

TANDEM MODULATING VALVE with Pilot Apply

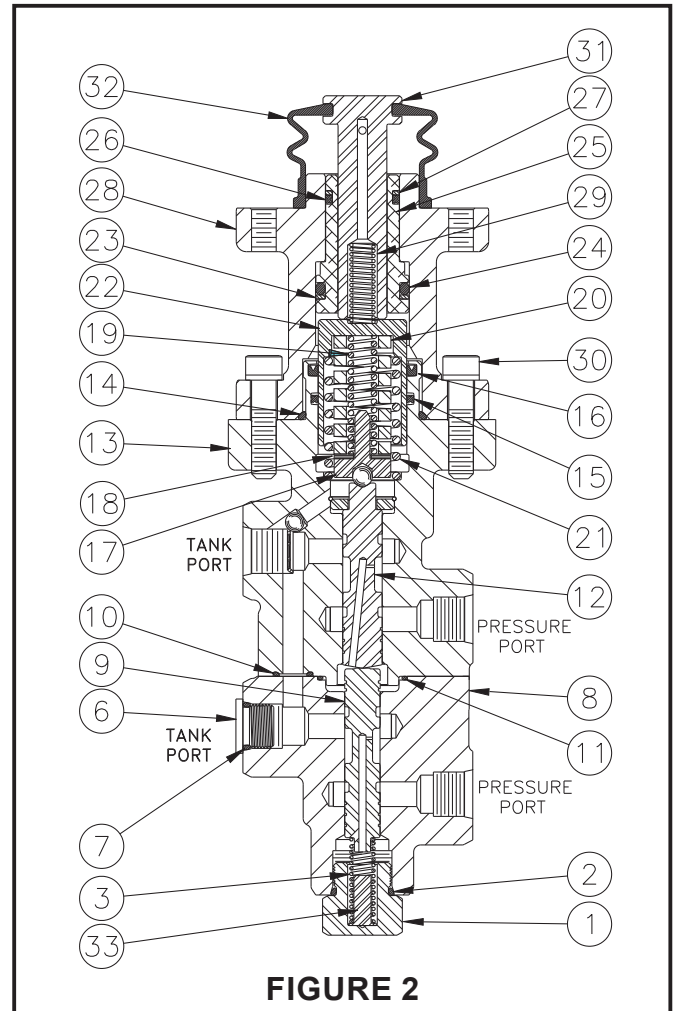
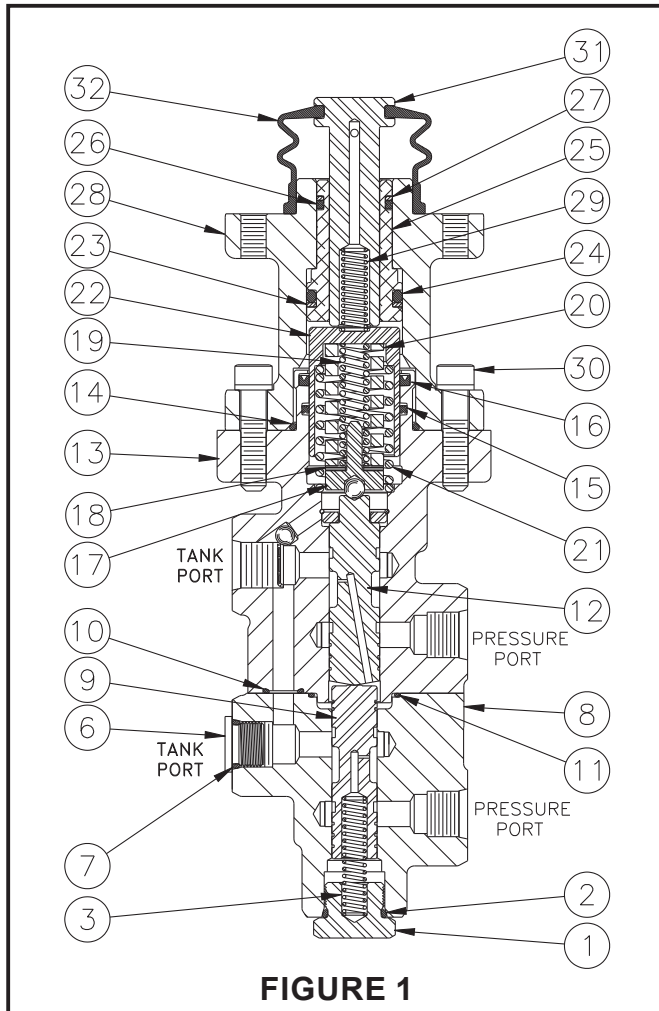


Service Instructions

TABLE 1 (Specifications)

Model Number	Valve Assembly Number	Brake Pressure Setting		Model Number	Valve Assembly Number	Brake Pressure Setting	
		bar	(PSI)			bar	(PSI)
03-466-300	20-100-809	27.6 ± 3.5	(400 ± 50)	06-466-480	20-100-588	158.6 ± 6.9	(2300 ± 100)
03-466-400	20-100-834	34.5 ± 1.7	(500 ± 25)	06-466-482	20-100-528	103.4 ± 5.2	(1500 ± 75)
06-466-281	20-100-559	55.2 ± 5.2	(800 ± 75)	06-466-484	20-100-635	55.2 ± 5.2	(800 ± 75)
06-466-402	20-100-538	151.7 ± 6.9	(2200 ± 100)	06-466-486	20-100-528	103.4 ± 5.2	(1500 ± 75)
06-466-404	20-100-539	69.0 ± 5.2	(1000 ± 75)	06-466-492	20-100-539	69.0 ± 5.2	(1000 ± 75)
06-466-406	20-100-528	103.4 ± 5.2	(1500 ± 75)	06-466-494	20-100-559	55.2 ± 5.2	(800 ± 75)
06-466-408	20-100-559	55.2 ± 5.2	(800 ± 75)	06-466-532	20-200-150	137.9 ± 6.9	(2000 ± 100)
06-466-410	n/a	103.4 ± 5.2	(1500 ± 75)	06-466-553	20-200-141	51.7 ± 3.5	(750 ± 50)
06-466-412	20-100-635	124.1 ± 6.9	(1800 ± 100)	06-466-950	20-100-528	103.4 ± 5.2	(1500 ± 75)
06-466-414	20-100-528	103.4 ± 5.2	(1500 ± 75)	06-466-952	20-100-559	55.2 ± 5.2	(800 ± 75)
06-466-416	20-100-729	69.0 ± 5.2	(1000 ± 75)	06-466-975	20-100-850	60.0 ± 5.2	(870 ± 75)
06-466-418	20-100-742	69.0 ± 5.2	(1000 ± 75)	20-100-809	n/a	27.6 ± 3.5	(400 ± 50)

NOTE: If your product number is not listed, contact ZF Off-Highway Solutions Minnesota Inc. for information.



Models: 03-466-300 06-466-492
 03-466-400 06-466-494
 06-466-281 06-466-553
 06-466-404 06-466-952
 06-466-408 06-466-975
 06-466-416 20-100-809
 06-466-484

DISASSEMBLY

(Refer to Figure 3)

NOTE

Housing halves (8 & 13) and spools (9 & 12) are manufactured as matched sets. These sets (Housing half & Spool) must not be intermixed with other parts.

1. Remove boot (32) from push rod (31). Then remove push rod (31) and spring (29) from pilot housing (28) bore.
2. Separate pilot housing (28) and valve housing half (13) by removing cap screws (30). Remove o-ring (14) from valve housing half (13).
3. Remove piston (25) from pilot housing (28). Piston must be removed through the bottom end of pilot housing.

NOTE: Be careful not to scratch or mar housing bore. A wooden dowel will help in this procedure.

4. Remove o-rings (24 & 26) and back-up rings (23 & 27) from piston (25).

NOTE: Be careful not to damage o-ring or back-up ring grooves.

5. Remove piston (22), springs (19, 20 & 21), shim(s) (18) and retainer assembly (17) from valve housing half (13). Not all models use spring (19). **NOTE: Be aware of the number of shim(s) being removed from housing.**

6. Carefully remove cup (16) and seal (15) from valve housing half (13) bore.

NOTE: Be careful not to scratch or mar housing bore.

7. Remove end plug (1) and spring (3) from valve housing half (8). Remove o-ring (2) from end plug.
8. Remove plug (6) from valve housing half (8). Remove o-ring (7) from plug. Not all models use plug (6) and o-ring (7).
9. Separate housing halves (8 & 13) by removing cap screws (4) and washers (5). Remove o-rings (10 & 11) from housing halves.

10. Carefully remove spools (9 & 12) from housing halves (8 & 13). **NOTE: Be careful not to damage spools or housing bores.**

CAUTION

Do not intermix spools & housings. Spool (9) and housing half (8) are a matched set as are spool (12) and housing half (13).

ASSEMBLY

(Refer to Figure 3)

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Clean all parts thoroughly before assembling.
2. Install new o-rings (10 & 11) in proper o-ring pockets on housings (8 & 13).
3. Lubricate spool (12) with clean system fluid and carefully slide into bottom end of valve housing half (13) bore. Note

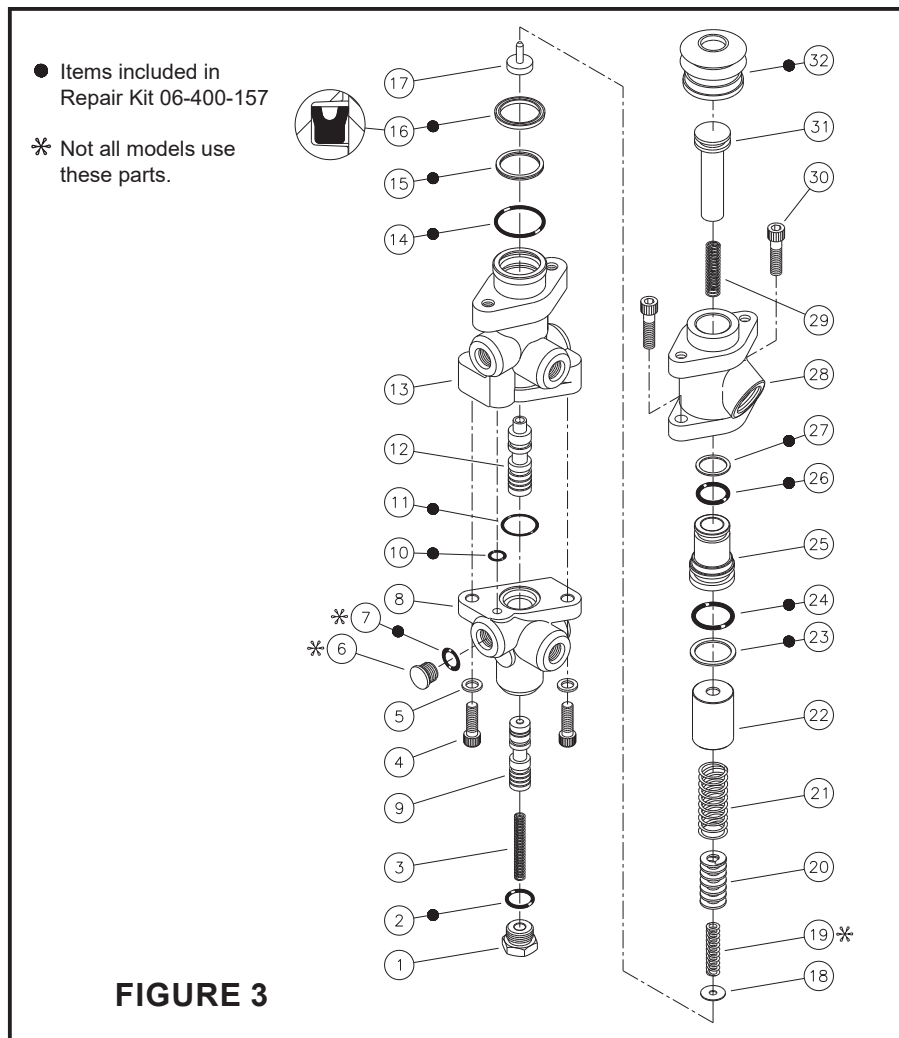


FIGURE 3

- direction of spool. **NOTE: Spool must slide freely into housing bore. If either part is damaged, a new valve assembly may be required.**
4. Reassemble valve housing halves (8 & 13) using cap screws (4) and washers (5). Use Loctite 242 on cap screws and torque 29.8-33.9 N·m (22-25 lb-ft). **NOTE: Make sure valve housing halves line up correctly and that o-rings (10 & 11) remain in their pockets during assembly.**
5. Install new o-ring (7) on plug (6) and install in valve housing half (8). Tighten securely. Not all models use plug (6) and o-ring (7).
6. Lubricate spool (9) with clean system fluid and carefully slide into valve housing half (8) bore. Note direction of spool (9). **NOTE: Spool must slide freely into housing bore. If either part is damaged, a new valve assembly may be required.**
7. Install new o-ring (2) on end plug (1).
8. Install spring (3) and end plug (1) into valve housing half (8). Torque 47.5-54.2 N·m (35-40 lb-ft).
9. Carefully install new seal (15) and new cup (16) into valve housing half (13) bore. **Note direction and order of cup and seal. NOTE: Be careful not to scratch or mar housing bore.**

10. Assemble springs (19, 20 & 21), shim(s) (18), and retainer assembly (17) in piston (22). Not all models use spring (19).
11. Carefully install piston (22) assembly into valve housing half (13) bore.
12. Install new o-rings (24 & 26) and new back-up rings (23 & 27) on piston (25). Note order of o-rings and back-up rings.
13. Install piston (25) into pilot housing (28) through the bore on the bottom end. Be sure to install piston as far as it will go into pilot housing bore.
14. Install new o-ring (14) on valve housing half (13).
15. Carefully attach pilot housing (28) to valve housing half (13) using cap screws (30). Torque cap screws 27.1-33.9 N·m (20-25 lb-ft).
16. Install spring (29) and push rod (31) into pilot housing (28) bore.
17. Install new boot (32) on push rod (31) and pilot housing (28).

NOTE

After service, the valve must develop the pressure indicated in the specifications, TABLE 1. Shim(s) (18) are used to obtain the correct pressure setting. Contact ZF Off-Highway Solutions Minnesota Inc. if brake pressure setting is not able to be obtained.

Models: 06-466-402 06-466-480
 06-466-406 06-466-482
 06-466-410 06-466-486
 06-466-412 06-466-532
 06-466-414 06-466-950
 06-466-418

DISASSEMBLY

(Refer to Figure 4)

NOTE

Housing halves (8 & 13) and spools (9 & 12) are manufactured as matched sets. These sets (Housing half & Spool) must not be intermixed with other parts.

1. Remove boot (32) from push rod (31). Then remove push rod (31) and spring (29) from pilot housing (28) bore.
2. Separate pilot housing (28) and valve housing half (13) by removing cap screws (30). Remove o-ring (14) from valve housing half (13).
3. Remove piston (25) from pilot housing (28). Piston must be removed through the bottom end of pilot housing.
NOTE: Be careful not to scratch or mar housing bore. A wooden dowel will help in this procedure.
4. Remove o-rings (24 & 26) and back-up rings (23 & 27) from piston (25).
NOTE: Be careful not to damage o-ring or back-up ring grooves.
5. Remove piston (22), springs (19, 20 & 21), shim(s) (18) and retainer assembly (17) from valve housing half (13). Not all models use spring (19). **NOTE: Be aware of the number of shim(s) being removed from housing.**
6. Carefully remove cup (16) and seal (15) from valve housing half (13) bore.
NOTE: Be careful not to scratch or mar housing bore.
7. Remove end plug (1), retainer (33) and spring (3) from valve housing half (8). Remove o-ring (2) from end plug.
8. Remove plug (6) from valve housing half (8). Remove o-ring (7) from plug. Not all models use plug (6) and o-ring (7).
9. Separate housing halves (8 & 13) by removing cap screws (4) and washers (5). Remove o-rings (10 & 11) from housing halves.
10. Carefully remove spools (9 & 12) from housing halves (8 & 13). **NOTE: Care must be taken so as not to damage spools or housing bores.**

CAUTION

Do not intermix spools & housings. Spool (9) and housing half (8) are a matched set as are spool (12) and housing half (13).

ASSEMBLY

(Refer to Figure 4)

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Clean all parts thoroughly before assembling.
2. Install new o-rings (10 & 11) in proper o-ring pockets on housings (8 & 13).
3. Lubricate spool (12) with clean system fluid and carefully slide into bottom end of valve housing half (13) bore. Note direction of spool. **NOTE: Spool must**

● Items included in Repair Kit 06-400-157

* Not all models use these parts.

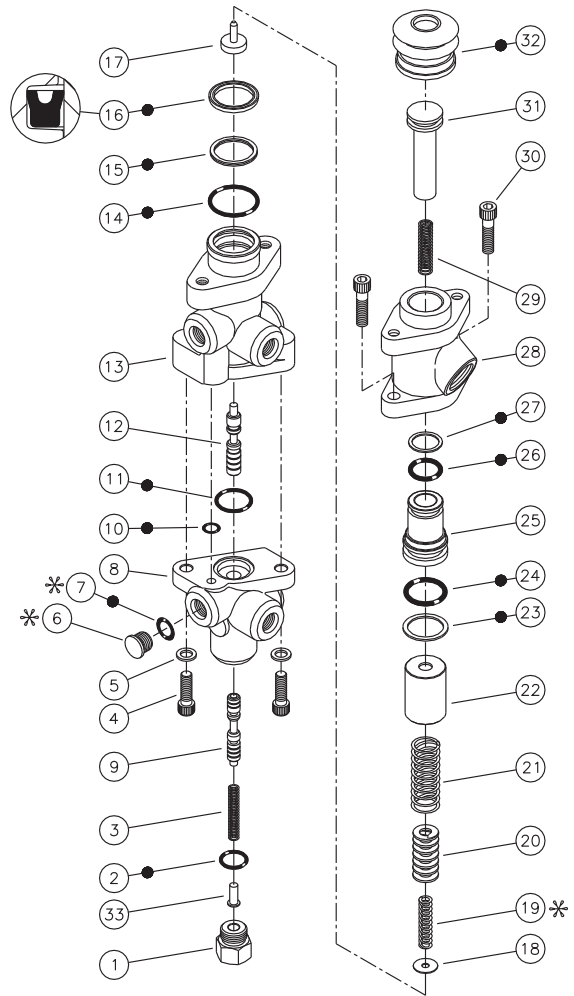


FIGURE 4

4. Reassemble valve housing halves (8 & 13) using cap screws (4) and washers (5). Use Loctite 242 on cap screws and torque 29.8-33.9 N·m (22-25 lb·ft). **NOTE: Make sure valve housing halves line up correctly and that o-rings (10 & 11) remain in their pockets during assembly.**
5. Install new o-ring (7) on plug (6) and install in valve housing half (8). Tighten securely. Not all models use plug (6) and o-ring (7).
6. Lubricate spool (9) with clean system fluid and carefully slide into valve housing half (8) bore. Note direction of spool (9). **NOTE: Spool must slide freely into housing bore. If either part is damaged, a new valve assembly may be required.**
7. Install new o-ring (2) on end plug (1).
8. Install spring (3), retainer (33) and end plug (1) into valve housing half (8). Torque 47.5-54.2 N·m (35-40 lb·ft).
9. Carefully install new seal (15) and new cup (16) into valve housing half (13) bore. Note direction and order of cup and seal. **NOTE: Be careful not to scratch or mar housing bore.**

10. Assemble springs (19, 20 & 21), shim(s) (18), and retainer assembly (17) in piston (22). Not all models use spring (19).
11. Carefully install piston (22) assembly into valve housing half (13) bore.
12. Install new o-rings (24 & 26) and new back-up rings (23 & 27) on piston (25). Note order of o-rings and back-up rings.
13. Install piston (25) into pilot housing (28) through the bore on the bottom end. Be sure to install piston as far as it will go into pilot housing bore.
14. Install new o-ring (14) on valve housing half (13).
15. Carefully attach pilot housing (28) to valve housing half (13) using cap screws (30). Torque cap screws 27.1-33.9 N·m (20-25 lb·ft).
16. Install spring (29) and push rod (31) into pilot housing (28) bore.
17. Install new boot (32) on push rod (31) and pilot housing (28).

NOTE

After service, the valve must develop the pressure indicated in the specifications, TABLE 1. Shim(s) (18) are used to obtain the correct pressure setting. Contact ZF Off-Highway Solutions Minnesota Inc. if brake pressure setting is not able to be obtained.

BLEEDING

Brake lines should be bled very carefully as soon as the valve is installed in the machine. Air in the system will not allow the brakes to release properly and may severely damage them.

1. Start engine and allow accumulator to reach full charge. Shut down engine, then slowly apply and release brakes, waiting one minute between applications until brakes will not apply. Repeat this step three times.
2. Operate engine to maintain accumulator pressure within working limits through out the bleeding procedure.
3. Open bleeder screw at wheel closest to brake valve and apply brakes cautiously until all air is bled out of line. Then close

bleeder screw. Repeat this step at each wheel, moving to the next farthest wheel from the brake valve each time, as follows:

- a. Left front
 - b. Right front
 - c. Right rear
 - d. Left rear
4. Release brake pressure for at least one (1) minute.
 5. Apply brakes, holding pedal down 10 seconds; then release pressure for one (1) minute. Repeat this step two more times.
 6. Repeat step 3.
 7. Check for system leaks and be sure of proper brake operation.

SERVICE CHECKS FOR 466 SERIES POWER BRAKE VALVES

BRAKES SLOW TO APPLY

1. No or improper gas charge in accumulator
- 1. Check gas charge**
2. Brakes not properly adjusted
- 2. Adjust brakes**
3. Inoperative brakes
- 3. Check brakes**
4. Hydraulic lines or fittings leaking
- 4. Check for leaks and repair**
5. Inoperative automatic adjuster
- 5. Check adjuster operation**
6. Damaged hydraulic brake lines
- 6. Check lines for dents that restrict flow of oil**

8. Brake valve inoperative
- 8. Replace valve**
9. Inoperative system relief valve
- 9. Check pressure in pressure line to valve**
10. Worn pump
- 10. Check pressure in pressure line to valve**

7. Pressure on return line too high
- 7. Reduce pressure**
8. Inoperative brake valve
- 8. Replace brake valve**

EXCESSIVE BRAKING

1. Inoperative brakes
- 1. Check brakes**
2. Inoperative brake valve
- 2. Replace brake valve**

NO BRAKES

1. No oil in hydraulic system
- 1. Check oil level in tank**
2. Broken or damaged brake line
- 2. Check lines for breaks or damaged condition**
3. Brakes not properly adjusted
- 3. Adjust brakes**
4. Inoperative system relief valve
- 4. Check pressure in pressure line to valve**
5. Worn pump
- 5. Check pressure in pressure line to valve**
6. Inoperative automatic adjuster
- 6. Check brake line pressure**
7. Inoperative or worn brakes
- 7. Check brakes**
8. Inoperative brake valve
- 8. Replace brake valve**

INSUFFICIENT BRAKES

1. No oil or low oil level in tank
- 1. Check oil level in tank**
2. Brakes not properly adjusted
- 2. Check brake adjustment**
3. Oil or grease on brake lining
- 3. Clean or install new linings**
4. Brake line damaged
- 4. Check lines and replace**
5. Inoperative automatic adjusters
- 5. Check operation of adjusters**
6. No or improper gas charge in accumulator
- 6. Check gas charge**
7. Inoperative brakes
- 7. Check brakes**

BRAKES WILL NOT RELEASE COMPLETELY

1. Brakes not properly adjusted
- 1. Adjust brakes**
2. Inoperative brakes
- 2. Check brakes**
3. Pedal angle out of adjustment
- 3. Adjust pedal angle**
4. Inoperative wheel cylinders
- 4. Replace wheel cylinders**
5. Inoperative automatic adjuster
- 5. Check operation of adjusters**
6. Air in brakes (when automatic adjusters used Goodrich Hi-torque Brakes only)
- 6. Bleed brakes**

PEDAL KICKBACK WHEN BRAKES ARE APPLIED

1. Air in brakes
- 1. Bleed brakes**

SERVICE DIAGNOSIS

(Refer to Figures 1 through 4)

BRAKES WILL NOT RELEASE COMPLETELY

1. Piston (22) binding
2. Pedal angle out of adjustment
3. Spring (3) broken

BRAKES WILL NOT RELEASE

1. Binding spools (9 & 12)
2. Piston (22) binding

NO BRAKES

1. Piston (22) binding
2. Broken spring (20)

OUTLET PRESSURE TOO HIGH (EXCESSIVE BRAKING)

1. Too many shims (18) installed in valve.

EXCESSIVE ACCUMULATOR LEAKAGE WHEN BRAKES ARE APPLIED

1. Damaged spools (9 & 12)
2. Damaged housings (8 & 13)

EXCESSIVE ACCUMULATOR LEAKAGE WHEN BRAKES ARE NOT BEING USED

1. Damaged spools (9 & 12)
2. Damaged housings (8 & 13)

INSUFFICIENT BRAKES

1. Broken pressure regulating spring (20)
2. Pedal travel is inhibited

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