

INSTRUCTIONS-PARTS LIST

This manual contains **IMPORTANT INSTRUCTIONS and WARNINGS.**
READ AND RETAIN FOR REFERENCE



307-691

Rev H
 Supersedes G

CORROSION-RESISTANT 'CROWN IMPERIAL PUMPS

250 psi (17 bar) *MAXIMUM WORKING PRESSURE*

*Electric, Multi-Stage, Centrifugal,
 Open Stand-Mounted Pumps for Circulating Systems*

PUMP MODEL CHART

No. of Stages	Standard Size Pumps For 60" High Tanks		High Profile Pumps For 85" High Tanks	
	Model No.	Series	Model No.	Series
5	218-635	A	220-275	A
6	218-636	A	220-276	A
7	218-637	A	220-277	A
8	218-638	A	220-278	A
9	218-639	A	220-279	A
10	218-640	A	220-280	A
11	218-641	A	220-281	A
12	221-012	A	221-112	A
13	221-013	A	221-113	A
14	221-014	A	221-114	A

PUMP MOUNTING STANDS

Must be purchased separately.

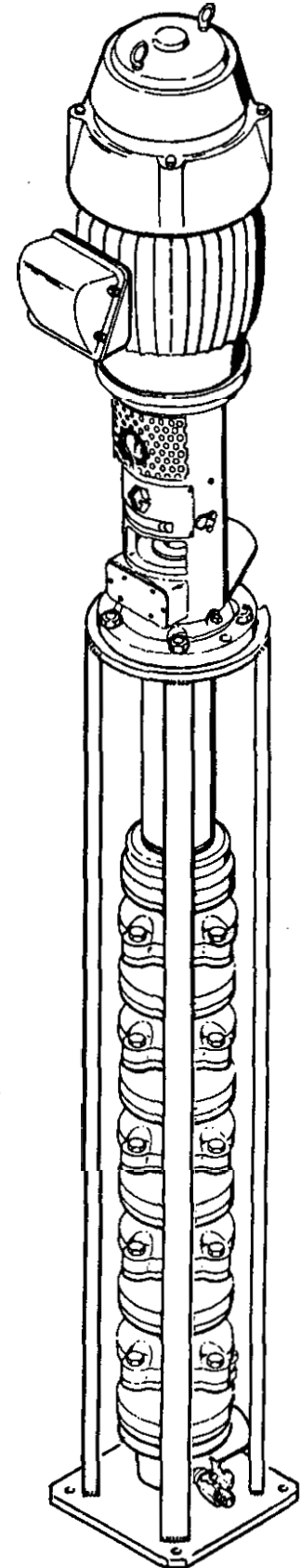
- 218-631 for standard size pump
- 220-266 for High Profile size pump

CONTENTS

Warnings	2
Typical Installation	2
Installation	3
Operation	4
Lubrication	5
Troubleshooting	6
Repair	7
Dimensions	11
Parts Drawing	12
Parts List	13
How To Order Replacement Parts	14
Accessories	14
Technical Data	Back Cover
Warranty	Back Cover

STANDARD SIZE
 PUMP SHOWN

MOTOR AND STAND
 NOT INCLUDED
 WITH PUMP



WARNING

GROUNDING AND ELECTRICAL WIRING

Be sure the pump, the object being sprayed, and all related equipment is properly grounded to reduce the risk of shock, fire or explosion caused by static sparking which can result in serious bodily injury and property damage.

Have a qualified, licensed electrician perform all wiring and grounding in accordance with all applicable safety codes in your area.

Consult the electric motor manufacturer for the proper heater-breaker requirements.

SYSTEM PRESSURE

Never operate the pump at more than **250 psi (17 bar) MAXIMUM WORKING PRESSURE** to reduce the risk of component rupture which could result in serious bodily injury and property damage, and cause premature bearing and seal failure.

Never run the pump for more than **10 seconds** without fluid circulating through it to avoid overheating the pump and damaging it.

KEEP CLEAR OF MOVING OR HEATED PARTS

Keep your fingers and hands away from the moving parts in the pump housing while the pump is operating to reduce the risk of amputation.

Keep all tools, etc. away from the moving parts to reduce the risk of accidentally catching and breaking them in the moving parts, which could cause broken pieces to be projected into the air, and cause serious bodily injury as well as pump damage.

Do not touch the pump housing or pump shaft couplers, which become heated during operation, until they have cooled, to reduce the risk of burning yourself.

Always shut off all electric power to the pump before attempting to service or adjust the pump to reduce the risk of electric shock and serious injury from moving parts.

Before removing the pump for repair, shut off the electric power, relieve the system pressure, and drain the pump by opening the drain valve (Y) at the pump base, to reduce the risk of serious bodily injury from shock, moving parts, or pressurized fluid.

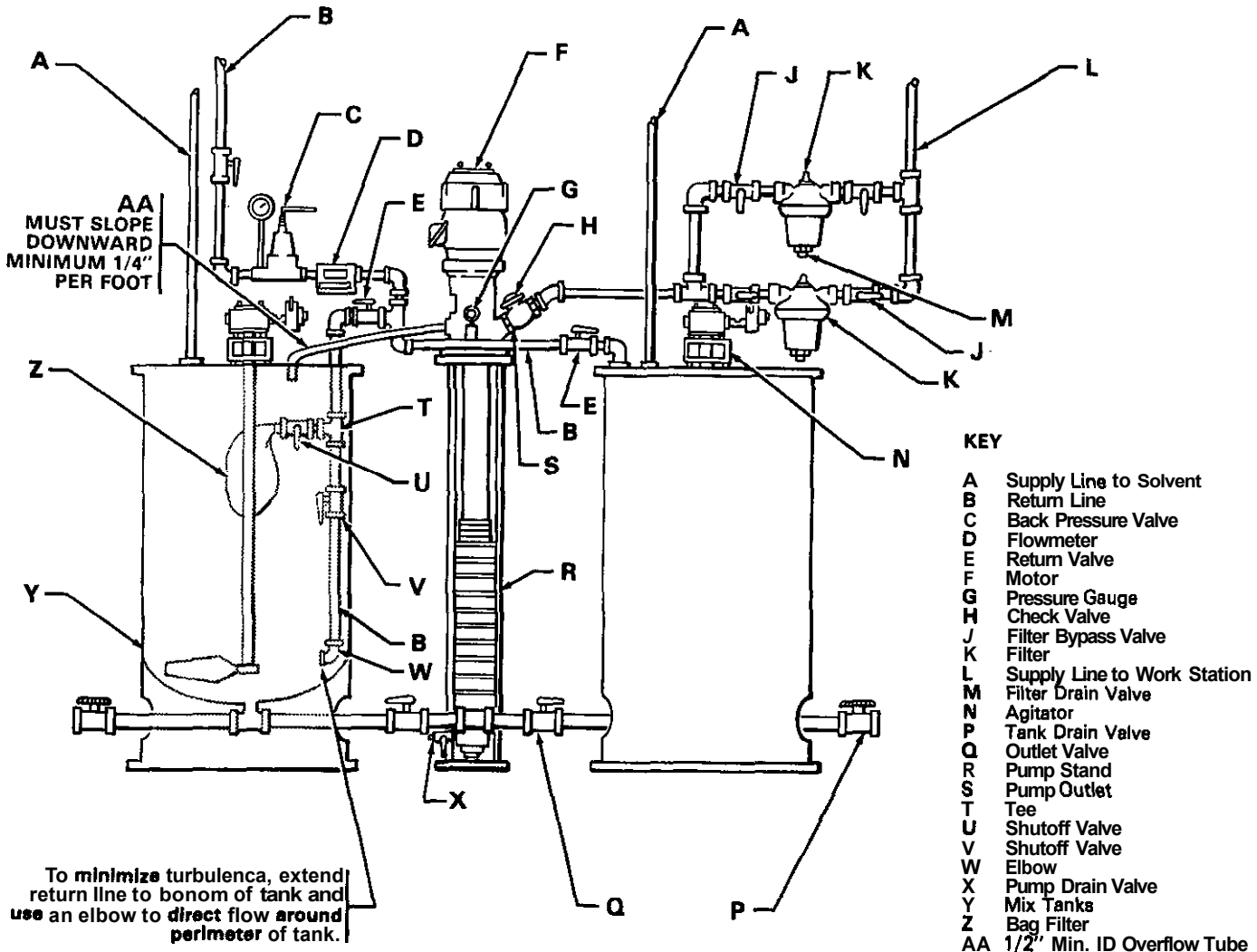


Fig 1

INSTALLATION

Grounding and Electrical Wiring

WARNING

Ground the pump in accordance with all applicable safety codes in your area. Proper grounding reduces the risk of shock, fire or explosion caused by static sparking, which can result in serious bodily injury and property damage.

1. Have a licensed electrician complete the electrical hookup and wiring.
2. Consult the electric motor manufacturer for proper heater-breaker requirements.
3. Before coupling the pump coupler to the motor shaft coupler, check to be sure the shaft rotates in the proper direction.

NOTE: The standard pump is designed for systems with mix tanks of a maximum 60 in. (1.5 m) height. The high profile pump is designed for systems with mix tanks of a maximum 85 in. (2.1 m) height.

System Design

The Typical Installation shown on page 2, and the following text, is only a guide to show the relationship of the pump to other system components. Due to the pressure characteristics of the pump, which vary widely with viscosity and specific gravity, professional systems design is essential. Contact an application engineer at one of the following locations for assistance:

Graco Detroit (313)471-0500
Graco Chicago (312)678-7200
Graco Minneapolis (612)623-6300

Pump dimensions and the mounting hole layout are shown on page 11. Accessories are shown on page 15. The Technical Data is given on the back cover.

Fluid Lines

Line sizes depend on the flow requirements and calculated pressure drop due to the length of the run.

The pipe, tubing and fittings must be compatible with the fluid and solvent you plan to use.

Keep in mind that sharp corners and fittings between lengths of pipe or tubing may cause flow restrictions and fluid breakdown. Use the longest lengths of pipe or tubing available to minimize couplings. Use the most direct route to the spray stations, and whenever practical, use long sweeping bends. A "holsclaw" bender is recommended for making bends in tubing; a common electrician's or plumber's bender is not satisfactory.

Remove burrs, dirt and contaminants from the ends of the tubes before installing the fittings.

Return Line

Install a back pressure valve (C) to maintain proper line pressure to all outlets. Install a flowmeter (D) to visually check the fluid flow rate.

Extend the return line (B) going into the mix tank (Y) to the bottom of the tank and end it with an elbow (W). The elbow directs fluid around the wells of the tank to help minimize air entrainment in the fluid. Near the top of the mix tank, install a tee (T), a shutoff valve (U) and a bag filter (Z).

NOTE: The bag filters (Z) are used only while flushing the pump and must not be used during normal operation.

Supply Line

Install a line check valve (H) near the 2 in. npt(f) pump outlet.

CAUTION

The line check valve (B) is required to prevent fluid backflow into the pump in case of a power failure or incorrect operating procedure.

Install a pressure gauge (G) at the plugged 1/2 npt(f) port at the left of the pump outlet. Make sure the gauge is correctly sized for the operating pressure.

Install two fluid filters (K) with bypass valves (J) on each side. This allows the system to be used while cleaning a filter.

Overflow Tube

Install a minimum 112 in. (13 mm) ID overflow tube (AA) in the port of the slinger cover (25). Slope the tube downward, a minimum of 1/4 in. (6 mm) per foot of tube and route the tube into the mix tank.

CAUTION

The overflow tube vents the seal chamber of excess fluid. The tube must have the proper downward slope to create gravity flow into the mix tank.

Mounting the Pump

Secure the pump, without the motor, in the pump stand (R), with the bolts provided.

Be sure the pump inlet and the plumbing to the mix tanks are at the same level. Install the necessary plumbing, using shims as necessary, and then bolt the pump stand and the tanks to the floor.

After All Lines Are Installed

Flush all lines with a compatible solvent and blow out with air, then clean the elements of the filters (K).

(Installation continued on page 41)

Installing the Motor

Remove the protective cover and the shipping dowel from the pump base (35). Remove the motor coupler (31 or 32).

Place the motor coupler on the motor shaft, pushing it up, well beyond the end of the shaft. Lightly snug the setscrew.

Lower the motor onto the pump base, making sure the motor locating flange seats properly on the pump base.

Loosen the motor coupler setscrew and pull the coupler down to engage with the pump coupler (54) and coupler insert (7).

Adjust the motor coupler to 0.094 in. (2.39 mm) clearance. See Fig 2. Tighten the pump coupler setscrew.

CAUTION

1. Before operating the pump, turn the motor coupler by hand to be sure the shaft rotates freely. Then recheck the 0.094 in. (2.39 mm) coupler clearance;
2. The pump is factory-set to deliver maximum outlet pressure. Do not tamper with this adjustment which could cause damage to the impellers and bowls and void the warranty.
3. Never leave any contaminants, such as nuts, bolts, rags, etc., in the fluid tank or supply lines which could seriously damage the impellers or bowls.

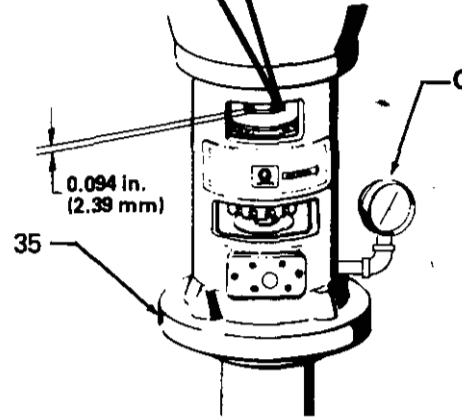
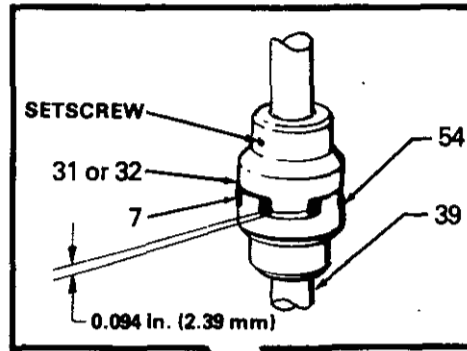


Fig 2

OPERATION

Cleaning, Flushing and Priming System (See Fig 1 and 2)

CAUTION

1. Do not run dry.
2. Make sure the motor rotates in the correct direction and the drive coupler clearance is set at 0.094 in. (2.39 mm). See Fig 2.
3. Make sure the circulating lines are flushed clean and primed with fluid as instructed below.
4. If the motor labors or the pump doesn't run smoothly, check the motor for high amp draw and the thrust bearing for overheating. The normal operating temperature is from 120° to 150° F (49° to 65° C). If the temperature is higher than 150° F (65° C), consult a qualified Graco representative after a repeat check of the drive coupler clearance.

Clean the inside of the mix tanks. Close the outlet valves (Q) of both tanks. Pour about 100 gallons (380 liters) of your fluid's solvent into each tank. Open the outlet and return valves (Q & E) on one tank only.

Attach a cheese cloth hay (Z) of six layers minimum thickness to the return line in the tank as shown in Fig 1 on page 2. Open the valve (U) and close the valve (V).

Startup Procedure

Start the pump. Always use *this* procedure to start the pump. Use the bypass filter valve (J) to control the pump flow to 50 psi (3.5 bar) until the lines are full, and then completely open the valve. Run the pump for several minutes, then shut off the pump. Recheck the drive coupler for 0.094 in. (2.39 mm) clearance.

CAUTION

The pump coupler and bearing could move up during shipment and then, when the pump is operated, it could move down, leaving too much clearance. This could damage both the coupler insert and the coupler.

Continue cleaning.. .

Restart the pump and check the entire system for leaks. Tighten leaking joints as necessary. Continue circulating, changing cheese cloth bags and solvent as needed until the system is thoroughly cleaned. Periodically check for leaks during flushing.

The procedure given here is for an open stand-mounted pump, two mix tank system as shown in the TYPICAL INSTALLATION. Some specific instructions may not apply to other systems; consult your plant's flushing procedures. Flushing is important; it cleans all equipment and lines of impurities. Following these instructions will help assure satisfactory operation with quality control.

When the system is clean, stop the pump and disconnect the return line from the back pressure valve (C) and direct the line into an empty waste container. Drain all filtered residue from the filters. Reconnect the return line to the back pressure valve. **Close** the valve (U) and open the valve (V). **Remove cheese cloth bag.**

Close the outlet and return valves (Q & E) for the tank being used and open the outlet and return valves for the other tank. Start the pump and circulate the solvent for at least one hour, changing cheese cloth bags as needed. While circulating, open the spray gun at each drop and flush the hoses with about one gallon (4 liters) of solvent. Also open the filter drain valves (M) to flush out all filtered residue.

When flushing is complete, stop the pump and drain all solvent from the tanks and lines. Thoroughly blow out the entire system with clean, dry compressed air, or nitrogen, to remove all solvent from the system.

Fill a tank with paint and start the agitator (N). Start the pump. Use the bypass filter valve (J) to control the pump flow to 50 psi (3.5 bar) until the lines are full, and then open the valve completely. Circulate the paint until all air is removed from the fluid lines. While the paint is circulating, check and adjust the viscosity as necessary.

Fill the other mix tank with paint and start the agitator. Leave the agitator running so that paint in the standby tank will be ready for use when needed. To keep air out of the system, always switch to the standby tank before the paint supply in the tank you have been using is completely exhausted.

LUBRICATION

Lubricate the thrust bearing once a month if the pump is operating continuously. To lubricate the bearing, pump one or two shots (about 0.1 oz/28 grams) of the specified grease through the fitting on the top of the seal retainer. See Fig 3.

CAUTION

Use only Chevron SR1/No. 2 NLGI grade grease. This green-colored grease is used for the factory pack and must not be mixed with any other type of grease to prevent bearing overheating and premature bearing failure. See the ACCESSORIES section on page 15 for ordering this grease.

CAUTION

Do not overgrease the pump, which may cause the bearing to overheat. Remove any excess grease after lubricating.

Consult the paint supplier for a compatible solvent for flushing paint from the system. Water reducible paints should use deionized water and a solvent which will keep resin in the solution. If water reducible paint has a 20% solvent content, the flush media should also contain approximately 20% solvent.

Adjusting System Pressure

Use the back pressure valve (C) to adjust the system pressure. Determine the line pressure required and, with paint circulating in the line loop only, set the back pressure valve so that the pressure at the last spray gun is 10 psi (0.7 bar) greater than needed. Refer to the "TYPICAL INSTALLATION" drawing on page 2 and the separate back pressure valve instructions.

The available pressure at the pump is shown by the gauge (G) installed at the pump base ahead of the main line shutoff valve and filters. See page 2. Normal return line fluid pressure is about 30 psi (2 bar).

CAUTION

The pump is set at the factory to deliver the maximum volume and outlet pressure. The pressure cannot be increased by any adjustment of the pump. Refer to Thrust Bearing Replacement Section, page 7, for proper adjustments.

NOTE: The drain valve (70) in the intake bowl (44) can be used to drain fluid from the pump. First close the outlet valves (Q) from the supply tanks, and provide a tube from the drain valve to a waste container.

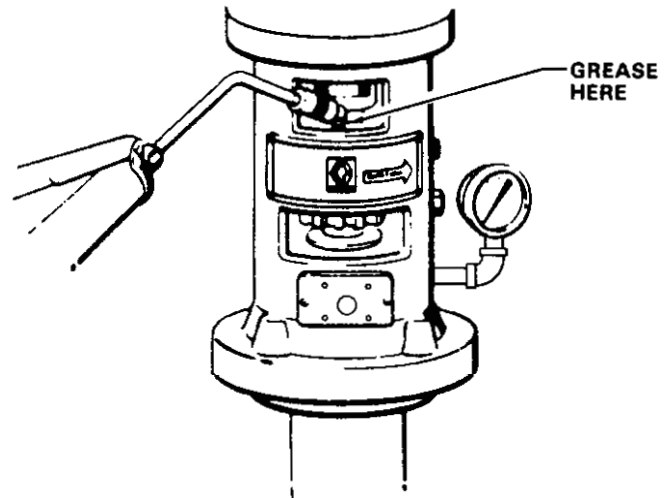


Fig 3.

REPAIR

CAUTION

DO NOT leave the outlet valve closed for more than 10 seconds while the pump is operating to avoid damage to the seals and bearings caused by overheating.

NOTE: Graco offers a rebuilt program on all Imperial and Crown Imperial pumps. Contact your local sales representative for details.

WARNING

Before removing the pump for repair, shut off the electric power, relieve the system pressure, and drain the pump by opening the drain valve at the pump base, to reduce the risk of serious bodily injury from electric shock, moving parts, or spraying fluid in the eyes.

CAUTION

To avoid costly damage to the pump, follow this repair procedure carefully. Do not attempt to repair anything that is not mentioned in this repair section.

Troubleshooting Guide

PROBLEM	CAUSE	SOLUTION
Pump won't run	<ol style="list-style-type: none"> 1. Electric power out 2. Fuses blown 3. Motor inoperative 	<ol style="list-style-type: none"> 1. Check fuses, clean terminals and connections. 2. Check coupler clearance, replace fuses, repair pump (call Graco Detroit). 3. Repair or replace motor.
Pump runs but pressure drops slightly	<ol style="list-style-type: none"> 1. Clogged pump intake 2. Increased flow rate 3. Parts worn or damaged 4. Air entrainment in fluid 	<ol style="list-style-type: none"> 1. Remove and clean. 2. Adjust back pressure valve. 3. Repair pump. 4. Purge air. See Startup Procedure on page 4.
Pump runs but pressure very low or unsteady	<ol style="list-style-type: none"> 1. Clogged pump inlet 2. Air entrainment in fluid 	<ol style="list-style-type: none"> 1. *Clean. 2. Purge air. See Startup Procedure on page 4.
Fluid leaking	<ol style="list-style-type: none"> 1. Screws or fittings loose 2. Parts worn or damaged 3. Clogged bypass drain 	<ol style="list-style-type: none"> 1. Tighten. 2. Repair pump. 3. Clean.
Noisy pump	<ol style="list-style-type: none"> 1. Improper coupler clearance 2. Motor not seated properly to pump housing 3. Lack of grease in main thrust bearing. 	<ol style="list-style-type: none"> 1. Assure 0.094 in. (2.39 mm) clearance. See Fig 2, page 4. 2. Loosen motor mount nuts, clean flange, and rotate motor to seat properly. 3. See Lubrication on page 5; Check for worn shaft bearings.
Coupler insert (7) wears out prematurely	<ol style="list-style-type: none"> 1. Motor not seated properly to pump housing 	<ol style="list-style-type: none"> 1. Loosen motor mount nuts, clean flange, and rotate motor to seat properly; check seal for damage.

Before removing **the pump** for cleaning, close the outlet line valves and note the maximum pump pressure. The pressure should be steady. If pressure variations or pulsations are noted, the problem could be a clogged intake, too low a fluid level in the tanks, or restricted plumbing. Correct the clogged condition to obtain steady pressure. Low pressure can also be caused by air entrainment in water reducible fluids. All return lines in tanks with water reducible fluid must be routed to the bottom of the tank. Be careful to avoid allowing deteriorated pieces of bag filters into the pump which can result in serious damage to the pump.

Before **you** start...

1. Special tools needed for repairing the pump are mentioned in the text and described in the Accessories section on page 15. Be sure you have all the necessary tools and repair parts on hand before starting.
2. Whenever the pump is removed from the mounting stand, install the shaft holding tool, to keep the shaft from moving will damage seals. Pumps 218-635 to 218-641 and 221-012 to 221-014 use tool 218-634. Pumps 220-275 to 220-281 and 221-112 to 221-114 use tool 207-727.

Pump Thrust Bearing and Seal Replacement

NOTES:

- a. It is not necessary to remove the pump from the stand to do this procedure. However, if you are also repairing the lower pump, **you** can install the shaft holding tool and move the pump to the repair stand at this time. Refer to Fig 12, page 10.
- b. Replace the pump thrust bearing (54) assembly at least once a year. Replace the assembly if the pump housing temperature goes over 150°F (53°C), which is the first sign of bearing failure.

Disassembly (Refer to Fig 4, except where indicated)

1. Shut off the power to the pump. Close outlet valve (J) and the filter bypass valves (N). Open the drain valve (Y) at the pump base, having a container ready to catch the fluid. Remove the motor. Refer to "Installing the Motor" on page 4.
2. Remove the retainer plate (54c) and rubber coupling insert (7) from the pump coupling assembly (54).
3. Hold the pump coupler and screw the shaft nut (30) off the shaft (39), using a 5/16 in. socket wrench.
4. Remove the screws (11), washers (12) and springs (29) and lift out the coupling assembly (54).
5. Remove the bearing support (26) and key (54b) from the shaft (39).
6. Remove the adjusting nut lock screws (14, 23) from the outside of the pump base (35). Then remove the adjusting nut (42).
7. Remove the three screws (15) and seal support (48).
8. Remove the slinger chamber screws, cover and gasket (4, 25, 24). Inspect the chamber opening and clean out any residue.

NOTE: If you plan to service the lower pump section, refer to page 9. Otherwise, continue with Step 9, below.

9. If the pump is mounted in a repair stand, install the shaft locating tool. See Fig 12, page 10.
10. Assemble the shaft seal (48) with the three screws (15).
11. Replace the shaft seal (9) in the adjusting nut (42). Install the adjusting nut, engaging just one thread in the pump base (35). See Fig 4.
12. Position the bearing support (26) on the adjusting nut (42) so the adjusting nut pin and the slot in the support align.

13. Screw the adjusting nut (42) down just until the bearing support (26) bottoms on the housing. Then turn the nut back 1 to 1-1/2 turns to re-engage the bearing support.
14. Slide the coupling assembly (54) over the shaft (39).
15. Align the keyway and insert the key (54b) between the coupling assembly and shaft.
16. Use the special tool, 178-779, to check the shaft location dimension. See Fig 5, page 8. Place the tool on the face of the coupler, between the coupler tabs as shown in the detail of Fig 5. The tabbed portion of the tool should touch the top of the shaft (39). Screw the adjusting nut (42) up until you attain the 0.25 in. (6.8 mm) dimension.
17. Install the shaft nut (30) using a socket wrench and bonom it on the coupling assembly (54).
18. Align the hex of the nut retainer plate (54c) with the shaft nut (30) and secure the lockwire (54d).
19. Install the two holddown screws, washers, and springs (11, 12, 29). Bottom the screws and check the vertical travel of the retainer against the spring. If the shaft nut and bearing are properly installed, the retainer should lift 0.12 to 0.19 in. (3.2 to 3.8 mm) before the springs are solidly compressed.

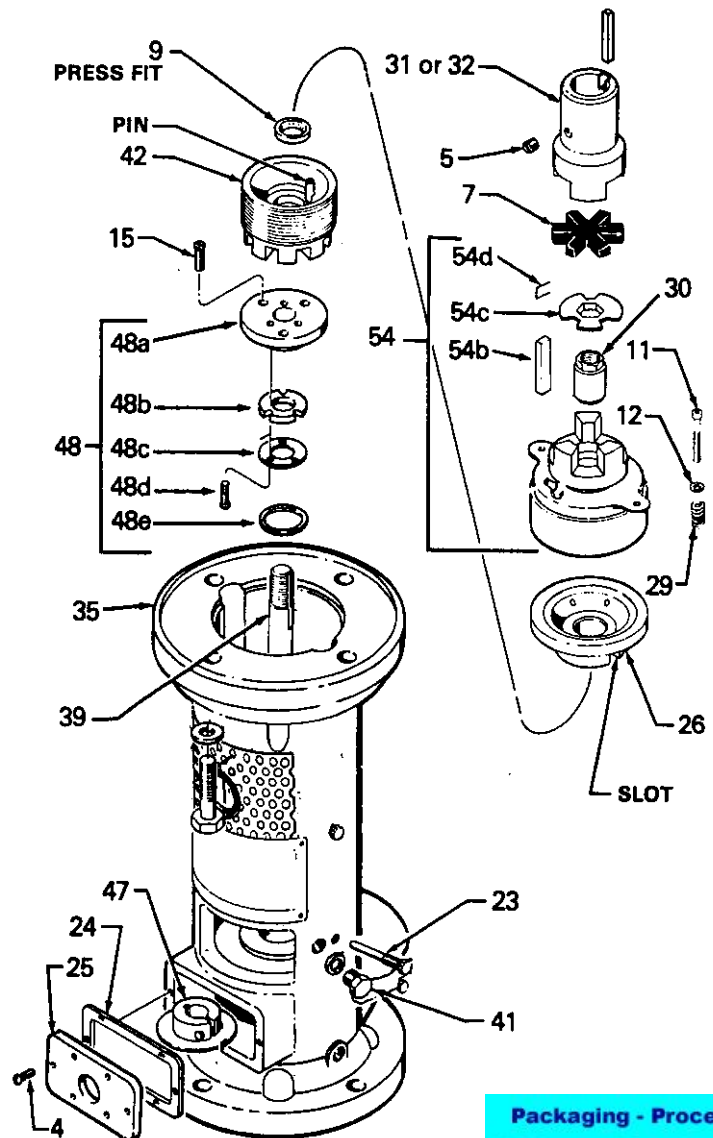


Fig 4

20. If the pump is mounted in an assembly stand, loosen the **shaft holding tool**. See Fig 9, page 9. Turn the bearing adjusting nut (42) seven notches to the right to raise the impellers off the bowls. Now turn the pump coupler (54) to be sure the shaft rotates freely. Check to see that the slinger is located approximately in the center of the slinger chamber.

If the repair is being done in the stand, turn the bearing adjusting nut (42) up until the shaft rotates freely. Then raise it another seven notches to raise the impellers off the bowls.

21. Insert the lock screw (23) through the pump base and into the hole in the adjusting nut without forcing it. Install the screw (41). If necessary, turn the nut a little in the same direction as pump rotation until the screw goes in easily. Tighten the screw securely and reattach the lock wire (21) and crimp.

22. Install the gasket (24), slinger chamber cover (25) and screws (4) on the front of the pump base.

23. Install the rubber coupling insert (7) and remount the motor. Refer to Fig 2, page 4.

24. With the shaft holding tool removed, start the pump. Use the bypass filter valve (N) to control the pump flow to 50 psi (3.5 bar) until the lines are full, and then completely open the valve. Circulate the paint until all air is removed from the fluid lines. Close the line valve (N). Note the maximum pump pressure. The pressure should be steady. If variations or pulsations are noted, the inlet flow to the pump is restricted, due to either a clogged screen or restricted plumbing. Correct the clogged condition.

CAUTION

DO NOT leave the outlet valve closed for more than 10 seconds while adjusting the nut (42) to avoid damage to the seals and bearings caused by overheating.

25. Shut the pump off and recheck the coupler clearance; Readjust if necessary to 0.094 in. (2.39mm). Refer to Fig 6.

26. Remove the seal chamber cover (25) and check to be sure the slinger is in the middle of the chamber. Loosen the setscrew with a 0.19 in. hex key wrench to readjust the slinger. Reinstall the cover, gasket and screws.

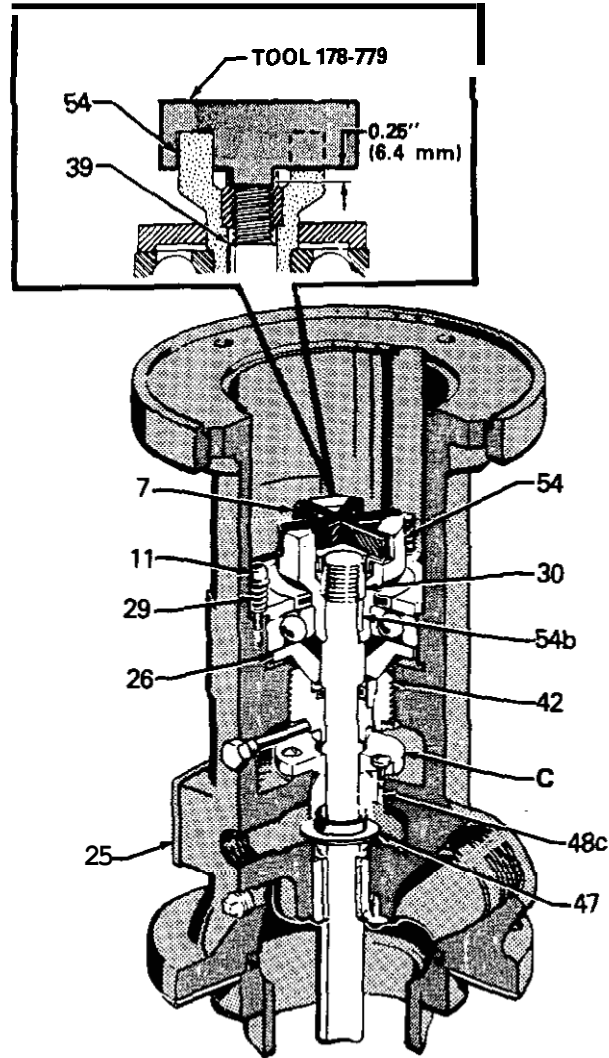


Fig 5

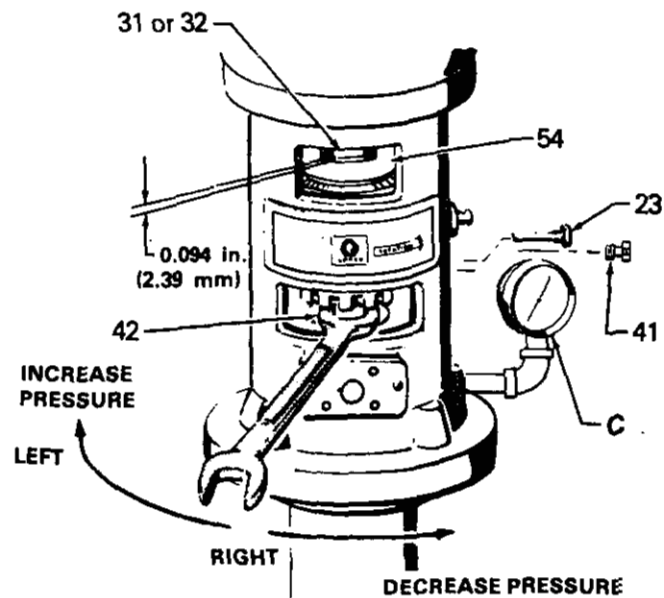


Fig 6

Repairing Shaft Bearings, *Impellers* and Seals Disassembly

NOTE: Remove the pump from the stand before continuing.

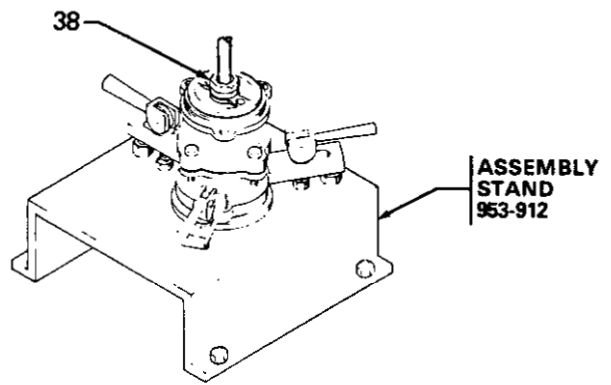
1. Support the pump in a vertical position on the accessory assembly stand 953-912 which should be bolted to the floor for stability. Lock the pump in place. Refer to Fig 7.
2. Follow the disassembly procedure, Steps 1-8, on page 7, and be sure the shaft holding tool is in place.
3. Loosen the setscrew in the slinger (47). Remove the capscrews (16 or 74) at the top flange of the riser tube (45). Refer to the Parts Drawing.

NOTE: You do not have to disassemble the two riser tubes used in the high profile pump.

4. Lift the pump base (35) straight up, off the shaft (139). Avoid bending the shaft by unequal pulling with a hoist or pry bars. Remove the capscrews (74) at the bottom of the tube and the riser tube (45 or 75 or 77).
5. Disassemble the impeller bowls, working from the top down.
 - a. Hold the first impeller with a spanner wrench 953-913 and use a close fitting wrench to loosen the impeller nut (38) one and a half turns. Refer to Fig 7.
 - b. Place a soft steel protecting bushing (0.75 in/19 mm) ID with a smooth turned end, on top of the hex nut. Use a sharp downward blow with a 1 foot (300 mm) length of pipe or tube over the shaft to loosen the collet (22). See Fig 8.
 - c. Remove the collet and impeller (33). Do not pry on the impeller.
 - d. Remove all of the impeller bowl assemblies in this way.
6. Inspect the shaft for signs of scoring or wear and replace it, if needed. Check all bowls and impellers for wear or damage and replace as needed. Install new O-rings (10) on all impeller bowls and the intake bowl, then lubricate the O-rings in place. Be sure the impeller nuts (38) rotate freely on the collets.

7. To replace the bearings:

- a. Use the short-nippled end of tool 177-219 to press out the bearings (43a, 44a) from all bowls (43b) and the intake bowl (44). See Fig 9.
- b. Use the long-nippled end of the tool to press new bearings into the bowls. This tool maintains the required 0.06 in. (1.6 mm) dimensions of the impeller bowls as shown in Fig 9.
- c. Thread the plug (68) into the bottom of the intake bowl as shown in Fig 10. **DO NOT** install the gasket (69).
- d. Use tool 177-219 to press the new bearing into the intake bowl until it bottoms against the plug (68). Refer to Fig 10.



Fig

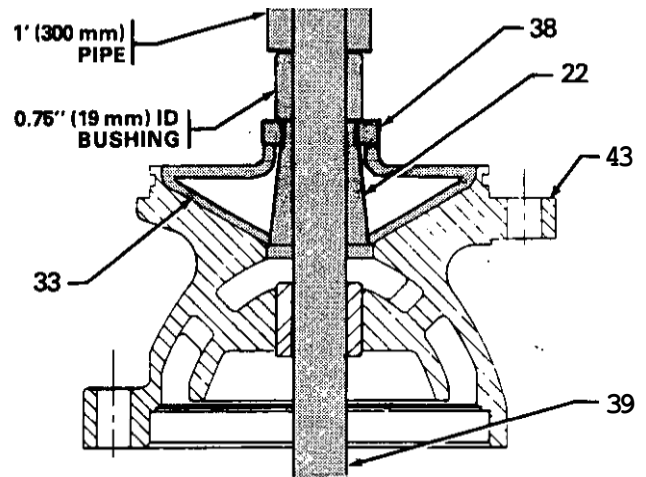


Fig 8

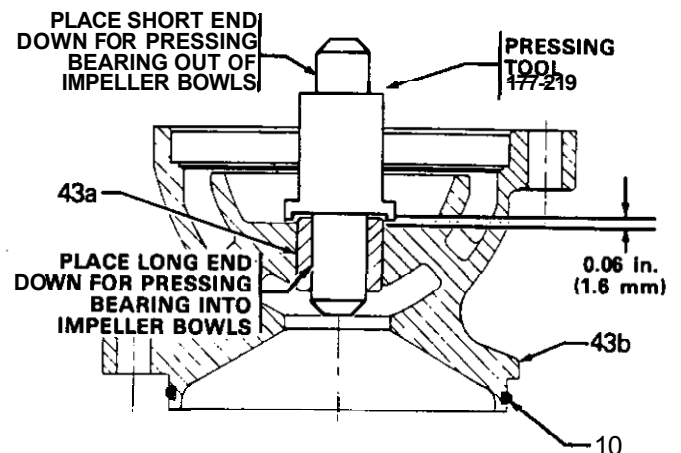


Fig 9

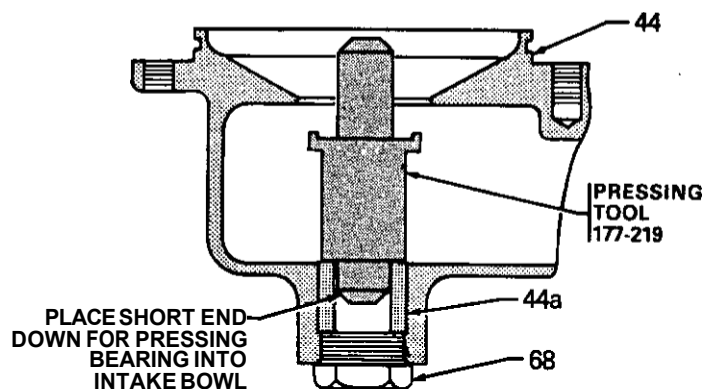


Fig 10

- e. Check the bearings for concentricity. Place the checking fixture 177-218 on the bowl as shown in Fig 10. Drop one end of the checking tool 177-217 into the center hole of the fixture. The tool should turn freely without binding. If the tool binds, the bearings must be replaced.

Reassembly

8. Slide the shaft (39) into the bearing in the intake bowl and lock it in place with the shaft holding tool. See Fig 12.
9. Clamp the intake bowl in a vise.
10. Assemble the first impeller (33), collet (22) and nut (38) onto the shaft. Push downward on the impeller and hold it with the spanner wrench, 953-913, while tightening the impeller nut to 120-140 ft-lb (165-190 N·m).
11. Install the first impeller bowl (43) and bolt it to the intake bowl (44) with screws (72) and lockwashers (19).

NOTE: Each impeller must be pushed down tightly into the bowl while tightening the impeller to assure contact with the machined face of the bowl which will ensure maximum pump performance.

12. Remove the assembly from the vise and mount it in the assembly stand 953-912. Refer to Fig 13.
13. Continue assembling the bowls and impellers as in Steps 10 and 11, but use screws (16), lockwashers (19) and nuts (17) to join the bowls.
14. Install the riser tube (45 or 76 or 77) with the screws (74), lockwashers (19) and nuts (17).
15. To replace the bearing (46) in the pump base (35), remove the three screws and washers (8, 40), holding the bearing from below. Press the bearing out using a 1.5 in. (38 mm) disc laid on the bearing, and a 0.68 in. (17.3 mm) rod inserted from the top to push it out. See Fig 14. This bearing has a medium-tight fit. Replace it when replacing the impeller bearings.

Assembling Lower Pump Section to Base

NOTE: Be sure the pump base is clean, and that a new base bearing (46) has been installed.

1. Install the slinger (47) in the pump base with the flange down. Use a wooden dowel, just under 0.75 in. (19 mm) dia. to align the slinger when assembling the pump base onto the shaft.
2. Carefully lower the base (35) over the shaft, passing the shaft through the bearings and slinger. Seat the base firmly on the riser tube (45 or 76 or 77). Install the four capscrews (74) and washers (19). Torque to 30-35 ft-lb (41-47 N·m).
3. Adjust the slinger to the center of the seal chamber opening. Tighten the slinger setscrew.
4. Continue assembling the pump as described in Steps 10 to 26 on page 7 and 8.

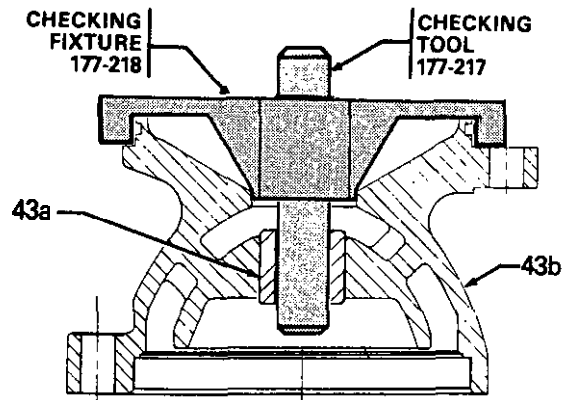


Fig 11

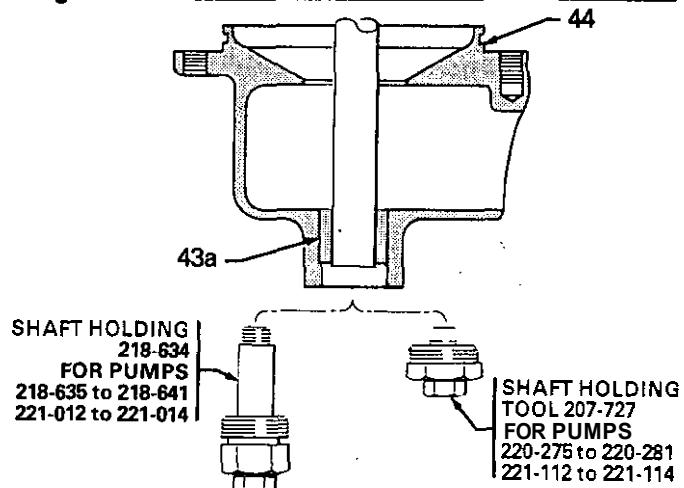


Fig 12

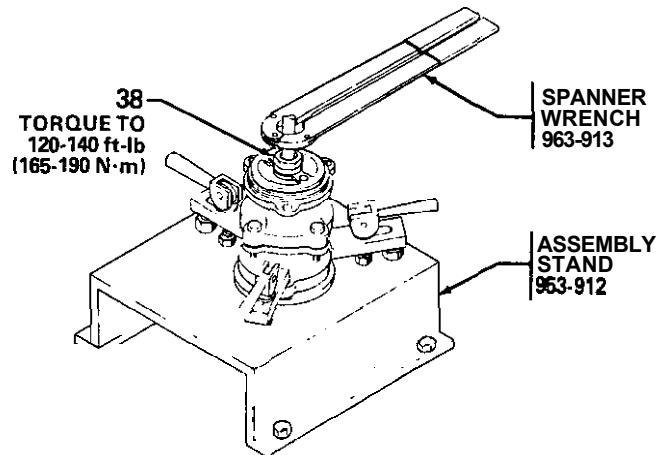


Fig 13

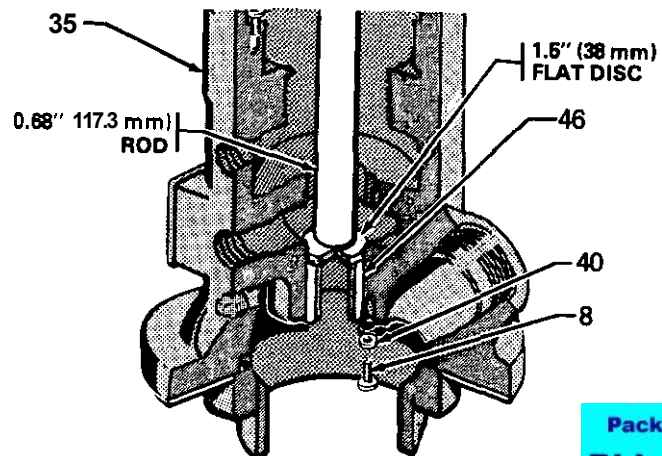
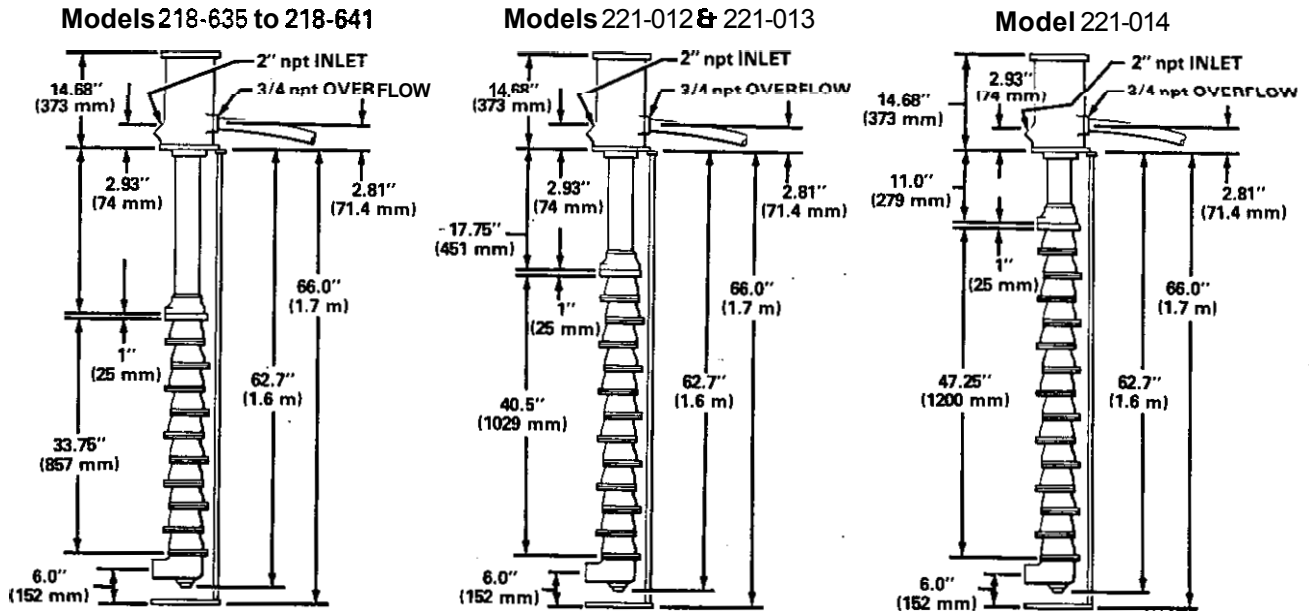
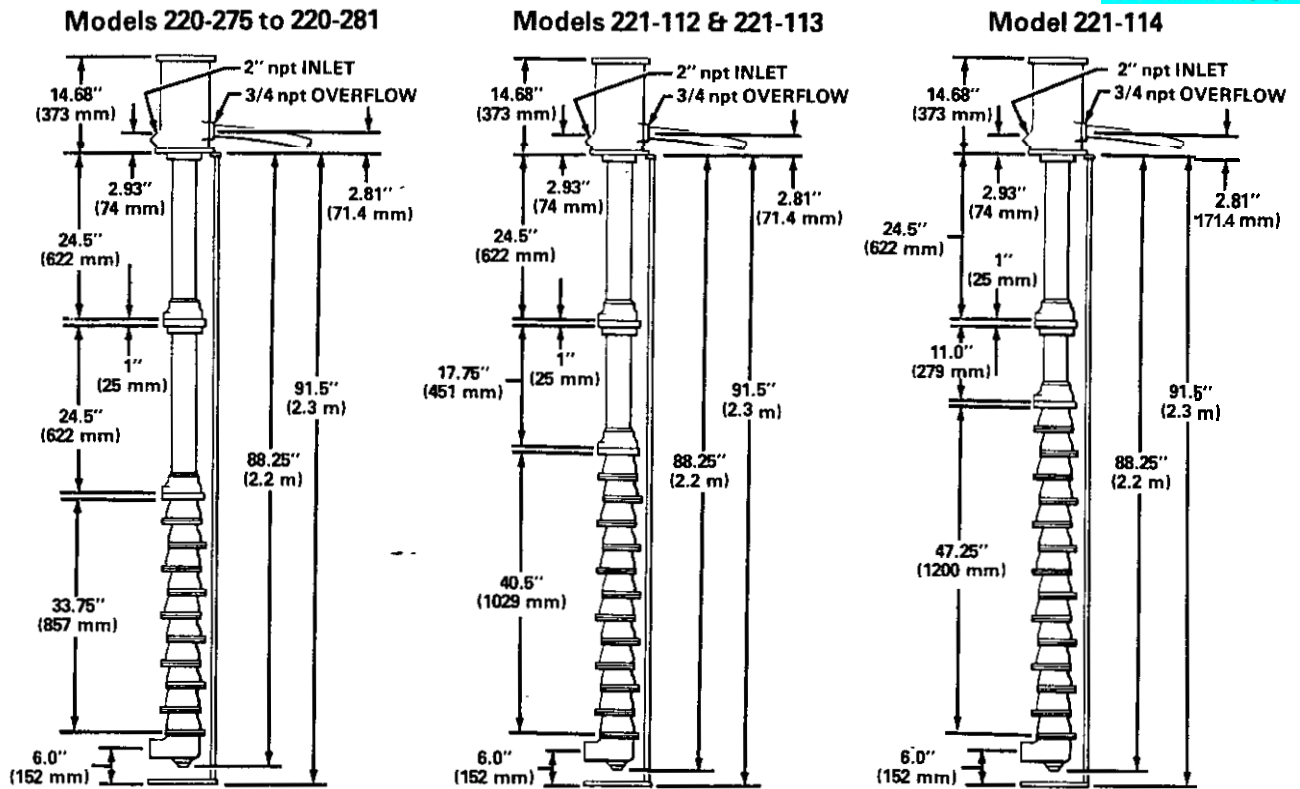


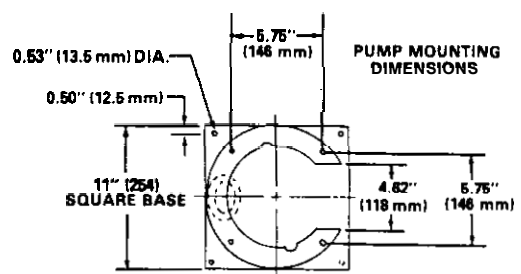
Fig 14

DIMENSIONS



Pump Model	Weight lb (kg)	Pump Model	Weight lb (kg)
218-635	209 (94)	220-275	248 (111)
218-636	210 (95)	220-276	249 (112)
218-637	212 (96)	220-277	251 (113)
218-638	214 (96)	220-278	252 (113)
218-639	215 (97)	220-279	254 (114)
218-640	217 (98)	220-280	256 (115)
218-641	218 (98)	220-281	257 (116)
221-012	220 (99)	221-112	259 (116)
221-013	222 (100)	221-113	260 (117)
221-014	223 (100)	221-114	262 (118)

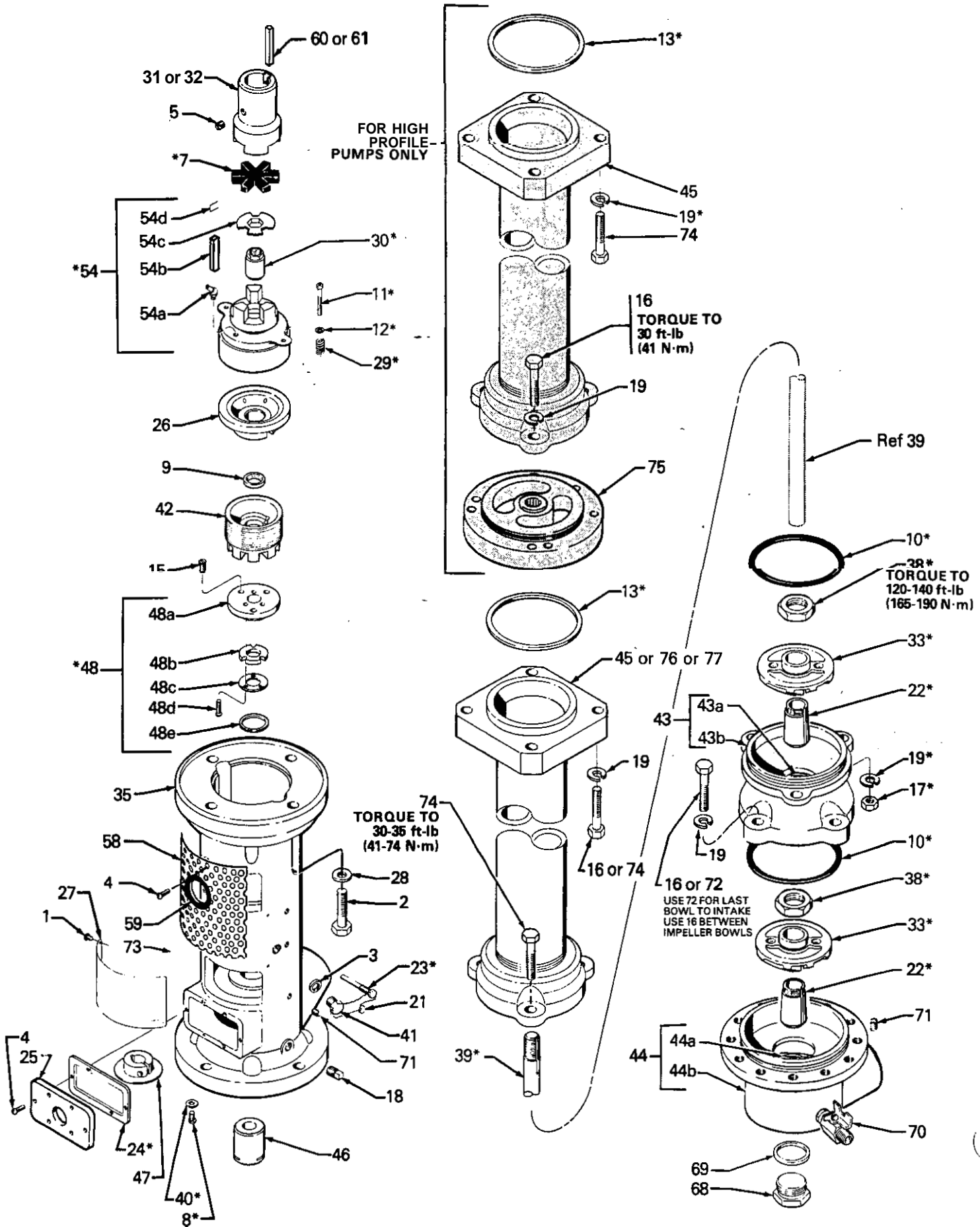
MOUNTING HOLE LAYOUT



STAND WEIGHTS
 220-266 92 lb 141.4 kg
 218-631 75 lb 133.8 kg

TOP VIEW OF PUMP MOUNTING STAND

PARTS DRAWING



PARTS LIST

REF NO.	PART NO.	DESCRIPTION	QTY	REF NO.	PART NO.	DESCRIPTION	QTY
1	100-055	SCREW, type "u" self lap; no. 6 x 1/4"	4	42	207-769	NUT, adjusting	1
2	100-060	SCREW, hex hd cap; 1/2-13 x 1-3/4"	4	43	218-092	IMPELLER BOWLASSY	
3	100-214	LOCKWASHER, spring; 5/16"	1			Each bowl includes items	
4	108-422	CAPSCREW, soc hd; no. 10-24 x 1/2"	7			43a and 436	See Chart
5	100-640	SCREW, cup pt slotted headless sat; 5/16 x 3/8"	1	43a	176-851	BEARING, impeller bowl	10
7	102-211*	INSERT, coupling; rubber	1	43b	179-774	.HOUSING, impeller bowl	10
8	102-234	SCREW, rd hd mach; 1/4-20 x 3/8"	3	44	218-097	INTAKE BOWLASSY	
9	102-776*	SEAL, shaft	1			Includes item 44a	1
10	106-524*	SEAL, o-ring; Viton®	See Chart	44a	176-851	.BEARING, intake bowl	1
11	102-795*	SCREW, soc hd cap; no. 8-32 x 1-5/8"	2	45	218-632	TUBE, riser	See Chart
12	102-796*	WASHER, flat; no. 8	2	46	218-309	BEARING, pump base	1
13	102-848*	PACKING, sq section	1	47	208-846	RING, slinger	1
		Standard Pump	1	48	208-847	SHAFT SEAL ASSY	
		High Profile Pump	2			Includes items 48a-48e	1
15	103-774	SCREW, pan hd mach; no. 10-24 x 5/8"	3	48a	168-366	SUPPORT, seal	1
16	102-789	SCREW, hex hd; 7/16-14 x 1-3/4"	See Chart	48b	178-697	.SEAL, shan; PTFE	1
17	104-348	NUT, hex; 7/16"	See Chart	48c	170-762	.RETAINER, seal	1
18	103-778	PLUG, hdless pipe; 1/2 npt	1	48d	107-246	SCREW, pan hd mach no. 5-40 x 5/8"	3
19	100-052	LOCKWASHER, spring, 7/16"	See Chart	48e	102-895*	.PACKING, o-ring; Viton®	1
21	104-274	LOCK, wire	1	54	210-308	COUPLING ASSY	
22	168-349*	COLLET, impeller	See Chart			Includes replacement items 54a-54d	1
23	168-352*	SCREW, lock; adjusting nut	1	54a	100-847	.FITTING, hydraulic; 1/4-28; 45°	1
24	178-550*	GASKET, siinger cover	1	54b	168-372	.KEY; 0.187" square x 1" long	1
25	180-661	COVER, slinger	1	54c	166-007*	.PLATE, retainer; shaft nut	1
26	168-363	SUPPORT, bearing	1	54d	068-069*	.WIRE, lock	1
27	176-647	PLATE, instruction	1	58	180-666	GUARD, metal	
28	168-381	WASHER, plain	4	59	108-027	GROMMET	
29	168-410*	SPRING, compression	2	60	160-906	KEY, parallel; 0.25" x 2.0": for coupling 169-445	1
30	168-500*	NUT, shaft	1			KEY, parallel; 5/16"; for coupling 170-067	1
31	169-445	COUPLING, motor; fits 1.12" (28.4 mm) motor shaft	See Chart	61	107-055	PLUG, 1-1/4 NF	1
32	170-067	COUPLING, motor; fits 1.38" (35 mm) motor shaft	See Chart	68	178-552	GASKET, plug, Delrin®	1
33	170-748'	IMPELLER, pump	See Chart	69	178-553	VALVE, ball, 3/8 npt(m x f)	1
35	178-544	BASE, pump	1	70	210-071	PLUG; 3/8 npt	2
38	170-770'	NUT, impeller	See Chart	71	101-748	SCREW, hex hd; 7/16 unc 2a x 1.5"	3
39	176-879	SHAFT, impeller	1	72	107-225	PLUG, pipe. 1/8 npt	1
		Standard Pump	1	73	104-765	SCREW, hhd; 7/16 unc 2a x 2"	See Chart
		High Profile Pump	1	74	104-347	PLATE, adapter	
40	170-772	WASHER, plain; 1/4"	3	75	220-267		
41	171-711	PLUG	1	76	220-008	SPACER, 17.75" (451 mm)	See Chart
			1	77	220-005	SPACER, 11" (280 mm)	See Chart

*Recommended tool box spare parts. Keep on hand to reduce down time.

QUANTITY VARIATION

	Stages	Ref 16 102-789	Ref 17 104-348	Ref 19 100-052	Ref 22 168-349	Ref 31 169-445	Ref 32 170-067	Ref 33 170-748	Ref 36 170-770	Ref 43 218-092	Ref 45 218-632	Ref 74 104-347	Ref 76 220-008	Ref 77 220-005
218-635	5	27	30	37	5				5	10	1	7	0	0
218-636	6	27	30	37	6				6	10	1	7	0	0
218-637	7	27	30	37	7				7	10	1	7	0	0
218-638	8	27	30	37	8				8	10	1	7	0	0
218-639	9	27	30	37	9				9	10	1	7	0	0
218-640	10	27	30	37	10			10	10	10	1	7	0	0
218-641	11	27	30	37	11			11	11	10	1	7	0	0
221-012	12	33	36	43	12		1	12	12	12	1	7	1	0
221-013	13	33	36	43	13	0	1	13	13	12	1	7	1	0
221-014	14	39	42	49	14	0	1	14	14	14	1	7	0	1
220-275	5	34	30	44	5	1	0	5	5	10	2	7	0	0
220-276	6	34	30	44	6				6	10	2	7	0	0
	7	34	30	44	7	1	1	7	7	10	2	7	0	0
220-278	8	34	30	44	8	1	1	8	8	10	2	7	0	0
220-279	9	34	30	44	9	1	1	9	9	10	2	7	0	0
220-280	10	34	30	44	10	0	1	10	10	10	2	7	0	0
220-281	11	34	30	44	11	0	1	11	11	10	2	7	0	0
221-112	12	33	36	50	12	0	1	12	12	12	1	11	1	0
221-113	13	33	38	50	13	0	1	13	13	12	1	11	1	0
221-114	14	39	42	56	14	0	1	14	14	14	1	11	0	1

NOTE: All pumps have 10 bowls. Pumps with less than 11 stages have less than 11 impellers. While disassembling the pump, note the number of stages and their location in the pump.

HOW TO ORDER REPLACEMENT PARTS

1. To be sure you receive the correct replacement parts, kit or accessories, always give all of the information requested in the chart below.
2. Check the parts list to identify the correct part number; **do not use the ref. no. when ordering.**
3. Order all parts from your nearest Graco distributor.

6 digit PART NUMBER	QTY	PART DESCRIPTION

ACCESSORIES (Must be purchased separately).

WARNING

Be sure the valves, plumbing and accessories used in your system have a working pressure rating at least as high as the maximum working pressure rating of the pump.

SERVICE TOOLS

SHAFT HOLDING TOOL 218-634

For pump models 218-635 to 218-641

SHAFT HOLDING TOOL 207-727

For pump models 220-275 to 220-281

SHAFT ADJUSTING TOOL 178-779

Required for setting coupler gap.

CHECKING TOOL 177-217

PRESSING TOOL 177-219

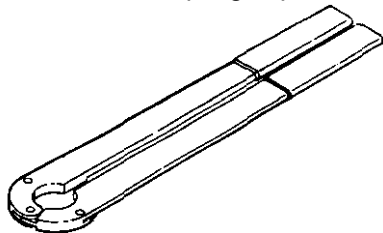
Used for pressing new bearings into bowls to maintain proper clearance of bearings.

CHECK FIXTURE 177-218

Used with checking tool 177-217 to check concentricity of new bearings pressed into impeller bowls.

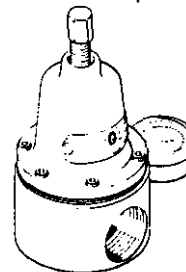
SPANNER WRENCH 953-913

For holding impellers while torquing impeller nuts.



BACK PRESSURE VALVE 208-997

180 psi (12 bar) CONTROLLED WORKING PRESSURE
200 psi (14 bar) MAXIMUM WORKING PRESSURE
 Stainless Steel. 0.5 in. (12.7mm) dia. orifice. 1-1/4 in. npt inlet and outlet. Includes **200 psi (14 bar)** pressure gauge.



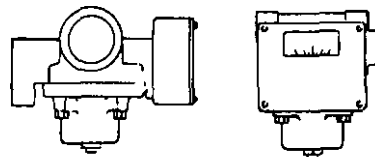
FLOWMETERS

300 psi (21 bar) MAXIMUM WORKING PRESSURE
 1-1/4 in. npt inlet and outlet; inline. Flow rating; **20 GPM (75 l/min)**. Calibrated at 100 centipoise. specific gravity 0.85.

103-998 Stainless Steel: left to right flow

104-025 Nickel Plated: left to right flow

104-138 Nickel Plated: right to left flow



ADAPTER KIT 213-049

For 502-250 and 501-251 Electric Motors. Includes:
 Adapter Plate
 Coupling
 Coupling Insert
 Screws and Washers

HIGH CAPACITY BAG FILTERS

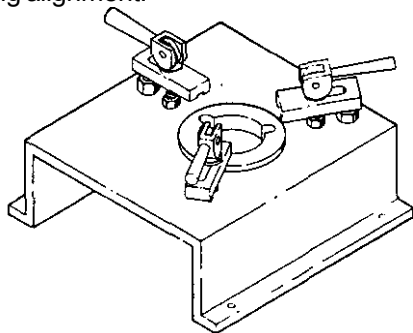
3W psi (21 bar) MAXIMUM WORKING PRESSURE

For effective filtering of large volumes of industrial paints and related liquids. The filter housing is permanently piped into the paint line and has easy accessibility for cleaning. Contact your sales representative for ordering information, or write to Graco and request literature form no. **300-081** and **304-139**.

ACCESSORIES (Continued)

ASSEMBLY STAND 953-912

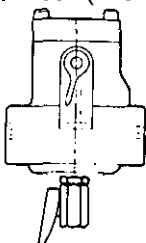
Must be used to assemble pump in proper upright position, maintaining alignment.



SILENT SENTRY FILTER 103-984

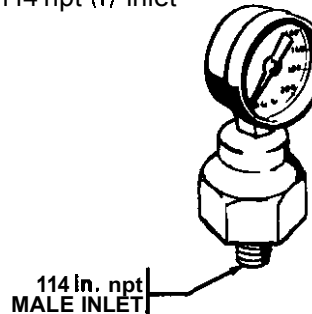
300 psi (21 bar) MAXIMUM WORKING PRESSURE

Electroless nickel plated. 1-114 in. npt inlet and outlet. 314 in. drain at bottom, 100 mesh (149 micron) element, Buna-N seals.



FLUID PRESSURE GAUGE & PULSATION DAMPENERS

- 208-855** For use with corrosive fluids.
300 psi (21 bar) MAXIMUM WORKING PRESSURE
 114 npt (m) inlet
- 206-171** For use with non-corrosive fluids.
200 psi (14 bar) MAXIMUM WORKING PRESSURE
 114 npt (f) inlet



CHEVRON SRI® / No. 2 NLGI 107411

Graco-approved grease for lubricating thrust bearing in 14.6 oz cartridge.

ELECTRIC MOTORS

3 Phase, 230/460 V, 60 Hz, 3600 RPM (no load), "U" Frame

Motor Part No.		H.P.	Shaft dia.	Coupling Supplied W/Pump	Adapter Kit**	Height
Standard	Energy Efficient*					
502-248	178-850	5	1.125 in.	169-445	none req'd	14.19 (360.4)
502-249	178-851	7.5	1.125 in.	169-445	none req'd	
502-250	178-852	10	1.375 in.	170-067	213-049	20.19 (512.9)
502-251	178-853	15	1.375 in.	170-067	213-049	24.56 (62.38)

*These energy-efficient motors meet GM, Ford and Chrysler specifications.

**See ACCESSORIES, page 15, for ordering adapter kit.

NOTE: The size of pump and motor required depends on the viscosity and specific gravity of the fluid to be pumped, and upon the flow volume and pressure required in the user's system. Users should contact a Graco branch or factory office for recommendations.

TECHNICAL DATA

Power Supply required 220/440 Volt, AC, 3 phase, 60 Hz
Flow rate 0 to 50 gallons per minute (0-189 liter/min)
Fluid Inlet & Outlet 2 in. npt(f)
Wetted Parts Stainless Steel, PTFE Viton®, Delrin®, Teflon-Coated Iron
PTFE Delrin®, and Viton® are registered trademarks of the DuPont Company.

SERVICE INFORMATION

This manual was updated to correct a part number error for item 43 in the Quantity Variation Chart.

THE GRACO WARRANTY AND DISCLAIMERS

WARRANTY

Graco warrants all equipment manufactured by it and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. As purchaser's sole remedy for breach of this warranty, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment proven defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for, any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility with Graco equipment of structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claim. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor and transportation.

DISCLAIMERS AND LIMITATIONS

THE TERMS OF THIS WARRANTY CONSTITUTE PURCHASER'S SOLE AND EXCLUSIVE REMEDY AND ARE IN LIEU OF ANY OTHER WARRANTIES (EXPRESS OR IMPLIED), INCLUDING WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY NON-CONTRACTUAL LIABILITIES, INCLUDING PRODUCT LIABILITIES, BASED ON NEGLIGENCE OR STRICT LIABILITY. EVERY FORM OF LIABILITY FOR DIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OR LOSS IS EXPRESSLY EXCLUDED AND DENIED, IN NO CASE SHALL GRACO'S LIABILITY EXCEED THE AMOUNT OF THE PURCHASE PRICE, ANY ACTION FOR BREACH OF WARRANTY MUST BE BROUGHT WITHIN TWO (2) YEARS OF THE DATE OF SALE.

EQUIPMENT NOT COVERED BY GRACO WARRANTY

GRACO MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO ACCESSORIES, EQUIPMENT, MATERIALS, OR COMPONENTS SOLD BUT NOT MANUFACTURED BY GRACO. These items sold, but not manufactured by Graco (such as electric motor, switches, hose, etc.) are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

Factory Branches: Atlanta, Dallas, Detroit, Los Angeles, West Caldwell (N.J.)
Subsidiary and Affiliate Companies: Canada; England; Switzerland; France; Germany; Hong Kong; Japan

GRACO INC. P.O. BOX 1441 MINNEAPOLIS, MN 55440-1444

PRINTED IN U.S.A. 307-691 4- 84 Revised 12-88