TANDEM MODULATING VALVE

Service Instructions

TABLE 1 (Specifications)

Complete Unit Model Number	Valve Assembly Number	Repair Kit Number	Brake Pressure Setting		Complete Unit Model Number	Valve Assembly Number	Repair Kit Number	Brake Pressure Setting	
			bar	(PSI)				bar	(PSI)
03-466-201 (BF)	20-100-798	06-400-257	144.8 ± 4.8	(2100 ± 70)	06-466-270 (HO)	20-100-728	06-400-152	53.4 ± 3.5	(775 ± 50
03-466-202 (HO)	20-100-555	06-400-152	27.6 ± 3.5	(400 ± 50)	06-466-276 (HO)	20-200-277	06-400-152	37.9 ± 3.5	(550 ± 50)
03-466-203 (BF)	20-100-843	06-400-257	158.6 ± 4.8	(2300 ± 70)	06-466-280 (HO)	20-100-789	06-400-152	34.5 ± 2.1	(500 ± 30)
03-466-204 (HO)	20-100-587	06-400-152	137.9 ± 6.9	(2000 ± 100)	06-466-282 (HO)	20-100-522	06-400-152	103.4 ± 5.2	(1500 ± 75)
03-466-206 (HO)	20-100-583	06-400-152	44.8 ± 3.5	(650 ± 50)	06-466-284 (HO)	20-100-574	06-400-152	137.9 ± 6.9	(2000 ± 100)
03-466-208 (HO)	20-100-667	06-400-152	103.4 ± 5.2	(1500 ± 75)	06-466-285 (HO)	20-100-522	06-400-152	103.4 ± 5.2	(1500 ± 75)
03-466-210 (HO)	n/a	06-400-152	43.1 ± 1.7	(625 ± 25)	06-466-286 (HO)	20-100-541	06-400-152	51.7 ± 5.2	(750 ± 75)
03-466-212 (HO)	20-100-808	06-400-152	131.0 ± 6.9	(1900 ± 100)	06-466-287 (HO)	20-100-887	06-400-152	103.4 ± 5.2	(1500 ± 75)
03-466-216 (HO)	20-100-833	06-400-152	62.1 ± 5.2	(900 ± 75)	06-466-288 (HO)	20-100-522	06-400-152	103.4 ± 5.2	(1500 ± 75)
06-466-195 (HO)	20-100-537	06-400-152	69.0 ± 5.2	(1000 ± 75)	06-466-290 (HO)	20-100-574	06-400-152	137.9 ± 6.9	(2000 ± 100)
06-466-200 (HO)	20-100-580	06-400-152	82.7 ± 5.2	(1200 ± 75)	06-466-292 (HO)	20-100-537	06-400-152	69.0 ± 5.2	(1000 ± 75)
06-466-201 (HO)	20-100-574	06-400-152	137.9 ± 6.9	(2000 ± 100)	06-466-295 (HO)	20-100-806	06-400-152	34.5 ± 3.5	(500 ± 50)
06-466-202 (HO)	20-100-536	06-400-152	151.7 ± 6.9	(2200 ± 100)	06-466-296 (HO)	20-100-522	06-400-152	103.4 ± 5.2	(1500 ± 75)
06-466-204 (HO)	20-100-792	06-400-152	112.0 ± 3.5	(1625 ± 50)	06-466-297 (HO)	20-100-805	06-400-152	158.6 ± 6.9	(2300 ± 100)
06-466-206 (HO)	20-100-522	06-400-152	103.4 ± 5.2	(1500 ± 75)	06-466-298 (HO)	n/a	06-400-152	158.6 ± 6.9	(2300 ± 100)
06-466-207 (HO)	20-100-522	06-400-152	103.4 ± 5.2	(1500 ± 75)	06-466-299 (HO)	20-100-782	06-400-152	51.7 ± 5.2	(750 ± 75)
06-466-208 (HO)	20-100-574	06-400-152	137.9 ± 6.9	(2000 ± 100)	06-466-301 (HO)	20-100-790	06-400-152	44.8 ± 3.5	(650 ± 50)
06-466-209 (HO)	20-100-723	06-400-152	103.4 ± 5.2	(1500 ± 75)	06-466-303 (HO)	20-200-011	06-400-152	34.5 ± 3.5	(500 ± 50)
06-466-210 (HO)	20-100-537	06-400-152	69.0 ± 5.2	(1000 ± 75)	06-466-315 (HO)	20-200-082	06-400-152	26.2 ± 1.7	(380 ± 25)
06-466-213 (HO)	20-100-806	06-400-152	34.5 ± 3.5	(500 ± 75)	06-466-316 (HO)	20-200-023	06-400-152	55.2 ± 3.5	(800 ± 50)
06-466-214 (HO)	20-100-663	06-400-152	89.6 ± 5.2	(1300 ± 75)	06-466-354 (HO)	20-100-849	06-400-152	69.0 ± 3.5	(1000 ± 50)
06-466-216 (HO)	20-100-554	06-400-152	41.4 ± 5.2	(600 ± 75)	06-466-358 (HO)	20-200-277	06-400-152	37.9 ± 3.5	(550 ± 50)
06-466-218 (HO)	20-100-537	06-400-152	69.0 ± 5.2	(1000 ± 75)	06-466-387 (HO)	20-100-536	06-400-152	151.7 ± 6.9	(2200 ± 100)
06-466-220 (HO)	20-100-522	06-400-152	103.4 ± 5.2	(1500 ± 75)	06-466-395 (HO)	20-200-252	06-400-152	151.7 ± 6.9	(2200 ± 100)
06-466-222 (HO)	20-100-522	06-400-152	103.4 ± 5.2	(1500 ± 75)	06-466-409 (HO)	20-100-895	06-400-152	48.3 ± 3.5	(700 ± 50)
06-466-227 (HO)	20-100-840	06-400-152	158.6 ± 6.9	(2300 ± 100)	06-466-425 (HO)	20-100-593	06-400-152	27.6 ± 3.5	(400 ± 50)
06-466-228 (HO)	20-100-613	06-400-152	53.4 ± 3.5	(775 ± 50)	06-466-429 (HO)	20-100-574	06-400-152	137.9 ± 6.9	(2000 ± 100)
06-466-229 (HO)	20-100-839	06-400-152	120.7 ± 6.9	(1750 ± 100)	06-466-430 (HO)	20-100-725	06-400-152	69.0 ± 5.2	(1000 ± 75)
06-466-230 (HO)	20-100-511	06-400-152	41.4 ± 5.2	(600 ± 75)	06-466-447 (HO)	20-100-900	06-400-152	59.0 ± 2.0	(855 ± 30)
06-466-231 (HO)	20-100-806	06-400-152	34.5 ± 3.5	(500 ± 50)	06-466-473 (HO)	20-200-096	06-400-152	117.2 ± 3.5	(1700 ± 50)
06-466-232 (HO)	20-100-583	06-400-152	44.8 ± 3.5	(650 ± 50)	06-466-488 (HO)	20-100-964	06-400-152	82.7 ± 5.2	(1200 ± 75)
06-466-233 (HO)	20-100-849	06-400-152	69.0 ± 3.5	(1000 ± 50)	06-466-536 (HO)	20-200-132	06-400-152	27.6 ± 1.7	(400 ± 25)
06-466-234 (HO)	20-100-593	06-400-152	27.6 ± 3.5	(400 ± 50)	06-466-559 (HO)	20-100-613	06-400-152	53.4 ± 3.5	(775 ± 50)
06-466-235 (HO)	20-100-839	06-400-152	120.7 ± 6.9	(1750 ± 100)	06-466-583 (HO)	20-200-173	06-400-152	65.5 ± 3.5	(950 ± 50)
06-466-236 (HO)	20-100-595	06-400-152	124.1 ± 6.9	(1750 ± 100)	06-466-597 (HO)	20-200-276	06-400-152	103.4 ± 5.2	(1500 ± 75)
06-466-237 (HO)	20-100-522	06-400-152	103.4 ± 5.2	(1500 ± 75)	06-466-601 (HO)	20-200-012	06-400-152	103.4 ± 5.2	(1500 ± 75)
06-466-238 (HO)	20-100-609	06-400-152	55.2 ± 5.2	(800 ± 75)	06-466-614 (HO)	20-200-309	06-400-152	137.9 ± 6.9	(2000 ± 100)
06-466-239 (HO)	20-100-663	06-400-152	89.6 ± 5.2	(1300 ± 75)	06-466-916 (HO)	20-100-535	06-400-152	120.7 ± 6.9	(1750 ± 100)
06-466-240 (HO)	20-100-613	06-400-152	53.4 ± 3.5	(775 ± 50)	06-466-919 (HO)	20-100-900	06-400-152	59.0 ± 2.1	(855 ± 30)
06-466-241 (HO)	20-100-790	06-400-152	44.8 ± 3.5	(650 ± 50)	06-466-939 (HO)	n/a	06-400-152	37.9 ± 3.5	(550 ± 50)
06-466-244 (HO)	20-100-628	06-400-152	48.3 ± 3.5	(700 ± 50)	20-100-749 (HO)	n/a	06-400-152	91.4 ± 3.5	(1325 ± 50)
06-466-245 (HO)	20-100-895	06-400-152	48.3 ± 3.5	(700 ± 50)	20-100-801 (HO)	n/a	06-400-152	179.3 ± 6.9	(2600 ± 100)
06-466-246 (HO)	20-100-688	06-400-152	103.4 ± 5.2	(1500 ± 75)	20-100-808 (HO)	n/a	06-400-152	131.0 ± 6.9	(1900 ± 100)
06-466-248 (HO)	20-100-676	06-400-152	44.8 ± 2.4	(650 ± 35)	20-100-833 (HO)	n/a	06-400-152	62.1 ± 5.2	(900 ± 75)
06-466-250 (HO)	20-100-678	06-400-152	124.1 ± 6.9	(1800 ± 100)	20-100-930 (HO)	n/a	06-400-152	65.5 ± 3.5	(950 ± 50)
06-466-252 (HO)	n/a	06-400-152	69.0 ± 3.5	(1000 ± 50)	20-100-952 (HO)	n/a	06-400-152	82.7 ± 5.2	(1200 ± 75)
06-466-253 (HO)	20-100-806	06-400-152	34.5 ± 3.5	(500 ± 50)	4071010660 (HO)	4071010682	06-400-152	155.1 ± 6.9	(2250 ± 100)
06-466-258 (HO)	20-100-722	06-400-152	151.7 ± 6.9	(2200 ± 100)	4071010670 (HO)	4071010672	06-400-152	103.4 ± 6.9	(1500 ± 100)
06-466-259 (HO)	20-200-023	06-400-152	55.2 ± 3.5	(800 ± 50)	4071011350 (HO)	20-100-663	06-400-152	89.6 ± 5.2	(1300 ± 75)
06-466-260 (HO)	20-100-723	06-400-152	103.4 ± 5.2	(1500 ± 75)	4071011340 (HO)	20-100-537	06-400-152	69.0 ± 5.2	(1000 ± 75)
06-466-262 (HO)	20-100-724	06-400-152	137.9 ± 6.9	(2000 ± 100)					
06-466-263 (HO)	20-100-806	06-400-152	34.5 ± 3.5	(500 ± 50)					
06-466-264 (HO)	20-100-725	06-400-152	69.0 ± 5.2	(1000 ± 75)					
06-466-266 (HO)	20-100-726	06-400-152	41.4 ± 5.2	(600 ± 75)					
06-466-268 (HO)	20-100-725	06-400-152	69.0 ± 5.2	(1000 ± 75)					

HO = Mineral Base Hydraulic Oil BF = Brake Fluid

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

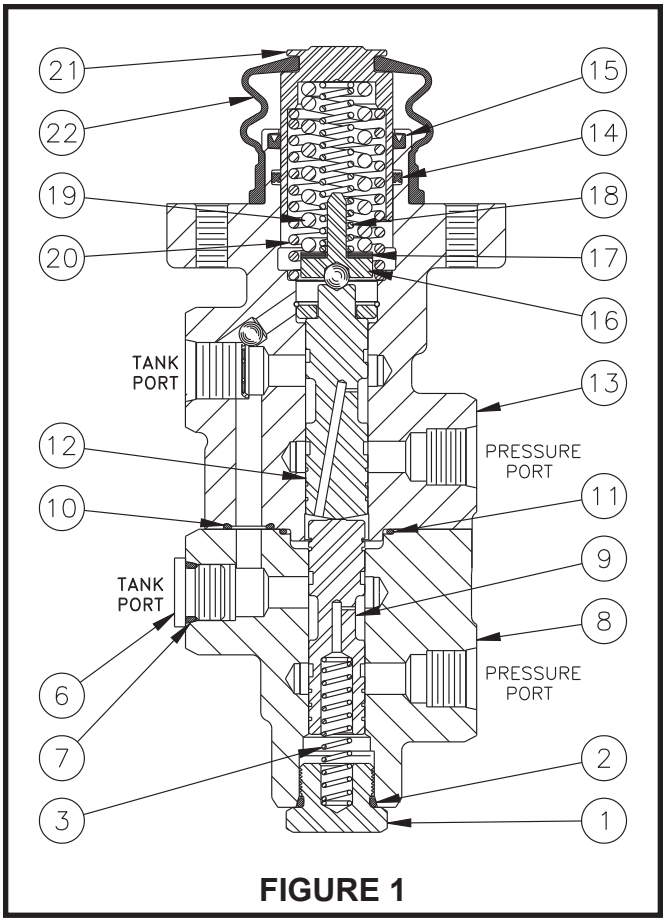

FIGURE 1

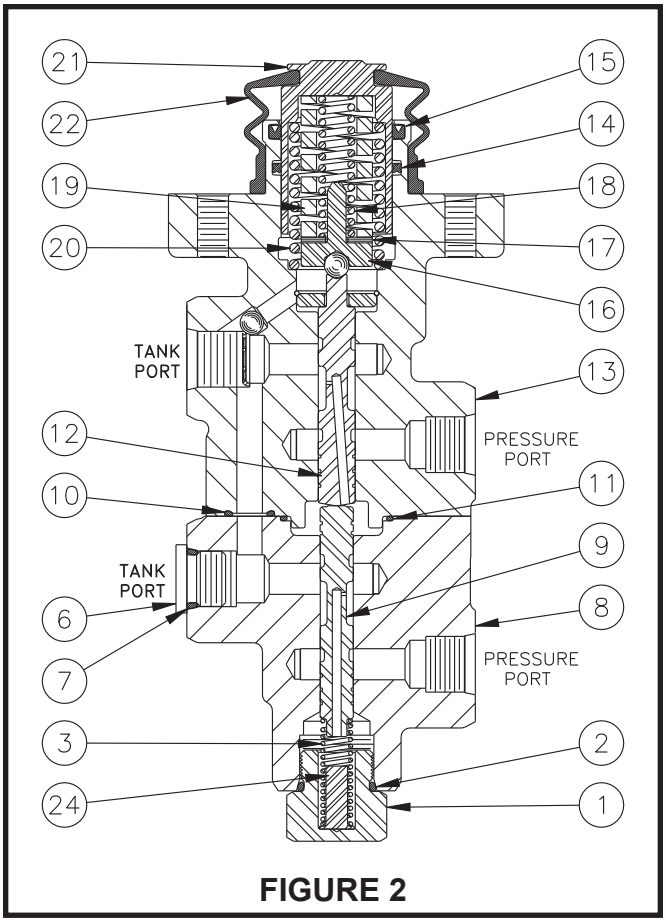

FIGURE 2

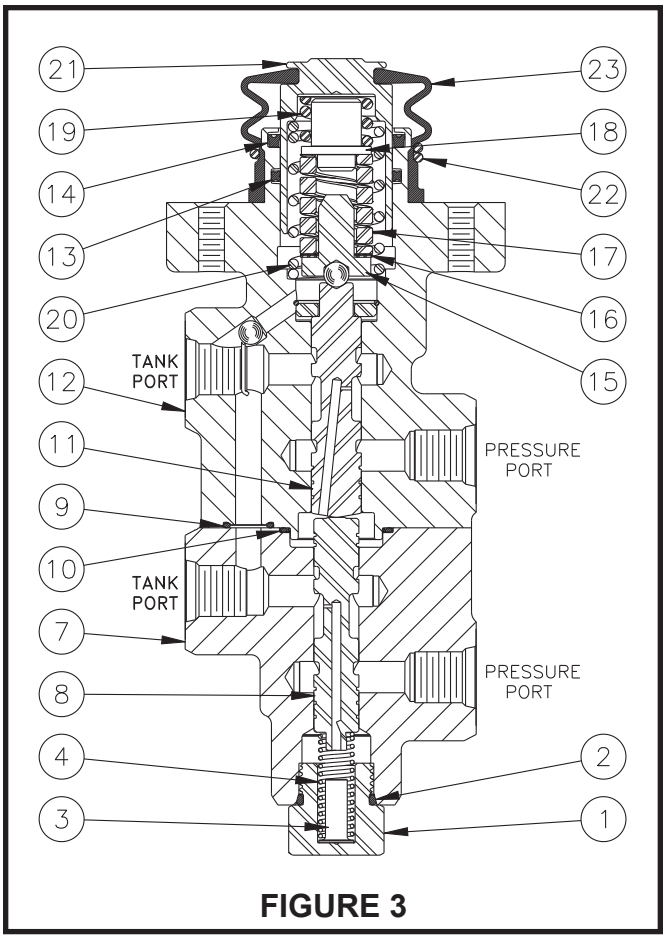

FIGURE 3

⚠ WARNING

Installation and test note: Piston (21) must be retained mechanically. This will prevent it from blowing out at high velocity if the power source is incorrectly connected to tank ports. **Be sure the tank ports are connected directly to tank.** Failure to do this could result in serious injury or death.

MODELS:	06-466-241	06-466-303
03-466-202	06-466-244	06-466-315
03-466-206	06-466-245	06-466-316
03-466-210	06-466-248	06-466-409
03-466-216	06-466-253	06-466-425
06-466-195	06-466-259	06-466-430
06-466-210	06-466-263	06-466-447
06-466-213	06-466-264	06-466-536
06-466-216	06-466-266	06-466-559
06-466-218	06-466-268	06-466-806
06-466-228	06-466-270	06-466-919
06-466-230	06-466-280	06-466-939
06-466-231	06-466-286	20-100-833
06-466-232	06-466-292	20-100-930
06-466-234	06-466-295	4071011340
06-466-238	06-466-299	
06-466-240	06-466-301	

DISASSEMBLY

(Refer to Figures 1 and 4)

NOTE

Housings (8 & 13) and spools (9 & 12) are manufactured as matched sets. These sets (housing & spool) must not be intermixed with other parts.

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

⚠ CAUTION

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

ASSEMBLY

(Refer to Figures 1 and 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 housing (13) bore. Note direction of spool (12). **NOTE: Spool must slide freely into bore. If either part is damaged, a new valve assembly may be required.**
4. Reassemble housings (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 housings line up correctly and o-rings (10 & 11) remain in the pockets during assembly.**
5. Install new o-ring (7) on plug (6) and install plug (6) in housing (8). Torque plug (6) 27.1-32.5 N·m (20-24 lb·ft). Not all models use plug (6) and o-ring (7).
6. Lubricate spool (9) with clean system fluid and carefully slide into housing (8) bore. Note direction of spool (9). **NOTE: Spool must slide freely into 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 housing (8). Torque end plug 47.5-54.2 N·m (35-40 lb·ft).
9. Carefully install new cup (15) and new seal (14) into housing (13) bore. Note direction and order of cup and seal. **NOTE: Be careful not to scratch or mar housing bore.**
10. Assemble springs (18, 19, & 20), shim(s) (17) and retainer assembly (16) in piston (21). Not all models use spring (18).
11. Carefully install piston (21) assembly into housing (13) bore.
12. Install new boot (22) on housing (13) and piston (21). Not all models use boot (22).
13. When reinstalling pedal actuated valve use new hex cap screws (23), 5/16-18UNC SAE grade 8. Torque cap screws 24.4-29.8 N·m (18-22 lb·ft). **NOTE: Not all repair kits include cap screws (23).**

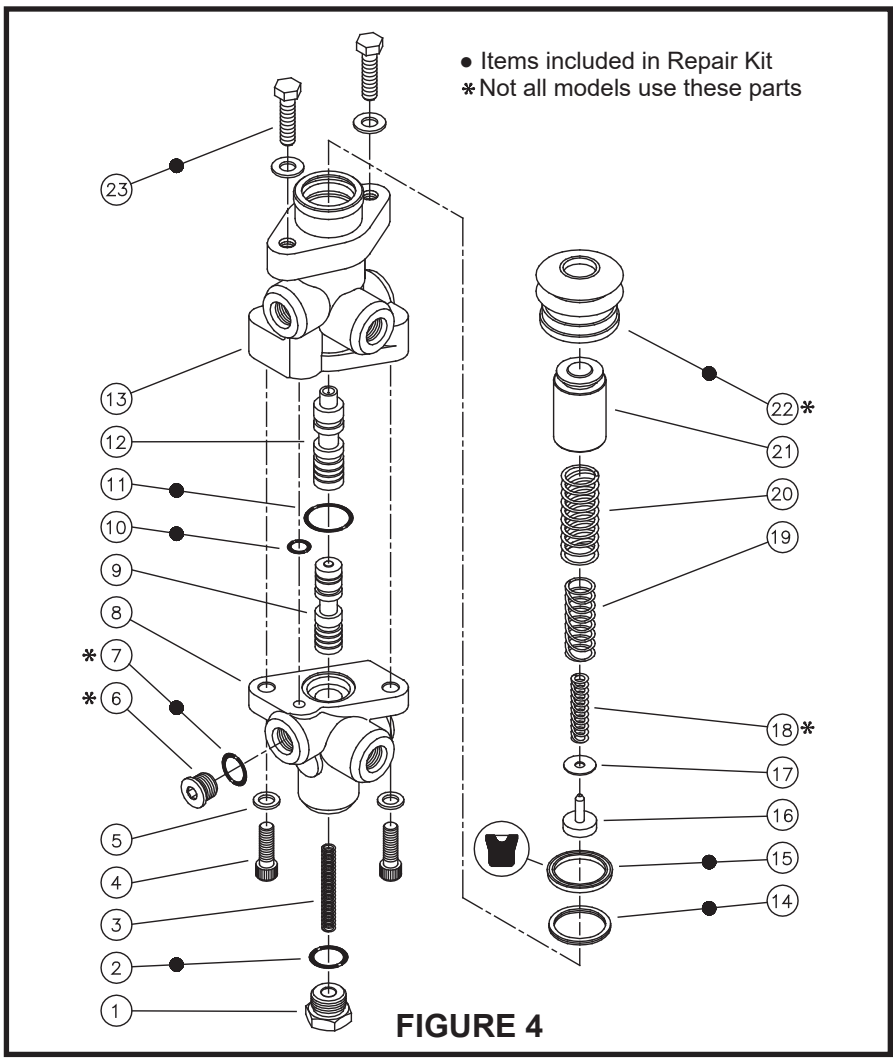

FIGURE 4

NOTE

After service, the valve must develop the pressure indicated in the specifications, TABLE 1. Shim(s) (17) 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:		
03-466-201	06-466-233	06-466-298
03-466-203	06-466-235	06-466-354
03-466-204	06-466-236	06-466-387
03-466-208	06-466-237	06-466-395
03-466-212	06-466-239	06-466-429
06-466-200	06-466-246	06-466-473
06-466-201	06-466-250	06-466-488
06-466-202	06-466-252	06-466-583
06-466-204	06-466-258	06-466-601
06-466-206	06-466-260	06-466-614
06-466-207	06-466-262	06-466-916
06-466-208	06-466-282	06-466-914
06-466-209	06-466-284	20-100-749
06-466-214	06-466-285	20-100-801
06-466-220	06-466-287	20-100-808
06-466-222	06-466-288	20-100-952
06-466-227	06-466-290	4071010660
06-466-229	06-466-296	4071010670
	06-466-297	4071011350

DISASSEMBLY

(Refer to Figures 2 and 5)

NOTE

Housings (8 & 13) and spools (9 & 12) are manufactured as matched sets. These sets (housing & spool) must not be intermixed with other parts.

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

⚠ CAUTION

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

ASSEMBLY

(Refer to Figures 2 and 5)

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 housing (13) bore. Note direction of spool (12). **NOTE: Spool must slide freely into bore. If either part is damaged, a new valve assembly may be required.**
4. Reassemble housings (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 housings line up correctly and o-rings (10 & 11) remain in the pockets during assembly.**
5. Install new o-ring (7) on plug (6) and install plug (6) in housing (8). Torque plug (6) 27.1-32.5 N·m (20-24 lb·ft). Not all models use plug (6) and o-ring (7).
6. Lubricate spool (9) with clean system fluid and carefully slide into housing (8) bore. Note direction of spool (9). **NOTE: Spool must slide freely into 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 housing (8). Torque end plug 47.5-54.2 N·m (35-40 lb·ft).
9. Carefully install new cup (15) and new seal (14) into housing (13) bore. Note direction and order of cup and seal. **NOTE: Be careful not to scratch or mar housing bore.**
10. Assemble springs (18, 19, & 20), shim(s) (17) and retainer assembly (16) in piston (21). Not all models use spring (18).
11. Carefully install piston (21) assembly into housing (13) bore.
12. Install new boot (22) on housing (13) and piston (21). Not all models use boot (22).
13. When reinstalling pedal actuated valve use new hex cap screws (23), 5/16-18UNC SAE grade 8. Torque cap screws 24.4-29.8 N·m (18-22 lb·ft). **NOTE: Not all repair kits include cap screws (23).**

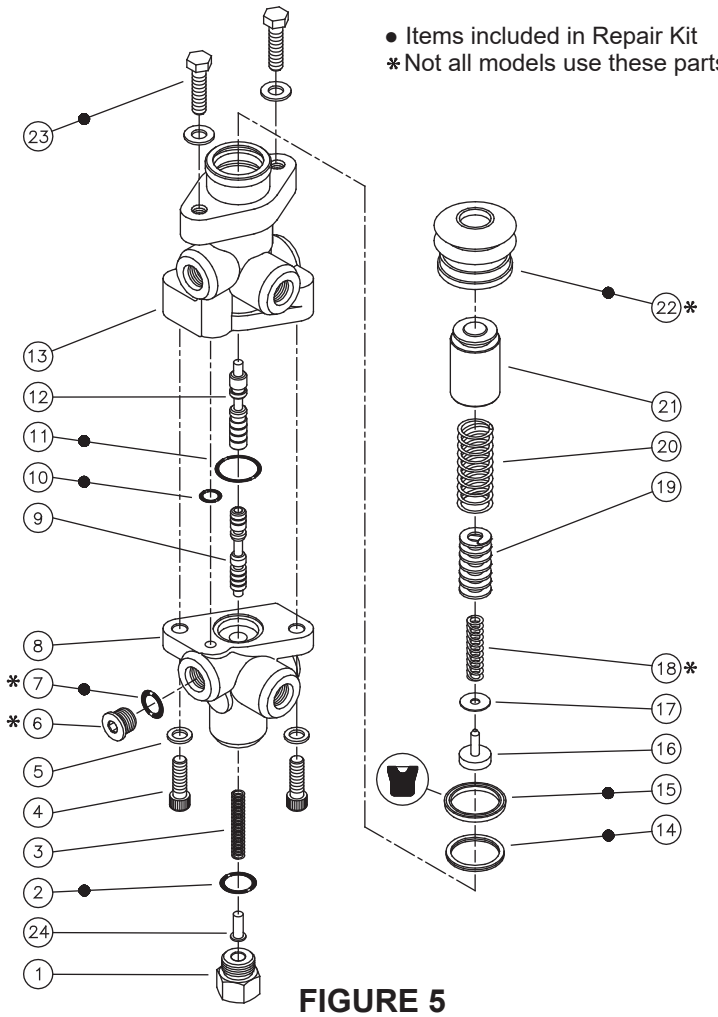

FIGURE 5

NOTE

After service, the valve must develop the pressure indicated in the specifications, TABLE 1. Shim(s) (17) 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.

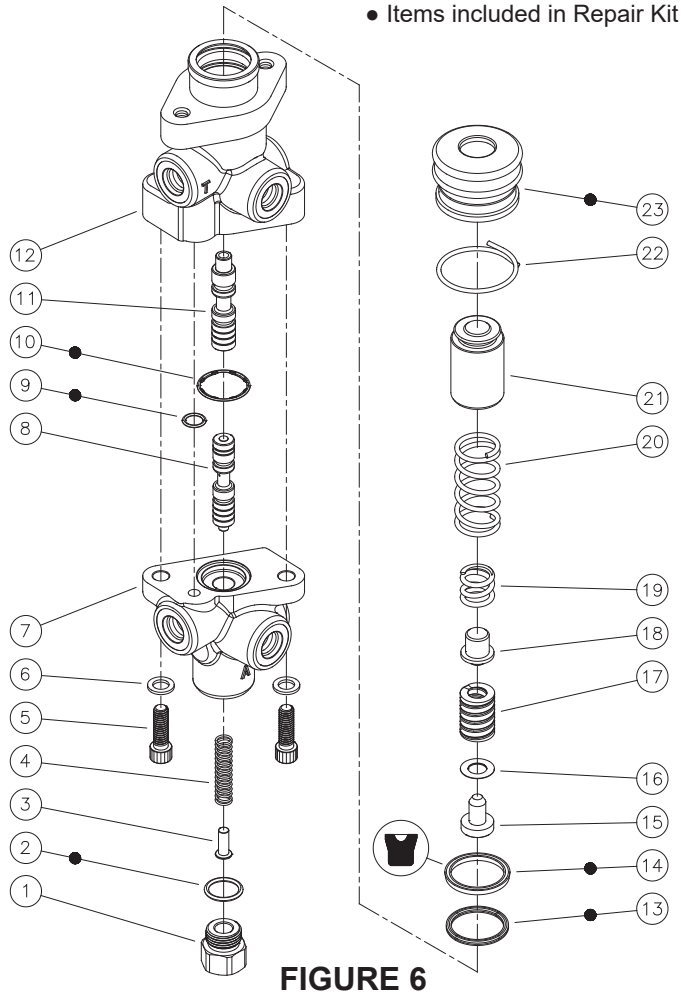

FIGURE 6

DISASSEMBLY

(Refer to Figures 3 and 6)

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

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

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

ASSEMBLY

(Refer to Figures 2 and 5)

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

> **NOTE**
> After service, the valve must develop the pressure indicated in the specifications, TABLE 1. Shim(s) (17) 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 throughout 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 re lease 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 re-strict 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 Figures 1, 2, 4, and 5)

BRAKES WILL NOT RELEASE COMPLETELY

1. Piston (21) binding
2. Pedal angle out of adjustment
3. Spring (3) broken

BRAKES WILL NOT RELEASE

1. Binding spools (9 & 12)
2. Piston (21) binding

NO BRAKES

1. Piston (21) binding
2. Broken spring (19)

OUTLET PRESSURE TOO HIGH (EXCESSIVE BRAKING)

1. Too many shims (17) 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 spring (19)
2. Pedal travel is inhibited

SERVICE DIAGNOSIS

(Refer to Figures 3 and 6)

BRAKES WILL NOT RELEASE COMPLETELY

1. Piston (21) binding
2. Pedal angle out of adjustment
3. Spring (4) broken

BRAKES WILL NOT RELEASE

1. Binding spools (8 & 11)
2. Piston (21) binding

NO BRAKES

1. Piston (21) binding
2. Broken spring (17)

OUTLET PRESSURE TOO HIGH (EXCESSIVE BRAKING)

1. Too many shims (16) installed in valve.

EXCESSIVE ACCUMULATOR LEAKAGE WHEN BRAKES ARE APPLIED

1. Damaged spools (8 & 11)
2. Damaged housings (7 & 12)

EXCESSIVE ACCUMULATOR LEAKAGE WHEN BRAKES ARE NOT BEING USED

1. Damaged spools (8 & 11)
2. Damaged housings (7 & 12)

INSUFFICIENT BRAKES

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

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

Form No. 81-466-002 Revised 2022-03-09

www.mico.com