

# ***U*** ***SER MANUAL***

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## ***Hydraulic Force Control***

***No. 6802876-R1 PL***

**cascade<sup>®</sup>  
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 Paper Roll Clamps to automatically apply clamp force proportional to 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 paper. Total load weight equals paper weight plus clamp weight.

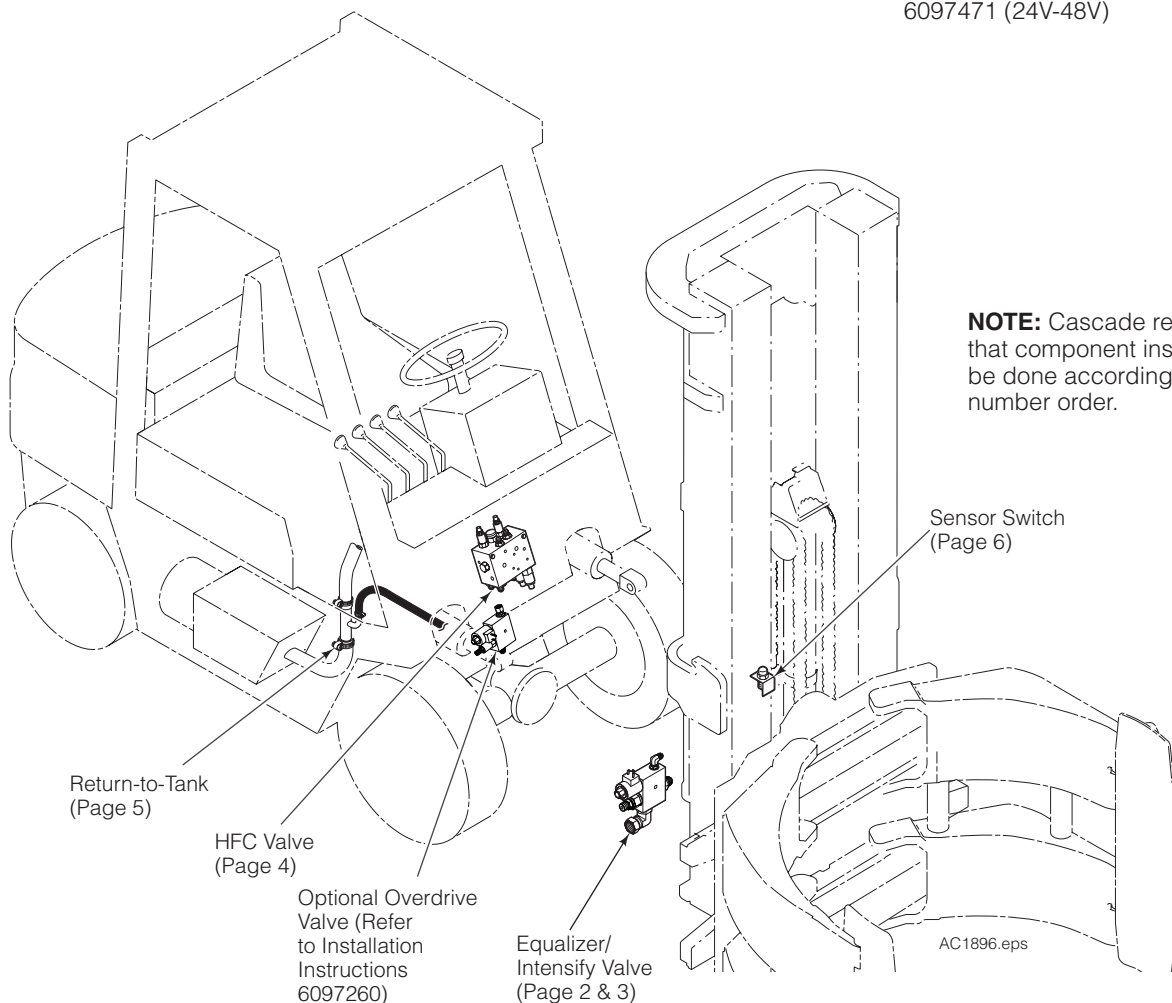
Confirm that the truck size is compatible with the clamp capacity. Available maximum hoist pressure with load weight (combined maximum size load and weight of the clamp) should be determined in freelif. The hoist pressure determined needs to be within 10% of the clamping pressure required to clamp the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

**HFC Kit  
(without switch)  
Part No.**

6093682

**HFC Kit  
(with switch)  
Part No.**

6097470 (12 V)  
6097471 (24V-48V)



## EQUALIZER/INTENSIFY VALVE AND HOSES



**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.

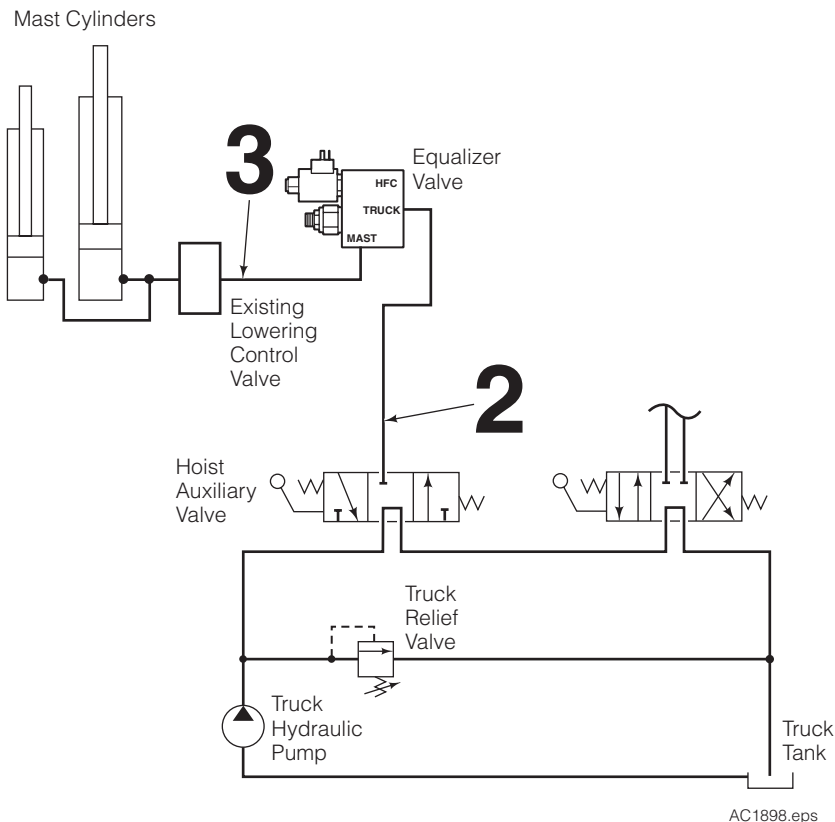
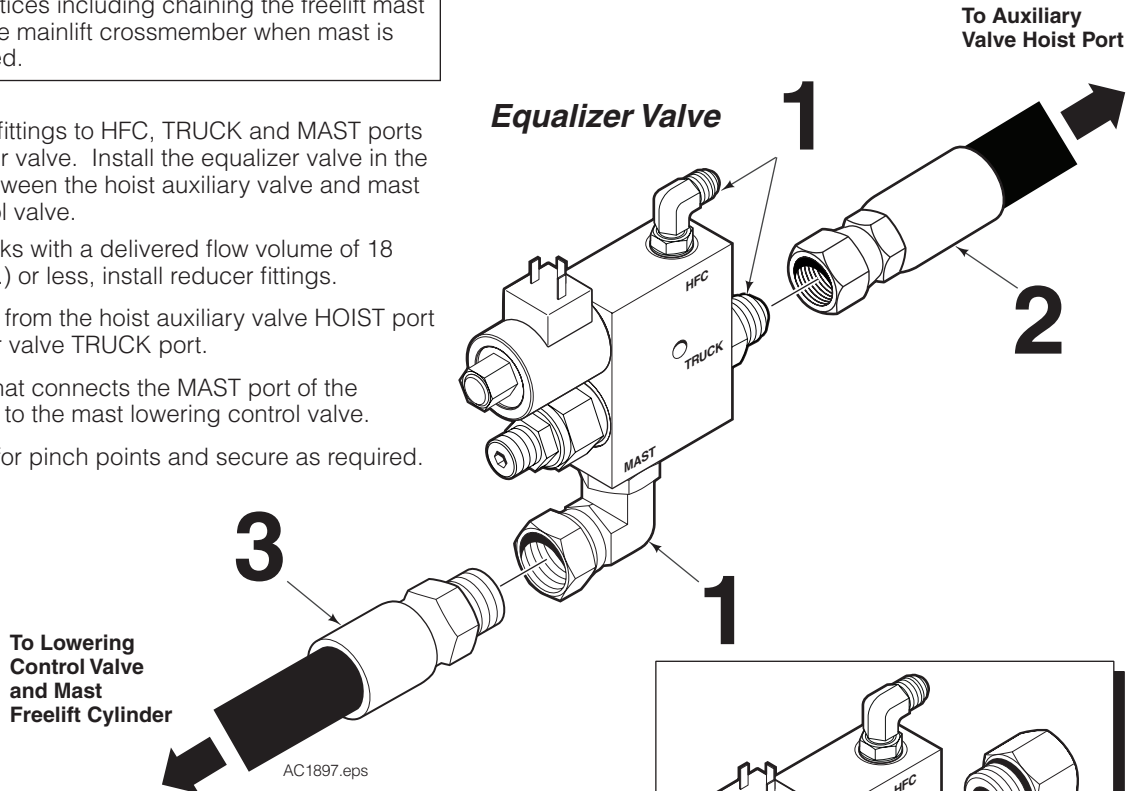
**WARNING:** Follow all recommended safety practices including chaining the freelift mast to the mainlift crossmember when mast is raised.

- 1 Install adapter fittings to HFC, TRUCK and MAST ports on the equalizer valve. 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.

Equalizer Valve



## NON-SOLENOID INTENSIFY VALVE AND HOSES

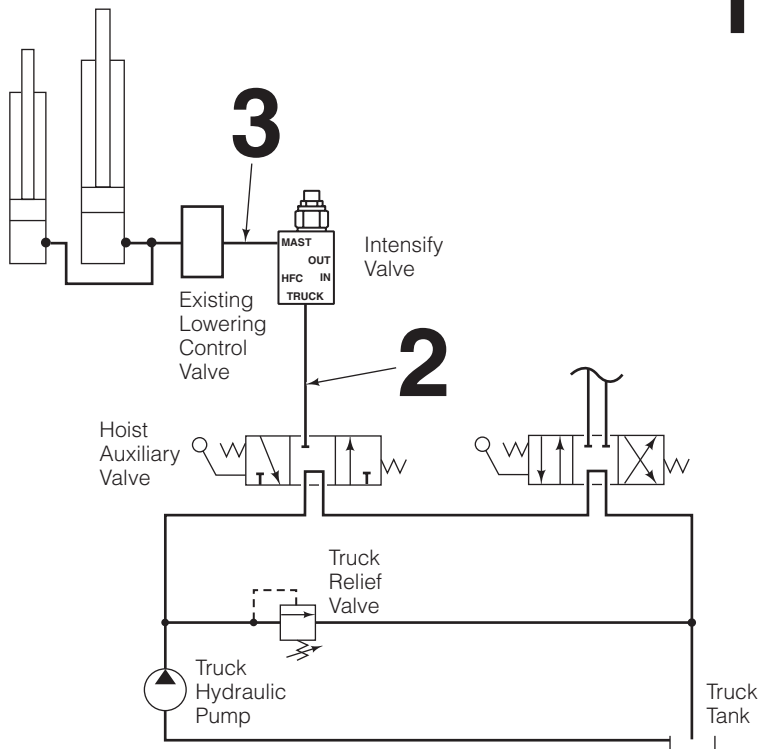


**WARNING:** Before removing hydraulic lines or components, relieve pressure in the hydraulic system. Turn truck off and open the truck auxiliary control valve(s) several times in both directions.

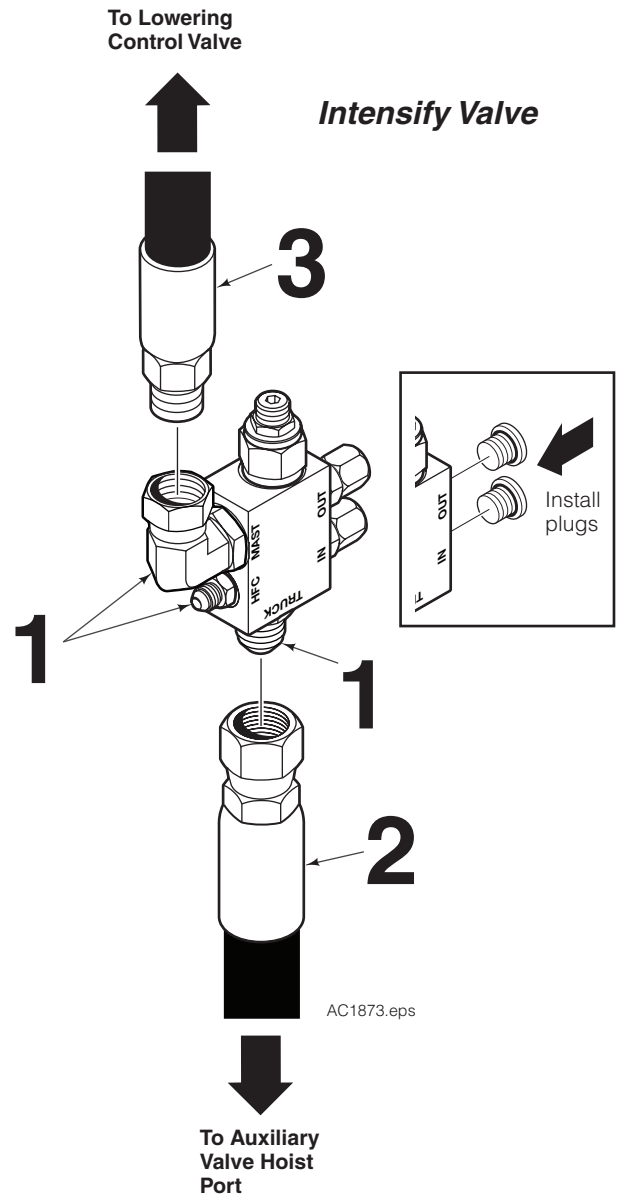
**WARNING:** Follow all recommended safety practices including chaining the freelift mast to the mainlift crossmember when mast is raised.

- 1 Install adapter fittings to HFC, TRUCK, and MAST ports. If IN and OUT ports are not plugged, install metal plugs.
- 2 Install the hose from the hoist auxiliary valve HOIST port to the intensify valve TRUCK port.
- 3 Install a hose that connects the MAST port of the intensify valve to the mast lowering control valve.
- 4 Inspect hoses for pinch points and secure as required.

Mast Cylinders



AC1735.eps

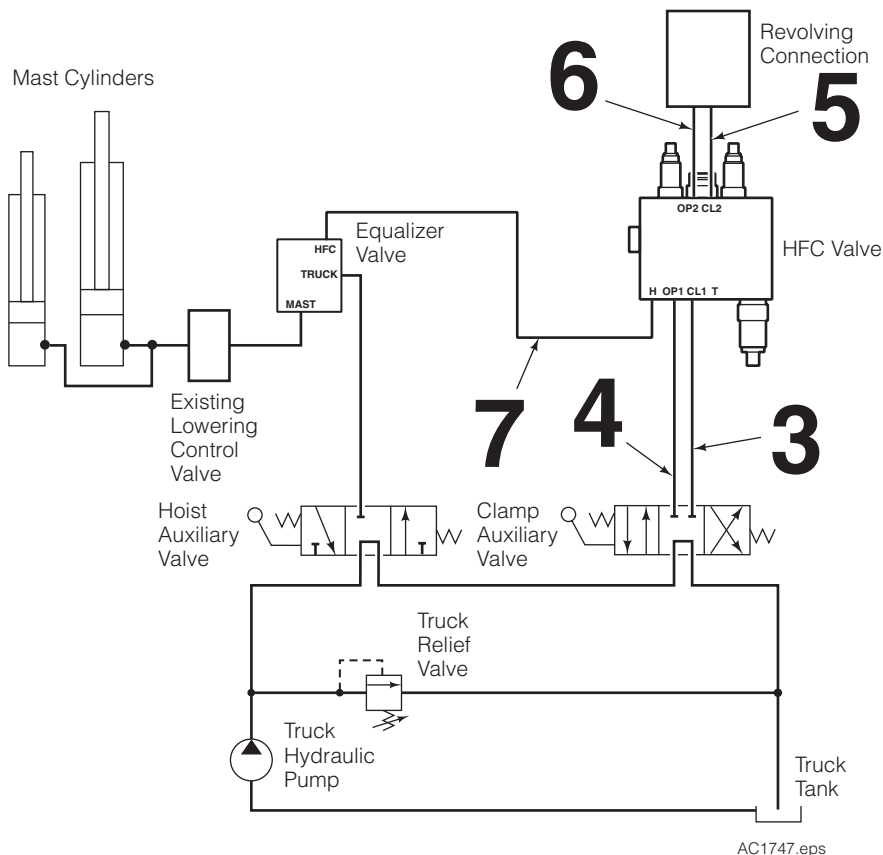
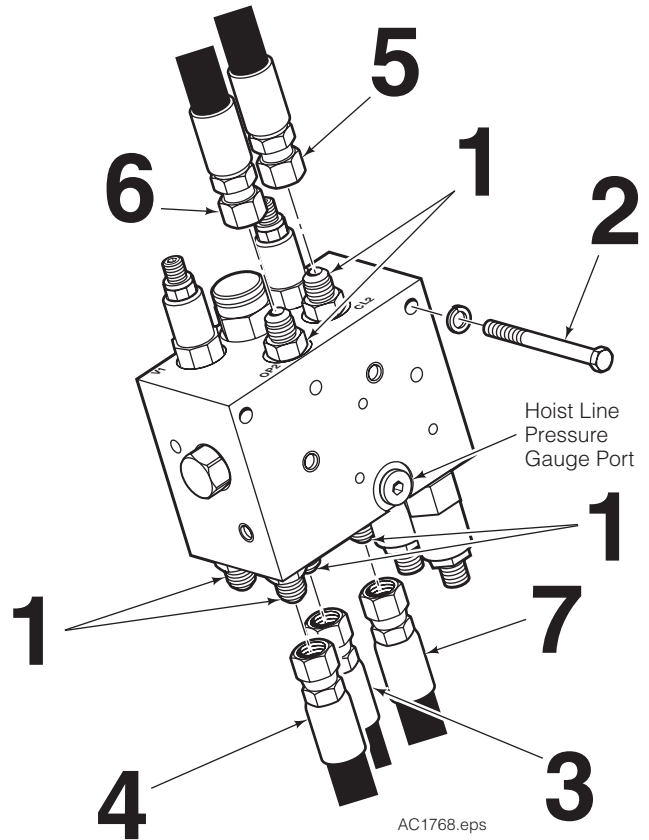


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## HFC VALVE AND HOSES

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

**HFC Valve**



## RETURN-TO-TANK & OPTIONAL OVERDRIVE VALVE

- 1 Install a return-to-tank fitting in the tank line. Lube hose ends and fitting for easy assembly. For complete installation procedure, refer to Installation Instructions 211744. Cascade Low Pressure Return Line Adapter Kits are as follows:

Tank Hose ID	Single Line Adapter Kit	Dual Line Adapter Kit
.75 in. (19 mm)	214062	6049380
1.00 in. (25 mm)	211745	6049381
1.25 in. (31 mm)	214066	6049382
1.50 in. (38 mm)	6037507	6049383

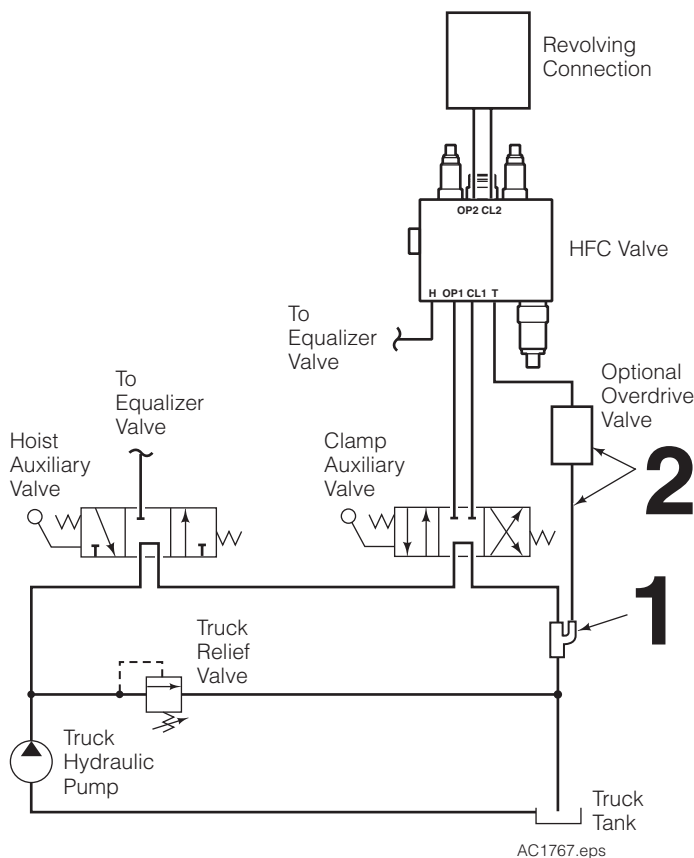
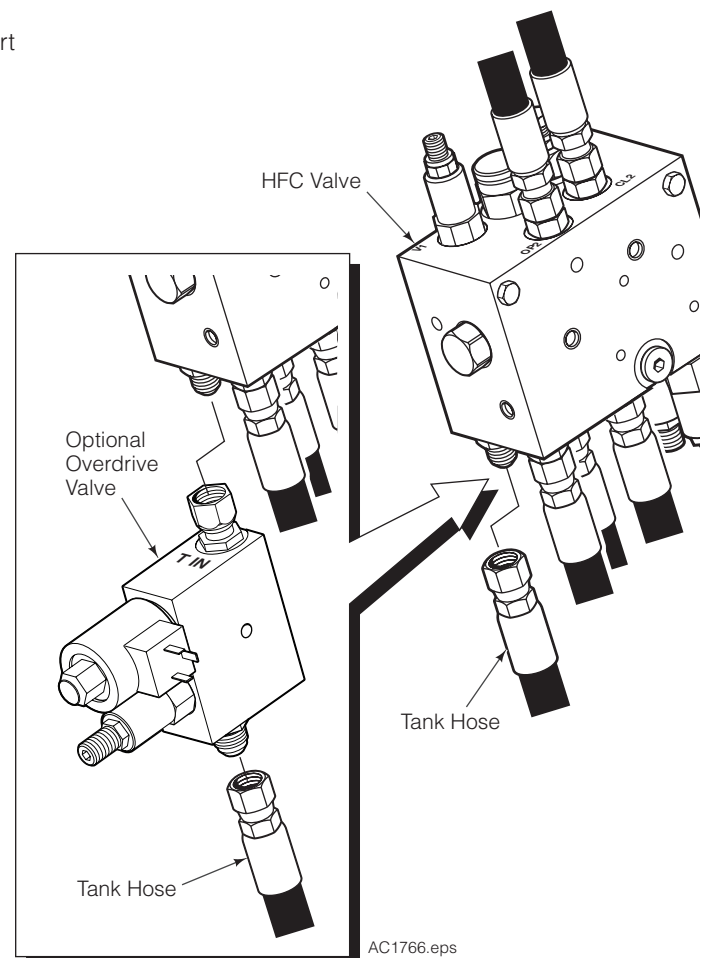
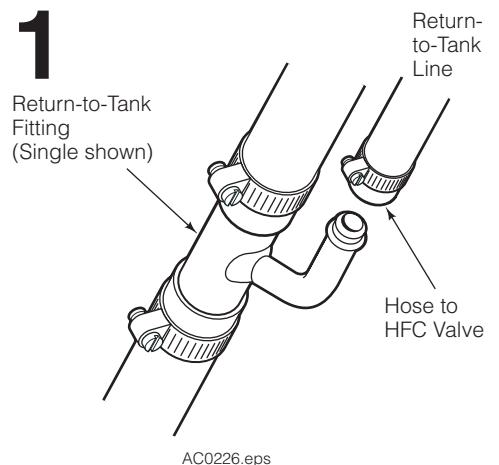
**NOTE:** For trucks with pressurized return-to-tank lines, the hydraulic tank filler cap must be opened to relieve trapped pressure.

- 2 **No Overdrive Valve** – Connect the T port on the bottom of the HFC Valve to the truck tank line fitting.

**Overdrive Valve** – Connect the overdrive valve T IN port with the HFC valve T port. Connect a hose from the overdrive valve T OUT port to the truck tank line fitting. Refer to installation instructions 6097260 for additional information.

**CAUTION:** If the overdrive valve is not directly installed to the HFC valve T port, a high pressure hose must be used. High pressure hose must be rated for 2300 psi (160 bar) working pressure.

- 3 Inspect hose for pinch points and secure as required.



## SENSOR SWITCH (IF EQUIPPED)

- 1 Determine locations to mount the sensor switch on a fixed location on the mast and the bracket with spring wire (if needed) on a moving member on the mast. The sensor switch will signal the mast transition from freelift to mainlift. The provided mounting bracket can be used or modified to aid with mounting the sensor switch.

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

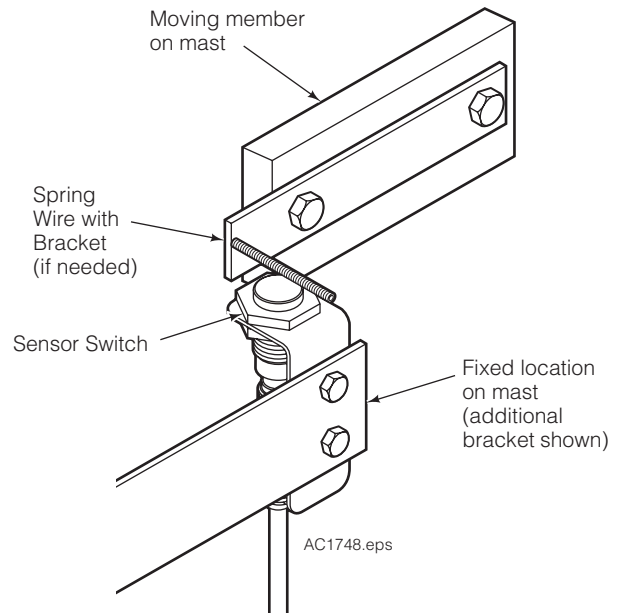
- 2 Connect the harness solenoid connector to the solenoid coil.
- 3 Connect the harness sensor switch connector to the sensor switch.
- 4 Connect the harness cable ends to the components shown.

**12V Systems** – Connect the fused positive wire from the cable harness to a switched power source and the ground wire to a chassis ground.

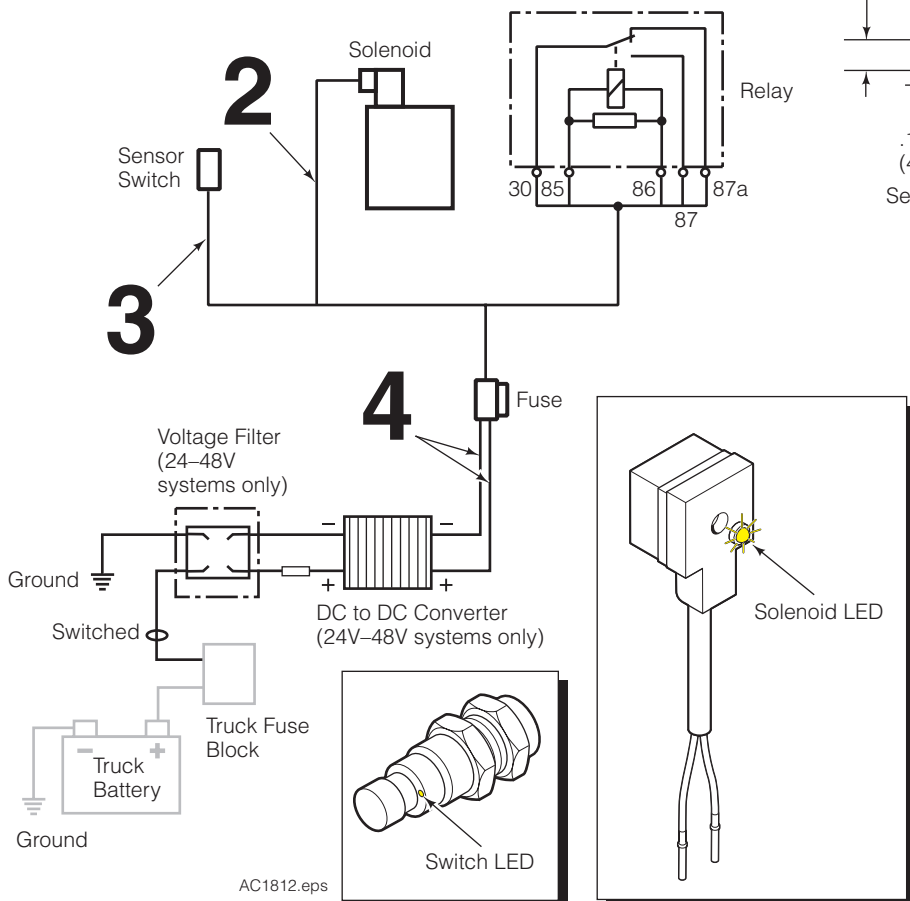
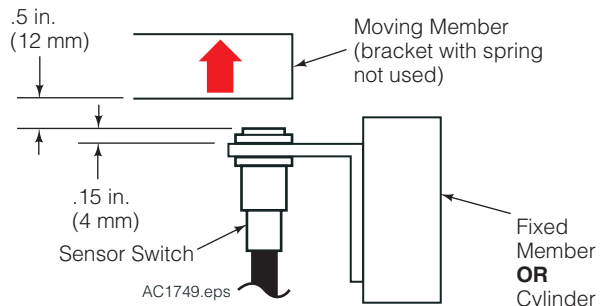
**24V–48V Systems** – Connect the fused positive wire from the cable harness to a DC-to-DC converter positive output wire and the ground wire to the converter negative output wire. Connect a 24V–48V switched power source to the converter fused positive input wire and connect the converter input ground wire to a chassis ground.

**NOTE:** For troubleshooting the wire harness, verify that the sensor switch, solenoid and relay are working properly. Check the LEDs on the sensor switch and solenoid. When the mast is in freelift, the LEDs will illuminate and when in mainlift, the LEDs will be off. Check current flow in and out of relay.

**NOTE:** When installing on electric trucks with regenerative breaking, voltage filter 6061953 must be installed. Failure to install voltage filter can cause damage to electrical components.



**OR**



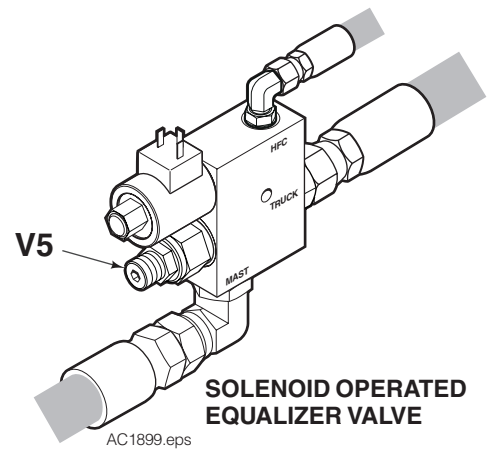
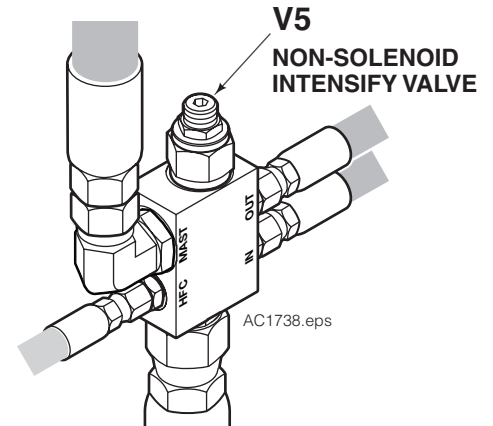
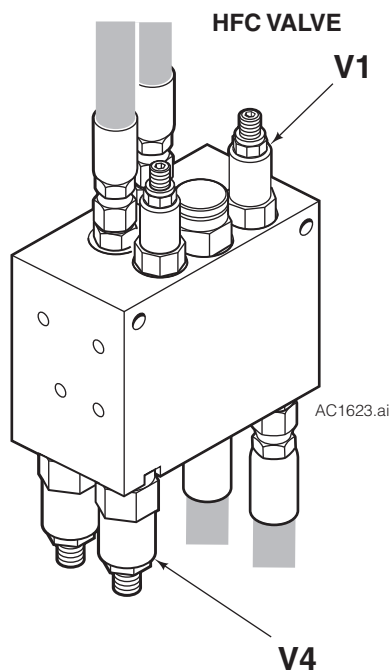


## DISABLING HFC SYSTEM

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

- 1 Turn V1 inward (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 V5 all the way out (CCW).
- 4 The truck attachment will now operate in the standard mode.

**NOTE:** To enable HFC features refer to Prior To Operation Section.



## CARTRIDGE ADJUSTMENT

### CARTRIDGE FUNCTION SUMMARY

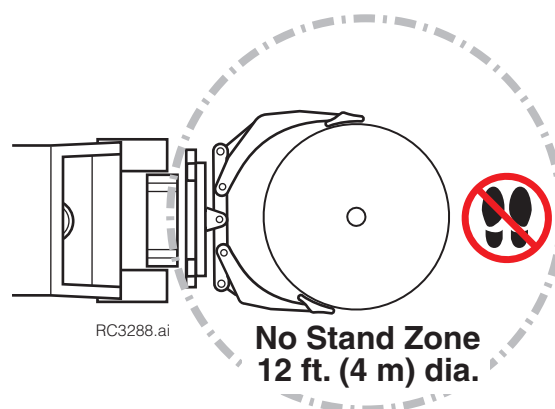
**Starting Pressure (V1)** – Sets starting pressure.

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

**Static Hoist Pressure (V3)** – Closes connection from hoist line to clamp line.

**Freelift Pressure (V4)** – Limits maximum clamping pressure. Must not be set lower than pressure needed to handle maximum roll.

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



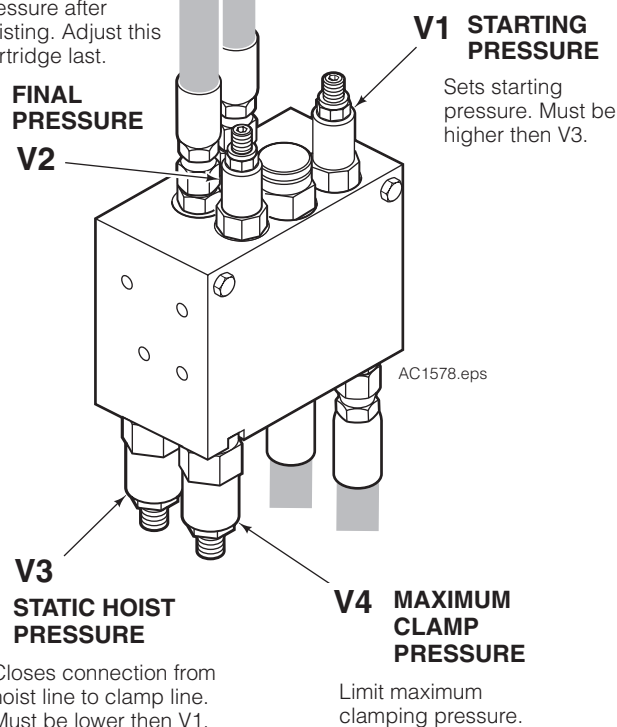
**IMPORTANT:** Check that V2 is completely turned out (counterclockwise) before adjustment process.

- 1 Install the pressure gauge (Cascade Pressure Test Kit 6034612) in the long arm clamp cylinder 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 Static Hoist Pressure (V3) cartridge. This pressure must be less than the Starting Pressure (V1).
  - 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, increase V3 by turning clockwise (CW).
- 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.

Adjusts clamping pressure after hoisting. Adjust this cartridge last.



## CARTRIDGE ADJUSTMENT (CONTINUED)

**5** To equalize the hoist pressure between freelif and mainlift, clamp an average load and hoist off the ground about 1 ft (30 cm) (freelift). Record the pressure. With the same load at a higher position (mainlift), set load down in mainlift position. Reclamp the load, hoist the load and lower to the ground without unclamping. Record the pressure.

- If pressure is within 150 psi (10.5 bar), no adjustment is required.
- If mainlift pressure is higher than the freelift pressure, increase V5 by turning CW to equalize pressure.
- If freelift pressure is higher than the 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 roll and hoist. Note the clamp cylinder pressure.

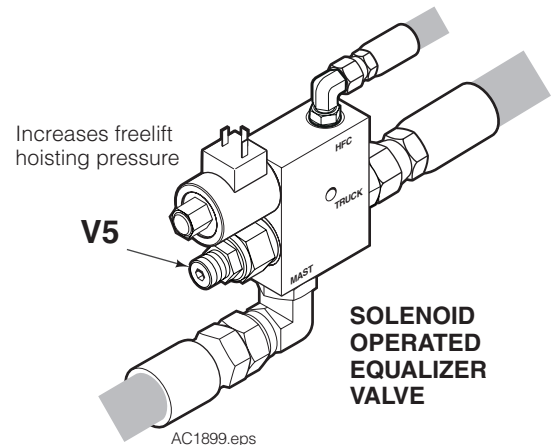
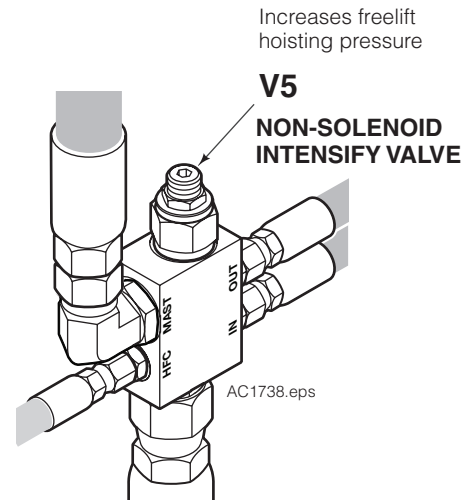
- If the pressure is less than the desired clamp pressure, increase the pressure by turning V5 in CW to match the desired clamp pressure.

**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.

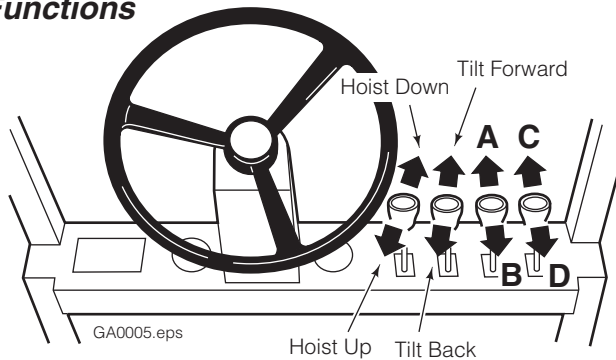
**7** To adjust the Final Pressure (V2), clamp a load. Hoist the load. Use the chart below to record the initial clamp pressure. If the pressure is too high for the heaviest load, turn the cartridge CW to reduce the adjusted clamp pressure. Record the adjusted clamp pressure.

ROLL WEIGHT	INITIAL CLAMP PRESSURE ●	ADJUSTED CLAMP PRESSURE ●
#1		
#2		
#3		
#4		
#5		

● Read from long arm clamp cylinder gauge port



## 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.

### ROTATE

(Driver's view)

**A** Counterclockwise (CCW)

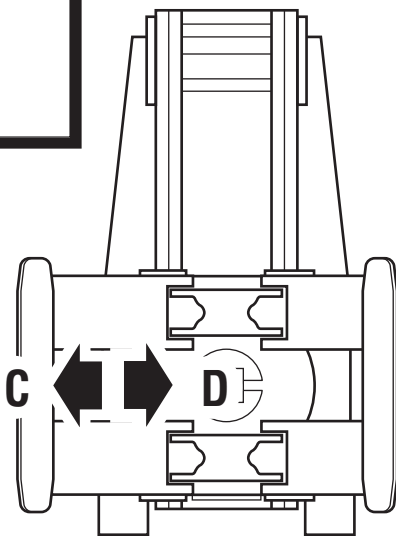
**B** Clockwise (CW)

### LONG ARM

(vertical & horizontal positions only)

**C** Release

**D** Clamp

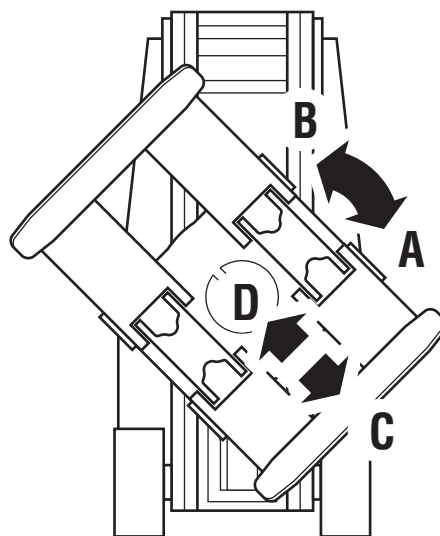


### SHORT ARM

(45-degree position only)

**C** Open

**D** Close



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

- 1 Clamp arms firmly on the roll. Hold for 1 second to build starting clamp pressure.
- 2 Lift the load. Clamp pressure will automatically increase according to load weight.
- 3 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.

- 4 Operation for a split arm clamp with HFC is the same as a solid arm clamp except for the following:

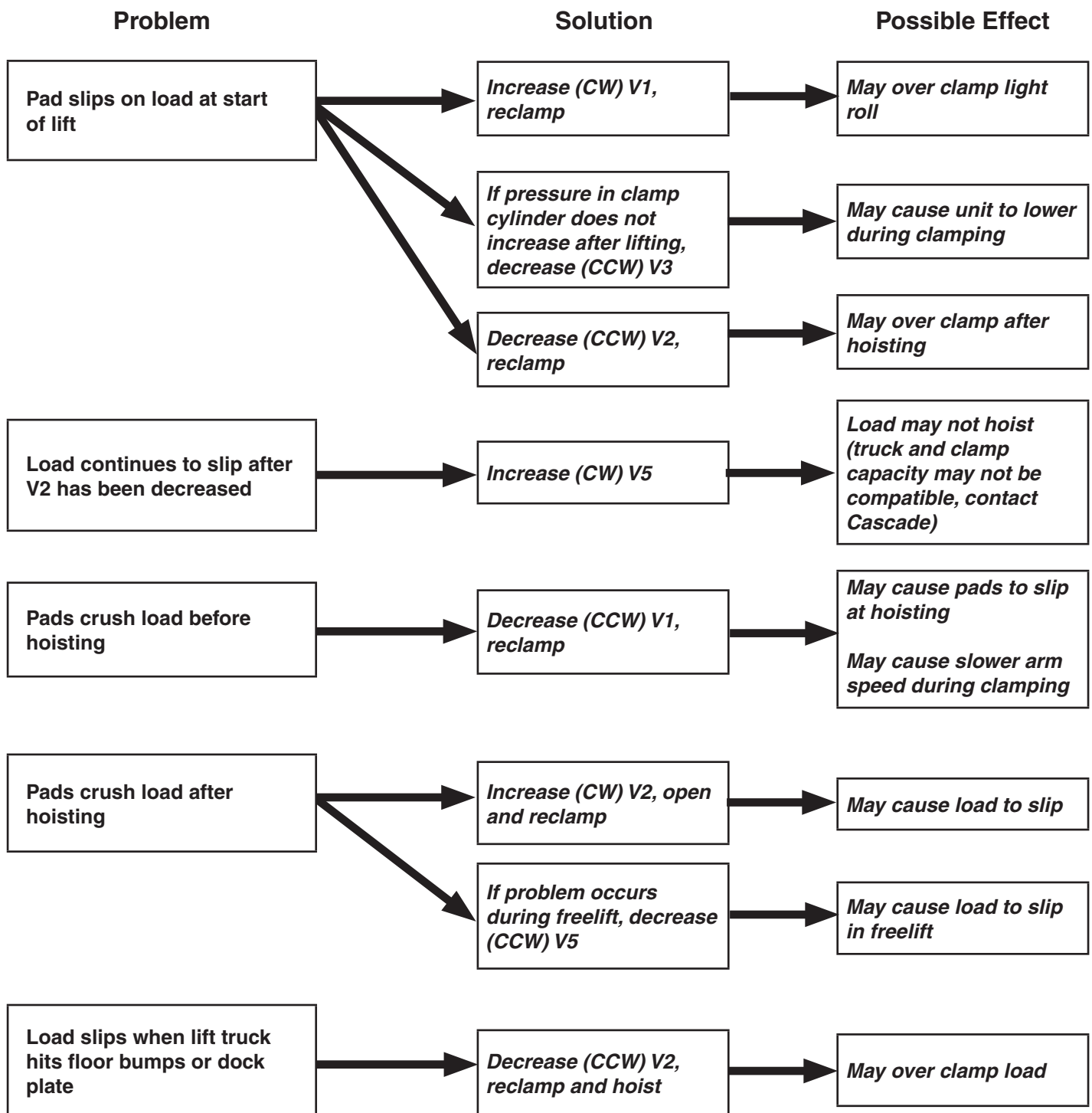
- HFC should be used with the Cascade full arm travel split arm circuit. Close the free arm fully when handling one roll with one split arm. Full clamp force develops after free arm bottoms.
- When clamping a full height roll with both split arms, operate the clamp as a solid arm clamp.

**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 roll diameters vary widely with very low starting pressures, the slower arm speed can be corrected with an optional arm overdrive system. Consult Cascade.

# TROUBLESHOOTING

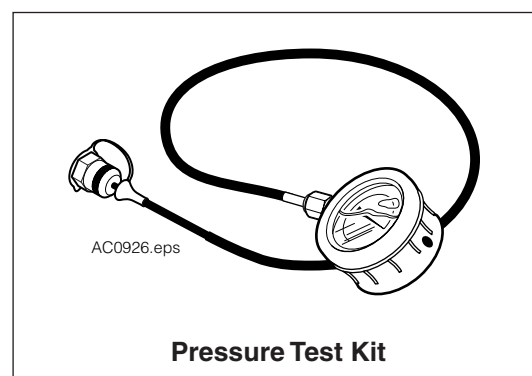
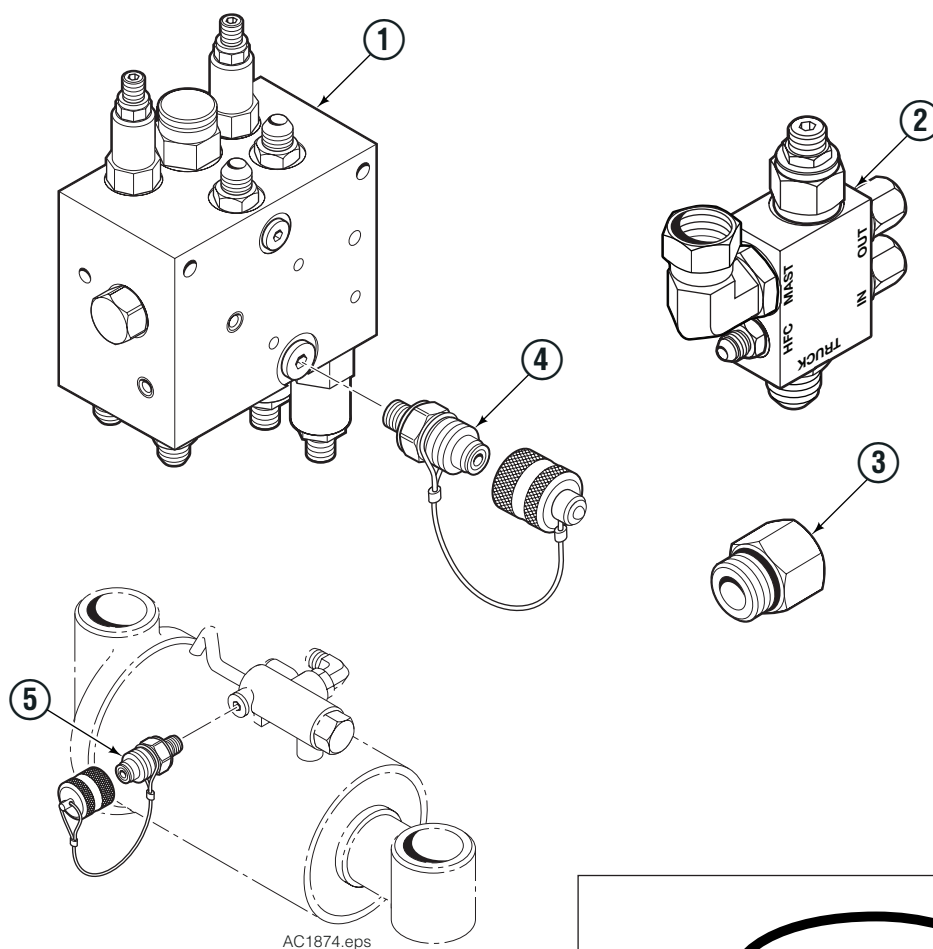
**CAUTION:** Prior to troubleshooting, verify that clamp is working properly and check for defective check valves and cylinder seals.

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



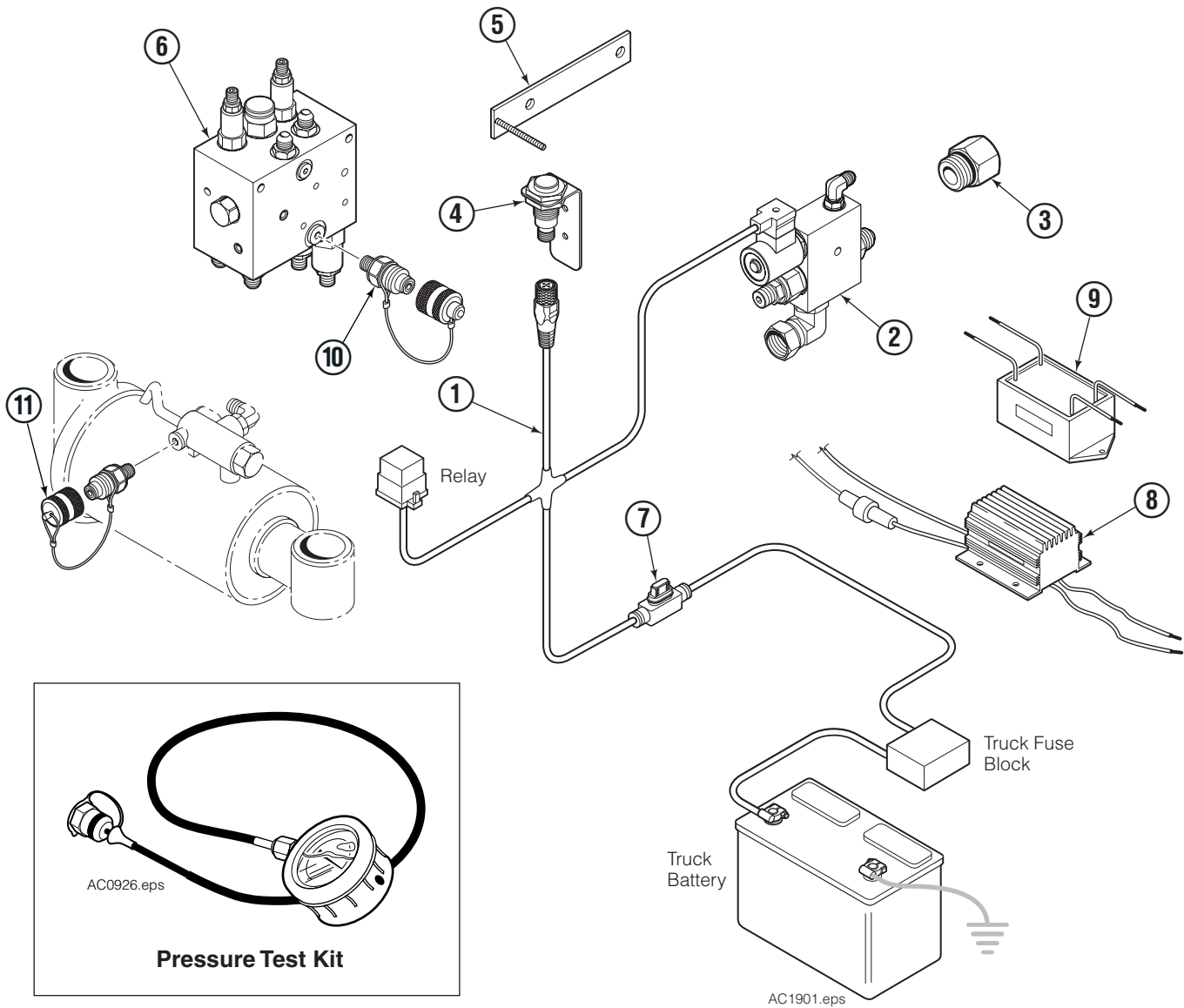
Problem	Solution	Possible Effect of Solution
Hoist cylinder will not lift with a high capacity load	Decrease (CCW) V5	May cause mainlift and freelif to be unbalanced
Hoist lowers while closing arms	Increase (CW) V3	May not add pressure during hoisting
Hoist speed is decreased	Decrease (CCW) V5	May have 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	Increase (CW) 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.

## HYDRAULIC FORCE CONTROL KITS – LIMITED FREELIFT MAST



REF	QTY	PART NO.	DESCRIPTION
		6093682	HFC Kit – without switch
1	1	6088041	HFC Valve
2	1	6092596	Non-Solenoid Intensify Valve
3	2	6802656	Fitting, 12-10
4	1	6006014	Test Point Fitting, 6-6
5	2	6004478	Test Point Fitting, 4-4
	1	6034612	Pressure Test Kit

**HYDRAULIC FORCE CONTROL KITS – FULL FREELIFT MAST**



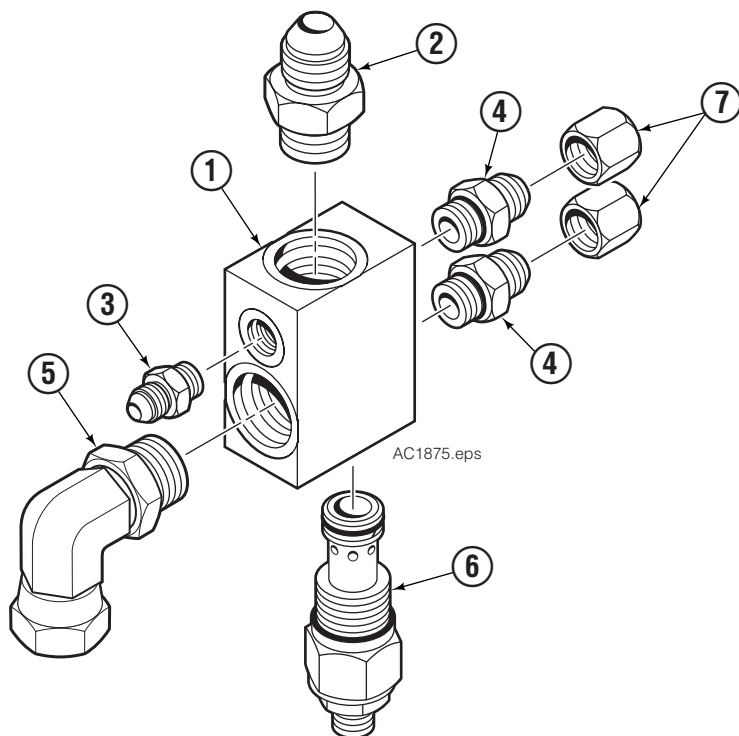
REF	QTY	PART NO.	PART NO.	DESCRIPTION
		6097470		HFC Kit – 12V
			6097471	HFC Kit – 24V-48V
			217932	Converter and Filter Kit ■
1	1	6095957 ◆	6095957 ●	Wire Harness
2	1	6097081	6097081	Solenoid Operated Equalizer Valve
3	2	6802656	6802656	Fitting, 12-10
4	1	6095969 ◆	6095969 ●	Switch Assembly
5	1	6095839 ◆	6095839 ●	Switch Mounting Bracket
6	1	6088041	6088041	HFC Valve
7	1	6017897 ◆	6017897 ●	Fuse - 5 amp
8	1	—	6061953 ●	Voltage Converter, 24-48V→12V
9	1	—	6064659 ●	Voltage Filter
10	1	6006014	6006014	Test Point Fitting, 6-6
11	2	6004478	6004478	Test Point Fitting, 4-4
	1	6034612	6034612	Pressure Test Kit

- Includes items 7 & 8.
- ◆ Included in Switch Group 6097464
- Included in Switch Group 6097465



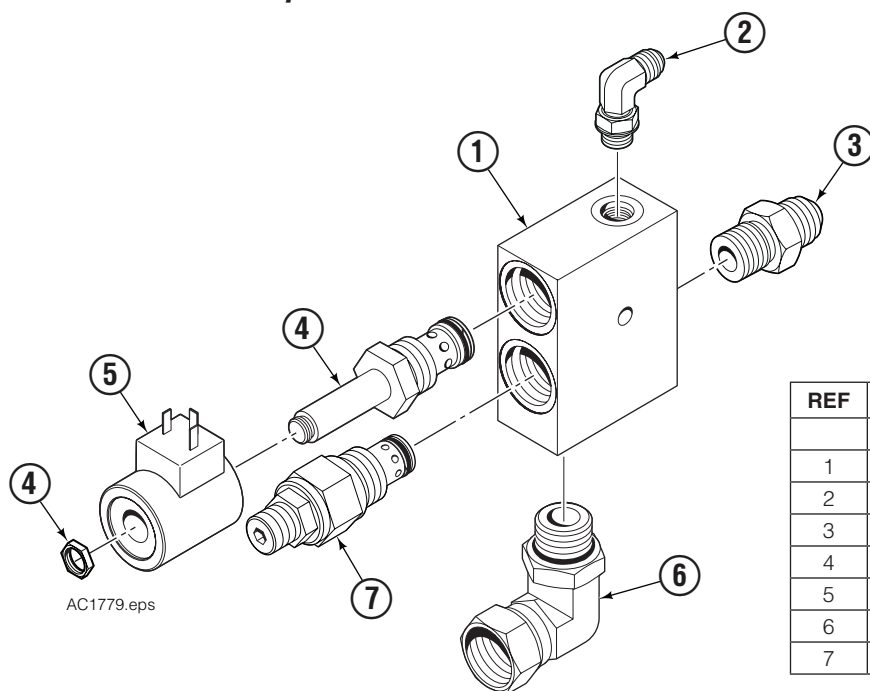
## EQUALIZER & INTENSIFY VALVES

### Non-Solenoid Intensify Valve



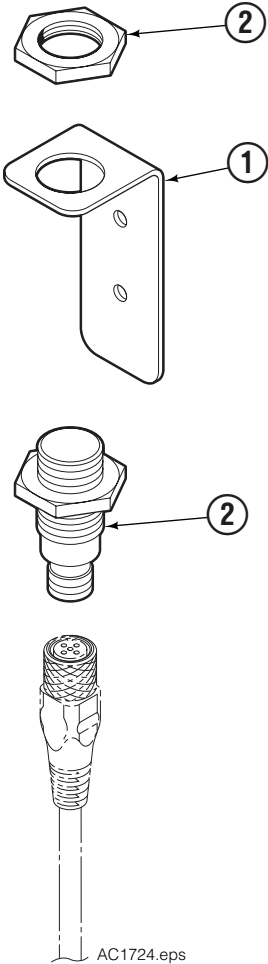
REF	QTY	PART NO.	DESCRIPTION
		6092596	Non-Solenoid Intensify Valve
1	1	6092590	Valve Body
2	1	611293	Fitting, 12-12
3	1	604511	Fitting, 6-6
4	2	601377	Fitting, 8-8
5	1	6093794	Fitting, 12-12
6	1	6092647	Relief Valve Cartridge
7	2	2646	Fitting, 8

### Solenoid Equalizer Valve



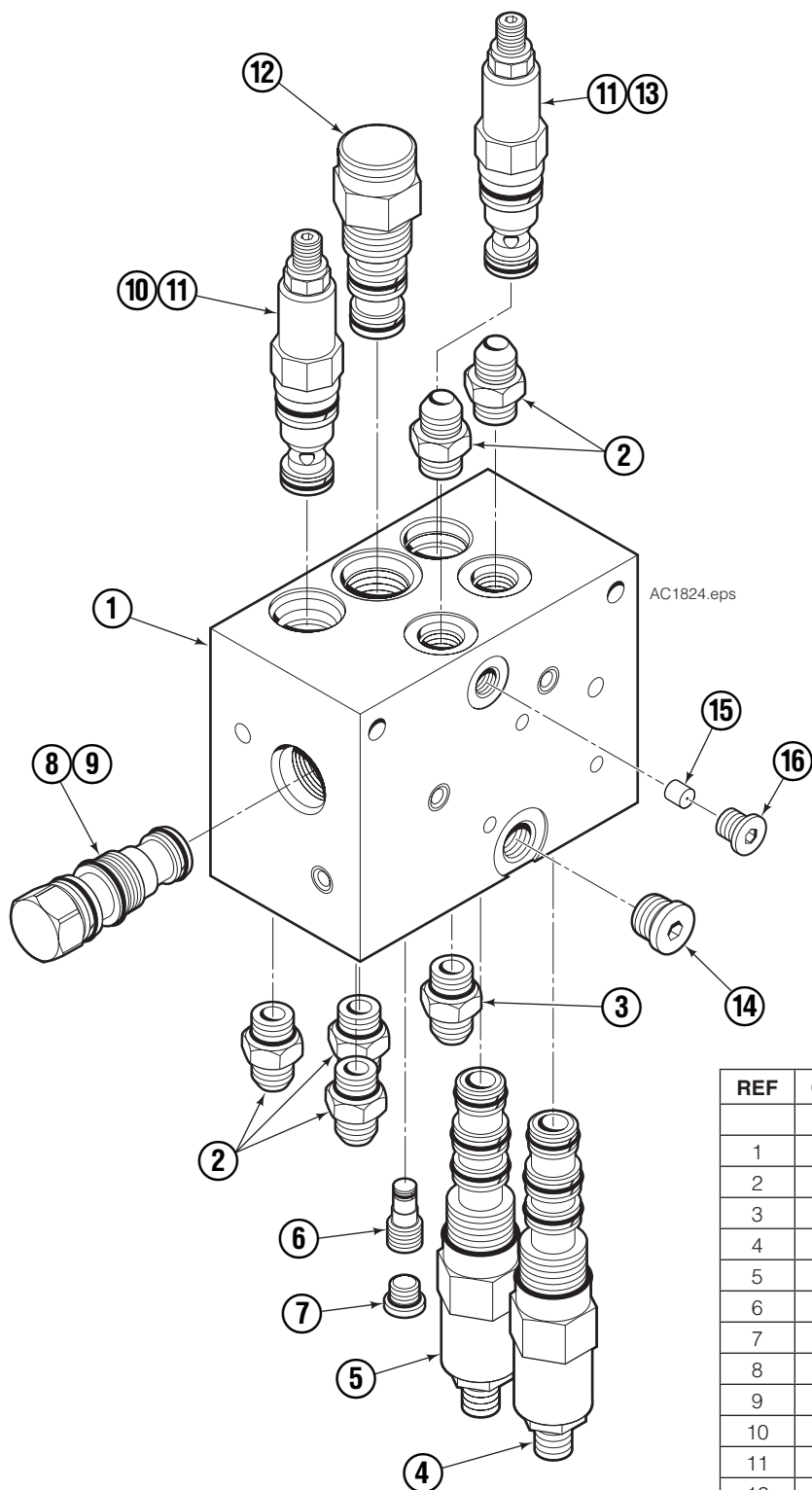
REF	QTY	PART NO.	DESCRIPTION
		6097081	Equalizer Valve
1	1	6097065	Valve Body
2	1	601676	Fitting, 6-6
3	1	611293	Fitting, 12-12
4	1	6056977	Solenoid Valve
5	1	6014287	Coil - 12V
6	1	6093794	Fitting, 12-12
7	1	6092647	Relief Valve Cartridge

SENSOR SWITCH



REF	QTY	PART NO.	DESCRIPTION
		6095969	Switch Assembly
1	1	6091430	Bracket
2	1	6092966	Switch

## HFC VALVE



REF	QTY	PART NO.	DESCRIPTION
		6088041	HFC Valve ■
1	1	6088042	Valve Body
2	5	601377	Fittings, 8-8
3	1	604511	Fitting, 6-6
4	1	6091000	Pressure Sequence Valve Cartridge
5	1	6090999	Pressure Sequence Valve Cartridge
6	1	220865	Shuttle Valve
7	2	609234	Fitting, 4
8	1	210379	PO Check Valve Cartridge
9	1	6024964	Seal Kit
10	1	661676	Relief Valve Cartridge
11	2	661312	Seal Kit
12	1	6086327	Directional Valve Cartridge
13	1	6098001	Relief Valve Cartridge
14	1	604510	Fitting, 6
15	1	6054498	Orifice .020
16	1	663694	Fitting, 3

■ Refer to Glossary for flow requirements

**Clamp Pressure** – Pressure set to clamp a load.

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

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

**Mainlift Pressure (V5)** – Pressure in the hoist line when the mast has extended above freelift.

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

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

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

**Static Hoist Pressure (V3)** – The hoist pressure to achieve prior to hoisting.

**Total Load Weight** – The sum of the paper roll weight and clamp weight.

BLANK

**Do you have questions you need answered right now?** Call your nearest Cascade Service Department. Visit us online at [www.cascorp.com](http://www.cascorp.com)

**Zijn er vragen waarop u direct een antwoord nodig hebt?** Neem dan contact op met uw dichtstbijzijnde serviceafdeling van Cascade. Of ga naar [www.cascorp.com](http://www.cascorp.com)

**Haben Sie Fragen, für die Sie sofort eine Antwort benötigen?** Wenden Sie sich an Ihren nächsten Cascade-Kundendienst. Besuchen Sie uns online: [www.cascorp.com](http://www.cascorp.com)

**En cas de questions urgentes,** contactez le service d'entretien Cascade le plus proche. Visitez le site Web [www.cascorp.com](http://www.cascorp.com).

**Per domande urgenti contattare** l'Ufficio Assistenza Cascade più vicino. Visitate il nostro sito all'indirizzo [www.cascorp.com](http://www.cascorp.com)

**¿Tiene alguna consulta que deba ser respondida de inmediato?** Llame por teléfono al servicio técnico de Cascade más cercano. Visítenos en [www.cascorp.com](http://www.cascorp.com)

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