

E-Flo™ Plus Electric Circulation Pump

311594 rev.B

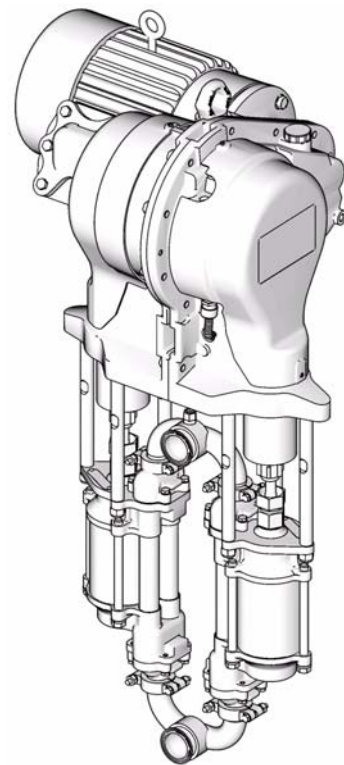
Durable, energy efficient piston pumps for high volume paint circulation applications.



Important Safety Instructions

Read all warnings and instructions in this manual.
Save these instructions.

See page 3 for model information, including maximum working pressure and approvals.



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PROVEN QUALITY. LEADING TECHNOLOGY.

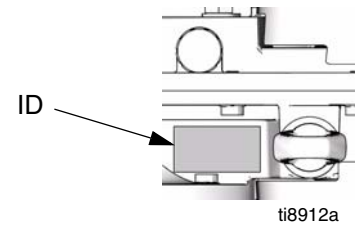
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Models

E-Flo Plus Electric Circulation Pumps

Check your pump's identification plate (ID) for the 6-digit part number of your pump. Use the following matrix to define the construction of your pump, based on the six digits. For example, Pump Part No. **E P 2 1 6 0** represents electric power (**E**), pump (**P**), 230/460V motor (**2**), sensor circuit installed (**1**), and 2000 cc Maxlife lower (**6**). The last digit (**0**) is unassigned. To order replacement parts, see **Parts**, beginning on page 32.



E	P	2		1		6		0	
First Digit	Second Digit	Third Digit		Fourth Digit		Fifth Digit		Sixth Digit	
Power Source	Equipment Style	Motor		Sensor Circuit		Lower Size		Unassigned	
E (electric)	P (pump)	0	No motor	0	No circuit	1	1000 cc Chromex	0	None assigned
		1	230/400V ATEX	1	Circuit installed	2	1500 cc Chromex		
		2	230/460V UL/CSA			3	2000 cc Chromex		
						4	1000 cc Maxlife		
						5	1500 cc Maxlife		
						6	2000 cc Maxlife		

Maximum Working Pressure and Pump Operational Limits

1000 cc Pumps: 460 psi (3.22 MPa, 32.2 bar) Maximum Working Pressure

1500 cc Pumps: 330 psi (2.31 MPa, 23.1 bar) Maximum Working Pressure

2000 cc Pumps: 250 psi (1.75 MPa, 17.5 bar) Maximum Working Pressure

See **Technical Data**, page 37, for pressure and flow limits.

Approvals

This equipment meets requirements of the following approval agencies:







Related Manuals







Manual	Description
311592	E-Flo Plus Installation Manual
311593	E-Flo Plus Operation Manual
311595	Pneumatic Back Pressure Regulator
311596	Variable Frequency Drive Instructions
311603	Sensor Circuit Option

Refer to the individual components for other specific hazardous location listings.

Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbol refers to procedure-specific risk. Refer back to these warnings. Additional, product-specific warnings may be found throughout the body of this manual where applicable.

 WARNING	
	<p>FIRE AND EXPLOSION HAZARD</p> <p>Flammable fumes, such as solvent and paint fumes, in work area can ignite or explode. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> • Use equipment only in well ventilated area. • Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static arc). • Keep work area free of debris, including solvent, rags and gasoline. • Do not plug or unplug power cords, or turn power or light switches on or off when flammable fumes are present. • Ground all equipment in the work area. See Grounding instructions. • Use only grounded hoses. • Hold gun firmly to side of grounded pail when triggering into pail. • If there is static sparking or you feel a shock, stop operation immediately. Do not use equipment until you identify and correct the problem. • Keep a working fire extinguisher in the work area.
	<p>EQUIPMENT MISUSE HAZARD</p> <p>Misuse can cause death or serious injury.</p> <ul style="list-style-type: none"> • Do not operate the unit when fatigued or under the influence of drugs or alcohol. • Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See Technical Data in all equipment manuals. • Use fluids and solvents that are compatible with equipment wetted parts. See Technical Data in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request MSDS forms from distributor or retailer. • Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only. • Do not alter or modify equipment. • Use equipment only for its intended purpose. Call your distributor for information. • Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces. • Do not kink or over bend hoses or use hoses to pull equipment. • Keep children and animals away from work area. • Comply with all applicable safety regulations.
	<p>ELECTRIC SHOCK HAZARD</p> <p>Improper grounding, setup, or usage of the system can cause electric shock.</p> <ul style="list-style-type: none"> • Turn off and disconnect power at main switch before disconnecting any cables and before servicing equipment. • Connect only to grounded power source. • All electrical wiring must be done by a qualified electrician and comply with all local codes and regulations.

 WARNING	
	<p>PRESSURIZED EQUIPMENT HAZARD</p> <p>Fluid from the gun/dispense valve, leaks, or ruptured components can splash in the eyes or on skin and cause serious injury.</p> <ul style="list-style-type: none"> • Follow Pressure Relief Procedure in this manual, when you stop spraying and before cleaning, checking, or servicing equipment. • Tighten all fluid connections before operating the equipment. • Check hoses, tubes, and couplings daily. Replace worn or damaged parts immediately.
	<p>MOVING PARTS HAZARD</p> <p>Moving parts can pinch or amputate fingers and other body parts.</p> <ul style="list-style-type: none"> • Keep clear of moving parts. • Do not operate equipment with protective guards or covers removed. • Pressurized equipment can start without warning. Before checking, moving, or servicing equipment, follow the Pressure Relief Procedure in this manual. Disconnect power or air supply.
	<p>TOXIC FLUID OR FUMES HAZARD</p> <p>Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.</p> <ul style="list-style-type: none"> • Read MSDS's to know the specific hazards of the fluids you are using. • Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines. • Always wear impervious gloves when spraying or cleaning equipment.
	<p>PERSONAL PROTECTIVE EQUIPMENT</p> <p>You must wear appropriate protective equipment when operating, servicing, or when in the operating area of the equipment to help protect you from serious injury, including eye injury, inhalation of toxic fumes, burns, and hearing loss. This equipment includes but is not limited to:</p> <ul style="list-style-type: none"> • Protective eyewear • Clothing and respirator as recommended by the fluid and solvent manufacturer • Gloves • Hearing protection
	<p>BURN HAZARD</p> <p>Equipment surfaces and fluid that's heated can become very hot during operation. To avoid severe burns, do not touch hot fluid or equipment. Wait until equipment/fluid has cooled completely.</p>

[illegible]

Pressure Relief Procedure

System pressure can cause the pump to cycle unexpectedly, which could result in serious injury from splashing or moving parts.						

1. Set START/STOP switch (ST) to STOP.
2. Push in SECURE DISABLE (SD) switch.
3. Open the back pressure regulator and all fluid drain valves in the system, having a waste container ready to catch drainage. Leave open until you are ready to pressurize system again.
4. Check that pressure gauges on fluid supply and return lines read zero. If gauges do not read zero, determine cause and carefully relieve pressure by VERY SLOWLY loosening a fitting. Clear obstruction before pressurizing system again.

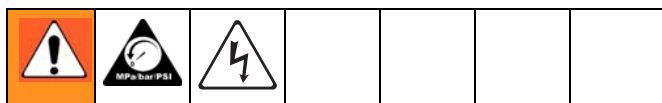
Flushing

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- Flush before changing colors, before storing, and before repairing equipment.
- Flush at the lowest pressure possible. Check connectors for leaks and tighten as necessary.
- Flush with a fluid that is compatible with the fluid being dispensed and the equipment wetted parts.

1. Follow **Pressure Relief Procedure**, page 7.
2. Supply the appropriate flushing material to the system.
3. Set pump to lowest possible fluid pressure, and start the pump.
4. Flush long enough to thoroughly clean the system.
5. Follow **Pressure Relief Procedure**, page 7.

Troubleshooting



1. Relieve the pressure.
2. Check all possible problems and solutions before disassembling pump.

PROBLEM	CAUSE	SOLUTION
Pump does not operate.	Insufficient power supply.	Verify that power supply meets requirements. See Technical Data , page 37.
	No flow rate input to VFD.	Select speed/flow setting.
	START/STOP switch set to STOP.	Set START/STOP switch to START.
	SECURE DISABLE switch not activated.	Pull out to activate.
	Outlet valve not open.	Open valve.
	Damaged electric motor.	Repair, page 15.
	Damaged gear reducer.	Disconnect pumps and operate. If speed is consistent, gear reducer is good. If speed is erratic, gear reducer is bad.
	Fluid dried on piston rod.	Disassemble and clean lower. See lower manual 311690. In future, stop lower at bottom of stroke.
	Throat packing nut is too tight.	Loosen packing nut and re-torque.
	3-phase wiring to motor is not correct.	Inspect and confirm wiring continuity.
Pressure too low.	Incorrect transducer calibration.	Check calibration. Replace transducer if necessary.
	Lowers need repair.	Check and repair. See lower manual 311690.
	Restricted pump fluid inlet.	Clear.
	Air in the fluid.	Check fluid level. Check inlet fittings for leaks.
Pump output low on both strokes.	Insufficient power supply.	Verify that power supply meets requirements. See Technical Data , page 37.
	Exhausted fluid supply.	Refill and reprime pump.
	Held open or worn ball check valves.	Check and repair.
	Wrong fluid lowers installed.	Verify size of lowers installed and configured.
Pump output low on only one stroke.	Held open or worn ball check valves.	Check and repair.
	Worn piston packings.	Replace. See lower manual 311690.
	Air in the fluid.	Check fluid level. Check inlet fittings for leaks.
Erratic flow or pressure.	Pump cavitation; suction/supply line leak.	Check and repair.
	Exhausted fluid supply.	Refill and reprime pump.
	Restricted fluid supply to pump.	Ensure all valves are fully open.
	Held open or worn ball check valves.	Check and repair.
	Pump packings are too tight.	Loosen and re-torque.
	Worn piston packing.	Replace. See lower manual 311690.
	Air in the fluid.	Check fluid level. Check inlet fittings for leaks.
	Motor rotation direction is backwards.	Check direction of rotation.
	3-phase wiring to motor is not correct.	Inspect and confirm wiring continuity.

PROBLEM	CAUSE	SOLUTION
Pump will not prime	Suction line clogged.	Clear. Flush more frequently.
	Held open or worn ball check valves.	Check and repair.
	Lower piston assembled with wrong nut.	Use only the large, round, special nut.
Excessive throat leakage.	Worn piston rod or throat packings.	Replace. See lower manual 311690.
High current trip (t043).	Pressure setting is too high.	Reduce pressure.
	Pump packings are too tight.	Loosen and re-torque.
	Gear reducer oil level is low.	Fill to correct oil level.
	Incorrect transducer calibration.	Perform calibration procedure.
	Wrong fluid lowers installed.	Verify size of lowers installed and configured.
High pressure trip (t040).	Downstream restriction is too high.	Open line and remove restriction.
	Circulation valve is closed.	Open back pressure regulator. Check solenoid.
	Clogged fluid filters.	Clean.
	Incorrect transducer calibration.	Perform calibration procedure.
Excessive noise.	Pump packings are too tight.	Loosen and re-torque.
	Gear reducer oil level is low.	Fill to correct oil level.
	Loose or worn drive linkage.	Inspect; repair or replace.
	Worn motor coupling.	Inspect; repair or replace.
	Worn gear reducer.	Replace.
Pump changes direction or shakes.	One leg of 3-phase is lost.	Inspect and correct wiring connections on VFD, motor, and wiring.

FIG. 2 shows components approved for installation in a hazardous location.



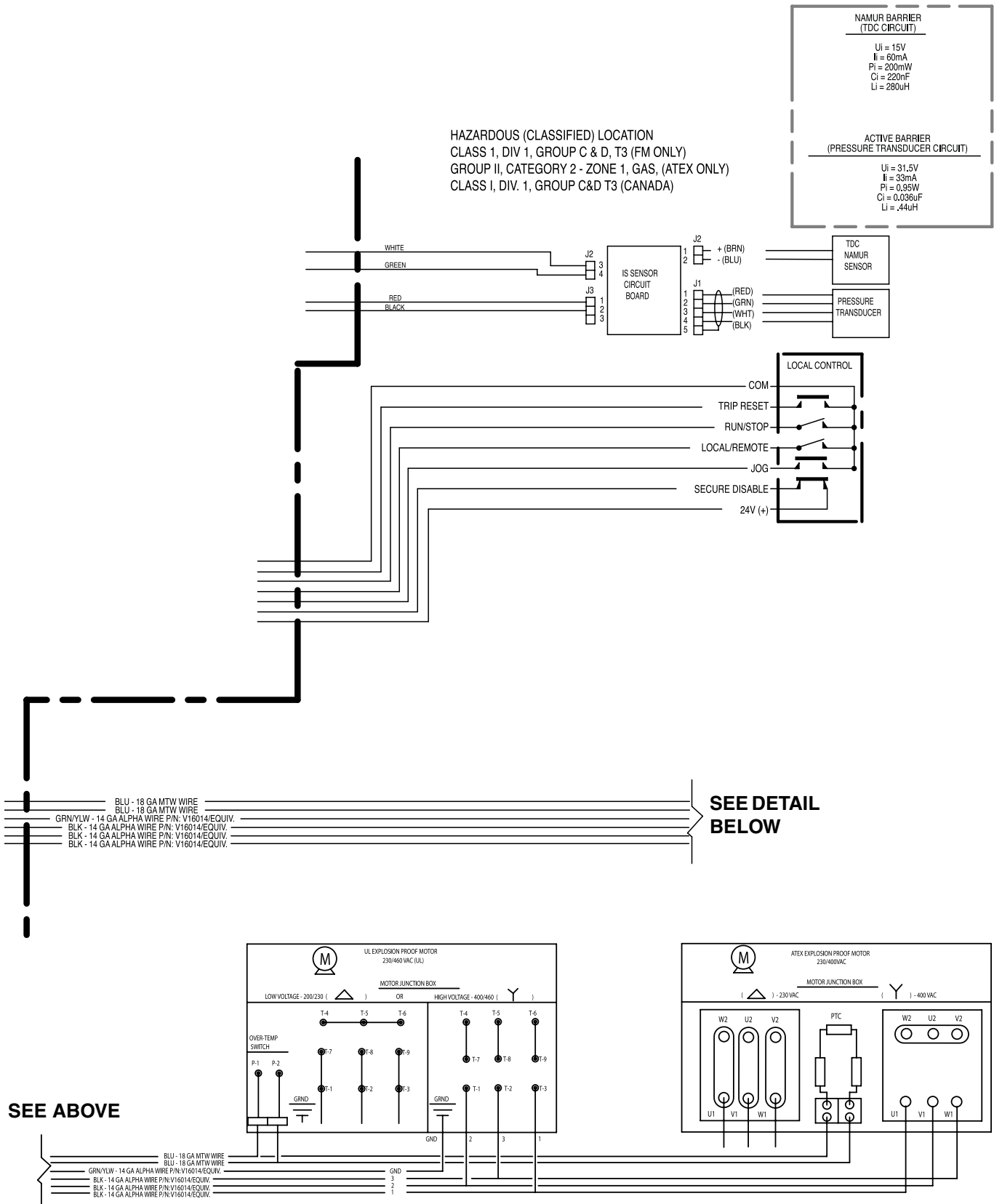


FIG. 2: System Wiring Schematic, Hazardous Location

Repair

Fluid Section

Complete kits are available to convert from one size lower to another. See the table below for available kits. Use all the new parts in the kit. The kits include two lowers, inlet/outlet manifolds, connecting hardware, and instruction manual 311611.

Kit Part No.	Lower Part No.	Description
15J747	253520	1000 cc, Chromex
15J748	253521	1500 cc, Chromex
15J749	253522	2000 cc, Chromex
15J750	253523	1000 cc, Maxlife
15J751	253524	1500 cc, Maxlife
15J752	253525	2000 cc, Maxlife

Manifold Gasket Kit 15H878 is available to replace the sanitary gaskets at the inlet and outlet manifolds. The kit includes items 16, 41, 58, two 120631 PTFE Gaskets, and instruction sheet 406637.

Disassembly



1. Flush the pump, see page 7.
2. Jog the motor to bring the lower on the side being repaired to the bottom of its stroke. This provides access to the coupling nut (14).
3. Relieve pressure, page 7.
4. See FIG. 3. Place a 3/4 in. wrench on the slider piston (9) flats (just above the coupling nut), to keep the slider piston/connecting rod from turning when you are loosening the coupling nut (14). Orient the wrench so it is braced against one of the tie rods (3). Applying excessive force to the slider piston/connecting rod can shorten the life of the lower pin bearing.

5. Using a 1-5/8 in. open-end wrench, unscrew the coupling nut (14) from the slider piston (9) and let it slide down onto the pump piston rod. Be careful not to lose the collars (13).
6. Repeat steps 2-5 for the other lower.
7. Shut off electrical power and allow the unit to cool.

Hold slider piston (9) flats with 3/4 in. wrench, and brace against tie rod (3).

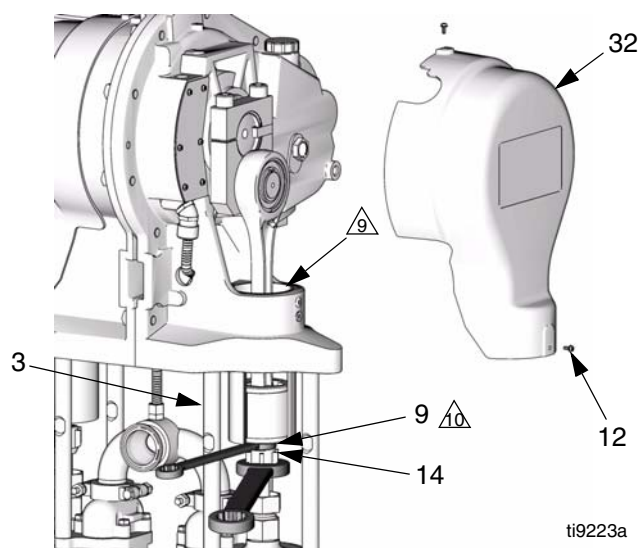


FIG. 3. Remove Coupling Nut

8. Disconnect the fluid inlet and outlet lines from the pump. Plug the ends to prevent fluid contamination.
9. See FIG. 4. At the pump outlet manifold (17), loosen the transducer nut (43) and unscrew the adapter (42) from the manifold. Remove the transducer (25a) from the manifold port. Remove the existing o-ring (41) and discard.
10. Loosen the clamps (18) at the inlet and outlet manifolds (17). Remove the manifolds and gaskets (16).
11. Remove the coupling nut (14) and collars (13) from the piston rods (PR).
12. Unscrew the locknuts (15). Remove the lower (22). To repair the lower, see manual 311690.

Reassembly

1. See FIG. 4. Install the coupling nut (14) on the lower's piston rod (PR).
2. Orient the lower (22) to the gear reducer (GR) as shown. Position the lower on the tie rods (3). Screw the tie rod locknuts (15) onto the tie rods handtight.
3. Assemble the inlet and outlet manifolds (17) to the lower, using new gaskets (16). Torque the clamps (18) to 15-20 ft-lb (21-27 N•m).
4. Torque the locknuts (15) to 50-60 ft-lb (68-80 N•m).
5. Install a new black o-ring (41) on the transducer (25a).
6. Insert the transducer into the outlet manifold (17). Torque the adapter (42) first, then the nut (43) to 15-20 ft-lb (21-27 N•m).
7. Install a black o-ring (41) on the plug (45). Screw the plug into the inlet manifold (17) and torque to 15-20 ft-lb (21-27 N•m).
8. Ensure that the collars (13) are in place in the coupling nut (14).
9. Place a 3/4 in. wrench on the flats of the slider piston (9), to keep it from turning when you are tightening the coupling nut (14). Orient the wrench so it is braced against one of the tie rods (3) or the pump stand. Tighten the coupling nut (14) onto the slider piston (9) and torque to 75-80 ft-lb (102-108 N•m).
10. Turn on power and jog the motor to bring the other drive to the bottom of its stroke. Repeat procedure to connect the other lower.



Update the drive software to reflect the change in size of the lowers. See manual 311596.

11. Flush and test the pump before reinstalling it in the system. Connect hoses and flush the pump. While it is pressurized, check for smooth operation and leaks. Adjust or repair as necessary before reinstalling in the system.

- Torque to 50-60 ft-lb (68-80 N•m).
- Torque to 75-80 ft-lb (102-108 N•m).
- Torque to 15-20 ft-lb (21-27 N•m).
- Apply lithium grease.

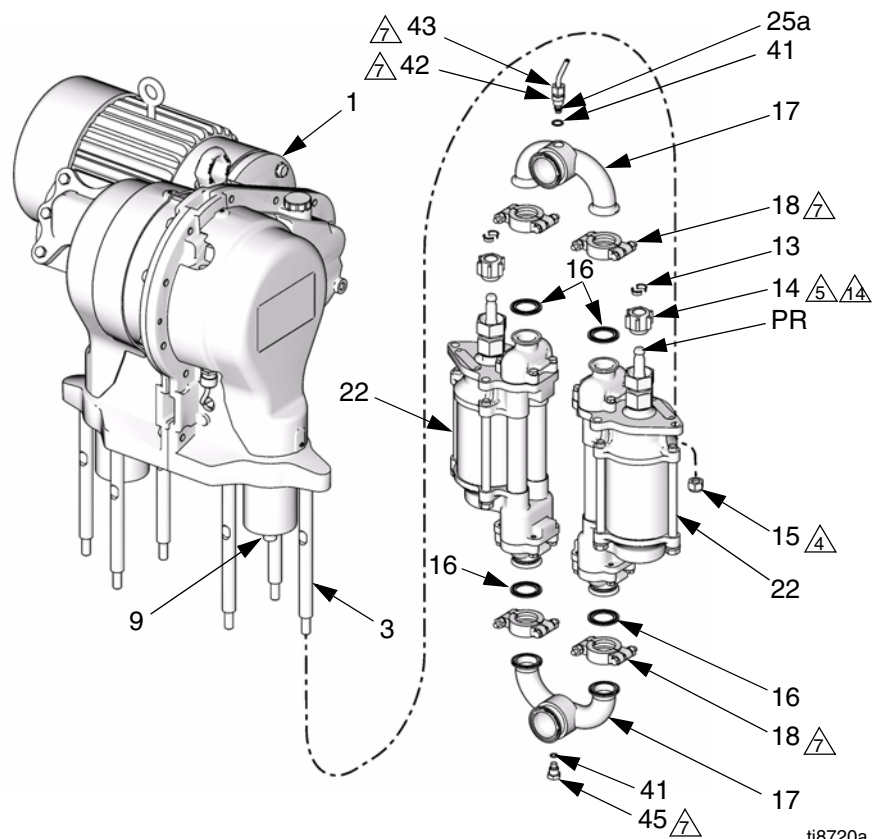


FIG. 4: Fluid Section

Slider Cylinder Rebuild Kit 15H874

Slider Cylinder Rebuild Kit 15H874 includes parts to rebuild one slider cylinder assembly. Order two kits to rebuild both slider cylinder assemblies. Use all the new parts in the kit. The kit includes manual 311599.



1. Perform the **Disassembly** procedure on page 12.
2. Remove two screws (12) and the cover. FIG. 5 shows the cover (32) on the stand side; the motor side cover is (21).
3. Remove the setscrew (31). Unscrew the slider cylinder (2) from the gear reducer (1).
4. Remove the bearings (8) from the slider piston (9).
5. Install the two new bearings (8) on the slider piston (9). The joints between the bearings must align with the pin hole (PH) in the slider piston.
6. Screw the slider cylinder (2) into the gear reducer (1). Torque to 15-20 ft-lb (21-27 N•m). Install the set-screw (31). Torque to 30-35 in-lb (3.4-3.9 N•m).
7. Install two screws (12) and the cover (32 is shown; use 21 on the motor side).
8. Perform the **Reassembly** procedure on page 13. Use the tie rod locknuts (15) included in the kit.
9. Return the pump to service.

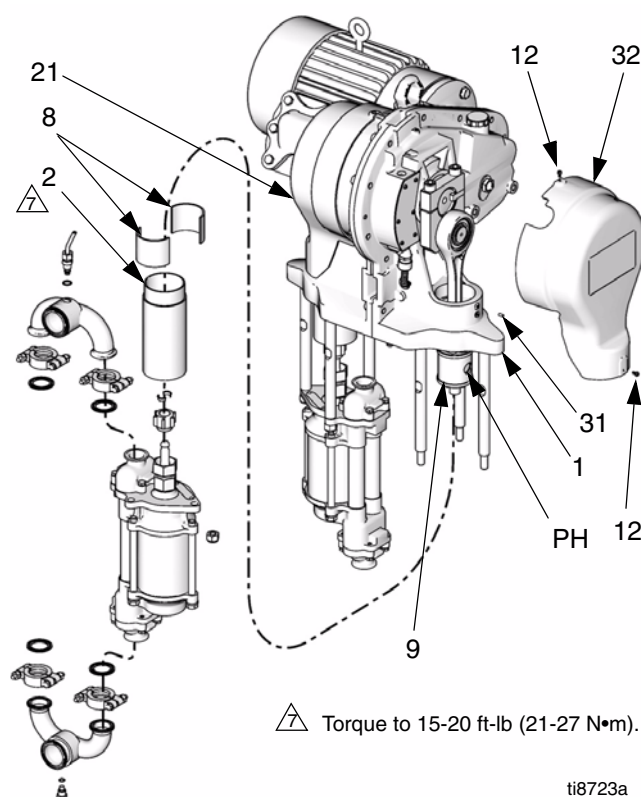




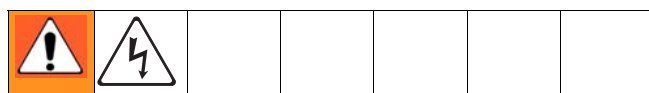
FIG. 5. Slider Cylinder Kit

Electrical Section

 Sensor Circuit Kit 15J755 is available to add the optional sensor circuit to a pump. Use all the new parts in the kit. See manual 311603.

Pressure Transducer Kit 15H876

 Pressure Transducer Kit 15H876 replaces the pressure transducer and the circuit board. Use all the new parts in the kit. The kit includes manual 311600.



1. Jog the motor to bring the stand side lower to the bottom of its stroke.
2. Relieve pressure, page 7.
3. Shut off electrical power to the unit.
4. Remove two screws (12) and the cover (32).
5. See FIG. 6. Remove six screws (12), the circuit board cover (34), and the gasket (33).
6. Disconnect the transducer cable (25a) from J1 on the circuit board (25c). See FIG. 6 and the **Electrical Diagrams**, page 10.
7. Disconnect the TDC cable (25b) from J2 on the circuit board (25c).
8. Disconnect the IS circuit field wire from J2 and J3.
9. Remove four screws (12) and the circuit board (25c).
10. Install the new circuit board (25c) using four screws (12).

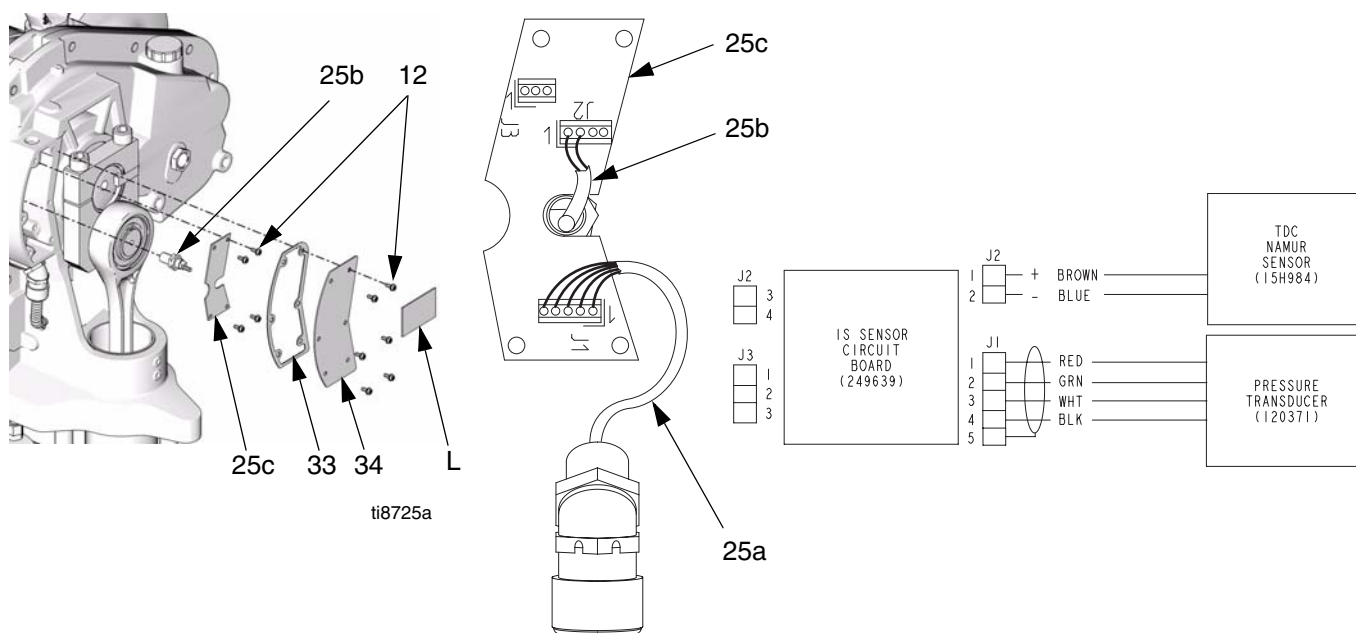



FIG. 6. Circuit Board

11. See FIG. 7. At the pump outlet manifold (17), loosen the transducer nut (43) and unscrew the adapter (42) from the manifold. Remove the transducer (25a) from the manifold port and pull its cable out of the conduit (44).
12. Install one new black o-ring (41) and the new brass spacer (58) on the transducer (25a).

 Torque to 15-20 ft-lb (21-27 N•m).

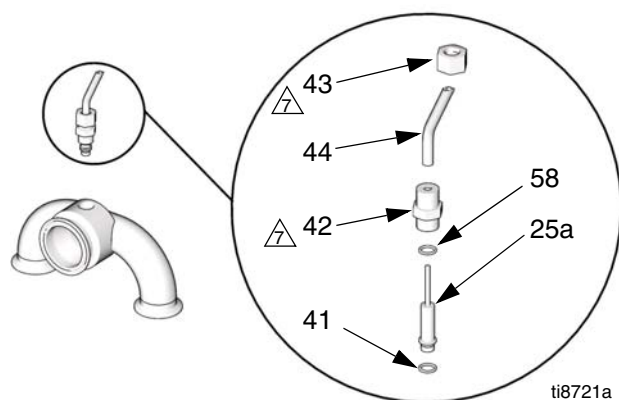


FIG. 7. Pressure Transducer

13. Thread the transducer's cable (25a) through the adapter (42) and conduit (44). Reconnect the cable to J1 on the circuit board (25c). See FIG. 6.
14. See FIG. 7. Insert the transducer into the outlet manifold (17). Torque the adapter (42) first, then the nut (43) to 15-20 ft-lb (21-27 N•m).
15. See FIG. 6. Connect the TDC cable (25b) to J2 on the circuit board (25c).
16. Connect the IS circuit field wire to J2 and J3. See the **Electrical Diagrams**, page 10.
17. Install the new gasket (33), the cover (34), and six screws (12).
18. Remove the old label (L) from the circuit board cover (34). Attach the new label (L) to the cover.
19. Enter calibration information found on the new label (L) into the VFD. See **Pressure Transducer Calibration Procedure**.
20. Reinstall the cover (32) with two screws (12).

Pressure Sensor Calibration Information

Pressure sensor information (Pr 20.34, 20.35, and 20.36) for your system must be keyed into the Variable Frequency Drive before system start-up.

To prevent accidental change of pressure sensor calibration parameters, they are locked by Pr 20.16. To enter calibration parameters, perform the following steps:

- a. Set Pr 20.16 to 777, to unlock pressure sensor parameters.
- b. Enter calibration parameters Pr 20.34, 20.35, and 20.36.
- c. Set Pr 20.16 to 0 to lock pressure sensor parameters.

Calibration Parameters from the label:

Pr 20.34 – Zero Calibration



Pr 20.35 – Calibration Pressure

Pr 20.36 – High Calibration

Pressure Transducer Calibration Procedure

E-Flo Plus pressure sensor must be calibrated against an instrument grade High Precision Pressure Transducer, which should be installed near the E-Flo Plus pressure sensor.


1. Ensure that the High Precision Pressure Transducer calibration is up to date.
2. Set Pr **20.11** to 777, to unlock pressure sensor parameters.
3. Calibrate Low Pressure Point as follows:
 - a. Ensure that system is not pressurized. Calibration instrument pressure reading should be 0 psi.
 - b. Use Keypad to navigate to Pr **20.33**; monitor its reading for 5 – 10 seconds to determine its average value. Make a record of it.
 - c. Navigate to Pr **20.34** and enter the recorded average value of Pr **20.33**.
4. Calibrate the High Pressure Point as follows:
 - a. Pressurize the system to 250 – 275 psi.

						
Do not exceed pressure rating of the system! If system is rated to a pressure lower than 250 psi, use maximum allowable rated pressure. Refer to Operation Manual 311593.						

- b. Keep the system pressurized and ensure that pressure does not fluctuate.
 - c. Take a pressure reading from the calibration instrument and make a record of it.
 - d. Navigate to Pr **20.35** and enter the recorded system pressure.
 - e. Navigate to Pr **20.33**; monitor its reading for 5-10 seconds to determine its average value. Make a record of it.
 - f. Navigate to Pr **20.36** and enter the recorded value of Pr **20.33**.
5. Set Pr **20.11** to 0 to lock pressure sensor parameters.
6. Verify pressure calibration.
 - a. Relieve system pressure.
 - b. Navigate to Pr **20.31** and verify that its reading is within the range of 0-3 psi.
 - c. Pressurize the system to about 100 psi. Verify that reading of Pr **20.31** is within +/- 2.5 psi of the system pressure.
 - d. Pressurize system to about 250 psi. Verify that reading of Pr **20.31** is within +/- 2.5 psi of the system pressure.


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TDC Sensor Kit 15H877

 TDC Sensor Kit 15H877 replaces the TDC sensor. Use all the new parts in the kit. The kit includes manual 311601.




1. Jog the motor to bring the stand side lower to the bottom of its stroke.
2. Relieve pressure, page 7.
3. Shut off electrical power to the unit.
4. Remove two screws (12) and the cover (32).
5. See FIG. 8. Remove six screws (12), the circuit board cover (34), and the gasket (33).
6. Disconnect the transducer cable (25a) from J1 on the circuit board (25c). See FIG. 6, page 15.
7. Disconnect the TDC cable (25b) from J2 on the circuit board (25c).
8. Disconnect the IS circuit field wire from J2 and J3. See the **Electrical Diagrams**, page 10.
9. See FIG. 8. Remove four screws (12) and the circuit board (25c).
10. Unscrew the TDC sensor (25b) from the gear housing.
11. Apply pipe sealant and screw the TDC sensor (25b) into the gear housing. Torque to 66-78 in-lb (7.4-8.8 N•m).

 TDC sensor nuts are locked in place to ensure correct positioning. Do not adjust.

12. Install the circuit board (25c) using four screws (12).
13. Reconnect the TDC cable (25b) to J2 on the circuit board (25c).
14. Reconnect the transducer cable (25a) to J1 on the circuit board (25c).
15. Reconnect the IS circuit field wire to J2 and J3. See the **Electrical Diagrams**, page 10.

16. Install the new gasket (33), the cover (34), and six screws (12).

17. Reinstall the cover (32) with two screws (12).

 Torque to 66-78 in-lb (7.4-8.8 N•m).

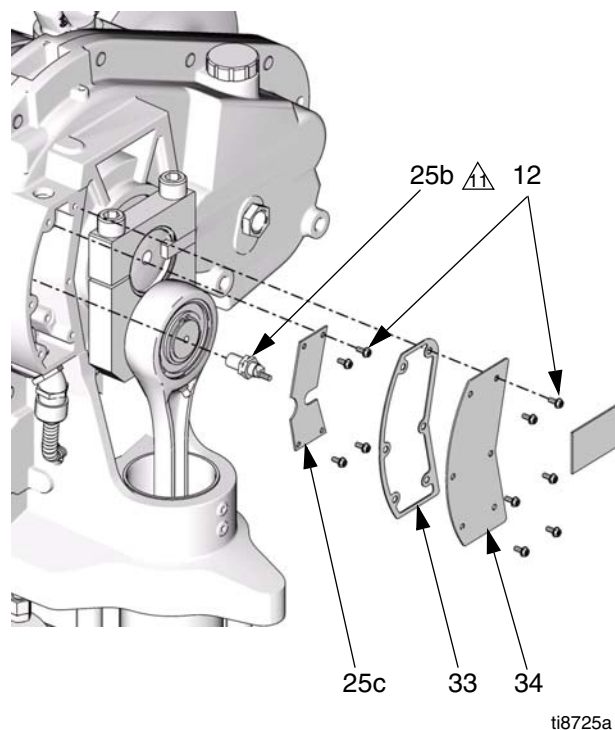



FIG. 8. TDC Sensor


Drive Section


Slider Bearing Kit 15H882

 Slider Bearing Kit 15H882 includes parts to rebuild both slider bearing assemblies. Use all the new parts in the kit. The kit includes manual 311616.



1. Jog the motor to bring the pump on the side being repaired to the bottom of its stroke. This provides access to the coupling nut (14).
2. Relieve pressure, page 7.
3. Shut off electrical power to the unit.
4. Remove two screws (12) and the cover. FIG. 9 shows the cover (32) on the stand side; the motor side cover is (21).

 Place clean rag over slider cylinder (2).

 Hold slider piston (9) flats with 3/4 in. wrench, and brace against tie rod (3).

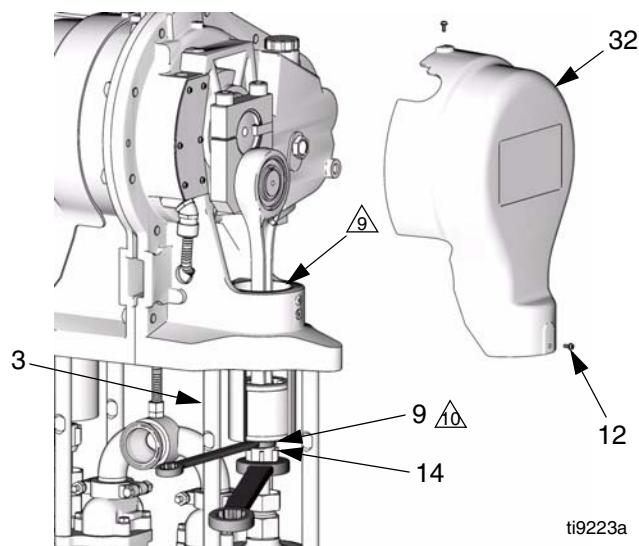




FIG. 9. Remove Coupling Nut

5. Place a clean rag over the top of the slider cylinder (2) to prevent debris from falling into the slider assembly during disassembly.
6. Place a 3/4 in. wrench on the slider piston (9) flats (just above the coupling nut), to keep the slider piston/connecting rod from turning when you are loosening the coupling nut (14). Orient the wrench so it is braced against one of the tie rods (3). Applying excessive force to the slider piston/connecting rod can shorten the life of the lower pin bearing.
7. Using a 1-5/8 in. open-end wrench, unscrew the coupling nut (14) from the slider piston (9) and let it slide down onto the pump piston rod. Be careful not to lose the collars (13).
8. See FIG. 10. Using a 1/2 in. hex driver, unscrew the two cap screws (5). Remove the crank arm cap (38) and key (39). If necessary, use a plastic hammer to break these parts loose.

 Place clean rag over slider cylinder (2).

 Apply antiseize lubricant to screw (5) threads. Torque key-side screw to 210-230 ft-lb (283-310 N•m) first, then torque gap side screw to 210-230 ft-lb (283-310 N•m).

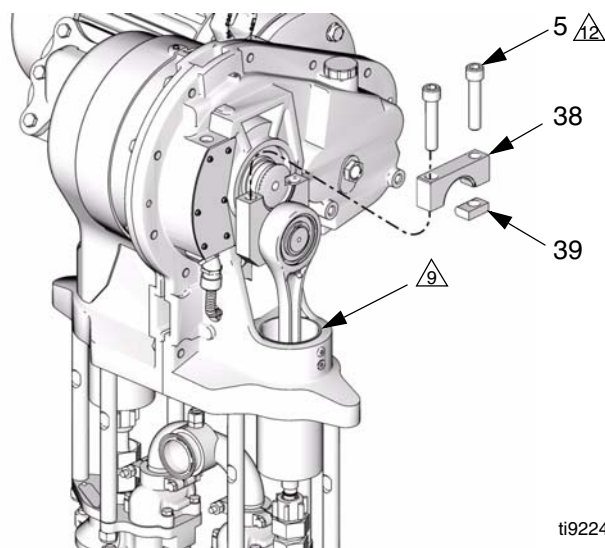


FIG. 10. Remove Crank Arm Cap

9. See FIG. 11. Rotate the crank arm (4) to allow it to be removed from the output shaft (OS).
10. Pull the crank arm/connecting rod/slider piston assembly (CR) up and out of the cylinder.
11. Remove the old bearings (8).

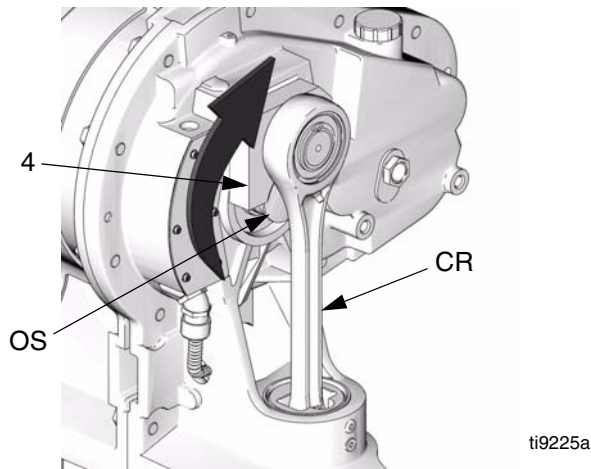


FIG. 11. Rotate Crank Arm

12. See FIG. 12. Install the two new bearings (8) on the slider piston (9). The joints between the bearings must align with the pin hole (PH) in the slider piston.

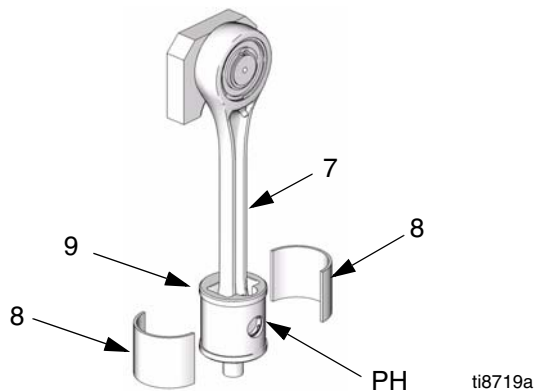


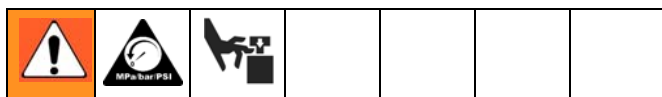
FIG. 12. Slider Bearings

13. Slide the piston (9) and connecting rod (7) into the cylinder (2).
14. Position the crank arm (4) to engage the output shaft (OS), and rotate it to the bottom of the output shaft.
15. Place a clean rag over the top of the slider cylinder (2) to prevent debris from falling into the slider assembly during reassembly.
16. See FIG. 10. Apply antiseize lubricant to the threads of the cap screws (5). Install the key (39), crank arm cap (38), and cap screws (5), oriented as shown. While the gap-side screw is still loose, torque the key-side screw to 210-230 ft-lb (283-310 N•m). Then torque the gap-side screw to 210-230 ft-lb (283-310 N•m).
17. Ensure that the collars (13) are in place in the coupling nut (14).
18. Place a 3/4 in. wrench on the flats of the slider piston (9), to keep it from turning when you are tightening the coupling nut (14). Orient the wrench so it is braced against one of the tie rods (3) or the pump stand. Tighten the coupling nut (14) onto the slider piston (9) and torque to 75-80 ft-lb (102-108 N•m).
19. Remove the rag. Reinstall the cover (32 or 21) and screws (12).
20. Repeat for the other side.

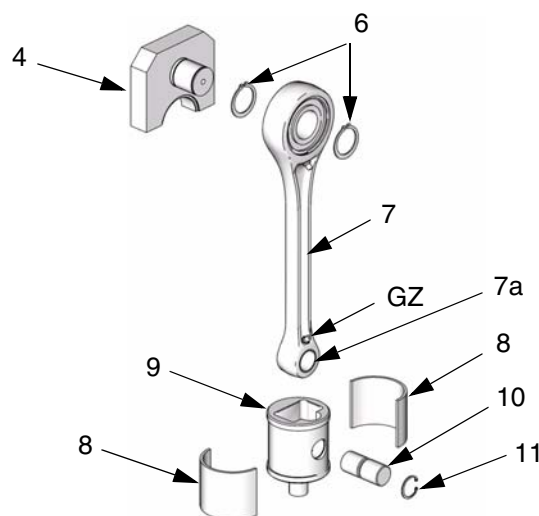
Drive Linkage Rebuild Kit 15H873

Drive Linkage Rebuild Kit 15H873 includes parts to rebuild one drive linkage assembly. Order two kits to rebuild both drive linkage assemblies. Use all the new parts in the kit. The kit includes manual 311598.

Replace the wrist pin bearings (7a) in the connecting rod annually. Wrist Pin Replacement Kit 255216 includes parts to replace the wrist pin bearings on both drive linkage assemblies. Use all the new parts in the kit. The kit includes manual 311609.



1. Jog the motor to bring the pump on the side being repaired to the bottom of its stroke. This provides access to the coupling nut (14).
2. Relieve pressure, page 7.
3. Shut off electrical power to the unit.
4. Disconnect the drive linkage. See steps 4-11 on pages 20-21.
5. See FIG. 13. Orient the new connecting rod (7) and slider piston (9) as shown. Assemble the crank arm (4), retaining rings (6), pin (10), and retaining ring (11).





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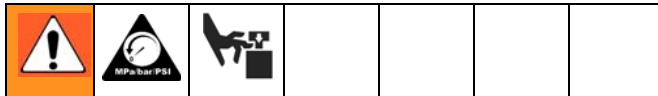
FIG. 13. Drive Linkage Assembly

6. Every 6 months, lubricate the wrist pin bearing (7a) on the connecting rod with 1 shot (1 cc) of 107411 Grease or equivalent, using grease zerk (GZ). The top bearing is prelubricated and does not require grease at installation.
7. Reconnect the drive linkage. See steps 12-19 on page 21.
8. Repeat for the other side.

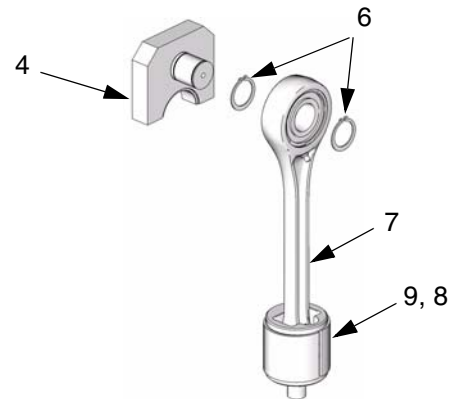
Crank Arm Kit 15H883

 Crank Arm Kit 15H883 is available. Order two kits to rebuild both crank arm assemblies. Use all the new parts in the kit. The kit includes manual 311604.

 Crank Arm Cover Kit 15H378 is available to replace both crank arm covers (21, 32). Use all the new parts in the kit.



1. Jog the motor to bring the pump on the side being repaired to the bottom of its stroke. This provides access to the coupling nut (14).
2. Relieve pressure, page 7.
3. Shut off electrical power to the unit.
4. Disconnect the crank arm. See steps 4-10 on pages 20-21.
5. See FIG. 14. Remove the outer retaining ring (6) securing the crank arm (4) to the connecting rod (7). Slide the crank arm shaft out of the connecting rod.
6. Assemble the crank arm (4) to the connecting rod (7) with two retaining rings (6), oriented as shown.
7. Ensure that the joints between the bearings (8) align with the pin hole (PH) in the slider piston. See FIG. 12 on page 21.
8. Reconnect the crank arm assembly. See steps 13-19 on page 21.
9. Repeat for the other side.

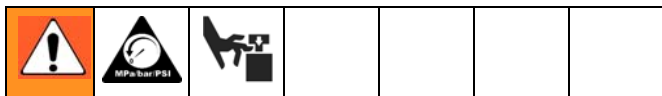


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FIG. 14. Crank Arm and Connecting Rod

Motor/Gear Reducer

Motor Removal



1. Relieve pressure, page 7.
2. Shut off electrical power to the unit.

 See FIG. 17 for all NEMA 184 TC Frame electric motors. See FIG. 18 for IEC 112M/B5 Frame electric motors.

3. While one person supports the motor (19), remove the screws (37). Pull the motor away from the gear reducer.
4. See FIG. 15. Loosen both setscrews (31). Insert the coupler removal tool (T) into the coupler (28). Turn nut clockwise until tight, then pull the coupler off the gear reducer input shaft (105) by turning hex-head screw (HS) clockwise.

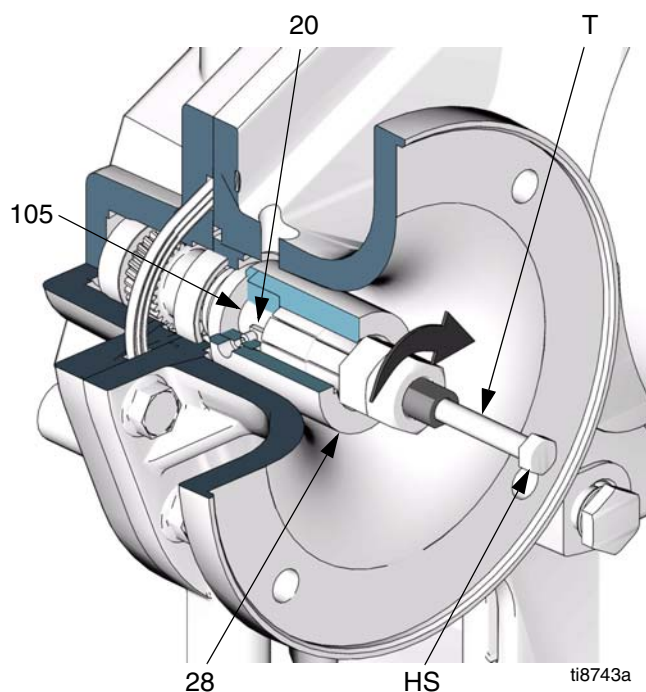



FIG. 15. Motor Coupler Removal

Motor Installation

-  To install a NEMA 184 TC Frame electric motor, order Motor Coupler Kit 15H880. See manual 311605.
- To install an IEC 112M/B5 Frame electric motor, order Motor Adapter Kit 15J893. See manual 311605.

1. See FIG. 16. Assemble the key (20) and two setscrews (31) in the coupler (28). Slide the coupler into the gear reducer so the key mates with the input shaft (105). Slide on until coupler and key bottom. Tighten setscrews to 66-78 in-lb (7.5-8.8 N•m). Apply antiseize lubricant to bore of coupling.

 Apply antiseize lubricant to bore of coupling (28).

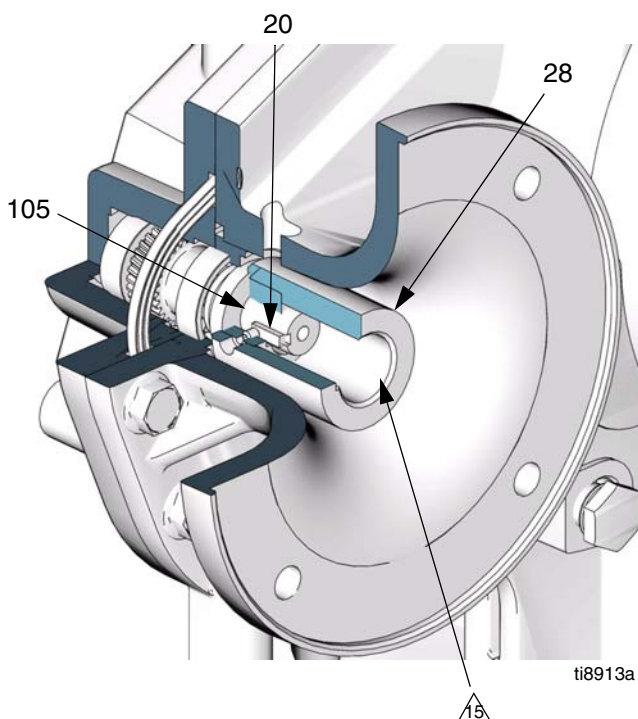

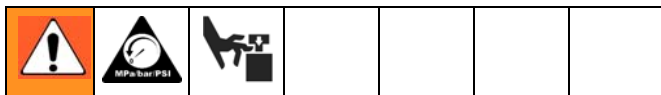



FIG. 16. Motor Coupler Installation

Gear Reducer Seal Kit 15H871

 Gear Reducer Seal Kit 15H871 and Output Shaft Seal Tool Kit 15J926 are available. Use all the new parts in the kit. The kits include manual 311597.



1. Jog the motor to bring the motor-side pump to the bottom of its stroke.

 Repair the motor side seals first, as follows.

2. Relieve pressure, page 7.
3. Shut off electrical power to the unit.
4. Remove the motor and coupler, see page 24.
5. Remove four screws (12) and both covers (21, 32).
6. See FIG. 19. On the motor side of the gear reducer, unscrew the oil drain plug (118) and remove the gasket (119). Pierce the input seal (109) with a hardened sheet metal screw and pull it out.

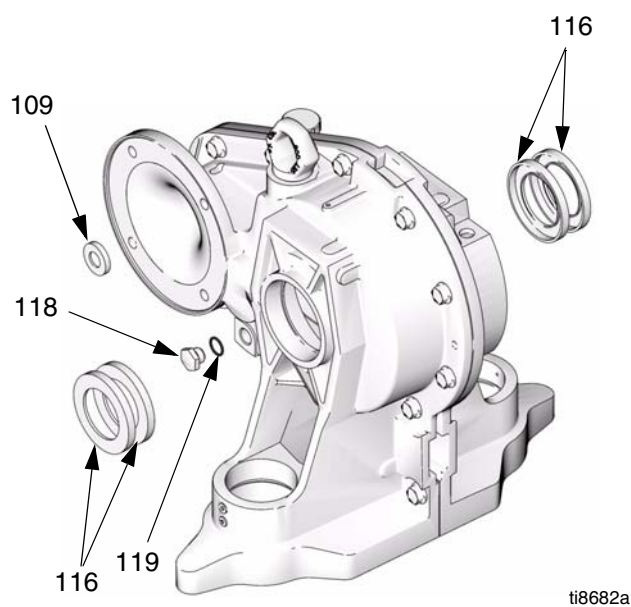


FIG. 19. Gear Reducer Seals

7. Place tape over the input shaft keyway, to prevent damage to the new seal. Pack the input shaft seal cavity with Part No. 107411 Grease. Install the input seal (109) with the lip facing in, until the seal contacts the shoulder of the gear reducer housing. Remove the tape.
8. Install the gasket (119) on the oil drain plug (118) and screw the plug into the gear reducer. Tighten securely.
9. Disconnect the crank arm. See steps 5-9 on page 20.
10. Remove the two output seals (116) as follows:
 - a. See FIG. 20. Place the tool (C) onto the output shaft (OS). Turn the tool 90°. Install and tighten the two 0.5 in. (13 mm) screws (G) to lock the tool in place.
 - b. Drill 1/8 in. (3 mm) diameter (maximum) pilot holes in the seals (116), using the holes for the sheet metal screws (D) as a template. Install the sheet metal screws (D) through the tool and into the seals (116).
 - c. Tighten screws (D) evenly to pull both seals out.

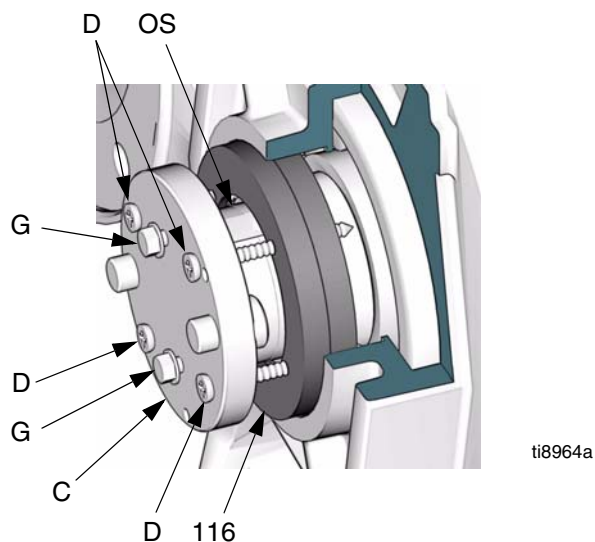


FIG. 20. Remove Output Shaft Seals

11. Install the two output seals (116) as follows:

- a. Place tape over the output shaft keyway, to prevent damage to the new seals. Pack the output shaft seal cavity with Part No. 107411 Grease.
- b. See FIG. 21. Push **one** output seal (116) onto the output shaft (OS), with the lips facing in.
- c. Remove the sheet metal screws from the tool (C). Place the tool (C) onto the output shaft (OS), fitting one screw (A) into the slot of the shaft. Turn the tool 90°. Tighten the screws (G) to lock it onto the shaft.
- d. Place the installation tool (E) against the seal (116) as shown.
- e. Install the tool cover (F) and evenly tighten the screws (J) to seat the seal on the output shaft (OS).

- f. Remove the tools. Take three measurements 120° apart, from the surface of the seal to the face of the housing (H). The three measurements must be within .020 in. (0.5 mm). If not, repeat steps c through e.

- g. Repeat for the second seal (116). Remove the tape.

12. Reconnect the crank arm. See steps 13-16 on page 21.

13. Reinstall the coupler and motor, see page 24.

14. Turn on electrical power to the unit.


15. Jog the motor to bring the stand-side pump to the bottom of its stroke.

16. Shut off electrical power to the unit.


17. Repeat steps 9-12 to replace the output seals on the stand-side.

18. Reinstall the covers (21, 32) and screws (12).

19. Add 2 quarts of gear oil, Part No. 288414.

 Pack cavity with grease before installing seal.

 Insert until 109 contacts shoulder.

 Insert until 116 contacts shoulder.

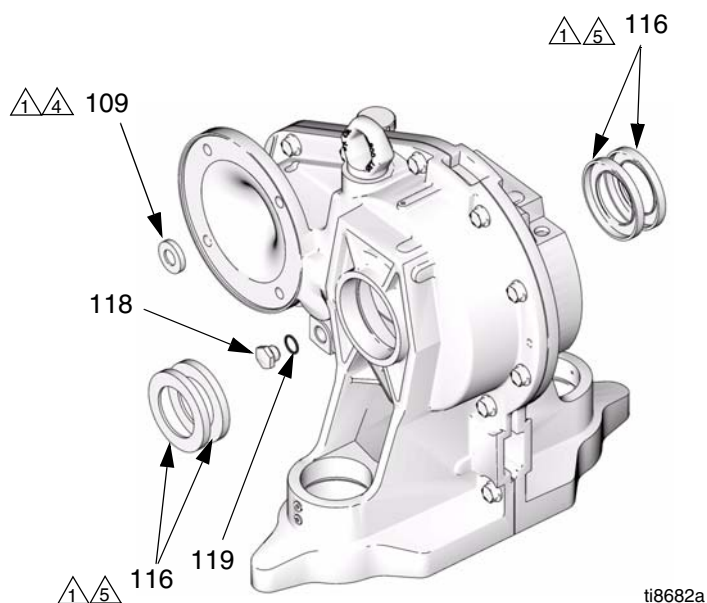
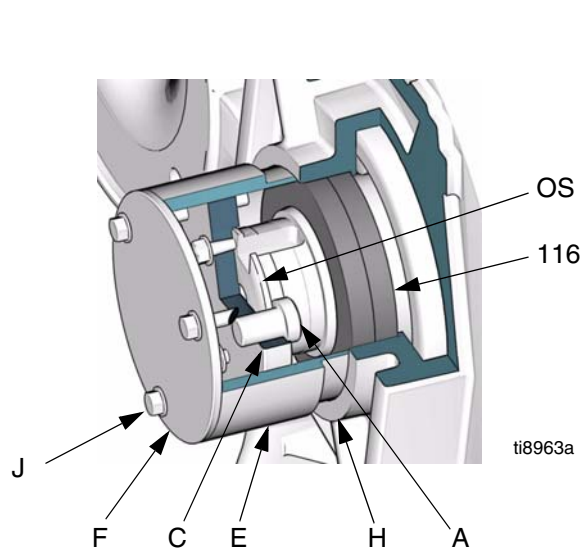

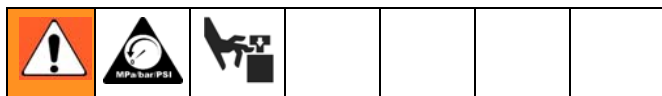


FIG. 21: Gear Reducer Seal Kit

Gear Reducer Replacement Kit 15H886

Disassembly

 Gear Reducer Kit 15H886 is available to replace the entire gear reducer. Use all the new parts in the kit. The kit includes manual 311615.



1. Jog the motor to bring the stand side lower to the bottom of its stroke. This provides access to the coupling nut (14).
2. Relieve pressure, page 7.
3. Shut off electrical power to the unit.
4. Disconnect the drive linkage. See steps 4-10 on pages 20-21.
5. Turn on power and jog the motor to bring the motor side lower to the bottom of its stroke.
6. Shut off electrical power to the unit. Repeat the procedure for the motor side lower.
7. Disconnect the fluid inlet and outlet lines from the pump and plug the ends to prevent fluid contamination.
8. Remove the motor (19), see page 24.
9. See FIG. 23. Remove the circuit board cover (34) and gasket (33).
10. See FIG. 22. If present, disconnect the transducer (25a) from J1 on the circuit board (25c).
11. If present, disconnect the IS circuit field wire from J2 and J3 on the circuit board.
12. If present, remove the circuit board (25c) and TDC sensor (25b). Retain for reassembly.
13. See FIG. 23. Unscrew the strain relief (35) from the gear housing and pull it and the transducer conduit out of the housing. Do not disconnect the transducer from the pump outlet manifold (17).
14. Unscrew the locknuts (15) from the tie rods (3). Remove the entire fluid section. Unscrew the tie rods (3) from the gear housing.

15. See FIG. 23. Remove the setscrew (31). Unscrew the slider cylinder (2) from the gear reducer.

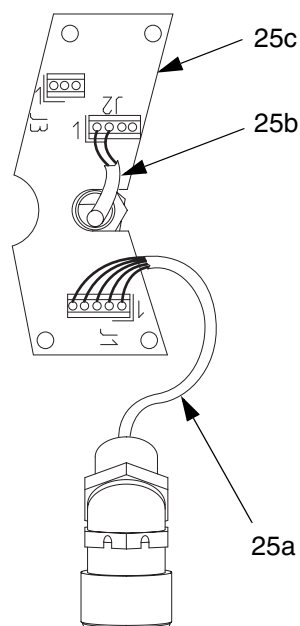
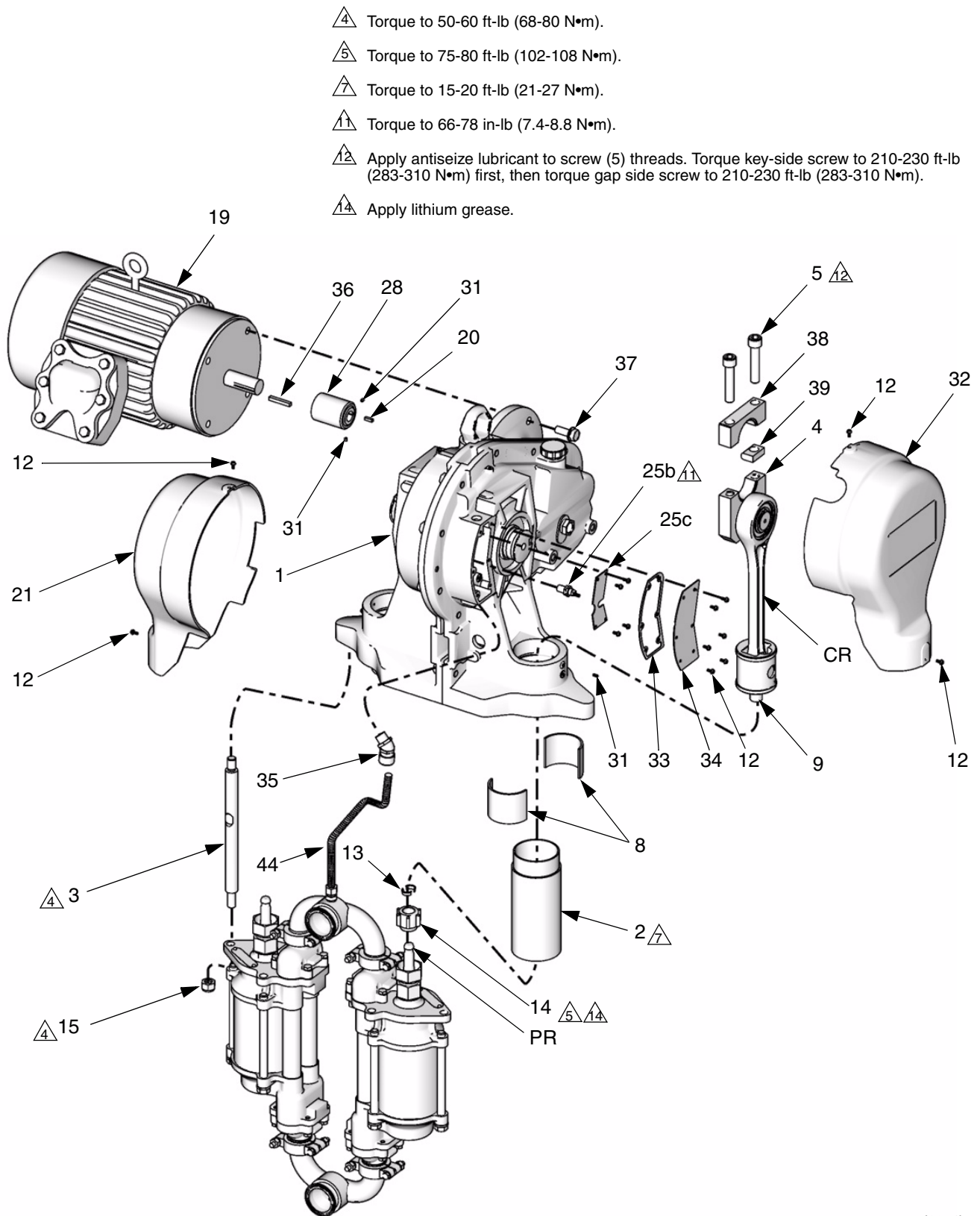


FIG. 22. Circuit Board Connections



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FIG. 23: Gear Reducer Replacement

Reassembly



The kit includes a motor coupler (28), already installed in the gear reducer. The coupler fits all NEMA 184 TC Frame electric motors.

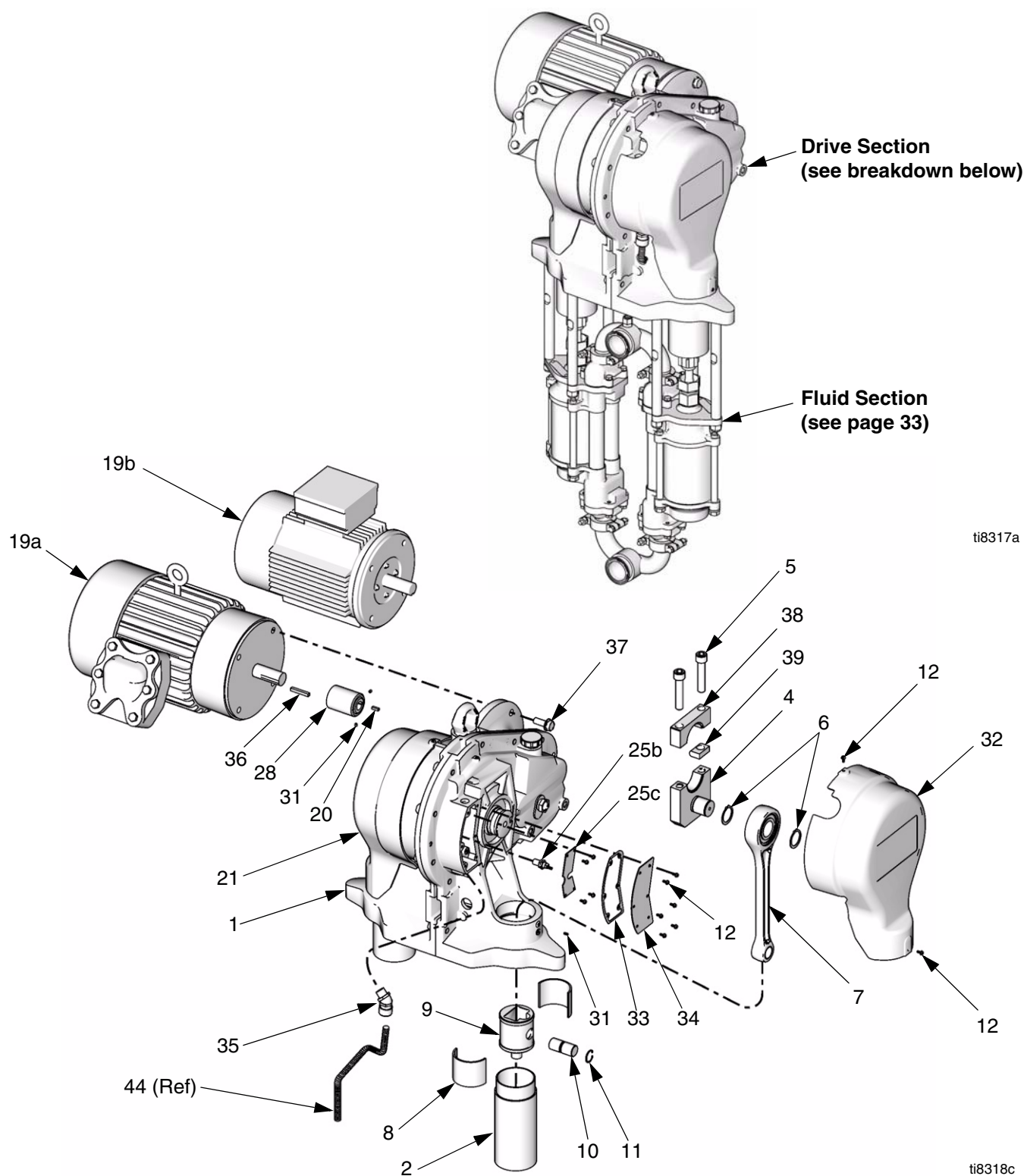
To install an IEC 112M/B5 Frame electric motor, order Motor Adapter Kit 15J893. See manual 311605.

1. Apply antiseize lubricant to bore of coupling.
2. Install the motor (19), see page 24.
3. See FIG. 23. Screw the slider cylinders (2) into the new gear reducer (1). Torque to 15-20 ft-lb (21-27 N•m). Install the setscrews (31). Torque to 30-35 in-lb (3.4-3.9 N•m).
4. Screw the tie rods (3) into the gear housing. Torque to 50-60 ft-lb (68-80 N•m).
5. Orient the lowers (22) to the gear reducer (1) as shown. Position the lowers on the tie rods (3). Screw the tie rod locknuts (15) onto the tie rods. Torque the locknuts to 50-60 ft-lb (68-80 N•m).
6. See FIG. 12 on page 21. Ensure that the joints between the slider bearings (8) align with the pin hole (PH) in the slider piston (9).
7. Reconnect the drive linkage. See steps 13-18 on page 21.
8. Remove the rag from the slider cylinder.
9. Turn on power and jog the motor to bring the other drive to the bottom of its stroke. Repeat procedure to connect the other lower.
10. On pumps with the sensor circuit:
 - a. Remove the plug from the TDC sensor port at the back of the circuit board cavity. Clean any excess sealant from the area.
 - b. Apply pipe sealant and screw the TDC sensor (25b) into the port. Torque to 66-78 in-lb (7.4-8.8 N•m).
 - c. Install the strain relief (35) and the transducer conduit into the gear housing.
 - d. Connect the transducer (25a) to J1 on the circuit board (25c). See FIG. 22.
 - e. Connect the IS circuit field wire to J2 and J3. See the **Electrical Diagrams**, page 10.
 - f. Connect the TDC sensor (25b) to J2 on the circuit board (25c). See FIG. 22.
 - g. Install the circuit board (25c), circuit board cover (34), and new gasket (33).
11. Reinstall the covers (32 and 21) and screws (12).
12. Add 2 quarts of gear oil, Part No. 288414.

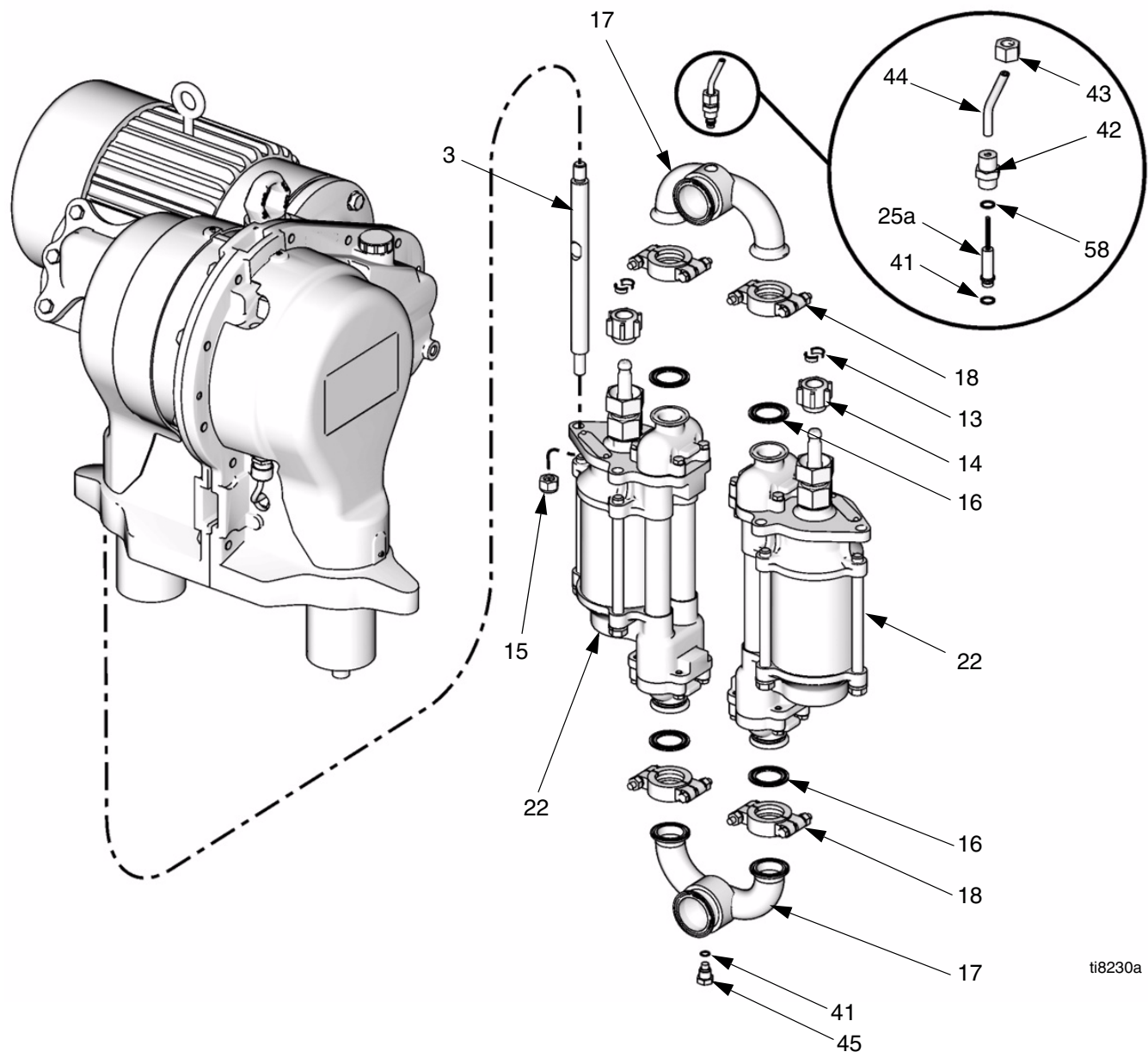
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Parts

Drive Section



Fluid Section



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Common Parts

Ref. No.	Part No.	Description	Qty	Ref. No.	Part No.	Description	Qty
1	15H886	KIT, 75:1 gear reducer; see 311615	1	27	n/a	PLUG, TDC sensor port; <i>not shown; used only on pumps without sensor circuit (25)</i>	1
2†	n/a	CYLINDER, slider	2	28	15H880	KIT, motor coupler; includes items 20, 31, 37; see page 35 for applicable models; see 311605	1
3	n/a	ROD, tie	6	31†	100664	SCREW, set, socket-head; 1/4-20 x 1/2 in. (13 mm)	4
4‡	n/a	ARM, crank	2	32	n/a	COVER, crank arm (stand side)	1
5*‡	n/a	SCREW, cap, socket-head; 5/8-11 x 3 in. (76 mm)	4	33	n/a	GASKET, circuit board; <i>used only on pumps with sensor circuit (25)</i>	1
6*‡	106082	RING, retaining	4	34	n/a	COVER, circuit board; <i>used only on pumps with sensor circuit (25)</i>	1
7*	n/a	ROD, connecting	2	35	n/a	CONNECTOR, strain relief, 45°; <i>used only on pumps with sensor circuit (25)</i>	1
8*†	15H882	KIT, slider bearing; includes 4 bearings and items 5 and 12; see 311616	4	36	120710	KEY, square; 0.25 x 1.75 in.	1
9*	n/a	PISTON, slider	2	37	111195	SCREW, cap, flange-head; 1/2-13 x 1.25 in. (31 mm); <i>used only on pumps supplied with motor (19a or 19b)</i>	4
10*	n/a	PIN, lower connecting rod	2	38‡	n/a	CAP, crank arm	2
11*	n/a	RING, retaining	2	39‡	n/a	KEY, crank arm	2
12*‡	116719	SCREW, 8-32 hex washer head <i>Pumps without sensor circuit (25)</i> <i>Pumps with sensor circuit (25)</i>	4 14	41†	111316	O-RING; chemically resistant fluoroelastomer	2
13	184128	COLLAR, coupling	4	42	n/a	ADAPTER, transducer; <i>used only on pumps with sensor circuit (25)</i>	1
14	184059	NUT, coupling	2	43	n/a	NUT, transducer; <i>used only on pumps with sensor circuit (25)</i>	1
15†	108683	NUT, lock, hex	6	44	n/a	CONDUIT, transducer; <i>used only on pumps with sensor circuit (25)</i>	1
16†	120351	GASKET, sanitary	4	45	n/a	PLUG, manifold <i>Pumps without sensor circuit (25)</i> <i>Pumps with sensor circuit (25)</i>	2 1
17	n/a	MANIFOLD	2	58	n/a	SPACER; brass; <i>used only on pumps with sensor circuit (25)</i>	1
18	120350	CLAMP, sanitary, 1.5	4	<i>Parts designated n/a are not available separately.</i>			
19a	255225	MOTOR, electric, 5HP, 230/460V; see page 35 for applicable models; includes items 36 and 37	1	* <i>Parts included in Drive Linkage Rebuild Kit 15H873 (purchase separately). Order two kits to rebuild both drive linkage assemblies. Includes manual 311598.</i>			
19b	255226	MOTOR, electric, 5HP, 230/400V, ATEX; see page 35 for applicable models; includes items 36 and 37	1	† <i>Parts included in Slider Cylinder Rebuild Kit 15H874 (purchase separately). Order two kits to rebuild both slider cylinder assemblies. Includes manual 311599.</i>			
20	n/a	KEY, square; 0.188 x 0.62 in.	1	‡ <i>Parts included in Crank Arm Rebuild Kit 15H883 (purchase separately). Order two kits to rebuild both crank arm assemblies. Includes manual 311604.</i>			
21	n/a	COVER, crank arm (motor side)	1				
22	253520	LOWER, 1000 cc, Chromex cylinder; see page 35 for applicable models; see 311690 for parts	2				
	253521	LOWER, 1500 cc, Chromex cylinder; see page 35 for applicable models; see 311690 for parts	2				
	253522	LOWER, 2000 cc, Chromex cylinder; see page 35 for applicable models; see 311690 for parts	2				
	253523	LOWER, 1000 cc, Maxlife cylinder; see page 35 for applicable models; see 311690 for parts	2				
	253524	LOWER, 1500 cc, Maxlife cylinder; see page 35 for applicable models; see 311690 for parts	2				
	253525	LOWER, 2000 cc, Maxlife cylinder; see page 35 for applicable models; see 311690 for parts	2				
25	n/a	SENSOR CIRCUIT; see page 35 for applicable models	1				
25a	15H876	KIT, pressure transducer replacement; see 311600	1				
25b	15H877	KIT, TDC sensor replacement; see 311601	1				
25c	15H879	KIT, circuit board replacement; see 311602	1				

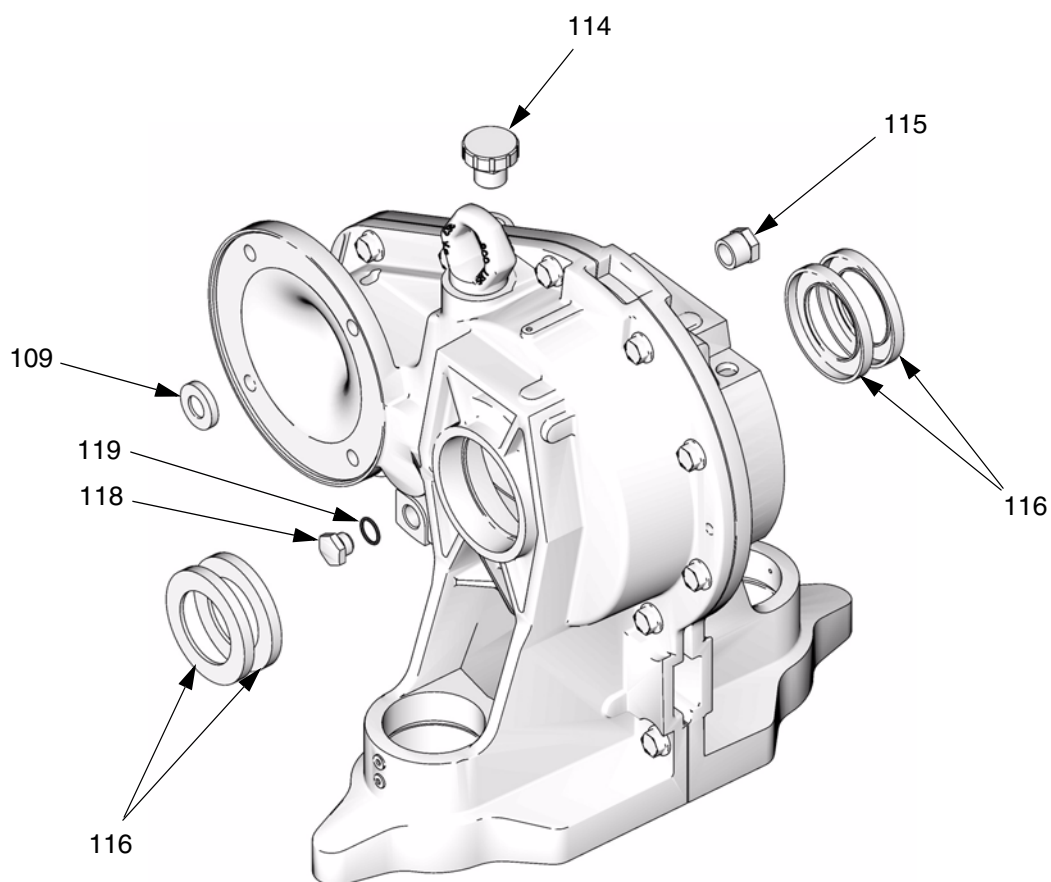
Model-Specific Parts

Pump Part No.	Motor Kit (19)			Lower (22)	Sensor Circuit (25)	Coupler Kit (28)	
	None	255226	255225			None	15H880
EP0010	✓			253520		✓	
EP0020	✓			253521		✓	
EP0030	✓			253522		✓	
EP0040	✓			253523		✓	
EP0050	✓			253524		✓	
EP0060	✓			253525		✓	
EP1010		✓		253520			✓
EP1020		✓		253521			✓
EP1030		✓		253522			✓
EP1040		✓		253523			✓
EP1050		✓		253524			✓
EP1060		✓		253525			✓
EP1110		✓		253520	✓		✓
EP1120		✓		253521	✓		✓
EP1130		✓		253522	✓		✓
EP1140		✓		253523	✓		✓
EP1150		✓		253524	✓		✓
EP1160		✓		253525	✓		✓
EP2010			✓	253520			✓
EP2020			✓	253521			✓
EP2030			✓	253522			✓
EP2040			✓	253523			✓
EP2050			✓	253524			✓
EP2060			✓	253525			✓
EP2110			✓	253520	✓		✓
EP2120			✓	253521	✓		✓
EP2130			✓	253522	✓		✓
EP2140			✓	253523	✓		✓
EP2150			✓	253524	✓		✓
EP2160			✓	253525	✓		✓

15H886 Gear Reducer

Ref.

No.	Part No.	Description	Qty
109	n/a	SEAL, input shaft	1
114	15H525	CAP, fill	1
115	n/a	SIGHTGLASS,	1
116	n/a	SEAL, output	4
118	n/a	PLUG, oil drain	1
119	120395	GASKET, oil plug	1

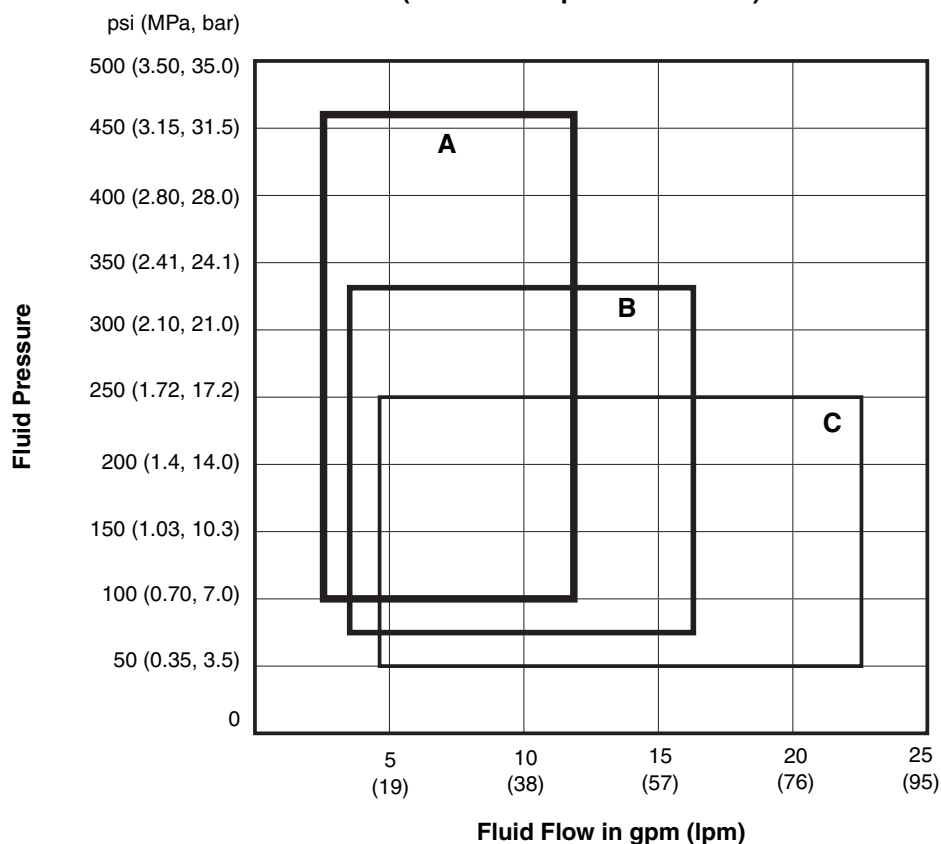


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Technical Data

Maximum Working Pressure	1000 cc Pumps: 460 psi (3.22 MPa, 32.2 bar) 1500 cc Pumps: 330 psi (2.31 MPa, 23.1 bar) 2000 cc Pumps: 250 psi (1.75 MPa, 17.5 bar)
Electrical Requirements	European Models: 230/400 Vac, 3 phase, 20 A North American Models: 230/460 Vac, 3 phase, 15 A
Ambient Temperature Range	32-104°F (0-40°C)
Maximum Fluid Output	22.6 gpm (85.6 liters per min) with 2000 cc lowers. See chart below.
Fluid Inlet and Outlet Size	2 in. Tri-clamp
Gear Reducer Oil Capacity	2 quarts (1.9 liters)
Required Gear Reducer Lubricant	ISO VG220 grade oil (Graco Part No. 288414)
Weight	Pump: 550 lb (249 kg)
Wetted Parts	Lower: see manual 311690 300 Series SST, CV-75, 17-4 PH SST, PTFE
Electric Motor	5 hp, 1750 rpm, 184TC NEMA Frame
Maximum Production Motor Speed	1500 rpm (50 Hz)
Maximum Motor Torque	15 ft-lb (20.3 N•m)
Gear Reduction Ratio	75.16:1

**Pressure and Flow Capability of E-Flo Plus
(continuous production use)**



Key:

- A** 1000 cc Pumps
- B** 1500 cc Pumps
- C** 2000 cc Pumps

Graco Standard Warranty

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be 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 general wear and tear, or 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 of Graco equipment with 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 claimed defect. 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.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

GRACO MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IN CONNECTION WITH ACCESSORIES, EQUIPMENT, MATERIALS OR COMPONENTS SOLD BUT NOT MANUFACTURED BY GRACO. These items sold, but not manufactured by Graco (such as electric motors, 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.

In no event will Graco be liable for indirect, incidental, special or consequential damages resulting from Graco supplying equipment hereunder, or the furnishing, performance, or use of any products or other goods sold hereto, whether due to a breach of contract, breach of warranty, the negligence of Graco, or otherwise.

FOR GRACO CANADA CUSTOMERS

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Graco Information

TO PLACE AN ORDER, contact your Graco distributor or call to identify the nearest distributor.

Phone: 612-623-6921 **or Toll Free:** 1-800-328-0211 **Fax:** 612-378-3505

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