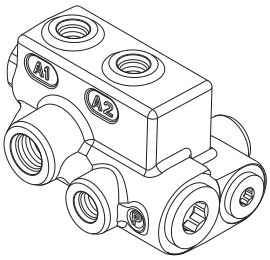

Single and Dual ACCUMULATOR CHARGING VALVE with Load Sensing

Product Explanation, Operating Information, and Service Instructions

ACV-SMN-LS and ACV-DMN-LS

PRODUCT EXPLANATION

The load sensing accumulator charging valve operates in a low and pressure on demand system. The charging valve senses the pressure in the accumulator(s). If pressure in one or both accumulators is below a specified pressure range the charging valve sends a pressure signal to a pressure and flow compensated pump. The pump senses the pressure signal from the charging valve and responds by supplying flow to meet the demand from the charging valve. Pressure in the accumulators rises as the volume of oil increases in them. Flow rate to the pressure accumulators is constant. The charging valve stops sending the pressure signal when pressure in the accumulators reaches the high limit of the charging valve. The accumulator charging valve is connected to the hydraulic system in parallel to other load sensing valves. The highest demand for pressure determines the operating pressure of the system. A load sensing priority valve and fixed displacement pump may be used in place of the pressure and flow compensated pump.

The pressure limiting device of the hydraulic system limits pressure in the accumulators. The system must be designed to ensure there is sufficient available flow for all foreseeable operating conditions or has proper priority function to ensure safe operation.

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 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**

Pressure in the accumulators is limited the the system pressure limiting device. Adjustment outside of the allowable range may result in system damage or failure.

D **⚠ WARNING**

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

NOTE
Locate the model number on the accumulator charging valve and compare it to the model number in TABLE 1. Be sure you 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 (1) from housing (10). Remove o-ring (2) from plug (1).

NOTE
Items 3 through 9 are not used in single accumulator charging valves.

2. Remove spring (3), poppet (4), sleeve (6), poppet (8) and spring (9) from housing (10). **NOTE: Be careful not to scratch or mar housing or sleeve bore.**
3. Remove o-rings (5 & 7) from sleeve (6).
4. Remove plug (25) from housing (10). Remove o-ring (12) from plug (25).
5. BEFORE moving screw (24), ACCURATELY MEASURE ITS DEPTH from the end of housing (10) and record for reassembly purposes. Remove screw (24) from housing (10).
6. Remove spring (22), retainer (21), and ball (20). Be sure to keep ball (20) separate from ball (15) for reassembly.
7. Remove pin (23) from screw (24) using a drive pin punch. **NOTE: Be careful not to damage threads.**
8. Remove plug (11) from housing (10). Remove o-ring (12) from plug (11).
9. Remove spring (13), stop (14), and ball (15) from housing (10).
10. Place housing (10) on a bench with plug (11) end down. Spool (16) may or may not fall out at this point.
11. Using a 6.4-7.9 mm (0.25-0.31 in) diameter wood or plastic dowel, carefully remove insert (17) and spool (16) from housing (10). Insert (17) must come out plug (11) side of housing (10). **NOTE: Be careful not to scratch or mar valve seats on insert (17).**
12. Remove spool (16) from insert (17). Remove o-rings (18 & 19) from insert (17).
13. Remove plug (34) from housing (10). Remove o-ring (33) from plug (34).
14. **Earlier Models:** Using a 1/4-20 UNC bolt, remove sleeve (32) and orifice (29) from housing (10). Remove poppet or steel ball (28), spring (27) and stop (26) from housing (10). Remove o-ring (31) from sleeve (32) and o-ring (30) from orifice (29). **NOTE: Not all models use stop (26).**
    Later Models: Remove sleeve (32) from housing (10). Using a 1/4-20 UNC bolt, remove orifice (29) from housing (10). Remove poppet or steel ball (28), spring (27), and stop (26) from housing (10). Remove o-ring (30) from orifice (29). **NOTE: Not all models use stop (26).**

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

Assembly
(Refer to Figure 1)

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

NOTE
Items 3 through 9 are not used in single accumulator charging valves.

1. Install new o-rings (5 & 7) on sleeve (6).
2. Install spring (9), new poppet (8), sleeve (6), new poppet (4), and spring (3) into housing (10).
3. Install new o-ring (2) on plug (1). Install plug (1) in housing (10) and torque 122.0-135.6 N·m (90-100 lb·ft).
4. Install new o-rings (18 & 19) on insert (17) and install in housing (10). Note direction of assembly. Seat insert (17) using a 12.7 mm (0.50 in) diameter wood dowel.
5. Install spool (16) into insert (17) in housing (10). Note direction of spool (16), long shoulder end is toward end plug (11), see Figure 1a.
6. Install ball (15) on insert (17) in housing (10). Install stop (14) on ball (15).
7. Install spring (13) over stop (14).
8. Install new o-ring (12) on plug (11) and install plug (11) in housing (10), centering spring (13). Torque plug (11) 47.5-54.2 N·m (35-40 lb·ft).
9. Turn housing (10) so plug (25) end is vertically upward. Install ball (20), 6.35 mm (0.25 in) diameter. Be sure ball (20) is centered in bottom of hole in housing (10). Install retainer (21) and spring (22) into housing (10).
10. Insert new pin (23) in screw (24). Be sure pin (23) is aligned properly and is evenly driven into screw (24). **NOTE: Do not damage threads.**
11. Thread screw (24) into housing (10) to the depth recorded during disassembly.
12. Install new o-ring (12) on plug (25) and install plug (25) in housing (10). Torque plug (25) 47.5-54.2 N·m (35-40 lb·ft).
13. Install new o-ring (30) on orifice (29).
14. Install stop (26), spring (27), new poppet or steel ball (28), and orifice (29) in housing (10). Note order and direction of parts. **NOTE: Not all models use stop (26).**
15. **Earlier Models:** Install new o-ring (31) on sleeve (32) and install sleeve (32) in housing (10). Note direction of sleeve (32). Install new o-ring (33) on plug (34). Install plug (34) into housing (10) and torque plug (34) 122.0-135.6 N·m (90-100 lb·ft).
    Later Models: Install sleeve (32) in housing (10). Install new o-ring (33) on plug (34). Install plug (34) into housing (10) and torque plug (34) 122.0-135.6 N·m (90-100 lb·ft).

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, stop pump and remove end plug (25) and turn screw (24) approximately 1/4 turn clockwise. Reinstall end plug (25). Check the high limit specifications (see TABLE 1). Repeat as needed until the high limit setting is met. Pressure limits can be checked correctly only if afte each adjustment of screw (24) the accumulator pressure is reduced below the low limit setting and the system recharges the accumulator pressure to its high limit. **NOTE: Be sure to reinstall plug (25) before starting pump.**

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

3. Torque end plug (25) 47.5-54.2 N·m (35-40 lb·ft).

● Items included in Repair Kit
▲ Used only in models 06-463-118, 06-463-156 and 06-463-162
∗ Not used in single accumulator charging valves

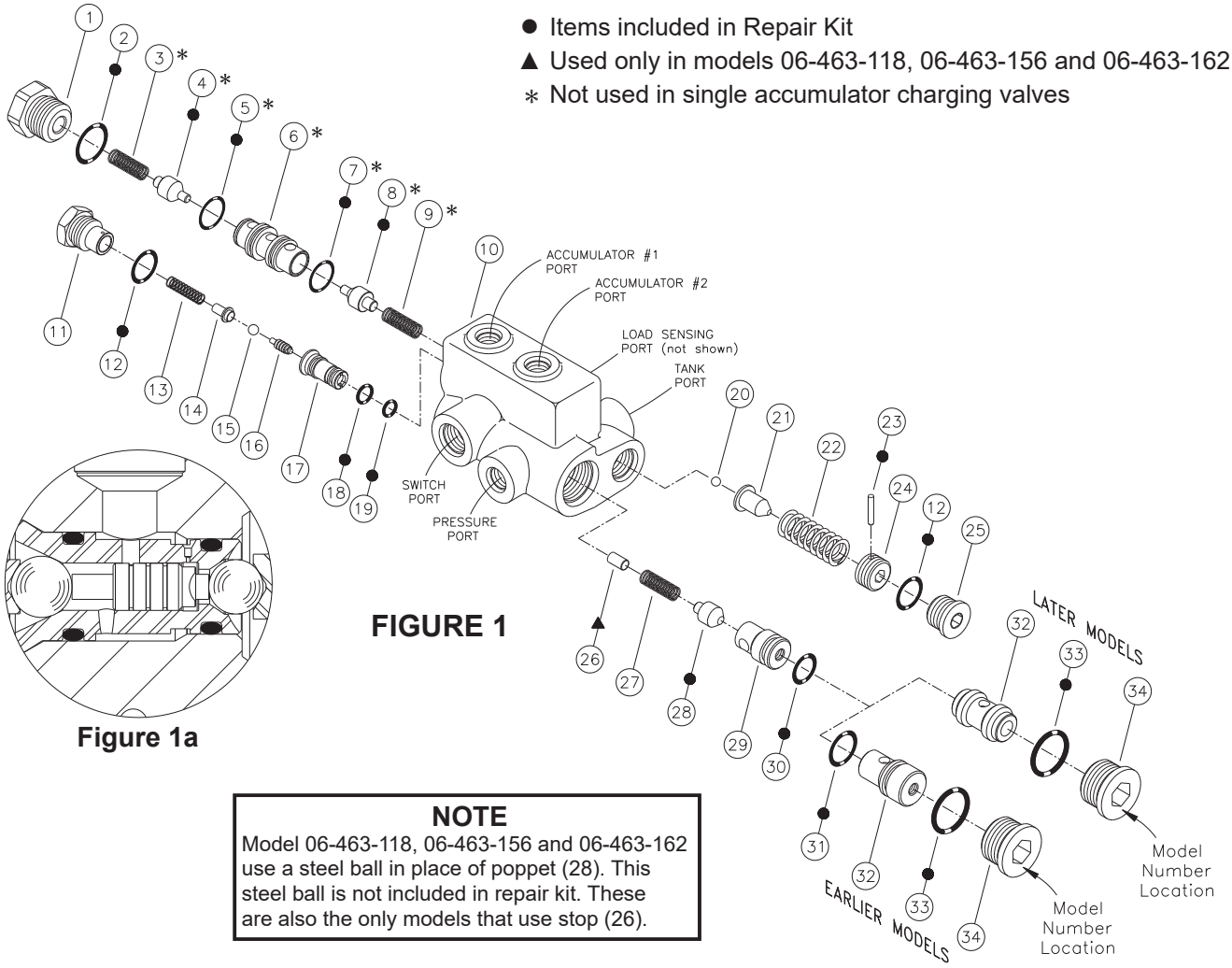

FIGURE 1

Figure 1a

NOTE
Model 06-463-118, 06-463-156 and 06-463-162 use a steel ball in place of poppet (28). This steel ball is not included in repair kit. These are also the only models that use stop (26).

TABLE 1 (Specifications)

Model Number	Description	Repair Kit Number	Nominal High Limit (cut out)		Nominal Low Limit (cut in)	
			bar	(PSI)	bar	(PSI)
06-463-100	Dual	06-400-107	77.6 ± 1.7	(1125 ± 25)	55.2 ± 3.5	(800 ± 50)
06-463-102	Single	06-400-107	106.9 ± 3.5	(1550 ± 50)	74.1 ± 3.5	(1075 ± 50)
06-463-104	Dual	06-400-107	144.8 ± 3.5	(2100 ± 50)	118.9 ± 3.5	(1725 ± 50)
06-463-106	Single	06-400-107	129.3 ± 1.7	(1875 ± 25)	104.3 ± 2.6	(1513 ± 38)
06-463-108	Single	06-400-107	158.6 ± 3.5	(2300 ± 50)	117.2 ± 3.5	(1700 ± 50)
06-463-110	Single	06-400-107	141.3 ± 3.5	(2050 ± 50)	115.5 ± 3.5	(1675 ± 50)
06-463-112	Single	06-400-107	158.6 ± 3.5	(2300 ± 50)	117.2 ± 3.5	(1700 ± 50)
06-463-114	Single	06-400-107	113.8 ± 3.5	(1650 ± 50)	93.1 ± 3.5	(1350 ± 50)
06-463-116	Single	06-400-107	103.4 ± 3.5	(1500 ± 50)	82.7 ± 3.5	(1200 ± 50)
06-463-118	Dual	06-400-107	158.6 ± 3.5	(2300 ± 50)	127.6 ± 3.5	(1850 ± 50)
06-463-122	Dual	06-400-192	144.8 ± 3.5	(2100 ± 50)	118.9 ± 3.5	(1725 ± 50)
06-463-126	Dual	06-400-107	113.8 ± 3.5	(1650 ± 50)	86.2 ± 3.5	(1250 ± 50)
06-463-128	Dual	06-400-107	189.6 ± 3.5	(2750 ± 50)	155.1 ± 3.5	(2250 ± 50)
06-463-136	Single	06-400-107	165.5 ± 3.5	(2400 ± 50)	127.6 ± 3.5	(1850 ± 50)
06-463-144	Dual	06-400-107	200.0 ± 3.5	(2900 ± 50)	165.5 ± 3.5	(2400 ± 50)
06-463-148	Dual	06-400-107	113.8 ± 3.5	(1650 ± 50)	86.2 ± 3.5	(1250 ± 50)
06-463-154	Dual	06-400-107	200.0 ± 3.5	(2900 ± 50)	165.5 ± 3.5	(2400 ± 50)
06-463-156	Dual	06-400-107	158.6 ± 3.5	(2300 ± 50)	127.6 ± 3.5	(1850 ± 50)
06-463-158	Single	06-400-107	186.2 ± 3.5	(2700 ± 50)	153.4 ± 3.5	(2225 ± 50)
06-463-162	Dual	06-400-107	175.8 ± 3.5	(2550 ± 50)	144.8 ± 3.5	(2100 ± 50)
06-463-164	Dual	06-400-107	158.6 ± 3.5	(2300 ± 50)	127.6 ± 3.5	(1850 ± 50)
06-463-172	Dual	06-400-316	93.1 ± 3.5	(1350 ± 50)	79.3 ± 3.5	(1150 ± 50)
06-463-176	Dual	06-400-107	184.4 ± 1.7	(2675 ± 25)	158.6 ± 5.2	(2300 ± 75)
06-463-178	Dual	06-400-107	124.1 ± 3.5	(1800 ± 50)	86.2 ± 3.5	(1250 ± 50)
06-463-184	Dual	06-400-107	127.6 ± 3.5	(1850 ± 50)	158.6 ± 3.5	(2300 ± 50)
06-463-186	Dual	06-400-107	104.3 ± 2.6	(1513 ± 38)	129.3 ± 1.7	(1875 ± 25)

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

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 and to remove charging valve from machine.

Disassembly

(Refer to Figure 2)

1. Remove plug (1) from housing (10). Remove o-ring (2) from plug (1).
2. Remove spring (3), poppet (4), sleeve (6), poppet (8), and spring (9) from housing (10). **NOTE: Be careful not to scratch or mar housing or sleeve bore.**
3. Remove o-rings (5 & 7) from sleeve (6).
4. Remove plug (27) from housing (10). Remove o-ring (12) from plug (27).
5. BEFORE moving screw (26), ACCURATELY MEASURE ITS DEPTH from the end of housing (10) and record for reassembly purposes. Remove screw (26) from housing (10).
6. Remove shim (24), springs (22 & 23), retainer (21), and ball (20). Be sure to keep ball (20) separate from ball (15) for reassembly.
7. Remove pin (25) from screw (26) using a drive pin punch. **NOTE: Be careful not to damage threads.**
8. Remove plug (11) from housing (10). Remove o-ring (12) from plug (11).
9. Remove spring (13), stop (14), and ball (15) from housing (10).
10. Place housing (10) on a bench with plug (11) end down. Spool (16) may or may not fall out at this point.
11. Using a 6.4-7.9 mm (0.25-0.31 in) diameter wood or plastic dowel, carefully remove insert (17) and spool (16) from housing (10). Insert (17) must come out plug (11) end of housing (10). **NOTE: Be careful not to scratch or mar valve seats on insert (17).**
12. Remove spool (16) from insert (17). Remove o-rings (18 & 19) from insert (17).
13. Remove plug (34) from housing (10). Remove o-ring (33) from plug (34).
14. Remove sleeve (32) from housing (10). Using a 1/4-20 UNC bolt, remove orifice (30) from housing (10). Remove poppet (29) and spring (28) from housing (10). Remove o-ring (31) from orifice (30).

NOTE

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

Assembly

(Refer to Figure 2)

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

1. Install new o-rings (5 & 7) on sleeve (6).
2. Install spring (9), new poppet (8), sleeve (6), new poppet (4), and spring (3) into housing (10).
3. Install new o-ring (2) on plug (1). Install plug (1) in housing (10) and torque 122.0-135.6 N·m (90-100 lb·ft).
4. Install new o-rings (18 & 19) on insert (17) and place into housing (10). Note direction of assembly. Seat insert (17) with 12.7 mm (0.50 in) diameter wood or plastic dowel.
5. Install spool (16) into insert (17) in housing (10). Note direction of spool (16), long shoulder end is toward end plug (11). See Figure 2a.
6. Install ball (15) on insert (17) in housing (10). Install stop (14) over ball (15) and spring (13) over stop (14).
7. Install new o-ring (12) on plug (11). Carefully install plug (11) in housing (10), centering spring (13). Torque plug (11) 47.5-54.2 N·m (35-40 lb·ft).
8. Turn housing (10) so plug (25) end is vertically upward. Install ball (20) in housing (10). Be sure ball (20) is centered in the bottom of hole in housing (10). Install retainer (21), springs (22 & 23), and shim (24) into housing (10).
9. Insert new pin (25) in screw (26). Be sure pin (25) is aligned properly and is evenly driven into screw (26). **NOTE: Be careful not to damage threads.**
10. Thread screw (26) into housing (10) to the depth recorded during disassembly.
11. Install new o-ring (12) on plug (27) and install plug (27) in housing (10). Torque plug (27) 47.5-54.2 N·m (35-40 lb·ft).
12. Install new o-ring (31) on orifice (30).
13. Install spring (28), poppet (29), and orifice (30) in housing (10). Note order and direction of parts.
14. Install sleeve (32) in housing (10). Install new o-ring (33) on plug (34). Install plug (34) into housing (10) and torque plug (34) 122.0-135.6 N·m (90-100 lb·ft).

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, stop pump and remove end plug (27) and turn screw (26) approximately 1/4 turn clockwise. Reinstall end plug (27). Check the high limit specifications (see TABLE 2). Repeat as needed until the high limit setting is met. Pressure limits can be checked correctly only if after each adjustment of screw (26) the accumulator pressure is reduced below the low limit setting and the system recharges the accumulator pressure to its high limit. **NOTE: Be sure to reinstall plug (27) before starting pump.**

⚠ WARNING

Do not exceed the high limit pressure setting indicated in TABLE 1 or system damage or failure may occur.

3. Torque end plug (27) 47.5-54.2 N·m (35-40 lb·ft).

● Items included in Repair Kit 06-400-316

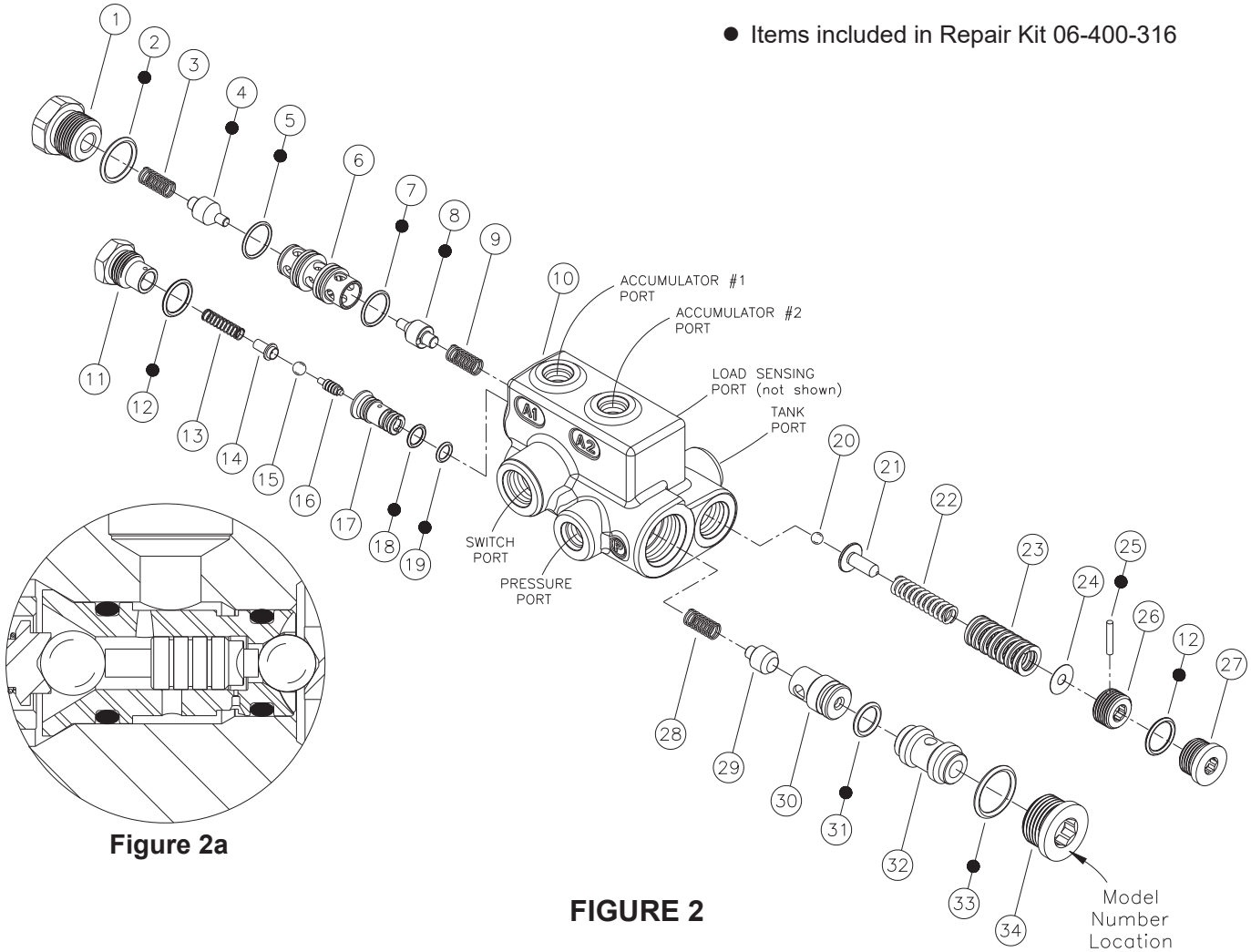

Figure 2a

FIGURE 2

TABLE 2 (Specifications)

Model Number	Description	Repair Kit Number	Nominal High Limit (cut out)		Nominal Low Limit (cut in)	
			bar	(PSI)	bar	(PSI)
06-463-166	Dual	06-400-316	186.2 ± 3.5	(2700 ± 50)	165.5 ± 3.5	(2400 ± 50)

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

SERVICE CHECKS FOR HYDRAULIC SYSTEMS

ACCUMULATOR CHARGING CYCLE REPEATS FREQUENTLY WHEN ACCUMULATORS ARE 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

ACCUMULATORS START TO CHARGE BUT DO 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
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

ACCUMULATORS FAIL 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
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

CHARGING VALVE SERVICE DIAGNOSIS

(Refer to Figure 1)

REPEATS FREQUENTLY WHEN ACCUMULATORS ARE NOT NORMALLY BEING DISCHARGED IN SERVICE

1. Poppet or ball (28) leaking
2. O-ring (30) leaking
3. O-ring (18) leaking
4. Ball (15) leaking
5. Inoperative seat on insert (17)

ACCUMULATORS START TO CHARGE BUT DO NOT REACH HIGH LIMIT

1. O-ring (19) leaking
2. O-ring (31) leaking (earlier models only)

ACCUMULATOR CHARGING TIME TOO LONG

1. Poppets (4, 8, or 28) stuck, partially closed
2. Orifice (29) partially plugged

ACCUMULATORS FAIL TO START CHARGING

1. Broken spring (22)
2. O-ring (19) leaking

VERY RAPID CYCLING OF CHARGING VALVE

1. Insert (17) worn
2. Poppets (4 or 8) stuck, partially closed

ACCUMULATOR PRESSURES ARE NOT ISOLATED FROM ONE ANOTHER

1. O-rings (5 or 7) leaking
2. Inoperative poppets (4 or 8)

CHARGING VALVE SERVICE DIAGNOSIS

(Refer to Figure 2)

REPEATS FREQUENTLY WHEN ACCUMULATORS ARE NOT NORMALLY BEING DISCHARGED IN SERVICE

1. Poppet (29) leaking
2. O-ring (31) leaking
3. O-ring (18) leaking
4. Ball (15) leaking
5. Inoperative seat on insert (17)

ACCUMULATORS START TO CHARGE BUT DO NOT REACH HIGH LIMIT

1 O-ring (19) leaking
2. O-ring (31) leaking

ACCUMULATOR CHARGING TIME TOO LONG

1. Poppets (4, 8, or 29) stuck, partially closed
2. Orifice (30) partially plugged

ACCUMULATORS FAIL TO START CHARGING

1. Broken spring (22 or 23)
2. O-ring (19) leaking

VERY RAPID CYCLING OF CHARGING VALVE

1. Insert (17) worn
2. Poppets (4 or 8) stuck, partially closed

ACCUMULATOR PRESSURES ARE NOT ISOLATED FROM ONE ANOTHER

1. O-rings (5 or 7) leaking
2. Inoperative poppets (4 or 8)

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