

Installation, Operation & Maintenance

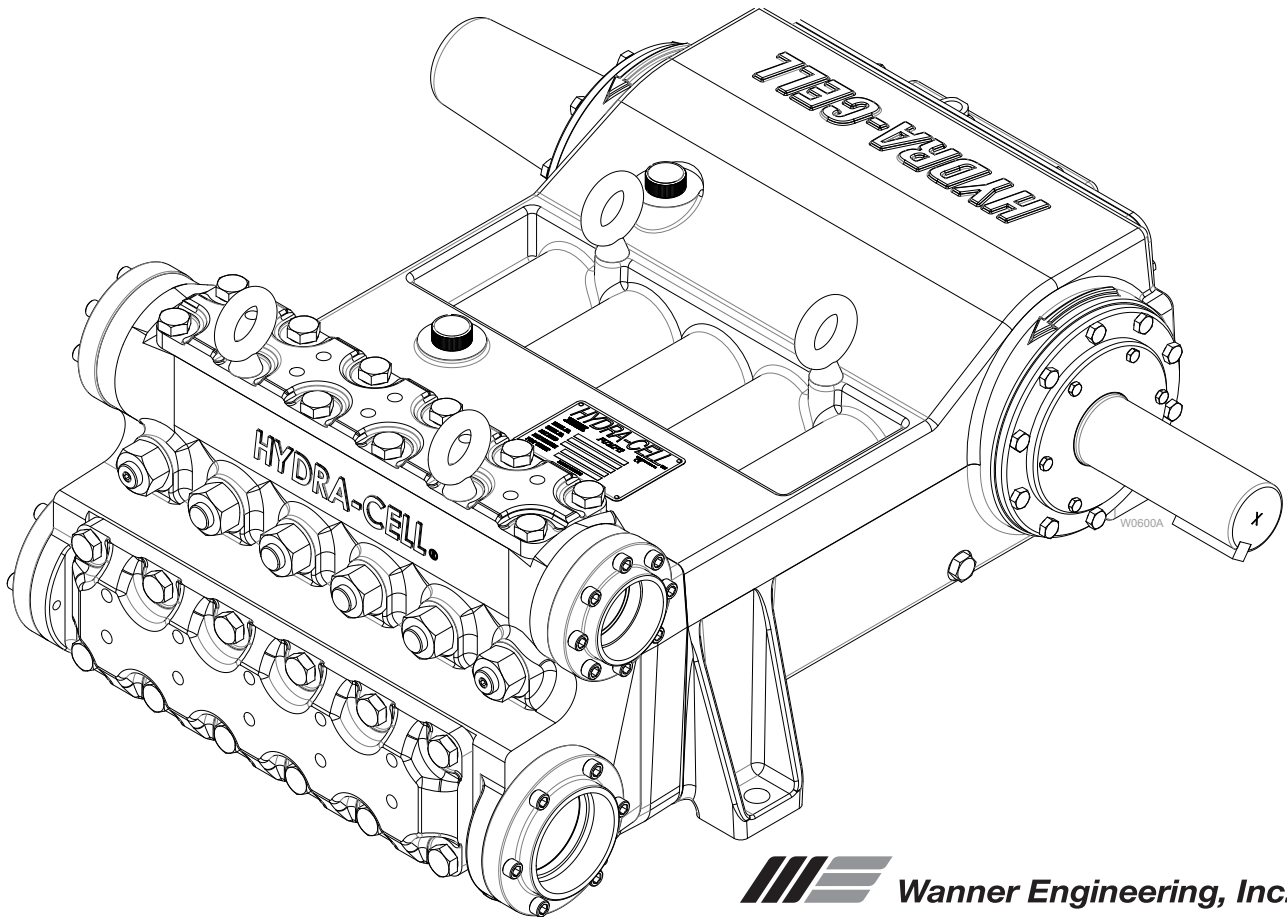
209-997 Rev D

Hydra-Cell®

Seal-less Pumps

Q155 Series Low Pressure

Models: Q155E, Q155F, and Q155H



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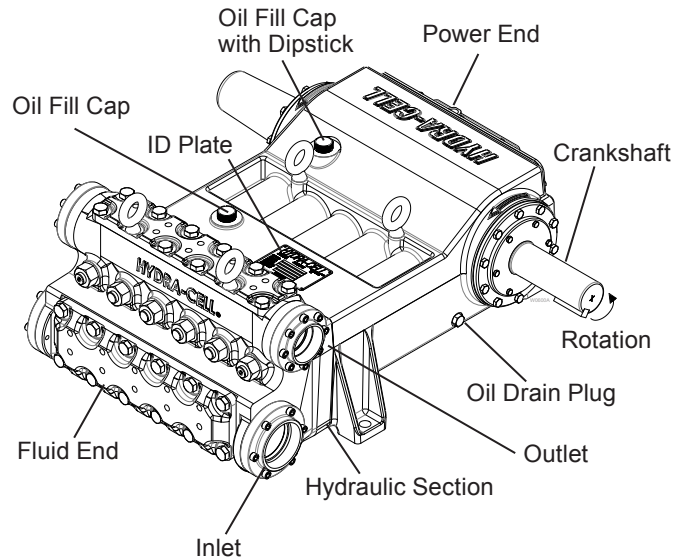
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Q155 Series Low Pressure - Contents

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Component Identification



Q155 Series Low - Specifications

Maximum Pressure:	Q155E 1500 psi (103 bar)
	Q155F 1850 psi (128 bar)
	Q155H 2100 psi (145 bar)

Flow Capacities @ maximum pressure				
	rpm	gpm	l/min	BPD
Q155E	450	157.0	595.0	5383
Q155F	450	127.0	490.0	4354
Q155H	450	111.0	421.0	3806

Delivery	Pressure psi (bar)	gal/rev	liter/rev
Q155E	500 (34)	0.358	1.354
	1000 (69)	0.353	1.338
	1500 (103)	0.350	1.323
Q155F	500 (34)	0.291	1.102
	1000 (69)	0.287	1.085
	1850 (128)	0.282	1.068
Q155H	500 (34)	0.256	0.967
	1000 (69)	0.251	0.951
	2100 (145)	0.247	0.936

rpm 450 Maximum
45 Minimum (contact factory for speeds less than 45 rpm)

Maximum Inlet Pressure 500 psi (34 bar)

Diaphragm Material	Minimum Service Temperature (°C)
Aflas	77°F (25°C)
EPDM	15°F (-9.4°C)
FKM	15°F (-9.4°C)
Buna-N	15°F (-9.4°C)

(contact factory for temperatures outside this range)

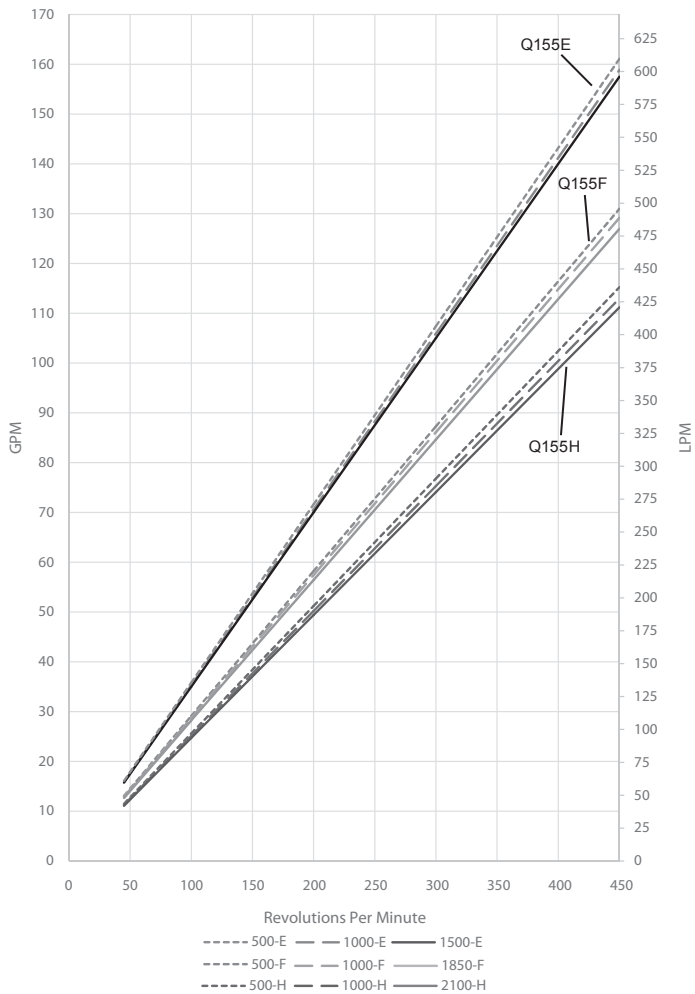
Operating Temperature	Maximum: 180 F (82.2 C)
Maximum Solids Size	800 microns
Input Shaft	Left or Right Side
Inlet Ports	Weld-On: 4" / SCH. 40, 4" NPT, 4" Class 300 RF ANSI
Discharge Ports	Weld-On: 3" / SCH. 80, 3" NPT, 3" Class 900 RF ANSI
Shaft Diameter	3 inch (76.2 mm)
Shaft Rotation	Uni-directional (see rotation arrows)
Oil Capacity	32 US quarts (30.3 liters) - blank back cover 34 US quarts (32.2 liters) - oil monitor back cover

Weight (dry)
Metallic Heads: 1700 lbs. (771 kg)

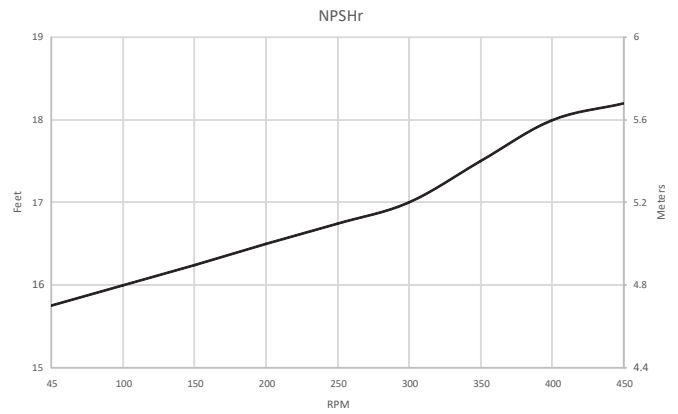
Fluid End Materials Wetted Components available in the following materials:
Austenitic SST
Duplex SST
Hastelloy

Q155 Series Low - 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.

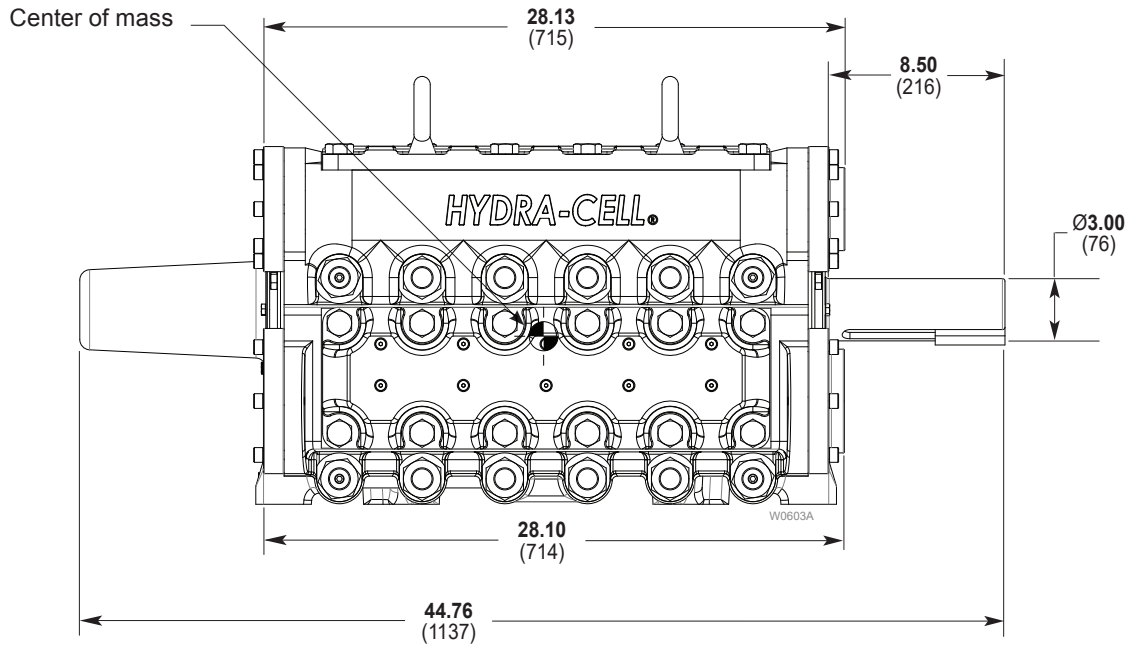
Attention!

When sizing motors with variable speed drives (VFD): 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.

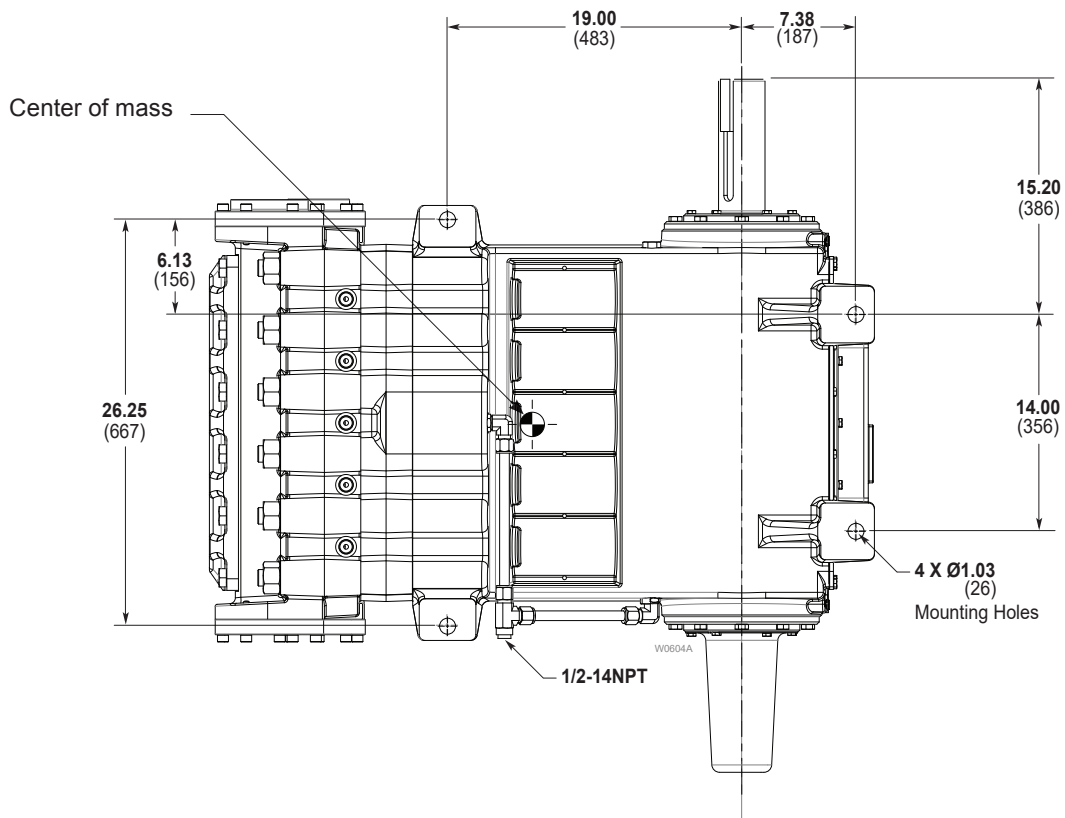
Q155 Series Low - Dimensions

NPT Version

inches
(mm)



Front View

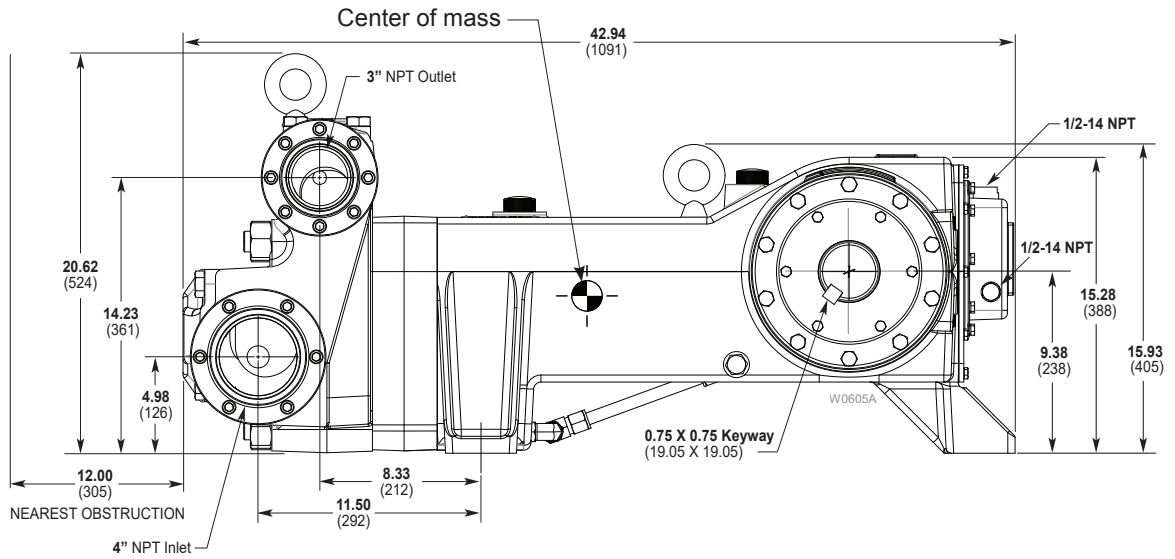


Bottom View

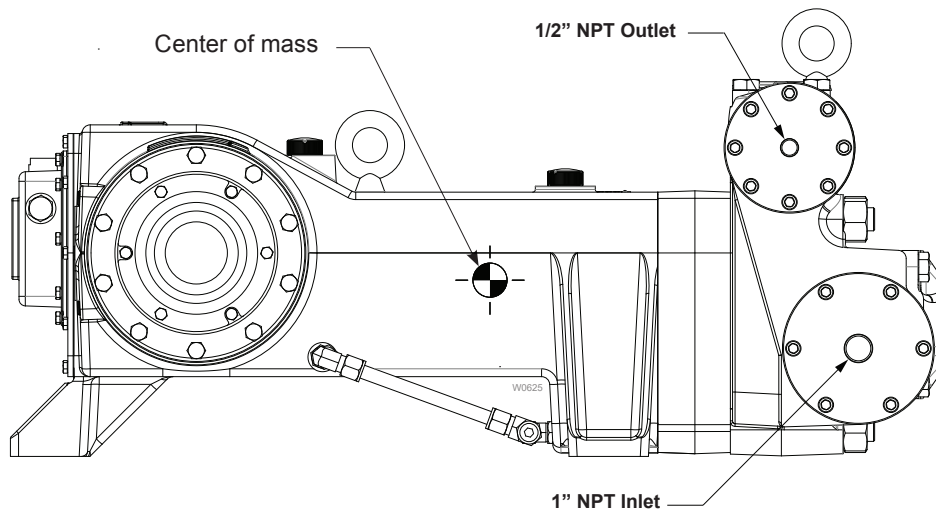
Q155 Series Low - Dimensions (Cont'd)

NPT Version

inches
(mm)



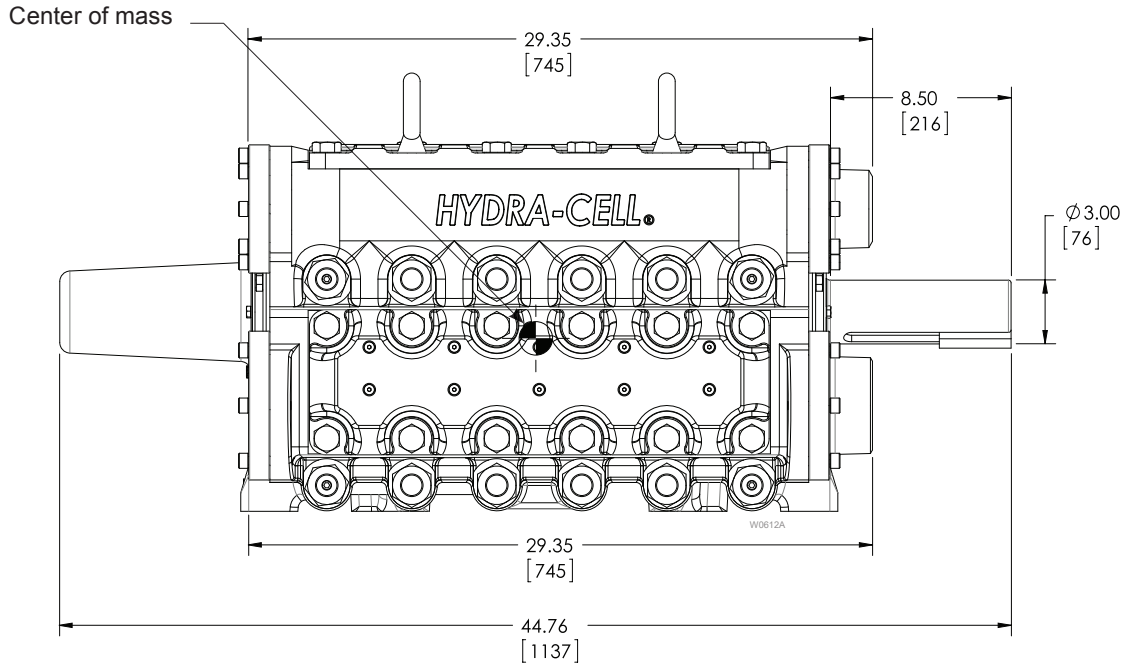
Side View



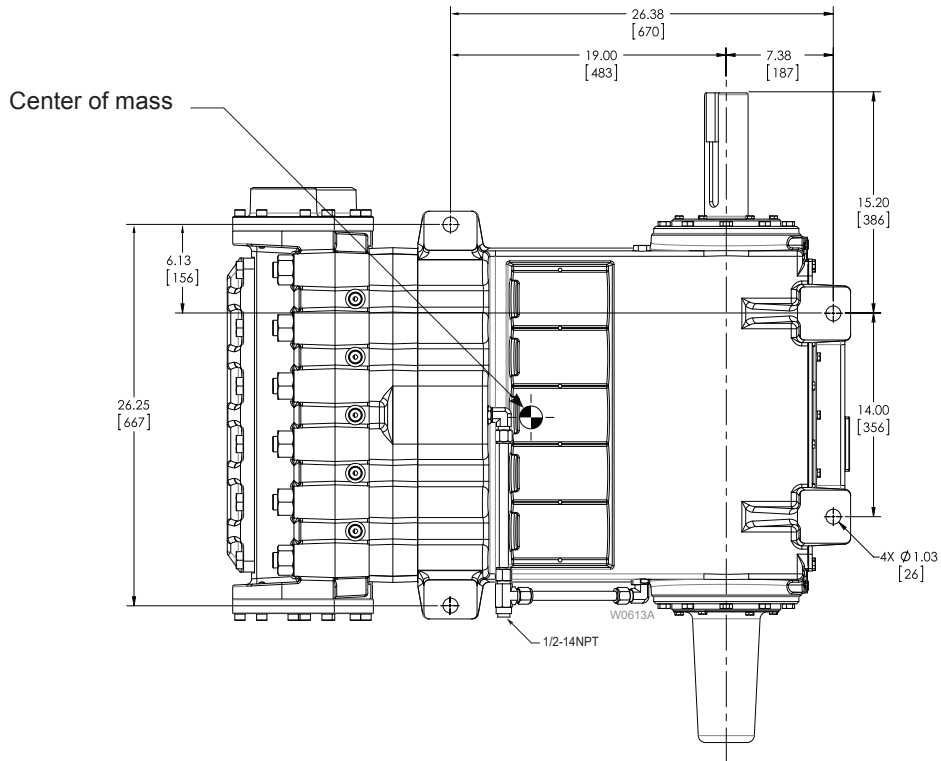
View - Opposite Side

Q155 Series Low - Dimensions (Cont'd)

Weldneck Version



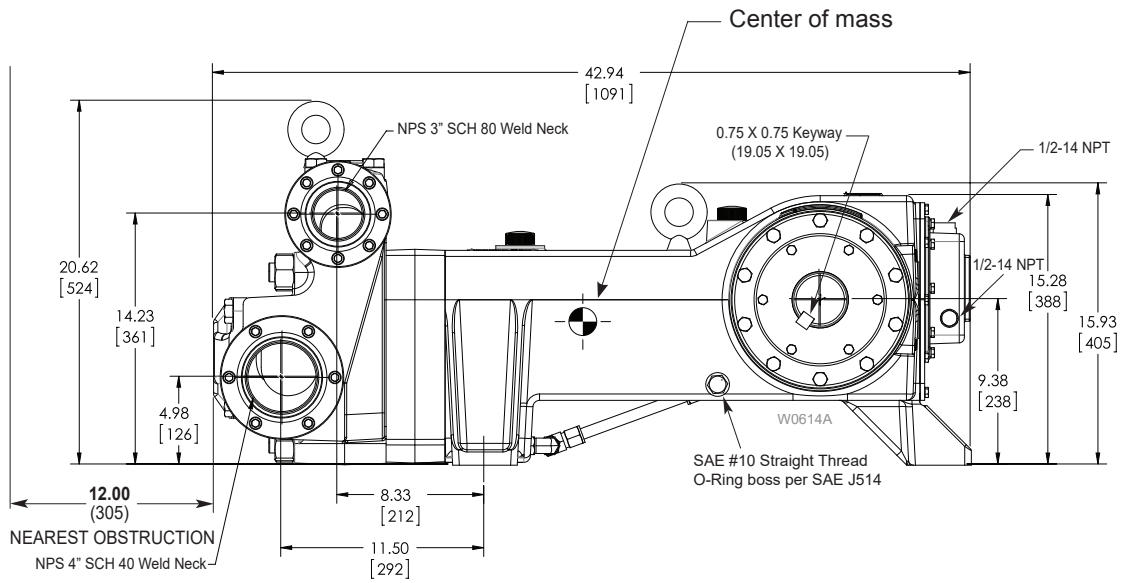
Front View



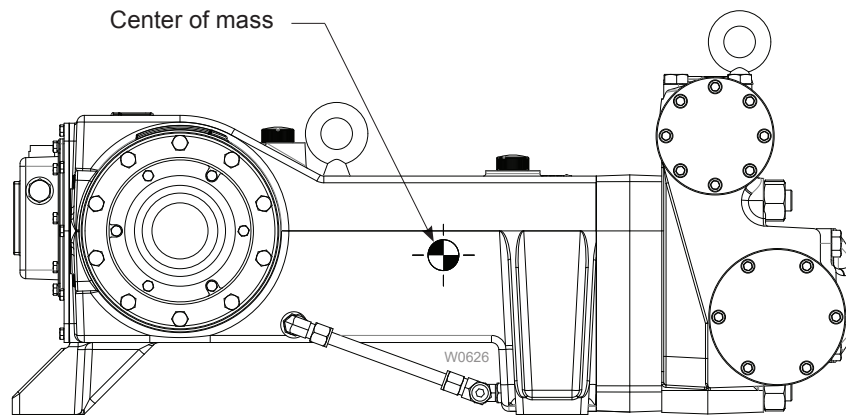
Bottom View

Q155 Series Low - Dimensions (Cont'd)

Weldneck Version



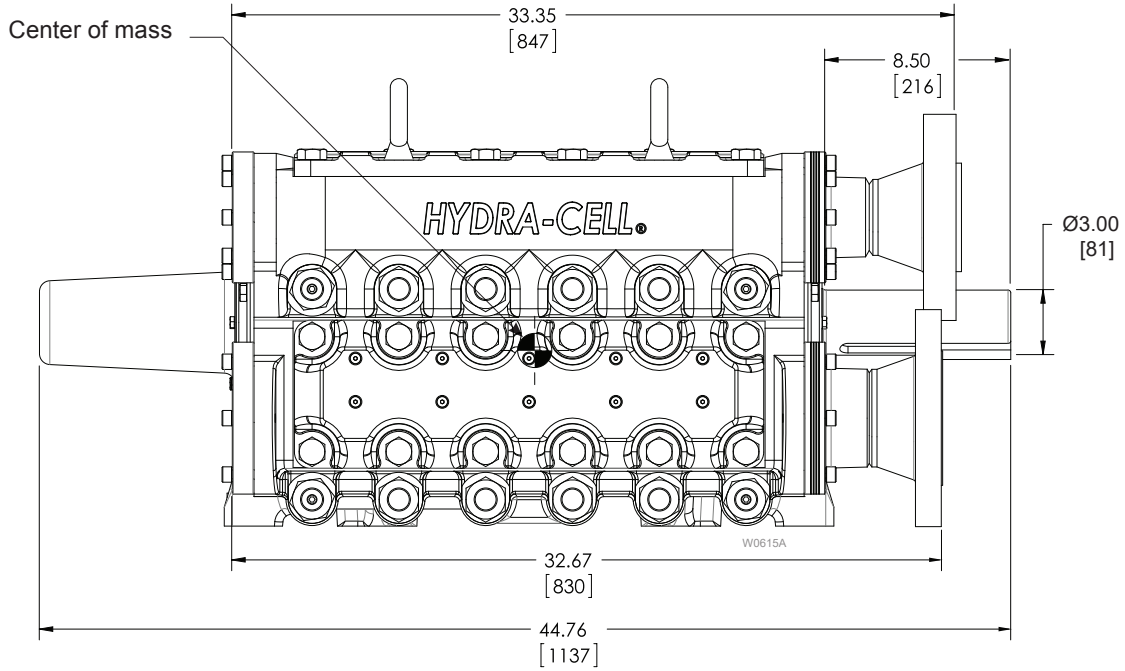
Side View



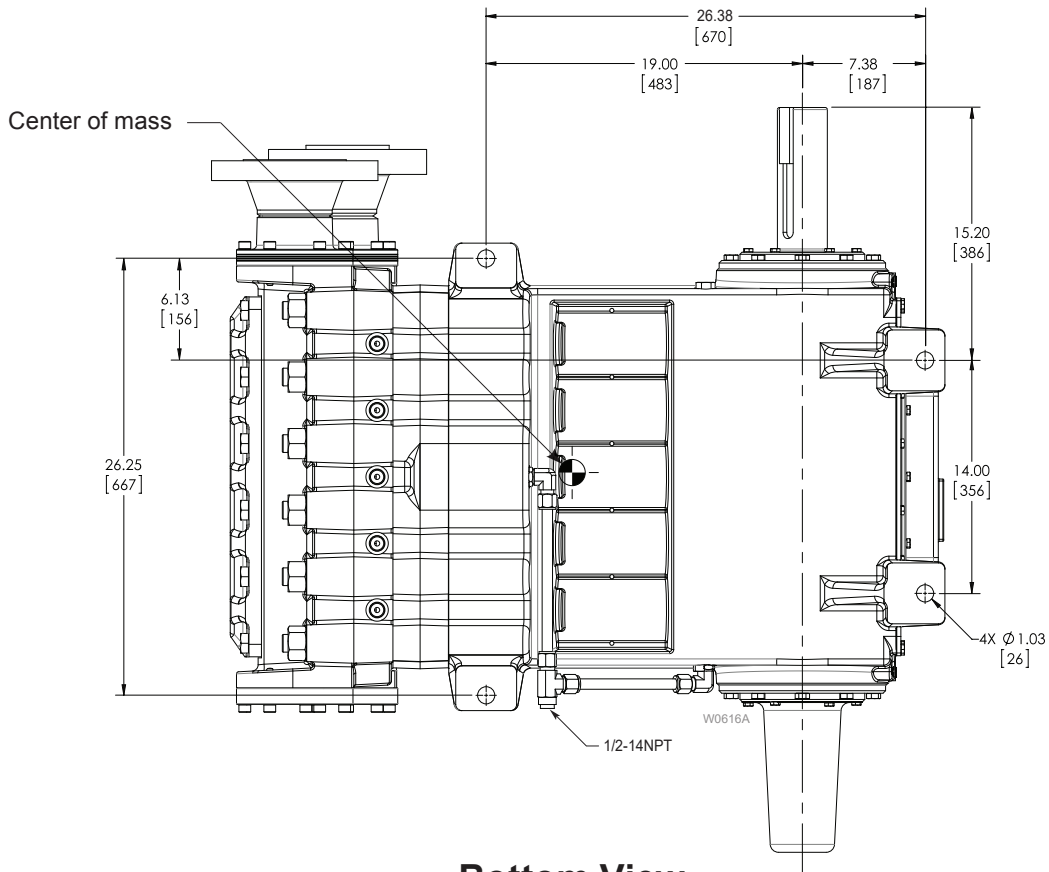
View - Opposite Side

Q155 Series Low - Dimensions (Cont'd)

ANSI Version



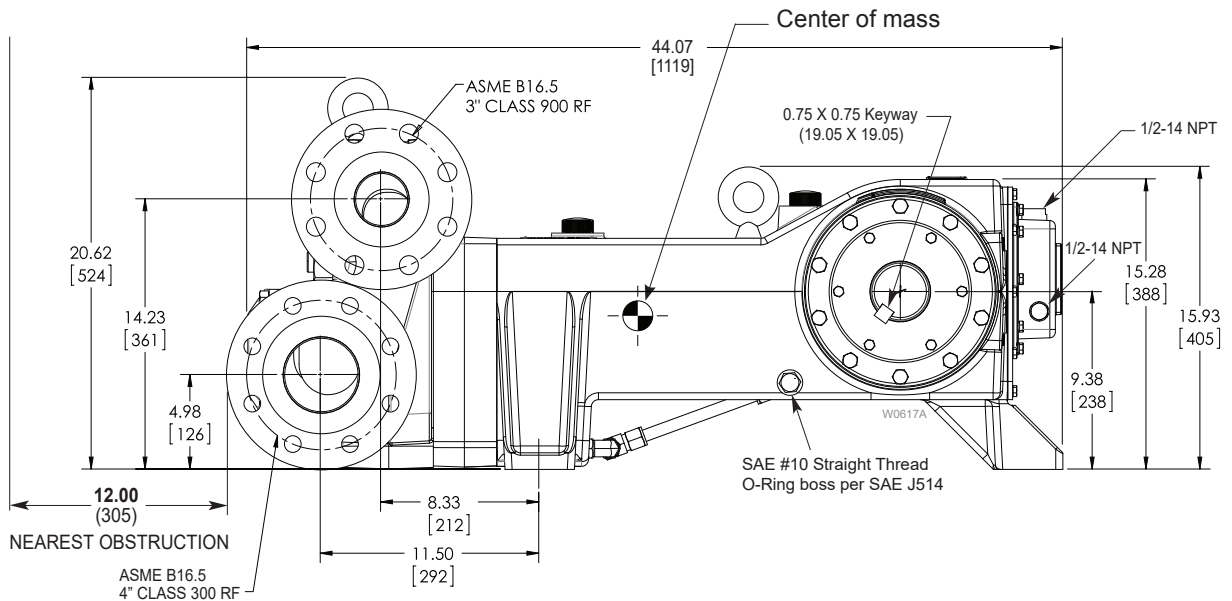
Front View



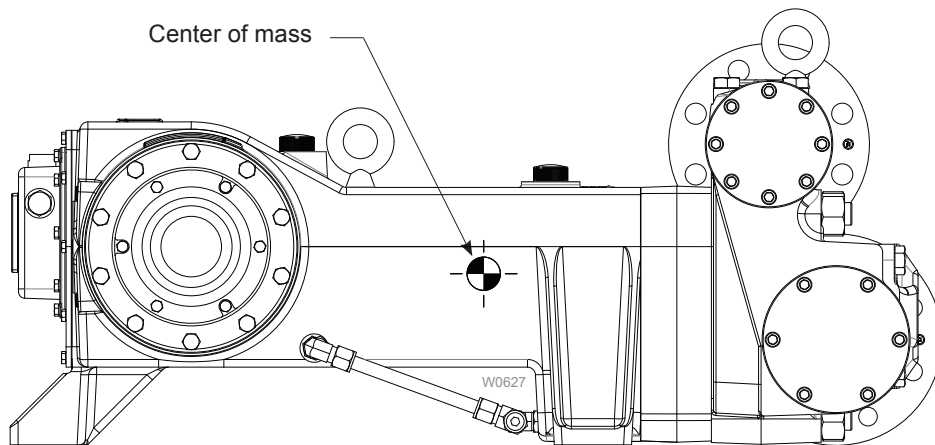
Bottom View

Q155 Series Low - Dimensions (Cont'd)

ANSI Version



Side View



View - Opposite Side

Q155 Series Low 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 bottom of pump), and removing the pump head components (inlet and outlet support plate, manifold, and related items).

Rigging Provisions and Procedures

Lift pump by attaching rigging to all four eyebolts (20). Adjust attachment lengths to keep pump level during lifting. **CAUTION: Eyebolts (20) are rated to lift the weight of the pump only. Also see center of mass references in the Dimension 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.

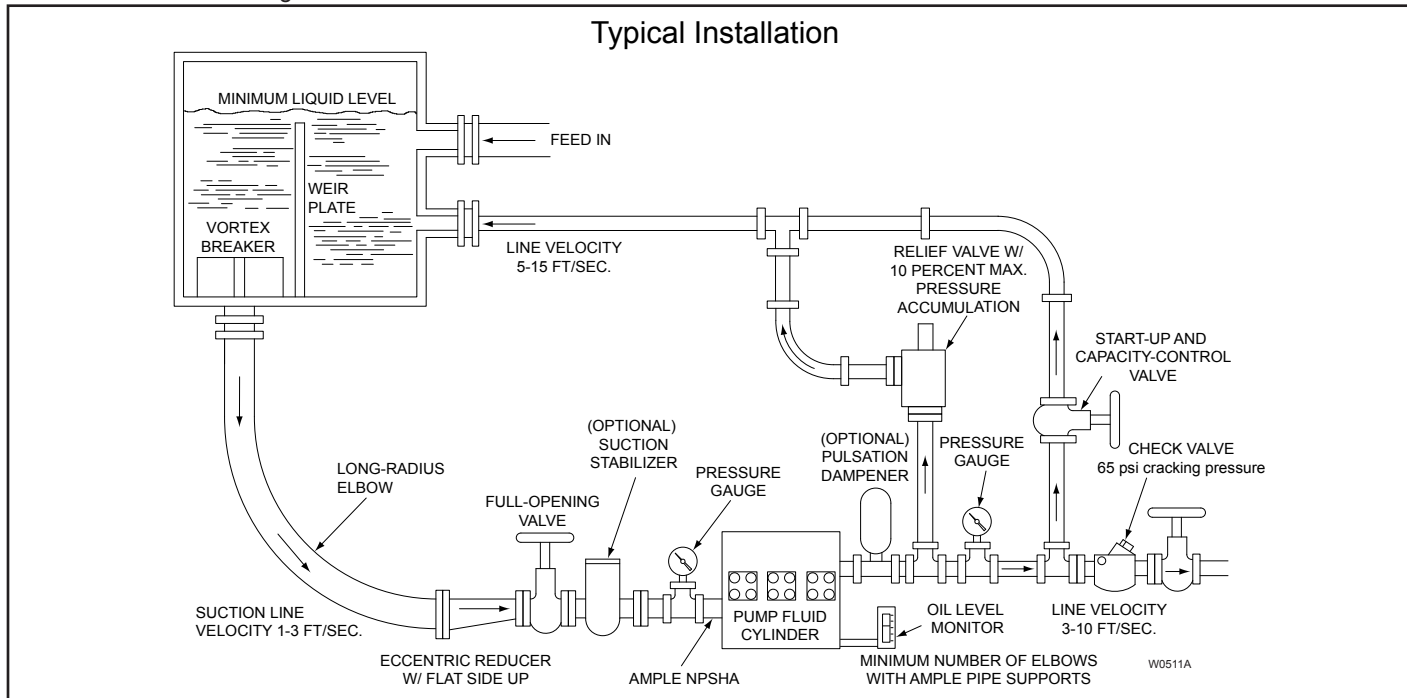
Shut-Off Valves. Never install shut-off valves between the pump and discharge pressure regulator, relief valve, or in the regulator bypass line.

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 45



Q155 Series Low - Installation (Cont'd)

Accessories

Consult installation drawing below 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. Install a low suction pressure shutdown switch.**

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 45 gpm, since trapped air takes five minutes to escape from water, $5 \times 45 = 225$ 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 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 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 the Q155 Series Hydra-Cell 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.

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

Q155 Series Low - Installation (Cont'd)

- Use at least 5 in. (127 mm) I.D. inlet hose
- 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. No 90° 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 system.

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 system.

Route the bypass line to the supply tank never back to the suction line of the pump.. 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 back cover float switch (53) 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 above the minimum service temperature 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 correct. Add oil as needed. The oil level can also be viewed through the sight glass (47) on the back cover (45). The oil level is OK when the float (53) is within the markings on the dipstick or the oil monitor cover.
- Connect the float switch (if used). See Float Switch Section.
- Test the float switch by removing the side port plug (55) and manipulating the float up and down using a suitable tool (screwdriver). Reinstall side port plug.
- **CAUTION: Take care not to drop tool inside pump.**
- 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.

Initial Start-Up

1. Pump must be at or above the minimum temperature 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. To maintain maximum flow, inlet vacuum must not exceed 7 in. Hg at 70° F (180 mm Hg at 21° C). Inlet pressure must not exceed 500 psi (34.5 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. Remove the pressure gauge from the tee fitting at the pump outlet (see installation diagram).

Q155 Series Low - Installation/Maintenance

Initial Start-Up (Cont'd)

Note: Fluid may come out of this port when the plug is removed. Provide an adequate catch basin for fluid spillage, if required. Fluid will come out of this port when the pump is started, so we recommend that you attach adequate plumbing from this port so fluid will not be sprayed or lost. Use high-pressure-rated hose and fittings from this port. Take all safety precautions to assure safe handling of the fluid being pumped.

- c. Jog the system on and off until the fluid coming from this port is air-free.
 - d. Turn off the power.
 - e. Remove the plumbing that was temporarily installed, and reinstall the pressure gauge or plug.
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.
 10. Provide a return line from the relief valve to the supply tank, similar to the bypass line.

Maintenance

Note: The numbers in parentheses are the Reference Numbers on the exploded view illustrations found in this manual and in the Parts Manual.

Daily

Check the oil level and the condition of the oil with the pump turned off. Oil level should be within the markings on the dipstick or the oil monitor cover. 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 (62) 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: Hydra-Cell Q155 Series Pumps come standard with 10W30 motor oil.

Note: Minimum oil viscosity for proper hydraulic end lubrication is 80 cST (371 SSU) at 104°F (40°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 (37) at the bottom 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.

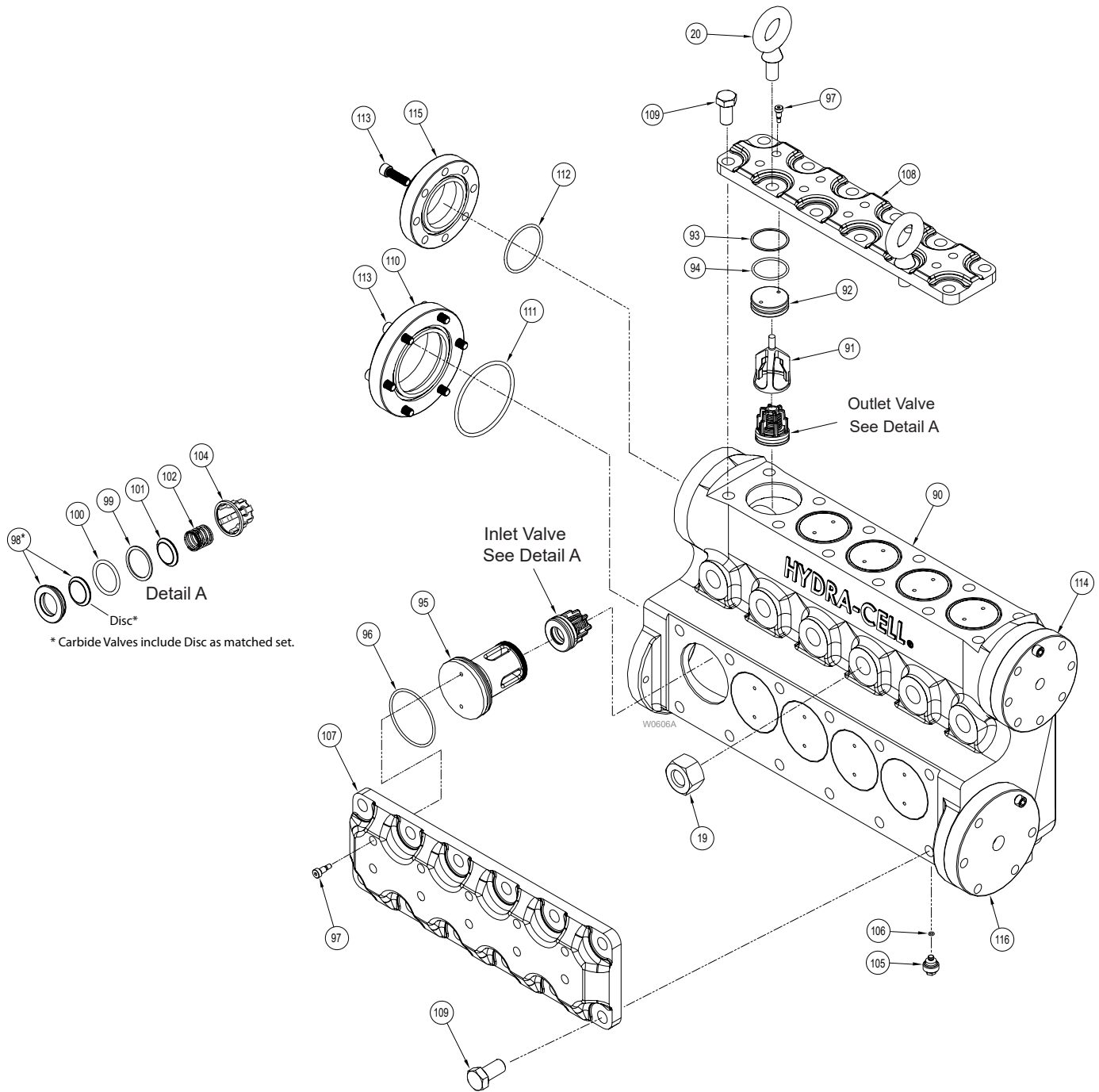
Recommended Tools and Supplies

The following tools and supplies are recommended for servicing the Q155 Low Pump:

- 10 mm hex socket with extension
- 30 mm hex socket
- 46 mm hex socket
- 3/4 in. hex socket
- 8 mm box-end wrench
- 13 mm open-end wrench
- 9/16 in. box-end wrench
- 3 mm hex wrench
- 4 mm hex wrench
- 8 mm hex wrench
- Torx T30
- Torx T45
- Flathead screwdriver
- No. 3 Phillips-head screwdriver
- Internal retaining ring pliers
- 8 in. adjustable wrench
- Torque wrench or torque multiplier, capable of 650 ft-lbs (881 N-m).
- Pipe wrench
- Loctite 242
- New Hydra-Oil
- Wanner Q155 Low Tool Kit (see Q155 Low Tool Kit Parts)
- Feeler Gauge (2)
- Insertion tool

Q155 Series Low Pressure - Fluid End Service

! **WARNING:** Manifold (90) and assembled parts weigh over 500 pounds (227 kg) and require mechanical lift. Use care in handling to prevent personal injury or damage to equipment.



Fluid End Parts

Q155 Series Low - Fluid End Service (Cont'd)

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

CAUTION - For servicing of pumps certified for use in explosive atmospheres (ATEX/IECEX) please see separate supplementary manual.

Note: The numbers in parentheses are the Reference Numbers in the Fluid End Parts exploded view illustration in this section and also in the Parts Section.

Fluid End Service

Inlet Check Valve Disassembly

- See *Fluid End Parts View*. Remove twelve bolts (109) around inlet support plate (107).
- Remove inlet support plate and five inlet retainer plugs (95) with assembled O-rings (96).
- Check O-rings and inlet retainer plugs for wear. Replace if worn. Lubricate new O-rings with petroleum jelly or lubricating gel. Each inlet retainer plug is attached to inlet support plate with two screws (97).
- Inspect inlet support plate for warping or wear around inlet ports. Look for corrosion, scale and wear. If wear is excessive, replace inlet support plate. Clean inlet support plate of any scale and corrosion with Scotch-Brite™ pad or fine emery cloth. Wash after cleaning. To check if inlet support plate is warped, place a straightedge across it. A warped inlet support plate should be replaced.
- Remove five inlet check valve cartridges (98-104) with check valve extraction tool. Tool is included in Wanner Tool Kit.

CAUTION - For Inlet Carbide Valve Assemblies (when used).

Inlet Carbide Valve Assemblies are a matched set (consisting of items 98 and 101) and must be installed together. Failure to install Inlet Carbide Valve Assemblies as a matched set will cause pump damage.

- Inspect each of five check valve cartridges for wear and leakage at seat. Replace inlet check valve cartridges as needed.
- Using a light, visually inspect diaphragms through inlet ports. If diaphragms appear abnormal or damaged, remove and replace as instructed in Diaphragm Parts Disassembly.

Inlet Check Valve Assembly

- Reinstall five inlet check valve cartridges (98-104).
- Reinstall inlet support plate (107) and inlet retainer plugs (95) with two screws (97) and assembled O-rings (96). Use twelve bolts (109) to fasten inlet support plate. Hand thread bolts, then tighten from inner to outer. See *Manifold Assembly Torque Sequence Diagram*. Torque to 300 ft-lbs (407 N-m).

Outlet Check Valve Disassembly

Note: Removal of Inlet Check Valves first will make removal of Outlet Check Valves easier.

- Remove two eyebolts (20) and ten bolts (109) around outlet support plate (108).
- Remove outlet support plate with assembled outlet valve port plugs (92), backup rings (93), O-rings (94), and outlet valve retainers (91).
- Check outlet valve port plugs, backup rings, O-rings, and outlet valve retainers for wear. Replace if worn. Lubricate new O-rings with petroleum jelly or lubricating gel. Outlet valve port plugs are attached to discharge retainers plate with two screws (97).
- Inspect outlet support plate for warping or wear around discharge ports. Look for corrosion, scale and wear. If wear is excessive, replace outlet support plate. Clean outlet support plate of any scale and corrosion with fine emery cloth. Wash after cleaning. To check if outlet support plate is warped, place a straightedge across it. A warped outlet support plate should be replaced.
- Remove five outlet check valve cartridges (98-104) with check valve extraction tool. Tool is included in Wanner Tool Kit.

CAUTION - For Outlet Carbide Valve Assemblies (when used).

Outlet Carbide Valve Assemblies are a matched set (consisting of items 98 and 101) and must be installed together. Failure to install Outlet Carbide Valve Assemblies as a matched set will cause pump damage.

- Inspect each of five check valve cartridges for wear and leakage at seat. Replace outlet check valve cartridges as needed.

Outlet Check Valve Assembly

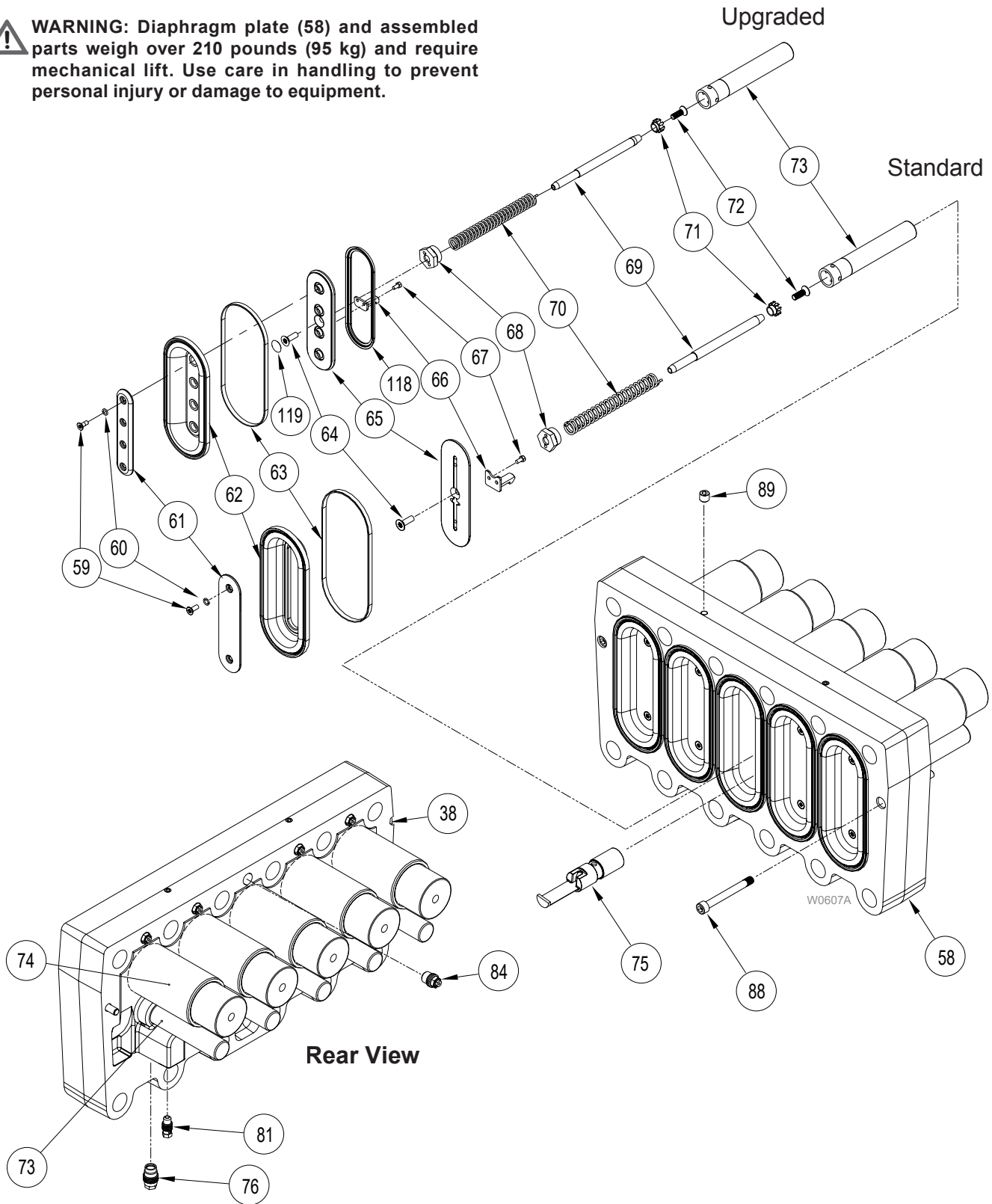
- Reinstall five outlet check valve cartridges (98-104).
- Reinstall outlet support plate (108) with assembled outlet valve port plugs (92) with two screws (97) [Torque to 75 in-lbs (8 N-m)], backup rings (93), O-rings (94), and outlet valve retainers (91); using ten bolts (109) and two eyebolts (20). (Check illustration) Hand thread cap screws and eyebolts.
- Tighten cap screws from opposing corners to opposing corners of outlet support plate. Torque to 300 ft-lbs (407 N-m).
- Tighten eyebolts with crow bar or hammer.

Drain Plug

- Remove and replace drain plug (105) and O-ring (106) as needed. Torque drain plug with O-ring to 40 ft-lbs (54 N-m). Apply loctite nickel anti-seize lubricant to thread and chamfer of plug with coverage on O-ring.

Q155 Series Low - Hydraulic Section Service

! **WARNING:** Diaphragm plate (58) and assembled parts weigh over 210 pounds (95 kg) and require mechanical lift. Use care in handling to prevent personal injury or damage to equipment.



Q155 Low - Hydraulic Section Service (Cont'd)

CAUTION - For servicing of pumps certified for use in explosive atmospheres (ATEX/IECEX) please see separate supplementary manual.

Note: The numbers in parentheses are the Reference Numbers shown in the Hydraulic Section Parts View in this section of the manual and in the Parts Section of the manual.

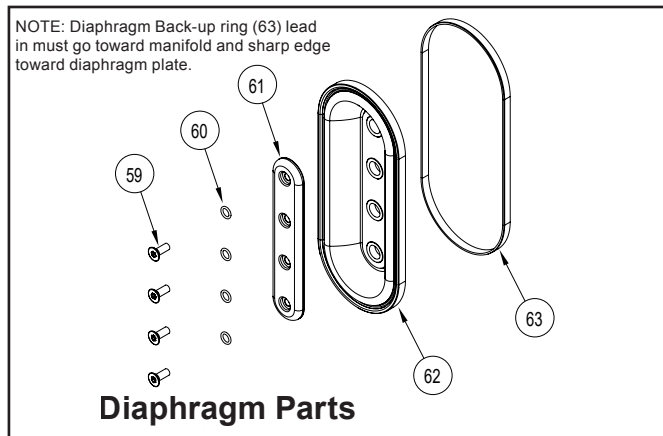
Hydraulic Section Disassembly

WARNING: Manifold (90) and assembled parts weigh over 500 pounds (227 kg) and require mechanical lift. Use care in handling to prevent personal injury or damage to equipment.

Manifold Disassembly

- See *Power End Parts Illustration in Parts List*. Remove drain plug (37) from bottom of pump and drain oil into container (capable of holding 38 qts [36 liters] of oil). Dispose of old oil in an approved way.
- Replace drain plug.
- See *Fluid End Parts View*. Remove twelve bolts (109) around inlet support plate (107).
- Remove twelve hex nuts (19) from fluid end of pump. Install four 177-393 Extender Studs from Q155 Low Tool Kit on studs (18). Carefully slide manifold (90) forward along extender studs to allow access to diaphragm plate (58).

Diaphragm Disassembly



- See *Diaphragm Parts View*. Remove four screws (59), four O-rings (60) and follower (61).

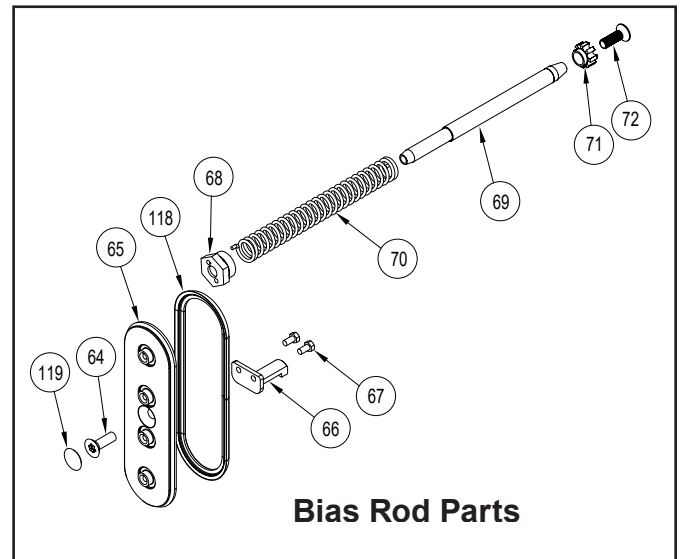
CAUTION: If a diaphragm has ruptured and foreign material or water has entered the oil reservoir, do not operate the pump. Check all diaphragms, then flush the reservoir completely and refill it with fresh oil. Never let the pump stand with foreign material or water in the reservoir, or with the reservoir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

- Remove the diaphragm (62) and diaphragm back-up ring (63). 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.
- 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.

- If needed replace diaphragm.
- Replace diaphragm back-up ring if needed.

Bias Rod Disassembly




- See *Bias Rod Parts and Diaphragm Parts Views*. Remove diaphragm parts as in steps a. through e. above.
- Remove screw (64) and diaphragm clamp (65) with support ring (118) valve arm (66) and two attaching screws (67).
- Remove valve spool (75) from diaphragm plate (58).
- Check diaphragm clamp for any rough surfaces, edges, or corrosion. Replace if necessary.
- Check support ring (118) for any rough surfaces, edges, corrosion, tears, or loose fitment around diaphragm clamp. Replace if necessary
- Unscrew bias tube cap (68).
- Remove bias rod parts: bias spring (70), bias rod (69), spring guide (71), and screw (72).
- Inspect rod parts. Smooth surfaces and edges as necessary with emery cloth or fine file. Replace parts as necessary.

Q155 Low - Hydraulic Section Service (Cont'd)

Hydraulic Section Disassembly (Cont'd)

Diaphragm Plate Disassembly

 **WARNING:** Manifold (90) and assembled parts weigh over 500 pounds (226 kg) and require mechanical lift. Use care in handling to prevent personal injury or damage to equipment.

- a. Slide manifold (90) away from diaphragm plate (40), following steps a. through d. in the Remove Manifold Assembly Section.

 **WARNING:** Diaphragm plate (58) and assembled parts weigh over 210 pounds (95 kg) and require mechanical lift. Use care in handling to prevent personal injury or damage to equipment.

Note: To ease handling of diaphragm plate, install two Eyebolts (177-058) from Q155 Low Pressure Tool Kit in place of two Setscrews (89) on top of diaphragm plate.

- b. See *Hydraulic Section Parts view*. Remove two cap screws (88) from diaphragm plate (58).
- c. Carefully slide diaphragm plate and assembled parts away from pump along pump studs.
- d. Replace diaphragm plate gasket (38) if damaged.

Check/Replace Airbleed Valve

- a. See *Valve Parts View*. Unthread airbleed valve (84) from diaphragm plate (58). Inspect valve and replace if needed.
- b. Reinstall airbleed valve. Torque to 75 ft-lbs (102 N-m).


Check/Replace Underfill Valve

- a. See *Valve Parts View*. Unthread underfill valve (76) from bottom of diaphragm plate (58). Inspect valve and replace if needed.
- b. Reinstall underfill valve. Torque to 30 ft-lbs (41 N-m).

Check/Replace Overfill Valve Assembly

- a. See *Valve Parts View*. Unthread overfill valve (81) from bottom of diaphragm plate (58). Inspect overfill valve and replace if needed.
- b. Reinstall overfill valve. Torque to 105 in-lbs (12 N-m).

Hydraulic Section Assembly

 **WARNING:** Diaphragm plate (58) and assembled parts weigh over 210 pounds (95 kg) and require mechanical lift. Use care in handling to prevent personal injury or damage to equipment.

Note: To ease handling of diaphragm plate, install two Eyebolts (177-058) from Q155 Low Tool Kit in place of two Setscrews (89) on top of diaphragm plate.

Diaphragm Plate Assembly

- a. Replace diaphragm plate gasket (38) if damaged.

CAUTION: Ensure plungers (57) 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 (58) and assembled parts along pump studs flush with Power End of pump.
- c. Screw two cap screws (88) into diaphragm plate. Torque to 50 ft-lbs (68 N-m).
- d. Hand rotate crankshaft to assure smooth operation.

Bias Rod Assembly

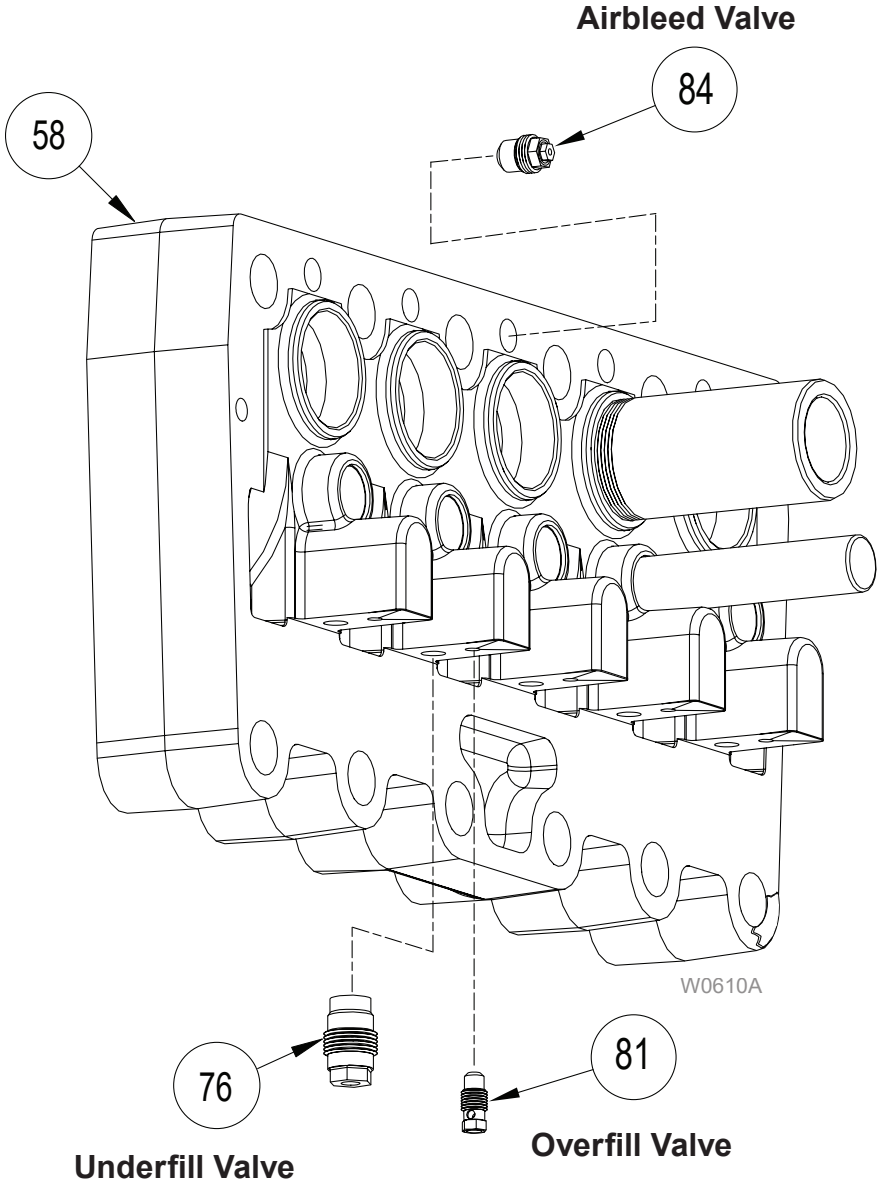
CAUTION: It is important to observe the following steps a. and b. to insure proper assembly.

- a. See *Bias Rod Parts View*. Clean internal threads of bias rod (69) screw (72). Make sure threads are dry and oil free. Prime threads with Loctite Primer N.
- b. Apply a small amount of No. 242 Loctite to internal threads of bias rod (69) and screw (72). Insert screw through spring guide (71) and thread into bias rod.
- c. Install bias rod assembly parts into diaphragm plate (58). Thread bias tube cap (68) into bias tube with: bias spring (70), bias rod, spring guide, and screw. Make sure spring tangs mate with spring guide and bias tube cap. Use Loctite 242 on bias tube cap and torque to 50 ft-lbs (68 N-m).
- d. Insert valve spool (75) into diaphragm plate.
- e. Thread screw (64) through diaphragm clamp (65) with valve arm (66) and two attaching screws (49) into bias rod. Use Loctite 242 on screw (64) and torque to 20 ft-lbs (27 N-m).

CAUTION: Use care not to over-tighten as that can cause the rod to rotate and bind the bias spring. Verify the bias spring is not bound by pulling the diaphragm clamp out and verifying that the clamp has full range of motion.

- f. Repeat for five rod assemblies.

Q155 Low - Hydraulic Section Service (Cont'd)



Valve Parts View

Q155 Low - Hydraulic Section Service (Cont'd)

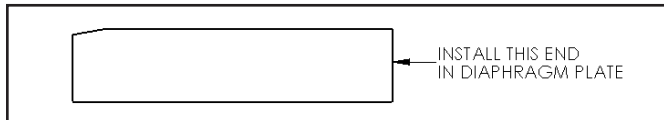
Hydraulic Section Assembly (Cont'd)

Diaphragm Assembly

a. See *Diaphragm Parts View*.

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

- Install screw plug (119) into screw (64). Make sure screw cap is flush with diaphragm clamp (65).
- Install the diaphragm (62) into diaphragm plate (58). Seat diaphragm edge with fingers. Make sure diaphragm bead is fully seated into the square groove of diaphragm plate.
- Install back-up ring (63) between diaphragm plate and diaphragm.



NOTE: Diaphragm Back-up ring (63) lead in must go toward manifold and sharp edge toward diaphragm plate.

- Install four O-rings (60) into follower (61).
- Attach follower to diaphragm clamp with four screws (59). Use Loctite 242 and torque to 80 in-lbs (9 N-m).
- Repeat steps a. through f. for three diaphragms.

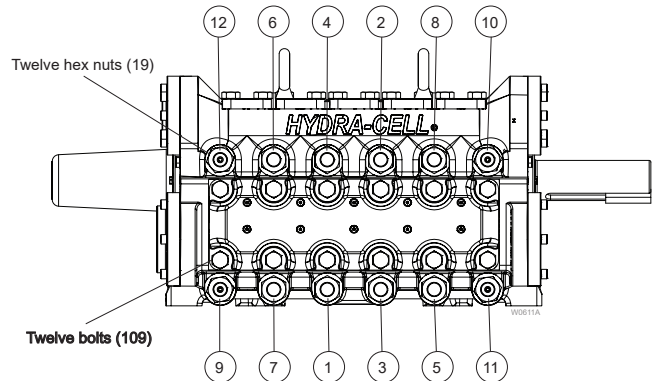
WARNING: Manifold (90) and assembled parts weigh over 500 pounds (226 kg) and require mechanical lift. Use care in handling to prevent personal injury or damage to equipment.

Manifold Assembly

- 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.
- Carefully slide manifold (90) onto pump studs. If used, remove four 177-393 Extender Studs from pump and install twelve bolts (109) around inlet support plate (107) and hand tighten.

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.

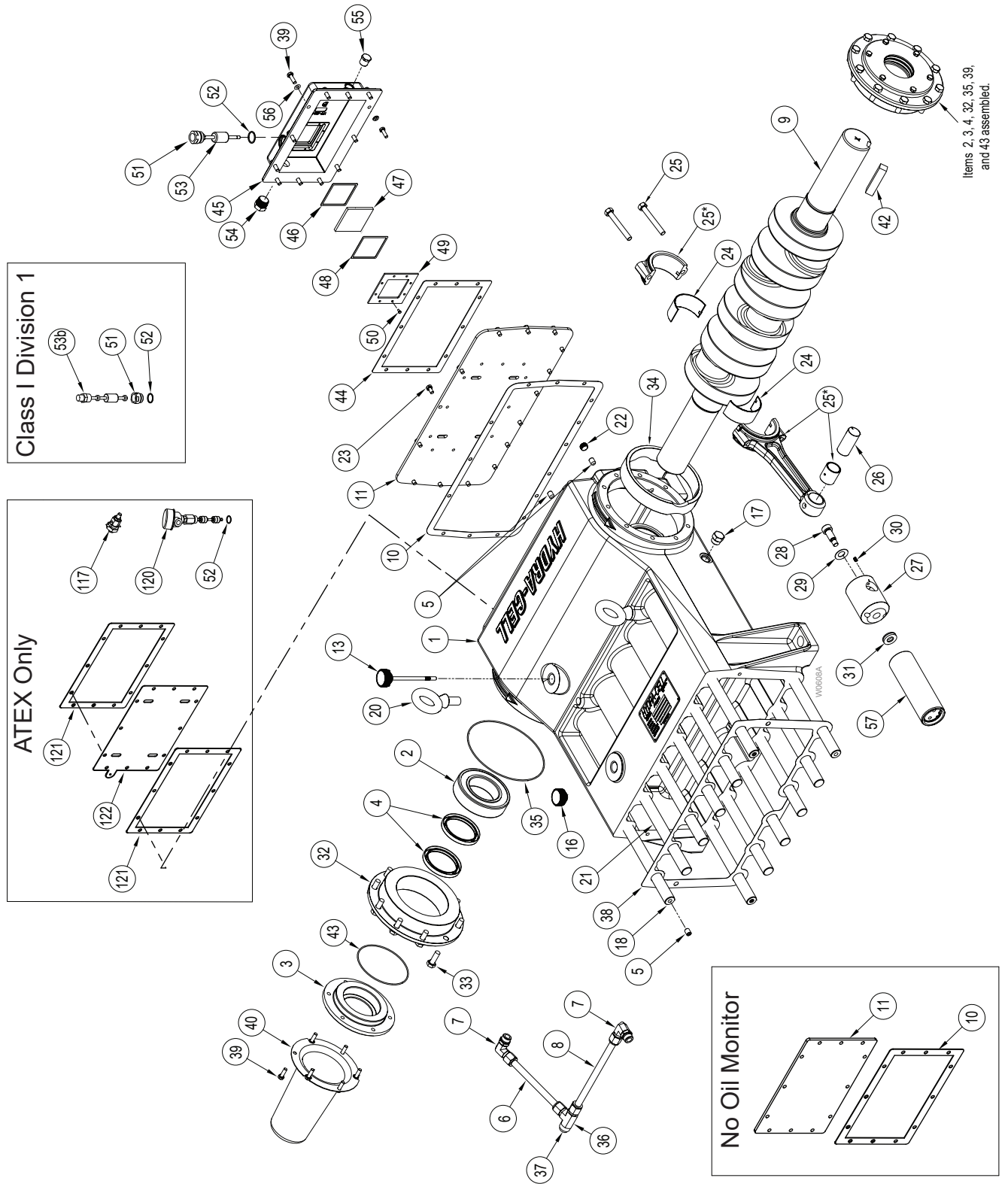
- Thread on twelve hex nuts (19) and hand tighten.
- Tighten hex nuts in sequence illustrated below then torque to 650 ft-lbs (881 N-m) in order indicated.
- Thread on twelve bolts (109) and hand tighten.
- Tighten bolts in torque sequence illustrated below to 650 ft-lbs (881 N-m).
- Fill pump with oil to cover marks on dipstick. Approximately 32 US quarts (30.3 liters) with flat back cover or 34 US quarts (32.2 liters) with oil monitor back cover.
- Follow instructions in Before Initial Start-Up and Initial Start-Up Section to start pump.



Torque sequence:
- Snug twelve hex nuts (19) in order indicated, then torque to 650 ft-lbs (881 N-m) in order indicated.
- Repeat same snug and torque sequence for corresponding bolts (109) to 300 ft-lbs (407 N-m).

Q155 Low Pressure - Power End Service


WARNING: Crankcase (1) and assembled parts weigh over 900 pounds (408 kg) and require mechanical lift. Use care in handling to prevent personal injury or damage to equipment.



Power End Parts

Q155 Low - Power End Service (Cont'd)

Power End Disassembly

 **WARNING:** Crankcase (1) and assembled parts weigh over 900 pounds (408 kg) and require mechanical lift. Use care in handling to prevent personal injury or damage to equipment.

CAUTION - For servicing of pumps certified for use in explosive atmospheres (ATEX/IECEx) please see separate supplementary manual.

Float Switch Back Cover Disassembly

Note: The numbers in parentheses are the Reference Numbers shown in the Power End Parts View in this section of the manual and in the Parts Section of the manual.

- Disconnect float switch (53).
- Remove float switch adapter (51) with float switch and O-ring (52) from back cover (11).
- Remove float switch from float switch adapter.
- Remove twelve screws (23) from crankcase (1).
- Remove back cover and baffle (11).
- Remove eight screws (50) from assembled frame (49) and back cover.
- Disassemble frame, gasket (48), sight glass (47), and thick gasket (46).

Crankcase Disassembly

- Remove Fluid End and Hydraulic plate as outlined in two preceding sections.
- See *Power End Parts Illustration*. Remove plug (37), cap with o-ring (16), dipstick (13), and crankshaft key (42) and drain lubricating fluid into a suitable container.
- On crankshaft end not used, remove three cap screws (39), crankshaft cover (40) used to attach seal and bearing assembly.
- Remove fifteen cap screws (23) and remove back cover (11) and back cover gasket (44).

Connecting Rod Removal

Note: Each of five Connecting rod assemblies (25*) consists of: connecting rod, connecting rod end cap, sleeve, 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 one half split shell bearing (24) for use in reassembly.

- Remove connecting rod assembly from crankshaft by reaching into rear of crankcase (1) around crankshaft (9). Push connecting rod assembly away from journal on the crankshaft. Move as far forward as possible.
- Repeat removal for five sets.

Crankshaft Removal

- Remove six 3/8 hex socket plugs (22) and six outer support setscrews (5).
- Remove 20 bearing carrier bolts (33) and two seal and bearing assemblies (assembled items 2, 3, 4, 32, 35, 39, 43) from both sides of crankcase (1).
- Carefully remove crankshaft (9) and store securely.

Main Journal Bearing Disassembly

- If not already disassembled, remove two setscrews (5) locking two main journal bearing shells (34) into crankcase (1).
- Remove two main journal bearing shells from crankcase using bearing shell insertion tool (Part No. 209-825).

Seal and Bearing Disassembly

- Separate seal and bearing assemblies by removing six cap screws (39).
- Remove O-ring (35) from bearing cover (32). Remove roller bearing (2) from bearing cover.
- Remove O-ring (43) from seal cover (3). Remove two crankshaft seals (4) from seal cover.
- Disassemble two sets.

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/plunger assembly and remove from crankcase.
- Remove remaining one half of split shell bearing (24) 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 setscrew (30) to unlock wrist pin (26). Remove wrist pin, assembled plunger and slider from connecting rod. Note alignment marks on wrist pin and alignment mark on slider (27).
- Disassemble and remove five sets.

Q155 Low - Power End Service (Cont'd)

Power End Disassembly (Cont'd)

Plunger Disassembly

- Remove shoulder screw (28) from plunger assembly to remove plunger (57), spherical washer (31), slider (27), and belleville spring (29).
- Disassemble five sets as in step a.
- Clean crankcase for later reassembly.

Power End Assembly

⚠ WARNING: Crankcase (1) and assembled parts weigh over 900 pounds (408 kg) and require mechanical lift. Use care in handling to prevent personal injury or damage to equipment.

Plunger Assembly

Note: The numbers in parentheses are the Reference Numbers shown in the Power End Parts Illustration.

- Start with crankcase (1) clean and ready to assemble.
- Assemble plunger (57), spherical washer (31), slider (27), belleville spring (29), with shoulder screw (28). Use Loctite 242 and torque to 50 ft-lbs (68 N-m).

Note: One concave side of spherical washer assy (31) mates with plunger (57) and the other convex side of spherical washer assy mates with slider (27).

- Assemble five sets.

Connecting Rod Assembly

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

- Attach assembled plunger and slider to connecting rod (25*) using wrist pin (26). Align marks on wrist pin with marks on slider (27). Lock wrist pin in place with setscrew (30). Use Loctite 271 and torque to 60 in-lbs (7 N-m).

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

- Remove two bolts (25*) and connecting rod end 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 (24) on connecting rod. Remaining one half of split shell bearing will be installed later.
- Insert connecting rod/plunger assembly into crankcase and push all the way forward. Ensure numbers are "top-up."
- Assemble and install five sets.

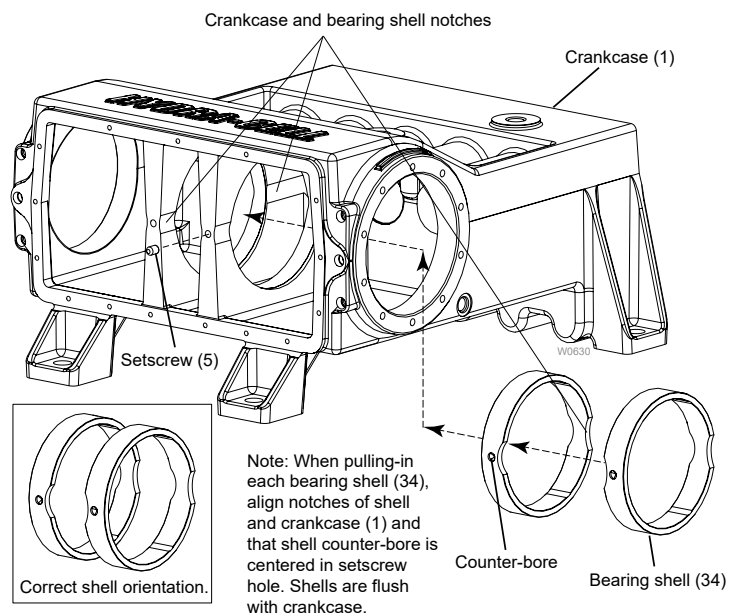
Seal and Bearing Assembly

- Press two crankshaft seals (4) into seal cover (3). Install O-ring (43) onto seal cover.
- Install roller bearing (2) into bearing cover (32). Install O-ring (35) onto bearing cover.
- Bolt seal and bearing assemblies together using six cap screws (39).
- Assemble two sets.

Main Journal Bearing Installation

- Pull each of the two main journal bearing shells (34) into crankcase (1) until flush; using bearing shell insertion tool (Part No. 209-825). See Inset following.

Note: Be sure shells are flush and orientation of shells is correct as shown following.



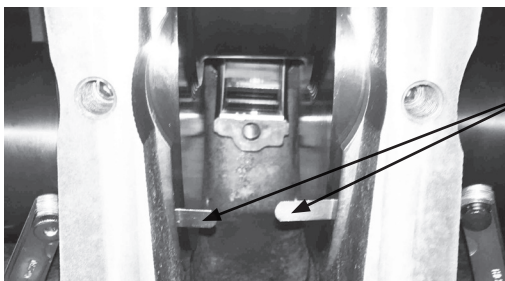
- Ensure proper alignment of the center main bearing by aligning the counter-bore in the OD of the bearing horizontally with the threaded hole in the main bearing web of the crankcase until the counter-bore of the bearing and the threaded hole of the main bearing web are concentric. At this point, the half moon shaped cutouts in the main bearing will also align with the machined clearance bore for the crosshead.
- Apply Loctite 242 to two setscrews (5). Thread into crankcase and finger tighten into the threaded holes in the crankcase web until they just engage the counter-bore of the bearing.

Caution: Care must be taken not to over tighten these setscrews and distort the main bearing.

Q155 Low - Power End Service (Cont'd)

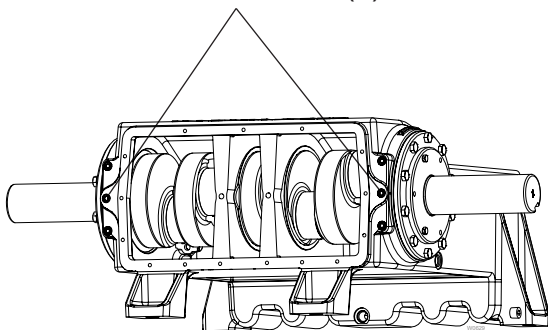
Crankshaft Installation

- Apply a film of oil to the main journal bearings (34).
- Install crankshaft (9) and rest it in place.
- Brace the crankshaft to ensure it cannot move left or right in the crankcase (1).
- Install two seal and bearing assemblies (assembled items 2, 3, 4, 32, 35, 39, 43) onto both sides of the crankcase. Finger tighten twenty screws (33). Ensure the spot faces align to the threaded holes in the crankcase.
- Remove the bracing form the crankshaft used in step c.
- With the crankshaft free to rotate, place two .010 in. feeler gauges in the clearance between both main journals and the bearing. See Inset following.



- Slide the feeler gauges toward the bottom of the crankcase as far as they will freely fit.
- Starting on the side with the feeler gauge furthest from the bottom, use the center setscrew (at that end of the crankcase) to move the outer bearing carrier; while sliding the feeler gauge toward the bottom of the pump. When the feeler gauge is at, or near, the 4 o'clock position; stop. Repeat the same procedure on the opposite side. Adjust both setscrews until the feeler gauges are even at the 4 o'clock position. See Inset following.

Center setscrews (5)



- With the feeler gauges in place tighten all 20 bearing carrier bolts (33) to lock the crankshaft in position.
- Torque all six outer support setscrews (5) to 25 ft-lbs with loctite 242 and install six 3/8 hex socket plugs (22).

Note: End play of crankshaft should be between 0.010 in. minimum to 0.200 in. maximum when installed.

Connecting Rod Installation

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

- Attach connecting rod assembly to crankshaft (9) 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.

- Retrieve connecting rod assembly bolts, end cap, and remaining split shell bearing (24) set aside in previous steps.
- Reinstall connecting rod end cap with remaining split shell bearing using connecting rod assembly bolts. Make sure numbers on connecting rod and end cap are 'top-up' in the assembly and match. Torque two bolts to 100 ft-lbs (136 N-m).
- Repeat installation for five sets.

Crankcase Assembly

Note: for torque values refer to the table preceding the Parts List Section.

- Install back cover (11) and back cover gasket (44) using fifteen cap screws (23).
- Install crankshaft cover (40) on crankshaft end not used with three cap screws (39) used to attach seal and bearing assembly.
- If removed, reinstall four studs (18), with four set screws (5), eight studs (21), and two eyebolts (20).
- Install plug (37), cap with o-ring (16), dipstick (13), and crankshaft key (42) and add lubricating fluid.

Float Switch Back Cover Assembly

- Align and assemble frame (49), gasket (48), sight glass (47), and thick gasket (46).
- Install eight screws (50) alternately through assembled frame into back cover (45) until snug.
- Assemble baffle (11) and back cover.
- Attach baffle and back cover to crankcase (1) with twelve screws (23)
- Assemble float switch (53) to float switch adapter (51) finger tight plus one half turn.
- Assemble float switch adapter with float switch and O-ring (52) into back cover until seated.
- Reconnect float switch.

Q155 Series Low 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

Q155 Series Low - Torque Specifications

Q155 Low Torque Specification Table				
Reference Number	Torque Specification (N-m)	Loctite No.	Part Number	Description
18	200 ft-lbs (271)	242	177-151	Stud, 27 mm x 300 mm, c-bore 12 mm
19	650 ft-lbs (881)		177-152	Nut, Hex, M27
20	200 ft-lbs (271)		177-059	Eyebolt, M20
21	200 ft-lbs (271)	242	177-150	Stud, 27 mm x 300 mm
23	12 ft-lbs (16)	242	177-043	Screw, Cap, hex-hd, M8, 15 mm
25	100 ft-lbs (136)		177-003-02	Bolts, Connecting Rod Assembly
28	50 ft-lbs (68)	242	177-047	Screw, Shoulder, M16, 30 mm
30	60 in-lbs (7)	271	G10-082-2010	Screw, Soc-hd, M6, 10 mm
33	100 ft-lbs (136)	242	G35-087-2010	Screw, Cap, hex-hd, M12, 35 mm
37	*	567	189-313	Plug, 1/2 in. NPT
39	12 ft-lbs (16)	242	177-048	Screw, Cap, hex-hd, M8, 25 mm
50	15 in-lbs (1.7)	271	189-565	Screw, Pan-hd, 10-24
54	□		189-311	Plug, 3/4 in. NPT, SST
55	□		177-459	Plug, 1/2-14 NPT
59	80 in-lbs (9)	242	177-176	Screw, Flat-hd, M6 x 1.0 x 16 mm
64	20 ft-lbs (27)	242	177-359	Screw, Flat-hd, M8, 25 mm
67	75 in-lbs (8)	242	177-050	Screw, Cap, hex-hd, M5, 10 mm
68	50 ft-lbs (68)	242	177-358	Cap, Bias tube
72	12 ft-lbs (16)	271	177-149	Screw, OH
74	50 ft-lbs (68) 200 ft-lbs (271) 200 ft-lbs (271)	242	177-329-01 177-329-02 177-329-03	Cylinder, E Cylinder, F Cylinder, H
76	30 ft-lbs (41)		177-904	Cartridge, Underfill valve
81	105 in-lbs (12)		177-905	Cartridge, Overfill valve
84	75 ft-lbs (102)		177-906	Cartridge, Air Bleed valve
88	50 ft-lbs (68)		G10-024-2010	Screw, Cap, soc-hd, M10, 90 mm
97	75 in-lbs (8)	242	177-052	Screw, Shoulder, M8, 12 mm
105	50 ft-lbs (68)	*	177-014-01	Plug, Drain
109	300 ft-lbs (407)		177-044	Screw, Cap, hex-hd, M20, 50 mm
113	100 ft-lbs (136)	242	G35-081-2010	Screw, M12 X 1.75 X 40

* Apply Loctite nickel anti-seize lubricant to threads and chamfer of item 105.

□ Apply instant pressure pipe thread sealant.

Q155 Series Low 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 (53) and adapter (51) can be removed from the back 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 (53) 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 Q155 Low Pressure Pump uses one of two float switch 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 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 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: The oil level should always be visible between the high and low oil marks viewed on sight glass (47). If the oil level reaches the high or low mark, the float switch will be activated.

Electrical Specifications

The following are the float switch electrical specifications:

- For P/N 177-453-02, 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 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 adapter: 1/2-14 NPT
- UL File No. E203716 under UL 508.
- Not rated for NEC/CEC hazardous locations. See page 28 for Class I Div 1 switch specs. For ATEX/IECEx applications, please consult factory.**

Additional Measurement Port

There is a port with plug (54) on the lower left side of the back cover. This port may be used for an additional measurement device.

Float Switch Logic Table						
	177-453-02 (Normally-Closed)			177-453-03 (Normally-Open)		
Oil Level	Low	Normal	High	Low	Normal	High
High	Closed	Closed	Open	Open	Open	Closed
Low	Open	Closed	Closed	Closed	Open	Open

Switch conditions shown for normal pump operation.		
	Oil Level Monitor Float Switch Conditions and Wiring Diagram	

Q155 Series Low - Oil Level Monitor (Cont'd)

Oil Level Monitor Float Switch Conditions and Wiring Diagram - Class I Division 1

Wiring Instructions

177-453-05 (48b) Normally-Closed (NC) float switch:

High and Low can be wired individually to different inputs by splitting the common (Black) wire and wiring separately with either the High or Low set-point. Alternatively, both High and Low can be wired in series to a common input without using the common (Black) wire. The ground wire should be connected to nearest common ground.

177-453-06 (48b) Normally-Open (NO) float switch:

High and Low can be wired individually to different inputs by splitting the common (Black) wire and wiring separately with either the High or Low set-point. Alternatively, both High and Low can be wired in parallel by connecting both High and Low leads together to one side of the input and the common (Black) wire to the other side of the input. The ground wire should be connected to nearest common ground.

Electrical Specifications - Class I Division 1

The following are the maximum electrical rating for Class I Division 1 float switches:

- For P/N 177-453-05 (48b), Normally-Closed (NC) float switch: two single-pole, double-throw (SPDT) reed switches rated at 30 VAC/VDC, 0.2 Amp, 20 Watts (maximum power), 50 Watts (maximum contact rating).

or

For P/N 177-453-06 (48b) Normally-Open (NO) float switch: switches rated at 300 VAC/VDC, 0.5 Amp AC/0.7 Amp DC, 50 Watts (maximum power), 3 VA (maximum contact rating).

- Sum total of current for both switches not to exceed: 1 Amp

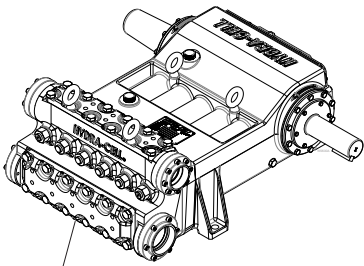
For both NC and NO switches:

- UL File No. E203716 under UL 508.
- Hazardous Area Certifying Body: Factory Mutual, File # 3021242.
- Hazardous Area Certification: Class I Division 1, Groups A, B, C, D; Class II, Groups E, F, G; Class III, T4 Type 4.
- Maximum ambient temperature = 300°F (149°C)
- Maximum gauge pressure = 50 psig (3.5 bar)
- Resistive load only
- Magnetic float actuation
- Electrical conduit connection at top of switch adapter: 1/2-14 NPT

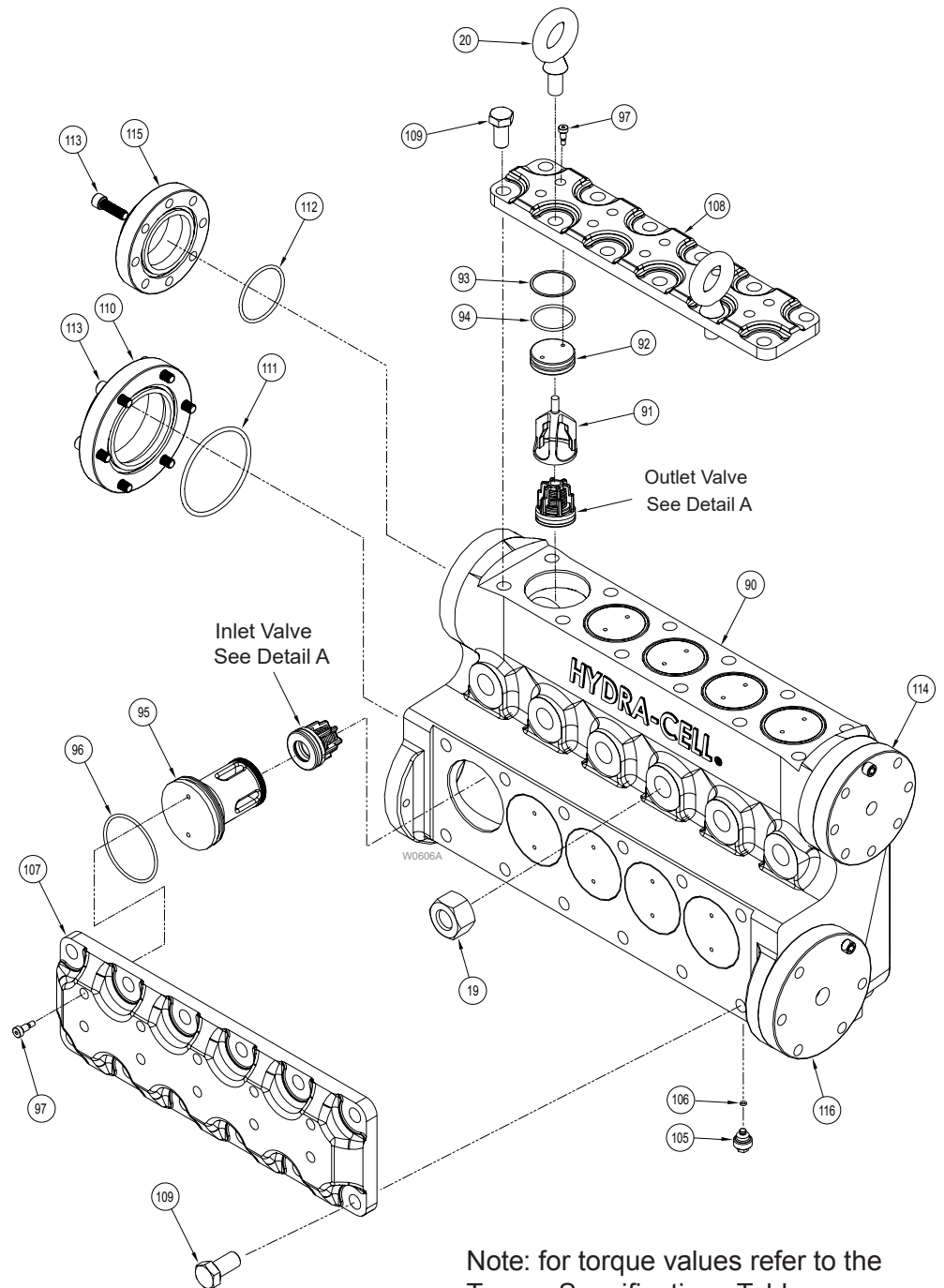
Class I Division 1 Logic Table						
Setpoint Contacts	177-453-05 (Normally-Closed)			177-453-06 (Normally-Open)		
	Float Down	Float in Middle	Float Up	Float Down	Float in Middle	Float Up
High	Closed	Closed	Open	Open	Open	Closed
Low	Open	Closed	Closed	Closed	Open	Open
Float Switch Wiring						

Oil Level Monitor Float Switch Conditions and Wiring Diagram

Q155 Series Low Pressure - Fluid End Parts



Fluid End



Detail A

Disc*

* Carbide Valves include Disc as matched set.

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

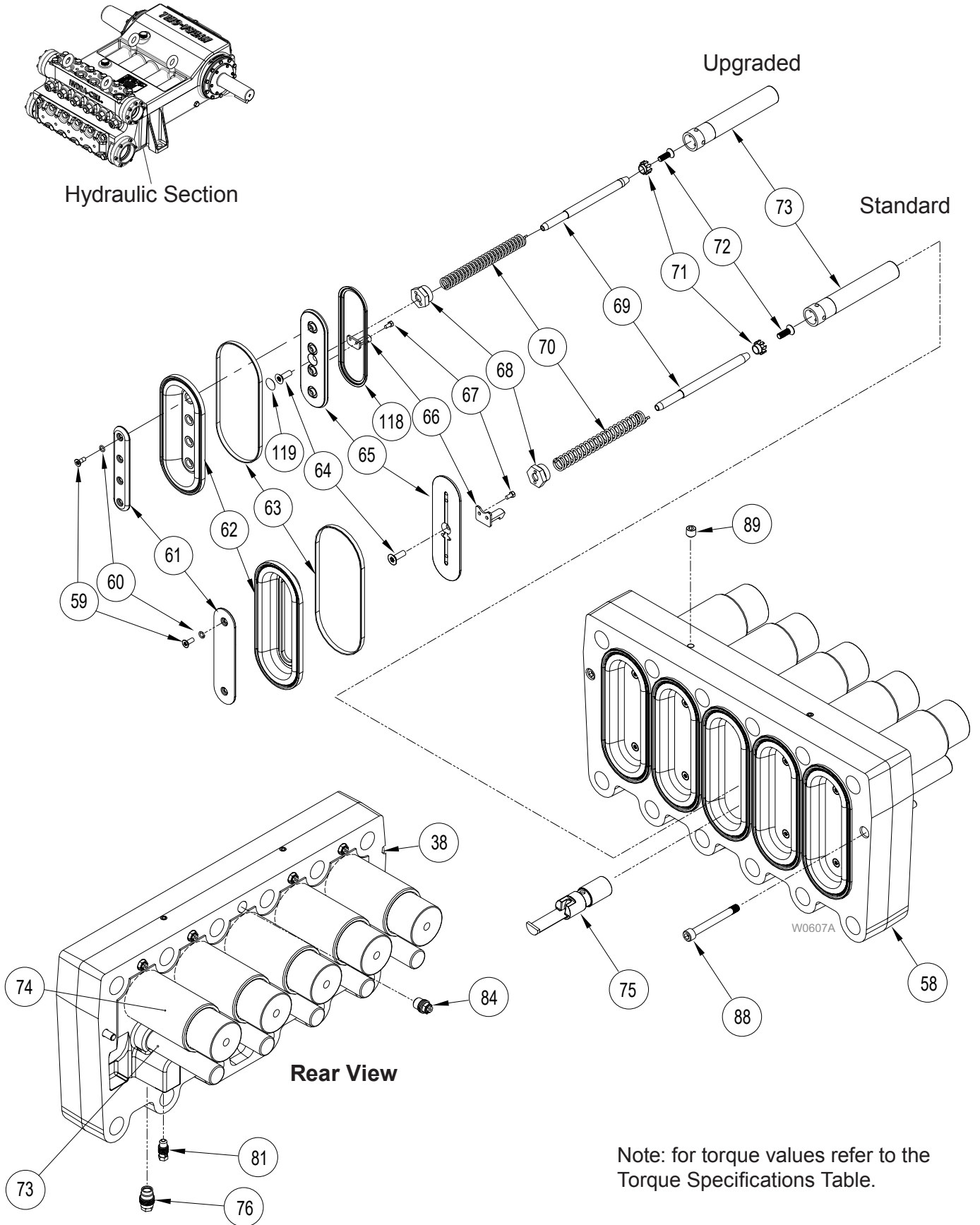
Q155 Series Low - Fluid End Parts (Cont'd)

Ref. No.	Part Number	Description	Quantity/ Pump
19	177-152	Nut, Hex, M27	12
20	177-059	Eyebolt, M20	2
90	209-300-10	Manifold, NAB	1
	209-300-11	Manifold, Austenitic SST	1
	209-300-12	Manifold, Duplex SST	1
	209-300-13	Manifold, Hastelloy	1
91	177-346-03	Retainer, Outlet, Austenitic SST.....	5
	177-346-05	Retainer, Outlet, Duplex SST.....	5
	177-346-06	Retainer, Outlet, Hastelloy.....	5
92	177-348-01	Plug, Outlet valve, Austenitic SST	5
	177-348-02	Plug, Outlet valve, Hastelloy	5
	177-348-03	Plug, Outlet valve, Duplex SST	5
93	177-381-01	Ring, Backup, Buna-N.....	5
	177-381-02	Ring, Backup, FKM	5
94	177-382-01	O-ring, Buna-N.....	5
	177-382-02	O-ring, FKM	5
	177-382-03	O-ring, EPDM.....	5
	177-382-04	O-ring, Aflas	5
95	177-314-03	Support Plug, Inlet valve, Austenitic.....	5
	177-314-05	Support Plug, Inlet valve, Duplex SST	5
	177-314-06	Support Plug, Inlet valve, Hastelloy.....	5
96	177-383-01	O-ring, Buna-N.....	5
	177-383-02	O-ring, FKM	5
	177-383-03	O-ring, EPDM.....	5
	177-383-04	O-ring, Aflas	5
97	177-052	Screw, Shoulder, M8, 12 mm	20
98*	177-302-01	Valve Seat, 17-4 SST, HT	10
	177-302-02	Valve Seat, Hastelloy C	10
	177-302-05	Valve Seat, Nitronic.....	10
	177-311-01	Valve Assembly, Carbide [includes valve (72) and seat (75)]	10
99	177-384-03	Ring, Back-up, PVDF	20
100	177-385-01	O-ring, Buna-N.....	10
	177-385-02	O-ring, FKM	10
	177-385-03	O-ring, EPDM.....	10
	177-385-04	O-ring, Aflas	10
101*	177-308-01	Valve Disc, 17-4 SST, HT.....	10
	177-308-02	Valve, Disc, Hastelloy C.....	10
	177-308-05	Valve, Disc, Nitronic.....	10
	177-311-01	Valve Assembly, Carbide [includes valve (72) and seat (75)]	10
102	177-309-01	Spring, Elgiloy.....	10
	177-309-02	Spring, Hastelloy	10
104	177-421-02	Retainer, Valve Spring, 316L SST.....	10
	177-421-03	Retainer, Valve spring, Hastelloy.....	10
105	177-014-01	Plug, Drain 316 SST.....	5
	177-014-02	Plug, Drain, Hastelloy.....	5
	177-014-03	Plug, Drain, Duplex 2205.....	5

Ref. No.	Part Number	Description	Quantity/ Pump
106	D10-047-2110	O-ring, Buna-N.....	5
	D10-047-2111	O-ring, FKM	5
	D10-047-2113	O-ring, EPDM.....	5
	D10-047-2114	O-ring, Aflas	5
107	209-121-02	Plate, Inlet support	1
108	209-110-02	Plate, Outlet support	1
109	177-044	Screw, Cap, hex-hd, M20, 50 mm....	22
110	209-721-01	Adaptor, 4" Weld Neck, Steel.....	1
	209-721-02	Adaptor, 4" Weld Neck, 316 SST	1
	209-721-03	Adaptor, 4" Weld Neck, Duplex SST	1
	209-721-04	Adaptor, 4", Weld Neck, Hastelloy.....	1
	209-726-01	Adaptor, 4", NPT, Steel.....	1
	209-762-01	Flange, 4", ANSI, Steel.....	1
	209-762-02	Flange, 4", ANSI, 316 SST	1
	209-762-03	Flange, 4", ANSI, Duplex SST.....	1
	209-762-04	Flange, 4", ANSI, Hastelloy	1
111	209-751-01	O-ring, Buna-N.....	2
	209-751-02	O-ring, FKM	2
	209-751-03	O-ring, EPDM.....	3
	209-751-04	O-ring, Aflas	3
112	209-752-01	O-ring, Buna-N.....	2
	209-752-02	O-ring, FKM	2
	209-752-03	O-ring, EPDM.....	3
	209-752-04	O-ring, Aflas	3
113	G35-081-2010	Screw, M12 X 1.75 X 40	28
114	209-738-01	Adaptor, Blind, Steel, 1/2" NPT	1
	209-729-01	Adaptor, Blind, Steel.....	1
	209-729-02	Adaptor, Blind, 316 SST	1
	209-729-03	Adaptor, Blind, Duplex SST.....	1
	209-729-04	Adaptor, Blind, Hastelloy	1
115	209-727-01	Adaptor, 3" Weld Neck, Steel.....	1
	209-727-02	Adaptor, 3" Weld Neck, 316 SST	1
	209-727-03	Adaptor, 3" Weld Neck, Duplex SST	1
	209-727-04	Adaptor, 3" Weld Neck, Hastelloy	1
	209-728-01	Adaptor, 3", NPT, Steel.....	1
	209-761-01	Flange, 3", ANSI, Steel.....	1
	209-761-02	Flange, 3", ANSI, 316 SST	1
	209-761-03	Flange, 3", ANSI, Duplex SST.....	1
	209-761-04	Flange, 3", ANSI, Hastelloy	1
116	209-735-01	Adaptor, Blind, Steel, 1" NPT	1
	209-723-01	Adaptor, Blind, Steel.....	1
	209-723-02	Adaptor, Blind, 316 SST	1
	209-723-03	Adaptor, Blind, Duplex SST.....	1
	209-723-04	Adaptor, Blind, Hastelloy	1

* Tungsten Carbide valve seat and disc are a matched set and must be installed together.

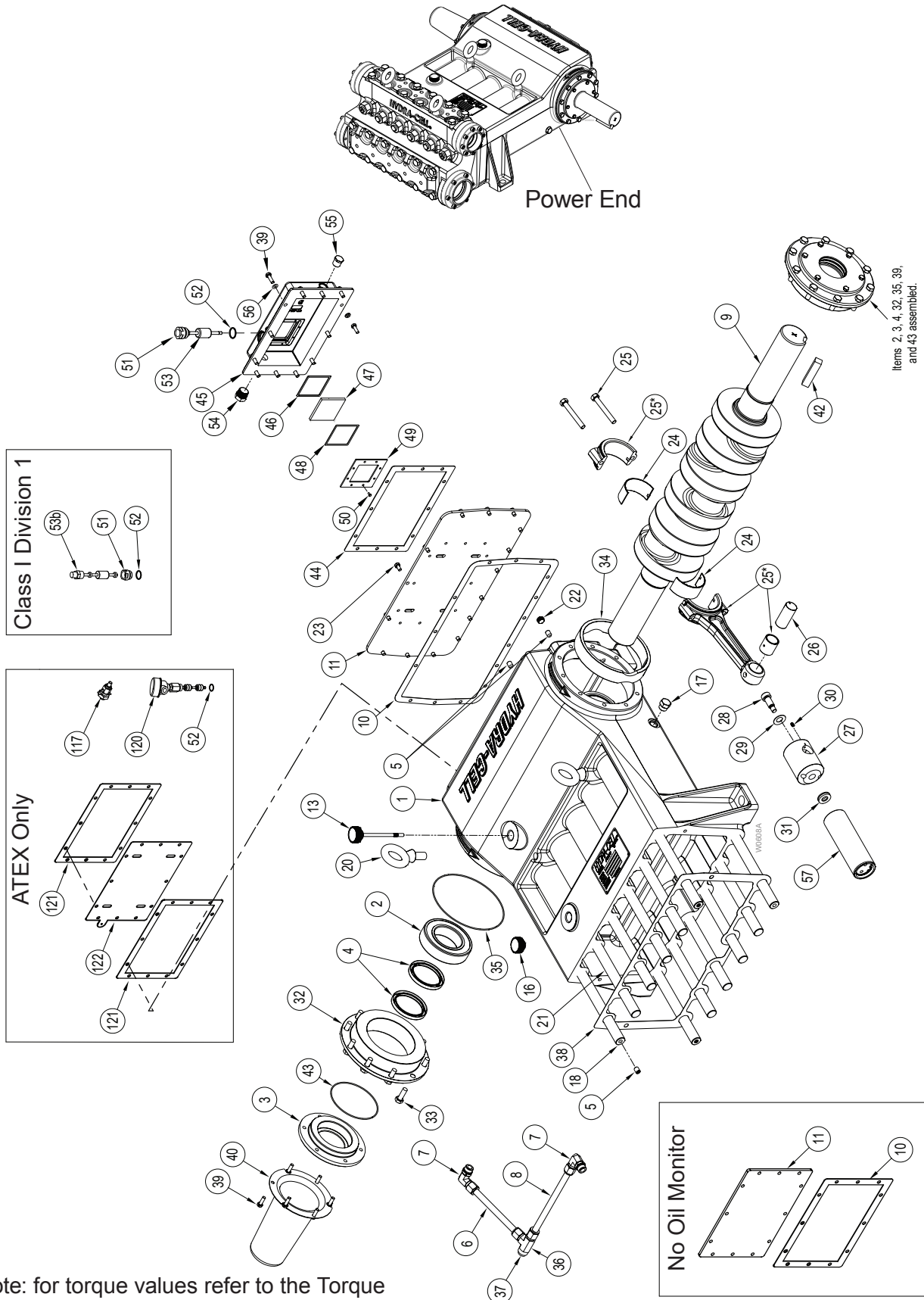
Q155 Series Low - Hydraulic Section Parts



Q155 Low - Hydraulic Section Parts (Cont'd)

Ref. No.	Part Number	Description	Quantity/ Pump	Ref. No.	Part Number	Description	Quantity/ Pump
58	209-301-02	Diaphragm Plate	1	75	177-009	Spool, Valve	5
59	177-176-01	Screw, FHSS M6 X 1.0-6G, 316 SST	10 or 20*	76	177-904	Cartridge, Underfill valve	5
	177-176-02	Screw, FHSS M6 X 1.0-6G, Hastelloy.....	10 or 20*	81	177-905	Cartridge, Overfill valve	5
	177-176-03	Screw, FHSS M6 X 1.0-6G, Duplex SST	10 or 20*	84	177-906	Cartridge, Air Bleed valve	5
60	100-217-01	O-ring, Buna-N.....	10 or 20*	88	G10-024-2010	Screw, Cap, soc-hd, M10, 90 mm	2
	100-217-02	O-ring, FKM	10 or 20*	89	177-117	Setscrew, M10, 10 mm	2
	100-217-03	O-ring, EPDM.....	10 or 20*	118	177-389	Support Ring	5
	100-217-04	O-ring, Aflas	10 or 20*	119	177-642	Plug, Screw head (upgraded).....	5
61	177-376-01	Diaphragm Follower, Austenitic SST ..	5	Note: * Upgraded diaphragm has quantity 20.			
	177-376-02	Diaphragm Follower, Hastelloy	5				
	177-376-03	Diaphragm Follower, Duplex SST	5				
	177-377-01	Diaphragm Follower, Austenitic SST (upgraded)	5				
	177-377-02	Diaphragm Follower, Hastelloy (upgraded)	5				
	177-377-03	Diaphragm Follower, Duplex SST (upgraded)	5				
62	177-375-01	Diaphragm, Buna-N	5				
	177-375-02	Diaphragm, FKM	5				
	177-375-03	Diaphragm, EPDM	5				
	177-375-04	Diaphragm, Aflas.....	5				
	177-388-01	Diaphragm, Buna-N (upgraded)	5				
	177-388-02	Diaphragm, FKM (upgraded)	5				
	177-388-03	Diaphragm, EPDM (upgraded)	5				
	177-388-04	Diaphragm, Aflas (upgraded)	5				
63	177-338	Ring, Diaphragm back-up	5				
64	177-359	Screw, Flat-hd, M8, 25 mm	5				
65	177-352	Clamp, Diaphragm	5				
	177-360	Clamp, Diaphragm (upgraded).....	5				
66	177-351	Arm, Valve	5				
	177-367	Arm, Valve (upgraded)	5				
67	177-050	Screw, Cap, hex-hd	10				
68	177-358	Cap, Bias tube	5				
69	177-355	Rod, Bias.....	5				
	177-194	Rod, Bias (upgraded)	5				
70	177-332	Spring, Bias	5				
	177-335	Spring, Bias (upgraded)	5				
71	177-312	Guide, Spring	5				
72	177-149	Screw, OH	5				
73	177-356	Tube, Bias spring.....	5				
74	177-329-01	Cylinder, E	5				
	177-329-02	Cylinder, F	5				
	177-329-03	Cylinder, H	5				

Q155 Series Low - Pressure Power End Parts



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

Q155 Series Low - Power End Parts (Cont'd)

Ref. No.	Part Number	Description	Quantity/ Pump
1	209-001-02	Crankcase	1
2	177-027	Bearing, Roller, spherical.....	2
3	177-034	Cover, Seal.....	2
4	177-028	Seal, Crankshaft.....	4
5	177-118	Setscrew, M12, 15 mm.....	12
6	209-707	Tube, 5/8 X 8 X .049.....	1
7	209-702	Fitting, 90 Elbow.....	2
8	209-708	Tube, 5/8 X 10 1/4 X .049.....	1
9	209-002-03	Crankshaft, Forged	1
10	209-026	Gasket, Back Cover.....	1
11	209-024	Back Cover (no Oil Monitor).....	1
	209-451	Back Cover, Slotted (Oil Monitor).....	1
13	177-912	Dipstick.....	1
16	D03-039-1030	Cap, Oil fill (with o-ring).....	1
17	177-038	Plug, SAE, 7/8-14	2
18	177-151	Stud, 27 mm x 300 mm, c-bore 12 mm ..	4
20	177-059	Eyebolt, M20	2
21	177-150	Stud, 27 mm x 300 mm	8
22	D25-038-2211	Plug, 3/8, socket, hex.....	6
23	177-043	Screw, Cap, hex-hd, M8, 15 mm.....	15
24	177-041	Bearing, Split shell (pair).....	5
25	177-003-02	Connecting Rod Assembly.....	5
26	177-032	Pin, Wrist.....	5
27	177-005	Slider	5
28	177-047	Screw, Shoulder, M16, 30 mm	5
29	177-030	Spring, Belleville.....	5
30	G10-082-2010	Setscrew, M6, 10 mm.....	5
31	177-031	Washer, Spherical	5
32	209-030-02	Bearing Carrier.....	2
33	G35-087-2010	Screw, M12 x 1.75, 35 mm	20
34	209-041	Bearing Shell, Main journal	2
35	H25-037-2110	O-ring, Buna-N.....	2
36	209-710	Tee Fitting, Flareless tube run	1
37	189-313	Plug, 1/2 Inch, NPT	1
38	209-013	Gasket, Diaphragm plate	1
39	177-048	Screw, Cap, hex-hd, M8, 25 mm.....	12
40	209-035	Cover, Crankshaft	1
42	177-036	Key, Crankshaft.....	1
43	D10-109-2110	O-ring, Buna-N.....	2
44	177-026	Gasket, Back cover	1
45	177-450-02	Back Cover, Oil monitor	1
46	177-456	Gasket, Sight glass, thick.....	1

Ref. No.	Part Number	Description	Quantity/ Pump
47	177-454	Glass, Sight.....	1
48	177-452	Gasket, Sight glass	1
49	177-455	Frame, Sight glass	1
50	189-565	Screw, 10-24 pan-hd.....	8
51	177-457	Adapter, Float switch.....	1
	177-461	Adapter, Float switch, Class I Div 1.....	1
52	D03-075-2110	O-Ring, Buna-N	
53	177-453-02	Switch, Float, normally closed	1
	177-453-03	Switch, Float, normally open.....	1
53b	177-453-05	Switch, Float, Class I Div 1, NC	1
	177-453-06	Switch, Float, Class I Div 1, NO	1
54	189-311	Plug, 3/4 NPT, SST	1
55	177-459	Plug, 1/2-14 NPT, SST	1
56	209-452	Washer, 8mm x 12 mm x 1 mm.....	12
57	177-324-01	Plunger, E	5
	177-324-02	Plunger, F	5
	177-324-03	Plunger, H	5
117	177-462	Stud, Earth grounding	1

ATEX Specific Parts

Ref. No.	Part Number	Description	Quantity/ Pump
120	177-453-01	Switch, Float, ATEX, discrete.....	1
121	209-026-01	Gasket, Back cover, ATEX (no oil monitor)	2
122	177-451-01	Baffle, Float switch, ATEX (oil monitor)	1

Q155 Series Low - Pump Storage/Tool Kit Parts

Pump Storage for the Q155 Low 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. Fill the oil reservoir completely to the top with the correct lubricant. Do not drain oil from the pump.

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

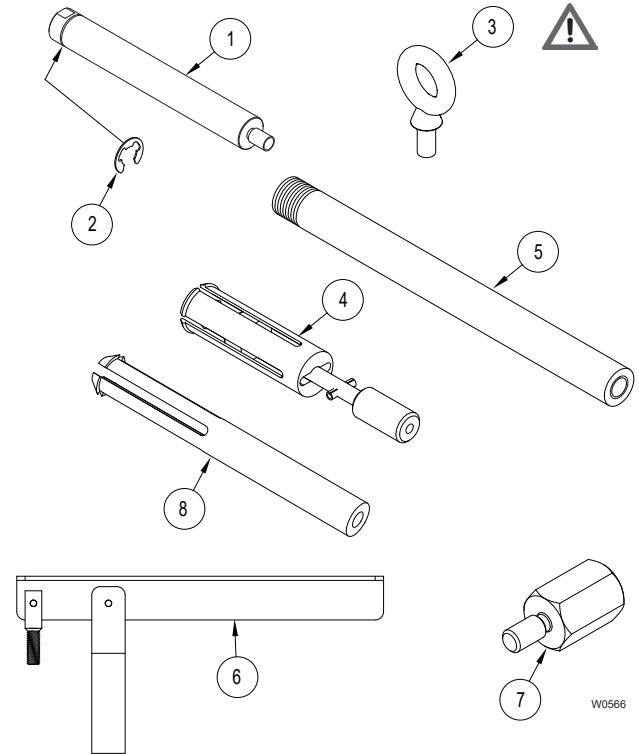
2. Flush the fluid end of the pump with a corrosion inhibitor that is compatible with the diaphragm material and process fluid.
3. Coat camshaft or crankshaft with rust preventative; wrap with wax-impregnated cloth and then with waterproof tape.
4. Plug the suction and discharge ports of the pump to 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 Hydra-Oil.

Q155 Low Tool Kit Parts

The Q155 Low Pressure Tool Kit (Part No. 177-811) contains the tools illustrated below. These tools are used to assist in the repair and maintenance of the Q155E, Q155F, and Q155H. See the maintenance sections of this manual for specific application.



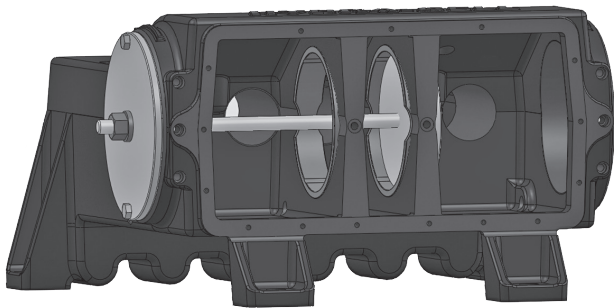
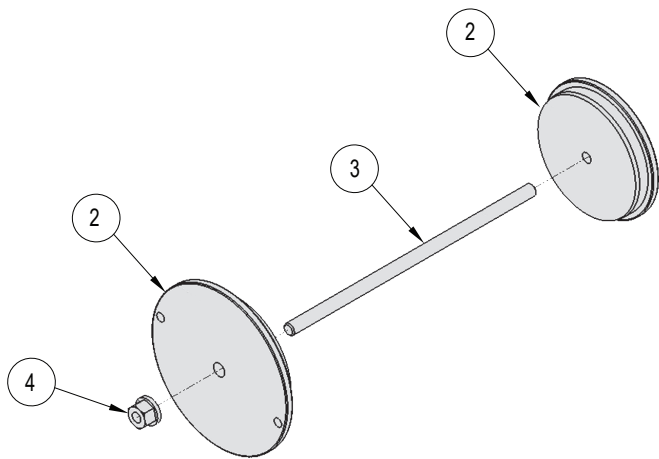
WARNING: Item 3, M10 Diaphragm Plate Eyebolt is used to lift Diaphragm Plate (52) only. Do not use to lift entire pump. Attempting to lift entire pump with Eyebolt (3) may cause personal injury or damage to equipment.

Ref. No.	Tool Part No.	Tool Description	Quantity/Kit
1	177-393	Stud Extender	4
2	177-392	Clip, E-style	4
3	177-058	Diaphragm Plate Eyebolt, M10.....	2
4	177-918	Inlet Check Valve Extractor	1
5	177-140	Outlet Check Valve Extractor, Flange	1
6	A03-124-1200	Check Valve Extractor Lever	1
7	177-157	Thread Adapter, Check Valve Extractor to Slide Hammer	1
8	177-137	Puller	1

Q155 Series - Main Bearing/Tool Kit Parts

Q155 Center Main Bearing Removal Tool (P/N 209-825)

The Q155 Center Main Bearing Removal Tool (Part No. 209-825) is used to install and uninstall both center main bronze bearings in the power end when bearing replacement is necessary. This tool can be mounted onto the crankcase on the bearing carrier boss with bearing carrier bolts (Item No. 33), and the flanged nut when turned will press the bearing in or out of the crankcase.



Ref. No.	Tool Part No.	Tool Description	Quantity/Kit
1	209-821	Plate Threaded.....	1
2	209-822	Plate, Non-Threaded.....	1
3	209-823	Rod, Threaded, 3/4-10 x 18.....	1
4	209-824	Hex Nut, Flanged, 3/4-10.....	1

Q155 Low - 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
---	---	---	---	---	---	---	---	---	----	----	----

Digit	Order Code	Description
1-4	Q155	Pump Configuration For all Q155 Series Pumps
5	L	Performance Low Pressure (Q155E, Q155F, Q155H)
6	D V	Kit Designator Diaphragm Kit Valve Kit
7	5 6	Pump Head Material Metallic Pump Head Version Metallic Pump Head Version - upgraded diaphragm with support ring (Diaphragm Kit only)
8	A E G T	Diaphragm & O-ring Material Aflas EPDM FKM Buna-N
9	D H N T X	Valve Seat Material Tungsten Carbide* 17-4 PH Stainless Steel Nitronic 50 Hastelloy C Not included in Diaphragm Kit
10	D F N T X	Valve Material Tungsten Carbide* 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	S T X	Valve Spring Retainers 316 Stainless Steel Hastelloy C Not included in Diaphragm Kit

* Tungsten Carbide valve seat and disc are a matched set and must be purchased together.

Q155 Low Pressure Kit D Contents		
Part Number**	Description	Quantity
177-375-__	Diaphragm	5
or 177-388-__	Diaphragm (upgraded)	
177-338	Ring, Back-up	5
177-217-__	O-ring	10 or 20*
177-176-__	Screw, M6 FHSS	10 or 20*
177-369	Support Ring (upgraded only)	5
177-642	Plug, Screw Head (upgraded only)	5

* Upgraded diaphragm has quantity 20.

Q155 Low Pressure Kit V Contents		
Part Number**	Description	Quantity
177-302-__	Valve Seat	10
or 177-311-01	Valve Assembly, Carbide (includes valve seat) *	
177-384-03	Ring, Back-up, PVDF	20
177-385-__	O-ring	10
177-308-__	Valve Disc	10
or 177-311-01	Valve Assembly, Carbide (includes valve seat) *	
177-309-__	Spring	10
177-421-__	Assembly, Spring retainer	10
177-381-__	Ring, Back-up	5
177-382-__	O-ring	5
177-383-__	O-ring	5

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

Hydra-Cell® is a registered trademark of Wanner Engineering, Inc.

Aflas® is a registered trademark of Asahi Glass Co., Ltd.

Buna®-N (Nitrile) is a registered trademark of E.I. Du Pont de Nemours and Company, Inc.

Elgiloy® is a registered trademark of Elgiloy Limited Partnership.

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Nitronic® 50 is a registered trademark of AK Steel Corporation.

Q155 Low - Replacement Parts Kits

Q155 Low Pressure Hydraulic End Kit Contents

(Part No. 209-810)

Part Number	Description	Quantity
177-804	Bias Rod Assembly	5
177-906	Valve, Air Bleed	5
177-904	Valve, Underfill	5
177-905	Valve, Overfill	5
177-009	Valve, Spool	5
177-013	Gasket, Diaphragm plate	1

Q155 Low Pressure Bias Rod Assembly Kit Contents

(Part No. 177-804)

Part Number	Description	Quantity
177-149	Screw, M8	1
177-312	Guide, Spring	1
177-355	Rod, Bias spring	1
177-332	Spring, Bias	1
177-050	Screw, M5	2
177-351	Arm, Valve	1
177-352	Clamp, Diaphragm	1
177-359	Screw, M8	1

Q155 Low Pressure Hydraulic End Kit Contents (Upgraded)

(Part No. 209-820)

Part Number	Description	Quantity
177-821	Bias Rod Assembly	5
177-906	Valve, Air Bleed	5
177-904	Valve, Underfill	5
177-905	Valve, Overfill	5
177-009	Valve, Spool	5
177-013	Gasket, Diaphragm plate	1

Q155 Low Pressure Upgrade Kits

Kit Part No. Diaphragm Material

209-921	FKM
209-922	Buna-N
209-923	Aflas

Part Number ** Description Quantity

177-176-01	Screw, M6, FHSS	20
100-217-__	O-ring	20
177-377-01	Follower	5
177-388-__	Diaphragm	5
177-338	Ring, back-up	5
177-149	Screw, M8, OHMS	5
177-312	Guide, spring	5
177-194	Rod, bias	5
177-335	Spring, bias	5
177-050	Screw, M5	6
177-367	Arm, valve	10
177-369	Support Ring	5
177-360	Clamp, Diaphragm	5
177-359	Screw, M8	5
177-642	Plug, screw head	5
209-391	Name Plate, diaphragm kit	1
177-180	Screw, M10	1

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

Q155 Low Pressure Bias Rod Assembly Kit Contents (Upgraded)

(Part No. 177-821)

Part Number	Description	Quantity
177-149	Screw, M8	1
177-312	Guide, Spring	1
177-194	Rod, Bias	1
177-335	Spring, Bias	1
177-050	Screw, M5	2
177-367	Arm, Valve	1
177-369	Ring, Support	1
177-360	Clamp, Diaphragm	1
177-359	Screw, M8	1
177-642	Plug, Screw head	1

Q155 - 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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