

# 4-Ball Lowers

3A0540L

3000cc and 4000cc Models

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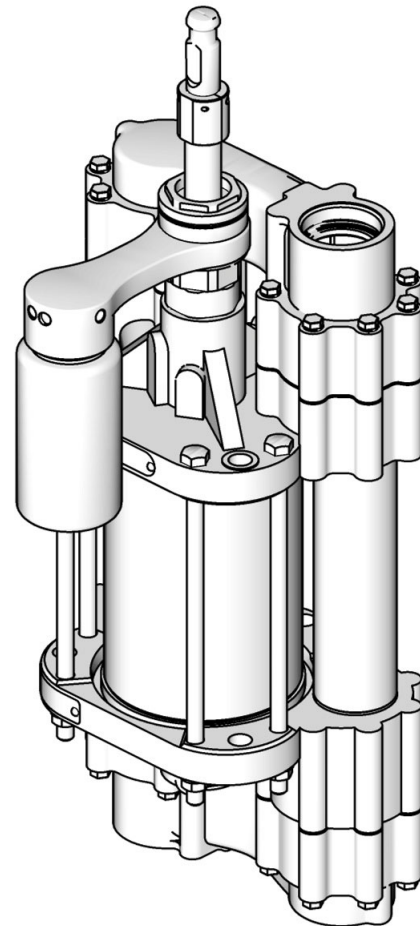
**Designed for low pressure, high volume circulation of finishing materials.  
Do not use for flushing or purging lines with caustics, acids, abrasive line strippers, and other similar fluids. For professional use only.**



### **Important Safety Instructions**

Read all warnings and instructions in this manual and in your separate pump manual. Save these instructions.

See page 2 for model information, including maximum working pressure.



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## Models

### 3000cc Lowers

Model No.	Series	Material	Maximum Pump Working Pressure psi (MPa, bar)	Rod/Cylinder Material	Packings	Inlet/Outlet Fitting Size and Type	Parts Page
24F448	A	SST	440 (3.0, 30)	Chromex/Chrome	UHMWPE/Leather	Inlet: 2 in. npt Outlet: 2 in. npt	18
24F450	A	CST	440 (3.0, 30)	Chromex/Chrome	UHMWPE/Leather	Inlet: 2 in. npt Outlet: 2 in. npt	18
24F449	A	SST	440 (3.0, 30)	Chromex/MaxLife	UHMWPE/Leather	Inlet: 2 in. npt Outlet: 2 in. npt	18

### 4000cc Lowers

Model No.	Series	Material	Maximum Pump Working Pressure psi (MPa, bar)	Rod/Cylinder Material	Packings	Inlet/Outlet Fitting Size and Type	Parts Page
24F451	A	SST	330 (2.3, 23)	Chromex/Chrome	UHMWPE/Leather	Inlet: 2 in. npt Outlet: 2 in. npt	20
24F453	A	CST	330 (2.3, 23)	Chromex/Chrome	UHMWPE/Leather	Inlet: 2 in. npt Outlet: 2 in. npt	20
24F452	A	SST	330 (2.3, 23)	Chromex/MaxLife	UHMWPE/Leather	Inlet: 2 in. npt Outlet: 2 in. npt	20
24J888	A	SST	330 (2.3, 23)	Chromex/Chrome	UHMWPE/Leather	Inlet: 2 in. BSPP Outlet: 2 in. BSPP	20

# 4-Ball Lowers Cross Reference Chart

This chart cross references earlier styles of 4-ball lowers to the current lowers, which include the TSL pump and spring loaded packings.





Earlier Lower Part No.	Current Lower Part No.
218523	24F286
218524	24F448
218530	24F453
218531	24F451
235526	24F448
239813	24F448
240588	24F451
240589	24F451

Earlier Lower Part No.	Current Lower Part No.
240590	24F451
240591	24F448
240592	24F448
240593	24F448
243732	24F450
243733	24F453
243735	24F448
243736	24F451

Earlier Lower Part No.	Current Lower Part No.
243772	24F448
243773	24F451
248330	24F448
248331	24F451
248333	24F448
248334	24F451

# Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbols refer to procedure-specific risks. When these symbols appear in the body of this manual, refer back to these Warnings. Product-specific hazard symbols and warnings not covered in this section may appear throughout the body of this manual where applicable.

 <b>WARNING</b>	
	<p><b>FIRE AND EXPLOSION HAZARD</b></p> <p>Flammable fumes, such as solvent and paint fumes, in <b>work area</b> can ignite or explode. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> <li>• Use equipment only in well ventilated area.</li> <li>• Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static arc).</li> <li>• Keep work area free of debris, including solvent, rags and gasoline.</li> <li>• Do not plug or unplug power cords, or turn power or light switches on or off when flammable fumes are present.</li> <li>• Ground all equipment in the work area. See <b>Grounding</b> instructions.</li> <li>• Use only grounded hoses.</li> <li>• Hold gun firmly to side of grounded pail when triggering into pail.</li> <li>• If there is static sparking or you feel a shock, <b>stop operation immediately</b>. Do not use equipment until you identify and correct the problem.</li> <li>• Keep a working fire extinguisher in the work area.</li> </ul> <p>Static charge may build up on plastic parts during cleaning and could discharge and ignite flammable vapors. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> <li>• Clean plastic parts only in a well ventilated area.</li> <li>• Do not clean with a dry cloth.</li> <li>• Do not operate electrostatic guns in equipment work area.</li> </ul>
	<p><b>PRESSURIZED EQUIPMENT HAZARD</b></p> <p>Fluid from the gun/dispense valve, leaks, or ruptured components can splash in the eyes or on skin and cause serious injury.</p> <ul style="list-style-type: none"> <li>• Follow the <b>Pressure Relief Procedure</b> when you stop spraying and before cleaning, checking, or servicing equipment.</li> <li>• Tighten all fluid connections before operating the equipment.</li> <li>• Check hoses, tubes, and couplings daily. Replace worn or damaged parts immediately.</li> </ul>
	<p><b>TOXIC FLUID OR FUMES HAZARD</b></p> <p>Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.</p> <ul style="list-style-type: none"> <li>• Read MSDSs to know the specific hazards of the fluids you are using.</li> <li>• Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines.</li> </ul>

# WARNING



## PERSONAL PROTECTIVE EQUIPMENT

You must wear appropriate protective equipment when operating, servicing, or when in the operating area of the equipment to help protect you from serious injury, including eye injury, hearing loss, inhalation of toxic fumes, and burns. This equipment includes but is not limited to:

- Protective eyewear, and hearing protection.
- Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer.



## EQUIPMENT MISUSE HAZARD

Misuse can cause death or serious injury.



- Do not operate the unit when fatigued or under the influence of drugs or alcohol.
- Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See **Technical Data** in all equipment manuals.
- Use fluids and solvents that are compatible with equipment wetted parts. See **Technical Data** in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request MSDS from distributor or retailer.
- Do not leave the work area while equipment is energized or under pressure. Turn off all equipment and follow the **Pressure Relief Procedure** when equipment is not in use.
- Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.
- Do not alter or modify equipment.
- Use equipment only for its intended purpose. Call your distributor for information.
- Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Do not kink or over bend hoses or use hoses to pull equipment.
- Keep children and animals away from work area.
- Comply with all applicable safety regulations.



## MOVING PARTS HAZARD

Moving parts can pinch, cut or amputate fingers and other body parts.



- Keep clear of moving parts.
- Do not operate equipment with protective guards or covers removed.
- Pressurized equipment can start without warning. Before checking, moving, or servicing equipment, follow the **Pressure Relief Procedure** and disconnect all power sources.

# Changing the TSL

Check the condition of the TSL and the level in the reservoir every week, minimum. TSL should be changed at least every month.

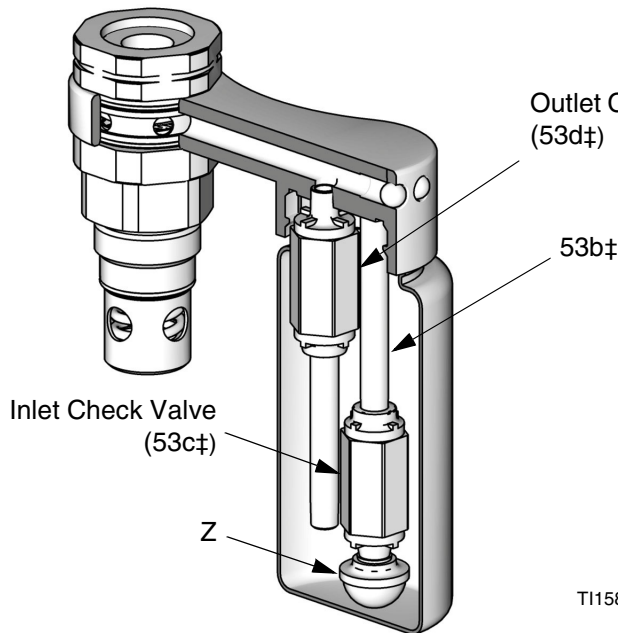
Part No. 206995 Throat Seal Liquid (TSL) carries residue from the pump rod into the reservoir. Discoloration of the TSL fluid is to be expected during normal operation. After some time the TSL will thicken and darken, and must be replaced. Thick, dirty TSL will not pump through the lines and will harden in the pump wet-cup.

How long TSL lasts depends on which chemicals are used, how much is used, what pressure, and condition of the pump seal and rod.

A drop in the level of TSL in the reservoir indicates that the throat packings are starting to wear. Add TSL to the reservoir and keep the level above the Minimum fill line. Monitor the usage and condition of the TSL. If pumped material bypasses the throat packings and enters the TSL reservoir, replace the packings.

To change the TSL:

1. Shut off the pump.



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To avoid the buildup of static charge, do not rub the plastic bottle with a dry cloth while it is attached to the pump. Remove the bottle to clean, if needed.						

2. Remove and empty the reservoir bottle. Clean any residue.
3. Clean screen (Z) of inlet check valve (53c‡). If check valves are not sealing and dirty TSL is getting into the wet-cup, replace the check valves (53c, 53d). See FIG. 1.

**NOTE:** Order Check Valve Repair Kit 24F404. Kit parts are marked with a symbol, for example (53b‡).

4. Fill the reservoir to the Maximum fill line with Throat Seal Liquid (TSL).
5. Run pump. Each time pump rod reaches bottom of stroke, check that some TSL is pumped from reservoir through wet-cup and back to reservoir.

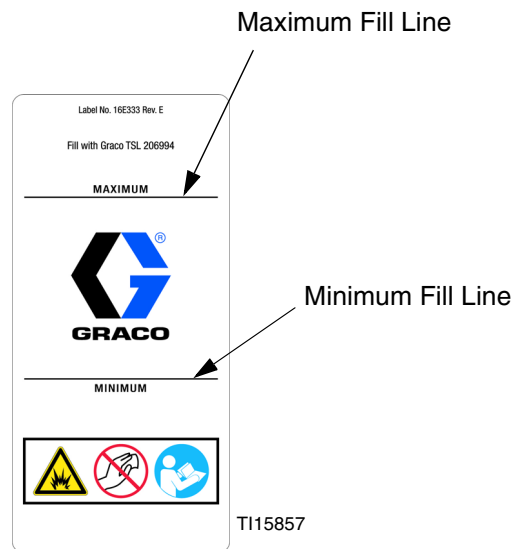


FIG. 1. Cutaway of TSL Reservoir, and Fill Lines

# Repair

## Replace the Throat Packings Without Disconnecting the Lower

**NOTE:** Throat packing kits are available. See page 22. Kit parts are marked with a symbol, for example (30†). For best results, install the TSL Pump Repair Kit 24F618 each time the throat packings are changed.

**NOTE:** To replace the throat packings as part of a complete service of the lower, see page 9.

**NOTE:** Tool Kit 24F494 is available as an accessory. The kit includes two wrenches for use with the wet-cup (34) and throat cartridge (27).

1. Flush the pump, if possible.
2. Stop the pump at the middle of its stroke.



3. Relieve the pressure. See your separate pump manual.
4. Following the instructions in your separate pump manual, remove the 2-piece shield covering the coupling assembly. Unscrew the coupling nut from the motor shaft. Lift the motor shaft and remove the coupling nut and collars.
5. See FIG. 5. Remove the collar (41) and screws (56), cap (40), and manifold and bottle assembly (53).
6. Remove the wet-cup (34) and o-ring (52). Remove the TSL pump piston seal (36◆), spring (35◆), and o-rings (51◆).
7. Remove the throat cartridge (27). Remove the o-ring (52), glands (32, 33), packings (30, 31), and spring (28).

**NOTE:** Inspect the surface of the piston rod (19). If it is scratched, replace the piston rod.

8. Lubricate the throat packings and glands. Install the spring (28) and one male gland (31†) in the throat cartridge (27), then seven v-packings with the lips facing down: one UHMWPE (30†), one leather (31†), UHMWPE, leather, UHMWPE, leather, UHMWPE. Install the female gland (32†). Install three v-packings with the lips facing up: UHMWPE, leather, UHMWPE. Install the other male gland (33†).
9. Lubricate the o-ring (52†) and install it on the wet-cup (34). Install the wet-cup finger-tight.
10. Install the o-ring (52†) on the throat cartridge (27). Apply lubricant to the throat cartridge threads then screw the cartridge into the outlet housing (1).
11. Torque the cartridge (27) to 95-100 ft-lb (129-135 N•m).
12. Torque the wet-cup (34) to 70-75 ft-lb (95-102 N•m).
13. Reassemble the spring (35◆), TSL pump piston seal (36◆), and o-rings (51◆).
14. Reassemble the manifold and bottle assembly (53), cap (40), collar (41) and screws (56). Torque the cap (40) to 34-40 N•m (25-30 ft-lb).
15. Reinstall the coupling nut and collars on the piston rod (19).
16. Reconnect the coupling nut to the motor shaft. See your separate pump assembly manual for correct torque specifications for your model. Reinstall the shield.

## TSL Pump Repair (if present)

**Table 1: TSL Pump Troubleshooting**

Problem	Cause	Solution
TSL pump not pumping TSL fluid.	Plugged manifold (53a).	Clear the manifold. Verify that the manifold is clear by blowing compressed air through the opening.
	Plugged check valves (53c, 53d).	Clear obstruction in check valves.
	Plugged inlet strainer (53c).	Clear strainer mesh.
	Damaged TSL pump piston (36).	Replace TSL pump piston.

**NOTE:** TSL Pump Repair Kit 24F618 is available. See page 22. Install the TSL Pump Repair Kit 24F618 each time the throat packings are changed. Kit parts are marked with a symbol, for example (36♦).

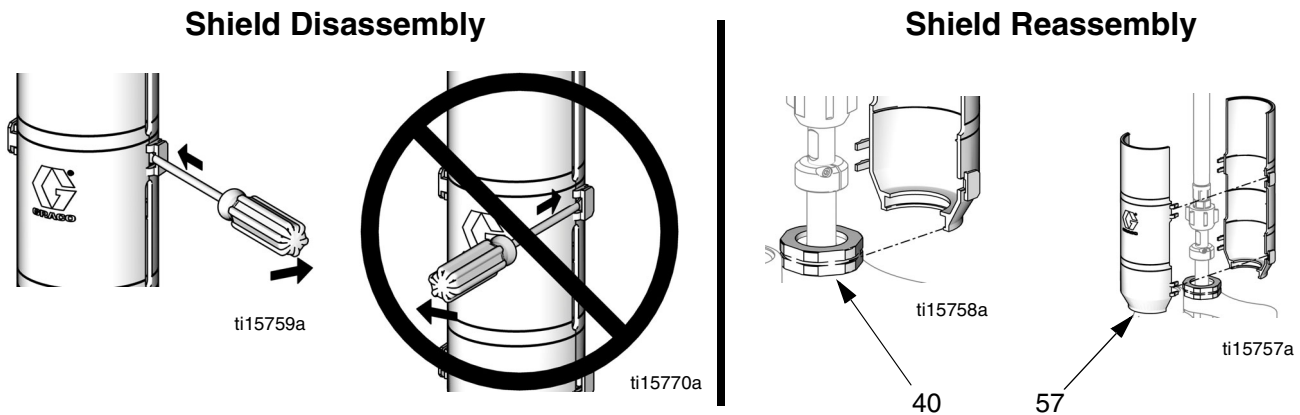
1. Follow steps 1-6 under **Replace the Throat Packings Without Disconnecting the Lower**, page 7.
2. Clean all parts and inspect for damage.
3. Follow steps 11-16 under **Replace the Throat Packings Without Disconnecting the Lower**.

## Shield Disassembly/Reassembly

The lowers include two shield kits. The correct size is determined by your lower and motor. See manual 406876 to select the correct size kit for your lower and motor.

See FIG. 2. Remove the 2-piece shield (57) by inserting a screwdriver straight into the slot, and using it as a lever to release the tab. Repeat for all tabs. **Do not** use the screwdriver to pry the shields apart.

Install the shields (57) by engaging the bottom lips with the groove in the wet-cup cap (40). Snap the two shields together.



**FIG. 2. Disassembly and Reassembly of the Shields**



## Lower Disassembly

**NOTE:** This pump is easiest to repair when left in the Part No. 218742 accessory pump stand and disassembled as instructed. For repair at a remote location, have another pump stand available.

**NOTE:** Seal kits are available for each lower size. See page 22. Kit parts are marked with an asterisk in the text and drawings, for example (3\*).

**NOTE:** Throat packing kits are available. See page 22. Kit parts are marked with a symbol, for example (30†). For best results, install the TSL Pump Repair Kit 24F618 each time the throat packings are changed.

**NOTE:** Tool Kit 24F494 is available as an accessory. The kit includes two wrenches for use with the wet-cup (34) and throat cartridge (27).

**NOTE:** Complete pump repair kits are also available. The kits include all seal kit parts, throat packing kit parts, and TSL pump repair kit parts. See page 22.

1. Flush the pump, if possible.
2. Stop the pump at the middle of its stroke.



3. Relieve the pressure. See your separate pump manual.
4. Remove the lower from the motor as described in your separate pump manual.

**NOTE:** See FIG. 5 for an exploded view of the entire lower. See FIG. 6 for a cutaway view of the lower and an exploded view of the throat packings.

5. Remove the collar (41) and screws (56), cap (40), and manifold and bottle assembly (53).

**NOTE:** To replace the check valves in the TSL bottle, order Check Valve Repair Kit 24F404. Kit parts are marked with a symbol, for example (53b†). To replace the bottle only, order Bottle Replacement Kit 24F405. Kit parts are marked with a symbol, for example (48e\*). The kit includes 5 bottles and 5 labels. See FIG. 1, FIG. 5, and FIG. 6.

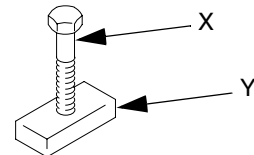
6. Use a 13 mm socket wrench to loosen and remove the twelve capscrews (9) and lockwashers (8) on the outlet manifold (1).
7. Lift the manifold (1) off the outlet valve housing (2) and remove the ball guides (16), balls (18), seats (13) and seals (17). Remove the o-ring (15) from the seats (13).

**NOTE:** See FIG. 3. Seat Puller Kit 220384 is available to make removal of the seats from the manifolds easier.

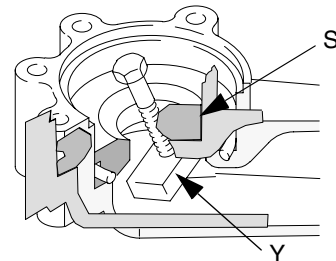
**NOTICE**

Be careful not to drop or damage the balls (18) or seats (13). A damaged ball or seat cannot seal properly and the pump will leak. The outlet valve seats (13) can be reversed to provide longer use of the seat.

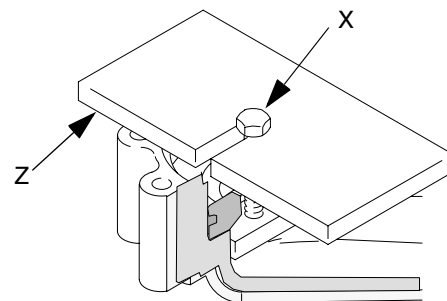
### Seat Puller Kit 220384



Screw bolt (X, Part 108481) into Seat Puller (Y, Part 181630). Position Seat Puller (Y) under the seat (S) by slipping it through at an angle.



Place Seat Puller (Z, Part 181629) on top of seat. Turn bolt (X) to pull the seat out.



**FIG. 3. Removing Seats from Manifold**

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8. Remove the wet-cup (34) and o-ring (52). Remove the TSL pump piston seal (36), spring (35), and o-rings (51).
9. Remove the throat cartridge (27). Remove the o-ring (52), glands (32, 33), packings (30, 31), and spring (28).
10. Remove the nuts (12), lockwashers (11), and six cylinder capscrews (10). Lift off the outlet valve housing (2).
11. Lift the riser tubes (6) and cylinder (4) off the inlet valve housing (7). The piston assembly may stay in the cylinder. Remove the seals (3 and 5) from the inlet and outlet housings (2, 7). See FIG. 5.

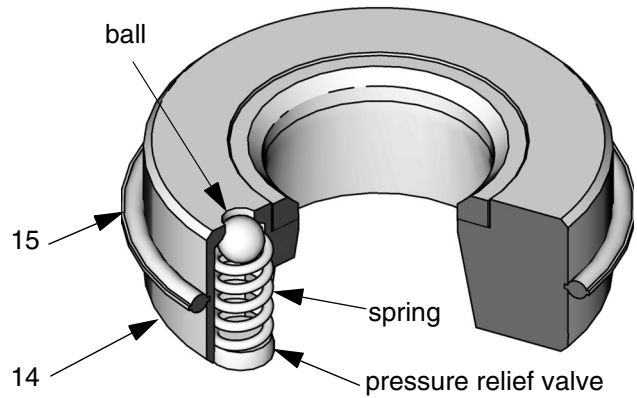
**NOTE:** Tap on the valve housings with a plastic mallet and use a slight rocking motion to help loosen and remove the cylinder and tubes.

12. If Part No. 218742 accessory pump stand is used, unscrew and remove the three pump stand bolts. Lift the inlet valve assembly off the stand. Place the inlet valve housing (7) face down on a protected surface.
13. Use a 13 mm socket wrench to loosen and remove the twelve capscrews (9) and lockwashers (8) from the inlet manifold (1). See FIG. 5.
14. Lift the manifold (1) off the inlet valve housing (7) and remove the seats (13 and 14). Remove the o-ring (15) from the seats. Remove the balls (18), ball guides (16) and seals (17).

**NOTICE**

Be careful not to drop or damage the balls (18) or seats (13 or 14). A damaged ball or seat cannot seal properly and the pump will leak. One inlet valve seat (13) can be reversed to provide longer use of the seat. However, the fluid inlet seat (14) contains a pressure relief valve and is not reversible. See FIG. 5 for proper orientation.

15. Inspect the pressure relief valve in the fluid inlet seat (14) to make sure it is not clogged. Press down on the valve's ball to see if the ball and spring are free to move. See FIG. 4.



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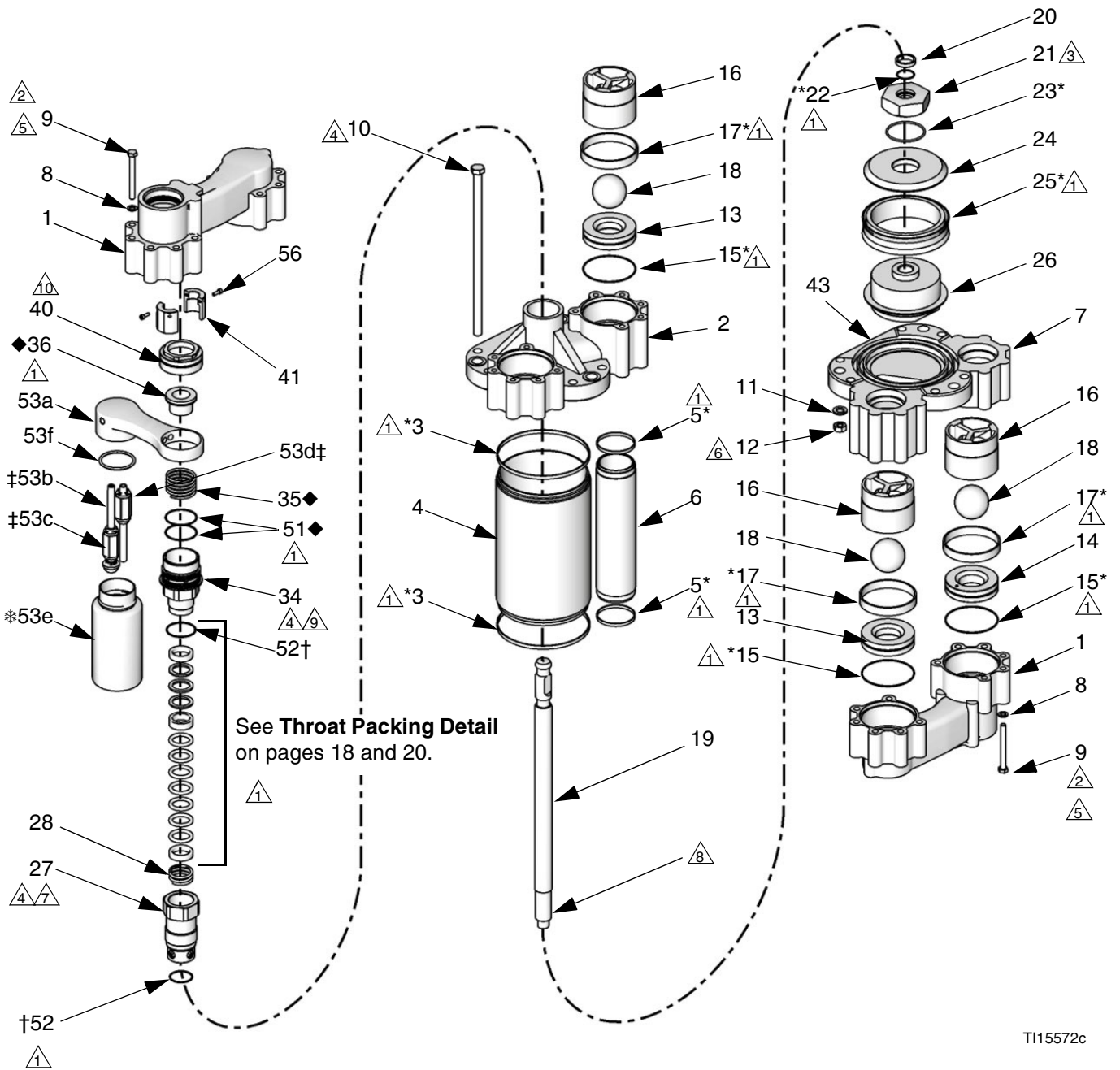
**FIG. 4. Inlet Seat with Pressure Relief Valve**

**NOTICE**

If the pressure relief valve in the inlet seat (14) is clogged or filled with material, soak the seat in a compatible solvent. Make sure all material residue is cleaned from the ball and seat area.

If the relief valve cannot be thoroughly cleaned so that the ball and spring are free to move, replace the seat (14).

16. Push the piston assembly through the cylinder just enough to expose the piston (26) flats. Secure the piston flats in a vise. Use a plastic mallet to tap the cylinder (4) up and off the piston assembly.
17. Loosen the piston nut (21). Use Tool Kit 220385 to remove the piston shaft (19) and piston nut (21). Remove the piston nut o-ring (22) and o-ring retainer (20) from the shaft. Remove the plate (24) and the seal (25) from the piston (26).
18. Inspect the piston shaft (19). If it is damaged or the surface is scored, replace it.
19. Clean all piston parts and the cylinder thoroughly in a compatible solvent. Inspect the inner surface of the cylinder for scoring, and replace it if necessary. A scored cylinder will quickly damage the packings.



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- △1 Apply lubricant to all packings and seals.
- △2 Apply removable (blue) Loctite® 243 to entire length of threads.
- △3 Torque to 200-210 ft-lb (270-285 N•m).
- △4 Apply thread lubricant.

- △5 Torque to 18-20 ft-lb (24-27 N•m).
- △6 Tighten uniformly until cylinder is seated then torque to 60-65 ft-lb (81-88 N•m).
- △7 Torque to 95-100 ft-lb (129-135 N•m).

- △8 Apply high strength (red) Loctite® 263 or 2760 to entire length of threads. Sealant must be allowed to cure for a minimum of 12 hours before use.
- △9 Torque to 70-75 ft-lb (95-102 N•m).
- △10 Torque to 25-30 ft-lb (34-40 N•m).

**FIG. 5. Exploded View of Lower**

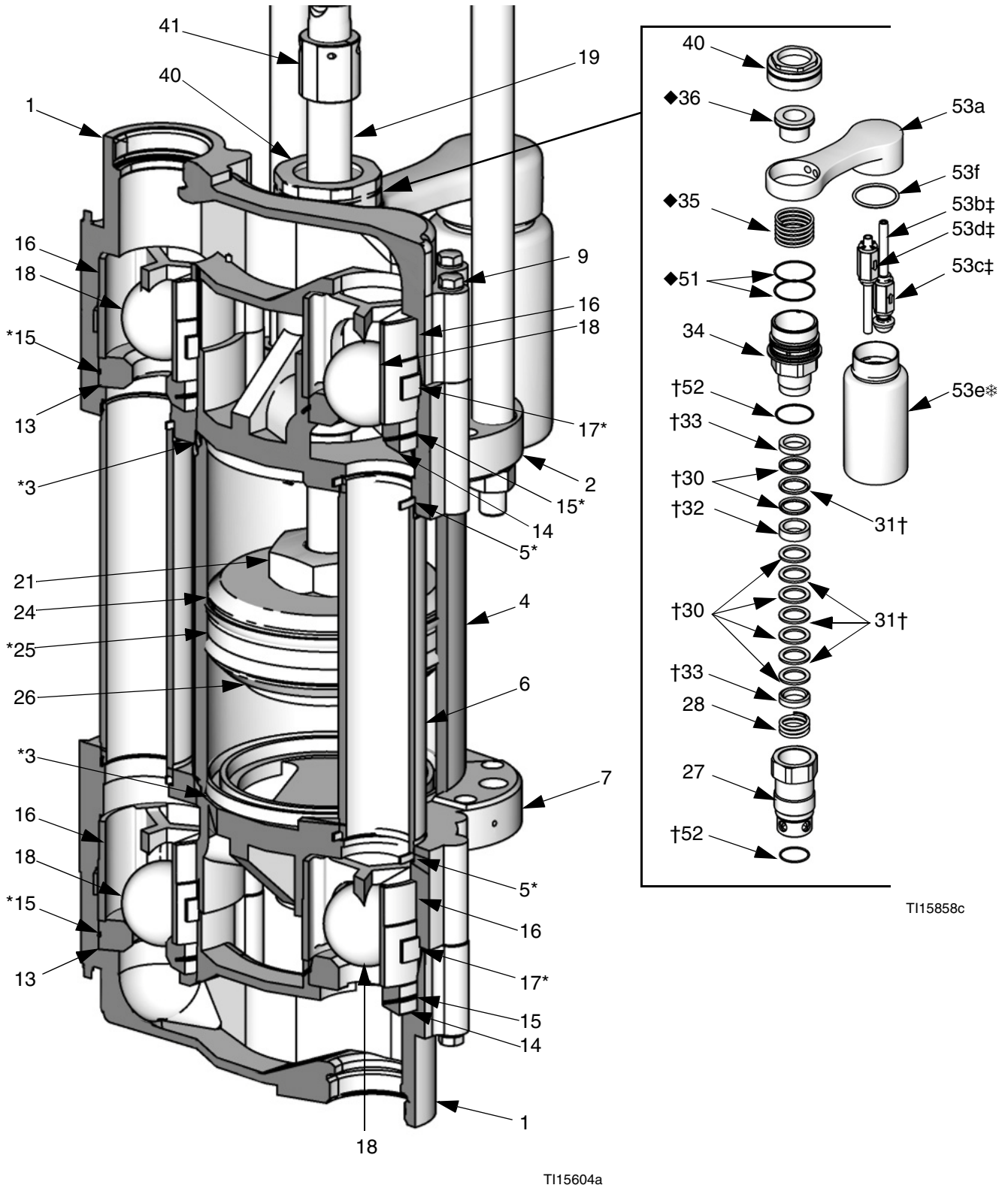
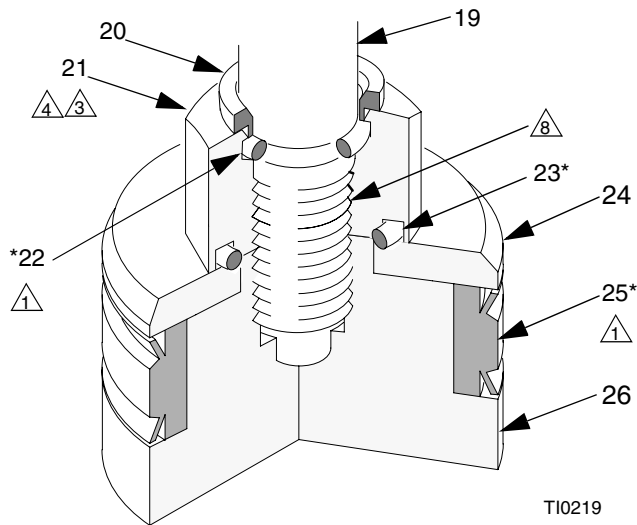


FIG. 6. Cutaway View of Lower

## Lower Reassembly

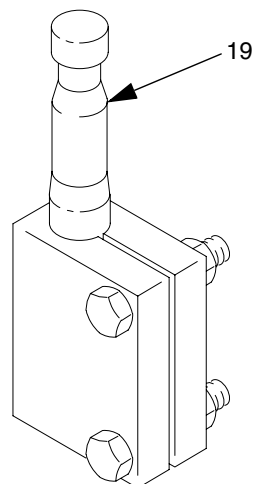
1. Lubricate the new piston seal (25\*) and install it on the piston.
2. Install the piston plate (24) with the beveled edge facing away from the piston seal. See FIG. 7.



- 1 Apply lubricant.
- 3 Torque to 200-210 ft-lb (270-285 N•m).
- 4 Apply lubricant to face of piston nut.
- 8 Apply high strength (red) Loctite® 263 or 2760 to entire length of threads. Sealant must be allowed to cure for a minimum of 12 hours before use.

FIG. 7. Piston Assembly

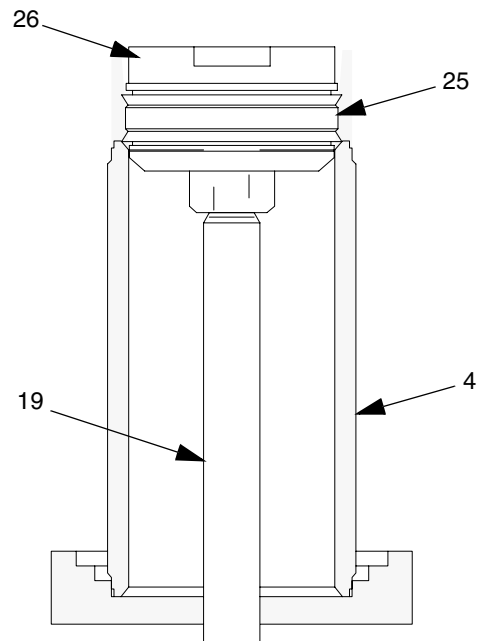
Tighten the tool on the widest part of the shaft (19). Grip the tool with a wrench and unscrew the shaft.



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FIG. 8. Tool Kit 220385

3. Install o-ring retainer (20). Lubricate o-ring (22\*) and slide it on over the threads of piston shaft. Apply high strength (red) Loctite® 263 or 2760 to entire length of the piston rod (19) threads. Sealant must be allowed to cure for a minimum of 12 hours before use. Screw the piston nut (21) snugly against the o-ring retainer (20). Apply lubricant to the bottom face of the piston nut (21). Assemble o-ring (23\*) and install in the groove on the piston nut. Screw rod (19) into piston (26) until snug. Tighten piston nut (21) to 270-285 N•m. (200-210 ft-lb).
4. Remove the piston assembly from the vise, but **do not lay it down on its side; doing so may damage the seal.**
5. Carefully and evenly guide the seal and the piston into the cylinder. The piston seal and piston may need to be tipped at an angle and the exposed, leading lip of the seal tapped into the cylinder with a plastic mallet. After the seal lip has entered the cylinder use an arbor press or tap the bottom of the piston assembly lightly with a plastic mallet to slide the piston assembly into the cylinder. Before pressing, ensure the piston seal lips are started into the cylinder. See FIG. 9.
6. Clean the remaining pump parts in a compatible solvent.



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- 1 Do not damage edges of seal.

FIG. 9. Install Piston in Cylinder

- Lubricate and install the new o-rings (15\*) around each of the four ball seats (13 and 14).

**NOTICE**

The orientation of the ball valves in the inlet and outlet valve housings is critical. Install the parts of the ball valve exactly as instructed and refer to FIG. 5. If installed incorrectly, the pump will not operate.

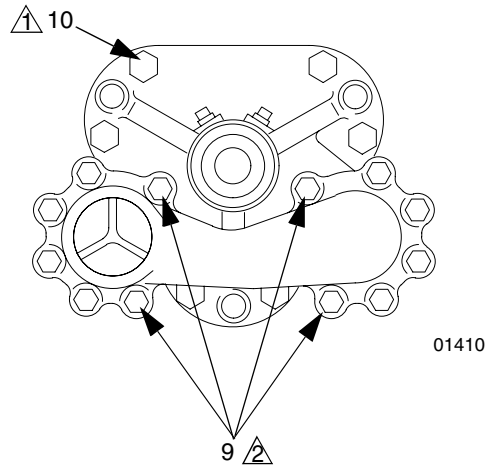
- Place the inlet valve housing (7) on a flat surface with the ball valve openings facing up. Lubricate the seals (17\*) and set them into each side of the inlet valve housing.
- Place the ball guides (16) and balls (18) in the inlet valve housing.

<b>COMPONENT RUPTURE HAZARD</b>							
The relief valve seat (14) must be installed at the fluid inlet, as shown in FIG. 5 and FIG. 6. The relief valve reduces the risk of pump overpressurization. The seat cannot relieve pressure if installed on the other side of the inlet housing.							

- Press the seat (14) with the pressure relief valve into the fluid inlet side of the inlet manifold (1). This seat is not reversible. Orient as shown in FIG. 5 and FIG. 6. Press the other seat (13), with the unworn side facing out, into the other side of the inlet manifold.

**NOTE:** The pressure relief seat kit (14) includes two seals (17) and two o-rings (15). When installing a new pressure relief seat, also install the seals and o-rings on both sides of the fluid inlet manifold (1).

- Apply removable (blue) Loctite® 243 to entire length of the screw (9) threads. Position the inlet manifold (1) on the inlet valve housing (1). Install the twelve capscrews (9) and lockwashers (8) loosely.
- Tighten the four inside screws (9) oppositely and evenly to 3 N•m (27 in-lb) to balance the load on the valves. Then tighten all twelve screws oppositely and evenly to 24-27 N•m (18-20 ft-lb). See FIG. 10.



- Torque oppositely and evenly to 81-88 N•m (60-65 ft-lb).
- Apply removable (blue) Loctite® 243 to entire length of threads on all 12 screws (9). Torque 4 inside screws oppositely and evenly to 3 N•m (27 in-lb), then tighten all 12 screws oppositely and evenly to 24-27 N•m (18-20 ft-lb).

**FIG. 10. Manifold Screws Torque Values**

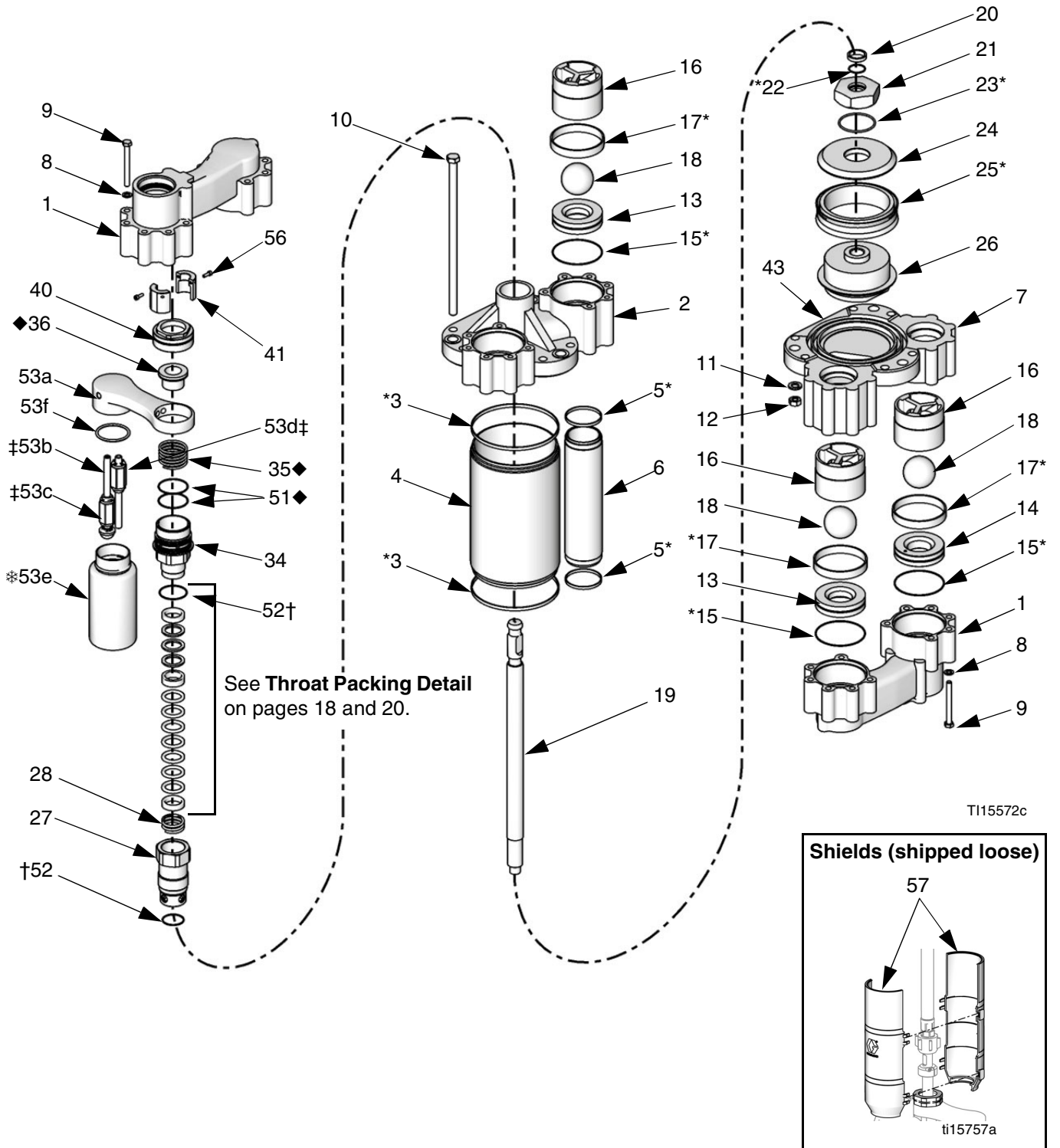
13. If Part No. 218742 accessory pump stand is used, place the inlet valve housing and manifold assembly on the pump stand. Install and tightly screw in the three pump stand bolts.
14. Lubricate and install the new seals (3\*, 5\*) in the inlet and outlet housings (2, 7). Set the cylinder (4) and riser tubes (6) into place in the inlet valve housing (7). Set the outlet housing (2) onto the cylinder and riser tubes.
15. Install the six cylinder capscrews (10), lockwashers (11) and nuts (12). Tighten the capscrews oppositely and evenly to 81-88 N•m (60-65 ft-lb). See FIG. 10.
16. Lubricate the seals (17\*) and press one into each side of the outlet valve housing (2). Press the seats (13), with the unworn sides facing the balls, into the outlet valve housing. Then install the balls (18) and ball guides (16).
17. Apply removable (blue) Loctite® 243 to entire length of the screw (9) threads. Place the outlet manifold (1) on the outlet valve housing (2) and install the twelve screws (9) and lockwashers (8) loosely.
18. Tighten the inside four screws (9) oppositely and evenly to 3 N•m (27 in-lb) to balance the load on the valves. Then tighten all twelve screws oppositely and evenly to 24-27 N•m (18-20 ft-lb). See FIG. 10.
19. Lubricate the throat packings and glands. Install the spring (28) and one male gland (33†) in the throat cartridge (27), then seven v-packings with the lips facing down: one UHMWPE (30†), one leather (31†), UHMWPE, leather, UHMWPE, leather, UHMWPE. Install the female gland (32†). Install three v-packings with the lips facing up: UHMWPE, leather, UHMWPE. Install the other male gland (33†).
20. Lubricate the o-ring (52†) and install it on the wet-cup (34). Install the wet-cup finger-tight.
21. Install the o-ring (52†) on the throat cartridge (27). Apply lubricant to the throat cartridge threads then screw the cartridge into the outlet housing (2).
22. Torque the cartridge (27) to 129-135 N•m (95-100 ft-lb).
23. Torque the wet-cup (34) to 95-102 N•m (70-75 ft-lb).
24. Reassemble the spring (35), TSL pump piston seal (36), and o-rings (51).
25. Reassemble the manifold and bottle assembly (53), cap (40), collar (41) and screws (56). Torque the cap (40) to 34-40 N•m (25-30 ft-lb).
26. Reinstall the coupling nut and collars on the piston rod (19).
27. Fill the cavity in the bottom of the motor shaft with grease. Reconnect the lower to the motor as described in your separate pump manual.





# Parts

See Parts Lists:  
3000cc, pages 18-19  
4000cc, pages 20-21



# 3000cc Lowers

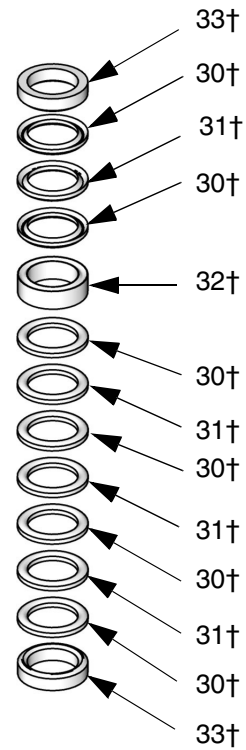
Part No. 24F448, Series A, Stainless Steel

Part No. 24F450, Series A, Carbon Steel

Part No. 24F449, Series A, Stainless Steel

Ref. No.	Description	Lower			Qty
		24F448	24F450	24F449	
1	MANIFOLD; sst	16E965		16E965	2
	MANIFOLD; cst		180520		2
2	HOUSING, outlet; sst	16E084		16E084	1
	HOUSING, outlet; cst		16E085		1
3*	GASKET, cylinder; UHMWPE	n/a	n/a	n/a	2
4	CYLINDER, pump; sst/chrome	180498	180498		1
	CYLINDER, pump; sst/MaxLife			24A345	1
5*	O-RING; PTFE	n/a	n/a	n/a	4
6	TUBE, fluid; sst	180530	180530	180530	2
7	HOUSING, inlet; sst	180523		180523	1
	HOUSING, inlet; cst		180521		1
8	WASHER, flat; 8.4 mm; sst	111003	111003	111003	24
9	CAPSCREW, hex hd; M8 x 1.25 x 25; sst	107554	107554	107554	24
10	CAPSCREW, hex hd; 9/16-12 unc x 7.5 in.; sst	107553	107553	107553	6
11	LOCKWASHER, spring; 9/16 in.; sst	108792	108792	108792	6
12	NUT, hex	107538	107538	107538	6
13	SEAT, valve; sst	180529	180529	180529	3
14	SEAT, intake valve, with relief valve; sst	237572	237572	237572	1
15*	O-RING; PTFE	n/a	n/a	n/a	4
16	GUIDE, ball; sst	180509	180509	180509	4
17	SEAL; UHMWPE	180761	180761	180761	4
18	BALL; 2 in. (51 mm) dia.; sst	110294	110294	110294	4
19	ROD, piston; sst	16A677	16A677	16A677	1
20	RETAINER, o-ring, piston	196356	196356	196356	1
21	NUT, piston	196243	196243	196243	1
22*	O-RING; PTFE encapsulated fluoroelastomer	n/a	n/a	n/a	1
23*	O-RING; PTFE	n/a	n/a	n/a	1
24	PLATE, retaining, piston	196264	196264	196264	1
25*	PACKING, piston; UHMWPE	n/a	n/a	n/a	1
26	PISTON	196263	196263	196263	1
27	CARTRIDGE, packing, throat	16A679	16A679	16A679	1
28	SPRING	16A545	16A545	16A545	1
30†	V-PACKING, throat; UHMWPE	n/a	n/a	n/a	6
31†	V-PACKING, throat; leather	n/a	n/a	n/a	4
32†	GLAND, female; sst	n/a	n/a	n/a	1
33†	GLAND, male; sst	n/a	n/a	n/a	2

### Throat Packing Detail



TI15573a

Ref. No.	Description	Lower			Qty
		24F448	24F450	24F449	
34	WET CUP	16A678	16A678	16A678	1
35◆	SPRING	n/a	n/a	n/a	1
36◆	SEAL, piston, TSL pump	n/a	n/a	n/a	1
39	SPACER, open wet-cup (not shown; shipped loose)	16E536	16E536	16E536	1
40	CAP, wet-cup	16F051	16A682	16F051	1
41	COLLAR, rod, piston	16E416	16E416	16E416	2
43▲	PLATE, warning	183460	183460	183460	1
48▲	TAG, warning (not shown)	172479	172479	172479	1
51◆	O-RING; fluoroelastomer	108657	108657	108657	2
52†	O-RING; PTFE	n/a	n/a	n/a	2
53	MANIFOLD/BOTTLE; includes 53a-53f	24T075	24T075	24T075	1
53a	MANIFOLD; nylon	n/a	n/a	n/a	1
53b‡	NIPPLE; sst	n/a	n/a	n/a	1
53c‡	INLET CHECK; nylon, sst, fluoroelastomer	n/a	n/a	n/a	1
53d‡	OUTLET CHECK; nylon, sst, pvc, fluoroelastomer	n/a	n/a	n/a	1
53e*	BOTTLE; hdpe	n/a	n/a	n/a	1
53f	O-RING	16G290	16G290	16G290	1
56	SCREW; M4 x 12	115263	115263	115263	1
57	SHIELD KITS; lowers include two shield kits; see manual 406876 to select the correct size kit for your lower and motor	24F254 24F255	24F254 24F255	24F254 24F255	1

[Click here to return to repair kit page.](#)

- ▲ Replacement Danger and Warning labels, tags, and cards are available at no cost.
  - \* Parts included in Seal Repair Kit 243728 (purchase separately).
  - † Parts included in Throat Packing Repair Kit 24F247 (purchase separately).
  - ◆ Parts included in TSL Pump Repair Kit 24F618 (purchase separately).
  - \* Order TSL Bottle Replacement Kit 24F405 (purchase separately). Includes 5 bottles.
  - ‡ Parts included in TSL Check Valve Repair Kit 24F404 (purchase separately).
- Complete Pump Repair Kit 24F664 is available (purchase separately).
- Parts labeled n/a are not available separately.

# 4000cc Lowers

Part No. 24F451, Series A, Stainless Steel

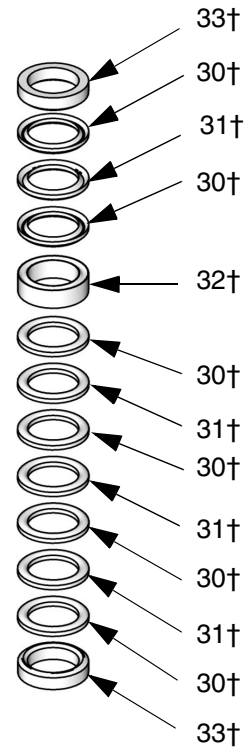
Part No. 24F453, Series A, Carbon Steel

Part No. 24F452, Series A, Stainless Steel

Part No. 24J888, Series A, Stainless Steel

Ref. No.	Description	Lower				Qty
		24F451	24F453	24F452	24J888	
1	MANIFOLD; sst; npt	16E965		16E965		2
	MANIFOLD; cst; npt		180520			2
	MANIFOLD; sst; BSPP				193203	2
2	HOUSING, outlet; sst	16E084		16E084	16E084	1
	HOUSING, outlet; cst		16E085			1
3*	GASKET, cylinder; UHMWPE	n/a	n/a	n/a	n/a	2
4	CYLINDER, pump; sst/chrome	180497	180497		180497	1
	CYLINDER, pump; sst/MaxLife			24A346		1
5*	PACKING, o-ring; PTFE	n/a	n/a	n/a	n/a	4
6	TUBE, fluid; sst	180530	180530	180530	180530	2
7	HOUSING, inlet; sst	180523		180523	180523	1
	HOUSING, inlet; cst		180521			1
8	WASHER, flat; 8.4 mm; sst	111003	111003	111003	111003	24
9	CAPSCREW, hex hd; M8 x 1.25 x 25; sst	107554	107554	107554	107554	24
10	CAPSCREW, hex hd; 9/16-12 unc x 7.5 in.; sst	107553	107553	107553	107553	6
11	LOCKWASHER, spring; 9/16 in.; sst	108792	108792	108792	108792	6
12	NUT, hex	107538	107538	107538	107538	6
13	SEAT, valve; sst	180529	180529	180529	180529	3
14	SEAT, intake valve, with relief valve; sst	237572	237572	237572	237572	1
15*	O-RING; PTFE	n/a	n/a	n/a	n/a	4
16	GUIDE, ball; sst	180509	180509	180509	180509	4
17	SEAL; UHMWPE	180761	180761	180761	180761	4
18	BALL; 2 in. (51 mm) dia.; sst	110294	110294	110294	110294	4
19	ROD, piston; sst	16A677	16A677	16A677	16A677	1
20	RETAINER, o-ring, piston	196356	196356	196356	196356	1
21	NUT, piston	196243	196243	196243	196243	1
22*	O-RING; PTFE encapsulated fluoroelastomer	n/a	n/a	n/a	n/a	1
23*	O-RING; PTFE	n/a	n/a	n/a	n/a	1
24	PLATE, retaining, piston	196266	196266	196266	196266	1
25*	PACKING, piston; UHMWPE	n/a	n/a	n/a	n/a	1
26	PISTON	196265	196265	196265	196265	1
27	CARTRIDGE, packing, throat	16A679	16A679	16A679	16A679	1
28	SPRING	16A545	16A545	16A545	16A545	1
30†	V-PACKING, throat; UHMWPE	n/a	n/a	n/a	n/a	6
31†	V-PACKING, throat; leather	n/a	n/a	n/a	n/a	4
32†	GLAND, female; sst	n/a	n/a	n/a	n/a	1
33†	GLAND, male; sst	n/a	n/a	n/a	n/a	2

Throat Packing Detail



T115573a

Ref. No.	Description	Lower				Qty
		24F451	24F453	24F452	24J888	
34	WET CUP	16A678	16A678	16A678	16A678	1
35◆	SPRING	n/a	n/a	n/a	n/a	1
36◆	SEAL, piston, TSL pump	n/a	n/a	n/a	n/a	1
39	SPACER, open wet-cup (not shown; shipped loose)	16E536	16E536	16E536	16E536	1
40	CAP, wet-cup	16F051	16A682	16F051	16F051	1
41	COLLAR, piston rod	16E416	16E416	16E416	16E416	2
43▲	PLATE, warning	183460	183460	183460	183460	1
48▲	TAG, warning (not shown)	172479	172479	172479	172479	1
51◆	O-RING; fluoroelastomer	108657	108657	108657	108657	2
52†	O-RING; PTFE	n/a	n/a	n/a	n/a	2
53	MANIFOLD/BOTTLE; includes 53a-53f	24T075	24T075	24T075	24T075	1
53a	MANIFOLD; nylon	n/a	n/a	n/a	n/a	1
53b‡	NIPPLE; sst	n/a	n/a	n/a	n/a	1
53c‡	INLET CHECK; nylon, sst, fluoroelastomer	n/a	n/a	n/a	n/a	1
53d‡	OUTLET CHECK; nylon, sst, pvc, fluoroelastomer	n/a	n/a	n/a	n/a	1
53e*	BOTTLE; hdpe	n/a	n/a	n/a	n/a	1
53f	O-RING	16G290	16G290	16G290	16G290	1
56	SCREW; M4 x 12	115263	115263	115263	115263	1
57	SHIELD KITS; lowers include two shield kits; see manual 406876 to select the correct size kit for your lower and motor	24F254	24F254	24F254	24F254	1
		24F255	24F255	24F255	24F255	

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▲ Replacement Danger and Warning labels, tags, and cards are available at no cost.

\* Parts included in Seal Repair Kit 243729 (purchase separately).

† Parts included in Throat Packing Repair Kit 24F247 (purchase separately).

◆ Parts included in TSL Pump Repair Kit 24F618 (purchase separately).

\* Order TSL Bottle Replacement Kit 24F405 (purchase separately). Includes 5 bottles.

‡ Parts included in TSL Check Valve Repair Kit 24F404 (purchase separately).

Complete Pump Repair Kit 24F665 is available (purchase separately).

Parts labeled n/a are not available separately.

## Repair Kits, Related Manuals, and Accessories

**NOTE:** The lowers listed in this manual **must** use the throat packing kits and the complete pump repair kits listed in the following table. **Do not** use kits for older-style lowers (see manual 311832) with these lowers. The throat packing gland height has changed.

**NOTE:** For best results, install the TSL Pump Repair Kit 24F618 each time the throat packings are changed.

Part No.	Description	Related Manuals	Manual Description	Repair Kits	Repair Kit Description
All lowers in this manual.	3000 cc and 4000 cc Lowers	3A0540	4-Ball Lower Instructions-Parts	24F247	Standard Throat Packing Kit, 4 Leather and 6 UHMWPE Packings. Includes items 30, 31, 32, 33, 52.
				24F248	Throat Packing Conversion Kit, 10 PTFE Packings. Includes items 30, 32, 33, 52.
				24J442	Throat Packing Conversion Kit, 6 PTFE and 4 Leather Packings. Includes items 30, 31, 32, 33, 52.
				24F618	TSL Pump Repair Kit. Includes items 35, 36, and 51. For best results, install each time the throat packings are changed.
				24F404	TSL Check Valve Repair Kit. Includes items 53b, 53c, 53d.
				24F405	TSL Bottle Replacement Kit. Includes five of item 53e.
24F448 24F449 24F450	3000 cc Lower	3A0540	4-Ball Lower Instructions-Parts	243728	Piston Seal Repair Kit. Includes items 3, 5, 15, 17, 22, 23, 25 (UHMWPE).
				235855	Piston Seal Conversion Kit. Includes items 3, 5, 15, 17, 22, 23, 25 (PTFE).
				24F664	Complete Pump Repair Kit. Includes items 3, 5, 15, 17, 22, 23, 25, 30, 31, 32, 33, 35, 36, 51, 52.
24F451 24F452 24F453 24J888	4000 cc Lower	3A0540	4-Ball Lower Instructions-Parts	243729	Piston Seal Repair Kit. Includes items 3, 5, 15, 17, 22, 23, 25 (UHMWPE).
				235854	Piston Seal Conversion Kit. Includes items 3, 5, 15, 17, 22, 23, 25 (PTFE).
				24F665	Complete Pump Repair Kit. Includes items 3, 5, 15, 17, 22, 23, 25, 30, 31, 32, 33, 35, 36, 51, 52.

# Technical Data

<b>4-Ball Pump Lowers (3000 and 4000 cc Sizes)</b>		
	<b>U.S.</b>	<b>Metric</b>
<b>Maximum Fluid Working Pressure</b>		
3000 cc Lowers	440 psi	3.0 MPa, 30 bar
4000 cc Lowers	330 psi	2.3 MPa, 23 bar
<b>Displacement per Cycle</b>		
3000 cc Lowers	3000 cc	
4000 cc Lowers	4000 cc	
<b>Maximum Fluid Temperature Rating</b>	150°F	66°C
<b>Fluid Inlet and Outlet Sizes</b>	See <b>Models</b> , page 2.	
<b>Weight</b>		
3000 cc Lowers	103 lb	46.7 kg
4000 cc Lowers	105 lb	47.6 kg
<b>Wetted Parts (main pump)</b>	Stainless Steel, PTFE, Leather, Ultra-High Molecular Weight Polyethylene, Carbon Steel ( <i>Models 24F450 and 24F453 only</i> )	
<b>Wetted Parts (enclosed wet-cup)</b>	Stainless Steel, Ultra-High Molecular Weight Polyethylene, High-density Polyethylene, Nylon, Fluoroelastomer	

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# Graco Standard Warranty

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

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

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

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**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.

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**TO PLACE AN ORDER**, contact your Graco distributor or call to identify the nearest distributor.  
**Phone:** 612-623-6921 **or Toll Free:** 1-800-328-0211 **Fax:** 612-378-3505

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Original instructions. This manual contains English. MM 3A0540

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