

SERVICE MANUAL

Electric AC-Powered Stand-Up Rider
Narrow Aisle Single & Double Reach

FR15K/18K/23K-3

S/N 169E00001 and up



WARNING

Read and observe all warnings on this unit before operating it.

DO NOT operate this equipment unless all factory-installed guards and shields are properly secured in place.

KOMATSU®

REVISED: JUNE 2012

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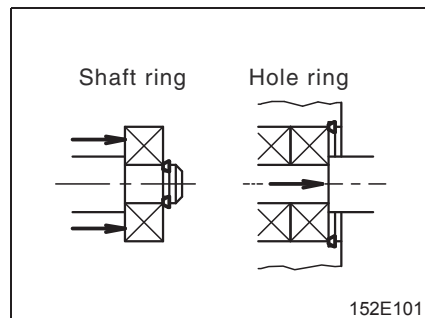
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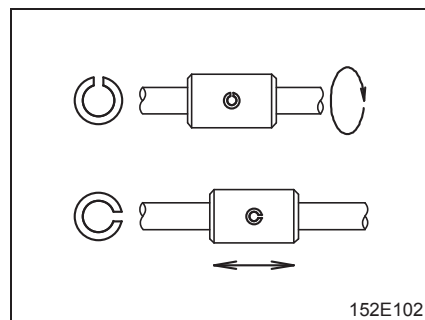
4. General precautions for maintenance

General precautions

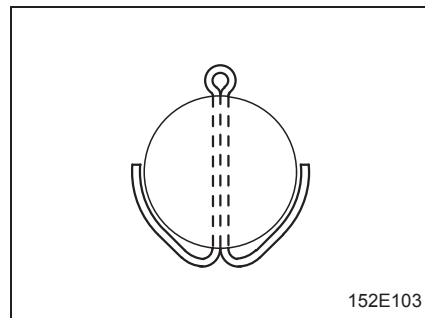
- When replacing parts, be sure to use genuine parts.
- During assembly, be sure to replace parts such as packing and O-rings with new parts. Apply a thin layer of grease to parts such as O-rings and oil seals before installing them.
- When installing a C-type snap ring, face the corner in the direction that bears the force, as shown in the figure.



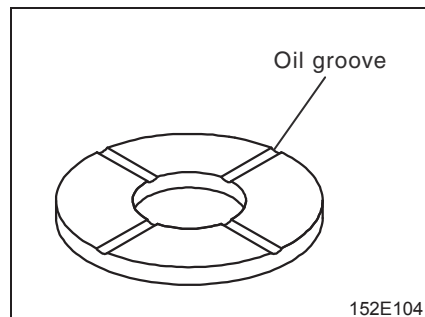
- When installing a spring pin (roll pin), face the split part (alignment line) in the direction that bears the force, as shown in the figure.



- Replace cotter pins with new parts and split them correctly.



- If the thrust washer contains an oil groove, pay attention to the installation direction.



- Be sure to disconnect the battery plug before removing or installing a coupler (connector) from/to an electrical component harness.

1-2-2. Mast Right Angle Stacking Aisle Widths

in. (mm)

FR18K		Load Width				
Load Length	30	36	40	42	44	48
30	83 (2108)	82 (2083)	81 (2057)	80 (2032)	80 (2032)	79 (2007)
36	91 (2311)	91 (2311)	90 (2286)	90 (2286)	90 (2286)	89 (2261)
40	96 (2438)	95 (2413)	95 (2413)	95 (2413)	95 (2413)	94 (2388)
42	98 (2489)	98 (2489)	97 (2464)	97 (2464)	97 (2464)	97 (2464)
44	100 (2540)	100 (2540)	100 (2540)	99 (2515)	99 (2515)	99 (2515)
48	105 (2667)	104 (2642)	104 (2642)	104 (2642)	104 (2642)	103 (2616)
FR23K		Load Width				
30	90 (2286)	88 (2235)	87 (2210)	87 (2210)	86 (2184)	85 (2159)
36	97 (2464)	97 (2464)	96 (2438)	96 (2438)	96 (2438)	95 (2413)
40	102 (2591)	101 (2565)	101 (2565)	101 (2565)	101 (2565)	100 (2540)
42	104 (2642)	104 (2642)	103 (2616)	103 (2616)	103 (2616)	103 (2616)
44	106 (2692)	106 (2692)	106 (2692)	105 (2667)	105 (2667)	105 (2667)
48	111 (2819)	110 (2794)	110 (2794)	110 (2794)	110 (2794)	109 (2769)
FR15K		Load Width				
30	97 (2464)	96 (2438)	96 (2438)	96 (2438)	95 (2413)	95 (2413)
36	104 (2642)	104 (2642)	103 (2616)	103 (2616)	103 (2616)	102 (2591)
40	108 (2743)	108 (2743)	108 (2743)	108 (2743)	107 (2718)	107 (2718)
42	111 (2819)	110 (2794)	110 (2794)	110 (2794)	110 (2794)	109 (2769)
44	113 (2870)	112 (2845)	112 (2845)	112 (2845)	112 (2845)	112 (2845)
48	117 (2972)	117 (2972)	116 (2946)	116 (2946)	116 (2946)	116 (2946)

1-2-3. Mast Battery Compartment Dimensions

in. (mm)

FR18K		FR23K		FR15K	
Length	16.4 (417)	Length	16.4 (417)	Length	16.4 (417)
Width	38.7 (984)		20.9 (531)		20.9 (531)
Height	32 (813)	Width	38.7 (984)	Width	38.7 (984)
			38.7 (984)		38.7 (984)
Height	32 (813)	Height	32 (813)	Height	32 (813)
			32 (813)		32 (813)

Gear and other parts

● Drive unit disassembly and assembly (3)

Coupling		G
Apply grease to the spline.		
Tightening torque		
180 - 200 N•m		
Adjust the pre-load before crimping.		
Tightening torque		
76 - 98 N•m		
Pre-load		
Measure at the periphery of the driven gear.	35 - 40 N	
Backlash		
0.1 - 0.3 mm		
Drive reduction ratio		18.74
Hard lock nut comp.		L
Tightening torque (convex side)	70 - 80 N•m	
Tightening torque (concave side)	120 - 130 N•m	
Apply Loctite [#242].		
Oil seal		B G
Lip: Apply grease. Periphery: Apply ThreeBond [#1104].		
B Pre-load		
Measure at the location of bolt [B].	170 - 180 N	
Tightening torque		
90 - 100 N•m (9.2 - 10.2 kgf•m)		
1 Shim		
For adjusting the pre-load		
2 Shim		
Install onto the bearing housing installation bolt (gear case side).		

T : Tightening torque
B : Apply ThreeBond.
G : Apply grease.
 Grease: Shell Albania Grease RA or an equivalent product
L : Apply Loctite.

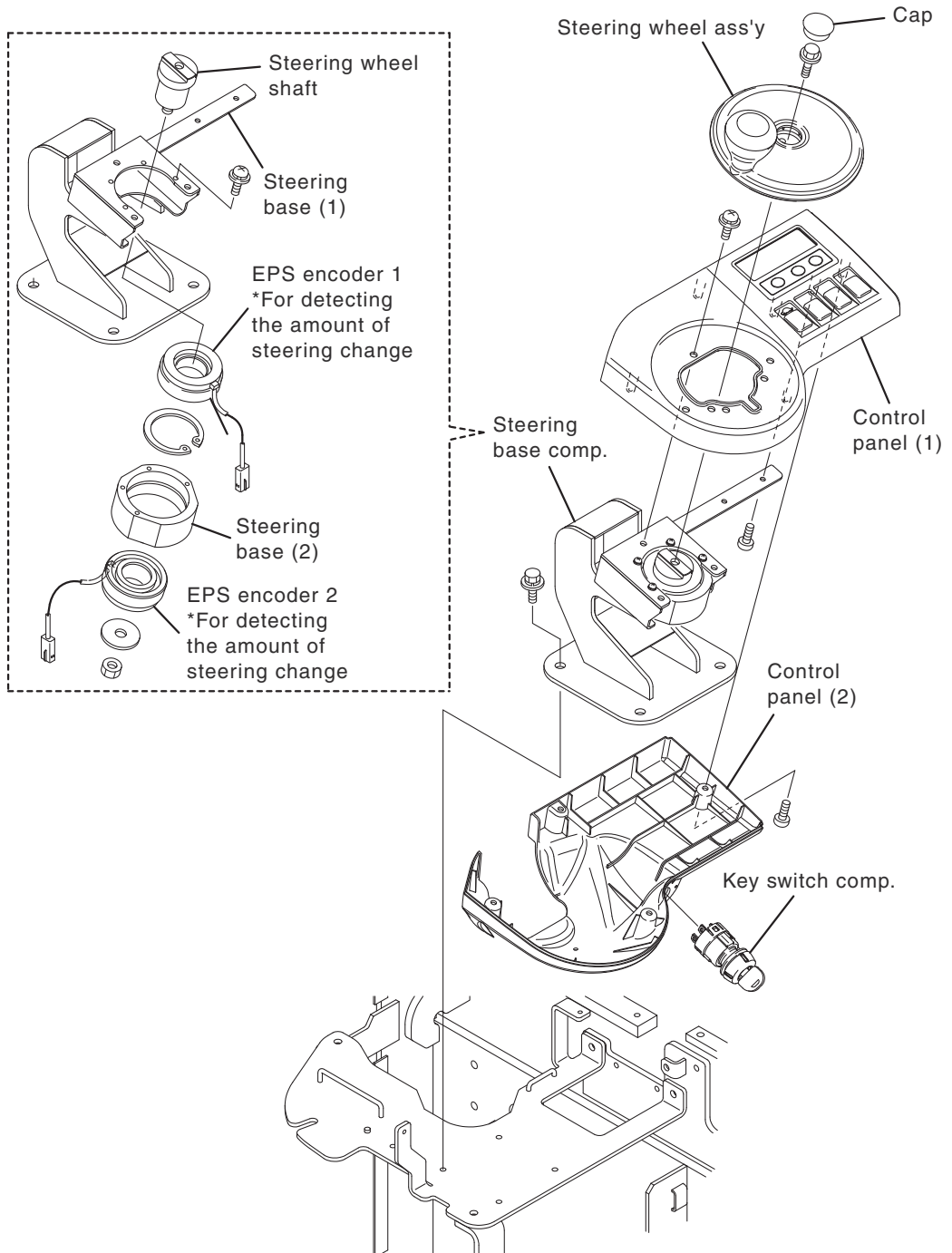


- If the oil seal or O-ring was removed, replace with new one.
- If the bearing was damaged, replace with new one.

4. STEERING ASSY

4-1. Names of parts

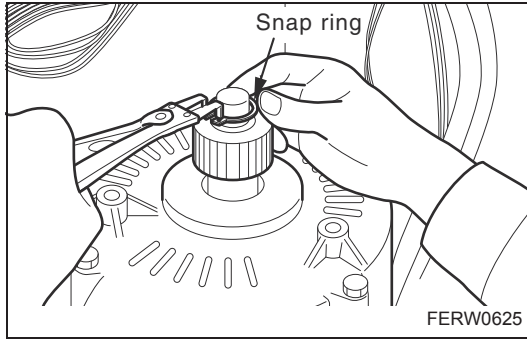
● Names of primary parts



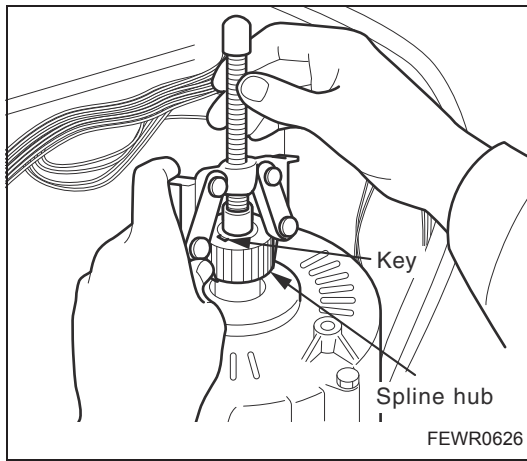
FERW0401

4. Remove the spline hub.

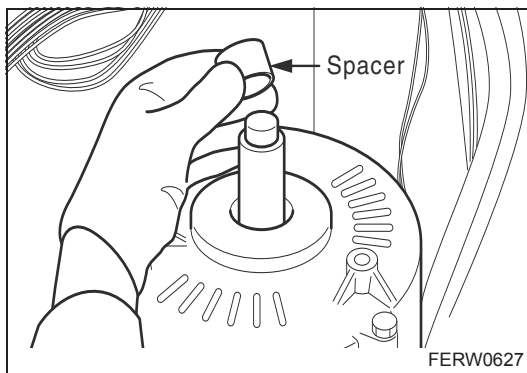
1. Remove the snap ring.



2. Remove the spline hub and key.



3. Remove the spacer.



7b. OIL TANK

7b-1. Disassembly and assembly



- Be sure to place wheel chocks at the tires.
- When draining the oil, place the fork in contact with the ground before removing the plug.
- Before disconnecting a high-pressure pipe or high-pressure hose, be sure to operate the lever to lower the fork and release the pressure from inside the pipe/hose. Depress the presence pedal and turn the key switch to the ON position, then operate the lever to lower the fork. Do not perform any lever operations other than lowering of the fork. Because pressure is applied when the hydraulic motor operates.
- When disconnecting hydraulic pipes, cap them so that dust and dirt do not enter them.
- When installing the filter and plug, wind the threads with seal tape and tighten securely.
- Turn the key switch to the OFF position and be sure to disconnect the battery plug.

7b-1-1. Removing and installing the oil tank

➔ See steps 1 - 7 in “Removing the drive unit” on page 22.

* When installing the oil tank, follow the procedure for removal in the opposite order.

7c-3. Troubleshooting

7c-3-1. Control valve troubleshooting

No.	Symptom	Cause	Corrective action
1	Lift and tilt do not operate.	(1) Pump or coupling failure	Replace
		(2) Oil level in oil tank is too low.	Add oil
		(3) Plunger spring is broken.	Replace the assy
		(4) Hydraulic micro switch or wiring malfunction.	Replace
		(5) Lift lock is engaged.	Check
		(6) Seat switch circuit malfunction	Check
2	It is not possible to lift the maximum allowable load.	(1) Relief valve malfunction	Replace the assy
		(2) Pump malfunction	Replace
3	Lift speed is slow.	(1) Battery has been over-discharged.	Charge the battery
		(2) Cylinder packing is damaged.	Replace
		(3) Relief valve pressure is low.	Adjust
		(4) Pump malfunction	Replace
		(5) Oil tank filter is clogged.	Clean or replace
		(6) Hydraulic pressure setting has not been adjusted correctly.	Set again
4	Hydraulic drift of lift cylinder and tilt cylinder	(1) Damage to cylinder inner surface or piston	Replace
		(2) Damage to piston packing	Replace
		(3) Valve malfunction <ul style="list-style-type: none"> ● Contamination of spool ● Contamination of lift lock poppet 	Clean or replace
5	Shock at start of lift is large.	(1) Operation timing malfunction of hydraulic micro switch	Adjust
		(2) Relief valve malfunction	Replace the assy
6	Oil leakage	(1) Damage to O-ring or wiper	Replace
		(2) Loose valve block bolt	Tighten further

8-3-2. Inspecting and replacing the armature comp. (EPS motor)

▶ 1 Checking for damage

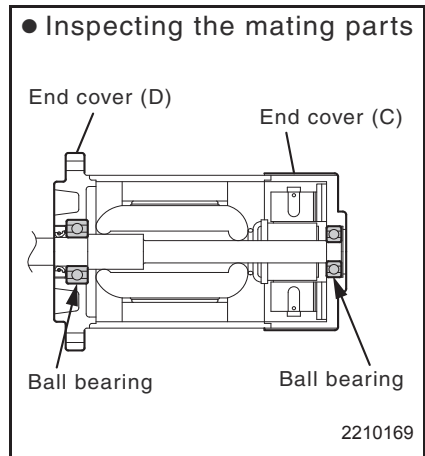
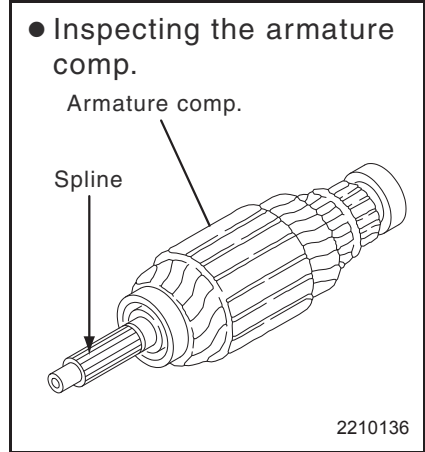
1. Check for damage and burning.
- ➔ If damage or burning is found, replace the armature comp.
- ➔ If the commutator is damaged, replace it.

▶ 2 Inspecting the spline

1. Check for spline wear.
- ➔ If extreme wear is found, replace it.

▶ 3 Inspecting the ball bearings

1. Check the parts that mate with End cover (C) and End cover (D).
- ➔ If loose, replace.



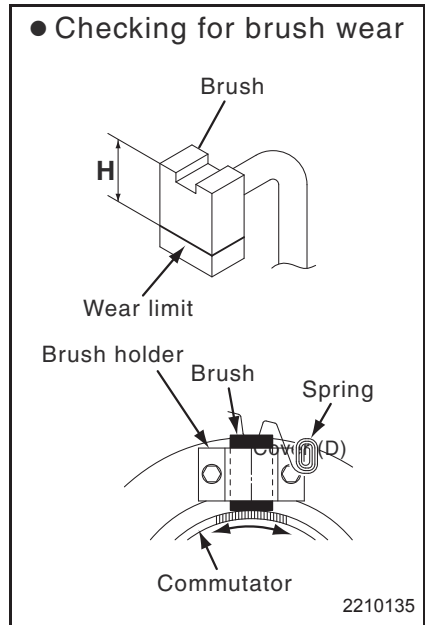
8-3-3. Inspecting and replacing the brushes, brush holders and springs (EPS motor)

▶ 1 Checking for brush wear

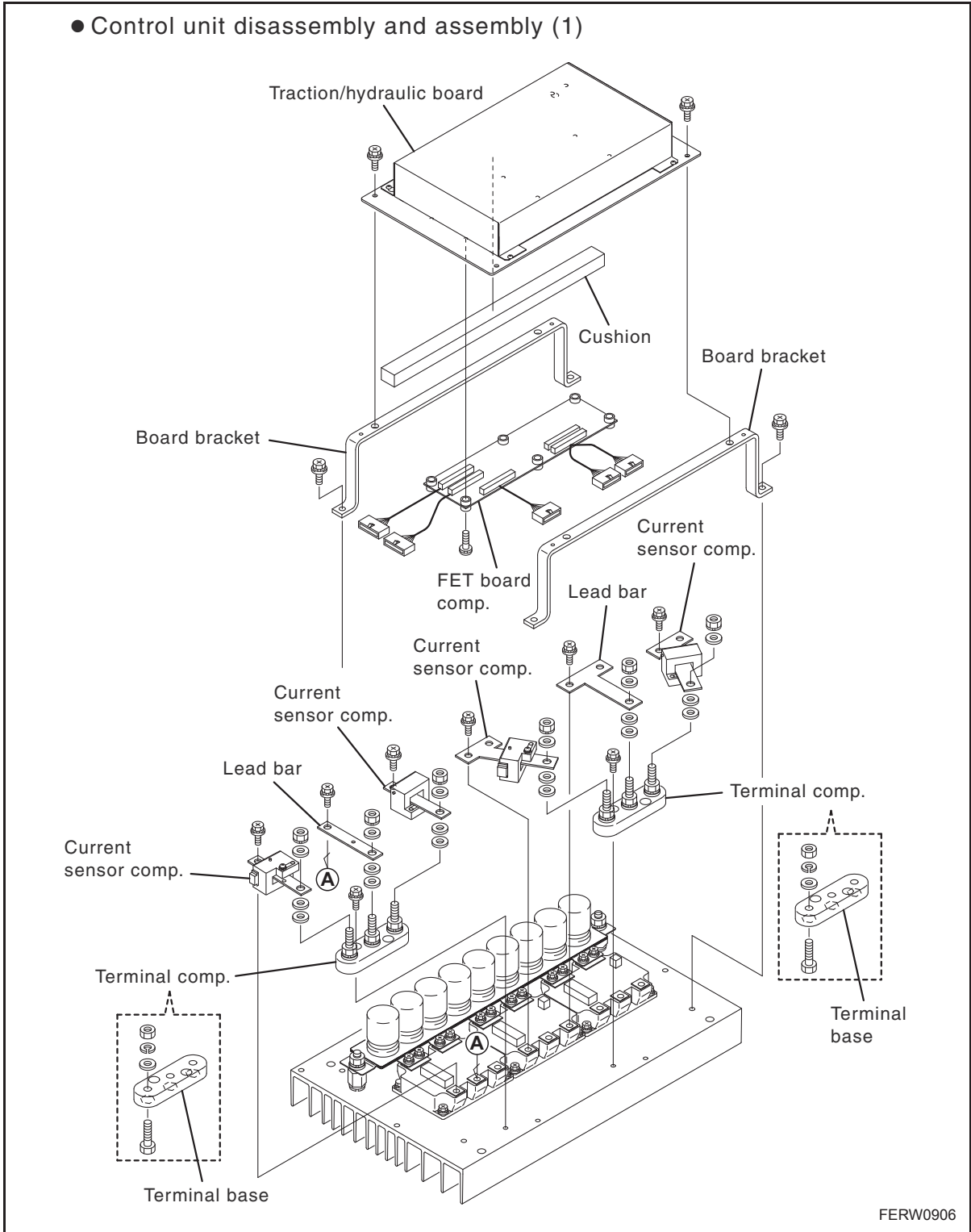
1. Measure dimension H. If it is at or below the wear limit shown in the table below, replace the brush.

<Standard value>

Applicable motor	Standard dimension	Wear limit [H]
EPS motor	20 mm	9 mm



9a-2-2. Control unit disassembly and assembly



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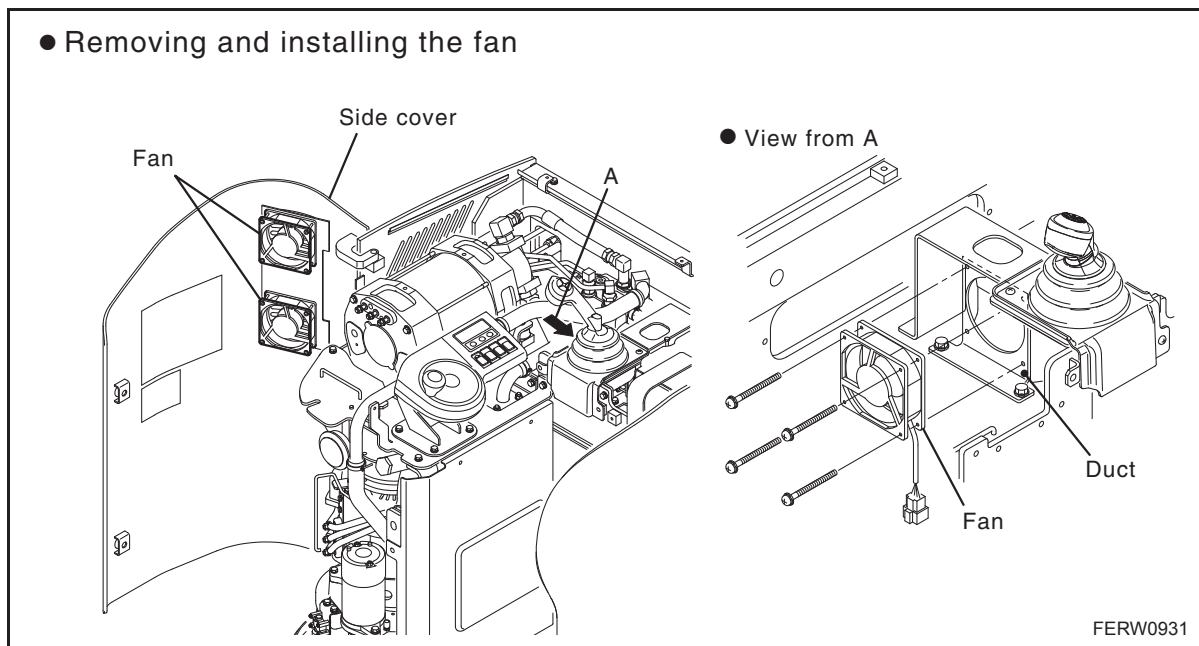



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9e. FAN

9e-1. Removing and installing the fan



 NOTE Type EE does not include a fan.

2.3-1 Chain Lubrication

The main and free lift chains have been factory lubricated using heat and pressure to force the lubrication thoroughly into the chain links. Avoid removal or contamination of this factory-applied lubrication. **Do not wash, sand blast, etch, steam clean, or paint the chains for initial Mast installation.** If chains need lubrication, refer to Section 7.2. **Chain Lubrication**

2.3-2 Upright and Carriage Position, Chain Tension

The main lift chains should be adjusted so that when the unloaded Mast is fully lowered, the uprights are flush at the bottom. The free lift chains should be adjusted so that when the unloaded Mast is fully lowered, the carriage is properly positioned depending on the truck type.

All chains should also be adjusted for equal tension of the pairs to ensure proper load distribution and mast operation. Chains are adjusted at the chain anchors (see Figure 2-2). To determine equal tension, extend the unloaded mast to put the chains under tension. Then press the center of the strand with your thumb. Then press at the same place on the other chain of the pair. Each chain in a pair should have equal “give”.

If the uprights or carriage are not in correct adjustment, or if the chain pairs do not have equal tension, perform the **Main Lift and Free Lift Chain Adjustments** as described in section 7.1.

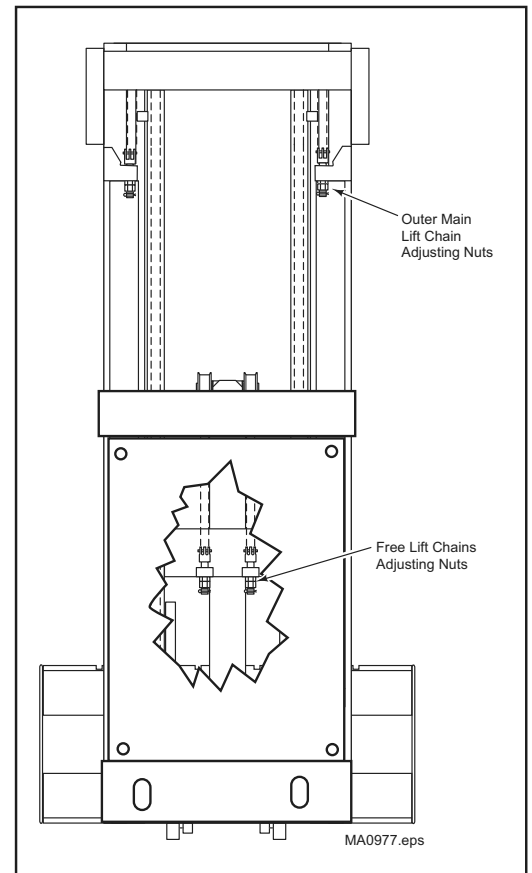


Figure 2-2. Adjusting Chain Anchor Location (driver's view).

6.2-1 Cable, Hose and Chain Sheaves (Refer to figure 6-8 6-10, 6-11 and 6-12)

- * Remove snap rings (6) and sheaves (5).
- * Remove screws (4) securing mounting plates to crosshead (16) and remove assembly from block.
- * Remove pins (15) and crosshead (16) from primary cylinder piston rod.
- * Loosen and remove nuts (1), capscrews (3), and spacers (2).
- * Disassemble assembly. Replace and worn and/or damaged components.

Installation is the reverse of removal.

6.2-2 Free Lift Cylinder (Refer to figure 6-8)

- * Remove cotter pins (7), jam nuts (11), full nuts (10) and ecentrical washer.
- * Remove chain anchors (8) and lift chains (13).
- * Remove snap ring (14). Lift cylinder off alignment pin (12) and out of upright.

Installation is reverse of removal.

NOTE

The free lift cylinder may be removed with upright attached to truck..



WARNING

The free lift cylinder is heavy and care must be taken to avoid personal injury.

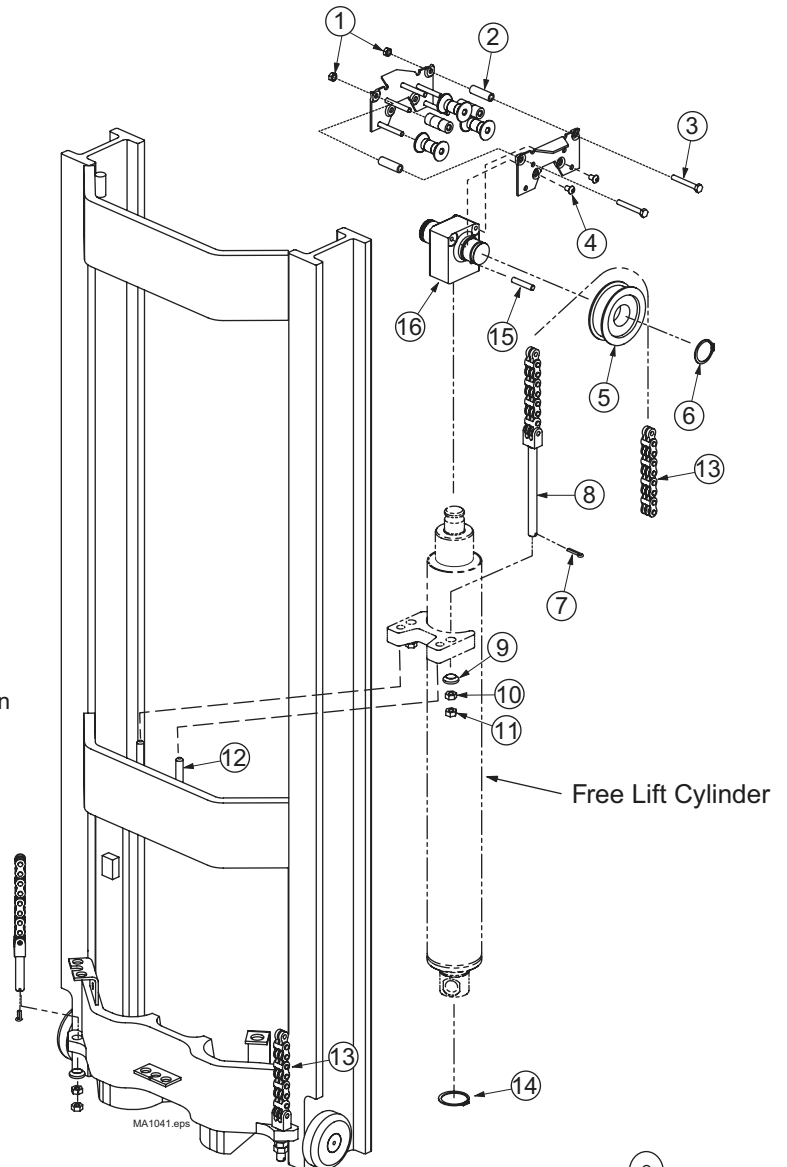


Figure 6-8

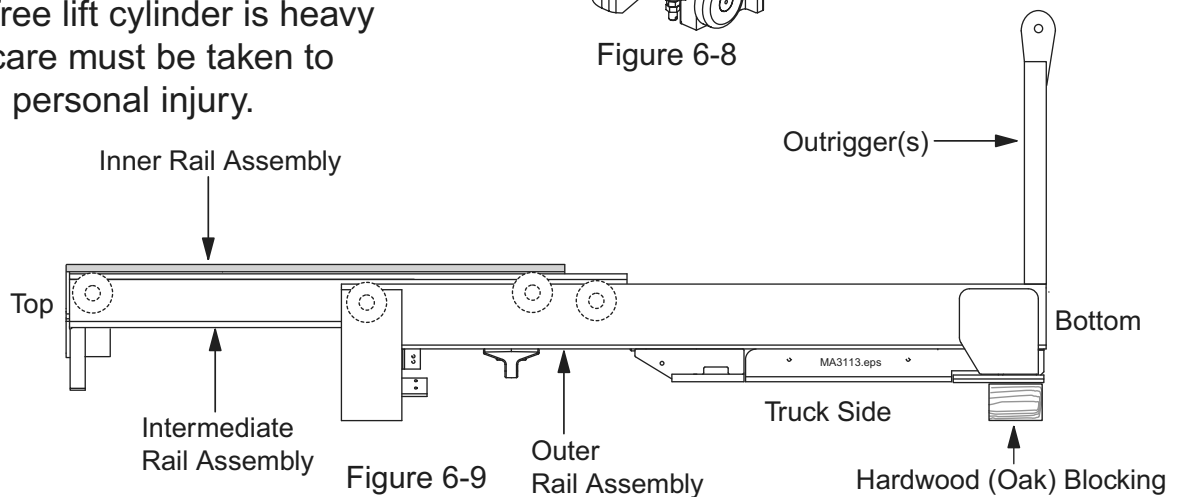


Figure 6-9

7.4 Chain Removal and Replacement



WARNING:

The procedures for removing and replacing chain set involve hoisting and blocking components.

- * Do not walk or stand under raised forks.
- * Keep your arms and fingers away from moving parts of the upright.
- * Do not reach through open areas of the upright.

Failure to follow these warnings can result in serious injury.

7.4-1 Lift Chains (Standard & TSU)

To remove and replace the lift cylinder and/or carriage chain set on standard and triple-stage uprights (TSU):

1. Attach a hoist strap on the carriage of the standard upright or inner of the TSU.
2. Lift the carriage or inner rail slightly to create slack in the chains. Block the carriage or inner rail up for safety.
3. Remove the chain anchor pins on the outer rail and pull the chains off of the sheaves on the inner or intermediate rails.
4. Remove the chain anchor pins from the carriage on the standard upright or the inner rail on the TSU. On the TSU, the inner rails must be lowered to the floor to access the chain anchor pins.

NOTE

If a hose adapter is used, the chain sheaves must be loosened and removed to prevent the hoses from stretching when the inner rails of the TSU are lowered to access the chain anchor pins.

5. Use the steps in reverse order to replace the lift chain set.

7.4-2 Primary Cylinder/Carriage Chains (TSUs)

1. Tilt the upright forward, lower it and completely collapse the primary cylinder to create slack in the chains. The carriage may also be lifted and blocked in position and the primary cylinder completely collapsed to create slack in the chains.
2. Remove the chain anchor pins from the back of the primary cylinder. Pull the chains through the chain sheave and lay them over the carriage load backrest.
3. Remove the chain anchor pins from the back of the carriage.
4. Use these steps in reverse order to replace the primary cylinder/carriage chain.

Perform the chain length adjustment and chain tension check before returning the truck to service.

Other Chain Service Notes

- * Use lengths of factory assembled chain. Do not build lengths from individual components.
- * Do not attempt to rework damaged chains by replacing only the components obviously faulty. The entire chain may be compromised and should be discarded.
- * Never electroplate assembled leaf chain of its components. Plating will result in failure from hydrogen embrittlement. Plated chains are assembled from modified, individually plated components.
- * Welding should not be performed on any chain or components. Welding splatter should never be allowed to come in contact with chain or components.
- * Leaf chains are manufactured exclusively from heat treated steels and therefore must be annealed. If heating a chain with a cutting torch is absolutely necessary for remove, the chain should not be used.

*** Always replace chains in sets, Failure to do so may damage new chain.**



CAUTION

Watch for overhead clearance when extending upright.



WARNING

Use extreme care when working on the upright to avoid placing hands or fingers into potential pinch points. Unexpected movement of the upright can cause serious injury.

Checking Lower Roller Clearance with upright 6” from fully retracted position

Evaluation of shim requirements generally dictates a specific roller is acceptable until 0.040” clearance is exceeded, meaning adjustment requires one standard 1/32” shims to reduce rail-to-roller clearance to proper tolerances.

ROLLERS SHOULD BE INSTALLED
“LINE-TO-LINE”
0.020” MINIMUM CLEARANCE

Refer to adjustment reference chart when using feeler gauges.

9.2 Roller Clearance Inspection

Before checking the roller clearances, place the intermediate rail approximately 6 inches out of the outer rail and the inner approximately 6 inches out of the intermediate rail as illustrated on the previous page. If the upright is mounted and the rails are being elevated hydraulically, the inner rail will automatically assume it’s correct position. Note the procedure for checking the clearance is basically the same whether the upright is mounted or has been removed from the truck.

There are two methods presented, one using a pry bar to position the rails and rollers and the other using a “C” clamp.

If the upright is mounted to the truck, the use of an approved safety platform or step ladder is recommended when making inspections and checking clearances at the upper levels.

If the upright has been removed and placed on the flat floor, proper blocking of hardwood (Oak) or steel supports must be used to keep the upright horizontal with the floor. This is especially important when fully extending the intermediate and inner rails.

Step	Feeler Gauge	Gauge will Pass / Not Pass	Shimmed Correctly	Shim QTY
1	0.020" 0.050"	PASS NOT PASS	Check with a YES	0
2	0.050" 0.080"	PASS NOT PASS	Check with a No, ADD	1
3	0.080" 0.120"	PASS NOT PASS	Check with a No, ADD	2

5. Disconnect electrical plug (3).
6. Remove both harness clamp bolts (4).
7. Disconnect hydraulic hoses from tube connections (5) using two wrenches. One wrench to hold the tube connection(s) while loosening the hose connection(s). There will be some hydraulic fluid leakage upon disconnecting fittings.
8. Remove cotter pins (6).
9. Remove chain anchor pins (7) securing the lift chains to the carriage chain anchors.

NOTE

Lift chains may be disconnected at the primary lift cylinder crosshead (see next page) or from the carriage as shown.

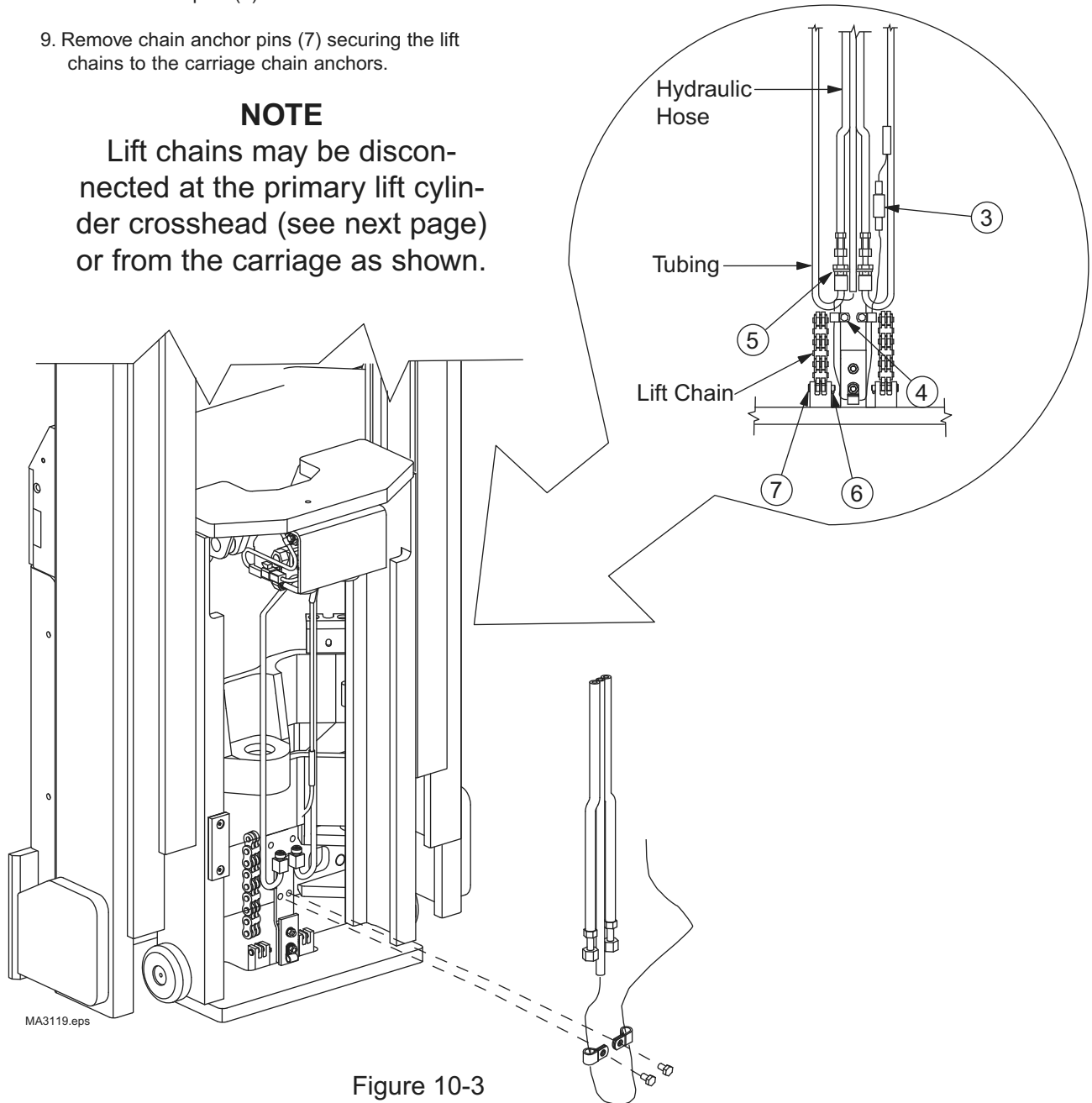


Figure 10-3

11.5 Tilt Cylinder Service

Cylinder Removal

Remove forks.
Refer to illustration 11-10.

Remove fork by releasing the locking pin on the top fork hanger and sliding the fork to the center of the carriage fork bar. Lift the fork up and disengage the fork hanger from the carriage bar.



Forks are heavy. Care must be taken to avoid personal injury.

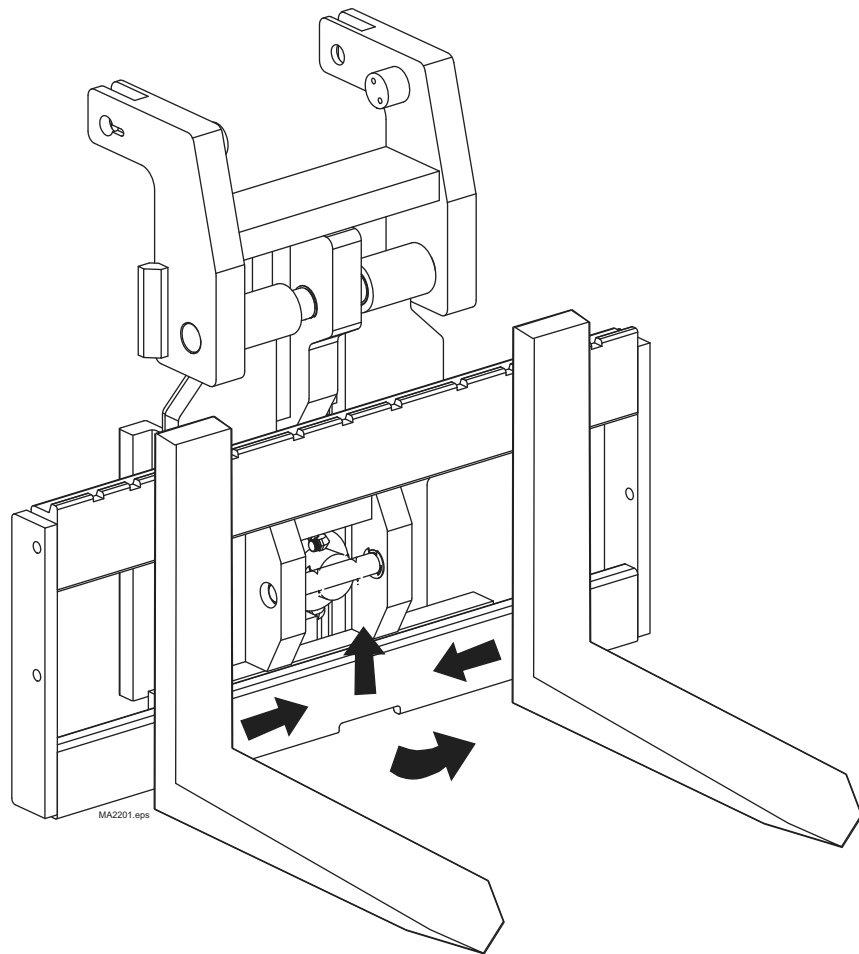


Figure 11-10

Retainer Assembly (Continued)

23. Using a small padded mallet, being careful not to damage the rod, hit the head gland until it is firmly into the cylinder. **Note:** If the head gland has a drill hole in the wrap-in-wire groove and you can not see the hole, use of a spanner wrench or chain vise to rotate the head gland to locate the hole.. Using a bronze punch, gently tap ring the rest of the way into the tube and groove. Be sure the shear ring is fully seated in it's groove.

24. Place the 90° end of the wrap wire into the slot. **Hint:** Sometime that wire that is placed into the groove has burrs on the 90° bend. To get rid of this place on flat surface and hit with hammer.

25. Begin turning the head gland with a spanner wrench. **Note:** This should only require only one revolution.

26. Push the rod all the way into the cylinder. Use a padded mallet to make sure that the rod assembly is all the way into the cylinder.

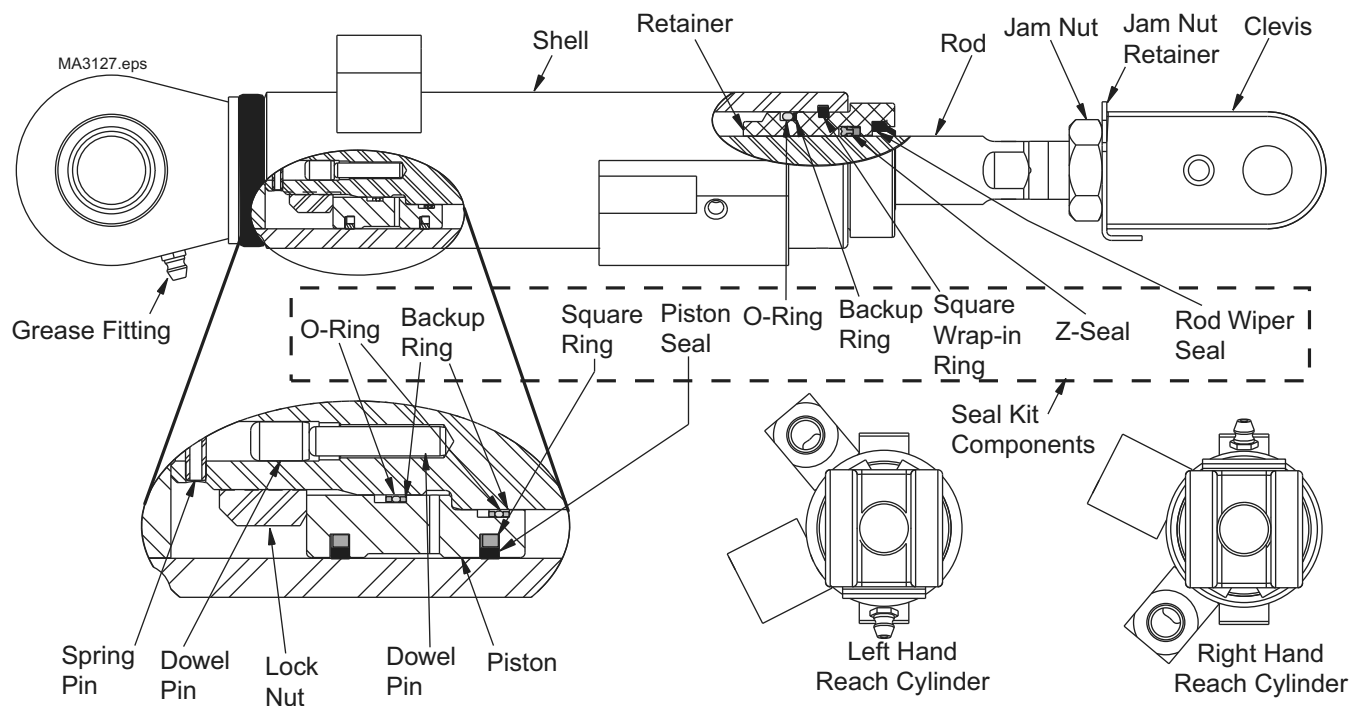


Figure 11-18

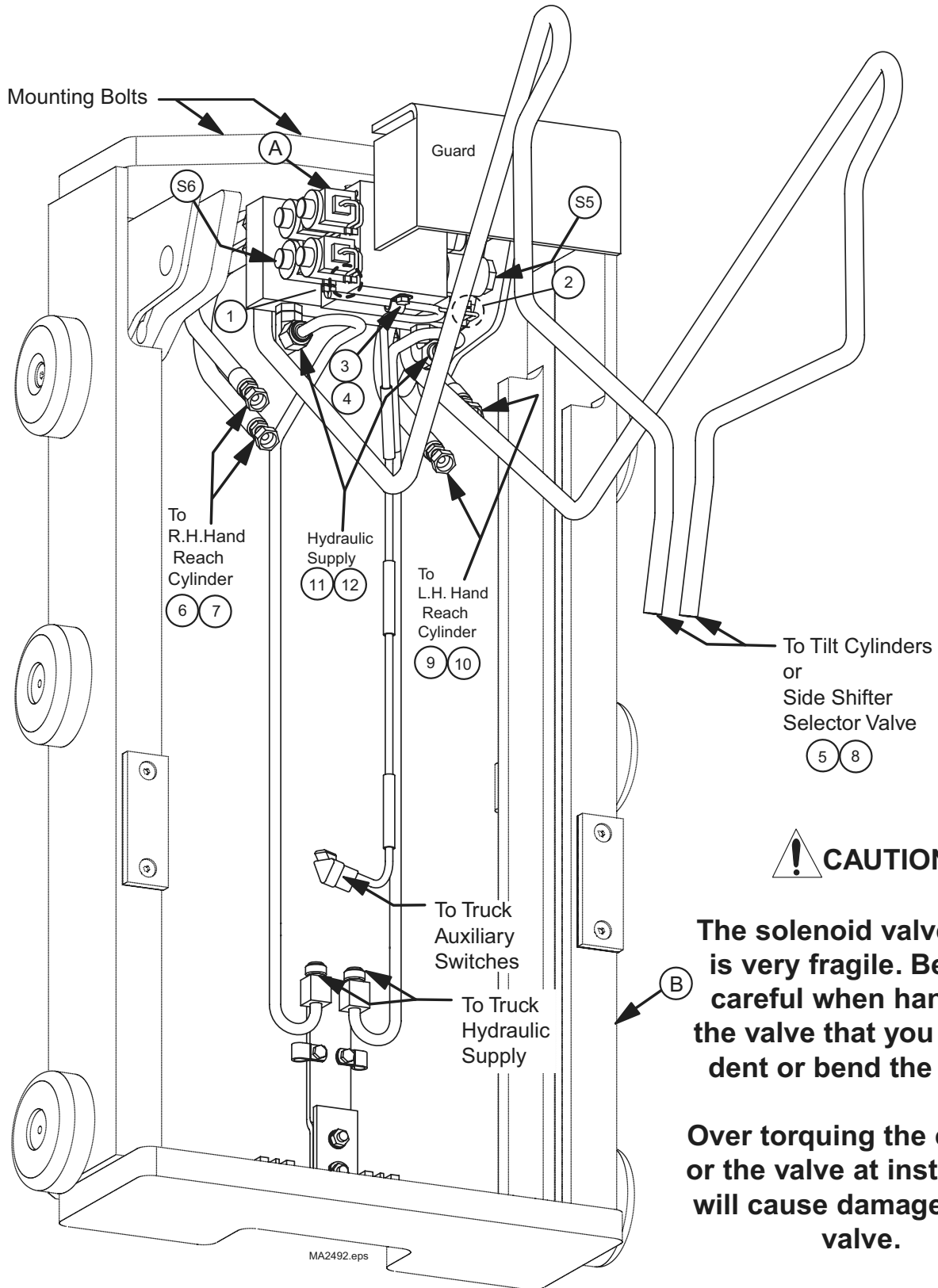
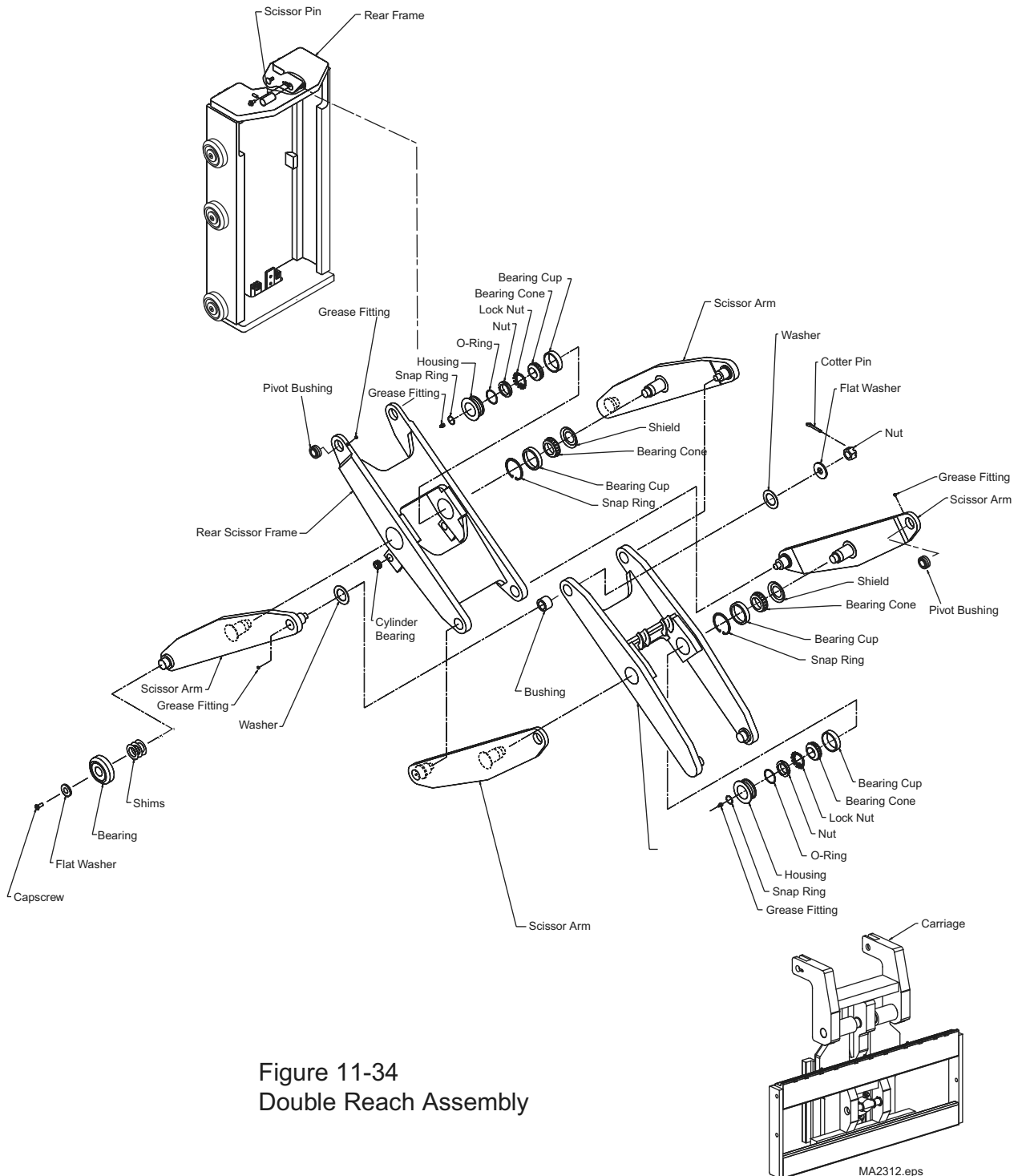


Figure 11-24

11.11 Servicing a Double Reach Pantograph

The Double Reach Pantograph is serviced the same as the Single Reach Pantograph with one exception. The Double Pantograph has two scissor assemblies. Follow service procedures outlined in Sections 11-1 through 11-9. Refer to Figures 11-34 through 11-37.



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