

CYLINDER REPAIR (MAST S/N F507, F508, F562, F563)

ERC22-35VG

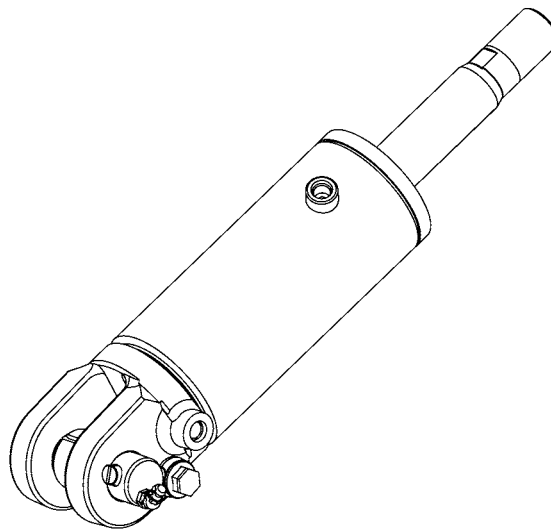
(ERC045-070VG) [A968];ERP22-35VL

(ERP045-070VL) [A976];GLC020-35VX

(GC/GLC040-070VX, GC/GLC055SVX) [A910, B910,

C910];GLP/GDP20-35VX (GP/GLP/

GDP040-070VX) [B875, C875, D875]



SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

- The Service Manuals are updated on a regular basis, but may not reflect recent design changes to the product. Updated technical service information may be available from your local authorized Yale® dealer. Service Manuals provide general guidelines for maintenance and service and are intended for use by trained and experienced technicians. Failure to properly maintain equipment or to follow instructions contained in the Service Manual could result in damage to the products, personal injury, property damage or death.
- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **YALE APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

NOTE: The following symbols and words indicate safety information in this manual:



WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and property damage.

On the lift truck, the **WARNING** symbol and word are on orange background. The **CAUTION** symbol and word are on yellow background.

TABLE OF CONTENTS

General	1
Safety Procedures When Working Near Mast	2
Main Lift Cylinder Repair	4
Remove	4
Disassemble	6
Clean	8
Inspect	8
Assemble	8
Install	9
Main Lift Cylinder Leak Check	9
Free-Lift Cylinder	10
Remove	10
Disassemble	11
Clean	13
Inspect	13
Assemble	13
Install	13
Tilt Cylinder Repair	14
Remove	14
Disassemble	16
Clean	18
Inspect	18
Assemble	18
Install	19
Tilt Cylinder Adjustment	20
Tilt Cylinder Leak Check	21
Integral Sideshift Cylinder Repair Prior to December 2016	23
Remove	23
Disassemble	24
Clean	25
Inspect	25
Assemble	25
Install	25
Integral Sideshift Cylinder Repair After December 2016	26
General	26
Remove	26
Disassemble	28
Clean	28
Inspect	28
Assemble	28
Install	29
Integral Side-Shift Cylinder Gland Leak Checks	30
Fork Positioner Cylinder Repair Prior to December 2016	31
Remove	31
Disassemble	31
Clean	33
Inspect	34
Assemble	34
Install	34
Fork Positioner Cylinder Adjustment	34
Fork Positioner Cylinder Repair After December 2016	35
General	35

TABLE OF CONTENTS (Continued)

Remove	35
Disassemble	35
Clean	38
Inspect	39
Assemble	39
Install	39
Fork Positioner Cylinder Adjustment	39
Seal Kit Installation	40
External Installation (Seal and Backup Ring)	40
Internal Installation (Piston Rod Assembly)	40
Torque Specifications	41
Main Lift Cylinders	41
Free-Lift Cylinder	41
Tilt Cylinders	41
Integral Sideshift Cylinder	41
Fork Positioner Cylinder	41

This section is for the following models:

ERC22-35VG (ERC045-070VG) [A968];
ERP22-35VL (ERP045-070VL) [A976];
GLC020-35VX (GC/GLC040-070VX, GC/GLC055SVX) [A910, B910, C910];
GLP/GDP20-35VX (GP/GLP/GDP040-070VX) [B875, C875, D875]

General



WARNING

Before working on or near the mast, see **Safety Procedures When Working Near Mast** in this manual.



CAUTION

Before working on any components of the hydraulic system, see the **Hydraulic Cleanliness Procedures** manual listed below, for procedures to prevent dirt and debris from entering the hydraulic system and cause damage.

This section contains the description and repair procedures for several different types of cylinders used on lift trucks equipped with a mast containing one of the following serial numbers:

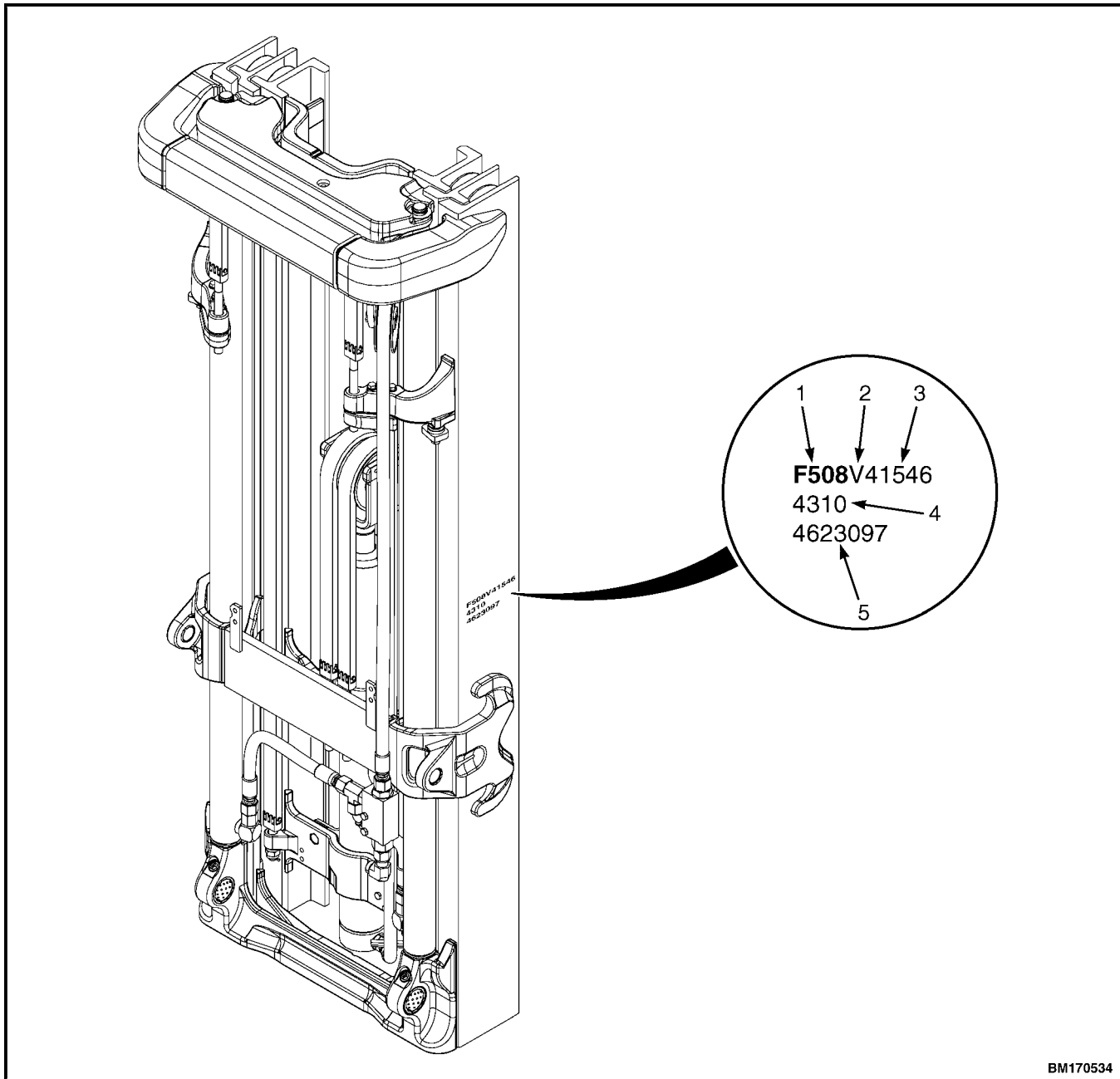
- **F507** - Two-Stage, Limited Free-Lift (LFL) mast
- **F508** - Three-Stage, Full Free-Lift (FFL) mast
- **F562** - Two-Stage, Limited Free-Lift (FFL) mast
- **F563** - Three-Stage, Full Free-Lift (FFL) mast

The mast serial number is located on the right side of the outer mast. Other information about the mast can also be found in this area. See Figure 1.

The number and design of the parts can be different, but the operation of the cylinders is the same.

Additional information concerning the cylinders may be included in other sections when the information is closely related to other systems. Sections may include:

- **Mast Repair (S/N F507, F508, F562, F563)**
4000YRM1669
- **Hydraulic Cleanliness Procedures**
1900YRM1620
- **Main Control Valves** 2000YRM1334 for lift truck models
ERC22-35VG (ERC045-070VG) (A968) and
ERP22-35VL (ERP045-070VL) (A976)
- **Main Control Valve** 2000YRM1137 for lift truck models
GLC20-35VX (GC/GLC040-070VX, GC/
GLC055SVX) (A910) and GLP/GDP20-35VX
(GP/GLP/ GDP040-070VX) (B875)
- **Main Control Valve** 2000YRM1684 for lift truck models
GLC20-35VX (GC/GLC040-070VX, GC/
GLC055SVX) (B910) and GLP/GDP20-35VX
(GP/GLP/ GDP040-070VX) (C875)
- **Main Control Valve** 2000YRM1745 for lift truck models
GLC20-35VX (GC/GLC040-070VX, GC/
GLC055SVX) (C910) and GLP/GDP20-35VX
(GP/GLP/ GDP040-070VX) (D875)



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NOTE: THE MAST AND TEXT SHOWN IN ABOVE ILLUSTRATION ARE FOR ILLUSTRATIVE PURPOSES ONLY. YOUR MAST AND TEXT MAY BE DIFFERENT, BUT THE TEXT IS FOUND IN THE SAME LOCATION.

- 1. MAST SERIAL NUMBER
- 2. MANUFACTURING PLANT
- 3. PRODUCTION SEQUENCE
- 4. MAST LIFT HEIGHT (IN MILLIMETERS)
- 5. MAST ASSEMBLY PART NUMBER

Figure 1. Mast Serial Number Location

Safety Procedures When Working Near Mast

The following procedures **MUST** be used when inspecting or working near the mast. Additional precautions and procedures can be required when repairing or removing the mast. See the correct Service Manual section for the specific mast being repaired.



WARNING

The following procedures **MUST** be used when inspecting or working near the mast. Additional precautions and procedures can be required when repairing or removing the mast. See the correct Service Manual section for the specific mast being repaired.

- Never put any part of the body into or under the mast or carriage unless all parts are completely lowered or a safety chain is installed. Also make sure that the power is off and the key is removed. Put a **DO NOT OPERATE** tag in the operator's compartment. Disconnect the battery on electric lift trucks and put a tag or lock on the battery connector.
- Be careful of the forks. When the mast is raised, the forks can be at a height to cause an injury.
- **DO NOT** climb on the mast or lift truck at any time. Use a ladder or personnel lift to work on the mast.
- **DO NOT** use blocks to support the mast weldments or to restrain their movement.
- Mast repairs require disassembly and removal of parts and can require removal of the mast or carriage. Follow the repair procedures in the correct Service Manual for the mast.

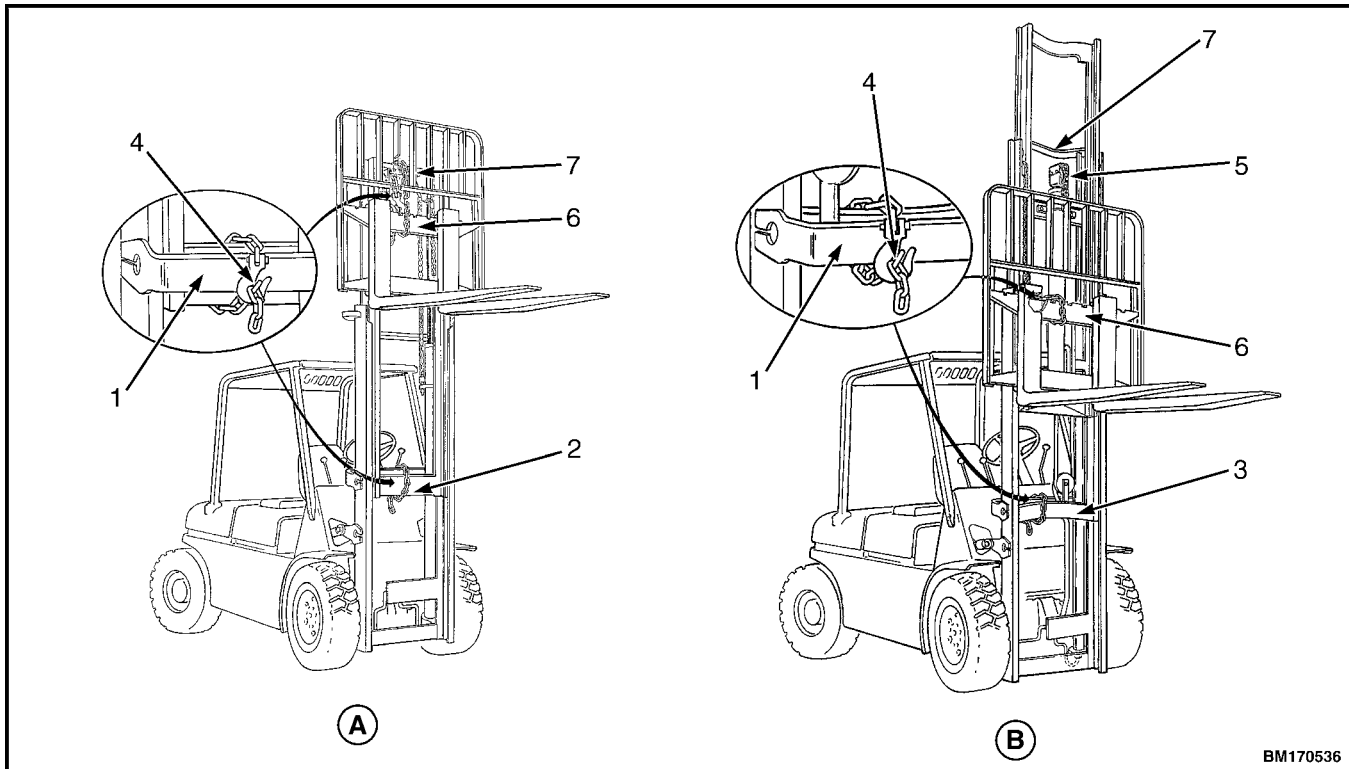
WHEN WORKING NEAR THE MAST ALWAYS:

- Lower the mast and carriage completely. Push the lift/lower control lever forward and make sure there is no movement in the mast. Make sure that all parts of the mast that move are fully lowered.

OR

- If parts of the mast must be in a raised position, install a safety chain to restrain the moving parts of the mast. Connect moving parts to a part that does not move. Follow these procedures:
 1. Put mast in vertical position.
 2. Raise mast to align bottom crossmember of weldment that moves in the outer weldment with a crossmember on the outer weldment. On the two-stage and free-lift mast, the moving part is the inner weldment. On the three-stage mast, it is the intermediate weldment. See Figure 2.
 3. Use a 3/8 inch minimum safety chain with a hook to fasten the crossmembers together so the movable member cannot lower. Put the hook on the back side of the mast. Make sure the hook is completely engaged with a link in the chain. Make sure the safety chain does not touch lift chains or chain sheaves, tubes, hoses, fittings, or other parts on the mast.
 4. Lower mast until there is tension in the safety chain and the free-lift cylinder (three-stage) is completely retracted. If running, stop the engine. Apply parking brake. Install a **DO NOT REMOVE** tag on the safety chain(s).
 5. Install another safety chain (3/8 inch minimum) between the top or bottom crossmember of the carriage and a crossmember on the outer weldment. See Figure 2.

NOTE: Apply parking brake. After lowering or restraining the mast, shut off power and remove key. Put a **DO NOT OPERATE** tag in the operator's compartment. Disconnect battery on electric lift trucks and put a tag or lock on battery connector.



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A. TWO-STAGE LFL MAST

1. OUTER WELDMENT
2. INNER WELDMENT
3. INTERMEDIATE WELDMENT
4. HOOK

B. THREE-STAGE FFL MAST

5. FREE-LIFT CYLINDER
6. CROSSMEMBER
7. CROSSMEMBER

Figure 2. Two-Stage LFL and Three-Stage FFL Masts

Main Lift Cylinder Repair

REMOVE



WARNING

Before working on or near the mast, see **Safety Procedures When Working Near Mast**

NOTE: The following procedures are for the removal of the main lift cylinders with the mast installed on the lift truck.

1. Remove the carriage as described in the carriage removal procedures located in the **Mast** service manual listed in the General section of this manual.

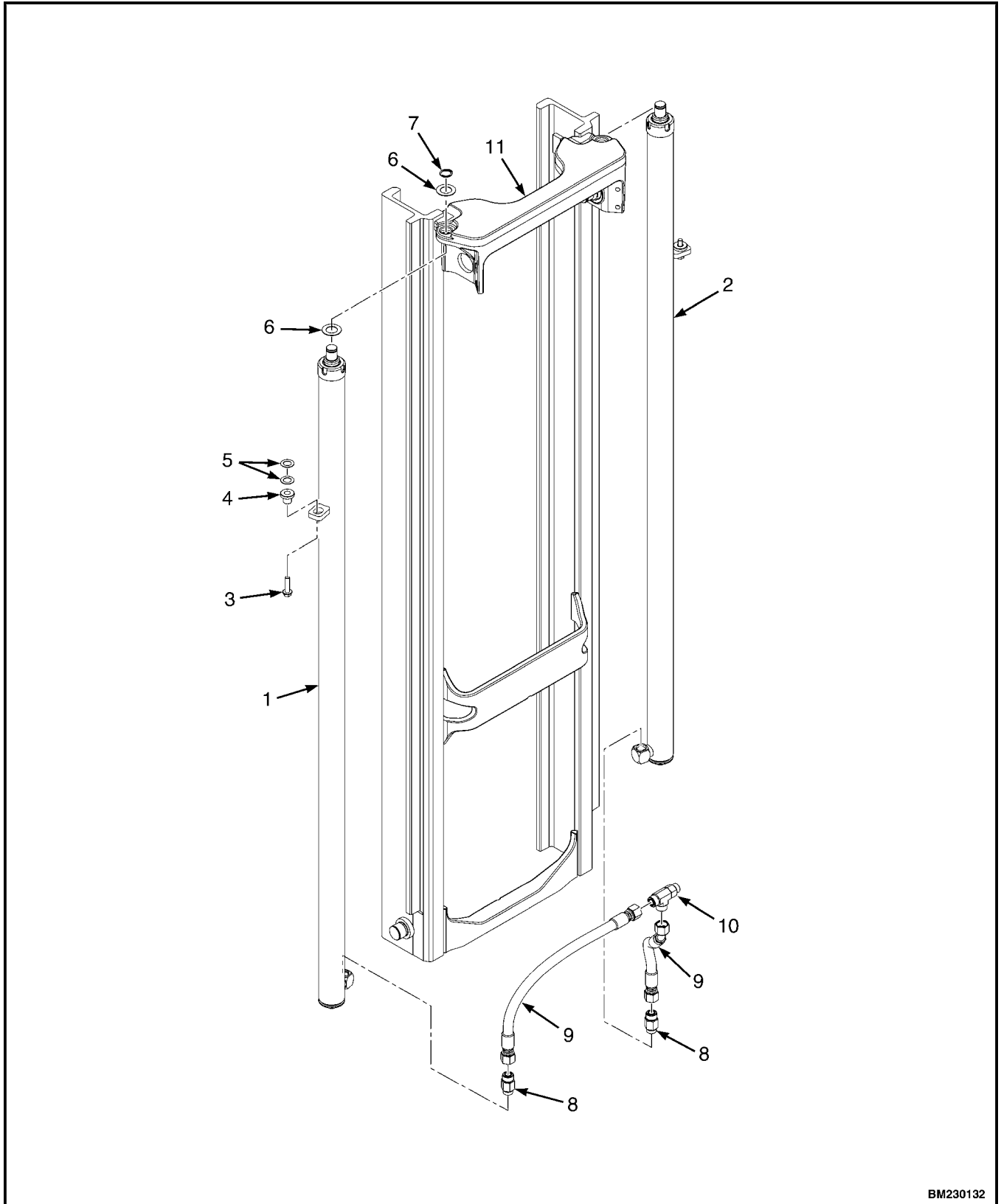
2. Raise the mast until it is almost fully extended. Chain the mast as instructed in the section **Safety Procedures When Working Near Mast**.



WARNING

Be careful when removing or install snap rings. These snap rings can come loose during removal or installation with enough force to cause an injury. Always use the correct snap ring pliers and wear eye and face protection during removal or installation.

3. Remove snap ring and shims (washers) at the top of the main lift cylinders. See Figure 3.



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Figure 3. Main Lift Cylinder, Remove

Legend for Figure 3.

- | | |
|-----------------------------|-----------------------|
| 1. LEFT MAIN LIFT CYLINDER | 7. SNAP RING |
| 2. RIGHT MAIN LIFT CYLINDER | 8. VELOCITY FUSE |
| 3. CAPSCREW | 9. HOSE ASSEMBLY |
| 4. ISOLATOR | 10. HYDRAULIC FITTING |
| 5. WASHER | 11. INNER MAST |
| 6. SHIM (WASHER) | |

**WARNING**

Hydraulic oil is hot after system operation and can cause burns. DO NOT disconnect any hydraulic hoses until the oil in the hydraulic system is cool.

4. Put a drain pan under the area of the hydraulic fittings. Disconnect and cap the hydraulic lines at the cylinder. Retract the rod into the lift cylinder. See Figure 3.
5. Remove the capscrew, washer, and isolator at the mounting plate. Disconnect main lift chain at the mount. See Figure 3.
6. Using a lifting device, remove main lift cylinder from mast.

DISASSEMBLE**CAUTION**

Carefully disassemble the main lift cylinders so the piston rods and sliding surfaces are not damaged.

1. Loosen gland with spanner wrench.
2. Remove gland from cylinder shell. See Figure 4.
3. Remove rod and piston assembly from cylinder shell. Drain hydraulic oil into container.

NOTE: To prevent damage to sealing surfaces, use brass tools when removing seals and O-rings.

4. Remove O-rings, rod seals, backup rings, wiper rings, and wear rings. Discard O-rings, rod seals, and wear rings. See Figure 4.

**WARNING**

Be careful when removing or install snap rings. These snap rings can come loose during removal or installation with enough force to cause an injury. Always use the correct snap ring pliers and wear eye and face protection during removal or installation.

5. Remove snap ring, washer, and check valve from base of piston. See Figure 4.
6. Remove and discard O-ring from check valve. See Figure 4.

NOTE: Perform Step 7 for two-stage LFL mast.

7. Remove wear ring, piston seal, backup ring, and spacer from base of piston. Discard wear ring and piston seal. See Figure 4.

NOTE: Perform Step 8 for three-stage FFL mast.

8. Remove piston ring, wear ring, piston seal, backup ring, and spacer from base of piston. Discard wear ring and piston seal. See Figure 4.
9. Repeat Step 1 through Step 8 for opposite main lift cylinder.

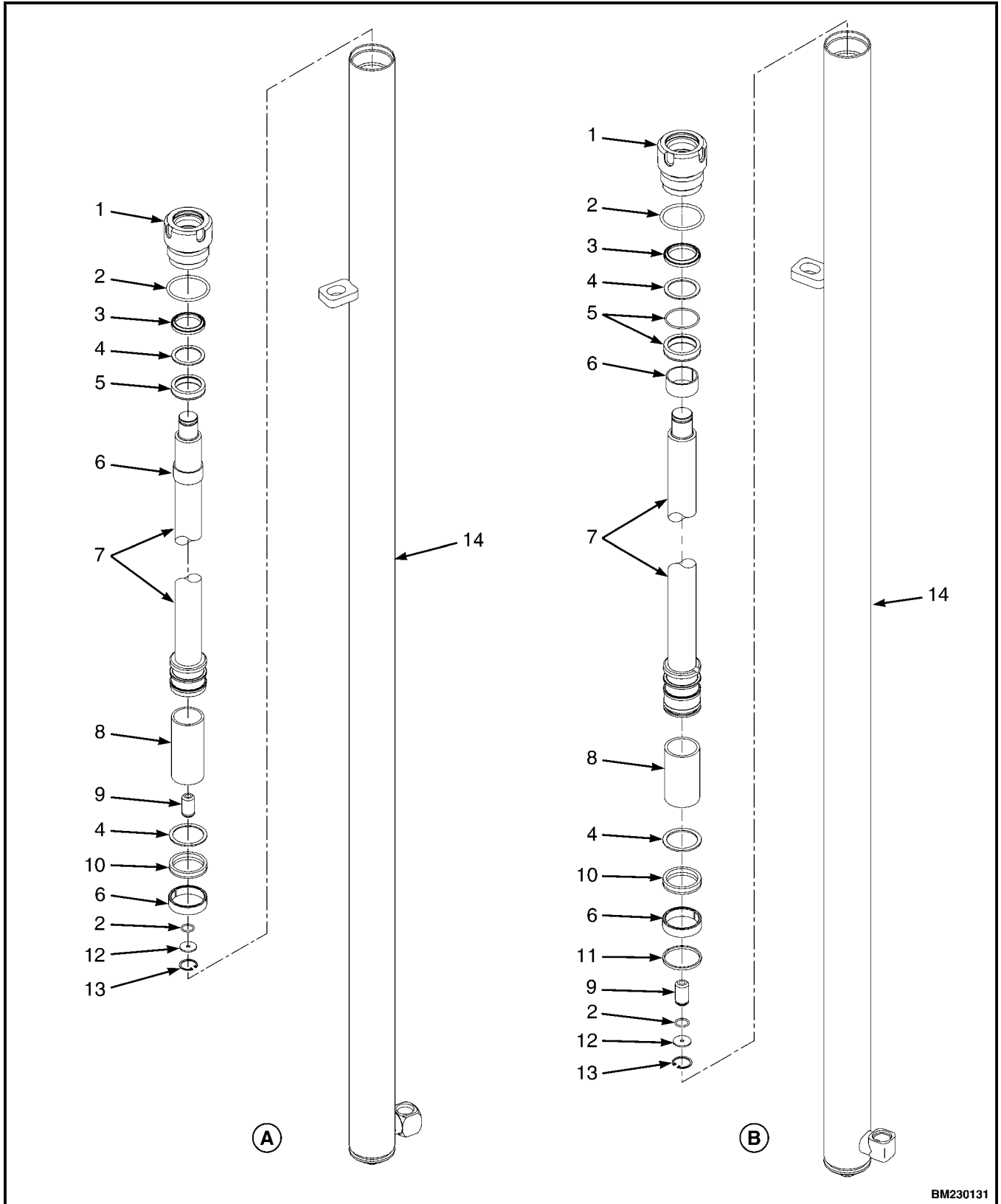


Figure 4. Main Lift Cylinder, Disassemble

Legend for Figure 4.**A. TWO-STAGE LFL MAIN LIFT CYLINDER**

1. GLAND
2. O-RING
3. WIPER RING
4. BACKUP RING
5. ROD SEAL
6. WEAR RING
7. ROD

B. THREE-STAGE FFL MAIN LIFT CYLINDER

8. SPACER
9. CHECK VALVE
10. PISTON SEAL
11. PISTON RING
12. WASHER
13. SNAP RING
14. SHELL

CLEAN**WARNING**

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

**WARNING**

Compressed air can move particles so they cause injury to the user or to other personnel. Make sure the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent injury to the eyes.

**CAUTION**

DO NOT allow cleaning solvent to come in contact with rubber components. It will damage those components.

Clean all metal parts in solvent and dry with compressed air.

INSPECT

NOTE: See the **Parts Manual** for all replacement parts.

- Inspect the gland for damage to the threads and the seal surfaces. If damaged, replace gland.
- Inspect the piston for any damage to the seal surfaces. If damaged, replace piston.
- Inspect the rod for damage to the rod surface and ensure that the rod is not bent. If damaged, replace rod.
- Inspect the inner surface of the cylinder tube for damage. If damaged, replace cylinder assembly.

ASSEMBLE

NOTE: To prevent damage to sealing surfaces, use brass tools when installing seals and O-rings.

1. Lubricate all internal parts of main lift cylinder with clean hydraulic oil. Use new O-rings, seals and wear rings. See Figure 4.
2. Install O-ring on check valve.

**WARNING**

Be careful when removing or installing snap rings. These snap rings can come loose during removal or installation with enough force to cause an injury. Always use the correct snap ring pliers and wear eye and face protection during removal or installation.

3. Install check valve, washer, and snap ring in base of piston. See Figure 4.

NOTE: For two-stage LFL mast, go to Step 4. For three-stage FFL mast, go to Step 5.

4. Install spacer, backup ring, piston seal, and wear ring on rod and piston. See Figure 4.
5. Install spacer, backup ring, piston seal, wear ring, and piston ring on rod and piston. See Figure 4.
6. Push piston and rod assembly into cylinder shell.
7. Install new wear ring, rod seals, backup rings, wiper ring, and O-ring on gland.
8. Install gland into cylinder shell and tighten gland to 340 to 410 N•m (250 to 300 lbf ft).
9. Repeat Step 1 through Step 8 for the opposite main lift cylinder.

INSTALL

1. Using a lifting device, install main lift cylinders in the mounts at the bottom of the outer mast.
2. Install isolator, washer, and capscrew at the mounting plate. Tighten capscrew to 38 N•m (28 lbf ft). See Figure 3.
3. Use a lifting device to lower the inner mast weldment (two-stage LFL mast) or the intermediate mast weldment (three-stage FFL mast) onto the main lift cylinders.
4. Install shims (washers) and snap rings at the top of main lift cylinders. See Figure 3.
5. Uncap hydraulic lines and cylinder ports. Connect hydraulic lines to cylinder ports.



CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

6. Dispose of drain pan contents.
7. Connect main lift chains and adjust as described in the **Mast** service manual listed in the General section of this manual.

MAIN LIFT CYLINDER LEAK CHECK



WARNING

During the test procedures for the hydraulic system, use chains to fasten the load to the carriage to prevent it from falling. Keep all people away from the lift truck during the tests.



WARNING

Do NOT try to find hydraulic leaks by putting your hand on hydraulic components under pressure. Hydraulic oil can be injected into the body by the pressure.

1. Operate hydraulic system. Put capacity load on forks. Use safety chain to hold load to carriage. Raise and lower load several times. Lower load and tilt mast forward and backward several times. Check for leaks.
2. Raise carriage and load 1 m (3 ft). If carriage slowly lowers when control valve is in **NEUTRAL** position, there are leaks in hydraulic system. The maximum speed the carriage is allowed to lower is 50 mm (2 in.) per 10 minutes when hydraulic oil is 30°C (86°F). If oil temperature is 70°C (158°F), the maximum speed the carriage can lower is 150 mm (6 in.) per 10 minutes.
3. Check lift cylinders for internal leaks. Remove load from forks. Install valve in supply line between main control valve and mast. Put capacity load on forks again. Raise carriage 1 m (3 ft). Close valve. If carriage or mast lower slowly, seals in lift cylinders have leaks.
4. If carriage does not move, open valve and check movement again. If carriage lowers when valve is open, check for leaks in hydraulic lines and fittings. If no leaks are found, main control valve can be worn or damaged. Remove load from forks.

Free-Lift Cylinder

REMOVE



WARNING

Before working on the mast, see the section **Safety Procedures When Working Near Mast**.

1. Remove the carriage as described in the carriage removal procedures in the **Mast** service manual listed in the General section of this manual.
2. Lower the mast completely.



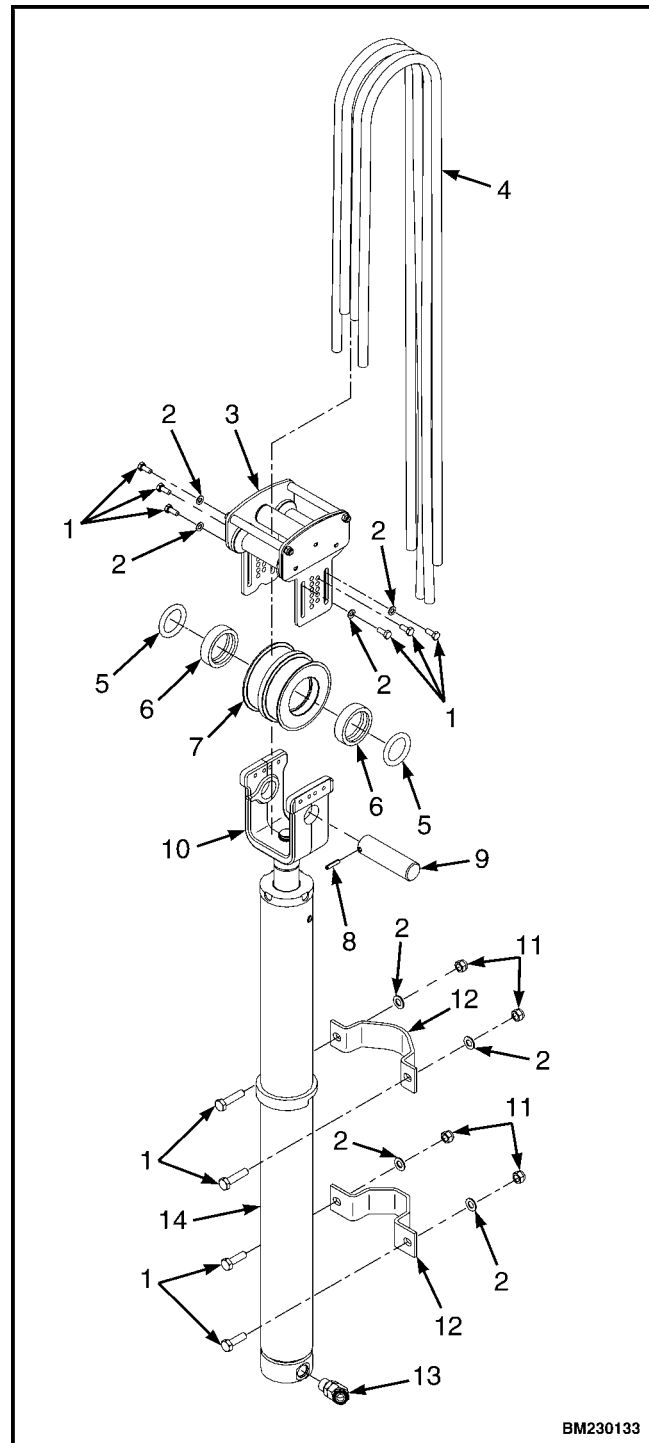
WARNING

Hydraulic oil is hot after system operation and can cause burns. **DO NOT** disconnect any hydraulic hoses until the oil in the system is cool.

3. Put a drain pan under the area of the hydraulic fittings. Disconnect and cap hydraulic line at the free-lift cylinder. See Figure 5.

NOTE: Be sure to tag header hoses prior to disconnecting them to aid in re-connecting.

4. Disconnect and remove header hoses from crosshead plate. See Figure 5.
5. Remove capscrews, washers, and crosshead plate from crosshead. See Figure 5.
6. Remove lift chains from chain sheaves.
7. Remove capscrews, washers, nuts, and clamps from free-lift cylinder and mast. See Figure 5.
8. Using a lifting device, remove free-lift cylinder from mast.
9. Remove roll pin, pin, and chain sheaves from crosshead. See Figure 5.
10. Remove crosshead from free-lift cylinder rod. See Figure 5.
11. If necessary, remove spacers and ball bearings from chain sheave. See Figure 5.



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Figure 5. Free-Lift Cylinder, Remove

Legend for Figure 5.

1. CAPSCREW
2. WASHER
3. CROSSHEAD PLATE
4. HEADER HOSE
5. SPACER
6. BALL BEARING
7. CHAIN SHEAVE
8. ROLL PIN
9. PIN
10. CROSSHEAD
11. NUT
12. CLAMP
13. HYDRAULIC FITTING
14. FREE-LIFT CYLINDER

DISASSEMBLE

NOTE: To prevent damage to sealing surfaces, use brass tools when removing and installing seals and O-rings.

NOTE: Perform only those steps below required to repair the free-lift cylinder.

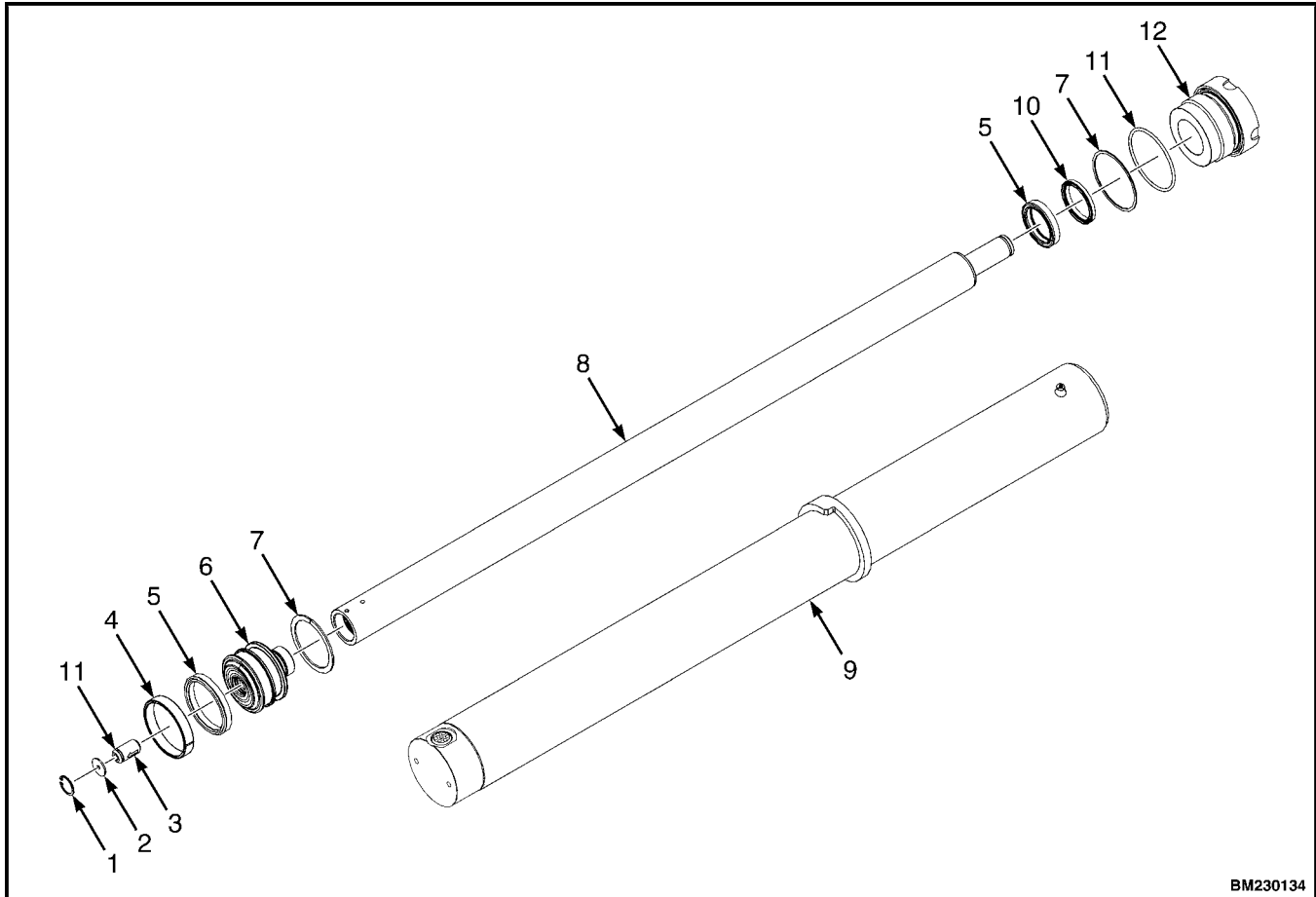
1. Loosen gland with spanner wrench.

2. Remove gland from shell. See Figure 6.
3. Remove rod and piston assembly from shell. Drain hydraulic oil into a container.
4. Remove and discard rod seal, rod wiper, backup ring, and O-ring from gland. See Figure 6.

**WARNING**

Be careful when removing or installing snap rings. These snap rings can come loose during removal or installation with enough force to cause an injury. Always use the correct snap ring pliers and wear eye and face protection during removal or installation.

5. Remove snap ring, washer, check valve, wear ring, rod seal, and backup ring from piston. Discard snap ring, wear ring, rod seal, and backup ring. Remove and discard O-ring from check valve. See Figure 6.



- | | |
|----------------|-----------------------|
| 1. SNAP RING | 7. BACKUP RING |
| 2. WASHER | 8. FREE-LIFT CYLINDER |
| 3. CHECK VALVE | 9. SHELL |
| 4. WEAR RING | 10. ROD WIPER |
| 5. ROD SEAL | 11. O-RING |
| 6. PISTON | 12. GLAND |

Figure 6. Free-Lift Cylinder, Disassemble

CLEAN**WARNING**

Cleaning solvents can be flammable and toxic and cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

**WARNING**

Compressed air can move particles so they cause injury to the user or to other personnel. Make sure the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent injury to the eyes.

**CAUTION**

DO NOT allow cleaning solvent to come in contact with rubber components. It will damage those components.

Clean all metal parts in solvent and dry with compressed air.

INSPECT

NOTE: See the **Parts Manual** for all replacement parts.

- Inspect the gland for damage to the threads and the seal surfaces. If damaged, replace gland.
- Inspect the piston for any damage to the seal surfaces. If damaged, replace piston.
- Inspect the rod for damage to the rod surface and ensure the rod is not bent. If damaged, replace rod.
- Inspect the inner surface of the cylinder tube for damages. If damaged, replace free-lift cylinder assembly.

ASSEMBLE

NOTE: To prevent damage to sealing surfaces, use brass tools when removing and installing seals and O-rings.

1. Lubricate all internal parts of the free-lift cylinder with clean hydraulic oil. Use new O-rings, seals, and wear rings. See Figure 6.

2. Install new O-ring on check valve. Install check valve in the base of the piston. Be sure arrow on check valve is pointing towards base of piston. Install washer and snap ring in the base of the pinon. See Figure 6.

**CAUTION**

A difficult and important step in assembling the free-lift cylinder is the correct installation of seals. Most free-lift cylinder repairs are caused by seal leaks. DO NOT damage any parts during assembly.

3. Install new backup ring, rod seal, and wear ring on the piston assembly. See Figure 6.
4. Carefully push the piston and rod assembly into the shell. See Figure 6.
5. Install rod wiper into the gland. Install new O-ring, backup ring, and rod seal on the outside of gland. See Figure 6.

**CAUTION**

Additives may damage the hydraulic system. Before using additives, contact your local Yale dealer.

NOTE: Hydraulic oil is poured into the free-lift cylinder to act as a cushion during load lifting to prevent damage to the cylinder.

6. Before installing the gland, pour 150 cc (5 oz) of hydraulic oil into the free-lift cylinder shell.
7. Install the gland on the piston rod and tighten to 475 to 540 N•m (350 to 400 lbf ft).

INSTALL

1. If chain sheave was disassembled, install ball bearings and spacers. See Figure 5.
2. Install chain sheave into crosshead.
3. Install pin through chain sheave, then install roll pin. See Figure 5.

NOTE: When installing the free-lift cylinder to the inner mast crossmembers, the nuts are installed on the clamp side of the free-lift cylinder. See Figure 5.

4. Using a lifting device, install free-lift cylinder, two clamps, four washers, capscrews, and nuts onto inner mast. Tighten capscrews 53 N•m (39 lbf ft). See Figure 5.
5. Install lift chains to chain sheaves and chain anchors.
6. Install crosshead plate washers and capscrews to crosshead. Tighten capscrews to 18 N•m (159 lbf in). See Figure 5.
7. Install header hoses to free-lift cylinder. See the **Mast** service manual listed in the General section of this manual. for procedures.

**CAUTION**

Disposal of lubricants and fluids must meet local environmental regulations.

8. Uncap hydraulic line and cylinder port. Connect hydraulic line to free-lift cylinder. Dispose of drain pan contents.
9. Install carriage. See the **Mast** service manual listed in the General section of this manual. for procedures.

Tilt Cylinder Repair

REMOVE**WARNING**

Before removing the tilt cylinder(s), tilt the mast forward. Use a chain to hold the mast to the frame to prevent the mast from moving forward.

**WARNING**

DO NOT push the anchor pins out of the rod end with your fingers and cause serious injury to hand and fingers. DO NOT permit the tilt cylinder to drop and cause damage to lift truck and/or tilt cylinders.

1. At the mast end, remove capscrew and retainer from anchor pin. Using a drift pin or similar tool, push anchor pin out of rod end.
See Figure 8 for lift trucks equipped with tilt cylinders without boots.
2. Stroke tilt cylinders to the full back tilt position.
3. Disconnect hydraulic line at tilt cylinder. Install cap on hydraulic line and in cylinder port.

4. Remove nut, capscrew, and washer from rod end on mast end of truck.

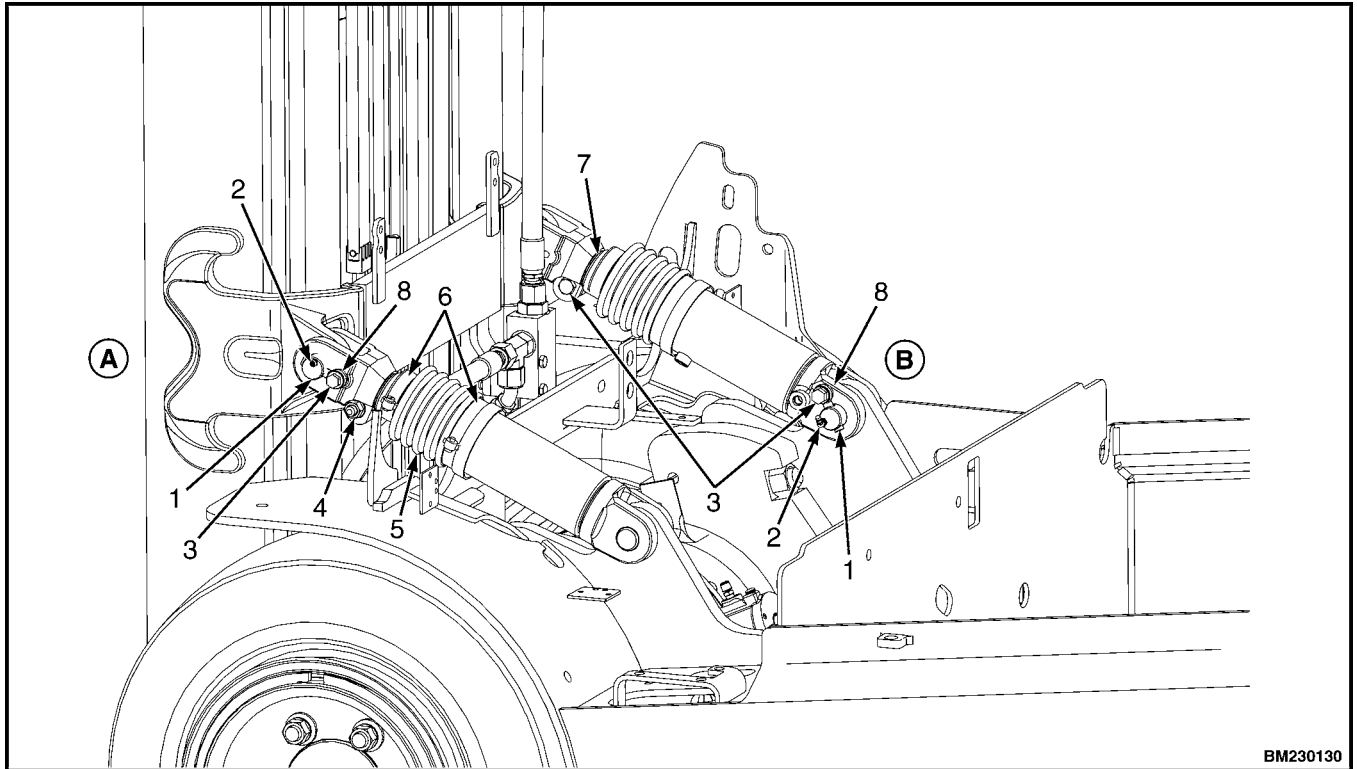
**WARNING**

DO NOT push the anchor pins out of the rod end with your fingers and cause serious injury to hand and fingers. DO NOT permit the tilt cylinder to drop and cause damage to lift truck and/or tilt cylinders.

5. Use a lifting device to hold tilt cylinder. At the truck end, remove capscrew and retainer from anchor pin. Using a drift pin, or similar tool, push anchor pin out of lift truck frame.

See Figure 7 for lift truck models ERP22-35VL (ERP045-070VL) (A976) equipped with tilt cylinders with optional boots.

See Figure 8 for lift trucks equipped with tilt cylinders without boots.
6. Using lifting device, remove tilt cylinder from lift truck.
7. If necessary, repeat Step 1 through Step 6 for other tilt cylinder.



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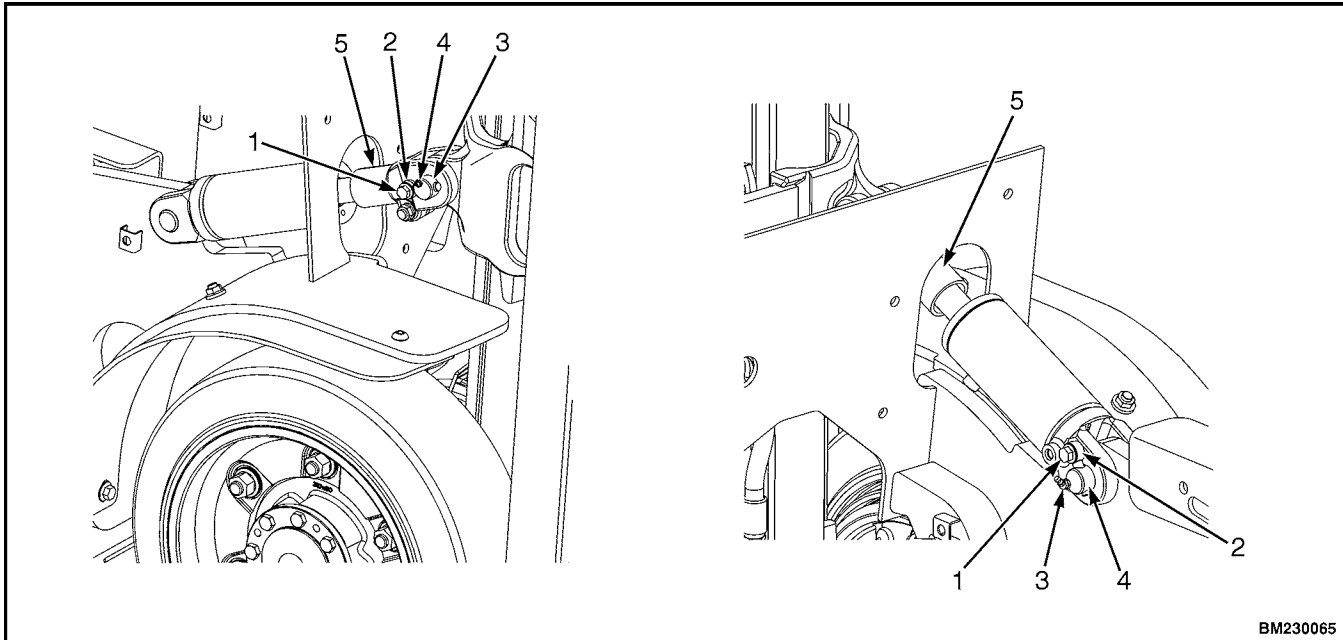
A. MAST END

B. TRUCK END

- 1. ANCHOR PIN
- 2. GREASE FITTING
- 3. CAPSCREW
- 4. NUT

- 5. BOOT
- 6. CLAMP
- 7. SPACER
- 8. RETAINER

Figure 7. Remove, Tilt Cylinder With Boot, Lift Truck Models ERP22-35VL (ERP045-070VL) (A976)



BM230065

NOTE: HYDRAULIC HOSES NOT SHOWN FOR CLARITY.

- | | |
|------------------------|----------------|
| 1. CAPSCREW | 4. ANCHOR PIN |
| 2. RETAINER | 5. TILT SPACER |
| 3. LUBRICATION FITTING | |

Figure 8. Remove, Tilt Cylinder Without Boot

DISASSEMBLE

NOTE: The following steps have detailed disassembly instructions. Perform only those steps required to repair the tilt cylinder.

NOTE: Note position of rod end and the number of turns used to remove it from rod.

1. Place tilt cylinder in a soft-jaw vise.
 - a. **Tilt Cylinder equipped with optional boot:** Remove rod end and, if equipped, shims. Remove two clamps and boot from tilt cylinder. Remove tilt spacer from rod. See Figure 7.
 - b. **Tilt cylinder not equipped with optional boot:** Remove rod end and, if equipped, tilt spacer from rod end. See Figure 8.
2. Using a pin-type spanner wrench, remove gland from rod and shell.
3. Remove rod and piston assembly from shell. See Figure 9.

NOTE: To prevent damage to sealing surfaces, use brass tools when removing seals and O-rings.

4. Remove and discard O-ring, backup ring, seal, and rod wiper from gland. See Figure 9.

NOTE: Perform Step 5 only if piston or rod has been damaged.

5. Place rod in a soft-jaw vise and remove nut and piston from rod. See Figure 9.

NOTE: Perform the following step for lift truck models

ERC22-30VG (ERC045-55VG) (A968)

ERP22-25VL (ERP045-050VL) (A976)

GLC20-25VX (GC/GLC040-050VX, GC/GLC055SVX) (A910, B910, C910)

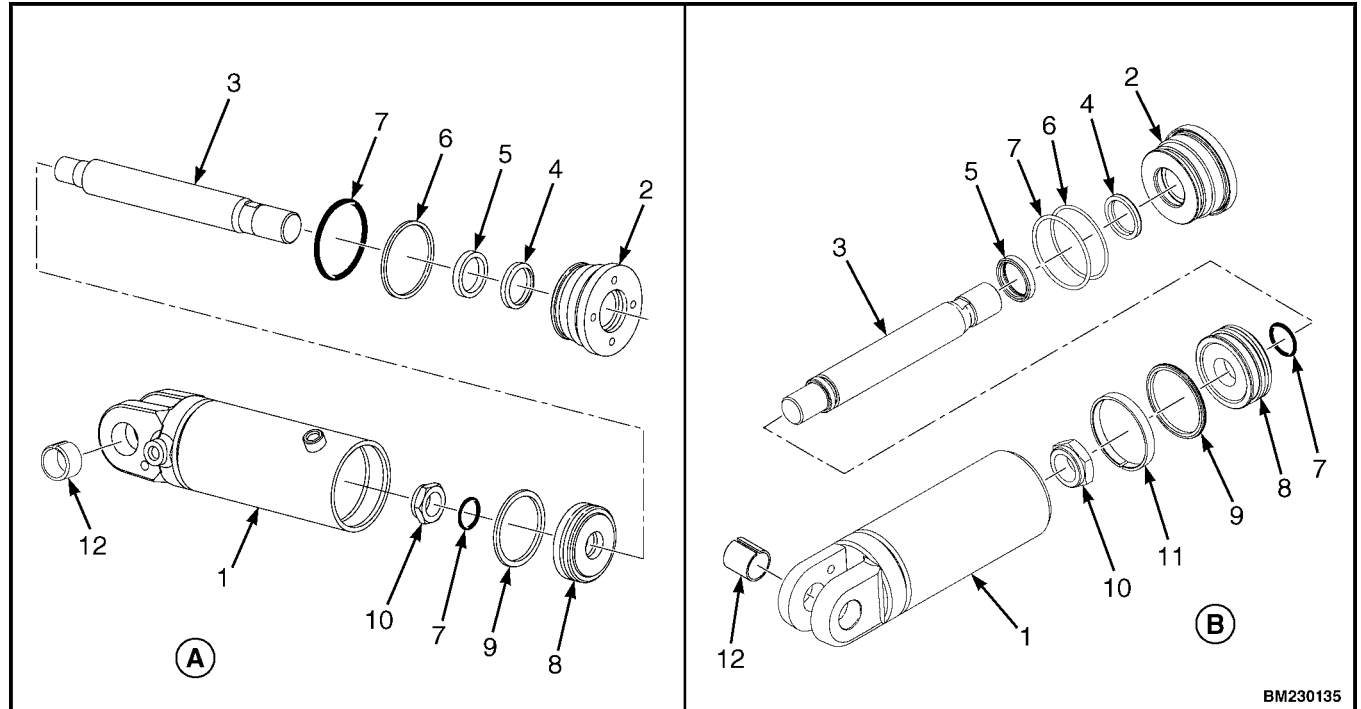
GLP/GDP20-25VX (GP/GLP/GDP040-050VX) (B875, C875, D875)

6. Remove and discard O-ring and piston seal from piston. See Figure 9.

NOTE: Perform the following step for lift truck models
 ERC32-35VG (ERC060-070VG) (A968)
 ERP32-35VL (ERP060-070VL) (A976)
 GLC30-35VX (GC/GLC060-070VX) (A910,
 B910, C910)

GLP/GDP30-35VX (GP/GLP/GDP060-070VX)
 (B875, C875, D875)

7. Remove and discard O-ring, piston seal, and wear ring from piston. See Figure 9.



- A. TILT CYLINDER FOR LIFT TRUCK MODELS ERC22-30VG (ERC045-055VG) (A968), ERP22-25VL (ERP045-050VL) (A976), GLC20-25VX (GC/GLC040-050VX, GC/GLC055SVX) (A910, B910, C910), AND GLP/GDP20-25VX (GP/GLP/GDP040-050VX) (B875, C875, D875)
- B. TILT CYLINDER FOR LIFT TRUCK MODELS ERC32-35VG (ERC060-070VG) (A968), ERP32-35VL (ERP060-070VL) (A976), GLC30-35VX (GC/GLC060-70VX) (A910, B910, C910), AND GLP/GDP30-35VX (GP/GLP/GDP060-070VX) (B875, C875, D875)

- | | |
|----------------|----------------|
| 1. SHELL | 7. O-RING |
| 2. GLAND | 8. PISTON |
| 3. ROD | 9. PISTON SEAL |
| 4. ROD WIPER | 10. NUT |
| 5. SEAL | 11. WEAR RING |
| 6. BACKUP RING | 12. BUSHING |

Figure 9. Disassemble Tilt Cylinder

CLEAN**WARNING**

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

**WARNING**

Compressed air can move particles so they cause injury to the user or to other personnel. Make sure the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent injury to the eyes.

**CAUTION**

DO NOT allow cleaning solvent to come in contact with rubber components. It will damage those components.

Clean all metal parts in solvent and dry with compressed air.

INSPECT

NOTE: See the **Parts Manual** for all replacement parts.

- Inspect gland for damage to the threads and the sealing surface. Replace gland if damaged.
- Inspect piston for damage to the seal surfaces. Replace piston if damaged.
- Inspect rod for damage to the rod surface and ensure rod is not bent. Replace rod if damaged.
- Inspect inner surface of cylinder tube for damage. If tube is found to be damaged, replace the cylinder.
- Inspect bushings for damage. If damaged, replace bushings.

ASSEMBLE

NOTE: To prevent damage to sealing surfaces, use brass tools when installing seals and O-rings.

NOTE: Lubricate new seals, O-rings, and rings with clean hydraulic oil before installation.

NOTE: Perform the following step for lift truck models

ERC22-30VG (ERC045-055VG) (A968)
ERP22-25VL (ERP045-050VL) (A976)

GLC20-25VX (GC/GLC040-050VX, GC/GLC055SVX) (A910, B910, C910)

GLP/GDP20-25VX (GP/GLP/GDP040-050VX) (B875, C875, D875)

1. Install new piston seal and O-ring on piston. See Figure 9.

NOTE: Perform the following step for lift truck models

ERC22-30VG (ERC045-055VG) (A968)

ERP22-25VL (ERP045-050VL) (A976)

GLC20-25VX (GC/GLC040-050VX, GC/GLC055SVX) (A910, B910, C910)

GLP/GDP20-25VX (GP/GLP/GDP040-050VX) (B875, C875, D875)

2. Install new wear ring, piston seal and O-ring on piston. See Figure 9.

NOTE: Perform Step 3 only if piston was removed from rod.

3. Place rod in a soft-jaw vise and lube the threads of the nut with clean hydraulic oil. Install piston and nut on rod. Tighten nut to 170 to 220 N•m (125 to 162 lbf ft).
4. Install new rod wiper, seal, backup ring, and O-ring on gland. See Figure 9.
5. Install rod and piston assembly into shell. Using a pin-type spanner wrench, install gland onto rod in shell.
6. Tighten gland to 170 to 237 N•m (125 to 175 lbf ft) for lift truck models
 - ERC22-30VG (ERC045-055VG) (A968)
 - ERP22-25VL (ERP045-050VL) (A976)
 - GLC20-25VX (GC/GLC040-050VX, GC/GLC055SVX) (A910, B910, C910)
 - GLP/GDP20-25VX (GP/GLP/GDP040-050VX) (B875, C875, D875)

Tighten gland to 400 to 500 N•m (295 to 370 lbf ft) for lift truck models

 - ERC32-35VG (ERC060-070VG) (A968)
 - ERP32-35VL (ERP060-070VL) (A976)
 - GLC30-35VX (GC/GLC060-70VX) (A910, B910, C910)
 - GLP/GDP30-35VX (GP/GLP/GDP060-070VX) (B875, C875, D875)

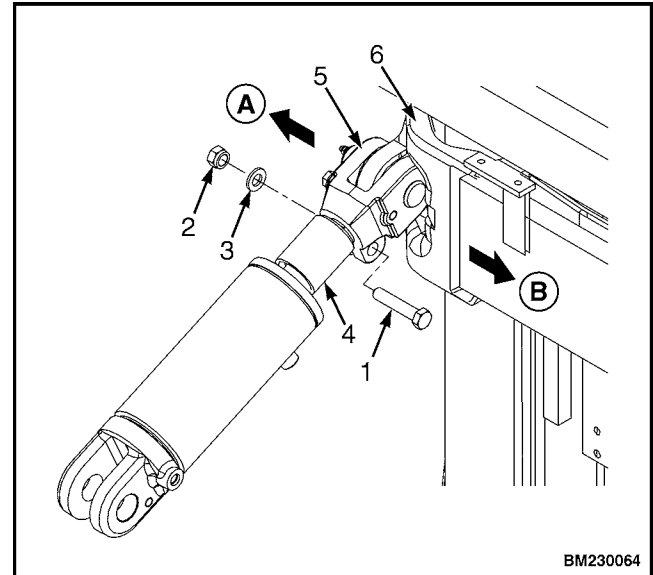
7. Place cylinder in a soft-jaw vise.
 - a. **Tilt cylinder not equipped with boot:** Install tilt spacer, if equipped, and rod end on rod as noted during removal. See Figure 8.
Lubricate threads on capscrew with lubricant (Yale P/N 504234269) . Install capscrew in rod end so that capscrew head is on the inboard side of rod end. Install washer and nut on capscrew. Washer and nut must be on outboard side of rod end. Tighten nut to 90 N•m (66 lbf ft). See Figure 10.
 - b. **Tilt Cylinder equipped with optional boot:** Install tilt spacer tight against rod end. Install tilt cylinder boot with air holes on the bottom. Install tilt cylinder boot to tilt cylinder and tilt spacer using two clamps. See Figure 7.
Lubricate threads on capscrew with lubricant (Yale P/N 504234269) . Install capscrew in rod end so that capscrew head is on the inboard side of rod end. Install washer and nut on outboard side of rod end. Tighten nut to 90 N•m (66 lbf ft). See Figure 10.
8. Repeat Step 1 through Step 7 for the opposite tilt cylinder.

INSTALL

1. Using a lifting device, place cylinder in mounting position on lift truck frame.

NOTE: Lubricate threads on capscrew that secures rod end to piston with lubricant, (Yale P/N 504234269) .

2. Install anchor pin, retainer, and capscrew.
3. Install rod end to mast with washer, capscrew, and nut. Tighten capscrew to 38 N•m (28 lbf ft).
See Figure 7 for lift truck models ERP22-35VL (ERP045-070VL) (A976) equipped with tilt cylinders with optional boots
See Figure 8
4. Connect hydraulic lines to tilt cylinder. Slowly stroke tilt cylinders until rod holes line up with mast tilt anchor holes.



NOTE: LEFT TILT CYLINDER WITHOUT BOOT SHOWN. TILT CYLINDERS WITH OPTIONAL BOOT INSTALLED IN SAME WAY.

- A. OUTBOARD SIDE OF ROD END
B. INBOARD SIDE OF ROD END

1. CAPSCREW
2. NUT
3. WASHER
4. TILT SPACER
5. ROD END
6. MAST END MOUNT

Figure 10. Install Rod End

5. Install anchor pin and retainer on tilt anchor.
See Figure 7 for lift truck models ERP22-35VL (ERP045-070VL) (A976) equipped with tilt cylinders with optional boots
See Figure 8 for lift trucks equipped with tilt cylinders without boots
6. Repeat Step 1 through Step 5 for opposite tilt cylinder.
7. Remove chain holding mast to lift truck frame.



WARNING

DO NOT put hands between the cylinder rod end and the mast. Serious injury can occur.

8. Operate tilt cylinders and check for correct operation and leakage.

- a. **Tilt cylinders equipped with optional boot:** Check that there is no slippage at boot collars when mast tilts forward and backward.
- b. **All tilt cylinders:** Adjust the tilt cylinders. See section Tilt Cylinder Adjustment for procedures.
- f. Tilt the mast fully backwards and measure the tilt angle. See the Nameplate for tilt angles. If necessary, adjust both rod ends equally for the correct angle.
- g. After adjustments are complete, tighten nuts on rod end to 90 N•m (66 lbf ft).

TILT CYLINDER ADJUSTMENT

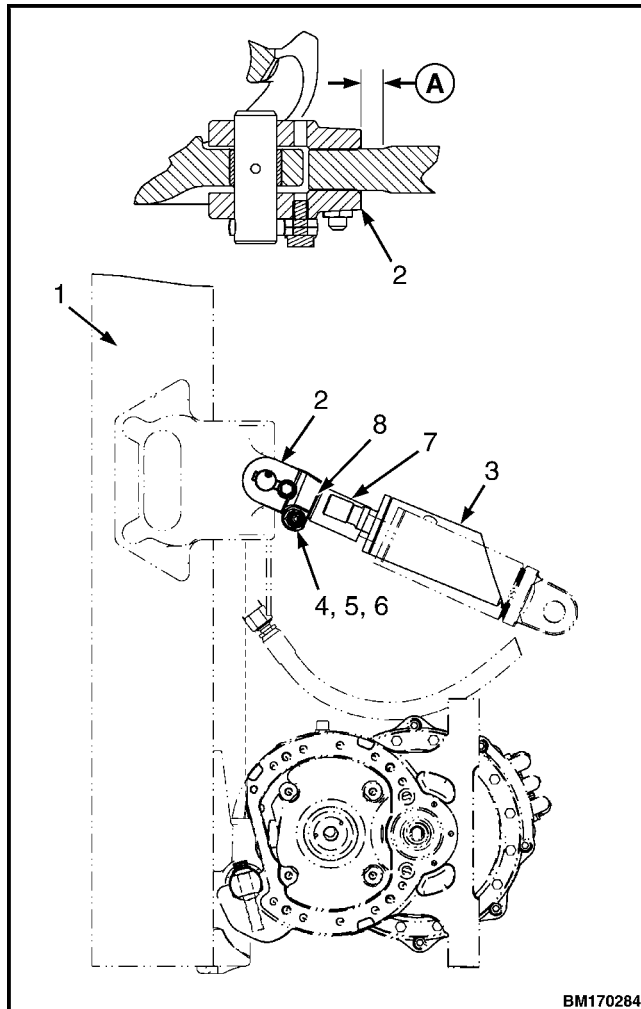


WARNING

When the tilt cylinders have tilt limit spacers, make sure they are installed during the assembly procedures. Without tilt limit spacers, the mast can tilt too much and cause an accident or serious injury.

Check the tilt cylinder stroke by slowly tilting the mast forward and backward several times. Both tilt cylinders must stop their stroke at the same time. Adjust the rod ends as shown in Figure 11. There must be no twist in the mast weldments.

1. Adjust the stroke of the tilt cylinders **WITHOUT** tilt limit spacers as follows:
 - a. Adjust the rod ends to 20 mm (0.80 in.).
 - b. Slowly tilt the mast backwards until one cylinder rod stops. On the opposite cylinder rod, loosen the capscrews on the rod end.
 - c. Measure the distance from the end of the cylinder to the back end of the rod end.
 - d. Use a wrench and turn the cylinder rod **IN** until the dimension starts to decrease, then stop.
 - e. Repeat Step b through Step d until both cylinder rods stop at the same position within 0.5 mm (0.02 in.).
2. Adjust the stroke of the tilt cylinders **WITH** tilt limit spacers as follows:
 - a. Adjust the rod ends to 20 mm (0.80 in.).
 - b. Slowly tilt the mast forward until one cylinder rod stops. On the opposite cylinder rod, loosen the capscrews on the rod end.
 - c. Use a wrench and turn the cylinder rod **IN** as necessary.
 - d. Repeat Step b and Step c until both cylinder rods stop at the same position within 0.5 mm (0.02 in.).
 - e. Slowly tilt the mast backward until one rod end just contacts the spacer. Add shims to fill the gap at the opposite rod end until both rod ends contact the spacers within 0.5 mm (0.02 in.).
 - f. Tilt the mast fully forward and measure the tilt angle. See the Nameplate for tilt angles. If necessary, add an equal number of shims to both rods for the correct angle.
 - g. After adjustments are complete, tighten nuts on rod end to 90 N•m (66 lbf ft).



NOTE: TILT CYLINDER WITHOUT BOOT SHOWN.
TILT CYLINDER WITH BOOT IS SIMILAR.

A. DIMENSION A = 20 mm (0.80 in.)

1. MAST
2. ROD END
3. TILT CYLINDER
4. WASHER
5. CAPSCREW
6. NUT
7. TILT LIMIT SPACER
8. SHIMS

Figure 11. Tilt Cylinder Adjustment

TILT CYLINDER LEAK CHECK



WARNING

Never allow anyone under a raised carriage. **DO NOT** put any part of your body in or through the lift mechanism unless all parts of the mast are completely lowered and the key switch or keyless switch is turned OFF.



WARNING

DO NOT try to find hydraulic leaks by putting your hand on hydraulic components under pressure. Hydraulic oil can be injected into the body by the pressure.

1. Put a capacity load on the forks. Use a safety chain to hold the load to the carriage. See Safety Procedures When Working Near Mast. Raise the load approximately 2.5 m (8 ft). Put the mast in a vertical position.
2. Measure the distance that one of the rods for the tilt cylinders extends from the shell. Check the distance the rod move in five or ten minutes. Multiply the rate in Table 1 by the time of the test and compare the numbers.
3. If the tilt rate is greater than the specifications shown in Table 1, lower the mast and remove the load from the forks. Install a gate valve between the port at the front of the tilt cylinder and the hydraulic line. The gate valve must be able to completely shut off the flow of hydraulic oil.
4. Put the load on the forks again. Close the gate valve.
5. Tilt the mast forward just past the vertical position.
6. If the mast continues to tilt slowly forward, the seals on the piston are leaking and need to be replaced. See the **Parts Manual** for replacement parts.
7. If the mast does not move, open the gate valve and check the movement again. If the mast moves forward when the gate valve is open, check for leaks in the hydraulic lines and fittings.

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