

# TANDEM MODULATING VALVE with Pilot Apply

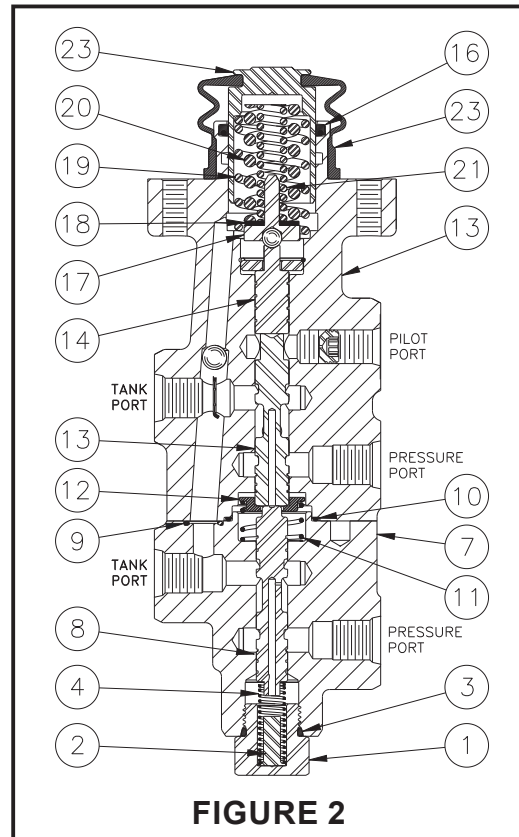
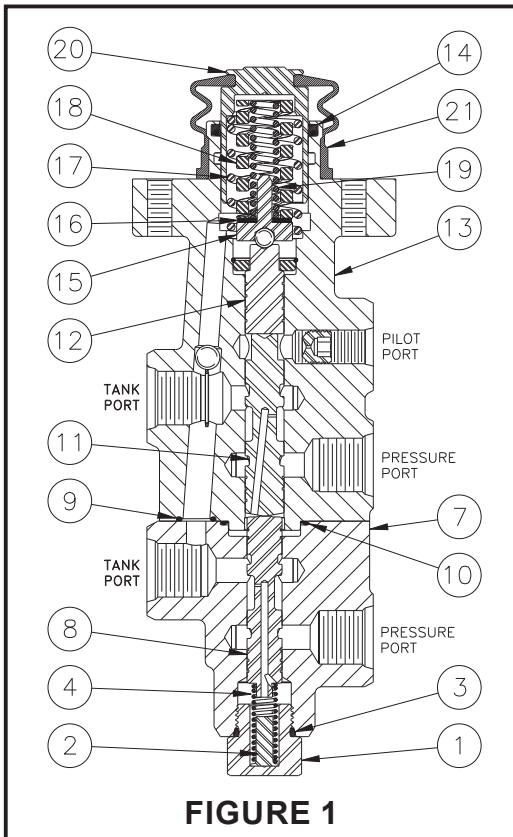


## Service Instructions

**TABLE 1** (Specifications)

Model Number	Valve Assembly Number	Repair Kit Number	Brake Pressure Setting	
			bar	(PSI)
06-466-461	20-200-161	06-400-497	103.4 ± 5.2	(1500 ± 75)
06-466-586	20-200-314	06-400-497	160.0 ± 5.2	(2320 ± 75)
06-466-588	20-200-313	06-400-497	120.0 ± 5.2	(1740 ± 75)
407 101 090 0	407 101 088 2	06-400-497	96.5 ± 3.4	(1400 ± 50)

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



### ⚠ WARNING

**Installation and test note:** Piston (20) in figure 1, or piston (23) in figure 2 must be retained mechanically. This will prevent it from blowing out at high velocity if an incorrect connection occurs from power source to tank ports. **Be sure the tank ports are connected directly to tank.** Failure to do this could result in serious injury or death.

Model Numbers: 06-466-461  
 06-466-586  
 06-466-588

## DISASSEMBLY

(Refer to Figures 1, 3, and Table 1)

### NOTE

Housings (7 & 13) and spools (8, 11, & 12) are manufactured as matched sets. These sets, housing and spool(s), must not be intermixed with other parts.

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

### CAUTION

Do not intermix spools and housings. Spool (8) and housing (7) are a matched set as are spools (11 & 12) and housing (13).

7. Remove plug (22). Remove o-ring (23) from plug (22).

## ASSEMBLY

(Refer to Figures 1, 3, and Table 1)

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

1. Clean all parts thoroughly before assembling.
2. Install new o-rings (9 & 10) in proper o-ring pockets on housings (7 & 13).
3. Lubricate spools (11 & 12) with clean system fluid and carefully slide into bottom end of housing (13) bore. Note direction and order of spools (11 & 12). **NOTE: Spools must slide freely into bore. If any parts are damaged, a new valve assembly may be required.**
4. Reassemble housings (7 & 13) using cap screws (5) and washers (6). Use Loctite 242 on cap screws and torque 27.1-33.9 N·m (22-25 lb·ft). **NOTE: Be sure housings line up correctly and that o-rings (9 & 10) remain in their pockets during assembly.**
5. Lubricate spool (8) with clean system fluid and carefully slide into housing (7) bore. Note direction of spool (8). **NOTE: Spool must slide freely into bore. If either part is damaged, a new valve assembly may be required.**
6. Install new o-ring (3) on end plug (1).
7. Install spring (4), retainer (2), and end plug (1) into housing (7). Torque end plug (1) 47.5-61.0 N·m (35-45 lb·ft).
8. Carefully install new cup (14) in housing (13) bore. Note direction of cup. **NOTE: Be careful not to scratch or mar housing bore.**

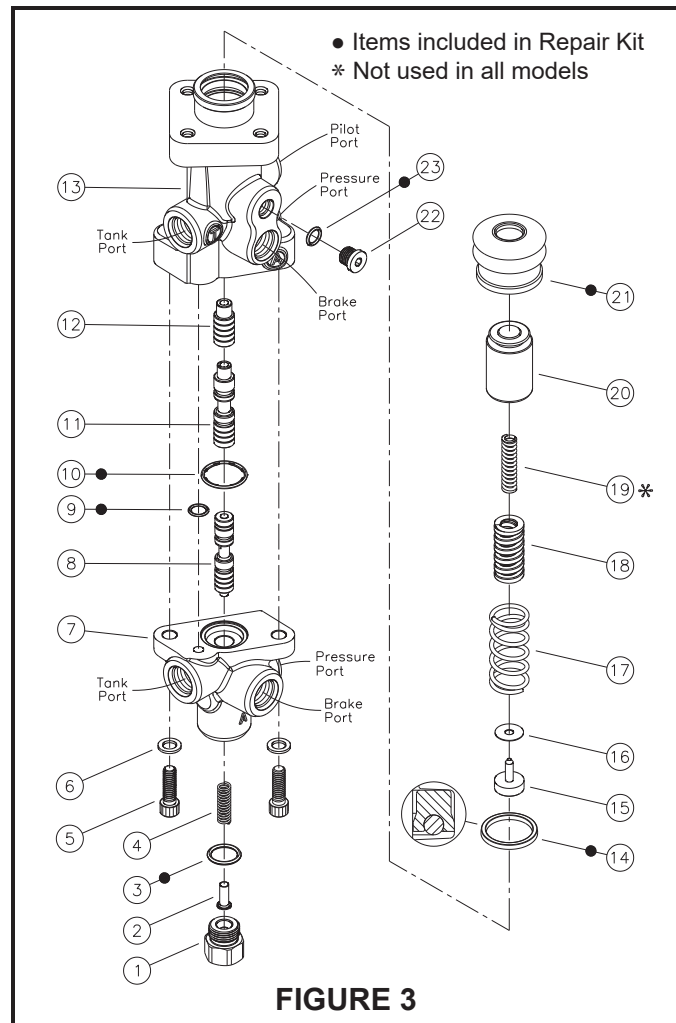


FIGURE 3

TABLE 1 O-ring Identification

Item Number	Description	Quantity
3	O-ring, 0.644 I.D. x 0.830 O.D. x 0.087 thick	1
9	O-ring, 0.364 I.D. x 0.504 O.D. x 0.070 thick	1
10	O-ring, 0.980 I.D. x 1.120 O.D. x 0.070 thick	1
23	O-ring, 0.351 I.D. x 0.495 O.D. x 0.072 thick	1

9. Assemble springs (17, 18, & 19), shim(s) (16), and retainer assembly (15) in piston (20). **NOTE: Not all models use spring (19).**
10. Carefully install piston (20) assembly into housing (13) bore.
11. Install new boot (21) on housing (13) and piston (21).
12. Install new o-ring (23) on plug (22). Install plug (22) in housing (13) and torque 6.8-7.9 N·m (60-70 lb·in).

### NOTE

After service, the valve must develop the pressure indicated in the specifications, TABLE 1. Shim(s) (16) 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.

## DISASSEMBLY

(Refer to Figures 2, 4, and Table 2)

### NOTE

Housings (7 & 15) and spools (8, 13, & 14) are manufactured as matched sets. These sets, housing and spool(s), must not be intermixed with other parts.

1. Remove boot (23) from piston (22) and housing (15).
2. Remove piston (22), springs (19, 20, & 21), shim(s) (18), and retainer assembly (17) from housing (15). **NOTE: Be aware of the number of shim(s) being removed from the housing.**
3. Carefully remove cup (16) from housing (15) bore.  
**NOTE: Be careful not to scratch or mar housing bore.**
4. Remove end plug (1), retainer (2), and spring (4) from housing (7). Remove o-ring (3) from end plug (1).
5. Separate housings (7 & 15) by removing cap screws (5) and washers (6). Remove o-rings (9 & 10), spring (11), and retainer 12 from housings (7 & 15).
6. Carefully remove spools (8, 13, & 14) from housings (7 & 15). **NOTE: Be careful not to damage spools or housing bores.**

### CAUTION

Do not intermix spools and housings. Spool (8) and housing (7) are a matched set as are spools (13 & 14) and housing (15).

7. Remove plug (24). Remove o-ring (25) from plug (24).

## ASSEMBLY

(Refer to Figures 2, 4, and Table 2)

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

1. Clean all parts thoroughly before assembling.
2. Install new o-rings (9 & 10) in proper o-ring pockets on housings (7 & 15). Install spring (11) and retainer (10).
3. Lubricate spools (13 & 14) with clean system fluid and carefully slide into bottom end of housing (15) bore. Note direction and order of spools (13 & 14).  
**NOTE: Spools must slide freely into bore. If any parts are damaged, a new valve assembly may be required.**
4. Reassemble housings (7 & 15) using cap screws (5) and washers (6). Use Loctite 242 on cap screws and torque 27.1-33.9 N·m (22-25 lb·ft). **NOTE: Be sure housings line up correctly and that o-rings (9 & 10) remain in their pockets during assembly.**
5. Lubricate spool (8) with clean system fluid and carefully slide into housing (7) bore. Note direction of spool (8).  
**NOTE: Spool must slide freely into bore. If either part is damaged, a new valve assembly may be required.**
6. Install new o-ring (3) on end plug (1).
7. Install spring (4), retainer (2), and end plug (1) into housing (7). Torque end plug (1) 47.5-61.0 N·m (35-45 lb·ft).
8. Carefully install new cup (16) in housing (15) bore. Note direction of cup. **NOTE: Be careful not to scratch or mar housing bore.**

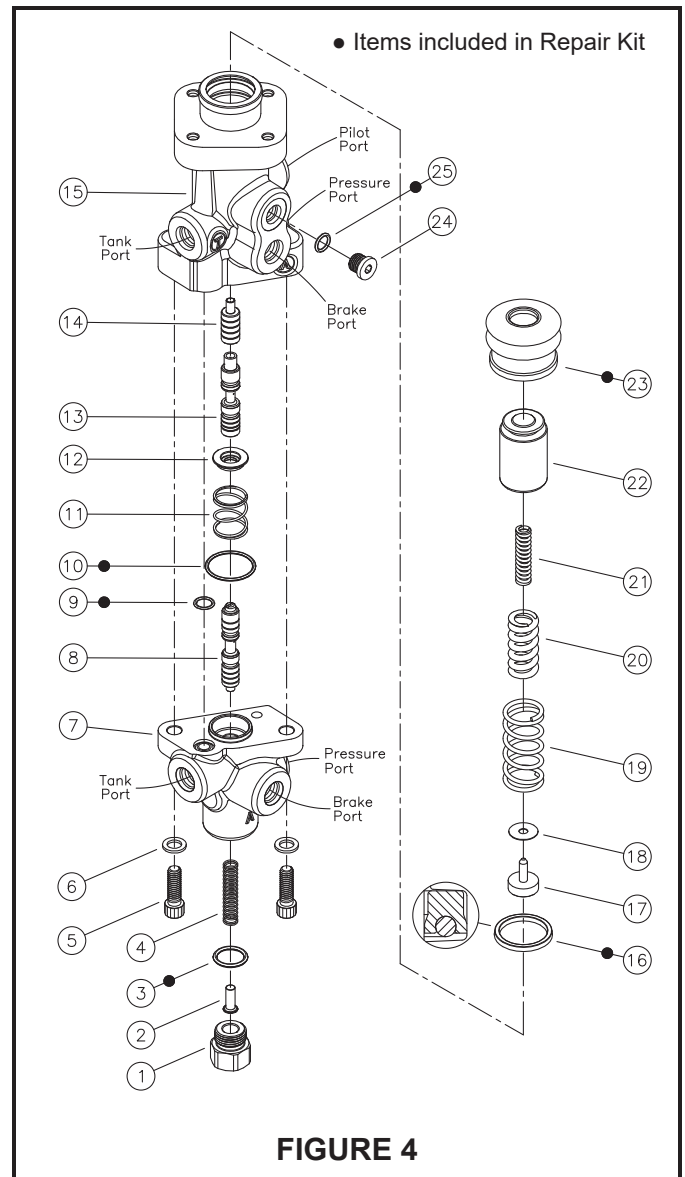


FIGURE 4

TABLE 2 O-ring Identification

Item Number	Description	Quantity
3	O-ring, 0.644 I.D. x 0.830 O.D. x 0.087 thick	1
9	O-ring, 0.364 I.D. x 0.504 O.D. x 0.070 thick	1
10	O-ring, 1.051 I.D. x 1.191 O.D. x 0.070 thick	1
25	O-ring, 0.351 I.D. x 0.495 O.D. x 0.072 thick	1

9. Assemble springs (19, 20, & 21), shim(s) (18), and retainer assembly (17) in piston (20).
10. Carefully install piston (20) assembly into housing (15) bore.
11. Install new boot (21) on housing (15) and piston (23).
12. Install new o-ring (25) on plug (24). Install plug (24) in housing (15) and torque 6.8-7.9 N·m (60-70 lb·in).

### 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.

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**ZF Off-Highway Solutions Minnesota Inc.**

1911 Lee Boulevard / North Mankato, MN U.S.A. 56003

**Tel:** +1 507 625 6426 **Fax:** +1 507 625 3212