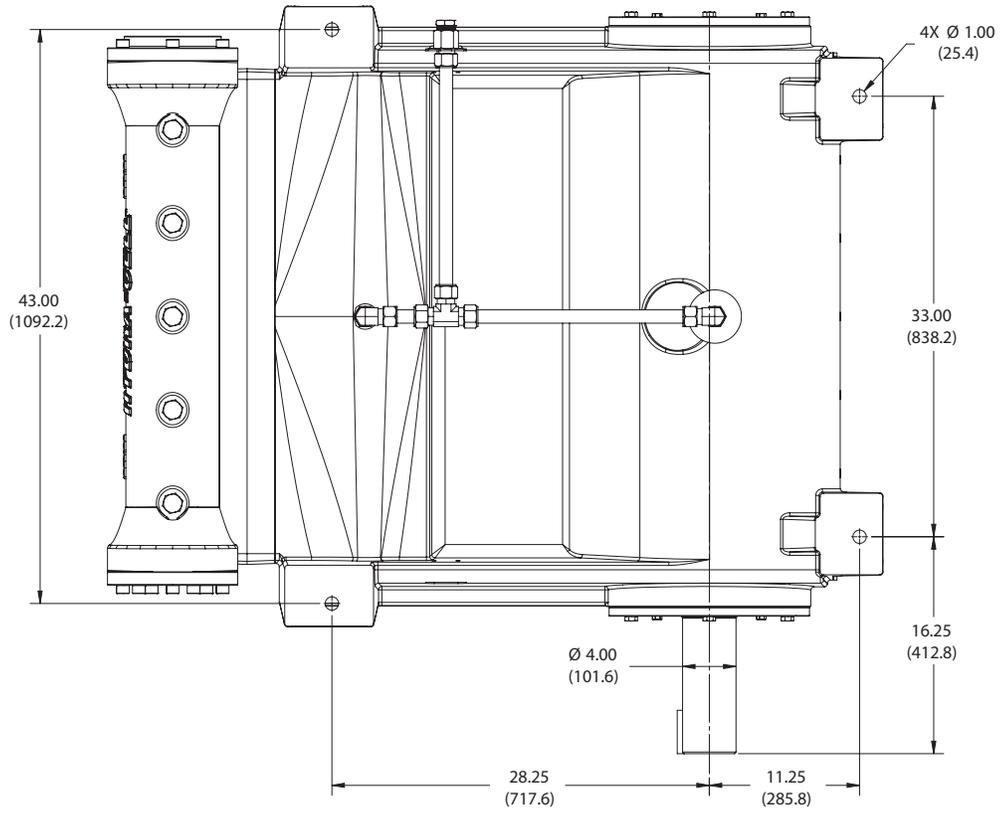
Front View



Side View

Q330 Medium - Representative Drawings (Cont'd)

inches
(mm)



Bottom View

Q330 Series Medium Pressure - Installation

Location

Locate the pump as close to the fluid supply source as possible.

Install it in a lighted clean space where it will be easy to inspect and maintain. Allow room for checking the oil level, changing the oil (drain plug on the side of pump), and removing the pump head components (inlet and discharge retainer plates, manifold, and related items). See side view representative drawing for required distance from nearest obstruction.

Rigging Information

Lift pump by attaching rigging to all four eyebolts (2). Adjust attachment lengths to keep pump level during lifting. **CAUTION: Eyebolts (2) are rated to lift the weight of the pump only. Also see center of mass references in the Representative Drawings Section.**

Mounting

CAUTION: The pump shaft rotation direction is indicated by arrows on the pump housing.

To prevent vibration, mount the pump and motor securely on a level rigid base.

On a belt-drive system, align the sheaves accurately; poor alignment wastes horsepower and shortens the belt and bearing life. Make sure the belts are properly tightened, as specified by the belt manufacturer.

On a direct-drive system, align the shafts accurately. Unless otherwise specified by the coupling manufacturer, maximum parallel misalignment should not exceed 0.015 in. (0.4 mm) and angular misalignment should be held to 1° maximum. Careful alignment extends life of the coupling, pump, shafts, and support bearings. Consult coupling manufacturer for exact alignment tolerances.

Important Precautions

Adequate Fluid Supply. To avoid cavitation and premature pump failure, be sure that the pump will have an adequate fluid supply and that the inlet line will not be obstructed. See "Inlet Piping" and consult NPSH chart.

Positive Displacement. This is a positive-displacement pump. Install a relief valve downstream from the pump. See "Discharge Piping".

Safety Guards. Install adequate safety guards over all pulleys, belts, and couplings. Follow all local codes and regulations regarding installation and operation of the pumping system.

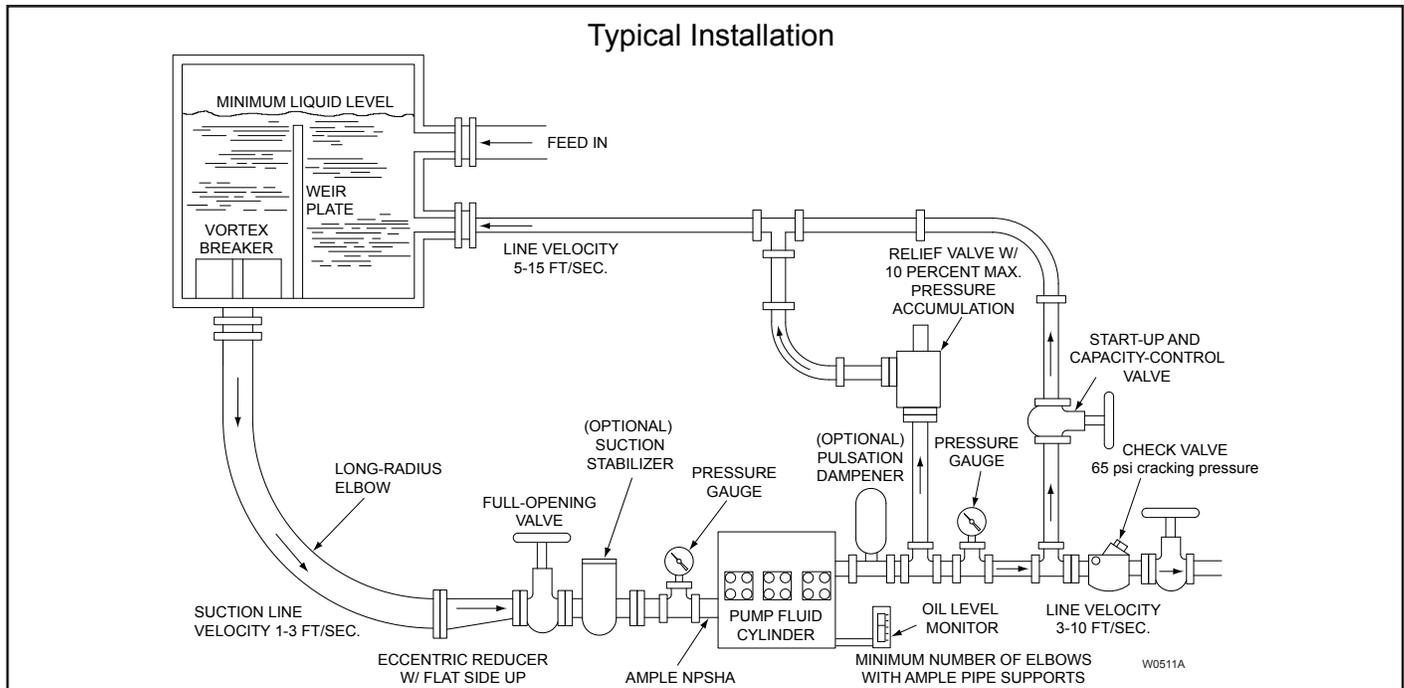
Shut-Off Valves. Never install shut-off valves between the pump and discharge pressure regulator, relief valve, or in the regulator bypass line.

Freezing Conditions. Protect the pump from freezing. See also the Maintenance Section.

Vacuum at Outlet. Do not allow a vacuum at the pump outlet during shutdown. A vacuum can damage the diaphragm at start-up. If there is a vacuum at the pump outlet, allow atmospheric pressure at the outlet for 30 minutes before starting. Wanner Engineering recommends installing an outlet check valve with a 65 psi (4.5 bar) cracking pressure to prevent a vacuum condition during shutdown.

Consult the Factory for the following situations:

- Fluid temperature applications – above 180° F (82° C) or below 40° F (4.4° C)
- Pressure feeding of pumps over 500 psig (34.5 bar)
- Viscous fluid applications above 100 Cps
- Chemical compatibility problems
- Hot ambient temperatures – above 110° F (43° C)
- Conditions where pump oil may exceed 200° F (93° C) because of a combination of hot ambient temperatures, hot fluid temperature, and full horsepower load — an oil cooler may be required
- Pump rpm less than 40
- If two or more pumps will draw fluid from a suction header.



Q330 Series Medium - Installation (Cont'd)

Accessories

Consult installation drawing on previous page for typical system components. Contact Wanner Engineering or the distributor in your area for more details.

Inlet Piping (Suction Feed)

Install drain cocks at any low points of the suction line, to permit draining in freezing conditions.

Provide for permanent or temporary installation of a vacuum gauge to monitor the inlet suction. To maintain maximum flow, NPSHA must exceed NPSHR (See chart in Specifications Section). **Do not supply more than one pump from the same inlet line if possible.**

Inlet fluid velocity 1-3 ft/s.

Supply Tank

Use a supply tank that is large enough to provide time for any trapped air in the fluid to escape. The tank size should be at least five times the maximum pump flow rate (in gpm or lpm). *For example: at a maximum rate of 96 gpm, since trapped air takes five minutes to escape from water, $5 \times 96 = 480$ gallons for a recommended supply tank size.*

Isolate the pump and motor stand from the supply tank, and support them separately.

Install a separate inlet line from the supply tank to each pump.

Install the inlet and bypass lines so they empty into the supply tank below the lowest water level, on the opposite side of the baffle from the pump suction line.

If a line strainer is used in the system install it in the inlet line to the supply tank.

To reduce aeration and turbulence, install a completely submerged baffle plate to separate the incoming and outgoing liquids.

Install a vortex breaker in the supply tank, over the outlet port to the pump.

Place a cover over the supply tank, to prevent foreign objects from falling into it.

Hose/Pipe and Routing

Size the suction line at least one size larger than the pump inlet, and so that the velocity will be 1-3 ft/sec (0.3 to 0.9 m/s):

For pipe in inches: Velocity (ft/sec) = $0.408 \times \text{GPM}/\text{Pipe ID}^2$

For pipe in mm: Velocity (m/sec) = $21.2 \times \text{LPM}/\text{Pipe ID}^2$

Keep the suction line as short and direct as possible.

Use flexible hose and/or expansion joints to absorb vibration, expansion, or contraction.

If possible, keep suction line level. Do not have any high points collecting vapor unless high points are vented.

To reduce turbulence and resistance, do not use 90° elbows. If turns are necessary in the suction line, use 45° elbows or arrange sweeping curves in the flexible inlet hose.

If a block valve is used, be sure it is fully opened so that the flow to the pump is not restricted. The opening should be at least the same diameter as the inlet plumbing ID.

Do not use a line strainer or filter in the suction line unless regular maintenance is assured. If used, choose a top loading basket. It should have a free-flow area of at least three times the free-flow area of the inlet.

Install piping supports where necessary to relieve strain on the inlet line and to minimize vibration.

Inlet Piping (Pressure Feed)

Provide for permanent or temporary installation of a vacuum/pressure gauge to monitor the inlet vacuum or pressure. Pressure at the pump inlet should not exceed 500 psi (34.5 bar); if it could get higher, install an inlet pressure reducing regulator. Do not supply more than one pump from the same inlet line.

Inlet fluid velocity 1-3 ft/s.

Inlet Calculations

Acceleration Head

Calculating the Acceleration Head

Use the following formula to calculate acceleration head losses. Subtract this figure from the NPSHa, and compare the result to the NPSHR of the Hydra-Cell pump.

$$H_a = (L \times V \times N \times C) \div (K \times G)$$

where:

H_a = Acceleration head (ft of liquid)

L = Actual length of suction line (ft) — not equivalent length

V = Velocity of liquid in suction line (ft/sec) [$V = \text{GPM} \times (0.408 \div \text{pipe ID}^2)$]

N = rpm of crankshaft

C = Constant determined by type of pump — use 0.040 for all Q330 pumps

K = Constant to compensate for compressibility of the fluid — use: 1.4 for de-aerated or hot water; 1.5 for most liquids; 2.5 for hydrocarbons with high compressibility

G = Gravitational constant (32.2 ft/sec²)

Friction Losses

Calculating Friction Losses in Suction Piping

When following the above recommendations (under "Inlet Piping") for minimum hose/pipe I. D. and maximum length, frictional losses in the suction piping are negligible (i.e., $H_f = 0$) if you are pumping a water-like fluid.

When pumping more-viscous fluids such as lubricating oils, sealants, adhesives, syrups, varnishes, etc.; frictional losses in the suction piping may become significant. As H_f increases, the available NPSH (NPSHa) will decrease, and cavitation will occur.

In general, frictional losses increase with increasing viscosity, increasing suction-line length, increasing pump flow rate, and decreasing suction-line diameter. Changes in suction-line diameter have the greatest impact on frictional losses: a 25% increase in suction-line diameter cuts losses by more than two times, and a 50% increase cuts losses by a factor of five times.

Consult the factory before pumping viscous fluids above 100 Cps.

Q330 Series Medium - Installation (Cont'd)

Minimizing Acceleration Head and Frictional Losses

To minimize the acceleration head and frictional losses:

- Keep inlet lines less than 6 ft (1.8 m) or as short as possible
- Use at least 6 in. (152 mm) I.D. inlet hose (fluid velocity 1-3 ft/s)
- Use **suction** hose (low-pressure hose, non collapsing) for the inlet lines
- Minimize fittings (elbows, valves, tees, etc.)
- **Use a suction stabilizer on the inlet.**

Net Positive Suction Head

NPSHa must be equal to or greater than NPSHr. If not, the pressure in the pump inlet will be lower than the vapor pressure of the fluid — and cavitation will occur.

Calculating the NPSHa

Use the following formula to calculate the NPSHa:

$$NPSHa = P_t + H_z - H_f - H_a - P_{vp}$$

where:

P_t = Atmospheric pressure

H_z = Vertical distance from liquid surface to pump center line (if liquid is below pump center line, the H_z is negative)

H_f = Friction losses in suction piping

H_a = Acceleration head at pump suction

P_{vp} = Absolute vapor pressure of liquid at pumping temperature

Notes:

- In good practice, NPSHa should be 2 ft greater than NPSHr
- All values must be expressed in feet of liquid

Atmospheric Pressure at Various Altitudes

Altitude (ft)	Pressure (ft of H ₂ O)	Altitude (ft)	Pressure (ft of H ₂ O)
0	33.9	1500	32.1
500	33.3	2000	31.5
1000	32.8	5000	28.2

Discharge Piping

Hose and Routing

Use the shortest, most-direct route for the discharge line.

Select pipe or hose with a **working pressure** rating of at least 1.5 times the maximum system pressure. EXAMPLE: Select a 1500 psi W.P.-rated hose for systems to be operated at 1000 psi-gauge pressure.

Use flexible hose between the pump and rigid piping to absorb vibration, expansion or contraction.

Do not use 90 degree elbows within 10 pipe diameters of the pump discharge port.

Support the pump and piping independently. Size the discharge line so that the velocity of the fluid will be 3-10 ft/sec (1-3 m/sec):

For pipe in inches: Velocity (ft/sec) = 0.408 x GPM/Pipe ID²

For pipe in mm: Velocity (m/sec) = 21.2 x LPM/Pipe ID²

Pressure Relief

Install a pressure relief valve in the discharge line. Bypass pressure must not exceed the pressure limit of the pump.

Size the relief valve so that, when fully open, it will be large enough to relieve the full capacity of the pump without overpressurizing the pump.

Locate the valve as close to the pump as possible and ahead of any other valves.

Adjust the pressure relief valve to no more than 10% over the maximum working pressure of the pump.

Route the bypass line to the supply tank, never into the suction line. See the diagram showing a typical installation at the beginning of the Installation Section.

If the pump may be run for a long time with the discharge closed and fluid bypassing, install a thermal protector in the bypass line (to prevent severe temperature buildup in the bypassed fluid).

CAUTION: Never install shutoff valves in the bypass line or between the pump and pressure relief valve.

Install a pressure gauge in the discharge line.

Vacuum at Outlet. Do not allow a vacuum at the pump outlet during shutdown. A vacuum can damage the diaphragm at start-up. If there is a vacuum at the pump outlet, allow atmospheric pressure at the outlet for 30 minutes before starting. Wanner Engineering recommends installing an outlet check valve with a 65 psi cracking pressure to prevent a vacuum condition during shutdown.

Oil Level Monitoring. Oil level is sensed by the top cover float switch (49) and can be used to control the pump system operation.

Before Initial Start-Up

Before you start the pump, be sure that:

- Pump is stored at a temperature between 40-180° F (4.4-82.2° C) for a minimum of 24 hours before start up.
- All shutoff valves are open, and the pump has an adequate supply of fluid.
- All connections are tight.
- The oil level is within the marking on the dipstick. Add oil as needed.
- Connect and test the float switch (if used). See Float Switch Section.
- The relief valve on the pump outlet is adjusted so the pump starts under minimum pressure.
- All shaft couplings or drive pulleys have adequate safety guards.

Q330 Series Medium - Installation (Cont'd)

Initial Start-Up

1. Pump must be at or above 40°F (4.4°C) for 24 hours prior to starting.
2. Open the bypass line start-up and capacity-control valve so the pump may be started against negligible discharge pressure.
3. Turn on power to the pump motor.
4. Check the inlet pressure or vacuum. Inlet pressure must not exceed 500 psi (34 bar).
5. Listen for any erratic noise, and look for unsteady flow. If the pump does not clear, refer to the Troubleshooting Section.
6. If the system has an air lock and the pump fails to prime:
 - a. Turn off the power.
 - b. Open the bypass line as indicated by the installation diagram.
 - c. Jog the system on and off until the fluid coming from this port is air-free.
 - d. Turn on the power.
7. Adjust the bypass line valve to the desired operating pressure. Do not exceed the maximum pressure rating of the pump.
8. After the system pressure is adjusted, verify the safety relief valve setting by closing the bypass line valve until the relief valve opens.

Note: Fluid may come out of the safety relief valve. Provide an adequate catch basin for fluid spillage. Take all safety precautions to assure safe handling of the spillage.
9. Reset the bypass line valve to obtain the desired system pressure if needed.
10. Provide a return line from the relief valve to the supply tank, similar to the bypass line. Never back to pump suction line.

Q330 Series Medium Pressure - Maintenance

Maintenance

Note: The numbers in parentheses are the Reference Numbers shown in the Parts Section of the manual.

Daily

Check the oil level and the condition of the oil with the pump turned off. The oil level should be within the marking on the dipstick. Add oil as needed or use continuous monitor.

Use the appropriate Hydra-Oil for the application (contact Wanner Engineering if in doubt).

CAUTION: If you are losing oil but don't see any external leakage, or if the oil becomes discolored and contaminated, one of the diaphragms (86) may be damaged. Refer to the Fluid-End Service Section. Do not operate the pump with a damaged diaphragm.

Do not leave contaminated oil in the pump housing or leave the housing empty. Remove contaminated oil as soon as discovered, and replace it with clean oil.

Periodically

Change the oil after the first 500 hours of operation; and then every 2000 hours or six months, whichever comes first.

Note: Minimum oil viscosity for proper hydraulic end lubrication is 4.5 cST (42.4 SSU) at 212°F (100°C).

Use of an oil cooler is recommended when process fluid and/or hydraulic end oil exceeds 180°F (82.2°C).

When changing oil, remove drain plug on the side of the pump so all oil and accumulated sediment will drain out.

Check the inlet pressure or vacuum periodically with a gauge. If vacuum at the pump inlet exceeds NPSHR, check the inlet piping system for blockages. If the pump inlet is located above the supply tank, check the fluid supply level and replenish if too low.

Inspect pump for hydraulic oil or process fluid leaks.

Shutdown Procedure During Freezing Temperatures

Take all safety precautions to assure safe handling of the fluid being pumped. Provide adequate catch basins for fluid drainage and use appropriate plumbing from drain ports, etc., when flushing the pump and system with a compatible antifreeze. Drain ports are located in the manifold.

1. Remove the inlet and outlet fluid connections.
2. Remove the five Manifold drain plugs (6).
3. Use long blunt instrument to reach through the manifold drain plug ports to open the inlet valves and purge fluid from the pumping chamber.
4. Operate pump dry at full speed to purge remaining fluid.

Recommended Tools and Supplies

The following tools and supplies are recommended for servicing the Q330K and Q330M Pump:

Ratchet and extension(s)

Bench Vise

4 mm hex bit socket

6 mm hex bit socket

10 mm hex bit socket

8 mm hex socket

14 mm hex socket

16 mm hex socket

17 mm hex socket

19 mm hex socket

22 mm hex socket

24 mm hex socket

30 mm hex socket

9/16 in. hex socket

13 mm open-end wrench

18 mm open-end wrench

41 mm open-end wrench

1 3/8 in. open-end wrench

1 1/2 in. open-end wrench

Torx T30

Flathead screwdriver

No. 3 Phillips-head screwdriver

Internal retaining ring pliers

External retaining ring pliers

8 in. adjustable wrench

In-lbs Adjustable Torque wrench or torque multiplier

Ft-lbs Adjustable Torque wrench or torque multiplier capable of 450 ft-lbs

Pipe wrench

Loctite 242

Loctite 271

Loctite 567

New Hydra-Oil

Wanner Q330 Medium Pressure Tool Kit (see Q330 Medium Pressure Tool Kit Parts)

Wanner Q330 Crankshaft Tool Kit

Wanner Q330 Crankshaft Lifter Tool

Q330 Series Medium Pressure - Fluid End Service

This section explains how to disassemble and inspect all easily-serviceable parts of the pump.

Note: The numbers in parentheses are the Reference Numbers shown in the Parts Section of the manual.

Fluid End Service

Valve Stack Disassembly

- a. Depressurize and empty the manifold before valve stack removal.
- b. *See Fluid End Parts View.* Loosen and turn up hex nut (116) on bolt (117). Remove bolts (117) from valve cap (113).
- c. Remove six bolts (109) from valve cap (113).
- d. Remove valve cap/outlet valve assembly by installing two bolts (117) into threaded jack screw holes on valve cap (113).
- e. Remove inlet valve assembly (103-111, 125) with valve extraction tools (3-5) from Q330 Tool Kit.
- f. Remove inlet valve support (101-102) with check valve extractor (2) from Q330 Tool Kit.

Outlet Valve Disassembly

- a. Check outlet O-rings (111), and outlet retainer plate (114) for wear. Replace if worn. Lubricate new O-rings. Outlet valve retainers (112) are attached to valve cap (113) with two screws (115).
- b. Inspect valve caps for warping or wear. Look for corrosion, scale, and wear. If wear is excessive, replace valve caps. Clean valve caps of any scale and corrosion with Scotch-Brite™ pad or fine emery cloth. Wash after cleaning. To check if valve cap is warped, place a straightedge across it. A warped valve cap should be replaced.
- c. Remove valve seat (103) by turning while holding retainer in place.
- d. Inspect each of the outlet valves, valve seats, O-ring, valve spring, valve stem bushings and valve spring retainers for damage or wear. Replace any outlet valve parts as needed.

Outlet Valve Assembly

- a. Reinstall valve cap (106) on assembled outlet valve (103-106, 108, 111-112, 114, 125) with two screws (115) [Torque to 75 in-lbs (8 N-m)]. *See Fluid End Parts View.*

Inlet Valve Disassembly

- a. Check inlet O-rings (111), and scarf cut backup rings (110) for wear. Replace if worn. Lubricate new O-rings and scarf cut backup rings.
- b. Remove valve seat (103) by turning while holding retainer in place.
- c. Inspect each of the inlet valves, valve seats, O-ring, valve spring, valve stem bushings and valve spring retainers for damage or wear. Replace any inlet valve parts as needed.

Inlet Valve Assembly

- a. Assemble inlet valve (103-111, 125). *See Fluid End Parts View.*

Valve Stack Assembly

- a. Reinstall inlet valve support (101-102).
- b. Reinstall inlet valve assembly (103-111, 125). Make Sure an inlet valve retainer window is facing diaphragm when installing.
- c. Reinstall valve cap/outlet valve assembly. Outlet valve ports need to be in line with the outlet flange. Valve cap mounting holes will not align if outlet valve is not properly aligned.
- d. Use six bolts (109) to fasten valve cap (113). Hand thread bolts, then tighten in crisscross pattern. Torque to 350 ft-lbs (474 N-m).
- e. Fully thread hex nut (116) onto bolt (117). Hand thread bolts (117) into valve cap (113). Preload valve stack by torquing the six bolts (117) in circular pattern to 30 ft-lbs (41 N-m).

Note: Continue tightening bolts in circular pattern (roughly 4-6 times) until bolts are properly torqued before moving to the next torque setting.

- f. Turn nut (116) down to valve cap (113) and tighten to jam nut against valve cap.

Drain Plug

- a. Remove and replace drain plug (6) as needed. Apply Loctite 567 to drain plug threads. Install and tighten drain plug.

Q330 Series Medium - Hydraulic Section Service

Note: The numbers in parentheses are the Reference Numbers shown in the Parts Section of the manual.

Hydraulic Section Disassembly

 **WARNING: Manifold (98) and assembled parts weigh over 1000 pounds (454 kg). Use care in handling to prevent personal injury or damage to equipment.**

- See *Power End Parts Illustration in Parts List*. Remove drain plug (6) from side of pump and drain oil into container (capable of holding 110 qts [104 liters] of oil). Dispose of old oil in an approved way.
- Replace drain plug.
- See *Fluid End Parts View*. Remove four bolts (100) and washers (99), one from each corner of manifold (98). Install four extended studs (6) from Q330 Tool Kit in removed bolt locations.
- Remove remaining sixteen bolts (100) and washers (99) from fluid end of pump. Carefully slide manifold (98) forward along extended studs to allow access to diaphragm plate (62).

Diaphragm Plate Disassembly

Note: Disassembly of diaphragm plate is only necessary if there is damage to the diaphragm plate itself.

 **WARNING: Manifold (98) and assembled parts weigh over 1000 pounds (454 kg). Use care in handling to prevent personal injury or damage to equipment.**

- Slide manifold (98) away from diaphragm plate (62), following steps a. through d. in the Manifold Disassembly Section.

 **WARNING: Diaphragm plate (62) and assembled parts weigh over 500 pounds (227 kg). Use care in handling to prevent personal injury or damage to equipment.**

- See *Power End Parts view*. Remove 16 cap screws (19) and remove top cover (38) on the crankcase.
- See *Hydraulic End Parts view*. Remove two cap screws (60), upper and lower plunger clamp (58 and 59). Push plunger (57) into cylinder (64). Rotate crankshaft (30) and repeat for remaining plungers.
- Remove six cap screws (81) and six flange nuts (61) from diaphragm plate (62).
- Carefully slide diaphragm plate and assembled parts away from pump along pump studs.
- Replace diaphragm plate gasket (35) if damaged.

Check/Replace Airbleed Valve Assembly

- See *Hydraulic Section Parts view*. Unthread airbleed valve assembly (77) from diaphragm plate (62). Inspect valve and replace if needed.
- Reinstall airbleed valve. Torque to 75 ft-lbs (102 N-m).

Check/Replace Underfill Valve Assembly

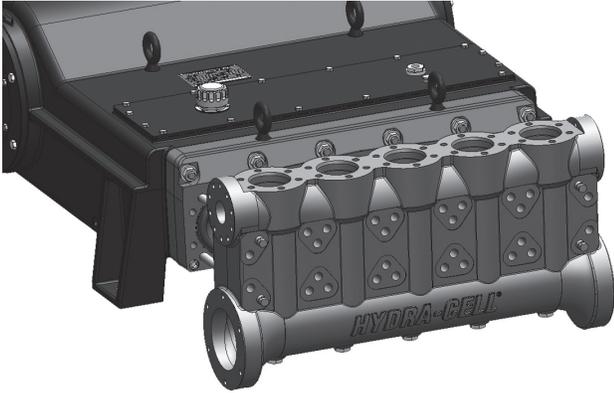
- See *Hydraulic Section Parts view*. Unthread underfill valve assembly (69) from bottom of bias tube (67). Inspect valve and replace if needed.
- Reinstall underfill valve. Torque to 30 ft-lbs (41 N-m).

Check/Replace Overfill Valve Assembly

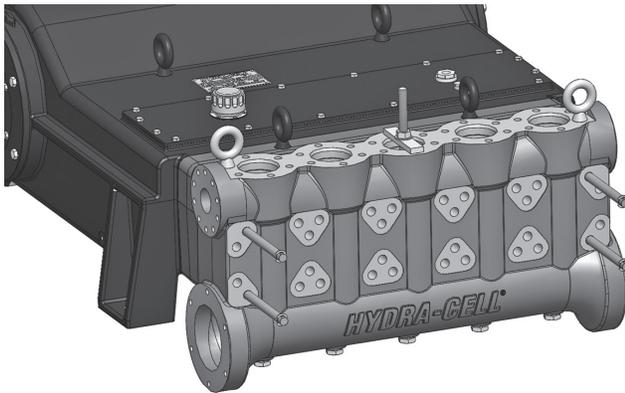
- See *Hydraulic Section Parts view*. Unthread overfill valve assembly (74) from bottom of bias tube (67). Inspect overfill valve and replace if needed.
- Reinstall overfill valve. Torque to 105 in-lbs (12 N-m).

Q330 Medium - Hydraulic Section Service (Cont'd)

Hydraulic Section Disassembly (Cont'd) Diaphragm Replacement



Extended Studs Installed, Open Assembly



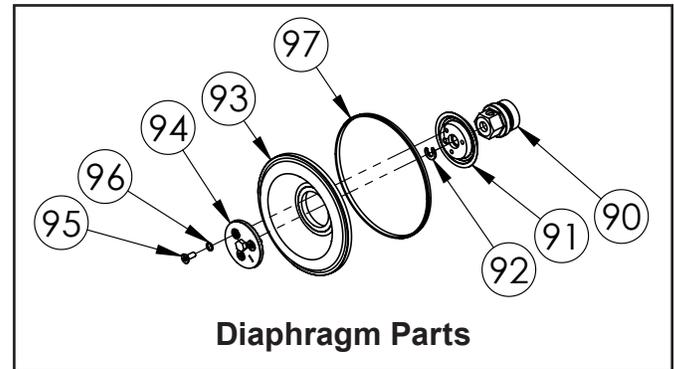
Extended Studs Installed, Closed Assembly

- Remove four manifold bolts (100) and washers and install extended studs in the locations shown above.
- Use wrench flats to turn the extended studs. When fully installed, the end of the extended stud should be no more than 8" from the flat face of the manifold. Do not overtighten the extended studs into the diaphragm plate, hand-tight is sufficient.
- After the extended studs have been fully installed, the remaining bolts and washers can be removed in any order, and the manifold can be pulled away from the diaphragm plate.
- A raised 13 mm hex boss is provided in the center of the followers to prevent rotation when loosening the T40 Torx screws.

- Before reinstalling the manifold onto the diaphragm plate, ensure that the diaphragm backup rings are all fully seated into the diaphragm pockets on the diaphragm plate side.
- Push the manifold against the diaphragm plate with force, listening for metal-on-metal contact. There should be a "clink" sound indicating that the backup rings were not caught between the diaphragm plate and manifold. There should be minimal gap, if any, between the diaphragm plate and manifold.
- Hold the manifold in place and re-install the manifold bolts and washers from the center of the manifold outwards, using an impact driver to fully install each one before the next.
- The extended studs can be removed once all possible bolts and washers have been fully seated. The final six bolts and washers can then replace the extended studs, and the manifold bolts can be torqued to 450 ft-lbs each, as shown in Manifold Bolt Torque Sequence.

CAUTION - Extended studs should be installed in the corner locations as shown in Manifold Eyebolt Install for maximum stability and available space between the manifold and diaphragm plate.

Diaphragm Disassembly



Diaphragm Parts

- See *Diaphragm Parts View*. Remove two screws (95), two O-rings (96) and follower (94).

CAUTION: If a diaphragm has ruptured and foreign material or water has entered the oil reservoir, do not operate the pump. Check all diaphragms, replace damaged diaphragms, then flush the reservoir completely and refill it with fresh oil. Never let the pump stand with foreign material or water in the reservoir, or with the reservoir empty.

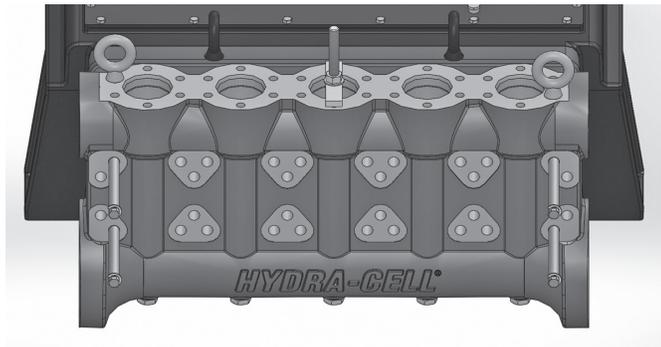
- Remove the diaphragm (93) and diaphragm back-up ring (97). Inspect diaphragm carefully for any abnormal conditions. A ruptured diaphragm generally indicates a pumping system problem, and replacing only the diaphragm will not solve the larger problem. Inspect the diaphragm for the following:
 - Small puncture.** Usually caused by a sharp foreign object in the fluid.
 - Diaphragm pulled away** from the center screw or from the cylinder sides. Usually caused by fluid being frozen in the pump, or by overpressurization of the pump.

Q330 Medium - Hydraulic Section Service (Cont'd)

Diaphragm Disassembly (Cont'd)

- **Diaphragm becoming stiff** and losing flexibility. Usually caused by pumping a fluid that is incompatible with the diaphragm material.
 - **Slice in ridge of diaphragm.** Occurs when diaphragm is operated at cold temperatures.
 - **Diaphragm torn concentrically in the mid convolute area.** Usually an indication of an outlet vacuum condition.
- c. Replace diaphragm if needed.
d. Replace diaphragm back-up ring if needed.

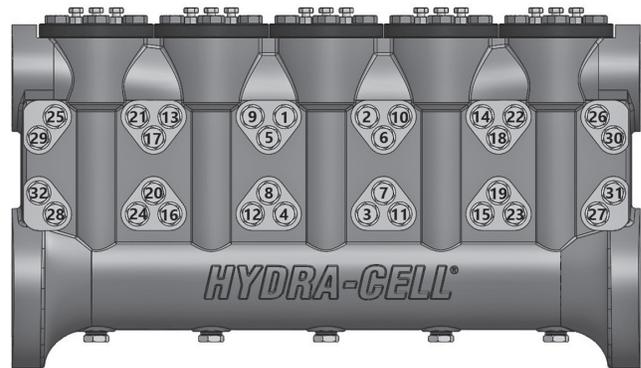
Manifold Lifting (Manifold Only)



Manifold Eyebolt Install

Eyebolts are provided for lifting the manifold by itself (not including the diaphragm plate or crankcase), when a hoist or forklift is available. The outlet check valve caps must be removed as previously described before using these eyebolts. Manifold Eyebolt Install shows where to install the eyebolts, which is in the outermost threads in line with the center of gravity.

CAUTION - Please do not lift the entire pump with the manifold/ tool kit eyebolts. Instead use the two larger eyebolts provided on top of the diaphragm plate, along with the other two located on top of the crankcase.

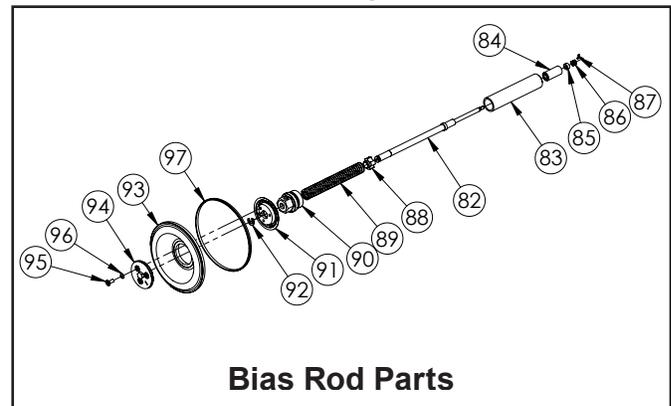


Manifold Bolt Torque Sequence

Torque Sequence:

- Snug 32 bolts (100) in order indicated, then torque to 450 ft-lbs (610 N-m) in the order indicated.

Bias Rod Disassembly



Bias Rod Parts

- See *Bias Rod Parts and Diaphragm Parts Views*. Remove diaphragm parts as in diaphragm disassembly steps a. through d.
- Remove retaining ring (92).
- Remove bias spring retainer nut (90) from diaphragm plate (62).
- Remove bias rod assembly from bias tube (67).
- Check bias spring retainer nut for any rough surfaces, edges, or corrosion. Replace if necessary.
- Remove coil spring pin (87), slotted hex nut (86), and bias washer (85).
- Remove bias rod parts: bias rod (82), spool stop (83), valve spool (84), rod guide (88), and bias spring (89).
- Inspect rod parts. Smooth surfaces and edges as necessary with emery cloth or fine file. Replace parts as necessary.

Q330 Medium - Hydraulic Section Service (Cont'd)

Hydraulic Section Assembly

Diaphragm Assembly

a. See *Diaphragm Parts View*.

CAUTION: It is important to observe the following steps to ensure proper assembly.

- b. Install the diaphragm (93) into diaphragm plate (62). Seat diaphragm edge with fingers. Make sure diaphragm bead is fully seated into the square groove of diaphragm plate.
- c. Install three O-rings (96) into follower (94).
- d. Attach follower to diaphragm clamp with three screws (95). Use Loctite 242 and torque to 80 in-lbs (9 N-m).
- e. Fully install back-up ring (97) between diaphragm plate and diaphragm.
- f. Repeat steps a. through e. for remaining diaphragms.

Diaphragm Plate Assembly

- a. Replace diaphragm plate gasket (35) if damaged.

CAUTION: Ensure plungers (57) and cylinders (64) are lubricated with oil before assembly. Dry plungers and cylinders can bind on start-up.

- b. See *Hydraulic Section Parts Illustration*. Carefully slide diaphragm plate (62) and assembled parts along pump studs (34) flush with Power End of pump.
- c. Install six cap screws (81) into diaphragm plate. Torque to

Note: For easier handling of diaphragm plate, use lifting device and the two eyebolts (2) installed on top of diaphragm plate.

200 ft-lbs (271 N-m).

- d. Install six flange nuts (61) onto studs. Torque to 250 ft-lbs (339 N-m).
- e. Align plunger (57) and crosshead plunger adaptor (21). Install plunger clamps (58 and 59) and two cap screws (60). Torque to 20 ft-lbs (27 N-m).

Note: Install threaded plunger clamp (59) on bottom. Position counter bored plunger clamp (58) on top. Install two cap screws (60) and tighten evenly.

- f. Hand rotate crankshaft to assure smooth operation.
- g. Install top cover gasket (37) and top cover (38) using 16 cap screws (19). Torque to 30 ft-lbs (41 N-m).

Bias Rod Assembly

CAUTION: It is important to observe the following steps to ensure proper assembly.

- a. Ensure O-ring (66) is seated.
- b. See *Bias Rod Parts View*. Install Bias Tube (67) to Diaphragm Plate (62).
- c. Clean all parts before assembling.
- d. Install spool stop (83), valve spool (84), and bias washer (85) on threaded end of bias rod (82).

- e. Fully thread slotted hex nut (86) on threaded end of bias rod by hand. Turn slotted hex nut until slot aligns with hole in bias rod. Insert coil spring pin (87). Center coil spring pin with slotted hex nut.
- f. Install rod guide (88), bias spring (89), and bias spring retainer nut (90) on bias rod.
- g. Apply Loctite 242 to bias spring retainer nut threads and install into diaphragm plate. Torque to 100 ft-lbs (136 N-m).
- h. Pull bias rod out slightly through bias spring retainer nut and install diaphragm clamp (91) install retaining ring (92) into groove nearest end of bias rod (82).
- i. Let bias rod retract back into diaphragm plate.
- j. Repeat for remaining bias rod assemblies.

Manifold Assembly

- a. See *Fluid End Parts View*. Prior to manifold assembly, inspect mating surfaces of pump and manifold. Make sure they are clean and free of any foreign material. Ensure diaphragm beads are seated.
- b. Install extended studs into top corners of diaphragm plate (62).
- c. Carefully align and slide manifold (98) on extended studs.

CAUTION: The manifold should slide cleanly onto the pump and the back-up rings should be engaged into the mating grooves in the manifold prior to tightening. Failure to slide the manifold all the way on engaging the back-up rings prior to tightening can cause the back-up ring to be pinched and cause the pump to leak. If the manifold does not slide easily onto the pump, use Scotch-Brite or fine abrasive paper to clean the outer edge of the groove where the back-up ring fits.

- d. Install washers (99) and bolts (100) in manifold and hand tighten.
- e. Remove extended studs, install remaining washers (99) and bolts (100) in manifold and hand tighten.
- f. Tighten bolts (100) in torque sequence shown in illustration on page 14 to 450 ft-lbs (610 N-m).
- g. Fill pump with oil to cover marks on dipstick. Approximately 110 qts (104 liters).
- h. Follow instructions in Before Initial Start-Up and Initial Start-Up Section to start pump.

Q330 Series Medium Pressure - Power End Service

Power End Disassembly

 **WARNING:** Crankcase (1) and assembled parts weigh over 3000 pounds (1361 kg). Use care in handling to prevent personal injury or damage to equipment.

Float Switch Disassembly

Note: The numbers in parentheses are the Reference Numbers shown in the Parts Section of the manual.

- Disconnect float switch (43).
- Remove float switch adaptor (42) with float switch and O-ring (45) from top cover (38).
- Remove snap ring from bottom of float switch and remove baffle end cap (46).
- Remove two screws (45) and remove float switch baffle (44).
- Remove float switch (43) from float switch adaptor (42).

Crankcase Disassembly

- See *Power End Parts Illustration*. Remove oil drain plug (6), plug (41), oil fill cap assembly (39), and crankshaft key (31) and drain lubricating fluid into a suitable container, approximately 110 qts.
- Remove Fluid End and Hydraulic plate as outlined in two preceding sections.
- Remove 18 cap screws (19) and remove back cover (33).

Connecting Rod Removal

Note: Each of three Connecting rod assemblies (25*) consists of: connecting rod end, connecting rod cap, rod bushing, and two bolts.

- Remove connecting rod assembly bolts (25*) and remove connecting rod end cap (25*) with split shell bearing. Make sure numbers on connecting rod and end cap are 'top-up' in the assembly and match.

Note: Make sure to note 'top-up' orientation of numbers on connecting rod and end cap when removing. These are matched parts and must be stored together as one assembly and not mixed with any other connecting rod assemblies or parts.

- Set aside connecting rod assembly bolts, end cap, and split shell bearing (28) for use in reassembly.
- Push connecting rod assembly away from journal on the crankshaft. Move as far forward as possible.
- Repeat for remaining connecting rod assemblies.

Main Journal Bearing Disassembly

- Remove four socket head cap screws (51) from bearing adjustment bolts (50).
- Remove four nuts (52) from bearing adjustment bolts (50).
- Remove two main bearing and cap assembly (11, 55-56) from pump.

Crankshaft Removal

Note: Reference page 29.

- Remove six cap screws (14) from shaft end of pump attaching bearing carrier assembly (assembled items 12, 13, 15, 16, 17, and 19) to the crankcase (1).
- Carefully remove crankshaft (30) and bearing carrier assembly from crankcase.
- Remove bearing carrier assembly from shaft end of crankshaft.
- Remove six screws (14) and blind end bearing carrier assembly from crankcase.
- Inspect spherical bearings (29) and replace if needed.

Note: Use a puller to remove main bearings from crankshaft if need to be replaced.

Bearing Carrier Disassembly

- Separate seal carrier and bearing carrier assemblies by removing six cap screws (19).
- Remove O-ring (12) from bearing carrier (13). Remove O-ring (15) from blind end seal carrier (18).
- Remove O-ring (15) from shaft end seal carrier (17). Remove two crankshaft seals (16) from shaft end seal carrier.

Connecting Rod Disassembly

Note: Make sure to note 'top-up' orientation of numbers on connecting rod and end cap when storing. These are matched parts and must not be mixed with parts from other connecting rod assemblies.

- Pull out connecting rod/crosshead assembly and remove from crankcase.
- Remove remaining one half of split shell bearing (28) from connecting rod (25*). Match with shell bearing already removed in **Connecting Rod Removal**.
- Retrieve bolts (25*), and end cap (25*) from previous step in **Connecting Rod Removal**. Be careful not to mix with parts from other connecting rod assemblies.
- Loosely assemble two bolts and connecting rod end cap with connecting rod assembly and set aside. Note proper orientation of numbers on connecting rod and end cap.
- Remove setscrews (27) by carefully applying heat to unlock wrist pin (26). Remove wrist pin, and crosshead from connecting rod end.
- Remove and disassemble remaining connecting rods.

Crosshead Disassembly

- Remove shoulder screw (23) from crosshead assembly to remove plunger adaptor (21), spherical washer pair (20), and disc springs (22).
- Disassemble remaining crosshead assemblies following step a.
- Clean crankcase for later reassembly.

Q330 Series Medium - Power End Service (Cont'd)

Power End Assembly

 **WARNING:** Crankcase (1) and assembled parts weigh over 3000 pounds (1361 kg). Use care in handling to prevent personal injury or damage to equipment.

Crosshead Assembly

Note: The numbers in parentheses are the Reference Numbers shown in the Parts Section of the manual.

- Start with crankcase (1) clean and ready to assemble.
- Assemble plunger adaptor (21), spherical washer (20), crosshead (24), and disc springs (22), with shoulder screw (23). Use Loctite 271 and torque to 100 ft-lbs (136 N-m).

Note: The concave half of spherical washer assembly (20) mates with plunger adaptor (21) and the other convex side of spherical washer assembly mates with crosshead (24).

Note: Place three disc springs (22) on shoulder screw in an alternating order, with the first disc spring curve facing away from the head of the screw.

- Assemble remaining sets.

Connecting Rod Assembly

Note: Each of three Connecting rod assemblies (25*) consists of: connecting rod end, connecting rod cap, rod bushing, and two bolts.

- Attach assembled plunger adaptor and crosshead to connecting rod (25*) using wrist pin (26). Align marks on wrist pin with marks on crosshead (24). Lock wrist pin in place with setscrews (27). Use Loctite 271 and torque to 15 ft-lbs (20 N-m).

Note: Make sure to note 'top-up' orientation of numbers on connecting rod and end cap during assembly. These are matched parts and must not be mixed with parts from other connecting rod assemblies.

- Remove two bolts (25*) and connecting rod cap (25*) from connecting rod assembly. Note orientation numbers on connecting rod and end cap.
- Set aside bolts and end cap for later installation. Do not mix with parts from other connecting rod assemblies.
- Install one half of split shell bearing (28) on connecting rod. Remaining one half of split shell bearing will be installed later.
- Insert connecting rod/crosshead assembly into crankcase and push all the way forward. Ensure numbers are 'top-up.'
- Assemble and install remaining sets.

Bearing Carrier Assembly

- Install O-ring (12) onto bearing carrier (13).
- Assemble two sets.

Seal Carrier Assembly

- Install two shaft seals (16) into shaft end seal carrier (17). Install O-ring (15) onto shaft end seal carrier.
- Install O-ring (15) onto blind end seal carrier (18).

Spherical Bearing Installation

Note: Wear appropriate safety equipment for the following procedure.

Note: When bearings are being installed on crankshaft, verify bearing is properly seated against crankshaft shoulder.

- Wipe down crankshaft (30).
- Heat spherical bearing (29) to approximately 200°F (93°C). Install spherical bearing on blind end of crankshaft against shoulder.
- Heat spherical bearing (29) to approximately 200°F (93°C). Install spherical bearing on shaft end of crankshaft against shoulder.

Note: Let bearings cool to ambient air temperature before continuing with crankshaft installation.

Crankshaft Installation

Note: Reference page 30.

- Install one bearing carrier assembly to blind side of crankcase (1) using six cap screws (14). Torque cap screws to 150 ft-lbs (203 N-m). Crankshaft (30) will be installed on opposite side.
- Place remaining bearing carrier assembly on shaft end of crankshaft.

Note: No shimming of crankshaft is necessary. End play of crankshaft should be between 0.010 in. minimum to 0.200 in. maximum when installed.

- Install shaft end seal carrier assembly to shaft end bearing carrier using six cap screws (19). Torque cap screws to 30 ft-lbs (41 N-m).
- Insert crankshaft with shaft end seal and bearing carrier assembly into crankcase and insert into installed bearing carrier assembly on opposite end of crankcase. Align flange of bearing carrier assembly with flange on crankcase.
- Bolt flange of bearing carrier assembly to crankcase with six cap screws (14). Torque cap screws to 150 ft-lbs (203 N-m).
- Install blind end seal carrier assembly to blind end bearing carrier using six cap screws (19). Torque cap screws to 30 ft-lbs (41 N-m).

Q330 Series Medium - Power End Service (Cont'd)

Connecting Rod Installation

Note: Each of three Connecting rod assemblies (25*) consists of: connecting rod end, connecting rod cap, rod bushing, and two bolts.

- a. Attach connecting rod assembly to crankshaft (30) by reaching into rear of crankcase around crankshaft and pulling connecting rod assembly until it reaches its journal on the crankshaft.

Note: Make sure to note 'top-up' orientation of numbers on connecting rod and end cap when installing. These are matched parts and must not be taken from other connecting rod assemblies.

- b. Retrieve connecting rod assembly bolts, cap, and remaining split shell bearing (28) set aside in previous steps.
- c. Reinstall connecting rod cap with remaining split shell bearing using connecting rod assembly bolts. Make sure numbers on connecting rod and cap are 'top-up' in the assembly and match. Torque two bolts to 175 ft-lbs (237 N-m).
- d. Repeat installation for remaining sets.

Main Journal Bearing Assembly

- a. Install two bearing adjustment bolts (50) vertical to each other, until bolts hit bottom of thread.
- b. Install main bearing (56) into main cap (55). Use socket head cap screw (11) with 242 loctite and torqued to 20 ft. lbs. to join main bearing (56) flush to main cap (55).
- c. Install a concave spherical washer (53) to each bearing adjustment bolt (50).
- d. Apply a film of oil to the main bearing (56) and install main bearing and cap assembly onto bearing adjustment bolts (50).
- e. Place two 0.015 in. feeler gauges in the clearance between the main journal and the bearing. Locating each on start relief cut from center, see Inset following.



- f. Install convex spherical washer (54) concave spherical washer (53) and nut (52) with Loctite 242 to the top bearing adjustment bolt (50).
- g. Using a pry bar between crankcase (1) and main cap (55), lift main cap (55) up so that the bottom of the bearing adjustment bolt (50) is centered on hole. Make sure feeler gauges are in correct position and hand tighten top nut (52) to hold position.
- h. Install convex spherical washer (54), concave spherical washer (53) and nut (52) with Loctite 242 to the bottom bearing adjustment bolt (50). Make sure feeler gauges are in correct position and hand tighten bottom nut (52).
- i. Using a 41 mm open-end wrench to hold nut (52), and a 16 mm hex socket, unscrew bearing adjustment bolt (50) until it comes in contact with main cap (55).
- j. Repeat step i. for opposite end.
- k. Check feeler gauges to see if they are stuck, move with friction, or move freely. The goal is to get both feeler gauges to move with friction, similar to each other at stated position in step e.
- l. Loosen bearing adjustment bolt (50) until feeler gauges start to move with friction. Do the same procedure to opposite bearing adjustment bolt. If one of the feeler gauges start to get stuck while the other one moves freely, loosen adjustment bolt opposite of stuck feeler gauge until feeler gauge is loose. Tighten adjustment bolt on same side of stuck feeler gauge until feeler gauge gets tighter. Continue until both feeler gauges move with friction.

Note: Nut (52) should turn with bearing adjustment bolt (50). If it does not, use a wrench to spin nut with movement of adjustment bolt.

- m. Once both feeler gauges move with friction similarly, remove them from bearing.
- n. Torque two socket head cap screws (51) into bearing adjustment bolts (50) to 150 ft. lbs. with Loctite 242.

Note: Bearing adjustment bolts should not move.

- o. Check gap feeler gauges on top and bottom on both left and right sides, gap may have gotten smaller due to inserting of socket head cap screw. **Clearance should be no smaller than 0.010 in. and within .002 in. at all locations checked.**
- p. Check the torque of both nuts (52) to 250 ft. lbs.
- q. Check to make sure left and right bearing clearances are similar. **Clearances should be no less than 0.010 in. and no greater than 0.015 in. and are within 0.003 in. from left to right.**
- r. Repeat steps a. - q.

Q330 Series Medium - Power End Service (Cont'd)

Crankcase Assembly

- a. Install back cover gasket (32) and back cover (33) using 18 cap screws (19). Torque to 30 ft-lbs (41 N-m).
- b. If removed, reinstall six studs (34) and torque to 75 ft-lbs (102 N-m). Reinstall two eyebolts (2) and torque to 300 ft-lbs (407 N-m).

Note: Install long threaded end of stud into crankcase (if applicable). Use Loctite 271 and torque to 75 ft-lbs (102 N-m).

- c. Install oil drain plug (6), top cover plug (41), oil fill cap assembly (39) crankshaft key (31), and add lubricating fluid.

Float Switch Assembly

- a. Assemble float switch (43) to float switch adaptor (42) finger tight plus one half turn.
- b. Remove snap ring from bottom of float switch.
- c. Install float switch baffle (44) and baffle end cap (46) on float switch.
- d. Reinstall snap ring on float switch.
- e. Position baffle end cap against snap ring.
- f. Align float switch baffle slots with holes in float switch adaptor and install screws (45). Position float switch baffle against baffle end cap and tighten screws.
- g. Install O-ring (47) on float switch adaptor. Install float switch assembly in top cover (38).
- h. Reconnect float switch.

Q330 Series Medium Pressure - Oil Level Monitor

Oil Level Monitor Float Switch Conditions and Wiring Diagram

CAUTION: For pumps certified for use in an explosive atmosphere (ATEX / IECEx) please see supplementary instructions and disregard the wiring instructions in this section.

CAUTION: The float switch will only operate with crankshaft rotation in the direction indicated on the pump casting.

Note: The numbers in parentheses are the Reference Numbers shown in the Parts Section of the manual.

Note: The float switch (43) and adaptor (42) can be removed from the top cover without draining the pump's oil. See the Installation and Maintenance sections of the manual for float switch set-up and use.

The float switch (43) monitors the pump's oil level. The switch is used to trigger an alarm or pump shutdown when a high or low oil level is sensed in the pump's crankcase.

The Q330 Medium Pressure Pump uses one of two float switch (43) configurations. The switch used can be identified by its wire lead colors and part number.

The wiring diagram below shows the operating conditions and wiring colors for each type of switch assembly.

1. Normally-Closed (NC) Switch.

The Normally-Closed Float Switch, 177-453-02 (43a) contains two normally-closed (NC) reed switches; one for high oil level, and one for low oil level. The (NC) float switch has solid Black, striped Yellow/White, and striped Red/White wire leads.

2. Normally-Open (NO) Switch.

The Normally-Open Float Switch, 177-453-03 (43a) contains two normally-open (NO) reed switches; one for high oil level, and one for low oil level. The (NO) float switch has solid Black, solid Yellow, and solid Red wire leads.

Note: Check the oil level on the dipstick to ensure within acceptable level.

Electrical Specifications

The following are the float switch electrical specifications:

- For P/N 177-453-02 (43a), Normally-Closed (NC) float switch: two single-pole, double-throw (SPDT) reed switches rated at 150 VDC/VAC, 1 Amp, 20 Watts (maximum).
- or
For P/N 177-453-03 (43a), Normally-Open (NO) float switch: switches rated at 300 VDC/VAC, 0.5 Amp AC/0.7 Amp DC, 50 Watts (maximum).
- Sum total of current for both switches not to exceed: 1 Amp
- Resistive load only
- Magnetic float actuation
- Electrical conduit connection at top of switch adaptor: 1/2-14 NPT
- UL File No. E203716 under UL 508.
- Not rated for NEC/CEC hazardous locations. Please consult factory for explosive environments.**

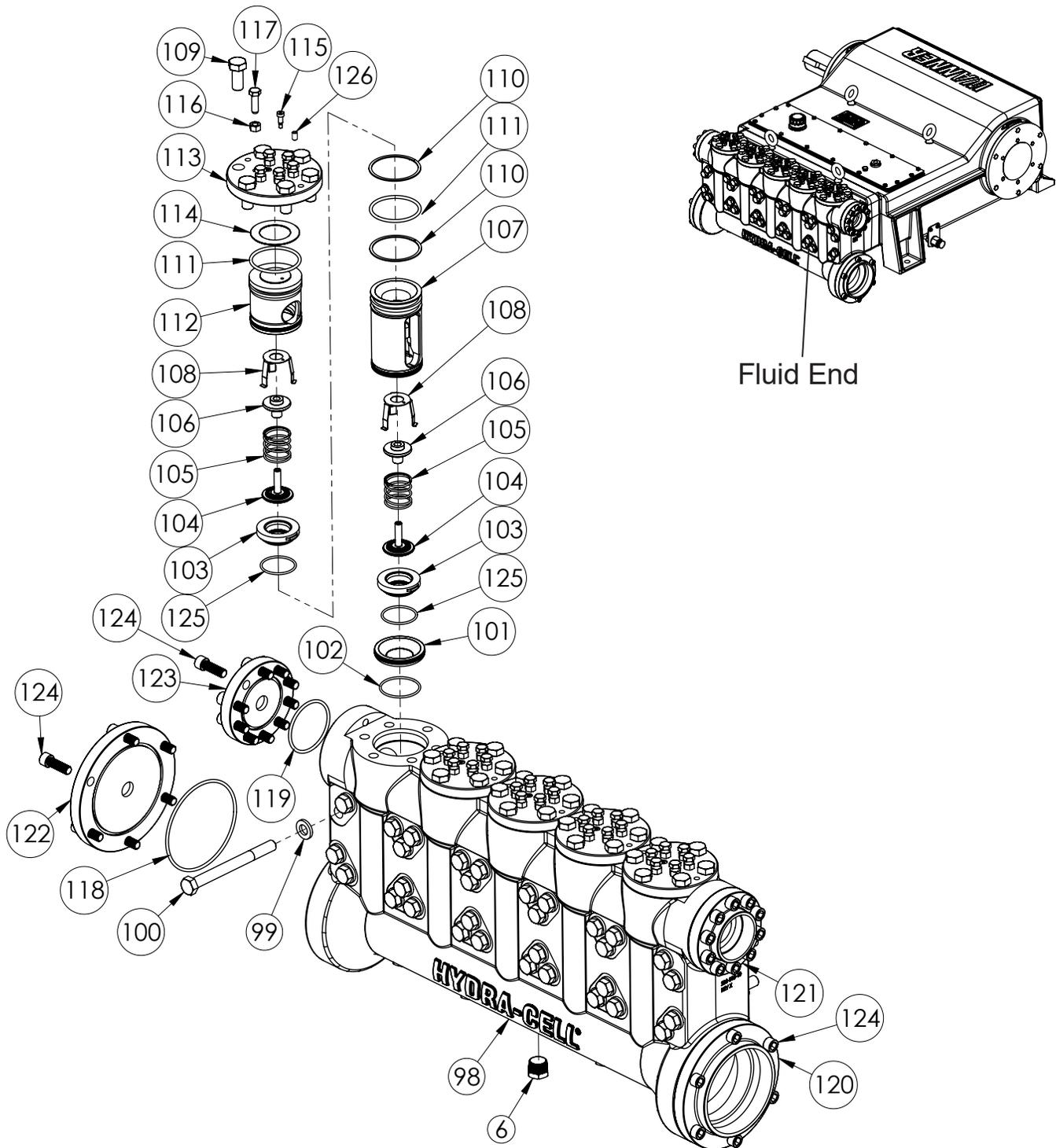
Reed Switch Logic Table						
Setpoint Contacts	177-453-02 (Normally-Closed)			177-453-03 (Normally-Open)		
	Float Down	Float in Middle	Float Up	Float Down	Float in Middle	Float Up
High	Closed	Closed	Open	Open	Open	Closed
Low	Open	Closed	Closed	Closed	Open	Open
Float Switch Wiring						

Oil Level Monitor Float Switch Conditions and Wiring Diagram

Q330 Series Medium - Torque Specifications

Q330K and Q330M Torque Specification Table				
Reference Number	Torque Specification ft-lbs (N-m)	Loctite No.	Part Number	Description
2	200 (271)	-	177-059	Eyebolt, M20
6	wrench-tight	567	189-312	Plug, 1 NPT SST
11	20 (27)	242	G10-089-2011	Screw, SHCS, M10
14	150 (203)	-	211-077	Screw, HHCS, M14
19	30 (41)	-	G10-029-2010	Screw, HHCS, M10
23	100 (136)	271	211-023	Screw, SHSS, M16
25	175 (237)	-	211-003-02	Bolt, Connecting Rod Assembly
27	15 (20)	271	211-014	Screw, Set, M8
34	75 (102)	271	211-066	Stud, M20
51	150 (203)	242	230-012	Screw, SHCS, M16
52	250 (339)	242	230-013	Nut, Hex, M27
60	20 (27)	-	211-020	Screw, SHCS, M8
61	250 (339)	-	211-067	Nut, Flanged, M20
40	15 in-lbs (1.7)	271	189-565	Screw, Pan Head
41	wrench-tight	567	177-459	Plug, 1/2-14 NPT
45	5 in-lbs (0.6)	271	211-065	Screw, FHSS, M4
65	100 (136)	-	G35-081-2010	Screw, SHCS, M12
68	100 (136)	-	211-370	Plug, Bias Tube
69	30 (41)	-	177-904	Assembly, Underfill Valve
74	105 in-lbs (12)	-	177-905	Assembly, Overfill Valve
77	75 (102)	-	177-906	Assembly, Air Bleed Valve
80	144 in-lbs (16.3)	-	172-119	Retainer, Air Bleeder
81	200 (271)	-	211-062	Screw, SHCS, M16
90	100 (136)	242	211-308	Retainer Nut, Bias Spring
95	80 in-lbs (9)	242	177-176-XX	Screw, FHSS, M6
100	450 (610)	-	211-039	Screw, HHCS, M20
109	350 (475)	-	177-044	Screw, HHCS, M20
115	75 in-lbs (8)	242	211-061	Screw, SHSS, 8MM
116	finger-tight	-	211-074	Nut, Hex, M12, Coated
117	30 (41)	-	211-073	Bolt, HHCS, M12, Coated
124	150 (203)	-	209-770	Screw, SHCS, M16

Q330 Series Medium Pressure - Fluid End Parts



Note: for torque values refer to the Torque Specifications Table.

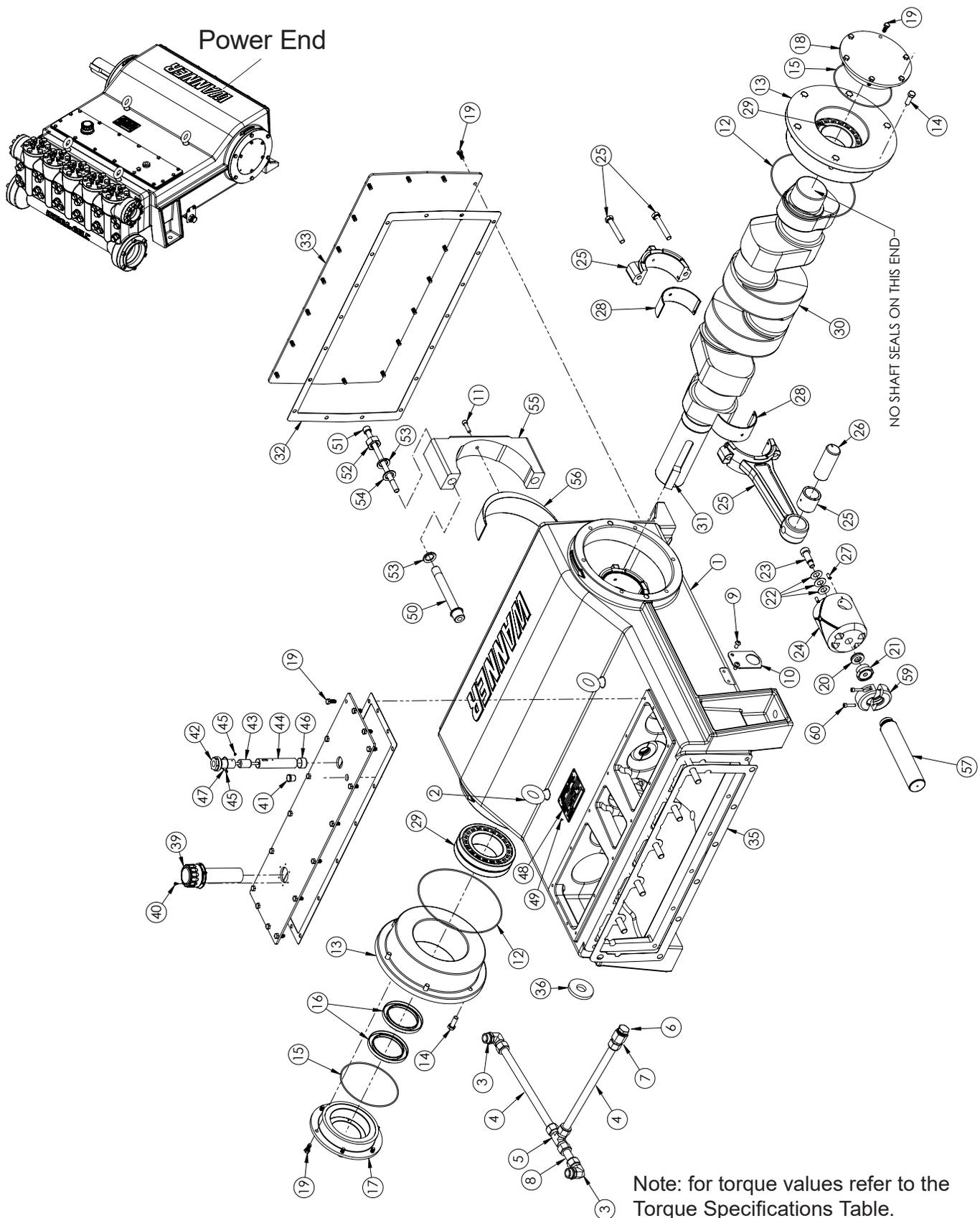
Q330 Series Medium Pressure - Fluid End Parts

Ref. No.	Part Number	Description	Quantity/ Pump	Ref. No.	Part Number	Description	Quantity/ Pump
6	189-312	Plug, 1" NPT SST.....	5	120	209-730-01	Flange, 6" weld neck, 500 psi, SCH. 40, Steel	1
98	230-300-10	Manifold, Medium Pressure	1		209-730-02	Flange, 6" weld neck, 500 psi, SCH. 40, Austenitic SST	1
99	D66-048-2024	Washer, 3/4"	32		209-730-03	Flange, 6" weld neck, 500 psi, SCH. 40, Duplex SST	1
100	211-039	Screw, HHCS, M20	32		209-730-04	Flange, 6" weld neck, 500 psi, SCH. 40, Hastelloy C	1
101	211-340-01	Inlet Valve Support, Austenitic SST	5		209-734-01	Flange, 6" NPT, 500 psi, Steel	1
	211-340-02	Inlet Valve Support, Hastelloy C	5		209-765-03	Spool, 6" ANSI Class 300 RF, Duplex SST	1
	211-340-03	Inlet Valve Support, Duplex SST	5		209-765-04	Spool, 6" ANSI Class 300 RF, Hastelloy C	1
102	177-382-01	O-ring, Buna-N	5	121	209-741-01	Flange, 3" weld neck, 4500 psi, SCH. 160, Steel	1
	177-382-02	O-ring, FKM	5		209-741-02	Flange, 3" weld neck, 4500 psi, SCH. 160, Austenitic SST	1
103	211-327-01	Seat, Valve, High Pressure, 17-4 SST	10		209-741-03	Flange, 3" weld neck, 4500 psi, SCH. 160, Duplex SST	1
	211-327-02	Seat, Valve, High Pressure, Hastelloy C	10		209-741-04	Flange, 3" weld neck, 4500 psi, SCH. 160, Hastelloy C	1
	211-327-05	Seat, Valve, High Pressure, Nitronic	10		209-740-01	Flange, 3" NPT, 4500 psi, Steel	1
104	211-339-01	Disc, Valve Stem-guided, 17-4 SST	10		209-766-03	Spool, 3" ANSI Class 2500 RTJ, Duplex SST	1
	211-339-02	Disc, Valve Stem-guided, Hastelloy C	10		209-766-04	Spool, 3" ANSI Class 2500 RTJ, Hastelloy C	1
	211-339-05	Disc, Valve Stem-guided , Nitronic	10	122	209-736-01	Flange, 6" blind, 500 psi, Steel	1
105	211-325-01	Spring, Valve, Elgiloy	10		209-736-02	Flange, 6" blind, 500 psi, Austenitic SST	1
	211-325-02	Spring, Valve, Hastelloy	10		209-736-03	Flange, 6" blind, 500 psi, Duplex SST	1
106	211-338	Bushing, Valve Stem	10		209-736-04	Flange, 6" blind, 500 psi, Hastelloy C	1
107	211-317-01	Inlet Valve Retainer, Austenitic SST	5		209-739-01	Flange, 6", blind x 1" NPT, 500 psi	1
	211-317-02	Inlet Valve Retainer, Hastelloy C	5	123	209-742-01	Flange, 3" blind, 4500 psi, Steel	1
	211-317-03	Inlet Valve Retainer, Duplex SST	5		209-742-02	Flange, 3" blind, 4500 psi, Austenitic SST	1
108	211-333-03	Retainer, Valve Spring, Hastelloy C	5		209-742-03	Flange, 3" blind, 4500 psi, Duplex SST	1
109	177-044	Screw, HHCS, M20	30		209-742-04	Flange, 3" blind, 4500 psi, Hastelloy C	1
110	211-334	Backup Ring, Scarf Cut	10		209-743-01	Flange, 3", blind x 1" NPT, 4500 psi, Steel	1
111	211-332-01	O-ring, Buna-N	10	124	209-770	Screw, HHCS, M16	32
	211-332-02	O-ring, FKM	10	125	211-414-01	O-ring, Buna-N	10
112	211-323-01	Outlet Valve Retainer, Austenitic SST	5		211-414-02	O-ring, FKM	10
	211-323-02	Outlet Valve Retainer, Hastelloy C	5	126	211-087	Screw, Set, M12	10
	211-323-03	Outlet Valve Retainer, Duplex SST	5				
113	211-475	Cap, Valve Plug	5				
114	211-474	Plate, Retainer, Outlet	5				
115	211-061	Screw, SHSS, 8MM	10				
116	211-074	Nut, Hex, M12, Coated	30				
117	211-073	Bolt, HHCS, M12, Coated	30				
118	209-753-01	O-ring, Buna-N	2				
	209-753-02	O-ring, FKM	2				
119	209-752-01	O-ring, Buna-N	2				
	209-752-02	O-ring, FKM	2				

Q330 Series Medium - Hydraulic Section Parts

Ref. No.	Part Number	Description	Quantity/ Pump	Ref. No.	Part Number	Description	Quantity/ Pump
2	177-059	Eyebolt, M20	2	90	211-308	Retainer Nut, Bias Spring	5
61	211-067	Nut, Flanged, M20.....	6	91	211-306	Clamp, Diaphragm	5
62	230-377-02	Diaphragm Plate, Medium Pressure ...	1	92	211-375	Retaining Ring.....	5
63	211-329	O-ring, Buna-N.....	5	93	211-302-01	Diaphragm, Medium Pressure, Buna-N	5
64	211-379-01	Cylinder K, 2.25".....	5		211-302-02	Diaphragm, Medium Pressure, FKM...5	5
	211-379-02	Cylinder M, 2.125".....	5	94	211-307-01	Follower, Medium Pressure, Austenitic SST.....	5
65	G35-081-2010	Screw, M12.....	40		211-307-02	Follower, Medium Pressure, Hastelloy	5
66	D25-034-2110	O-ring, Buna-N.....	5		211-307-03	Follower, Medium Pressure, Duplex SST.....	5
67	211-326-02	Bias Tube	5	95	177-176-01	Screw, FHSS, M6, Austenitic SST	10
68	211-370	Plug, Bias Tube	5		177-176-02	Screw, FHSS, M6, Hastelloy C	10
69	177-904	Assembly, Underfill valve	5		177-176-03	Screw, FHSS, M6, Duplex SST	10
74	177-905	Assembly, Overfill valve	5	96	100-217-01	O-ring, Buna-N.....	10
77	177-906	Assembly, Air Bleed valve.....	5	97	211-330	Backup Ring, Diaphragm	5
81	211-062	Screw, SHCS, M16.....	6				
82	211-312	Bias Rod, Medium Pressure	5				
83	211-374	Spool Stop.....	5				
84	211-313	Valve Spool	5				
85	211-335	Washer, Bias	5				
86	211-369	Nut, Slotted Hex, M6.....	5				
87	211-311	Pin, M2 Coiled Spring	5				
88	211-310	Rod Guide	5				
89	211-309	Bias Spring.....	5				

Q330 Series Medium Pressure - Power End Parts



Q330 Medium Pressure - Power End Parts

Ref. No.	Part Number	Description	Quantity/ Pump	Ref. No.	Part Number	Description	Quantity/ Pump
1	230-001-02	Crankcase	1	36	211-055	Magnet, Ceramic Ring	2
2	177-059	Eyebolt, M20	2	37	230-053	Gasket, Top Cover	1
3	211-703	Fitting, 90 Elbow.....	2	38	230-021	Cover, Top	1
4	230-702	Tube, 1", Straight.....	2	39	211-037	Cap, Oil Fill, Assembly	1
5	230-700	Fitting, Run Tee	1	40	189-565	Screw, Pan Head	6
6	189-312	Plug, 1 NPT SST.....	6	41	177-459	Plug, 1/2-14 NPT	1
7	230-701	Fitting, 1" Tube x 1" NPT	1	42	211-063	Adaptor, Float Switch	1
8	230-703	Tube, 1" Straight.....	1	43	177-453-02	Float Switch, Normally-Closed (NC)...	1
9	177-180	Screw, BHSCS, M10	2		177-453-03	Float Switch, Normally-Open (NO)	1
10	230-016	Bracket	1	44	211-064	Baffle, Float Switch.....	1
11	G10-089-2011	Screw, SHCS, M10.....	2	45	211-065	Screw, FHSS, M4.....	2
12	D40-037-2110	O-ring	2	46	211-071	End Cap, Baffle	1
13	211-043	Bearing Carrier.....	2	47	C23-010-2110	O-ring	1
14	211-077	Screw, HHCS, M14	12	48	177-198	Nameplate	1
15	211-051	O-ring	2	49	177-196	Screw Nail, Size 4	4
16	211-029	Seal, Radial Shaft	2	50	230-011	Bolt, Bearing Cap.....	4
17	211-046	Seal Carrier, Shaft End	1	51	230-012	Screw, SHCS, M4	4
18	211-045	Seal Carrier, Blind End.....	1	52	230-013	Nut, Hex, M27	4
19	G10-029-2010	Screw, HHCS, M10	46	53	230-014	Washer, Spherical, Concave.....	8
20	211-018	Washer, Spherical, Assembly	5	54	230-015	Washer, Spherical, Convex.....	4
21	211-019	Adaptor, Plunger.....	5	55	230-042-02	Cap, Main	2
22	211-015	Spring, Disc.....	15	56	230-041-02	Bearing, Main	2
23	211-023	Screw, SHSS, M16.....	5	57	211-304-01	Plunger K, 2.25"	5
24	211-005-02	Crosshead	5		211-304-02	Plunger M, 2.125"	5
25	211-003-02	Rod, Connecting, Assembly.....	5	58	211-344	Clamp, Plunger, CB Side	5
26	211-008	Wrist Pin	5	59	211-345	Clamp, Plunger, Threaded Side.....	5
27	211-014	Screw, Set, M8	10	60	211-020	Screw, SHCS, M8	10
28	211-041	Bearing, Split Shell (pair)	10				
29	211-006	Bearing, Double Row Spherical.....	2				
30	230-002-02	Crankshaft.....	1				
31	211-068	Key, Shaft.....	1				
32	230-052	Gasket, Back Cover	1				
33	230-007	Cover, Back	1				
34	211-066	Stud, M20.....	6				
35	211-056	Gasket, Crankcase Front	1				

Q330 Series Medium Pressure - Troubleshooting

Cavitation

- Inadequate fluid supply because:
 - Inlet line collapsed or clogged
 - Clogged line strainer
 - Inlet line too small or too long
 - Air leak in inlet line
 - Worn or damaged inlet hose
 - Suction line too long
 - Too many valves and elbows in inlet line
- Fluid too hot for inlet suction piping system
- Air entrained in fluid piping system
- Aeration and turbulence in supply tank
- Inlet vacuum too high (refer to “Inlet Calculations” paragraph)

Symptoms of Cavitation

- Excessive pump valve noise
- Premature failure of spring or retainer
- Volume or pressure drop
- Rough-running pump
- Premature failure

Drop in Volume or Pressure

A drop in volume or pressure can be caused by one or more of the following:

- Air leak in suction piping
- Clogged suction line or suction strainer
- Suction line inlet above fluid level in tank
- Inadequate fluid supply
- Pump not operating at proper RPM
- Relief valve bypassing fluid
- Worn pump valve parts
- Foreign material in inlet or outlet valves
- Loss of oil prime in cells because of low oil level
- Ruptured diaphragm
- Cavitation
- Warped manifold from overpressurized system
- O-rings forced out of their grooves from overpressurization
- Air leak in suction line strainer or gasket
- Cracked suction hose
- Empty supply tank
- Excessive aeration and turbulence in supply tank
- Worn and slipping drive belt(s)
- Worn spray nozzle(s)
- Cracked cylinder

Pump Runs Rough

- Worn pump valves
- Air lock in outlet system
- Oil level low
- Wrong viscosity of oil for cold operating temperatures (change to lighter weight)
- Cavitation
- Air in suction line
- Restriction in inlet/suction line
- Hydraulic cells not primed after changing diaphragm
- Foreign material in inlet or outlet valve
- Damaged diaphragm
- Fatigued or broken valve spring

Premature Failure of Diaphragm

- Frozen pump
- Puncture by a foreign object
- Elastomer incompatible with fluid being pumped
- Pump running too fast
- Excess pressure
- Cavitation
- Aeration or turbulence in supply tank

Valve Wear

- Normal wear from high-speed operation
- Cavitation
- Abrasives in the fluid
- Valve incompatible with corrosives in the fluid
- Pump running too fast

Loss of Oil

- External seepage
- Rupture of diaphragm
- Frozen pump
- Worn shaft seal
- Oil drain plug or fill cap loose
- Valve plate and manifold bolts loose

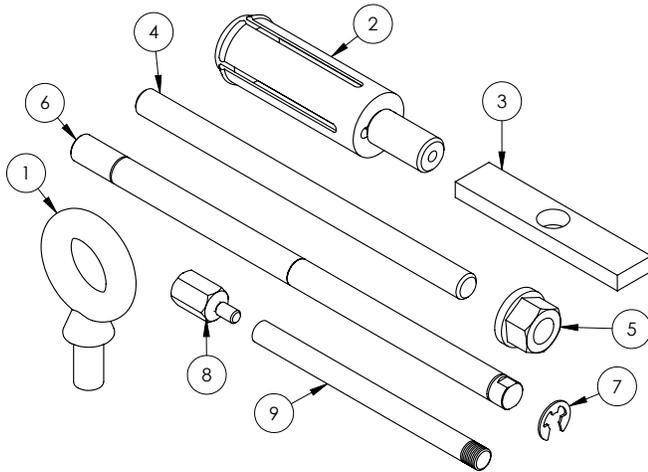
Premature Failure of Valve Spring or Retainer

- Cavitation
- Foreign object in the pump
- Pump running too fast
- Spring/retainer material incompatible with fluid being pumped
- Excessive inlet pressure

Q330 Series Medium - Tool Kit and Pump Storage

Q330 Medium Pressure Tool Kit

The Q330 Medium Pressure Tool Kit (Part No. 211-800) contains the tools illustrated below. These tools are used to assist in the repair and maintenance of the Q330K and Q330M. See the maintenance sections of this manual for specific application.



WARNING: Item 1 used to lift manifold only. Do not use to lift entire pump. Attempting to lift entire pump with Eyebolt (3) may cause personal injury or damage to equipment.

Ref. No.	Tool Part No.	Tool Description	Quantity/Kit
1	177-059-01	Eyebolt, M20	2
2	177-918	Check Valve Extractor.....	1
3	211-801	Reaction Bar.....	1
4	211-802	Threaded Rod, 3/4-10	1
5	211-803	Flanged Nut, 3/4-10.....	1
6	211-081	Extended Stud	4
7	211-082	Clip, E-Style	4
8	177-157	Threaded Adaptor, Check Valve Extractor to Slide Hammer	1
9	177-140	Outlet Check Valve Extractor, Flanged	1

Pump Storage for Q330 Medium Pressure

CAUTION: If the pump is to be stored more than six months take the following steps to protect against corrosion:

After Shut Down of the pump:

1. Drain all process fluid from pump. Do not drain oil from the pump.

CAUTION - Do not store the pump without oil in the reservoir.

2. Flush the fluid end of the pump with a corrosion inhibitor that is compatible with the diaphragm material and process fluid.
3. Coat camshaft or crankshaft with rust preventative; wrap with wax-impregnated cloth and then with waterproof tape.
4. Plug the suction and discharge ports of the pump to protect against dirt and moisture.
5. Store in a clean, dry place.

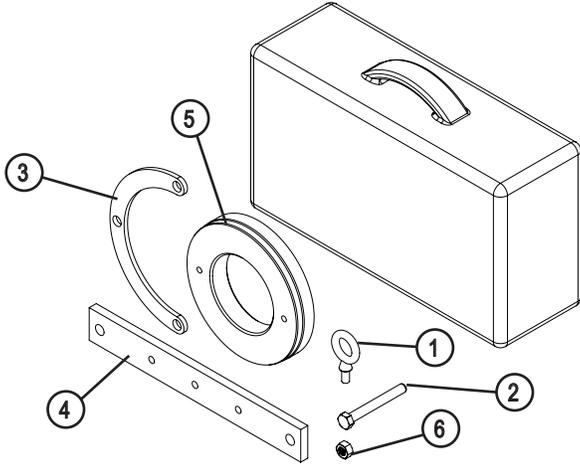
Prior to Start-up of the pump:

1. Drain and refill the hydraulic end of the pump with the appropriate oil.

Q330 Medium - Crankshaft Kit and Instructions

Q330 Crankshaft Tool Kit

The Q330 Crankshaft Tool Kit (Part No. 211-812) contains the tools illustrated below. These tools are used to assist in installation and removal of the crankshaft.



NOTE: Thread eyebolts (1) completely into crank alignment donut (5) before use.

Ref. No.	Tool Part No.	Tool Description	Quantity/Kit
1	177-058	Eyebolt, M10	2
2	211-072	HHCS, M12	3
3	211-805	Bar, Crankshaft Install	1
4	211-806	Bar, Crankshaft Removal	1
5	211-808	Donut, Crank Alignment.....	1
6	A04-045-2010	Nut, Hex M12.....	3

Crankshaft Installation

Crankshaft installation (with properly seated main roller bearing) can be aided with the use of the Crankshaft Lifter (P/N 211-708-99), plastic Crankshaft Alignment Donut (5) along with the curved Crankshaft Installation Bar (3). The crankshaft end should be fully inserted into the liner, and the eyebolt centered over the correct mark on the lifter before lifting. The donut is seated against the blind-side main bearing before installation, and helps to pilot the crankshaft into the bearing carrier. The Installation bar is attached to the interior face of the blind-side bearing carrier with three hex-head cap bolts (2) and nuts (6), and helps to push the main roller bearing into the bearing carrier. The provided bolts (with nuts already threaded on) are turned into the blind bores in the bearing carrier while the nuts bear against the curved bar. By turning each bolt in a little bit at a time in turn,

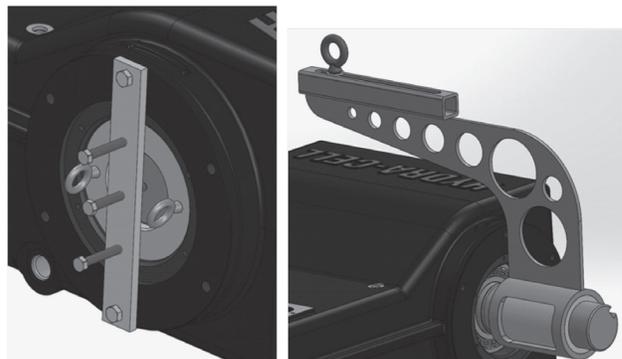
the main roller bearing axis will remain mostly concentric with the bearing carrier bore. This allows the main roller bearing to be “pushed” into the bearing carrier. Parts utilized for this operation are included in the Q330 Crankshaft Kit (P/N 211-812).



Crankshaft Alignment Donut Crankshaft Installation Bar

Crankshaft Removal

Removal of the crankshaft can be aided with the use of the Crankshaft Lifter (P/N 211-708-99), plastic Crankshaft Alignment Donut (5) and the Crankshaft Removal Bar (4). With the donut seated against the blind-side main roller bearing, the bar is bolted to the crankcase with two of the bearing carrier bolts, as shown in Figure below. Three of the provided bolts (2) are then turned through the threaded holes in the bar until the outer bolts are seated against the donut, and the center bolt is seated against the end of the crankshaft. By turning each of these repeatedly in succession, the crankshaft (along with seated main roller bearing) can be pushed out of the bearing carrier and removed from the pump.



Crankshaft Removal Bar Crankshaft Lifter (P/N 211-708-99)

Q330 Medium Pressure - Replacement Parts Kits

TO ORDER REPLACEMENT PARTS KIT: A Replacement Parts Kit contains 12 digits corresponding to customer-specified design options.

1	2	3	4	5	6	7	8	9	10	11	12
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Digit	Order Code	Description
1-4	Q330	Pump Configuration For all Q330 Series Pumps
5	M	Performance Medium Pressure (Q330K, Q330M)
6	D V	Pump Head Version Diaphragm Kit Valve Kit
7	5	Pump Head Material Metallic Pump Head Version
8	G T	Diaphragm & O-ring Material FKM Buna-N
9	H N T X	Valve Seat Material 17-4 PH Stainless Steel Nitronic 50 Hastelloy C Not included in Diaphragm Kit
10	F N T X	Valve Material 17-4 PH Stainless Steel Nitronic 50 Hastelloy C Not included in Diaphragm Kit
11	E T X	Valve Springs Elgiloy Hastelloy C Not included in Diaphragm Kit
12	T X	Valve Spring Retainers Hastelloy C Not included in Diaphragm Kit

*Tungsten carbide valves are not yet available for the Q330.

Q330 Medium Pressure Hydraulic End Kit (Part No. 230-811)		
Part Number	Description	Quantity
177-904	Assembly, Underfill Valve	5
177-905	Assembly, Overfill Valve	5
177-906	Assembly, Air Bleed Valve	5
230-056	Gasket, Diaphragm Plate	1
211-308	Nut, Bias Spring Retainer	5
211-810	Bias Rod Assembly	5

Q330 Medium Pressure Kit D Contents		
Part Number**	Description	Quantity
211-302-__	Diaphragm	5
211-330	Ring, Backup	5
100-217-__	O-ring	15
177-176-__	Screw	15

Q330 Medium Pressure Kit V Contents		
Part Number**	Description	Quantity
211-327-__	Seat, Valve	10
211-414-__	O-ring	10
211-339-__	Disc, Valve, Stem-guided	10
211-325-__	Spring, Valve	10
211-338	Bushing, Valve Stem, PVDF	10
211-333-__	Retainer, Valve Spring	5
211-334	Ring, Backup	10
211-332-__	O-ring	10

** Last two digits of part numbers with __ refer to specific material of construction.

Q330 Medium Pressure Bias Rod Assembly Kit (Part No. 211-810)		
Part Number	Description	Quantity
211-306	Clamp, Diaphragm	1
211-309	Spring, Bias	1
211-310	Guide, Spring	1
211-311	Pin, Spring	1
211-312	Rod, Bias	1
211-313	Valve, Spool	1
211-335	Washer, Bias	1
211-369	Nut, Castle, M6	1
211-374	Stop, Spool	1
211-375	Retaining, Ring	1

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Q330 Series - Warranty

Limited Warranty

Wanner Engineering, Inc. ("Wanner") extends to the original purchaser of equipment supplied or manufactured by Wanner and bearing its name, a limited one-year warranty from the date of purchase against defects in material or workmanship, under normal use and service, and provided the equipment is installed, operated and maintained in accordance with instructions supplied by Wanner. Wanner will repair or replace, at its option, defective parts without charge if: (a) you provide written notice of any defect within thirty (30) days from the discovery of the defect; (b) the claim is received by Wanner before the expiration of the warranty period; and (c) such parts are returned with transportation charges prepaid to Wanner Engineering, Inc., 1204 Chestnut Avenue, Minneapolis, Minnesota 55403. A return goods authorization must be received prior to the return of the defective part. No allowance will be made for repairs undertaken without Wanner written consent or approval.

Notwithstanding anything to the contrary, this warranty does not cover:

1. Electric motors (if applicable) not manufactured by Wanner. The warranties, if any, on such equipment are assigned to you by Wanner (without recourse) at the time of purchase.
2. Normal wear and/or damage caused by or related to abrasion, corrosion, abuse, negligence, accident, faulty installation or tampering which impairs normal operation.
3. Transportation costs.

This limited warranty is exclusive, and is in lieu of any other warranties (oral, express, implied or statutory) including, but not limited to, implied warranties of merchantability and fitness for a particular purpose; warranties of non-infringement; warranties arising from course of dealing or usage of trade or any other matter. Any descriptions of the equipment, drawings, specifications, and any samples, models, bulletins, or similar material used in connection with the sale of equipment are for the sole purpose of identifying the equipment and are not to be construed as an express warranty that the equipment will conform to such description. Any field advisory or installation support is advisory only. Every form of liability for direct, special, incidental or consequential damages or loss is expressly excluded and denied. All liability of Wanner shall terminate one (1) year from the date of purchase of the equipment.



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