

SERVICE MANUAL

C-Series ***Fork Positioner***

Manual Number 6009757

cascade[®]

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1.1

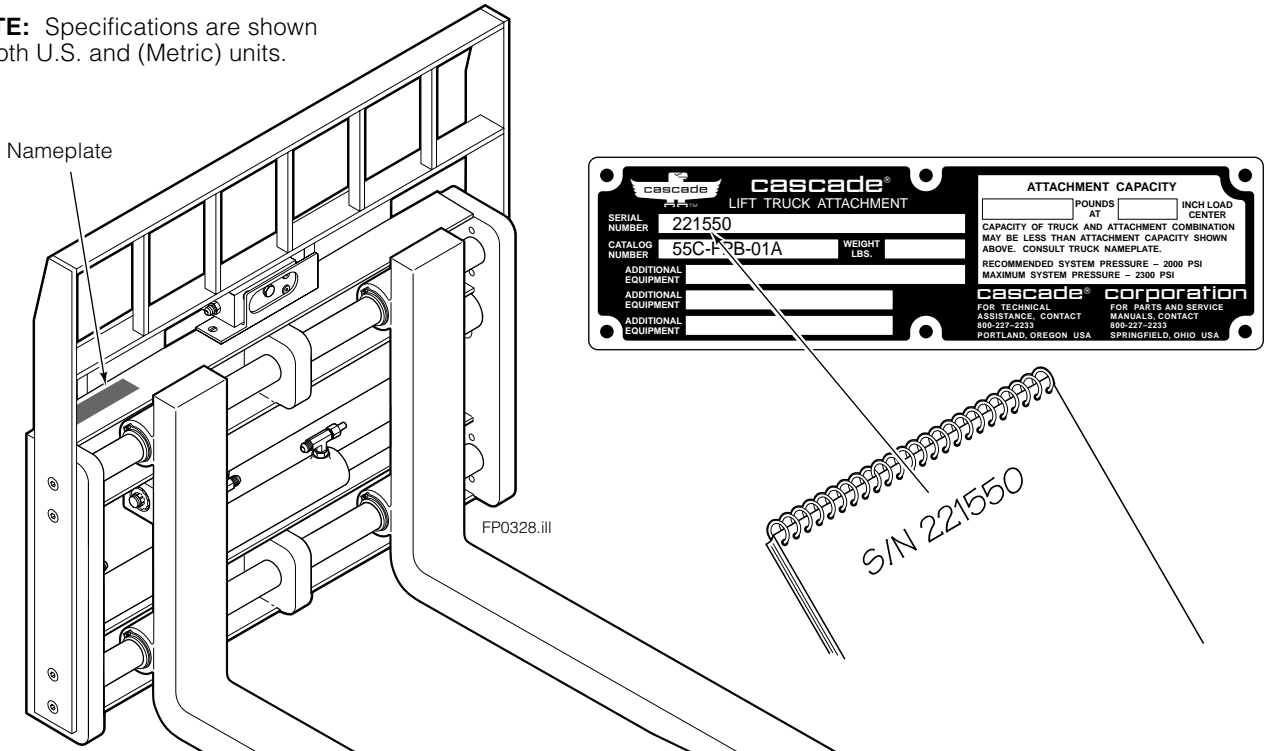
Introduction

This Manual provides the Installation Instructions, Periodic Maintenance, Troubleshooting, Service and Specifications for Cascade C-Series Fork Positioners.

In any communication about the Fork Positioner, refer to the product I.D. number stamped on the nameplate as shown. If the nameplate is missing, the numbers can be found stamped on the back of the baseplate.

IMPORTANT: All hoses, tubes and fittings on C-Series Fork Positioners are JIC.

NOTE: Specifications are shown in both U.S. and (Metric) units.



1.2

Special Definitions

The statements shown appear throughout this Manual where special emphasis is required. Read all WARNINGS and CAUTIONS before proceeding with any work. Statements labeled IMPORTANT and NOTE are provided as additional information of special significance or to make the job easier.



WARNING - A statement preceded by WARNING is information that should be acted upon to prevent **bodily injury**. A WARNING is always inside a ruled box.

CAUTION - A statement preceded by CAUTION is information that should be acted upon to prevent machine damage.

IMPORTANT - A statement preceded by IMPORTANT is information that possesses special significance.

NOTE - A statement preceded by NOTE is information that is handy to know and may make the job easier.

2.1

Truck System Requirements

C-Series Fork Positioners will provide maximum operating capability when the following requirements are met.



WARNING: Rated capacity of the truck/attachment combination is a responsibility of the original truck manufacturer and may be less than that shown on the attachment nameplate. Consult the truck nameplate.

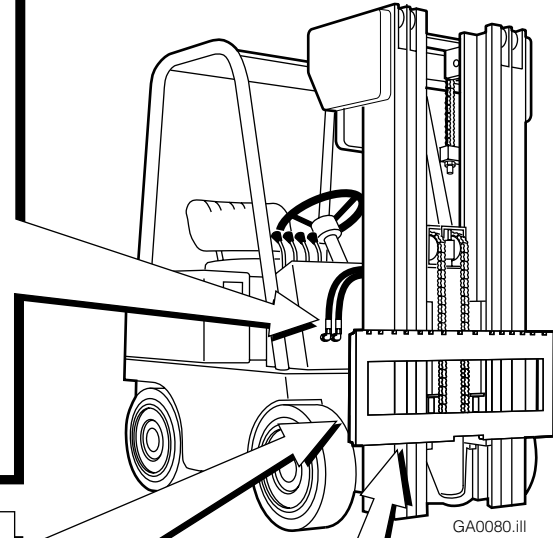
Truck Relief Setting

2000 psi (140 bar) Recommended
2300 psi (160 bar) Maximum

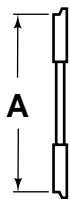
Truck Flow Volume ^①

	Min. ^②	Recommended	Max. ^③
55C, 100C, 120C, 150C	5 GPM (19 L/min.)	7 GPM (26 L/min.)	10 GPM (38 L/min.)

- ① Cascade C-Series Fork Positioners are compatible with SAE 10W petroleum base hydraulic fluid meeting Mil. Spec. MIL-0-5606 or MIL-0-2104B. Use of synthetic or aqueous base hydraulic fluid is not recommended. If fire resistant hydraulic fluid is required, special seals must be used. Contact Cascade.
- ② Flow less than recommended will result in slow and unequal fork movement.
- ③ Flow greater than maximum can result in excessive heating, reduced system performance and reduced hydraulic system life.



GA0080.iii



Carriage Mount Dimension (A) ITA (ISO)

	Minimum	Maximum
Class II	14.96 in. (380.0 mm)	15.00 in. (381.0 mm)
Class III	18.68 in. (474.5 mm)	18.74 in. (476.0 mm)
Class IV	23.44 in. (595.5 mm)	23.50 in. (597.0 mm)

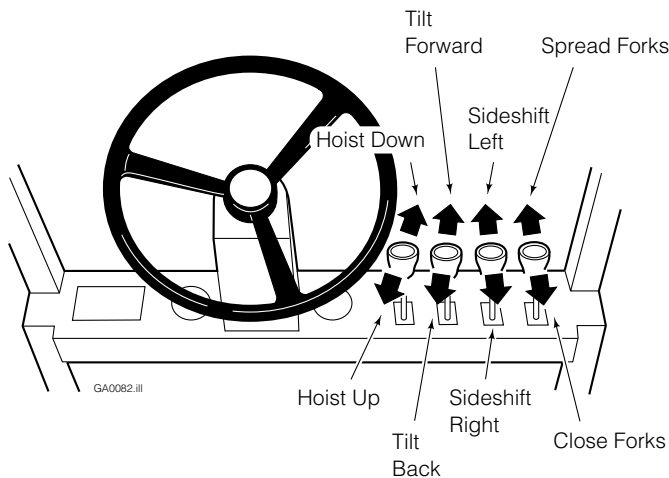
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Carriage

Clean and inspect carriage bars for damage and smoothness. Repair any protruding welds or damaged notches.

Auxiliary Valve Functions

Check for compliance with ITA (ISO) standards:



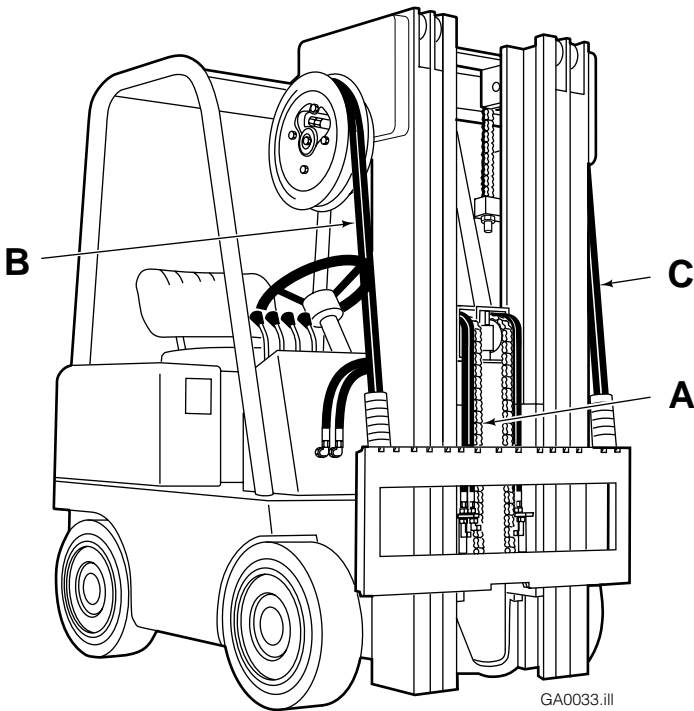
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2.2

Recommended Hydraulic Supply Options

C-Series Fork Positioners can be operated with any of the hydraulic supply arrangements shown below. Refer to *Cascade Hose & Cable Reel Selection Guide*, Part No. 212199, to select the correct hose reel for the mast and truck. Hose and fitting requirements are as follows:

- All hoses and fittings for the fork-positioning and sideshifting (if equipped) functions should be at least **No. 6** with 9/32 in. (7 mm) minimum I.D.



Non-Sideshifting

A Mast Single Internal Reaving

OR

B RH THINLINE™ 2-Port Hose Reel Group

Sideshifting

A Mast Double Internal Reaving

OR

A and B Mast Single Internal Reaving and RH THINLINE™ 2-Port Hose Reel Group

OR

B and C RH and LH THINLINE™ 2-Port Hose Reel Groups

Solenoid Adaption

A and B Mast Single Internal Reaving and RH Cable Reel Group

OR

B RH 6-N-1 Cable/Hose Reel Group

2.3 Installation Procedure

Follow the steps shown to install the Fork Positioner on the truck. Read and understand all **WARNING** and **CAUTION** statements. If you don't understand a procedure, ask your supervisor, or call the nearest Cascade Service Department for assistance.

1 Attach overhead hoist

A Remove banding.

B Attach hoist to top of backrest as shown and lift Attachment into vertical position on pallet. Use wood blocking as required to stabilize Attachment.

C Remove bolt-on lower mounting hooks (if equipped).

WARNING: Make sure overhead hoist has a rated capacity of at least 2000 lbs. (910 kg.)

2 Unlock Quick-Change lower mounting hooks (if equipped)

- A** Remove pin and drop hooks into unlocked position.
- B** Re-install pin in lower hole.

NOTE: Guides can be reversed to reduce hook-to-carriage clearance (See lower hook installation, Step 6).

5/8-in. (16 mm) offset on top provides max. clearance.

Tighten Capscrews:
Class II / III Mounting – 165 ft.-lbs. (225 Nm)
Class IV Mounting – 190 ft.-lbs. (255 Nm)

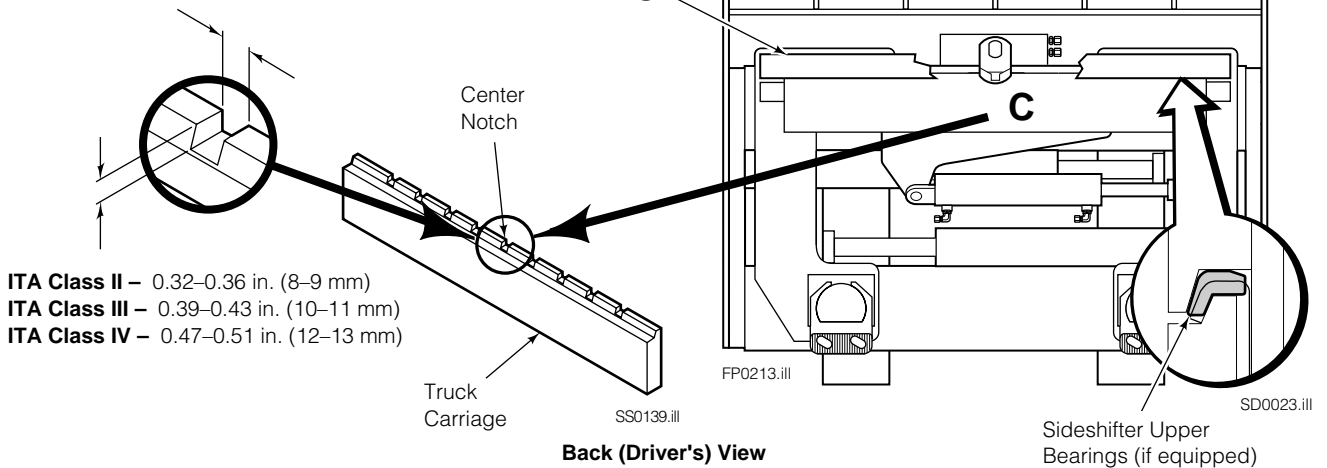
3 Mount Fork Positioner on truck

- A** Center truck behind Attachment.
- B** Hang Attachment onto truck carriage, or raise carriage into upper hooks (see inset).
- C** Engage upper mounting hooks or sideshifting full-length upper hook. **IMPORTANT:** If sideshifter equipped, assure upper bearings are installed properly and centering tab engages center notch on truck carriage bar.

ITA Class II – 0.60–0.66 in. (15–17 mm)

ITA Class III – 0.72–0.78 in. (18–20 mm)

ITA Class IV – 0.72–0.78 in. (18–20 mm)



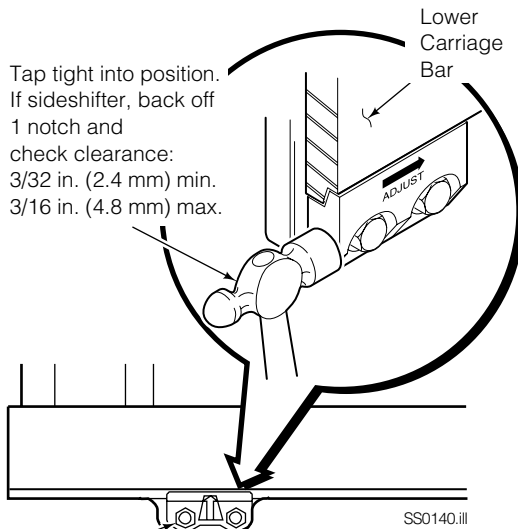
ITA Class II – 0.32–0.36 in. (8–9 mm)

ITA Class III – 0.39–0.43 in. (10–11 mm)

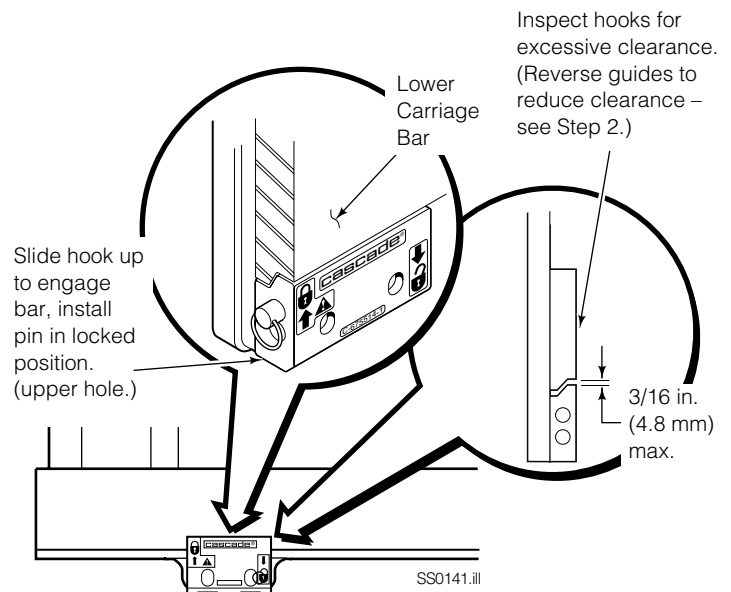
ITA Class IV – 0.47–0.51 in. (12–13 mm)

4 Install or engage lower hooks

BOLT-ON TYPE



QUICK-DISCONNECT TYPE (optional)



Tighten Capscrews:

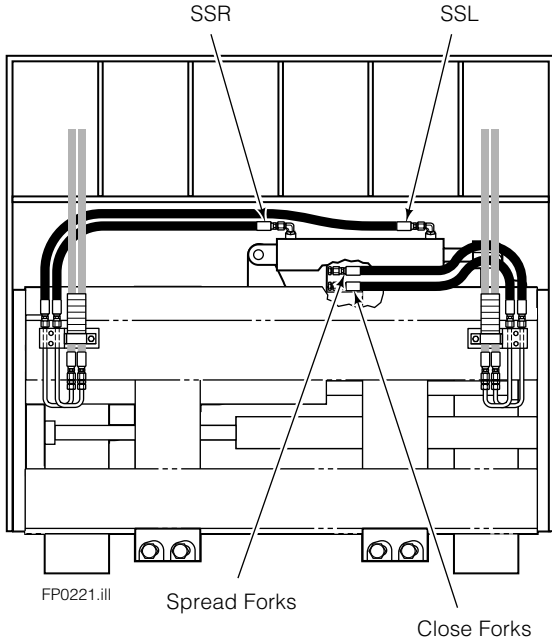
Class II, III Mounting – 165 ft.-lbs. (225 Nm)

Class IV Mounting – 190 ft.-lbs. (255 Nm)

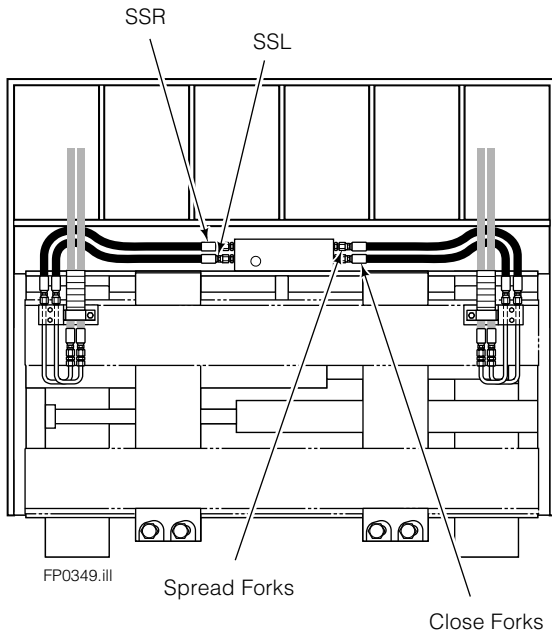
5 Prepare hoses

- A** Determine hose lengths required for hydraulic supply configuration of truck.
- B** Cut hoses to length and install end fittings or quick-disconnect kits.

HOSE REELS – 55C Frame Sideshifting

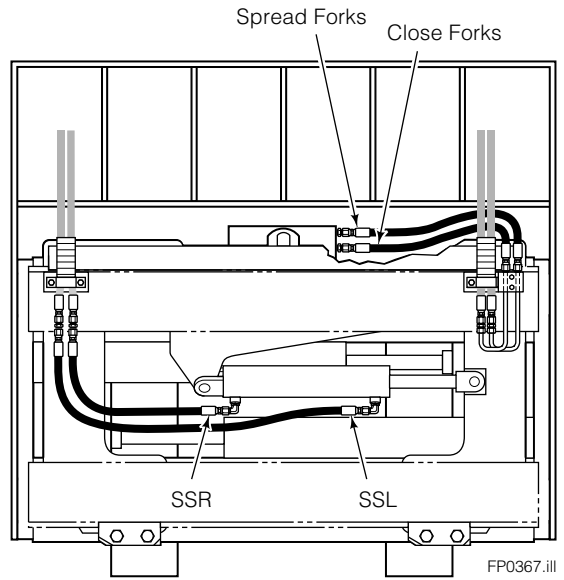


HOSE REELS – 55C Internal Sideshifting

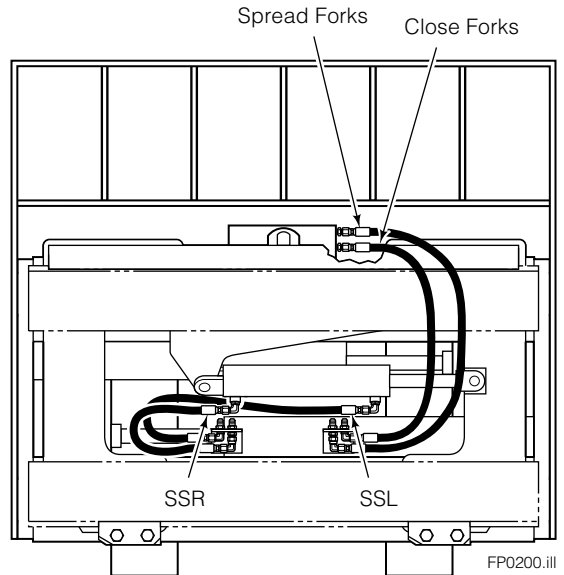


Back (Driver's) Views

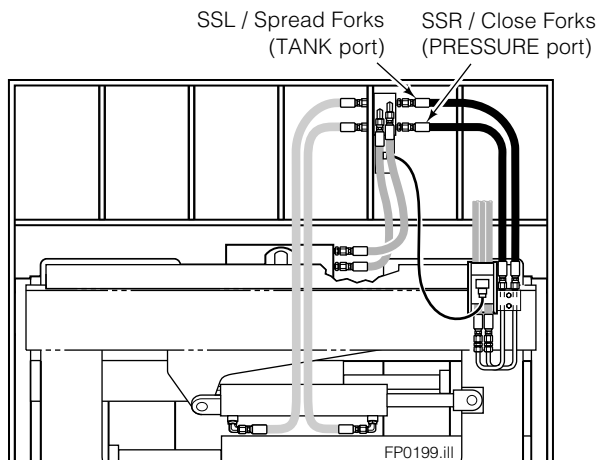
HOSE REELS – 100C, 120C, 150C



INTERNAL HOSE REEVING – 100C, 120C, 150C



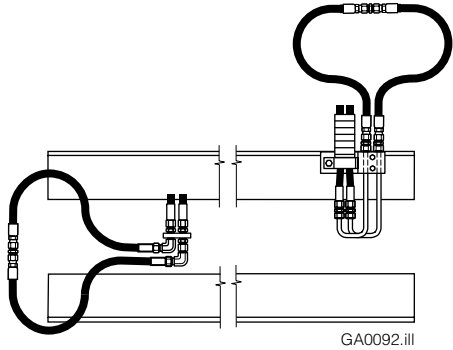
SOLENOID – 6-N-1 CABLE/HOSE REEL



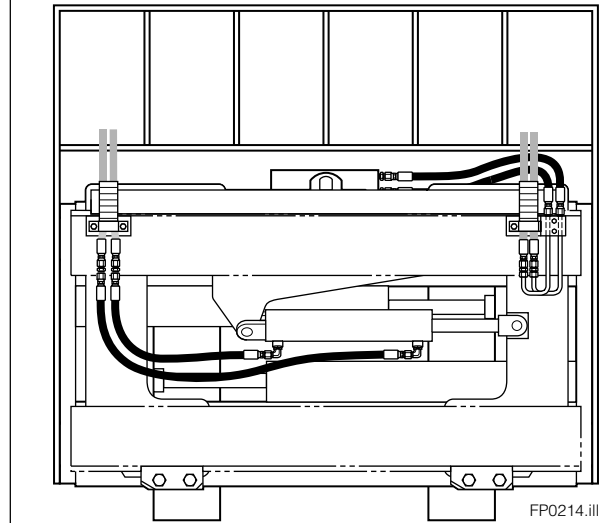
INSTALLATION

6 Flush hydraulic supply hoses

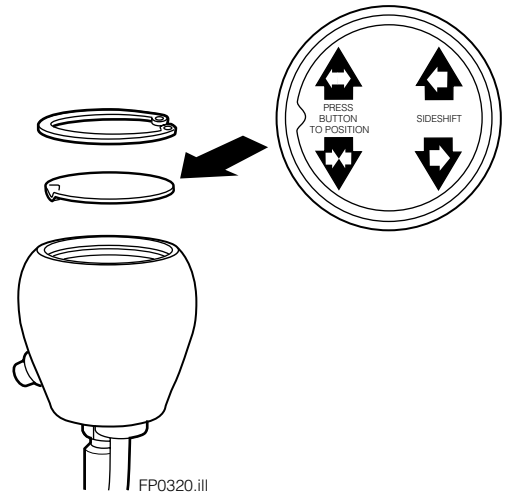
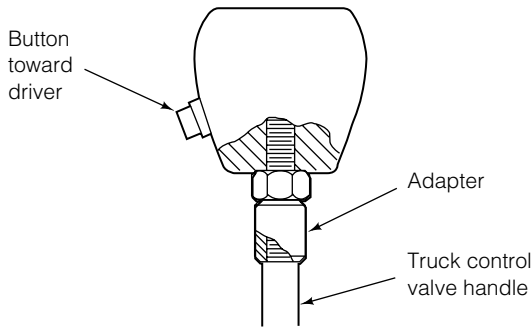
- A** Install hoses to hose terminals on carriage. Connect using union fittings.
- B** Operate auxiliary valves for 30 sec.
- C** Remove union fittings.



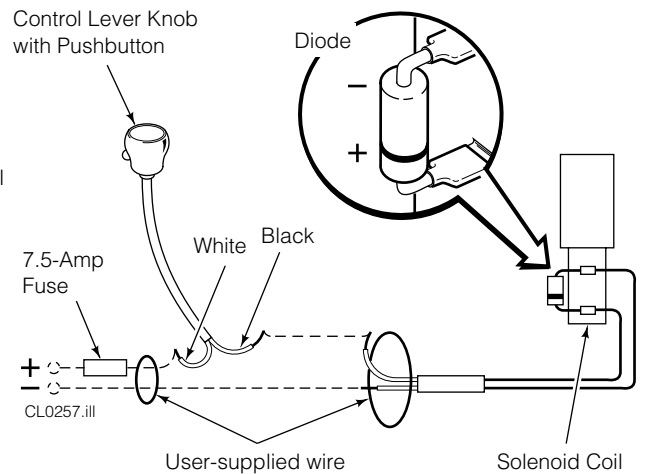
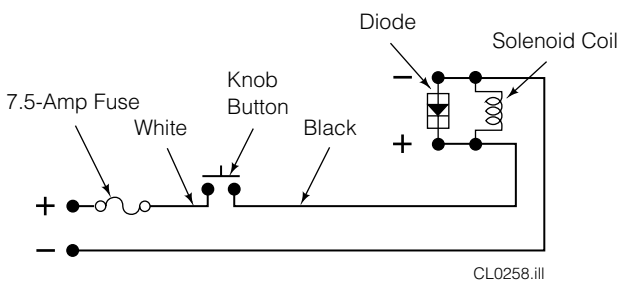
7 Connect hoses prepared in Step 5 to Attachment



8 Install solenoid control knob – (Solenoid-equipped units)



9 Install wiring – (Solenoid-equipped units)

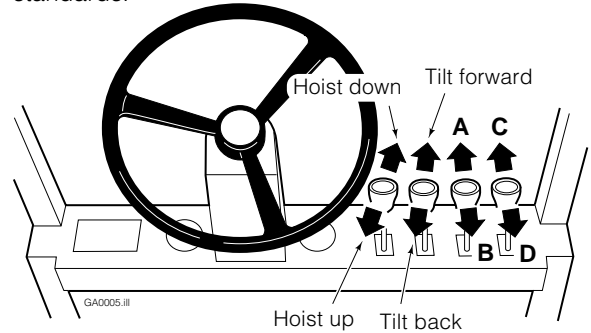


10 Cycle Fork Positioner functions

- Spread forks and close forks several times. Sideshift (if equipped) left and right. Check for smoothness and equal movement.
- Check for operation in accordance with ITA (ISO) standards.
- Check for leaks at fittings, valve, cylinders.

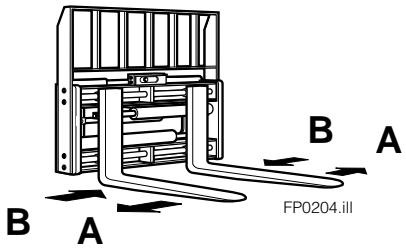
AUXILIARY VALVE FUNCTIONS

Check for compliance with ITA (ISO) standards:



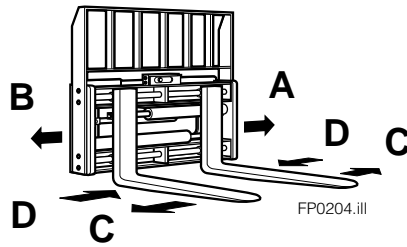
NON-SIDESHIFTING

- A** Spread Forks
- B** Close Forks



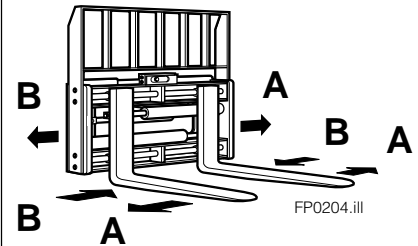
SIDESHIFTING

- A** Sideshift Left
- B** Sideshift Right
- C** Spread Forks
- D** Close Forks



SIDESHIFTING WITH SOLENOID VALVE

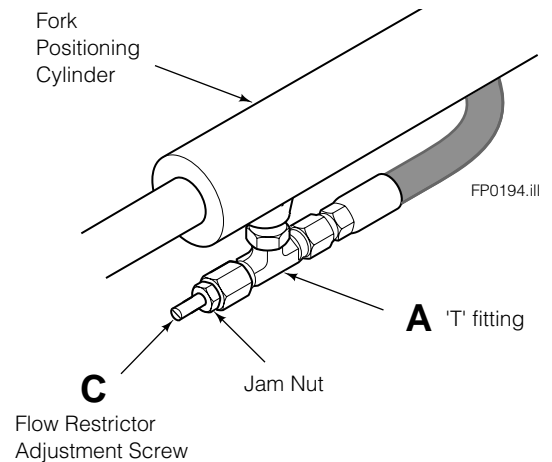
- A** Sideshift Left
- A** Spread Forks (press knob button)
- B** Sideshift Right
- B** Close Forks (press knob button)



11 Adjust forks for equal movement (if required)

NOTE: Attachment is Factory-adjusted for equal fork movement when operated at recommended pressure and flow rate.

- A** Locate cylinder 'T' fittings with flow restrictor adjustment. Loosen jam nuts and screw both flow restrictors in until they bottom. Screw each restrictor out (CCW) three turns.
- B** Spread forks fully, then close. Look for unequal fork movement.
- C** On faster fork (one that bottoms first), screw flow restrictor in (CW) 1/2-turn.
- D** Repeat Steps B and C until fork movement is equal. Tighten jam nuts.



Front View



WARNING: After completing any service procedure, always test each function through five complete cycles. First test with no load, then test with a load to make sure the attachment operates correctly before returning it to the job.

3.1 100-Hour Maintenance

Every time the lift truck is serviced or every 100 hours of truck operation, whichever comes first, complete the following maintenance procedures on the Fork Positioner:

- Check for loose or missing bolts, worn or damaged hoses and hydraulic leaks.

3.2 500-Hour Maintenance

After each 500 hours of truck operation, in addition to the 100-hour maintenance, perform the following procedures:

- Tighten lower mounting hook capscrews:
 - Class II, III Mounting** – 165 ft.-lbs. (225 Nm)
 - Class IV Mounting** – 190 ft.-lbs. (255 Nm)
- Apply chassis grease to fork bearing grease fittings.
- Apply chassis grease to fork cylinder rod anchors.
- Apply chassis grease to sideshifter (if equipped) upper bearing grease fittings and lower flat bearings.

3.3 1000-Hour Maintenance

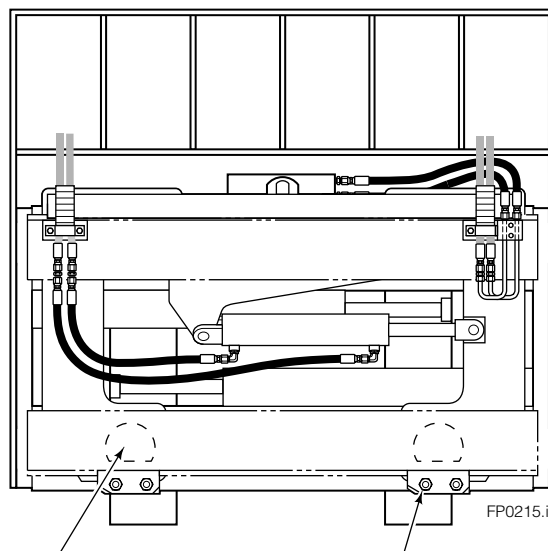
After each 1000 hours of truck operation, in addition to the 100 and 500-hour maintenance, perform the following procedures:

- Inspect forks for wear. Cascade Fork Safety Kit 3014162 is available for this procedure.
- Inspect fork bearings for wear and replace if necessary.
- Inspect fork cylinder rod anchors for wear and replace if necessary.
- Inspect sideshifter (if equipped) upper and lower bearings for wear and replace if necessary.

3.4 2000-Hour Maintenance

After each 2000 hours of truck operation, in addition to the 100, 500 and 1000-hour maintenance, perform the following procedures:

- Replace fork bearings (see Section 5.2-3).
- Replace upper and lower sideshifter bearings (if equipped). See Section 5.6.



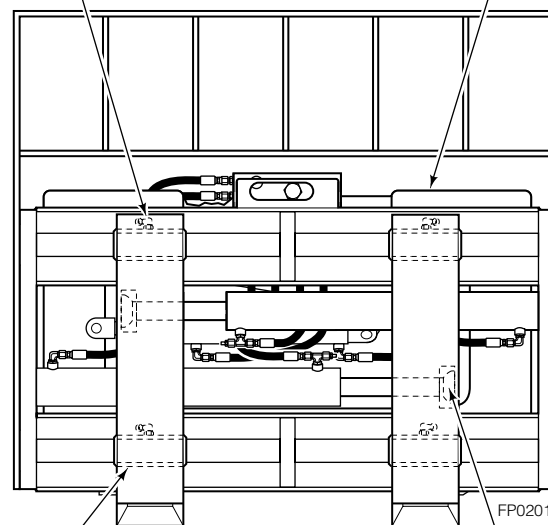
Sideshifter
Lower Bearings (2)

Lower Mounting Hook
Capscrews (4)

Back (Driver's) View

Fork Bearing
Grease Fittings (4)

Sideshifter Upper Bearing
Grease Fittings (2)
(sideshift to expose fittings)



Fork
Bearings (4)

Cylinder Rod
Anchors (2)

Front View

4.1 General Procedures

4.1-1 Truck System Requirements

- Truck hydraulic pressure should be within the range shown in Specifications, Section 6.1. **PRESSURE TO THE FORK POSITIONER MUST NOT EXCEED 2300 psi (160 bar).**
- Truck hydraulic flow should be within the range shown in Specifications, Section 6.1.
- Hydraulic fluid supplied to the Fork Positioner must meet the requirements shown in Specifications, Section 6.1.



WARNING: Before servicing any hydraulic component, relieve pressure in the Attachment system. Turn the truck off and move the truck auxiliary control lever several times in both directions.

After completing any service procedure, always test the Attachment through several cycles. First test empty to bleed any air trapped in the system to the truck tank. Then test with a load to assure that the Attachment operates correctly before returning to the job. Stay clear of the load while testing. Do not raise the load more than 4 in. (10 cm) off the floor while testing.

4.1-2 Tools Required

In addition to a normal selection of hand tools, the following are required:

- 20 GPM (75 L/min) inline flow meter. (Cascade Flow Meter Kit, part no. 671477.)
- 3000 psi (200 bar) pressure gauge. (Cascade Pressure Gauge Kit, part no. 671212.)
- Assorted fittings, drain hoses and quick-disconnects as required.

4.1-3 Troubleshooting Chart

Determine All The Facts – It is important to gather all the facts about the problem before beginning any service procedures. The first step is to talk to the equipment operator. Ask for a complete description of the malfunction. Guidelines below and on the following pages can then be used as a starting point to begin troubleshooting.

Fork Positioning Circuit

- Forks have uneven travel.
- Forks move slowly.
- Forks will not move.

To correct these problems, see Section 4.3.

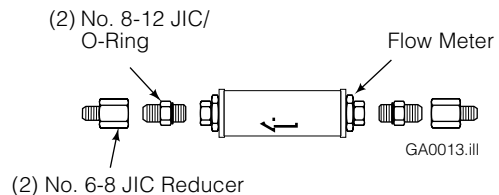
NOTE: Some Fork Positioners have a regenerative hydraulic circuit that causes the forks to open at a faster speed than when closing. This is a normal function.

Sideshift Circuit

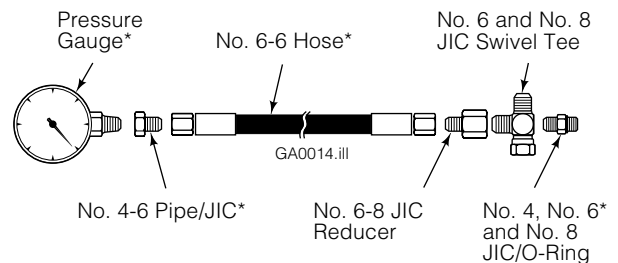
- Forks sideshift left and right at different speeds.
- Forks will not sideshift.

To correct these problems, see Section 4.4.

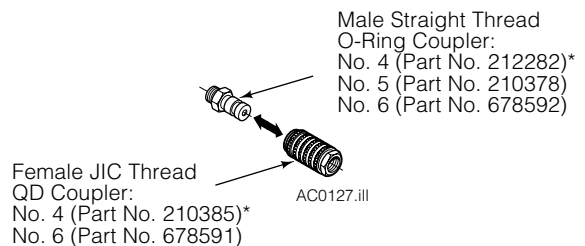
Flow Meter Kit 671477



Pressure Gauge Kit 671212



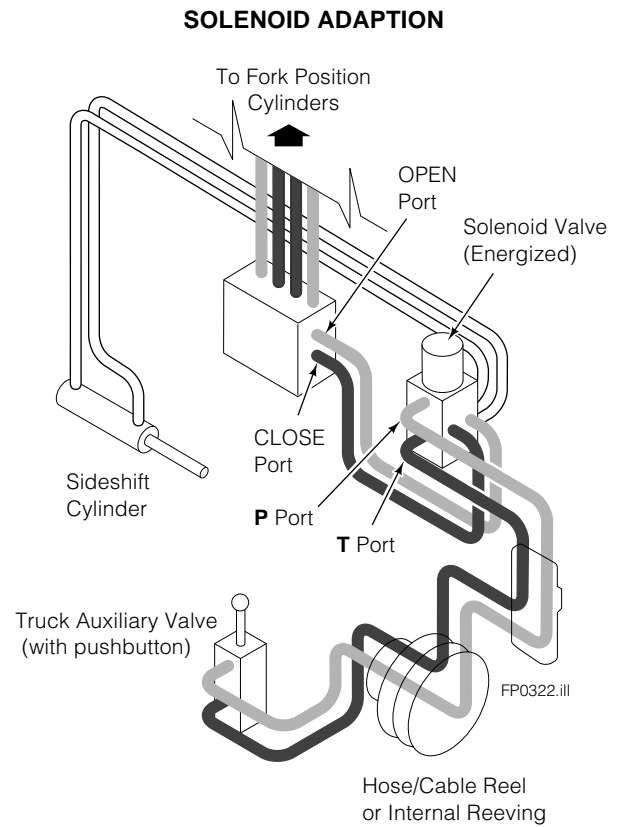
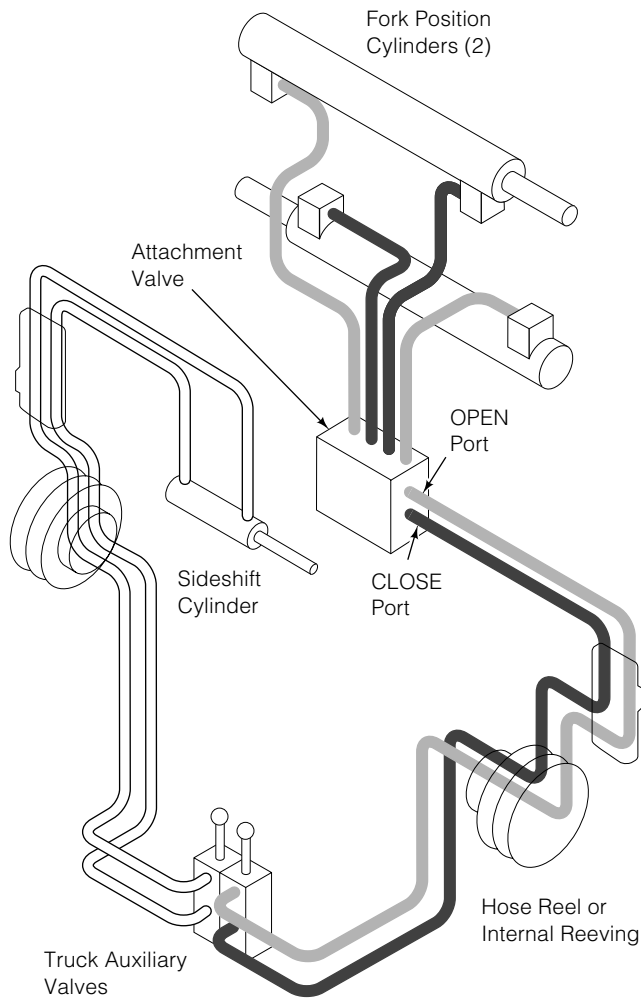
Diagnostic Quick-Disconnects



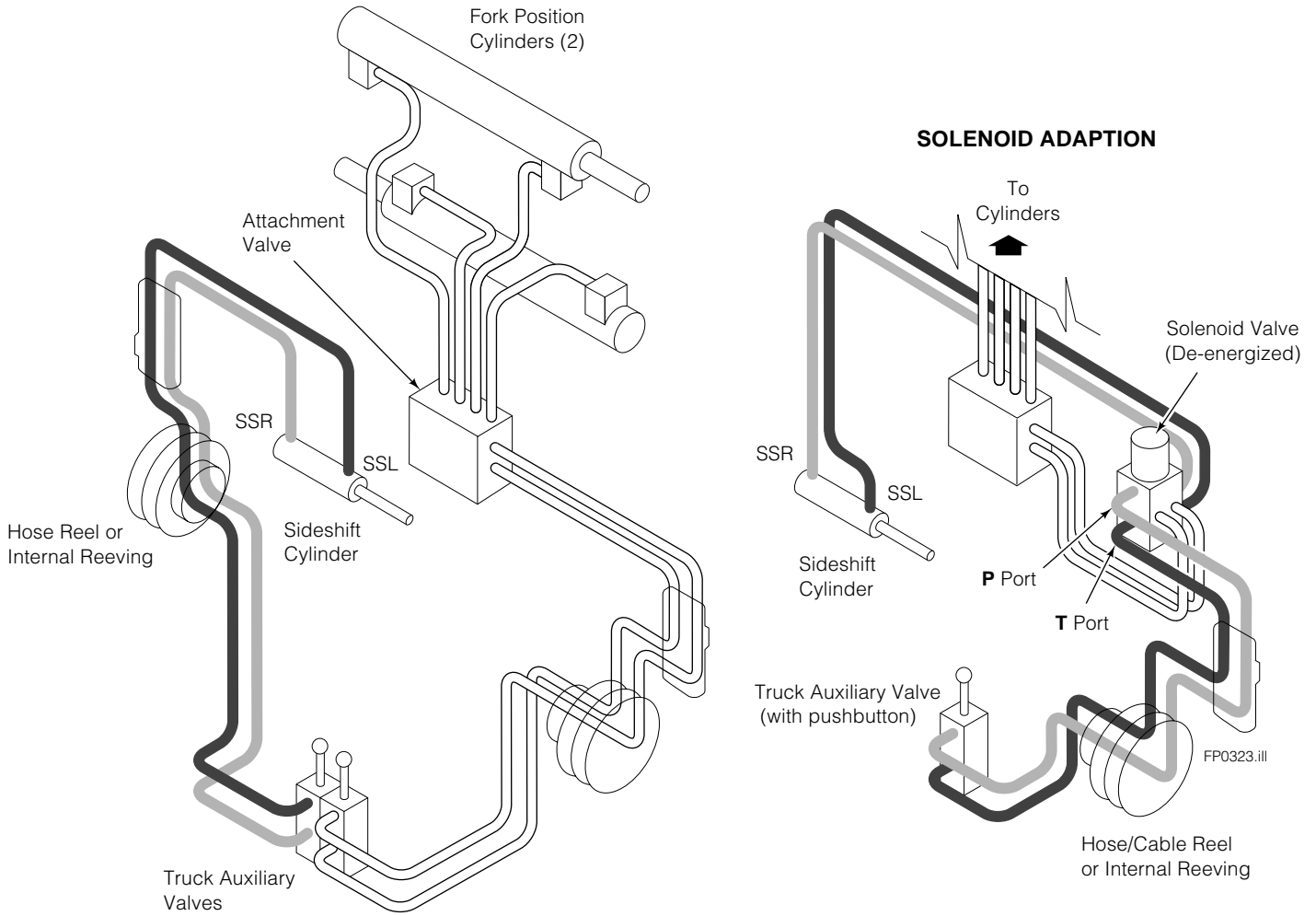
* included in Diagnostics Kit 394382.

4.2 Plumbing

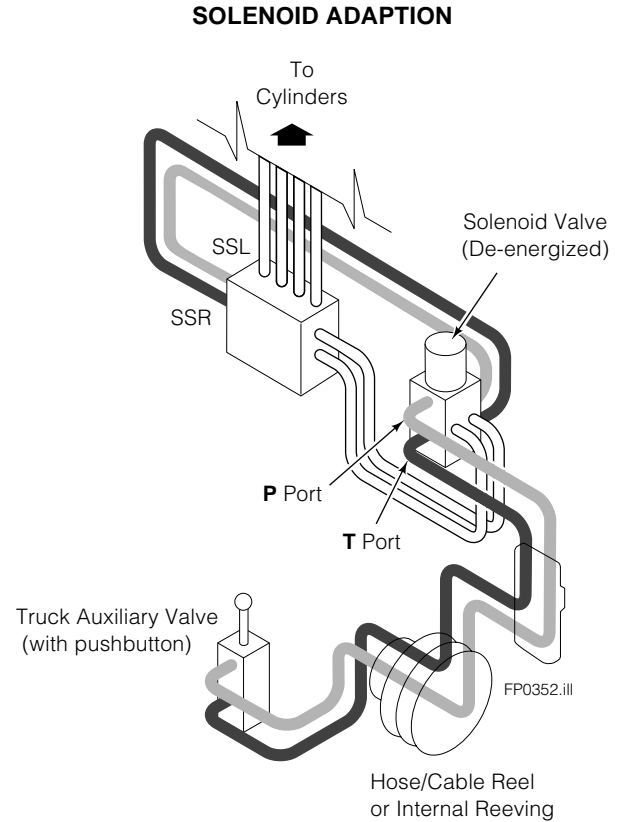
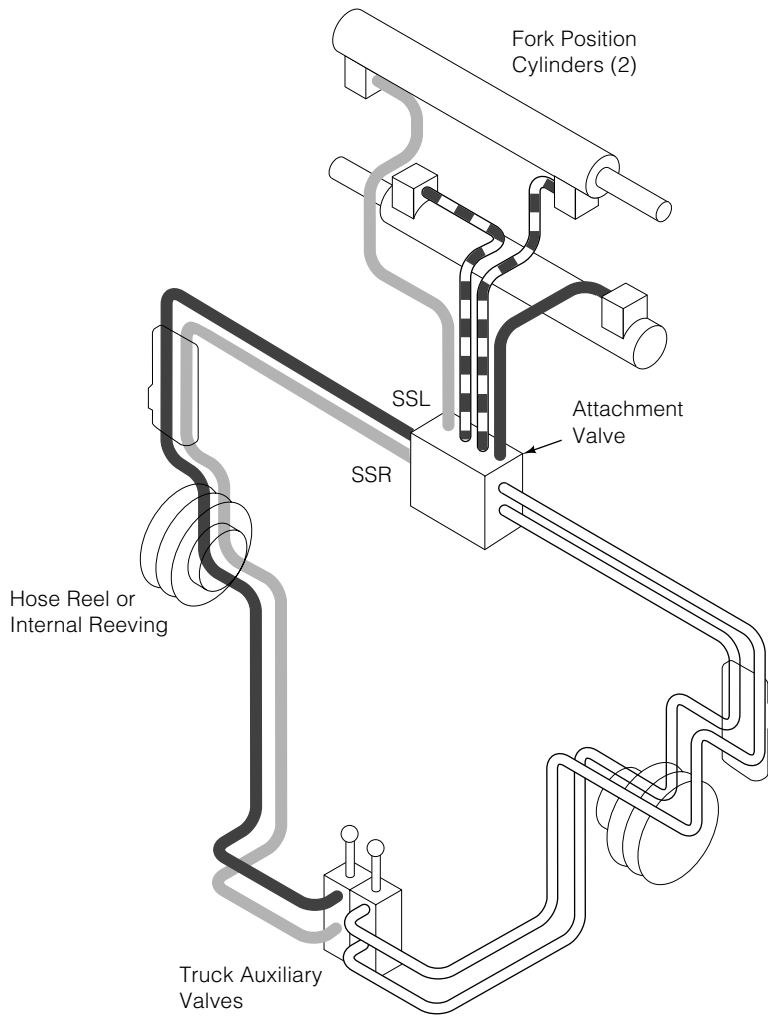
4.2-1 Hosing Diagram, Fork Position Circuit



4.2-2 Hosing Diagram, Frame Sideshift Circuit

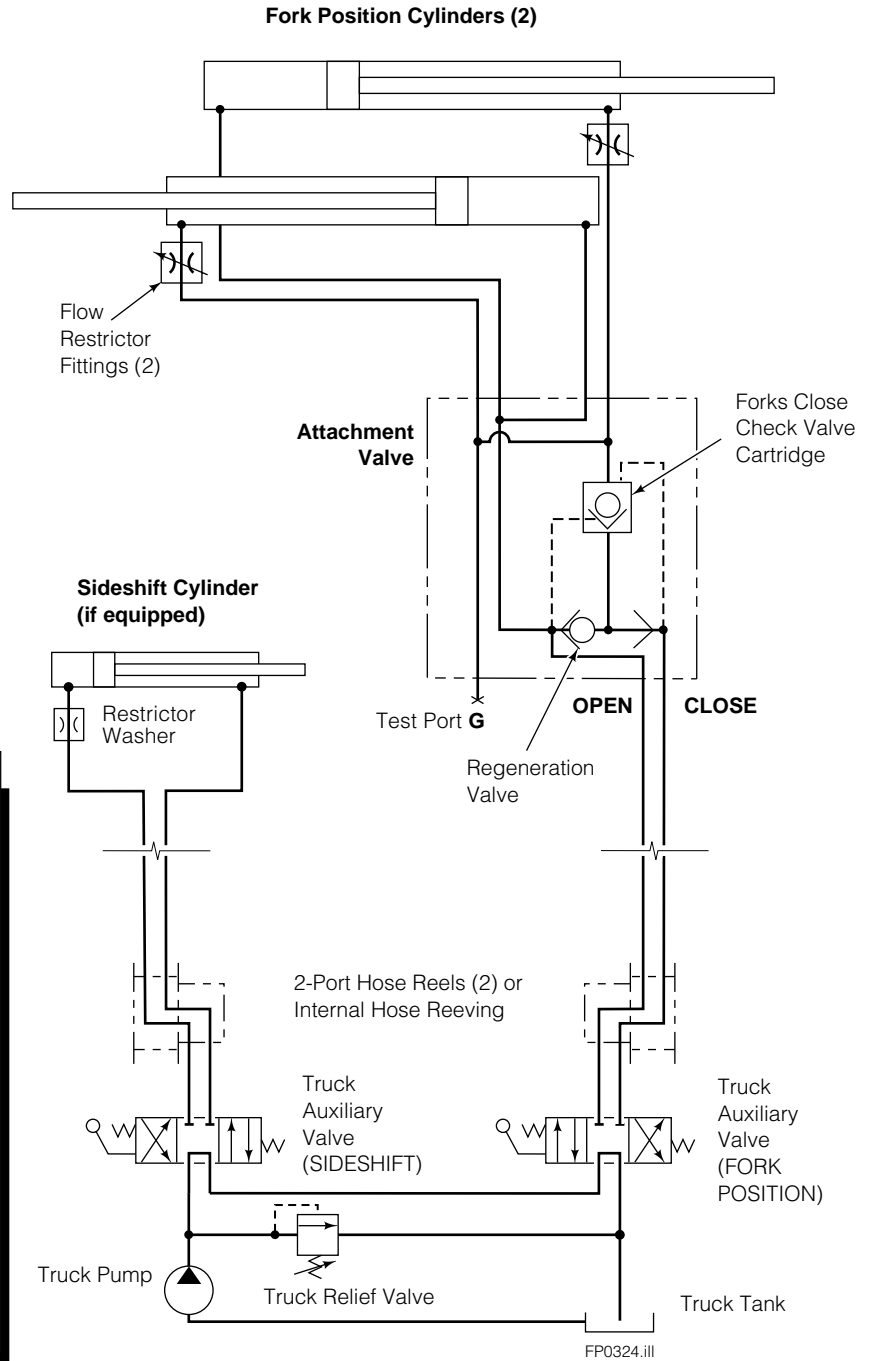
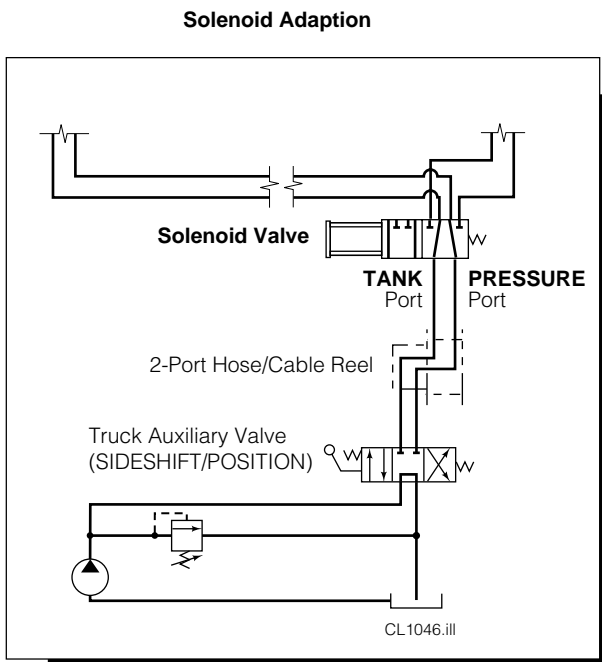


4.2-3 Hosing Diagram, Integral Sideshift Circuit

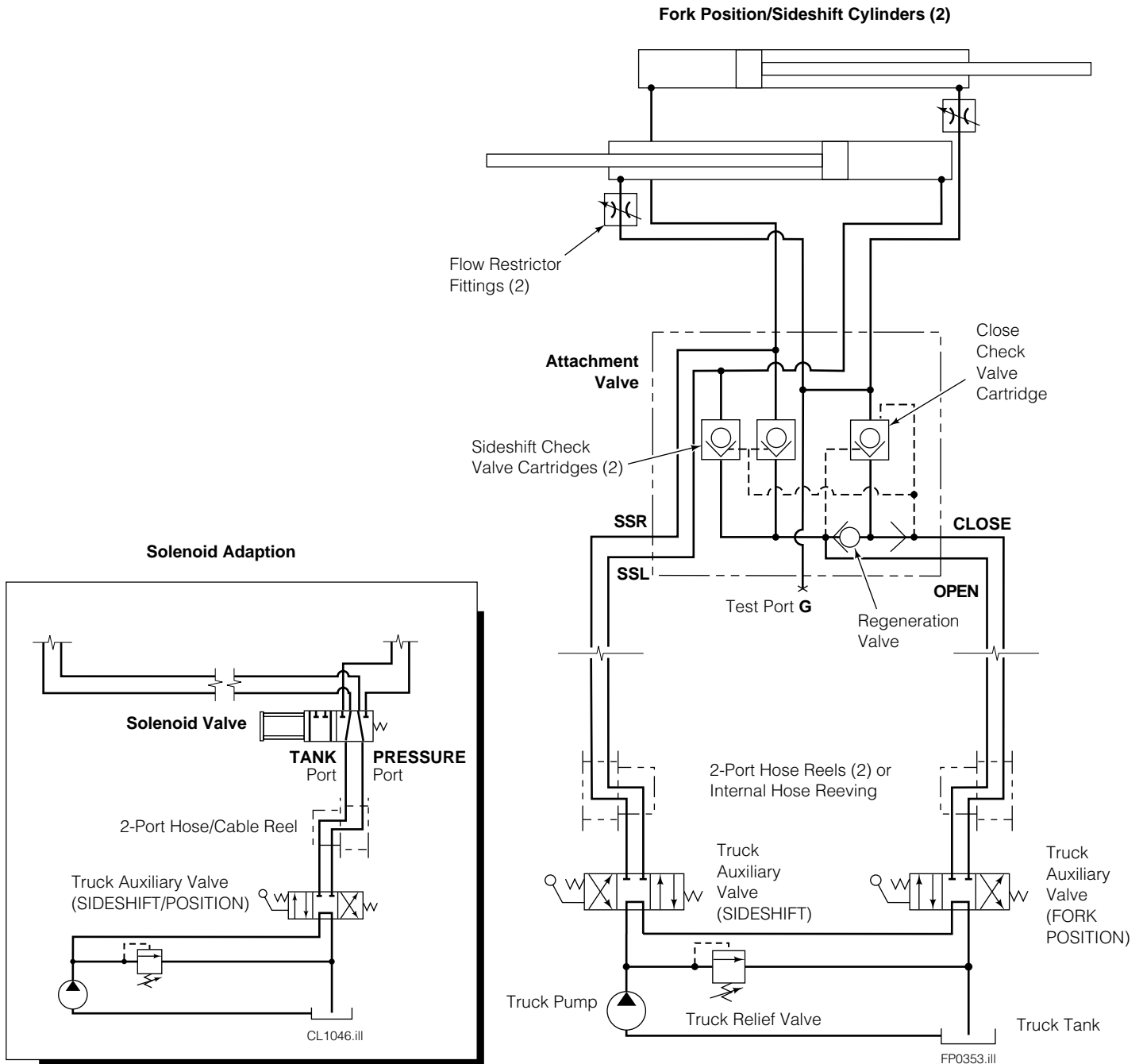


	SIDESHIFT LEFT	SIDESHIFT RIGHT
Pressure:		
Return:		
Slave:		

4.2-4 Hydraulic Circuit – Fork Positioner, Frame Sideshifter



4.2-5 Hydraulic Circuit – Fork Positioner with Integral Sideshifting



4.3

Fork Position Function

There are six potential problems that could affect the FORK POSITION function:

- Damaged or bent frame.
- Incorrect load handling. Refer to *Operator's Guide* for suggested procedures.
- Incorrect hydraulic pressure or flow from the lift truck.
- External leaks.
- Defective solenoid coil or valve (if equipped).
- Worn or defective cartridge valves or cylinder seals.

4.3-1 Supply Circuit Test

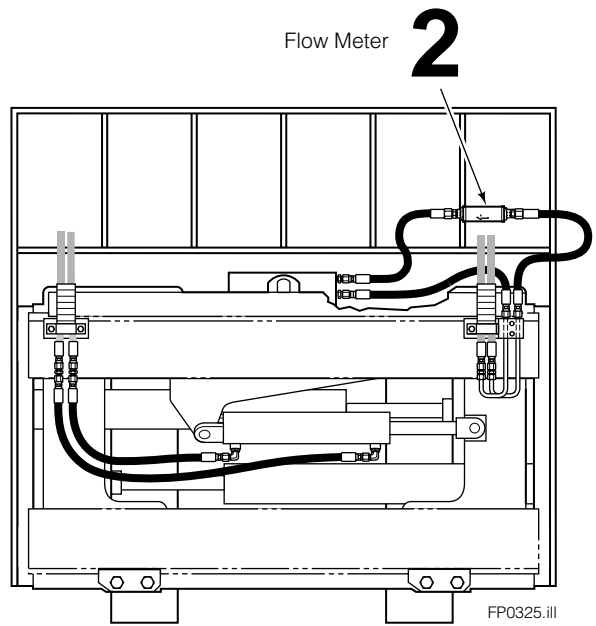
- 1 Check the pressure supplied by the truck at the carriage hose terminal. Pressure must be within the range shown in Specifications, Section 6.1. **PRESSURE TO THE FORK POSITIONER MUST NOT EXCEED 2300 PSI (160 bar).**
- 2 Check the flow volume at the carriage hose terminal. Flow must be within the range shown in Specifications, Section 6.1.
- 3 Close the forks fully, holding the lever in the CLOSE position for a few seconds. Release the lever and check for external leaks at fittings, hoses, valve and manifold.

4.3-2 Fork Circuit Test

- 1 Press the solenoid button (if equipped) and listen for a 'click' at the solenoid valve. If no sound is heard, first check the fuse, wiring and coil (see Section 4.5). Assume that the valve is not jammed (see Section 5.7).
IMPORTANT: Solenoid-operated valves must be plumbed so that the solenoid is **energized** during the FORK POSITION function.
- 2 Position the forks to mid-stroke. Turn the truck off and connect a 3000 psi (200 bar) pressure gauge to the 'G' test port on the back of the main valve.
- 3 Start the truck and close the forks fully, holding the lever in the CLOSE position for a few seconds.
- 4 Release the lever and watch the pressure gauge:
 - If the pressure drop **is less** than 150 psi (10 bar) initially, and additional drop does not exceed 25 psi (1.7 bar) per minute, the problem is not hydraulic (see Section 4.3).
 - If the pressure drop **is more** than 150 psi (10 bar) initially, and additional drop exceeds 25 psi (1.7 bar) per minute, Turn the truck off and proceed to Valve Test, Section 4.3-3.

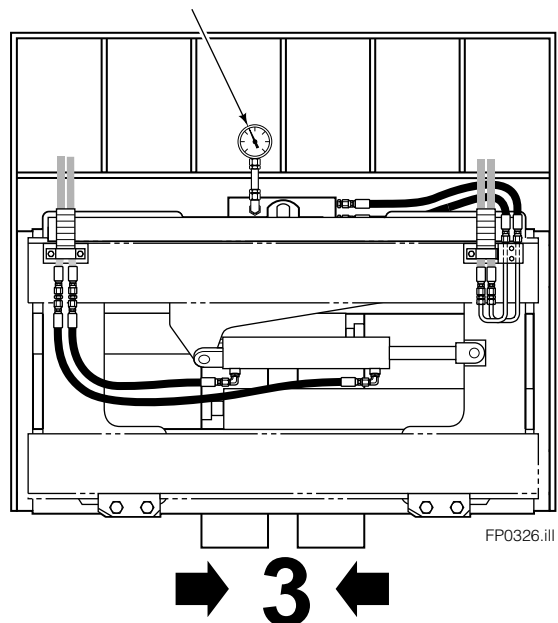


WARNING: Before removing hydraulic lines or components, relieve pressure in the Attachment hydraulic system. Turn the truck off and move the auxiliary control lever several times in both directions.



Pressure Gauge on test port 'G'

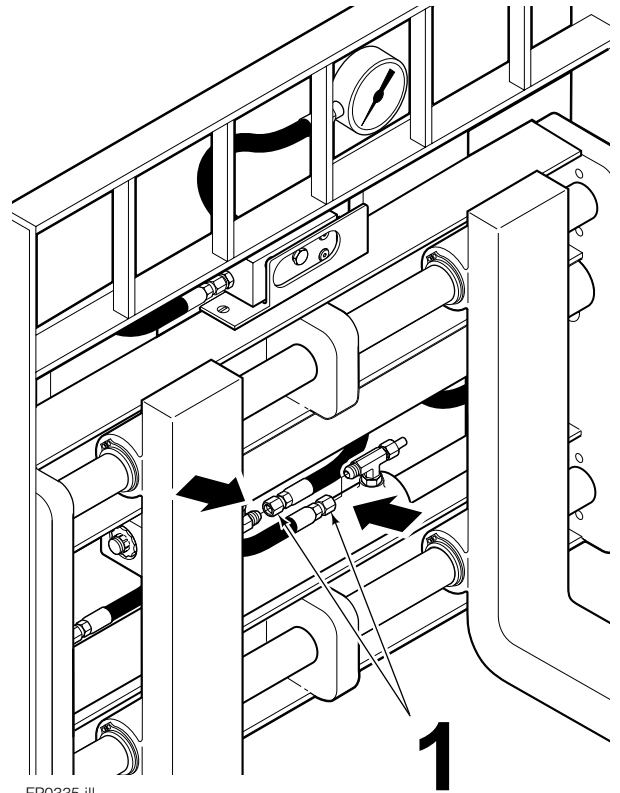
2



Back (Driver's) View

4.3-3 Valve Test

- 1 Disconnect both hydraulic supply lines from the rod end of the cylinders. Plug the lines and cap the ports.
- 2 Start the truck and hold the lever in the CLOSE position for a few seconds.
- 3 Release the lever and watch the pressure gauge:
 - If the pressure drop **is more** than 150 psi (10 bar) initially, and additional drop exceeds 25 psi (1.7 bar) per minute, the fork check valve cartridge in the main valve is faulty and requires service (see Section 5.3).
 - If the pressure drop **is less** than 150 psi (10 bar) initially, and additional drop does not exceed 25 psi (1.7 bar) per minute, one or both cylinders require service. Turn the truck off and proceed to Cylinder Test, Section 4.3-4.

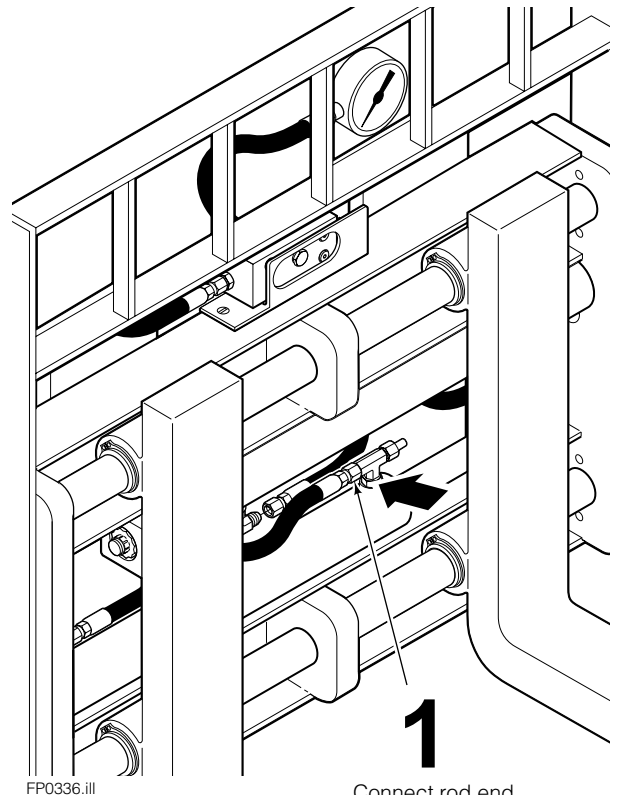


Disconnect cylinder rod end supply lines (plug lines and cap ports).

4.3-4 Cylinder Test

- 1 Connect one (1) of the rod-end hydraulic lines to its cylinder. **IMPORTANT:** The other line and cylinder port must remain plugged.
- 2 Start the truck and hold the lever in the CLOSE position for a few seconds.
- 3 Release the lever and watch the pressure gauge:
 - If the pressure drop **is more** than 150 psi (10 bar) initially, and additional drop exceeds 25 psi (1.7 bar) per minute, the cylinder connected to the valve is faulty and requires service (see Section 5.5).
 - If the pressure drop **is less** than 150 psi (10 bar) initially, and additional drop does not exceed 25 psi (1.7 bar) per minute, the other cylinder is faulty and requires service (see Section 5.5).

It is recommended that a similar pressure test be performed on the other cylinder before servicing.



Connect rod end supply line to one (1) cylinder.

4.4

Sideshift Function

The following potential problems could affect the sideshifting function:

- Damaged or bent frame.
- Incorrect hydraulic pressure or flow from lift truck.
- External leaks.
- Defective solenoid coil or valve (if equipped).
- Worn or defective cartridge valves or cylinder seals.
- Flow restrictor fittings plugged or incorrectly adjusted.

(Frame-type sideshifter only)

- Inadequate upper bearing lubrication or worn bearings.
- Lower mounting hooks installed with incorrect clearance.
- Sideshift cylinder flow restrictor plugged or incorrectly installed.

4.4-1 Supply Circuit Test

- 1 Check the pressure supplied by the truck at the carriage hose terminal. Pressure must be within the range shown in Specifications, Section 6.1. **PRESSURE TO THE ATTACHMENT MUST NOT EXCEED 2300 PSI (160 bar).**
- 2 Check the flow volume at the carriage hose terminal. Flow must be within the range shown in Specifications, Section 6.1.
- 3 Sideshift fully left or right, holding the lever in the SIDE-SHIFT position for a few seconds. Release the lever and check for external leaks at fittings, hoses, and cylinder rod ends.

4.4-2 Sideshift Cylinder Test

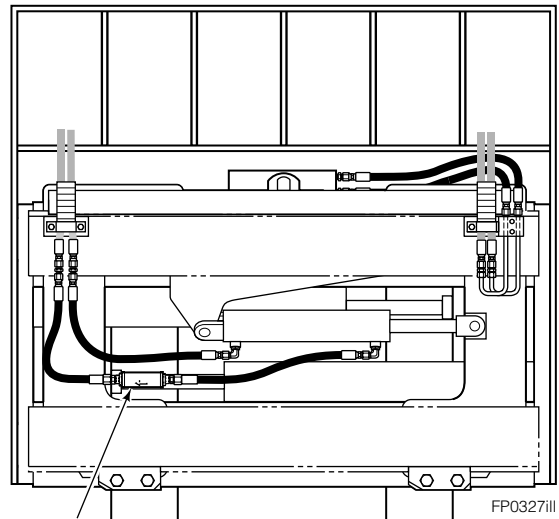
- 1 Press the solenoid button (if equipped) and listen for a 'click' at the solenoid valve. If no sound is heard, first check the fuse, wiring and coil (see Section 4.5). Assure that the valve is not jammed (see Section 5.7).

IMPORTANT: Solenoid-operated valves must be plumbed so that the solenoid is **not energized** during the SIDESHIFT function.

- 2 Sideshift fully to the right. Turn the truck off and relieve Attachment system pressure. Disconnect the SIDESHIFT LEFT supply hose from the truck hose terminal and route to a drain bucket. Cap the supply fitting.
- 3 Start the truck and actuate the SIDESHIFT RIGHT lever for 5 seconds:
 - If there is **substantial hydraulic flow** out of the drain hose, the sideshift cylinder seals are defective and require service. Refer to Section 5.4.
 - If there is **no hydraulic flow** out of the drain hose, check for plugged or incorrectly-adjusted flow restrictor fittings. If there is still no hydraulic flow, the problem is not hydraulic (see Section 4.4).



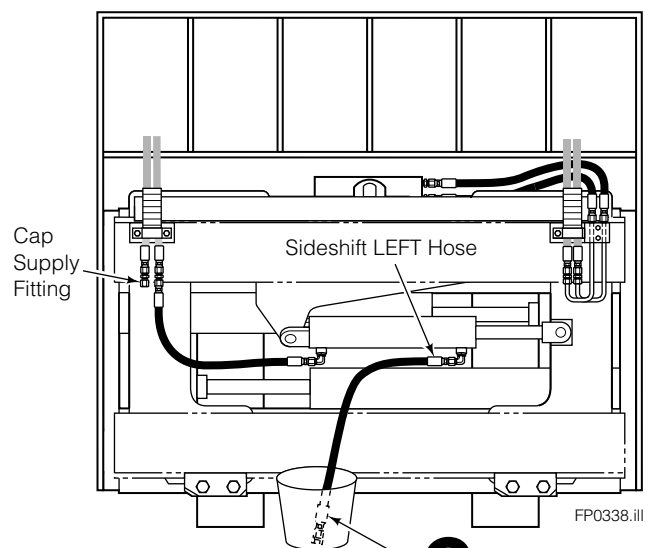
WARNING: Before removing hydraulic lines or components, relieve pressure in the Attachment hydraulic system. Turn the truck off and move the auxiliary control valve lever several times in both directions.



2

Back (Driver's) View

Flow Meter



2

Hose end in drain bucket.

Back (Driver's) View

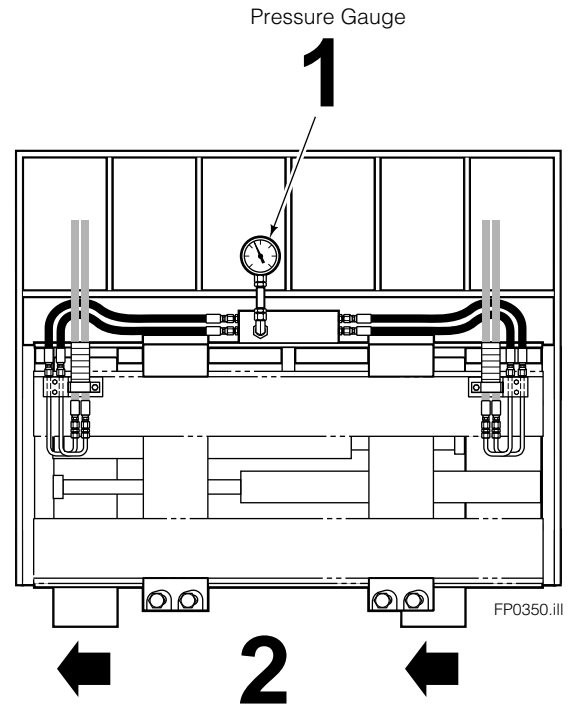
4.4-3 Sideshifting Valve Test

IMPORTANT: This procedure tests only for proper operation of the sideshifting check valve cartridges. Perform the fork position circuit test (see Section 4.3-2) to assure proper cylinder operation.



WARNING: Before removing hydraulic lines or components, relieve pressure in the Attachment hydraulic system. Turn the truck off and move the auxiliary control valve lever several times in both directions.

- 1 Install a 3000 psi (200 bar) pressure gauge in the valve test port 'G', located on the back of the valve body.
- 2 Start the truck and actuate the SIDESHIFT LEFT lever for 5 seconds.
- 3 Return the control lever to neutral and watch the gauge:
 - If the pressure drop **is more** than 150 psi (10 bar) initially, and additional drop exceeds 25 psi (1.7 bar) per minute, the sideshift left cartridge is faulty and requires replacement or service (see Section 5.3-3).
 - If the pressure drop **is less** than 150 psi (10 bar) initially, and additional drop does not exceed 25 psi (1.7 bar) per minute, actuate the SIDESHIFT RIGHT lever for 5 seconds.
- 4 Return the control lever to neutral and watch the gauge:
 - If the pressure drop **is more** than 150 psi (10 bar) initially, and additional drop exceeds 25 psi (1.7 bar) per minute, the sideshift right cartridge is faulty and requires replacement or service (see Section 5.3-3).
 - If the pressure drop **is less** than 150 psi (10 bar) initially, and additional drop does not exceed 25 psi (1.7 bar) per minute, the problem is not hydraulic (see Section 4.4).



Back (Driver's) View

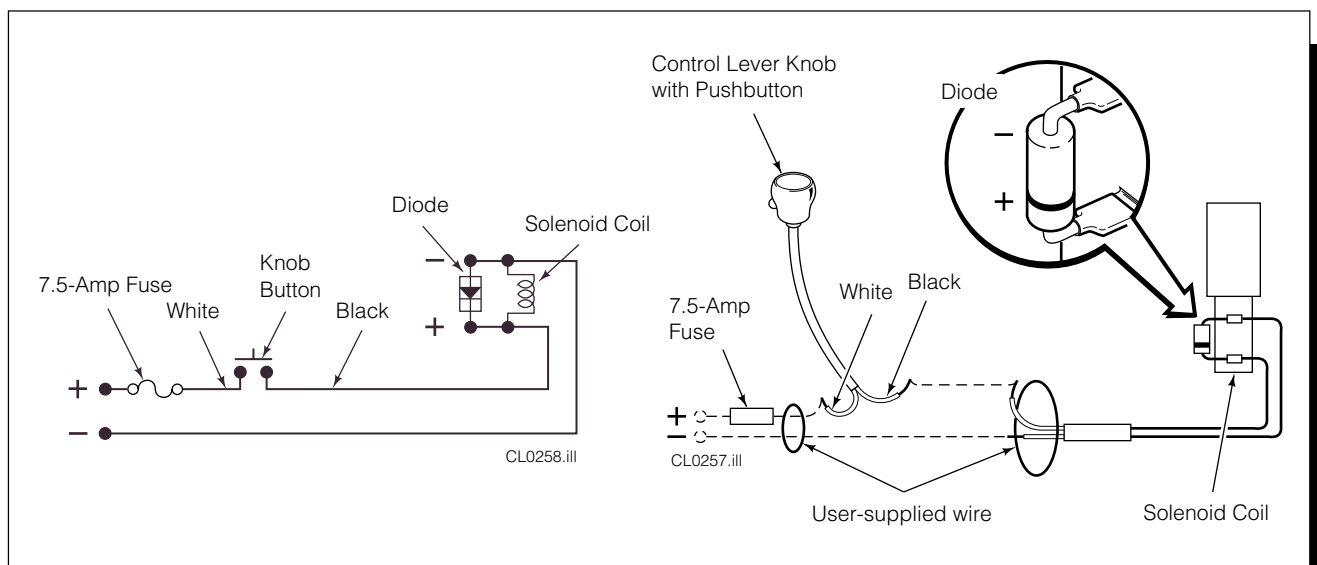
4.5

Electrical Circuit (Solenoid-equipped Clamps)

Use the electrical schematic and diagram shown and follow the steps below:

- 1 Check the control knob circuit fuse. Replace if necessary.
- 2 Check for loose electrical connections at the truck ignition switch, control knob button, solenoid coil terminals and diode.
- 3 Remove the diode from the solenoid coil terminal. Test with an ohmmeter for high resistance in one direction and no resistance in the other direction. If there is no resistance in both directions, replace the diode.

NOTE: When replacing the diode, the banded (+) end must be connected to the coil and wiring as shown.
- 4 Disconnect the electrical leads from the solenoid coil terminals. Use a voltmeter to determine if voltage is present at the electrical leads when the button is depressed.
 - If there is **no current** to the solenoid, troubleshoot the electrical circuit for shorts.
 - If there is **current** to the solenoid, test for coil continuity.
- 5 Test for coil continuity by placing an ohmmeter test lead on each solenoid coil terminal (ohmmeter on Rx1 scale).
 - If there is an ohmmeter reading, the coil is good.
 - If the coil is good, but the solenoid does not 'click' when the control knob button is depressed, the solenoid cartridge may be jammed. Refer to Section 5.7.
 - If there is no ohmmeter reading, the coil is defective and should be replaced. Refer to Section 5.7.



5.1 Fork Positioner Removal

- 1 Position the forks to the width of the frame.



WARNING: Before removing hydraulic lines or hoses, relieve pressure in the Attachment hydraulic system. Turn the truck off and move the auxiliary control lever several times in both directions.

- 2 Disconnect and plug the hydraulic supply hoses to the fork position cylinders and sideshifting cylinder (if equipped). Tag hoses for reassembly.
- 3 Disconnect the lower hooks:

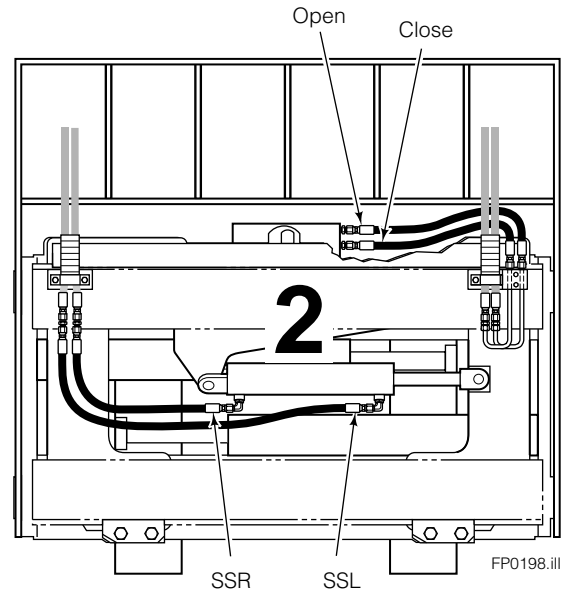
Quick-Change Hooks – Remove the locking pins and drop the hooks into the unlocked position. Replace the pins in the lower holes. For reassembly, remove the pins and slide the hooks up to the locked position. Replace the pins in the upper holes.

Bolt-On Hooks – Remove the capscrews and mounting hooks. For reassembly, tap hooks tight into position for non-sideshifting frame. If sideshifting frame, back off 1 notch and check clearance: 3/32 in. (2.4 mm) min., 3/16 in. (4.8 mm) max. Tighten capscrews as follows:

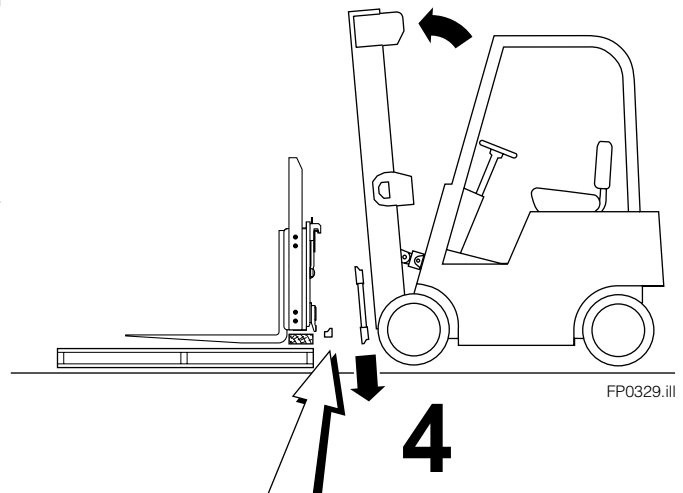
Class II/III Mounting – 165 ft.-lbs. (225 Nm).

Class IV Mounting – 190 ft.-lbs. (255 Nm).

- 4 Lower the Fork Positioner onto a pallet. Tilt the mast forward and lower the carriage to disengage the upper hook and anchor plate from the carriage.
- 5 For Fork Positioner installation, reverse the above procedures. Refer to Section 2.3 for complete installation information.

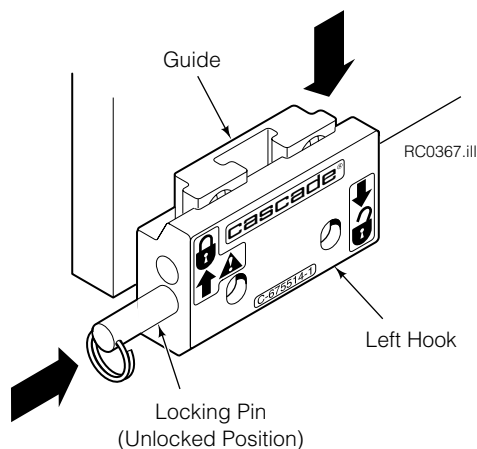


Back (driver's) View

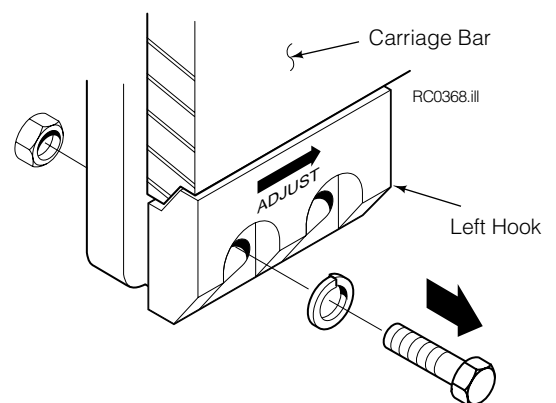


3

QUICK-CHANGE LOWER HOOKS



BOLT-ON LOWER HOOKS



5.2 Forks, Shafts

5.2-1 Removal and Installation

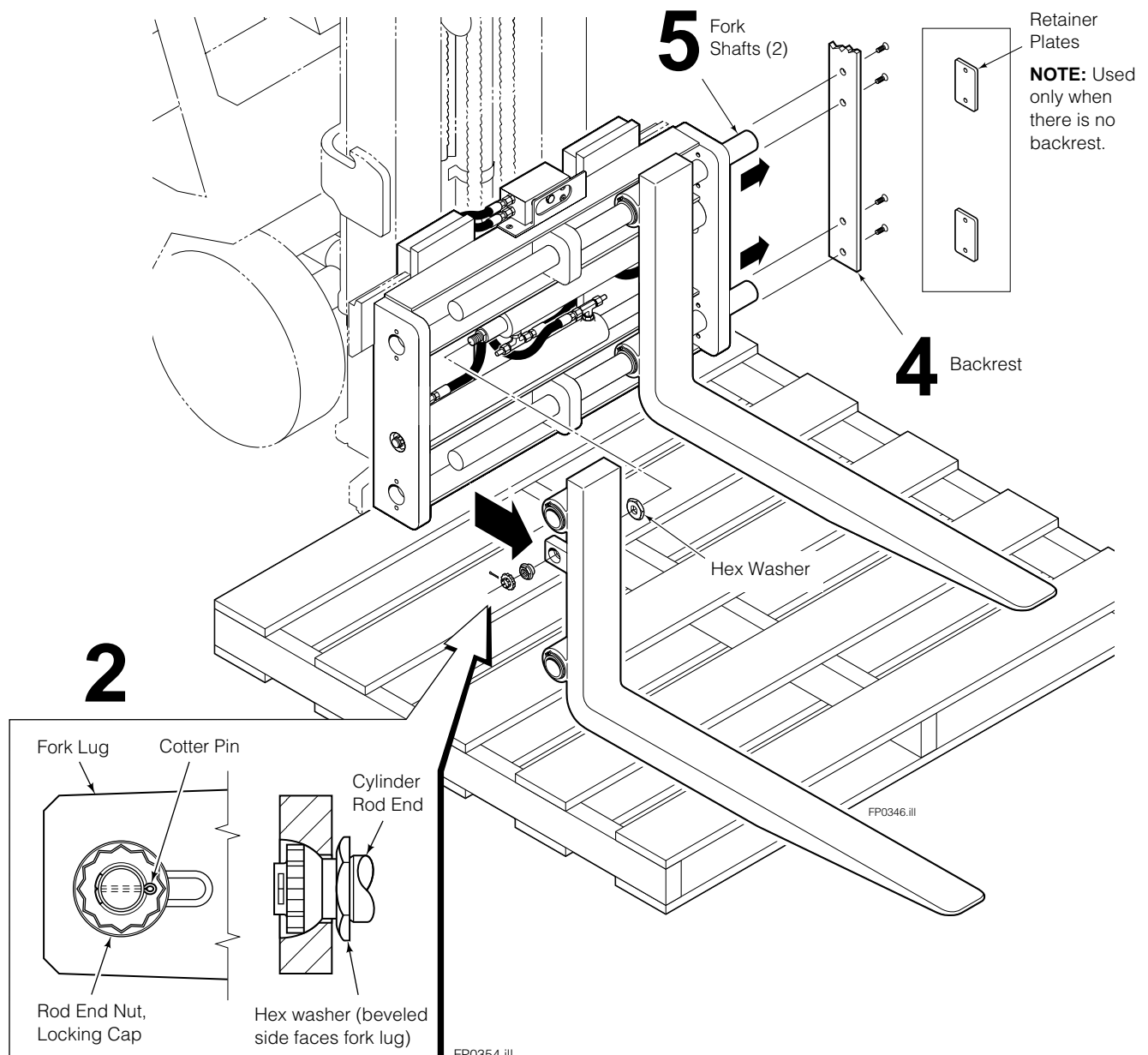
The following procedures can be performed with the Fork Positioner mounted on the truck.

- 1 Close the Forks to midrange. Lower forks to rest lightly on a pallet or wood blocking.
- 2 Disconnect the spherical rod end nut that fastens the cylinder rod to the fork lug. For reassembly, assemble the parts as shown. Tighten the rod end nut to 160 ft.-lbs. (220 Nm). **NOTE:** Spherical nut tightens against hex washer, providing a loose operating clearance for the anchor joint. Lubricate with chassis grease.
- 3 Retract the cylinders fully to disengage the rod ends from the fork lugs.



WARNING: Make sure forks are properly supported by a pallet or wood blocking before disengaging from bearing shafts. Keep hands and feet clear from under forks.

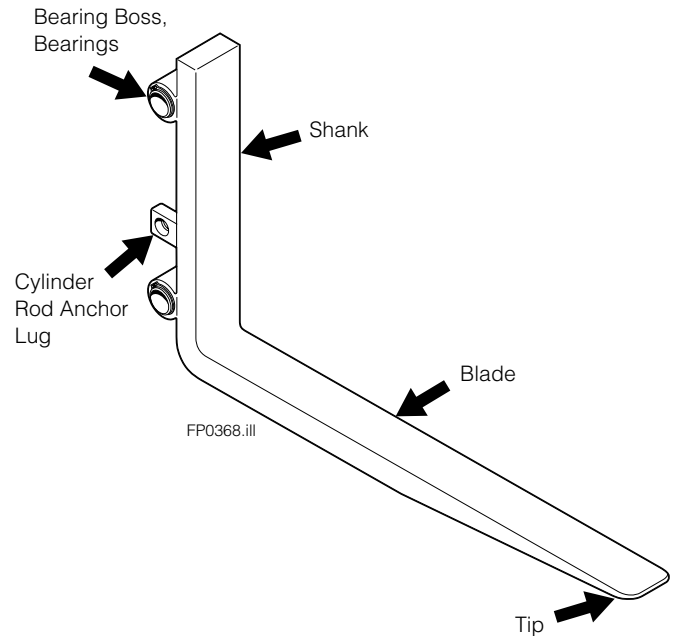
- 4 Remove the backrest (or retainer plates if equipped). For reassembly, tighten the capscrews to 75 ft.-lbs. (100 Nm).
- 5 Slide the fork shafts out of the frame, disengaging the forks from the shafts.
- 6 For reassembly, reverse the above procedures with the following exceptions:
 - Inspect fork shafts for wear or bending damage. Replace shafts if necessary.
 - After reassembly, lubricate fork bearings with chassis grease.



5.2-2 Fork Inspection

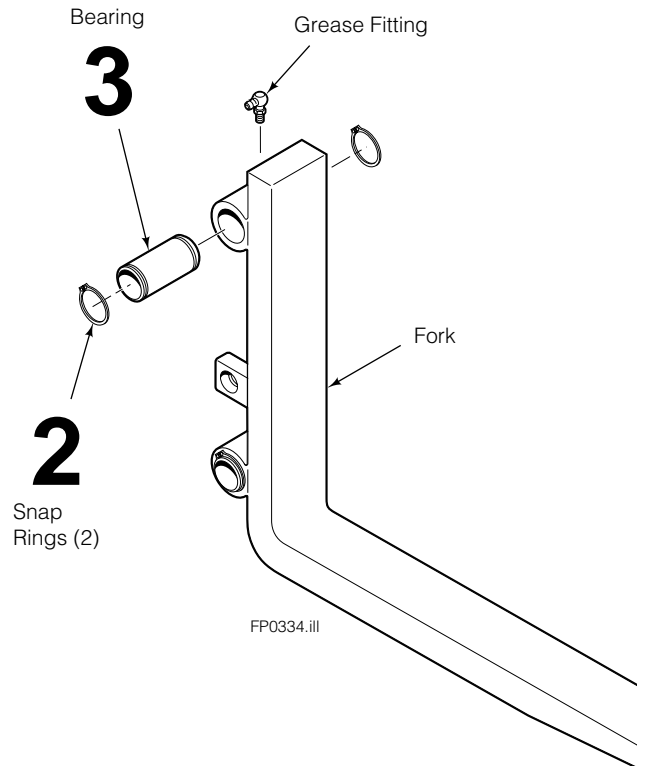
- Inspect the fork blade and tip for wear or damage.
NOTE: Cascade Fork Safety Kit 3014162 is available for this procedure and contains wear calipers, inspection sheets and safety poster.
- Inspect the fork bearings for wear. Replace the bearings if necessary (see Section 5.2-3).
- Inspect the fork bearing boss and cylinder rod anchor lug for cracked welds or other damage. Replace the fork if necessary.

CAUTION: Repairing cracked welds must be approved by Cascade. Contact Cascade Service for approval and recommended welding procedures.



5.2-3 Fork Bearing Service

- 1 Remove the forks as described in Section 5.2-1.
- 2 Remove the snap rings that retain the bearing in the bearing boss. Remove the bearings.
- 3 For reassembly, reverse the above procedures with the following exceptions:
 - Install a new bearing in each bearing boss.
 - Inspect the forks for damage or wear (see Section 5.2-2).
 - After reassembly, lubricate fork bearings with chassis grease.



5.2-4 Fork Carrier

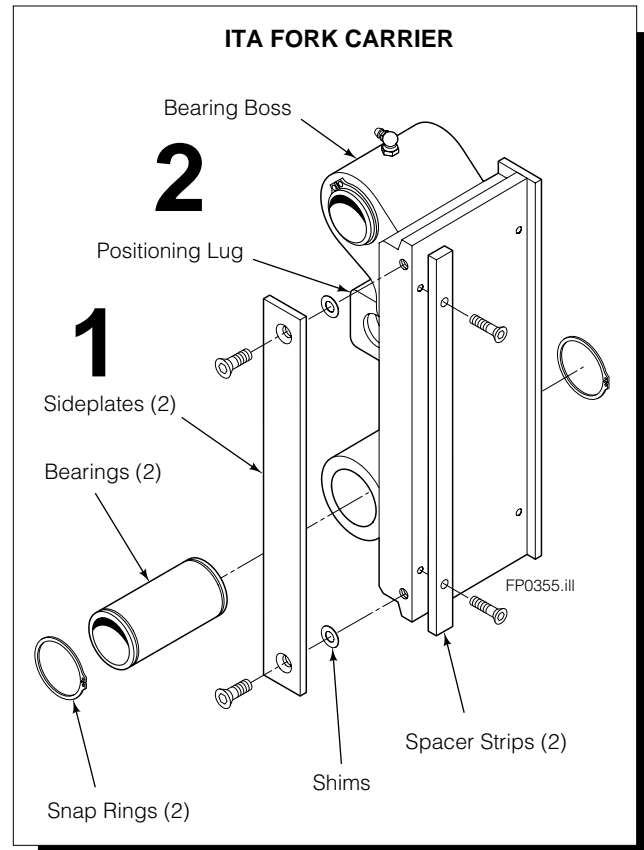
ITA FORK CARRIER

1 Inspect the ITA Fork Carriers for sideplate damage, spacer strip damage, or worn bearings. Replace damaged parts as required.

If the carrier bearings are worn, remove the fork carriers as described in Section 5.2-1. Replace the carrier bearings as described in Section 5.2-3.

2 Inspect the bearing bosses and cylinder rod anchor lugs for cracked welds for other damage. Replace the fork carrier if required.

CAUTION: Repairing cracked welds must be approved by Cascade. Contact Cascade Service for approval and recommended welding procedures.



BOLT-ON FORK CARRIER

1 Inspect the bearing bosses for cracked welds or worn bearings.

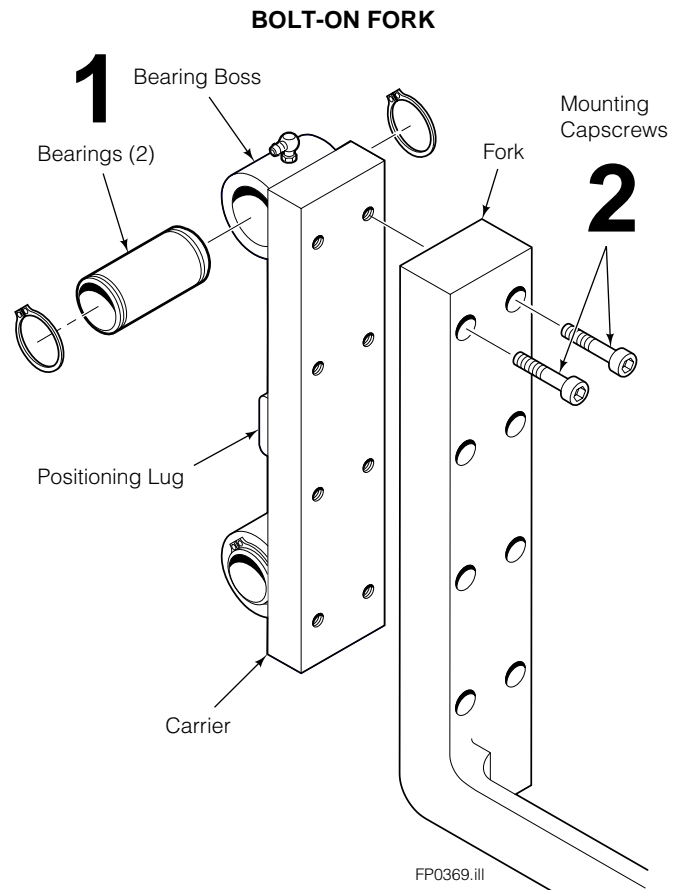
If the carrier bearings are worn, remove the fork carriers as described in Section 5.2-1. Replace the carrier bearings as described in Section 5.2-3.

2 Remove the fork capscrews. A torque multiplier is required to remove and tighten the larger capscrews.

3 For reassembly, reverse the above procedures with the following exceptions:

- Lubricate the capscrews and tighten to the torque value indicated in the Table below. **IMPORTANT:** Use of new capscrews is recommended. See appropriate Cascade Parts Manual to order, or assure replacement capscrews are SAE Grade 8 or Metric/ISO 10.9.

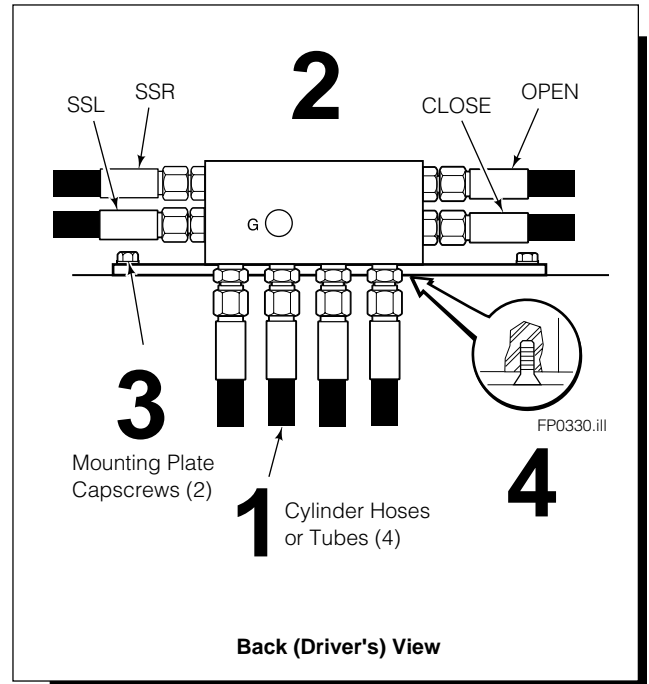
Unit	Capscrew Torque Values
55C	190-220 ft.-lbs. (257-298 Nm)
100C	280-320 ft.-lbs. (380-434 Nm)
120/150C	680-720 ft.-lbs. (922-976 Nm)



5.3 Valve

5.3-1 Valve Removal and Installation


- 1 Disconnect the cylinder tubes/hoses from the bottom of the Valve. Plug the ends and tag for reassembly.
- 2 Disconnect the supply hoses from the side of the Valve. Plug the hose ends and tag for reassembly.
- 3 Remove the capscrews fastening the Valve mounting plate and guard (if equipped) to the frame. For reassembly, tighten the capscrews to 15 ft.-lbs. (20 Nm).
- 4 Remove the two (2) flathead capscrews fastening the valve to the mounting plate. For reassembly, tighten the capscrews to 15 ft.-lbs. (20 Nm).
- 5 For reassembly, reverse the above procedures with the following exceptions:
 - Service the Valve as described in Section 5.3-3.



5.3-2 Eliminating Regenerative (fast arm opening) Circuit

The regenerative circuit can be deactivated to reduce the arm opening speed as follows:

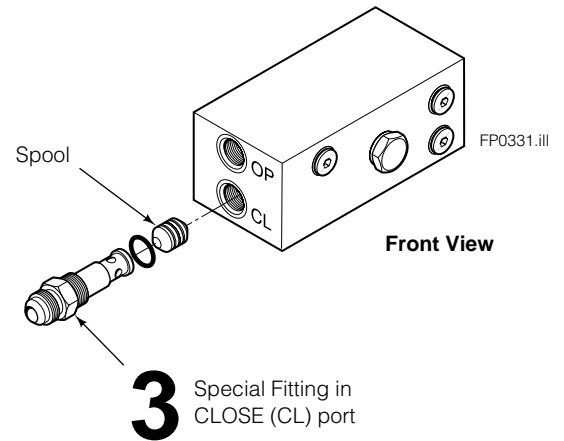
- 1 Open the forks to frame width.




WARNING: Before removing hydraulic lines or components, relieve pressure in the Attachment hydraulic system. Turn the truck off and move the auxiliary control lever several times in both directions.

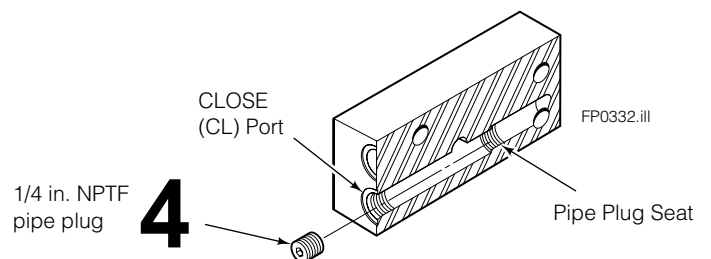
- 2 Disconnect the hydraulic hose from the Valve CLOSE (CL) port.
- 3 Remove the special fitting and spool.
- 4 Install a 1/4-in. NPTF pipe plug within the port.

NOTE: Thread seat for pipe plug is approximately 4 in. (10 cm) inside port (see illustration).
- 5 For reassembly, reverse the above procedures with the following exceptions:
 - **Do not** reinstall spool in port.
 - Make sure special fitting is reinstalled in CLOSE (CL) port.





WARNING: Special fitting must be reinstalled in CLOSE (CL) port. Clamp arms will not function properly without special fitting installed.

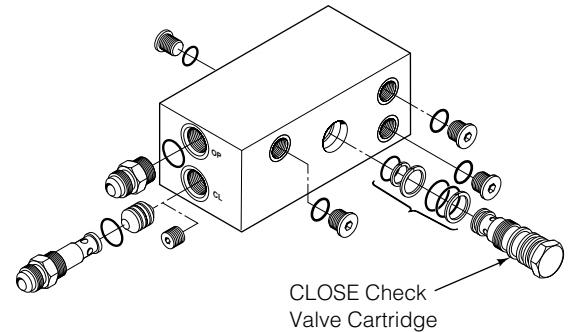


5.3-3 Valve Service

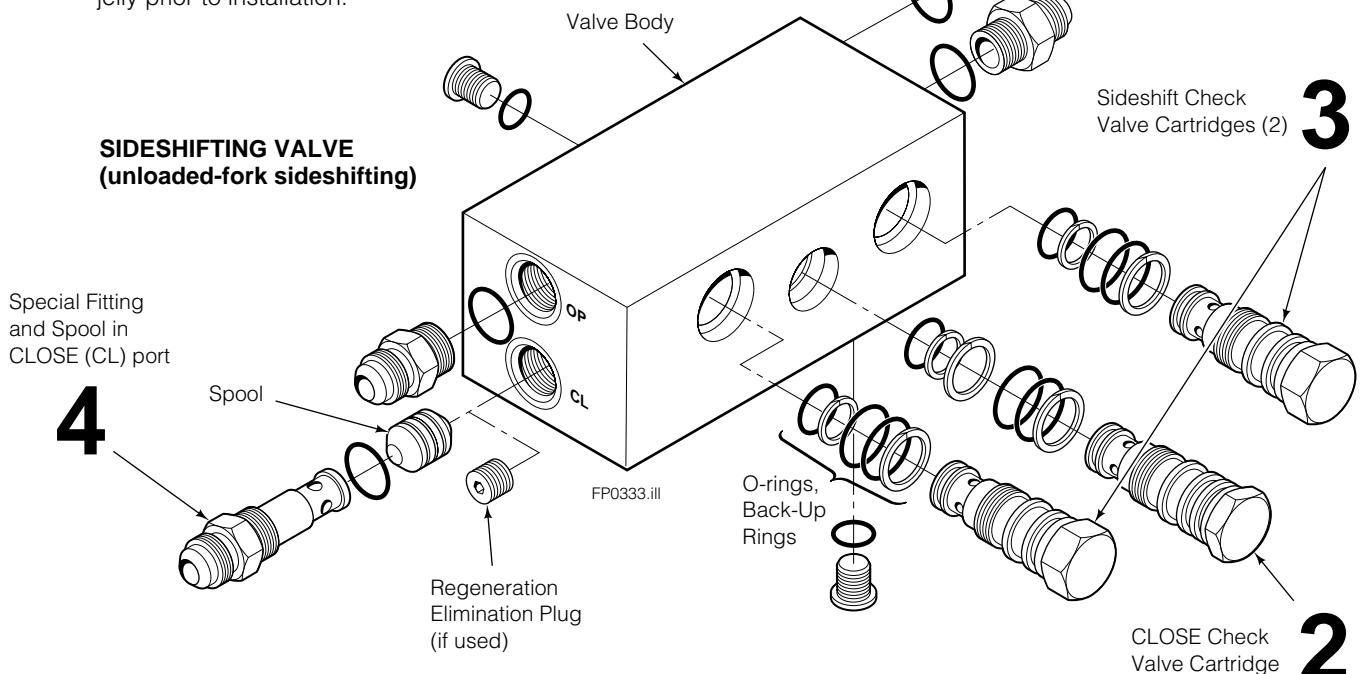
IMPORTANT: Service the Valve in a clean work area.

- 1 Remove the Valve from the Fork Positioner as described in Section 5.3-1.
- 2 Remove the CLOSE check valve cartridge. For reassembly, tighten cartridge to 50 ft.-lbs. (65 Nm).
- 3 Remove the sideshift check valve cartridges (if equipped). For reassembly, tighten cartridges to 50 ft.-lbs. (65 Nm).
- 4 Remove the special fitting and spool.
- 5 Remove the remaining plugs and fittings.
- 6 Remove the O-rings and back-up rings from the cartridge valves, fittings and plugs.
- 7 Clean all parts with cleaning solvent or kerosene.
- 8 For reassembly, reverse the above procedures with the following exceptions:
 - Replace O-rings and back-up rings on cartridges and fittings as shown below.
 - Lubricate cartridge, fittings and plugs with petroleum jelly prior to installation.

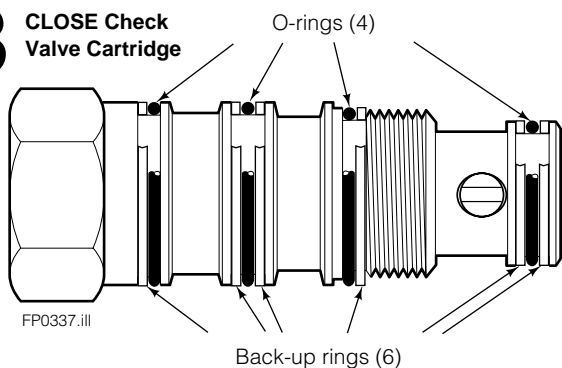
NON-SIDESHIFTING VALVE



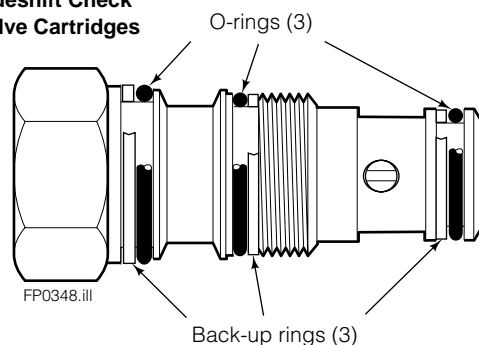
SIDESHIFTING VALVE (unloaded-fork sideshifting)



8 CLOSE Check Valve Cartridge



Sideshift Check Valve Cartridges



5.4 Sideshift Cylinder

5.4-1 Removal and Installation

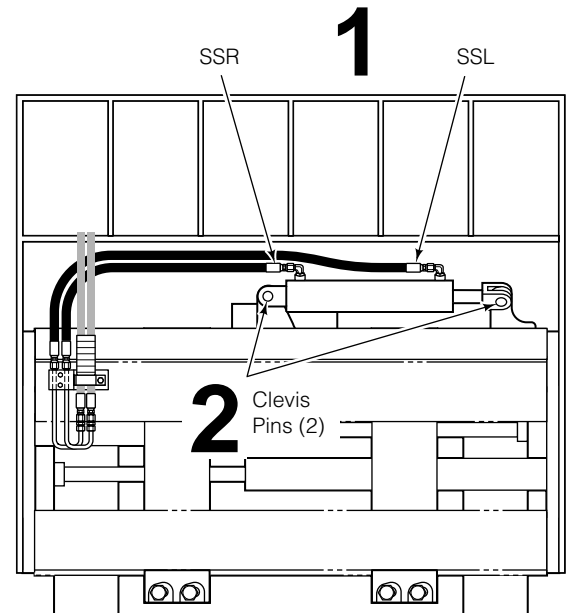
NOTE: The following procedures can be performed with the Fork Positioner mounted on the truck.



WARNING: Before disconnecting hydraulic lines, relieve pressure in the Attachment hydraulic system. Turn the truck off and move the auxiliary control levers several times in both directions.

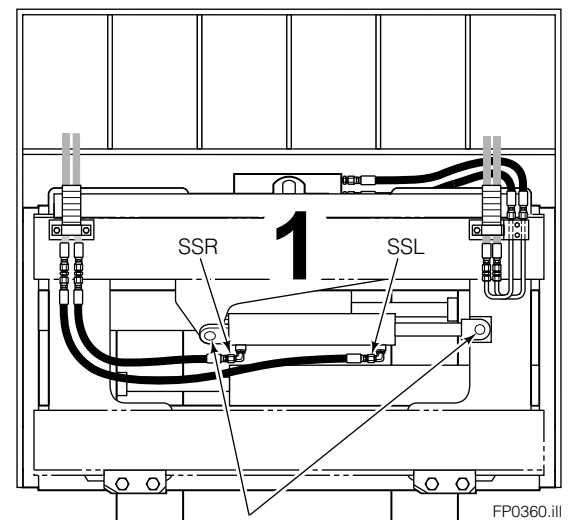
- 1 Disconnect the hoses from the cylinder ports. Tag the hoses for reassembly
- 2 Remove the clevis pins from the cylinder ends and remove the cylinder from the sideshifting frame.
- 3 For reassembly, reverse the above procedures with the following exceptions:
 - Service the cylinder as described in Section 5.4-2.
 - Operate the sideshifter through several full cycles to clear the system of any entrapped air. Check fittings and hoses for leaks.

55C FRAME SIDESHIFTING FORK POSITIONER



FP0359.ill

100C, 120C, 150C FRAME SIDESHIFTING FORK POSITIONER



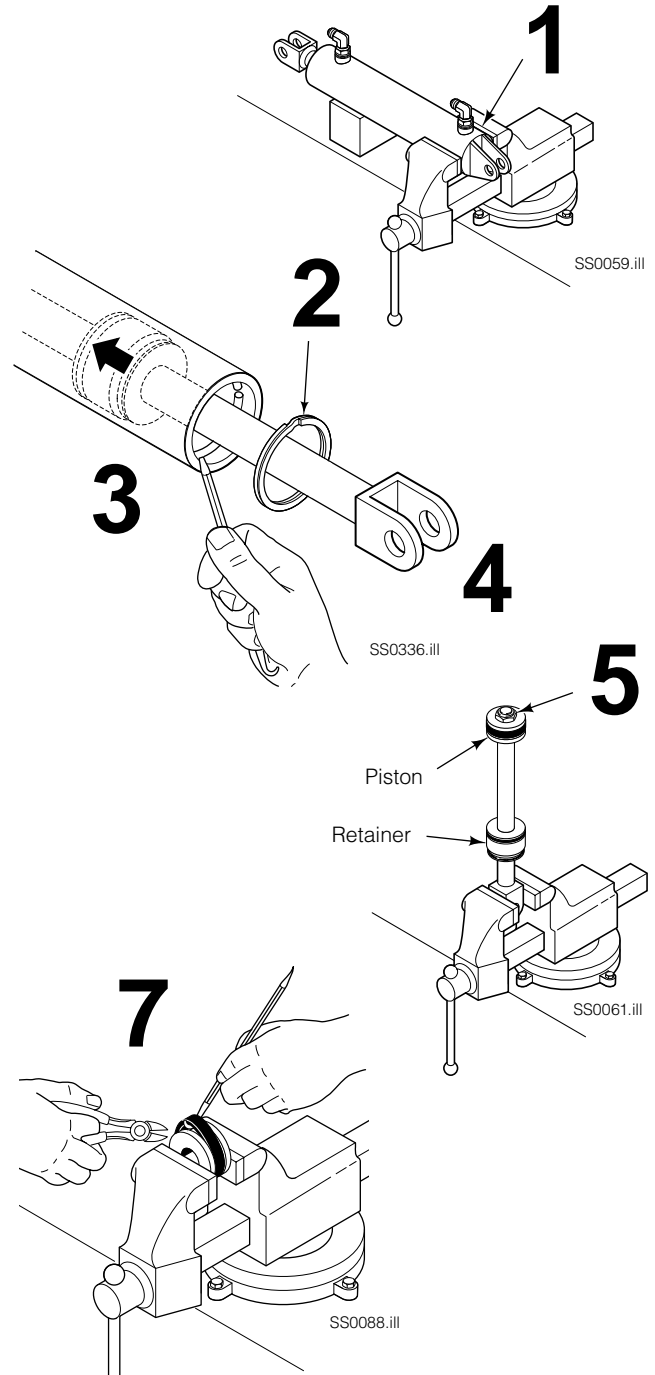
FP0360.ill

2 Clevis Pins (2)

Back (Driver's) Views

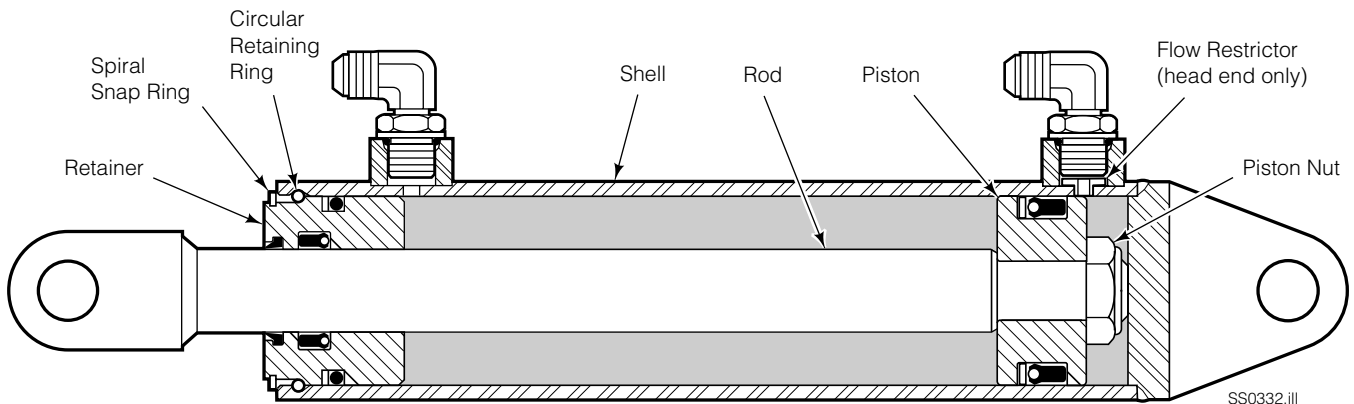
5.4-2 Cylinder Disassembly

- 1 Clamp the cylinder in a soft-jawed vise at the extreme head end only. Do not clamp on the shell.
- 2 Pull the cylinder rod to the fully extended position. Remove the spiral snap ring from the retainer.
- 3 Tap the retainer into the shell approximately 2 in. (50 mm). Remove the circular retaining ring by prying it out of its groove on the opposite side from the split ends. **CAUTION:** Do not scratch the cylinder bore. Service Tool Kit 674424 includes two double-edged brass tools that make seal and retaining ring removal easy and won't damage the cylinder components with dents or scratches.
- 4 Remove the rod/piston assembly from the cylinder.
- 5 To remove the piston, clamp the rod assembly in a vise on the clevis end as shown. **CAUTION:** Do not clamp on the cylinder rod sealing surface.
- 6 Remove the piston nut and remove the piston from the cylinder rod.
- 7 Place the piston or retainer in a soft-jawed vise to remove the seals. Pry the seals or O-rings out with a brass seal removal tool (Cascade Part No. 674424) and cut the seals to remove them. **CAUTION:** Do not scratch the seal grooves.



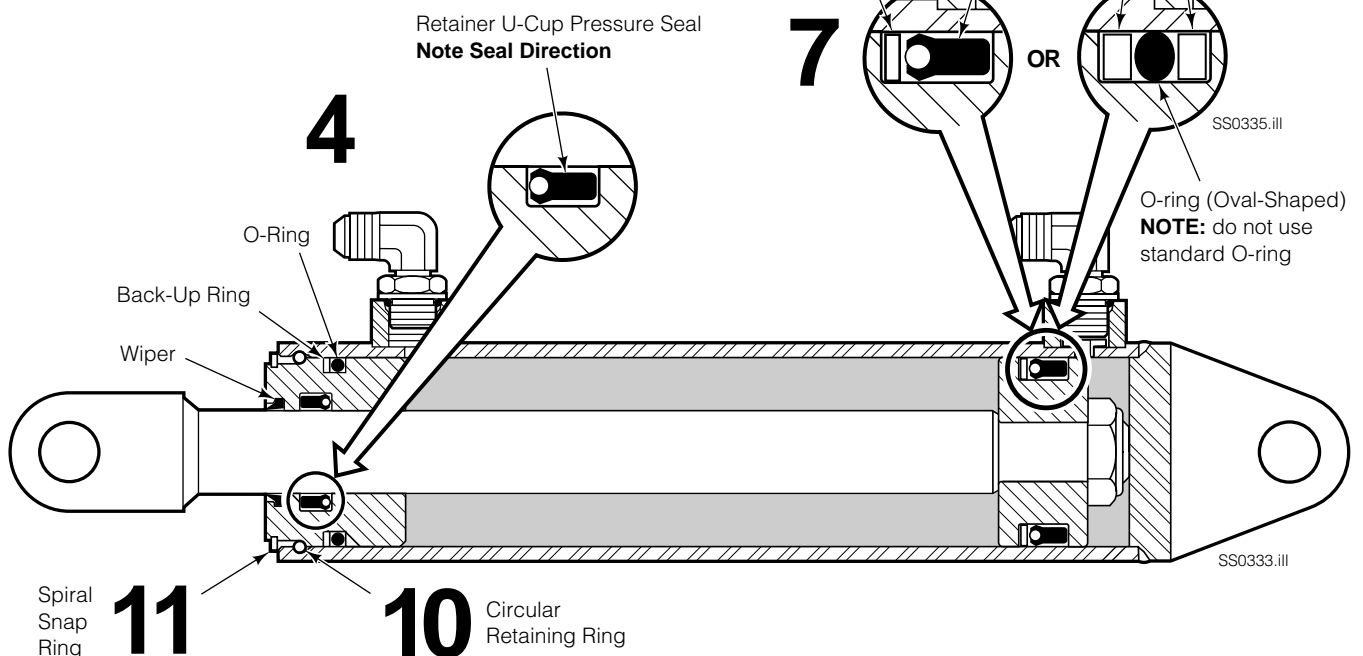
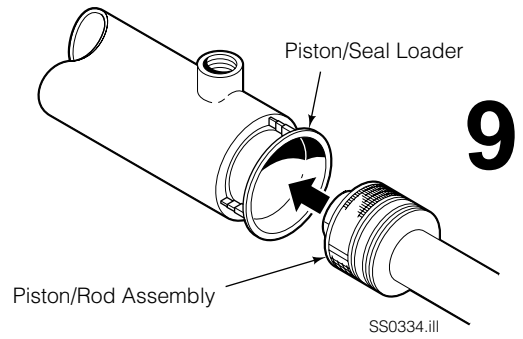
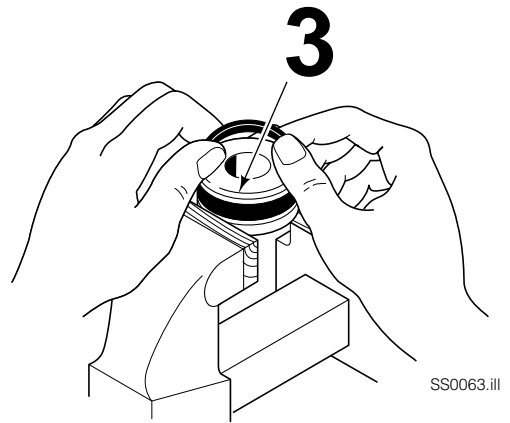
5.4-3 Cylinder Inspection

- Inspect the rod, piston and retainer for nicks or burrs. Minor nicks or burrs may be removed with 400-grit emery cloth. If they cannot be removed, replace the parts.
- Inspect the cylinder bore and remove any minor nicks or burrs with a butterfly. If they cannot be removed, replace the part. **NOTE:** Minor nicks are those that will not pass hydraulic fluid under pressure.
- Inspect the outside of the shell for any deformities or cuts that could impair performance or cause leaks under pressure. If necessary, replace the part.



5.4-4 Cylinder Reassembly

- 1 Lubricate new seals and O-rings with petroleum jelly.
- 2 Note the direction of the U-cup seals. **Pressure seals must be installed with the lip toward the high pressure side of the cylinder.**
- 3 Polish the piston and retainer chamfer angles with 400-grit emery cloth to ease seal installation.
- 4 Install a new pressure seal, wiper seal, O-ring and back-up ring on the retainer (see illustration below).
- 5 Clamp the piston rod at the clevis end in a soft-jawed vise. **CAUTION:** Do not clamp on the cylinder rod sealing surface.
- 6 Apply a thick film of petroleum jelly to the retainer ID and install the retainer on the rod. Use a seal loader as required to prevent damage to the seals.
- 7 Install a new pressure seal (U-cup or O-ring type), and back-up rings on the piston (see illustration below).
- 8 Install the piston on the rod. Tighten the nut as follows:
 - 55C – 75 ft.-lbs. (100 Nm)
 - 100C – 120 ft.-lbs. (160 Nm)
 - 120/150C – 120 ft.-lbs. (160 Nm)
- 9 Apply a thick film of petroleum jelly to the cylinder shell and piston OD and install the rod assembly into the cylinder shell. Use a piston/seal loader as required to prevent damage to the seals.
- 10 Tap the retainer into the shell far enough to install the circular retaining ring in its groove.
- 11 Pull the rod out to the fully extended position and install the spiral snap ring on the retainer.



5.5 Fork Position Cylinders

5.5-1 Removal and Installation

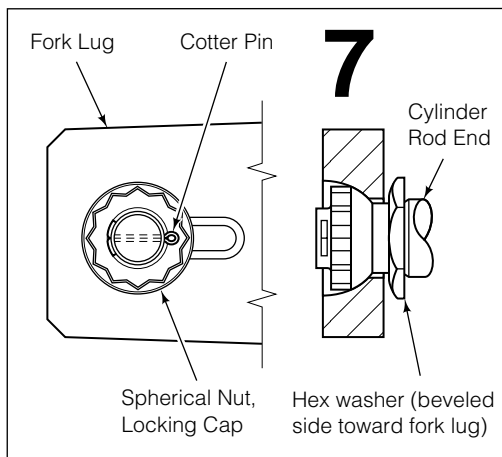
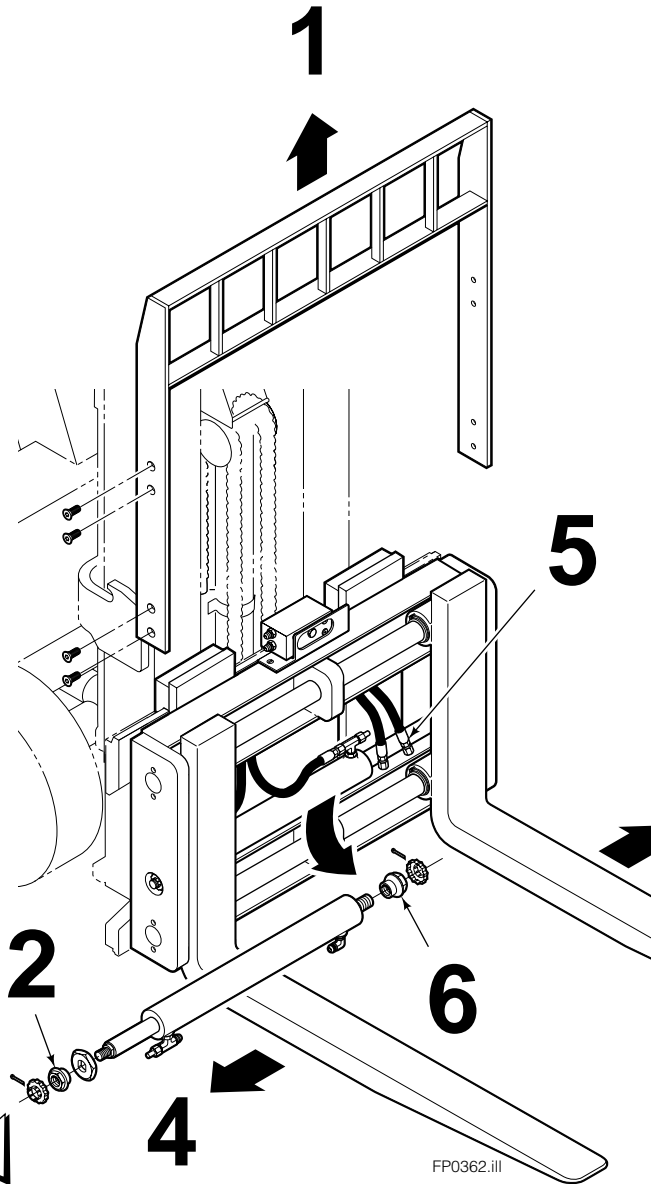
NOTE: The following procedures can be performed with the Fork Positioner mounted on the truck.

- 1 Remove the backrest to provide access to the cylinder head end anchors. For reassembly, tighten the capscrews to 75 ft.-lbs. (100 Nm).
- 2 Position the forks to midrange and disconnect the cylinder rod ends from the forks by removing the cotter pin, locking cap and spherical nut.
- 3 Retract the cylinder rods until they disengage from the fork lugs.
- 4 Slide the disconnected forks to maximum frame width to provide room to remove the cylinders.



WARNING: Before disconnecting hydraulic lines, relieve pressure in the Attachment hydraulic system. Turn the truck off and move the auxiliary control levers several times in both directions.

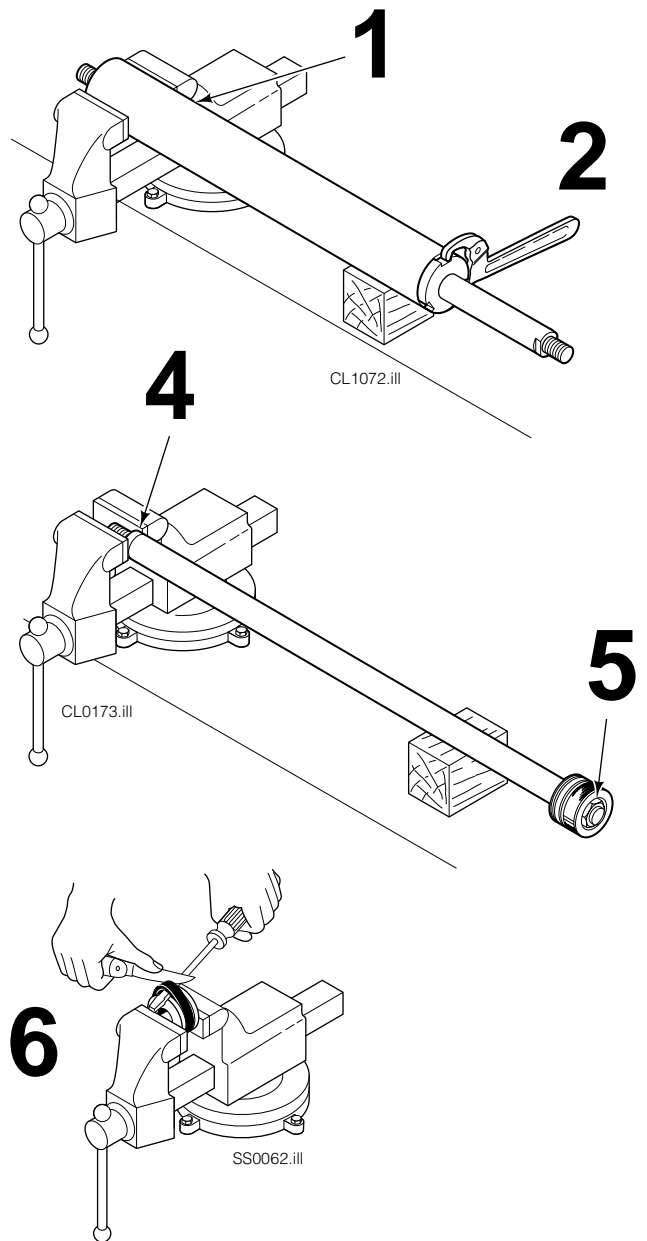
- 5 Disconnect the hydraulic lines from the cylinder to be removed. Plug the lines and cap the cylinder ports. Tag lines for reassembly.
- 6 Disconnect the cylinder head end from the frame by removing the cotter pin, locking cap and spherical nut. Lift the cylinder away from the frame. During reassembly, assure that dowel pins are in place on the cylinder head end.
- 7 For reassembly, reverse the above procedures with the following exceptions:
 - Service cylinder as described in Section 5.5-2.
 - Lubricate threads and spherical nuts with grease.
 - Install hex beveled washer on cylinder rod end. **NOTE:** Make sure beveled side faces lug as shown.
 - Tighten spherical nuts to 160 ft.-lbs. (220 Nm). **NOTE:** Nut tightens against hex washer, providing a loose operating clearance. Lubricate anchor joints with chassis grease.
 - Install locking caps using new cotter pins.



WARNING: After completing this service procedure, test the Fork Positioner through five complete cycles. First test empty, then test with a load to make sure the Attachment operates correctly before returning it to the job.

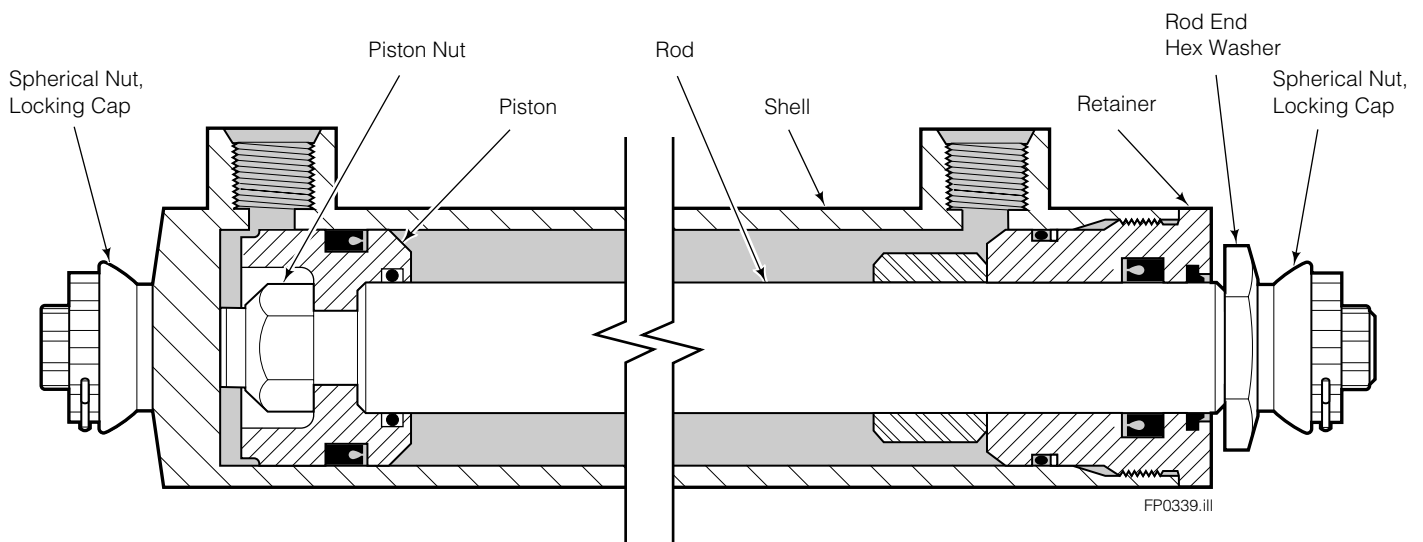
5.5-2 Cylinder Disassembly

- 1 Clamp the cylinder in a soft-jawed vise at the extreme head end only. Do not clamp on the shell.
- 2 Unscrew and remove the retainer using a claw-type spanner wrench as shown. (Cascade Part No. 678598)
- 3 Remove the rod/piston assembly from the cylinder.
- 4 To remove the piston, clamp the rod assembly in a vise on the wrench flats as shown. **CAUTION:** Do not clamp on the cylinder rod sealing surface.
- 5 Remove the piston nut and remove the piston from the cylinder rod.
- 6 Place the piston or retainer in a soft-jawed vise to remove the seals. Pry the seals or O-rings up with a brass seal removal tool (Cascade Part No. 674424) and cut the seals to remove them. **CAUTION:** Do not scratch seal grooves.



5.5-3 Cylinder Inspection

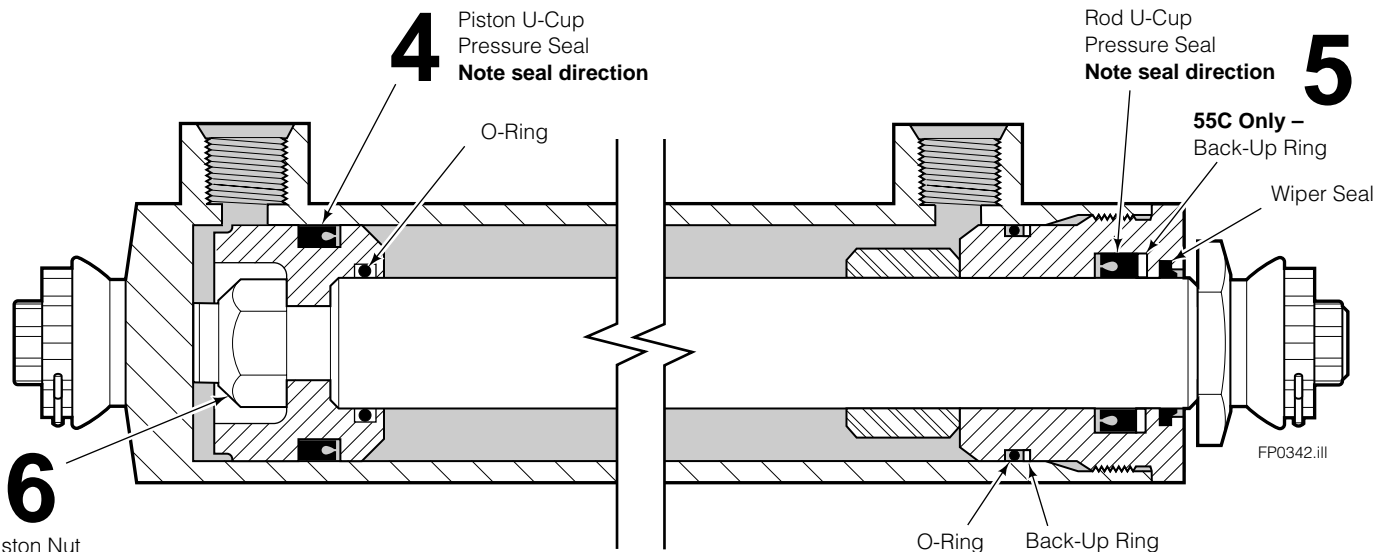
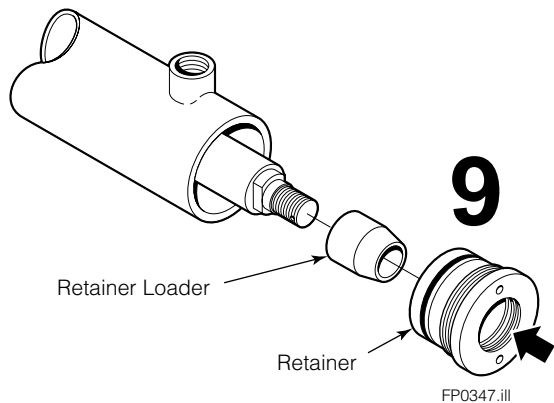
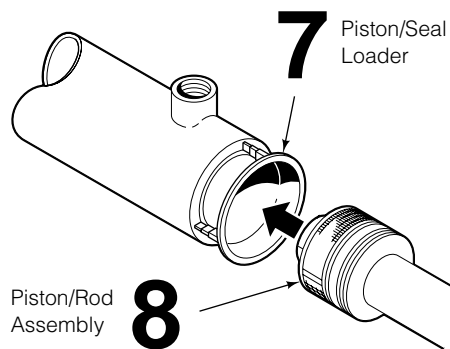
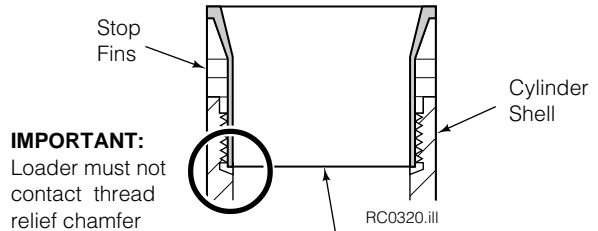
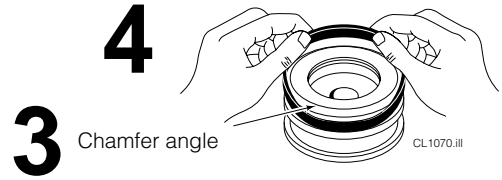
- Inspect the rod, piston and retainer for nicks or burrs. Minor nicks or burrs may be removed with 400-grit emery cloth. If they cannot be removed, replace the parts.
- Inspect the cylinder bore and remove any minor nicks or burrs with a butterfly. If they cannot be removed, replace the part.
- Inspect the outside of the shell for any deformities or cuts that could impair performance or cause leaks under pressure. If necessary, replace the part.
- Inspect the spherical nuts and hex washer for wear and replace as necessary.



5.5-4 Cylinder Reassembly

- 1 Lubricate all new seals and O-rings with petroleum jelly.
- 2 Note the direction of the U-cup seals. **Pressure seals must be installed with the lip toward the high pressure side of the cylinder.**
- 3 Polish the piston and retainer chamfer angles with 400-grit emery cloth to ease seal installation.
- 4 Install a new seal and O-ring on the piston. Install the piston seal from the rod end side of the piston by hooking one side into the groove and carefully working the seal over the piston as shown.
- 5 Install a new rod seal, back-up ring, and wiper seal in the retainer I.D., and a new O-ring and back-up ring on the retainer O.D. as shown. **NOTE:** Use internal seal installation tool (Cascade Part No. 599512) to ease seal installation. If installing by hand, form the seal into a 'kidney' shape and position into the internal groove. Use finger pressure to smooth the seal into the groove.
- 6 Apply petroleum jelly to the piston internal O-ring and install the piston on the rod. Tighten the nut as follows:
 - 55C** – 75 ft.-lbs. (100 Nm)
 - 100C, 120C, 150C** – 120 ft.-lbs. (160 Nm)
- 7 Place the piston loader into the cylinder shell.

IMPORTANT: The loader must cover all of the shell threads but not contact the thread relief chamfer. If necessary, trim the stop fins for a correct fit. The piston will not enter the shell if the loader contacts the thread relief chamfer.
- 8 Apply a thick film of petroleum jelly to the piston, shell and loader. Using a rubber mallet, tap the piston/rod assembly into the cylinder shell.
- 9 Place the retainer loader over the rod end threads. Apply petroleum jelly to the retainer I.D. and slide it onto the rod. Remove the loader and screw the retainer into the shell. Tighten the retainer as follows:
 - 55C** – 100 ft.-lbs. (135Nm)
 - 100C, 120C, 150C** – 175 ft.-lbs. (235 Nm)



5.6 Sideshifting Frame

5.6-1 Bearings and Anchor Plate Replacement

NOTE: The Fork Positioner must be removed from the truck to accomplish the following procedures.

- 1 Remove the Fork Positioner from the truck as described in Section 5.1.
- 2 Remove the sideshifter anchor plate and bearings. Clean the upper hook and truck carriage with solvent.
- 3 Inspect the truck carriage for damaged notches. Repair as required. If replacing bearings only, inspect the centering tab on the anchor plate to assure that it is not damaged or broken off.

- 4 Replace the upper bearings. All bearings should be replaced if any bearing is worn to less than 1/16 in. (1.5 mm) thick on the back surface as shown.

CAUTION: During reassembly, assure that the upper bearings are installed correctly in the anchor plate as shown. Lower hook clearance will not be correct if the upper bearings are not installed correctly.

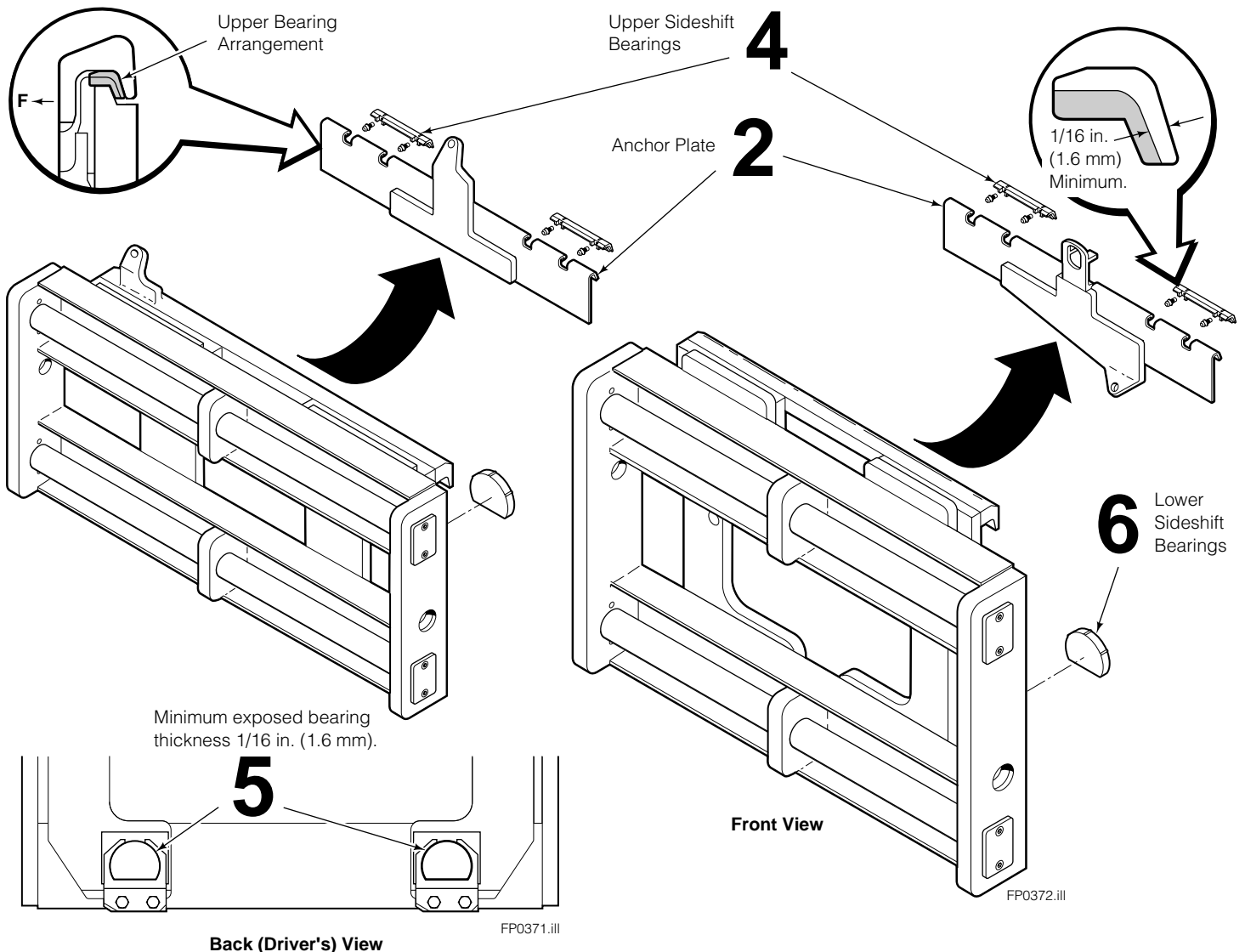
- 5 Replace the lower bearings. All bearings should be replaced if any bearing is worn to less than 1/16 in. (1.5 mm) exposed thickness.

- 6 Pry the lower bearings out of the bearing pockets. Clean the bearing pockets with solvent. **NOTE:** Lower bearings should be a tight press fit into the frame pockets.

- 7 For reassembly, reverse the above procedures.

55C FORK POSITIONER

100C, 120C, 150C FORK POSITIONER



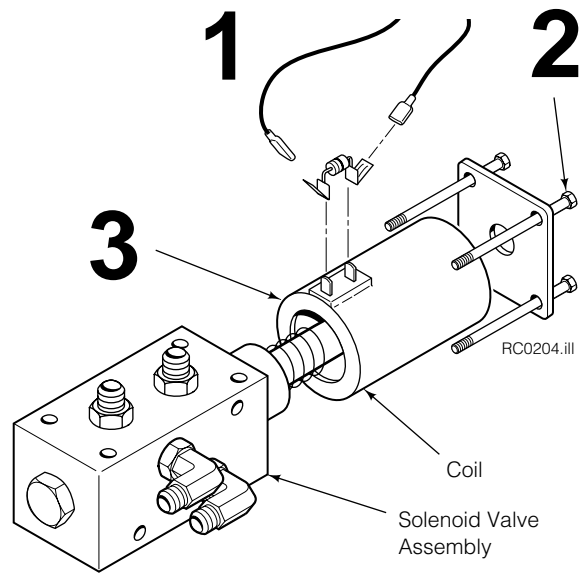
5.7 Solenoid Valve

5.7-1 Coil Service

- 1 Disconnect the wires and diode from the coil terminals.
- 2 Loosen the end cover capscrews. Remove the end cover and coil.
- 3 Install the new coil and end cover. Assure that the terminals are positioned correctly.
- 4 For reassembly, reverse the above procedures except as follows:
 - Refer to the electrical schematic in Section 4.5 for correct wire and diode installation.

5.7-2 Valve Service

- Check the plunger within the valve body for freedom of movement. If jammed or damaged, replace the solenoid valve as a complete assembly.



6.1 Specifications

6.1-1 Hydraulics

Truck Relief Setting

2000 psi (140 bar) Recommended
2300 psi (160 bar) Maximum

Truck Flow Volume ①

	Min. ②	Recommended	Max. ③
55C, 100C	5 GPM	7 GPM	10 GPM
120C, 150C	(19 L/min.)	(26 L/min.)	(38 L/min.)

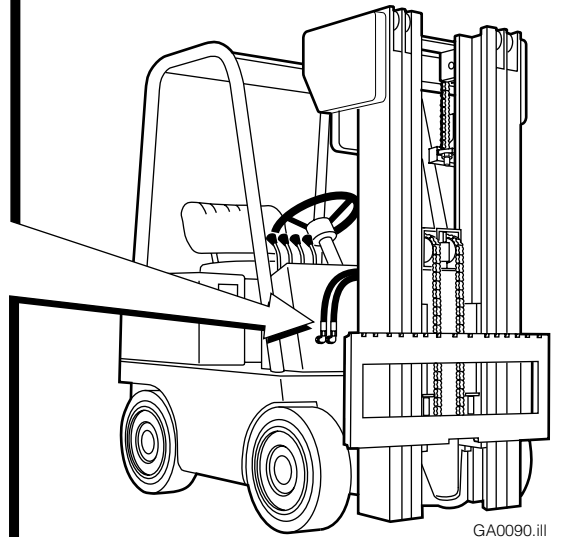
① Cascade C-Series Fork Positioners are compatible with SAE 10W petroleum base hydraulic fluid meeting Mil. Spec. MIL-0-5606 or MIL-0-2104B. Use of synthetic or aqueous base hydraulic fluid is not recommended. If fire resistant hydraulic fluid is required, special seals must be used. Contact Cascade.

② Flow less than recommended will result in slow and unequal fork movement.

③ Flow greater than maximum can result in excessive heating, reduced system performance and reduced hydraulic system life.

Hoses and Fittings

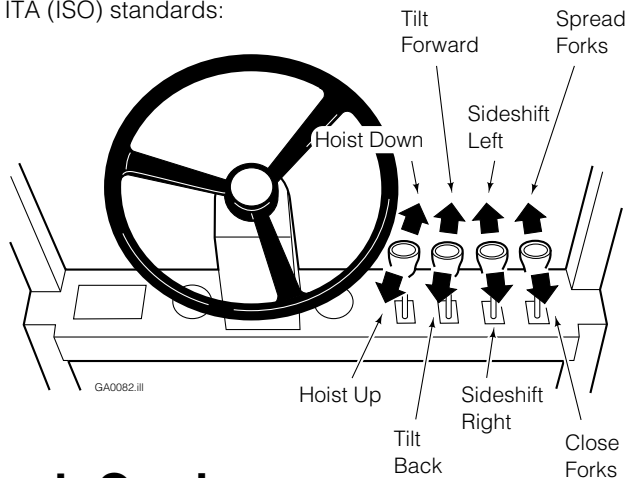
All hoses and fittings for the fork-positioning and sideshift (if equipped) functions should be at least No. 6 with 9/32 in. minimum I.D.



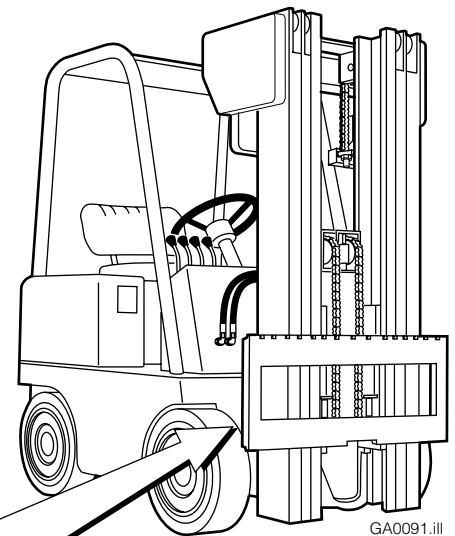
GA0090.iii

6.1-2 Auxiliary Valve Functions

Check for compliance with ITA (ISO) standards:



GA0082.iii



GA0091.iii

6.1-3 Truck Carriage

Carriage Mount Dimension (A) ITA (ISO)

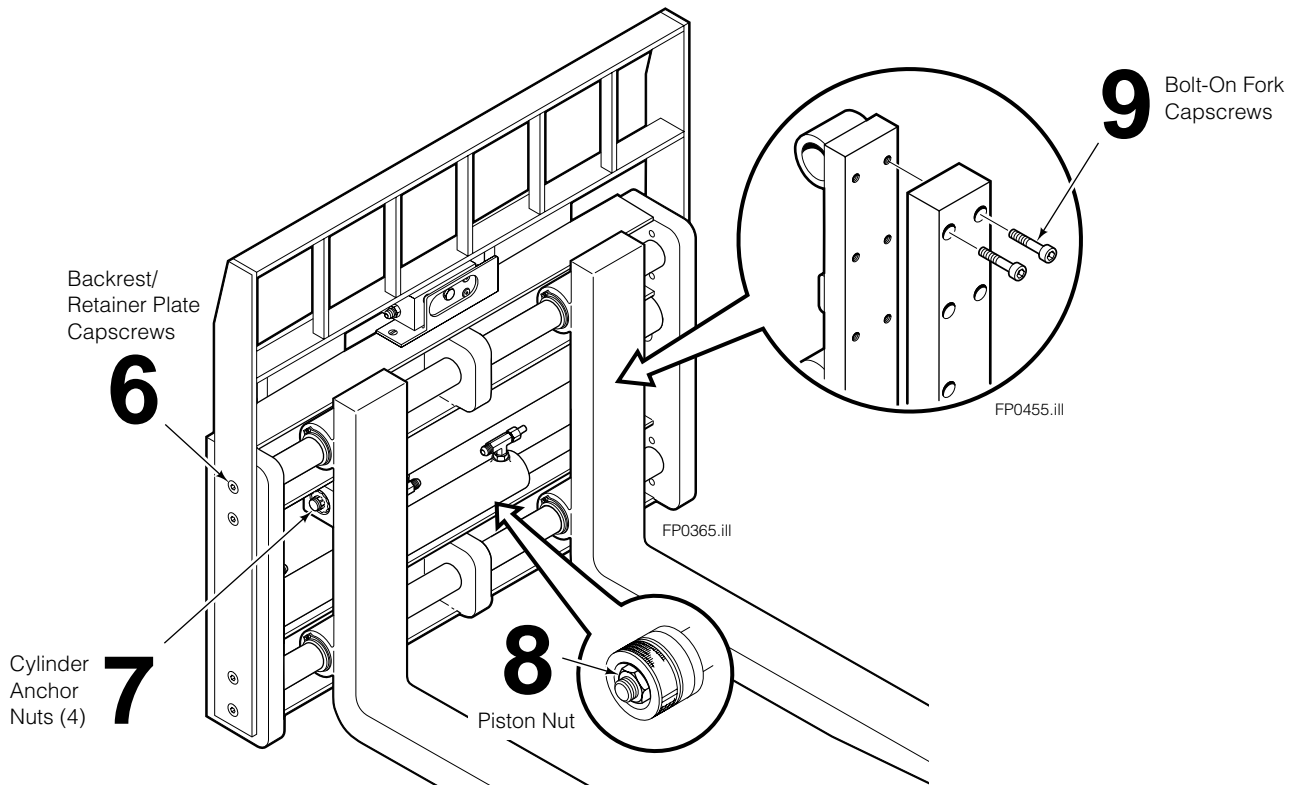
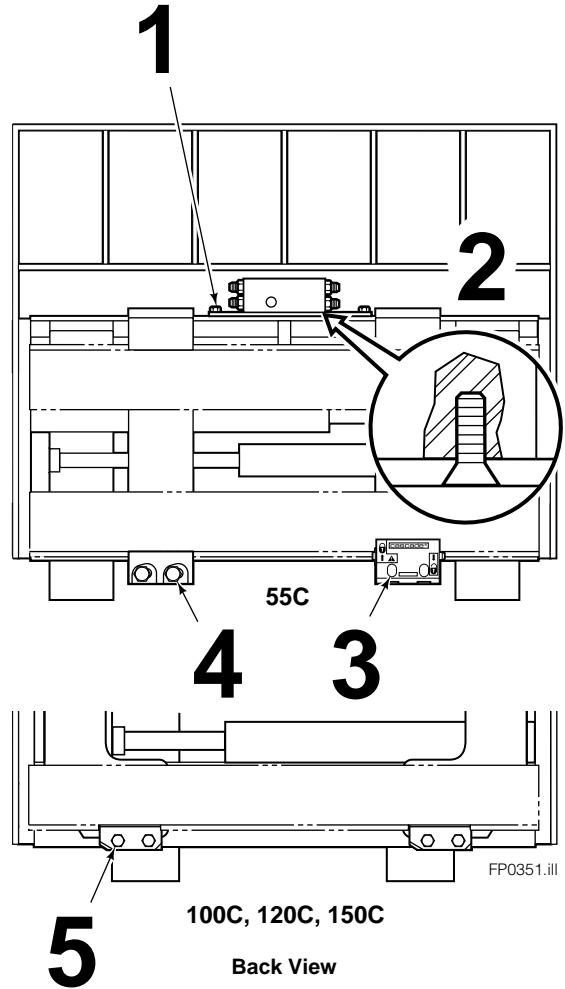
	Minimum	Maximum
Class II	14.94 in. (380.0 mm)	15.00 in. (381.0 mm)
Class III	18.68 in. (474.5 mm)	18.74 in. (476.0 mm)
Class IV	23.44 in. (595.5 mm)	23.50 in. (597.0 mm)

GA0028.iii

6.1-4 Torque Values

Fastener torque values for C-Series Fork Positioners are shown in the table below in both U.S. and Metric units. All torque values are also called out in each specific service procedure section throughout the Manual.

Ref.	Fastener	Size	Ft.-lbs.	Nm
1	Valve mounting plate-to-frame (2)	M-10	15	20
2	Valve-to-mounting plate (2)	M-10	15	20
3	Quick-Change lower hook (4), CL II / III	M-16	165	225
		CL IV M-16	190	255
4	Bolt-on lower hook (4), CL II / III	M-16	165	225
		CL IV M-16	190	255
5	Sideshifter lower hook (4), CL II / III	M-16	165	225
		CL IV M-16	190	255
6	Backrest/Retainer Plate-to-frame (8)	M-12	75	100
7	Cylinder anchor nut (4)	3/4 UNF	160	220
8	Cylinder piston-to-rod nut (2)	5/8 UNF	75	100
		7/8 UNF	120	160
9	Bolt-on fork- 55C	1/2 UNC (M16)	200	280
	to-carrier 100C/	5/8 UNC (M20)	300	405
	120C/150C	3/4 UNC (M24)	700	950



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