

INSTRUCTIONS-PARTS LIST



400
307-592

Rev. F
SUPERSEDES E

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

5.5 INCH EFFECTIVE DIAMETER

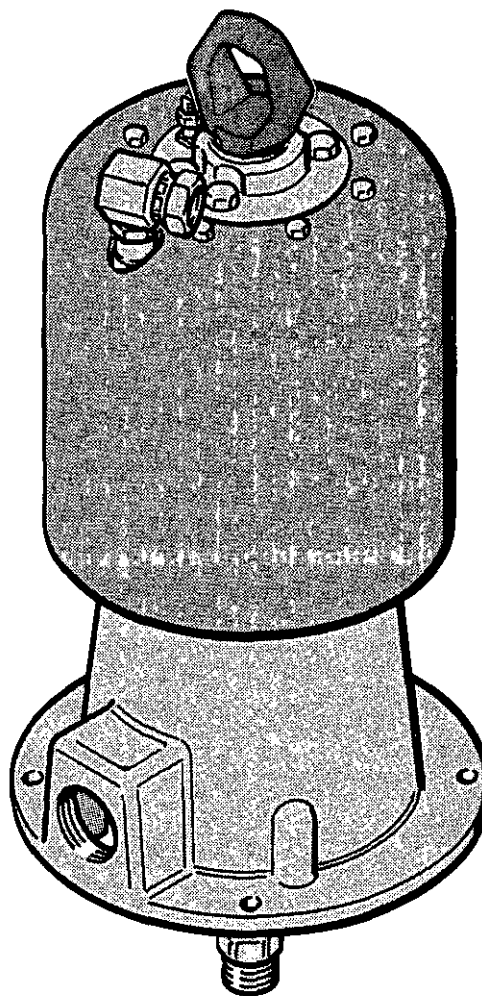
SENATOR® and QUIET SENATOR® AIR MOTORS

100 psi (6.9 bar) MAXIMUM WORKING PRESSURE

Model 217-540, Series C
Senator® Air Motor
4.75 in. Piston Stroke

Model 220-571, Series A
Quiet Senator® Air Motor
4.75 in Piston Stroke

Model 218-580, Series A
Senator® II Air Motor
8 in. Piston Stroke



MODEL 217-540 SHOWN

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WARNING

HIGH PRESSURE SPRAY CAN CAUSE SERIOUS INJURY. FOR PROFESSIONAL USE ONLY. OBSERVE ALL WARNINGS.

Read and understand all instruction manuals before operating equipment.

FLUID INJECTION HAZARD

General Safety

This equipment generates very high fluid pressure. Spray from the gun, leaks or ruptured components can inject fluid through your skin and into your body and cause extremely serious bodily injury, including the need for amputation. **Also**, fluid injected or splashed into the eyes or onto the skin can **cause serious damage**.

NEVER point the spray gun or dispensing valve at anyone or at any part of the body. **NEVER** put hand or fingers over the spray tip.

ALWAYS have the tip guard in place on the spray gun when spraying.

ALWAYS follow the Pressure Relief Procedure, at **right**, before cleaning or removing the spray tip or nozzle or servicing any system equipment.

NEVER try to stop or deflect leaks **with** your hand or body.

Be sure equipment safety devices are operating properly before **each use**.

Medical Alert—Airless Spray Wounds

If any fluid appears to penetrate your skin, get **EMERGENCY MEDICAL CARE AT ONCE. DO NOT TREAT AS A SIMPLE CUT**. Tell the doctor exactly what fluid was injected.

Note to Physician: *Injection in the skin is a traumatic injury. It is important to treat the injury surgically as soon as possible. Do not delay treatment to research toxicity. Toxicity is a concern with some exotic coatings injected directly into the blood stream. Consultation with a plastic surgeon or reconstructive hand surgeon may be advisable.*

Spray Gun and Dispensing Valve Safety Devices
Be sure all gun safety devices are operating properly before **each use**. **Do not** remove or modify any part of the gun; this can cause a malfunction and result in serious bodily injury.

Safety Latch

Whenever you stop spraying, even for a moment, always **set** the gun safety latch in the closed or "safe" position, making the gun inoperative. Failure to set the safety latch can result in accidental triggering of the gun.

Diffuser on Spray Guns

The gun diffuser breaks up spray and reduces the risk of fluid injection when the **tip** is not installed. Check diffuser operation regularly. Follow the Pressure Relief Procedure, at **right**, then remove the spray tip. Aim the gun into a grounded metal pail, holding the gun firmly to the pail. Using the lowest possible pressure, trigger the gun. If the fluid emitted **is not diffused** into an irregular stream, replace the diffuser immediately.

Tip Guard on Spray Guns

ALWAYS have the tip guard **in place** on the spray gun while spraying. The tip guard alerts you to the fluid injection hazard and helps reduce, but does not prevent, the **risk of accidentally** placing your fingers or any part of your **body** close to the spray tip.

Trigger Guard

Never operate the gun with the trigger guard removed. This guard helps prevent the gun from triggering accidentally if it is dropped or bumped.

Spray Tip and Nozzle Safety

Use extreme **caution** when cleaning or changing spray tips or nozzles. If the spray tip or nozzle clogs while spraying, **engage the gun safety latch immediately. ALWAYS follow the Pressure Relief Procedure** and then remove the spray tip or nozzle to clean it.

NEVER wipe off build-up around the spray tip or nozzle until pressure is fully relieved and the gun **safety** latch is engaged.

Pressure Relief Procedure

To reduce the **risk of serious bodily injury**, including fluid injection, splashing in the **eyes** or on the skin, and injury from moving parts, **always** follow this procedure whenever you **shut off the pump** when checking or servicing any part of the system. **when installing or changing spray tips, and whenever you stop spraying.**

1. Engage the spray gun or dispensing **valve** safety latch.
2. **Turn off** the air to the motor.
3. Close the bleed-type master air valve (required).
4. **Disengage the gun or dispensing valve safety latch.**
5. **Hold a metal part of the gun or valve firmly to the side of a grounded metal waste container** and trigger it to relieve the fluid pressure.
6. Engage the safety latch again.
7. **Open** the pump drain valve (required in **system**), having a container ready to catch the **drainage**.
8. Leave the drain valve open until you are **ready** to spray again.

If you suspect that the spray tip or hose is dogged, or that pressure has not been fully relieved after following the above steps, VERY SLOWLY loosen the tip guard retaining nut or hose end coupling and allow pressure to be relieved gradually, then remove completely. Now clear the tip or hose.

EQUIPMENT MISUSE HAZARD

General Safety

Any misuse of the spray equipment or **accessories**, such as overpressurizing, modifying parts, using incompatible chemicals and fluids, or using worn or damaged **parts**, can cause them to rupture and result in fluid injection or other **serious** bodily injury, fire, explosion or property damage.

NEVER alter or modify any part of this equipment; doing so could cause it to malfunction.

CHECK all spray equipment regularly and repair or replace worn or damaged parts immediately.

ALWAYS read and follow the fluid and solvent manufacturer's recommendations regarding the **use** of protective clothing and equipment.

System Pressure

NEVER exceed 100 psi (6.9 bar) air pressure to the motor, and NEVER exceed the stated maximum working pressure of the pump or of the lowest rated component in your system. Refer to your separate pump instruction manual.

Be sure that all **accessories** you add to the spray system are properly rated to withstand the maximum air and fluid working pressures of this system.

Fluid Compatibility

BE SURE that all fluids and solvents **used** are **chemically compatible** with the **wetted** parts of the system. **Always read the fluid and solvent manufacturer's literature before using them in the pump.**

FIRE OR EXPLOSION HAZARD

Static electricity is created by the flow of fluid through the pump and hose. If every part of the spray equipment is not properly grounded, sparking may occur, and the system may become hazardous. Sparking may also occur when plugging in or unplugging a power supply cord. Sparks can ignite fumes from solvents and the fluid being sprayed, dust particles and other flammable substances, whether you are spraying indoors or outdoors, and can cause a fire or explosion and serious bodily injury and property damage. Do not plug in or unplug any power supply cords in the spray area when there is any chance of igniting fumes still in the air.

If you experience any static sparking or even a slight shock while using this equipment, **STOP SPRAYING IMMEDIATELY**. Check the entire system for proper grounding. Do not use the system again until the problem has been identified and corrected.

Grounding

To reduce the risk of static sparking, ground the pump and all other spray equipment used or located in the spray area. **CHECK** your local electrical code for detailed grounding instructions for your area and type of equipment. **BE SURE** to ground all of this spray equipment:

1. **Pump:** use a ground wire and clamp as instructed at the right.
2. **Air hoses:** use only grounded air hoses.
3. **Fluid hoses:** use only grounded fluid hoses.
4. **Air compressor:** follow manufacturer's recommendations.
5. **Spray gun or dispensing valve:** grounding is obtained through connection to a properly grounded fluid hose and pump.
6. **Object being sprayed:** according to your local code.
7. **Fluid supply container:** according to your local code.
8. **All solvent pails** used when flushing, according to local code. Use only metal pails, which are conductive, placed on a grounded surface. **Do not** place the pail on a non-conductive surface, such as paper or cardboard, which interrupts the grounding continuity.
9. **To maintain** grounding continuity when flushing or relieving pressure, always hold a metal part of the gun firmly to the side of a grounded metal pail, then trigger the gun.

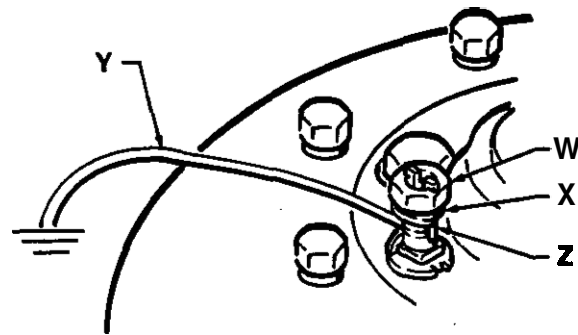


Fig 3-1

To ground the pump, loosen the grounding lug locknut (W) and washer (X). Insert one end of a 12ga. (1.5 mm²) minimum ground wire (Y) into the slot in lug (Z) and tighten locknut securely. See Fig 3-1. Connect the other end of the wire to a true earth ground. Refer to page 10 to order a ground wire and clamp.

Flushing Safety

Reduce the risk of fluid injection injury, static sparking, or splashing by following the specific flushing procedure given in your separate pump instruction manual. Follow the Pressure Relief Procedure on page 2, and remove the spray tip (*spray guns only*) before flushing. Hold a metal part of the gun firmly to the side of a grounded metal pail and use the lowest possible fluid pressure during flushing.

MOWING PARTS HAZARD

The piston in the air motor, located behind the air motor shield, moves when air is supplied to the motor. Moving parts can pinch or amputate your fingers or other body parts. Therefore, **NEVER** operate the pump with the air shield removed. **KEEP CLEAR** of moving parts when starting or operating the pump. Before checking or servicing the pump, follow the Pressure Relief Procedure on page 2 to prevent the pump from starting accidentally.

HOSE SAFETY

High pressure fluid in the hoses can be very dangerous. If the hose develops a leak, split or rupture due to any kind of wear, damage or misuse, the high pressure spray emitted from it can cause a fluid injection injury or other serious bodily injury or property damage.

ALL FLUID SPRAY HOSES MUST HAVE SPRING GUARDS ON BOTH ENDS! The spring guards help protect the hose from kinks or bends at or close to the coupling which can result in hose rupture.

TIGHTEN all fluid connections securely before each use. High pressure fluid can dislodge a loose coupling or allow high pressure spray to be emitted from the coupling.

NEVER use a damaged hose. Before each use, check entire hose for cuts, leaks, abrasion, bulging cover, or damage or movement of the hose couplings. If any of these conditions exist, replace the hose immediately. **DO NOT** try to recouple high pressure hose or mend it with tape or any other device. A repaired hose cannot contain the high pressure fluid.

HANDLE AND ROUTE HOSES CAREFULLY. Do not pull on hoses to move equipment. Do not use fluids or solvents which are not compatible with the inner tube and cover of the hose. **DO NOT** expose Graco hose to temperatures above 180°F (82°C) or below -40°F (-40°C).

Hose Grounding Continuity

Proper hose grounding continuity is essential to maintaining a grounded spray system. Check the electrical resistance of your air and fluid hoses at least once a week. If your hose does not have a tag on it which specifies the maximum electrical resistance, contact the hose supplier or manufacturer for the maximum resistance limits. Use a resistance meter in the appropriate range for your hose to check the resistance. If the resistance exceeds the recommended limits, replace the hose immediately. An ungrounded or poorly grounded hose can make your system hazardous. Also, read **FIRE OR EXPLOSION HAZARD**, above.

IMPORTANT

United States Government safety standards have been adopted under the Occupational Safety and Health Act. These standards—particularly the General Standards, Part 1910, and the Construction Standards, Part 1926—should be consulted.

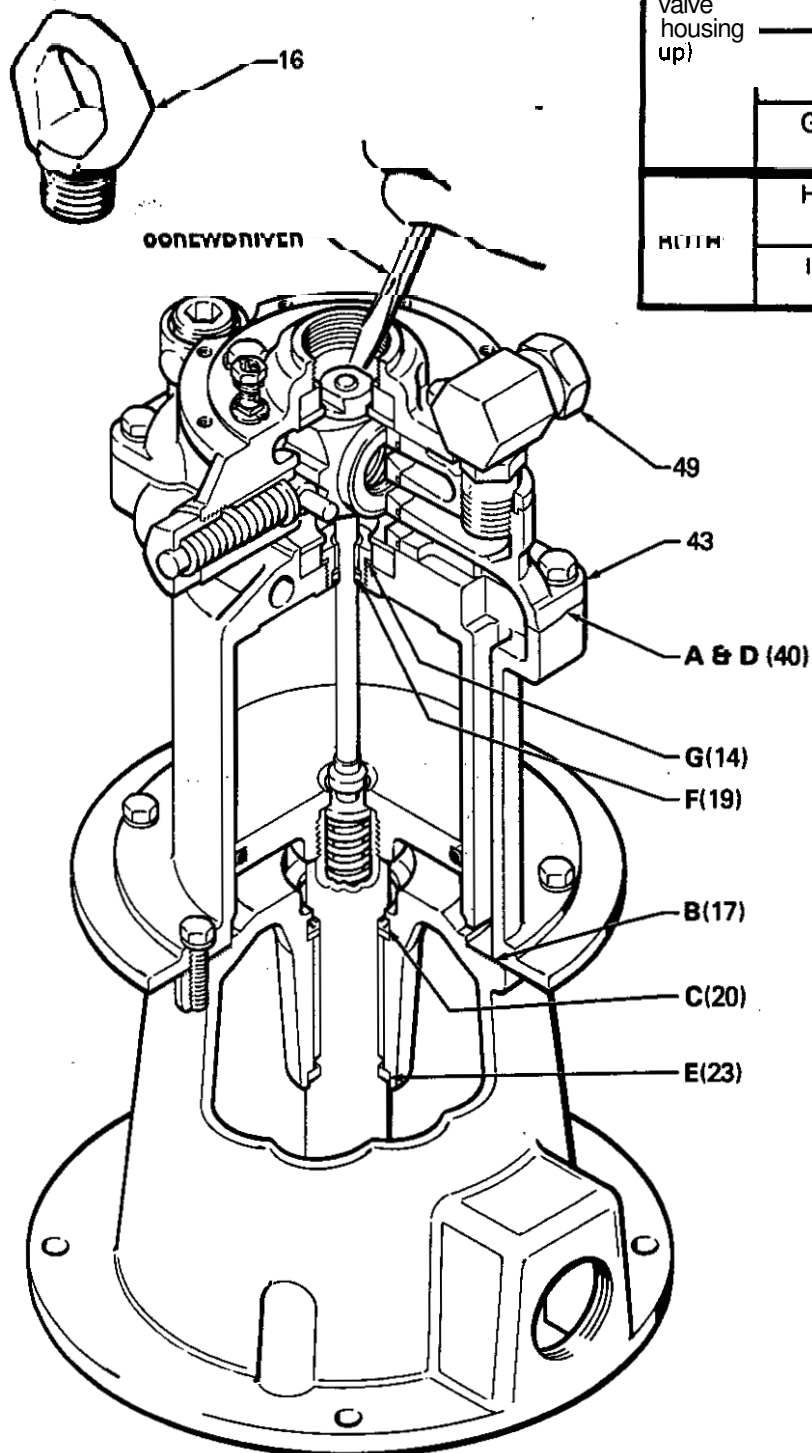
To restart a stalled motor, screw the **lift ring (16)** out of the detent housing (36) and use a screwdriver to push the valve housing (29) down. See Figs 4-1.

Locating Air Leaks

To locate where air is leaking, shut **off** the air supply and disconnect the hose. Screw the inlet union (49) out of the air manifold (43), remove the shield (35), then screw the union back into the manifold. See the Parts Drawing and Fig 4-1. Connect the air hose and turn the air on, then use the checking methods listed in the **CHECK CHART** to find where air is leaking.

WARNING

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



CHECK CHART (See Fig 4-11)

Stroke Position	Fig. Ref. Points	Checking Method	Cause of Leakage
UP 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 throat packings (20)
DOWN only (air valve housing up)	D	By feel	Blown air manifold gaskets (40)
	E	By feel	Damaged conn. tube seal (23)
		Squirt oil around bearing	Worn trip rod packing (19)
	G	Squirt oil around bearing	Damaged trip rod bearing gasket (14)
HOTH	H	Squirt oil around air valve (39)	Worn air valves (39) or their packings (15)
	I	Hold paper strip over exh. holes	Worn air piston packing (27)

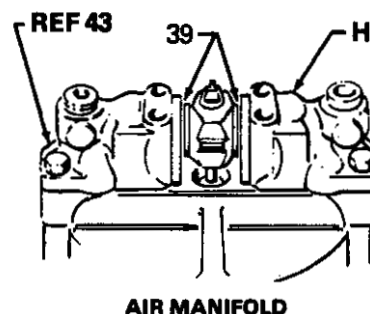


Fig 4-1

Air Valve Repair

1. Follow the Pressure Relief Procedure Warning on page 2.

NOTE: Refer to the Parts Drawing on page 12 for Steps 2 and 3.

2. Remove the air inlet fitting (49), disconnect the ground wire, and remove the lift ring (16).

NOTE: A repair kit, part no. 218-122, is available. See page 13. For the best results, use all the new parts in the kit, even if the old ones still look good.

In the Parts List and Repair Procedure, reference numbers with one asterisk, for example (14*), indicate that this part is included in the repair kit.

3. Remove the screws (6), washers (1) and air motor shield (35).

NOTE: Refer to Fig 5-1 for Steps 4 to 11.

4. Unscrew each spring retainer (31) and remove the spring (33), guide (32) and plunger (28) from each side of the detent housing (36).

CAUTION

Handle all springs carefully. Nicks and scratches weaken springs and may cause them to break during use.

5. Remove the four screws (9) and washers (3) from the detent housing (36). Then carefully lift the housing so the rollers (10) and axles (11) are not dropped or damaged.
6. While holding in the director valves (39), push the motor piston up from the bottom of the base (48). Turn the air valve housing (29) so it rests on the manifolds (43). Remove the spring (24), O-ring (15) and air director valve (39) from each side of the housing.
7. Pull the trip rod (50) up as far as possible and grasp it with the special locking pliers (order part no. 207-579). Hold the flats of the air valve housing with a wrench, screw off the trip rod nut (30) and remove the lockwasher (5). Remove the air valve housing (29). Screw off the hub (34). Now release the pliers.

CAUTION

Be careful not to damage the surface of the rod.

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

WARNING

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

9. Check the valve plates (38) and seals (41) and replace them if they are worn or damaged.

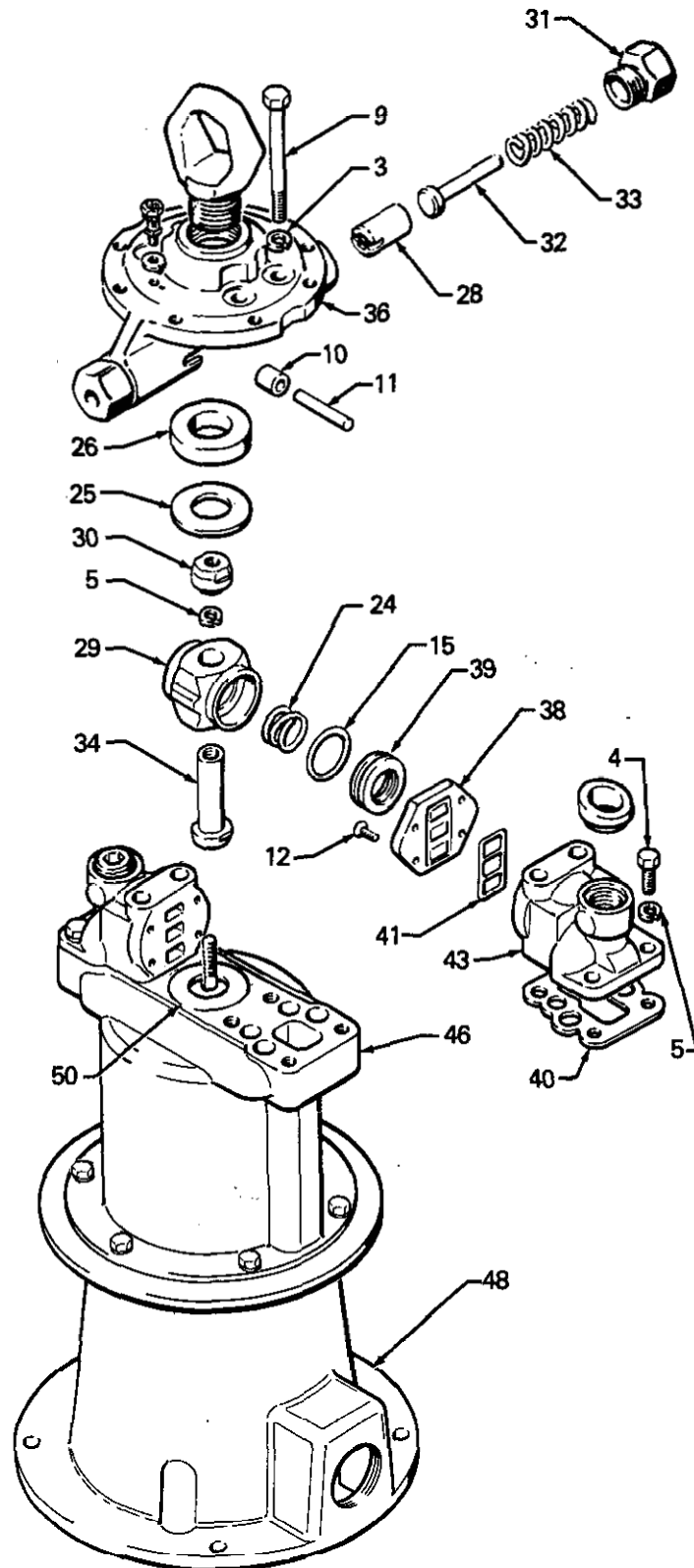


Fig 61

10. Clean the mating surfaces of the valve plates and manifolds, then reassemble using the screws (12).

11. Remove the washer (25) and pad (26).

NOTE: If no further service is needed, skip to Reassembly. Step 8.

If you plan to service the piston, continue as follows.

Piston Repair

1. Remove the screws (7) and lockwashers (5) and pull the cylinder (46) **straight up** off the piston. See Fig 6-1.
2. Remove the trip rod bearing (47), using a 1 in. socket wrench. Remove the gasket (14), washer (18) and packing (19) from the bearing. See Fig 6-1.
3. Pull the piston (2) and trip rod (50) up out of the base (48). Remove the O-ring (27) from the piston. Unscrew the adapter (37) from the piston shaft (2). See Fig 6-2.

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

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

NOTE: Be sure the clearance between the shoulders of the trip rod spring guides is EXACTLY 5.5 in. (139.7 mm) whenever you install a new or used trip rod. If the clearance is different, replace the trip rod; do not attempt to adjust it. See Fig 6-2.

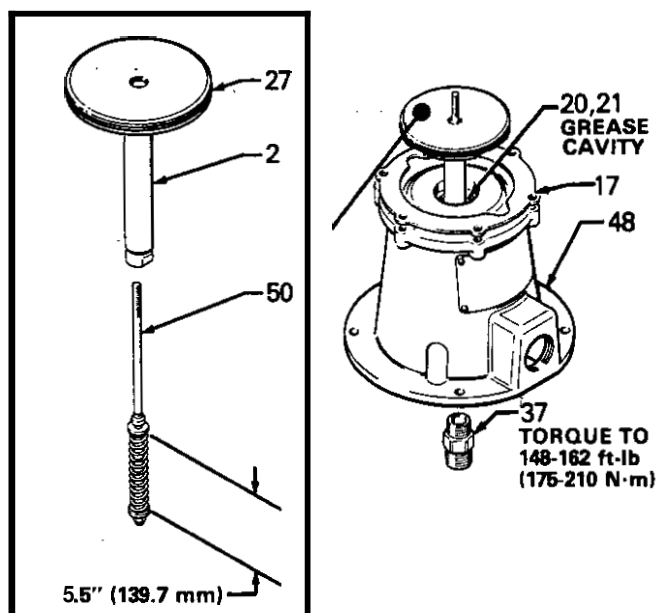


Fig 6-2

Reassembly

1. Clean all parts thoroughly and inspect for wear or damage. Replace parts as necessary.
2. Grease the trip rod (50) and install it in the piston (2). Screw the adapter (37) into the piston and torque to 148-162 ft-lb (175-210 N·m). See Fig 6-2.
3. Grease the cavity in the base (48) and install a washer (21*) and a v-packing (20*) so the lips of the v-packing **face up** in the base. See Fig 6-1 and 6-2.

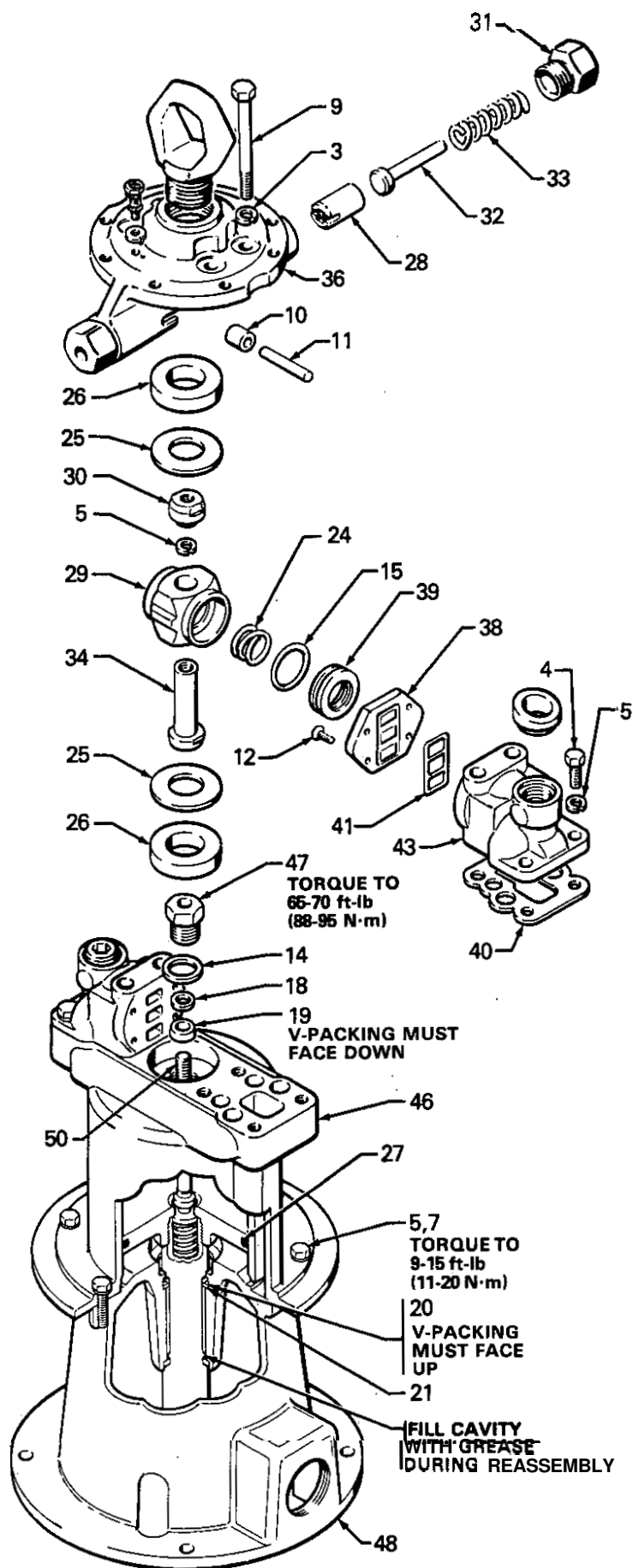


Fig 6-1

4. Grease the piston (2), O-ring (27*), and cylinder (46). Place the cylinder upside down on a flat surface. 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 notches on the flange of the cylinder. Use your fingers to push the O-ring out of the notch and seat it in the piston groove. Push the piston into the cylinder to hold the O-ring in place.
5. Regrease the inside of the cylinder (46) and the trip rod (50). Be sure the gasket (17) is properly located on the base (48). See Fig 6-2.
6. Guide the piston assembly and cylinder into the base, aligning the cylinder and base correctly. Install the lockwashers (5) and screws (7), and torque to 9-15 ft-lb (11-20 N·m). See Fig 6-1.
7. Install a backup washer (18*) and v-packing (19*) in the bearing (47) so the lips of the v-packing **face down** in the cylinder. Install the gasket (14*) on the bearing. Install the bearing in the cylinder throat. Use a 1 in. socket wrench to tighten the bearing to 65-70 ft-lb (88-95 N·m). See Fig 6-1.
8. Install the dampener pad (26) and washer (25) in the cylinder throat.
9. Place the air valve alignment tool (order part no. 168-513) on the cylinder. Position the gaskets (40*) and manifolds (43) on the cylinder. Install the screws (4) and washers (5). See Fig 7-1. Remove the tool.

NOTE: The air valve alignment tool ensures a proper clearance and makes reassembly easier.

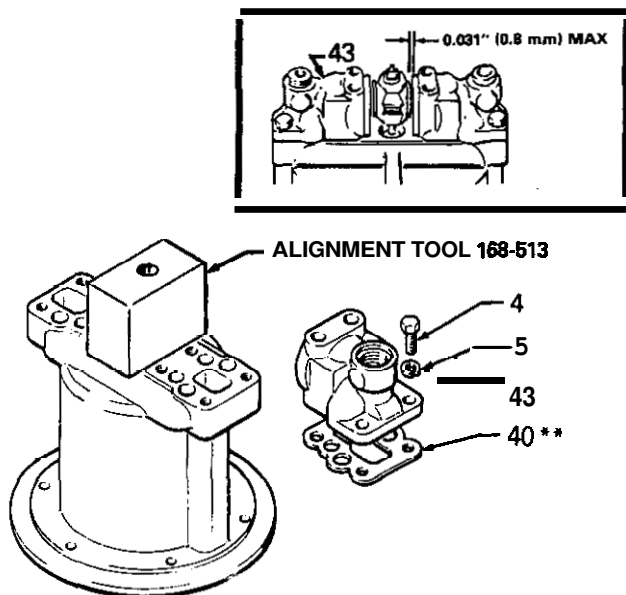
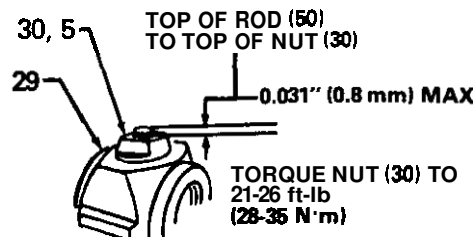


Fig 7-1

10. Slide the hub (34) onto the rod (50). Grasp the rod below the hub with the special locking pliers. Screw the hub down as far as possible. See Fig 6-1.

11. Install the air valve housing (29), washer (5) and trip rod nut (30). Hold the flats of the valve housing with a wrench. With another wrench, tighten the trip rod nut so there is a 0.031 in. (0.8mm) clearance between the top of the rod and the top of the nut and the nut is torqued to 21-25 ft-lb (28-35 N·m). See Fig 7-2. Turn the valve housing so it rests on the manifolds, then release the pliers.



VALVE HOUSING CLEARANCE

Fig 7-2

12. 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. Hold the parts in at the top and carefully rotate the valve housing until it slides down between the manifolds. Be very careful **not** to pinch your fingers! See Fig 6-1.
13. Recheck the clearance by holding the air valve alignment tool up close to the manifolds. Refer to Fig 7-1.
14. Grease the plunger (28) and guide (32) and install them with the spring (33) into each side of the detent housing (36). **Loosely** screw a retainer (31) into each side of the housing. See Fig 6-1.
15. Install the dampener pad (26) and washer (25) in the bottom of the detent housing. Grease and assemble the axles (11) and rollers (10) and install them in the detent housing. See Fig 6-1.
16. Position the detent housing on the manifolds and loosely install the washers (3) and screws (9). Now finish tightening the retainers (31) simultaneously. Finally, tighten the screws (9) firmly.

WARNING

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.

17. Install the air motor shield, washers and screws, and the air inlet fitting. Reconnect the ground wire.
18. Before connecting the displacement pump, connect an air hose to the motor and run it slowly to check for smooth operation.

INSTALLATION OF MODEL 220-571 FOR NOISE REDUCTION

For the recommended air supply system installation see Instruction Manual 307-375.

These are additional recommendations for Maximum Noise Reduction.

1. The air line should be connected to air motor with a flexible hose. Also, flexible fluid outlet hose and suction hoses should be used. Avoid solid plumbing where possible, 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 ability or minimum pressure and flow. This will result in less system wear and **less** overall noise.
4. Air supply to the motor should be conditioned to a pressure dew point of 55°F with inlet air temperature of 70°F (21°C).

TROUBLESHOOTING MODEL 220-571

To restart a stalled motor, screw the **lift** ring (28) out of the manifold housing (35) and use a screwdriver to push the valve housing (5) down. See Fig 8-1.

WARNING

Keep fingers out of manifold housing (35) to reduce the risk of pinching or amputating them.

WARNING

To reduce the risk of serious bodily injury from fluid injection or moving parts, follow the Pressure Relief Procedure on page 2 before servicing the motor.

Locating Air Leaks

To locate where air is leaking, shut off the air supply and disconnect the hose. Screw the inlet union (38) out of the air manifold cap (35), remove the shield, then screw the union back into manifold. See Fig 8-1. 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 (0.7-1 bar). Then use the checking methods listed in the **CHECK CHART** to find where air is leaking.

The filter element (38b) in the air inlet filter assembly (38) should be cleaned at least every 6 months to help ensure unrestricted air flow to the motor.

CHECK CHART (See Fig 8-1)			
Stroke Position	Letter Ref. Points	Check Method	Cause of Leakage
UP stroke only	F	By listening for air leak at exhaust outlets	Worn trip rod packing (43), or o-ring (39)
	B	By feel	Blown air cylinder gasket (40)
	C, D, E or K	Squirt oil around wiper (57)	Worn throat packing (63)
DOWN stroke only	D, F, G, H or K	By feel	Damaged air manifold gasket (36)
30TH	E	By feeling exhaust or hearing a high pitched sound	Worn air valves (3). Replace or lap faces with #500 grit sandpaper
	F	By feeling or hearing a high pitched sound	Worn o-ring packing (39)
	D or G	By feel	Blown manifold gaskets (45 & 36)
	H	Squirt oil around o-ring (15)	Damaged housing

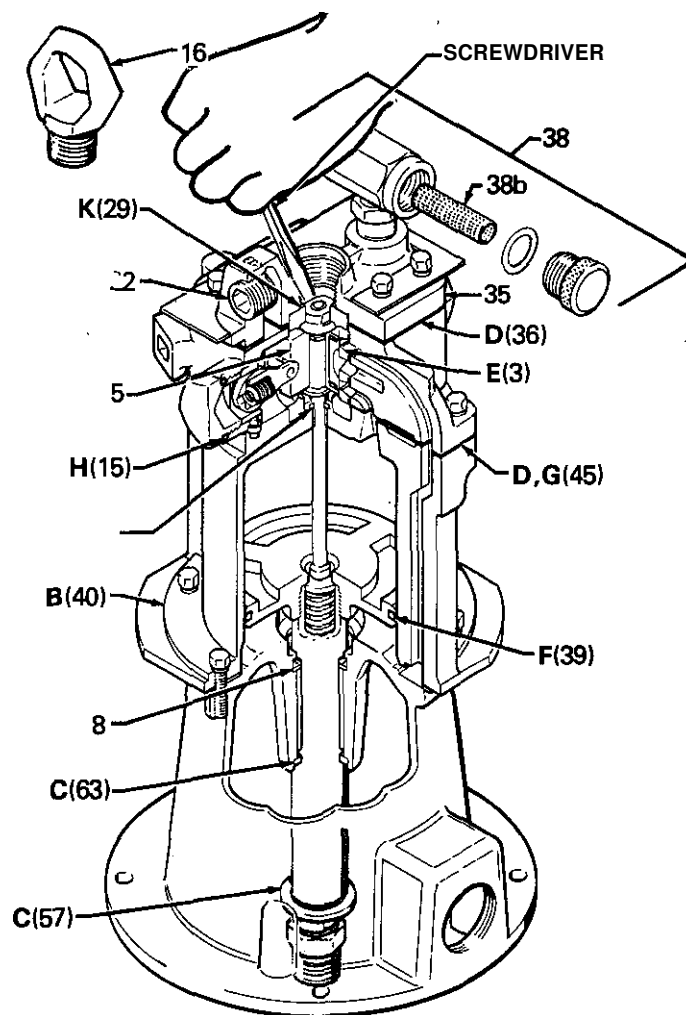


Fig 51

Air Valve Repair

1. Follow the Pressure Relief Procedure Warning on page 2.

NOTE: Refer to the Parts Drawing on page 14 for when doing steps 2 and 3.

2. Disconnect the displacement pump. Remove the air inlet fitting (38), disconnect the ground wire, and remove the lift ring (28).

NOTE: A repair kit, part no. 220-916, is available. See page 15. For the best results, use all the new parts in the kit, even if the old ones still look good.

3. Remove the screws (26), washers (25) and air motor shield (34).

NOTE: Refer to Fig 9-1 for Steps 4 to 12.

4. Lift off the manifold cap (35).
5. Unscrew the toggle retainers (14), o-rings (15), housing guides (16), springs (18), housings (19) and pins (20) from each side of the manifold (21).

CAUTION

Handle all springs and pins carefully. Nicks and scratches weaken these parts and may cause them to break during use.

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) up 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 from the bottom of the manifold allowing the valves to release gently.
8. Place a wrench on the flats of the adjusting screw (11) and nut (12) and turn the screw further into the nut until you can remove them. Do this in all four positions.
9. Remove and check each valve plate (2), seal (1) and spring (4), handling them carefully. Clean the plates and the mating surfaces of the manifold (21).
10. Remove the nut (7) and lockwasher (6) from the trip rod (55). Pull the valve housing (5) off the rod. Grip the rod below the bushing (10) with padded pliers and screw the bushing off the rod.

CAUTION

Be careful not to damage the surface of the rod, which would restrict its free movement. Special padded pliers, part no. 207-579, are available.

11. Remove and check the packing (43) which is around the rod (55) in the air cylinder (41). When replacing the packing, lubricate it with light oil.
12. Remove the rubber pad (8) from the manifold (21) and from the air cylinder (41).

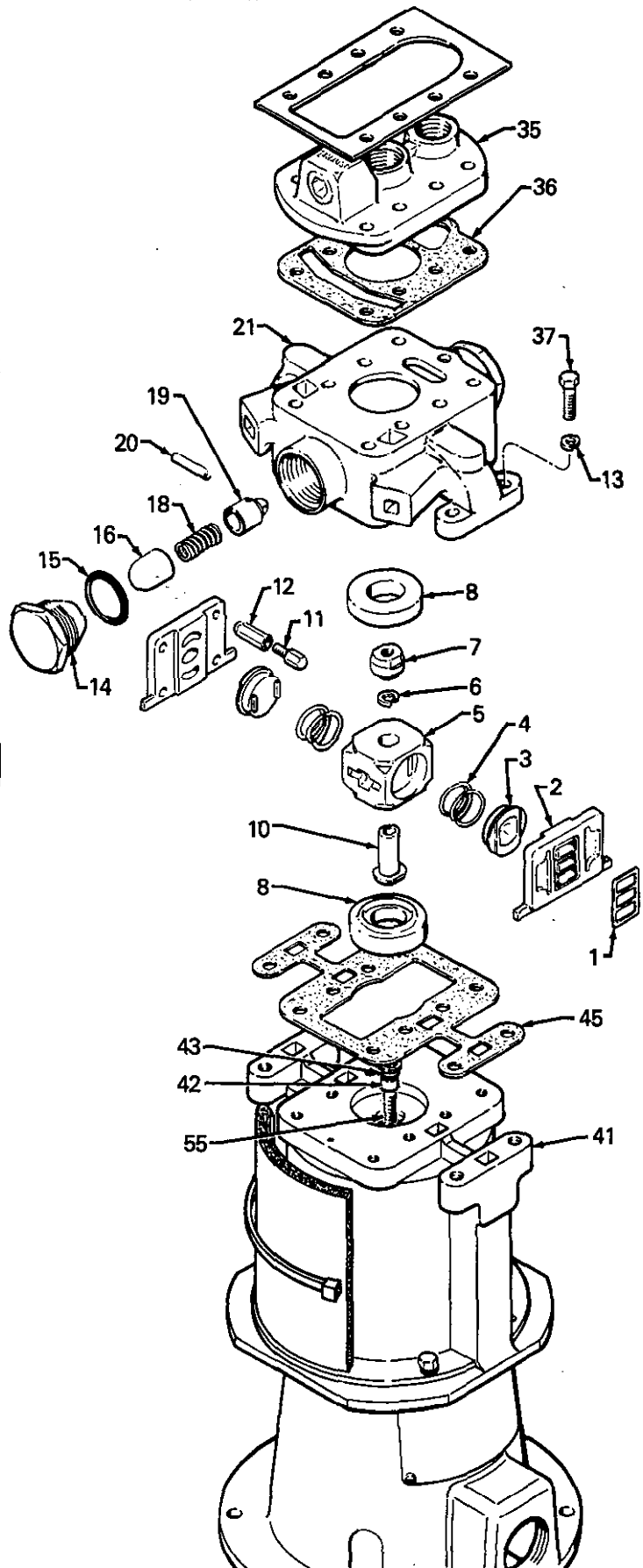


Fig 9-1

NOTE: If no further service is needed, skip to Reassembly. Step 7.

NOTE: Refer to Fig 10-1 for this procedure.

1. Remove the eight screws (30) and lockwashers (31) holding the air cylinder (41) to the base (58). Pull the cylinder straight up off the piston (46).

CAUTION

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

2. Remove the piston O-ring (39).
3. Lift the piston shaft (47) from the base (58). Remove the packing (63) and backup washer (64).
4. Check the bearing in the air motor base for wear. If wear is excessive, replace the base (58). The bearing is not sold separately.
5. Inspect the trip rod spring (A): unscrew the locknut (B) from the piston rod (53), using a wrench on the flats on the piston shaft (47). Don't damage the polished surface of the tube.

CAUTION

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

6. Check the trip rod bearing (42), pressed into the air cylinder (41), and remove it if it's worn. Use special bearing tool, Graco Pan No. T38251, to press the bearing into place.

Reassembly

NOTE: See Fig 10-1 for Steps 1 - 6.

1. Use the special bearing tool, Graco Part No. T38251, to press a new bearing (42) into the cylinder (41).
2. When replacing the trip rod assembly (55), lubricate the spring and guides with light, water-proof grease. Be sure the distance between the *inside* shoulders of the springs guides is exactly 106.9 mm (4.21 in.). Slide the trip rod into the tube of the piston assembly (46). Apply Loctite® 242 or the equivalent to the threads of the piston rod (53), and torque it into the bottom of the piston assembly (46) to 200-220 N·m (147-162 ft-lb).
3. Pack light, water-proof grease into the cavity above the wiper 1571. Thoroughly lubricate the new packing (63). Carefully tuck a new backup washer (64) and the v-packing into the throat cavity of the air cylinder (41). Be sure the lips of the v-packing face up, toward the piston.
4. Place a new O-ring (39*) around the piston.

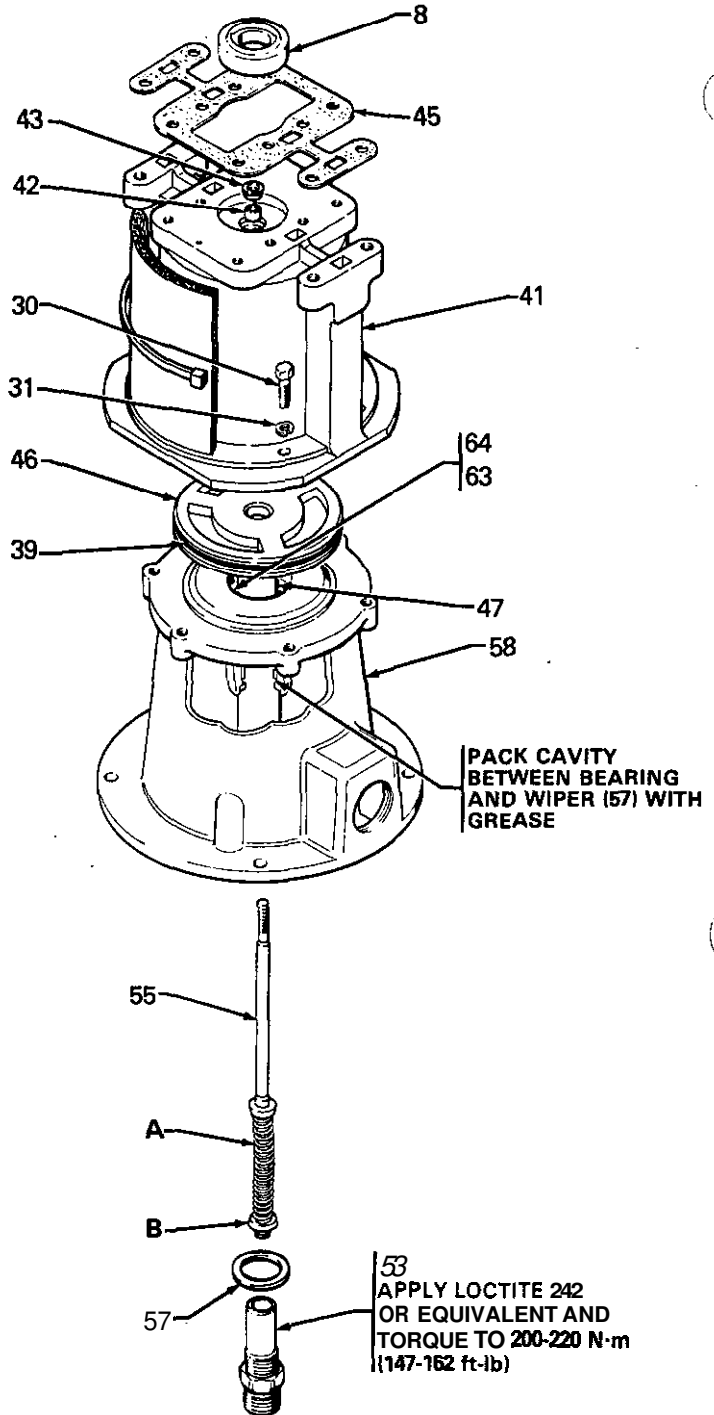


Fig 10-1

5. Slide the piston assembly (46) into the motor base. Lubricate the inside walls of the air cylinder (41) with light oil. Install the air cylinder carefully over the piston, and slide it down into place, without tilting it.

CAUTION

Do not tilt or force the air cylinder over the piston, to avoid damaging the smooth inner cylinder wall.

6. Install the lockwashers (31) and screws (30) in the base (58) and tighten securely. Place a rubber pad (8) in the cylinder top.

NOTE: See Figs 11-1 and 11-2 for Steps 7 - 12.

7. Grease and install the valve bushing (10). Grease and install the housing (5), lockwasher (6) and nut (7) on the trip rod (55). Adjust the housing (5) and nut (7) until 1 mm (0.039 in.) of the rod projects, and then lock the nut in place.

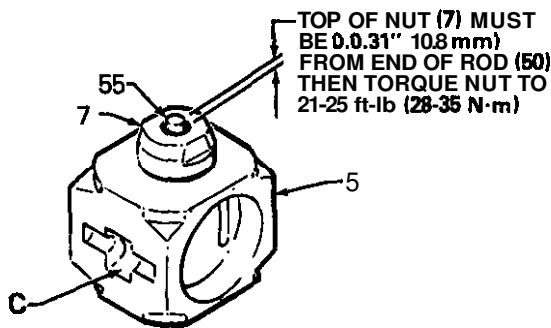


Fig 11-1

8. Place a gasket (45) on top of the cylinder (41).
9. Place the valve plates (2) in the manifold housing (21). Install the adjusting screw (11) and nut (12) assemblies in all four corners of the plates. Adjust the screws and nuts evenly so they snugly hold the plates.
10. Place a gasket (45) on top of the cylinder (41).
11. Place the springs (4) and air director valves (3) into the valve housing (5). Hold the valve housing in place and install the air manifold (21). Be sure the 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).
12. Lubricate the housing (19), spring (18) and guide (16) with light, water-proof grease. Assemble the housing and spring into the guide. Slide these assembled parts into the air manifold (21).
13. Continue reassembling the motor in the reverse order. Be sure the pin (20) is aligned with the slot (C) of the air valve housing (5) before assembling the rest of the air valve.

WARNING

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

14. Before returning the motor to service, connect an air line and run the motor slowly to see that it cycles smoothly.
15. Reconnect the displacement pump and the ground wire.

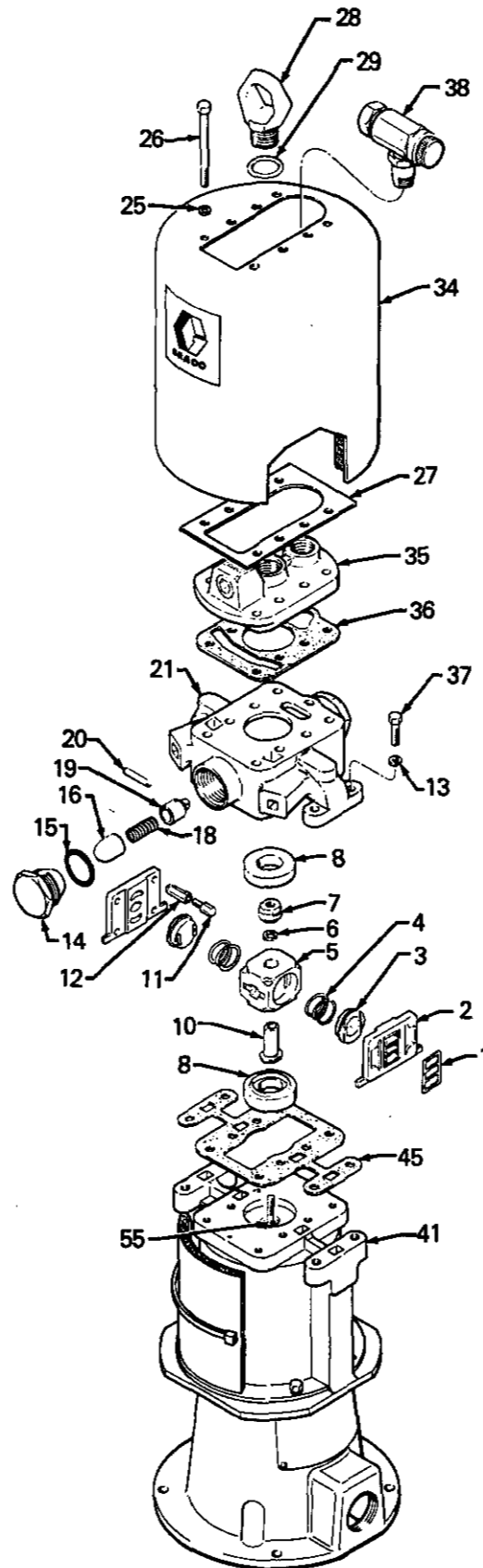


Fig 11-2

Model 218-580, Series A
Includes items 1-52



PARTS LIST

Model 217-540, Series C

Includes items 1-52

Model 218-580, Series A

Includes items 1-52

REF NO.	PART NO.	DESCRIPTION	QTY	REF NO.	PART NO.	DESCRIPTION	QTY
1	100-016	LOCKWASHER, spring; 1/4"	8	30	161-586	NUT; 3/8-24	1
2	*217-524	PISTON, air; <i>Model 217-540</i>	1	31	161-587	RETAINER, detent spring	2
	*218-995	PISTON, air; <i>Model 218-580</i>	1	32	161-588	GUIDE, spring	2
3	100-052	LOCKWASHER, spring; 7/16"	4	33	**161-589	SPRING, compression	2
4	100-101	SCREW, hex hd cap; 3/8-16 x 1	4	34	161-590	HUB, valve housing	1
5	100-133	LOCKWASHER, spring; 3/8"	11		178-906	SHIELD, air motor; 1 npt(f) exhaust connection; <i>Model 217-540</i>	1
6	100-333	SCREW, hex hd cap; 1/4-20 x 1/2"	8	35	180-631	SHIELD, air motor; 1 npt(f) exhaust connection; <i>Model 218-580</i>	1
7	100-004	SCREW, hex hd cap; 3/8-16 x 1-1/4"	6		177-664	HOUSING, detent	1
	100-884	SCREW, type "f" self tap; no. 6-32 x 1/4"; <i>Model 218-580</i>	4	36	168-180	STUD, connecting rod	1
6	101-845	SCREW, type "f" self tap; no. 6-32 x 3/8"; <i>Model 217-540</i>	4	37	169-584	PLATE, valve	2
9	101-713	SCREW, hex hd cap; 7/16-14 x 3-1/2"	4	38	168-182	VALVE, air director	2
10	*169-585	ROLLER, axle	2	39	*168-183	GASKET, air manifold	2
11	169-586	AXLE, detent	2	40	168-184	SEAL, valve plate	2
12	101-716	SCREW, flat head mach; no. 10-24 x 1/2"	8	41	168-185	GROMMET	1
13	102-726	PLUG, pipe; soc hd; 3/4 npt	1	42	168-187	MANIFOLD, air	2
14	**150-647	GASKET	1	43	172-476	PLATE, instruction	1
15	**156-698	PACKING, o-ring	2	44	178-904	CYLINDER, air motor; <i>Model 217-540</i>	1
16	180-952	RING, lift	1	45	180-633	CYLINDER, air motor; <i>Model 218-580</i>	1
17	*178-907	GASKET, fiber	1	46	**204-649	BEARING	1
18	**161-559	WASHER, backup	1	47	218-961	BASE, air motor	1
19	**161-560	V-PACKING	1	48	207-648	UNION, 90°, adapter; 3/4 npt(m) x 3/4 npsm(f) swivel	1
20	**161-562	PACKING, v-block	1	49	**214-852	ROD, trip; <i>Model 214-540</i>	1
21	**161-563	WASHER, backup	1	50	**218-626	ROD, trip; <i>Model 218-580</i>	1
22	**161-569	SEAL	1	51	104-582	WASHER, tab	1
23	161-575	SPRING, compression	2	52	104-029	LUG, grounding	1
24	161-576	WASHER, flat	2				
25	161-577	PAD, dampening	2				
26	**107-082	PACKING, O-ring	1				
27	169-583	PLUNGER, detent	2				
28	161-585	HOUSING, air valve	1				
29							

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

*Included in repair kit 218-122.

HOW TO ORDER REPLACEMENT PARTS

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

6 digit PART NUMBER	QTY	PART DESCRIPTION

REPAIR KIT 218-122

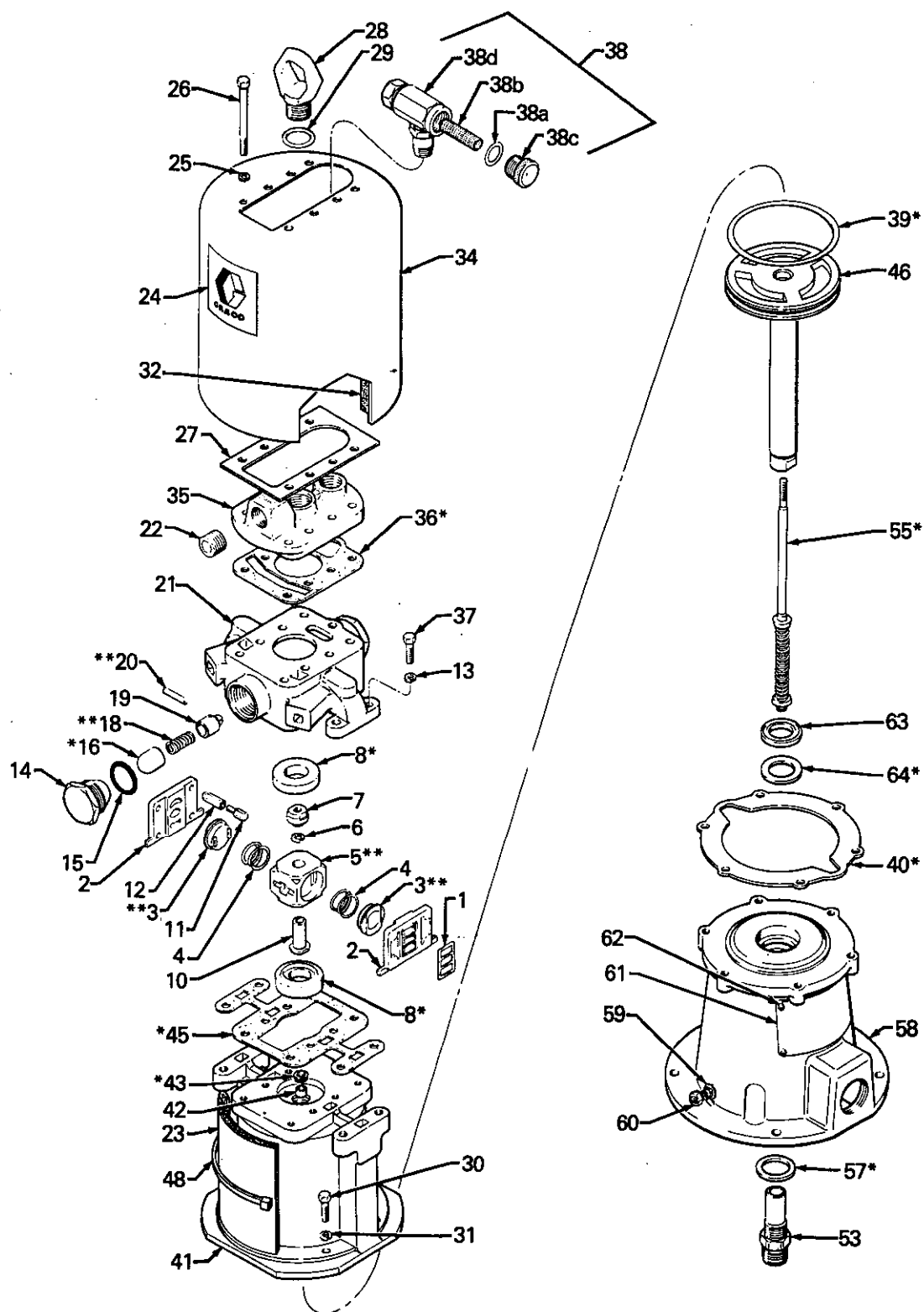
(Must be purchased separately)

Includes:

REF. NO.	QTY.
14	1
15	2
18	1
19	1
20	1
21	1
23	1
27	1
40	2

PARTS DRAWING

Model 220-571, Series A
Includes items 1-64



PARTS LIST

Quiet Senator **Air Motor**

Model **220-571**, Series **A**

Includes items **1-64**

REF. NO.	PART NO.	DESCRIPTION	QTY	REF. NO.	PART NO.	DESCRIPTION	QTY
1	168-184	SEAL, plate, valve buna-n	2	35	176-539	CAP, manifold	1
2	176-536	PLATE, valve	2	36	*176-580	GASKET, cellulose fiber	1
3	**176-518	VALVE, director	2	37	105-324	CAPSCREW, hex hd; M8 x 1.5 x 30	4
4	176-543	SPRING, compression	2	38	215251	AIR INLET FILTER ASSY.	
5	**176-519	HOUSING, air valve	1			Includes items 38a - 38d	
6	105-319	LOCKWASHER, 10 mm	1	38a	104-093	O-RING, buna-n	1
7	176-569	NUT, trip rod	1	38b	**176-488	ELEMENT, filter	1
8	*161-577	PAD, dampening	1	38c	176-572	PLUG, filter	1
10	176-568	BUSHING, trio rod	1	38d	215-252	HOUSING, filter, 3/4 npt(m)	
11	176-550	SCREW, adjusting	4			x 3/4 npsm swivel	1
12	176-548	NUT, adjusting	4	39	107-082	PACKING, O-ring	1
13	100418	LOCKWASHER	4	40	*183-312	GASKET, cellulose fiber	1
14	178-428	RETAINER, toggle	2	41	183-105	CYLINDER, air	1
15	105-318	O-RING, nitrile rubber	2	42	105-312	BEARING, sleeve	1
16	**178-427	GUIDE, housing	2	43	*176-546	V-PACKING, lubricated polyurethane	1
18	**178-429	SPRING, compression	2	45	*176-545	GASKET, cellulose fiber	1
19	178-426	HOUSING, spring	2	46	220-915	PISTON ASSEMBLY	1
m	**105-321	PIN, dowel	2	48	108-774	STRAP, tie, wire	3
21	183-509	MANIFOLD	1	53	176-564	ROD, piston	1
22	105325	PLUG, pipe, 1" npt(f)	1	55	*218-597	TIP ROD ASSEMBLY	1
23	183-356	PAD, dampener	1	57	*181-569	SEAL, wiper	1
24	168-491	DECAL, "Gram"	1	58	220-843	BASE, air motor	1
25	104-572	LOCKWASHER, 8 mm	8	59	104-582	WASHER, tab	1
26	105-322	CAPSCREW, hex hd; M8 x 1.5 x 1/4"	8	60	104-029	LUG, grounding	1
27	177-081	GASKET, neoprene	1	61	172-476	PLATE, instruction	1
28	176-537	RING, lift	1	62	105316	SCREW, pan hd; self tapping; M3.5 x 0.6 x 6	4
29	166-221	O-RING, nitrile rubber	1	63	176547	V-PACKING, nitrile rubber	1
30	100-004	CAPSCREW, hex hd; 3/8-16 x 1-1/4"	6	E4	*176-551	WASHER, backup	1
31	100-133	LOCKWASHER, spring; 3/8"	6				
32	183-318	PAD, dampener	1				
34	183-311	SHIELD	1				

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

*Included in Repair Kit 220-916.

REPAIR KIT 220-916

(Must be purchased separately)

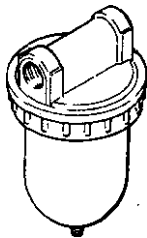
Includes:

REF. NO.	QTY.
8	1
36	1
39	1
40	1
43	1
45	1
55	1
57	1

ACCESSORIES (Must be purchased separately)

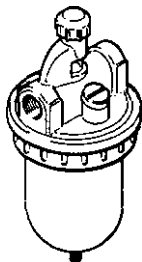
AIR LINE FILTER 106-150

250 psi (17.5 bar) MAXIMUM WORKING PRESSURE
40 Micron element; 3/4 npt inlet and outlet



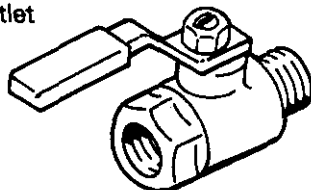
AIR LINE LUBRICATOR 214-849

250 psi (17.5 bar) MAXIMUM WORKING PRESSURE
3/4 npt inlet and outlet



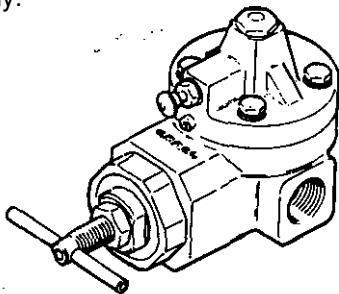
BLEED-TYPE MASTER AIR VALVE 107-142

300 psi (21 bar) MAXIMUM WORKING PRESSURE
Relieves air trapped in the air line between the pump air inlet and this valve when closed.
1/2 npt(m x f) inlet & outlet



PUMP RUNAWAY VALVE 215-362

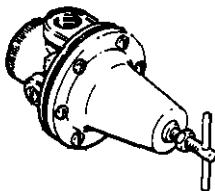
Shuts off air to pump automatically if it senses that the pump is running too fast, a condition caused by a depleted fluid supply.



AIR REGULATOR 207-755

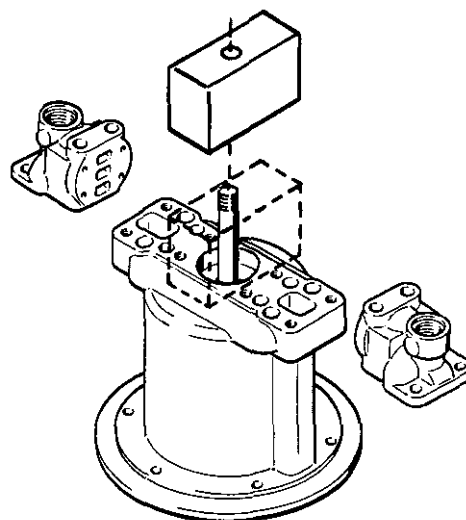
0-9 bar (0-125 psi) OPERATING PRESSURE

Inlet and Outlet Ports 3/4 NPT, with 1/4 NPT Pressure Gauge Port.



ALIGNMENT TOOL 168-513

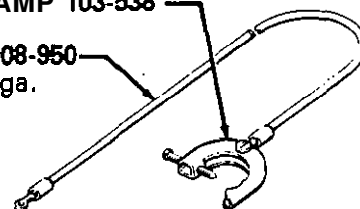
For correctly aligning and spacing air manifolds.
On Models 217-540 and 218-580



Position tool on trip rod as shown.
Install manifolds loosely.
Hold manifolds against block and tighten.
Remove block and complete assembly of pump.

GROUNDING CLAMP 103-538

GROUND WIRE 208-950
25 ft (7.6 m) lg, 12 ga.

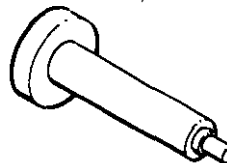


PADDED LOCKING PLIERS 207-579

For holding trip rod.

BEARING TOOL T38251

Correctly sizes the inside diameter of bearing (5) when it is replaced.



TRIP ROD PLIERS 207-579

Used to hold trip rod without damaging trip rod's plated surface.

REGULATOR end MOUNTING PART KITS 207-651

Use air regulator 207-755 (see above).

Inlet and Outlet Ports 3/4 NPT

Effective piston area..... 24 sq. in. (154 cm²)
 Effective diameter 5.5 in. (140 mm)
 Stroke **Model 217-540: 4.75 in. (121 mm)**
 Model 218-580: 8.0 in. (203 mm)
 Air valves Dual, slide type
 Valve housing.....Balanced, opposing seals and detent rollers

SERVICE INFORMATION

ADDED MODEL NOTE: Model **220-571** Quiet Senator® Air Motor has been added to the manual.

THE GRACO WARRANTY AND DISCLAIMERS

WARRANTY

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

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

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective for examination by Graco to verify 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.

DISCLAIMERS AND LIMITATIONS

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