

U ***SER MANUAL***

Hydraulic Force Control

Carton Clamps

Manual Number 6913761

**cascade[®]
corporation**

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HYDRAULIC FORCE CONTROL (HFC)

This manual provides installation instructions, prior to operation, operation, troubleshooting and parts for Cascade Hydraulic Force Control (HFC) systems. If you need additional information or assistance, contact Cascade Corporation. Refer to the back cover.

What The System Does

The HFC system enables Cascade Carton Clamps to automatically apply clamp force proportional to the weight of the load. This system will reduce the chance of damage caused by excessive clamp force.

How The System Works

An initial no-slip starting pressure is applied to the load when it is first clamped. As the load is lifted, the HFC system increases clamp force and applies a consistent clamp force proportional to load weight. The hoist system provides pressure to the HFC to increase clamp pressure as hoist pressure increases.

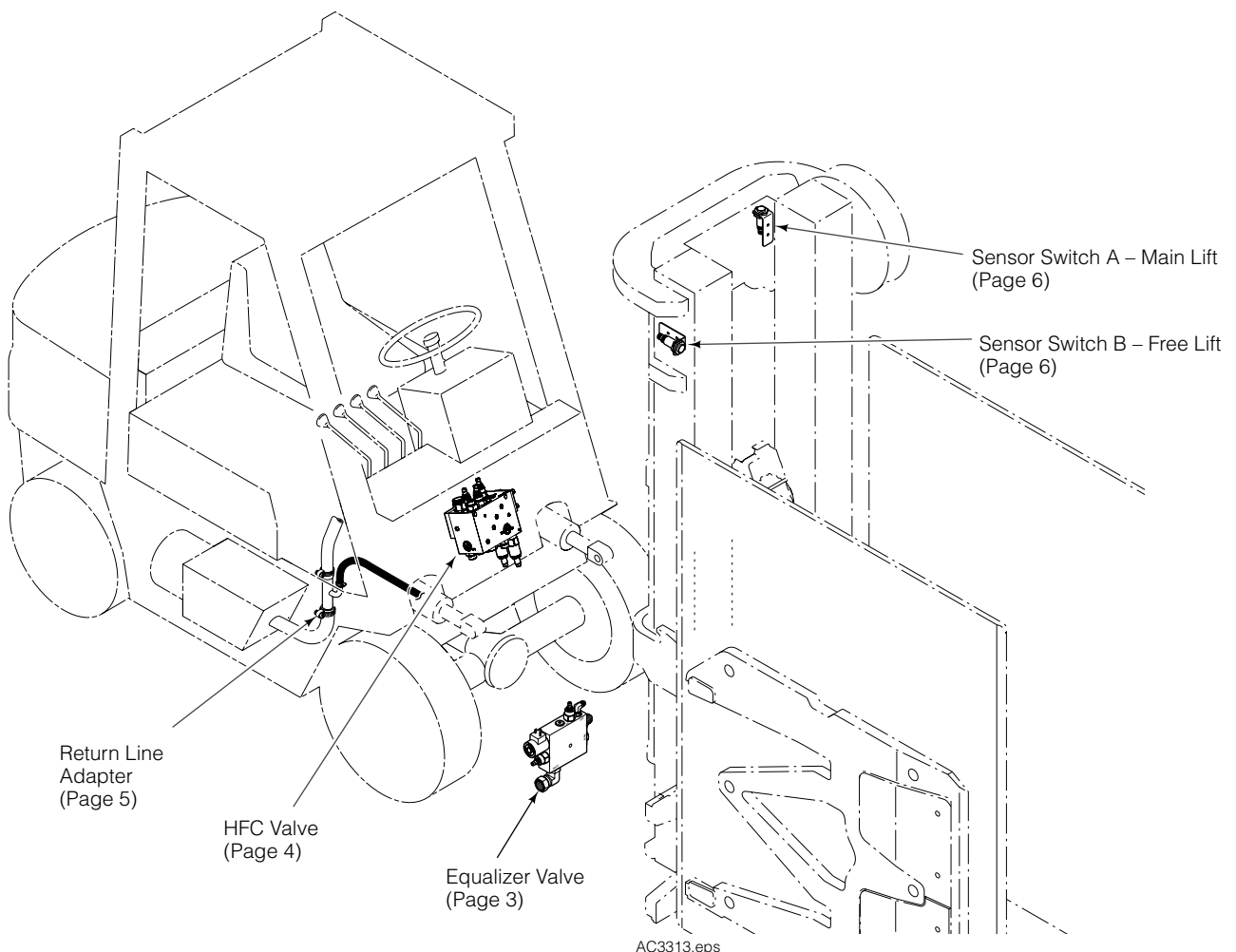
Prior to Installation

The system can be calibrated to balance the clamp force relationship of clamp capacity and truck size. The truck HOIST pressure should be equal to or higher than clamp pressure to properly clamp the load. Total weight equals load weight plus clamp weight.

Confirm that the truck size is compatible with the clamp capacity. Available maximum hoist pressure with load weight (combined maximum size load and weight of the clamp) should be determined in freelif. The hoist pressure determined needs to be within 10% of the clamping pressure required to clamp the heaviest load.

The following is provided to assist in planning hose and fitting sizes to match the lift truck hoist line:

Equalizer Valve Fittings – The mast and truck ports are No. 12 O-Ring with No. 12 JIC fittings installed.



INSTALLATION

PREPARE ATTACHMENT VALVE

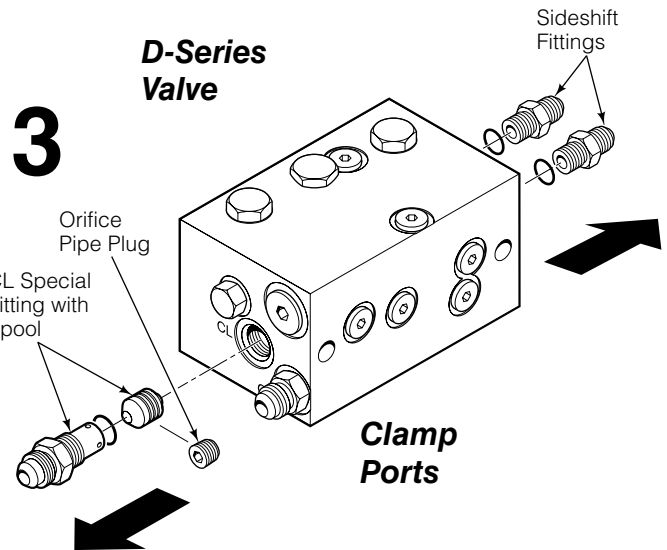


WARNING: Before removing hydraulic lines or components, relieve pressure in the hydraulic system. Turn truck off and open the truck auxiliary control valve(s) several times in both directions.

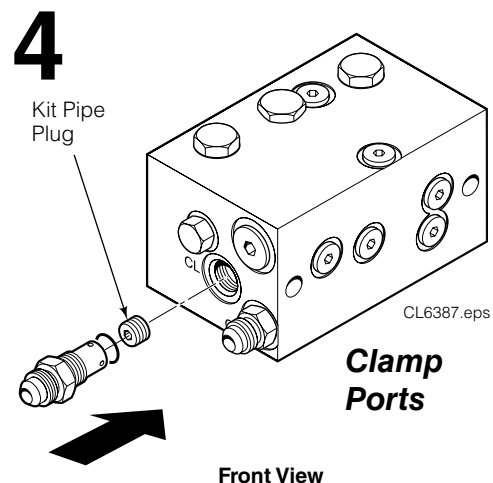
WARNING: Follow all recommended safety practices including chaining the freelif mast to the mainlift crossmember when mast is raised.

D-Series Valves

- 1 Open attachment arms to frame width.
- 2 Disconnect the hydraulic hoses from the valve CLAMP (CL), OPEN (OP) ports.
- 3 Remove CL port special fitting with spool or orifice pipe plug.
- 4 Install kit .25 in. dia. NPTF plug (Part No. 6603) into CL port and reinstall fitting leaving spool out.



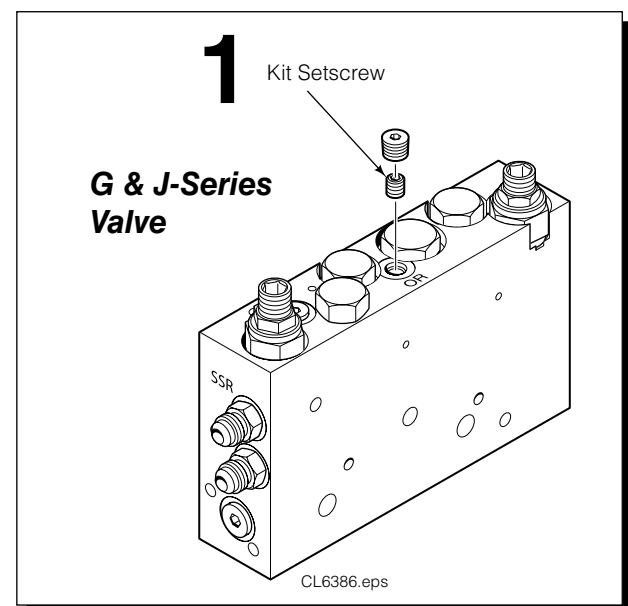
Front View



Front View

G & J-Series Valves

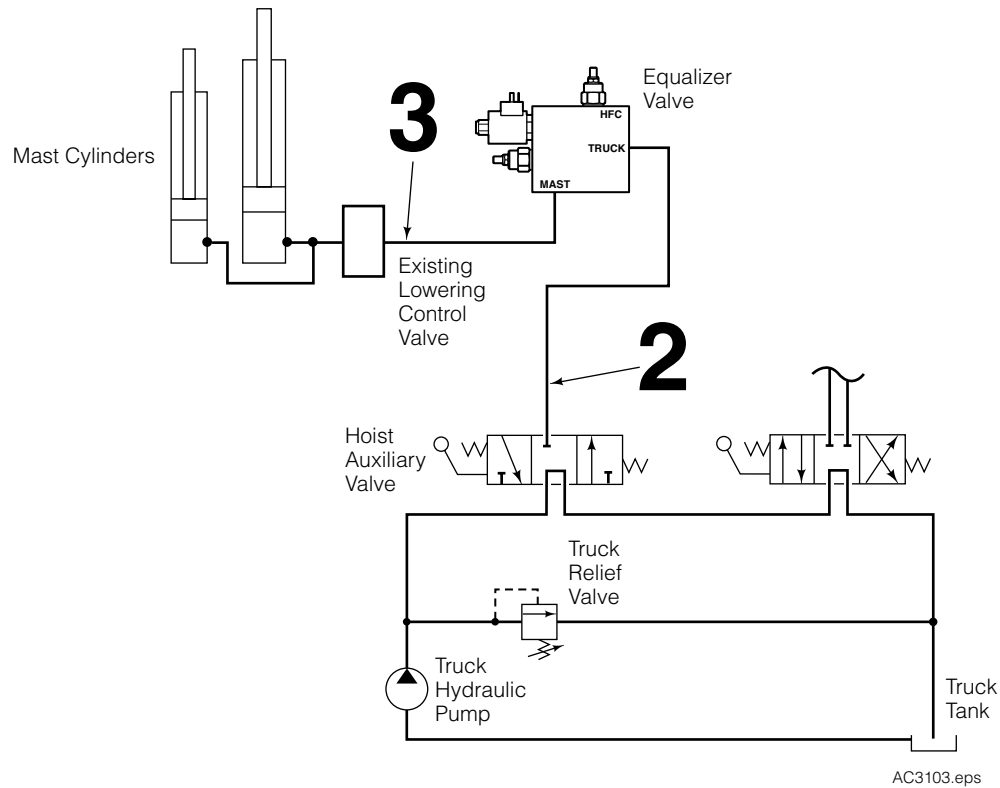
- 1 Install kit .3125 in. dia. setscrew (Part No. 5304) and pipe plug into OR port.



INSTALLATION

EQUALIZER VALVE AND HOSES

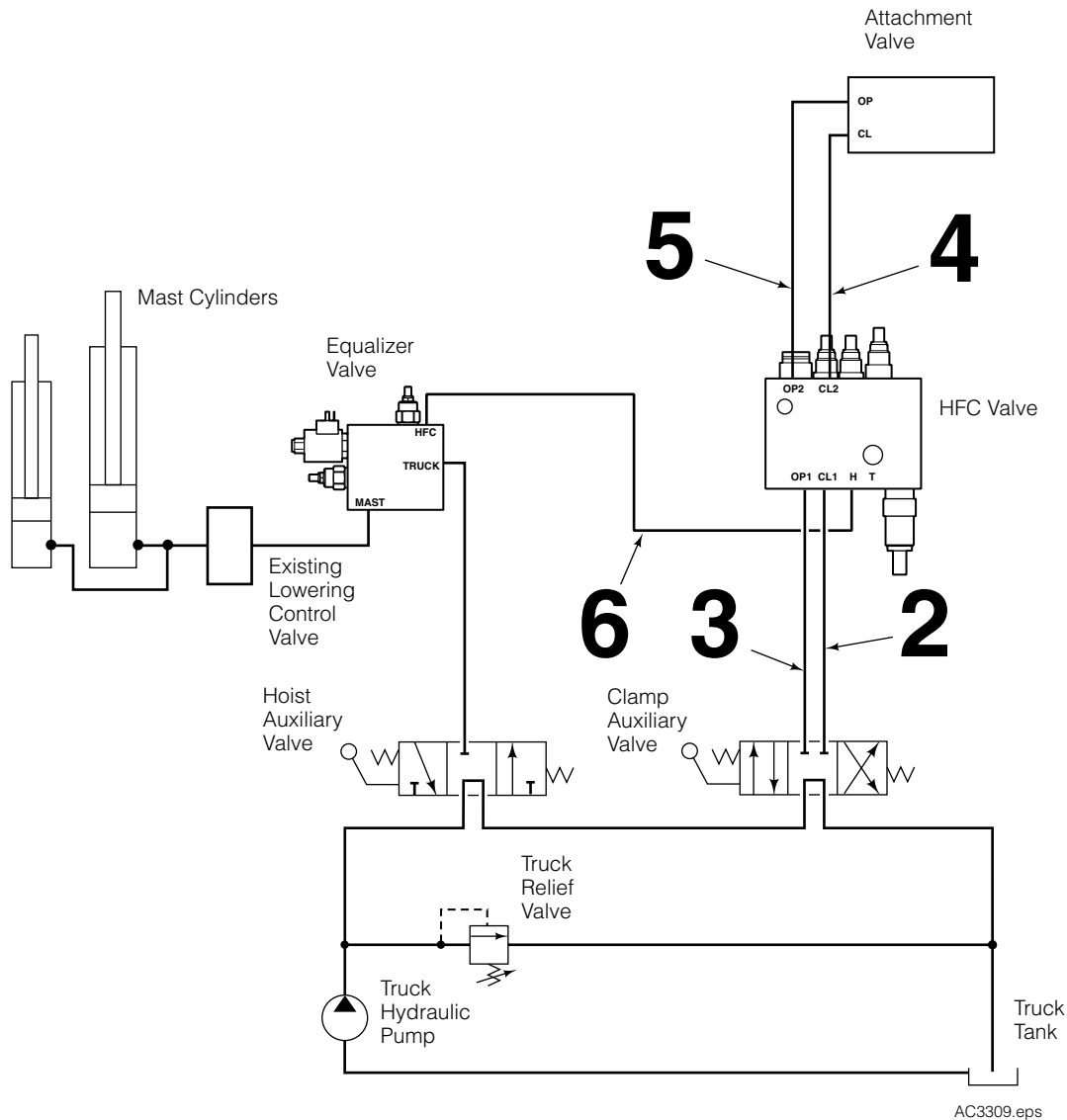
- 1 Install the equalizer valve in the hoist circuit between the hoist auxiliary valve and mast lowering control valve.
NOTE: For trucks with a delivered flow volume of 18 GPM (68 L/min.) or less, install reducer fittings.
- 2 Install the hose from the hoist auxiliary valve HOIST port to the equalizer valve TRUCK port.
- 3 Install a hose that connects the MAST port of the equalizer valve to the mast lowering control valve.
- 4 Inspect hoses for pinch points and secure as required.



INSTALLATION

HFC VALVE AND HOSES

- 1 Locate and install the HFC valve on the truck cowl using 5/16 in. (8 mm) capscrews. Use the supplied bracket if needed. Watch for clearance when the mast is tilted back. The HFC valve cartridges have adjustment screws that will need to be easily accessed.
- 2 Connect a No. 6 (minimum) hose from the truck clamp auxiliary valve clamp port to the CL1 port of the HFC valve.
- 3 Connect a No. 6 (minimum) hose from the truck clamp auxiliary valve open port to the OP1 port of the HFC valve.
- 4 Connect a No. 6 (minimum) hose from the CL2 port on the HFC valve to the attachment CLAMP supply port.
- 5 Connect a No. 6 (minimum) hose from the OP2 port of the HFC valve to the attachment OPEN port.
- 6 Connect a No. 6 (minimum) hose from the H port on the HFC valve to the HFC port on the equalizer valve.
- 7 Inspect hoses for pinch points and secure as required.



INSTALLATION

RETURN LINE ADAPTER

- 1 Install a return line adapter fitting in the tank line. Lube hose ends and fitting for easy assembly. For complete installation procedure, refer to Installation Instructions 211744.

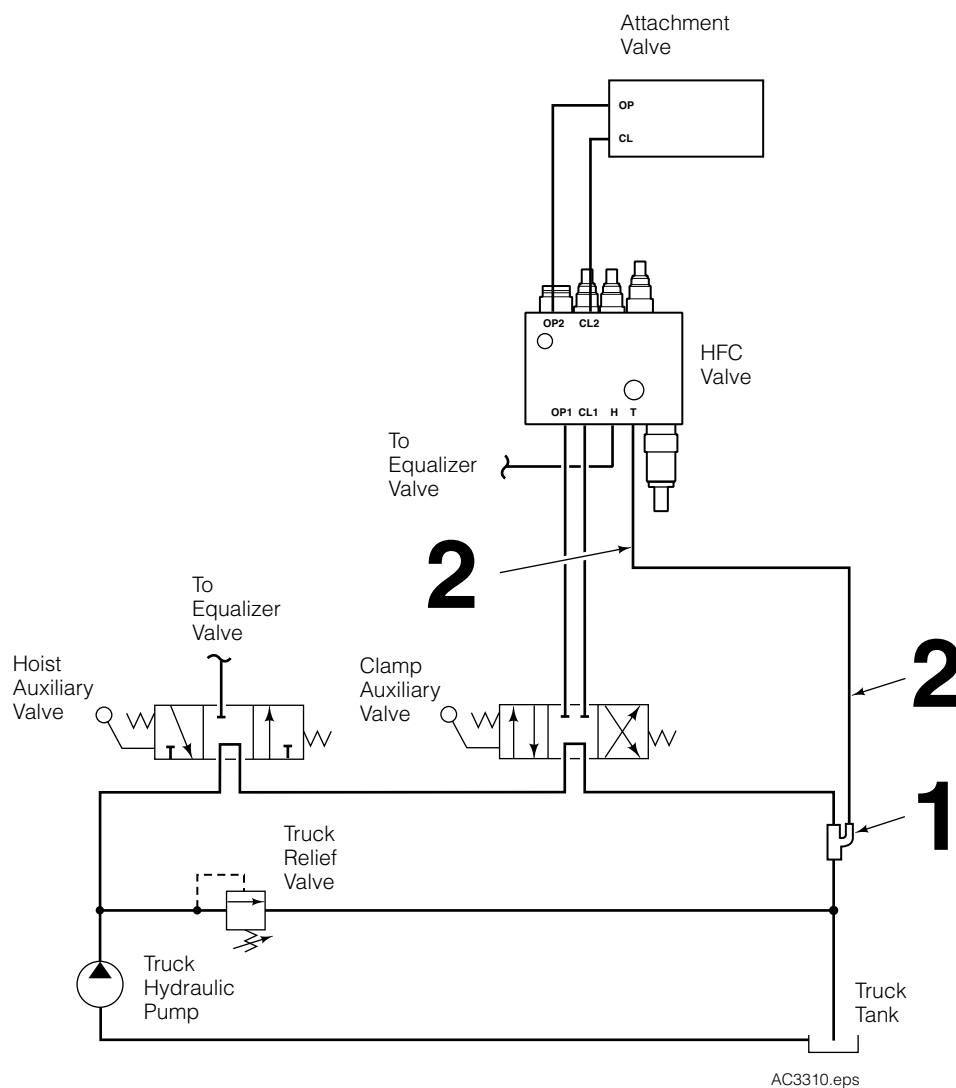
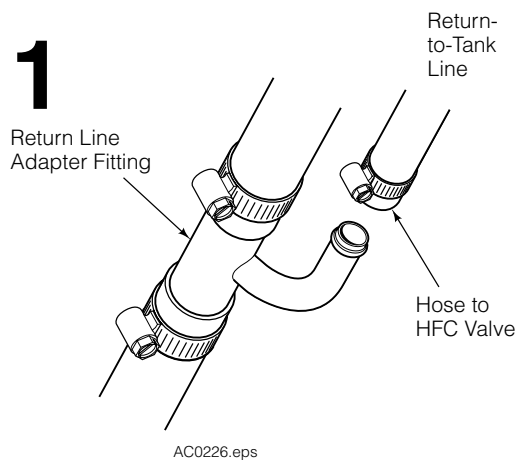
Single Line Adapter Kits

Tank Hose ID	Adapter Tee Length	Kit Part No.
.75 in. (19 mm) *	4.12 in. (105 mm)	6807816
1.00 in. (25 mm) *	4.12 in. (105 mm)	6807816
1.25 in. (31 mm) *	4.12 in. (105 mm)	6807816

* Included in Kit 6807816

NOTE: For trucks with pressurized return-to-tank lines, the hydraulic tank filler cap must be opened to relieve trapped pressure.

- 2 Connect the T port on the bottom of the HFC Valve to the truck tank line fitting.
- 3 Inspect hose for pinch points and secure as required.



INSTALLATION

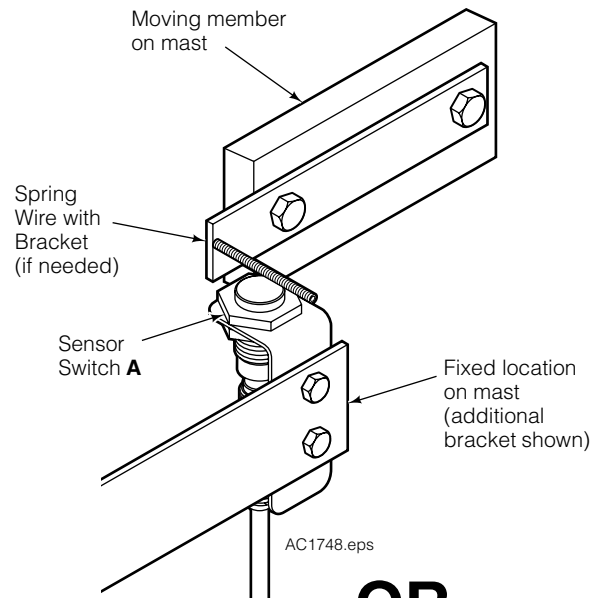
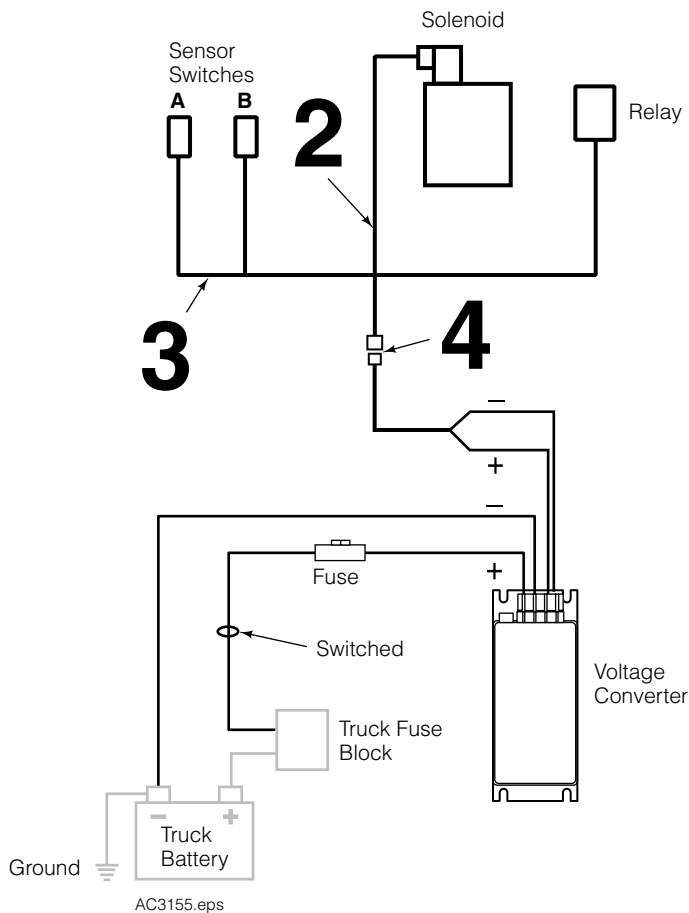
SENSOR SWITCHES

- 1 Determine locations to mount sensor switches A and B on the mast. Sensor A is used to detect inner upright extension. Sensor B is used to detect when the carriage is positioned near full freelif. The sensor switches signal the mast transition from freelif to mainlift. The provided sensor mounting brackets can be used with the doublesided tape, mounting blocks or holes drilled and tapped to mount the sensor switches. Install Sensor A to a fixed mast member or cylinder and Sensor B to the side of the mast outer upright.

CAUTION: Consult the Lift Truck OEM for proper + power source connection.

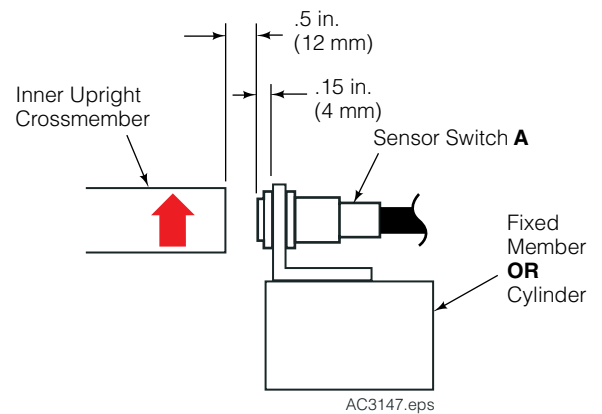
- 2 Connect the harness solenoid connector to the solenoid coil.
- 3 Connect the harness sensor switch connectors to the sensor switches.
- 4 Connect the harness cable ends to the components shown. Connect the fused positive wire from the cable harness to a switched power source and the ground wire to a chassis ground.

NOTE: For troubleshooting the wire harness, refer to page 11.

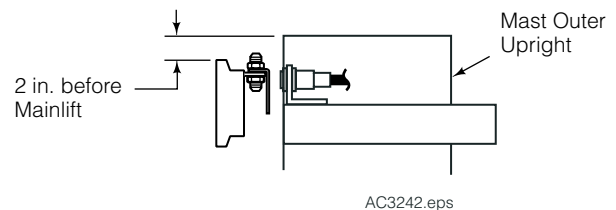
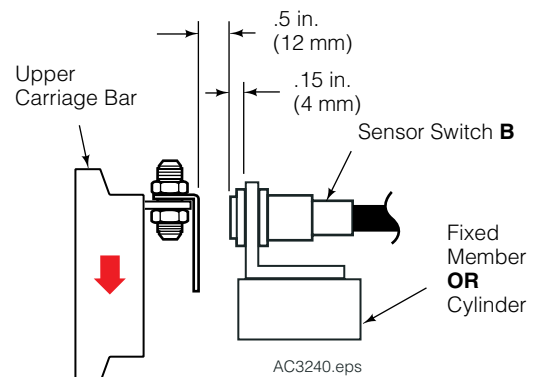


OR

Sensor Switch A



Sensor Switch B



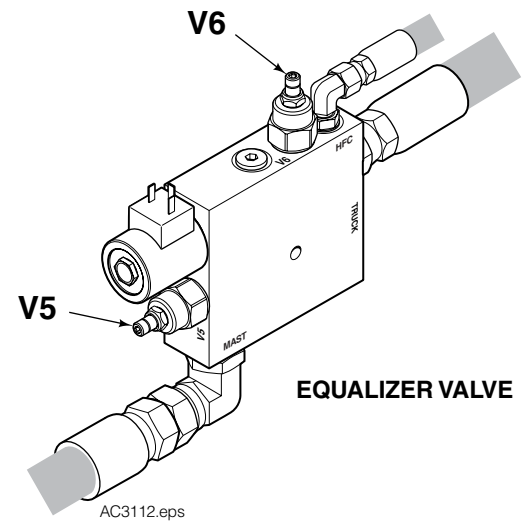
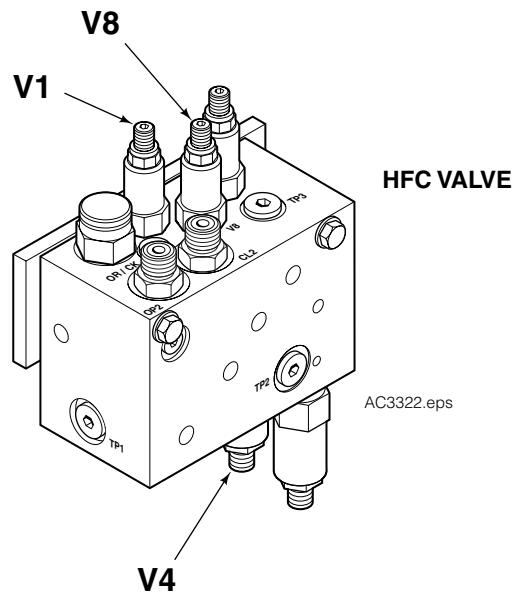
INSTALLATION

DISABLING HFC SYSTEM

To temporarily disable the HFC features, perform the following steps:

- 1 Turn V1 in (CW) or until desired clamp pressure is reached. The maximum pressure that the cartridge is capable of handling is 3000 psi (207 bar).
- 2 Turn V4 all the way out (CCW).
- 3 **OPTIONAL:** If the hoist capacity is affected by lifting a load, turn V6 all the way out (CCW).
- 4 Turn V8 all the way in (CW).
- 5 The truck attachment will now operate in the standard mode.

NOTE: To enable HFC features refer to Setup Section.



CARTRIDGE ADJUSTMENT

CARTRIDGE FUNCTION SUMMARY

Starting Pressure (V1) – Sets starting pressure.

Final Pressure (V2) – Adjusts clamping pressure after hoisting. Must be adjusted **after** all other cartridges are set.

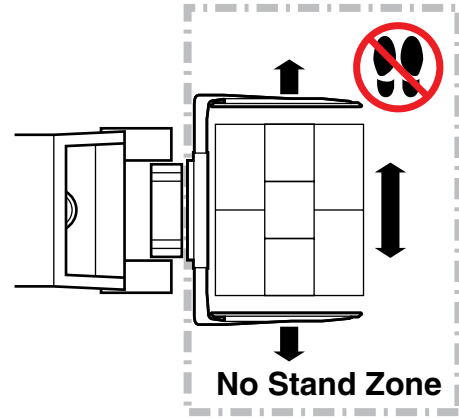
HFC Enable Pressure (V3) – Closes connection from hoist line to clamp line.

Max. Clamp Pressure (V4) – Limits maximum clamping pressure. Must not be set lower than pressure needed to handle maximum load.

Freelift Pressure (V5) – Increases freelift hoisting pressure. Balances freelift and mainlift hoisting pressure and make pressure available to clamping circuit.

Hoist/Clamp Pressure (V6) – Increases clamp pressure when a load is hoisted. This should only be adjusted after all other cartridges (except V2) are set, if need. **NOTE:** This cartridge is fully turned out at the factory.

Backhand Pressure (V8) – Adjusts the maximum backhand pressure.



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IMPORTANT: Check that V2 and V6 (on equalizer valve) is completely turned out (counterclockwise) before adjustment process.

1 Install the pressure gauge (Cascade Pressure Test Kit 6034612) in the clamp gauge port.

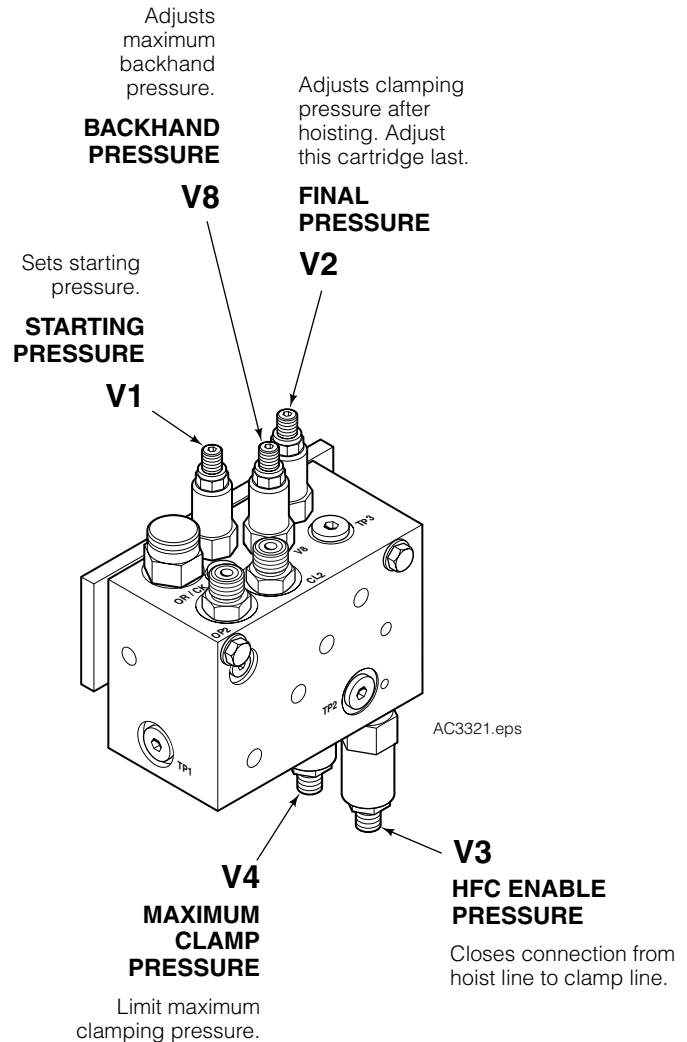
2 Adjust the Starting Pressure (V1) cartridge so that a light load is not damaged or over clamped and the heaviest load does not slip upon hoisting.

NOTE: For attachments that are retrofitted from three position relief to HFC system and lowest pressure is known, use the lowest pressure as starting pressure.

3 To prevent carriage/attachment from lowering during arm closing, adjust the HFC Enable Pressure (V3) cartridge.

- If the maximum weight load slips when hoisting, reduce V3 by turning counterclockwise (CCW).
- If the carriage lowers when closing the arms of the clamp or light loads are over clamped, increase V3 by turning clockwise (CW).
- Fine tuning with happen during final setup.

4 To limit the maximum clamp pressure (V4), fully close arms without a load and hoist to maximum lift. Fully extend the mast and hold the lever for 2 seconds. Lower the mast without unclamping and check the pressure. If the pressure exceeds the desired maximum clamp pressure for the heaviest load, turn the cartridge (V4) CCW to decrease the maximum pressure.



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CARTRIDGE ADJUSTMENT (CONTINUED)

- 5** To equalize the hoist pressure between freelift and mainlift, install a gauge to the HG port on the HFC valve. Hoist the attachment only at a fixed rate (at idle or full throttle) in mainlift, recording the steady state pressure reading. Hoist the attachment only at the same fixed rate in freelift, recording the steady state pressure reading.

- If freelift pressure is lower than mainlift pressure, increase V5 by turning CW to equalize pressure.
- If freelift pressure is higher than mainlift pressure, decrease V5 by turning CCW to equalize pressure.

- 6** For non-freelift mast large trucks with small attachments, clamp pressure may need to be increased. If equipped, the solenoid should be powered at all times by mounting the sensor switch in a location that will always switch on a ferrous object. Clamp a load and hoist. Note the clamp cylinder pressure.

- If the pressure is less than the desired clamp pressure, increase the pressure by turning V6 in CW to match the desired clamp pressure.

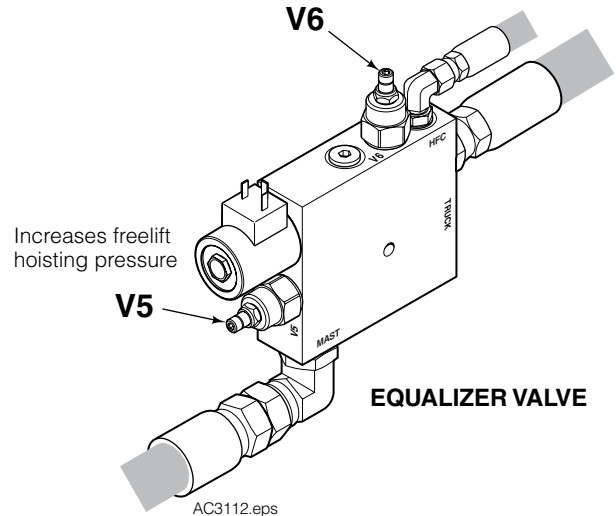
NOTE: For freelift mast large trucks with small attachments and adequate clamp pressure can not be achieved with the standard valve, a special equalizer valve may be required. Contact Cascade for more detail.

- 7** To adjust the Final Pressure (V2), clamp a load. Hoist the load. Use the chart below to record the initial clamp pressure. If the pressure is too high for the heaviest load, turn the cartridge CW to reduce the adjusted clamp pressure. Record the adjusted clamp pressure.

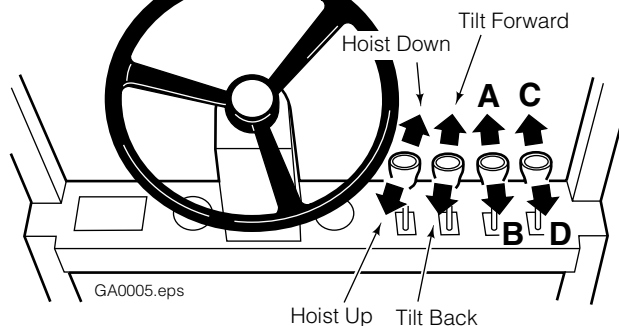
LOAD WEIGHT	INITIAL CLAMP PRESSURE ●	ADJUSTED CLAMP PRESSURE ●
No. 1		
No. 2		
No. 3		
No. 4		
No. 5		

● Read from attachment valve gauge port.

- 8** Fine tune HFC Enable Pressure (V3) by clamping and hoisting a light load. If over clamped, increase V3 setting by turning CW. Check this setting clamping the heaviest load. If slippage occurs, decrease V3 or increase V1.
- 9** Set backhand pressure by adjusting V8. Install a gauge in OPG port. Open arms to maximum opening and record pressure. Decrease V8 setting by turning V8 CCW. Must be set at least 1/3 of the maximum clamp pressure V4.



Auxiliary Valve Functions



WARNING: Truck control handle and attachment function activation shown here conforms to ASME/ANSI B56.1 recommended practices. Failure to follow these practices may lead to serious bodily injury or property damage. End user, dealer and OEMs should review any deviation from the practices for safe operation.

The HFC system works fundamentally the same as a normal lift truck system when used with a carton clamp. Use the following techniques when clamping loads:

To Lift a Unit Load

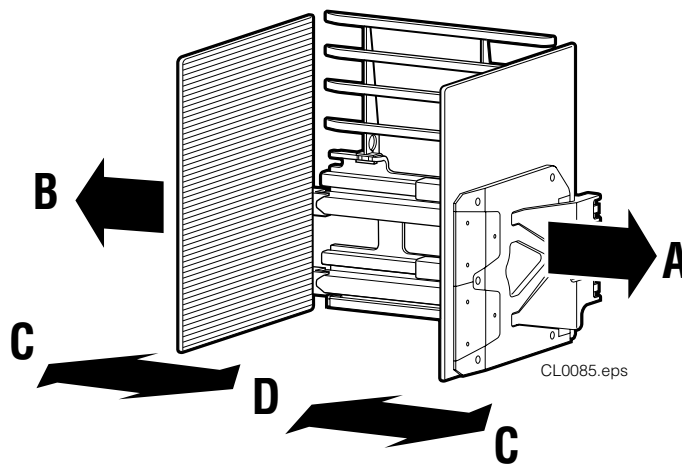
- 1 If equipped with Light Load Option, verify cab light is off.
- 2 Clamp a unit load. Hold for 1-2 seconds to build starting clamp pressure.
- 3 Lift the load. Clamp pressure will automatically increase according to load weight.
 - If feathering is used to reduce clamp force on light loads, use the same process with HFC. However, it is recommended to use the techniques above for all loads unless absolutely necessary.

CAUTION: Develop adequate clamp force to hold the load when feathering

NOTE: HFC allows lower clamp starting pressures so that light loads can be handled without damage along with heavier loads. Slightly slower arm speed is normal. If product widths vary widely with very low starting pressures, the slower arm speed can be corrected with an optional arm overdrive system. Consult Cascade.

CLAMP/SIDESHIFT

- A** Sideshift Left
- B** Sideshift Right
- C** Release Arms
- D** Clamp Arms



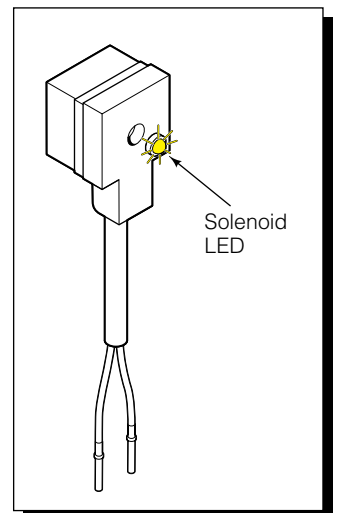
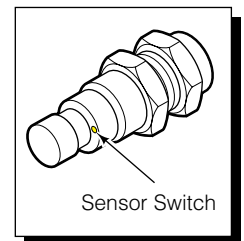
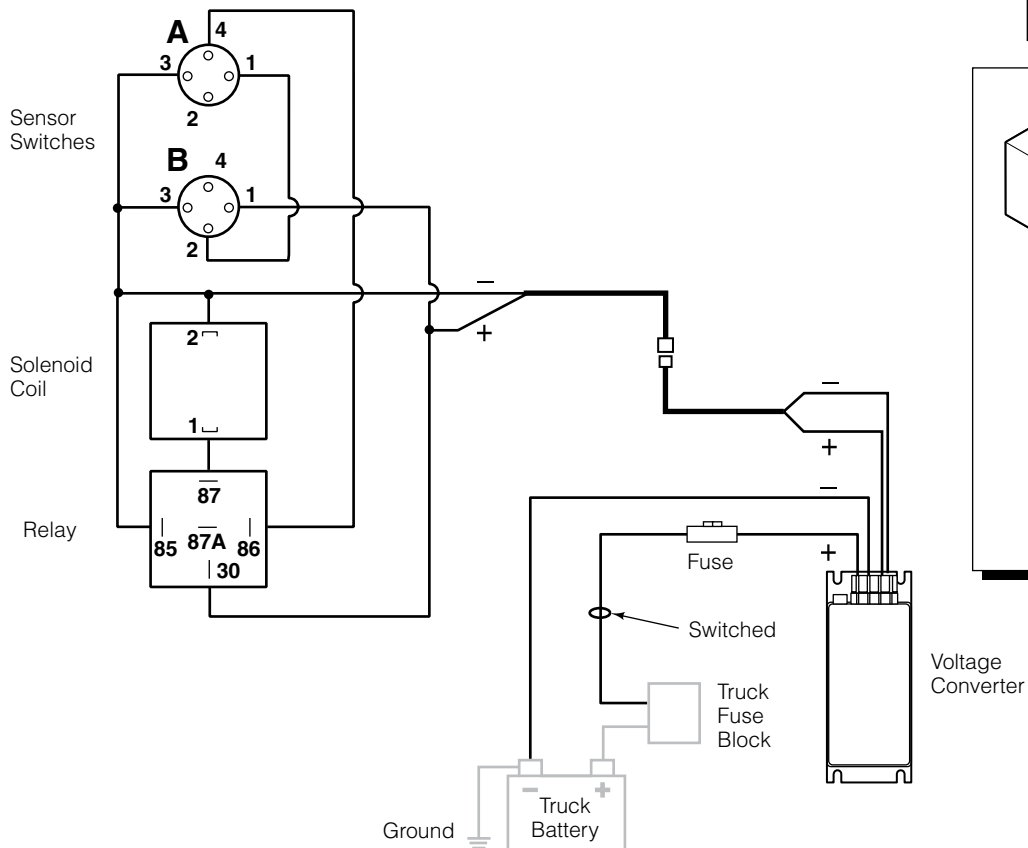
TROUBLESHOOTING

WIRE HARNESS

Verify the sensor switches, solenoid and relay are working properly. Check the LEDs on the sensor switch and solenoid.

- When the mast is in freelif, the LEDs will be on.
- When in mainlift, the LEDs will be off.

- 1 Check fuse.
- 2 Remove relay and cables from sensor switch and solenoid coil.
- 3 Check for 12V power between relay socket terminals 30 and 86. If no power, check continuity:
 - 30 and (+) truck battery
 - 85 and (-) truck battery
- 4 Check for continuity at all corresponding pins and terminals.
- 5 Install cable to sensor switches, switch **A** fixed on a target and switch **B** not on a target (both switch LED's should be illuminated). Check for power at relay socket terminal 86.
- 6 Test the relay by adding 12V (+) power to 86 and (-) ground to 85. With a meter, check for continuity between 30 and 87. Remove power, verify that there is no continuity between 30 and 87.
- 7 With the relay installed and sensor switch **A** fixed on a target and switch **B** not on a target (both switch LED's illuminated), check for power at the solenoid connector between 1 and 2. Solenoid connector LED should be illuminated.
- 8 Connect cable to solenoid coil, listen for a 'click'. If there is no 'click', remove connector and check for coil resistance of 7.2 ohms at 60°F (20°C). If no resistance, replace coil.

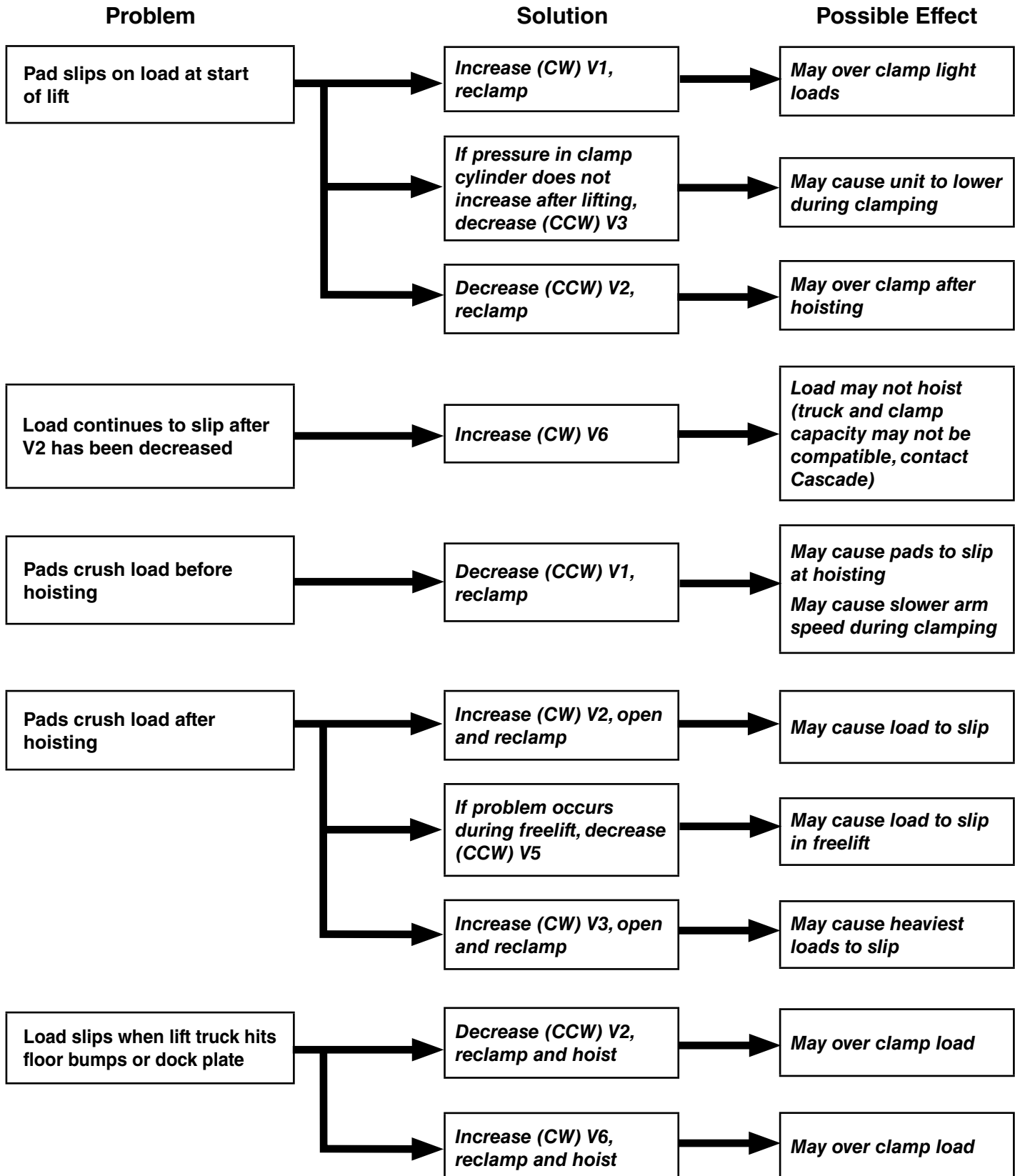


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TROUBLESHOOTING

CAUTION: Prior to troubleshooting, verify that clamp is working properly and check for defective check valves and cylinder seals.

NOTE: When adjusting cartridges, turn in 1/2 turn increments.

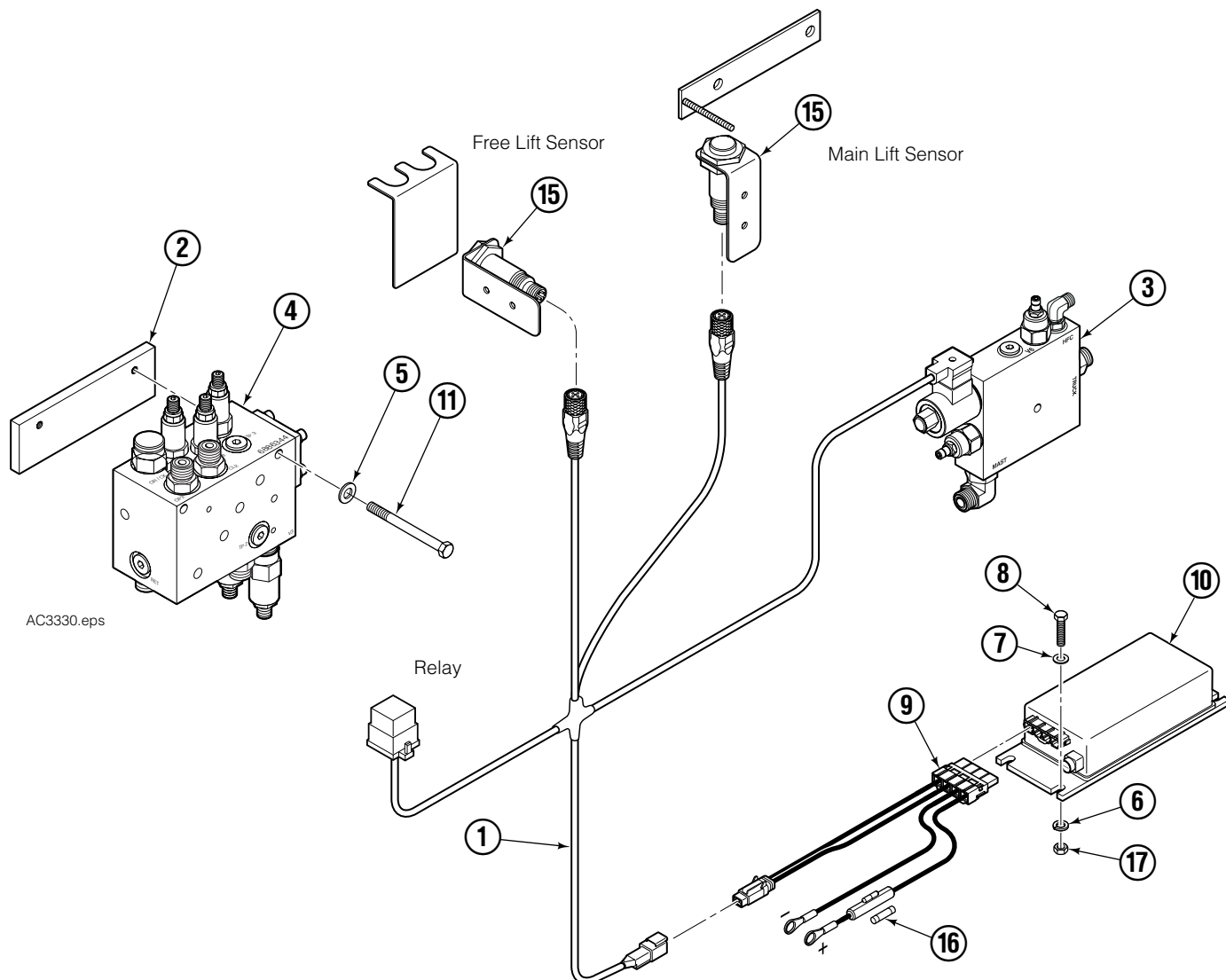


TROUBLESHOOTING

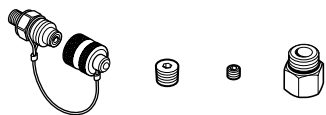
Problem	Solution	Possible Effect of Solution
Hoist cylinder will not lift with a high capacity load	Decrease (CCW) V6	May cause heaviest loads to slip
Hoist lowers while closing arms	Increase (CW) V3	May not add pressure during hoisting
Hoist speed is decreased	Decrease (CCW) V6	May have more clamp pressure in mainlift than freelif. Available clamping pressure in freelif will be reduced.
Clamped pressure is substantially higher in freelif over mainlift	Install switch if not installed	Improved accuracy
	Decrease (CCW) V5	Load may slip in freelif
Clamped pressure is substantially lower in freelif over mainlift	Increase (CW) V5	May over clamp in freelif
Over clamps when mast runs out of travel	Decrease (CCW) V4	May cut off needed clamp pressure on heavy loads
Arm speed is too slow during clamping	Increase (CW) V1	May over clamp light loads
	Light loads that require low starting pressure, install optional arm overdrive system	Driver may overclamp load if button is not released in time or relief not properly set.

PARTS

HYDRAULIC FORCE CONTROL KIT

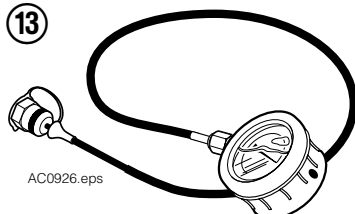


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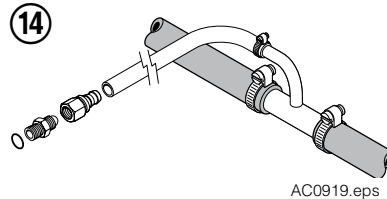
Fitting Group

13



Pressure Test Kit

14



Connector Kit

PARTS

HYDRAULIC FORCE CONTROL KIT

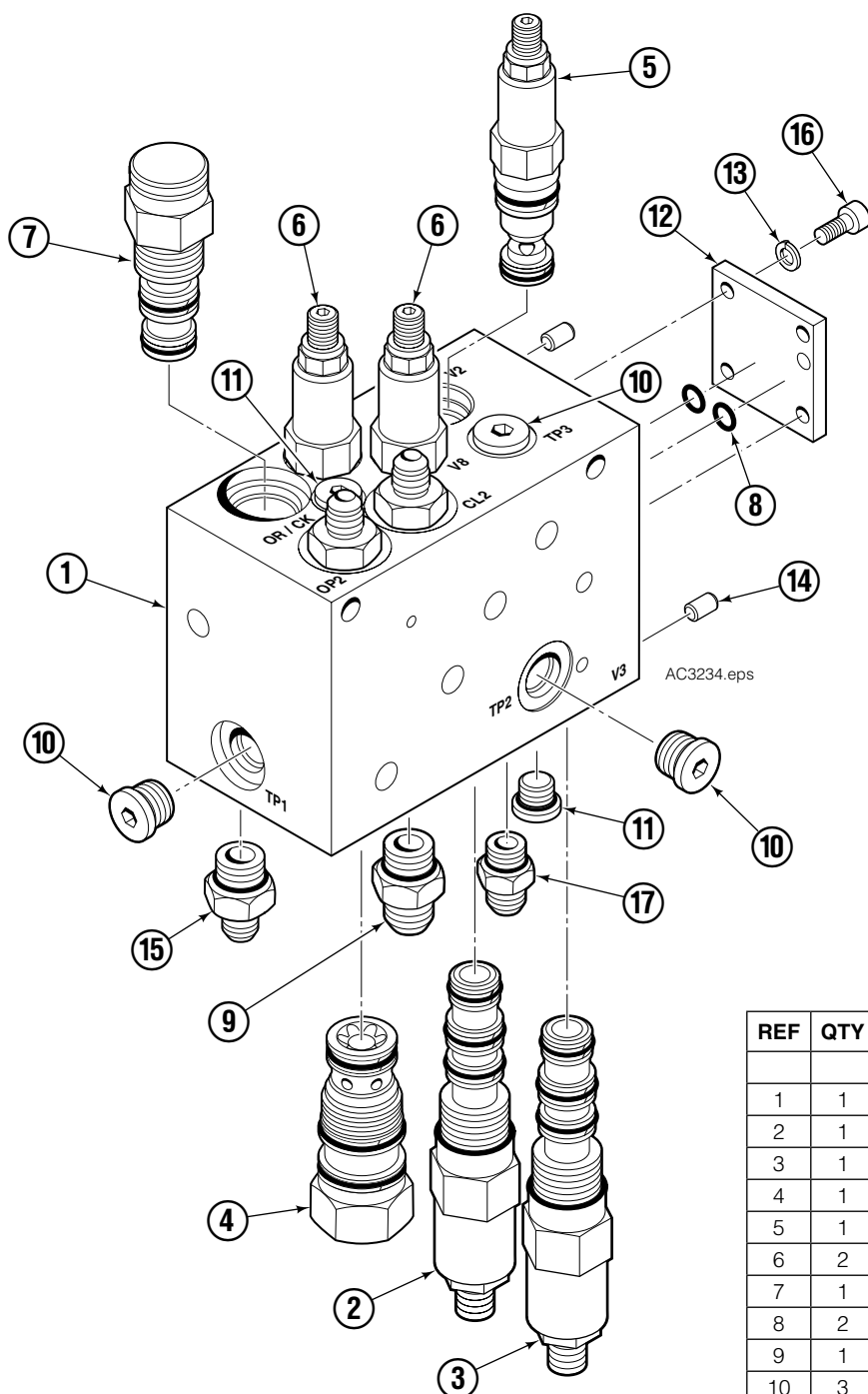
REF	QTY	HFC 60V-100V PART NO.	DESCRIPTION
		6913759	HFC Kit
1	1	6893305	Wire Harness
2	1	6879842	Bracket
3	1	6811009	Equalizer Valve ●
4	1	6902319	HFC Valve ●
5	2	221494	Washer, M8
6	4	206323	Lockwasher, M6 ■
7	4	202346	Washer, M6 ■
8	1	762900	Capscrew, M6 x 25 ■
9	1	6884689	Converter Wire Harness ■
10	1	6884670	Voltage Converter ■
11	2	6876071	Capscrew, M8 x 85
12	1	6895855	Fitting Group ●
13	1	6034612	Pressure Test Kit ●
14	1	6807816	Connector Kit ●
15	1	6893743	Switch Group ●
16	1	6806701	Fuse - 2 Amp ■
17	4	765718	Nut, M6 ■

● See specific parts page for breakdown.

■ Included in Voltage Converter Kit 6882798.

PARTS

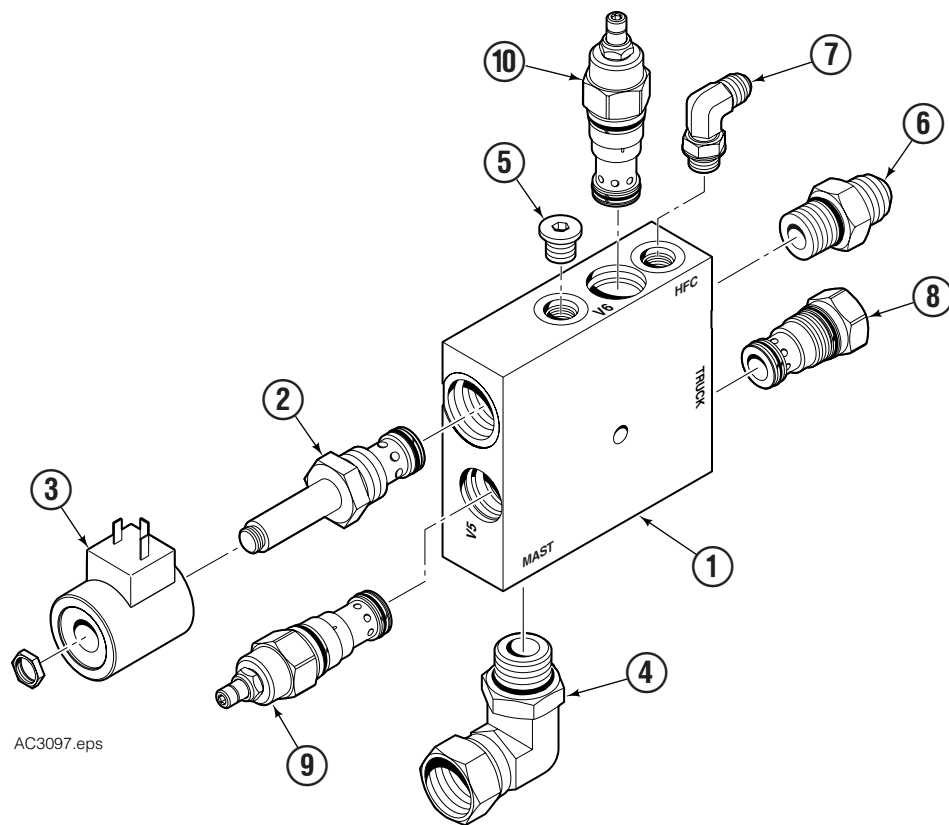
HFC VALVE ASSEMBLY



REF	QTY	PART NO.	DESCRIPTION
		6902319	Clamp Valve
1	1	6902256	Valve Body
2	1	6090999	Pressure Control Cartridge
3	1	6091000	Pressure Control Cartridge
4	1	6863754	Check Valve Cartridge
5	1	6098001	Pressure Control Cartridge
6	2	6867664	Pressure Control Cartridge
7	1	6086327	Direction Control Cartridge
8	2	684587	O-Ring
9	1	601377	Fitting, 8-8
10	3	604510	Fitting, 6
11	2	609234	Fitting, 4
12	1	6889063	Plate
13	4	678993	Washer, M6
14	2	6407196	Dowel Pin
15	4	611288	Fitting, 6-8
16	4	682662	Capscrew, M6 x 16
17	1	604511	Fitting, 6-6

PARTS

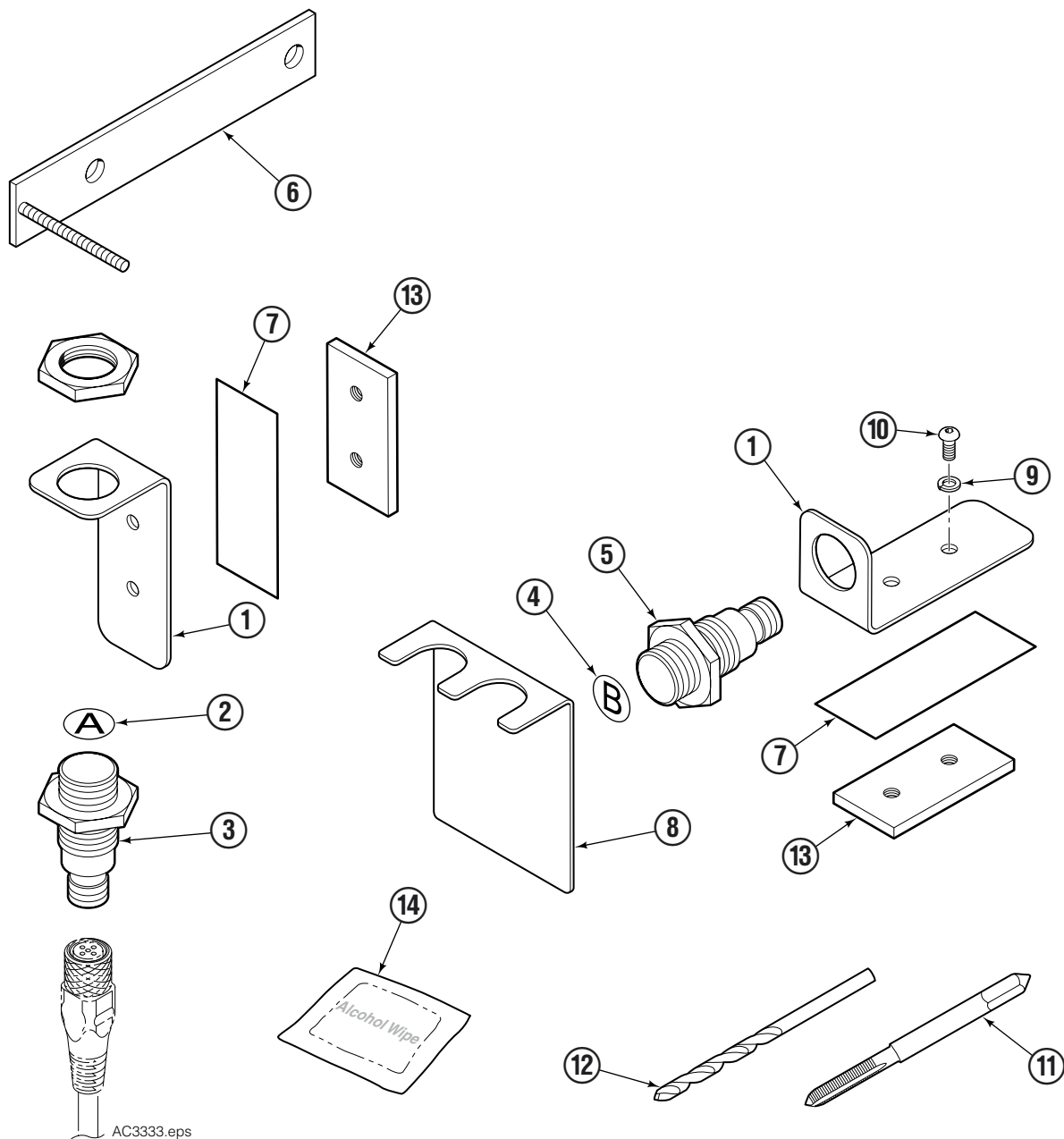
EQUALIZER VALVE



REF	QTY	PART NO.	DESCRIPTION
		6811009	Valve Assembly
1	1	6811010	Valve Body
2	1	6056977	Directional Control Cartridge
3	1	6014287	Coil-12V
4	1	6093794	Fitting
5	1	604510	Fitting, 6
6	1	611293	Fitting, 12
7	1	601676	Fitting, 3
8	1	221191	Check Valve Cartridge
9	1	6811045	Pressure Control Cartridge
10	1	6811046	Pressure Control Cartridge

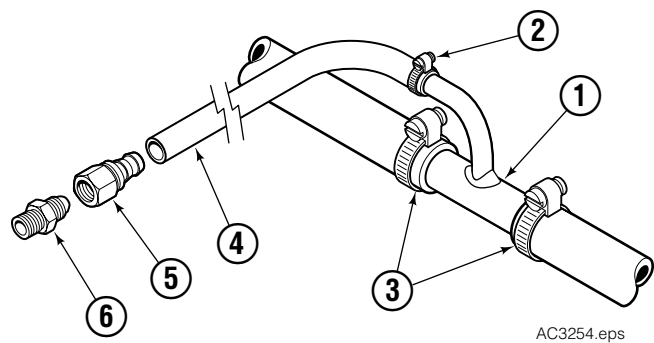
PARTS

SENSOR SWITCH KIT

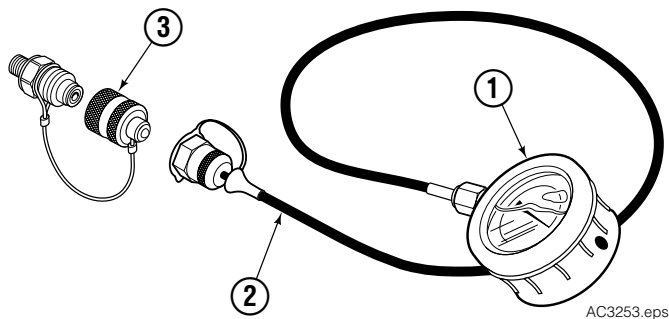


REF	QTY	PART NO.	DESCRIPTION
		6893743	Switch Kit
1	2	6091430	Bracket
2	1	6893590	Label A
3	1	6893338	Switch
4	1	6893595	Label B
5	1	6893360	Switch
6	1	6095839	Bracket
7	4	6014987	Tape, 2 Sided
8	1	6893606	Bracket
9	4	6406253	Washer, M4
10	4	6817000	Capscrew, M4 x 8
11	1	6852542	Tap, M4 x 0.7
12	1	6852537	Drill Bit, 3.30 mm
13	2	6916160	Mounting Plate
14	6	6914758	Alcohol Wipe

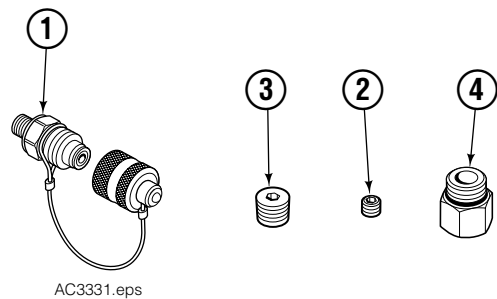
PARTS



REF	QTY	PART NO.	DESCRIPTION
		6807816	Tank Line Connector Kit – Single Line
1	1	214056	Adapter – .75 in. (19 mm) Hose ID
	1	211739	Adapter – 1.00 in. (25 mm) Hose ID
	1	212891	Adapter – 1.25 in. (31 mm) Hose ID
2	1	211742	Hose Clamp, .38 → .87 in.
3	2	211743	Hose Clamp – .50 → 1.25 in.
	2	213140	Hose Clamp – .75 → 1.75 in.
4	1	211740	Hose, 72 in.
5	1	211741	Fitting, 8
6	1	601377	Fitting, 8-8



REF	QTY	PART NO.	DESCRIPTION
		6034612	Pressure Gauge Kit
1	1	6006017	Gauge with Guard
2	1	6004477	Hose
3	1	6004478	Test Point Fitting



REF	QTY	PART NO.	DESCRIPTION
		6895855	Fitting Group
1	2	6006014	Test Point Fitting
2	1	5304	Setscrew, .312 NF x .25
3	1	6603	Fitting, .25 NPT
4	2	6802656	Fitting, 12-10

GLOSSARY

Clamp Pressure – Pressure set to clamp a load.

Starting Pressure (V1) – The minimum clamp pressure that will be applied, even on light loads.

Final Pressure (V2) – The final HFC adjusted clamp pressure applied when the load is hoisted.

HFC Enable Pressure (V3) – The hoist pressure to achieve prior to hoisting.

Maximum Clamp Pressure (V4) – The maximum pressure set to clamp a load.

Freelift Pressure (V5) – Pressure in the hoist line when the mast is in freelift state.

Hoist/Clamp Pressure (V6) – Increases clamp pressure when a load is hoisted.

Sideshift Pressure (V7) – Adjusts the available sideshift pressure.

Backhand Pressure (V8) – Adjusts the maximum backhand pressure.

Overdrive System – A system to aid with increasing arm speed and allows an attachment to have higher clamping pressure when breaking out rolls.

Total Load Weight – The sum of the load weight and clamp weight.

Blank

Do you have questions you need answered right now?

Call your nearest Cascade Service Department.

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