

Three-Piston Pump

Customer Product Manual

Part 108537E

Issued 3/04

**For parts and technical support, call the
Finishing Customer Support Center at (800) 433-9319.**

This document is available on the Internet at <http://emanuals.nordson.com/finishing>



NORDSON CORPORATION • AMHERST, OHIO • USA

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Three-Piston Pump

Repair Preparations



WARNING: Allow only qualified personnel to perform the following tasks. Follow the safety instructions in this document and all other related documentation.

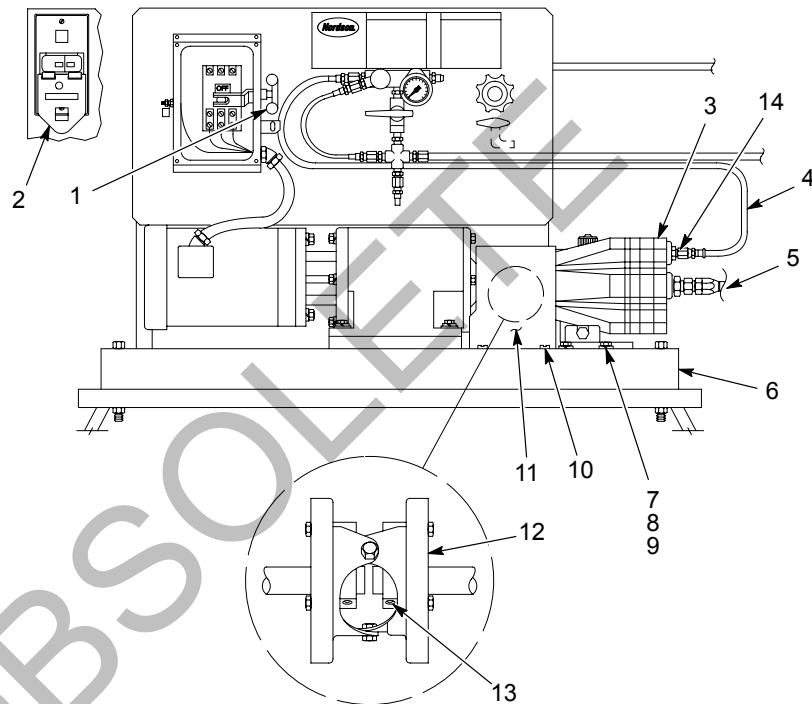


WARNING: System or material pressurized. Relieve pressure. Failure to observe this warning may result in serious injury.

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Pump Removal

1. See Figure 1. Turn the motor starter switch (1 or 2) off. Lock out the switch.
2. Remove the screws (10) securing the shroud (11).
3. Loosen the set screws (13) on the coupling (12).
4. Disconnect the output and input hoses (4, 5).
5. Remove the screws (7), lock washers (8), and flat washers (9) securing the pump (3) to the frame (6).



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Figure 1 Removing the Pump

- | | |
|--|----------------|
| 1. Motor starter switch (US version) | 8. Lock washer |
| 2. Motor starter switch (European version) | 9. Flat washer |
| 3. Pump | 10. Screw |
| 4. Output hose | 11. Shroud |
| 5. Input hose | 12. Coupling |
| 6. Frame | 13. Set screw |
| 7. Screw | 14. Coupling |

Checking Cam Shaft End Play

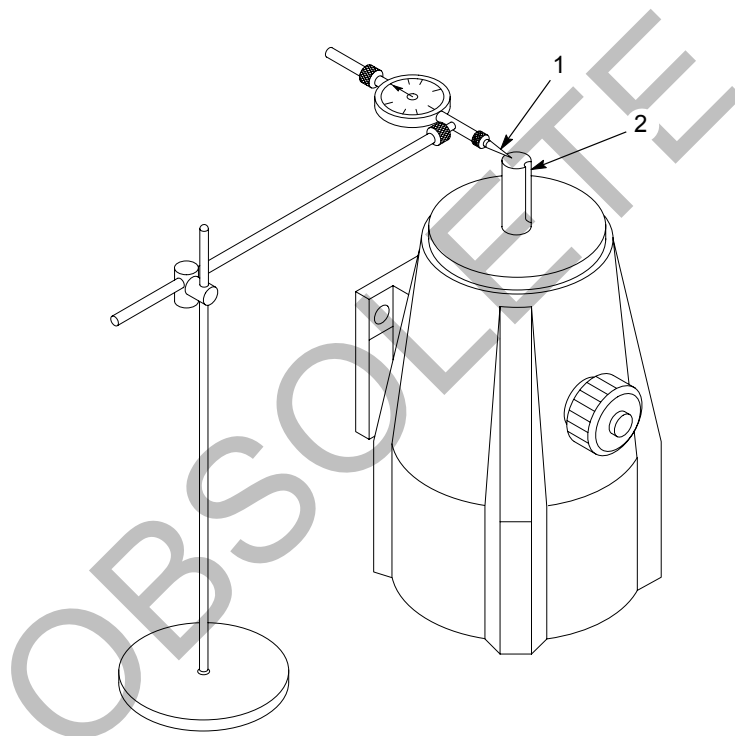
Check the cam shaft end play before replacing any parts or rebuilding the pump. A dial indicator and arbor press are required to do this.

1. See Figure 2. Position the dial indicator tip (1) on the end of the cam shaft (2).



CAUTION: Use extreme care when operating the arbor press. Excessive force may cause damage to the cam shaft bearings and races.

2. Use the arbor press (not shown) to check cam shaft end play. If the cam shaft end play exceeds 0.18 mm (0.007 in.), replace the pump. If the cam shaft end play is less than 0.18 mm (0.007 in.), perform required maintenance.



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Figure 2 Checking Cam Shaft End Play

1. Dial indicator tip

2. Cam shaft

Draining Oil

NOTE: To reduce the draining time, order the optional quick oil change kit. Refer to *Optional Oil Change Suction Gun* on page 20 for the part number.

1. Place a pan or absorbent material under the pump.



CAUTION: To prevent losing the oil prime in the piston assemblies, never rotate the pump shaft during routine oil changes.

2. Drain the oil from the pump housing with or without the optional oil change kit:

Without the Optional Oil Change Kit	With the Optional Oil Change Kit
a. See Figure 3. Remove the oil fill cap (1) from the pump.	a. See Figure 3. Remove the oil fill cap (1) from the pump.
b. Remove the drain plug (2).	b. Connect the suction gun fitting (4) to the drain fitting (3).
c. Replace the drain plug after the oil has drained.	c. Pull the handle (5) to draw the oil out of the pump.
	d. Disconnect the suction gun fitting from the drain fitting.

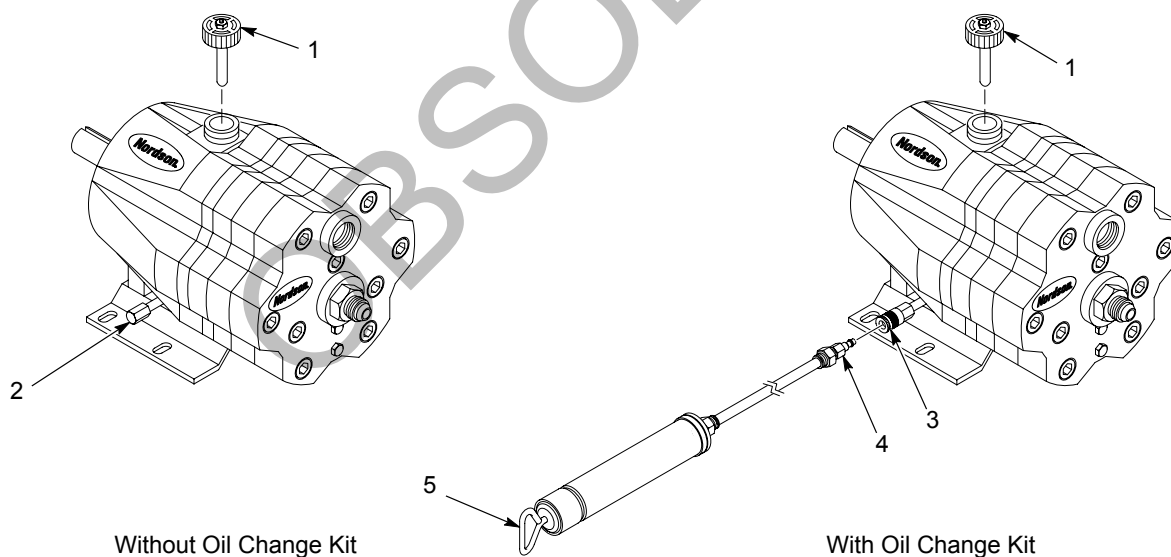


Figure 3 Draining the Oil

1. Fill cap
2. Drain plug

3. Drain fitting
4. Suction gun fitting

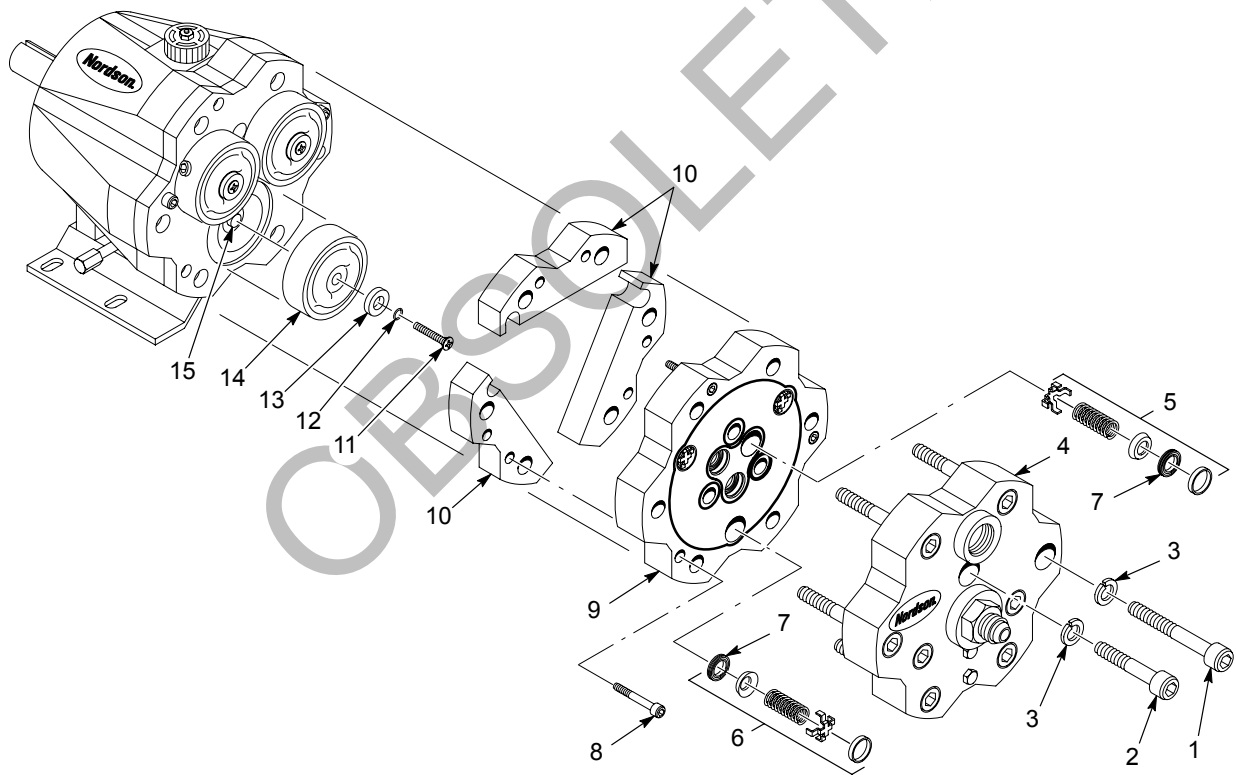
5. Handle

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Diaphragm Cartridge Replacement

Disassembly

1. See Figure 4. Remove the screws (1, 2) and lock washers (3) securing the end plate (4) to the pump housing.
2. Remove the screws (8) securing the valve plate (9) to the pump housing.
3. Use a valve/seat removal tool to remove the inlet and outlet valve assemblies (5, 6) and valve seats (7) from the valve plate. Inspect the valves and seats for wear or obstruction. Replace or clean them as necessary.
4. Remove the diaphragm plates (10).
5. Remove the screw (11), O-ring (12), and follower (13) securing the diaphragm cartridge (14) to the plunger shaft (15). Repeat this step for the remaining diaphragm cartridge assemblies.



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Figure 4 Disassembly

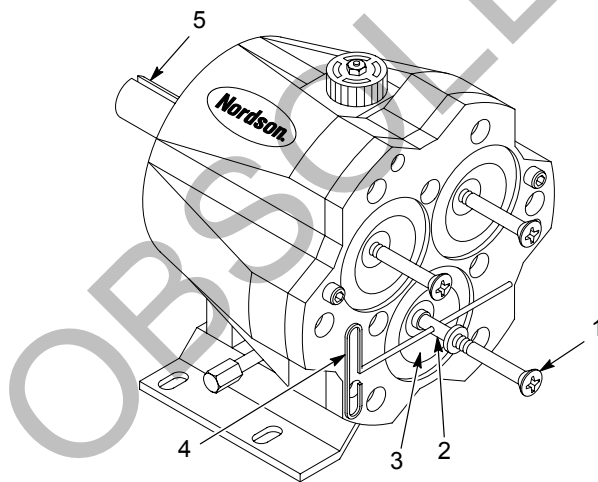
- | | | |
|--------------------------------|------------------------------|-------------------------------|
| 1. Socket head screw (4 in.) | 6. Outlet valve assembly | 11. Diaphragm cartridge screw |
| 2. Socket head screw (3.5 in.) | 7. Valve seat | 12. O-ring |
| 3. Lock washer | 8. Socket head screw (2 in.) | 13. Follower |
| 4. End plate | 9. Valve plate | 14. Diaphragm cartridge |
| 5. Inlet valve assembly | 10. Diaphragm plates | 15. Plunger shaft |

Assembly

1. See Figure 5. To prevent air from being drawn in through the pump plungers during priming, install the diaphragm cartridge screws (1) into the plunger shafts (2).
2. Fill the oil reservoir with new EP1 oil. To purge oil and air out from around the plungers (3), slowly rotate the pump shaft (5) several revolutions by hand. Turn the pump shaft until the expelled oil is free of bubbles.

NOTE: The oil level must always be maintained above the piston assemblies inside the pump housing.

3. The keyway on the shaft corresponds to the high spot on the cam. Use a shaft rotator tool to rotate the shaft until a plunger is aligned with the keyway.
4. Install the diaphragm cartridges using the following steps:
 - a. Pull the diaphragm cartridge screw (1) until you expose a drilled cross hole on the plunger shaft (2). Insert a wrench (4) into the drilled cross hole.
 - b. Remove the diaphragm cartridge screw from the plunger shaft.
 - c. Remove the screws and shipping plates from the new diaphragm cartridge assemblies.



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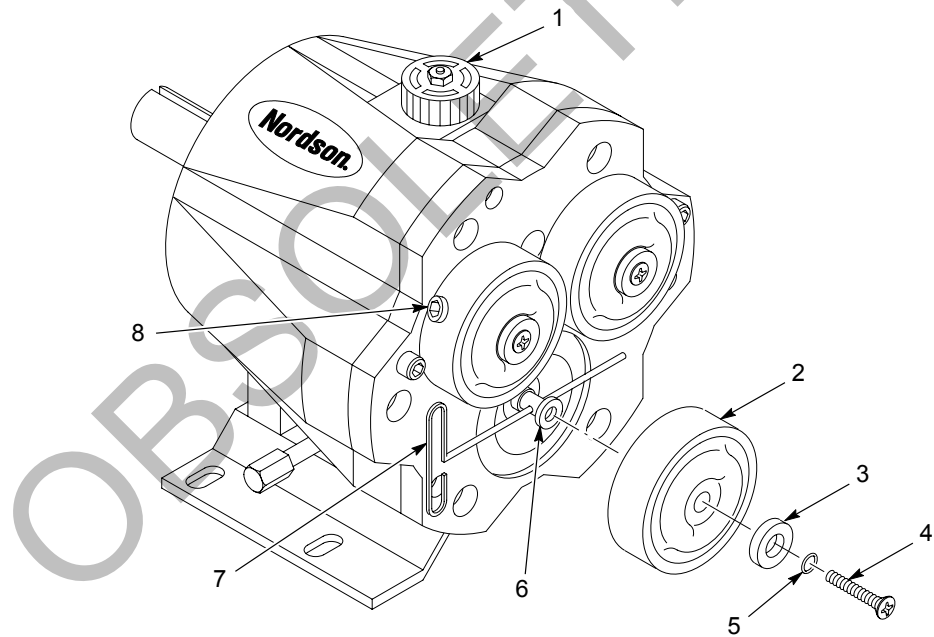
Figure 5 Installing Screws into the Plunger Shafts

- | | |
|------------------------------|-----------|
| 1. Diaphragm cartridge screw | 4. Wrench |
| 2. Plunger shaft | 5. Shaft |
| 3. Plunger | |

- d. See Figure 6. Install the O-ring (5) and follower (3) on the screw (4). Apply adhesive (included in diaphragm kit) to the end portion of the screw.
 - e. Insert the diaphragm cartridge screw (4) through the diaphragm cartridge assembly (2).
 - f. Install the diaphragm cartridge assembly on the plunger shaft (6). Position the diaphragm cartridge with the plug (8) facing outward. Tighten the screw.
 - g. Remove the wrench (7).
 - h. Repeat steps a–g for the remaining diaphragm cartridges.
5. After the diaphragm cartridges are installed, rotate the shaft to purge remaining air.

NOTE: The oil level must always be maintained above piston assemblies inside the pump housing.

6. Install the oil fill cap (1).



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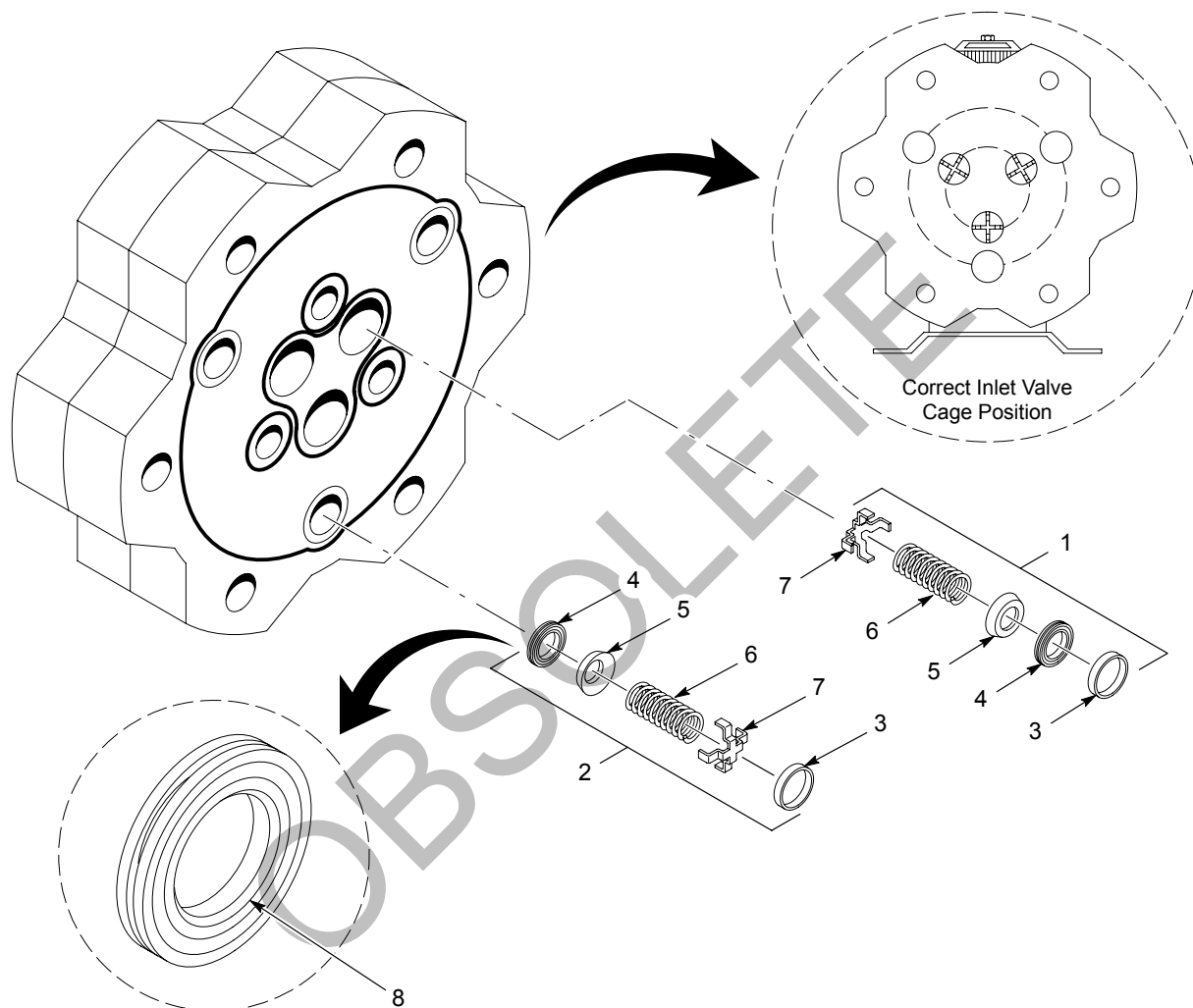
Figure 6 Installing the Diaphragm Cartridge

- | | |
|------------------------|------------------|
| 1. Fill cap | 5. O-ring |
| 2. Diaphragm cartridge | 6. Plunger shaft |
| 3. Follower | 7. Wrench |
| 4. Screw | 8. Plug |

Assembly (contd)

7. See Figure 7. Install the inlet and outlet check valves (1, 2) as illustrated. Each valve seat (4) has grooves on one side with a beveled edge (8) on the inner diameter. The valve (5), spring (6), cage (7), and spacer (3) must be installed on this side.

NOTE: To help support the diaphragms during operation, position the inlet valve cage so one leg partially blocks the inlet port (as illustrated).

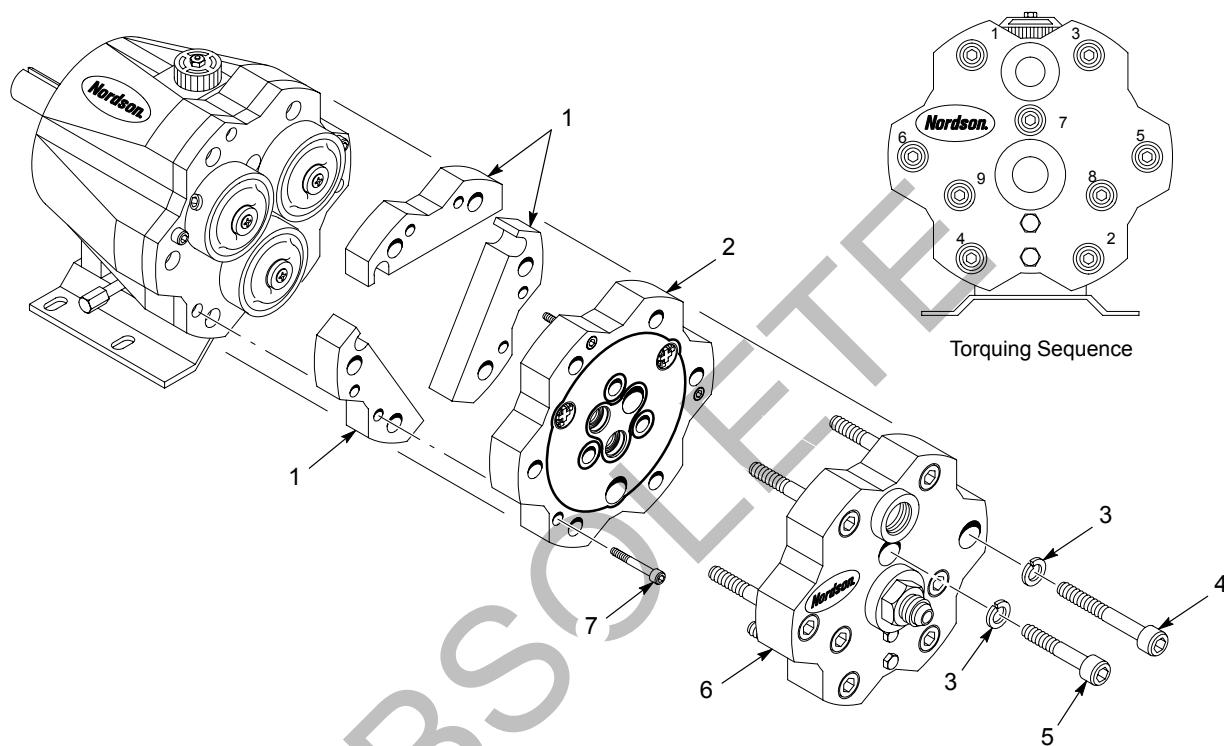


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Figure 7 Installing Inlet and Outlet Check Valves

- | | | |
|-----------------------|---------------|-----------------|
| 1. Inlet check valve | 4. Valve seat | 7. Cage |
| 2. Outlet check valve | 5. Valve | 8. Beveled edge |
| 3. Spacer | 6. Spring | |

8. See Figure 8. Place the diaphragm plates (1) on the pump.
9. Use the screws (7) to secure the valve plate (2) and diaphragm plate on the pump.
10. Use the screws (4, 5) and lock washers (3) to install the end plate (6). Torque screws to 74–81 N•m (55–60 ft-lb). Follow the torquing sequence shown in the illustration.
11. Install the pump on the frame. Refer to *Pump Installation* on page 16.



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Figure 8 Installing Diaphragm, Valve, and End Plates

- | | | |
|---------------------|--------------------------------|------------------------------|
| 1. Diaphragm plates | 4. Socket head screw (4 in.) | 6. End plate |
| 2. Valve plate | 5. Socket head screw (3.5 in.) | 7. Socket head screw (2 in.) |
| 3. Lock washer | | |

Rebuilding the Oil-Filled Section

NOTE: Before rebuilding the oil-filled section, make sure you have all the replacement parts and the EP tool kit.

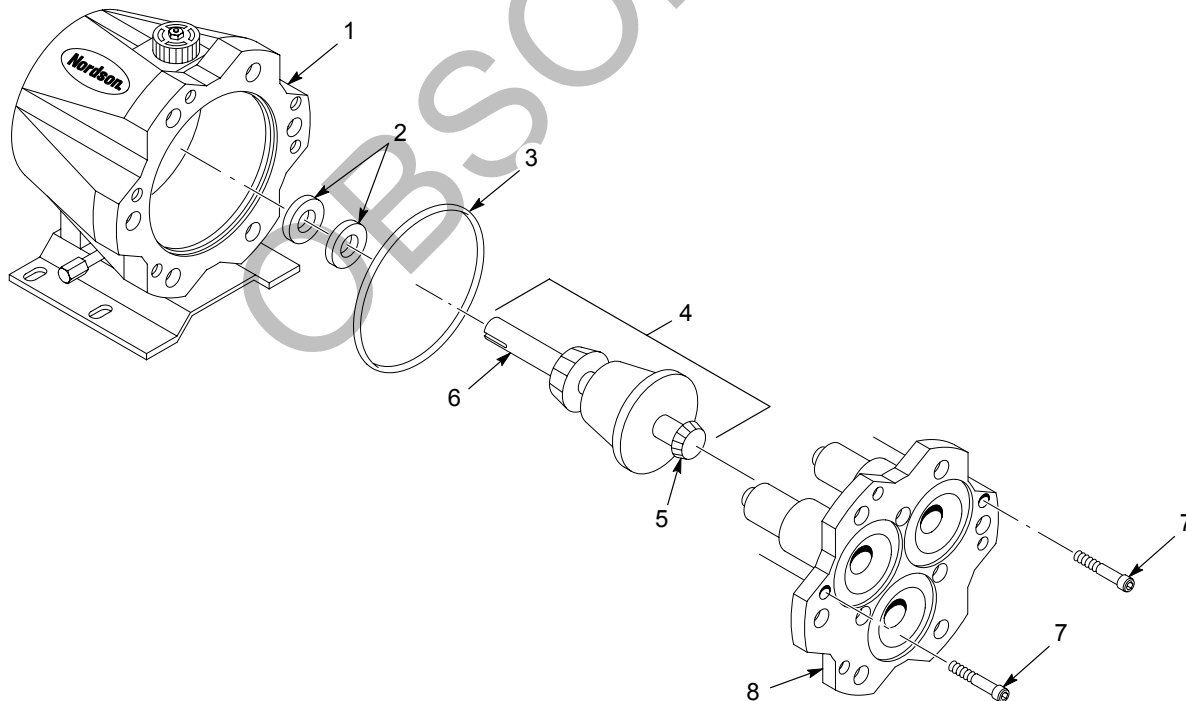
Pump Housing Disassembly

1. Remove the pump. Refer to *Pump Removal* on page 2.
2. Drain oil from the pump housing. Refer to *Draining Oil* on page 4.
3. Remove the end, valve, and diaphragm plates and the diaphragm cartridges. Refer to *Diaphragm Cartridge Replacement* on page 5.
4. See Figure 9. Remove the bolts (7) securing the cylinder casting (8). To even the load from the springs, alternate turns on the bolts.
5. Lift the cylinder casting off and turn it face down.
6. Remove the cam shaft assembly (4) from the pump housing (1). Inspect the shaft (6) for burrs. If any burrs exist, smooth them out.
7. Inspect the cam shaft assembly bearings (5) and bearing race for any damage or wear. Replace the pump if they are damaged or worn.
8. Remove the O-ring (3) from the pump housing.



CAUTION: Use extreme care when removing shaft seals to prevent scratching or denting the inside of the pump housing.

9. Place a 32–33 mm ($1\frac{1}{4}$ - to $1\frac{5}{16}$ - in.) diameter rod on the pump shaft seals (2). Carefully tap the rod to remove the seals from the pump housing.



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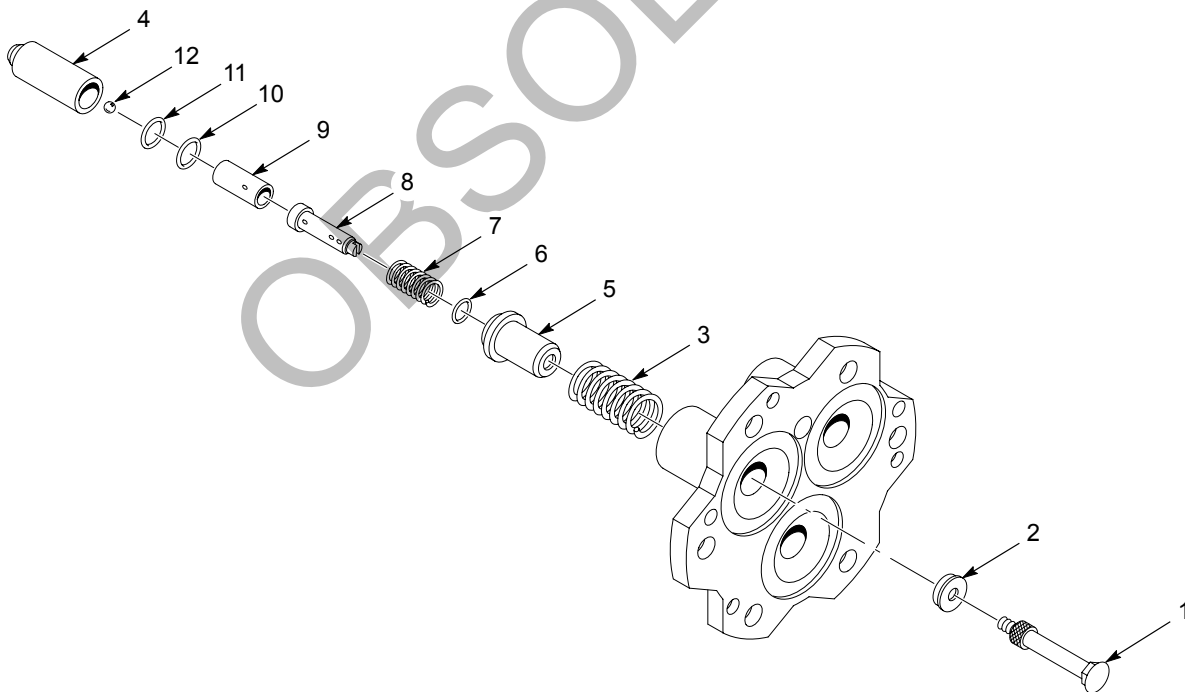
Figure 9 Pump Housing Disassembly

- | | | |
|-----------------|--------------------------------|---------------------|
| 1. Pump housing | 4. Cam shaft assembly | 7. Bolts |
| 2. Shaft seals | 5. Shaft | 8. Cylinder casting |
| 3. O-ring | 6. Cam shaft assembly bearings | |

Rebuilding the Pistons

Disassembly

1. See Figure 10. Screw the plunger guide lifter (1) into the plunger (2).
2. Lightly tap the plunger guide lifter with a hammer to slip the plunger off the shaft. Discard the plunger.
3. Remove the piston return spring (3) by pulling it outward and turning it counterclockwise.
4. Remove these parts from the piston case (4):
 - spring retainer (5)
 - valve cylinder O-ring (6)
 - valve cylinder spring (7)
 - plunger stem (8)
 - valve cylinder (9)
 - O-ring (10)
 - retaining washer (11)
 - ball (12)
5. Inspect the parts for any damage or wear. If any parts are worn or damaged, replace the complete piston assembly.
6. Repeat steps 1 through 5 for the remaining pistons.



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Figure 10 Piston Replacement

- | | | |
|-------------------------|--------------------------|----------------------|
| 1. Plunger guide lifter | 5. Spring retainer | 9. Valve cylinder |
| 2. Plunger | 6. Valve cylinder O-ring | 10. O-ring |
| 3. Return spring | 7. Valve cylinder spring | 11. Retaining washer |
| 4. Piston case | 8. Plunger stem | 12. Ball |

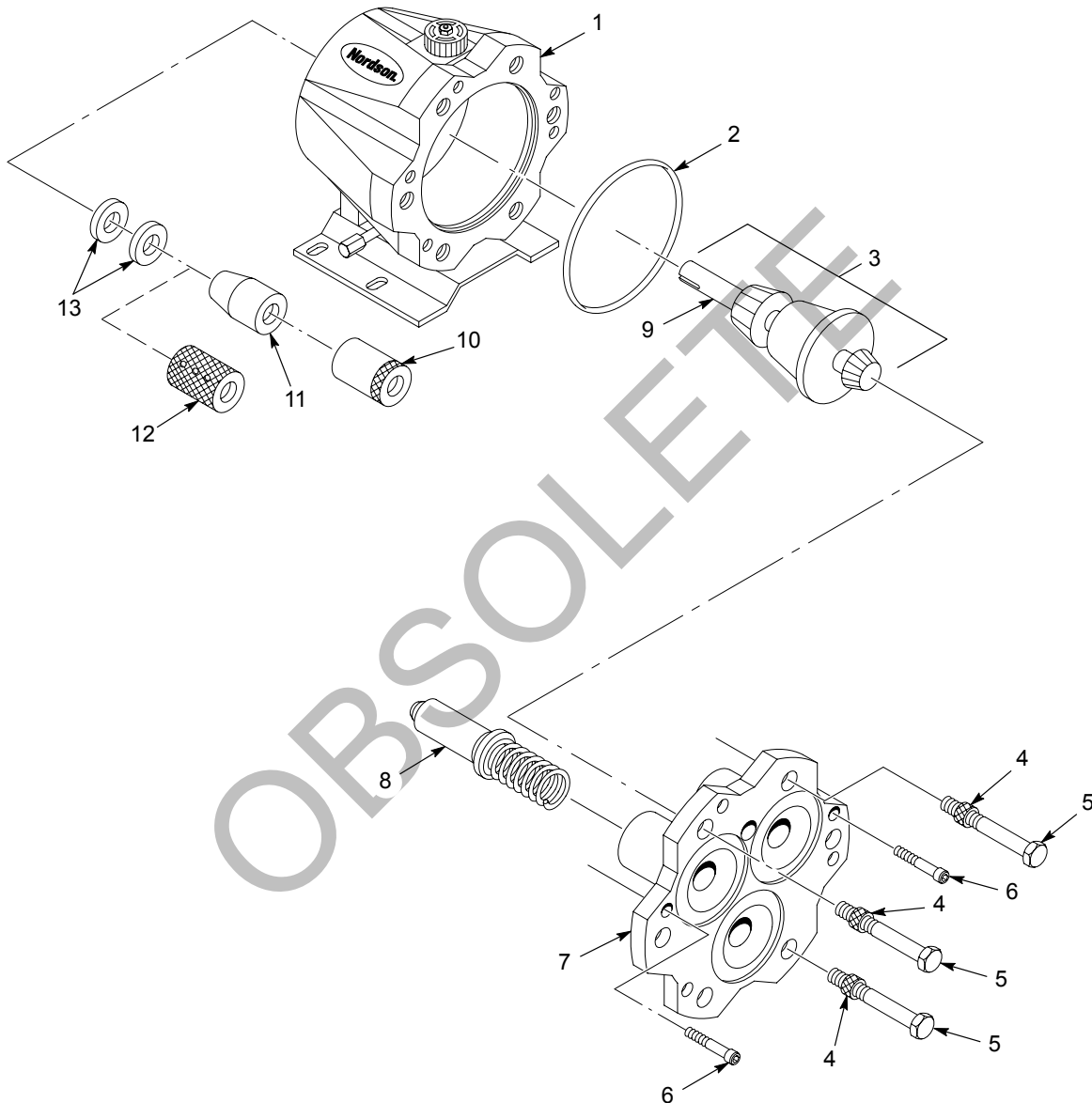
Rebuilding

1. See Figure 10. Place the ball (12) into the piston case (4). Make sure the ball seats into the hole at the bottom of the case.
2. Insert the retaining washer (11) and O-ring (10) into the piston case.
3. Insert the plunger stem (8) into the valve cylinder (9).
4. Slide the valve cylinder spring (7) over the plunger stem.
5. Insert the valve cylinder O-ring (6) into the spring retainer (5).
6. Slide the valve cylinder assembly into the spring retainer. Slide this assembly into the piston case (4).
7. Insert the piston return spring (3), wide end first, into the piston case. Turn the spring counterclockwise until it bottoms out.
8. Repeat steps 1 through 7 for the remaining pistons.

Pump Housing Assembly

1. See Figure 11. Insert the pistons (8) into the cylinder casting (7). Make sure the hole on the foot end of each piston is pointing toward the center of the cylinder casting.
2. Clean the pilot bearing race on the cylinder casting. Apply a thin film of EP1 oil to its surface.
3. Apply O-ring lubricant to the O-ring (2). Install the O-ring on the inside surface of pump housing (1).
4. Clean the bearing race on the pump housing. Apply a thin film of EP1 oil to its surface.
5. Carefully place the cam shaft assembly (3) into the pump housing. Nest the bearing into the bearing race.
6. Place the cylinder casting (7) on the pump housing. Make sure the cylinder casting and the pump housing bolt holes are aligned.
7. Install the draw bolts (5) and nuts (4) as illustrated. Tighten the draw bolt nuts evenly.
8. Use a shaft rotator tool (12) to rotate the shaft (9). If the shaft begins to bind, loosen the nuts and realign the shaft.
9. Install the cylinder casting retainer bolts (6).
10. Loosen the nuts (4) and remove the draw bolts (5).
11. Rotate the shaft (9) to check for proper alignment. Remove the shaft rotator tool.
12. Apply a thin film of O-ring lubricant to the seal protector tool (11). Slide the seals (13) on the tool, with the spring side of the seals toward the open end of the tool.

13. Apply a coating of Loctite high-performance pipe sealant with PTFE or a comparable product to the outer surface of the seals (13) and to the surface of the pump housing where the seals will be installed.
14. Apply a thin film of grease to the shaft (9). Slide the seal protector tool (11) over the end of the shaft.
15. Slide the seal inserter tool (10) over the seal protector tool (11). Press seals (13) completely into place. Tap the inserter tool with a soft mallet to firmly seat the seals. Remove both tools from the shaft.



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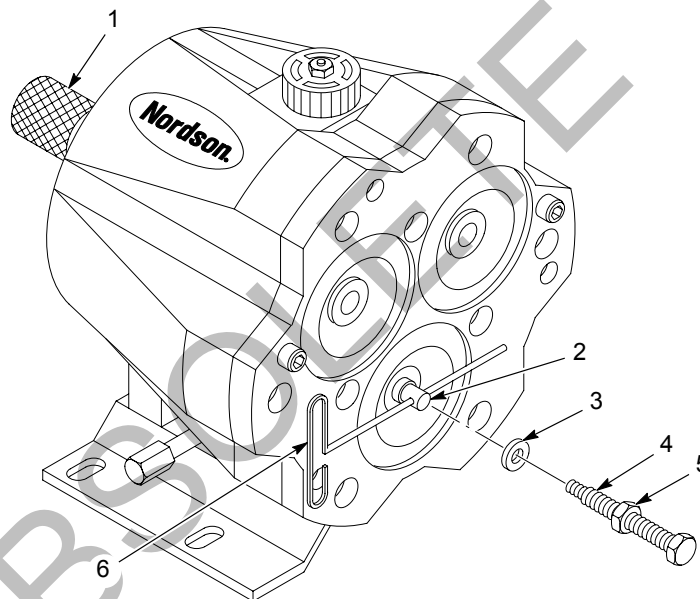
Figure 11 Pump Housing Assembly

- | | | |
|-----------------------|-----------------------------------|-------------------------|
| 1. Pump housing | 6. Cylinder casting retainer bolt | 10. Seal inserter tool |
| 2. O-ring | 7. Cylinder casting | 11. Seal protector tool |
| 3. Cam shaft assembly | 8. Piston | 12. Shaft rotator tool |
| 4. Nut | 9. Shaft | 13. Seals |
| 5. Draw bolt | | |

Plunger Installation

NOTE: Do not install used plungers. Use new plungers.

1. See Figure 12. Install the shaft rotator tool (1) on the pump shaft. The keyway on the pump shaft corresponds to the high spot on the cam. Rotate the pump shaft until a plunger stem (2) is aligned with the keyway.
2. Place a plunger (3) on the screw end of the plunger guide tool (4). The flat side of the plunger should face the tool.
3. Screw the plunger guide tool into the plunger stem.
4. Pull the plunger guide tool until a drilled cross hole is exposed. Install the wrench (6) into the drilled cross hole.



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Figure 12 Plunger Installation

- | | |
|-----------------------|---------------------------|
| 1. Shaft rotator tool | 4. Plunger guide tool |
| 2. Plunger stem | 5. Plunger guide tool nut |
| 3. Plunger | 6. Wrench |
5. Press fit the plunger to the plunger stem (2):
 - a. Tighten the plunger guide tool nut (5) down against the plunger (3) by hand.
 - b. Use a wrench to further tighten the plunger guide tool nut until the plunger is secure against the shoulder of the plunger stem.
 6. Remove the plunger guide tool.
 7. Remove the wrench from the plunger stem.
 8. Repeat steps 1 through 7 for remaining plungers.

Priming Piston Assemblies

1. With the pump in a horizontal position, fill the reservoir with EP1 oil.
2. See Figure 5. Install the diaphragm cartridge screws (1) into the plunger shafts (2).
3. Use the shaft rotator tool to rotate the shaft until a bubble-free flow of oil comes from behind each plunger. Watch the oil level in the reservoir. If the oil level falls below the top of the upper piston assemblies, refill the reservoir.
4. After air has been purged from the hydraulic section, check the oil level. The oil level, indicated on the dip stick, should be 25.4 mm (1 in.) from the cap.

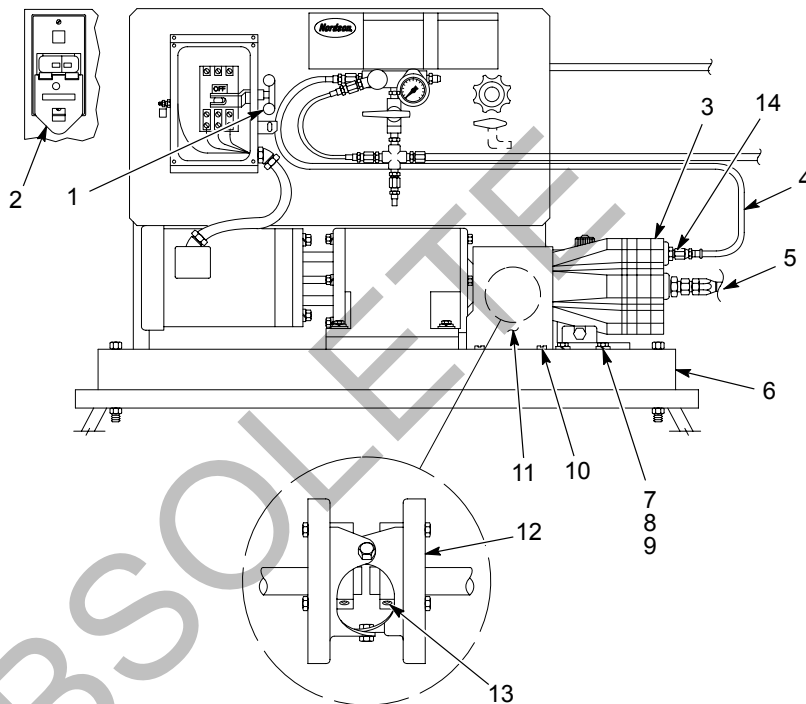
Diaphragms and Valve Assemblies

Install the diaphragms and the check valve assemblies. Refer to *Diaphragm Cartridge Replacement* on page 5.

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Pump Installation

1. See Figure 13. Use screws (5), lock washers (6), and flat washers (7) to install the pump (3) on the frame (4). Tighten the screws securely.
2. Tighten the set screws (8) on the coupling (9).
3. Use the screws (11) to install the shroud (10). Tighten the screws securely.
4. Connect the input and output hoses (12, 13).



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Figure 13 Pump Installation

- | | |
|--|-----------------|
| 1. Motor starter switch (US version) | 8. Set screw |
| 2. Motor starter switch (European version) | 9. Coupling |
| 3. Pump | 10. Shroud |
| 4. Frame | 11. Screw |
| 5. Screw | 12. Input hose |
| 6. Lock washer | 13. Output hose |
| 7. Flat washer | 14. Coupling |

Parts

To order parts, call the Nordson Customer Service Center or your local Nordson representative. Use this five-column parts list, and the accompanying illustration, to describe and locate parts correctly.

Using the Illustrated Parts List

Numbers in the Item column correspond to numbers that identify parts in illustrations following each parts list. The code NS (not shown) indicates that a listed part is not illustrated. A dash (—) is used when the part number applies to all parts in the illustration.

The number in the Part column is the Nordson Corporation part number. A series of dashes in this column (-----) means the part cannot be ordered separately.

The Description column gives the part name, as well as its dimensions and other characteristics when appropriate. Indentions show the relationships between assemblies, subassemblies, and parts.

- If you order the assembly, items 1 and 2 will be included.
- If you order item 1, item 2 will be included.
- If you order item 2, you will receive item 2 only.

The number in the Quantity column is the quantity required per unit, assembly, or subassembly. The code AR (As Required) is used if the part number is a bulk item ordered in quantities or if the quantity per assembly depends on the product version or model.

Letters in the Note column refer to notes at the end of each parts list. Notes contain important information about usage and ordering. Special attention should be given to notes.

Item	Part	Description	Quantity	Note
—	0000000	Assembly	1	
1	000000	• Subassembly	2	A
2	000000	• • Part	1	

Three Piston Pump

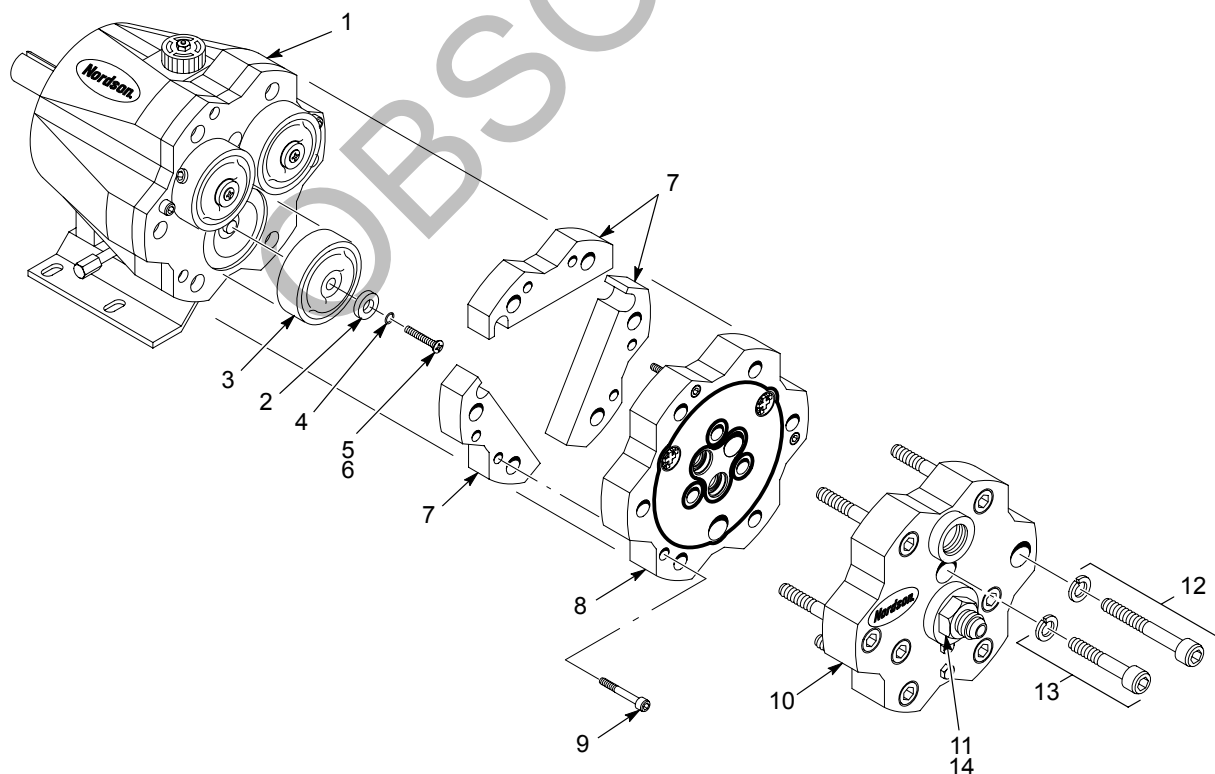
See Figure 14.

Item	Part	Description	Quantity	Note
—	104198	PUMP, Three Piston, dual-diaphragm, water-based	1	
1	-----	• PUMP, Three Piston, 82.75 bar (1200 psi)	1	
2	-----	• • FOLLOWER	3	
3	-----	• DIAPHRAGM/SENSOR cartridge assembly	3	A
4	940080	• O-RING, 0.188 x 0.313 x 0.063 in.	3	A
5	981260	• SCREW, cross, flat head, #10-32 x 1 ¹ / ₄ -in., stainless steel	3	
6	900464	• ADHESIVE, threadlocking	AR	
7	-----	• PLATE, diaphragm	3	
8	162861	• PLATE, valve	1	
9	981436	• SCREW, socket head ⁵ / ₃₂ -18 x 2 in., black	3	
10	-----	• PLATE, end	1	
11	972112	• CONNECTOR, straight ³ / ₄ -in. NPT x ⁷ / ₈ -14	1	
12	981373	• SCREW, socket head, ⁷ / ₁₆ -14 x 4 in., black	6	
13	981368	• SCREW, socket head, ⁷ / ₁₆ -14 x 3.5 in., black	3	
14	900481	• ADHESIVE, pipe/thread/hydraulic sealant	AR	
NS	900315	• OIL, EP1, 1 qt	1	

NOTE A: Parts included in *EP Diaphragm Cartridge Kit*. Refer to kit list on page 19.

AR: As Required

NS: Not Shown



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Figure 14 Three Piston Pump

Service Kits

EP Diaphragm Cartridge Kit

See Figure 15.

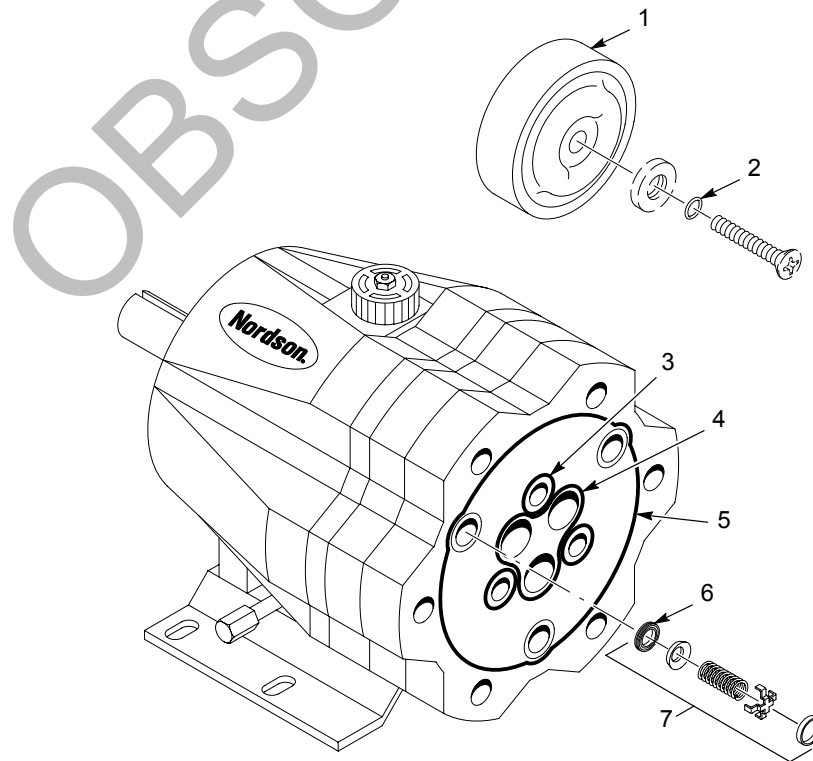
Item	Part	Description	Quantity	Note
—	111731	KIT, diaphragm cartridge, EP	1	
1	-----	• DIAPHRAGM/SENSOR CARTRIDGE assembly	3	
2	940080	• O-RING, hotpaint, 0.188 x 0.313 x 0.063 in.	3	
3	941160	• O-RING, hotpaint, 0.075 x 0.938 x 0.094 in.	3	
4	941500	• O-RING, hotpaint, 2.875 x 3.062 x 0.094 in.	1	
5	941610	• O-RING, hotpaint, 5.000 x 5.688 x 0.094 in.	1	
6	940214	• O-RING, hotpaint, 0.938 x 1.063 x 0.063 in.	6	

EP Valve Repair Kit

See Figure 15.

Item	Part	Description	Quantity	Note
7	111730	SERVICE KIT, EP valve repair	1	A

NOTE A: This kit contains all necessary parts to repair the check valves in the three-piston pump.



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Figure 15 Repair Kits

Shaft Seal Kit

See Figure 16.

Item	Part	Description	Quantity	Note
—	141431	SERVICE KIT, EP shaft seal	1	
1	941182	• O-RING, Buna N, 0.875 x 1.063 x 0.094 in.	1	
2	-----	• SEAL, EP shaft	2	
3	941611	• O-RING, Buna N, 5.500 x 5.688 x 0.094 in.	1	
NS	900431	• ADHESIVE, pipe/thread/hydraulic sealant	1	
NS: Not Shown				

EP Piston Assembly Kit

See Figure 16.

Item	Part	Description	Quantity	Note
—	141434	SERVICE KIT, EP piston assembly	1	
3	941611	• O-RING, Buna N, 5.500 x 5.688 x 0.094 in.	1	
4	-----	• PISTON ASSEMBLY, EP	1	

EP Plunger Kit

See Figure 16.

Item	Part	Description	Quantity	Note
5	141432	PLUNGER, EP	1	

Oil Cap

See Figure 16.

Item	Part	Description	Quantity	Note
6	141446	CAP, oil, EP	1	

Optional Oil Change Suction Gun

Part	Description	Note
179490	GUN, suction, oil change	

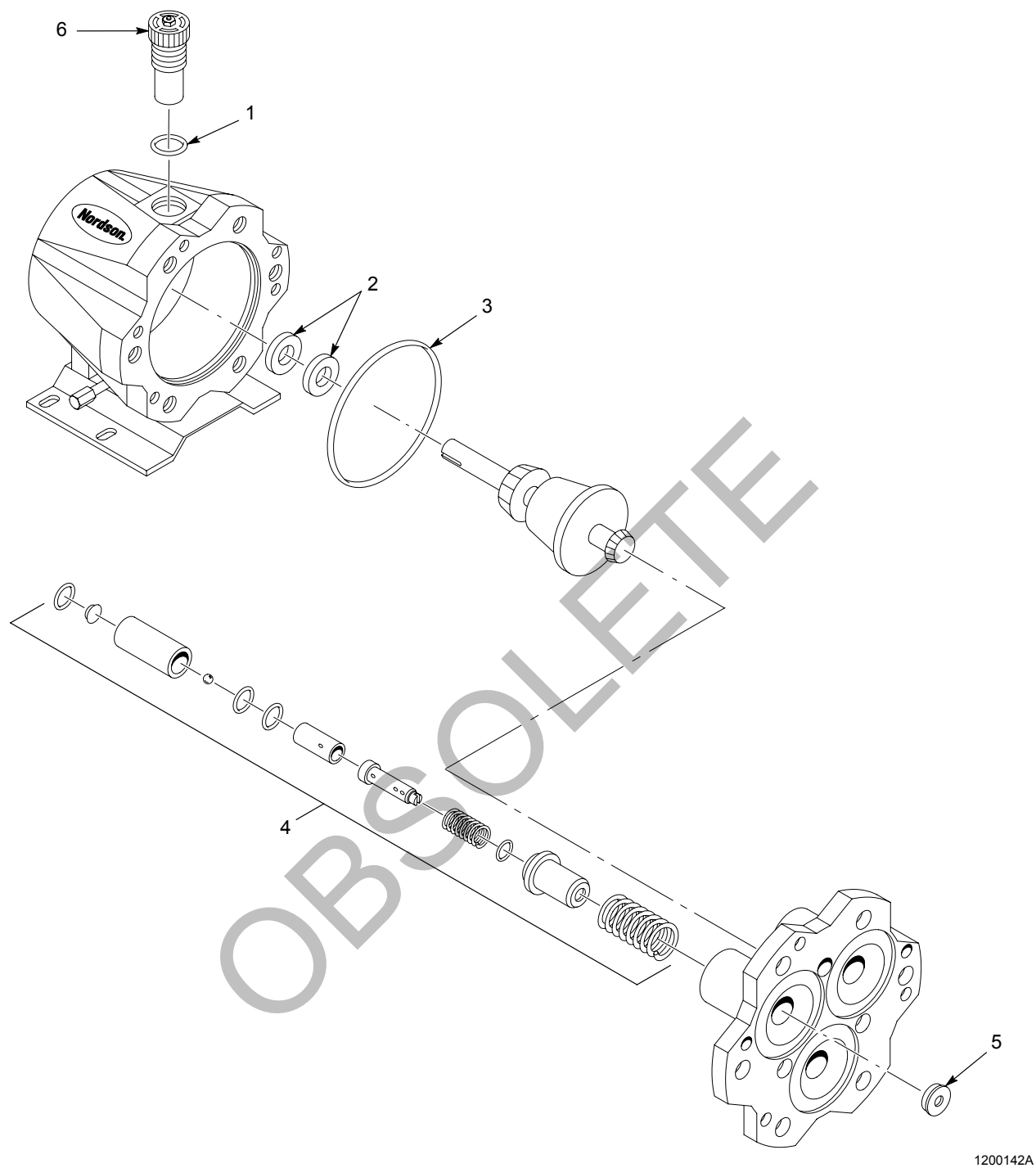


Figure 16 Oil-Filled Section Kits

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