Two-stage MASTER CYLINDER (with low pressure relief valve)

Service Instructions

TABLE 1

Model Number	Repair Kit Number	Uses Seat (6), Check Valve (7), and Spring (8)	Model Number	Repair Kit Number	Uses Seat (6), Check Valve (7), and Spring (8)
02-020-231 (BF)	02-001-205	Yes	03-020-449 (BF)	02-001-157	Yes
02-020-243 (BF)	02-001-205	Yes	03-020-457 (BF)	02-001-214	Yes
02-020-245 (BF)	02-001-205	Yes	03-020-459 (BF)	02-001-168	Yes
02-020-257 (BF)	02-001-158	Yes	03-020-461 (BF)	02-001-170	Yes
02-020-258 (HO)	02-001-253	Yes	03-020-462 (HO)	02-001-141	No
02-020-259 (BF)	02-001-206	Yes	03-020-463 (BF)	02-001-171	Yes
02-020-261 (BF)	02-001-159	No	03-020-466 (HO)	02-001-173	Yes
02-020-264 (HO)	02-001-081	Yes	03-020-468 (HO)	02-001-175	No
02-020-266 (HO)	02-001-081	Yes	03-020-469 (BF)	02-001-176	Yes
02-020-268 (HO)	02-001-082	Yes	03-020-471 (BF)	02-001-177	Yes
02-020-301 (BF)	02-001-207	Yes	03-020-473 (BF)	02-001-180	Yes
02-020-303 (BF)	02-001-207	Yes	03-020-478 (HO)	02-001-183	No
02-020-305 (BF)	02-001-207	Yes	03-020-479 (BF)	02-001-169	No
02-020-307 (BF)	02-001-216	Yes	03-020-483 (BF)	02-001-181	No
02-020-312 (HO)	02-001-228	Yes	03-020-487 (BF)	02-001-216	Yes
02-020-313 (BF)	02-001-182	Yes	03-020-489 (BF)	02-001-198	Yes
02-020-316 (HO)	02-001-230	Yes	03-020-492 (HO)	02-001-145	Yes
02-020-317 (BF)	02-001-249	Yes	03-020-495 (BF)	02-001-219	yes
02-020-321 (BF)	02-001-234	Yes	03-020-501 (BF)	02-001-140	Yes
02-020-327 (BF)	02-001-207	Yes	03-020-505 (BF)	02-001-224	Yes
02-020-329 (BF)	02-001-216	Yes	03-020-507 (BF)	02-001-222	Yes
02-020-332 (HO)	02-001-238	Yes	03-020-508 (HO)	02-001-145	Yes
02-020-343 (BF)	02-001-282	Yes	03-020-509 (BF)	02-001-140	yes
02-021-231 (BF)	02-001-205	No	03-020-513 (BF)	02-001-216	Yes
02-021-258 (HO)	02-001-253	No	03-020-515 (BF)	02-001-223	Yes
02-021-264 (HO)	02-001-081	No	03-020-517 (BF)	02-001-216	Yes
02-021-305 (BF)	02-001-207	No	03-020-519 (BF)	02-001-294	Yes
02-021-313 (BF)	02-001-182	No	03-020-520 (HO)	02-001-227	yes
02-021-316 (HO)	02-001-230	No	03-020-521 (BF)	02-001-216	Yes
02-021-321 (BF)	02-001-234	No	03-020-530 (HO)	02-001-226	Yes
02-021-324 (HO)	02-001-238	No	03-020-531 (BF)	02-001-207	Yes
02-021-332 (HO)	02-001-238	No	03-020-533 (BF)	02-001-210	Yes
02-021-343 (BF)	02-001-282	No	03-020-535 (BF)	02-001-210	yes
03-020-283 (BF)	02-001-157	Yes	03-020-537 (BF)	02-001-182	Yes
03-020-309 (BF)	02-001-067	No	03-020-539 (BF)	02-001-229	Yes
03-020-317 (BF)	02-001-205	Yes	03-020-541 (BF)	02-001-182	Yes
03-020-353 (BF)	02-001-207	Yes	03-020-549 (BF)	02-001-207	Yes
03-020-357 (BF)	02-001-207	No	03-020-551 (BF)	02-001-235	yes
03-020-358 (HO)	02-001-212	No	03-020-554 (HO)	02-001-236	Yes
03-020-363 (BF)	02-001-216	Yes	03-020-555 (BF)	02-001-237	Yes
03-020-367 (BF)	02-001-207	Yes	03-020-557 (BF)	02-001-180	Yes
03-020-393 (BF)	02-001-207	Yes	03-020-559 (BF)	02-001-207	Yes
03-020-395 (BF)	02-001-160	Yes	03-020-561 (BF)	02-001-207	yes
03-020-396 (HO)	02-001-097	Yes	03-020-563 (BF)	02-001-170	Yes
03-020-409 (BF)	02-001-164	No	03-020-565 (BF)	02-001-182	Yes
03-020-411 (BF)	02-001-209	Yes	03-020-568 (HO)	02-001-230	Yes
03-020-415 (BF)	02-001-210	Yes	03-020-569 (BF)	02-001-243	Yes
03-020-418 (HO)	02-001-144	No	03-020-571 (BF)	02-001-245	yes
03-020-419 (BF)	02-001-207	Yes	03-020-572 (HO)	02-001-277	Yes
03-020-420 (HO)	02-001-211	Yes	03-020-573 (BF)	02-001-216	Yes
03-020-421 (BF)	02-001-163	Yes	03-020-575 (BF)	02-001-244	Yes
03-020-422 (HO)	02-001-145	Yes	03-020-586 (HO)	02-001-256	Yes
03-020-423 (BF)	02-001-207	Yes	03-020-588 (HO)	02-001-260	yes
03-020-425 (BF)	02-001-161	Yes	03-020-598 (HO)	02-001-145	Yes
03-020-427 (BF)	02-001-216	Yes	03-020-599 (BF)	02-001-273	No
03-020-428 (HO)	02-001-213	Yes	03-020-605 (BF)	02-001-276	Yes
03-020-429 (BF)	02-001-214	Yes	03-020-607 (BF)	02-001-216	Yes
03-020-430 (HO)	02-001-146	No	03-020-610 (HO)	02-001-290	yes
03-020-431 (BF)	02-001-214	Yes	03-020-612 (HO)	02-001-291	Yes
03-020-441 (BF)	02-001-162	Yes	03-020-613 (BF)	02-001-177	Yes

BF = DOT 3, 4, 5, and 5.1 brake fluid HO = mineral base hydraulic oil

continued on next page...

Model Number	Repair Kit Number	Uses Seat (6), Check Valve (7), and Spring (8)	Model Number	Repair Kit Number	Uses Seat (6), Check Valve (7), and Spring (8)
03-020-614 (HO)	02-001-295	Yes	03-021-531 (BF)	02-001-207	No
03-020-616 (HO)	02-001-297	Yes	03-021-533 (BF)	02-001-210	No
03-021-367 (BF)	02-001-207	No	03-021-535 (BF)	02-001-210	No
03-021-395 (BF)	02-001-160	No	03-021-541 (BF)	02-001-210	No
03-021-396 (HO)	02-001-097	No	03-021-549 (BF)	02-001-207	No
03-021-415 (BF)	02-001-210	No	03-021-551 (BF)	02-001-235	No
03-021-419 (BF)	02-001-207	No	03-021-554 (HO)	02-001-236	No
03-021-420 (HO)	02-001-211	No	03-021-555 (BF)	02-001-237	No
03-021-421 (BF)	02-001-163	No	03-021-557 (BF)	02-001-180	No
03-021-422 (HO)	02-001-145	No	03-021-559 (BF)	02-001-207	No
03-021-423 (BF)	02-001-207	No	03-021-561 (BF)	02-001-207	No
03-021-427 (BF)	02-001-216	No	03-021-563 (BF)	02-001-170	No
03-021-428 (HO)	02-001-213	Yes	03-021-568 (HO)	02-001-230	No
03-021-431 (BF)	02-001-214	No	03-021-572 (HO)	02-001-277	No
03-021-432 (HO)	02-001-275	No	03-021-575 (BF)	02-001-244	No
03-021-436 (HO	02-001-218	No	03-021-586 (HO)	02-001-256	No
03-021-461 (BF)	02-001-170	No	02-021-598 (HO)	02-001-213	No
03-021-466 (HO)	02-001-173	No	03-021-607 (BF)	02-001-216	No
03-021-471 (BF)	02-001-177	No	03-021-610 (HO)	02-001-290	No
03-021-487 (BF)	02-001-216	No	03-021-612 (HO)	02-001-291	No
03-021-489 (BF)	02-001-198	No	03-021-614 (HO)	02-001-295	No
03-021-505 (BF)	02-001-224	No	03-021-616 (HO)	02-001-297	No
03-021-513 (BF)	02-001-216	No			
03-021-520 (HO)	02-001-227	No			
03-021-521 (BF)	02-001-216	No			

BF = DOT 3, 4, 5, and 5.1 brake fluid HO = mineral base hydraulic oil

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

DISASSEMBLY

(Refer to Figure 1)

NOTE

Most repair kits include seat (6), check valve (7) and spring (8), but not all master cylinders use them. Notice what type cylinder you have and use these parts only if your cylinder uses them. See TABLE 1.

This literature services various models of master cylinders. The components shown in Figure 1 may appear different than what is found in your brake.

1. Drain fluid from unit before disassembling.
2. Remove boot (28). Not all models use boot (28).
3. Place cylinder in a vise, (5) upward, in a vertical position.
4. Remove line bolt (1), washer (2), fitting block (3), and washer (4) from end plug (5). **NOTE: Not all models use line bolt (1), washer (2), fitting block (3), or washer (4).**
5. Remove plug (5). Several parts should follow plug as it is removed due to tension of spring (12).

⚠ CAUTION

Plug is under tension of spring (12).

6. Remove spring (8), check valve (7) and seat (6). **NOTE: Not all models use spring (8), check valve (7) or seat (6).**
7. Retainer assembly (10) should follow end plug (5) as it is removed. Remove o-ring (11) from housing (22).
8. Remove spring (12) from housing (22).
9. Remove piston assembly (21) from housing (22) by pushing on piston assembly with a wooden dowel from the small diameter end of housing.
10. Depress piston (14) and remove retaining ring (13) from piston (19). Remove spring (17) and retainer (16) from piston (19).
11. Remove cup (15) from piston (14) and cups (18 & 20) from piston (19). **NOTE: When removing cups be careful not to scratch or mar pistons.**
12. Remove filler plug (26) and gasket (27) from housing (22). **NOTE: Some models use a filter plug in place of filler plug. Some models also use a standpipe in filler plug (26) hole, it is unnecessary to remove this standpipe.**

ASSEMBLY

(Refer to Figure 1)

BE SURE ENTIRE ASSEMBLY PROCEDURE IS DONE WITH CONTAMINATION FREE METHODS. LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Clean cylinder bore and all parts thoroughly in clean system fluid.
2. **NOTE: Before installing filler plug (26) be sure the filler plug breather hole is free of all contaminants. Use air pressure to clean and dry this hole. Install new gasket (27) and filler plug or filter plug (26) in housing (22). Finger tighten plug (26).**
3. Install new cups (18 & 20) on piston (19). Note direction of cups. **NOTE: Be careful not to scratch or mar piston.**
4. Install spring (17) into piston (19). Place new retainer (16) over end of spring (17) or reinstall bullet style retainer (16) removed during disassembly on the end of spring (17).
5. a. Insert piston (14) into piston (19) with new cup (15) against retainer (16). Depress piston (14) and install new retaining ring (13).
   b. Install new cup (15) on nose of piston (14). Seat the nose of piston (14) inside of bullet style retainer (16). Install piston (14) into piston (19). Depress piston (14) and install new retaining ring (13).

6. Carefully insert piston assembly (21) into housing (22). Note direction of piston assembly.
7. Install new o-ring (11) in housing (22).
8. Install spring (12) over piston assembly (21).
9. Install new seal (9) on new retainer assembly (10). Install new retainer assembly into housing. Note direction of retainer assembly.
10. Lubricate threads on plug (5). Assemble new spring (8), new check valve (7) and new seat (6) between retainer assembly (10) and plug (5). Note order of components. Install plug (5) into housing (22) and torque 67.8-108.5 N·m (50-80 lb·ft). **NOTE: Not all models use spring (8), check valve (7), or seat (6).**
11. Install new washer (4), fitting block (3), new washer (2), and line bolt (1). Finger tighten line bolt (1). **NOTE: Not all models use washer (4), fitting block (3), washer (2), or line bolt (1).**
12. Install new boot (28) on housing (22). **NOTE: Not all models use boot (28).**
13. Refer to RELIEF VALVE DISASSEMBLY for relief valve (23) replacement.
14. Install unit on vehicle and connect fluid lines. Hold fitting block (3) in a fixed position and torque line bolt (1) 47.5-61.0 N·m (35-45 lb·ft). Connect push rod. Fill reservoir and bleed system of air. Tighten fittings if leaks occur. Make several applications to be sure the brake valve is working properly. **NOTE: All fittings must be inspected for leaks and tightened if leaks occur.**
15. After bleeding is completed, fill reservoir to within 12.7 mm (0.50 in) of top. Torque filler plug (26) 33.9-47.5 N·m (25-35 lb·ft).

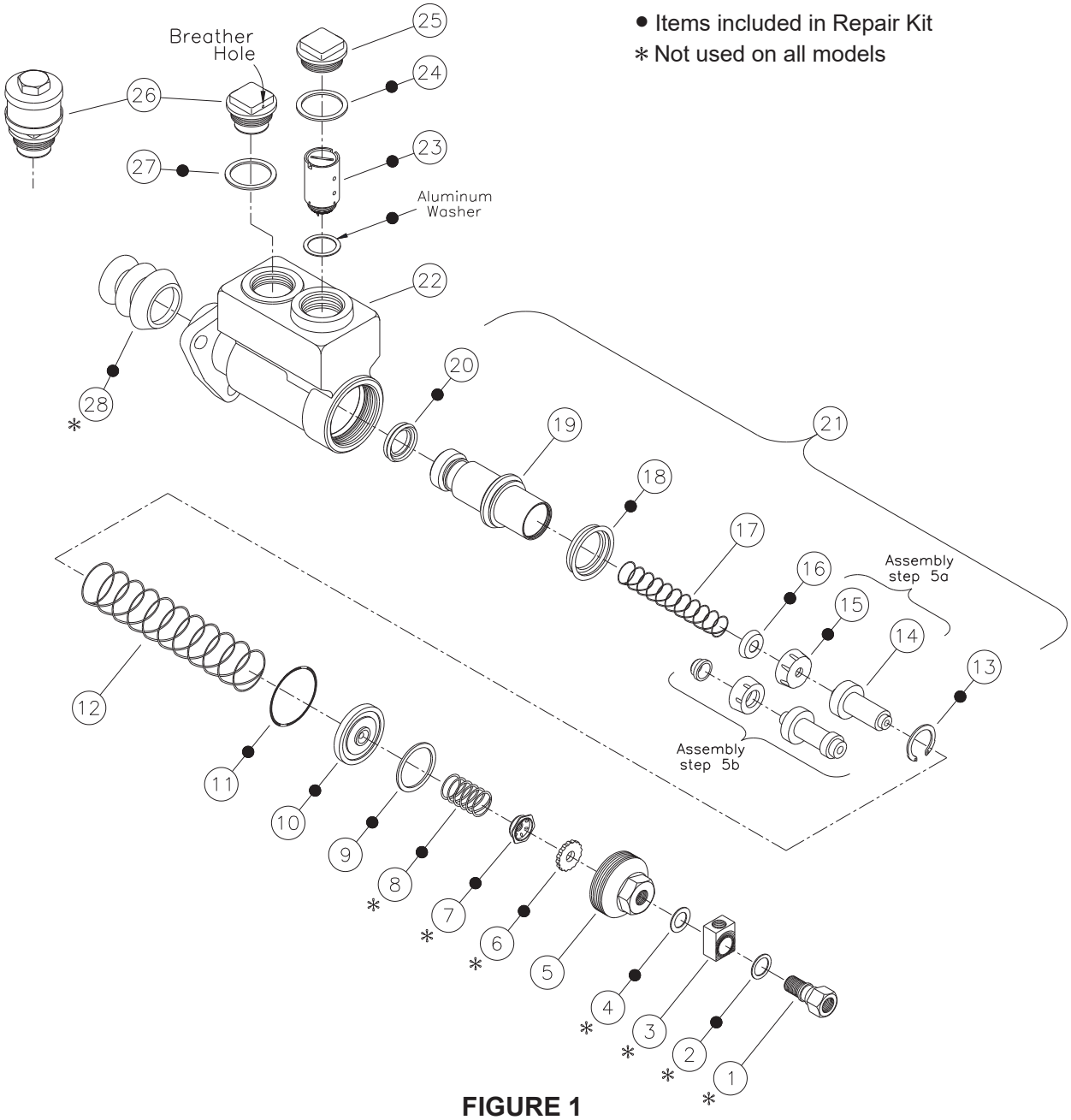

FIGURE 1

RELIEF VALVE DISASSEMBLY

(Refer to Figures 1 and 2)

NOTE

The following procedures are for relief valve replacement. Not all repair kits include a relief valve, if your repair kit does not include a relief valve, it is recommended that you contact ZF Off-Highway Solutions Minnesota Inc. for proper replacement relief valve.

1. Remove filler plug (25) and gasket (24). **NOTE: Some models use a standpipe in filler plug (25) hole, remove this standpipe.**
2. Remove relief valve (23) by turning it counter clockwise. **NOTE: Do not tamper with factory setting on relief valve. Adjusting screw is staked.** The relief valve housing is slotted on the top edge use these slots ONLY, when removing or inserting relief valve. If the relief valve will not turn, position tool on relief valve, rap sharply with hammer then turn valve out.
3. After removing the relief valve, an aluminum washer may still be in the reservoir at the relief valve port. Remove the aluminum washer.

RELIEF VALVE ASSEMBLY

(Refer to Figures 1 and 2)

1. Insert new aluminum washer from new relief valve into reservoir at relief valve port.
2. Insert new relief valve (23) into master cylinder. Tighten relief valve using the slots on top edge of relief valve housing only. Torque 20.3-27.1 N·m (15-20 lb·ft).
3. Install new gasket (24) and filler plug (25). Torque filler plug 33.9-47.5 N·m (25-35 lb·ft). **NOTE: If your model uses a standpipe, install standpipe and torque 33.9-47.5 N·m (25-35 lb·ft).**
4. Refer to ASSEMBLY procedures 14 and 15 on page 3.

NOTE: Do not tamper with factory setting on relief valve. Adjusting screw is staked.

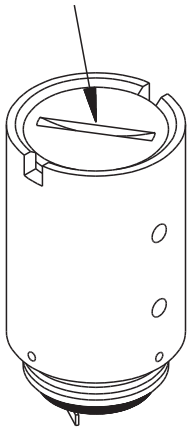

FIGURE 2

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