

ACCUMULATOR CHARGING VALVE with Relief Valve

Product Explanation, Operating Information, and Service Instructions



ACV-DMO-RV

PRODUCT EXPLANATION

The accumulator charging valve is designed for installation in an open center hydraulic system between the pump and the downstream secondary hydraulic devices.

The accumulator charging valve supplies oil on demand to the accumulator from the open center circuit. Accumulator charging is accomplished at a preset rate (GPM) and is relatively constant within the preset pressure limits.

The flow to the downstream secondary hydraulic devices will be reduced fractionally for a short time when the accumulator is charging. This does not noticeably affect the operation of these components. Full system pressure is available to the downstream secondary hydraulic devices at all times provided oil delivery and pressure from the pump is not impeded.

The accumulator charging valve incorporates a full flow relief valve to limit the maximum pressure in the hydraulic system.

The accumulator upper and lower pressure limits, charging flow rate, and the relief valve setting are set at the time of manufacture.

OPERATING INFORMATION

End user must provide proper maintenance of valve, should it become inoperable, by replacing the valve or servicing it with the proper repair kit. See TABLE 1 on page 3 or TABLE 2 on page 5 for the proper repair kit number. Observe service instruction procedures on following pages. See Warnings A, B, C, and D below.

IMPORTANT INFORMATION

A **⚠ WARNING**
Due to allowable operating temperature of accumulator charging valve avoid contact or burn injury may occur.

B **⚠ WARNING**
Be sure system energy is relieved from accumulator charging valve before removing from machine. See machine operating instructions for procedures to relieve system energy.

C **⚠ WARNING**
Relief valve is preset at the factory. DO NOT READJUST or system damage or failure may occur.

D **⚠ WARNING**
Do not exceed the high limit pressure setting indicated in TABLE 1 and TABLE 2 or system damage or failure may occur.

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NOTE

Locate the model number on the accumulator charging valve and compare it to the model number in TABLE 1. Be sure you have the proper service instructions.

SERVICE INSTRUCTIONS

⚠ WARNING

Be sure system energy is relieved from accumulator charging valve before removing from machine. See machine operating instructions for procedures to relieve system energy.

Disassembly

(Refer to Figure 1)

1. Remove plug (7) from housing (15). Remove o-ring (2) from plug (7). **NOTE: Plug (7) is under spring tension.**
2. Remove spring (5) and rod (6) from housing (15).
3. Remove plug (1) from housing (15) and remove o-ring (2) from plug (1).
4. Remove spool (3) from housing (15) through plug (7) end ONLY. Remove seal (4) from spool (3).
5. **Earlier Design:** Loosen nut (32) on screw assembly (31) and remove screw assembly (31) from housing (15). Remove o-ring (30) from screw assembly (31). Remove spring (29), poppet or steel ball (28), seat (27), o-ring (9) and washer (26) from housing (15). **Later Design: Some later designs use a directional spring (29). Directional spring (29) is attached to screw assembly (30) by means of the small diameter end of spring (29) being snapped into a groove on the nose end of screw assembly (30). See Figure 1b.** Remove nut (32) and remove screw assembly (30) from housing (15). Remove o-ring (31) from screw assembly (30) from nut (32) side of screw assembly. Remove shim (46), spring (29), steel ball (29), seat (27), o-ring (9), and washer (26) from housing (15).
6. Remove filter/screen (25) and washer (24) from housing (15).
7. Remove plug (8) from housing (15) and remove o-ring (9) from plug (8).
8. BEFORE moving screw (10), ACCURATELY MEASURE ITS DEPTH from the end of housing (15) and record for reassembly purposes. Remove screw (10) from housing (15).
9. Remove spring (12), retainer (13) and ball (14). Be sure to keep ball (14) separate from ball (20) for reassembling.
10. Remove pin (11) from screw (10) using a drive pin punch. **NOTE: Be careful not to damage threads.**
11. Remove plug (23) from housing (15). Remove o-ring (9) from plug (23).
12. Remove spring (22), stop (21) and ball (20) from housing (15).
13. Place housing (15) on a bench with plug (23) end down. Spool (19) may or may not fall out at this point.
14. Using a 6.35-7.87 mm (0.25-0.31 in) diameter wood or plastic dowel, carefully remove insert (18) and spool (19) from housing (15). Insert (18) must come out plug (23) end of housing (15). Be careful not to scratch or mar valve seats on insert (18).
15. Remove spool (19) from insert (18). Remove o-rings (16 & 17) from insert (18).
16. Remove plug (41) from housing (15). Remove o-ring (40) from plug (41).
17. Remove spring (39), poppet (38), sleeve (36), poppet (34), and spring (33) from housing (15). **NOTE: Be careful not to scratch or mar housing or sleeve bore. Model number 06-463-425 will reuse existing poppets (34 & 38).**
18. Remove o-rings (35 & 37) from sleeve (36).
19. Remove relief valve (44) from housing (15). Remove o-rings (42 & 30) and back-up ring (43) from relief valve (44).

⚠ WARNING

Relief valve (44) is preset at the factory. DO NOT READJUST or system damage or failure may occur.

20. Remove plug (45) from housing (15) switch port. Remove o-ring (9) from plug (45). **NOTE: Not all models use plug (45) or o-ring (9) in housing (15) switch port.**

NOTE

Observe torque specifications as indicated in assembly procedures or system damage or failure may occur.

Assembly

(Refer to Figure 1)

CLEAN ALL PARTS WITH CLEAN SOLVENT AND DRY. LUBRICATE ALL RUBBER PARTS WITH CLEAN SYSTEM FLUID PRIOR TO ASSEMBLY. BE SURE ENTIRE ASSEMBLY PROCEDURE IS DONE USING CONTAMINATION FREE METHODS.

1. Install new o-ring (2) on plug (1). Install plug (1) in housing (15) and torque 67.8-81.4 N·m (50-60 lb·ft).
2. Install new seal (4) on spool (3). Be sure seal (4) does not twist in groove.
3. Lubricate spool (3) with clean system fluid and properly install into housing (15).
4. Install spring (5) and rod (6) into housing (15).
5. Install new o-ring (2) on plug (7). Install plug (7) into housing (15) and torque 67.8-81.4 N·m (50-60 lb·ft).
6. Install new o-rings (16 & 17) on insert (18) and install insert into housing (15). Note direction of assembly. Seat insert (18) with a 12.7 mm (0.50 in) diameter wood or plastic dowel.
7. Install spool (19) into insert (18) in housing (15). Note direction of spool (19), long shoulder end faces end plug (23). See Figure 1a.
8. Install ball (20) on insert (19) in housing (15). Install stop (21) over ball (20), and spring (22) over stop (21).
9. Install new o-ring (9) on plug (23). Carefully install plug (23) into housing (15), centering spring (22). Torque plug (23) 47.5-54.2 N·m (35-40 lb·ft).
10. Turn housing (15) so plug (1) is vertically upward. Install ball (14) in housing (15). Be sure ball (14) is centered in bottom of hole in housing (15). Install retainer (13) and spring (12) into housing (15).
11. Insert new pin (11) in screw (10). Be sure pin (11) is aligned properly and is evenly driven into screw (10). **NOTE: Be careful not to damage threads.**
12. Thread screw (10) into housing (15) to the depth recorded during disassembly.
13. Install new o-ring (9) on plug (8). Install plug (8) in housing (15) and torque 47.5-54.2 N·m (35-40 lb·ft).
14. Install washer (24) and new filter/screen (25) in housing (15).
15. **Earlier Design:** Install new o-ring (30) on screw assembly (31). Install washer (26), o-ring (9), seat (27), new poppet or steel ball (28), spring (29), and screw assembly (31) into housing (15). Torque screw assembly (31) 24.4-29.8 N·m (18-22 lb·ft). Then install nut (32) on screw assembly (31) and torque nut 43.4-51.5 N·m (32-38 lb·ft). **Later Design: Some later designs use a directional spring (29). Directional spring (29) is attached to screw assembly (30) by means of the small diameter end of spring (29) being snapped into a groove on the nose end of screw assembly (30). If necessary, reattach the small diameter of spring (29) into the groove on the nose end of screw assembly (30) using a slight twisting motion. See Figure 1b.** Install new o-ring (31) on screw assembly (30) from nut (32) side of screw assembly. Install washer (26), new o-ring (9), seat (27), steel ball (28), and spring (29) in housing (15). Fully lubricate shim (46) with clean system fluid and install in housing (15) on end of seat (27). Install screw assembly (30) in housing (15). Torque screw assembly (30) 24.4-29.8 N·m (18-22 lb·ft). Then install nut (32) on screw assembly (30) and torque nut 43.4-51.5 N·m (32-38 lb·ft).
16. Install new o-rings (35 & 37) on sleeve (36).
17. Install spring (33), new poppet (34), sleeve (36), new poppet (38), and spring (39) into housing (15). **NOTE: Model number 06-463-425 will reuse existing poppets (34 & 38).**
18. Install new o-ring (40) on plug (41). Install plug (41) in housing (15) and torque 67.8-81.4 N·m (50-60 lb·ft).
19. Install new o-rings (30 & 42) and new back-up ring (43) on relief valve (44).
20. Install relief valve (44) in housing (15) and torque 47.5-54.2 N·m (35-40 lb·ft).

⚠ WARNING

Relief valve (44) is preset at the factory. DO NOT READJUST or system damage or failure may occur.

21. Install new o-ring (9) on plug (45). Install plug (45) in housing (15) switch port and torque 47.5-54.2 N·m (35-40 lb·ft). **NOTE: Not all models use plug (45) or o-ring (9) in switch port.**

● Items included in Repair Kit

* Not used on all models

** Model number 06-463-425 will reuse poppets (34 & 38).

NOTE
Model numbers 06-463-415, 06-463-440, and 06-463-455 use a ball in place of poppet (28). This ball is not included in the repair kit.

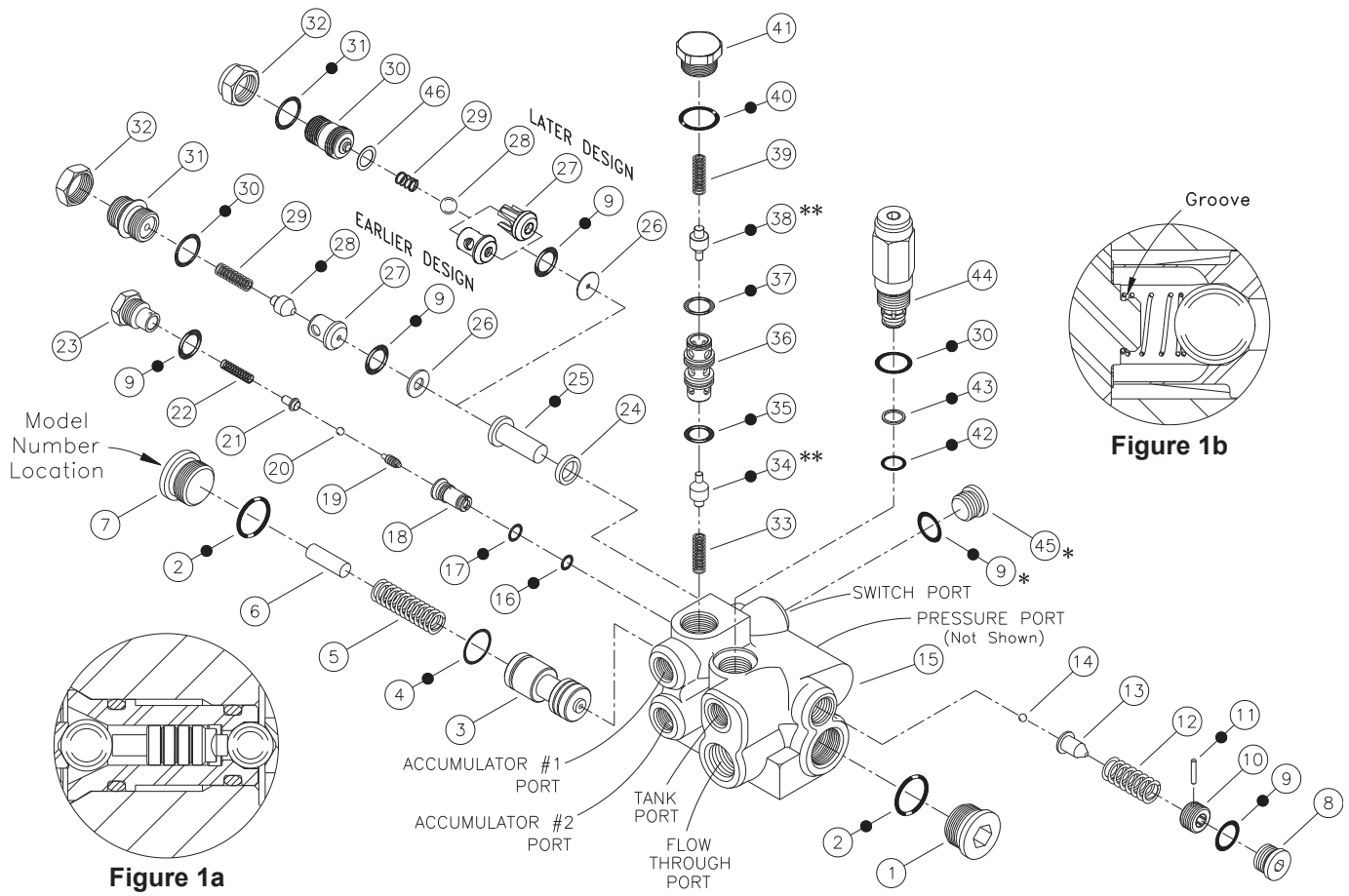


FIGURE 1

TABLE 1 (Specifications)

Model Number	Repair Kit Number	Nominal High Limit (cut out)		Nominal Low Limit (cut in)	
		bar	(PSI)	bar	(PSI)
06-463-415	06-400-184	103.4 ± 3.5	(1500 ± 50)	86.2 ± 3.5	(1250 ± 50)
06-463-424	06-400-184	186.2 ± 3.5	(2700 ± 50)	155.1 ± 3.5	(2250 ± 50)
06-463-425	06-400-452	175.8 ± 3.5	(2550 ± 50)	146.5 ± 3.5	(2125 ± 50)
06-463-426	06-400-184	181.0 ± 3.5	(2625 ± 50)	150.0 ± 3.5	(2175 ± 50)
06-463-432	06-400-184	155.1 ± 3.5	(2250 ± 50)	125.8 ± 3.5	(1825 ± 50)
06-463-434	06-400-184	127.6 ± 3.5	(1850 ± 50)	103.4 ± 3.5	(1500 ± 50)
06-463-439	06-400-439	168.9 ± 3.5	(2450 ± 50)	150.0 ± 3.5	(2175 ± 50)
06-463-440	06-400-228	193.1 ± 3.5	(1850 ± 50)	137.9 ± 3.5	(2000 ± 50)
06-463-441	06-400-439	127.6 ± 3.5	(1850 ± 50)	103.4 ± 3.5	(1500 ± 50)
06-463-455	06-463-498	172.4 ± 3.5	(2500 ± 50)	125.8 ± 3.5	(1825 ± 50)
06-463-496	06-400-184	188.6 ± 3.5	(2735 ± 50)	140.3 ± 3.5	(2035 ± 50)

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

VALVE ADJUSTMENT

(Refer to Table 1)

1. See machine servicing instructions to properly reinstall accumulator charging valve. Tee an accurate pressure gauge on an accumulator line.
2. Start pump and allow approximately one minute for charging to start (pressure in gauge will read accumulator precharge plus). If valve does not begin to charge remove plug (8) and turn screw (10) in, stopping when gauge shows an increase in pressure. Check the high limit specifications (see TABLE 1) and adjust screw (10) until the high limit setting is met. Reinstall plug (8).

This pressure can be checked correctly only if after each adjustment of screw (10) the accumulator pressure is reduced below the low limit setting and the system recharges the accumulator pressure to its high limit. Repeat process until high pressure setting is accurately adjusted. **NOTE: Be sure to reinstall plug (8) before starting pump.**

3. Torque plug (8) 47.5-54.2 N·m (35-40 lb·ft).

NOTE

Locate the model number on the accumulator charging valve and compare it to the model number in TABLE 2. Be sure you have the proper service instructions.

SERVICE INSTRUCTIONS

⚠ WARNING

Be sure system energy is relieved from accumulator charging valve before removing from machine. See machine operating instructions for procedures to relieve system energy.

Disassembly

(Refer to Figure 2)

1. Remove plug (7) from housing (15). Remove o-ring (2) from plug (7). **NOTE: Plug (7) is under spring tension.**
2. Remove spring (5) and rod (6) from housing (15).
3. Remove plug (1) from housing (15) and remove o-ring (2) from plug (1).
4. Remove spool (3) from housing (15) through plug (7) end ONLY. Remove seal (4) from spool (3).
5. **Some later designs use a directional spring (28). Directional spring (28) is attached to screw assembly (31) by means of the small diameter end of spring (28) being snapped into a groove on the nose end of screw assembly (31). See Figure 2b.** Loosen nut (32) and remove screw assembly (31) from housing (15). Remove o-ring (30) from screw assembly (31). Remove shim (29), spring (28), steel ball (27), seat (26), o-ring (9), washer (25), and two washers (24) from housing (15).
6. Remove plug (8) from housing (15) and remove o-ring (9) from plug (8).
7. BEFORE moving screw (10), ACCURATELY MEASURE ITS DEPTH from the end of housing (15) and record for reassembly purposes. Remove screw (10) from housing (15).
8. Remove spring (12), retainer (13), and ball (14). Be sure to keep ball (14) separate from ball (20) for reassembling.
9. Remove pin (11) from screw (10) using a drive pin punch. **NOTE: Be careful not to damage threads.**
10. Remove plug (23) from housing (15). Remove o-ring (9) from plug (23).
11. Remove spring (22), stop (21), and ball (20) from housing (15).
12. Place housing (15) on a bench with plug (23) end down. Spool (19) may or may not fall out at this point.
13. Using a 6.35-7.87 mm (0.25-0.31 in) diameter wood or plastic dowel, carefully remove insert (18) and spool (19) from housing (15). Insert (18) must come out plug (23) end of housing (15). Be careful not to scratch or mar valve seats on insert (18).
14. Remove spool (19) from insert (18). Remove o-rings (16 & 17) from insert (18).
15. Remove plug (41) from housing (15). Remove o-ring (40) from plug (41).
16. Remove spring (39), poppet (38), sleeve (36), poppet (34), and spring (33) from housing (15). **NOTE: Be careful not to scratch or mar housing or sleeve bore.**
17. Remove o-rings (35 & 37) from sleeve (36).
18. Remove relief valve (44) from housing (15). Remove o-rings (42 & 30) and back-up ring (43) from relief valve (44).

⚠ WARNING

Relief valve (44) is preset at the factory. DO NOT READJUST or system damage or failure may occur.

NOTE

Observe torque specifications as indicated in assembly procedures or system damage or failure may occur.

Assembly

(Refer to Figure 2)

CLEAN ALL PARTS WITH CLEAN SOLVENT AND DRY. LUBRICATE ALL RUBBER PARTS WITH CLEAN SYSTEM FLUID PRIOR TO ASSEMBLY. BE SURE ENTIRE ASSEMBLY PROCEDURE IS DONE USING CONTAMINATION FREE METHODS.

1. Install new o-ring (2) on plug (1). Install plug (1) into housing (15) and torque 67.8-81.4 N·m (50-60 lb·ft).
2. Install new seal (4) on spool (3). Be sure seal (4) does not twist in groove.
3. Lubricate spool (3) with clean system fluid and properly install into housing (15).
4. Install spring (5) and rod (6) into housing (15).
5. Install new o-ring (2) on plug (7). Install plug (7) into housing (15) and torque 67.8-81.4 N·m (50-60 lb·ft).
6. Install new o-rings (16 & 17) on insert (18) and install insert into housing (15). Note direction of assembly. Seat insert (18) with a 12.7 mm (0.50 in) diameter wood or plastic dowel.
7. Install spool (19) into insert (18) in housing (15). Note direction of spool (19), long shoulder end faces end plug (23). See Figure 2a.
8. Install ball (20) on insert (18) in housing (15). Install stop (21) over ball (20), and spring (22) over stop (21).
9. Install new o-ring (9) on plug (23). Carefully install plug (23) into housing (15), centering spring (22). Torque plug (23) 47.5-54.2 N·m (35-40 lb·ft).
10. Turn housing so plug (1) is vertically upward. Install ball (14) in housing (15). Be sure ball (14) is centered in bottom of hole in housing (15). Install retainer (13) and spring (12) into housing (15).
11. Insert new pin (11) in screw (10). Be sure pin (11) is aligned properly and is evenly driven into screw (10). **NOTE: Be careful not to damage threads.**
12. Thread screw (10) into housing (15) to the depth recorded during disassembly.
13. Install new o-ring (9) on plug (8). Install plug (8) in housing (15) and torque 47.5-54.2 N·m (35-40 lb·ft).
14. Install new o-ring (30) on screw assembly (31).
15. **Some later designs use a directional spring (28). Directional spring (28) is attached to screw assembly (31) by means of the small diameter end of spring (28) being snapped into a groove on the nose end of screw assembly (31). If necessary, reattach the small diameter of spring (28) into the groove on the nose end of screw assembly (31) using a slight twisting motion. See Figure 2b.** Install two washers (24), washer (25), new o-ring (9), seat (26), steel ball (27), and spring (28) into housing (15). Fully lubricate shim (29) with clean system fluid and install in housing (15) on end of seat (26). Install screw assembly (31) in housing (15). Torque screw assembly (31) 24.4-29.8 N·m (18-22 lb·ft).
16. Install nut (32) on screw assembly (31) and torque 34.4-51.5 N·m (32-38 lb·ft).
17. Install new o-rings (35 & 37) on sleeve (36).
18. Install spring (33), new poppet (34), sleeve (36), new poppet (38), and spring (39) into housing (15).
19. Install new o-ring (40) on plug (41). Install plug (41) in housing (15) and torque 67.8-81.4 N·m (50-60 lb·ft).
20. Install new back-up ring (43) and new o-rings (30 & 42) on relief valve (44).
21. Install relief valve (44) in housing (15) and torque 47.5-54.2 N·m (35-40 lb·ft).

⚠ WARNING

Relief valve (44) is preset at the factory. DO NOT READJUST or system damage or failure may occur.

● Items included in Repair Kit

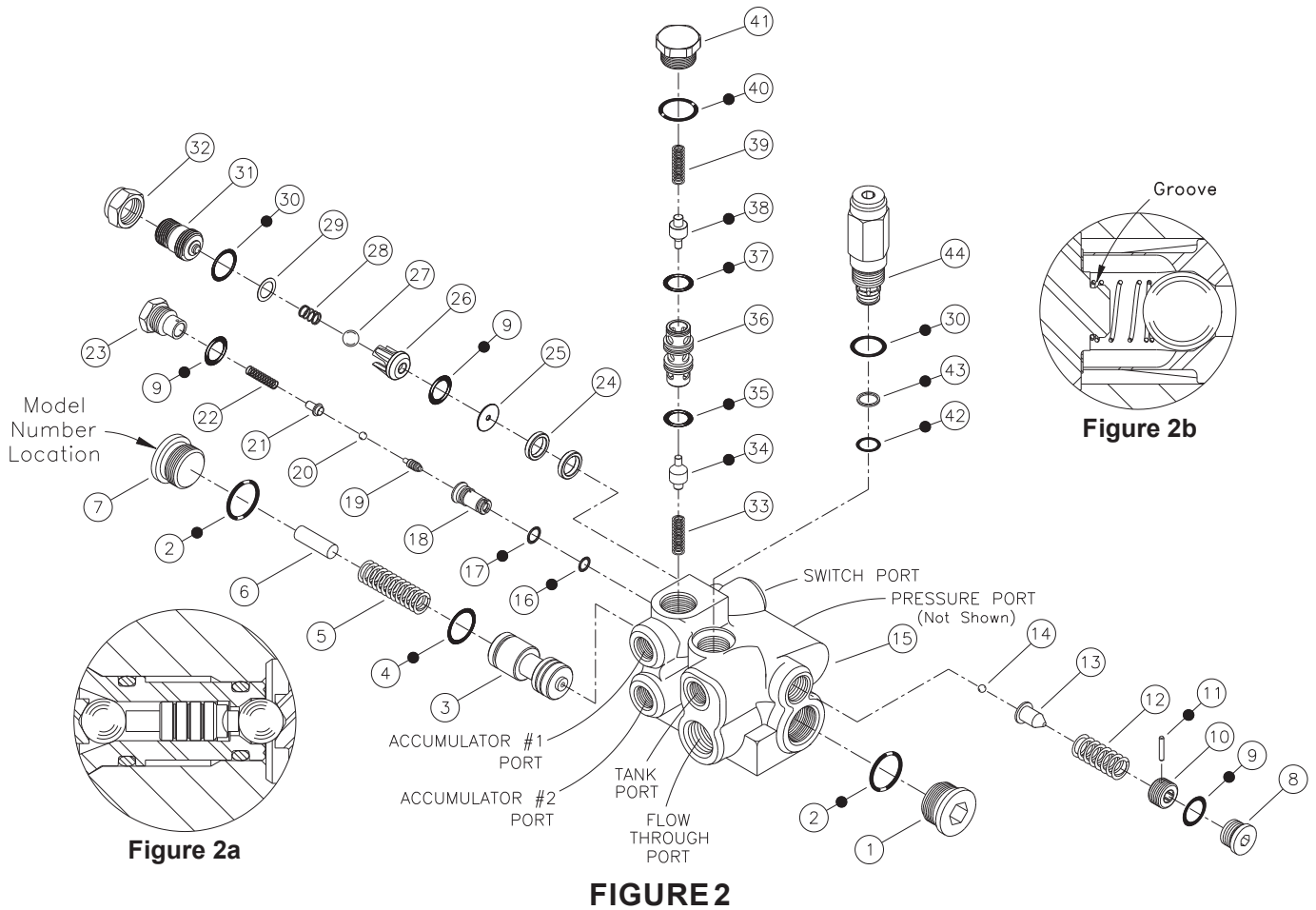


TABLE 2 (Specifications)

Model Number	Repair Kit Number	Nominal High Limit (cut out)		Nominal Low Limit (cut in)	
		bar	(PSI)	bar	(PSI)
06-463-401	06-400-299	179.3 ± 3.5	(2600 ± 50)	144.8 ± 3.5	(2100 ± 50)

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

VALVE ADJUSTMENT

(Refer to Table 1)

1. See machine servicing instructions to properly reinstall accumulator charging valve. Tee an accurate pressure gauge on an accumulator line.
2. Start pump and allow approximately one minute for charging to start (pressure in gauge will read accumulator precharge plus). If valve does not begin to charge remove plug (8) and turn screw (10) in, stopping when gauge shows an increase in pressure. Check the high limit specifications (see TABLE 2) and adjust screw (10) until the high limit setting is met. Reinstall plug (8).

This pressure can be checked correctly only if after each adjustment of screw (10) the accumulator pressure is reduced below the low limit setting and the system recharges the accumulator pressure to its high limit. Repeat process until high pressure setting is accurately adjusted. **NOTE: Be sure to reinstall plug (8) before starting pump.**

3. Torque plug (8) 47.5-54.2 N·m (35-40 lb·ft).

SERVICE CHECKS FOR HYDRAULIC SYSTEMS

ACCUMULATOR CHARGING CYCLE REPEATS FREQUENTLY WHEN ACCUMULATOR IS NOT NORMALLY BEING DISCHARGED IN SERVICE

1. Leaking accumulator lines or fittings
- 1. Check lines and fittings for leaks and correct**
2. Incorrect setting of accumulator gas charge
- 2. Check accumulator gas charge**
3. Line to accumulator plugged
- 3. Replace line**
4. Inoperative charging valve
- 4. Replace charging valve**

ACCUMULATOR STARTS TO CHARGE BUT DOES NOT REACH HIGH LIMIT

1. No oil or low oil level in tank
- 1. Check oil level**
2. Pump worn or inoperative and not delivering full flow or pressure
- 2. Check pump**

SERVICE DIAGNOSIS

(Refer to Figure 1)

ACCUMULATOR CHARGING CYCLE REPEATS FREQUENTLY WHEN ACCUMULATOR IS NOT NORMALLY BEING DISCHARGED IN SERVICE

1. Poppet or ball (28) leaking.
2. O-ring (9) next to seat (27) leaking.
3. O-ring (17) leaking.
4. Ball (20) leaking.
5. Inoperative seat on insert (18).

ACCUMULATOR STARTS TO CHARGE BUT DOES NOT REACH HIGH LIMIT

1. O-ring (16) leaking.
2. Seal (4) on spool (3) has been damaged or worn.

SERVICE DIAGNOSIS

(Refer to Figure 2)

ACCUMULATOR CHARGING CYCLE REPEATS FREQUENTLY WHEN ACCUMULATOR IS NOT NORMALLY BEING DISCHARGED IN SERVICE

1. Ball (27) leaking.
2. O-ring (9) next to seat (26) leaking.
3. O-ring (17) leaking.
4. Ball (20) leaking.
5. Inoperative seat on insert (18).

ACCUMULATOR STARTS TO CHARGE BUT DOES NOT REACH HIGH LIMIT

1. O-ring (16) leaking.
2. Seal (4) on spool (3) has been damaged or worn.

3. Inoperative system relief valve (valve leaking or has low setting so full flow and pressure are not available)
- 3. Check relief valve**
4. Inoperative charging valve
- 4. Replace charging valve**

ACCUMULATOR CHARGING TIME TOO LONG

1. No oil or low oil level in tank
- 1. Check oil level**
2. Relief valve setting too low
- 2. Check valve setting**
3. Pump worn or inoperative and not delivering full flow or pressure
- 3. Check pump**
4. Inoperative charging valve
- 4. Replace charging valve**

ACCUMULATOR FAILS TO START CHARGING

1. No oil or low oil level in tank
- 1. Check oil level**
2. Worn or inoperative pump
- 2. Check pump pressure and flow**
3. Inoperative relief valve
- 3. Check relief valve setting**

ACCUMULATOR CHARGING TIME TOO LONG

1. Dirt in filter/screen (25).
2. Poppet or ball (28) or poppets (34 or 38) stuck, partially closed.
3. Seat (27) partially plugged.

ACCUMULATOR FAILS TO START CHARGING

1. Broken spring (12).
2. Broken spring (5).
3. Spool (3) stuck.
4. Dirt in filter/screen (25).

ACCUMULATOR CHARGING TIME TOO LONG

1. Ball (27) or poppet (34 or 38) stuck, partially closed.
2. Seat (26) partially plugged.

ACCUMULATOR FAILS TO START CHARGING

1. Broken spring (12).
2. Broken spring (5).
3. Spool (3) stuck.

4. Air in accumulator line
- 4. Bleed accumulator line**
5. Inoperative charging valve
- 5. Replace charging valve**

VERY RAPID CYCLING OF CHARGING VALVE

1. Incorrect setting of accumulator gas charge
- 1. Check accumulator gas charge**
2. Inoperative charging valve
- 2. Replace charging valve**

LACK OF ADEQUATE FLOW THROUGH VALVE

1. Inoperative pump
- 1. Check pump pressure and delivery**
2. Inoperative relief valve
- 2. Check relief valve setting**
3. Blocked lines
- 3. Replace lines**
4. Inoperative charging valve
- 4. Replace charging valve**

VERY RAPID CYCLING OF CHARGING VALVE

1. Insert (18) worn.
2. Poppets (34 or 38) stuck, partially closed.

ACCUMULATOR PRESSURES ARE NOT ISOLATED FROM ONE ANOTHER

1. O-rings (35 or 37) leaking.
2. Inoperative poppets (34 or 38).

VERY RAPID CYCLING OF CHARGING VALVE

1. Insert (18) worn.
2. Poppets (34 or 38) stuck, partially closed.

ACCUMULATOR PRESSURES ARE NOT ISOLATED FROM ONE ANOTHER

1. O-rings (35 or 37) leaking.
2. Inoperative poppets (34 or 38).

NOTES
