Instructions–Parts List

5.5 in. (140 mm) DIAMETER

Senator® and Quiet Senator® Air Motors

307592T

Important Safety Instructions
Read all warnings and instructions in this manual.
Save these instructions.
See page 2 for Table of Contents.

Model 217540, Series C
Senator® Air Motor
4.75 in. Piston Stroke

120 psi (0.8 MPa, 8.3 bar) Maximum Working Pressure

Model 624250
Senator® Air Motor
4.75 in. Piston Stroke
Electroless Nickel Plated.

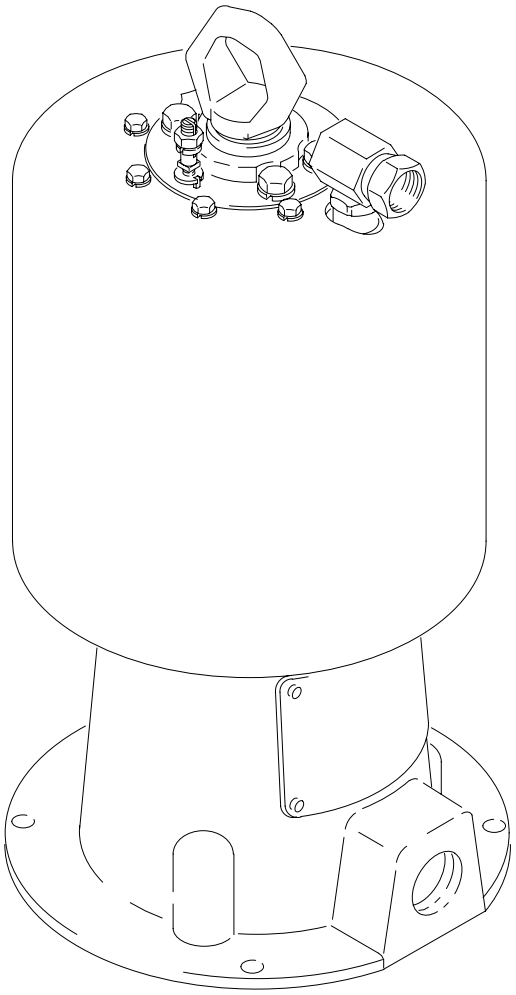
100 psi (0.7 MPa, 7 bar) Maximum Working Pressure

Model 249441, Series A
Senator® Air Motor
4.75 in. Piston Stroke

100 psi (0.7 MPa, 7 bar) Maximum Working Pressure

Model 220571, Series B
Quiet Senator® Air Motor
4.75 in. Piston Stroke
Standard Quiet Air Motor.
Adapts to all existing Senator Pumps.
Includes auxiliary air exhaust port for use in a Header System.

120 psi (0.8 MPa, 8.3 bar) Maximum Working Pressure



Model 217540 shown

03337

Table of Contents

Symbols

Warning Symbol

⚠ WARNING

This symbol alerts you to the possibility of serious injury or death if you do not follow the instructions.

Caution Symbol

⚠ CAUTION

This symbol alerts you to the possibility of damage to or destruction of equipment if you do not follow the instructions.

⚠ WARNING

INSTRUCTIONS

EQUIPMENT MISUSE HAZARD

Equipment misuse can cause the equipment to rupture or malfunction and result in serious injury.

- This equipment is for professional use only.
- Read all instruction manuals, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are uncertain about usage, call your Graco distributor.
- Do not alter or modify this equipment. Use only genuine Graco parts and accessories.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure stated on the equipment or in the **Technical Data** for your equipment. Do not exceed the maximum working pressure of the lowest rated component in your system.
- Use fluids and solvents which are compatible with the equipment wetted parts. Refer to the **Technical Data** section of all equipment manuals. Read the fluid and solvent manufacturer's warnings.
- Do not kink or over bend hoses or use hoses to pull equipment.
- Route hoses away from traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose Graco hoses to temperatures above 82°C (180°F) or below –40°C (–40°F).
- Wear hearing protection when operating this equipment.
- Do not lift pressurized equipment.
- Do not lift the equipment by the air motor lift ring if the total weight of the equipment exceeds 550 lb (250 kg).
- Comply with all applicable local, state, and national fire, electrical, and safety regulations.

⚠ WARNING

SKIN INJECTION HAZARD

Spray from the gun/valve, hose leaks, or ruptured components can inject fluid into your body and cause extremely serious injury, including the need for amputation. Fluid splashed in the eyes or on the skin can also cause serious injury.

- Fluid injected into the skin might look like just a cut, but it is a serious injury. **Get immediate surgical treatment.**
- Do not point the gun/valve at anyone or at any part of the body.
- Do not put your hand or fingers over the spray tip/nozzle.
- Do not stop or deflect leaks with your hand, body, glove or rag.
- Do not “blow back” fluid; this is not an air spray system.
- Always have the tip guard and the trigger guard on the spray gun when spraying.
- Check the spray gun diffuser operation weekly. Refer to the gun manual.
- Be sure the gun/valve trigger safety operates before spraying/dispensing.
- Lock the gun/valve trigger safety when you stop spraying/dispensing.
- Follow the **Pressure Relief Procedure** on page 8 whenever you: are instructed to relieve pressure; stop spraying/dispensing; clean, check, or service the equipment; and install or clean the spray tip/nozzle.
- Tighten all fluid connections before operating the equipment.
- Check the hoses, tubes, and couplings daily. Replace worn, damaged, or loose parts immediately. Permanently coupled hoses cannot be repaired; replace the entire hose.
- Use only Graco approved hoses. Do not remove any spring guard that is used to help protect the hose from rupture caused by kinks or bends near the couplings.

MOVING PARTS HAZARD

Moving parts, such as the air motor piston, can pinch or amputate your fingers.

- Keep clear of all moving parts when starting or operating the pump.
- Before servicing the equipment, follow the **Pressure Relief Procedure** on page 8 to prevent the equipment from starting unexpectedly.

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Improper grounding, poor ventilation, open flames or sparks can cause a hazardous condition and result in a fire or explosion and serious injury.

- Ground all equipment in the work area. Refer to **Grounding** on page 7.
- If there is any static sparking or you feel an electric shock while using this equipment, **stop spraying/dispensing immediately.** Do not use the equipment until you identify and correct the problem.
- Provide fresh air ventilation to avoid the buildup of flammable fumes from solvents or the fluid being sprayed/dispensed.
- Keep the spray/dispense area free of debris, including solvent, rags, and gasoline.
- Electrically disconnect all equipment in the spray/dispense area.
- Extinguish all open flames or pilot lights in the spray/dispense area.
- Do not smoke in the spray/dispense area.
- Do not turn on or off any light switch in the spray/dispense area while operating or if fumes are present.
- Do not operate a gasoline engine in the spray/dispense area.
- Keep a fire extinguisher in the work area.

TOXIC FLUID HAZARD

Hazardous fluid or toxic fumes can cause serious injury or death if splashed in the eyes or on the skin, inhaled, or swallowed.

- Know the specific hazards of the fluid you are using.
- Store hazardous fluid in an approved container. Dispose of hazardous fluid according to all local, state and national guidelines.
- Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.

Installation

Air Motor Icing

Moisture in the compressed air can collect in the air motor and freeze, causing the motor to stall. This is called icing. If icing occurs, shut off the air supply and allow the ice to thaw.

To minimize icing, reduce the moisture in your compressed air supply by using an air dryer or a filter which traps water.

Slope the main air line slightly downward so water will collect at the end of the line, where it can be drained. Additionally, plumb each drop line from the top of the main air line. Install an automatic drain or a drain valve at the bottom of each drop.

For additional help in designing your system, contact your Graco distributor.

Installation of Model 220571 for Noise Reduction

For the recommended air supply system installation, see Instruction Manual 307375.

The following are additional recommendations for Maximum Noise Reduction:

1. See Fig. 1. The air line should be connected to the air motor inlet (S) with an electrically conductive flexible hose. Also, use flexible fluid outlet and suction hoses. Where possible, avoid using solid plumbing, which carries noise vibrations.

2. Mount the air motor on resilient rubber pads, rather than sheet metal.

3. Determine minimum air inlet pressure and pump cycle rate to achieve desired spray/dispensing results or minimum fluid pressure and flow. This will result in less system wear and less overall noise.

Auxiliary Air Exhaust (Model 220571)

An auxiliary air exhaust line may be connected to Model 220571, for use in a header system. Remove the pipe plug (22, see the parts drawing) from the 1" npt(f) auxiliary air exhaust port (L) at the top of the motor. Connect a 1" npt(m) exhaust hose (M) to this port. The exhaust hose **must** slope downward, and the exhaust manifold (N) connection **must** be lower than the base of the motor (P), to prevent moisture from accumulating in the line and draining back into the motor. See Fig. 1.

Plug the two air exhaust ports (R) in the air manifold with 1/2 npt pipe plugs (100 737).

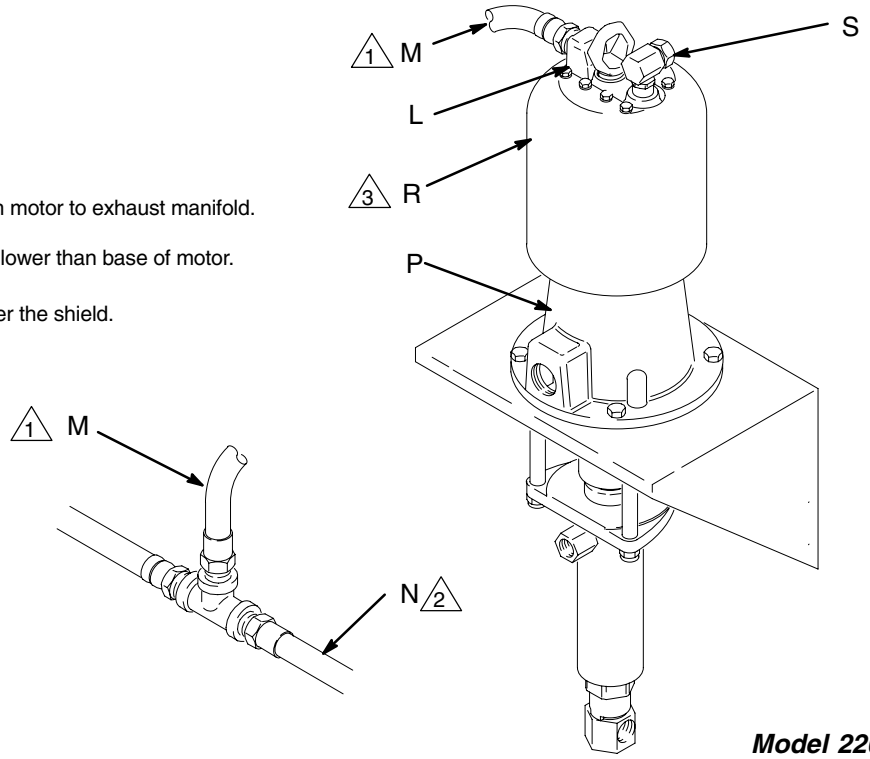
KEY

L Auxiliary Air Exhaust Port
M 1" npt(m) Air Exhaust Hose
N Exhaust Manifold
P Motor Base
S Main Air Inlet

1 Must slope downward from motor to exhaust manifold.

2 Exhaust manifold must be lower than base of motor.

3 Exhaust ports (R) are under the shield.



Model 220571 Shown

07261B

Fig. 1

Notes

Installation

Grounding

⚠ WARNING

FIRE AND EXPLOSION HAZARD
Before operating the pump, ground the system as explained below. Also read the section **FIRE AND EXPLOSION HAZARD** on page 4.

1. *Pump:* use a ground wire and clamp as shown in Fig. 2. Loosen the grounding lug locknut (W) and washer (X). Insert one end of a 12 ga (1.5 mm^2) minimum ground wire (Y) into the slot in lug (Z) and tighten the locknut securely. Connect the other end of the wire to a true earth ground. Order part number 237569 Grounding Clamp and Wire.

2. *Air and fluid hoses:* use only electrically conductive hoses.

3. *Air compressor:* follow manufacturer's recommendations.

4. *Spray gun or dispensing valve:* grounding is obtained through connection to a properly grounded fluid hose and pump.

5. *Object being sprayed:* according to your local code.

6. *Fluid supply container:* according to your local code.

7. *Solvent pails used when flushing:* follow your local code. Use only metal pails, which are conductive, placed on a grounded surface. Do not place the pail on a nonconductive surface, such as paper or cardboard, which interrupts the grounding continuity.

8. *To maintain grounding continuity when flushing or relieving pressure*, hold a metal part of the spray gun/dispense valve firmly to the side of a grounded *metal* pail, then trigger the gun/valve.

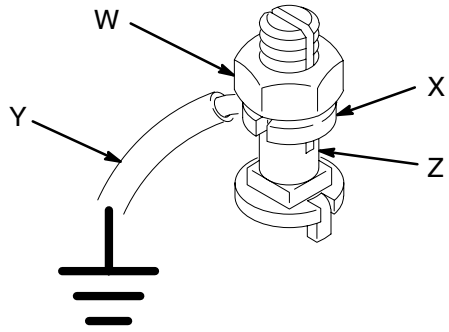


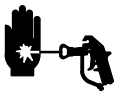
Fig. 2

Troubleshooting

Models 217540, 249441, and 624250

Pressure Relief Procedure

⚠ WARNING



SKIN INJECTION HAZARD
To reduce the risk of serious injury, including fluid injection, splashing in the eyes or on the skin, or moving parts, always follow the **Pressure Relief Procedure** whenever you:

- are instructed to relieve the pressure,
- shut off the pump,
- stop spraying/dispensing,
- check or service any of the system equipment,
- or install or clean the spray tip/nozzle.

1. Lock the gun/valve trigger safety.
2. Turn off the air to the motor.
3. Close the bleed-type master air valve (required in your system).
4. Unlock the gun/valve trigger safety. Hold a metal part of the gun/valve firmly to a grounded metal pail. Trigger the gun/valve to relieve pressure.
5. Lock the gun/valve trigger safety.
6. Open the fluid drain valve. Leave the fluid drain valve open until you are ready to spray/dispense again.

If you suspect that the spray tip/nozzle or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, ***very slowly*** loosen the tip guard retaining nut or hose end coupling to relieve pressure gradually, then loosen completely. Now clear the tip/nozzle or hose obstruction.

If the Motor Stalls

To restart a stalled motor, close the bleed-type master air valve to bleed off all trapped air pressure. Screw the lift ring (16) out of the detent housing (36) and use a screwdriver to push the valve housing (29) down. See Fig. 3.

Locating Air Leaks

See Fig. 3. Shut off the air supply and disconnect the hose. Screw the inlet union (49) out of the air manifold (43). Remove the eight screws (6), the shield (35), and the grommet (42), then screw the inlet union back into the manifold. Connect the air hose and turn on the air. Stall the pump on both the up and down stroke as indicated in the **Check Chart** and adjust the air regulator to 10–15 psi (.07–0.1 MPa, 0.7–1 bar). Then use the checking methods listed in the **Check Chart** to find where air is leaking.

⚠ WARNING

MOVING PARTS HAZARD
Keep fingers out of detent housing (36) to reduce the risk of pinching or amputating them.

Check Chart (See Fig. 3)

Stroke Position	Fig. Ref. Points	Checking Method	Cause of Leakage
UP stroke only (air valve housing down)	A	By feel	Blown air manifold gaskets (40)
	B	By feel	Blown air cylinder gasket (17)
	C	Squirt oil around wiper seal (23)	Worn shaft packing (20)
DOWN stroke only (air valve housing up)	D	By feel	Blown air manifold gaskets (40)
	E	Squirt oil around bearing (47)	Worn trip rod packing (19)
	F	Squirt oil around bearing (47)	Damaged trip rod bearing gasket (14)
BOTH	G	Squirt oil around air director valves (39)	Worn air director valves (39) or their o-rings (15)
	H	Hold paper strip over exhaust holes	Worn air piston o-ring (27)

Troubleshooting

Models 217540, 249441, and 624250

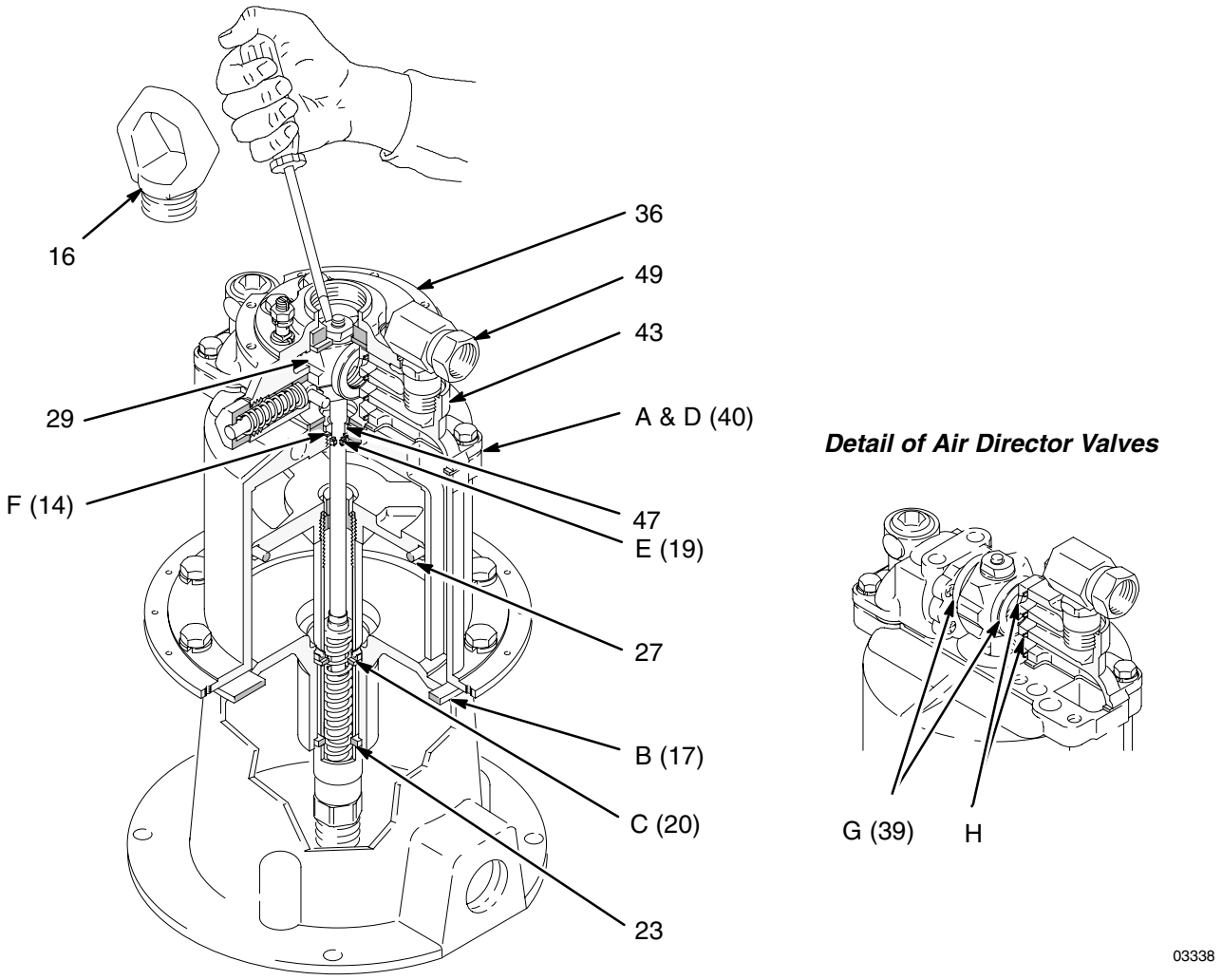


Fig. 3

Service

Models 217540, 249441, and 624250

⚠ WARNING

To avoid serious injury and equipment damage, do not lift the equipment by the air motor lift ring if the total weight of the equipment exceeds 550 lb (250 kg). The lift ring cannot support that weight.

NOTE: Repair kit 218122 is available. Reference numbers of parts included in the kit are marked with an asterisk, i.e., (15*). See page 31. For the best results, use all the new parts in the kit, even if the old ones still look good.

NOTE: Inspect all parts as they are disassembled and replace any worn or damaged parts.

Disassembly

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 8.

1. Relieve the pressure.
2. Disconnect the displacement pump. Disconnect the ground wire. Set the motor upright on a workbench.

NOTE: Refer to Fig. 4 for steps 3 to 5.

3. Remove the air inlet fitting (49). Remove the screws (6) and lift off the air motor shield (35). Remove the grommet (42).
4. Unscrew the spring retainers (31) and remove the spring (33), guide (32), and plunger (28) from each side of the detent housing (36).
5. Remove the four screws (9) and lockwashers (3) from the detent housing (36). Carefully lift the housing so the rollers (10) and axles (11) do not fall out. Remove the rollers, axles, washer (25), and rubber pad (26).

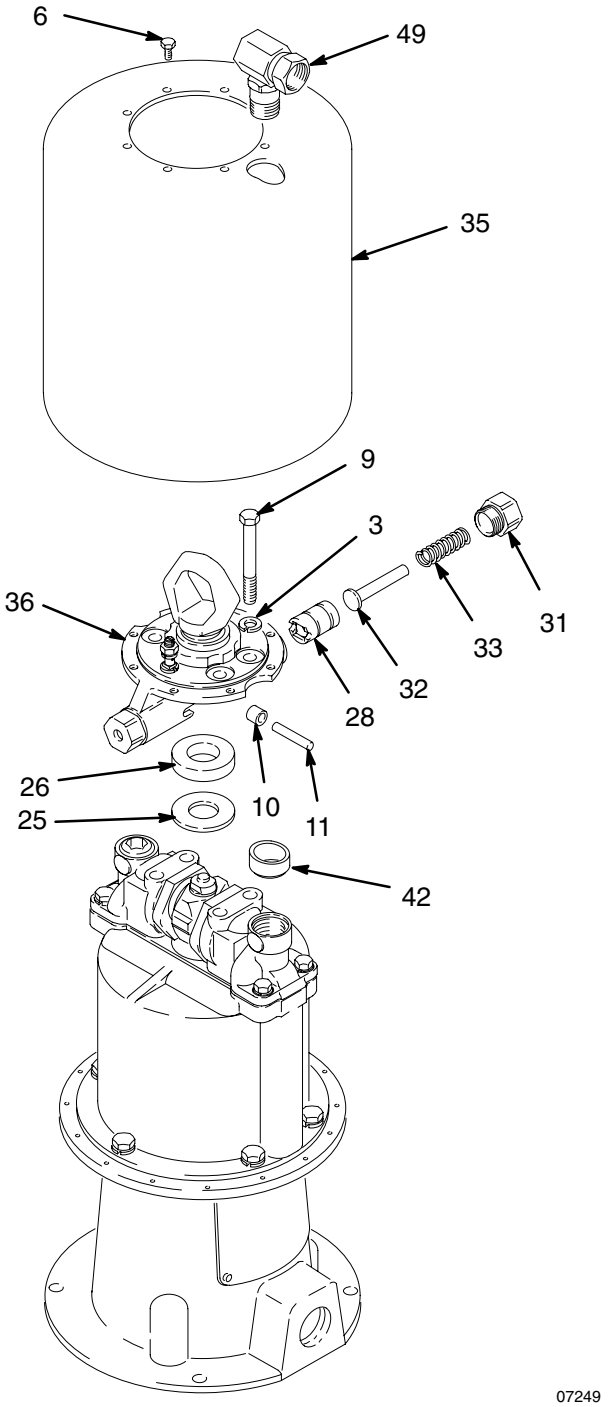


Fig. 4

Service

Models 217540, 249441, and 624250

NOTE: Refer to Fig. 5 for steps 6 to 9.

6. **To prevent the spring-loaded director valves (39) from popping out of the air valve housing (29),** hold them in with your fingers. Lift the air valve housing and rotate it 90°, so it rests on the manifolds (43). Remove your fingers slowly, allowing the valve springs to release gently. Remove and inspect the director valves (39), o-rings (15), and springs (24).

⚠ CAUTION

Be careful not to damage the surface of the trip rod (50), which would restrict its free movement. Special padded pliers, Part No. 207579, are available.

7. Pull the trip rod (50) up and grasp it with the padded locking pliers (order Part No. 207579) below the hub (34). Hold the flats of the hub with a wrench, screw off the trip rod nut (30), and remove the air valve housing (29). Remove the lockwasher (5) and screw off the hub. Now release the pliers.

8. Remove the two screws (4) and lockwashers (5) from each air manifold (43). Remove the manifolds and gaskets (40) from the cylinder (46).

⚠ WARNING

The openings in the valve plates (38) are very sharp. Be careful not to cut yourself.

9. Remove and check the valve plates (38) for wear or damage, handling them carefully. Clean the plates and mating surfaces of the manifolds (43).

NOTE: If you replace the valve plates, also replace the seals (41).

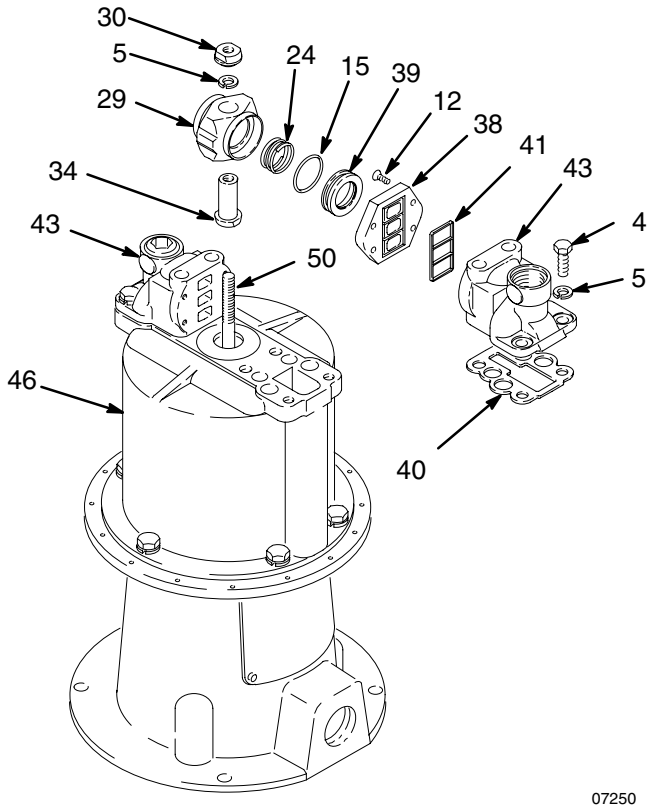


Fig. 5

Service

Models 217540, 249441, and 624250

NOTE: Refer to Fig. 6 for steps 10 to 17.

10. Remove the washer (25) and rubber pad (26) from the cylinder (46).

11. Remove the trip rod bearing (47), using a 1 in. deep-well socket wrench. Remove the gasket (14), v-block packing (19), and backup washer (18) from the bearing.

⚠ CAUTION

Be careful not to tilt the cylinder when removing it from the piston to avoid damaging the smooth inner surface of the cylinder.

12. Remove the screws (7) and lockwashers (5) and carefully pull the cylinder (46) straight up off the piston (2).

13. Pull the piston (2) and trip rod (50) up out of the base (48). Remove the o-ring (27) from the piston.

NOTE: The connecting rod stud (37) is fastened to the piston shaft (2) with anaerobic sealant, and may be difficult to remove.

⚠ CAUTION

Be careful not to damage the polished surface of the piston shaft.

14. Lock the hex of the piston shaft (2) in a vise and unscrew the connecting rod stud (37) from the piston shaft.

⚠ CAUTION

Handle the trip rod assembly (50) carefully. Nicks and scratches cause premature spring failure.

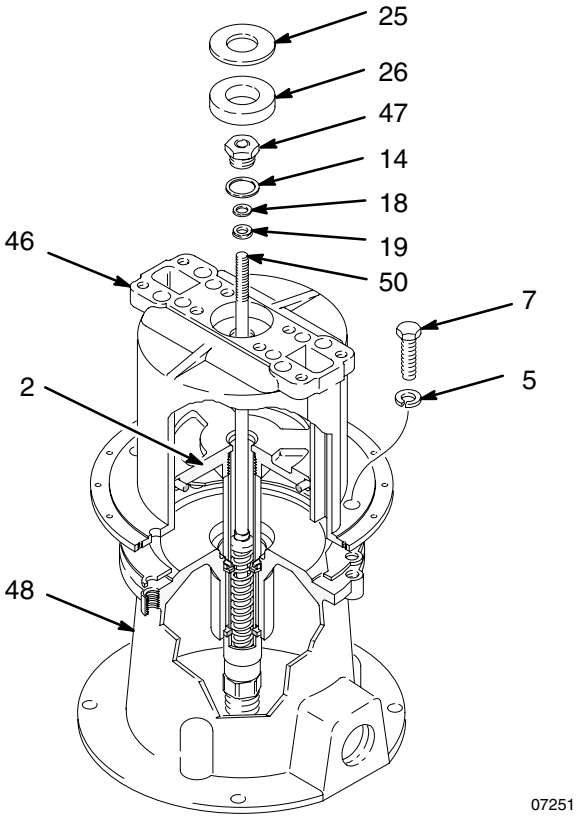
NOTE: A damaged trip rod cannot be repaired; use a new one.

15. Remove the trip rod (50) from the piston (2).

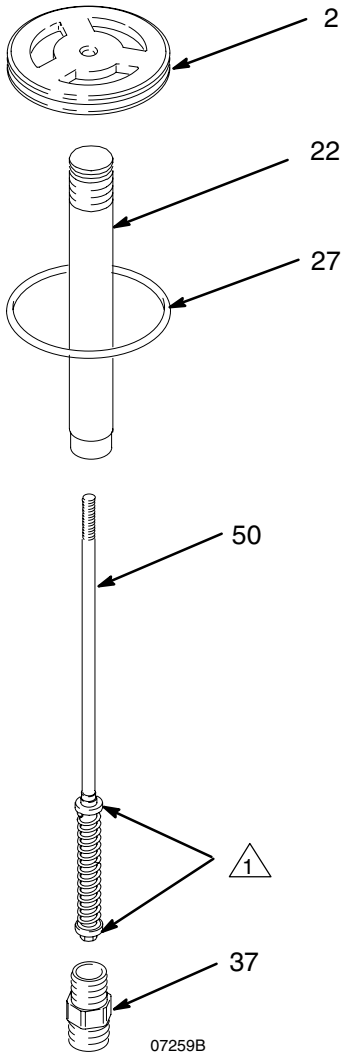
NOTE: Check that the clearance between the inside shoulders of the trip rod spring guides is exactly 5.5 in. (139.7 mm). If the clearance is different, replace the trip rod; do not attempt to adjust it.

16. Remove the v-block packing (20), backup washer (21), and gasket (17) from the base (48).

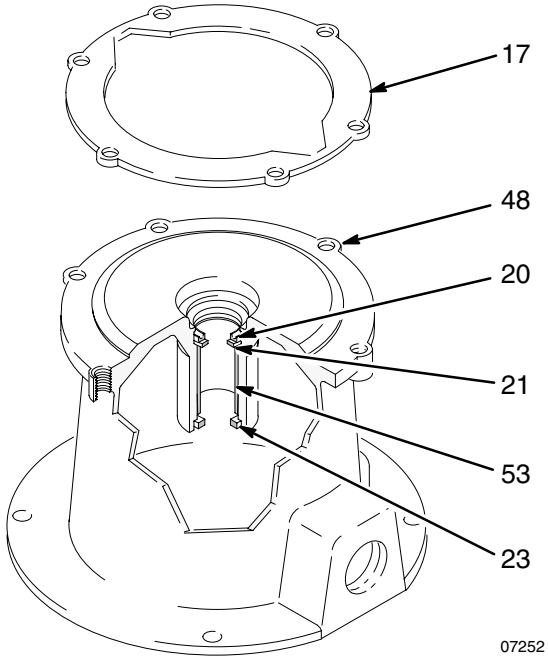
17. Turn the base over and remove the wiper seal (23). Inspect the bearing (53) in place. Remove only if damaged.



Detail of Piston



Detail of Base



1 Clearance between the inside shoulders must be exactly 5.5 in. (139.7 mm).

Fig. 6

Service

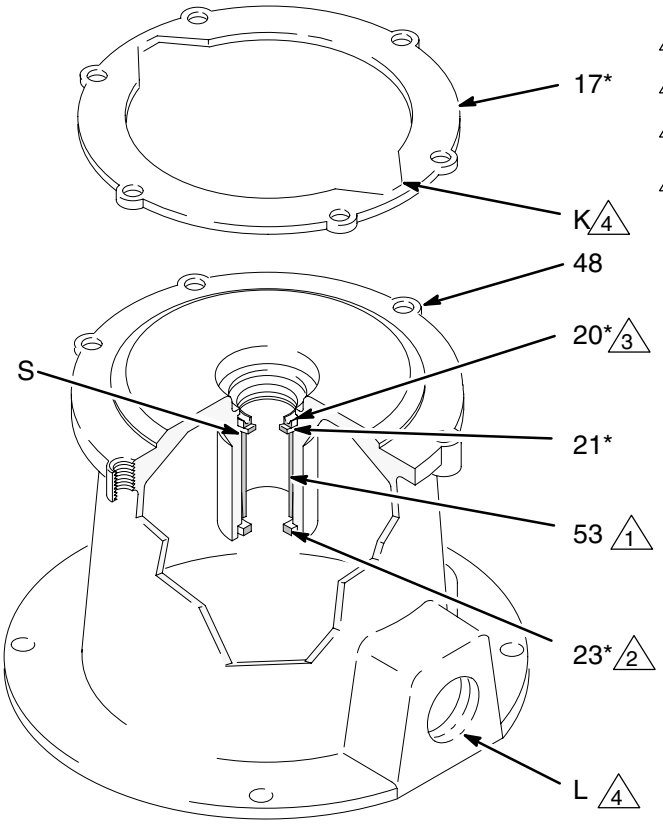
Models 217540, 249441, and 624250

Reassembly

1. Clean all parts thoroughly and inspect for wear or damage. Replace parts as necessary.

NOTE: Refer to Fig. 7 for steps 2 to 5.

2. Turn the base (48) upside down. If the bearing (53) was removed, press-fit the new bearing so its top edge is flush with the shoulder (S) of the packing cavity. After installation, measure the inner diameter of the bearing. It must be uniformly 1.375 in. (35 mm) to ensure that the piston shaft does not bind. If incorrect, size the bearing while in place; this can be done with a 1.375 in. diameter steel ball.
3. Grease the wiper seal (23*) and press-fit in the base (48).
4. Turn the base upright. Install the backup washer (21*) in the base (48). Grease the v-block packing (20*) and install it in the base so the lips face up.
5. Place the gasket (17*) on the base (48) so one of its notches (K) aligns with the optional fluid outlet (L).



1 Inner diameter of the bearing must be uniformly 1.375 in. (35 mm).

2 Grease.

3 Lips of packing must face up.

4 Align notch (K) in gasket (17) with the optional fluid outlet (L) in the base (48).

Fig. 7

Service

Models 217540, 249441, and 624250

NOTE: Refer to Fig. 8 for steps 6 to 10.

6. Grease the trip rod (50) with light, water-proof grease and slide it into the piston (2) shaft. Clean the threads of the piston and the connecting rod stud (37). Apply Loctite® 242 or the equivalent to both. Screw the stud into the piston and torque to 148–162 ft–lb (200–220 N•m).

7. Place the cylinder (46) upside down on the base (48). Grease the piston (2), o-ring (27*), and inside of the cylinder. Place the o-ring around the piston; the o-ring is larger than the piston groove. Install the piston in the cylinder so the excess of the o-ring fits into one of the air channels (M) of the cylinder. Use your fingers to push the o-ring out of the channel and seat it in the piston groove. Very carefully lower the piston into the cylinder.

8. Regrease the inside of the cylinder (46). Carefully turn the piston assembly and cylinder over and guide it into the base (48). Align one of the cylinder's air channels (M) with the notch (K) in the gasket (17) and with the optional fluid outlet (L) of the base. Install the lockwashers (5) and screws (7) and torque to 9–15 ft-lb (11–20 N•m).

9. Install the backup washer (18*) and v-block packing (19*) in the bearing (47) so the lips of the packing face *out of* the bearing. Install the gasket (14*) on the bearing. Grease the trip rod (50) and thread the bearing onto the trip rod and into the cylinder (46). Use a 1 in. deep-well socket wrench to tighten the bearing to 14–18 ft-lb (19–24 N•m).

10. Install the rubber pad (26) and washer (25) in the cylinder (46).

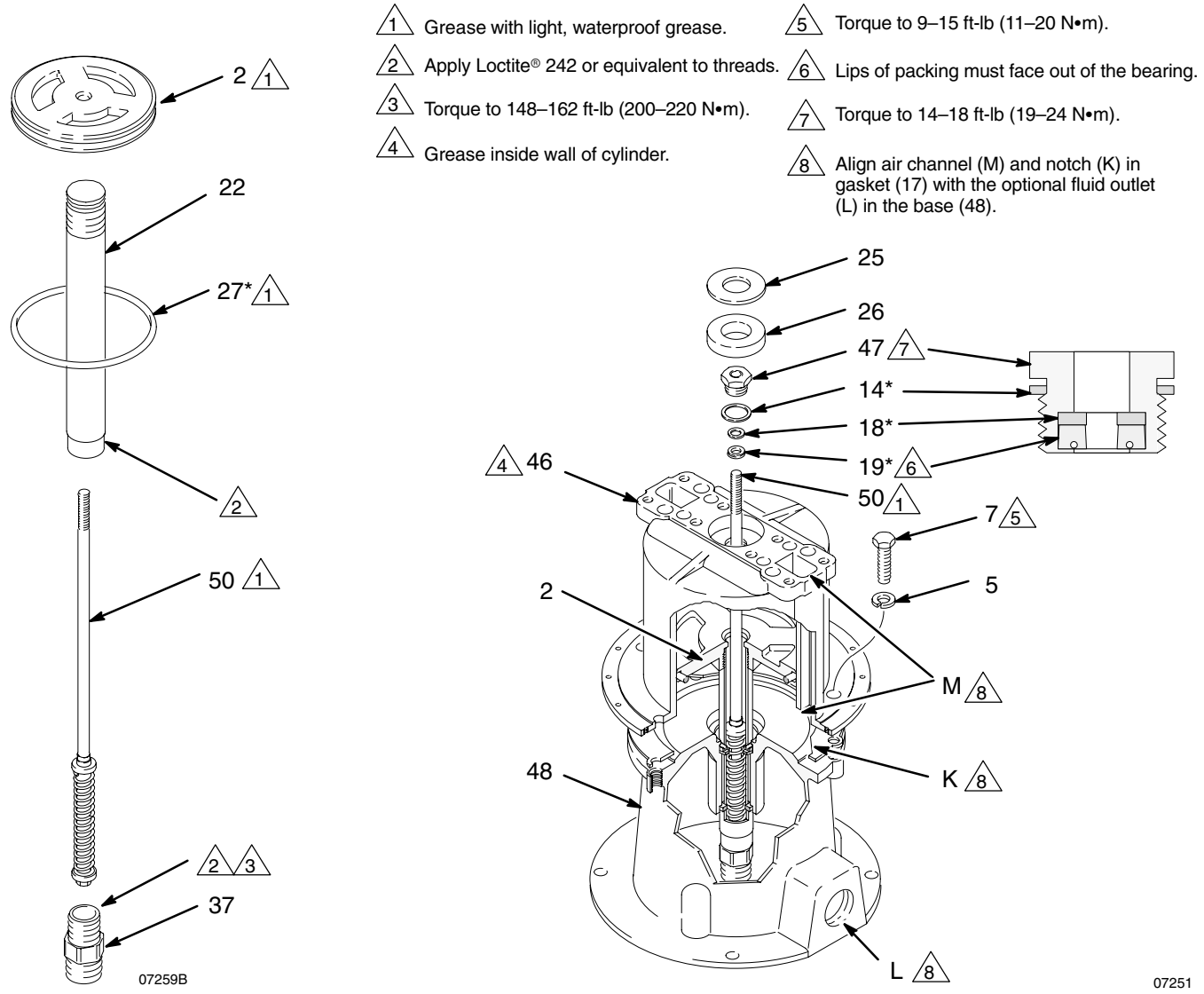


Fig. 8

11. See Fig. 9. Make sure the seals (41) are in place on the valve plates (38). Attach the plates to the manifolds with the screws (12).
12. Place the air valve alignment tool (N, order Part No. 168513) on the trip rod (50). Place the gaskets (40*) on the cylinder (46) so the wide end of the slot aligns with the air channel (M). Install the manifolds (43). The air inlet manifold (the one with the open port, P) must align with the optional fluid outlet in the base (L, Fig. 8). Install the screws (4) and washers (5). Remove the tool.

NOTE: The air valve alignment tool (N) ensures proper clearance and alignment for the manifolds.

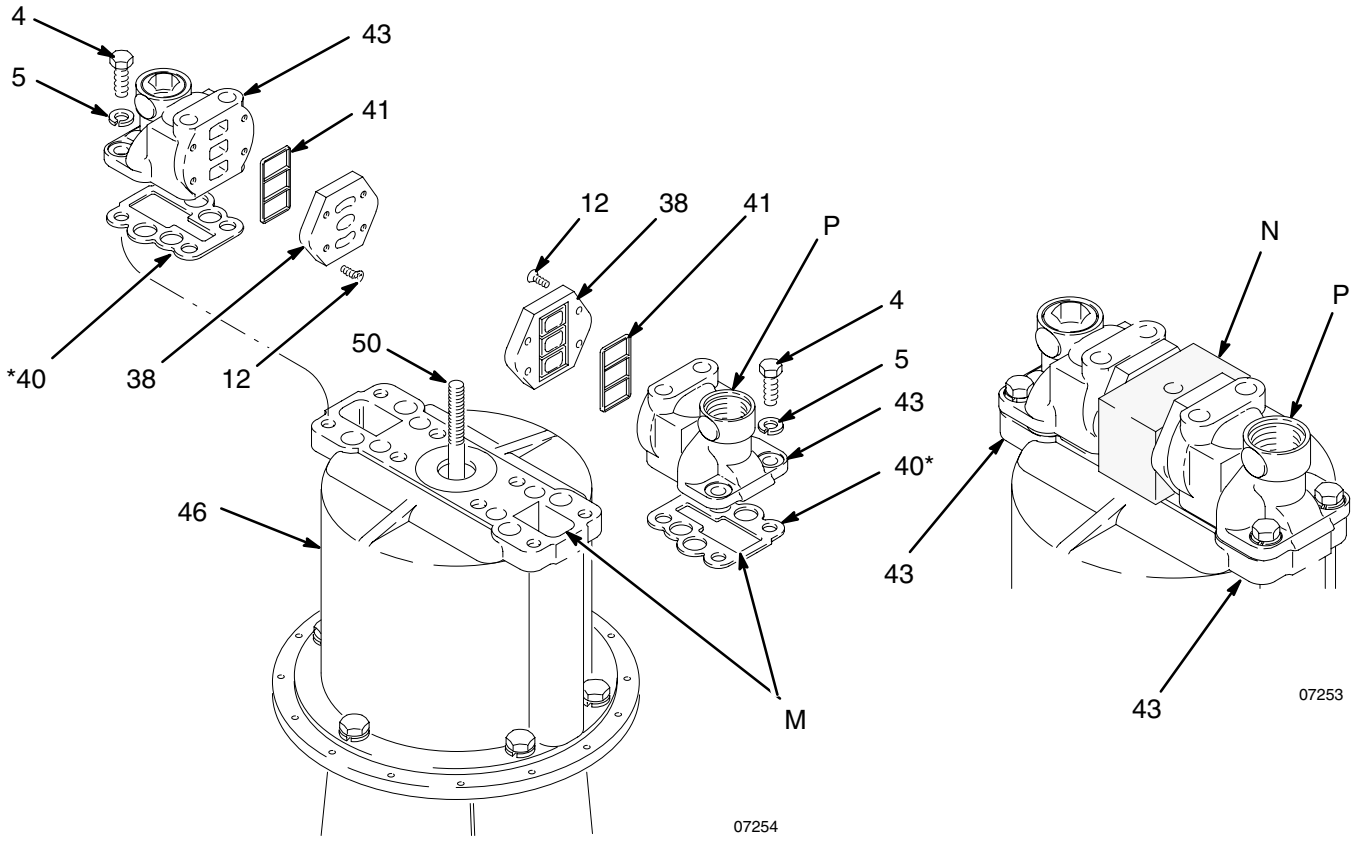


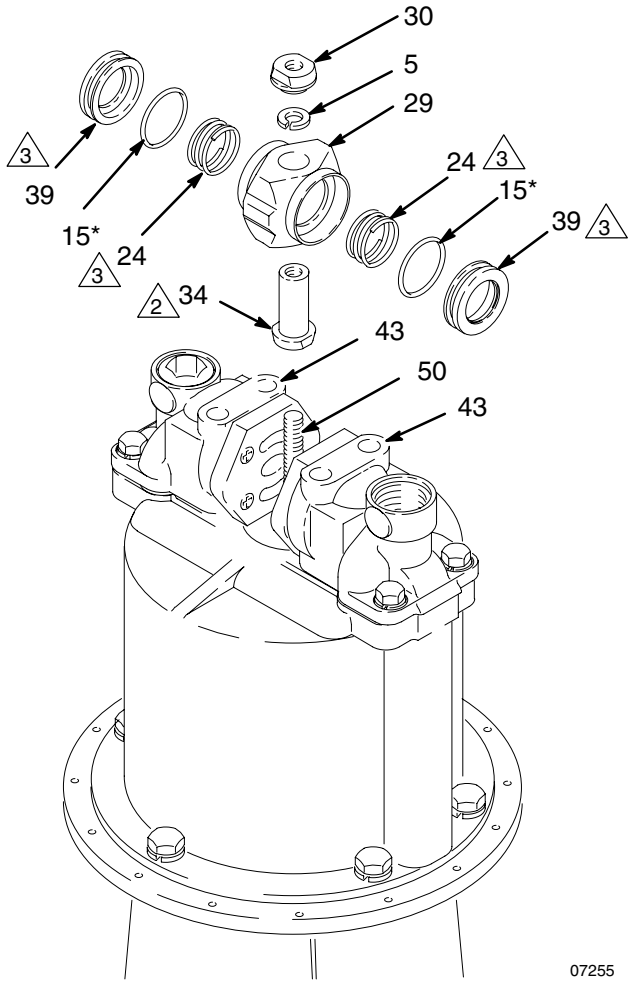
Fig. 9

Service

Models 217540, 249441, and 624250

NOTE: Refer to Fig. 10 for steps 13 to 15.

13. Thread the hub (34) onto the trip rod (50). Lift the rod and grasp it with the padded locking pliers. Screw the hub down as far as possible by hand.
14. Install the air valve housing (29), lockwasher (5), and trip rod nut (30) so the nut is flush with the top of the trip rod (50). Tighten the nut 11/2 turns more, so there is 0.031 in. (0.8 mm) clearance between the top of the rod and the top of the nut. Hold the flats of the trip rod nut with a wrench. With another wrench, tighten the hub (34) to 21–25 ft-lb (28–35 N•m). Turn the valve housing so it rests on the manifolds, then release the pliers.
15. Install an o-ring (15*) on each director valve (39). Grease the director valves and springs (24) and place them in each side of the air valve housing (29). Hold the parts in the housing and carefully rotate the housing 90° until it slides down between the manifolds (43). **Be very careful not to damage the air director valves (39).**



1 Make top of nut flush with top of trip rod, then tighten 1–1/2 turns more. Top of nut (30) must be 0.031” (0.8 mm) from end of rod (50).

2 Torque to 21–25 ft-lb (28–35 N•m)

3 Grease

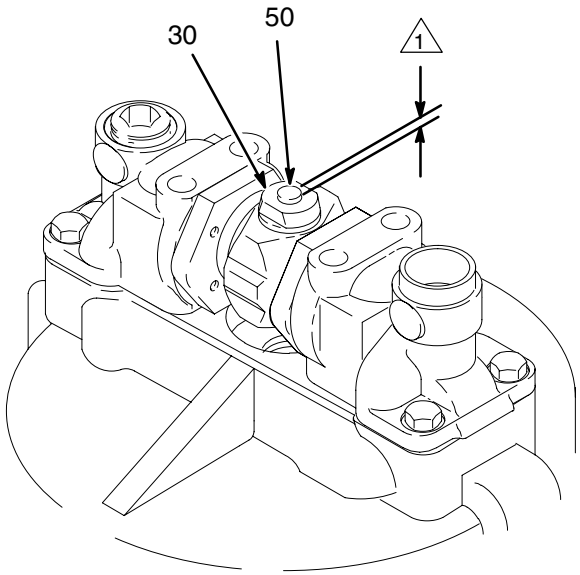


Fig. 10

Service

Models 217540, 249441, and 624250

NOTE: Refer to Fig. 11 for steps 16 to 20.

16. Install the rubber pad (26) and washer (25) in the bottom of the detent housing (36). Grease the plunger (28), assemble the axles (11) and rollers (10) and grease them, and install these parts in the detent housing.

17. Position the detent housing (36) on the manifolds (43), and install the washers (3) and screws (9). Tighten securely.

18. Grease the guides (32) and install with the springs (33) into each side of the detent housing (36). Screw the retainers (31) into both sides of the housing; they should readily screw all the way into the housing by hand. If they do not, the detents are not assembled correctly; inspect, and correct any misalignment. Now firmly tighten the retainers (31).

⚠ WARNING

MOVING PARTS HAZARD
Do not operate without the air motor shield in place. Pinching or amputation of fingers or hands may occur. See **MOVING PARTS HAZARD** on page 3.

19. Install the grommet (42), air motor shield (35), and the air inlet fitting (49). Install the screws (6). Reconnect the ground wire.

20. Before connecting the displacement pump, connect an air hose to the motor and run it slowly to check for smooth operation.

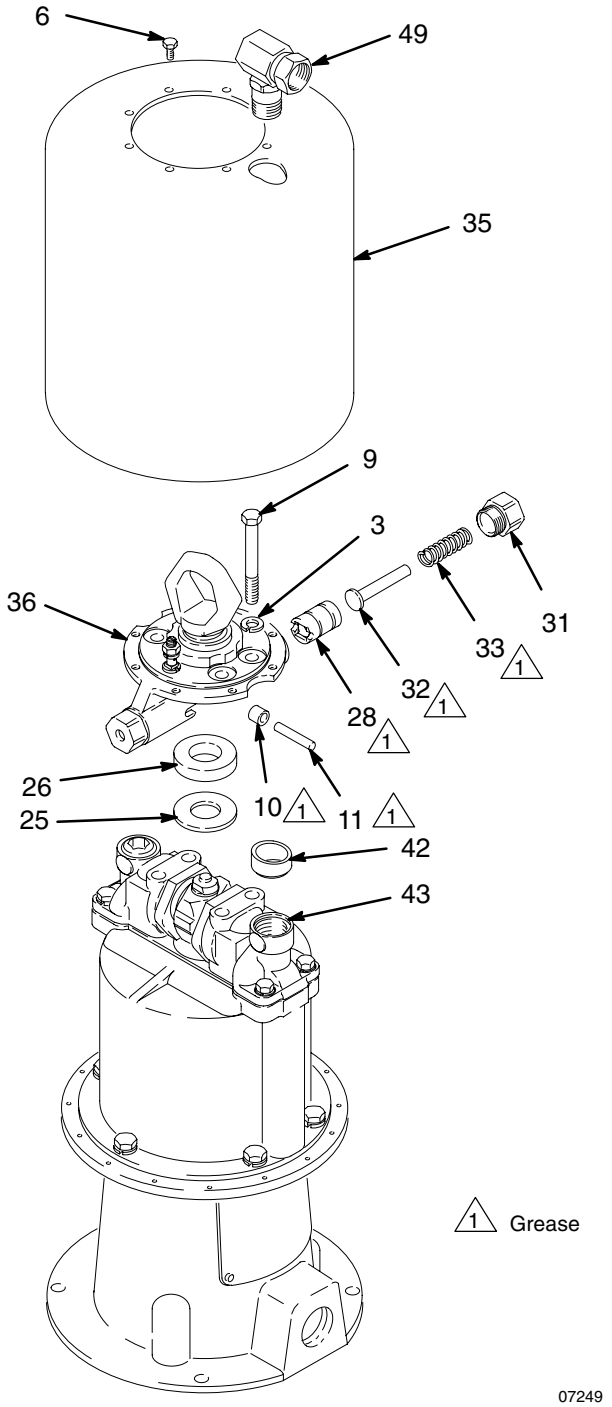


Fig. 11

Notes

Troubleshooting

Model 220571

Pressure Relief Procedure

⚠ WARNING

SKIN INJECTION HAZARD
To reduce the risk of serious injury, including fluid injection, splashing in the eyes or on the skin, or moving parts, always follow the **Pressure Relief Procedure** whenever you:

- are instructed to relieve the pressure,
- shut off the pump,
- stop spraying/dispensing,
- check or service any of the system equipment,
- or install or clean the spray tip/nozzle.

1. Lock the gun/valve trigger safety.
2. Turn off the air to the motor.
3. Close the bleed-type master air valve (required in your system).
4. Unlock the gun/valve trigger safety. Hold a metal part of the gun/valve firmly to a grounded metal pail. Trigger the gun/valve to relieve pressure.
5. Lock the gun/valve trigger safety.
6. Open the fluid drain valve. Leave the fluid drain valve open until you are ready to spray/dispense again.

If you suspect that the spray tip/nozzle or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, ***very slowly*** loosen the tip guard retaining nut or hose end coupling to relieve pressure gradually, then loosen completely. Now clear the tip/nozzle or hose obstruction.

If the Motor Stalls

To restart a stalled motor, shut off the air supply. Screw the lift ring (28) out of the manifold housing (35) and use a screwdriver to push the valve housing (5) down. See Fig. 12.

Locating Air Leaks

Shut off the air supply and disconnect the hose. Screw the inlet union (38) out of the air manifold cap (35). Remove the shield (34). Reinstall the shield screws (26) and lockwashers (25) and then screw the inlet union back into the manifold cap. See Fig. 12. Connect the air hose and turn on the air. Stall the pump on both the up and down stroke as indicated in the **Check Chart** and adjust the air regulator to just 10–15 psi (.07–0.1 MPa, 0.7–1 bar). Then use the checking methods listed in the **Check Chart** to find where air is leaking.

⚠ WARNING

MOVING PARTS HAZARD
Keep fingers out of the manifold cap (35) and manifold (21) to reduce the risk of pinching or amputating them.

Check Chart (See Fig. 12)

Stroke Position	Fig. Ref. Points	Checking Method	Cause of Leakage
UP stroke only	F	Listen for air at exhaust outlets	Worn trip rod bearing (43) or piston o-ring (39)
	B	Feel	Blown air cylinder gasket (40)
	C	Squirt oil around wiper seal (57)	Worn shaft seal (63)
BOTH	D,F,G or K	Feel	Damaged air manifold gasket (36)(45)
	E	Feel exhaust or hear high pitched sound	Worn air valves (3). Replace or lap faces with #500 grit sandpaper
	F	Feel or hear high pitched sound	Worn piston o-ring (39)
	H	Squirt oil around o-ring (15)	Damaged retainer o-ring (15)
	K	Feel	Damaged o-ring (29)

Troubleshooting

Model 220571

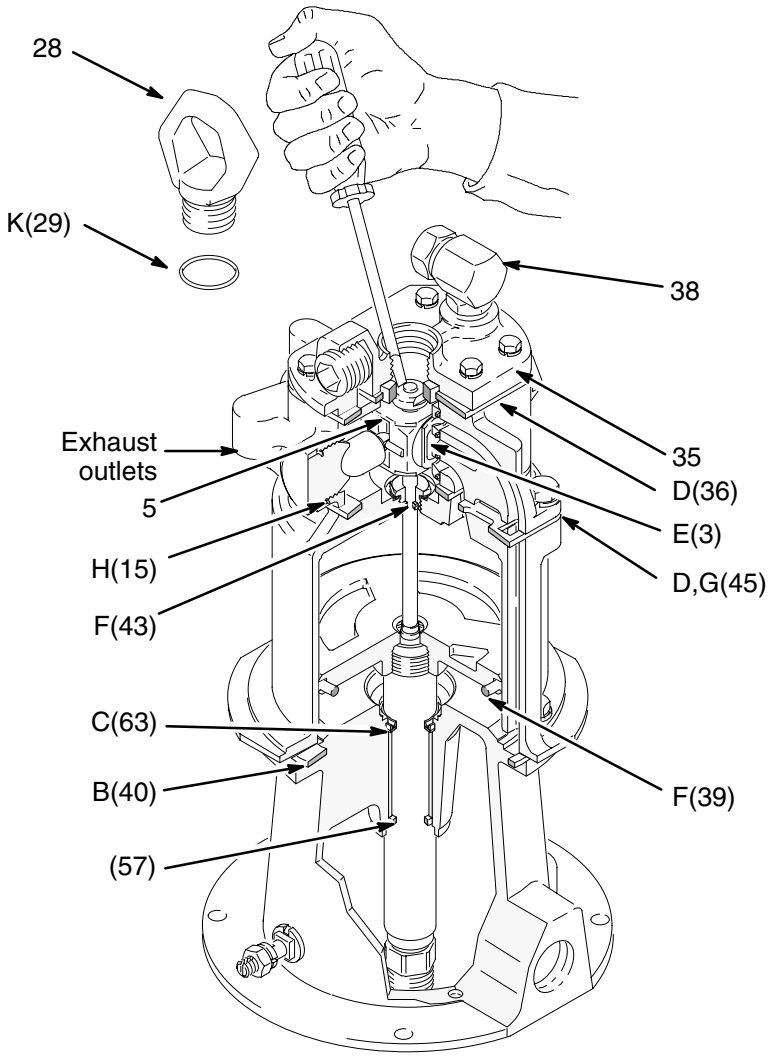


Fig. 12

Service

Model 220571

⚠ WARNING

To avoid serious injury and equipment damage, do not lift the equipment by the air motor lift ring if the total weight of the equipment exceeds 550 lb (250 kg). The lift ring cannot support that weight.

NOTE: Repair kit 220916 is available. Reference numbers of parts included in the kit are marked with an asterisk, i.e., (39*). See page 33. For the best results, use all the new parts in the kit, even if the old ones still look good.

NOTE: Inspect all parts as they are disassembled and replace worn or damaged parts.

Disassembly

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 20.

1. Relieve the pressure.
2. Disconnect the displacement pump. Disconnect the ground wire. Set the motor upright on a workbench.

NOTE: Refer to Fig. 13 for steps 3 to 5.

3. Remove the air inlet fitting (38). Remove the screws (26) and lockwashers (25), and lift off the air motor shield (34).
4. Remove the gasket (27). Lift off the manifold cap (35). Remove the gasket (36).
5. Unscrew the toggle retainers (14), and remove the o-rings (15), housing guides (16), springs (18), housings (19), and pins (20) from each side of the manifold (21).

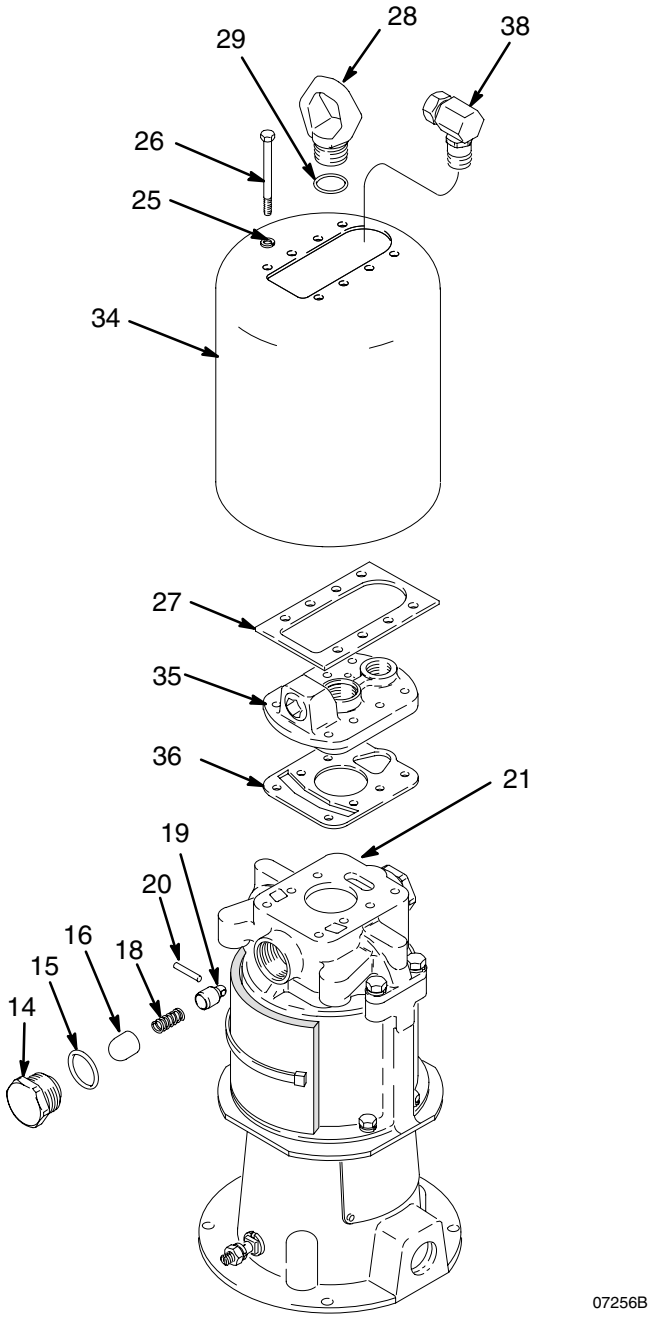


Fig. 13

Service

Model 220571

NOTE: Refer to Fig. 14 for steps 6 to 11.

6. Remove the four screws (37) and lockwashers (13) from the manifold (21).

7. **To prevent the spring-loaded director valves (3) from popping out,** carefully lift the manifold (21) about 51 mm (2 in.) from the air cylinder (41). Place one hand under the manifold to hold in the director valves, and continue lifting off the manifold. Remove your hand slowly, allowing the valve springs to release gently. Inspect the director valves (3) and compression springs (4).

8. Turn the manifold (21) over. Place wrenches on the flats of the adjusting screw (11) and nut (12) and turn the screw further into the nut until you can remove it. Do this in all four positions.

⚠ WARNING

The openings in the valve plates (2) are very sharp. Be careful not to cut yourself.

9. Remove and check the valve plates (2), handling them carefully. Clean the plates and mating surfaces of the manifold (21). Remove the rubber pad (8).

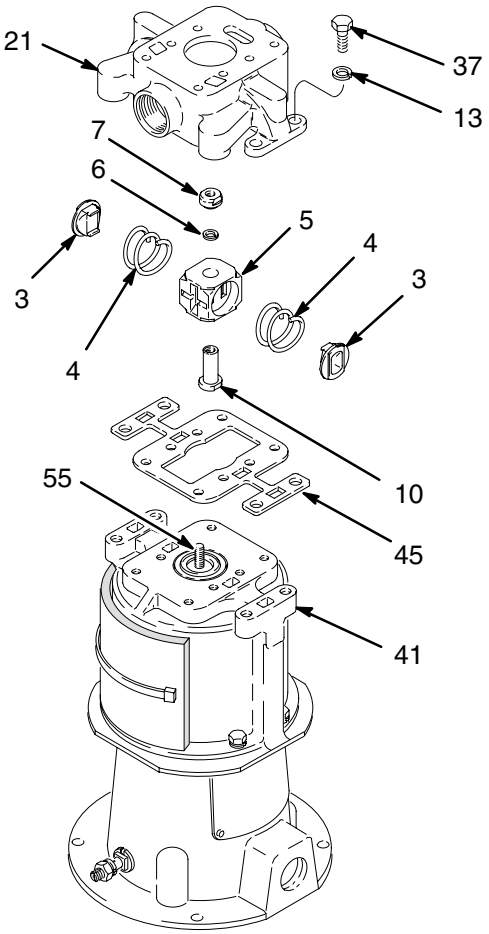
NOTE: If you replace the valve plates, also replace the seals (1).

⚠ CAUTION

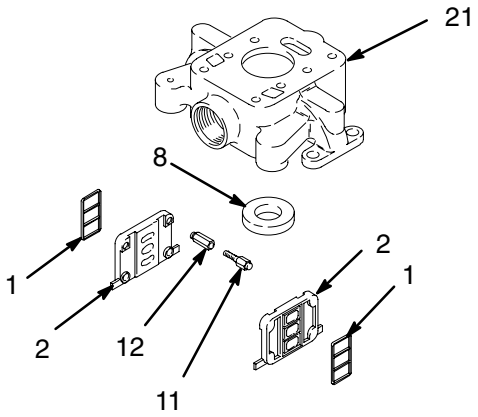
Be careful not to damage the surface of the trip rod (55), which would restrict its free movement. Special padded pliers, 207579, are available.

10. Pull the trip rod (55) up and grasp it with the padded locking pliers (order 207579). Hold the flats of the valve housing hub (10) with a wrench, screw off the trip rod nut (7) and remove the air valve housing (5). Remove the lockwasher (6) and screw off the hub (10). Now release the pliers.

11. Remove the gasket (45) from the air cylinder (41).



Detail of Air Manifold and Valve Plates



07257

Fig. 14

Service

Model 220571

NOTE: Refer to Fig. 15 for steps 12 to 18.

12. Remove the rubber pad (8) from the cylinder (41). Remove the trip rod bearing (43), using a 1 in. deep-well socket wrench. Remove the gasket (50), v-block packing (52), and backup washer (51) from the bearing.

⚠ CAUTION

Be careful not to tilt the cylinder when removing it from the piston to avoid damaging the smooth inner surface of the cylinder.

13. Remove the screws (30) and lockwashers (31) and carefully pull the cylinder (41) straight up off the piston (46).

14. Pull the piston (46) and trip rod (55) up out of the base (58). Remove the o-ring (39) from the piston.

NOTE: The connecting rod stud (53) is fastened to the piston shaft (46) with anaerobic sealant, and may be difficult to remove.

⚠ CAUTION

Be careful not to damage the polished surface of the piston shaft.

15. Lock the hex of the piston (46) in a vise and unscrew the connecting rod stud (53) from the piston shaft.

⚠ CAUTION

Handle the trip rod assembly (55) carefully. Nicks and scratches cause premature spring failure.

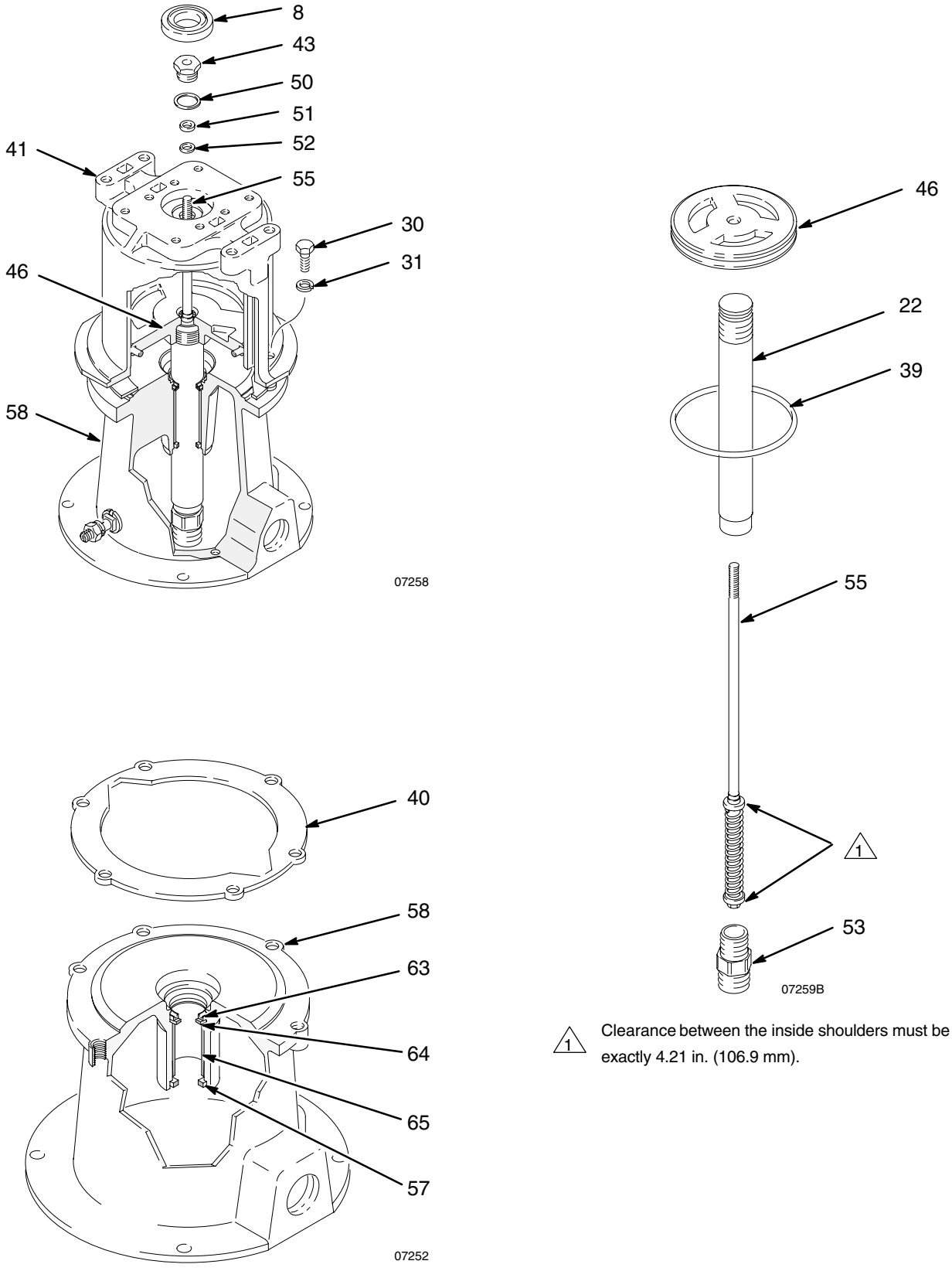
NOTE: A damaged trip rod cannot be repaired; use a new one.

16. Remove the trip rod (55) from the piston (46).

NOTE: Check that the clearance between the shoulders of the trip rod spring guides is exactly 4.21 in. (106.9 mm). If the clearance is different, replace the trip rod; do not attempt to adjust it.

17. Remove the v-block packing (63), backup washer (64), and gasket (40) from the base (58).

18. Turn the base over and remove the wiper seal (57). Inspect the bearing (65) in place. Remove only if damaged.



1 Clearance between the inside shoulders must be exactly 4.21 in. (106.9 mm).

Fig. 15

Service

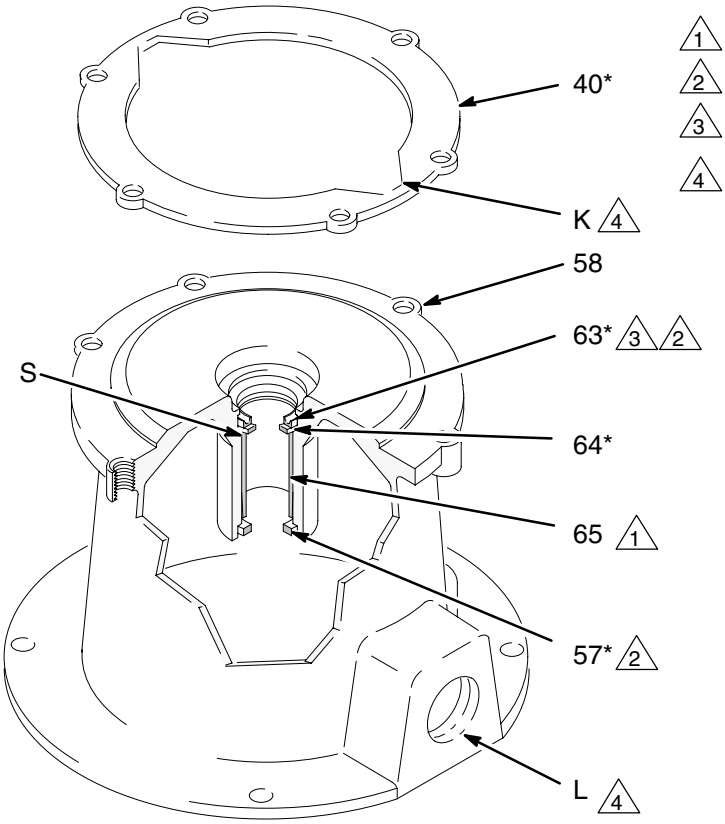
Model 220571

Reassembly

1. Clean all parts thoroughly and inspect for wear or damage. Replace parts as necessary.

NOTE: Refer to Fig. 16 for steps 2 to 5.

2. Turn the base (58) upside down. If the bearing (65) was removed, press-fit the new bearing so its top edge is flush with the shoulder (S) of the packing cavity. After installation, measure the inner diameter of the bearing. It must be uniformly 1.375 in. (35 mm) to ensure that the piston shaft does not bind. If incorrect, size the bearing while in place; this can be done with a 1.375 in. diameter steel ball.
3. Grease the wiper seal (57*) and press-fit in the base (58).
4. Turn the base upright. Install the backup washer (64*) in the base (58). Grease the v-block packing (63*) and install it in the base so the lips face up.
5. Place the gasket (40*) on the base (58) so one of its notches (K) aligns with the optional fluid outlet (L).



1 Inner diameter of the bearing must be uniformly 1.375 in. (35 mm).

2 Grease.

3 Lips of packing must face up.

4 Align notch (K) in gasket (40) with the optional fluid outlet (L) in the base (58).

Fig. 16

NOTE: Refer to Fig. 17 for steps 6 to 10.

6. Grease the trip rod (55) with light, water-proof grease and slide it into the piston (46) shaft. Clean the threads of the piston and the connecting rod stud (53). Apply Loctite® 242 or the equivalent to both. Screw the stud into the piston and torque it to 148–162 ft–lb (200–220 N•m).

7. Place the cylinder (41) upside down on the base (58). Grease the piston (46), o-ring (39*), and inside of the cylinder. Place the o-ring around the piston; the o-ring is larger than the piston groove. Install the piston in the cylinder so the excess of the o-ring fits into one of the air channels (M) of the cylinder. Use your fingers to push the o-ring out of the channel and seat it in the piston groove. Very carefully lower the piston into the cylinder.

8. Regrease the inside of the cylinder (41). Carefully turn the piston assembly and cylinder over and guide it into the base (58). Align one of the cylinder's air channels (M) with the notch (K) in the gasket (40) and with the optional fluid outlet (L) of the base. Install the lockwashers (31) and screws (30) and torque to 25 ft-lb (34 N•m).

9. Install the backup washer (51*) and v-block packing (52*) in the bearing (43) so the lips of the packing face *into* the bearing. Install the gasket (50*) on the bearing. Grease the trip rod (55) and thread the bearing onto the trip rod and into the cylinder (41). Use a 1 in. deep-well socket wrench to tighten the bearing.

10. Install the rubber pad (8) in the cylinder (41).

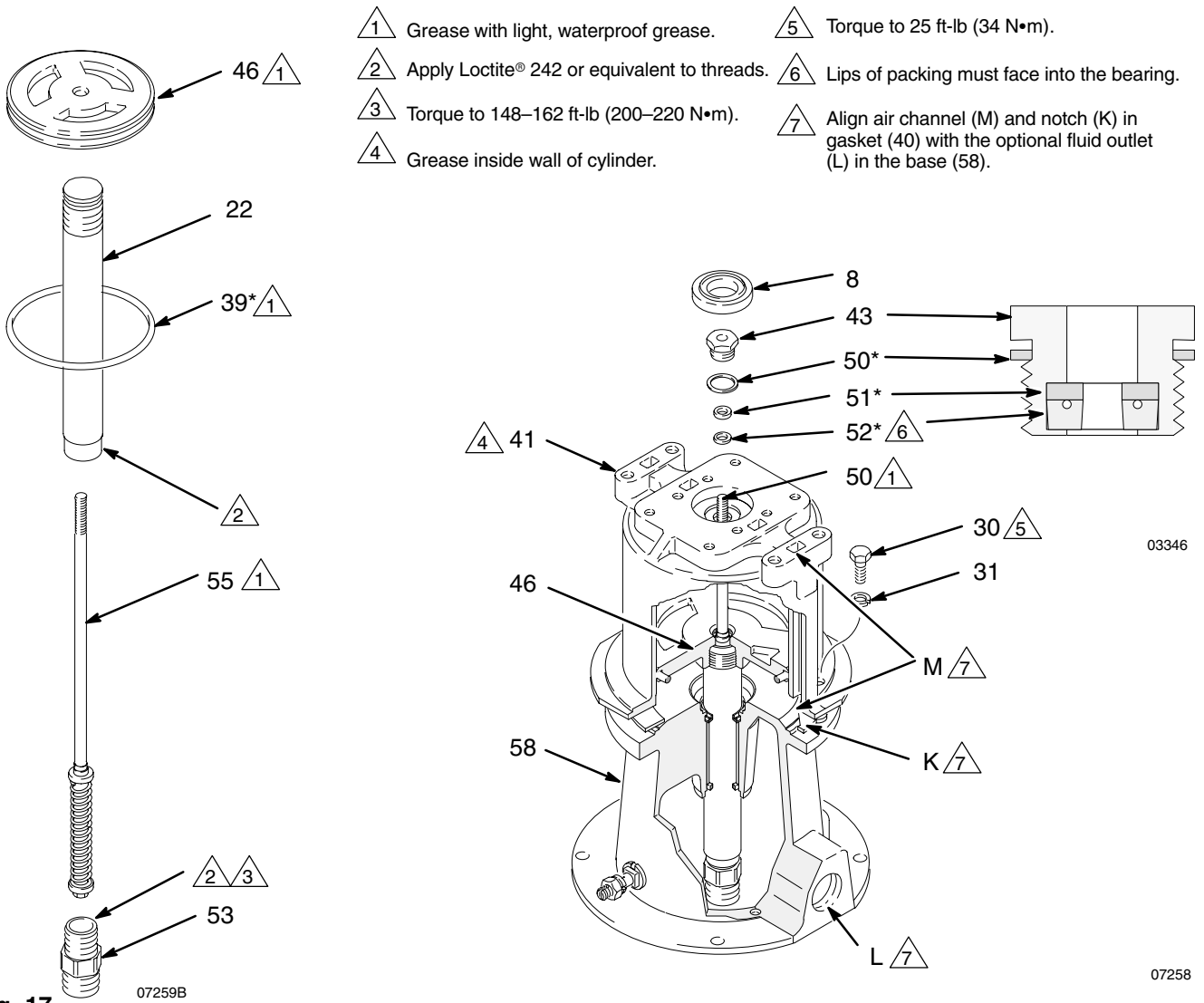


Fig. 17

Service

Model 220571

NOTE: Refer to Fig. 18 for steps 11 to 16.

11. Place the gasket (45*) on top of the cylinder (41).

12. Thread the hub (10) onto the trip rod (55). Lift the rod and grasp it with the padded locking pliers. Screw the hub down as far as possible.

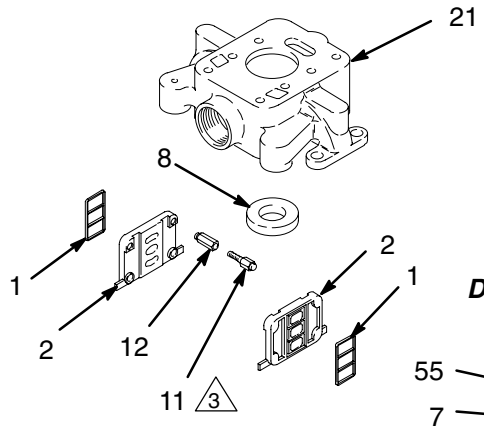
13. Install the air valve housing (5), lockwasher (6), and trip rod nut (7) so the nut is flush with the top of the trip rod (55). Tighten the nut 3/4 turn more, so there is 0.04 in. (1 mm) clearance between the top of the rod and the top of the nut. Hold the flats of the trip rod nut with a wrench. With another wrench, tighten the hub (10) to 21–25 ft-lb (28–34 N•m). Release the pliers.

14. Place the plate seals (1) on the valve plates (2). Place the plates in the air manifold (21). Install the adjusting screw (11) and nut (12) assemblies in all four corners of the plates. ***Important:*** Adjust the screws and nuts evenly so they snugly hold the plates. Do not exceed 35 in-lb (4 N•m).

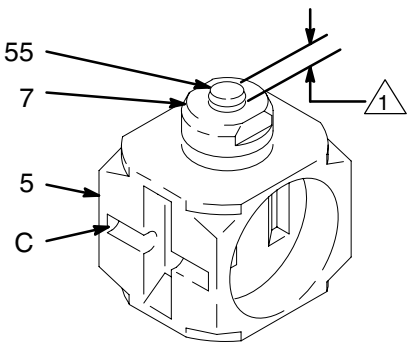
15. Install the rubber pad (8) in the air manifold (21).

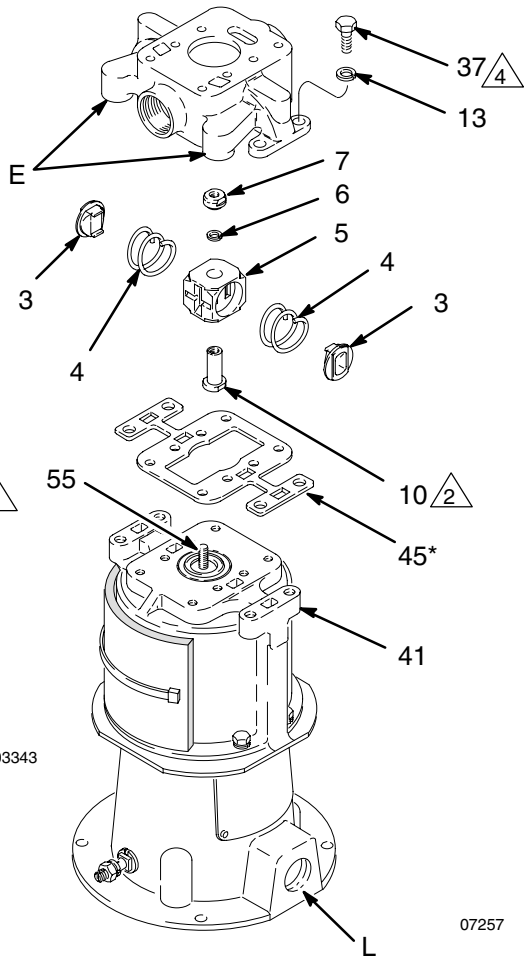
16. Place the springs (4) and air director valves (3) into the valve housing (5). Hold the springs and valves in place and install the air manifold (21) over the housing, making sure it is properly oriented. The exhaust ports (E) must be oriented to the optional outlet (L) of the base as shown. Be sure the valve housing (5) moves up and down freely, and then install and tighten the screws (37) and lockwashers (13) holding the manifold (21) to the cylinder (41).

Detail of Air Manifold and Valve Plates



Detail of Valve Housing





03343

1 Make top of nut flush with top of trip rod, then tighten 3/4 turn more. Top of nut (7) must be 0.04" (1 mm) from end of rod (55).

2 Torque to 21–25 ft-lb (28–34 N•m)

3 Tighten snugly. Do not exceed 35 in-lb (4 N•m)

4 Torque to 25 ft-lb (34 N•m)

Fig. 18

Service

Model 220571

NOTE: Refer to Fig. 19 for steps 17 to 23.

17. Lubricate the housing (19), spring (18), and guide (16) with light, water-proof grease. Assemble the housing and spring into the guide. Lubricate the pin (20) and slide it into the housing. Slide these assembled parts into the air manifold (21). Be sure the pin (20) is aligned with the slot (C, Fig. 18) of the air valve housing (5) before assembling the rest of the air valve. Repeat for the other side.

18. Install the o-ring (15) on the retainer (14). Screw the retainers into both sides of the manifold (21); they should readily screw all the way into the manifold by hand. If they do not, the parts are not assembled correctly; inspect, and correct any misalignment. Now firmly tighten the retainers (14).

19. Place the gasket (36*), cap (35), and gasket (27) on the air manifold (21). Be sure these parts are oriented as shown.

⚠ WARNING

MOVING PARTS HAZARD
Do not operate without the air motor shield in place. Pinching or amputation of fingers or hands may occur. See **MOVING PARTS HAZARD** on page 3.

20. Install the shield (34), screws (26), and lockwashers (25). Torque to 9–12 ft-lb (12–16 N•m).

21. Install the air inlet fitting (38).

22. Before returning the motor to service, connect an air line and run the motor slowly to see that it cycles smoothly.

23. Reconnect the displacement pump and the ground wire.

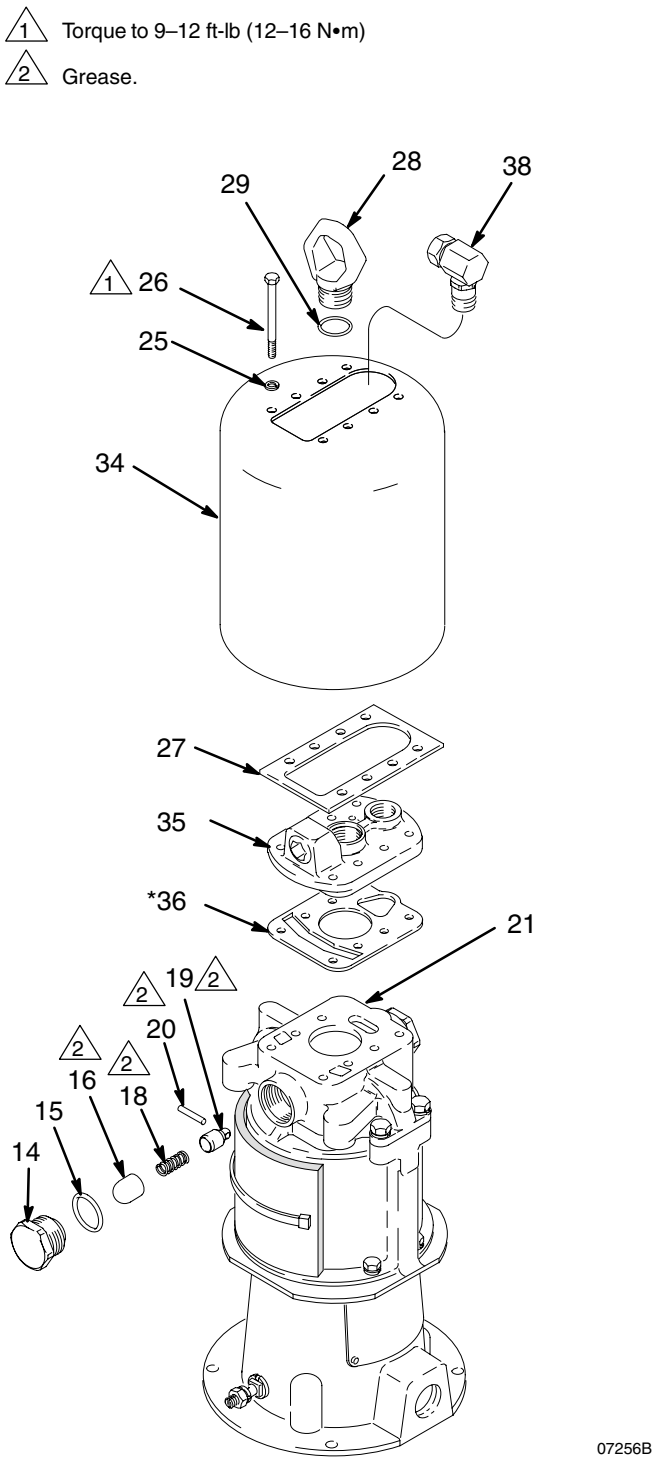
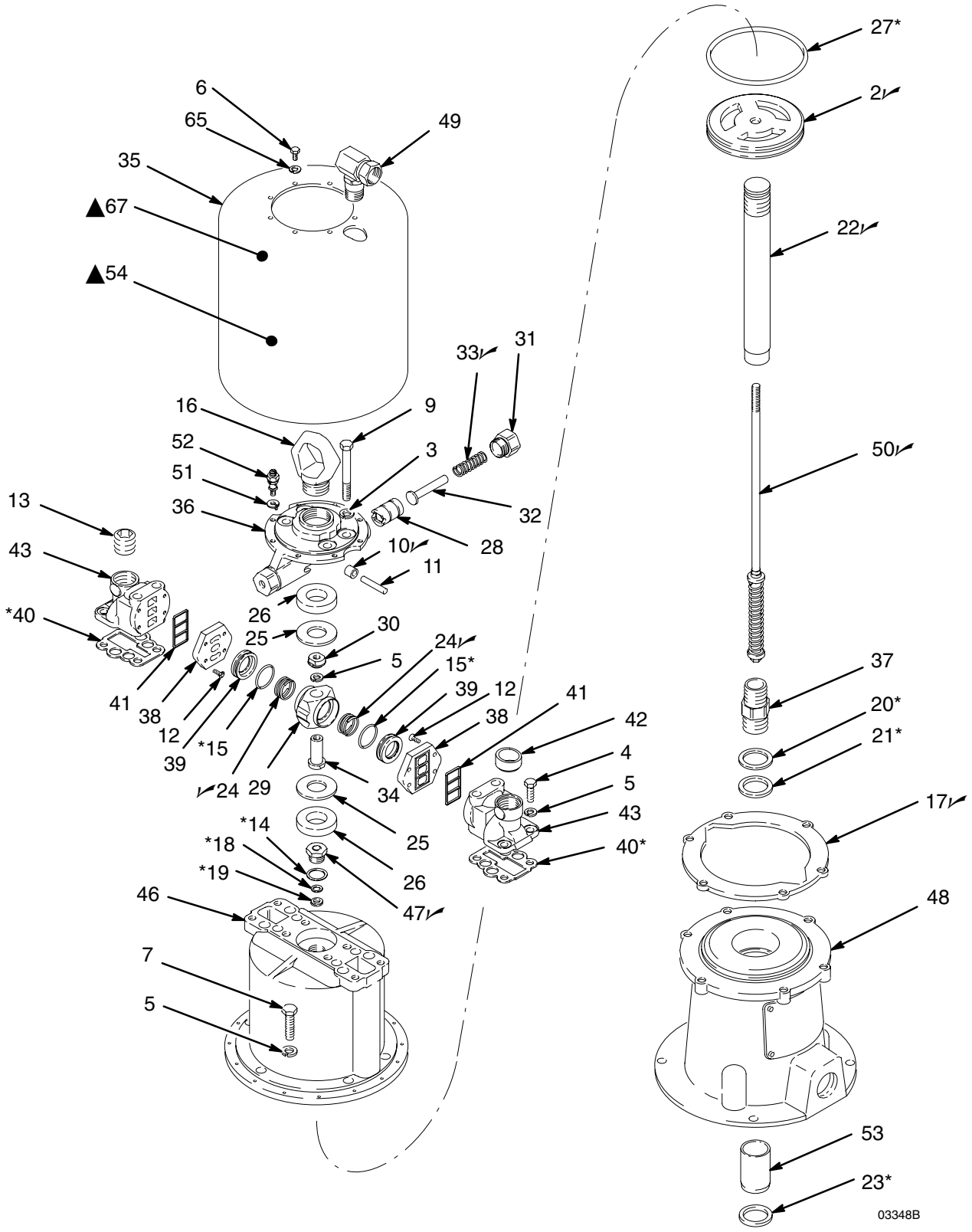


Fig. 19

Parts

Model 217540, Series C
Includes items 2–67
Model 624250, Series A
Includes items 2–67

Model 249441, Series A
Includes items 2–67



Parts

Model 217540, Series C
Includes items 2–67
Model 624250, Series A
Includes items 2–67

Ref No.	Part No.	Description	Qty
2✓	178905	PISTON, air	1
3	100052	LOCKWASHER, spring; 7/16”; *Model 217540*	4
	103780	LOCKWASHER, spring; 7/16”; *Models 624250 and 249441*	4
4	100101	SCREW, hex hd cap; 3/8–16 x 1”	4
5	100133	LOCKWASHER, spring; 3/8”	11
6	113161	SCREW, hex hd cap; 1/4–20 x 1/2”; *Model 217540*	8
	102235	SCREW, hex hd cap; 1/4–20 x 1/2”; *Models 624250 and 249441*	8
7	100004	SCREW, hex hd cap; 3/8–16 x 1–1/4”	6
9	101713	SCREW, hex hd cap; 7/16 –14 x 3.5”; *Model 217540*	4
	513059	SCREW, hex hd cap; sst; 7/16–14 x 3–1/2”; *Models 624250 and 249441*	4
10✓	169585	ROLLER, axle	2
11	169586	AXLE, detent	2
12	101716	SCREW, flat head mach; No. 10–24 x 1/2”	8
13	102726	PLUG, pipe; soc hd; 3/4 npt	1
14*	150647	GASKET, flat; copper alloy	1
15*	156698	PACKING, o-ring	2
16	180952	RING, lift	1
17✓	178907	GASKET, fiber	1
18*	161559	WASHER, backup	1
19*	161560	PACKING, v-block	1
20*	161562	PACKING, v-block	1
21*	161563	WASHER, backup	1
22	181142	SHAFT, piston	1
23*	161569	SEAL	1
24✓	161575	SPRING, compression	2
25	161576	WASHER, flat	2
26	161577	PAD, rubber	2
27*	107082	PACKING, o-ring	1
28	169583	PLUNGER, detent	2
29	161585	HOUSING, air valve	1
30	161586	NUT; 3/8–24	1
31	161587	RETAINER, detent spring	2
32	161588	GUIDE, spring	2
33✓	161589	SPRING, compression	2

Model 249441, Series A
Includes items 2–67

Ref No.	Part No.	Description	Qty
34	161590	HUB, valve housing	1
35	178906	SHIELD; *Model 217540*	1
	624254	SHIELD; *Models 624250 and 249441*	1
36	177664	HOUSING, detent *Models 217540 and 249441*	1
	16A544	HOUSING, detent; *Model 624250*	1
37	168180	STUD, connecting rod; *Models 217540 and 624250*	1
	626044	STUD, connecting rod; *Model 249441*	1
38	169584	PLATE, valve	2
39	168182	VALVE, air director	2
40*	168183	GASKET, air manifold	2
41	168184	SEAL, valve plate	2
42	168185	GROMMET	1
43	168187	MANIFOLD, air	2
46	178904	CYLINDER; *Model 217540*	1
	194981	CYLINDER; *Models 624250 and 249441*	1
47✓	204649	BEARING	1
48	181141	BASE, air motor; *Model 217540*	1
	194982	BASE, air motor; *Models 624250 and 249441*	1
	115235	UNION, 90°, adapter; 3/4 npt(m) x 3/4 npsm(f) swivel; *Models 624250 and 249441*	1
50✓	214852	TRIP ROD	1
51	104582	WASHER, tab	1
52	104029	LUG, grounding	1
53	189059	BEARING	1
54▲	290331	LABEL, warning; English	1
65	104123	LOCKWASHER, spring; 1/4”; *Models 624250 and 249441*	8
67▲	189991	LABEL, warning	1

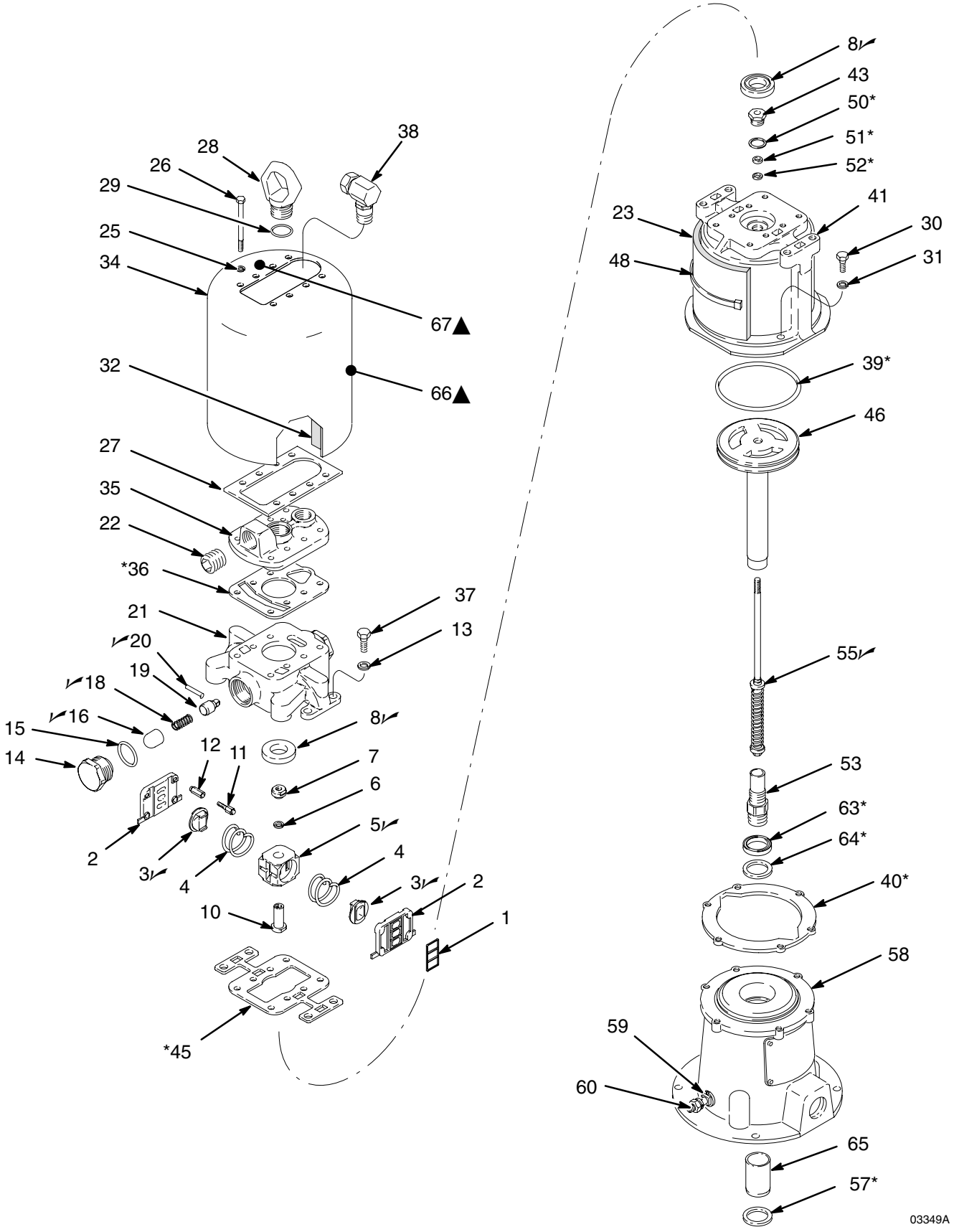
* *These parts are included in Repair Kit 218122, which may be purchased separately.*

✓ *Keep these spare parts on hand to reduce down time.*

▲ *Replacement Danger and Warning labels, tags and cards are available at no cost. The 290331 label is also available in the following languages:*
German (Part No. 290396)
French (Part No. 290397)
Spanish (Part No. 290398).

Parts

Model 220571, Series B
Includes items 1–67



Parts

Quiet Senator Air Motor
Model 220571, Series B
Includes items 1–67

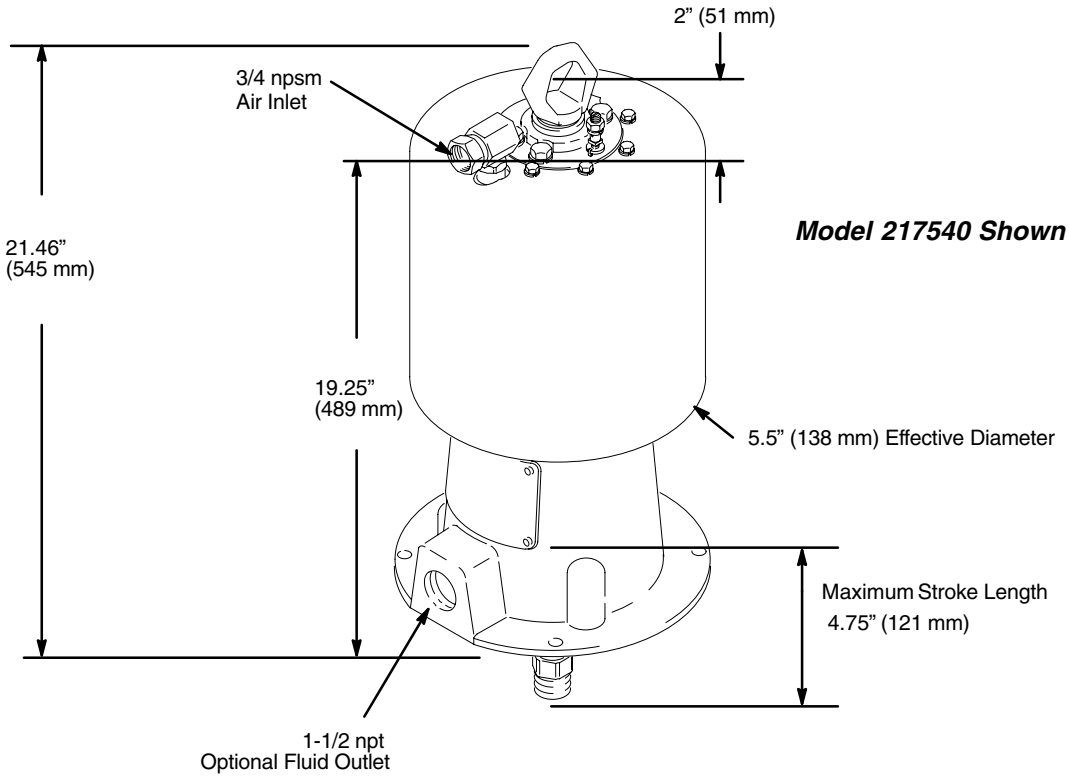
Ref No.	Part No.	Description	Qty
1	168184	SEAL, plate, valve, buna-n	2
2	176536	PLATE, valve	2
3↙	176518	VALVE, director	2
4	176543	SPRING, compression	2
5↙	176519	HOUSING, air valve	1
6	105319	LOCKWASHER, 10 mm	1
7	176569	NUT, trip rod	1
8↙	161577	PAD, rubber	2
10	176568	HUB, valve housing	1
11	176550	SCREW, adjusting	4
12	176548	NUT, adjusting	4
13	100018	LOCKWASHER	4
14	178428	RETAINER, toggle	2
15	105318	O-RING, nitrile rubber	2
16↙	178427	GUIDE, housing	2
18↙	178429	SPRING, compression	2
19	178426	HOUSING, spring	2
20↙	105321	PIN, dowel	2
21	176540	MANIFOLD	1
22	105325	PLUG, pipe, 1” npt(f)	1
23	183356	PAD, dampening	1
25	104572	LOCKWASHER, 8 mm	8
26	105322	CAPSCREW, hex hd; M8 x 1.5 x 100	8
27	177081	GASKET, neoprene	1
28	176537	RING, lift	1
29	166221	O-RING, nitrile rubber	1
30	100004	CAPSCREW, hex hd; 3/8–16 x 1–1/4”	6
31	100133	LOCKWASHER, spring, 3/8”	6
32	183318	PAD, dampener	1
34	183311	SHIELD	1
35	176539	CAP, manifold	1
36*	176580	GASKET, cellulose fiber	1
37	105324	CAPSCREW, hex hd; M8 x 1.5 x 30	4
38	207648	FITTING, union, adapter, 90°	1
39*	107082	PACKING, o-ring	1
40*	183312	GASKET, cellulose fiber	1
41	183105	CYLINDER	1
43	215933	BEARING	1
45*	176575	GASKET, cellulose fiber	1
46	220915	PISTON, air	1
48	108774	STRAP, wire tie	3
50*	150647	GASKET, flat, copper alloy	1
51*	161559	WASHER, backup, leather	1
52*	161560	PACKING, v-block, polyurethane	1
53	176564	STUD, connecting rod	1
55↙	218597	TRIP ROD ASSEMBLY	1
57*	161569	SEAL, wiper	1
58	220843	BASE, air motor (includes item 65)	1
59	104582	WASHER, tab	1
60	104029	LUG, grounding	1
63*	161562	PACKING, v-block, nitrile rubber	1
64*	161563	WASHER, backup	1
65	189058	BEARING	1
66▲	290331	LABEL, warning; English	1
67▲	189991	LABEL, warning	1

* *These parts are included in Repair Kit 220916, which may be purchased separately.*

↙ *Keep these spare parts on hand to reduce down time.*

▲ *Replacement Danger and Warning labels, tags and cards are available at no cost. The 290331 label is also available in the following languages:*
German (Part No. 290396)
French (Part No. 290397)
Spanish (Part No. 290398).

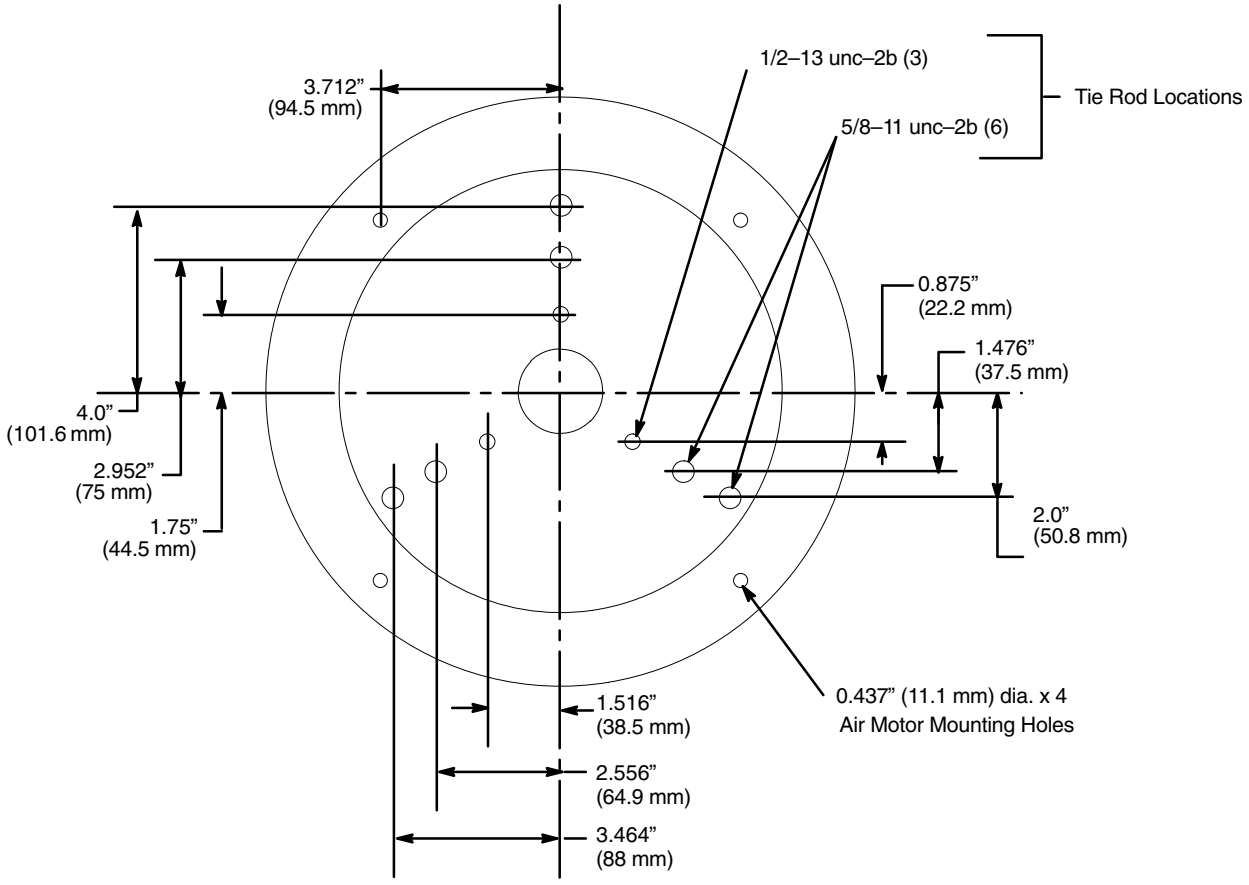
Dimensions



Model 217540 Shown

03337

Mounting Hole Layout



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Technical Data

Category	Data
Maximum Incoming Air Pressure	*Models 217540 and 220571:* 120 psi (0.8 MPa, 8.3 bar) *Models 249441 and 624250:* 100 psi (0.7 MPa, 7 bar)
Effective Piston Area	24 sq. in. (154 cm^2)
Piston Diameter	5.5 in. (140 mm)
Stroke Length	4.75 in. (121 mm)
Air Valves	Dual, slide type
Valve Housing	Balanced, opposing seals and detent rollers

The Graco Standard Warranty

Graco warrants all equipment 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.

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Graco Information

For the latest information about Graco products, visit www.graco.com.

TO PLACE AN ORDER, contact your Graco distributor, or call one of the following numbers to identify the distributor closest to you:

1–800–328–0211 Toll Free
612–623–6921
612–378–3505 Fax

All written and visual data contained in this document reflects the latest product information available at the time of publication. Graco reserves the right to make changes at any time without notice.

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