

U *SER MANUAL*

Hydraulic Force Control For Carton Clamps

Manual Number 6809795-R2

cascade[®]
corporation

Cascade is a Registered Trademark of Cascade Corporation

BLANK

	Page
OVERVIEW	1
INSTALLATION	2
Prepare Attachment Valve	2
Equalizer Valve and Hoses	3
HFC Valve and Hoses	4
Return-to-Tank	5
Sensor Switch (if equipped)	6
Disabling HFC System	7
SETUP	8
OPERATION	10
DAILY CHECK LIST	11
TROUBLESHOOTING	12
PARTS	15
GLOSSARY	20

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 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:

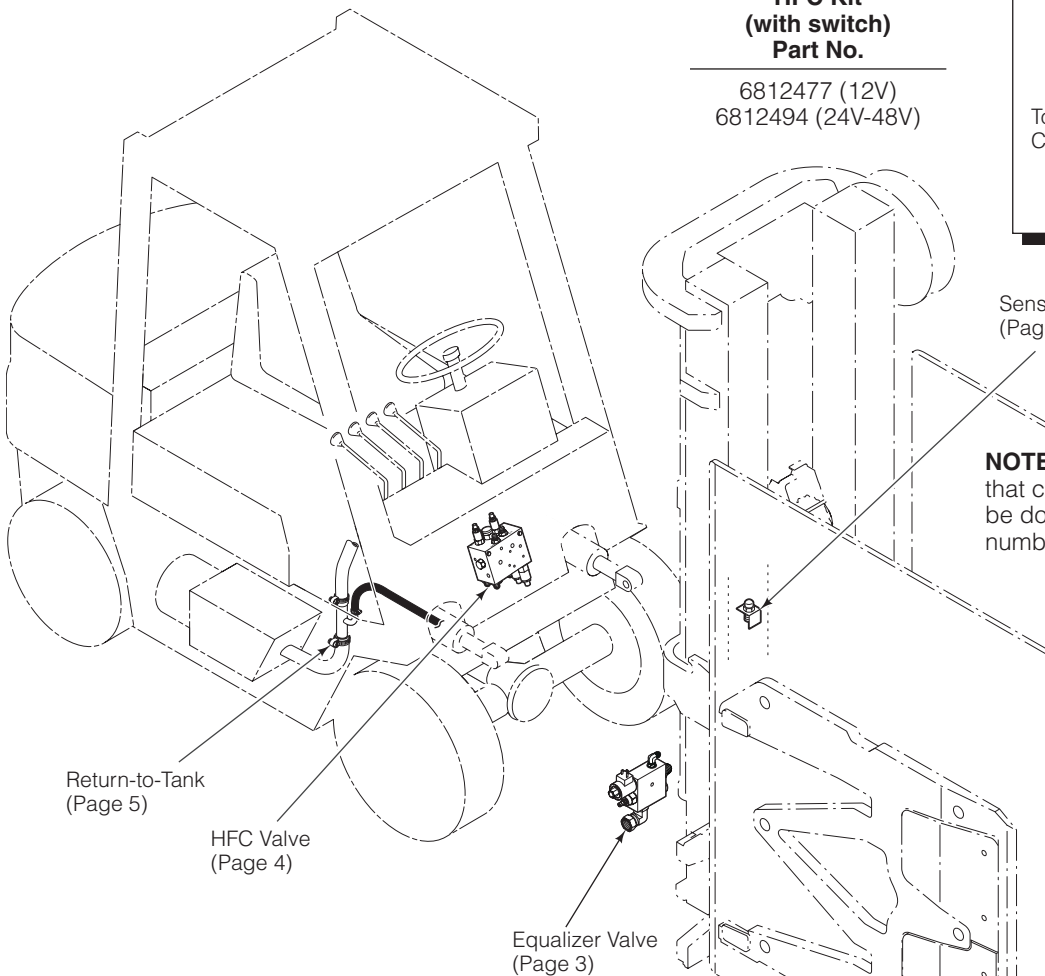
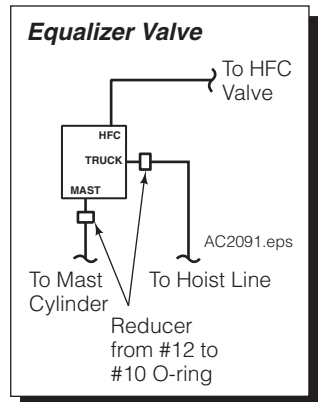
Equalizer Valve Fittings – The mast and truck ports are No. 12 O-ring with No. 12 JIC Fittings installed. No. 12-10 O-ring reducers are supplied to adapt to smaller hoist lines.

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

6812531

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

6812477 (12V)
6812494 (24V-48V)



NOTE: Cascade recommends that component installation be done according to page number order.

INSTALLATION

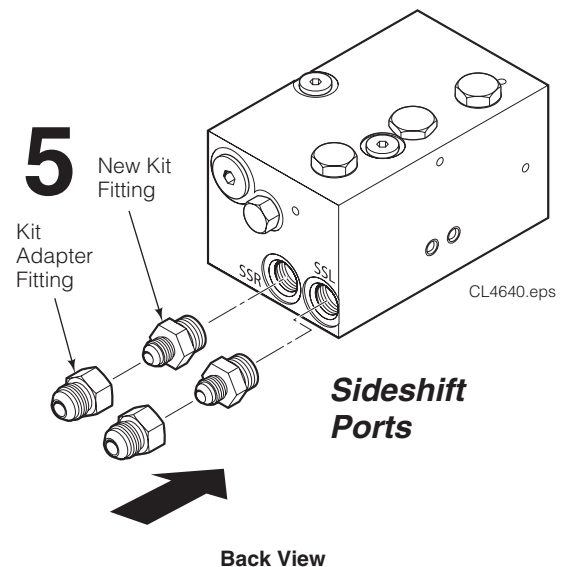
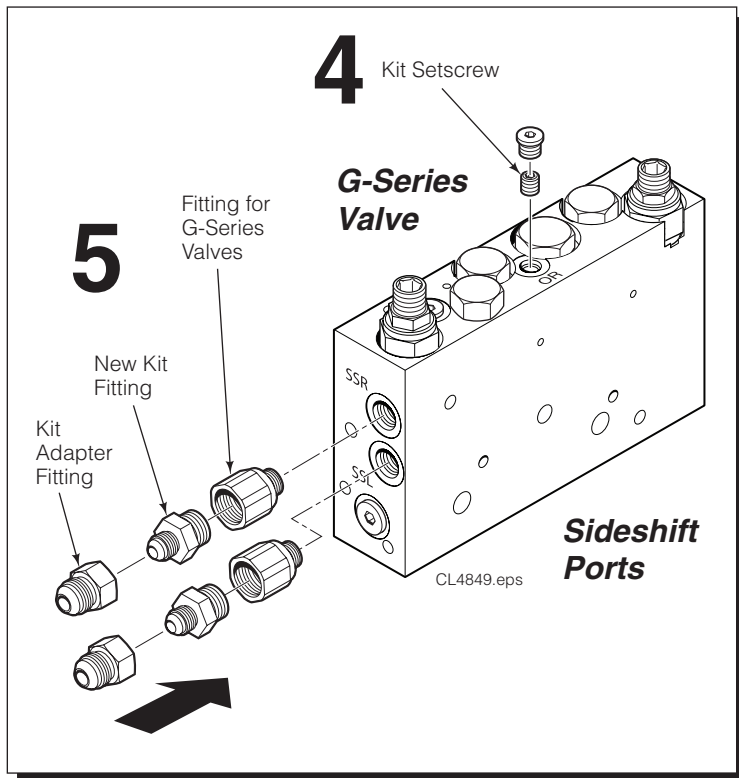
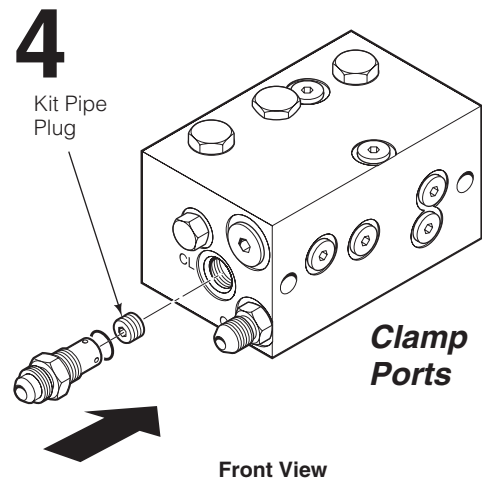
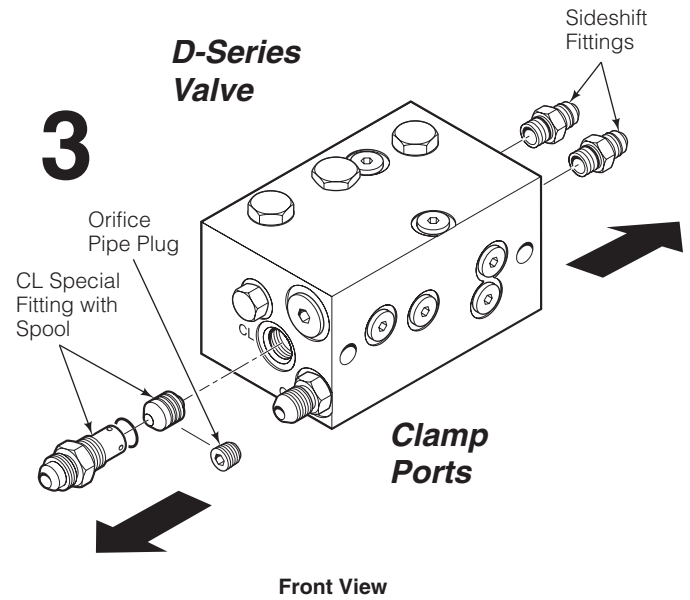
PREPARE ATTACHMENT VALVE



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.

- 1 Open attachment arms to frame width.
 - 2 Disconnect the hydraulic hoses from the valve CLAMP (CL), OPEN (OP), SIDESHIFT RIGHT (SSR) and SIDESHIFT LEFT (SSL) ports.
 - 3 Remove CL port special fitting with spool or orifice pipe plug.
 - 4 Install kit pipe plug into CL port and reinstall fitting leaving spool out (as needed for G-Series valves).
- D-Series Valves** – .25 in. dia. NPTF plug (Part No. 6603)
G-Series Valves – .3125 in. dia. setscrew (Part No. 5304)
- 5 Install kit fitting into SSR and SSL ports. If equipped with No. 8 hoses, install adapter fittings.



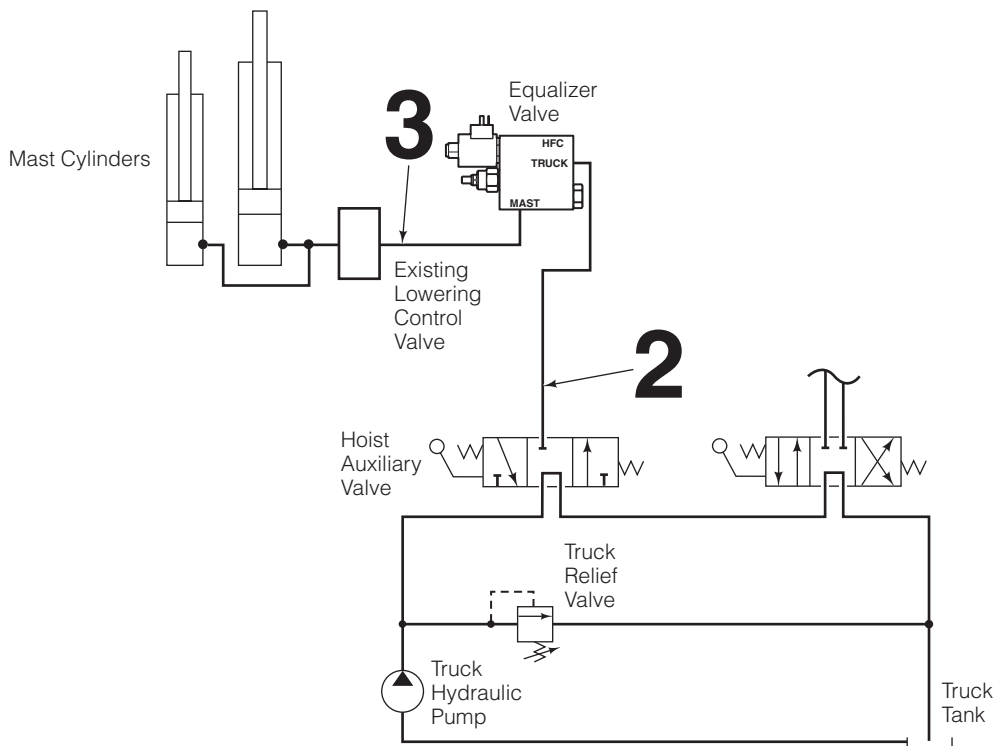
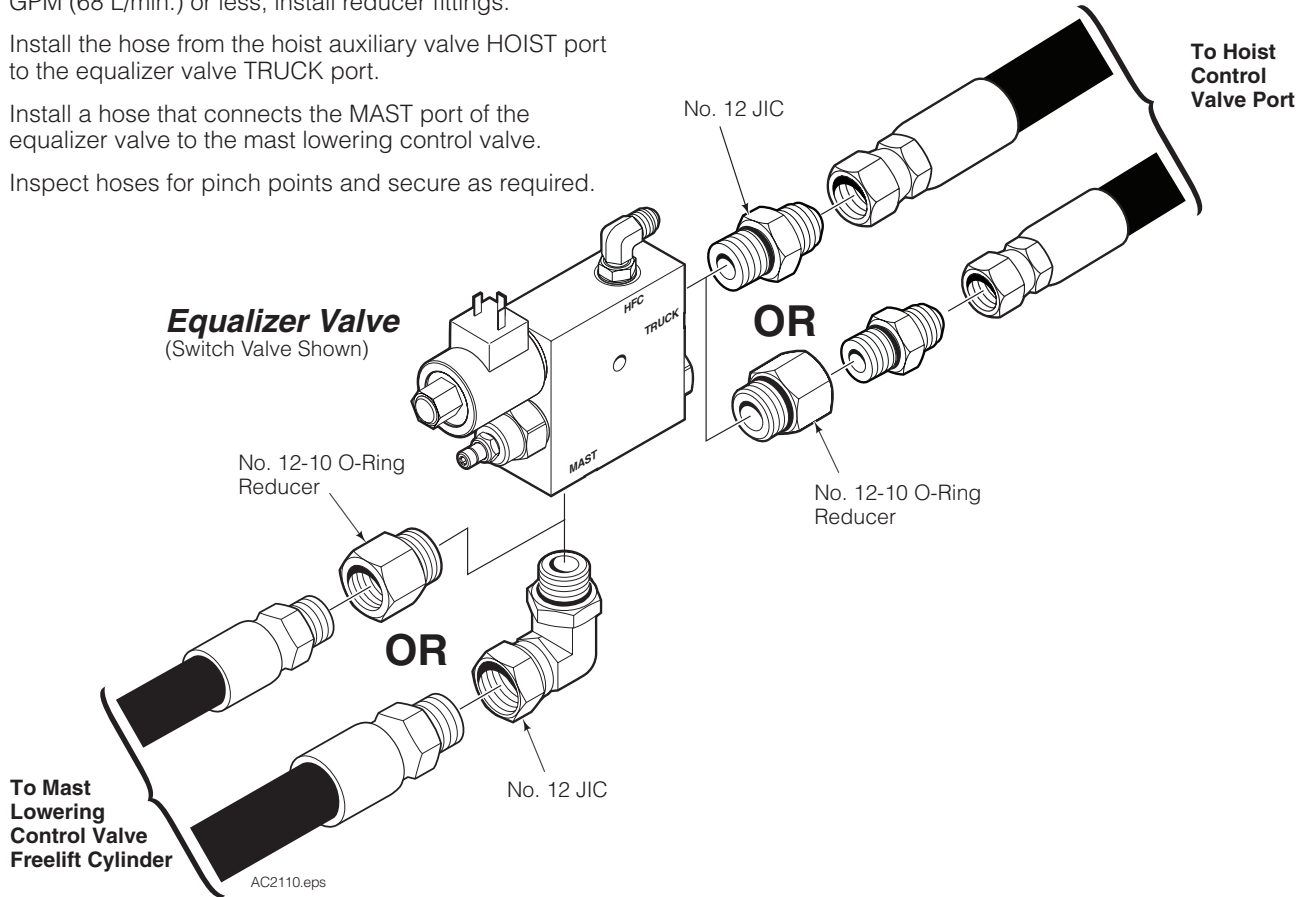
INSTALLATION

EQUALIZER VALVE AND HOSES

- 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.

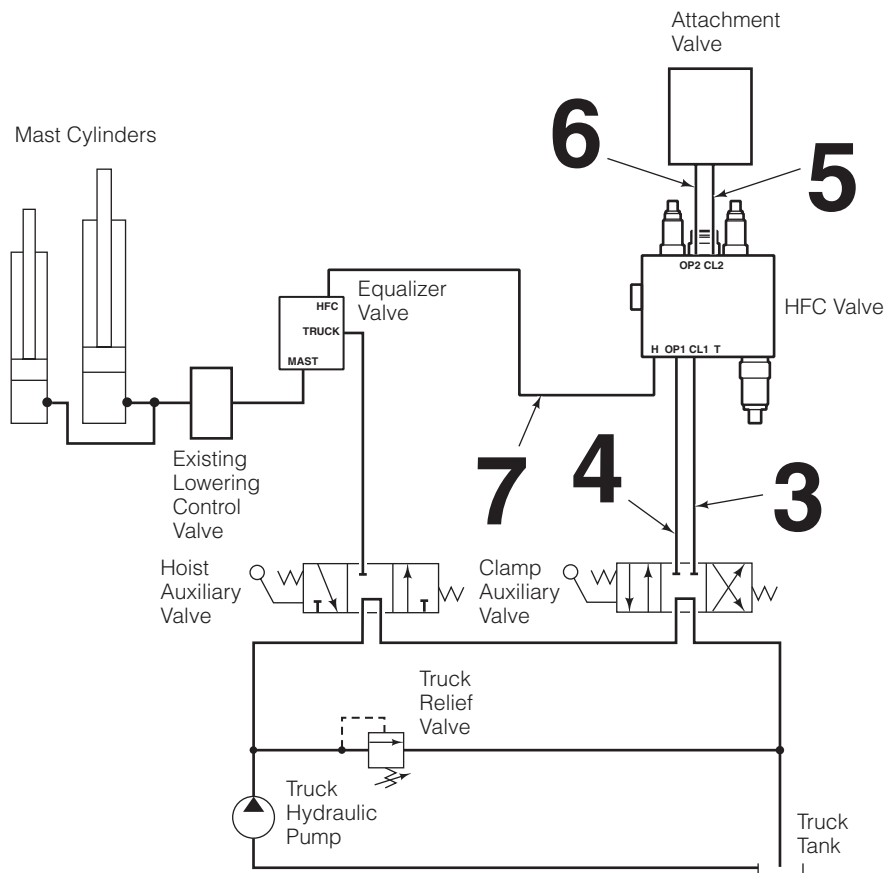
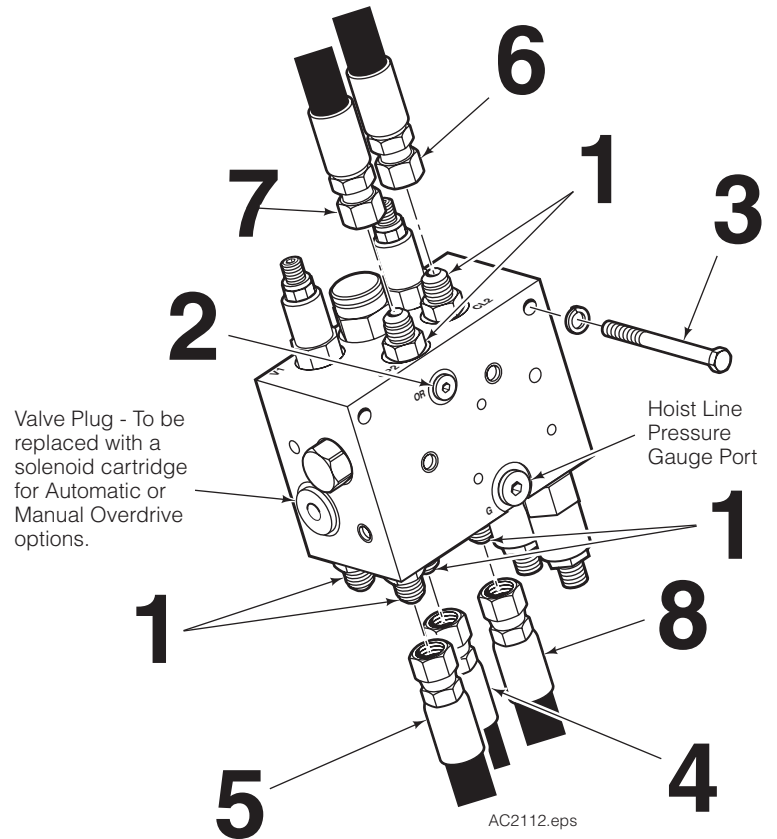


INSTALLATION

HFC VALVE AND HOSES

- 1 Install adapter fittings to T, H, CL1, CL2, OP1 and OP2 ports on the HFC valve.
- 2 Remove orifice plug (OR) from the valve. Remove the orifice. Reinstall orifice plug (OR).
- 3 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.
- 4 Connect a No. 6 (minimum) hose from the truck auxiliary clamp circuit CLAMP port to the CL1 port of the HFC valve.
- 5 Connect a No. 6 (minimum) hose from the truck auxiliary valve clamp circuit OPEN port to the OP1 port of the HFC valve.
- 6 Connect a No. 6 (minimum) hose from the CL2 port of the HFC valve to the attachment CLAMP port supply circuit.
- 7 Connect a No. 6 (minimum) hose from the OP2 port of the HFC valve to the attachment OPEN port supply circuit.
- 8 Connect a No. 6 (minimum) hose from the H port of the HFC valve to the HFC port of the equalizer valve.
- 9 Inspect hoses for pinch points and secure as required.

HFC Valve



INSTALLATION

RETURN-TO-TANK

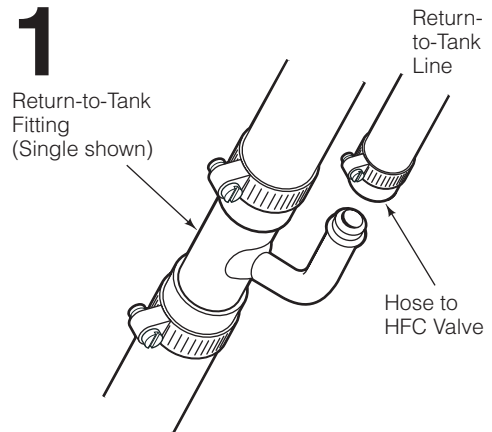
- 1 Install a return-to-tank fitting in the tank line. Lube hose ends and fitting for easy assembly. For complete installation procedure, refer to Installation Instructions 211744. Cascade Low Pressure Return Line Adapter Kits are as follows:

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

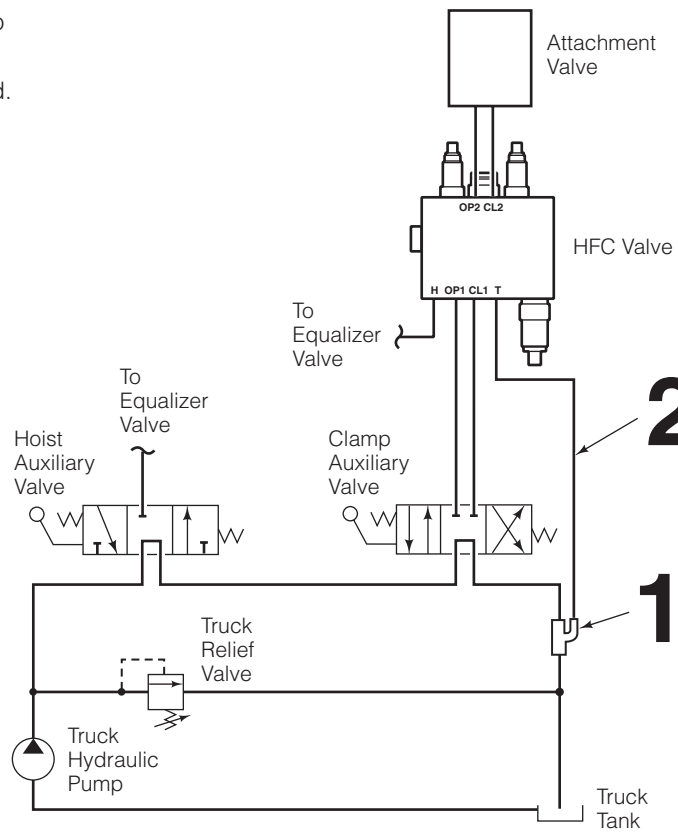
- ◆ Included in adapter kit 6807816.

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.



AC0226.eps



AC2115.eps

INSTALLATION

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 freelif 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.

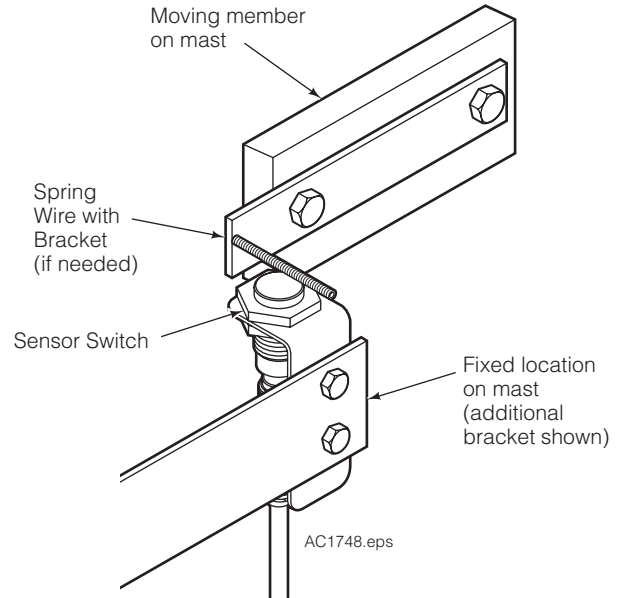
- 2 Connect the harness solenoid connector to the solenoid coil.
- 3 Connect the harness sensor switch connector to the sensor switch.
- 4 Connect the harness cable ends to the components shown.

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

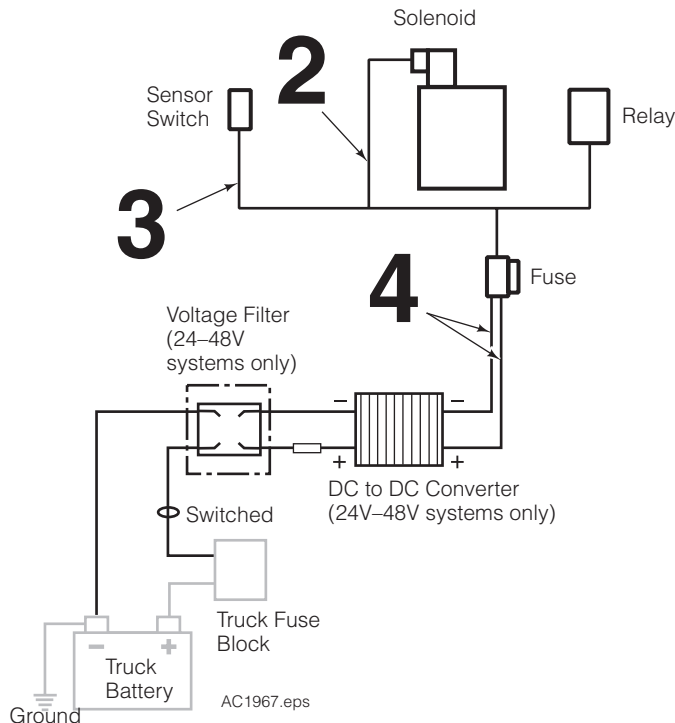
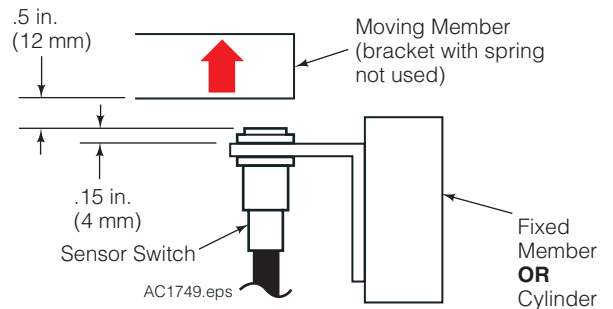
24V–48V Systems – Connect the fused positive wire from the cable harness to a DC-to-DC converter positive output wire and the ground wire to the converter negative output wire. Connect a 24V–48V switched power source to the converter fused positive input wire and connect the converter input ground wire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

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

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



OR



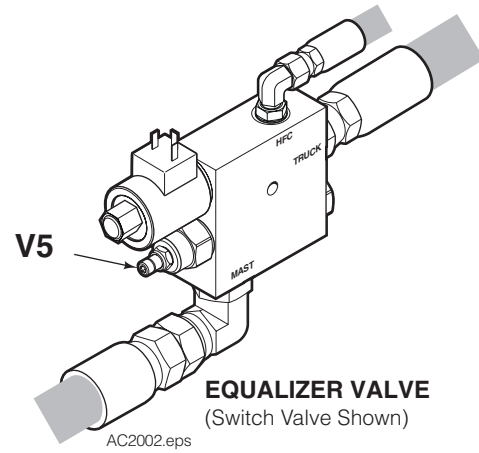
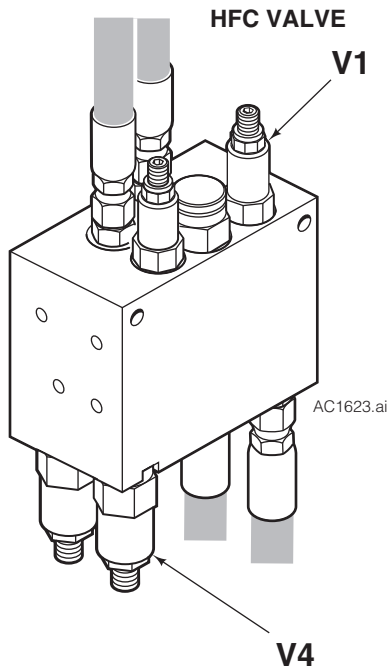
INSTALLATION

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 FUNCTION SUMMARY

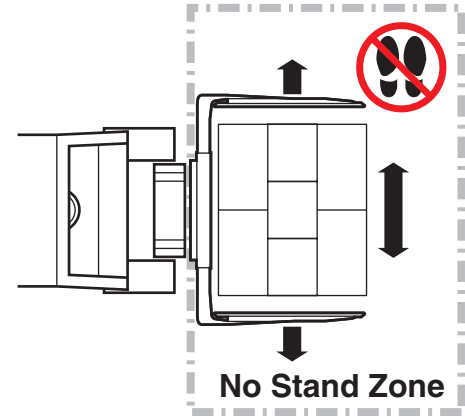
Starting Pressure (V1) – Sets starting pressure.

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 load.

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



CL4644.eps

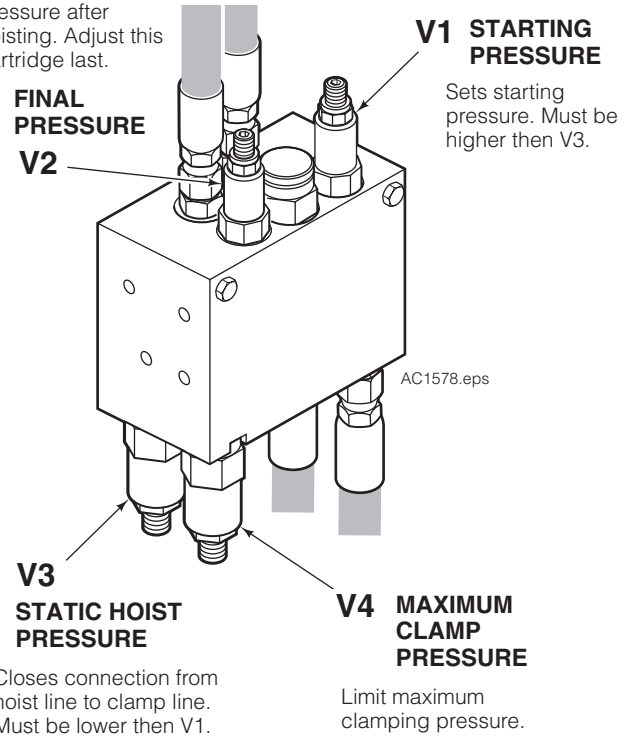
IMPORTANT: Check that V2 is completely turned out (counterclockwise) before adjustment process.

- 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.



AC1578.eps

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

6 For non-freelif 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.

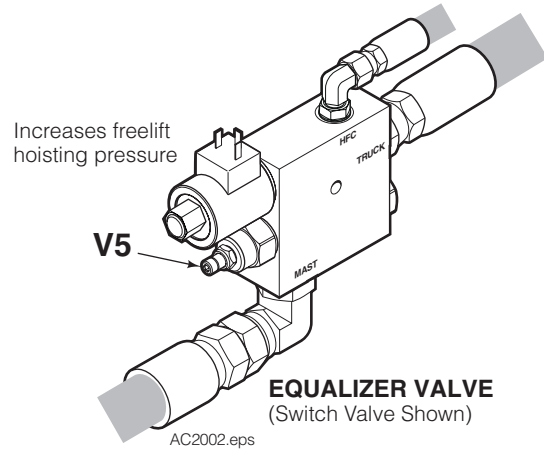
- If the pressure is less than the desired clamp pressure, increase the pressure by turning V5 in CW to match the desired clamp pressure.

NOTE: For freelif 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.

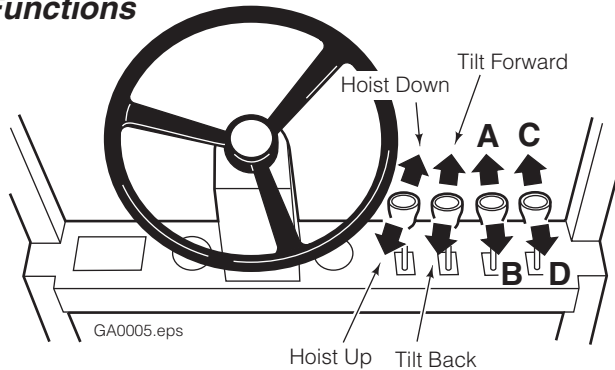
7 To adjust the Final Pressure (V2), clamp a load. Hoist the load. Use the chart below to record the initial clamp pressure. If the pressure is too high for the heaviest load, turn the cartridge CW to reduce the adjusted clamp pressure. Record the adjusted clamp pressure.

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

- Read from attachment valve gauge port.



Auxiliary Valve Functions



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.

To Lift a Light Load (1 Layer)

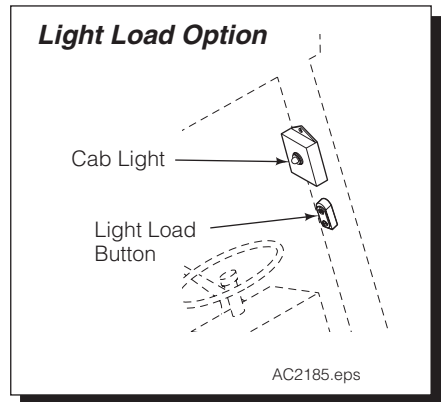
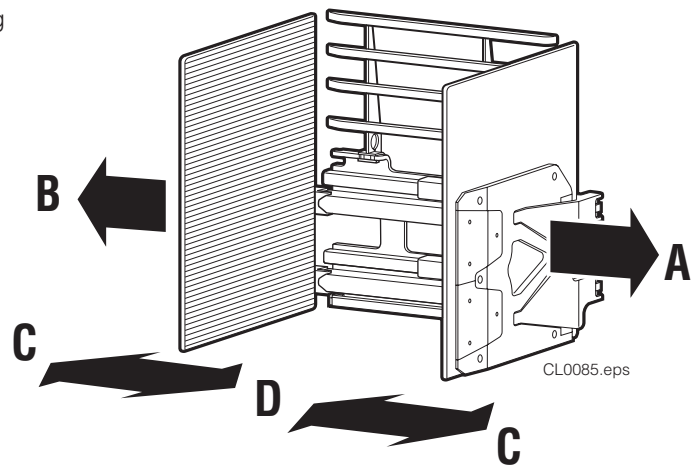
- 1 If equipped with Light Load Option, press the Light Load button "On" and verify cab light is on.
- 2 Using low to mid engine RPM, clamp a light load. Hold for 1 to 2 seconds to build starting clamp pressure.
- 3 Lift the load.
 - **Without Light Load Option** – If feathering is used to reduce clamp 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 roll diameters vary widely with very low starting pressures, the slower arm speed can be corrected with an optional arm overdrive system. Consult Cascade.

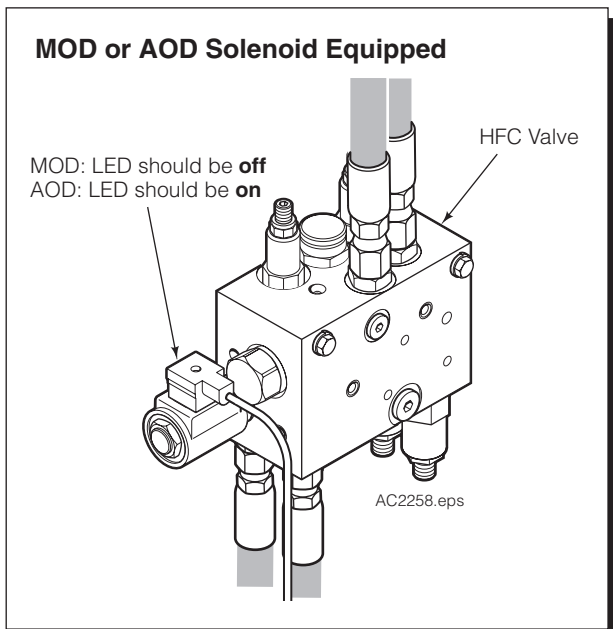
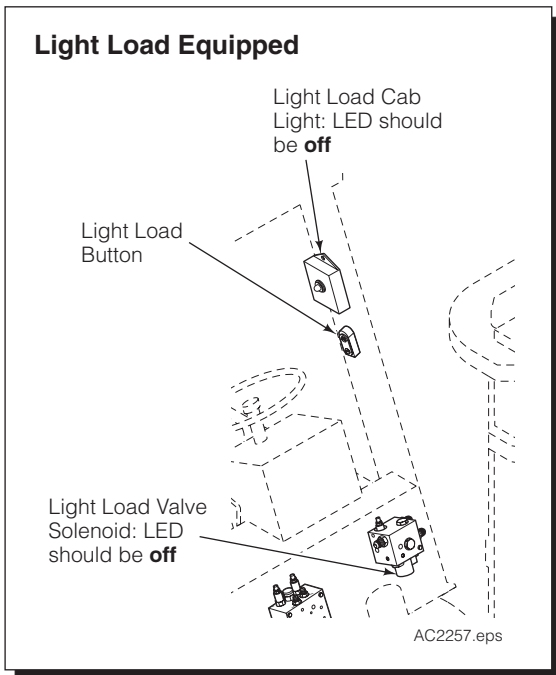
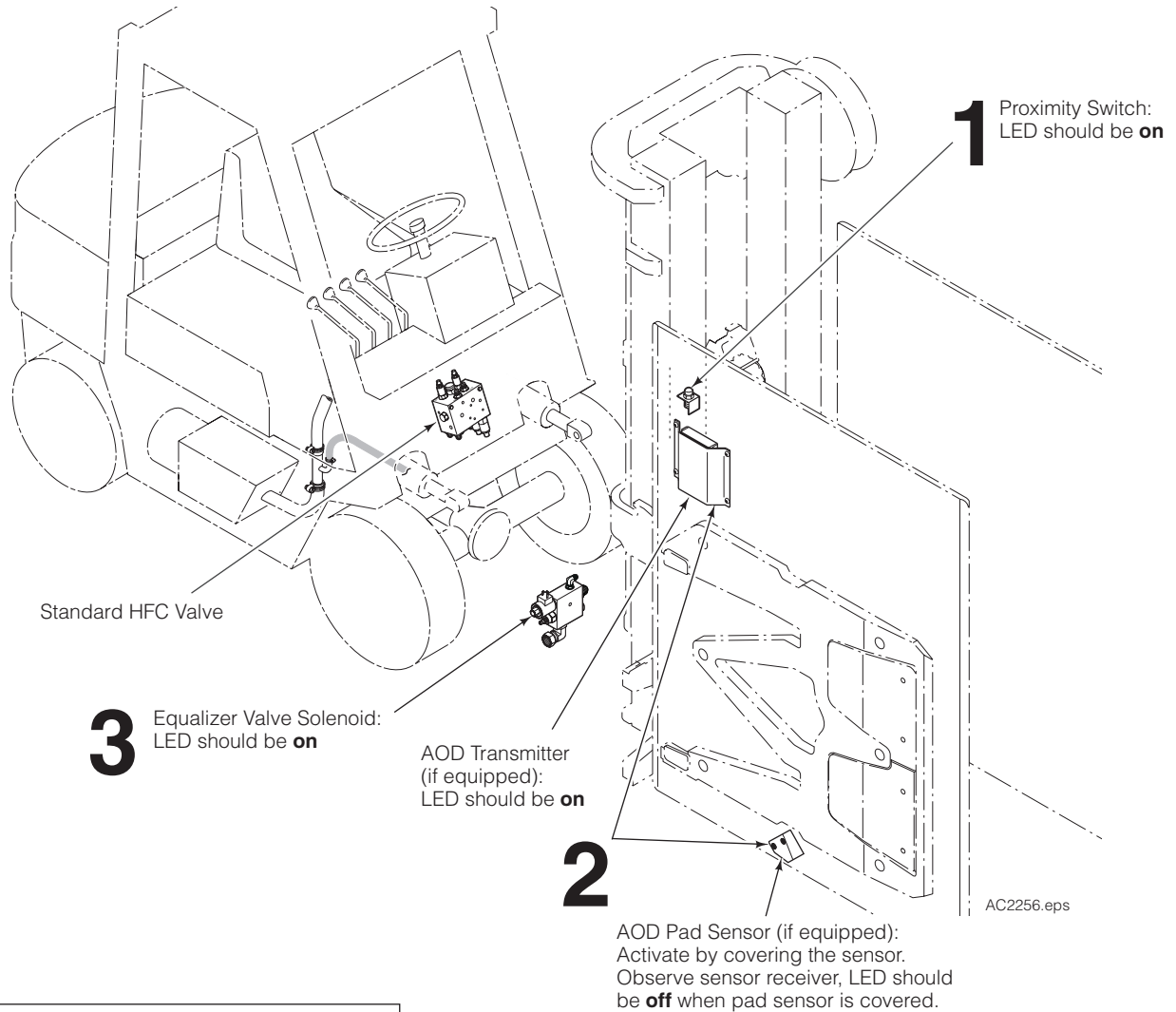
WARNING: Truck control handle and attachment function activation shown here conforms to ASME/ANSI B56.1 recommended practices. Failure to follow these practices may lead to serious bodily injury or property damage. End user, dealer and OEMs should review any deviation from the practices for safe operation.

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



DAILY CHECK LIST

At the beginning of each shift, after turning on the truck key, check the following components:



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

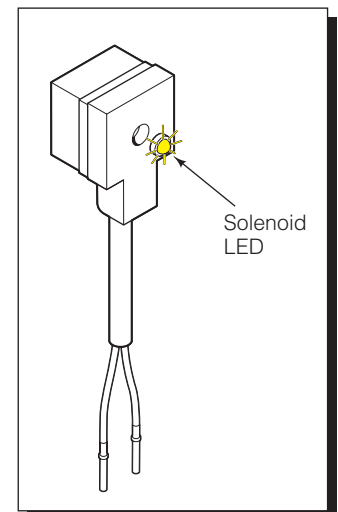
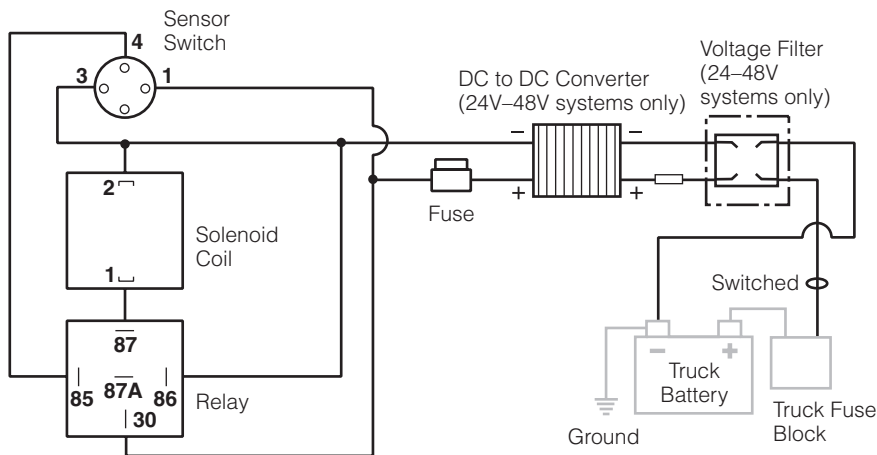
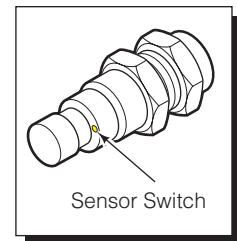
- When the mast is in freelift, the LEDs will be on.
 - When in mainlift, the LEDs will be off.
- 1 Check fuse.
 - 2 Remove relay and cables from sensor switch and solenoid coil.
 - 3 Check for 12V power between relay socket terminals 30 and 86. If no power, check continuity:
 - 30 and (+) truck battery
 - 86 and (-) truck battery
 - 4 Check for continuity at all corresponding pins and terminals.
 - 5 Install cable to sensor switch, fixed on a target (switch LED should be illuminated). Check for power at relay socket terminal 85.
 - 6 Test the relay by adding 12V (+) power to 85 and (-) ground to 86. 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 the sensor switch fixed on a target (LED 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.

Full Height Pressure Limiter Valve Kit

This kit prevents excessive clamp force in applications where the mast is extended to full height on a regular basis while clamping a load.

For LED troubleshooting, check the LEDs on the sensor switch and solenoid.

- When the mast is below maximum height, the LEDs will be off.
- When at mast full height, the LEDs will be on.

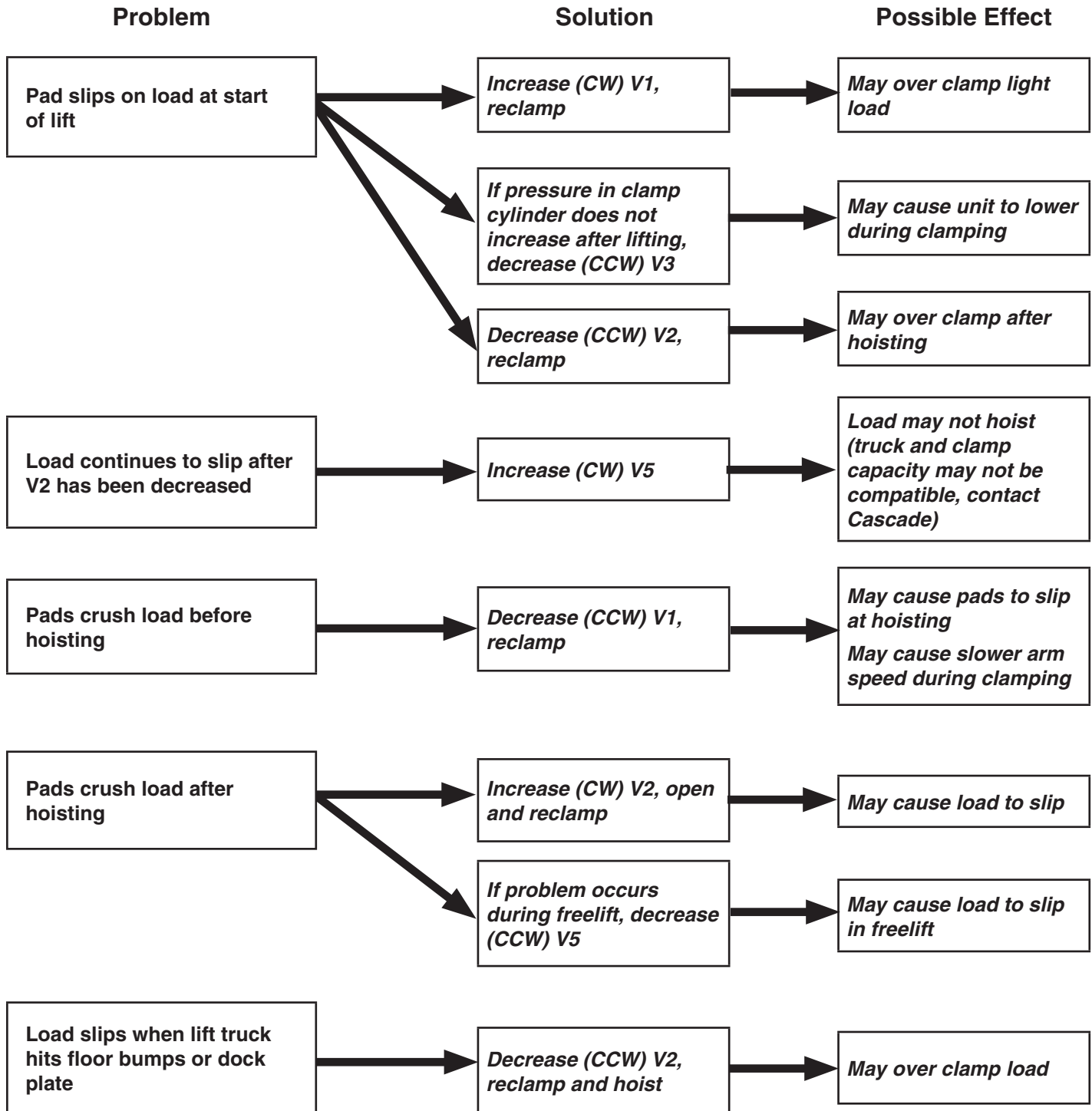


AC1960.eps

TROUBLESHOOTING

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

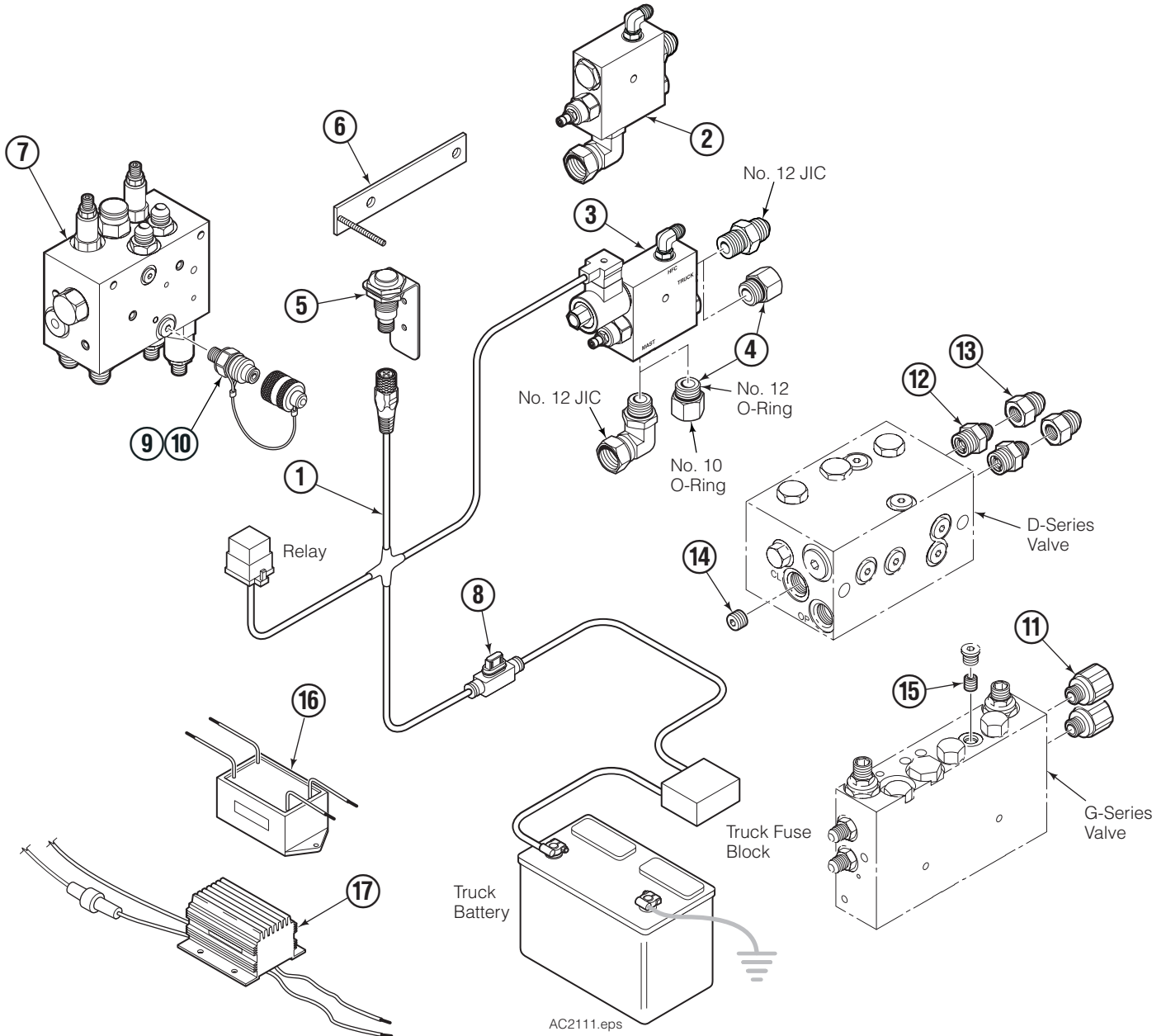
NOTE: When adjusting cartridges, turn in 1/2 turn increments.



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.

PARTS

HYDRAULIC FORCE CONTROL KITS



REF	QTY	HFC No Switch PART NO.	HFC 12V PART NO.	HFC 24V-48V PART NO.	DESCRIPTION
		6812531	6812477	6812494	HFC Kit
		—	6097464	6097465	Switch Group ▲
		6809723	6809723	6809723	Valve Kit ■
		—	—	217932	Voltage Converter Kit ◆
1	1	—	6095957	6095957	Wire Harness
2	1	6812529	—	—	Equalizer Valve – No Switch ✕
3	1	—	6810190	6810190	Equalizer Valve – With Switch ✕
4	2	6802656	6802656	6802656	Fitting, 12-10
5	1	—	6095969	6095969	Switch Assembly
6	1	—	6095839	6095839	Switch Mounting Bracket
7	1	6809010	6809010	6809010	HFC Valve ● ❖
8	1	—	6017897	6017897	Fuse - 5 amp
9	1	6006014	6006014	6006014	Test Point Fitting, 6-6
10	2	6004478	6004478	6004478	Test Point Fitting, 4-4
11	2	6812270	6812270	6812270	Reducer Fitting, 6-8
12	2	6809724	6809724	6809724	Fitting, 8-6
13	1	6203694	6203694	6203694	Adapter Fitting, 6-8
14	1	5304	5304	5304	Plug, 3/16 dia.
15	1	6603	6603	6603	Plug, .25 dia. NPTF
16	1	—	—	6061953	Voltage Filter
17	1	—	—	6064659	Power Converter
18	1	6034612	6034612	6034612	Pressure Test Kit
19	1	6807816	6807816	6807816	Connector Kit

▲ Includes items 1, 5, 6 and 8.

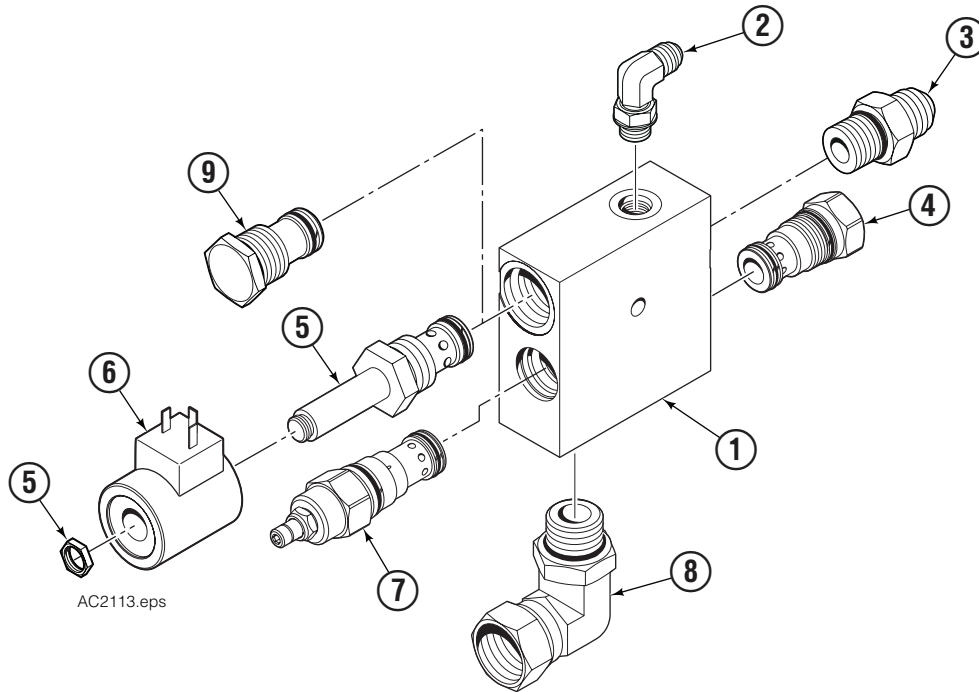
■ Includes items 11-15.

◆ Includes items 16 and 17.

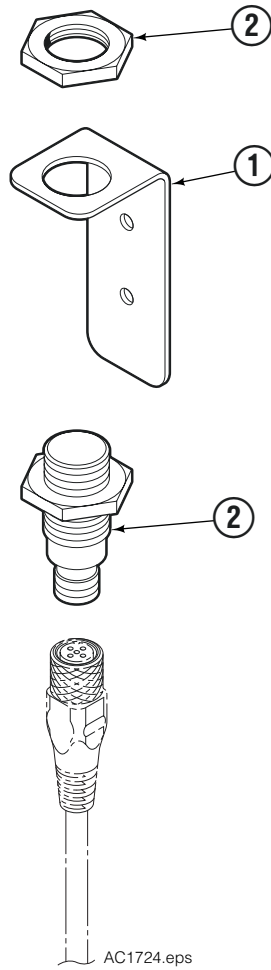
✕ See Equalizer valve page for parts breakdown.

● See HFC valve page for parts breakdown.

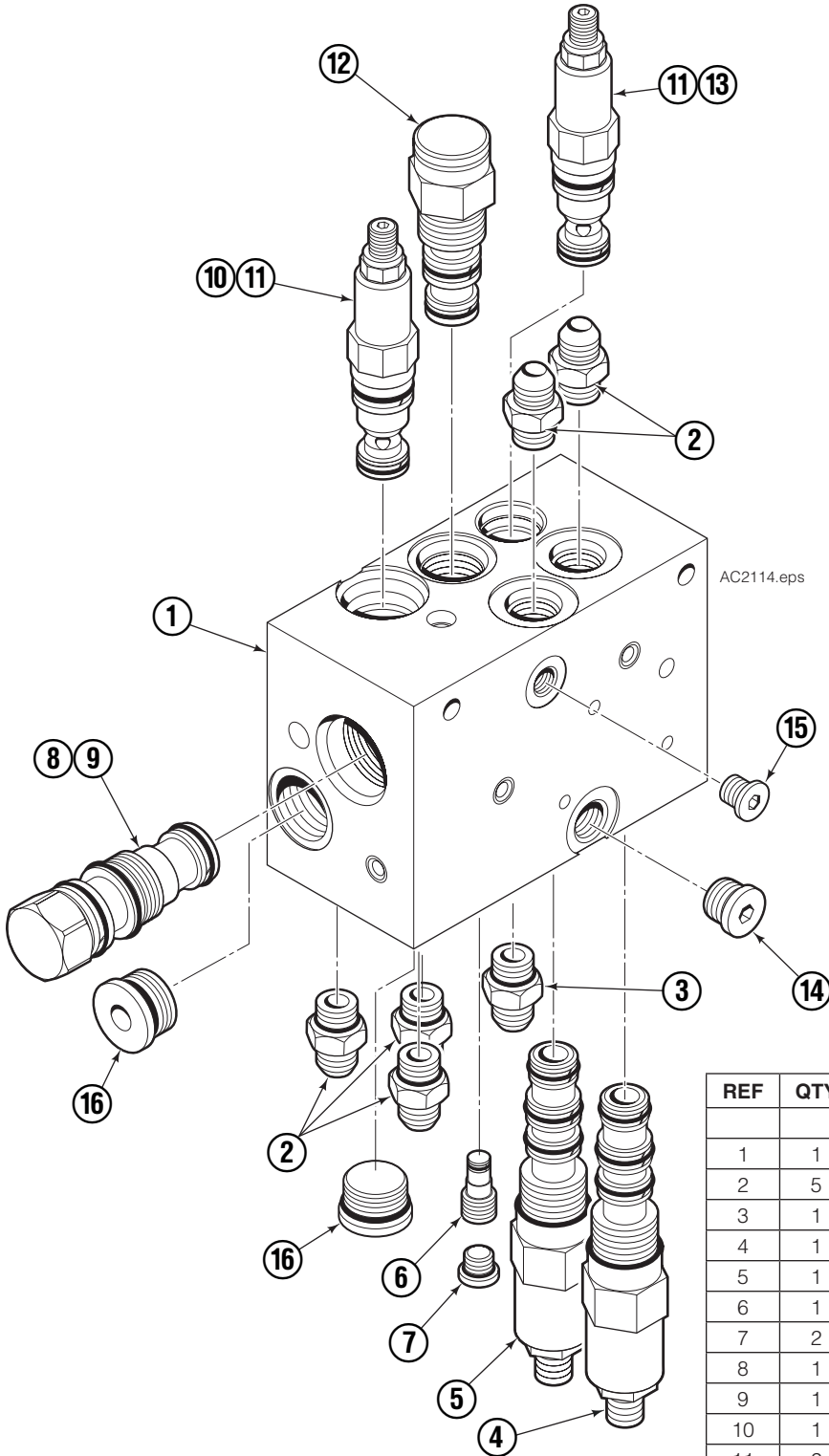
❖ Early production HFC kits used valve 6088041. See Valve 6809010 for service parts.



REF	QTY	PART NO.	PART NO.	DESCRIPTION
		6810190	—	Equalizer Valve – With Switch
		—	6812529	Equalizer Valve – No Switch
1	1	6810191	6810191	Valve Body
2	1	601676	601676	Fitting, 6-6
3	1	611293	611293	Fitting, 12-12
4	1	221191	221191	Check Valve
5	1	6056977	—	Solenoid Valve
6	1	6014287	—	Coil - 12V
7	1	6811045	6811045	Relief Valve Cartridge
8	1	6093794	6093794	Fitting, 12-12
9	1	—	6812497	Plug



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



REF	QTY	PART NO.	DESCRIPTION
		6809010	HFC Valve ❖
1	1	6809011	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	663694	Fitting, 3
16	2	609453	Plug

❖ Early production HFC kits used valve 6088041. All service parts are similar to Valve 6809010.

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 load weight and clamp weight.

Do you have questions you need answered right now?

Call your nearest Cascade Service Department.
Visit us online at www.cascorp.com

AMERICAS

**Cascade Corporation
U.S. Headquarters**
2201 NE 201st
Fairview, OR 97024-9718
Tel: 800-CASCADE (227-2233)
Fax: 888-329-8207

Cascade Canada Inc.
5570 Timberlea Blvd.
Mississauga, Ontario
Canada L4W-4M6
Tel: 905-629-7777
Fax: 905-629-7785

Cascade do Brasil
Rua João Guerra, 134
Macuco, Santos - SP
Brasil 11015-130
Tel: 55-13-2105-8800
Fax: 55-13-2105-8899

EUROPE-AFRICA

**Cascade Italia S.R.L.
European Headquarters**
Via Dell'Artigianato 1
37030 Vago di Lavagno (VR)
Italy
Tel: 39-045-8989111
Fax: 39-045-8989160

Cascade (Africa) Pty. Ltd.
PO Box 625, Isando 1600
60A Steel Road
Sparton, Kempton Park
South Africa
Tel: 27-11-975-9240
Fax: 27-11-394-1147

ASIA-PACIFIC

Cascade Japan Ltd.
2-23, 2-Chome,
Kukuchi Nishimachi
Amagasaki, Hyogo
Japan, 661-0978
Tel: 81-6-6420-9771
Fax: 81-6-6420-9777

Cascade Korea
121B 9L Namdong Ind.
Complex, 691-8 Gojan-Dong
Namdong-Ku
Inchon, Korea
Tel: +82-32-821-2051
Fax: +82-32-821-2055

Cascade-Xiamen
No. 668 Yangguang Rd.
Xinyang Industrial Zone
Haicang, Xiamen City
Fujian Province
P.R. China 361026
Tel: 86-592-651-2500
Fax: 86-592-651-2571

**Cascade India Material
Handling Private Limited**
No 34, Global Trade Centre
1/1 Rambaugh Colony
Lal Bahadur Shastri Road,
Navi Peth, Pune 411 030
(Maharashtra) India
Phone: +91 020 2432 5490
Fax: +91 020 2433 0881

Cascade Australia Pty. Ltd.
1445 Ipswich Road
Rocklea, QLD 4107
Australia
Tel: 1-800-227-223
Fax: +61 7 3373-7333

Cascade New Zealand
15 Ra Ora Drive
East Tamaki, Auckland
New Zealand
Tel: +64-9-273-9136
Fax: +64-9-273-9137

**Sunstream Industries
Pte. Ltd.**
18 Tuas South Street 5
Singapore 637796
Tel: +65-6795-7555
Fax: +65-6863-1368

