

## 4-Ball Lowers

3A2023C

1500cc and 2000cc Models

EN

**Designed for low pressure oil transfer.**

**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 before using the equipment. Save these instructions.

### **Models:**

**24J088 - 1500cc, Series A**

**24J089 - 2000cc, Series A**

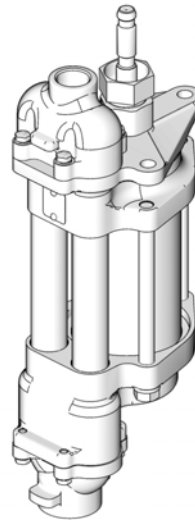
*Maximum Working Pressure, 460 psi (3.2 MPa, 32 bar)*

**24J090 - 2000cc, Series A**

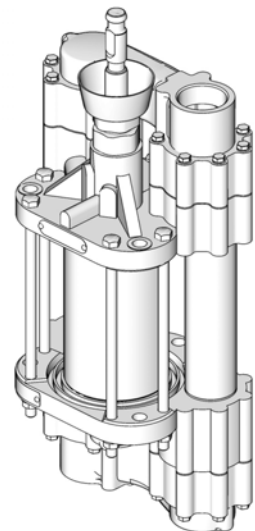
*Maximum Working Pressure, 400 psi (2.8 MPa, 28 bar)*

US Patent Pending

**Models 24J088 and  
24J089**







**Model 24J090**



# 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>When flammable fluids are present in the work area, such as gasoline and windshield wiper fluid, be aware that flammable fumes 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 cigarettes and portable electric lamps.</li> <li>• Keep work area free of debris, including rags and spilled or open containers of solvent and gasoline.</li> <li>• Do not plug or unplug power cords or turn lights on or off when flammable fumes are present.</li> <li>• Ground all equipment in the work area.</li> <li>• Use only grounded hoses.</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



## 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.



## 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.

## Repair - Models 24J088 and 24J089 Only

The following instructions are for models 24J088 and 24J089 only. Instructions for model 24J090 begin on page 9.

Reference numbers used in the following instructions refer to parts page 20.

### Pressure Relief Procedure



Follow the **Pressure Relief Procedure** whenever you see this symbol.



This equipment stays pressurized until pressure is manually relieved. To help prevent serious injury from pressurized fluid, such as skin injection, splashing fluid and moving parts, follow the Pressure Relief Procedure when you stop pumping and before cleaning, checking, or servicing the equipment.

1. Close the bleed-type master air valve.
2. Open the dispensing valve, if used.
3. Open all fluid drain valves (N) in the system, having a waste container ready to catch drainage. Leave drain valve(s) open until you are ready to spray again.

### 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 (19†).

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



3. **Relieve the pressure.**

4. Unscrews the coupling nut (a) from the motor shaft. Lift the motor shaft and remove the coupling nut (a) and collars (b) (FIG. 1).

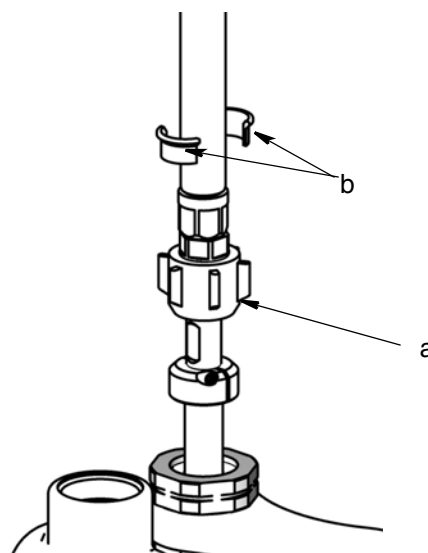


FIG. 1

5. Remove the o-ring (35), glands (19, 26), packings (20, 25) (FIG. 2).

**NOTE:** Inspect the surface of the piston rod (17). If it is scratched, replace the piston rod.

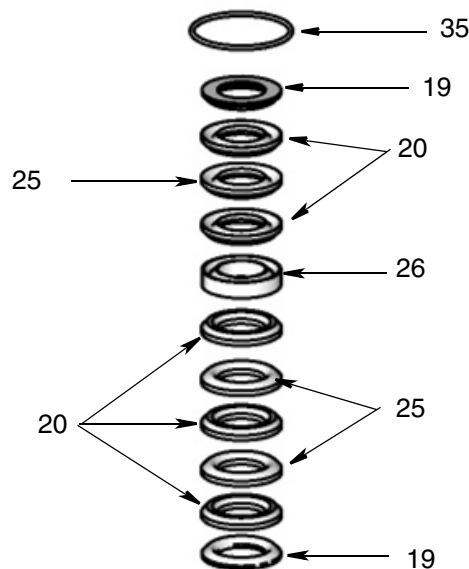


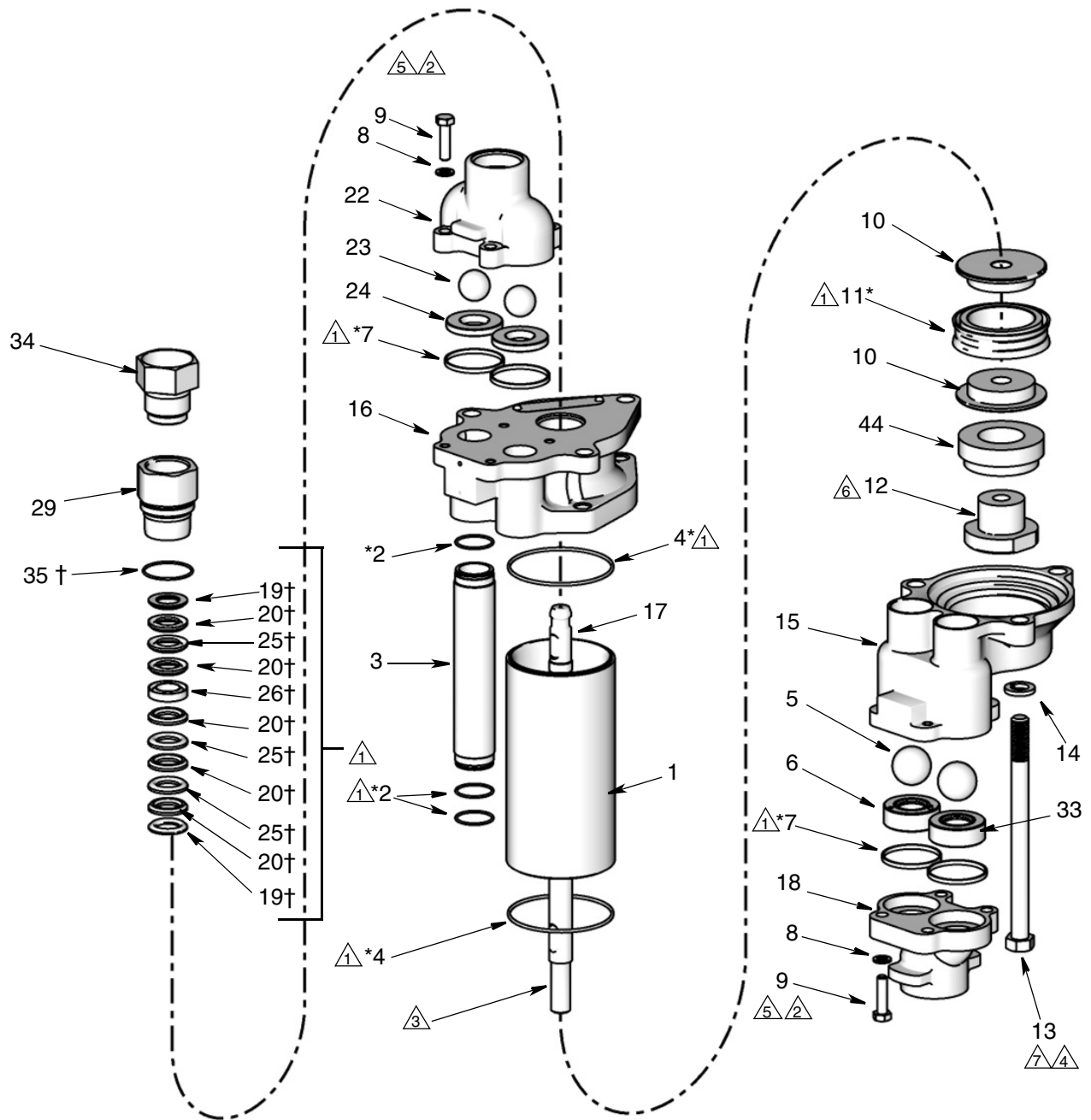
FIG. 2



**NOTE:** If the pressure relief valve in the seat (6) 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 (6).

15. Place the flats of the piston nut (12) in a vise. Unscrew the rod (17) from the nut. Remove the spacer (44). Disassemble the piston (10) and remove the seal (11).
16. Clean all parts in a compatible solvent. Inspect all parts for wear or damage. If you are using a repair kit, use all the new parts in the kit, discarding the old ones they replace. Replace any other parts as needed. Worn or damaged parts may cause the pump to perform poorly or cause premature wear of the new seals and packings.



1 Apply lubricant to all packings and seals.

2 Apply removable (blue) Loctite® 243 to entire length of threads.

3 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.

4 Tighten uniformly until cylinder (4) is seated. Torque to 25-30 ft-lb (34-40 N•m).

5 Torque 25-30 ft-lb (34-40 N•m).

6 Torque 95-100 ft-lb (129-135 N•m).

7 Apply thread lubricant. Torque 70-75 ft-lb (95-102 N•m).

FIG. 4. Exploded View of Lower

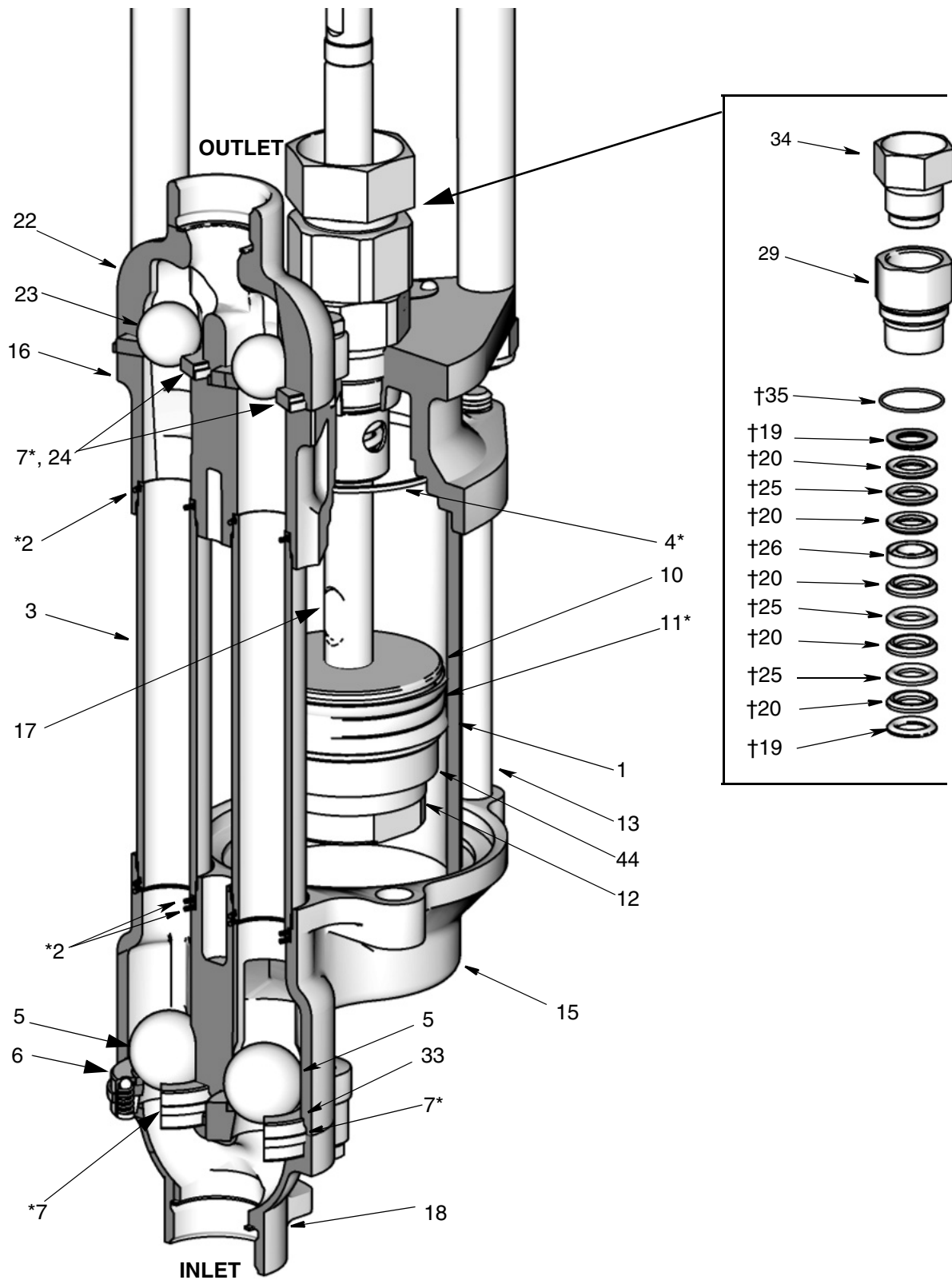


FIG. 5: Cutaway View



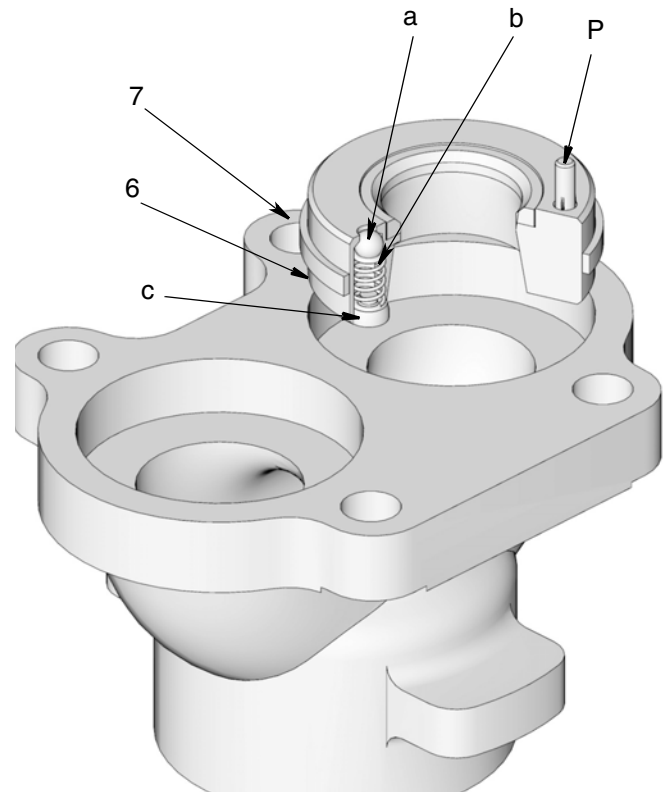
## Lower Reassembly

1. See FIG. 4. Place the halves of the piston (10) around the packing (11) and snap them together.
2. Apply high strength (red) Loctite® 263 or 2760 to entire length of the piston rod (17) threads. Sealant must be allowed to cure for a minimum of 12 hours before use. Screw the rod through the piston and spacer (44) and into the piston nut (12). Torque the nut to 95-100 ft-lb (129-135 N•m).
3. With the inlet housing (15) turned upside down, install the balls (5) and the gaskets (7\*).

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

4. Install the relief valve inlet seat (6) in the left side of the inlet housing (15), as viewed in FIG. 6. (Text cast into the inlet housing identifies the correct location for the relief valve seat.) The pin (P) on the seat must point into the housing. The pin limits the posi-

tioning of the seat, ensuring that the vent is not blocked by part of the housing. See FIG. 6.



**FIG. 6. Inlet Seat with Pressure Relief Valve (Left side is shown as the back of this illustration)**

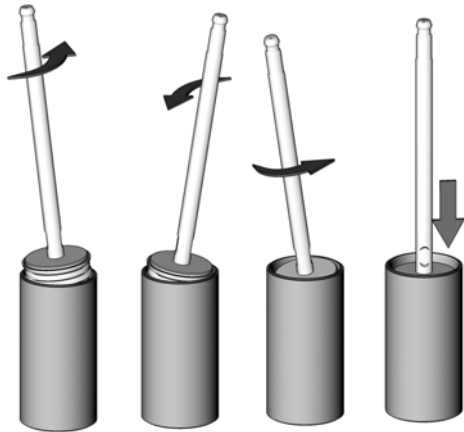
5. Install the inlet seat without a relief valve (33) in the right side of the inlet housing (15).

**NOTE:** The inlet seats (6 and 33) are not reversible; the chamfered side must face the ball.

6. Place the inlet manifold (18) on the inlet housing (15). Apply removable (blue) Loctite® 243 to entire length of the screw (9) threads. Install the lockwashers (8) and screws (9), and torque to 25-30 ft-lb (34-40 N•m).
7. Place the inlet manifold (18) in a vise. Place one o-ring (2\*) in each side of the inlet housing (15), where the tubes (3) sit. Place o-rings (2\*) in the grooves at each end of the tubes. Place a gasket (4) in both the inlet and outlet housing (15 and 16). Position the tubes and cylinder (1) in the inlet housing.

**NOTE:** It may be necessary to use a rubber mallet to set the fluid tubes (3) and cylinder (4) in place.

8. Lubricate the inside of the cylinder (4). Slide the piston assembly into the cylinder. Rotate the piston as shown in FIG. 7.



**FIG. 7. Install Piston in Cylinder**

9. Lubricate the throat packings and glands. Install one male gland (19†) in the throat cartridge (40), then five v-packings with the lips facing down: one UHMWPE (20†), one leather (25†), UHMWPE, leather, UHMWPE. Install the female gland (26†). Install three v-packings with the lips facing up: UHMWPE, leather, UHMWPE. Install the other male gland (19†).
10. Install the outlet housing (16). It may not seat well on the tubes and cylinder. Install the screws (13) and lockwashers (14) from the inlet housing (15). As you tighten the screws into the outlet housing (16), they will draw the housings firmly onto the tubes and cylinders. Tighten the screws uniformly and torque to 25-30 ft-lb (34-40 N•m).
11. Place a ball (23), seat (24) and gasket (7\*) in each side of the outlet manifold (22). Install the outlet manifold on the outlet housing (16).
12. Apply removable (blue) Loctite® 243 to entire length of the screw (9) threads. Install the lockwashers (8) and screws (9), and torque to 25-30 ft-lb (34-40 N•m).

**NOTE:** The outlet seats (24) are reversible.

13. 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.

## Repair - Model 24J090

*The following instructions are for models 24J090 only. Instructions for model 24J088 and 24J089 begin on page 4.*

*Reference numbers used in the following instructions refer to parts page 23.*

### Replace the Throat Packings Without Disconnecting the Lower

**NOTE:** Throat packing kits are available. See page 24. Kit parts are marked with a symbol, for example (30†).

**NOTE:** To replace the throat packings as part of a complete service of the lower, see page 11.

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



3. **Relieve the pressure**, page 4.

- Unscrews the coupling nut (a) from the motor shaft. Lift the motor shaft and remove the coupling nut (a) and collars (b) (FIG. 8).

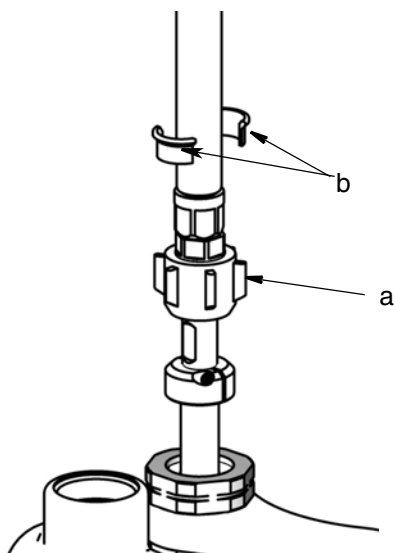


FIG. 8

- Remove the throat cartridge (45). Remove the o-ring (40), glands (29, 30), and packings (27, 28).

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

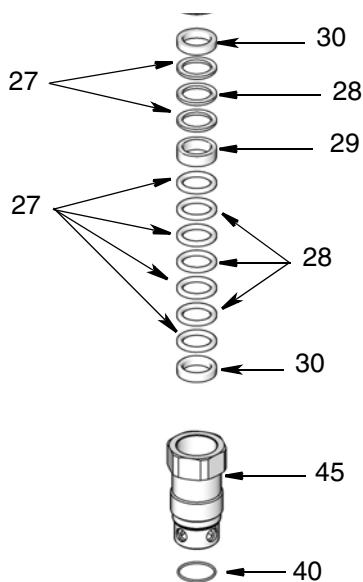


FIG. 9

- Lubricate the throat packings and glands. Install one male gland (30†) in the throat cartridge (45), then seven v-packings with the lips facing down: one UHMWPE (27†), one leather (28†), UHMWPE, leather, UHMWPE, leather, UHMWPE. Install the female gland (29†). Install three v-packings with the

lips facing up: UHMWPE, leather, UHMWPE. Install the other male gland (30†). Also see page 23 for additional information regarding torque and lubricants for these parts.

- Install the o-ring (40†) on the throat cartridge (45). Apply lubricant to the throat cartridge threads then screw the cartridge into the outlet housing (1).
- Torque the cartridge (45) to 95-100 ft-lb (129-135 N•m).
- Reinstall the coupling nut and collars on the piston rod (19).
- Reconnect the coupling nut to the motor shaft. See your separate pump assembly manual for correct torque specifications for your model.

## 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 24. Kit parts are marked with an asterisk in the text and drawings, for example (3\*).

**NOTE:** Throat packing kits are available. See page 24. Kit parts are marked with a symbol, for example (30†).

**NOTE:** Complete pump repair kits are also available. The kits include all seal kit parts. See page 25.

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



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

**NOTE:** See FIG. 12, page 14 for an exploded view of the entire lower. See FIG. 13, page 15 for a cutaway view of the lower and an exploded view of the throat packings.

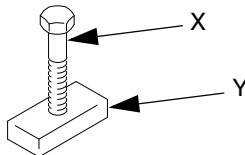
5. Use a 13 mm socket wrench to loosen and remove the twelve caps crews (9) and lockwashers (8) on the outlet manifold (1).
6. Lift the manifold (1) off the outlet valve housing (2) and remove the ball guides (16), balls (18), seats (13) and seals (17). Remove the o-ring (15) from the seats (13).

**NOTE:** See FIG. 10. Seat Puller Kit 220384 is available to make removal of the seats from the manifolds easier.

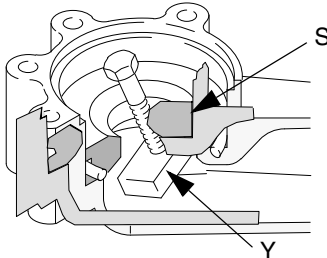
#### NOTICE

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.

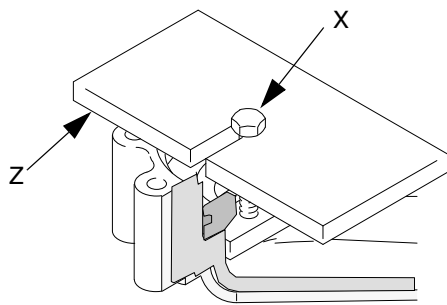
#### Seat Puller Kit 220384



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. 10. Removing Seats from Manifold**

7. Remove the throat cartridge (45). Remove the o-ring (40), glands (29, 30), and packings (27, 28).
8. Remove the nuts (12), lockwashers (11), and six cylinder caps crews (10). Lift off the outlet valve housing (2).
9. 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. 12.

**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.

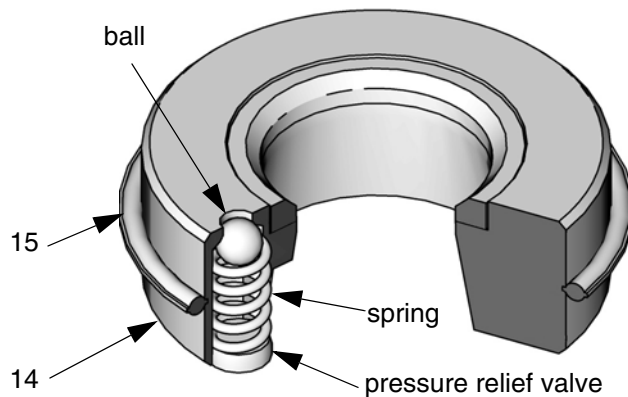
10. If Part No. 218742 accessory pump stand is used, unscrew and remove the three pump stand bolts. Lift the inlet valve assembly off the stand. Place the inlet valve housing (7) face down on a protected surface.
11. Use a 13 mm socket wrench to loosen and remove the twelve caps crews (9) and lockwashers (8) from the inlet manifold (1). See FIG. 12.
12. 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. 11 for proper orientation.

13. 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. 11.

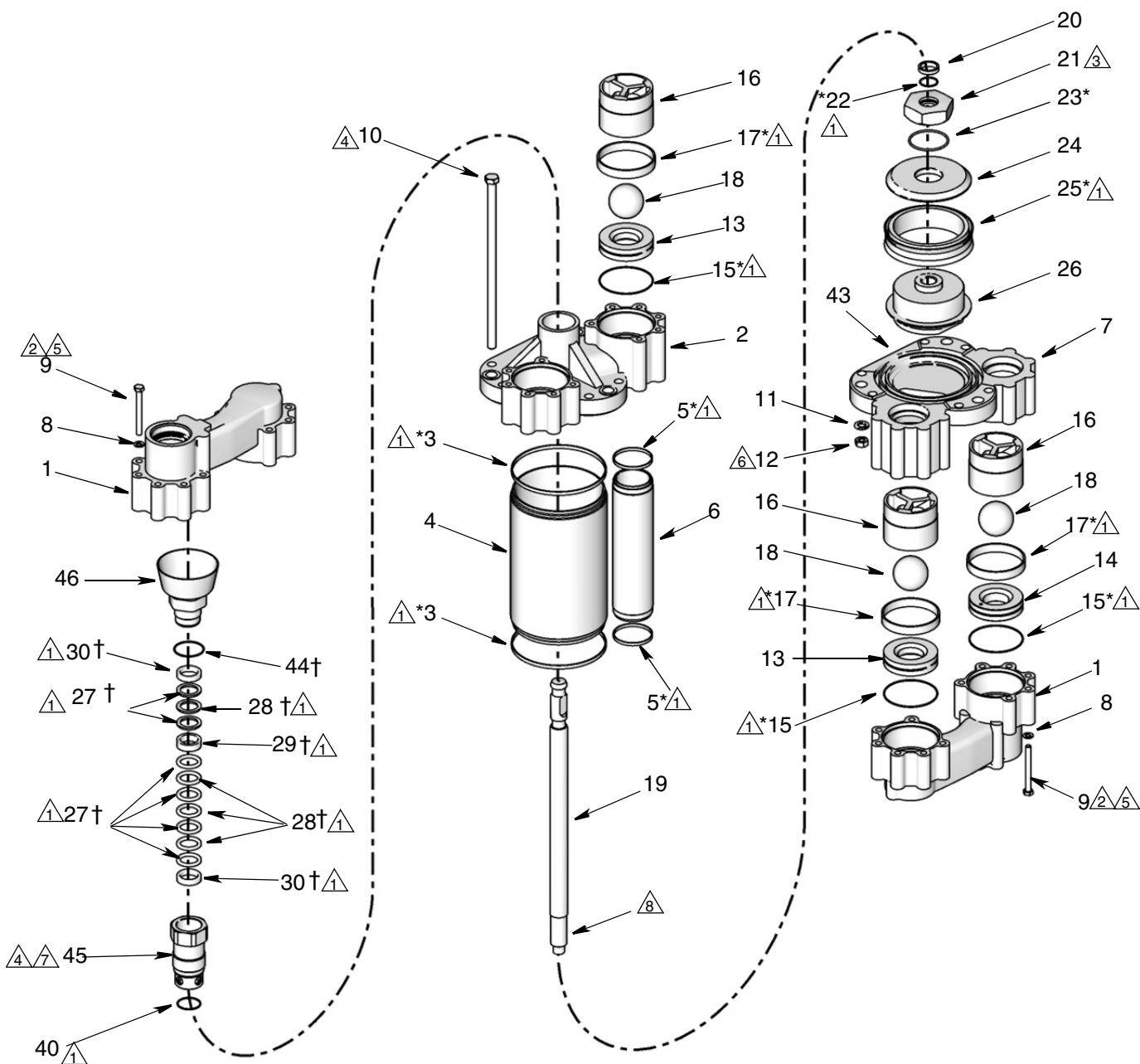


**FIG. 11. Inlet Seat with Pressure Relief Valve**

**NOTE:** 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).

14. 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.
15. 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).
16. Inspect the piston shaft (19). If it is damaged or the surface is scored, replace it.
17. 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.



- 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. 12: Exploded View of Lower

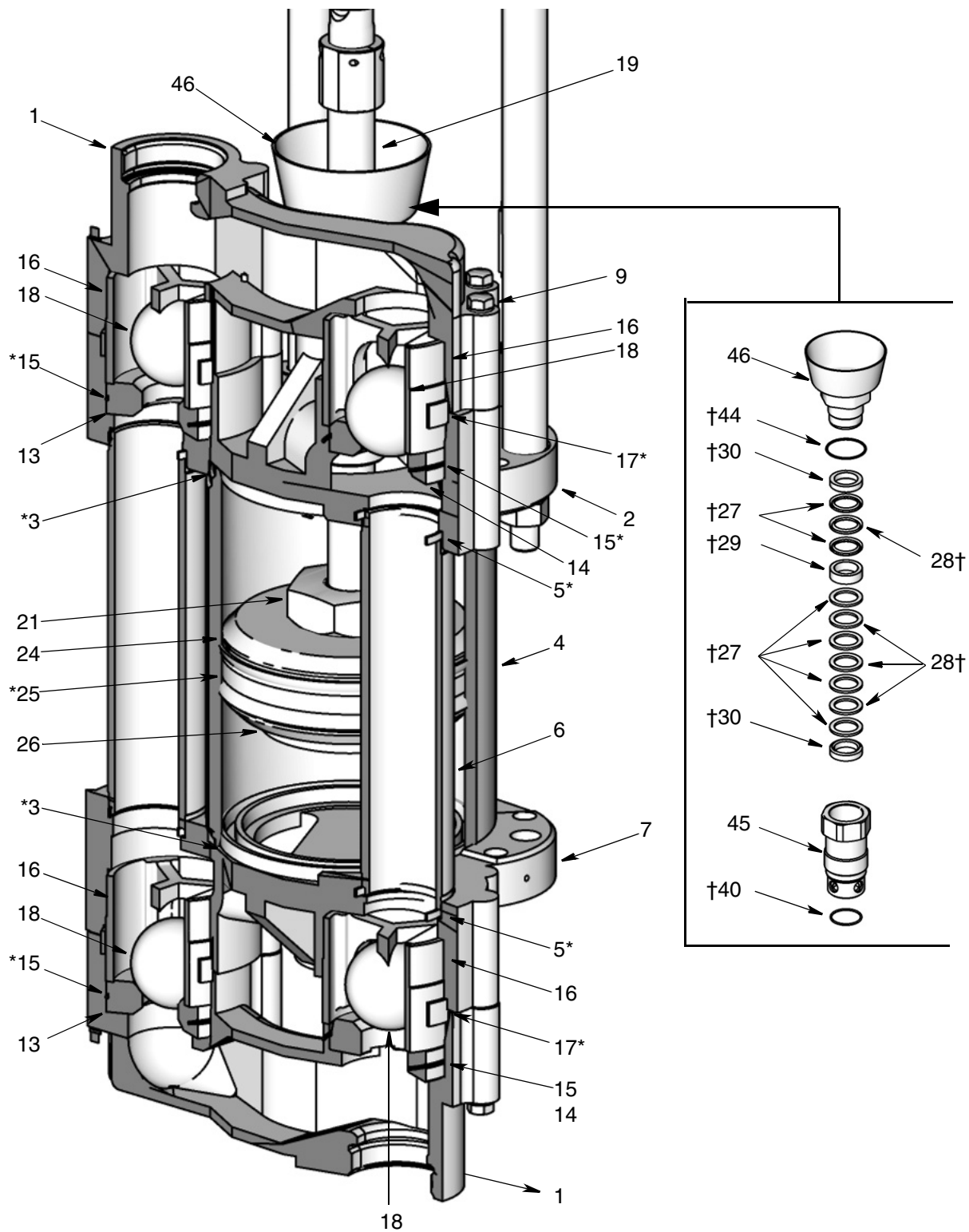
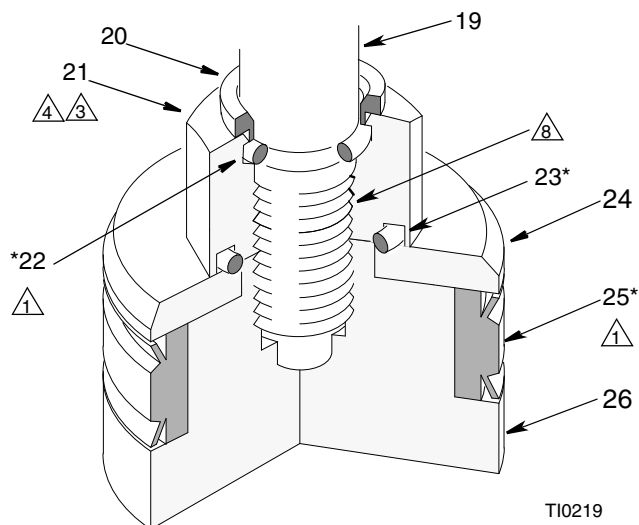


FIG. 13: Cutaway View of Lower

## 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. 14.



- △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.

3. Install o-ring retainer (20). Lubricate o-ring (22\*) and slide it on over the threads of piston rod (19). 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.
4. 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).
5. Remove the piston assembly from the vise, but **do not lay it down on its side; doing so may damage the seal.**
6. 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. 16.

FIG. 14. Piston Assembly

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

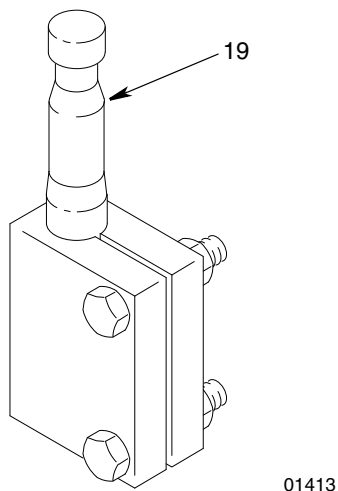
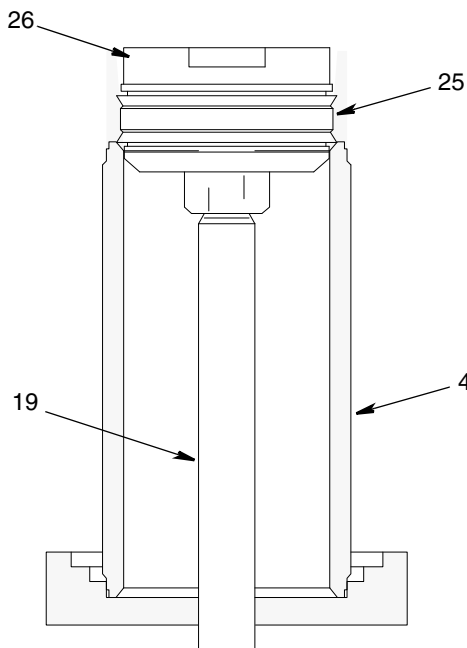


FIG. 15. Tool Kit 220385



7. Clean the remaining pump parts in a compatible solvent.



TI0221

⚠ Do not damage edges of seal.

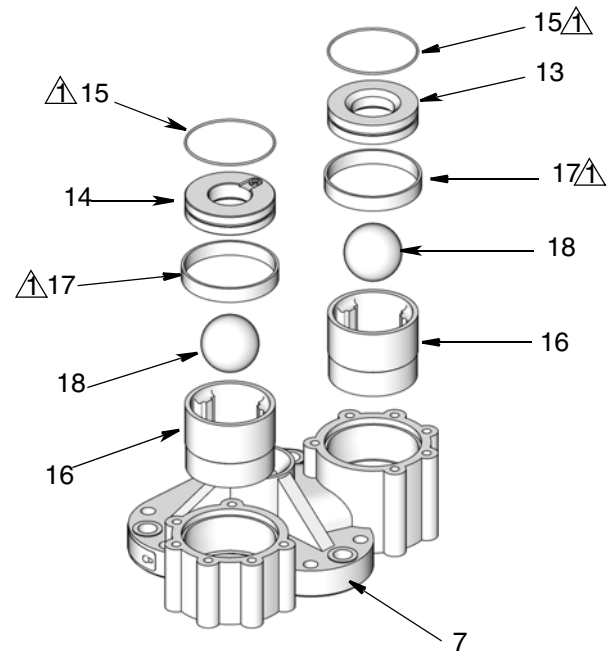
**FIG. 16. Install Piston in Cylinder**

8. 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. 18. If installed incorrectly, the pump will not operate.

9. 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.
10. Place the ball guides (16) and balls (18) in the inlet valve housing.



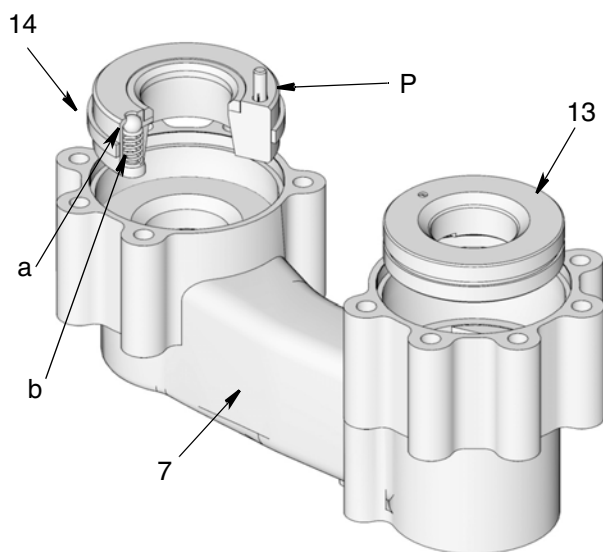
⚠ Apply lubricant to all packings and seals.

**FIG. 17**



**COMPONENT RUPTURE HAZARD**

The relief valve seat (14) must be installed at the fluid inlet, as shown in FIG. 18. The relief valve reduces the risk of pump over pressurization. The seat cannot relieve pressure if installed on the other side of the inlet housing.



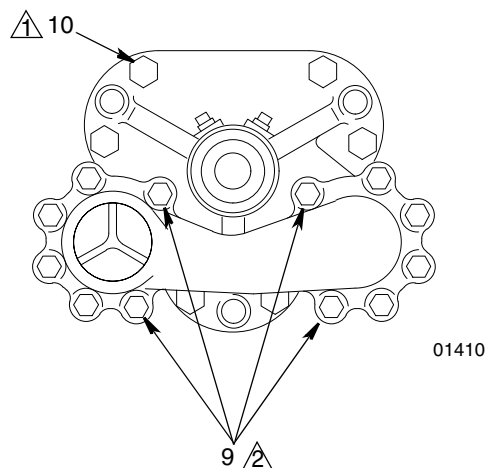
**FIG. 18. Inlet Seat with Pressure Relief Valve**

11. Press the relief valve 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. 18. 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).

12. 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 caps crews (9) and lockwashers (8) loosely.
13. 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. 19.



1. Torque oppositely and evenly to 81-88 N•m (60-65 ft-lb).

2. 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).

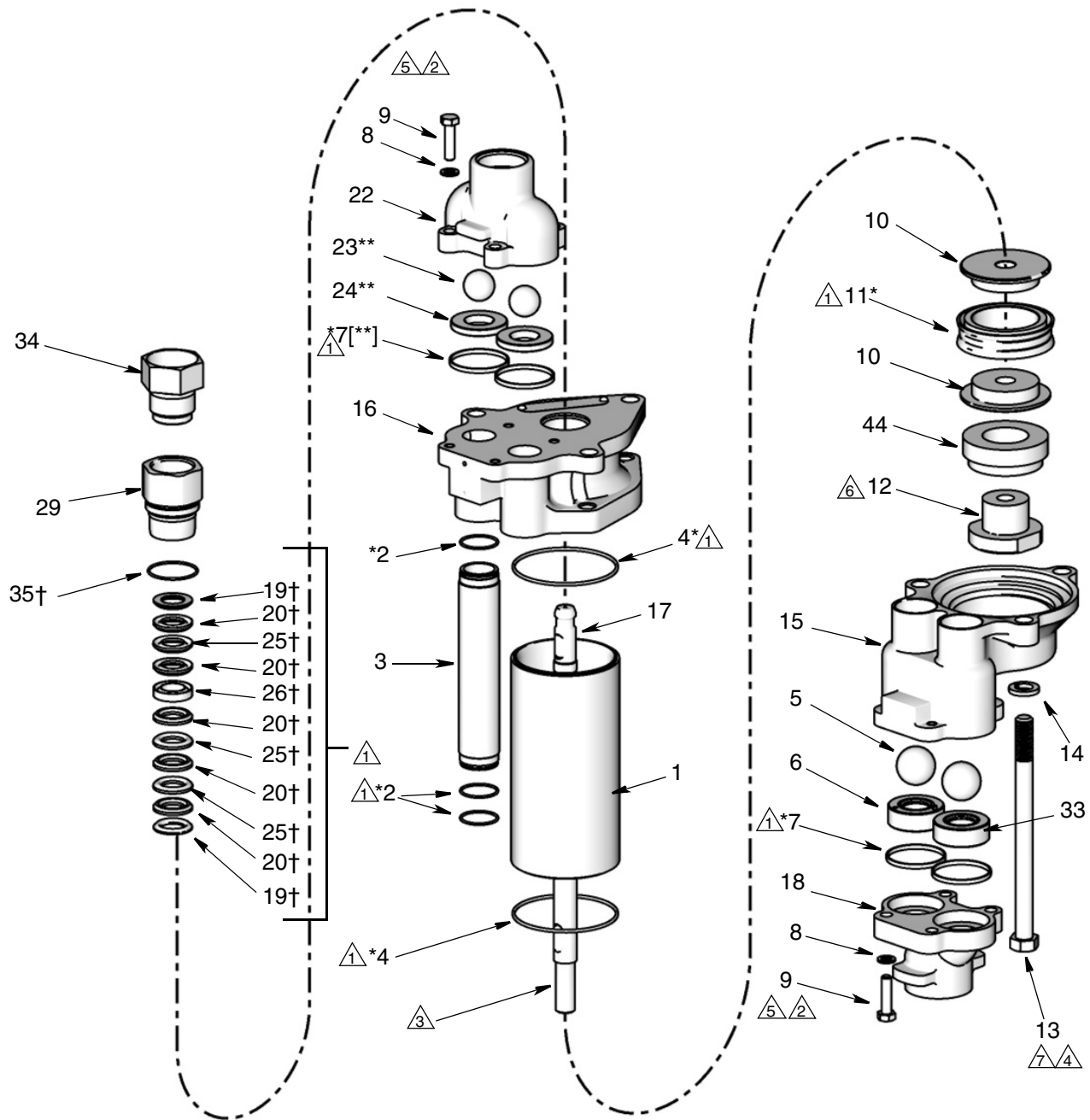
**FIG. 19. Manifold Screws Torque Values**

14. 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.
15. 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.
16. Install the six cylinder caps crews (10), lockwashers (11) and nuts (12). Tighten the caps crews oppositely and evenly to 81-88 N•m (60-65 ft-lb). See FIG. 19.
17. 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).
18. 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.

19. 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. 19.
20. Lubricate the throat packings and glands. Install one male gland (30†) in the throat cartridge (45), then seven v-packings with the lips facing down: one UHMWPE (27†), one leather (28†), UHMWPE, leather, UHMWPE, leather, UHMWPE. Install the female gland (29†). Install three v-packings with the lips facing up: UHMWPE, leather, UHMWPE. Install the other male gland (30†).
21. Torque the cartridge (45) to 129-135 N•m (95-100 ft-lb).
22. Reinstall the coupling nut and collars on the piston rod (19). 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.
23. 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 - 24J088 and 24J089



- △1 Apply lubricant to all packings and seals.
- △2 Apply removable (blue) Loctite® 243 to entire length of threads.
- △3 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.

- △4 Tighten uniformly until cylinder (4) is seated. Torque to 25-30 ft-lb (34-40 N•m).
- △5 Torque 25-30 ft-lb (34-40 N•m).
- △6 Torque 95-100 ft-lb (129-135 N•m).

- △7 Apply thread lubricant. Torque 70-75 ft-lb (95-102 N•m).

## Part No. 24J088 Series A

| Ref.    | Part No. | Description                                  | Qty |
|---------|----------|--|-----|
| 1       | 183048   | CYLINDER, pump; sst/chrome                   | 1   |
| 2*      | n/a      | PACKING, o-ring; PTFE                        | 6   |
| 3       | 183085   | TUBE, fluid; sst                             | 2   |
| 4*      | n/a      | GASKET, cylinder; UHMWPE                     | 2   |
| 5       | 101968   | BALL, inlet; 1.25 in. dia; sst               | 2   |
| 6       | 253483   | SEAT, inlet valve, with relief valve; sst    | 1   |
| 7* [**] | n/a      | GASKET, seat, valve; UHMWPE                  | 4   |
| 8       | 111003   | WASHER, flat; 8.4 mm; sst                    | 8   |
| 9       | 107558   | CAPSCREW, hex hd; M8 x 1.25 x 25; sst        | 8   |
| 10      | 15G884   | PISTON                                       | 2   |
| 11*     | n/a      | PACKING, piston; UHMWPE                      | 1   |
| 12      | 15H989   | NUT, piston                                  | 1   |
| 13      | 120446   | CAPSCREW, hex hd; 9/16-12 unc x 7.5 in.; sst | 3   |
| 14      | 101333   | LOCKWASHER, spring; 9/16 in.; sst            | 3   |
| 15      | 16D848   | HOUSING, inlet; sst                          | 1   |
| 16      | 16D849   | HOUSING, outlet; sst                         | 1   |

| Ref. | Part No. | Description                           | Qty |
|------|----------|---------------------------------------|-----|
| 17   | 16A462   | ROD, piston; sst                      | 1   |
| 18   | 192260   | MANIFOLD, inlet; tri-clamp; sst       | 1   |
| 19†  | n/a      | GLAND, male; sst                      | 2   |
| 20†  | n/a      | V-PACKING, throat; UHMWPE             | 5   |
| 22   | 181728   | MANIFOLD, outlet; tri-clamp; sst      | 1   |
| 23** | n/a      | BALL, outlet; 1 in. (25 mm) dia.; sst | 2   |
| 24** | n/a      | SEAT, outlet valve; sst               | 2   |
| 25†  | n/a      | V-PACKING, throat; leather            | 3   |
| 26†  | n/a      | GLAND, female; sst                    | 1   |
| 29   | 16E926   | FITTING, packing cartridge            | 1   |
| 33   | 239865   | SEAT, inlet valve; sst                | 1   |
| 34   | 181684   | NUT, packing                          | 1   |
| 35†  | n/a      | PACKING, o-ring                       | 1   |
| 36▲  | 172479   | TAG, warning (not shown)              | 1   |
| 44   | 16D851   | SPACER, piston                        | 1   |

## Part No. 24J089 Series A

| Ref.    | Part No. | Description                                  | Qty |
|---------|----------|--|-----|
| 1       | 15G882   | CYLINDER, pump; sst/chrome                   | 1   |
| 2*      | n/a      | PACKING, o-ring; PTFE                        | 6   |
| 3       | 183085   | TUBE, fluid; sst                             | 2   |
| 4*      | n/a      | GASKET, cylinder; UHMWPE                     | 2   |
| 5       | 101968   | BALL, inlet; 1.25 in. dia; sst               | 2   |
| 6       | 253483   | SEAT, inlet valve, with relief valve; sst    | 1   |
| 7* [**] | n/a      | GASKET, seat, valve; UHMWPE                  | 4   |
| 8       | 111003   | WASHER, flat; 8.4 mm; sst                    | 8   |
| 9       | 107558   | CAPSCREW, hex hd; M8 x 1.25 x 25; sst        | 8   |
| 10      | 15G885   | PISTON                                       | 2   |
| 11*     | n/a      | PACKING, piston; UHMWPE                      | 1   |
| 12      | 15H989   | NUT, piston                                  | 1   |
| 13      | 120446   | CAPSCREW, hex hd; 9/16-12 unc x 7.5 in.; sst | 3   |
| 14      | 101333   | LOCKWASHER, spring; 9/16 in.; sst            | 3   |
| 15      | 16D848   | HOUSING, inlet; sst                          | 1   |
| 16      | 16D849   | HOUSING, outlet; sst                         | 1   |

| Ref. | Part No. | Description                           | Qty |
|------|----------|---------------------------------------|-----|
| 17   | 16A462   | ROD, piston; sst                      | 1   |
| 18   | 192260   | MANIFOLD, inlet; tri-clamp; sst       | 1   |
| 19†  | n/a      | GLAND, male; sst                      | 2   |
| 20†  | n/a      | V-PACKING, throat; UHMWPE             | 5   |
| 22   | 181728   | MANIFOLD, outlet; tri-clamp; sst      | 1   |
| 23** | n/a      | BALL, outlet; 1 in. (25 mm) dia.; sst | 2   |
| 24** | n/a      | SEAT, outlet valve; sst               | 2   |
| 25†  | n/a      | V-PACKING, throat; leather            | 3   |
| 26†  | n/a      | GLAND, female; sst                    | 1   |
| 29   | 16E926   | FITTING, packing cartridge            | 1   |
| 33   | 239865   | SEAT, inlet valve; sst                | 1   |
| 34   | 181684   | NUT, packing                          | 1   |
| 35†  | n/a      | PACKING, o-ring                       | 1   |
| 36▲  | 172479   | TAG, warning (not shown)              | 1   |
| 44   | 16D852   | SPACER, piston                        | 1   |

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

\* Parts included in Seal Repair Kit 277362 (purchase separately). See page 22.

† Parts included in Throat Packing Repair Kit 24F245 (purchase separately). See page 22.

\*\* Carbide Seat Kit 24F249 is available for applications causing excessive wear (purchase separately). See page 22.

Complete Pump Repair Kit 24F662 (model 24J088) and 24F663 (model 24J089) is available (purchase separately). See page 23.

Parts labeled n/a are not available separately.

# Kits

## For Part Nos. 24J088 1500 cc 4-Ball Pump Repair Kit 24F662

| Ref. | Description                                | Qty |
|------|--|-----|
| 2*   | PACKING, o-ring; 1.25 in. (31 mm) OD; PTFE | 6   |
| 4*   | SEAL, gasket, cylinder                     | 2   |
| 7*   | GASKET, seat, valve                        | 4   |
| 11*  | PACKING, piston; 4.0 in.; UHMWPE           | 1   |
| 19†  | GLAND, male                                | 2   |
| 20†  | V-PACKING; UHMWPE                          | 5   |
| 25†  | V-PACKING; leather                         | 3   |
| 26†  | GLAND, female                              | 1   |
| 35†  | PACKING, o-ring; PTFE; 1.5 in. (38 mm) OD  | 1   |

\* These parts are included in Seal Repair Kit 277362.

† These parts are included in Throat Packing Repair Kit 24F245.

## Throat Packing Kit 24F245

With leather and UHMWPE throat packings.

| Ref. | Description                               | Qty |
|------|---|-----|
| 19†  | GLAND, male                               | 2   |
| 20†  | V-PACKING; UHMWPE                         | 5   |
| 25†  | V-PACKING, leather                        | 3   |
| 26†  | GLAND, female                             | 1   |
| 35†  | PACKING, o-ring; PTFE; 1.5 in. (38 mm) OD | 1   |

## Seal Repair Kit 277362

| Ref. | Description                                | Qty |
|------|--|-----|
| 2*   | PACKING, o-ring; 1.25 in. (31 mm) OD; PTFE | 6   |
| 4*   | GASKET, cylinder                           | 2   |
| 7*   | GASKET, seat, valve                        | 4   |
| 11*  | PACKING, piston; 3.5 in.; UHMWPE           | 1   |

## Carbide Seat Kit 17K756

### For Part Nos. 24J088 and 24J0889

For applications causing excessive wear to the standard stainless steel outlet seats. Kit fits all lowers in this manual. Includes manual 406875.

| Ref. | Description                           | Qty |
|------|---------------------------------------|-----|
| 7**  | GASKET, seat, valve                   | 2   |
| 23** | BALL, outlet; 1 in. (25 mm) dia.; sst | 2   |
| 24** | SEAT, outlet valve; 17-4 SST          | 2   |

## For Part Nos. 24J089 2000 cc 4-Ball Pump Repair Kit 24F663

| Ref. | Description                                | Qty |
|------|--|-----|
| 2*   | PACKING, o-ring; 1.25 in. (31 mm) OD; PTFE | 6   |
| 4*   | SEAL, gasket, cylinder                     | 2   |
| 7*   | GASKET, seat, valve                        | 4   |
| 11*  | PACKING, piston; 3.5 in.; UHMWPE           | 1   |
| 19†  | GLAND, male                                | 2   |
| 20†  | V-PACKING; UHMWPE                          | 5   |
| 25†  | V-PACKING; leather                         | 3   |
| 26†  | GLAND, female                              | 1   |
| 35†  | PACKING, o-ring; PTFE; 1.5 in. (38 mm) OD  | 1   |

\* These parts are included in Seal Repair Kit 277362.

† These parts are included in Throat Packing Repair Kit 24F245.

## Throat Packing Kit 24F245

With leather and UHMWPE throat packings.

| Ref. | Description                               | Qty |
|------|---|-----|
| 19†  | GLAND, male                               | 2   |
| 20†  | V-PACKING; UHMWPE                         | 5   |
| 25†  | V-PACKING, leather                        | 3   |
| 26†  | GLAND, female                             | 1   |
| 35†  | PACKING, o-ring; PTFE; 1.5 in. (38 mm) OD | 1   |

## Seal Repair Kit 277358

| Ref. | Description                                | Qty |
|------|--|-----|
| 2*   | PACKING, o-ring; 1.25 in. (31 mm) OD; PTFE | 6   |
| 4*   | GASKET, cylinder                           | 2   |
| 7*   | GASKET, seat, valve                        | 4   |
| 11*  | PACKING, piston; 4.0 in.; UHMWPE           | 1   |

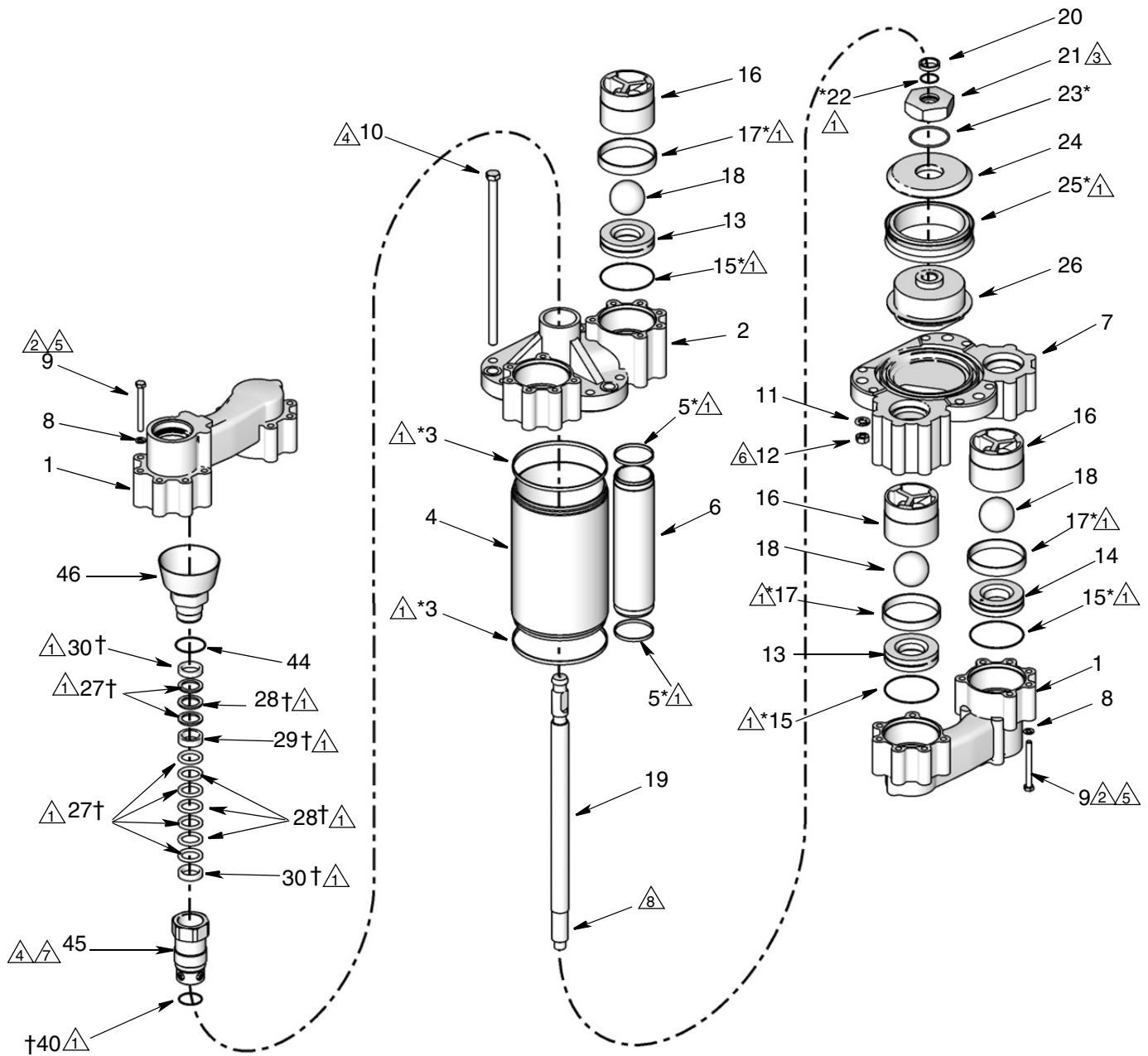
## (Optional) Carbide Seat Kit 24F249

### For Part Nos. 24J088 and 24J0889

For applications causing excessive wear to the standard stainless steel outlet seats. Kit fits all lowers in this manual. Includes manual 406875.

| Ref. | Description                           | Qty |
|------|---------------------------------------|-----|
| 7**  | GASKET, seat, valve                   | 2   |
| 23** | BALL, outlet; 1 in. (25 mm) dia.; sst | 2   |
| 24** | SEAT, outlet valve; carbide           | 2   |

# Parts - 24J090



△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).

## Part No. 24J090 Series A

| Ref. | Part No. | Description                                  | Qty |
|------|----------|--|-----|
| 1    | 180520   | MANIFOLD; cst                                | 2   |
| 2    | 16E085   | HOUSING, outlet; cst                         | 1   |
| 3*   | n/a      | GASKET, cylinder; UHMWPE                     | 2   |
| 4    | 180499   | CYLINDER, pump; sst/chrome                   | 1   |
| 5*   | n/a      | O-RING; PTFE                                 | 4   |
| 6    | 180530   | TUBE, fluid; sst                             | 2   |
| 7    | 180521   | HOUSING, inlet; cst                          | 1   |
| 8    | 111003   | WASHER, flat; 8.4 mm; sst                    | 24  |
| 9    | 107554   | CAPSCREW, hex hd; M8 x 1.25 x 25; sst        | 24  |
| 10   | 107553   | CAPSCREW, hex hd; 9/16-12 unc x 7.5 in.; sst | 6   |
| 11   | 108792   | LOCKWASHER, spring; 9/16 in.; sst            | 6   |
| 12   | 107538   | NUT, hex                                     | 6   |
| 13   | 180529   | SEAT, valve; sst                             | 3   |
| 14   | 237572   | SEAT, intake valve, with relief valve; sst   | 1   |
| 15*  | n/a      | SEAL; PTFE                                   | 4   |
| 16   | 180509   | GUIDE, ball; sst                             | 4   |
| 17   | n/a      | SEAL; UHMWPE                                 | 4   |
| 18   | 110294   | BALL; 2 in. (51 mm) dia.; sst                | 4   |
| 19   | 16A677   | ROD, piston; sst                             | 1   |

| Ref. | Part No. | Description                                | Qty |
|------|----------|--|-----|
| 20   | 196356   | RETAINER, o-ring, piston                   | 1   |
| 21   | 196243   | NUT, piston                                | 1   |
| 22*  | n/a      | O-RING; PTFE encapsulated fluoro-elastomer | 1   |
| 23*  | n/a      | O-RING; PTFE                               | 1   |
| 24   | n/a      | PLATE, retaining, piston                   | 1   |
| 25*  | n/a      | PACKING, piston; UHMWPE                    | 1   |
| 26   | 196261   | PISTON                                     | 1   |
| 27†  | n/a      | V-PACKING, female                          | 1   |
| 28†  | n/a      | PACKING                                    | 6   |
| 29†  | n/a      | GLAND, packing, female                     | 4   |
| 30†  | n/a      | GLAND, packing, male                       | 1   |
| 32   | 183460   | PLATE, warning (not shown)                 | 1   |
| 37▲  | 172479   | TAG, warning (not shown)                   | 1   |
| 40†  | n/a      | PACKING, o-ring, PTFE                      | 2   |
| 44   | n/a      | PACKING, o-ring                            | 2   |
| 45   | 16E945   | HOUSING, packing                           | 1   |
| 46   | 24F167   | CUP, wet, torque able                      | 1   |

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

\* Parts included in Seal Repair Kit 243727 (purchase separately).

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

Parts labeled n/a are not available separately.

## Kits for Part No. 24J090

### Seal Repair Kit 243727

| Ref. No. | Description  | Qty |
|----------|--|-----|
| 3*       | GASKET, cylinder   | 2   |
| 5*       | O-RING; UHMWPE   | 4   |
| 15*      | SEAL, PTFE   | 4   |
| 17*      | SEAL; UHMWPE   | 4   |
| 22*      | O-RING; PTFE encapsulated fluoroelastomer; 1.07 in. (27 mm) OD | 1   |
| 23*      | O-RING; PTFE; 2.32 in. (59 mm) OD                              | 1   |
| 25*      | PACKING, piston; 4.0 in.; UHMWPE                               | 1   |

### Standard Throat Packing Kit 24F247

With leather and UHMWPE throat packings.

| Ref. No. | Description                       | Qty |
|----------|-----------------------------------|-----|
| 27†      | V-PACKING; UHMWPE                 | 6   |
| 28†      | V-PACKING; leather                | 4   |
| 29†      | GLAND, female                     | 1   |
| 30†      | GLAND, male                       | 2   |
| 40†      | O-RING; PTFE; 1.75 in. (44 mm) OD | 2   |



## Pump Repair Kit 24F664

| Ref.<br>No. | Description   | Qty | Ref.<br>No.   | Description                       | Qty |
|-------------|---|-----|---|-----------------------------------|-----|
| 3*          | SEAL, gasket, cylinder  | 2   | 27†   | V-PACKING; UHMWPE                 | 6   |
| 5*          | SEAL; UHMWPE  | 4   | 28†   | V-PACKING; leather                | 4   |
| 15*         | GASKET, seat, valve   | 4   | 29†   | GLAND, female                     | 1   |
| 17*         | SEAL; UHMWPE  | 4   | 30†   | GLAND, male                       | 2   |
| 22*         | O-RING; PTFE encapsulated fluoroelastomer;<br>1.07 in. (27 mm) OD | 1   | 40†   | O-RING; PTFE; 1.75 in. (44 mm) OD | 2   |
| 23*         | O-RING; PTFE; 2.32 in. (59 mm) OD                                 | 1   | * These parts are included in Seal Repair Kit 243727.           |                                   |     |
| 25*         | PACKING, piston; 5.0 in.; UHMWPE                                  | 1   | † These parts are included in Throat Packing Repair Kit 24F247. |                                   |     |

## Technical Data

|  |  |
|--|--|
| Maximum Fluid Working Pressure . . . . .                   | Models 24J088 and 24J089 Lowers: 460 psi (3.2 MPa, 32 bar)<br>Model 24J090 Lowers: 440 psi (3.0 MPa, 30 bar)   |
| Displacement per Cycle (4.75 in. [12 cm] stroke) . . . . . | Model 24J088 Lowers: 1500cc<br>Model 24J089 Lowers: 2000cc<br>Model 24J090 Lowers: 3000cc  |
| Maximum Fluid Temperature Rating . . . . .                 | 150°F (66°C)   |
| Fluid Inlet and Outlet Sizes . . . . .                     | Model 24J088 and 24J089: Inlet: 1-1/2 in. npt Outlet: 1 in. npt<br>Model 24J090: Inlet: 2 in. npt<br>Outlet: 2 in. npt   |
| Weight . . . . .   | Models 24J088 Lowers: 43 lb (19.5 kg)<br>Models 24J089 Lowers: 44 lb (20.0 kg)<br>Models 24J090 Lowers: 103 lb (46.7 kg)   |
| Wetted Parts (main pump). . . . .                          | Models 24J088 and 24J089: Stainless Steel, PTFE, Leather, Ultra-High Molecular Weight Polyethylene, Tungsten Carbide, Acetal, Carbon Steel<br><br>Model 24J090: Stainless Steel, PTFE, Leather, Ultra-High Molecular Weight Polyethylene, Carbon Steel |

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## California Proposition 65

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Original instructions. This manual contains English. MM 3A2023

**Graco Headquarters:** Minneapolis

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Revision C, 2020-3