TANDEM MODULATING VALVE with Pilot Apply

Service Instructions

TABLE 1 (Specifications)

Model Number	Valve Assembly Number	Repair Kit Number	Brake Pressure Setting	
			bar	(PSI)
06-466-403	20-100-965	06-400-334	57.9 + 2.1/- 3.5	(840 + 30/- 50)
06-466-575	20-200-238	06-400-515	60.0 ± 5.2	(870 ± 75)
06-466-593	20-200-208	06-400-515	57.9 + 2.1/- 3.5	(840 + 30/- 50)

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

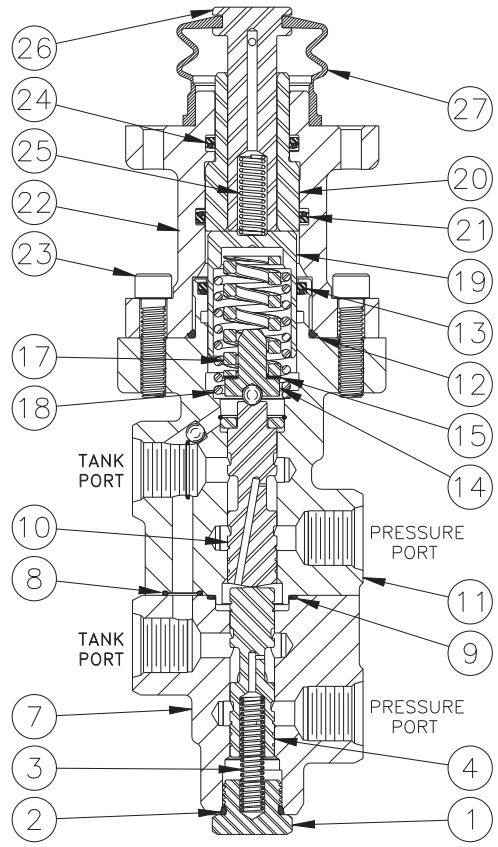

FIGURE 1
(20-100-965 shown)

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DISASSEMBLY
(Refer to Figure 2)

NOTE
Housings (7 & 11) and spools (4 & 10) are manufactured as matched sets. These sets, housing and spool, must not be not be intermixed with other parts.

1. Remove boot (27) from push rod (26) and pilot housing (22). Remove push rod (26) and spring (25) from pilot housing (22) bore.
2. Separate pilot housing (22) and housing (11) by removing cap screws (23). Remove o-ring (12) from housing (11).
3. Remove piston (20) from pilot housing (22). Piston (20) must be removed through the bottom of pilot housing (22). **NOTE: Be careful not to scratch or mar housing bore.**
4. Remove cups (21 & 24) from pilot housing (22). **NOTE: Be careful not to scratch or mar the cup grooves or bore in pilot housing.**
5. Remove piston (19), springs (18, 17, & 16), shim(s) (15), and retainer assembly (14) from housing (11). Not all models use spring (16). **NOTE: Be aware of the number of shim(s) being removed from housing (11).**
6. Carefully remove cup (13) from housing (11) bore. **NOTE: Be careful not to scratch or mar the cup groove or housing bore.**
7. Remove end plug (1) and spring (3) from housing (7). Remove o-ring (2) from end plug (1).
8. Separate housings (7 & 11) by removing cap screws (5) and washers (6). Remove o-rings (8 & 9) from housings (7 & 11).
9. Carefully remove spools (4 & 10) from housings (7 & 11). **NOTE: Be careful not to damage spools or housing bores.**

⚠ CAUTION
Do not intermix spools and housings. Spool (4) and housing (7) are a matched set as are spool (10) and housing (11).

ASSEMBLY
(Refer to Figure 2)

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 (8 & 9) in the proper o-ring pockets on housings (7 & 11).
3. Lubricate spool (10) with clean system fluid and carefully slide into the bottom side of housing (11) bore. Note the direction of spool (10). **NOTE: Spool must slide freely into housing bore. If either part is damaged, a new valve assembly may be required.**
4. Assemble housings (7 & 11) using cap screws (5) and washers (6). Use Loctite 242 on threads of cap screws and torque 29.8-33.9 N·m (22-25 lb·ft). **NOTE: Make sure the housings line up correctly and that o-rings (8 & 9) remain in the pockets during assembly.**
5. Lubricate spool (4) with clean system fluid and carefully slide into housing (7) bore. Note direction of spool (4). **NOTE: Spool must slide freely into housing bore. If either part is damaged, a new valve assembly may be required.**
6. Install new o-ring (2) on end plug (1). Install spring (3) and end plug (1) into housing (7). Torque end plug (1) 47.5-54.2 N·m (35-40 lb·ft).
7. Carefully install new cup (13) into housing (11) bore. Note direction of cup (13). **NOTE: Be careful not to scratch or mar cup groove or housing bore.**
8. Assemble springs (16, 17, & 18), shim(s) (15), and retainer assembly (14) in piston (19). Not all models use spring (16).
9. Carefully install piston (19) assembly into housing (11) bore.
10. Install new cups (21 & 24) in pilot housing (22). Note the direction of cups (21 & 24). **NOTE: Be careful not to scratch or mar the cup grooves or bore in pilot housing.**
11. Install piston (20) into pilot housing (22) bore from the bottom side. Be sure piston (20) bottoms on the borestep in pilot housing (22).
12. Install new o-ring (12) on housing (11). Attach pilot housing (22) to housing (11) using cap screws (23). Use Loctite 242 on threads of cap screws and torque 29.8-33.9 N·m (22-25 lb·ft).
13. Install spring (25) and push rod (26) in pilot housing (22) bore.
14. Install new boot (27) on push rod (26) and pilot housing (22).

NOTE
After service, the valve must develop the pressure indicated in the specifications, TABLE 1. Shim(s) (15) 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.

● Items included in Repair Kit
✻ Not used in all models

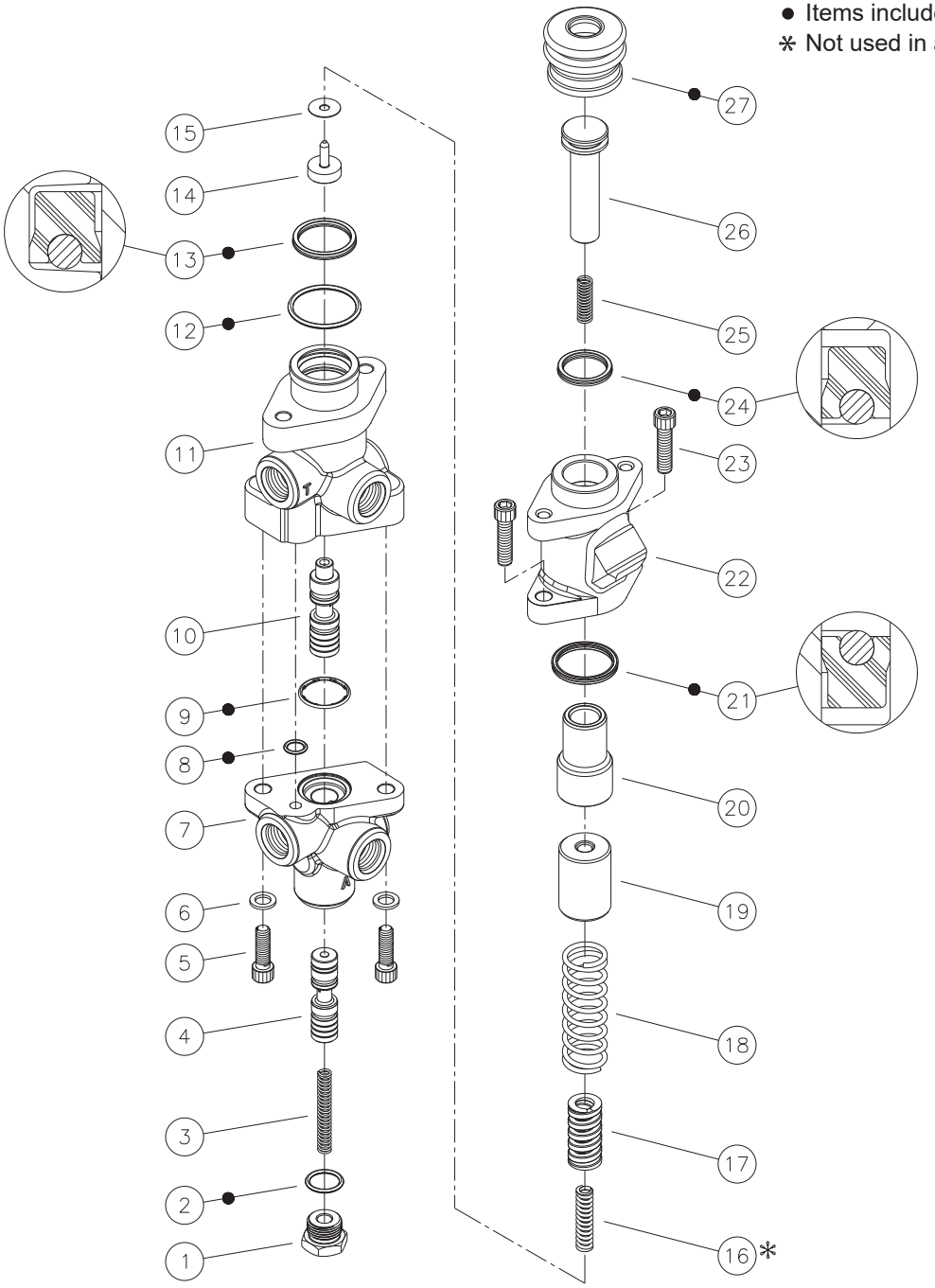

FIGURE 2

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 the 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**

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**
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**

EXCESSIVE BRAKING

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

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

PEDAL KICKBACK WHEN BRAKES ARE APPLIED

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

SERVICE DIAGNOSIS

(Refer to Figure 2)

BRAKES WILL NOT RELEASE COMPLETELY

1. Piston (19) binding
2. Pedal angle out of adjustment
3. Spring (3) broken

BRAKES WILL NOT RELEASE

1. Binding spools (4 & 10)
2. Piston (19) binding

NO BRAKES

1. Piston (19) binding
2. Broken spring (17)

OUTLET PRESSURE TOO HIGH (EXCESSIVE BRAKING)

1. Too many shims (15) installed in the valve.

EXCESSIVE ACCUMULATOR LEAKAGE WHEN BRAKES ARE APPLIED

1. Damaged spools (4 & 10)
2. Damaged housings (7 & 11)

EXCESSIVE ACCUMULATOR LEAKAGE WHEN BRAKES ARE NOT BEING USED

1. Damaged spools (4 & 10)
2. Damaged housings (7 & 11)

INSUFFICIENT BRAKES

1. Broken pressure regulating spring (17)
2. Pedal travel is inhibited