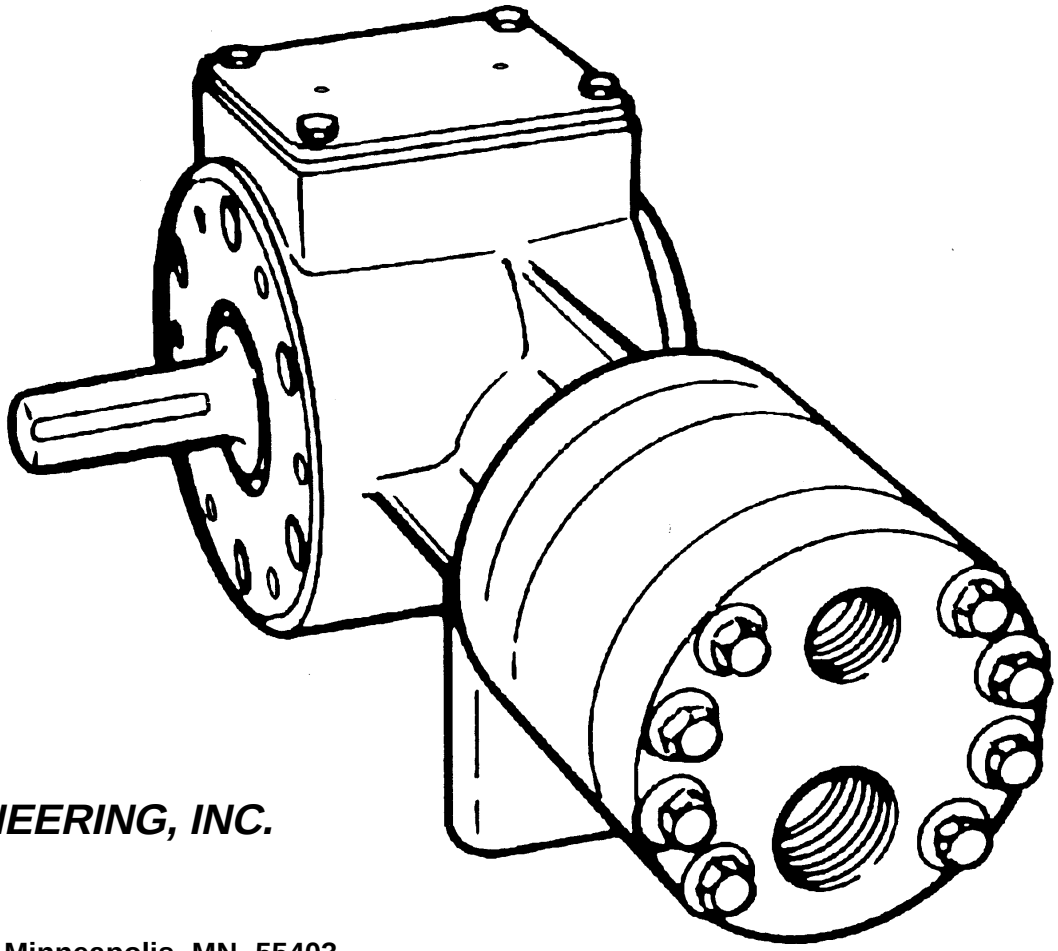
HOME

INSTALLATION & SERVICE

Hydra-Cell®

INDUSTRIAL PUMPS

MODELS: F-20 F-21 F-22
G-20 G-21 G-22



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Location

NOTE: The numbers in parentheses are the Ref. Nos. on the illustrations in the Parts Manual.

Locate the pump as close to the 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, and removing the manifold (3) and valve plate (21).

Mounting

The pump shaft can be rotated in either direction.

To prevent vibration, securely attach the pump or motor to a 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.

On a close-coupled system, coat the motor shaft liberally with Loctite® Nickel Anti-Seize #77164.

Important Precautions

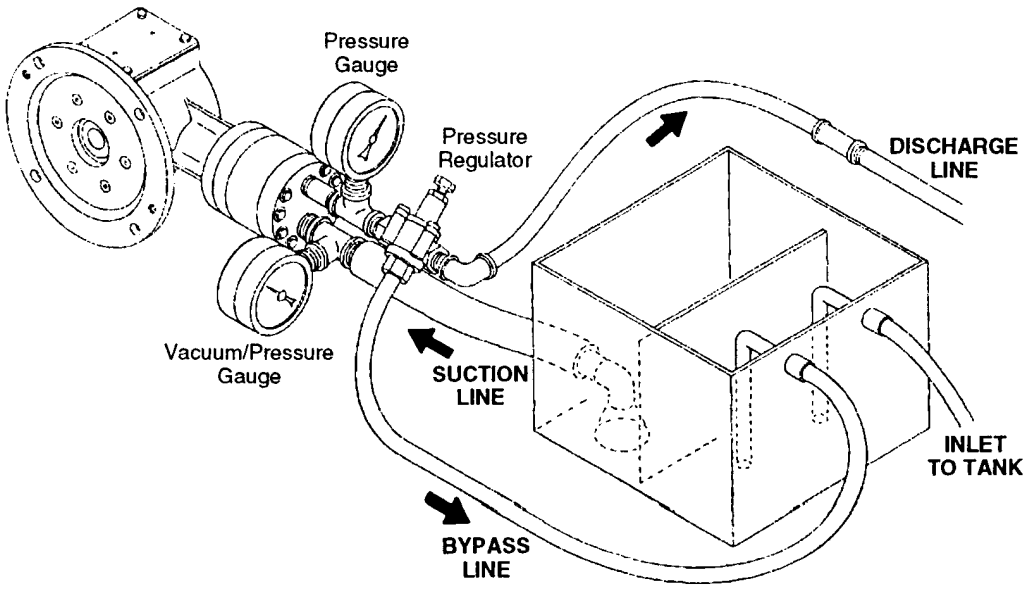
Adequate Fluid Supply. To avoid cavitation and premature pump failure, be sure that the pump will have an adequate fluid supply and that the inlet line will not be obstructed. See “Inlet Piping”.

Positive Displacement. This is a positive-displacement pump. To avoid severe system damage if the discharge line ever becomes blocked, 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 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, or in the regulator bypass line.

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



Installation

Inlet Piping (Suction Feed)

CAUTION: When pumping at temperatures above 160° F, use a pressure-feed system.

Install draincocks 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, vacuum at the pump inlet should not exceed 7 in. Hg. **Do not supply more than one pump from the same inlet line.**

Supply Tank

If a supply tank is used, it must be large enough. As a general rule, the tank size (in gallons) should be at least twice the flow rate (in gpm). The tank must have baffles to prevent aeration and turbulence. Also, the tank inlet and bypass inlet must be separated from the tank outlet by a baffle (see the illustration on Page 3).

Fluid Supply

The fluid supply at the pump inlet must at least exceed the flow rate required of the pump. Connect to the inlet port of the pump, marked “IN” (this is always the larger of the two ports).

Hose Size and Routing

Use the shortest, most-direct route from the supply tank to the pump. If elbows are needed, 45° are recommended. Any restrictions in the inlet piping may cause pump output to drop. The reduced flow reduces pump efficiency and may cause premature failure. **Do not install any 90° elbows in the pump inlet.**

- Use flexible noncollapsible hose between the pump and rigid piping or supply tank.
- Use the largest practical hose. The smallest permissible size is 3/4 in. I.D.
- All valves, fittings, and unions must also have 3/4 in. minimum I.D.
- Support the pump and piping independently.
- Make sure all joints are air-tight.

Minimizing Friction Losses

To minimize friction losses in the inlet piping:

- Eliminate filters
- Use as coarse a filter screen as practical for your application
- For high-viscosity materials, increase the size of the hose and all plumbing fittings to a minimum of 1 in. I.D. Use short plumbing runs.

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 100 psi; if it could get higher, install an inlet pressure regulator. **Do not supply more than one pump from the same inlet line.**

Inlet Calculations

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 = Pt + Hz - Hf - Ha - Pvp

where:

Pt = Atmospheric pressure

Hz = Vertical distance from surface liquid to pump centerline (if liquid is below pump centerline, the Hz is negative)

Hf = Friction losses in suction piping

Ha = Acceleration head at pump suction

Pvp = 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_2O)	Altitude (ft)	Pressure (ft of H_2O)
0	33.9	1500	32.1
500	33.3	2000	31.5
1000	32.8	5000	28.2

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.

Ha = (L x V x N x C) ÷ (K x G)

where:

Ha = 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 = GPM x (0.408 ÷ pipe ID^2)]

N= RPM of crank shaft

C= Constant determined by type of pump — use 0.10 for the Hydra-Cell pump

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/sec^2)

Minimizing Acceleration Head

To minimize the acceleration head:

- Keep inlet lines less than 3 ft long
- Use at least 3/4-in. I.D. inlet hose
- Use soft hose (low-pressure hose, noncollapsing) for the inlet lines
- Minimize fittings (elbows, valves, tees, etc.)
- Use a suction stabilizer on the inlet.

Installation

Discharge Piping

NOTE: Consult the Factory before manifolding two or more pumps together.

NOTE: Single-acting pumps create a pulsing flow. Using pulsation dampening devices in the discharge line can reduce or eliminate this.

Hose and Routing

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

Connect to the outlet port of the pump, marked “OUT” (this is always the smaller of the two ports).

Select pipe or hose that meets the pressure requirements of the system. Working pressure of the hose should not exceed one-fourth of the bursting pressure.

Use about 6 ft of flexible hose between the pump and rigid piping.

Support the pump and piping independently.

Pressure Regulation

Install a pressure regulator or unloader in the discharge line, within 6 in. of the pump outlet. Bypass pressure must not exceed the pressure limit of the pump.

Route the bypass line to the supply tank, or to the suction line as far as possible from the pump (to reduce the chance of turbulence, cavitation, and pump overheating).

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 regulator or relief valve.

Provide for permanent or temporary installation of a pressure gauge to monitor the discharge pressure at the pump.

For additional system protection, install a “pop-off” safety relief valve in the discharge line, downstream from the pressure regulator.

Before Initial Start-Up

Before you start the pump, be sure that:

- All shut-off valves are open, and the pump has an adequate supply of fluid.
- All connections are tight.
- The oil reservoir beneath the reservoir diaphragm (71) is completely full. NOTE: The reservoir is filled and sealed at the factory. If you are unsure about the oil level, remove the cover (70) and slowly lift the diaphragm (71). Refer to Service Procedure #6, “Fill and Seal the Oil Reservoir”, in the Fluid-End Service Section.
- The relief valve on the outlet of the pump is adjusted so the pump starts under minimum pressure.
- All pulleys and belts are properly aligned, and belts are tensioned according to specification.
- All pulleys and belts have adequate safety guards.Initial

Start-Up Procedure

1. Turn on power to the pump motor.
2. Check the inlet pressure or vacuum. To maintain maximum flow, inlet vacuum must not exceed 7 in. Hg. Inlet pressure must not exceed 100 psi.
3. Listen for any erratic noise and look for unsteady flow.
4. Adjust the discharge pressure regulator to the desired operating and bypass pressures. Do not exceed the maximum pressure rating of the pump.
5. After the pressure regulator is adjusted, set the “pop-off” safety relief valve at 100 psi higher than the desired operating pressure.

Maintenance

NOTE: The numbers in parentheses are the Ref. Nos. on the illustrations in the Parts Manual.

Daily

Check the oil reservoir for level and condition of the oil. There should be no trapped air under the oil reservoir diaphragm (71). Refer to Service Procedure #6, “Fill and Seal the Oil Reservoir”, in the Fluid-End Service Section.

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, the diaphragm (22) may be damaged. Refer to the Fluid-End Service Section. Do not operate the pump with a damaged diaphragm.

CAUTION: 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 100 hours of operation, and every 1000 operating hours thereafter. When changing, remove the drain plug (69), and the oil reservoir cover (70) and diaphragm (71). Allow all oil and contaminant to drain out.

CAUTION: Do not turn the drive shaft while the oil reservoir is empty.

Check the inlet pressure or vacuum periodically with a gauge.

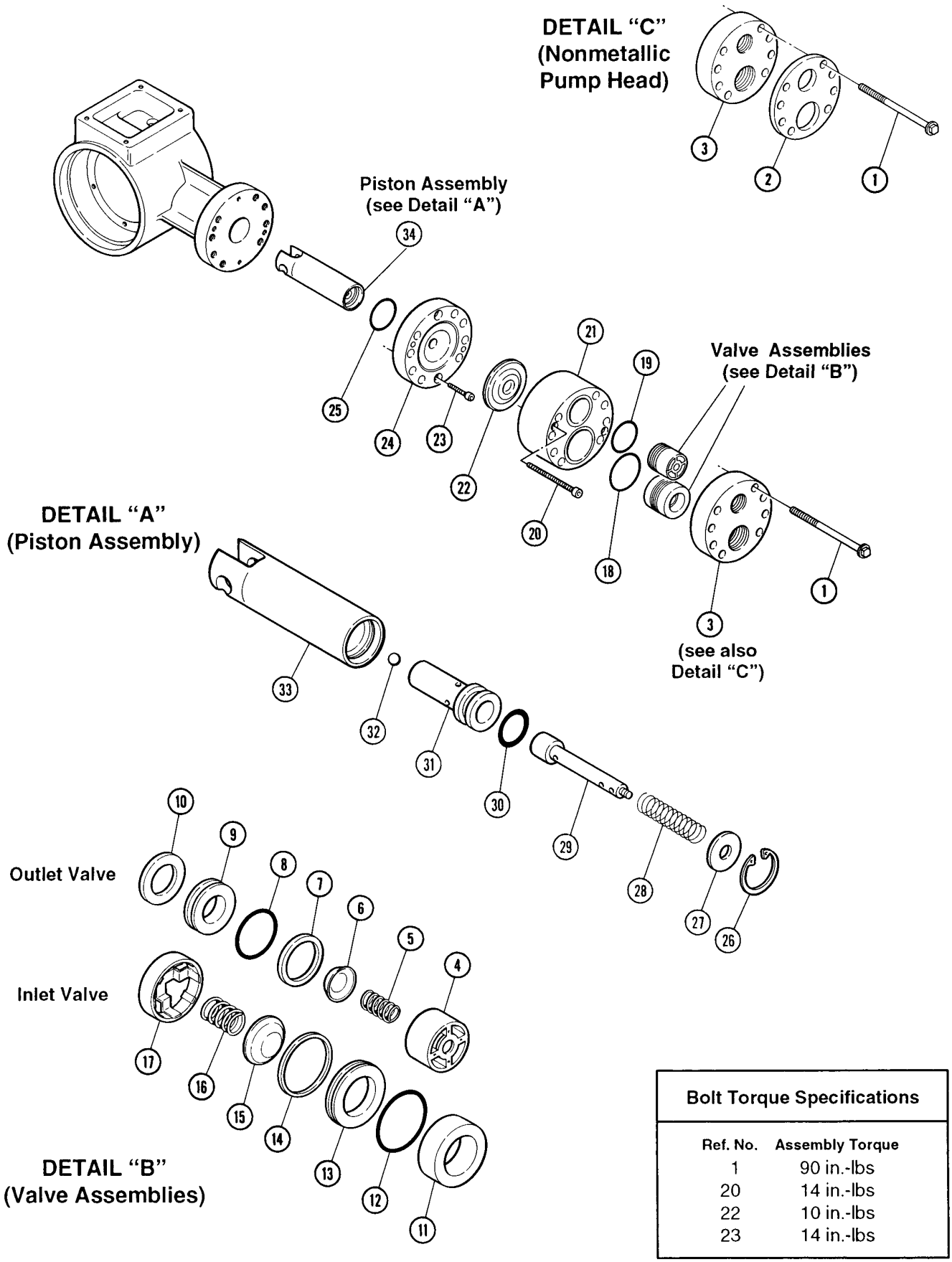
CAUTION: Protect the pump from freezing. Refer also to the “Shutdown Procedure”.

Shutdown Procedure During Freezing Temperatures

1. Disconnect the inlet and outlet piping from the pump.
2. Remove the inlet port plug in the pump manifold, and drain.
3. Open any draincocks in the piping.
4. Start the pump, and allow it to run until all fluid is removed from the pump head.
5. Stop the pump, and reinstall the inlet plug.
6. Fill the pump with antifreeze.

When you put the pump back into service, thoroughly flush the antifreeze and dispose of it properly.

Service (Fluid End)



Bolt Torque Specifications	
Ref. No.	Assembly Torque
1	90 in.-lbs
20	14 in.-lbs
22	10 in.-lbs
23	14 in.-lbs

Service (Fluid End)

NOTE: The number in parentheses are the Reference numbers on the illustration at right (also shown in the Parts Manual).

This section explains how to disassemble and inspect all easily-serviceable parts of the pump. Repair procedures for the hydraulic end (oil reservoir) of the pump are included in a later section of the manual.

NOTE: All bolts, nuts, and screws are metric sizes.

CAUTION: Do not disassemble the hydraulic end unless you are a skilled mechanic. For assistance, contact Wanner Engineering (612-332-5681) or the distributor in your area.

1. Remove Manifold (3)

a. Remove all eight bolts (1) around the manifold.

b. Remove the manifold (3).

c. Inspect the manifold for warping or wear around the inlet and outlet ports. If wear is excessive, replace the manifold or return it to Wanner Engineering for resurfacing.

To check if the manifold is warped, place a straightedge across it. A warped manifold should be replaced.

2. Inspect Valves (4-17)

The inlet and outlet valve assemblies are different (the inlet valve is larger) and face in opposite directions. Inspect each valve as follows:

a. Check the spring retainers (4,17), and replace if worn.

b. Check the valve springs (5,16). If shorter than a new spring, replace them (do not just stretch the old spring).

c. Check the valve poppets (6,15). If worn excessively, replace them.

d. Remove the valve seats (9,13). A seat remover is included in the Wanner Tool Kit.

Inspect the valve seats for wear, and replace if necessary. A new O'ring (8,12) should be installed.

e. Check the dampening washers (10,11), and replace if worn.

f. Reinstall the valve assemblies:

- Clean the valve ports and shoulders with emery cloth, and lubricate them with lubricating gel or petroleum jelly (do not use petroleum products when installing EPDM O-rings).
- Install the O-rings (8,12) on the valve seats (9,13).
- **Inlet Valve.** Insert the spring retainer (17) into the valve plate, then insert the spring, valve, Tetra seal, valve seat, and dampening washer (16 - 11). A flat O-ring [Tetra seal] (14) goes between the retainer and seat.
- **Outlet Valve.** Insert the dampening washer, valve seat, Tetra seal, valve, and spring, then the retainer. Install the flat O-ring between the retainer and seat.

3. Inspect and Replace Diaphragm (22)

a. Remove the two capscrews (20) from the valve plate (21). Use a 3-mm Allen wrench — included in the Wanner Tool Kit.

b. Lift the diaphragm by one edge, and turn the pump shaft until the diaphragm moves up to "top dead center". This will expose machined cross holes in the plunger shaft behind the diaphragm.

NOTE: **If the pump has a hollow shaft, use the shaft rotator from the Wanner Tool Kit.**

c. Insert the diaphragm wrench (from the Wanner Tool Kit) through one of the machined cross holes, to hold the diaphragm up. The proper size tool is included in the Wanner Tool Kit. (Don't remove the tool until the new diaphragm is installed in step "G" below).

d. Unscrew the diaphragm. Use an 8-mm or 5/16-in. open-end wrench, and turn counterclockwise.

e. Inspect the diaphragm carefully. A damaged 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, or by an ice particle.
- **Diaphragm pulled away from the 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.
- **Diaphragm edge chewed away.** Usually caused by overpressurizing the system.

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

f. Clean away any spilled oil. Apply Loctite #242 Threadlocker to the threads of the new diaphragm (or the old one, as appropriate).

g. Install the diaphragm and tighten to 10 in-lbs.

Service (Fluid End)

4. Flush Contaminant from Hydraulic End (only if a diaphragm has ruptured)

a. With the valve plate and manifold still removed (see above), remove the oil drain cap (69), and the oil reservoir cover (70) and diaphragm (71). Allow all oil and contaminant to drain out.

b. Fill the reservoir with kerosene or solvent, manually turn the pump shaft to circulate the kerosene, and drain. Dispose of this contaminated fluid properly.

CAUTION: If you have an EPDM diaphragm, or if food grade oil is in the reservoir, do not use kerosene or solvents. Instead, flush with the same lubricant that is in the reservoir. Pumps with an EPDM diaphragm have an "E" as the 7th digit of the Model No.

c. Repeat the flushing procedure (step "b" above).

d. Fill the reservoir with fresh oil, manually turn the pump shaft to circulate the oil, and drain once again.

e. Refill the reservoir. If the oil appears milky, there is still contaminant in the reservoir. Repeat the flushing procedure until the oil appears clean.

5. Prime the Hydraulic Cell

a. With the pump **horizontal**, fill the reservoir with the appropriate Hydra oil for the application.

b. All air in the oil within the hydraulic cell (behind the diaphragm) must be forced out by turning the shaft — and thus pumping the piston. A shaft rotator is included in the Wanner Tool Kit.

Turn the shaft until a **bubble-free** flow of oil comes from behind the diaphragm. Watch the oil level in the reservoir; if it gets too low during priming, air will be drawn into the piston (inside the hydraulic end). This will cause the pump to have a loss in flow, and you will have to start over again with priming the hydraulic cell.

c. Wipe excess oil from the diaphragm plate and diaphragm.

6. Fill and Seal the Oil Reservoir

a. The oil reservoir diaphragm (71) protrudes down into the pump housing approximately 1/4 to 3/8 in. Add oil, if required, so that when the diaphragm is set into the reservoir all air is pushed out.

Take care not to allow any oil overflow to get between the pump housing (62 or 66) and the cover (54). This may result in an apparent oil leak later, when the pump is put into use and heats up.

b. Install the cover (70) using the four bolts.

c. Wipe off any excess oil that got squeezed out onto the outside of the pump housing.

NOTE: The diaphragm (71) will flex up and down slightly as the pump operates. The vent holes in the reservoir cover (70) allow this action to freely occur.

7. Reinstall Valve Plate (21) and Manifold (3)

a. Reinstall the valve plate (21), with the valve assemblies installed as outlined above, onto the diaphragm plate (24).

b. Reinstall the O-rings (18,19) onto the valve plate (21). Use petroleum jelly or lubricating gel to hold them in place (do not use petroleum products when installing EPDM O-rings).

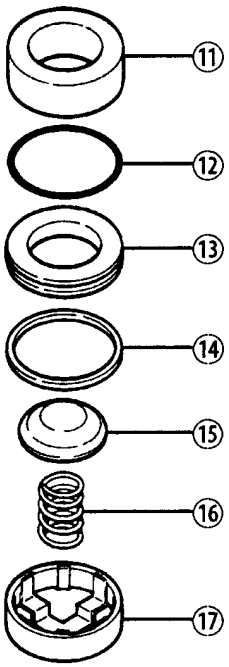
c. Reinstall the manifold onto the valve plate.

d. Insert all bolts (1) around the edge of the manifold, and alternately tighten opposite bolts until all are secure. Torque to 90 in.-lbs.

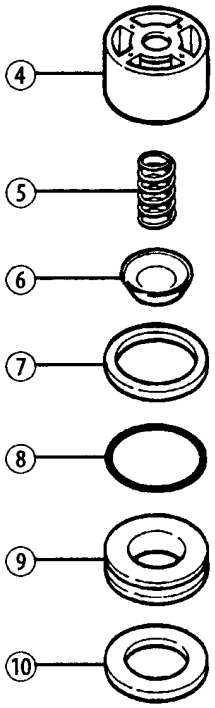
e. Recheck all bolts for tightness.

Service (Fluid End)

Valve Assembly (Inlet)



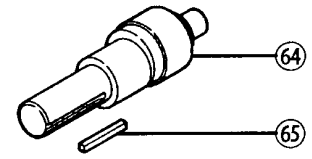
Valve Assembly (Outlet)

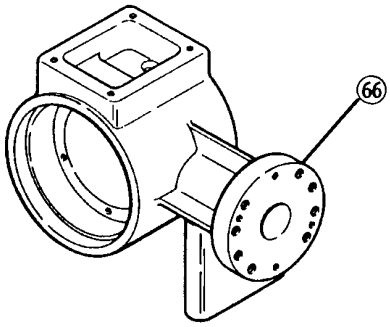


Service (Hydraulic End)

F21 Pump

- **Uses extended shaft (64) instead of (58)**
- **Housing (66) has legs**
- **Does not include flange (51) and screws (50)**



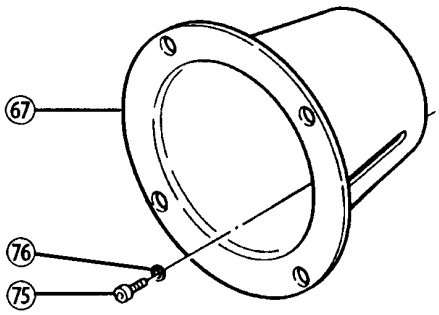


F20 Pump shown

Refer to detail drawings for other models.

F22 Pump

- **Uses Extended Flange Accessory (67) instead of (51)**



Bolt Torque Specifications	
Ref. No.	**Assembly Torque**
50	35 in.-lbs
52	14 in.-lbs
72	10 in.-lbs
75	35 in.-lbs

Service (Hydraulic End)

NOTE: The numbers in parentheses are the Reference numbers on the illustration at right (also shown in the Parts Manual).

This section explains how to disassemble and inspect the hydraulic end (oil reservoir) of the pump.

CAUTION: Do not disassemble the hydraulic end unless you are a skilled mechanic. For assistance, contact Wanner Engineering (612-332-5681) or the distributor in your area.

Depending on the repair you are attempting, you may or may not have to remove the motor from a direct-drive pump/motor unit.

Internal piston components (26 - 32) can be serviced without removing the motor or crankshaft. The motor and crankshaft must be removed to service the connecting rod (59), piston (33), crankshaft (58), front bearing (60), back bearing (57), or seal (56).

To Service Piston Without Removing Motor or Crankshaft

1. Disassemble Piston

Remove the manifold, valve plate, diaphragm plate and diaphragm, and drain the oil from the pump (see the Fluid-End Service Section):

a. Remove the snap ring (26) from the piston, using a standard #1 snap-ring pliers.
b. Pull out the valve plunger (29). This also removes the washer (27) and spring (28).
c. (31), and pull the cylinder out of the piston. Be careful not to damage the piston.
d. Inspect all parts, and replace the O-ring and any other parts that are worn or may be damaged.

2. Reassemble Piston

a. Tip the pump so the piston is upright.
b. Drop the ball (32) into the opening in the bottom of the piston.
c. Insert the valve plunger (29) into the valve cylinder (31). Slide the spring (28) over the plunger, inside the valve cylinder.
d. Slide the assembled valve cylinder, plunger, and spring (28 - 31) into the piston (33).
e. Insert the washer (27) over the plunger.
f. Using the snap-ring pliers, insert the snap ring (26) into the piston.

To Remove Motor from Direct-Coupled Unit (F20)

1. Disassemble Motor from Pump

a. Remove the four bolts and flat washers that secure the pump and motor together.
b. Install two of the bolts into the threaded holes in the pump flange (51).
c. Alternately turn the bolts clockwise until the pump and motor separate.

2. Reassemble Motor to Pump

a. Thoroughly clean the motor shaft and the hollow pump shaft.
b. Apply a liberal amount of Loctite Nickel Anti-Seize #77164 to the pump shaft.
c. Install the shaft key into the motor shaft keyway.
d. Slide the motor shaft into the hollow pump shaft.

   CAUTION: When assembling this pump to the direct-coupled motor, be careful that the shaft key remains in the motor shaft keyway and does not ride up the keyway and contact the shaft seal (which would cause premature seal failure). Incorrect key placement could also cause the hollow pump shaft to fail.

   Use a screwdriver to move the shaft key back in the motor shaft keyway as the motor and pump are drawn together.
e. Reinstall the four bolts and flat washers.

To Service Remainder of Hydraulic End

1. Remove Pump Housing

a. Remove the manifold, valve plate, and diaphragm, as outlined in the Fluid-End Service Section.
b. Drain the oil from the pump housing by removing the drain plug (69), and the oil reservoir cover (70) and diaphragm (71).
c. Stand the pump on end, with the drive shaft up.
d. Remove the bolts (52) that secure the cover (54) to the housing (62 or 66). Use a 5-mm socket wrench. Save the O-rings (53).
e. Remove the cover and the cover O-ring (55).
f. Remove the crankshaft (58) by pulling it through the connecting rod (59).

Service (Hydraulic End)

2. Remove and Replace Piston

To remove the piston (33), first remove the connecting rod (59) and pin (61) by pressing the pin through the connecting rod.

Reverse the process to reinstall the piston.

Refer to Steps 5 and 6 below to replace the diaphragm and reassemble the pump.

3. Reassemble Housing and Casting

NOTE: Inspect the shaft seal (56) before continuing. If it looks damaged in any way, replace it. Refer to “Replace Shaft Seal” below.

a. Stand the pump on end.
b. With the piston and connecting rod in place, reinstall the crankshaft by threading it through the connecting rod.
c. Reinstall the cover, cover O-ring, and bolts (with their O-rings).

4. Replace Shaft Seal

a. Press the back bearing (57) and seal (56) out of the cover (54). Discard the seal.
b. Apply a coating of Loctite High-Performance Pipe Sealant With Teflon®, or a comparable product, to the outer surface of a new seal and the inside surface of the opening in the back cover (54) where the seal will rest.
c. Press the new seal into the back cover.
d. Inspect the bearing (57). If pitted or damaged, replace it.

5. Reinstall Diaphragm

a. Screw the plunger puller (from the Wanner Tool Kit or Repair Kit) into the plunger (29). Pull out to expose the cross hole in the plunger. Rotate the shaft until the piston is at top dead center.
b. Insert the diaphragm wrench (from the Wanner Tool Kit), or similar dowel-type object, through the plunger hole — to hold the plunger away from the diaphragm plate (24), and to keep the plunger from turning when the diaphragm is being installed.
c. Apply a small amount of Loctite #242 to the threads of the diaphragm (be sure the threads are clean).
d. Set the diaphragm (22) on the plunger (29), ridge-side out. Screw the diaphragm onto the plunger.
e. Hold the diaphragm wrench, and tighten the diaphragm to 10 in.-lbs of torque.
f. Fill the reservoir with fresh oil and prime the pump, as outlined in the Fluid-End Service Section.

6. Reassemble Pump

Fill and seal the oil reservoir, then reassemble the pump as outlined in the Fluid-End Service Section.

Troubleshooting

Cavitation

- Inadequate fluid supply caused by:
  - 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
  - NPSHa is less than NPSHr
- Fluid too hot for inlet suction piping system.
- Air entrained in fluid piping system.
- Aeration and turbulence in supply tank.
- Inlet suction vacuum too high.

Symptoms of Cavitation

- Excessive pump valve noise
- Premature failure of spring or retainer (4,5,16,17)
- Volume or pressure drop
- Rough-running pump

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 (22)
- 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
- Abrasives in the fluid
- Valve incompatible with corrosives in the fluid
- Pump running too fast
- Worn and slipping drive belt(s)
- Worn spray nozzle(s)

Pump Runs Rough

- Worn pump valves
- Airlock in outlet system
- Oil level low
- Wrong weight 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 (22)
- Foreign material in inlet or outlet valve
- Damaged diaphragm (22)
- Broken valve spring (5,16)

Premature Failure of Diaphragm (22)

- Frozen pump
- Puncture by a foreign object
- Elastomer incompatible with fluid being pumped
- Pump running too fast
- Excess pressure

Water in Oil Reservoir

- Condensation
- Ruptured diaphragm (22)
- Hydraulic cell not properly primed after diaphragm (22) replacement
- Frozen pump

Strong Water Pulsations

NOTE: Small pulsations are normal with a single-acting pump.

- Foreign object lodged in pump valve
- Loss of prime in hydraulic cell because of low oil level
- Air in suction line
- Valve spring (5,16) broken
- Cavitation
- Aeration or turbulence in supply tank

Valve Wear

- Normal wear

Pump Runs, But Fluid Doesn't Flow

- Unit air-locked

Loss of Oil

- External seepage
- Rupture of diaphragm (22)
- Frozen pump
- Worn shaft seal
- Oil drain, fill cap, or oil reservoir cover 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

Limited Warranty

Wanner Engineering, Inc. extends to the original purchaser of equipment manufacturerd by it and bearing its name, a limited one-year warranty from the date of purchase against defects in material or workmanship, provided that the equipment is installed and operated in accordance with the recommendations and instructions of Wanner Engineering, Inc. Wanner Engineering, Inc. will repair or replace, at its option, defective parts without charge if such parts are returned with transportation charges prepaid to Wanner Engineering, Inc., 1204 Chestnut Avenue, Minneapolis, Minnesota 55403.

This warranty does not cover:

1. The electric motors (if any), which are covered by the separate warranties of the manufacturers of these components.

2. Normal wear and/or damage caused by or related to abrasion, corrosion, abuse, negligence, accident, faulty installation or tampering in a manner which impairs normal operation.

3. Transportation costs.

This limited warranty is exclusive, and is in lieu of any other warranties (express or implied) including warranty of merchantability or warranty of fitness for a particular purpose and of any noncontractual liabilities including product liabilities based on negligence or strict liability. Every form of liability for direct, special, incidental or consequential damages or loss is expressly excluded and denied.

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