

# Hydraulic System Settings and Adjustments

## Section 04-01-05

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# Scope of This Publication

**Hydraulic Settings and Adjustments** contains ESSENTIAL information for owners and maintenance personnel about making certain settings within the hydraulic system. It is ESSENTIAL for all personnel associated with performing maintenance or any type of work on the machine, to become familiar with this information and the instructions contained in the other publications in this manual BEFORE performing any maintenance or repair procedures on the machine.

## Customer Responsibilities and Warranty Advisories

The P&H wheel loaders are warranted in accordance with the warranty policy provided with the machine. The recommended operating and maintenance procedures set forth shall be followed to ensure warranty coverage is not jeopardized. Failure to comply with recommended operating and maintenance procedures may void machine warranty.

Any questions or problems relating to warranty policy or administration should be directed to Komatsu Service Center. Include the model and serial number, in-service date of the machine, and hour meter reading. **We especially draw your attention to the following safety advisors.**

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# Safety

This publication contains special instructions that pertain to safety, operation, maintenance, and repair of the machine. Listed below are the signal words and symbols that precede these instructions and their meanings:



## DANGER

- The danger label indicates a hazardous situation which, if not avoided, will result in death or serious injury.



## WARNING

- The warning label indicates a hazardous situation which, if not avoided, could result in death or serious injury.



## CAUTION

- The caution label, used with the safety alert symbol indicates a hazardous situation which, if not avoided, could result in minor or moderate injury (includes the safety alert symbol .

## CAUTION

- The caution label (without safety alert symbol) is used to address practices not related to personal injury – only equipment damage.

## NOTICE

The NOTICE graphic is to indicate areas of importance to the reader that are not related to personal injury or machine damage.

## Safety, Warnings, and Cautions



## WARNING

### CRUSH HAZARD

- Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.
- Crush hazards exist if standing under, or placing any body part under hoisted/suspended components. Never stand under hoisted/suspended components. Ensure appropriate lifting devices are used, and blocking is adequate to prevent the component from unexpectedly moving during transportation. Refer to SAFETY, WARNINGS, AND CAUTIONS before attempting to

remove components. Failure to stay out from under hoisted/suspended components can cause crush hazard resulting in serious injury or death.

- Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.
- Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.
- Crush hazard exists if all personnel are not cleared from around the bucket and lift arms. Do not allow personnel work around lift arm area during any procedure in which the lift arms will be moved. Failure to clear all personnel from the lift arm area could cause crush hazards resulting in serious injury or death.
- Crush hazards exist if the machine is operated without purging air from the steering system. Do NOT operate the machine until air has been purged from the steering system. Erratic machine movement and loss of steering control could occur if air is not purged from the steering system. Purge air from the steering system before operating the machine. Failure to purge air from the steering system can cause crush hazards resulting in serious injury or death.
- Crush hazards exist in machine pivot area and area between the tires when purging air from the steering cylinders. The frame lock must be in the UNLOCKED position when purging air from the steering cylinders. DO NOT allow personnel in the area between the tires or in the pivot area of the machine. Allowing personnel in the area between the tires or in the pivot area can cause crush hazards resulting in serious injury or death.

#### **CRUSH, SHOCK, OR OTHER HAZARDS**

- Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.

#### **STRUCK-BY OR CUT HAZARDS**

- Struck-by or cut hazards exist when setting pressure on the auxiliary oil cooler circuit pressure relief valve. The auxiliary oil cooler circuit pressure relief valve is in close proximity of the rotating fan. The fan can cause serious cuts. Power down the machine before making any pressure adjustment. Failure to power down the machine prior to making setting adjustments can cause struck-by or cut hazards resulting in serious injury or death.

#### **ENTANGLEMENT HAZARD**

- Entanglement hazard exists when working around the steering pump if the engine is running. Long unconfined hair or loose clothing can get wrapped around the drive shaft. The pump is adjacent to the drive line shaft. Do not make pressure adjustments while the engine is running. Stop the engine and make adjustments. Failure to stop the engine before making adjustments to the steering pump can cause entanglement hazards around the drive shaft resulting in serious injury or death.
- Entanglement hazard exists when working around rotating components if the engine is running. Long unconfined hair or loose clothing can get wrapped around rotating components. Failure to

avoid rotating components while making adjustments can cause entanglement hazards resulting in serious injury or death.

### **STRUCK-BY OR CUT HAZARDS**

- Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. DO NOT tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. DO NOT make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.

### **BURN HAZARDS**

- Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. DO NOT tighten or loosen hydraulic fluid hoses without first relieving the pressure. DO NOT make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.

### **SKIN INJECTION HAZARD**

- Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, NEVER use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. DO NOT tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.



### **BURN HAZARD**

- Burn hazard exists when draining the hydraulic reservoir. Wear all locally required personal protective equipment (PPE) and prevent any bodily contact with oil. If the oil is still hot, it can cause serious bodily burns. Failure to wear PPE while draining the reservoir or performing this procedure could cause burn hazards resulting in personal injury.

**CAUTION**

### **ENVIRONMENTAL HAZARD**

- Environmental hazard exists when draining the hydraulic reservoir. The hydraulic reservoir must be drained to prevent an oil spill during this procedure when hydraulic fittings are loosened or removed. The Shock and Suction valves are located below the level of oil in the Hydraulic Reservoir. These valves are directly connected through a return line to the hydraulic reservoir. If the valves are removed without draining the Hydraulic Reservoir, a great amount of oil will be spilled. Catch all fluids and dispose of them according to local rules, regulations, and laws.

Failure to drain the reservoir could cause an environmental hazard resulting in environmental contamination.

- Handling and disposal of used oils/fluids may be subject to federal, state and local laws and regulations. Use authorized waste disposal facilities; for example, local collection sites and garages providing authorized facilities for receipt of used oil. If in doubt, contact your state and local environmental authorities or the Environmental Protection Agency for direction on proper handling and disposal of used oil.

# NOTICE

The weights in the table “Weights of major components are only used as an approximate guide for determining proper lifting procedures and equipment. These weights do not include liquids or external hardware in or on components. Always allow a safety margin above these weights.

| Item/Equipment                              | LBS.  | KGS.  |
|---------------------------------------------|-------|-------|
| Hoist Cylinder                              | 4,200 | 1,905 |
| Bucket Cylinder                             | 2,700 | 1,225 |
| Steering Cylinder                           | 800   | 363   |
| Hydraulic Reservoir                         | 2,300 | 1,043 |
| Hydraulic Pump Gearbox                      | 3,000 | 1,361 |
| Fast Hoist control valve (single spool)     | 200   | 91    |
| Hoist and Bucket control valve (dual spool) | 300   | 136   |

**Table 1. Weights of major components (L-1350)**

| Item/Equipment                              | Standard Lift |       | High Lift |       |
|---------------------------------------------|---------------|-------|-----------|-------|
|                                             | LBS.          | KGS.  | LBS.      | KGS.  |
| Hoist Cylinder                              | 5,600         | 2,540 | 5,600     | 2,540 |
| Bucket Cylinder                             | 3,300         | 1,496 | 3,700     | 1,678 |
| Steering Cylinder                           | 800           | 363   | 800       | 363   |
| Hydraulic Reservoir                         | 2,300         | 1,678 | 2,300     | 1,678 |
| Hydraulic Pump Gearbox                      | 3,000         | 1,361 | 3,000     | 1,361 |
| Fast Hoist Control Valve (single spool)     | 200           | 91    | 200       | 91    |
| Hoist and Bucket Control Valve (dual spool) | 300           | 136   | 300       | 136   |

**Table 2. Weights of major components (L-1850)**

| Item/Equipment                              | Standard Lift |       |
|---------------------------------------------|---------------|-------|
|                                             | LBS.          | KGS.  |
| Hoist Cylinder                              | 5,600         | 2,540 |
| Bucket Cylinder                             | 3,000         | 1,361 |
| Steering Cylinder                           | 800           | 363   |
| Hydraulic Reservoir                         | 2,300         | 1,043 |
| Hydraulic Pump Gearbox                      | 3,000         | 1,361 |
| Fast Hoist Control Valve (single spool)     | 200           | 91    |
| Hoist and Bucket Control Valve (dual spool) | 300           | 136   |

**Table 3. Weights of major components (L-2350)**

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# Lubrication and Fluid Specifications

| Component                              | Model and Engine |         | Capacity   |            | Lubricant or Fluid                                  |
|----------------------------------------|------------------|---------|------------|------------|-----------------------------------------------------|
| Engine Crankcase<br>(includes filters) | L-1350           | Detroit | 58 gallons | 219 liters | Refer to engine<br>manufacturer's<br>specifications |
|                                        |                  | Cummins | 48 gallons | 182 liters |                                                     |
|                                        | L-1850           | Detroit | 50 gallons | 189 liters |                                                     |
|                                        |                  | Cummins | 54 gallons | 204 liters |                                                     |
|                                        | L-2350           | Detroit | 60 gallons | 207 liters |                                                     |
|                                        |                  | Cummins | 58 gallons | 219 liters |                                                     |

**Table 4. Engine crankcase capacity**

| Component             | Model and Engine |         | Capacity    |            | Lubricant or Fluid                            |
|-----------------------|------------------|---------|-------------|------------|-----------------------------------------------|
| Engine Cooling System | L-1350           | Detroit | 101 gallons | 382 liters | Refer to engine manufacturer's specifications |
|                       |                  | Cummins |             |            |                                               |
|                       | L-1850           | Detroit | 110 gallons | 416 liters |                                               |
|                       |                  | Cummins |             |            |                                               |
|                       | L-2350           | Detroit | 130 gallons | 492 liters |                                               |
|                       |                  | Cummins |             |            |                                               |

**Table 5. Engine cooling system capacity**

| Component                      | Model  |                   | Capacity   |            | Fluid                                                    |
|--------------------------------|--------|-------------------|------------|------------|----------------------------------------------------------|
| Drive Module Cooling<br>System | L-1350 | Coolant Reservoir | 31 gallons | 117 liters | Use engine<br>manufacturer's<br>Engine<br>specifications |
|                                | L-1850 | Coolant Reservoir | 40 gallons | 151 liters |                                                          |
|                                | L-2350 | Coolant Reservoir | 41 gallons | 155 liters |                                                          |

**Table 6. Drive module cooling system capacity**

| Component           | Model  | Capacity    |              | Lubricant or Fluid                                                     |
|---------------------|--------|-------------|--------------|------------------------------------------------------------------------|
| Hydraulic Reservoir | L-1350 | 375 gallons | 1,419 liters | See following chart for approved<br>oils for a given temperature range |
|                     | L-1850 | 375 gallons | 1,419 liters |                                                                        |
|                     | L-2350 | 382 gallons | 1,446 liters |                                                                        |

**Table 7. Hydraulic reservoir capacity**

## CAUTION

Be sure all lubrication/oil is suitable for the climate at your location. See your oil vendor to assure the oil will flow at minimum temperature experienced. Using lubricants other than what is specified by the manufacturer (including viscosity differences) can cause severe damage to components

# Hydraulic Oil Lubrication Requirements

## General Requirements

Hydraulic oils used in Komatsu loaders must be category HV oils with improved viscosity/temperature properties, and zinc additives for wear in addition to those modifiers to inhibit oxidation, foam, rust, and corrosion.

## ISO Viscosity Grade

ISO viscosity grade of hydraulic oil must be as follows:

| Hydraulic System Operating Temperature Range* | ISO Viscosity Grade |
|-----------------------------------------------|---------------------|
| 45°C to 60°C (113°F to 140°F)                 | 32                  |
| 49°C to 74°C (120°F to 165°F)                 | 46                  |
| 57°C to 85°C (135°F to 185°F)                 | 68                  |

\* Arctic conditions are defined as an ambient temperature consistently below 0°F (-18°C). These conditions represent a specialized field where extensive use is made of heating equipment before starting, and/or use specially developed oils for arctic conditions, such as synthetics.

## Hydraulic Oil Properties

Properties of oil must comply with the following table:

| Property                                                         | Value        |              |              |
|------------------------------------------------------------------|--------------|--------------|--------------|
|                                                                  | ISO 32 Grade | ISO 46 Grade | ISO 68 Grade |
| Kinematic Viscosity at 40°C (cSt), min                           | 28.8-35.2    | 41.4-50.6    | 61.2-74.8    |
| Kinematic Viscosity at 100°C (cSt), min                          | 5.0          | 6.1          | 7.8          |
| Viscosity Index, minimum                                         | 150          | 140          | 140          |
| Pour point, maximum <sup>1</sup>                                 | -30°C        | -30°C        | -25°C        |
| FZG Gear Scuffing (ISO 14635-1) Failure Load Stage, min.         | 10           | 10           | 10           |
| Vane Pump Testing (DIN 51389-2) mass loss in mg, ring/vane, max. | 120/30       | 120/30       | 120/30       |
| Copper Corrosion (DIN EN ISO 2160 – 3 hrs@100°C), max            | 2            |              |              |
| Foaming (ISO 6247) maximum (ml/ml)                               | 150/0        |              |              |
| Rust protection (DIN ISO 7120, Proc. A)                          | Passed       |              |              |

<sup>1</sup> Oil with different pour point may be used, provided the pour point is 5°C lower than the minimum ambient temperature.

## Special Conditions

Special operating conditions or limited hydraulic oil availability may necessitate the use of oils having properties that fall outside this specification. Approval for use of these oils will be considered on a case-by-case basis. The use of non-recommended oils or the mixing of incompatible oils may damage components and void the warranty. Refer to the following information for a list of approved oils.

## Approved Oils

Hydraulic oils listed in the following table are granted approval for use in loaders, within the specifications and conditions stated for each. Oils may be submitted for approval by providing the associated product data sheet to the Komatsu Mining Products engineering department. Oils submitted for approval will be considered on a case-by-case basis. Some may be required to go through a performance trial period prior to approval that is at the user's risk. Length of trial period will be determined by engineering review of the oil properties. The use of non-recommended oils or the mixing of incompatible oils may damage components and void the warranty. Approvals may be revoked at any time without notice.

Properties of the oil and conditions for use must comply with the following table:

| Source  | Description        | Nominal Operating Temp (deg.C) <sup>1</sup> | ISO Viscosity Grade | Kinematic Viscosity |                | Viscosity Index | Flash Point (deg.C) | Pour Point (deg.C) | Denison Spec | Rexroth Spec | Conditions / Notes               |
|---------|--------------------|---------------------------------------------|---------------------|---------------------|----------------|-----------------|---------------------|--------------------|--------------|--------------|----------------------------------|
|         |                    |                                             |                     | at 40°C (cSt)       | at 100°C (cSt) |                 |                     |                    |              |              |                                  |
| BP      | Bartran HV         | 57-85                                       | 68                  | 70.5                | 10.8           | 142             | 208                 | -39                |              | Yes          | approval based on history of use |
| BP      | HLP-HM             | 45-65                                       | 46                  | 46.0                | 6.8            | 95              | 215                 | -27                | HF-0         | RE90220      |                                  |
| BP      | HLP-HM             | 55-75                                       | 68                  | 68.0                | 8.8            | 95              | 226                 | -24                | HF-0         | RE90220      | approval based on history of use |
| Caltex  | Rando HD           | 45-65                                       | 46                  | 44.0                | 6.8            | 110             | 238                 | -33                | HF-0         | ---          | approval based on history of use |
| Castrol | Hyspin AWH-M       | 45-70                                       | 46                  | 46                  | 8.32           | 150             | 215                 | -42                | HF-0         | RE90220      |                                  |
| Fuchs   | Renolin B HVI Plus | 47-73                                       | 46                  | 46                  | 8.1            | 149             | 186                 | -45                | HF-0         | ---          | approval based on history of use |
| Mobil   | DTE 10 Excel       | 38-62                                       | 32                  | 32.7                | 6.6            | 164             | 250                 | -54                | HF-0         | RE90220-01   |                                  |
| Mobil   | DTE 10 Excel       | 46-72                                       | 46                  | 45.6                | 8.5            | 164             | 232                 | -45                | HF-0         | RE90220-01   | Ref. Komatsu p/n 4123226         |
| Mobil   | DTE 10 Excel       | 57-84                                       | 68                  | 68.4                | 11.2           | 156             | 240                 | -39                | HF-0         | RE90220-01   |                                  |
| Mobil   | DTE 20 (25)        | 45-65                                       | 46                  | 44.2                | 6.7            | 98              | 232                 | -27                | HF-0,-1,-2   | ---          |                                  |
| Mobil   | Mobilfluid 424     | 51-77                                       | ---                 | 55.0                | 9.3            | 145             | 198                 | -42                | HF-0,-1,-2   | Approved     | Ref. Komatsu p/n 4123226         |
| Shell   | Tellus S3 M        | 46-67                                       | 46                  | 46                  | 6.8            | 105             | 220                 | -33                | HF-0,-1,-2   | ---          | approval based on history of use |
| Shell   | Tellus S68         | 54-77                                       | 68                  | 68                  | 8.7            | 97              | 222                 | -30                | HF-0,-1,-2   | Yes          | approval based on history of use |
| Shell   | Tellus S100        | 63-86                                       | 100                 | 100                 | 11.2           | 96              | 234                 | -24                | ---          | Yes          | approval based on history of use |
| Shell   | Tellus 68          | 54-77                                       | 68                  | 68                  | 8.7            | 98              | 225                 | -27                | HF-0,-1,-2   | Yes          | approval based on history of use |

1. Approval based on oil operating temperatures within range shown.

**Table 8. Approved hydraulic oils**

| Model                                                                                                               | Component                                    | Capacity  |           | Lubrication                                              |
|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------|-----------|----------------------------------------------------------|
| L1350/L1850/L2350                                                                                                   | Hydraulic Pump<br>Drive Gearbox <sup>2</sup> | 7 gallons | 27 liters | SAE 75W-140W synthetic gear oil or SAE 80W-90W gear oil. |
| 1 ARCTIC CONDITIONS represent a specialized field where extensive use is made of heating equipment before starting. |                                              |           |           |                                                          |
| 2 Refer to Section 3 of this manual. The hydraulic pump drive gearbox is factory equipped with synthetic oil.       |                                              |           |           |                                                          |

**Table 9. HPD gearbox fluid specifications**

## Planetary Drive (Driver) General Lubrication Requirements

Lubricants used in Komatsu wheel loader planetary drives (drivers) must be synthetic gear oils with EP additive packages.

| Component       | Model and Size |      | Capacity   |            | Lubricant                                  |
|-----------------|----------------|------|------------|------------|--------------------------------------------|
| Planetary Drive | L-1350         | 51A3 | 36 gallons | 135 liters | see following chart for approved lubricant |
|                 | L-1850         | 57   | 40 gallons | 151 liters |                                            |
|                 | L-2350         | 57   | 40 gallons | 151 liters |                                            |

**Table 10. Planetary drive (drivers) capacities**

## ISO Viscosity Grade

ISO viscosity grade of lubricant must be as follows for individual drivers: (see exception in endnote #3)

| Driver                                                                                    | Conditions |         |
|-------------------------------------------------------------------------------------------|------------|---------|
|                                                                                           | Standard   | Arctic* |
| 51A3                                                                                      | 460        | 220     |
| 57                                                                                        | 460        | 220     |
| * Arctic conditions are defined as an ambient temperature consistently below 0°F (-18°C). |            |         |

**Table 11. Planetary drive lubricant viscosity grade**

## Lubricant properties

Properties of lubricant must comply with the following table: (see exception in endnote #3)

| Property                                                        | Value          |               |
|-----------------------------------------------------------------|----------------|---------------|
|                                                                 | ISO 220 Grade  | ISO 460 Grade |
| Kinematic Viscosity at 40°C (cSt)                               | 198-242        | 414-506       |
| Kinematic Viscosity at 100°C, minimum (cSt)                     | 25             | 45            |
| Viscosity Index, minimum                                        | 150            |               |
| Pour point, maximum <sup>1</sup>                                | -36°C          |               |
| 4-Ball EP Test (ASTM D2783): Weld load (kg) <sup>2</sup>        | 250            |               |
| Timken OK Load (lb.) <sup>2</sup>                               | 60             |               |
| FZG Gear Scuffing (ISO 14635-1) Pass Stage                      | 12             |               |
| Copper Corrosion (ASTM D130 – 3 hrs@100°C)                      | 1B             |               |
| Foaming (ASTM D892, Sequence I, II, III) maximum values (ml/ml) | 5/0, 10/0, 5/0 |               |
| Rust protection (ASTM D665 – Method B)                          | Pass           |               |

## Endnotes

<sup>1</sup> Lubricant with higher pour point may be used, provided the pour point is 5°C lower than the minimum ambient temperature.

<sup>2</sup> Oil manufacturer may report either 4-Ball EP test or Timken OK load. However, if both results are reported, fluid must meet requirements of both tests.

<sup>3</sup> **Mobil SHC Gear OH** is available in a lowest viscosity grade of 320. However, this upgraded lubricant will outperform the older-technology MobilGear SHC 220 in arctic temperatures due to its higher viscosity index and lower pour point.

**Table 12. Planetary drive lubrication properties**

## Automatic Lubrication System

| **Type of Grease                                                                                                                                                                                                                                  | **Minimum Ambient Temperature | **Grease Grade  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-----------------|
| Pumpable auto lube grease fortified with extremely high pressure and anti-wear properties for slow speed, high shock application<br><br>The grease is required to have minimum 3% to maximum 5% MoS <sub>2</sub> "Molybdenum Disulfide" additive. | +70°F (+20°C) and above       | NLGI #2 grease  |
|                                                                                                                                                                                                                                                   | +50°F (+10°C) and above       | NLGI #1 grease  |
|                                                                                                                                                                                                                                                   | +10°F(-12°C) to 50°F(+10°C),  | NLGI #0 grease  |
|                                                                                                                                                                                                                                                   | -30°F(-34°C) to +10°F(-12°C)  | NLGI #00 grease |

## CAUTION

**\*\* The values listed for grade and temperature in the table GREASE SPECIFICATIONS are only general guidelines for grease grade. Grease specifications can vary widely, depending on the location where the grease was blended and local conditions. Each grease meeting the 3-5% Molybdenum Disulfide requirement should also have the Lincoln Ventmeter number verified to make sure it meets system requirements. Use of incorrect grease that does not meet the Ventmeter specification may cause pump problems and the injectors may not cycle and refill properly.**

**Depending on the characteristics of the grease it is possible that a thicker NLGI grade of grease may be used at lower temperatures than shown in the table GREASE SPECIFICATIONS as long as the grease meets the Lincoln Ventmeter specifications.**

# NOTICE

## LINCOLN VENTMETER SPECIFICATION

At a temperature that is 10°F (5°C) below the minimum ambient temperature to which the machine will be exposed, the Lincoln Ventmeter reading should be:

| Injector Type              | Ventmeter Reading          |
|----------------------------|----------------------------|
| SL-1 injectors             | 500 psi (34.5 bar) or less |
| SL-V and SL-V XL injectors | 900 psi (62.0 bar) or less |

### For Example:

- The minimum mine temperature is 0°F (-17.8°C).

| Mine Site Temperature | Minus | 10°F (5°C) | Equals | Target Temperature |
|-----------------------|-------|------------|--------|--------------------|
| 0°F (-17.8°C)         | minus | 10°F (5°C) | =      | -10°F (-23.3°C)    |

### Examples:

| Grease/Grade | Ventmeter Reading  | Target Temperature | ACCEPTABILITY |
|--------------|--------------------|--------------------|---------------|
| Brand XYZ    | 900 psi (62 bar)   | 15°F (-9.4°C)      | UNACCEPTABLE  |
| Brand ABC    | 400 psi (27.6 bar) | -10°F (-23.3°C)    | ACCEPTABLE    |

The Lincoln Ventmeter test is typically performed by Lincoln and/or the grease manufacturer, by using a ventmeter tool as shown.



|                     |                                    |        |         |                 |
|---------------------|------------------------------------|--------|---------|-----------------|
| <b>All Machines</b> | Lincoln Automatic Lubrication Pump | 15 oz. | 444 ml. | 10W30 motor oil |
|---------------------|------------------------------------|--------|---------|-----------------|

**Table 13. Auto lube pump lubrication and grease specifications**

## Hydraulic Pump Gearbox (HPD) Pump Arrangement

| Model/Fan          | Main | Fast Hoist | Steering                                 | Blower | Fan | Accessory | Circulation |
|--------------------|------|------------|------------------------------------------|--------|-----|-----------|-------------|
| L-1350<br>8-Blade  | 3    | 1          | 2 (tandem)                               | Tandem |     | 1         | 1           |
| L-1850<br>8 Blade  | 3    | 1          | 2 (tandem)                               | Tandem |     | 1         | 1           |
| L-1850<br>11 Blade | 3    | 1          | 2 (tandem)                               | 1      | 1   | 1         | 1           |
| L-2350<br>8 Blade  | 3    | 1          | 2<br>(one mounted on<br>fast hoist pump) | Tandem |     | 1         | 1           |
| L-2350<br>11 Blade | 3    | 1          | 2<br>(one mounted on<br>fast hoist pump) | 1      | 1   | 1         | 1           |

**Table 14. Pump Arrangement**

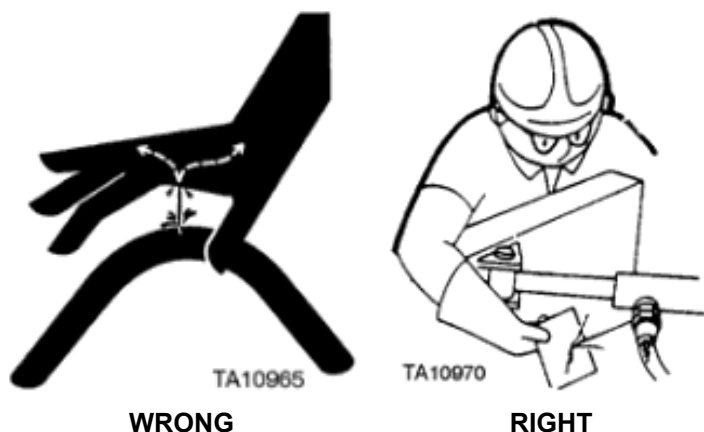
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## Service Advisories and Precautions

The following service advisories and precautions should be observed in the maintenance of the loader's hydraulic system:

### WARNING

Skin injection hazard exists when around diesel fuel, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids. Always read the instructions and have appropriate training in the use of the test bench that is being used. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.



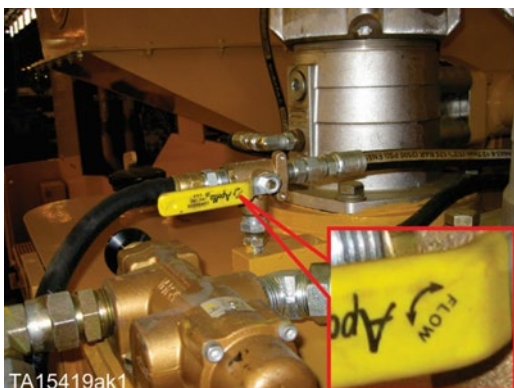
### NOTICE

Using the Manual Bleed Valve Assembly is the only way to lower the lift arms or relieve system pressure from the hoist and bucket circuits if the engine is not running.

### WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is **NOT** running. Before using the Manual Bleed Valve Assembly, refer to "HYDRAULIC AND GREASE SYSTEMS", "MANUAL BLEED VALVE ASSEMBLY", in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

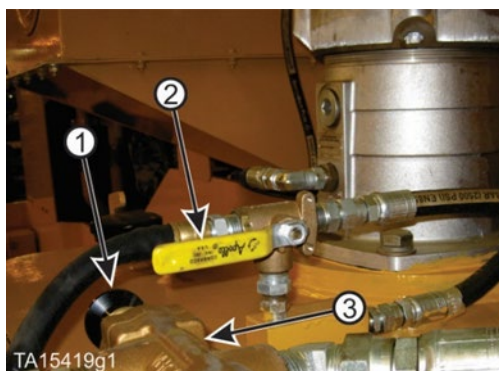
ALWAYS release air pressure in the hydraulic oil reservoir before servicing or repairing anything requiring removal of the reservoir filler cap or the return filter assemblies. Release of the reservoir air pressure is done by moving the manual air release valve handle, located on top of the hydraulic reservoir, to the OPEN position. The air pressure in the reservoir will be released, and at the same time, the valve will lock in the air pressure in the rest of the system. After servicing, repairing, or inspecting the hydraulic oil reservoir, make certain to move the air release valve handle to the CLOSED position, (see illustration "Hydraulic reservoir air release valve") to allow the reservoir to pressurize.



## NOTICE

There is a small "arc arrow" on the handle of the valve that shows the air path direction when the handle is moved in either position.

"Arc Arrow" showing direction of air path



1) Reset plunger 2) Manual air release valve (reservoir pressurized) 3) Automatic air release valve

Hydraulic reservoir air release valve

## NOTICE

**When the hydraulic system is opened for service or repair, the hydraulic pumps must be primed (release of air entrapped in oil) to prevent aeration or cavitation.**

When the emergency stop or fire suppression systems are actuated, the automatic air release valve, located on top of the hydraulic reservoir, will automatically release air pressure from the hydraulic reservoir. Once tripped, the valve must be manually reset by pushing the plunger IN to the closed position.

## CAUTION

Handling and disposal of used oils may be subject to federal, state and local laws and regulations. Use authorized waste disposal facilities; for example, local collection sites and garages providing authorized facilities for receipt of used oil. If in doubt, contact your state and local environmental authorities or the Environmental Protection Agency for direction on proper handling and disposal of used oil.



## WARNING

Crush hazards exist if standing under, or placing any body part under hoisted/suspended components. Never stand under hoisted/suspended components. Ensure appropriate lifting devices are used, and blocking is adequate to prevent the component from unexpectedly moving during transportation. Refer to SAFETY, WARNINGS, AND CAUTIONS before attempting to remove components. Failure to stay out from under hoisted/suspended components can cause crush hazard resulting in serious injury or death.



## WARNING

Struck-by or cut hazards exist when setting pressure on the auxiliary oil cooler circuit pressure relief valve. The auxiliary oil cooler circuit pressure relief valve is in close proximity of the rotating fan. The fan can cause serious cuts. Power down the machine before making any pressure adjustment. Failure to power down the machine prior to making setting adjustments can cause struck-by or cut hazards resulting in serious injury or death.



1. Alternate Height Switch
2. Bucket Return To Dig
3. Drive Enable Switch
4. Hazard Switch
5. Throttle Switch
6. Front Windshield Wiper Switch
7. Rear Window Wiper Switch
8. Front Windshield Washer Switch

9. Rear Window Washer Switch
10. Not Used
11. Alternate Speed Switch
12. Auto Lube Switch
13. Alternate Torque Switch
14. Cruise Switch
15. Beacon Switch
16. Light Switch

Overhead keypad

 **WARNING**

Entanglement hazard exists when working around rotating components if the engine is running. Long unconfined hair or loose clothing can get wrapped around rotating components. Failure to avoid rotating components while making adjustments can cause entanglement hazards resulting in serious injury or death.

 **WARNING**

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. **DO NOT** tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.

 **WARNING**

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. **DO NOT** tighten or loosen hydraulic fluid hoses without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.

 **WARNING**

Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

GEN 3 Hydraulic Specifications Sheet

|                                                                                                     | All pressures with Engine at High Throttle | Procedure paragraph number | L-1350                                     | L-1850                                                                       | L-2350                                                                       |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------|--------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------|
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Govenor                                                                                             | System air pressure                        | A                          | 130psi +5 /-0                              | 130psi +5 /-0                                                                | 140psi +5 /-0                                                                |
| KLENZ                                                                                               | KLENZ regulator air pressure               | B                          | 90 PSI                                     | 90 PSI                                                                       | 90 PSI                                                                       |
| Hyd Res Air                                                                                         | Hydraulic Reservoir regulator              | C                          | 4 to 6 psi                                 | 4 to 6 psi                                                                   | 4 to 6 psi                                                                   |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Engine Fan Circuit                                                                                  | Fan Pump (Stand by) - Idle                 | D                          | 450 ± 50 (Stand-by)                        | 450 ± 50 (Stand-by)                                                          | 450 ± 50 (Stand-by)                                                          |
|                                                                                                     | Fan Pump (Compensator) - High              | D                          | 820 RPM @ 1900 Eng RPM                     | 820 RPM @ 1900 Eng RPM (8 blade fan)<br>RPM @ 1900 Engine RPM (11 blade fan) | 820 RPM @ 1900 Eng RPM (8 blade fan)<br>RPM @ 1900 Engine RPM (11 blade fan) |
|                                                                                                     | Fan Remote Relief - High                   | D                          | 800 RPM (Max) @ 1900 Eng RPM               | 800 RPM @ 1900 Eng RPM (8 blade fan)<br>RPM @ 1900 Engine RPM (11 blade fan) | 800 RPM @ 1900 Eng RPM (8 blade fan)<br>RPM @ 1900 Engine RPM (11 blade fan) |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Blower Circuit                                                                                      | Blower Pump (Stand by)                     | E                          | 450 ± 50 (Stand-by)                        | 450 ± 50 (Stand-by)                                                          | 450 ± 50 (Stand-by)                                                          |
|                                                                                                     | Blower Pump (Compensator)                  | E                          | 3400 RPM @ Eng 1900                        | 3400 RPM @ Eng 1900                                                          | 3400 RPM @ Eng 1900                                                          |
|                                                                                                     | Blower Remote Relief                       | E                          | 3100 RPM @ 1900 Eng RPM                    | 3100 RPM @ 1900 Eng RPM                                                      | 3100 RPM @ 1900 Eng RPM                                                      |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Accessory Pump                                                                                      | Accessory Pump Compensator                 | F                          | 2500psi ± 20                               | 2500psi ± 20                                                                 | 2500psi ± 20                                                                 |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Pilot Circuit                                                                                       | Pilot Pressure Relief Valve                | G                          | 450 ± 10                                   | 450 ± 10                                                                     | 450 ± 10                                                                     |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Driver Filtration                                                                                   | Sequence Valve                             | H                          | 2200psi ± 20                               | 2200psi ± 20                                                                 | 2200psi ± 20                                                                 |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Hoist / Bucket Circuit                                                                              | Main Valve Relief                          | I                          | 4500 psi +50 -0                            | 4500 psi +50 -0                                                              | 4500 psi +50 -0                                                              |
|                                                                                                     | Hoist Base Circuit Relief                  | I                          | 4500 psi ± 50                              | 4500 psi ± 50                                                                | 4500 psi ± 50                                                                |
|                                                                                                     | Hoist Rod Circuit Relief                   | I                          | 2000 psi ± 50                              | 2000 psi ± 50                                                                | 2000 psi ± 50                                                                |
|                                                                                                     | Bucket Base Circuit Relief                 | I                          | 4500 psi ± 50                              | 4500 psi ± 50                                                                | 4500 psi ± 50                                                                |
|                                                                                                     | Bucket Rod Circuit Relief                  | I                          | 2000 psi ± 50                              | 2000 psi ± 50                                                                | 2000 psi ± 50                                                                |
|                                                                                                     | Hoist & Bucket Pump Compensators           | J                          | 4000 psi +100 / -0                         | 4000 psi +100 / -0                                                           | 4000 psi +100 / -0                                                           |
|                                                                                                     | Secondary Dump Relief                      | K                          | 800 ~ 1200 psi ± 50                        | 800 psi ± 50                                                                 | 800 psi ± 50                                                                 |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Steer Circuit                                                                                       | Steering Main Relief (Flow Amp)            | L                          | Turn in Full                               | Turn in Full                                                                 | Turn in Full                                                                 |
|                                                                                                     | Steering Remote Relief (L950 & L1150)      | L                          | N/A                                        | N/A                                                                          | N/A                                                                          |
|                                                                                                     | Steering Pump (Stand By)                   | M                          | 450 ± 50 (Stand-by)                        | 450 ± 50 (Stand-by)                                                          | 450 ± 50 (Stand-by)                                                          |
|                                                                                                     | Steering Pump (Compensator)                | M                          | 3400 psi ± 50                              | 3400 psi ± 50                                                                | 3600 psi ± 50                                                                |
|                                                                                                     | Steering Crossover Relief Valve            | M1                         | N/A                                        | N/A                                                                          | 4300 psi ± 50                                                                |
|                                                                                                     | Shock and Suction (Flow Amp)               | N                          | 4000 psi ± 50                              | 4000 psi ± 50                                                                | 4000 psi ± 50                                                                |
|                                                                                                     | Relief (PVG)                               | O                          | 4000 psi ± 50                              | 4000 psi ± 50                                                                | 4000 psi ± 50                                                                |
|                                                                                                     | Aux. Steering Relief (L950 & L1150)        | P                          | N/A                                        | N/A                                                                          | N/A                                                                          |
|                                                                                                     | Aux. Steering Relief (L1350 thru L2350)    | Q                          | 2000 psi +50 -0                            | 2000 psi +50 -0                                                              | 2000 psi +50 -0                                                              |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Aux Oil Cooler Circuit                                                                              | Aux oil cooler relief (L950 & L1150)       | R                          | N/A                                        | N/A                                                                          | N/A                                                                          |
|                                                                                                     | Aux Oil Cooler Pump (Stand by) (Idle)      | S                          | 300 psi                                    | 300 psi                                                                      | 300 psi                                                                      |
|                                                                                                     | Aux Oil Cooler Pump (Compensator)          | S                          | 1400 RPM 1050 Hz                           | 1400 RPM 1050 Hz                                                             | 1400 RPM 1050 Hz                                                             |
|                                                                                                     | Aux Remote Relief (High)                   | S                          | 1300 RPM 975 Hz                            | 1300 RPM 975 Hz                                                              | 1300 RPM 975 Hz                                                              |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Gear Box Circuit                                                                                    | Gearbox                                    | Reference                  | 50 to 125 psi at High Throttle             | 50 to 125 psi at High Throttle                                               | 50 to 125 psi at High Throttle                                               |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| AutoLube Circuit                                                                                    | Pressure Reducing Valve                    | Reference                  | 3500 psi (Grease Pressure) Non-Adjustable  | 3500 psi (Grease Pressure) Non-Adjustable                                    | 3500 psi (Grease Pressure) Non-Adjustable                                    |
|                                                                                                     | Flow Control                               | Reference                  | 1.5 to 2 strokes per second Non-Adjustable | 1.5 to 2 strokes per second Non-Adjustable                                   | 1.5 to 2 strokes per second Non-Adjustable                                   |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Cycle Times                                                                                         | Hoist Up                                   |                            | 15 Sec                                     | 16 Sec                                                                       | 17 Sec                                                                       |
|                                                                                                     | Hoist Down                                 |                            | 9-11 Sec                                   | 9-11 Sec                                                                     | 12-14 Sec                                                                    |
|                                                                                                     | Float                                      |                            | 5 Sec                                      | 6 Sec                                                                        | 6 Sec                                                                        |
|                                                                                                     | Bucket Rollback                            |                            | 3-5 Sec                                    | 3-5 Sec                                                                      | 3-5 Sec                                                                      |
|                                                                                                     | Bucket Dump                                |                            | 3 Sec                                      | 4 Sec                                                                        | 3 Sec                                                                        |
|                                                                                                     | Steer Lock to Lock                         |                            | 6 Sec                                      | 6 Sec                                                                        | 6 Sec                                                                        |
|                                                                                                     |                                            |                            |                                            |                                                                              |                                                                              |
| Revision Notes: Replace Steering Remote Relief (L1350 thru L2350) with Steering Crossover Relief M1 |                                            |                            |                                            |                                                                              |                                                                              |

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# Procedures

## Procedure A Compressor Governor Pressure Setting

### Safety Preparations

Follow all local safety prescribed measures. Use appropriate hearing protection. Follow risk assessment of this task. Two people are needed for this task; one to monitor the air system pressure and one to make the needed adjustment.

For numbers in parenthesis, refer to illustration "Location of compressor governor adjusting screw". This governor is located behind the air dryer.



### WARNING

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

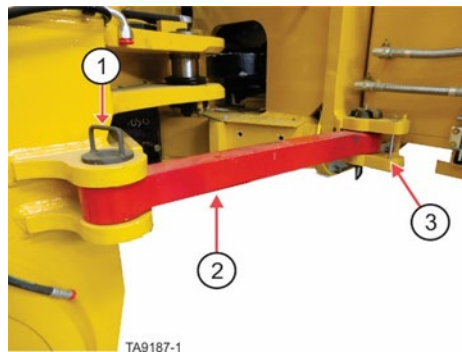
The machine engine must be started and shut down during this procedure.

- Use appropriate hearing protection.
  - Stay clear of all rotating equipment or components
- a. Ensure the bucket is empty and clear of debris.
  - b. Park the machine with the bucket flat on the ground.
  - c. Move the frame lock to the locked position so that the frame cannot be steered.



### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,  
3) Retaining pin bracket for un-locked position

**Figure 1. Frame Lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.



## WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to "HYDRAULIC AND GREASE SYSTEMS", "MANUAL BLEED VALVE ASSEMBLY", in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.



## WARNING

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. DO NOT tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. DO NOT make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.



## WARNING

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. DO NOT tighten or loosen hydraulic fluid hoses without first relieving the pressure. DO NOT make adjustments

to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.

## WARNING

Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

### Setting Procedure

- Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- Open the valve completely and leave it open during the procedure.

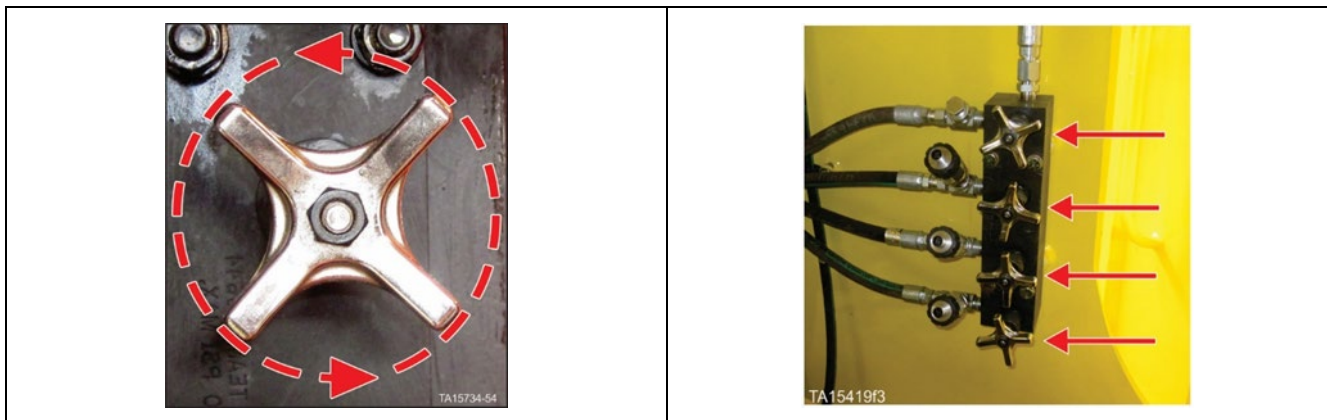
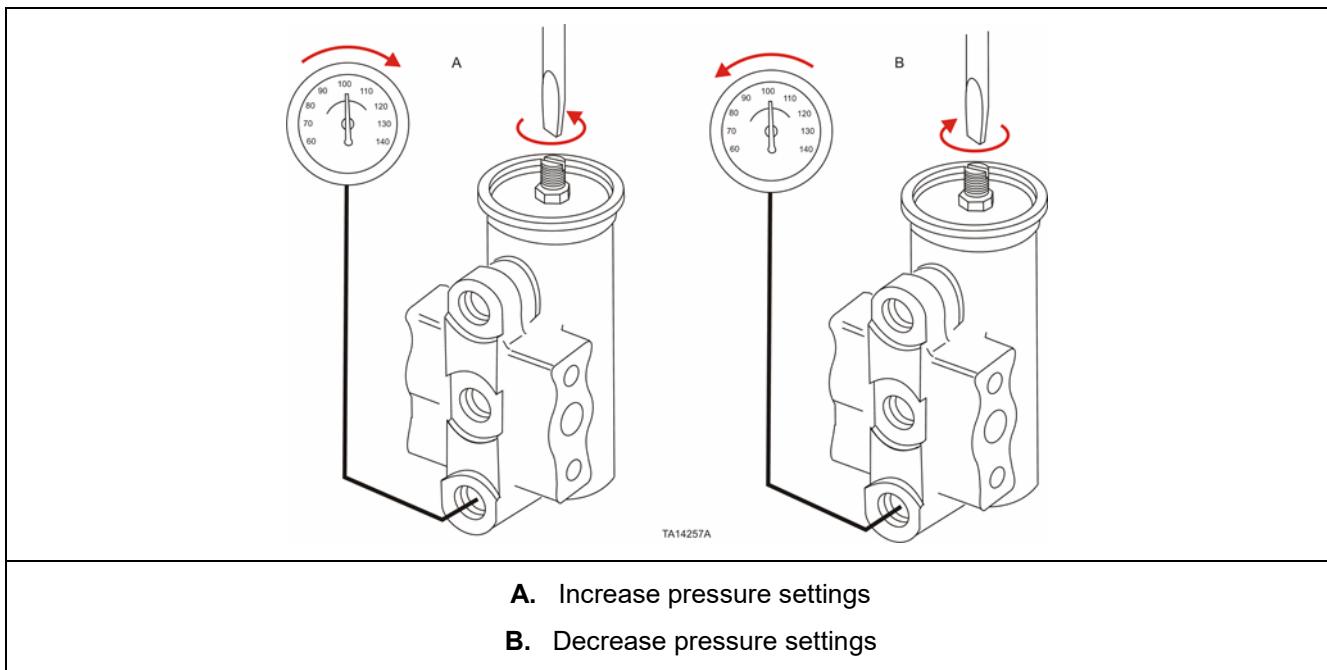
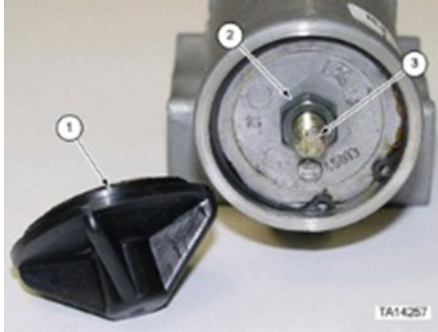


Figure 2. Pressure bleed down valves

**Governor settings**

- d. Remove the protective cap (1) from governor adjustment screw area.
- e. Use a flat blade screwdriver to hold the adjusting screw.
- f. Loosen the adjusting screw jam nut (2).

- g.** Adjust adjustment screw (3) to appropriate pressure setting (per your machine settings).
- To increase the pressure settings, turn the adjusting screw counter-clockwise.
    - ¼ turn increases pressure approximately 4 PSI.
  - To decrease the pressure settings, turn the adjusting screw clockwise.
    - ¼ turn decreases pressure approximately 4 PSI.
- h.** Tighten locking nut (2).
- i.** Reinstall protective cap (1) for governor adjustment screw.



1. Protective cap
2. Locking nut
3. Adjustment screw

**Location of compressor governor adjusting screw**

## Checking for Proper Operation Procedure

- a. With the machine running, monitor the system air pressure in LINCS. Observe system air pressure is increasing, when the pressure setting is reached, the Discharge Line Unloader (DLU) vents to atmosphere. The system air pressure will not rise any more.
- b. Open the manual drain valve until the distribution reservoir pressure reads 20 to 25 psi (1.38-1.7 bar), lower than the governor setting. Close the manual drain valve.
- c. The DLU valve should stop venting to atmosphere and air pressure should again build to the prescribed system air pressure.

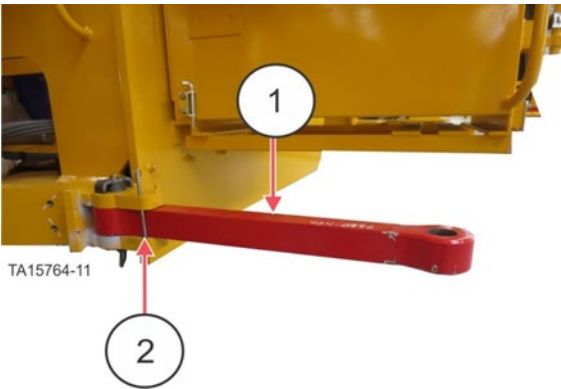


**Location of compressor governor**

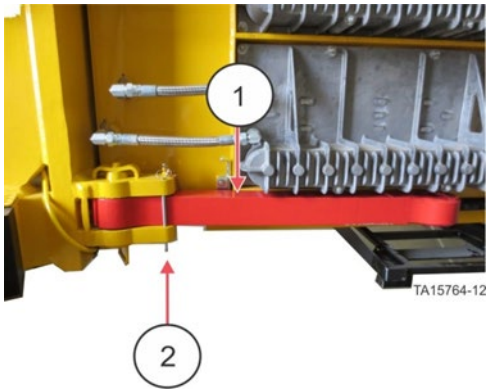


Discharge line unloader (DLU) valve

- d. Follow all local rules and regulations to return the machine to operating condition.
  - Remove the safety link between the frames and secure.



L-1350



L-1850 and L-2350

- 1) Frame lock shown in carry position
- 2) Retaining pin for carry position

## Procedure B

### KLENZ™ Regulator Air Pressure Setting

#### Safety Preparations

Follow all local safety prescribed measures. Follow risk assessment of this task. Two people are needed for this task; one to monitor the air system pressure and one to make the needed adjustment.

#### WARNING

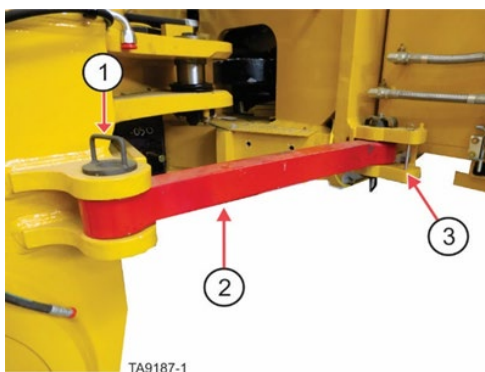
Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine engine must be started and shut down during this procedure.

- Use appropriate hearing protection.
- Stay clear of all rotating equipment or components
- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.

#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,  
3) Retaining pin bracket for un-locked position

Figure 3. Frame Lock in locked position

- d. Place wheel chocks in front and behind each wheel.
- e. Set bucket flat and level on the ground.
- f. Set the parking brakes.

 **WARNING**

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

 **WARNING**

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. DO NOT tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. DO NOT make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.

 **WARNING**

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. DO NOT tighten or loosen hydraulic fluid hoses without first relieving the pressure. DO NOT make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.

 **WARNING**

Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, NEVER use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. DO NOT tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

- g. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- h. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- i. Open the valve completely and leave it open during the procedure.

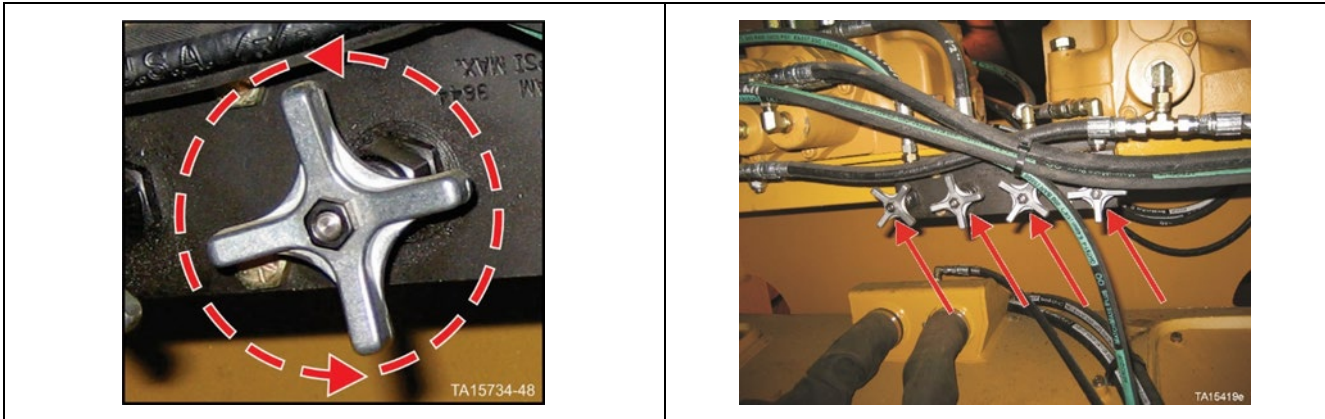


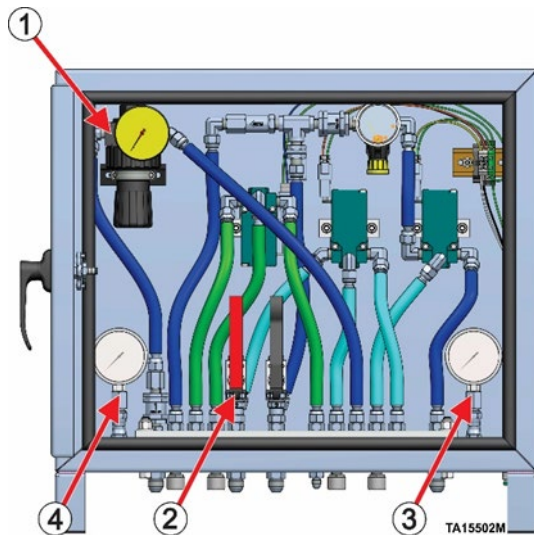
Figure 4. Pressure bleed down valves

## Setting Procedure

### NOTICE

The KLENZ™ air pressure setting procedure requires a minimum stabilization time. Typically, the air pressure settings should stabilize in less than 10 minutes.

- a. Release the air pressure from the KLENZ™ reservoir.
- b. Boot up LINCOS and start the machine using mine specific regulations.
- c. Read the system air pressure on the LINCOS monitoring screen. System air pressure should be correct as listed on the specification sheet.
- d. Engine running at high throttle (1800 rpm).
- e. Push and hold the KLENZ™ manifold shut off valve.



## NOTICE

The handle #2 in the opposite picture is not painted red on the machine. It is only painted red in the opposite picture for clarity purposes.

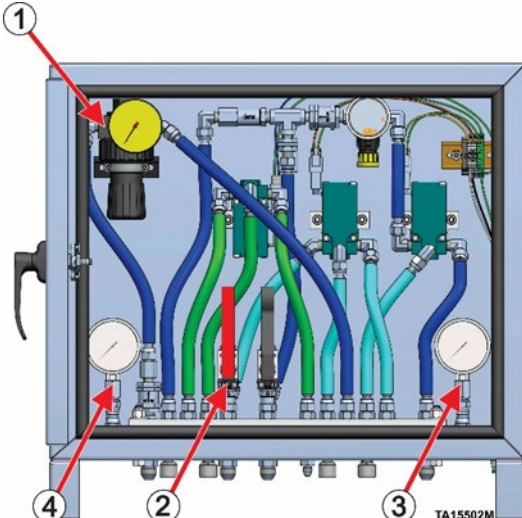
- 1) air pressure regulator 2) KLENZ™ manifold shut-off valve  
3) KLENZ™ reservoir pressure (reference) 4) system air pressure (reference)

- f. Read the KLENZ™ pressure on the LINC'S monitoring screen (gauge reading may be used for reference, but LINC'S relies on pressure transducer connected to the KLENZ™ reservoir). While holding the shut off valve closed, adjust the pressure regulator to set the KLENZ™ pressure to 90 psi.
- Pull down on the pressure regulator adjustment cap to unlock.

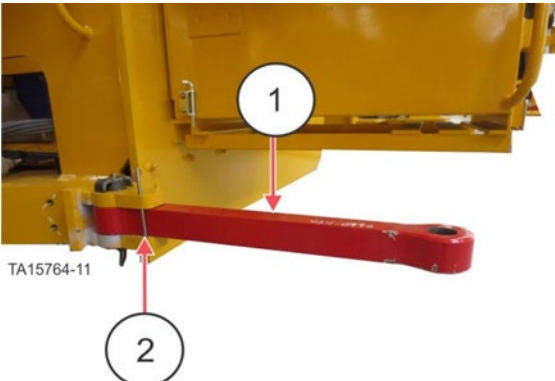
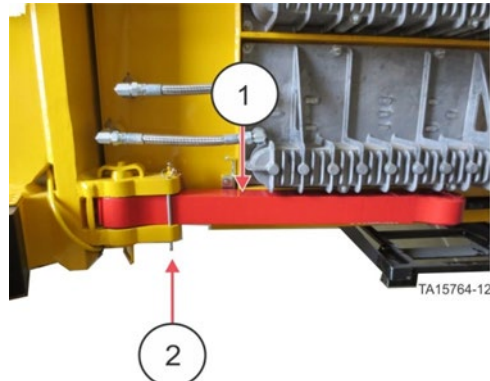
## NOTICE

The handle must be pressed the entire time. This handle shuts off air going to the KLENZ™ Manifold which is located in the KLENZ™ structure. Releasing the handle allows air to flow to the KLENZ™ Manifold which greatly increases the stabilizing time.

- g. Once the pressure is stabilized and is correctly set, release the red handle (see NOTICE below). The pressure should drop momentarily and then build and stabilize at the correct pressure.

|                                                                                                                                                    |                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                   | <div style="background-color: #0056b3; color: white; padding: 10px; text-align: center; font-weight: bold; font-size: 1.2em;">NOTICE</div> <p>The handle #2 in the opposite picture is not painted red on the machine. It is only painted in the opposite picture for clarity purposes.</p> |
| <p>1) air pressure regulator 2) KLENZ™ manifold shut-off valve<br/>3) KLENZ™ reservoir pressure (reference) 4) system air pressure (reference)</p> |                                                                                                                                                                                                                                                                                             |

- h. Lock the adjustment cap on the air pressure regulator.
- i. Follow all local rules and regulations to return the machine to operating condition.
- Remove the safety link between the frames and secure.

|                                                                                      |                                                                                      |
|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|   |  |
| <p><b>L-1350</b></p>                                                                 | <p><b>L-1850 and L-2350</b></p>                                                      |
| <p>1) frame lock shown in carry position<br/>2) retaining pin for carry position</p> |                                                                                      |

**Required Tools:**

None

**Troubleshooting**

If the KLENZ™ pressure cannot be set, the following items need to be inspected, repaired, and/or replaced.

- Air Pressure Regulator

- Air Leaks
- Air Supply Solenoid Valve Assembly
- Hydraulic Tank Regulator

## Procedure C

### Hydraulic Reservoir Air Adjustment

#### Safety Preparations

Follow all local safety rules for performing the following procedure. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

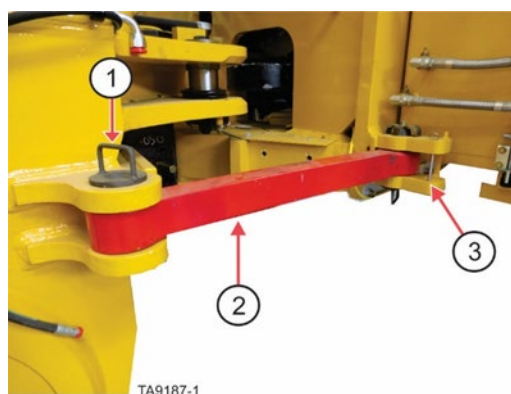
#### WARNING

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.

#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,  
3) Retaining pin bracket for un-locked position

**Figure 5. Frame Lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.



## WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- f. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- g. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- h. Open the valve completely and leave it open during the procedure.

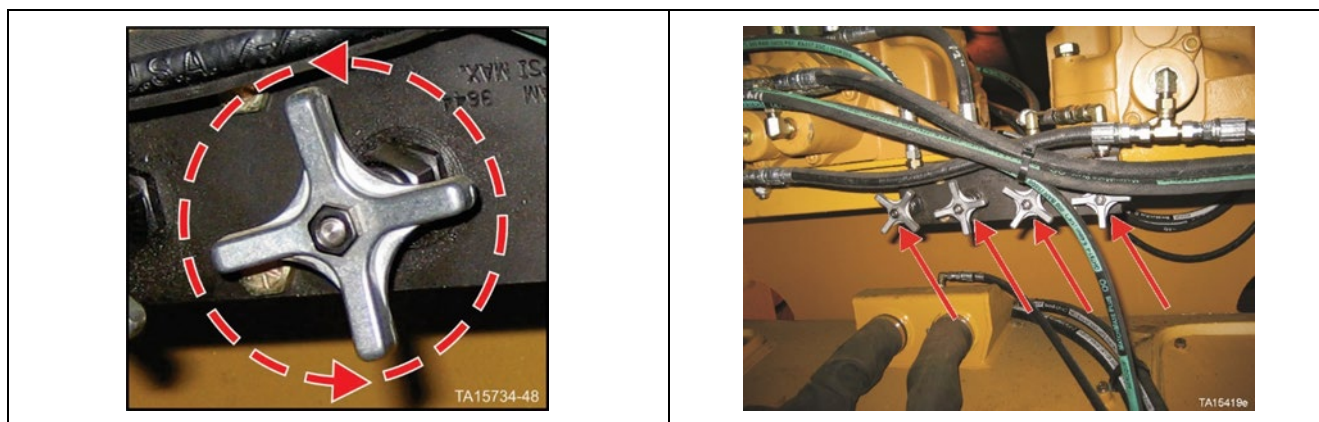


Figure 6. Pressure bleed down valves



## WARNING

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. **DO NOT** tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.



## WARNING

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. **DO NOT** tighten or loosen hydraulic fluid hoses without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.



## WARNING

Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

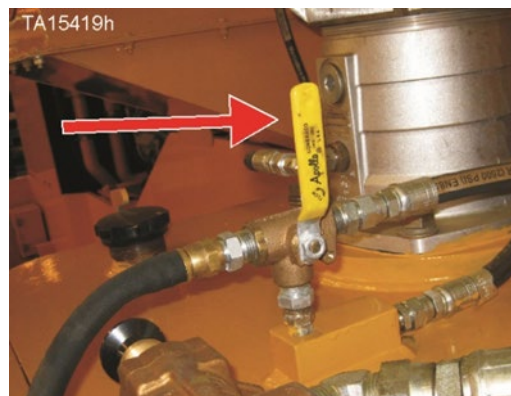
## Setting the air pre-charge pressure of the hydraulic reservoir

- a. With the bucket set flat and level on the ground, check the oil level in the hydraulic reservoir. The level should be approximately 2" inches above the center of the sight glass. If the oil level is too high, nuisance hydraulic reservoir air pressure alarms will occur.

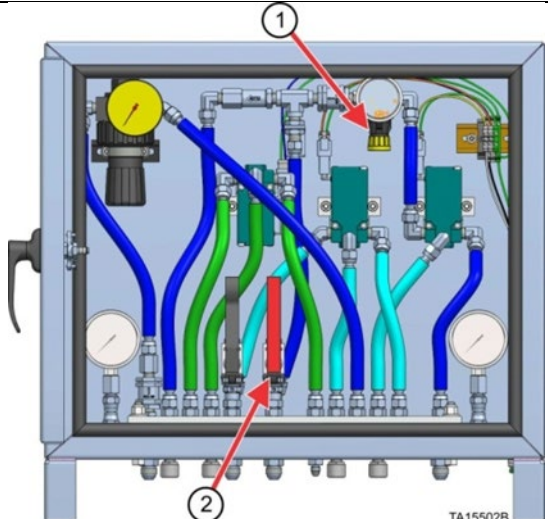


1) Sight Glass 2) Side Access Panel

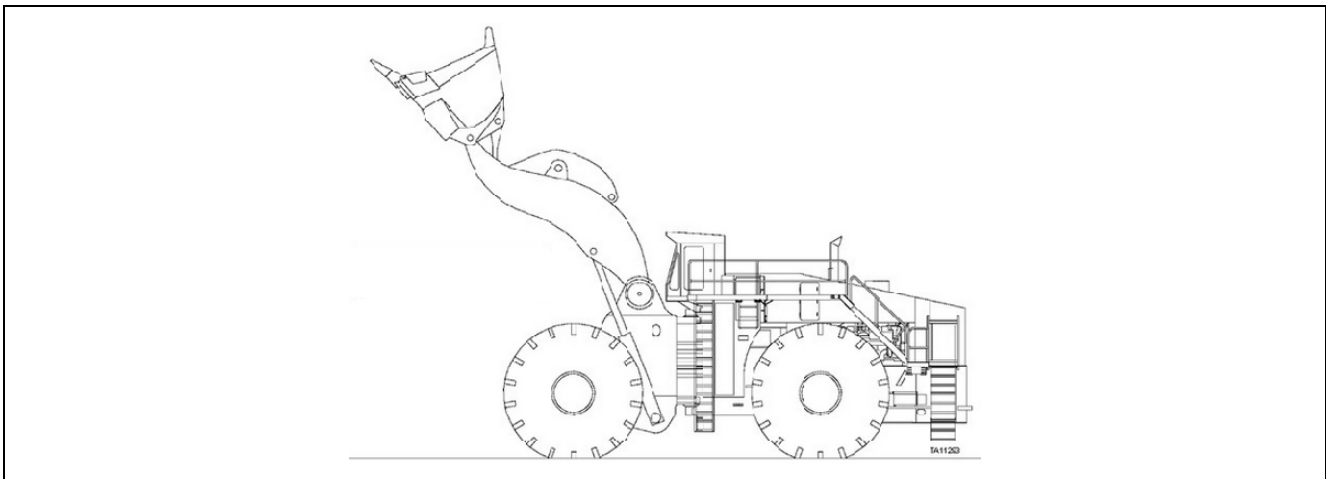
- b. Remove air from the hydraulic reservoir by opening the manual air release valve.
- Handle-up vents the air.
  - Handle down allows the reservoir to pressurize.



- c. When all air is removed, close the release valve. Verify that the automatic hydraulic reservoir air pressure dump valve is in the CLOSED position. The black plunger should be pushed all the way towards the valve.
- d. Locate the hydraulic reservoir regulator in the air box located on top of the low voltage control cabinet. Push the hydraulic reservoir test valve lever (red handle-see NOTE below). While holding the lever in the pushed position, pull the end cap on the regulator adjustment down firmly to unlock the regulator for adjustment. Rotate the cap clockwise to increase, counter-clockwise to decrease. Turn the cap slightly and allow the pressure to stabilize. Once the specified pressure is obtained, push the adjustor cap upward to lock. Release the test valve lever.

|                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                    |                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
|  <p><b>CW</b><br/>Increasing</p>                                                                                                                                                                                                                                                                                                     |  |  <p><b>CCW</b><br/>Decreasing</p> |
| <div style="background-color: #003366; color: white; text-align: center; padding: 10px;"> <h2 style="margin: 0;">NOTICE</h2> <p>The handle #2 in the opposite picture is not painted red on the machine. It is only painted in the opposite picture for clarity purposes.</p> </div> <div style="text-align: center; padding: 10px;"> <p>1) Air pressure regulator 2) Hydraulic reservoir test valve lever</p> </div> |                                                                                    |                                                                                                                      |

- e. The first time the lift arms are raised, after air has been released from the reservoir for service or maintenance, hoist the lift arms and leave them in the UP position for two (2) minutes to allow air to fill the top area of the reservoir.



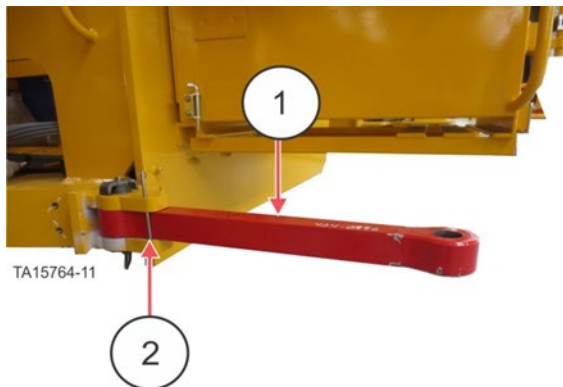
- f. After the lift arms are lowered back down, the relief cap on the top of the surge reservoir needs to be checked for proper operation. Air should not escape out of the relief cap as the lift arms are lowered. A continual release of air would indicate improper operation of the relief cap.



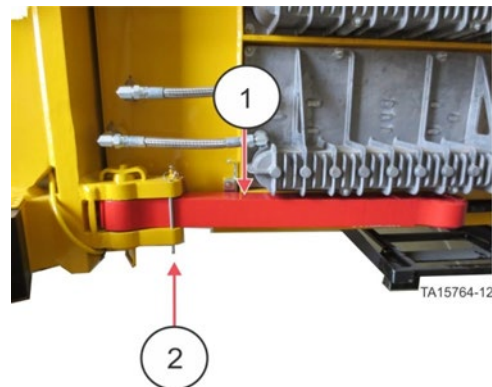
Surge reservoir relief cap

g. Follow all local rules and regulations to return the machine to operating condition.

- Remove the safety link between the frames and secure.



L-1350



L-1850 and L-2350

1) frame lock shown in carry position

2) retaining pin for carry position

### Troubleshooting

If the pressure cannot be set, the following items need to be inspected and repaired and or replaced.

- Main air system pressure is between 130-135 psi (8.9-9.3 bar); L-2350 (140-145 psi) [9.6-9.9 bar].
- Solenoid HA (air supply to the air pressure regulator) is operating properly.
- Hydraulic Reservoir air pressure regulator is operating properly.
- 12 psi (0.83 bar) check valve operating properly.
- Automatic dump valve is closed.
- Relief valve is operating properly.
- Emergency stop button (s) are not pressed (automatic air dump valve will not reset to closed position).
- Fill Cap seal.
- Hydraulic oil level is correct.
- Loose air lines on top of tank.

## Procedure D

### Engine Fan Speed Setting

#### Safety Preparations

Follow all local safety rules for performing the following procedure. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.



#### WARNING

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

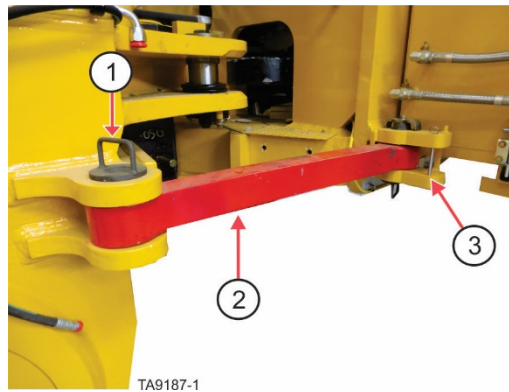
The machine engine must be started and shut down during this procedure.

- Use appropriate hearing protection.
  - Stay clear of all rotating equipment or components
- a. Ensure the bucket is empty and clear of debris.
  - b. Park the machine with the bucket flat on the ground.
  - c. Move the frame lock to the locked position so that the frame cannot be steered.



#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.

**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,  
3) Retaining pin bracket for un-locked position

**Figure 7. Frame Lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.

## **WARNING**

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- f. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- g. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- h. Open the valve completely and leave it open during the procedure.

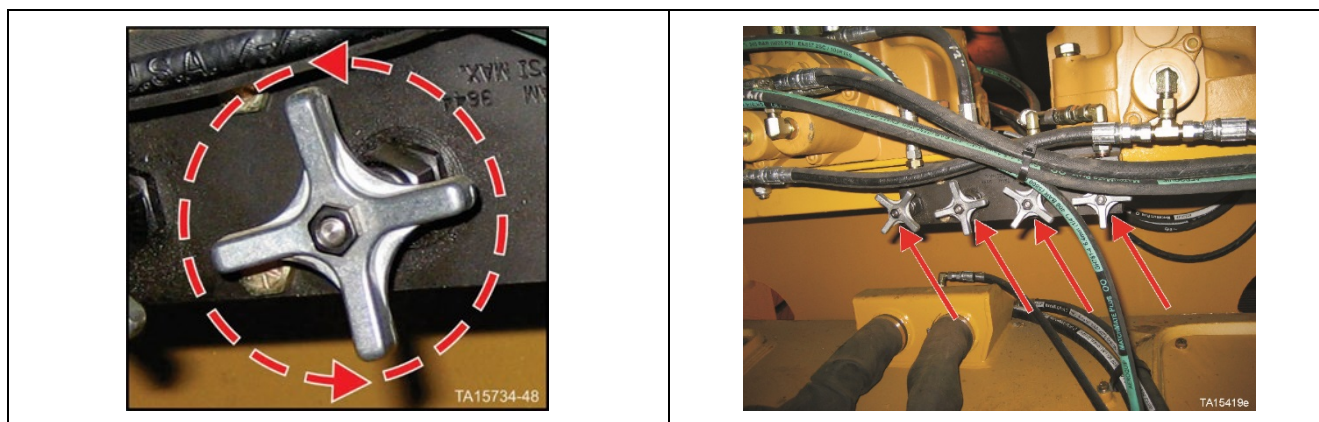


Figure 8. Pressure bleed down valves



## WARNING

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. **DO NOT** tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.



## WARNING

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. **DO NOT** tighten or loosen hydraulic fluid hoses without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.



## WARNING

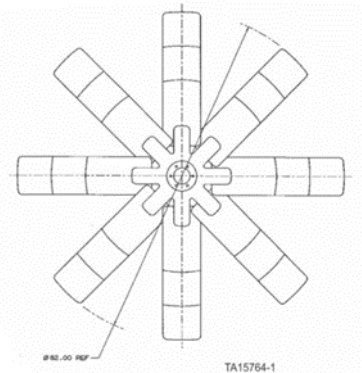
Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

Setting Procedure

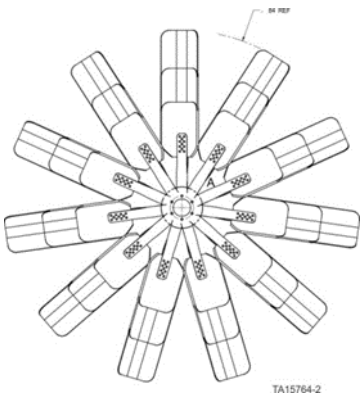
- Procedure performed at High throttle
- Maximum Fan Speed is much more important than maximum fan pump pressures.

NOTICE

**GENERATION3 MACHINES:** Fan Speed is directly related to altitude. If the machine is being operated at high altitudes, it is very important not to allow the fan to go above the maximum RPM value listed in the Specification Sheet.



82 inch fan 8 blade  
850 rpm absolute maximum speed  
(operational set speeds are lower than this)



84 inch fan 11 blade  
800 rpm absolute maximum speed  
(operational set speeds are lower than this)

NOTICE

Three settings are performed on the radiator fan; Pump Standby (pressure), Pump Compensator (RPM), and Remote Relief (RPM). Under normal operation, engine rpm will be around 1800. During dynamic braking, the engine is driven to overspeed. During this engine overspeed condition, the fan speeds should not be allowed to go above the maximum speeds listed above. Engine speed is forced to 1900 RPM during the fan setting procedure to simulate this overspeed condition. Refer to the specification sheet for values.

The fan and blower pumps have compensators mounted on the side. These compensators have adjustment screws for controlling the fan and blower speed and hydraulic pressure.

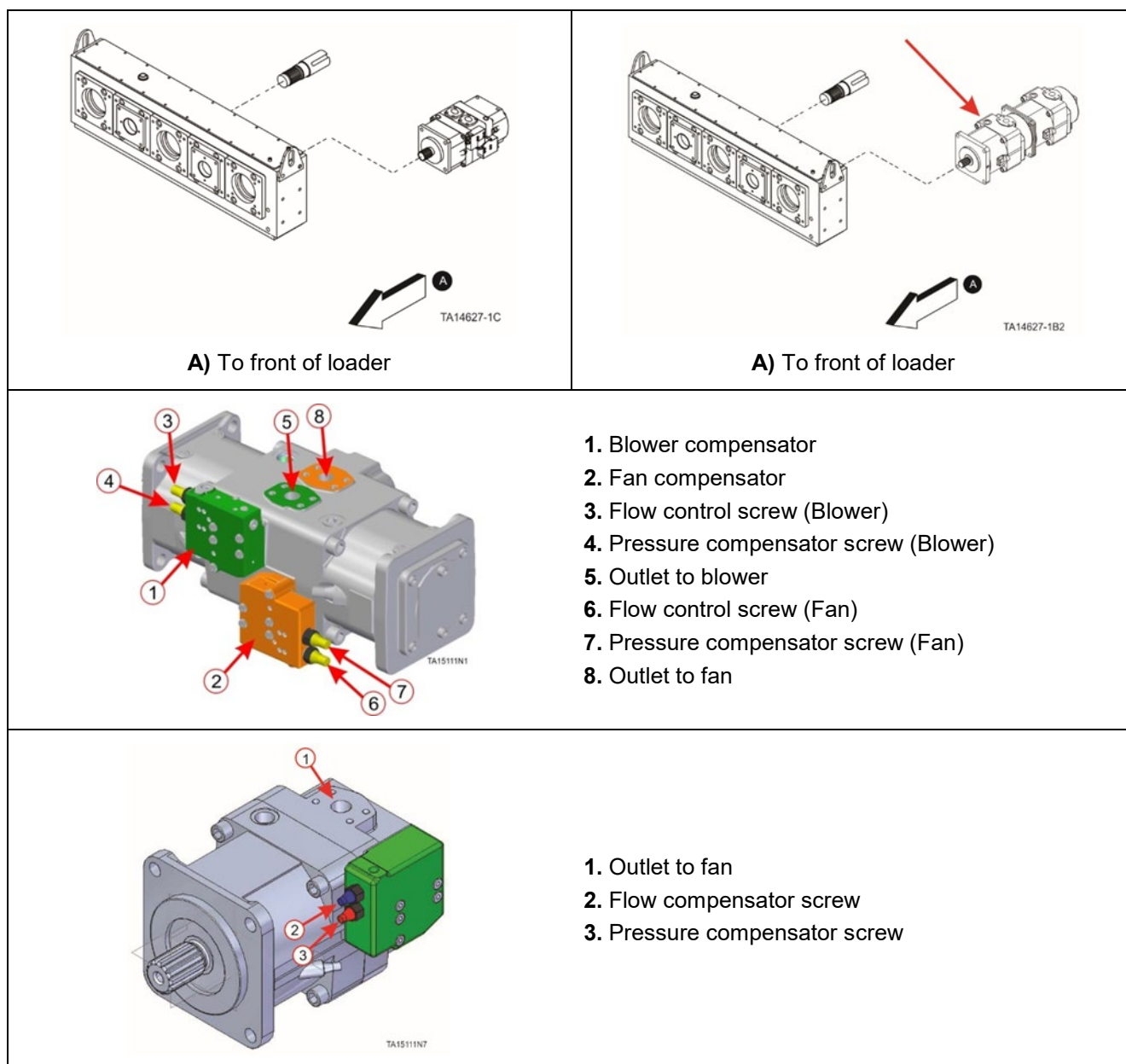


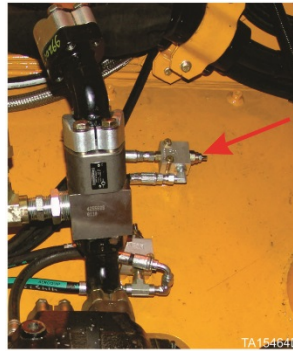
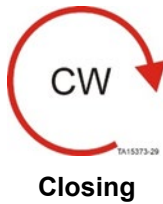
**Figure 9. Pump compensators and outlet ports**

The fan pump Stand By pressure must be set before setting fan speeds.

## NOTICE

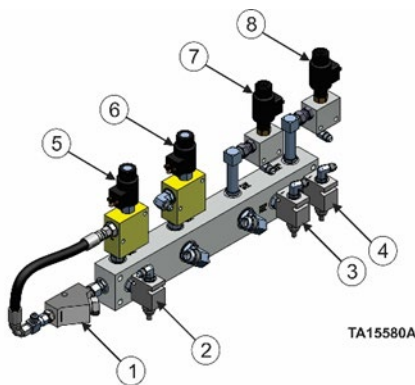
**Check the configuration of the machine before performing the following procedure. This procedure shows an earlier and current version graphic/photo.**

- a. Start the engine, and engage high throttle.
  - Follow all local engine startup safety procedures.
- b. View the fan pump pressure in LINCS.
- c. Fully close the remote relief valve. To close the relief valve, loosen the jam nut and turn the adjustment screw fully clockwise.



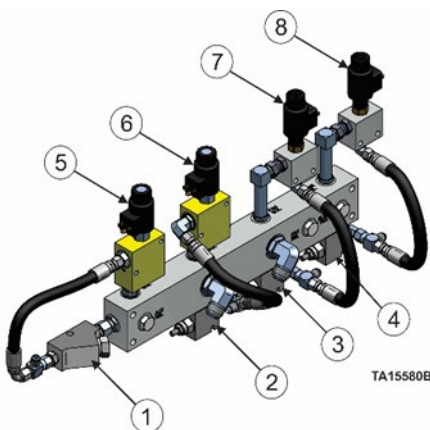
### Fan pump remote relief valve

Early Production Machines - L-1850 L-2350



1. Check valve 100 psi oil cooler control
2. Aux oil cooler pump remote relief
3. Radiator fan pump remote relief
4. Blower pump remote relief
5. Oil cooler bypass solenoid
6. Aux oil cooler control solenoid
7. Radiator fan proportional control valve
8. Blower proportional control valve

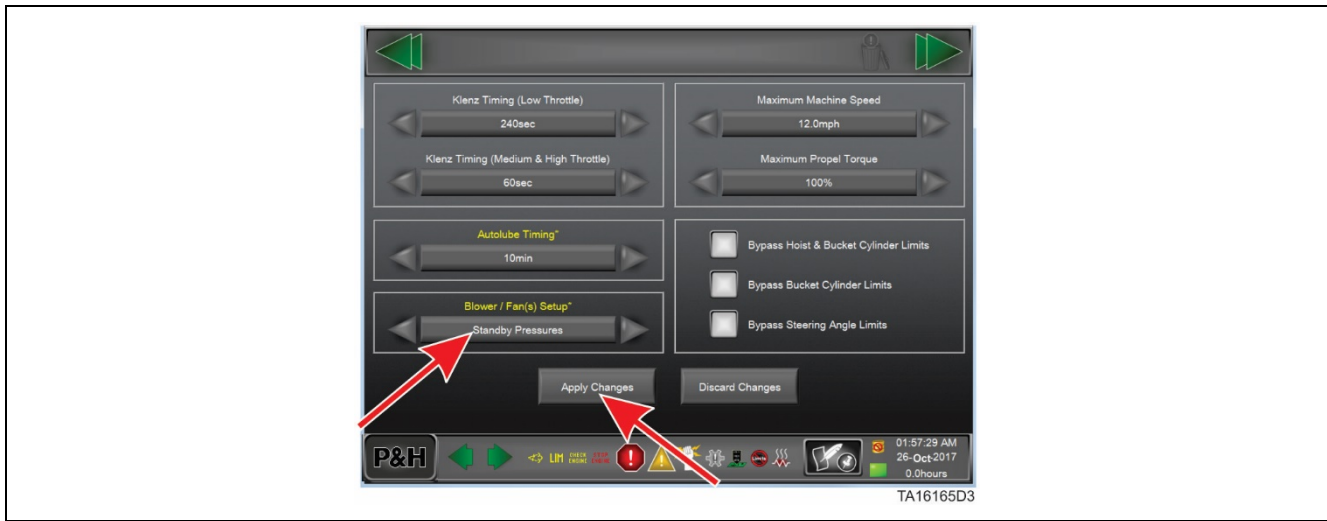
### Early L-1350 Machines



1. Check valve 100 psi oil cooler control
2. Aux oil cooler pump remote relief
3. Radiator fan pump remote relief
4. Blower pump remote relief
5. Oil cooler bypass solenoid
6. Aux oil cooler control solenoid
7. Radiator fan proportional control valve
8. Blower proportional control valve

### Current Production Machines

- d. In the maintenance menu of the LINC S computer system, command the radiator fan to “standby pressures”.
- LINC S access key is required.



## NOTICE

The apply button must be pressed for the selection to actuate. Before the apply button is pressed to actuate the command, the following conditions must be met:

- Park Brake set (Button pressed IN).
  - Engine in High Throttle (Press the button once to place into High Throttle).
  - Electrical Drive System disabled (If the 4 LEDs are illuminated, push the switch to disable the drive).
- e. View the pressure in LINC S and adjust the pump standby (flow) to specification. Adjust standby pressure by loosening the jam nut on the adjustment screw. To increase standby pressure, turn the adjustment screw clockwise. To decrease standby pressure, turn the adjustment screw counter clockwise. Once standby pressure is set, re-tighten the jam nut.

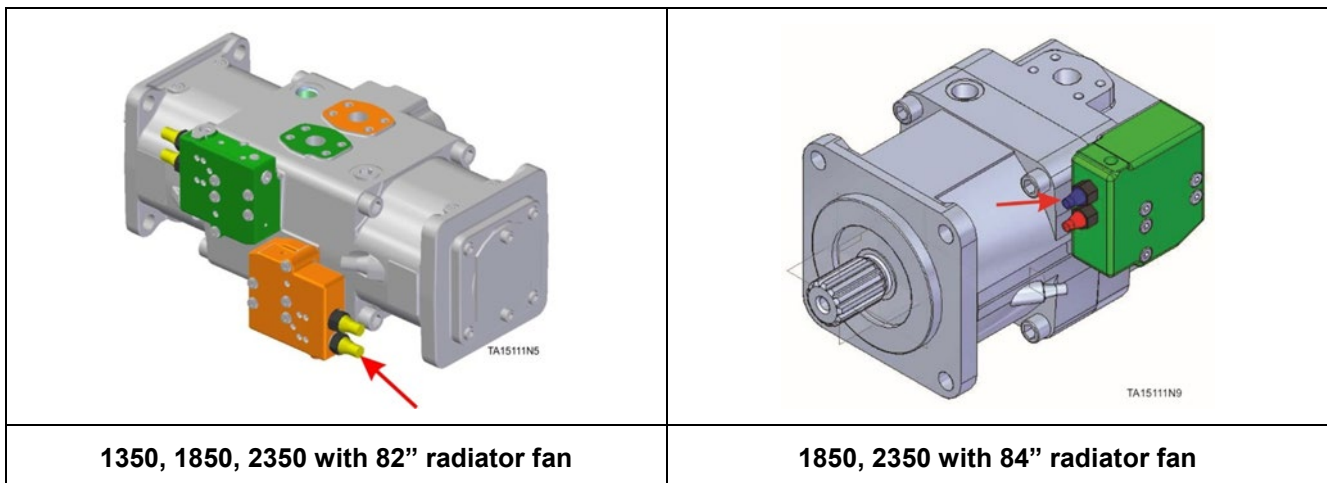


Figure 10. Fan standby (flow) compensator



- f. Decrease the fan pressure compensator (pressure) by loosening the jam nut and turning the fan pressure adjusting screw counter clockwise two turns.

**NOTICE**

This step decreases the possibility of radiator fan overspeed when the maximum speed is being set.

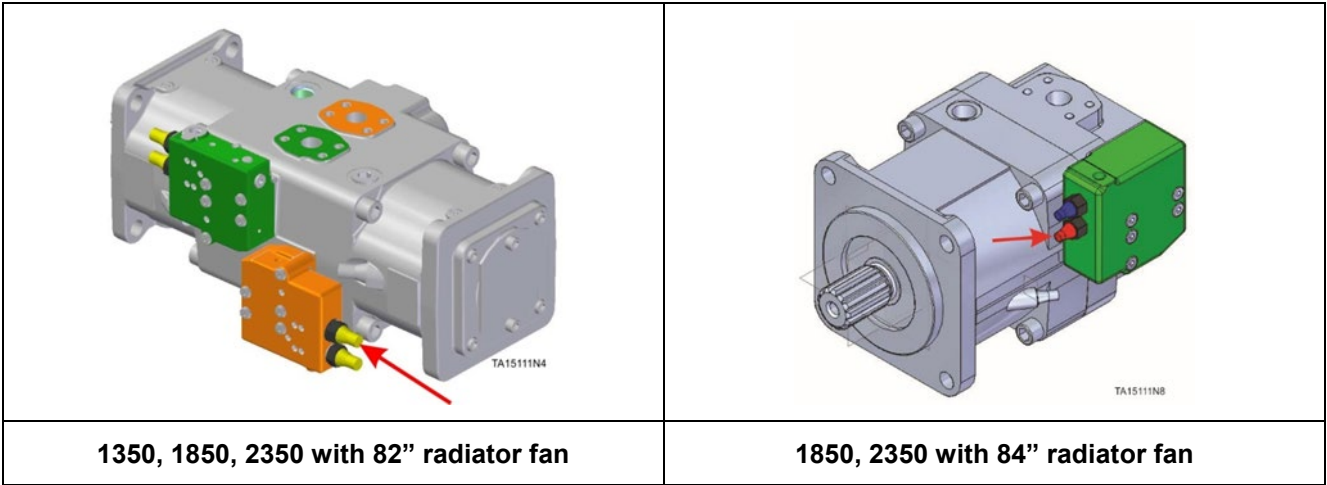
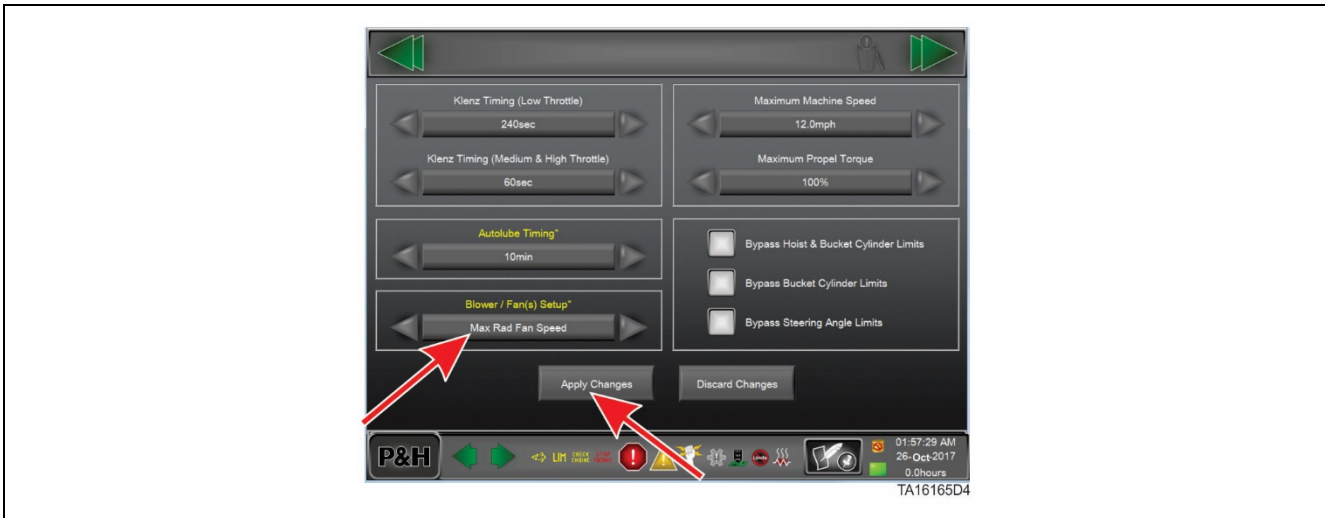


Figure 11. Fan pressure compensator



- g. In the maintenance menu of the LINCOS computer system, command the fan to “Max Rad Fan Speed” (Maximum radiator fan speed).

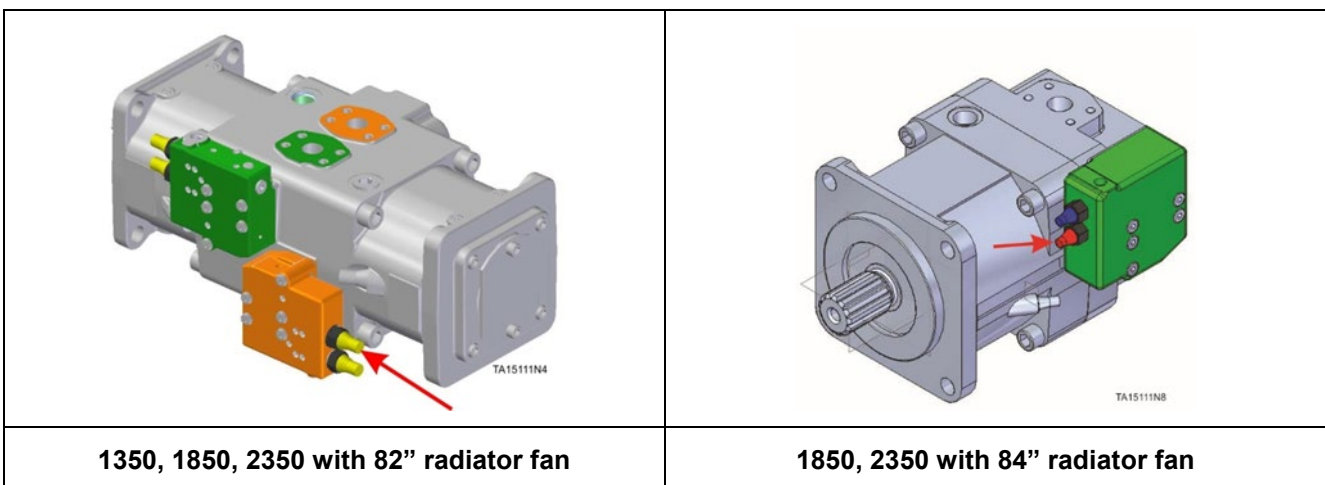


## NOTICE

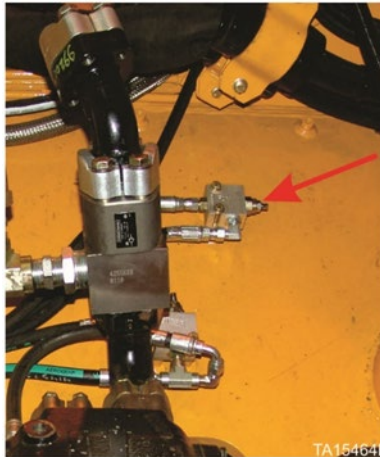
Apply button must be pressed for selection to actuate. Before apply button is pressed to actuate the command, the following conditions must be met:

- Park Brake set (Button pressed IN).
- Engine in High Throttle (Press the button once to place into High Throttle).
- Electrical Drive System disabled (If the 4 LEDs are illuminated, push switch to disable the drive).

- h. Loosen the jam nut on the fan pump pressure compensator. Adjust the pressure compensator screw until engine fan speed is the correct rpm as listed on the specification sheet. (view fan rpm in LINCOS.) To increase the speed, turn the adjustment screw clockwise, or counter-clockwise to decrease speed. Once the desired speed is achieved, tighten the jam nut.



- i. Lower the remote relief setting until the specified radiator fan rpm is achieved. (view fan rpm in LINCS.) Tighten jam nut on remote relief.



- j. In maintenance menu of LINCS computer system (overrides), command the fan to automatic.



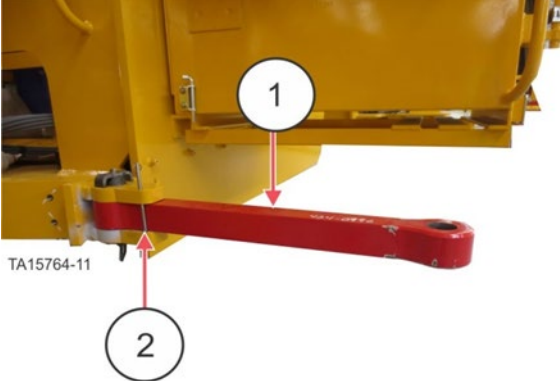
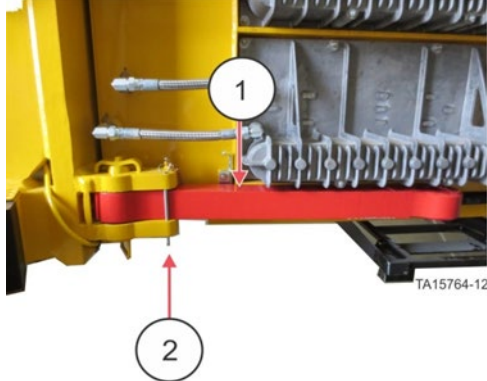
## NOTICE

Apply button must be pressed for selection to actuate. Before apply button is pressed to actuate the command, the following conditions must be met:

- Park Brake set (Button pressed IN).
- Engine in High Throttle (Press the button once to place into High Throttle).
- Electrical Drive System disabled (If the 4 LEDs are illuminated, push the switch to disable the drive).

k. Follow all local rules and regulations to return the machine to operating condition.

- Remove frame lock and secure properly.

|                                                                                         |                                                                                    |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|        |  |
| <b>L-1350</b>                                                                           | <b>L-1850 and L-2350</b>                                                           |
| <p>1) frame lock shown in carry position</p> <p>2) retaining pin for carry position</p> |                                                                                    |

#### Required tools:

- 4mm Hex wrench
- 1/2" open-end wrench

#### Troubleshooting

If the speed cannot be set, the following items need to be inspected, repaired, and/or replaced.

- Condition of fan and fan blades
- Fan Motor
- Fan Pump
- Remote Relief Valve
- Fan Control Solenoids (proportional solenoid control valve or solenoid control valve-SOL RF)
- Fan Pump flow and pressure compensator valves for contamination

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## Procedure E

### Blower Speed Setting

#### Safety Preparations

Follow all local safety rules for performing the following procedure. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

#### **WARNING**

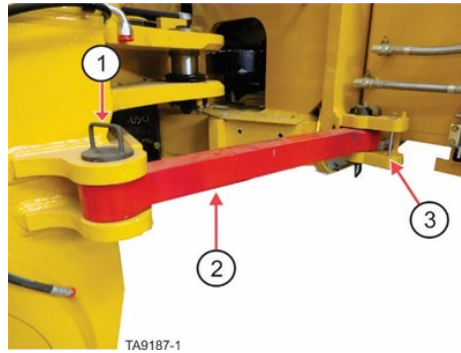
Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. **ANYONE** performing inspections or service procedures to the machine should be familiar with **ALL** instructions and procedures contained in the machine's **SERVICE MANUAL**. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine engine must be started and shut down during this procedure.

- Use appropriate hearing protection.
  - Stay clear of all rotating equipment or components
- a. Ensure the bucket is empty and clear of debris.
  - b. Park the machine with the bucket flat on the ground.
  - c. Move the frame lock to the locked position so that the frame cannot be steered.

#### **WARNING**

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,  
3) Retaining pin bracket for un-locked position

**Figure 12. Frame Lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.

## ⚠ WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- f. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- g. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- h. Open the valve completely and leave it open during the procedure.

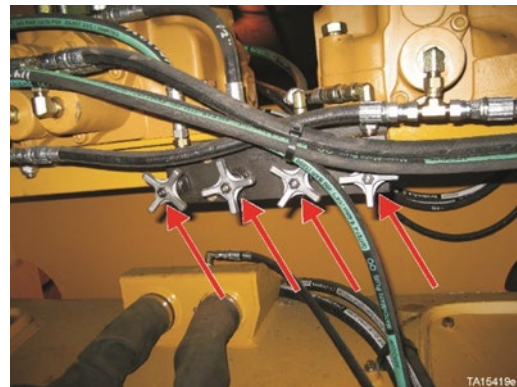
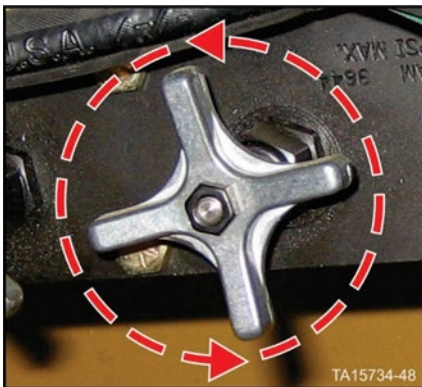


**Figure 13. Pressure bleed down valves**



## WARNING

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. **DO NOT** tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.



## WARNING

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. **DO NOT** tighten or loosen hydraulic fluid hoses without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.



## WARNING

Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

## Setting the Blower Speed

The fan and blower pumps have compensators mounted on the side. These compensators have adjustment screws for controlling the fan and blower speed and hydraulic pressure.

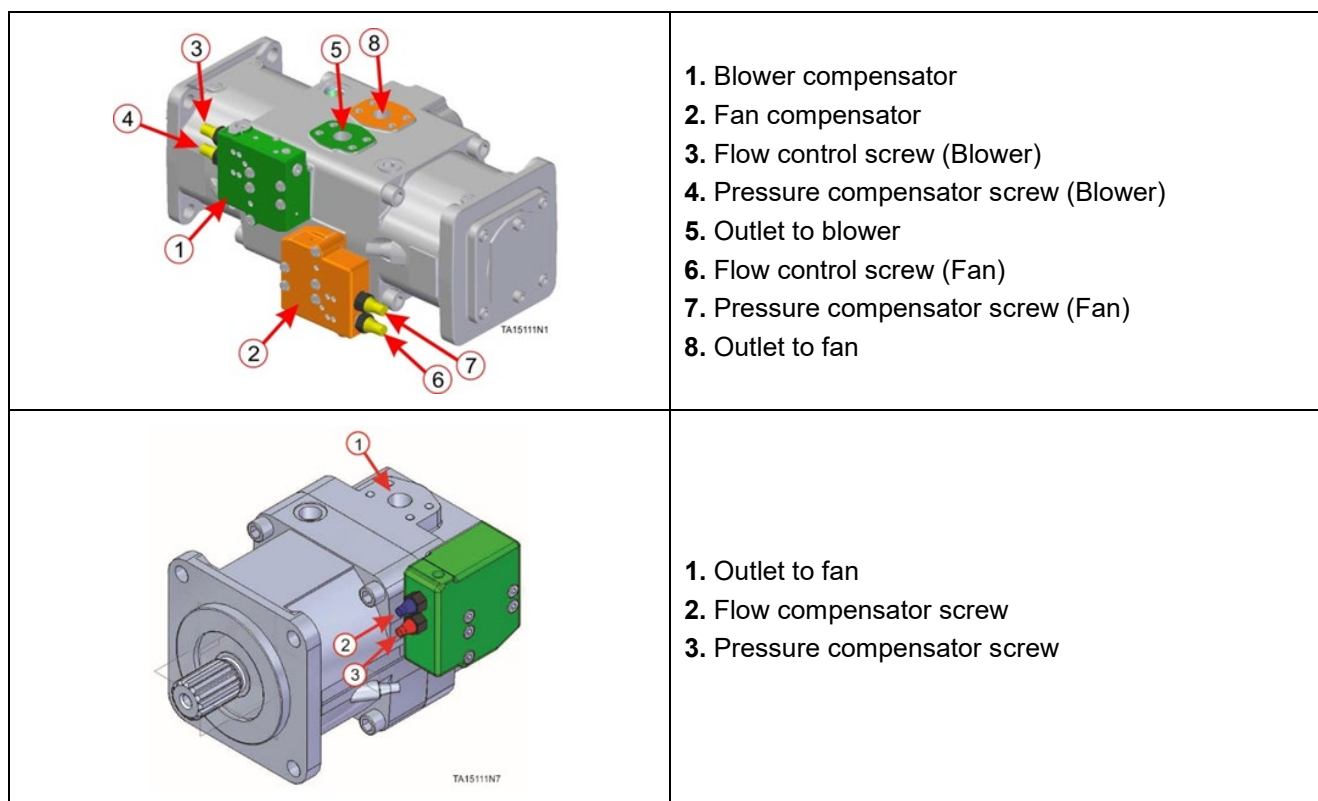
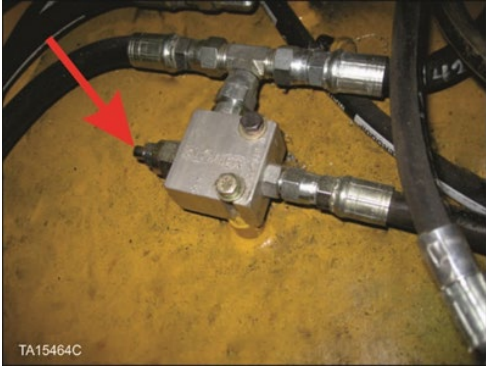


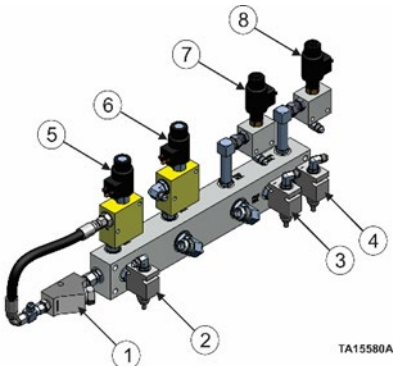
**Figure 14. Pump compensators and outlet ports**

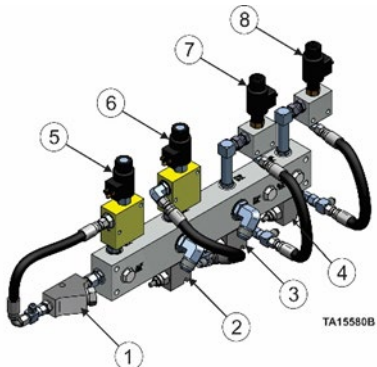
## NOTICE

### Procedure performed at HIGH throttle

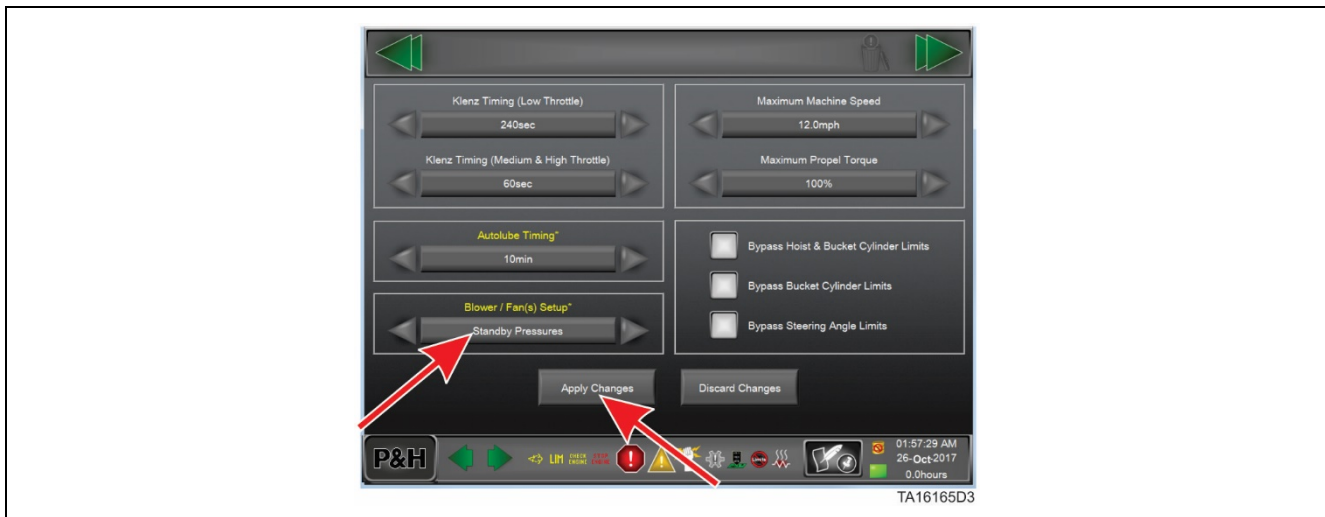
- a. View pump pressure in LINCS.
- b. Fully close the remote relief valve. To close relief valve, loosen the locknut and turn the adjustment screw fully clockwise.

|                                                                                                       |                                                                                                                                  |                                                                                                        |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
|  <p><b>Close</b></p> |  <p><b>Blower pump remote relief valve</b></p> |  <p><b>Open</b></p> |
| <p><b>Early Production Machines L-1850 L-2350</b></p>                                                 |                                                                                                                                  |                                                                                                        |

|                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>Blower pump remote relief valve adjustment screw</b></p> | <ol style="list-style-type: none"> <li>1. Check valve 100 psi oil cooler control</li> <li>2. Aux oil cooler pump remote relief</li> <li>3. Radiator fan pump remote relief</li> <li>4. Blower pump remote relief</li> <li>5. Oil cooler bypass solenoid</li> <li>6. Aux oil cooler control solenoid</li> <li>7. Radiator fan proportional control valve</li> <li>8. Blower proportional control valve</li> </ol> |
| <p><b>Early L-1350 Machines</b></p>                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>Blower pump remote relief valve adjustment screw</b></p> | <ol style="list-style-type: none"> <li>1. Check valve 100 psi oil cooler control</li> <li>2. Aux oil cooler pump remote relief</li> <li>3. Radiator fan pump remote relief</li> <li>4. Blower pump remote relief</li> <li>5. Oil cooler bypass solenoid</li> <li>6. Aux oil cooler control solenoid</li> <li>7. Radiator fan proportional control valve</li> <li>8. Blower proportional control valve</li> </ol> |
| <p><b>Current Production Machines</b></p>                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                  |

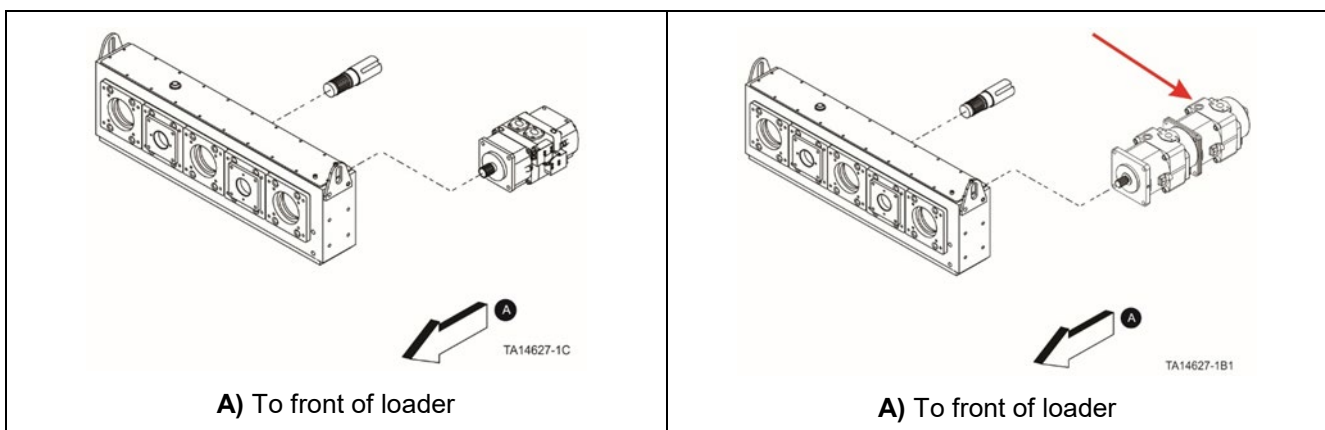
- c. Start the engine and engage high throttle.
  - Follow all local engine startup safety procedures.
- d. In maintenance menu of the LINCOS computer system (System Settings/Machine settings), command blower to “standby pressures”.

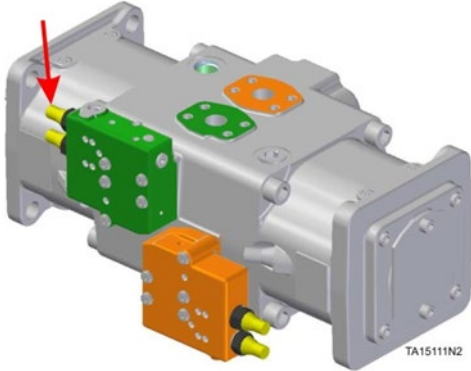
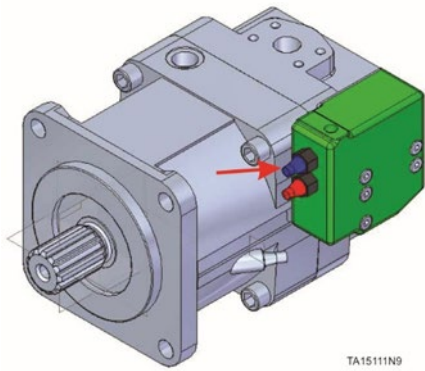


## NOTICE

Apply button must be pressed for selection to actuate. Before apply button is pressed to actuate command, the following conditions must be met:

- **Park Brake set (Button pressed IN).**
  - **Engine in High Throttle (Press the button once to place into HIGH Throttle).**
  - **Electrical Drive System disabled (If the 4 LEDs are illuminated, push the switch to disable the drive).**
- e. Pump standby pressure (flow) (low speed): View pressure in LINCOS and adjust pump standby pressure to specification. Adjust standby pressure by loosening the jam nut on the adjustment screw. To change pressure, turn adjustment screw clockwise to increase, counter clockwise to decrease pressure. Once pressure is set, re-tighten jam nut.



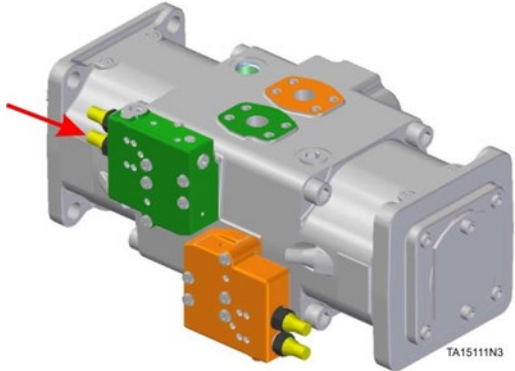
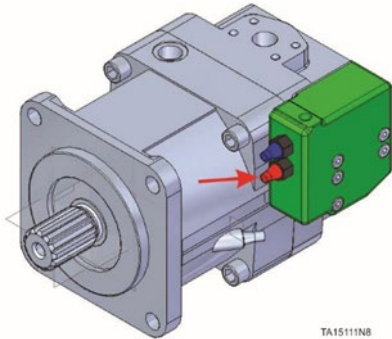
|                                                                                                     |                                                                                                     |                                                                                                       |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
|  <p>TA15111N2</p>  |  <p>TA15111N9</p> |                                                                                                       |
| <b>1350, 1850, 2350 with 82" radiator fan</b>                                                       | <b>1850, 2350 with 84" radiator fan</b>                                                             |                                                                                                       |
|  <p>Increasing</p> |  <p>TA14599B</p>  |  <p>Decreasing</p> |

Typical flow compensator

- f. Decrease the pressure compensator by loosening the jam nut and turning the screw counter clockwise two turns. Do not remove the screw.

## NOTICE

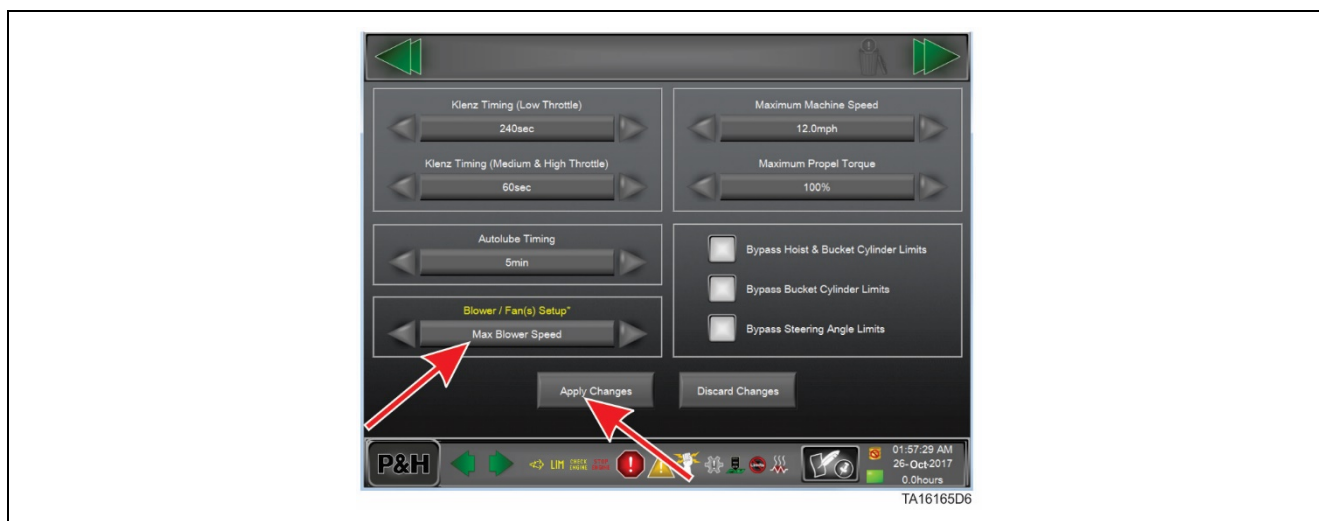
This step decreases the possibility of blower wheel overspeed when the maximum speed is being set.

|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |
| <p>1350, 1850, 2350 with 82" radiator fan pump</p>                                  | <p>1850, 2350 with 84" radiator fan pump</p>                                         |



Typical pressure compensator

- g. In the maintenance menu of the LINCOS computer system (System Settings/Machine settings), command blower to “Max Blower Speed” (Maximum blower speed).



## NOTICE

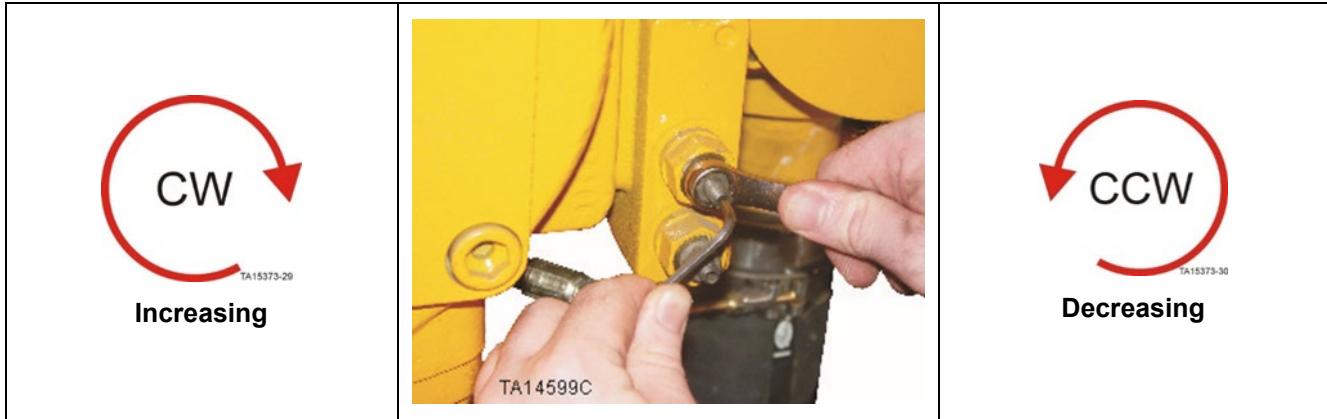
Apply button must be pressed for selection to actuate. Before apply button is pressed to actuate command, the following conditions must be met:

- **Park Brake set (Button pressed IN).**
- **Engine in High Throttle (Press the button once to place into High Throttle).**
- **Electrical Drive System disabled (If the 4 LEDs are illuminated, push the switch to disable the drive).**

- h. **Maximum run speed setting:** Reading the RPM channel for the blower fan, adjust the blower pump pressure compensator to specification. To adjust pressure, loosen jam nut on pressure compensator adjustment screw. To increase pressure (rpm) turn adjustment screw clockwise, counter clockwise to decrease. Once proper speed is obtained, re-tighten the jam nut.

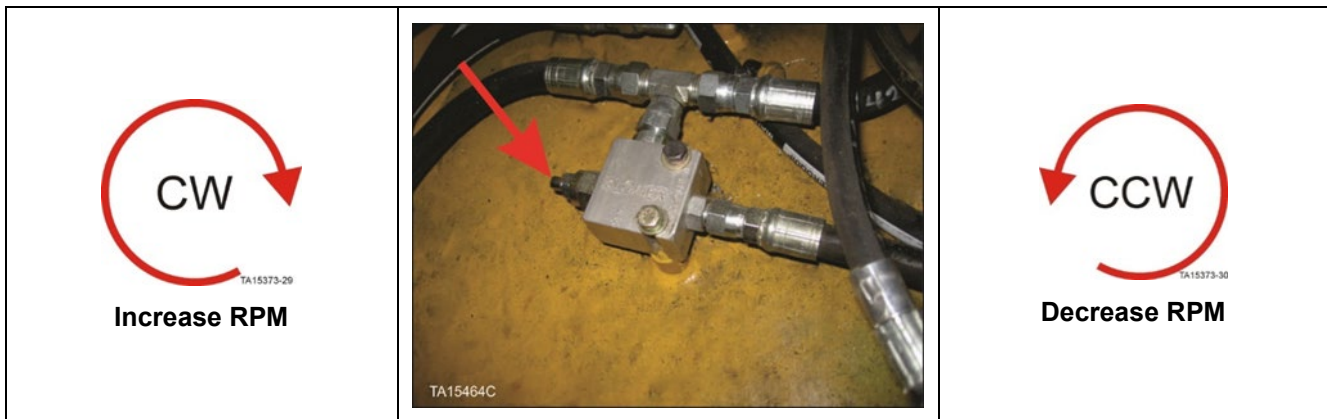
## NOTICE

This adjustment sets the maximum blower speed based on pump pressure/flow rate. This is a secondary (safety) control for the circuit. Normal blower speed operation is controlled by the remote relief setting.



Typical pressure compensator adjustment

- i. **Normal operation speed setting:** While continuing to watch blower fan speed (rpm) open the remote relief valve. To lower RPM, turn the adjustment screw counter clockwise. To increase RMP, turn the adjustment screw clockwise. Once blower fan speed is correct, re-tighten jam nut.



Blower pump remote relief valve adjustment screw

- j. In the maintenance menu of the LINC S computer system (System Settings/Machine settings), command the blower to automatic.



- k. Follow all local rules and regulations to return the machine to operating condition.

- Remove frame lock and secure properly.

|                                                                                      |                                 |
|--------------------------------------------------------------------------------------|---------------------------------|
| <p>TA15764-11</p>                                                                    | <p>TA15764-12</p>               |
| <p><b>L-1350</b></p>                                                                 | <p><b>L-1850 and L-2350</b></p> |
| <p>1) frame lock shown in carry position<br/>2) retaining pin for carry position</p> |                                 |

#### Required Tools:

- 4mm Hex wrench
- 1/2" open-end wrench
- Various open-end wrenches

#### Troubleshooting

If the pressure cannot be set, then the following items need to be inspected, repaired, and or replaced.

- Blower Motor
- Blower Pump
- Blower Pump Compensators contamination (Flow and Pressure)
- Remote Relief
- Blower Proportional Valve (SOL BF)
- Blower Wheel/Hub

## Procedure F

### Accessory Pump Pressure Setting

#### Safety Preparations

Follow all local safety rules for performing the following procedure. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

#### WARNING

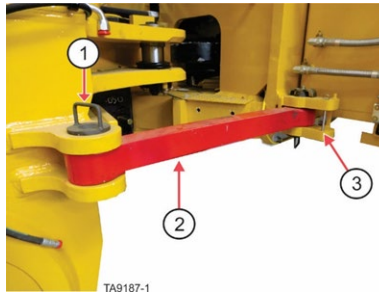
Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine engine must be started and shut down during this procedure.

- Use appropriate hearing protection.
  - Stay clear of all rotating equipment or components
- 
- a. Ensure the bucket is empty and clear of debris.
  - b. Park the machine with the bucket flat on the ground.
  - c. Move the frame lock to the locked position so that the frame cannot be steered.

#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,  
3) Retaining pin bracket for un-locked position

**Figure 15. Frame Lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.



## WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- f. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- g. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- h. Open the valve completely and leave it open during the procedure.

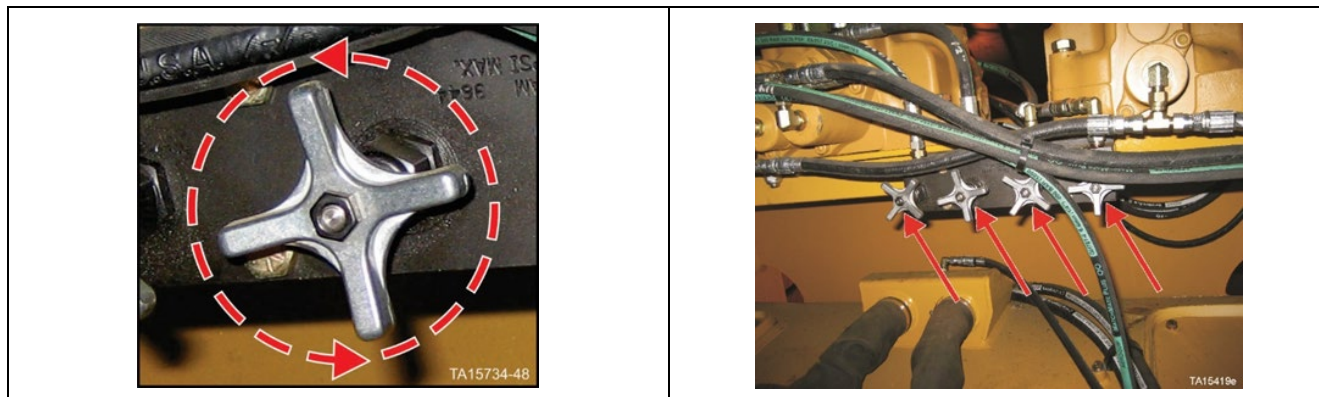


Figure 16. Pressure bleed down valves



## WARNING

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. **DO NOT** tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.



## WARNING

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. **DO NOT** tighten or loosen hydraulic fluid hoses without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.

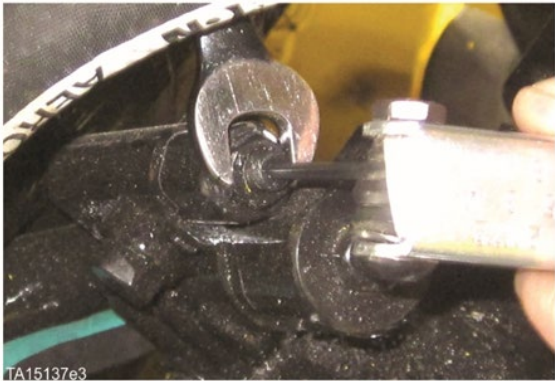


## WARNING

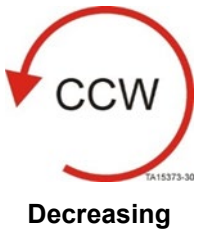
Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

Setting Procedure

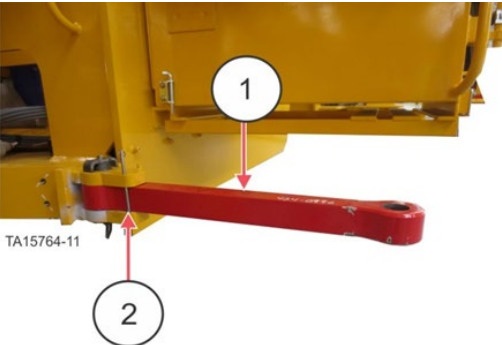
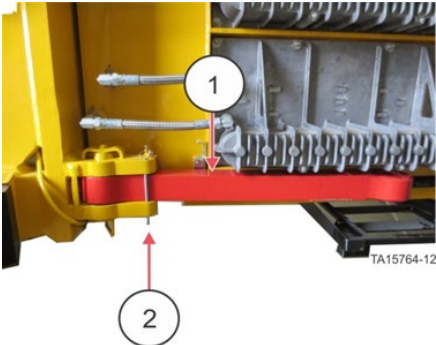
- a. Ensure that flow (stand-by) set screw is screwed completely in. Loosen jam nut and turn adjusting screw fully clockwise, re-tighten jam nut.

|                                                                                   |                                                                                    |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|  |  |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|

- b. View pump pressure in LINCS.
- c. If pressure needs to be adjusted, loosen jam nut on pressure compensator adjustment screw. To increase pressure, turn adjustment screw clockwise, turn adjustment screw counter-clockwise to decrease. Once desired pressure is obtained, re-tighten jam nut.

|                                                                                    |                                                                                     |                                                                                      |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |  |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|

- d. Follow all local rules and regulations to return the machine to operating condition.
  - Remove frame lock and secure properly.

|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |
| <b>L-1350</b>                                                                       | <b>L-1850 and L-2350</b>                                                             |
| <b>1) frame lock shown in carry position, 2) retaining pin for carry position</b>   |                                                                                      |

**Required Tools:**

- 4mm Hex wrench
- 1/2" open-end wrench
- 9/16" open-end wrench

**Troubleshooting**

If the pressure cannot be set, the following items need to be inspected, repaired, and/or replaced.

- 6 gpm (22.71 lpm) Flow Control on the Air Conditioning system
- 2.5 gpm (9.46 lpm) Flow Control on the Rear Driver Filtration
- 2.5 gpm (9.46 lpm) Flow Control on the Front Driver Filtration
- Solenoid FD for the float valves
- 2.5 gpm (9.46 lpm) Flow Control on the Pilot Supply
- 2.5 gpm (9.46 lpm) Flow Control on the Auto Lube
- Contamination in the Accessory pump flow and pressure compensators
- Accessory pump failure (high case drain flow)

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## Procedure G

### Pilot Relief Valve Pressure Setting

#### Safety Preparations

Follow all local safety rules for performing the following procedure. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

#### WARNING

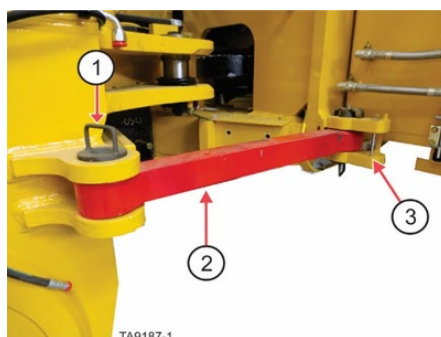
Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine engine must be started and shut down during this procedure.

- Use appropriate hearing protection.
  - Stay clear of all rotating equipment or components
- a. Ensure the bucket is empty and clear of debris.
  - b. Park the machine with the bucket flat on the ground.
  - c. Move the frame lock to the locked position so that the frame cannot be steered.

#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,  
3) Retaining pin bracket for un-locked position

**Figure 17. Frame Lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.



## WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- f. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- g. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- h. Open the valve completely and leave it open during the procedure.

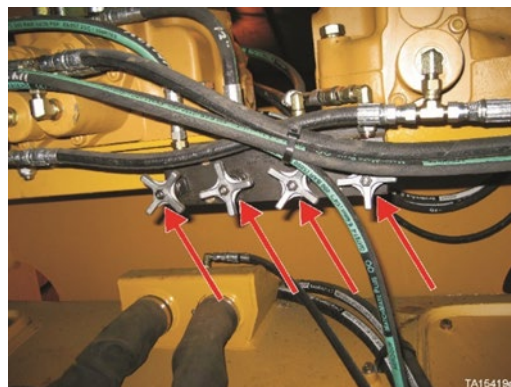
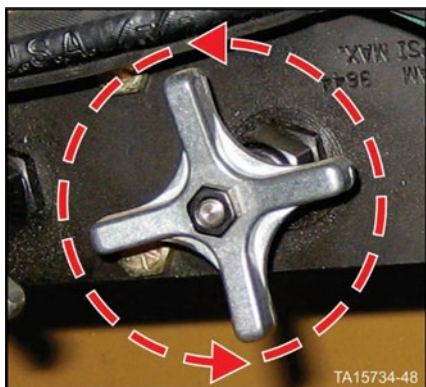


**Figure 18. Pressure bleed down valves**



## WARNING

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. **DO NOT** tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.



## WARNING

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. **DO NOT** tighten or loosen hydraulic fluid hoses without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.

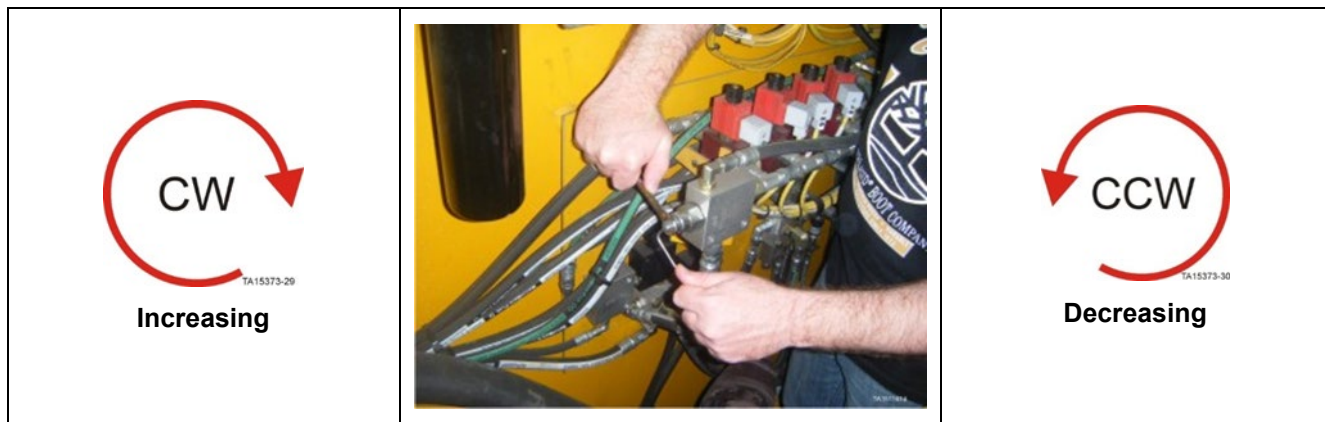


## WARNING

Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

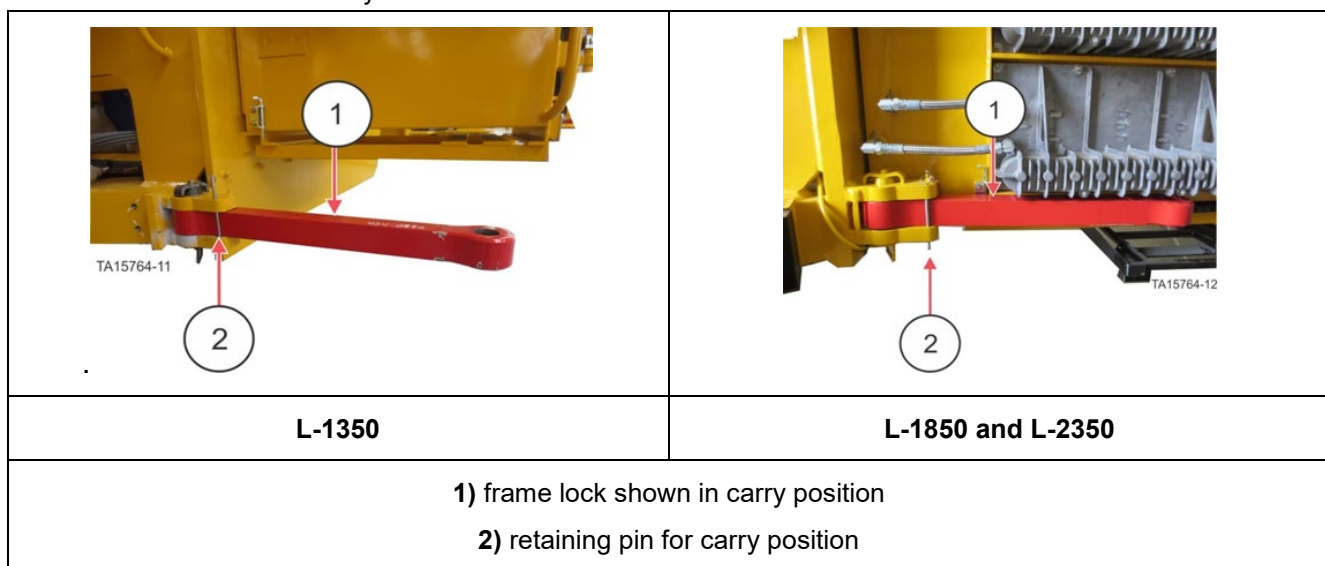
## Setting Procedure

- a. View pilot supply pressure in LINCS. Hydraulic oil must be  $> 140^{\circ}\text{F}$  ( $60^{\circ}\text{C}$ ).
- b. With machine at high throttle, adjust pilot relief valve to specification. To adjust pressure, loosen jam nut on relief valve adjustment screw. Turn adjustment screw clockwise to increase pressure, counter-clockwise to decrease pressure. Once the desired pressure is obtained, re-tighten the jam nut.



c. Follow all local rules and regulations to return the machine to operating condition.

- Remove the safety link between the frames and secure.



#### Required Tools:

- 4mm Hex wrench
- 1/2" open-end wrench
- 9/16" open-end wrench

#### Troubleshooting

If pressure cannot be set, the following items need to be inspected, repaired, and/or replaced.

- Accessory Pump (set at specification)
- Leaking Pilot Control Solenoids (Bucket Base, Bucket Rod, Hoist Base, and/or Hoist Rod)
- Pilot Supply 2.5 gpm (9.46 lpm) flow control
- Pilot Supply Relief Valve
- Float Valve Solenoid FD valve
- Air conditioning 6 gpm (22.71 lpm) flow control
- Rear Driver Filtration 2.5 gpm (9.46 lpm) flow control
- Front Driver Filtration 2.5 gpm (9.46 lpm) flow control

## Procedure H

### Driver Filtration Sequence Valve Pressure Setting

#### Safety Preparations

Follow all local safety rules for performing the following procedure. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

#### **WARNING**

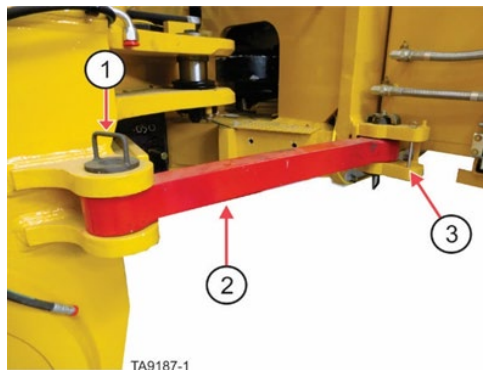
Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine is not running for this setting. The adjustment is done on a test bench.

- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.

#### **WARNING**

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position  
3) Retaining pin bracket for un-locked position

**Figure 19. Frame Lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.
- f. Shut off the engine.

## ⚠ WARNING

**Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.**

- g. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



**Figure 20. GEN 2 Battery Isolation Box – Battery isolation switch in OFF position with locks in place**

- h. Release the air from the hydraulic reservoir by using the hydraulic reservoir air valve (ball valve) on top of the reservoir. The supply line from main air system will be blocked and reservoir air will vent out the hose that runs down the outside of the hydraulic reservoir.
  - Turn the handle to the up position as shown

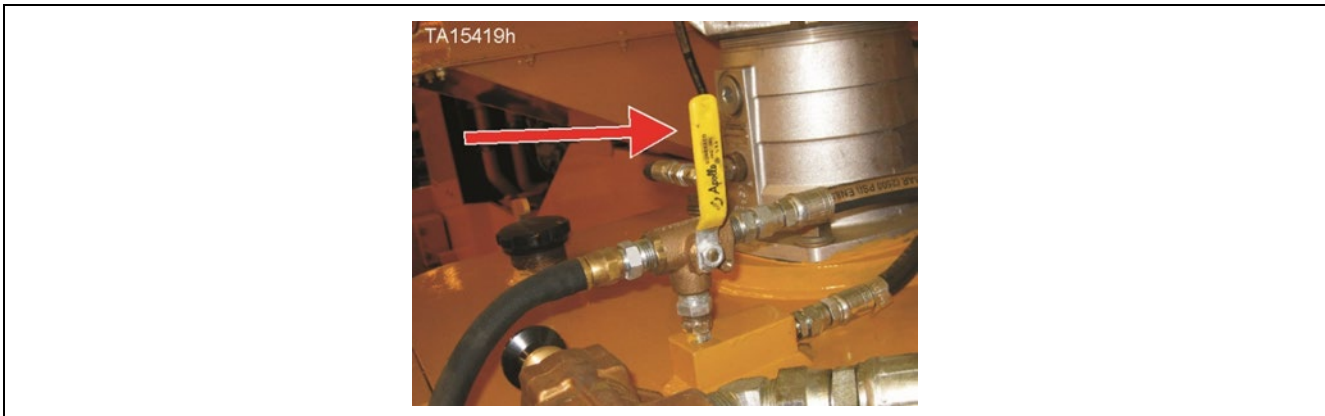


**Figure 21. Hydraulic reservoir air valve handle UP**

- i. Release the air from the various air storage reservoirs by opening all of the air bleed valves.

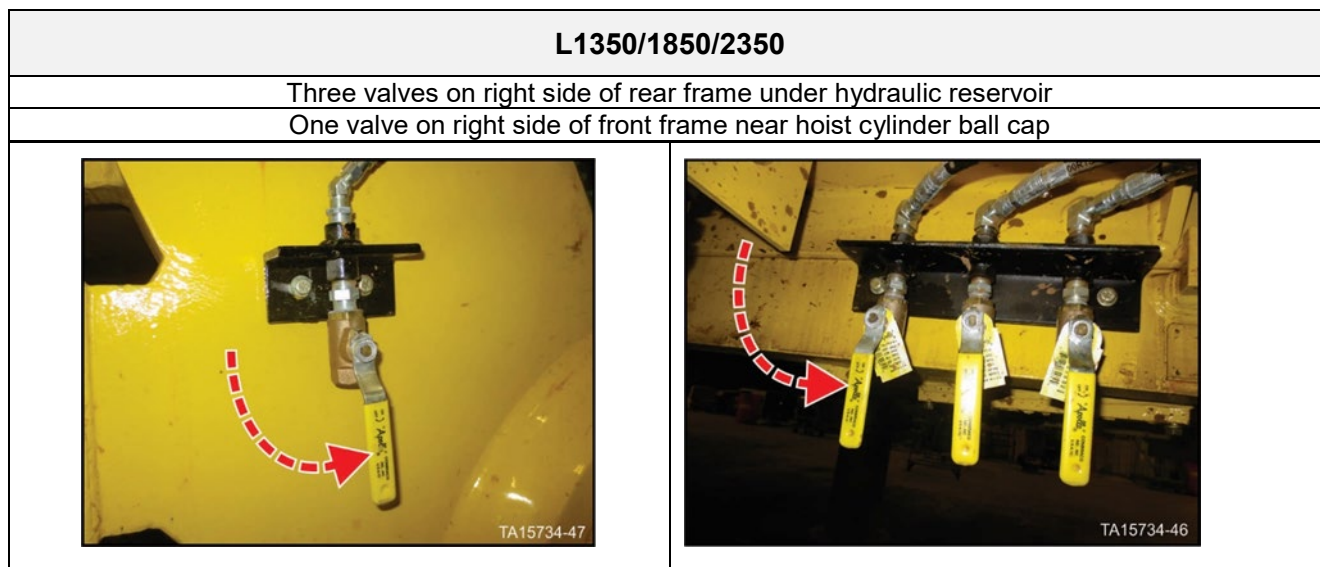


Figure 22. Open air reservoir bleed valves



## WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- j. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- k. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- l. Open the valve completely and leave it open during the procedure.

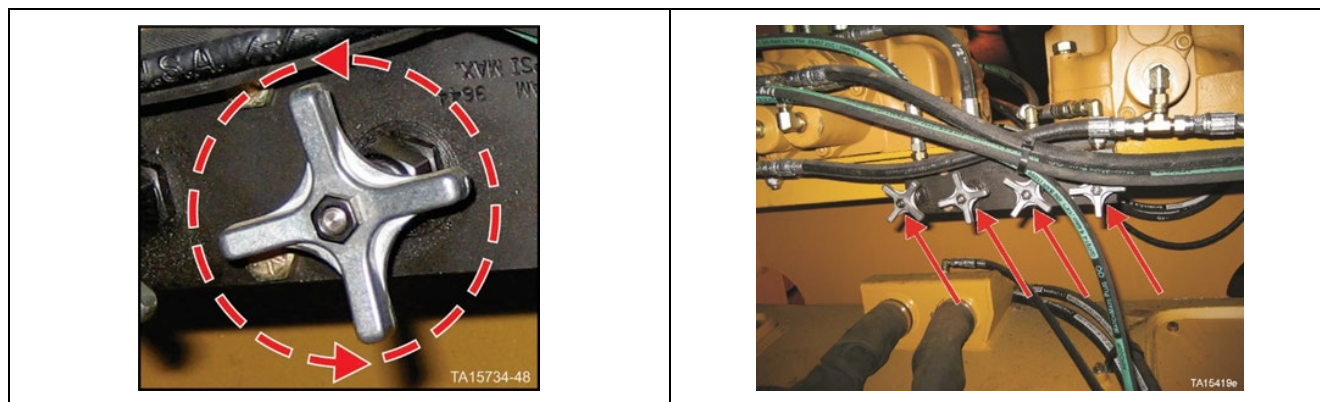


Figure 23. Pressure bleed down valves

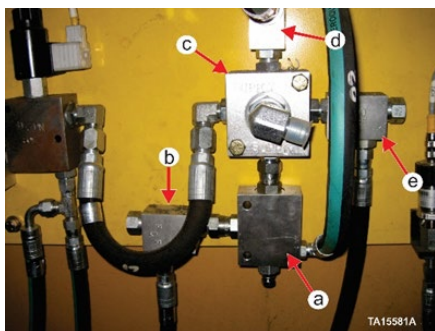
- m. Following all local environmental rules and regulations, take precautions to catch any oil that might spill or drain the hydraulic reservoir.

## NOTICE

When finished with the procedure, if drained, refill the hydraulic reservoir, bleed the pumps, and follow all local rules and regulations to return the machine to operating condition.

### Front Axle Driver Filtration Sequence Valve Setting Procedure

- a. Remove sequence valve from front frame pilot panel.

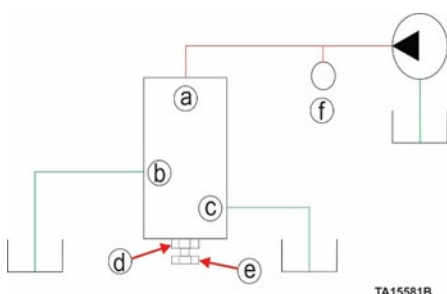


- a. Sequence valve
- b. Front driver filtration flow control
- c. Distribution block
- d. Pilot supply flow control
- e. Grease system flow control

- b. Plumb sequence valve on a test bench. Test bench must be capable of 4 gpm (15.14 lpm) with a pressure rating over 2500 psi (172.4 bar).

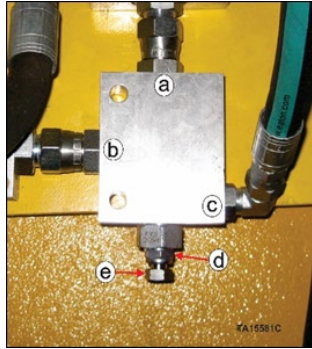
## CAUTION

Valve will not set with PortaPower must have 4-6 gpm.



- a. Inlet
- b. Outlet
- c. Vent line
- d. Jam nut
- e. Adjustment screw
- f. Pressure gauge

- c. Adjust sequence valve pressure by loosening the jamnut and turning the adjustment screw. To increase pressure, turn adjustment screw clockwise. To decrease pressure, turn adjustment screw counter-clockwise. When adjustment is completed, re-tighten the jam nut. REFER TO SPECIFICATIONS SHEET FOR SPECS.

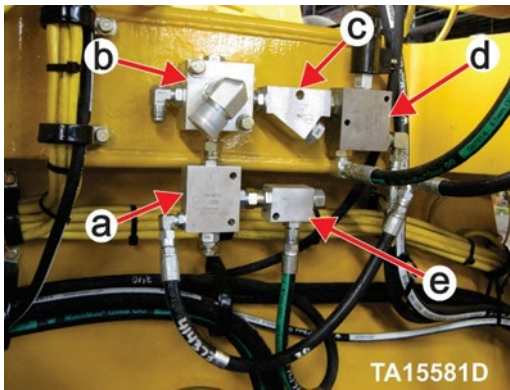


- a. Inlet
- b. Outlet
- c. Vent line
- d. Jam nut
- e. Adjustment screw

d. Remove the valve from the test bench and re-install on the front frame pilot panel.

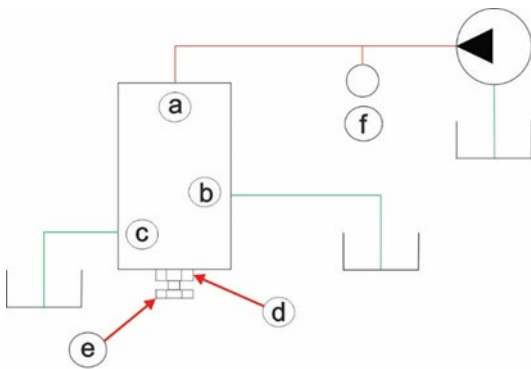
## Rear Axle Driver Filtration Sequence Valve Setting Procedure

- a. Remove the sequence valve from the Accessory Pump distribution block located under the rear of the cab.



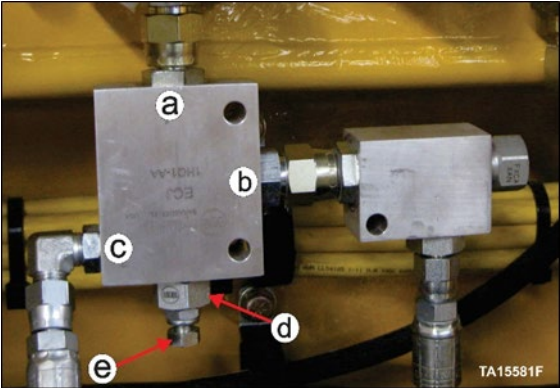
- a. Sequence valve
- b. Distribution block
- c. A/C flow control 6 gpm
- d. A/C motor solenoid
- e. Rear driver filtration flow control

- b. Plumb sequence valve on a test bench. Test bench must be capable of 4 gpm (15.14 lpm) with a pressure rating over 2500 psi (172.4 bar).

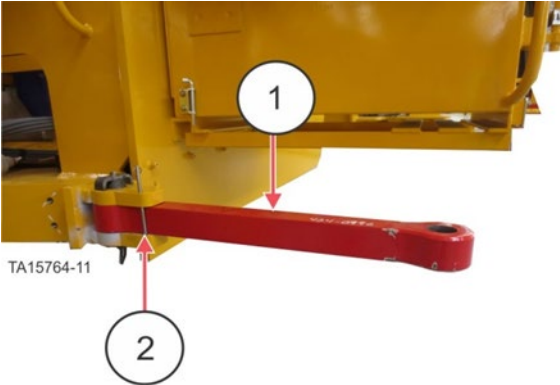
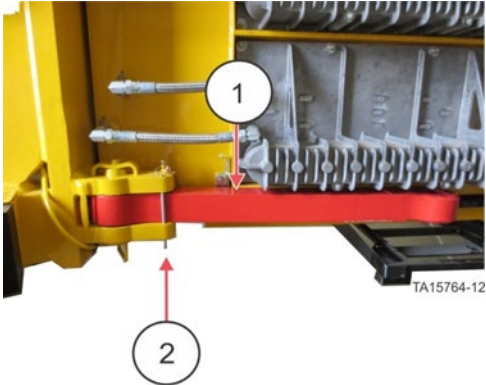


- a. Inlet
- b. Outlet
- c. Vent line
- d. Jam nut
- e. Adjustment screw
- f. Pressure gauge

- c. Adjust sequence valve pressure by loosening the jamnut and turning the adjustment screw. To increase pressure, turn adjustment screw clockwise. To decrease pressure, turn adjustment screw counter-clockwise. When adjustment is completed, re-tighten the jam nut. REFER TO SPECIFICATIONS SHEET FOR SPECS.

|                                                                                   |                                                                                          |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
|  | <p>a. Inlet<br/>b. Outlet<br/>c. Vent Line<br/>d. Jam Nut<br/>e. Pressure Adjustment</p> |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|

- d. Remove valve from test bench and re-install on rear frame accessory pump distribution block.
- e. Follow all local rules and regulations to return the machine to operating condition.
  - Remove the safety link between the frames and secure.

|                                                                                    |                                                                                     |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |
| L-1350                                                                             | L-1850 and L-2350                                                                   |
| 1) frame lock shown in carry position, 2) retaining pin for carry position         |                                                                                     |

Required Tools:

- 1/2" open-end wrench
- 9/16" open-end wrench
- Gauge 0 5000 psi (0 345 bar)

Troubleshooting

If the pressure cannot be adjusted, the following items need to be inspected, repaired, and/or replaced.

- Sequence Valve

## Procedure I HUSCO Reliefs

### Safety Preparations

Follow all local safety rules for performing the following procedure. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

#### **WARNING**

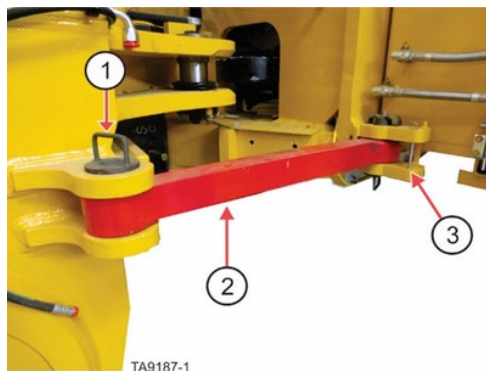
Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine is not running for this setting. The adjustment is done on a test bench.

- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.

#### **WARNING**

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position
- 3) Retaining pin bracket for un-locked position

**Figure 24. Frame lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.
- f. Shut off the engine.



## WARNING

Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.

- g. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.

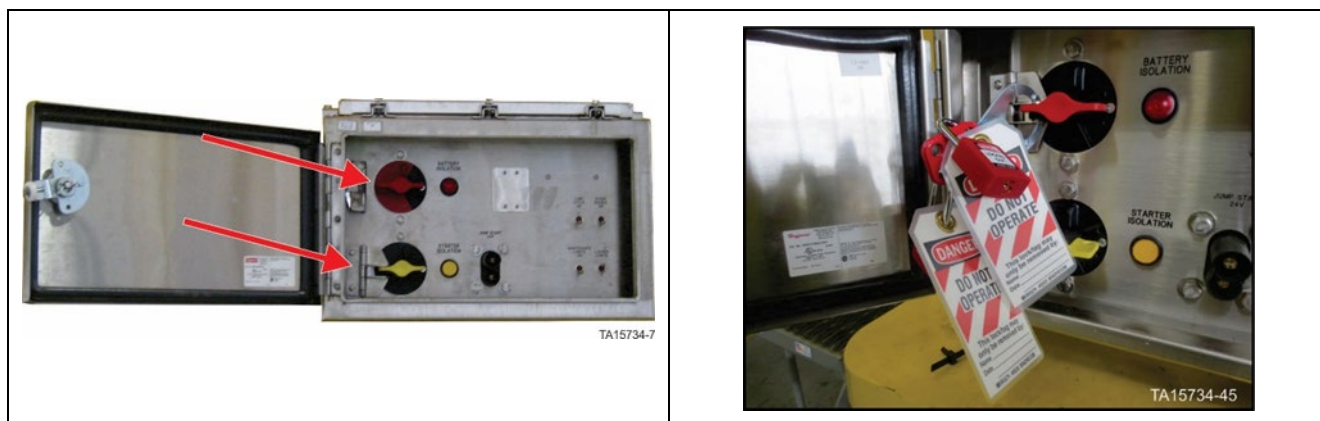


**Figure 25. GEN 2 Battery Isolation Box – Battery isolation switch in OFF position with locks in place**

- h. Release the air from the hydraulic reservoir by using the hydraulic reservoir air valve (ball valve) on top of the reservoir. The supply line from main air system will be blocked and reservoir air will vent out the hose that runs down the outside of the hydraulic reservoir.
  - Turn the handle to the up position as shown

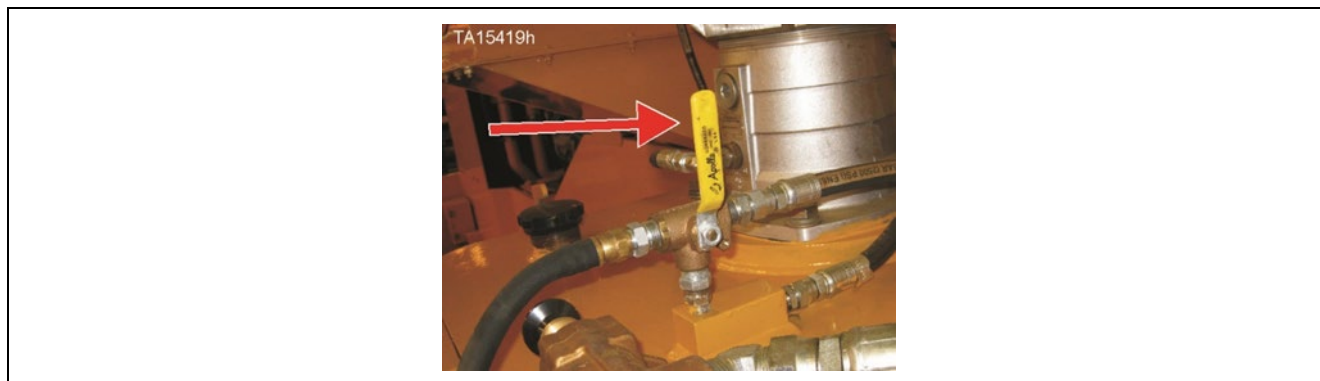


**Figure 26. Hydraulic reservoir air valve handle UP**

- i. Release the air from the various air storage reservoirs by opening all of the air bleed valves.

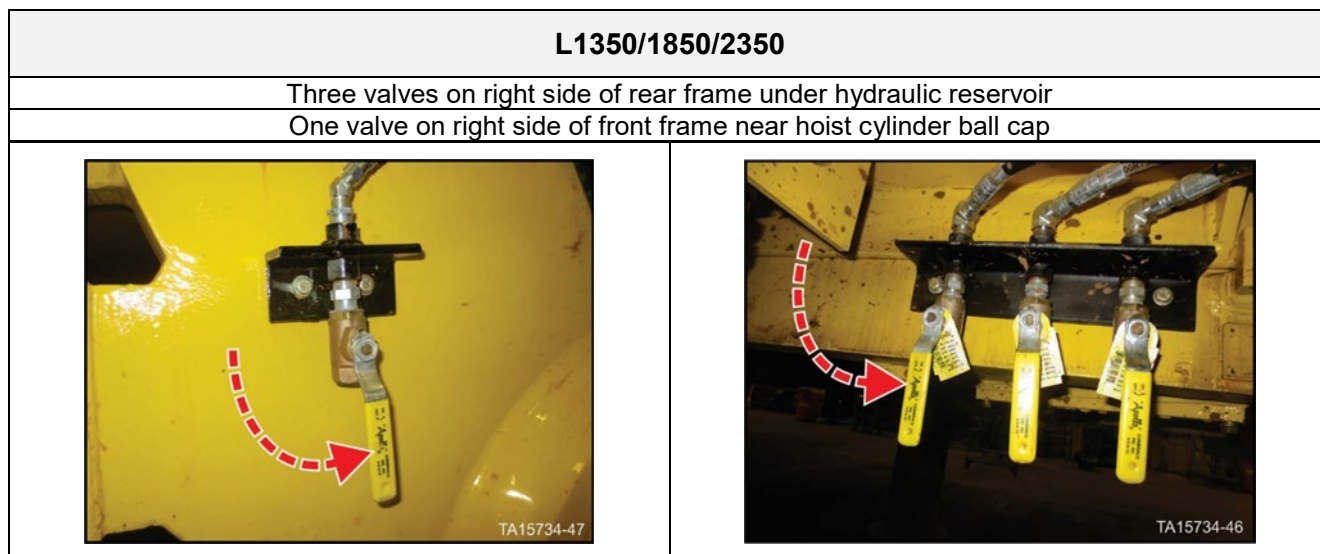


Figure 27. Open air reservoir bleed valves



## WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- j. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- k. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- l. Open the valve completely and leave it open during the procedure.

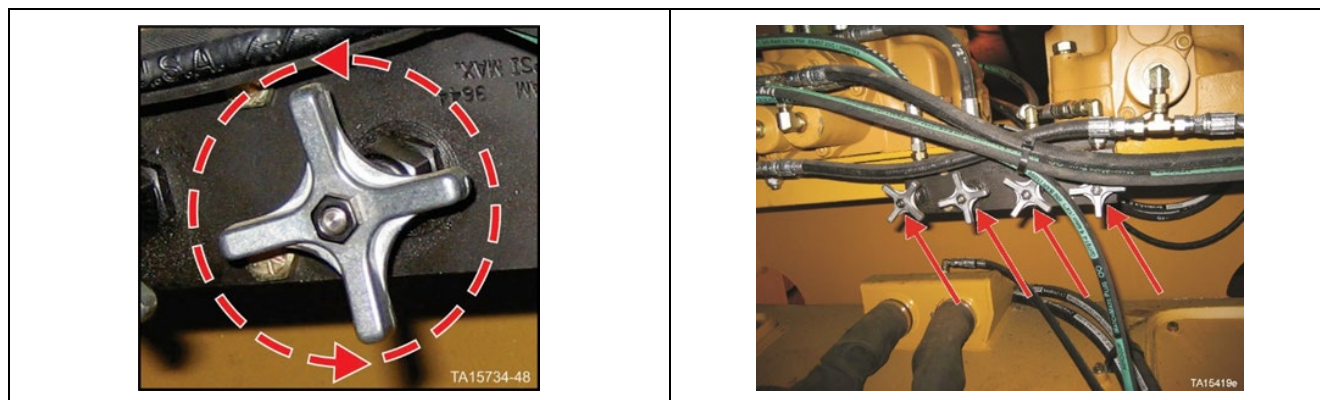


Figure 28. Pressure bleed down valves

- m. Following all local environmental rules and regulations, drain the hydraulic reservoir and any residual fluid in the hydraulic lines.

## NOTICE

**When finished with the procedure, if drained, refill the hydraulic reservoir and follow all local rules and regulations to return the machine to operating condition.**

Dual and single spool HUSCO valves are used on all Generation3 loaders. Each valve has a main inlet relief. The dual spool valve has additional circuit reliefs. Depending on the machine, the pressure settings of these reliefs vary. Before installing a new valve or replacing a relief, verify the setting using the test block (P/N 4210352). The test block is provided in the tool group for each machine. A flow of 4 gpm (15.14 lpm) and 5000 psi (345 bar) is required, which can be provided by the test bench.

### Setting Procedure

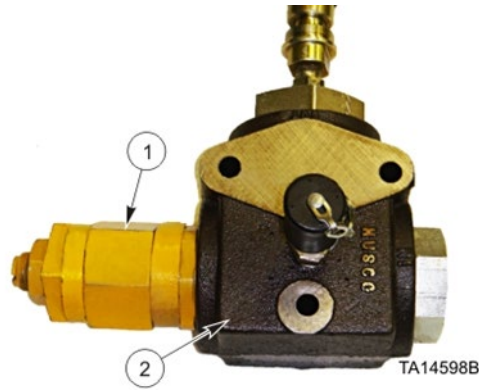


Typical Test Bench

- a. Remove relief valves from valve body.



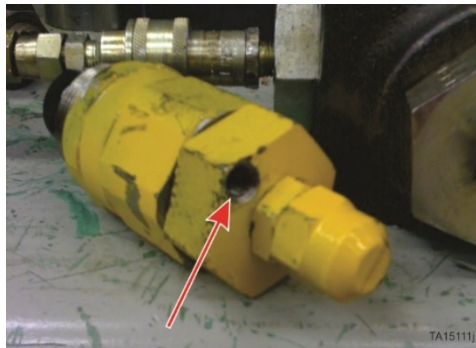
- b. Screw relief valve into test block. Test block hose connections are labeled IN and OUT.



1) Relief valve 2) Test block

## NOTICE

The bucket rod relief has a #4 NPT port that must be plugged prior to testing.



Needs to be plugged before adjustments

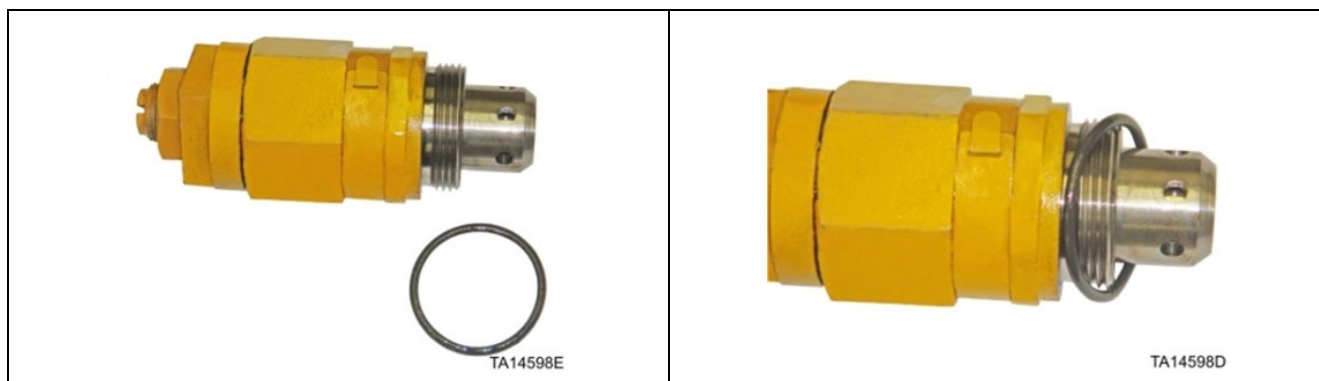
- c. Turn on hydraulic power unit and push directional valve IN and note pressure. Record pressure when valve is flowing, not when it first opens.
- d. If adjustment is necessary, loosen jam nut on adjusting screw. Turn adjusting screw clockwise to increase pressure and counter clockwise to decrease pressure. (1 turn = 1000 psi (68.9 bar) change of pressure.)



1) Jam nut



- e. Recheck pressure after adjusting screw and retighten jam nut.
- f. When pressure is adjusted correctly, install a new O-ring found in seal kit (P/N 422-2113) on the relief valve.

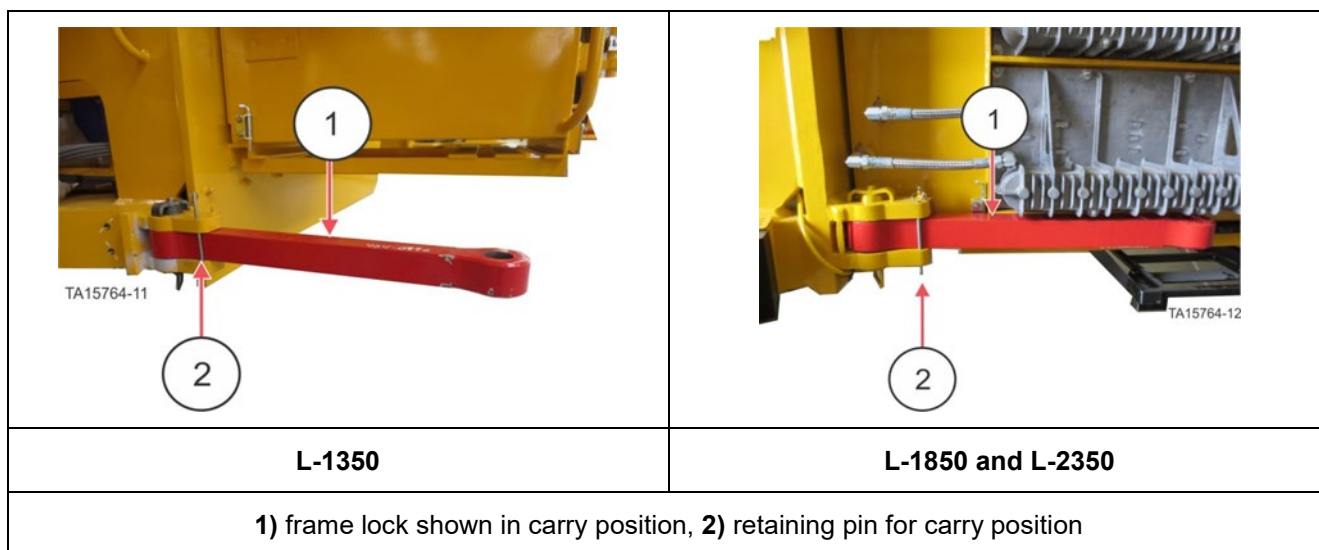


- g. Install relief valves back into the valve body.



- h. Follow all local rules and regulations to return the machine to operating condition.

- Remove frame lock and secure properly.



**Required Tools:**

- 4 gpm (15.1 lpm) @ 5000 psi (345 bar) power unit.
- Gauge 0 5000 psi (0 345 bar).
- Flat screwdriver.
- Hex Wrenches.
- Open-end wrenches.

**Troubleshooting**

If the pressures cannot be set the following items need to be inspected, repaired, and or replaced:

- Pilot spool in the middle of the end of relief valve should move freely.
- The tapered valve seat area should be flat, excessive grooving or hydraulic erosion will not allow the valve to seal properly.
- Internal spring damaged or broken.
- Contamination internal to the spools are preventing proper operation.
- Test bench main relief valve set to low (should be 5000 psi [345 bar]).

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## Procedure J

# Bucket and Hoist Pumps Pressure Setting

### Safety Preparations

Follow all local safety rules for performing the following procedures. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.



## WARNING

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine engine must be started and shut down during this procedure.

- Use appropriate hearing protection.
- Stay clear of all rotating equipment or components
- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.



## WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



## WARNING

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. DO NOT tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. DO NOT make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.



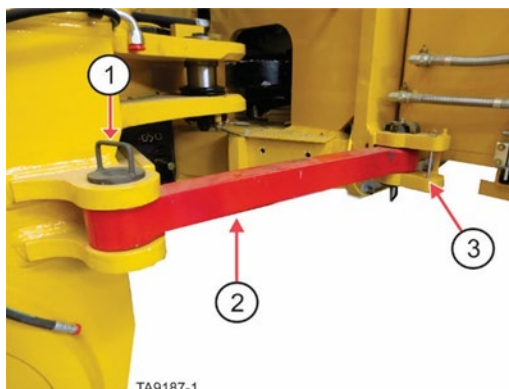
## WARNING

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. **DO NOT** tighten or loosen hydraulic fluid hoses without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.



## WARNING

Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.



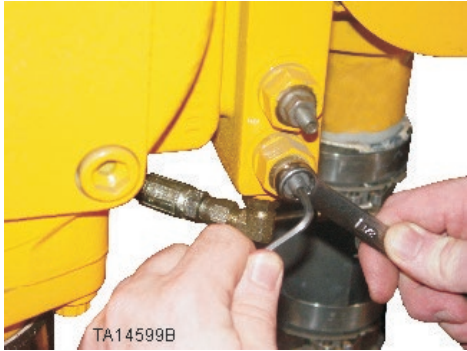
**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,  
3) Retaining pin bracket for un-locked position

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.

## Setting Procedure

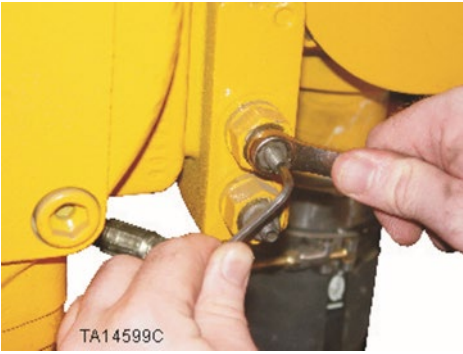
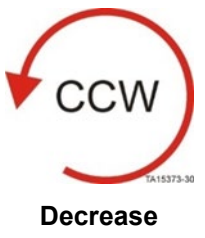
- a. All bucket and hoist main pumps flow (stand-by) adjustments should be screwed all the way in. Loosen jam nut and turn adjustment screw all the way in clockwise. Re-tighten jam nut.

|                                                                                                                  |                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
|  <p><b>Completely Tight</b></p> |  <p><b>Flow Compensator</b></p> |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|

- b. Bypass hoist motion limits in LINC3 and slowly extend the hoist cylinders fully. Place the engine into high throttle. Using LINC3 look at each main pump pressure while commanding hoist at full extension. Verify the correct setting on each main pump.

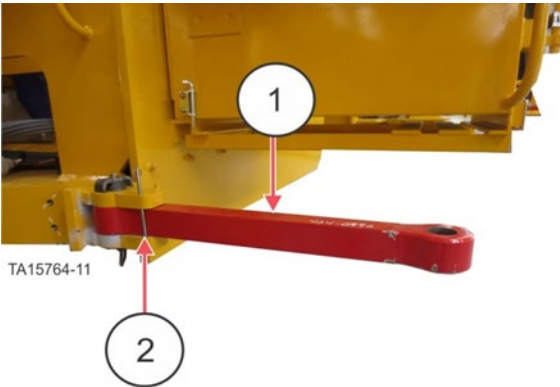
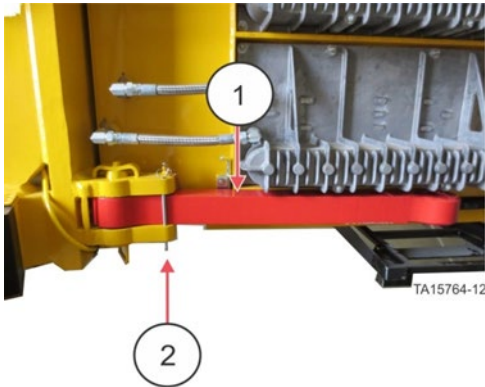
|                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>***This screen capture is for illustration of channels to be monitored. The pressure and charts indicated on this graphic do not represent actual machine values.***</b></p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

- c. To adjust main pump pressure, loosen locknut on pressure compensator adjustment and rotate adjustment clockwise to increase pressure, counter clockwise to decrease pressure. Once correct pressure is reached, tighten locknut and recheck pump pressure.

|                                                                                                            |                                                                                                                         |                                                                                                              |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
|  <p><b>Increase</b></p> |  <p><b>Pressure Compensator</b></p> |  <p><b>Decrease</b></p> |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|

- d. Follow all local rules and regulations to return the machine to operating condition.

- Remove frame lock and secure properly.

|                                                                                   |                                                                                    |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|  |  |
| <b>L-1350</b>                                                                     | <b>L-1850 and L-2350</b>                                                           |
| 1) frame lock shown in carry position, 2) retaining pin for carry position        |                                                                                    |

#### Required Tools:

- 4mm Hex wrench
- 1/2" open-end wrench
- Gauge 0 5000 psi (0 345 bar)

#### Troubleshooting

If the pressure cannot be set, the following items need to be inspected, repaired, and/or replaced:

- Hoist and Bucket calibration function may need to be completed.
- Calibration can affect maximum pilot pressure, causing reduced pressures.
- Pilot system problems: Pilot supply pressure, proportional control solenoids, pilot logic elements and orifice.
- HUSCO Main Relief Adjustment (Refer to HUSCO Relief Adjustment Procedure).
- HUSCO Port Relief Adjustment (Refer to HUSCO Relief Adjustment Procedure).
- Main Pump Compensator Valve contamination.
- Bypassing cylinder(s)/Float valve.
- Main Pump Case Drain flow excessive.
- Main Pump Q min and Q max settings.
- Failed Pump

## Procedure K

### Secondary Dump Relief Pressure Setting

#### Safety Preparations

Follow all local safety rules for performing the following procedures. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

#### WARNING

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine engine must be started and shut down during this procedure.

- Use appropriate hearing protection.
- Stay clear of all rotating equipment or components
  - a. Ensure the bucket is empty and clear of debris.
  - b. Park the machine with the bucket flat on the ground.
  - c. Move the frame lock to the locked position so that the frame cannot be steered.

#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.

#### WARNING

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. DO NOT tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. DO NOT make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.

#### WARNING

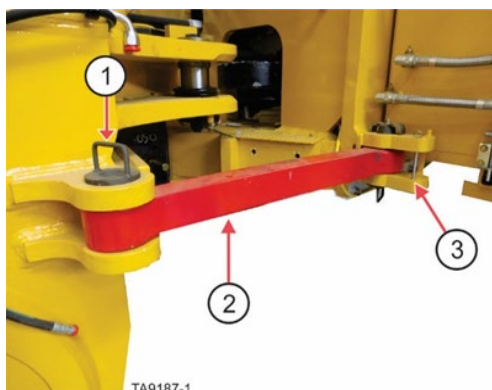
Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. DO NOT

tighten or loosen hydraulic fluid hoses without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.



## WARNING

Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position  
3) Retaining pin bracket for un-locked position

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.

## Setting Procedure



## WARNING

Crush hazard exists if all personnel are not cleared from around the bucket and lift arms. Do not allow personnel work around lift arm area during any procedure in which the lift arms will be moved. Failure to clear all personnel from the lift arm area could cause crush hazards resulting in serious injury or death.

- a. Raise the lift arms to full height.
- b. With lift arms at full height, dump the bucket. At this time, the maximum dump pressure reading of bucket cylinder rod (XDR BR) should read as specified on the specifications sheet.

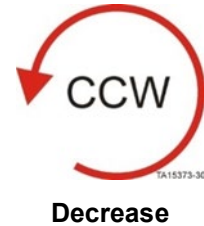


\*\*\*This screen capture is for illustration of channels to be monitored. The pressure and charts indicated on this graphic do not represent actual machine values. \*\*\*

- c. If incorrect, adjust relief valve located in the front frame on right-hand side. Loosen locknut and turn clockwise to increase pressure and counter clockwise to decrease pressure to the correct level.

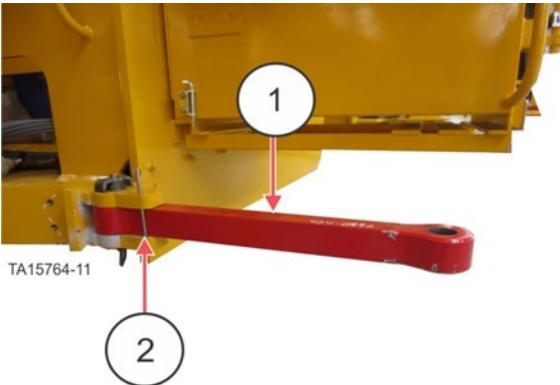
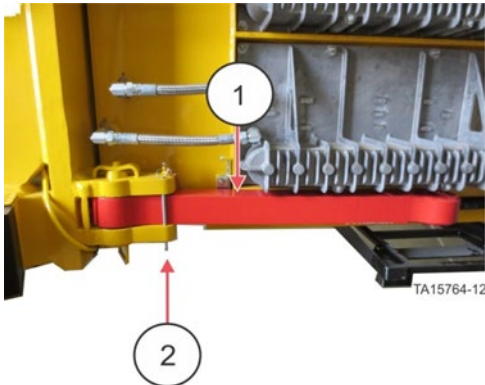


Secondary dump pressure relief 800 psi  
(55 bar) SOL SD



- d. Once the correct pressure is reached, tighten locknut.

- e.
- f. Follow all local rules and regulations to return the machine to operating condition.
  - Remove the safety link between the frames and secure.

|                                                                                   |                                                                                    |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|  |  |
| <b>L-1350</b>                                                                     | <b>L-1850 and L-2350</b>                                                           |
| 1) frame lock shown in carry position, 2) retaining pin for carry position        |                                                                                    |

#### Required Tools:

- 4mm Hex wrench
- 1/2" open-end wrench

#### Troubleshooting

If the pressure cannot be set, the following items need to be inspected, repaired, and or replaced.

- Pressure reducing valve (SD)
- Solenoid (SD)
- HUSCO Bucket Rod Relief valves

## Procedure L

### Steering Valve Main Relief Pressure Setting

#### Safety Preparations

Follow all local safety rules for performing the following procedures. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

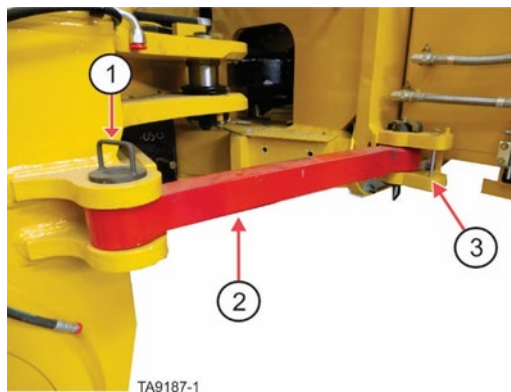
#### WARNING

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.

#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,  
3) Retaining pin bracket for un-locked position

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.
- f. Shut off the engine.

## WARNING

Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.

- g. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.

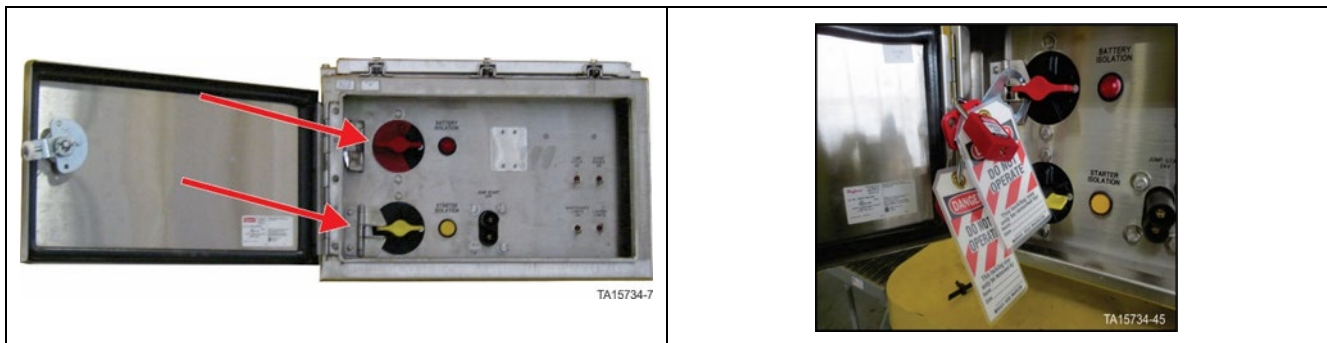


**Figure 29. GEN 2 Battery Isolation Box – Battery isolation switch in OFF position with locks in place**

- h. Release the air from the hydraulic reservoir by using the hydraulic reservoir air valve (ball valve) on top of the reservoir. The supply line from main air system will be blocked and reservoir air will vent out the hose that runs down the outside of the hydraulic reservoir.
  - Turn the handle to the up position as shown

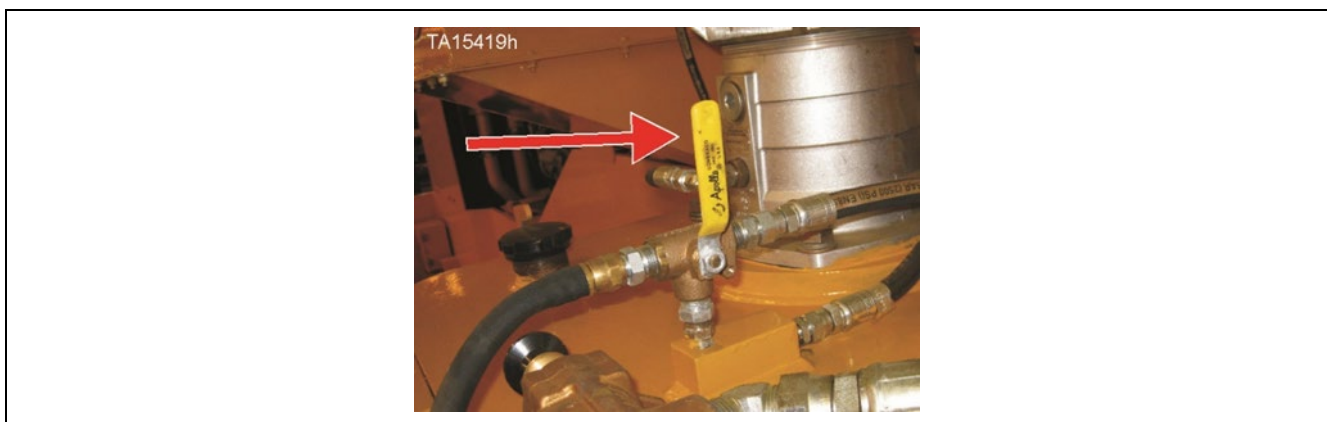


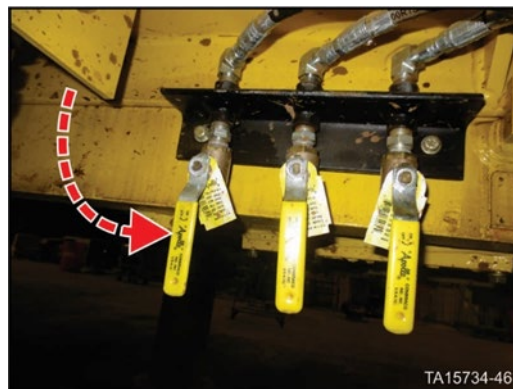
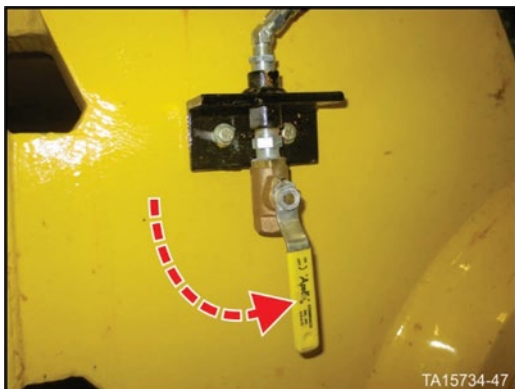
**Figure 30. Hydraulic reservoir air valve handle UP**

- i. Release the air from the various air storage reservoirs by opening all of the air bleed valves.

**L1350/1850/2350**

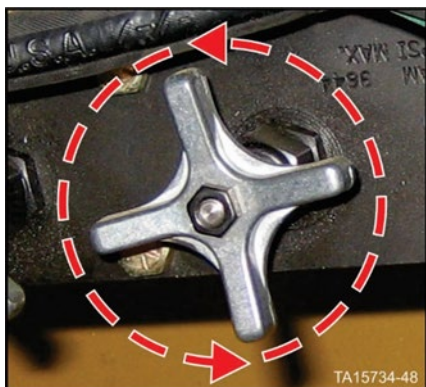
Three valves on right side of rear frame under hydraulic reservoir

One valve on right side of front frame near hoist cylinder ball cap

**Figure 31. Open air reservoir bleed valves****WARNING**

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- j. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- k. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- l. Open the valve completely and leave it open during the procedure.

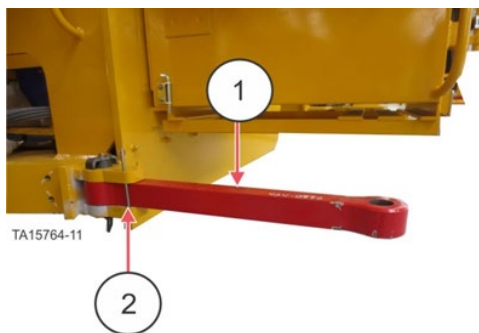
**Figure 32. Pressure bleed down valves**

## Setting the Steering Valve Main Relief

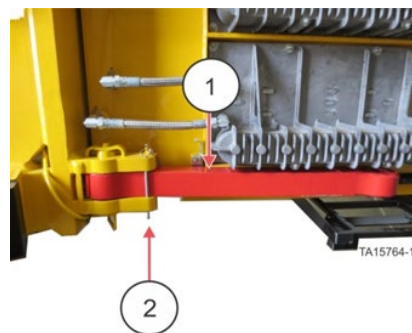
- a. Locate the main relief valve on top of the DANFOSS Flow Amplifier Valve.
  - This valve should be screwed all the way in.



- b. Follow all local rules and regulations to return the machine to operating condition.
  - Remove the safety link between the frames and secure.



**L-1350**



**L-1850 and L-2350**

1) frame lock shown in carry position, 2) retaining pin for carry position

### Required tools:

- 4mm Hex wrench Need to verify sizes
- Two gauges 0 5000 psi (0 345 bar)

### Troubleshooting

If the pressure cannot be set, the following items need to be checked.

- DANFOSS main relief valve not bottomed out.
- Steering Pumps
- Auxiliary Steering Check valve (if installed)
- PVG 32 Valve
- Electrical Signal to PVG 32 Valve
- Steering Interface Card
- LINCS Steering Limits and Position Sensor
- Steering High Pressure Filter
- Steering Joystick
- Digital Card
- Digital Module 6

## Procedure M

### Steering Pump Compensator Setting

#### Safety Preparations

Follow all local safety rules for performing the following procedures. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.



#### WARNING

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. **ANYONE** performing inspections or service procedures to the machine should be familiar with **ALL** instructions and procedures contained in the machine's **SERVICE MANUAL**. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

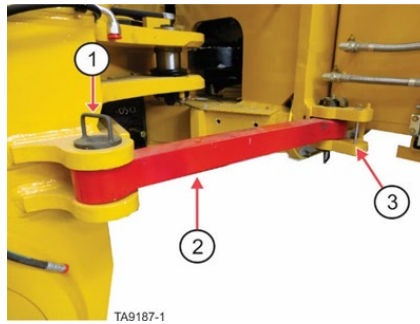
The machine engine must be started and shut down during this procedure.

- Use appropriate hearing protection.
  - Stay clear of all rotating equipment or components
- 
- a. Ensure the bucket is empty and clear of debris.
  - b. Park the machine with the bucket flat on the ground.
  - c. Move the frame lock to the locked position so that the frame cannot be steered.



#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



### L1350/1850/2350

#### Frame lock in locked position

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position  
3) Retaining pin bracket for un-locked position

- d. Place wheel chocks in front and behind each tire.
- Do not place the chocks tight against the tires. See NOTICE below.

## NOTICE

During this test the machine will be steered against the frame lock. Provide three to five inches of clearance between the wheel chock and the tire. The tire will move slightly during steering and will crush the chock if it is too tight against the tire.

- e. Set the parking brakes.

## f. WARNING

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. DO NOT tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. DO NOT make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.

## WARNING

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. DO NOT tighten or loosen hydraulic fluid hoses without first relieving the pressure. DO NOT make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.

## WARNING

Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

## Setting the Steering Pump Compensators

### Standby Setting

- a. Start the engine, and engage high throttle.
  - Follow all local engine startup safety procedures.
- b. Set the Standby (flow) pressure.
  - In LINCS, view steering pump A and steering pump B channels.
  - With engine in high throttle, check pump standby (flow) pressure.
    - (Steering Joystick in neutral)
    - Pressure should read per specification on Specification sheet on both pumps.

## WARNING

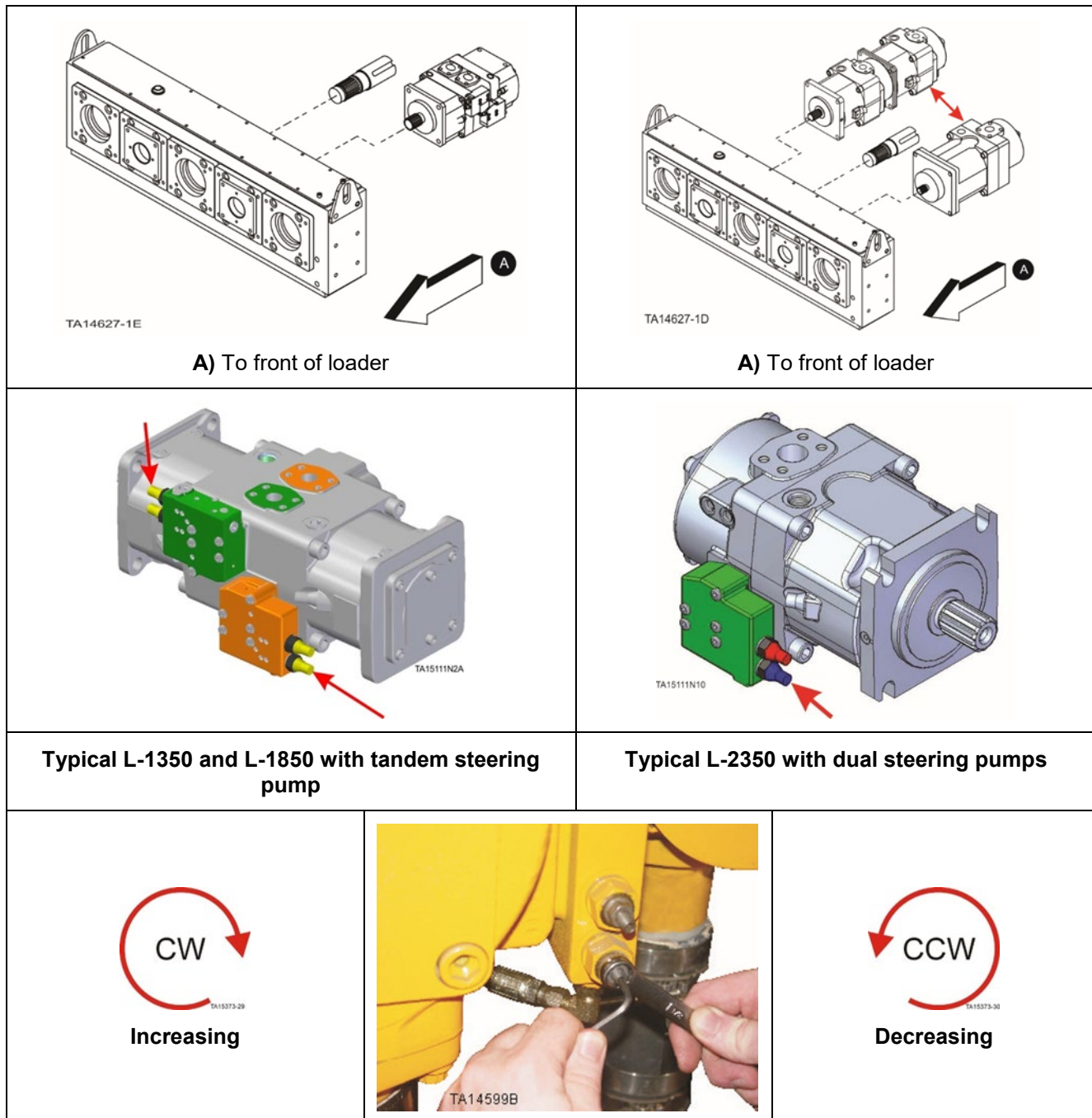
Entanglement hazard exists when working around the steering pump if the engine is running. Long unconfined hair or loose clothing can get wrapped around the drive shaft. The pump is adjacent to the drive line shaft. Do not make pressure adjustments while the engine is running. Stop the engine and make adjustments. Failure to stop the engine before making adjustments to the steering pump can cause entanglement hazards around the drive shaft resulting in serious injury or death.



1) Pump flow compensator

- c. Stand-by pressure (flow) is adjusted by loosening the jam nut on the flow compensator adjustment screw and then turning flow control clockwise to increase pressure, counter clockwise to decrease pressure.

- d. Re-tighten the flow compensator adjustment screw jam nut when correct pressure is obtained.



**Typical flow compensator adjustment screw**

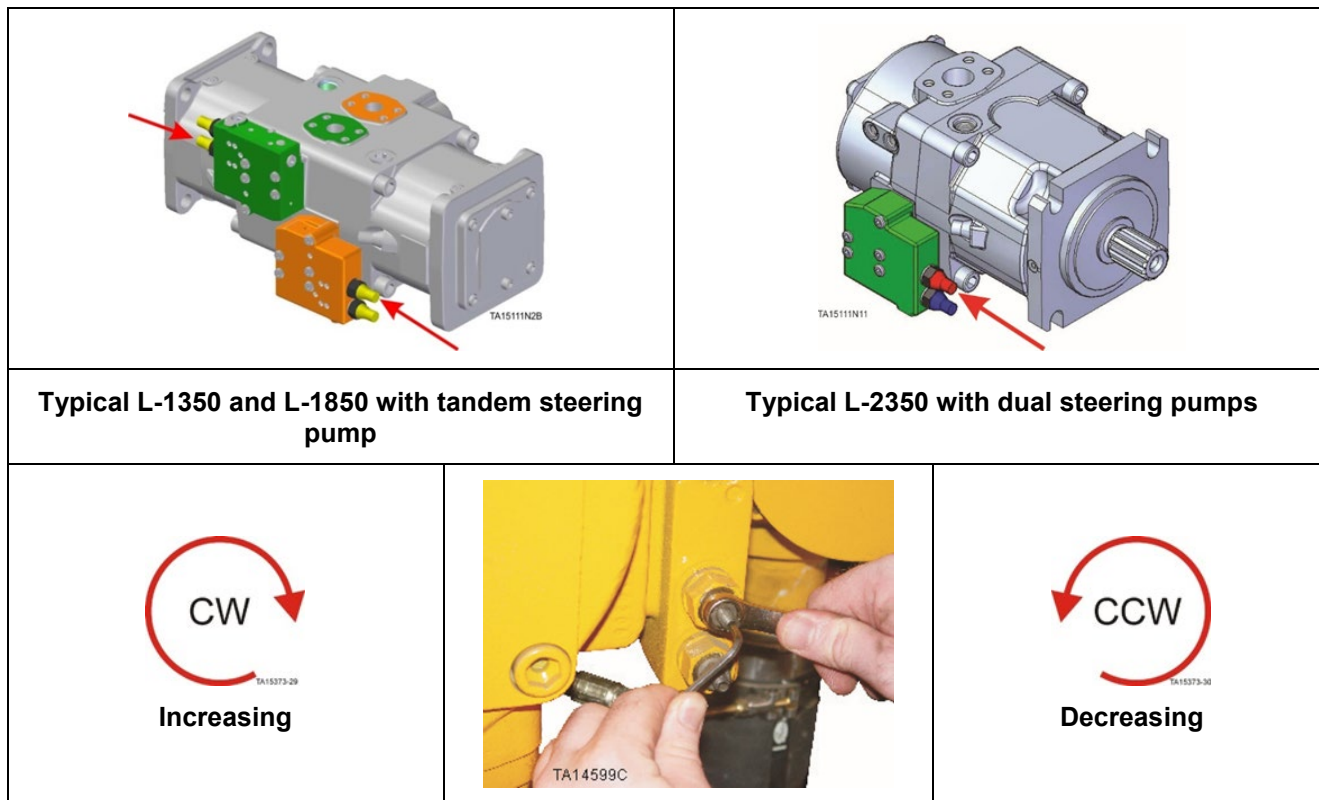
## Pressure Setting

- Navigate to the "User Preference" screen in LINCII.
- Enable "Inhibit Park Brake Release Mode".
  - Touch the "Inhibit Park Brakes Release Mode Enable" button to allow the Park Brakes Switch to be pulled OUT without actually releasing the park brakes.



User Preferences Screen

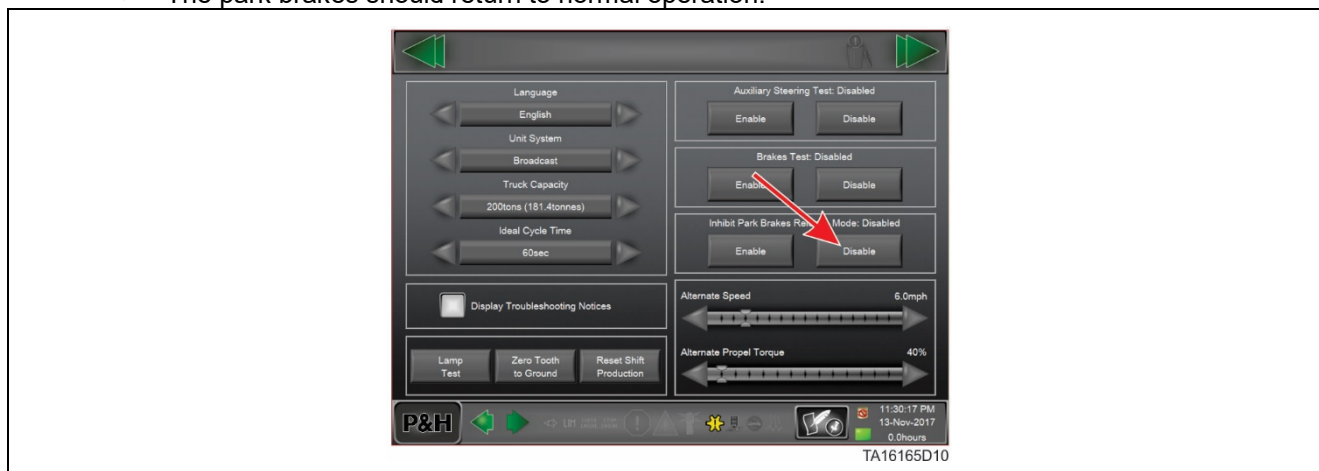
- c. Pull out the park brake switch.
  - If the Park Brake Switch is pulled OUT, the Park Brake Switch Light will flash and hydraulic operations are allowed (steering, hoist, bucket).
  - Propel is prevented because the park brakes do not release.
- d. Ensure the machine throttle is set at HIGH.
- e. Steer to the right and hold the pumps at stall, and record pressure.
- f. Steer to the left and hold the pumps at stall, and record pressure.



Typical pressure compensator adjustment screw

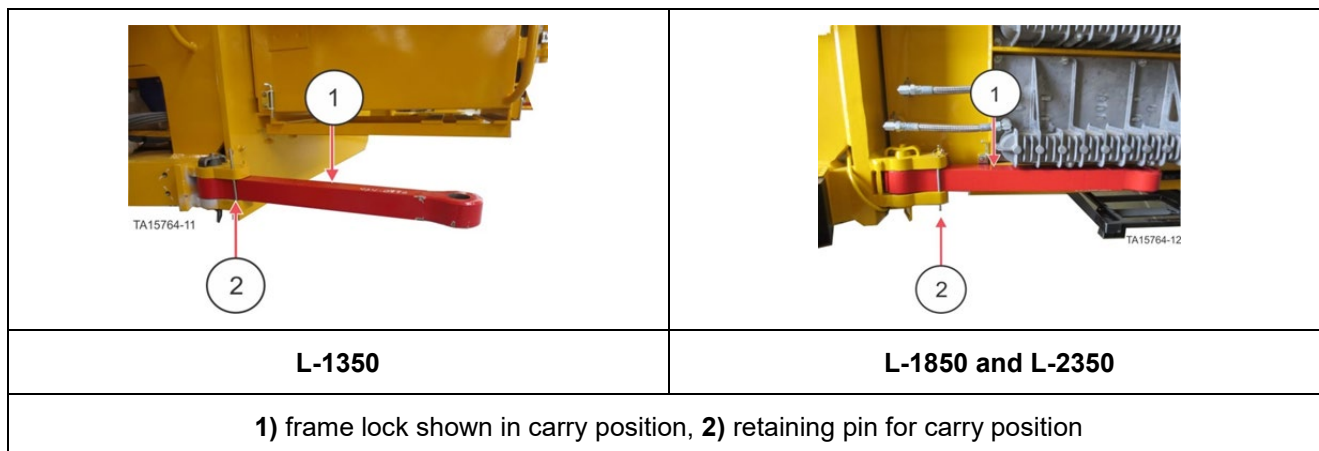
- g. Compare the left and right steering pressures.
  - Both right and left steering pressures should be the same.

- If both pump pressures are incorrect in one direction only, the problem is either the interface card, PVG 32 valve, or the shock/suction valve for that direction. See procedure “DANFOSS STEERING SHOCK AND SUCTION RELIEF VALVE”.
  - If only one pump pressure is incorrect, adjust that pump's compensator.
  - If both pump pressures are the same, adjust both pump pressure compensators to the value specified on the Specification sheet.
- h. Disable the “Inhibit Park Brake Release Mode”.
- The park brakes should return to normal operation.



User Preferences Screen

- i. Follow all local rules and regulations to return the machine to operating condition.
- Remove the safety link between the frames and secure.

**Required Tools:**

- Pressure Gauge
- Various open-end and Hex wrenches

**Troubleshooting**

If pressures cannot be set, the following items need to be cleaned or replaced.

- Shock/suction valve
- O-ring
- Interface card
- PVG 32 valve

## Procedure M1 (L-2350 Only) Steering Crossover Relief Valves

### Safety Preparations

Follow all local safety rules for performing the following procedures. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

The machine is not running for this setting. The adjustment is done on a test bench.

### **WARNING**

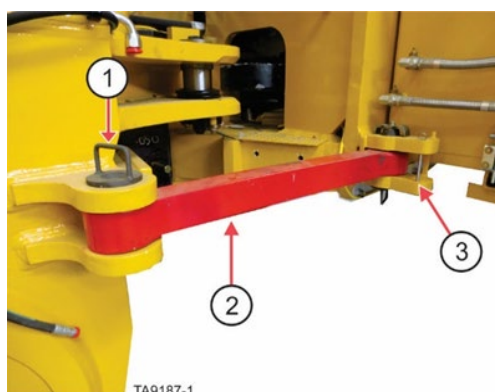
Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine must not be running during this procedure.

- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.

### **WARNING**

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position  
3) Retaining pin bracket for un-locked position

**Figure 33. Frame Lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.
- f. Shut off the engine.



## WARNING

Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.

- g. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



**Figure 34. Battery Isolation Box – Battery isolation switch in OFF position with locks in place**

- h. Release the air from the hydraulic reservoir by using the hydraulic reservoir air valve (ball valve) on top of the reservoir. The supply line from main air system will be blocked and reservoir air will vent out the hose that runs down the outside of the hydraulic reservoir.
- Turn the handle to the up position as shown

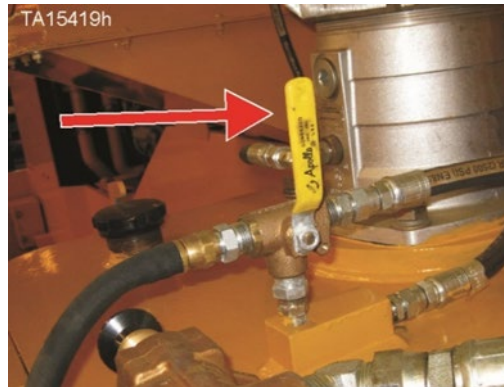


**Figure 35. Hydraulic reservoir air valve handle UP**

- i. Release the air from the various air storage reservoirs by opening all of the air bleed valves.

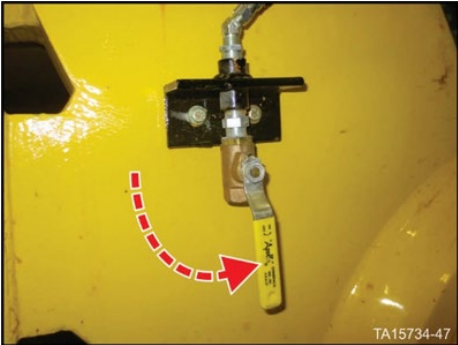
| <b>L1350/1850/2350</b>                                                              |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Three valves on right side of rear frame under hydraulic reservoir                  |                                                                                      |
| One valve on right side of front frame near hoist cylinder ball cap                 |                                                                                      |
|  |  |

**Figure 36. Open air reservoir bleed valves**

## ⚠ WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- j. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.

- k. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- l. Open the valve completely and leave it open during the procedure.

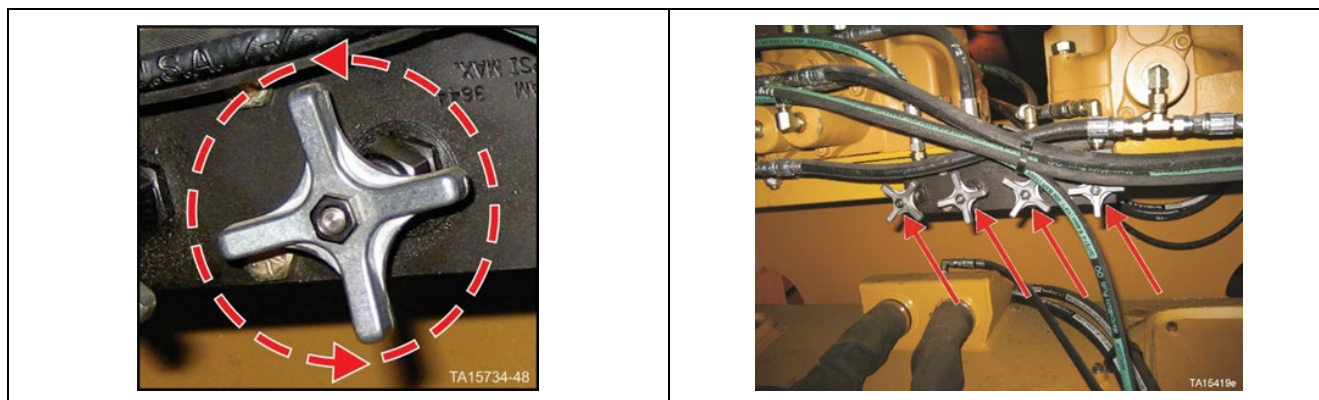


Figure 37. Pressure bleed down valves

- m. Following all local environmental rules and regulations, drain the hydraulic reservoir and any residual fluid in the hydraulic lines.

## CAUTION

Environmental hazard exists when draining the hydraulic reservoir. The hydraulic reservoir must be drained to prevent an oil spill during this procedure when hydraulic fittings are loosened or removed. The Shock and Suction valves are located below the level of oil in the Hydraulic Reservoir. These valves are directly connected through a return line to the hydraulic reservoir. If the valves are removed without draining the Hydraulic Reservoir, a great amount of oil will be spilled. Catch all fluids and dispose of them according to local rules, regulations, and laws. Failure to drain the reservoir could cause an environmental hazard resulting in environmental contamination.



## CAUTION

Burn hazard exists when draining the hydraulic reservoir. Wear all locally required personal protective equipment (PPE) and prevent any bodily contact with oil. If the oil is still hot, it will cause serious bodily burns. Failure to wear PPE while draining the reservoir or performing this procedure could cause burn hazards resulting in personal injury.

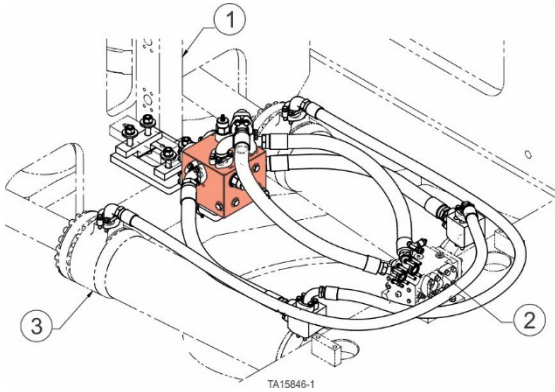
## NOTICE

The Steering Crossover Relief valves are located below the level of oil in the Hydraulic Reservoir. Because of anti-cavitation valves in the flow amplifier, if the valves are removed without draining the Hydraulic Reservoir, a great amount of oil will be spilled when the valves are removed.

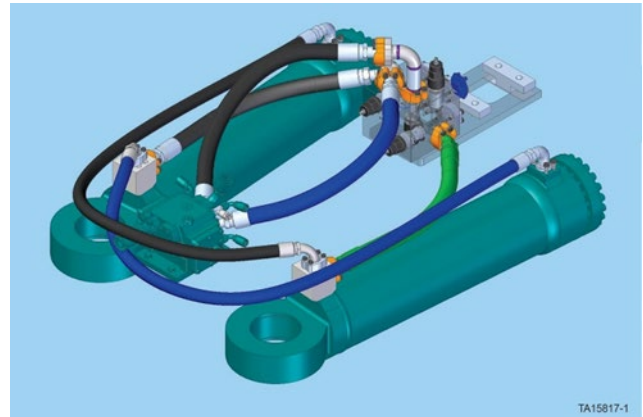
## NOTICE

When finished with the procedure, refill the hydraulic reservoir and follow all local rules and regulations to return the machine to operating condition.

## Setting the Steering Crossover Relief Valves



- 1) Rear Manifold Reference 2) Flow Amplifier  
3) LH Steering Cylinder



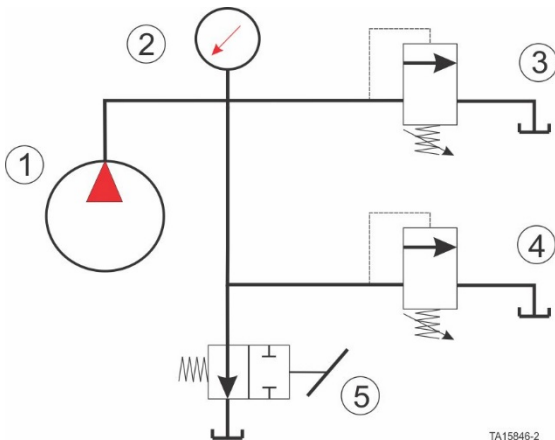
**Steering Crossover Relief Valve Assembly**

## NOTICE

This valve **cannot** be set with a hand or air operated port-a-power pump. The reliefs cannot be set on the machine.

The use of a test bench pump with a capability to produce a minimum of 5000 psi at 4 gpm. (344 bar @ 15.14 liter), is required for setting the Steering Crossover Relief Valves. There are two (2) on the machine. The valves are set with a flow rate of 4 gpm (15.14 liter).

A typical test bench will normally be set up according to the schematic below.



**Pump Relief:**  
5000 PSI @ 4 gpm (344 bar @ 15.14 lpm)

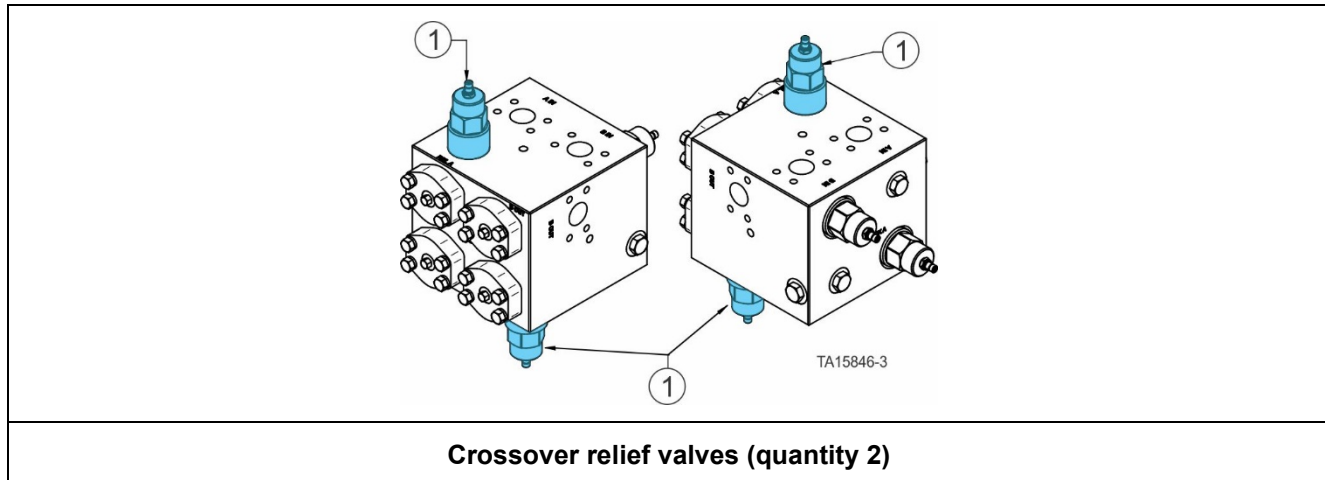
**Steering Crossover Relief**  
4300 PSI (297 bar)

- 1) Pump, 2) Pressure Gauge, 3) Test Bench Pump Relief, 4) Steering Crossover Relief Valve,  
5) Unloading Valve (Manual)

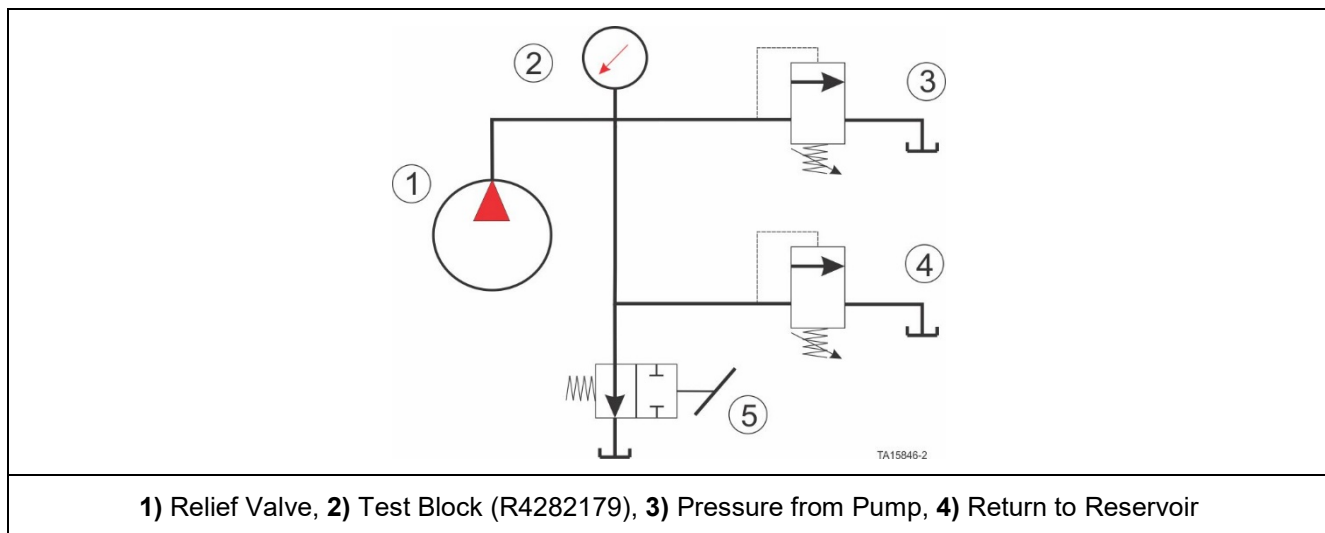
**Typical Test Bench Setup Schematic**

- a. Place a suitable catch basin below the Steering Crossover valve assembly.

- b. Remove the two (2) Crossover relief valves.



- c. Insert the valves into the test block (Part Number R4282179).



### Test Block Set Up

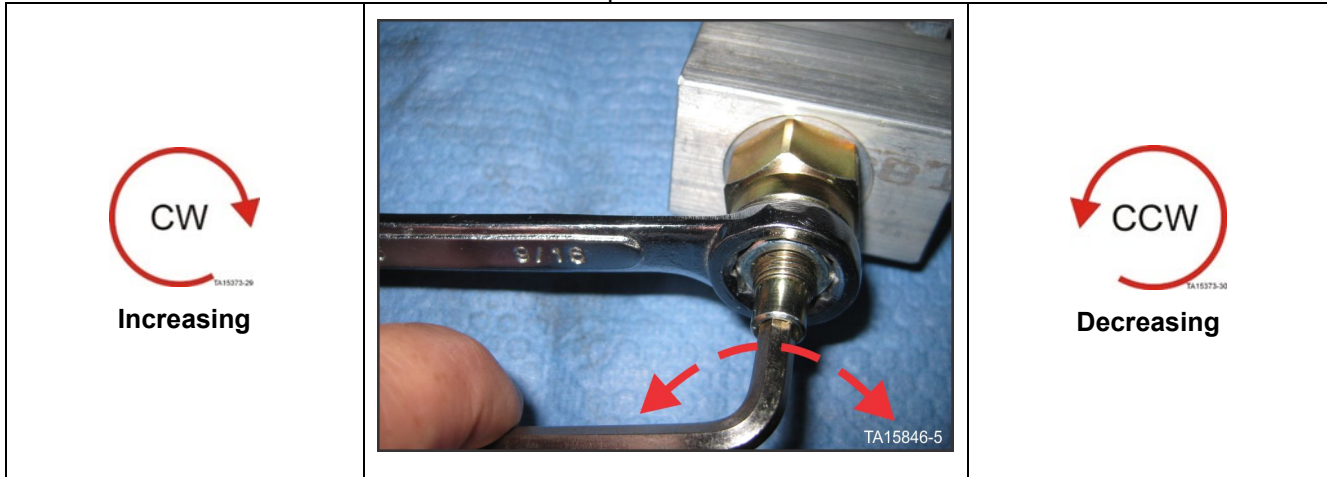
- d. Start the test bench and close the unloading valve. Verify the pressure setting.
- e. Adjust the Steering Crossover relief valve to  $4300 \pm 50$  psi. ( $297 \pm 3.5$  bar).

## NOTICE

The seals on the adjusting screw are exposed to system pressure, which means this valve can only be adjusted when the pressure is removed. The setting procedure is; check the setting, remove the pressure, adjust the valve, check the new setting.

- f. Loosen the jam nut.

- g. Turn the adjusting screw to adjust the pressure.
- CW clockwise to increase pressure
  - CCW counter clockwise to decrease pressure



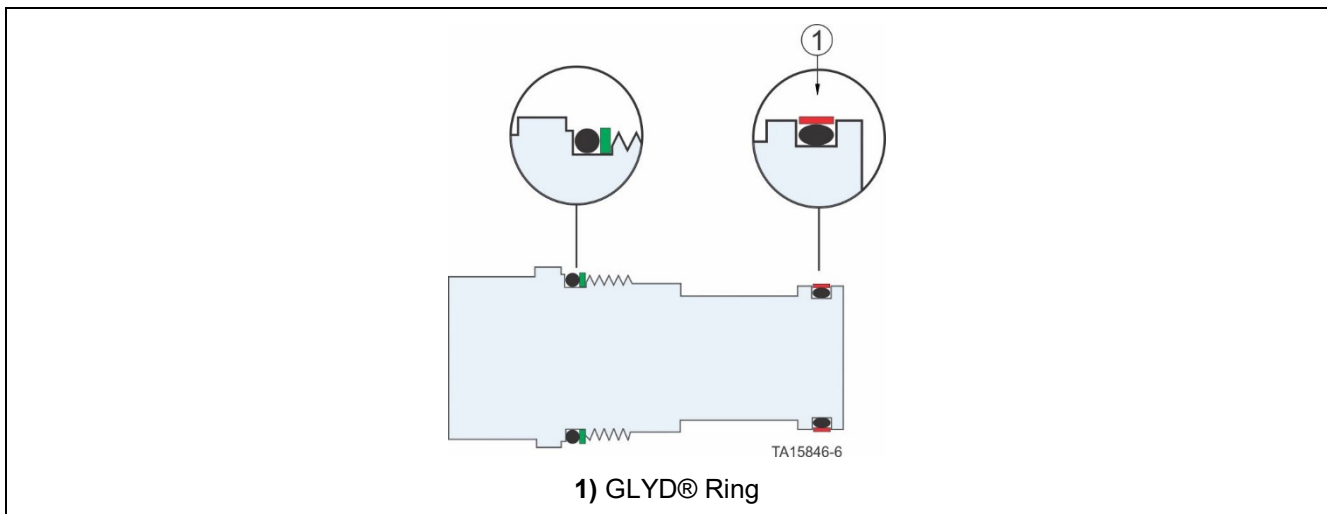
**Typical Valve Adjustment**

- h. Tighten the jam nit to 80-90 lbf-in. (9-10 Nm)
- i. Verify pressure
- j. Unload the pump and turn off the test bench.
- k. Remove the relief valve from the test block assembly.

## NOTICE

**These are special seals. Only use OEM specified seals. The seal kit part number is R4276933. Follow the instructions included in the seal kit for installation.**

- l. Inspect the seals on the relief valve for damage. If damage is noted, replace the seals.



**Relief Valve Seal Locations**

- m. Re-install the valves into the Crossover Relief valve block.

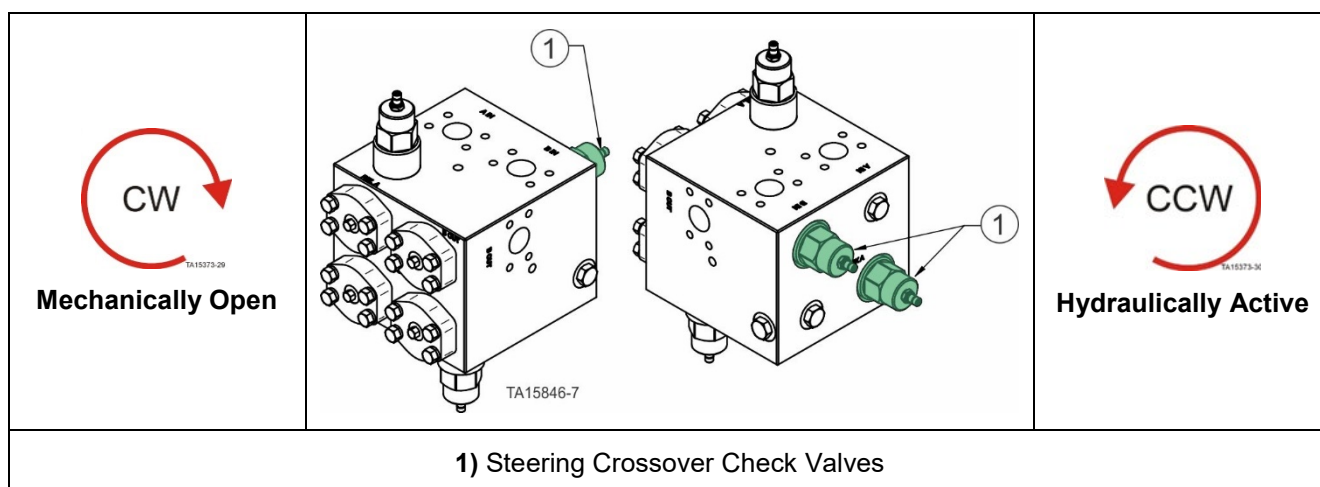
## NOTICE

The relief cartridge has a torque requirement of 350 to 375 ft.-lbs. (474.5 to 508.4 Nm)

## NOTICE

The check valves on the Steering Relief Valve assembly must be screwed all the way in.

If the machine has experienced abrupt starting and stopping during the steering cycle, it could indicate that the Steering Crossover Check Valves are being activated. These check valves are used to prevent damage to the flow amplifier spool in the Steering amplifier valve. To remove the abrupt starting and stopping problems, these check valves should be mechanically opened using the adjusting screw in the valve.

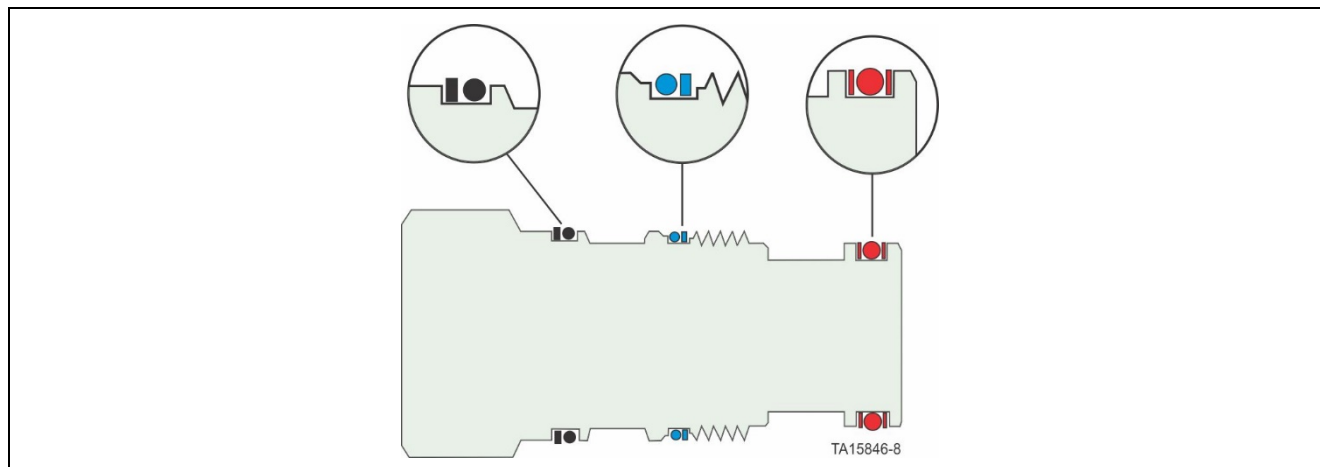


Check Valve locations

## NOTICE

The seals on the Check Valve are all different sizes. Follow the instructions included in the seal kit for installation. The seal kit part number is R4276932.

- n. Inspect the seals on the Check valves for damage. If damage is noted, replace the seals.



Check Valve Seal locations

## NOTICE

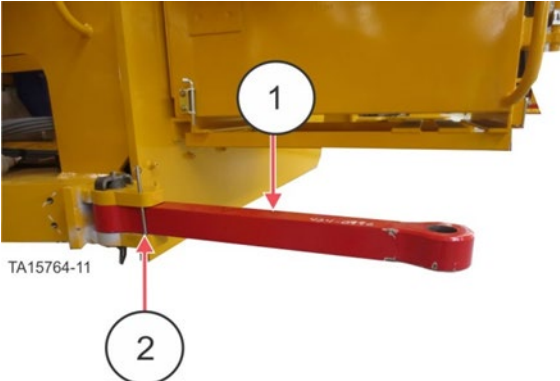
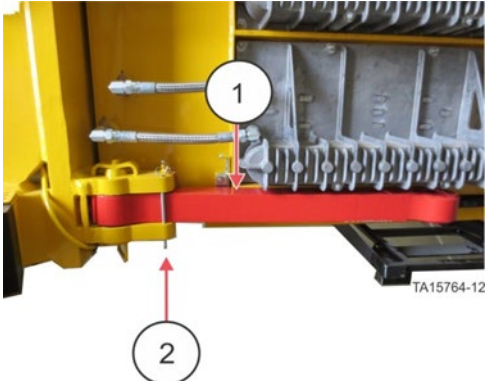
**The Check Valve cartridge has a torque requirement of 350 to 375 ft.-lbs. (474.5 to 508.4 Nm)**

- o. Re-fill the Hydraulic Reservoir.
- p. Bleed all of the hydraulic pumps following the pump bleeding procedure (machine will be booted but not started. Use local Lock Out Tag Out rules)
- q. Restart the machine per the local rules.
- r. Check for leaks.

## CAUTION

**Be sure to move the frame lock to the unlocked position. If the machine is moved before removing the frame lock, equipment damage will occur.**

- s. Follow all local rules and regulations to return the machine to operating condition.
  - Remove the safety link between the frames and secure.

|                                                                                    |                                                                                     |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |
| <b>L-1350</b>                                                                      | <b>L-1850 and L-2350</b>                                                            |
| 1) frame lock shown in carry position, 2) retaining pin for carry position         |                                                                                     |

### Required Tools:

- 9/16" open-end wrench
- 5/32" Hex wrench
- 1 5/8" Combination wrench or socket
- Torque wrench capable of 400 lbf ft (542 Nm)
- Torque wrench capable of 100 lbf in (45 Nm)
- Test Bench (minimum 4 gpm @ 5000 psi)

### Troubleshooting

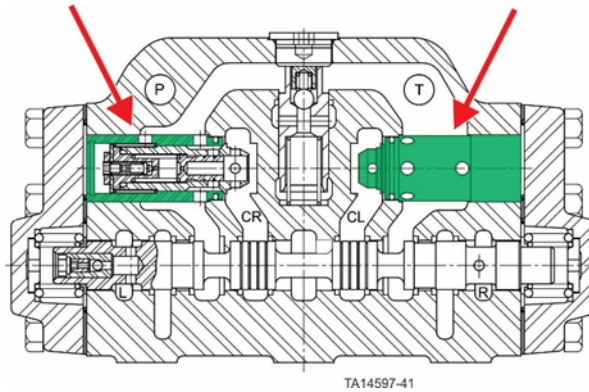
If the pressure cannot be set, replace the seals on the valve. If the valve still cannot be set, replace the relief valve.

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## Procedure N

### DANFOSS Steering Shock and Suction Relief Valve

The machine is not running for this setting. The adjustment setting is performed by using a test bench.



#### DANFOSS Steering Flow Amplifier Shock and Suction Valves (2)

There are two (2) shock and suction valves in the Danfoss Steering Flow Amplifier Valve Assembly. The relief valve must be set in a test block using a test bench that is capable of 2.5 to 2.65 gpm (9.7 to 10 lpm) at 5000 psi (345 bar). **Lower or higher flow rates will give inaccurate results.**

Three test blocks have been used. However, due to the possibility of improper machining on test block P/N R4274682, only the original P/N R4219622 and the latest design P/N R4285343 test blocks should be used.

This document contains the following sections:

- Safety Preparations
- Required Tools and recommended spare parts
- Shock and Suction Valve Removal Procedure
- Shock and Suction Valve Disassembly and Inspection
- Shock and Suction Valve Assembly
- Test Block R4219622 (Original Block) Setting Procedure
- Newer Style Test Block Identification and Warning
- Test Block R4285343 (New Block) Setting Procedure
- Shock and Suction Valve Installation Procedure

## Safety Preparations

Follow all local safety rules for performing the following procedures. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.



### WARNING

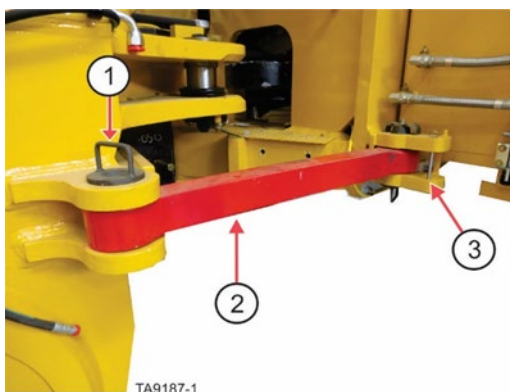
Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.



### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position  
3) Retaining pin bracket for un-locked position

**Figure 38. Frame Lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.
- f. Shut off the engine.

## ⚠ WARNING

Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.

- g. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



**Figure 39. GEN 2 Battery Isolation Box – Battery isolation switch in OFF position with locks in place**

- h. Release the air from the hydraulic reservoir by using the hydraulic reservoir air valve (ball valve) on top of the reservoir. The supply line from main air system will be blocked and reservoir air will vent out the hose that runs down the outside of the hydraulic reservoir.

- Turn the handle to the up position as shown

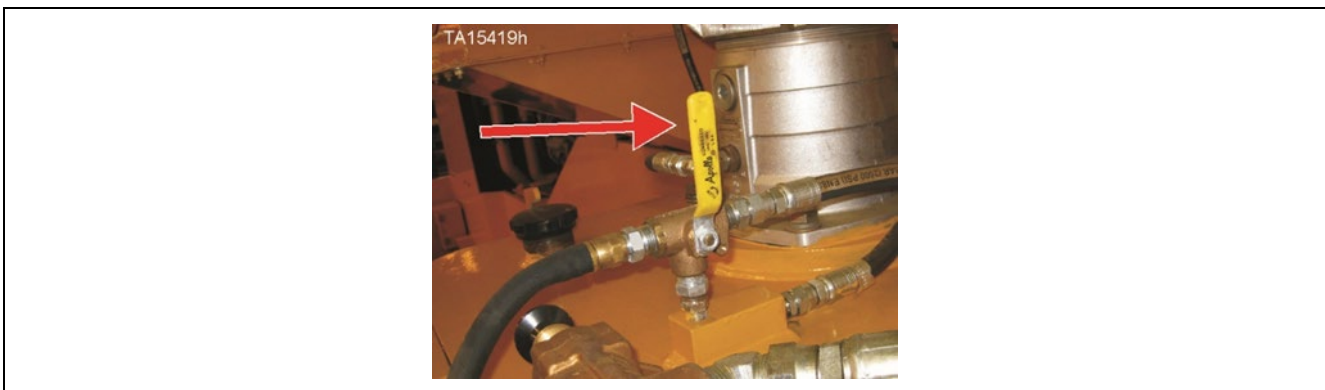


**Figure 40. Hydraulic reservoir air valve handle UP**

- i. Release the air from the various air storage reservoirs by opening all of the air bleed valves.

### L1350/1850/2350

Three valves on right side of rear frame under hydraulic reservoir

One valve on right side of front frame near hoist cylinder ball cap

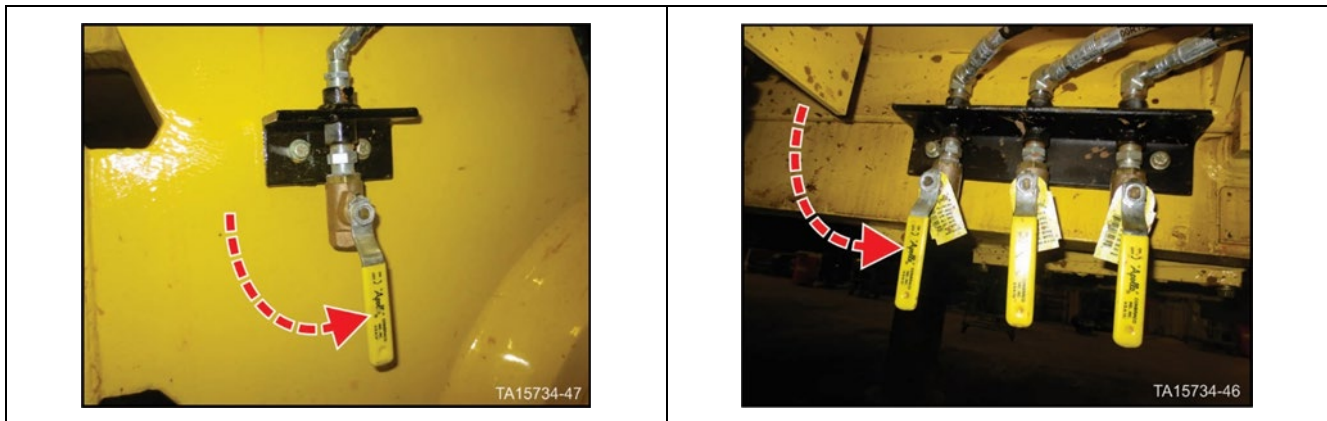


Figure 41. Open air reservoir bleed valves

## ⚠ WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- j. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- k. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- l. Open the valve completely and leave it open during the procedure.

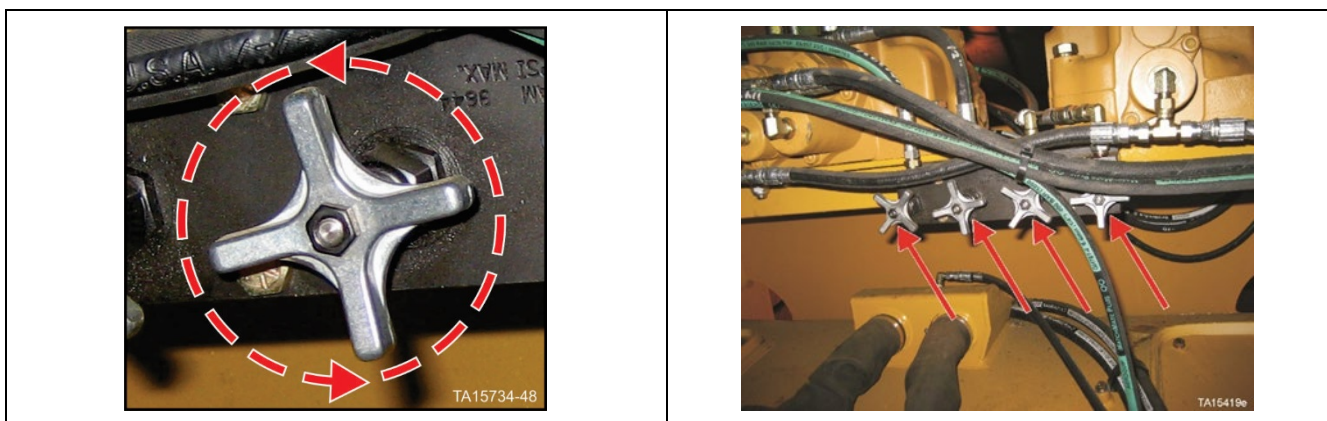


Figure 42. Pressure bleed down valves

- m. Following all local environmental rules and regulations, drain the hydraulic reservoir and any residual fluid in the hydraulic lines.

## CAUTION

Environmental hazard exists when draining the hydraulic reservoir. The hydraulic reservoir must be drained to prevent an oil spill during this procedure when hydraulic fittings are loosened or removed. The Shock and Suction valves are located below the level of oil in the Hydraulic Reservoir. These valves are directly connected through a return line to the hydraulic reservoir. If the valves are removed without draining the Hydraulic Reservoir, a great amount of oil will be spilled. Catch all fluids and dispose of them according to local rules, regulations, and laws. Failure to drain the reservoir could cause an environmental hazard resulting in environmental contamination.



## CAUTION

Burn hazard exists when draining the hydraulic reservoir. Wear all locally required personal protective equipment (PPE) and prevent any bodily contact with oil. If the oil is still hot, it will cause serious bodily burns. Failure to wear PPE while draining the reservoir or performing this procedure could cause burn hazards resulting in personal injury.

## Required Tools and recommended Spare Parts

To set the Shock and Suction Valves properly, the following tools are required:

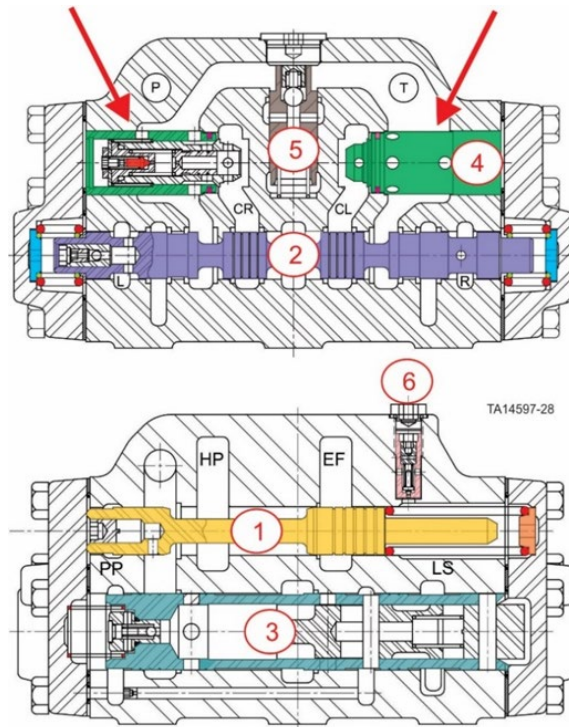
- a. Typical Test Bench must be capable of 2.5 to 2.65 gpm (9.7 to 10 lpm) @ 5000 psi (345 bar)
- b. Flow Control 2.5 GPM (9.7 lpm) (P/N R4244881 flow control can be used to provide the correct flow during the setting of the valve)
- c. Slide Hammer Puller P/N R4284476 (OTC #1173) or equivalent
- d. Hand tools
  - 10 mm hex wrench
  - 13 mm combination wrench or socket
  - 19 mm combination wrench or socket

The following Spare Parts are recommended to have available:

- a. P/N R4278419 Shock and Suction Valve O-Ring Kit
- b. P/N R4116620 Seal Kit Danfoss Valve

## Removing a Shock and Suction Valve

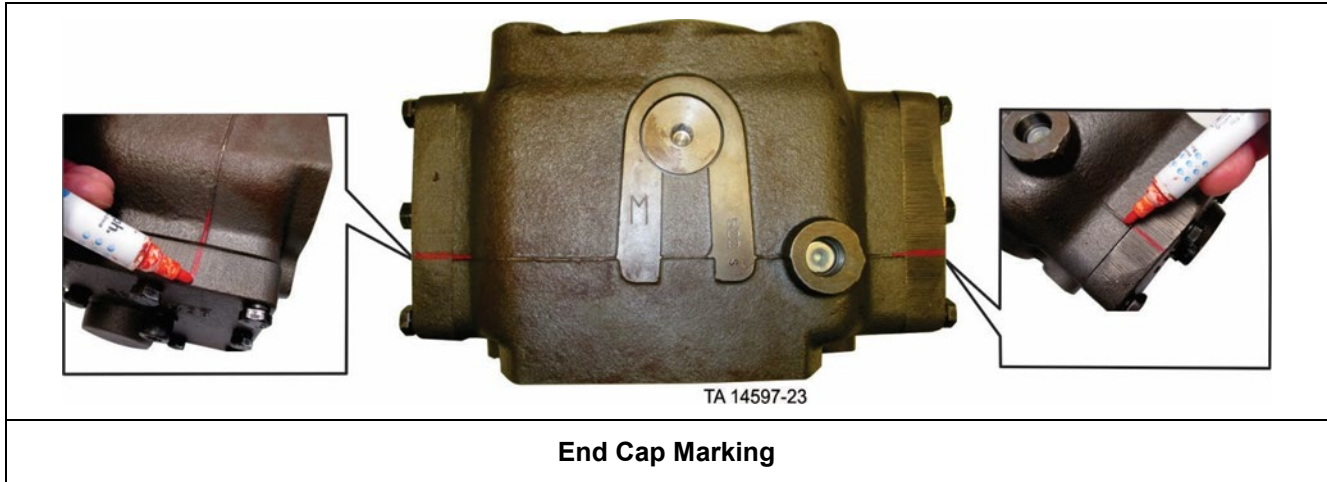
The steering amplifier valve contains several different valves. This procedure is specific to the shock and suction valves. There are two (2) shock and suction valves in the steering valve assembly.



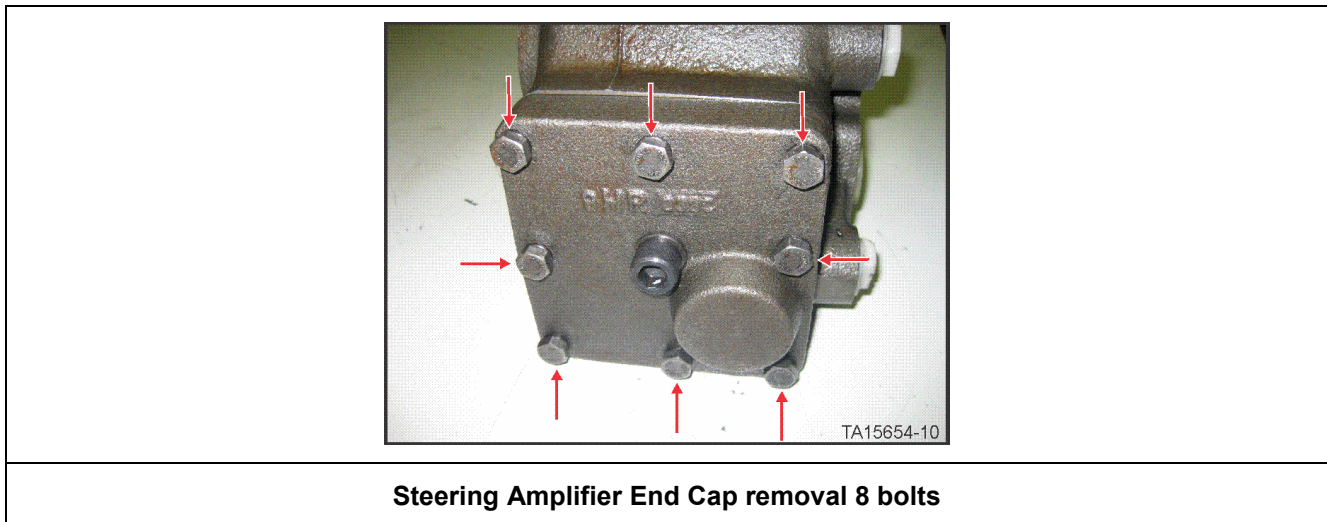
1. Priority Spool
2. Direction Spool
3. Flow Amplifier Spool
4. Shock and Suction Valves (2 total)
5. Back Pressure Valve and Anti-Cavitation Check Valve
6. Main Relief (screwed all the way in)

**Steering Valve Cross Section**

- a. Mark both end caps with a marking device. This provides proper orientation when re-assembly occurs (using the casting line in the valve assembly works well).



- b. With the hydraulic reservoir drained remove the 8 hex bolts using a 13 mm wrench or socket from one of the end caps of the steering amplifier valve.



- c. Remove the socket head capscrew in the center of the end cap with, a 10 mm hex wrench.

## CAUTION

There are springs located on various spools under the end cap. Extra caution must be taken to ensure that the springs are properly located in the correct position during re-assembly. The cap must be supported as the socket head capscrew is removed because the end cap will be under slight spring pressure. This spring pressure will cause the end cap to move rapidly when the bolt threads disengage from the valve body.



**Steering Amplifier End Cap removal socket head capscrew  
(picture shows 2 of the 8 bolts previously removed)**

d. Spring and spring retainer locations.



**CL Port End (6 O-rings)**



**CR Port End (4 O-Rings)**

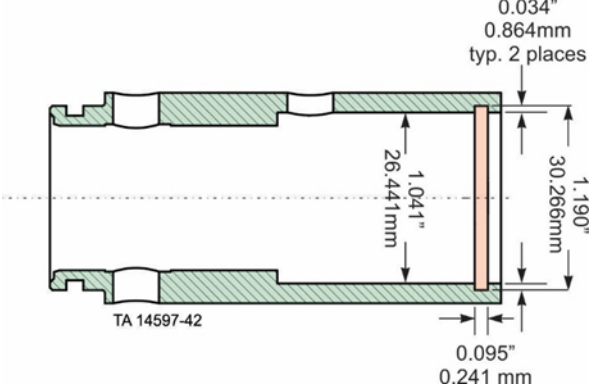
**Spring and Spring Washer locations**

e. Seal Inspection. Inspect all of the seals in the end caps. Should any seal be damaged, replace all of the seals using Seal Kit P/N R4116620. An example of a damaged seal is shown below.



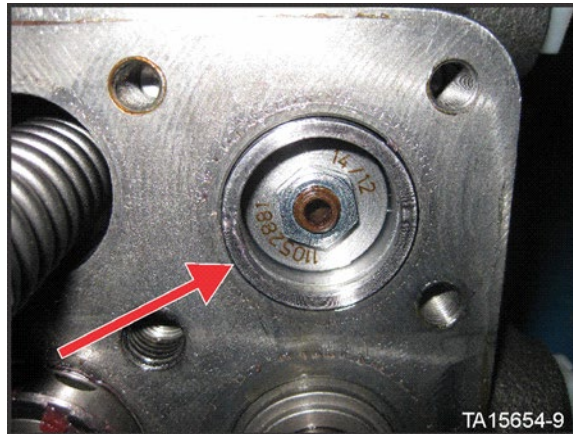
**Seal Inspection (Damaged seal shown for example purposes)**

- f. Remove and visually inspect all of the spool valves in the steering valve for damage. Replace the steering amplifier valve assembly if significant damage is found on any of the spools.
- g. Remove the shock and suction valve. The valve can be very difficult to remove due to tight tolerances and the sealing properties of the O-ring. A recess ring (groove) inside the valve housing allows for the use of a slide hammer puller to pull the shock and suction valve from the housing. The adjustment screw, jam nut, and disk are spring loaded. When positioning the slide hammer, this assembly may be depressed into the valve slightly to get better access to the recess ring.

|                                                                                    |                                                                                    |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|   |  |
| <p><b>Slide Hammer Puller (Preferred Method)</b></p>                               | <p><b>Recess Groove Dimensions</b></p>                                             |
|  | <p><b>Slide Hammer Puller<br/>P/N R4284476 or Equivalent</b></p>                   |
| <p><b>Shock and Suction Valve removal</b></p>                                      |                                                                                    |

- h. Remove the end cap on the other end of the steering valve and remove the shock and suction valve following the same steps as listed above.
- i. Inspect the seals in the end cap. Replace all seals, if any are damaged.

- j. It is recommended that the caps be re-installed to limit the amount of oil spillage while the shock and suction valves are being set.
- k. Identify if the shock and suction valve has been updated:
  - If there are numbers embossed on the end of the valve, then the valve is current production and it has the updated adjustment screw. Continue to the shock and suction Setting Procedure.
  - If no numbers are present, the shock and suction valve will need to be inspected. Refer to the Shock and Suction Valve Disassembly and Inspection section.



**Current Production Shock and Suction Valve Identification markings (P/N R4271024)**

The valve will have embossed numbers if it is current production (has the slotted adjustment screw).  
If no numbers are present, the valve will have to be disassembled and inspected.

## Disassembling and Inspecting a Shock and Suction Valve

- a. Disassembly and inspection of the shock and suction valve.
- b. A rod (3/16" - 4.76mm) or other device (punch shown) must be inserted through holes in the end of the valve and held. Then loosen the adjustment screw jam nut with a 13 mm socket.



**Loosening of the adjustment screw jam nut**

- c. Disassemble the shock and suction valve.



**Loosening of the adjustment screw jam nut (original non-modified adjustment screw shown)**

- d. Inspect the adjustment screw for a slot cut across the end opposite of the hex drive.



**Unmodified screw DO NOT USE**



**Current Production Adjustment Screw**

## CAUTION

If the adjustment screw does not have a slot across it, it must be modified by machining or the entire shock and suction valve must be replaced. The replacement valve (current production) is P/N R4271024.

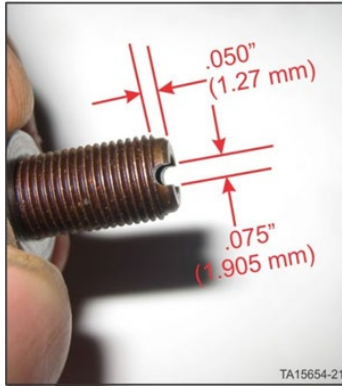
## NOTICE

If the adjustment screw has not been modified, it may be modified by machining. Then order the new style shock and suction valve P/N R4271024.

## CAUTION

If machining is going to be performed, follow all local requirements for the proper PPE (personal protection equipment) during the machining process. Refer to site specific rules and operation procedures for the proper PPE required for this operation.

- e. If an existing adjustment screw does not have the slot it must be modified. Mount the adjustment screw in a suitable holding device. Machine the groove to the specifications shown below. Carefully clean the adjustment screw so no machining material contaminates the shock and suction valve when it is re-assembled.



**Adjustment Screw Groove dimensions**

- f. Remove the suction (anti-void) spring.



**Anti-Void Spring removal**

- g. Remove the suction (anti-void) assembly.



**Anti-Void Spool Assembly removal**

- h. Remove the spring and the cone and inspect the cone (looking for broken cone as shown in example). If broken, replace valve with P/N R4271024.



Relief Valve Cone and Spring removal



Example of broken cone

## CAUTION

A broken cone shaft in combination with an un-slotted adjustment screw may prevent the relief valve function of the shock and suction valve from operating. Under no circumstances should a shock and suction valve with a broken cone be put back into service.

- i. Disassemble the relief valve assembly. A 3/16" (4.76mm) rod or other device (punch shown) must be inserted through holes in the end of the valve and held. Then loosen the cone valve seat using a 19 mm (3/4 in.) socket.



Valve Seat removal

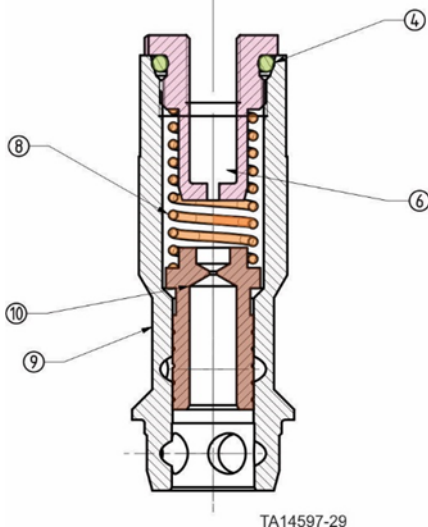
- j. Carefully inspect each individual part of the relief valve assembly. The relief valve spool should be inspected for any evidence of galling, scoring, and / or other damage. If damage is found, the shock and suction valve should be replaced.



**Relief Valve Assembly Inspection**

## Assembling a Shock and Suction Valve

- a. Relief Valve Assembly: Coat all the relief valve parts in hydraulic oil. Assemble the relief spool (piston) into the anti-cavitation piston. Place the relief valve spring on the relief valve spool. Install the valve seat. The valve seat has a torque value of  $175 \pm 45$  in-lbs ( $2 \pm 0.5$  daNm).



- 4) O-Ring, 6) Cone, 8) Compress Spring,  
9) Piston, 10) Piston



**Relief Valve Assembly**

- b. Valve Seat Torque.



**Valve Seat Torque  $175 \pm 45$  in-lbs ( $2 \pm 0.5$  daNm)**

**c. Relief Valve Cone and Spring Installation.**



**Installing Relief Valve Cone and Spring**

**d. Anti-cavitation (suction) valve spool installation.**



**Anti-cavitation (suction) valve spool installation**

- e. Install the anti-cavitation spring.



**Anti-cavitation (suction) Spring**

- f. Install the relief Valve Adjustment Screw with jam nut, and anti-cavitation spring retaining washer.
- g. After installation of the adjustment screw, the valve is ready to be pressure tested and set. Refer to the pressure setting procedure.



**Relief Valve Adjustment Screw installation**

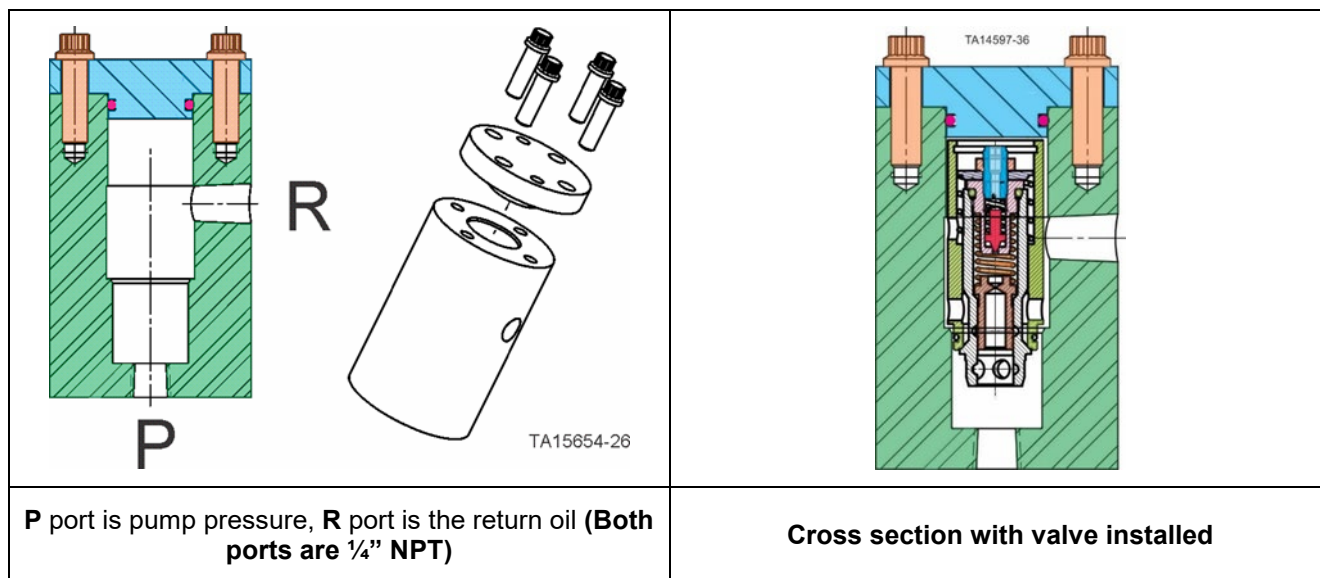
- h. Installing the relief Valve Adjustment Screw with jam nut, and anti-cavitation spring retaining washer.
- i. Torque the Jam Nut. The jam nut has a torque value of  $135 \pm 20$  in-lbs ( $1.5 \pm 0.2$  daNm) when it is re-assembled.



**Jam Nut Torque  $135 \pm 20$  in-lbs ( $1.5 \pm 0.2$  daNm)**

## Setting a Test Block R4219622 (Original Block)

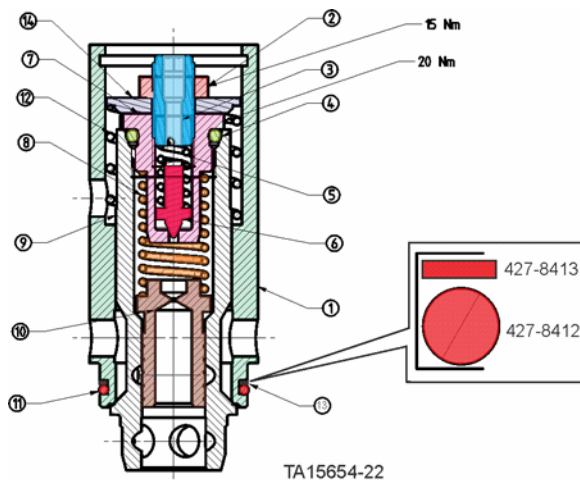
- a. Original Block connection ports.



- b. Remove the four bolts that hold the top cover on the test block. Remove the top cover and install the shock and suction valve inside.

## NOTICE

Verify that the seals on the shock and suction valve are not worn or damaged. Incorrect sealing will result in incorrect pressure settings.



Shock and Suction Valve P/N R4271024

1. Bushing
2. Nut
3. Adjusting Screw
4. O-Ring
5. Compress Spring
6. Cone
7. Valve Seat
8. Compress Spring
9. Piston
10. Piston
11. O-Ring P/N R4278412
12. Compress Spring
13. Backup P/N R4278413
14. Washer

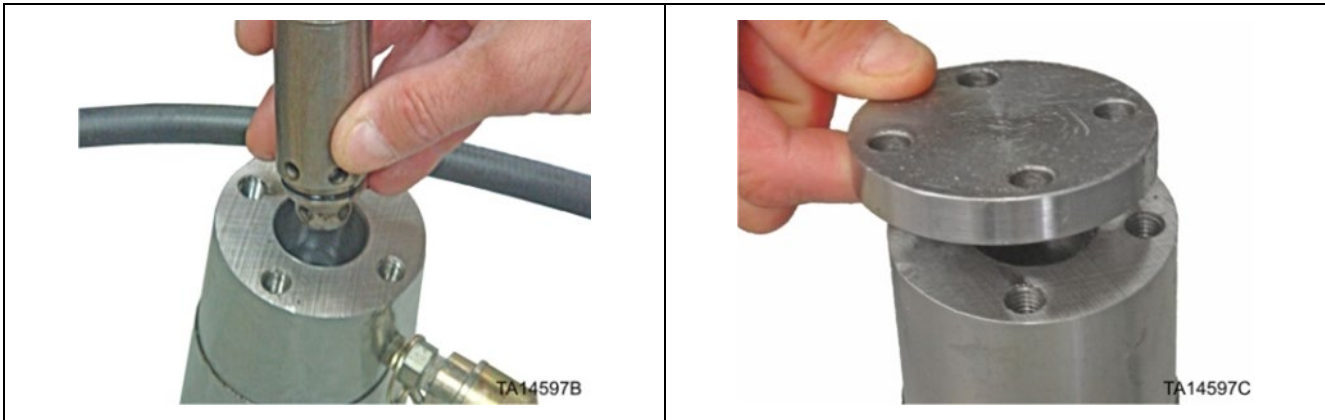
## NOTICE

Seal Kit P/N R4278419 contains 3 each of items number 11 and 13. Spare seals are included in the kit.

### New O-Ring and Backup seals for the shock and suction valve



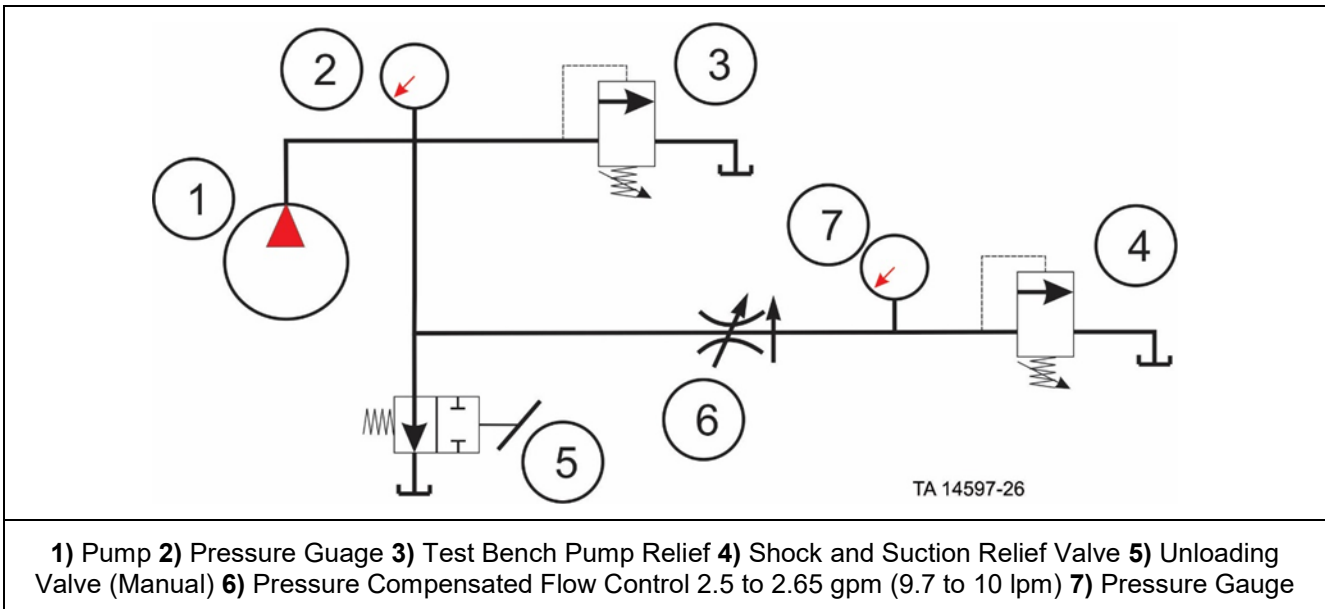
Check for undamaged seals



- c. Reinstall top cover and torque bolts to 80-ft lbs (108 N•m) lubed.

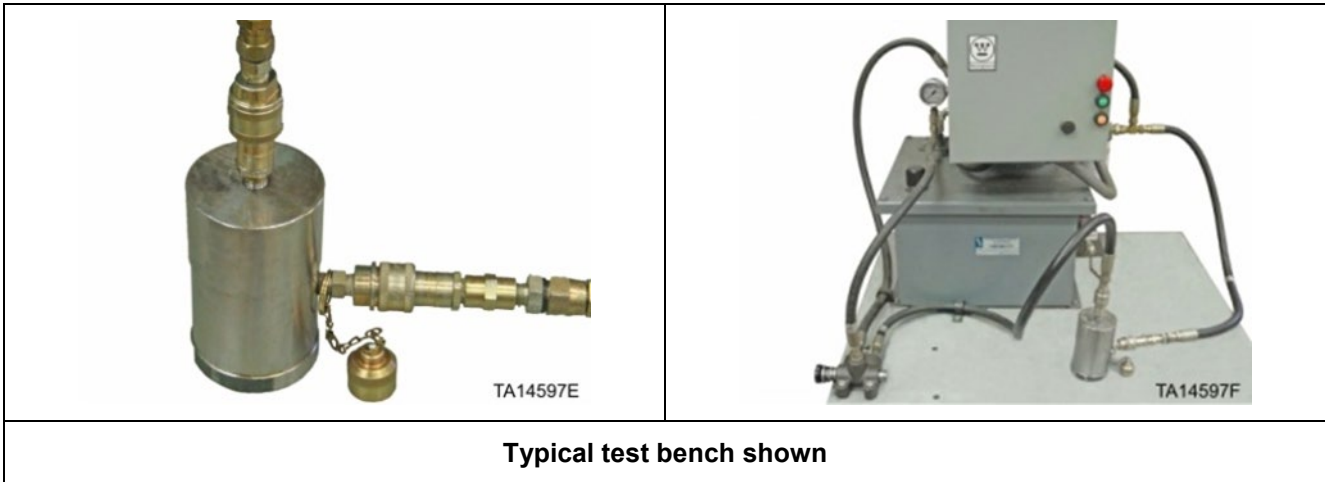


- d. Connect the test block assembly onto a test bench that is set at 2.5 to 2.65 gpm (9.7 to 10 lpm) at 5000 psi (345 bar). Start the test bench using its specific startup and operating instructions. Verify that the pressure reading is correct, based on the values given in the settings and adjustment table at the beginning of this section.

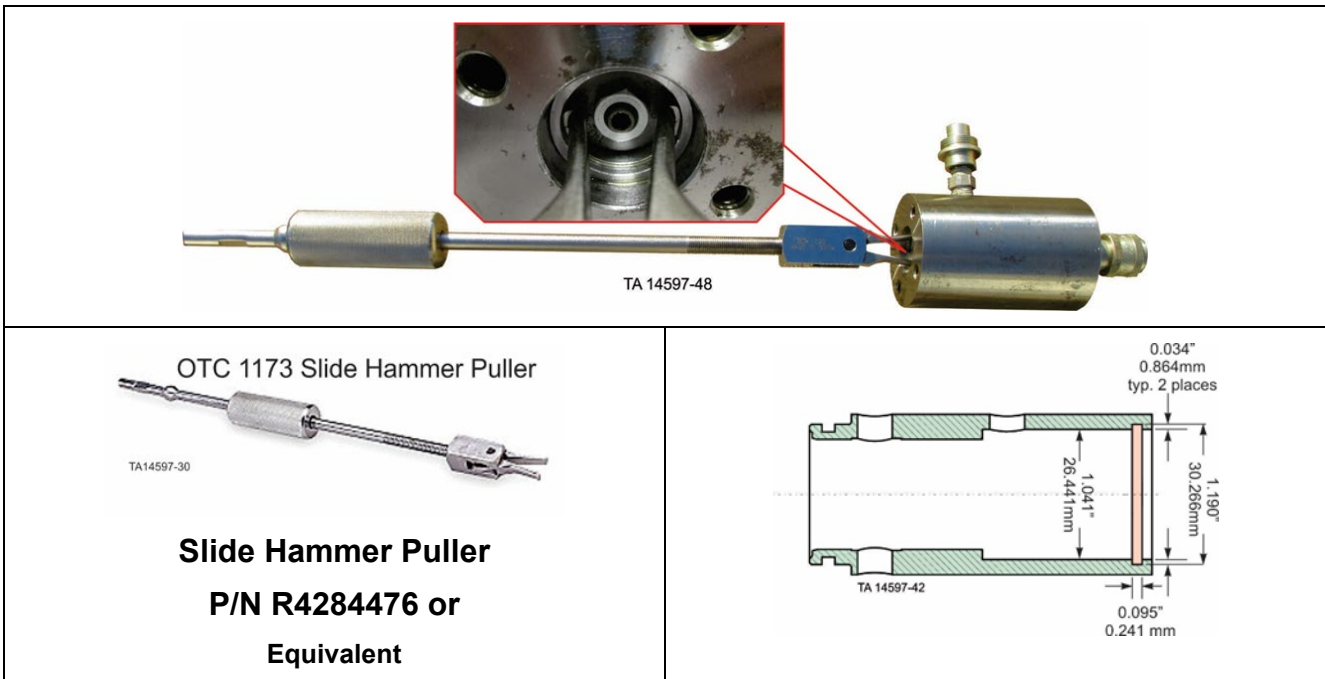


## ⚠ WARNING

Skin injection hazard exists when around diesel fuel, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids. Always read the instructions and have appropriate training in the use of the test bench that is being used. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.



- e. If adjustment is necessary, remove valve from test block.



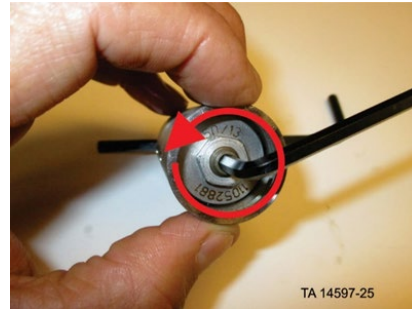
## CAUTION

The valve assembly is a very tight fit in the test block assembly. Care should be used so as not to damage the valve assembly during removal.

- f. To adjust the pressure, while holding the set screw, loosen the locknut. Rotate adjusting screw clockwise to increase pressure and counter clockwise to decrease pressure. Reinstall the valve in the block and verify that the pressure is correct. Repeat this process until obtaining the correct pressure setting.



**Increase Pressure (clockwise)**



**Decrease Pressure (counter clockwise)**

## NOTICE

One turn of the adjustment screw is approximately 1600 psi (110.316 bar)

One quarter (1/4) turn of the adjustment screw is approximately 400 psi (27.579 bar)

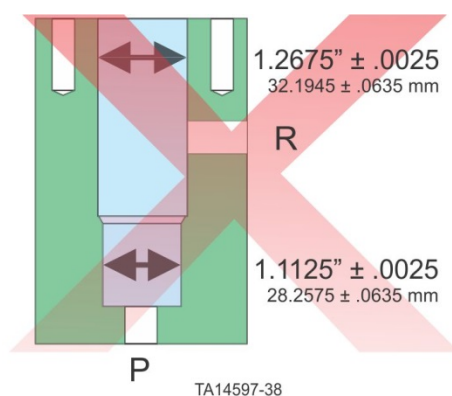
- g. Once correct pressure is achieved, reinstall overload relief valve in the DANFOSS flow amplifier.

## Identifying a New Style Test Block

Komatsu discovered that the test block assembly (R4274682) was not manufactured according to engineering drawings. The bore inside the test block body was found to be incorrect and would block pilot flow thru the valve body, which could actually set the relief pressure several hundred PSI above the factory recommended set point of 4000 PSI. With the relief pressure set too high this could lead to internal bypassing of a steering cylinder and cause a diminished response in steering movements. Since discovered, Komatsu has developed a new test block with the vendor. In September 2015, Komatsu received and validated a first article of test block R4285343.

### CAUTION

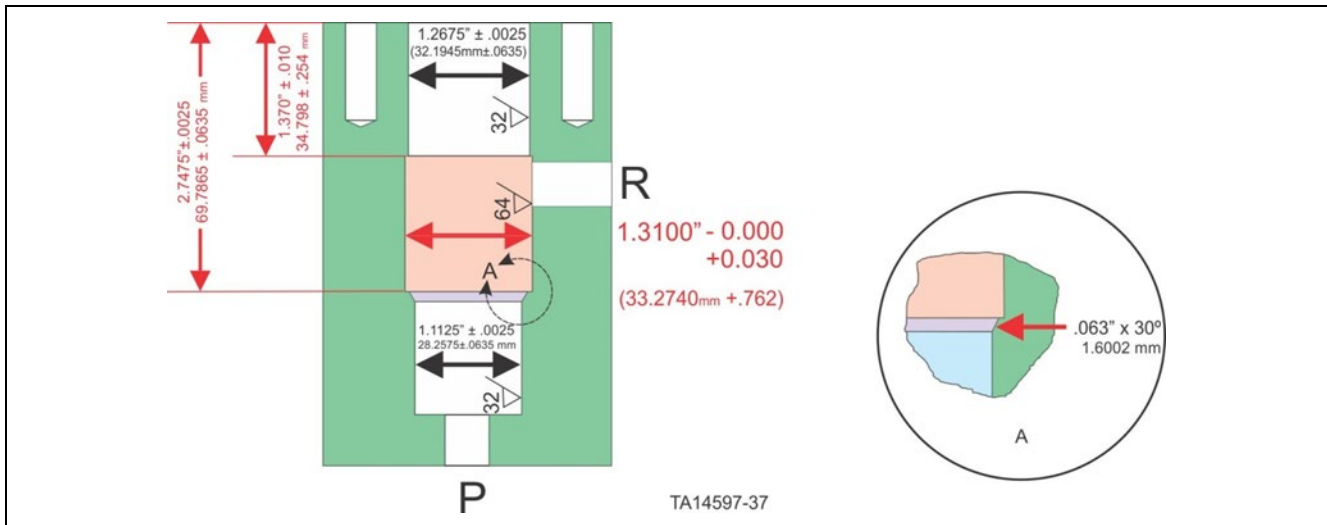
Several of the “new” style test blocks (P/N R4274682) were improperly machined. The return oil galley bore was not machined out. This causes a block saturation to occur which causes the valve to not fully relieve properly. Thus the pressure setting of the valve will be wrong. Before using any of the “new” style blocks, verify that the galley has been machined correctly as shown in the following illustrations.



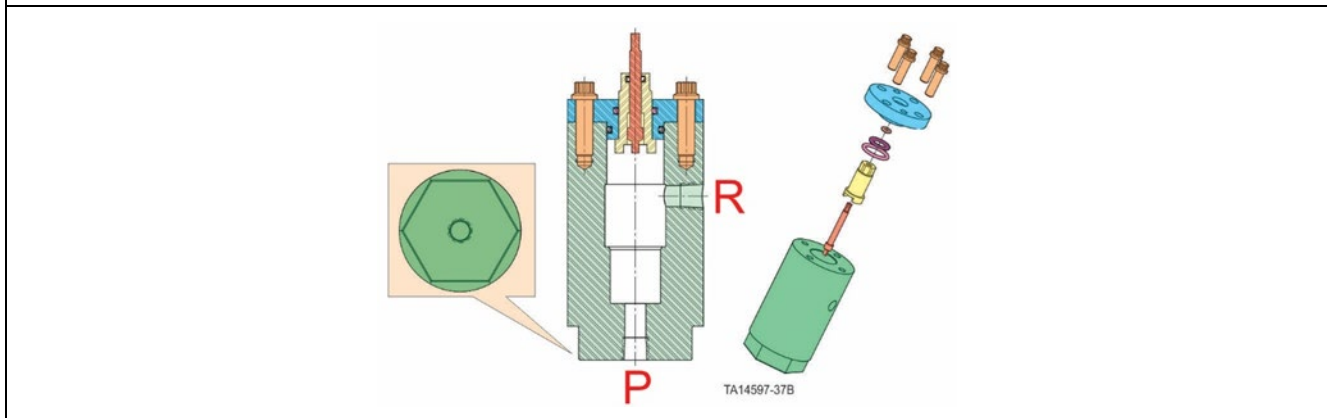
**Incorrectly Machined Test Block (P/N R4274682)**

**DO NOT USE**

**Recommended Action:** Test block assembly R4274682 should be removed from service and or inventory. The test block then should be scrapped and destroyed.



**Correctly Machined Test Block**



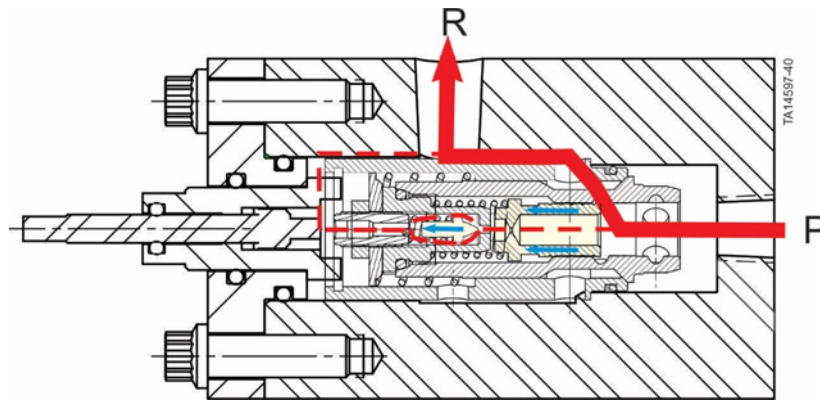
**New Correctly machined Test Block P/N R4285343**  
has a machined Hex shape bottom for easy identification

## CAUTION

The shock and suction valve is a pilot operated relief valve. The relief valve function will not be set correctly if either the pilot oil flow through the poppet, or the main oil flowing out of the valve is restricted.

- The pilot oil flows through the center of the adjustment screw
- The adjustment tool must be disengaged from the adjustment screw during pressure verification; the adjustment tool will restrict the pilot oil if left engaged.
  - The adjustment screw should only be adjusted when the test bench is shut down (no oil flow).
- The manifold block must have proper dimensions for unrestricted oil flow through:
  - The pilot port.

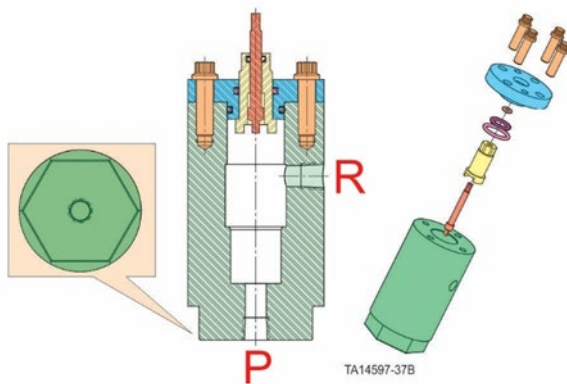
- Main flow to test block return port.



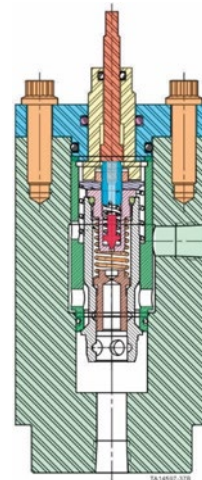
Oil flow through the relief valve function

## Setting a Test Block R4285343 (Correct New Block)

- New Block connection ports.



**P** port is pump pressure, **R** port is the return oil  
(both ports are 1/4" NPT)



Cross section with valve installed

- Remove the four bolts that hold the top cover on the test valve. Remove the top cover and install the shock and suction valve inside.

## NOTICE

Verify that the seals on the shock and suction valve are not worn or damaged. Incorrect sealing will result in incorrect pressure settings.

15 Nm

20 Nm

427-8413

427-8412

TA15654-22

**Shock and Suction Valve P/N R4271024**

- 1. Bushing
- 2. Nut
- 3. Adjusting Screw
- 4. O-Ring
- 5. Compress Spring
- 6. Cone
- 7. Valve Seat
- 8. Compress Spring
- 9. Piston
- 10. Piston
- 11. O-Ring P/N R4278412
- 12. Compress Spring
- 13. Backup P/N R4278413
- 14. Washer

Seal Kit P/N R4278419 contains 3 each of items number 11 and 13. Spare seals are included in the kit.

New O-Ring and Backup seals for the shock and suction valve



Check for undamaged seals

- b. Remove the jam nut adjustment tool from the cover. This tool must be positioned on the Shock and Suction valve jam nut before the cap is installed. Align the tool flats to the jam nut flats and place the tool over the jam nut.



Align the flats to the jam nut

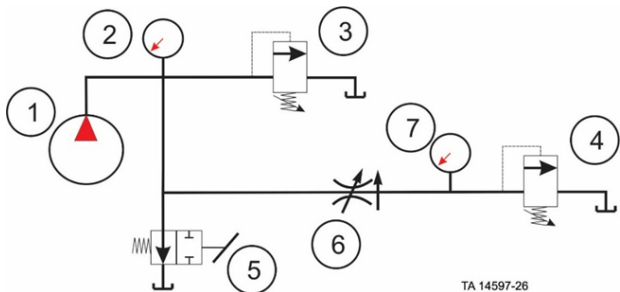


Place the tool on the jam nut

- c. Reinstall top cover and torque bolts to 80-ft lbs (108 N•m) lubed.



- d. Connect the test block assembly onto a test bench that is set at 2.5 to 2.65 gpm (9.7 to 10 lpm) at 5000 psi (345 bar). Start the test bench using its specific startup and operating instructions. Verify that the pressure reading is correct, based on the values given in the settings and adjustment table at the beginning of this section.

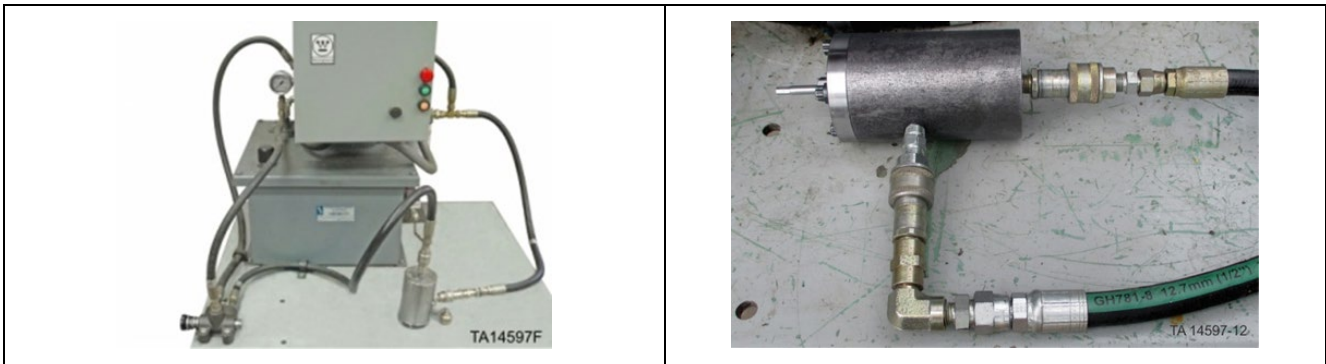


1) Pump 2) Pressure Guage 3) Test Bench Pump Relief 4) Shock and Suction Relief Valve 5) Unloading Valve (Manual) 6) Pressure Compensated Flow Control 2.5 to 2.65 gpm (9.7 to 10 lpm) 7) Pressure Gauge

Typical Test Bench Setup

## ⚠ WARNING

Skin injection hazard exists when around diesel fuel, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids. Always read the instructions and have appropriate training in the use of the test bench that is being used. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.



e. If adjustment is necessary, shut off the test bench. The valve is adjusted by:

- Pressing the hex shaft in the middle of the jam nut tool downward. The adjustment shaft will engage the adjustment screw on the Shock and Suction valve.



**Adjustment shaft engaged into the adjustment screw on the Shock and Suction valve.**

- While holding the adjustment shaft from turning, turn the jam nut tool counterclockwise. This will loosen the jam nut and allow the adjustment screw to turn.



Holding adjustment shaft, loosen the jam nut.

- To increase the pressure setting, hold the jam nut to prevent turning. Turn the adjustment shaft clockwise. To decrease the pressure setting, turn the adjustment shaft counter clockwise.



Hold jam nut, turn adjustment shaft clockwise

Pressure Increase



Hold jam nut, turn adjustment shaft counter clockwise

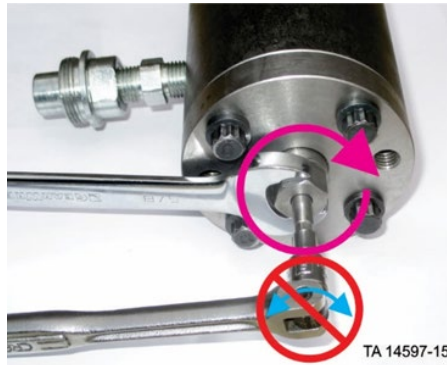
Pressure Decrease

# NOTICE

One turn of the adjustment screw is approximately 1600 psi (110.316 bar)

One quarter (1/4) turn of the adjustment screw is approximately 400 psi (27.579 bar)

- While holding the adjustment shaft stationary, tighten the jam nut.



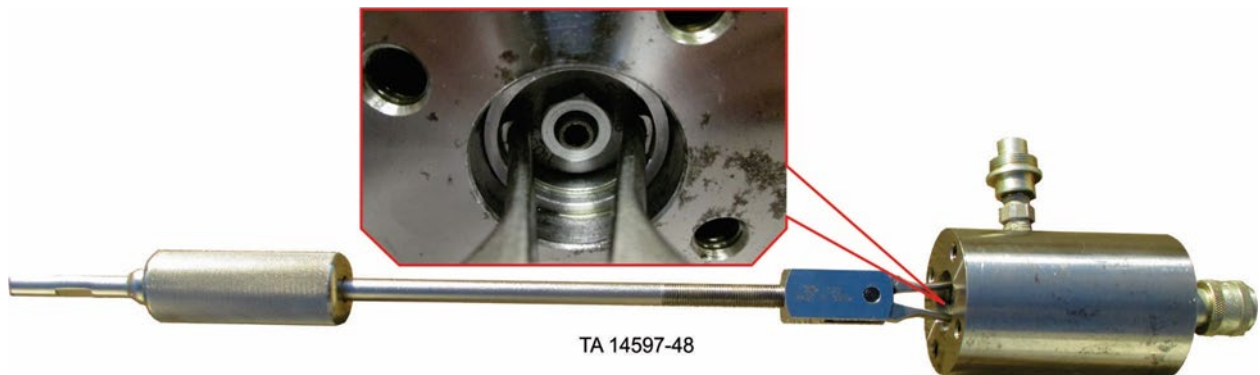
**Holding adjustment shaft, tighten the jam nut.**

- Pull the adjustment shaft out as far as it will go.



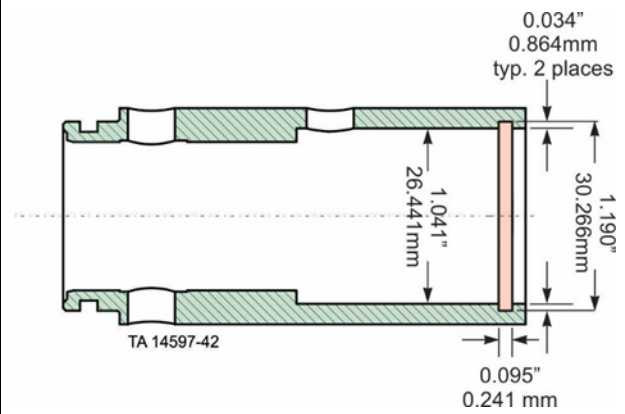
**Adjustment shaft disengaged from the adjustment screw**

- Restart the test bench and re-test the pressure. Should the pressure need to be adjusted more, repeat the previous steps.
- Remove the valve from the test block





**Slide Hammer Puller**  
**P/N R4284476 or**  
**Equivalent**

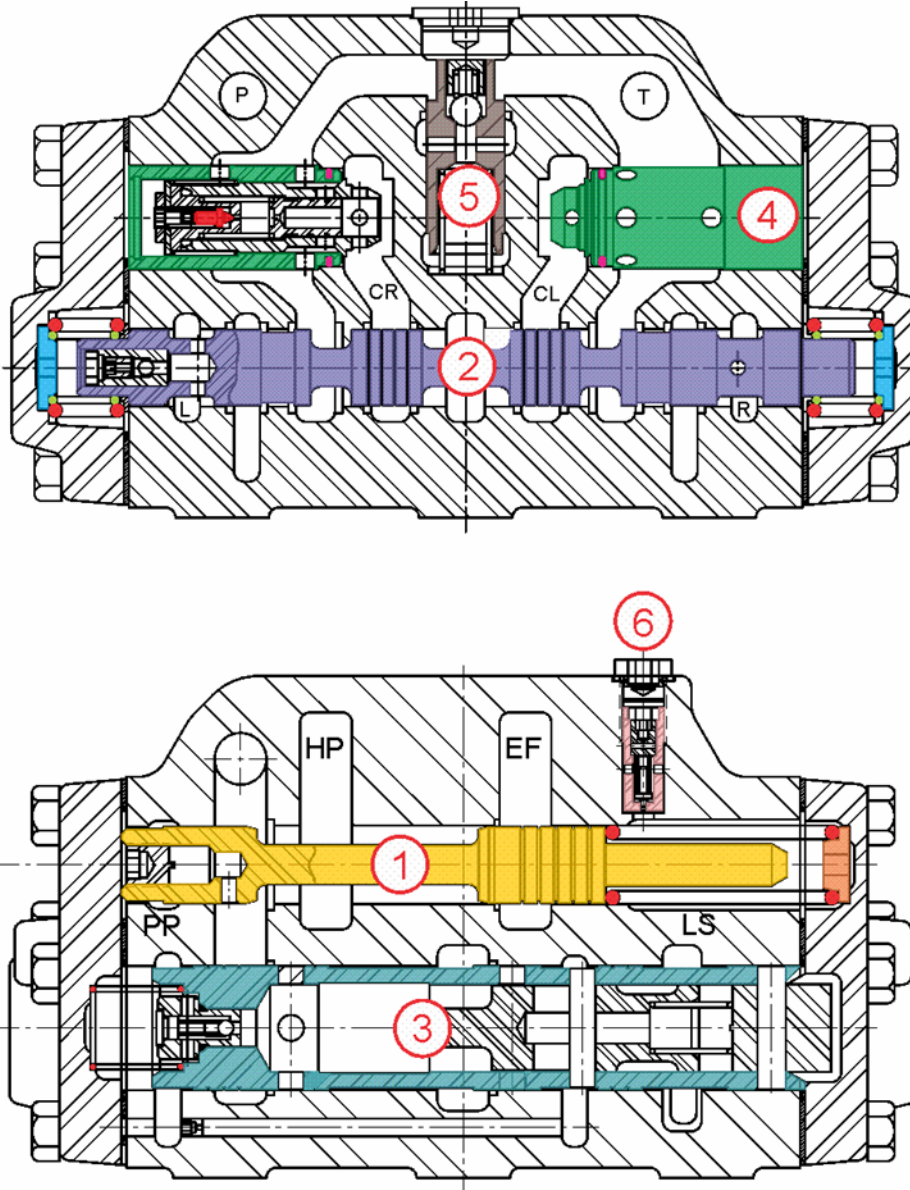


## CAUTION

The valve assembly is a very tight fit in the test block assembly. Care should be used so as not to damage the valve assembly during removal.

## Installing a Shock and Suction Valve

- a. Visually inspect all of the spool valves in the steering valve for damage. Replace the steering amplifier valve assembly if significant damage is found on any of the spools.

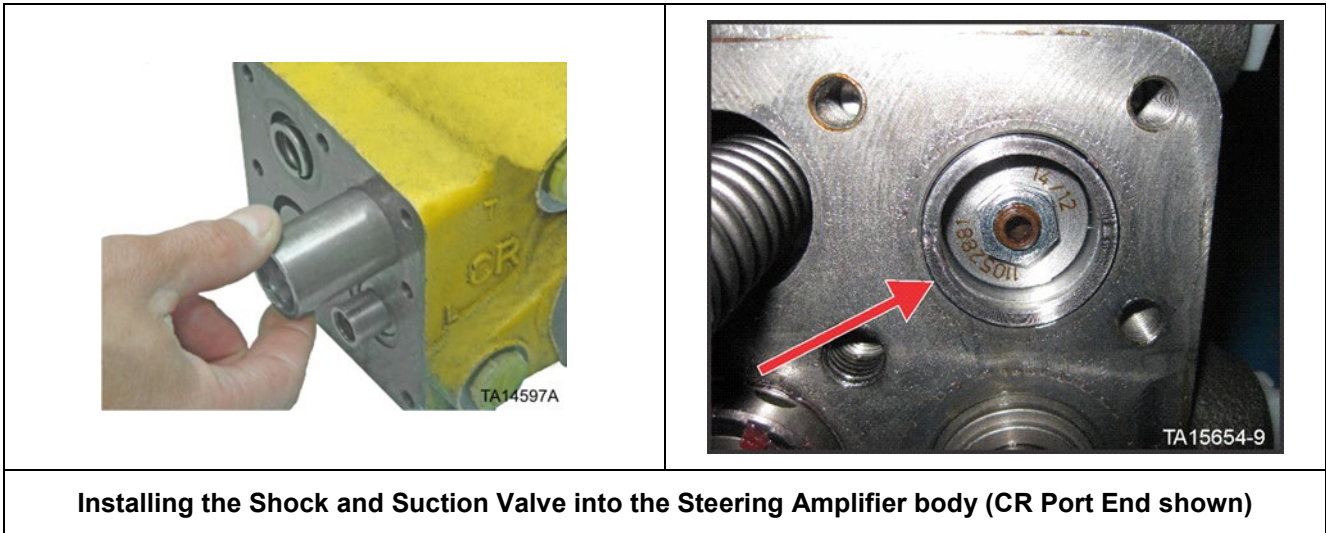


TA15654-23

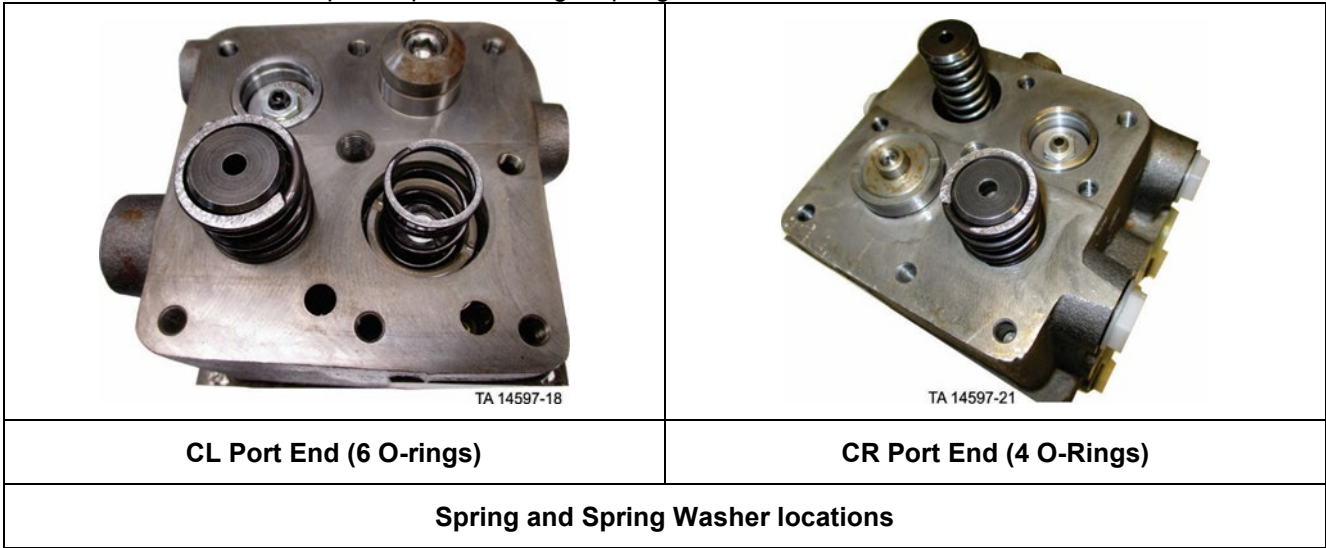
1. Priority Spool
2. Direction Spool
3. Flow Amplifier Spool
4. Shock and Suction Valves (2 total)
5. Back Pressure Valve and Anti-Cavitation Check Valve
6. Main Relief (screwed all the way in)

**Figure 43. Steering Valve Cross Section**

- b. Dip the valve in hydraulic oil and then install it into the Steering Amplifier. The valve fits tightly in its main valve bore. A small amount of pressure will be required to compress the seals as it is seated in the bore.



- c. Install the spring and washer placement.
- The Priority spool has one heavy spring and washer on the CL Port End.
  - The Direction spool has two springs (one inside the other); a washer that fits over the end of the spool and a washer on the smaller spring. This spring and washer combination is on both CL and CR Port ends.
  - The Flow Amplifier spool has a light spring on the CL Port End.



- d. The end cap install: Verify that all springs, washers, and spools are properly positioned in the main body before installing the end caps. Inspect and install the End Caps.

# NOTICE

Verify that the O-rings in the End Caps have not been damaged. If replacement of the O-rings is required, please use seal kit P/N R4116620.

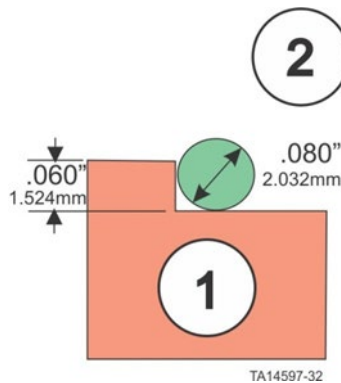


Example of a damaged O-ring

## NOTICE

When installing the O-Rings into the end caps, the O-rings will fit into the recessed area of the end cap. The O-ring outside diameter (OD) is slightly larger than the inner diameter (ID) of the end Cap. When the O-ring is installed, it should NOT require any grease, sealant, or other substance to hold it in place. The interference fit is about .005 inch (.127 mm).

The depth of the O-Ring groove is approximately .060 inch (1.524 mm). The cross section of the O-ring is approximately .080 inch (2.032 mm). The O-ring will sit in the groove with approximately .020 inch (.508 mm) sticking up above surface of the end cap.



1) End Cap 2) O-ring

### O-Ring Installation

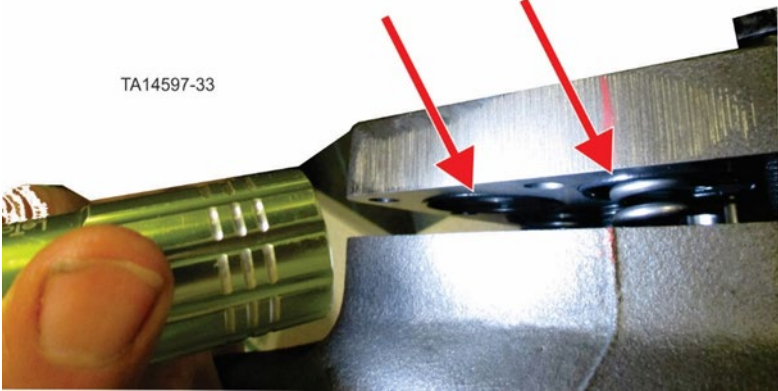
## CAUTION

Spring pressure will be present when trying to install the end caps. Care must be taken to ensure that the O-rings are not damaged while the end cap bolts are installed.

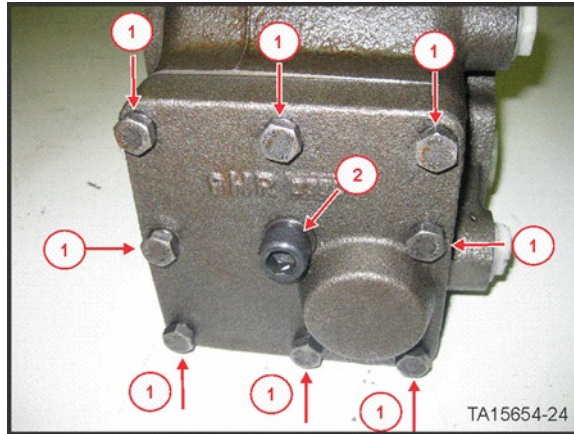
|                                                                                                      |                                                                                                       |
|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
|  <p>TA 14597-20</p> |  <p>TA 14597-19</p> |
| CL Port End (6 O-rings)                                                                              | CR Port End (4 O-Rings)                                                                               |
| End Cap O-Ring Inspection                                                                            |                                                                                                       |

CAUTION

Install a couple of end cap bolts to hold the end caps against the spring pressure. Before the end caps are pulled up tight, a final inspection of the O-rings is advised. Using an external light source, inspect that none of the O-rings have become dislodged during the assembly process. Failure to verify proper installation may cause leaks or cause other damage.

|                                                                                                        |
|--------------------------------------------------------------------------------------------------------|
|  <p>TA14597-33</p> |
| Typical final end cap O-ring inspection with an external light source                                  |

- e. Torque the end cap bolts.

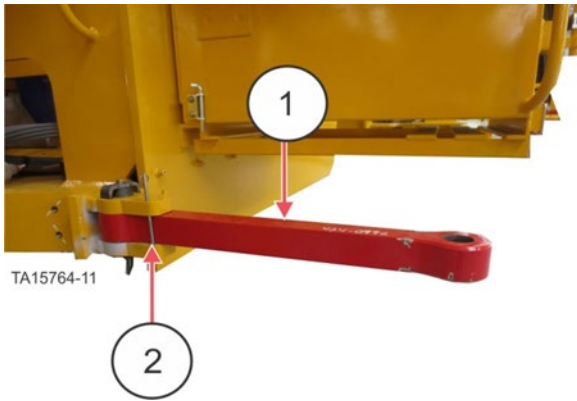


**Steering Amplifier End Cap Bolt Torques**

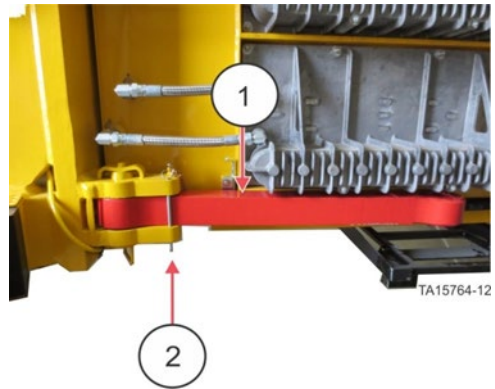
- 1) Bolts 220 + 45 in-lbs (2.5 + 0.5 daNm)  
 2) Bolt 710 ± 90 in-lbs (8 ± 1 daNm)

- f. Follow all local rules and regulations to return the machine to operating condition.

- Remove the safety link between the frames and secure.



**L-1350**



**L-1850 and L-2350**

- 1) frame lock shown in carry position  
 2) retaining pin for carry position

**Required Tools:**

- Test Bench
- Pressure Gauge
- Various open-end and Hex wrenches

**Troubleshooting**

If pressures cannot be set, the following items need to be cleaned replaced.

- Shock/Suction Valve

## Procedure O

### PVG 32 Inlet Relief

#### Safety Preparations

Follow all local safety rules for performing the following procedures. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

The machine is not running for this setting. The adjustment is done on a test bench.

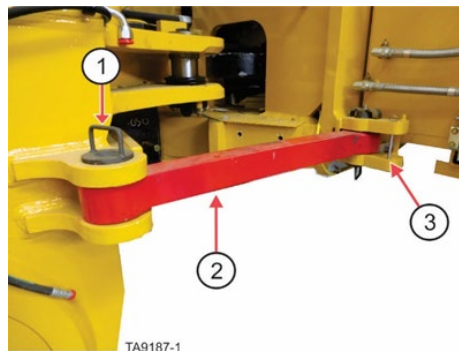
#### WARNING

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.

#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position  
3) Retaining pin bracket for un-locked position

**Figure 44. Frame Lock**

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.
- f. Shut off the engine.

## ⚠ WARNING

Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.

- g. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



**Figure 45. GEN 2 Battery Isolation Box – Battery isolation switch in OFF position with locks in place**

- h. Release the air from the hydraulic reservoir by using the hydraulic reservoir air valve (ball valve) on top of the reservoir. The supply line from main air system will be blocked and reservoir air will vent out the hose that runs down the outside of the hydraulic reservoir.
  - Turn the handle to the up position as shown

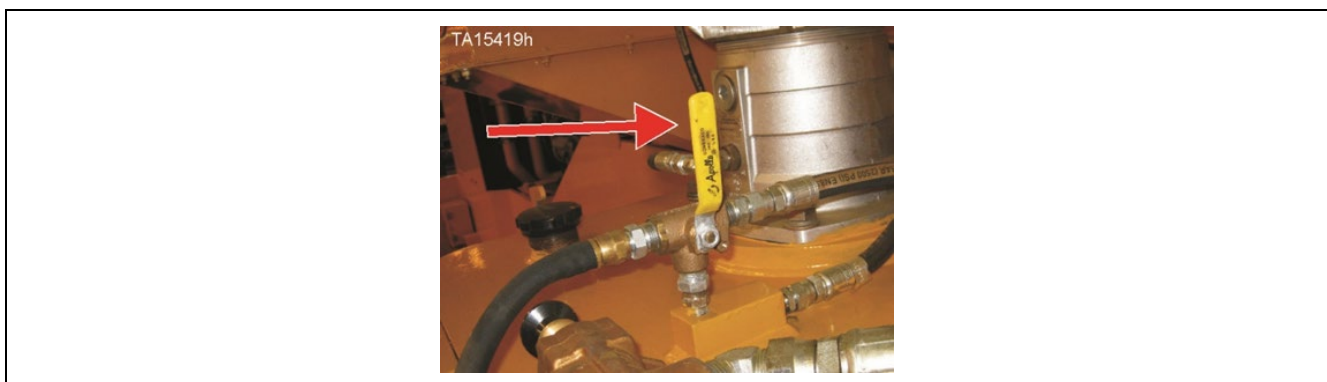


**Figure 46. Hydraulic reservoir air valve handle UP**

- i. Release the air from the various air storage reservoirs by opening all of the air bleed valves.

Three valves on right side of rear frame under hydraulic reservoir  
One valve on right side of front frame near hoist cylinder ball cap

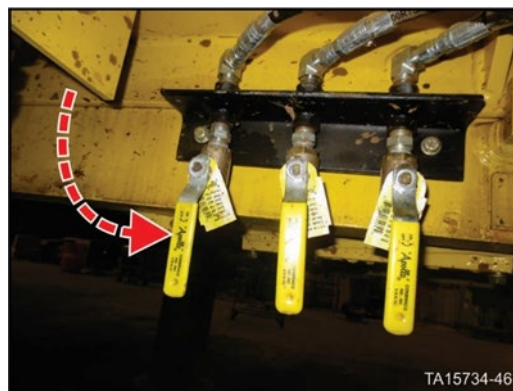
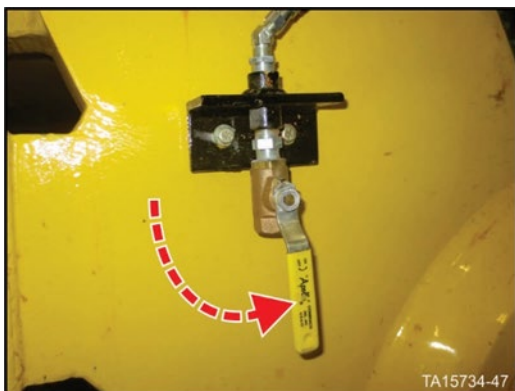


Figure 47. Open air reservoir bleed valves



## WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- j. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- k. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- l. Open the valve completely and leave it open during the procedure.

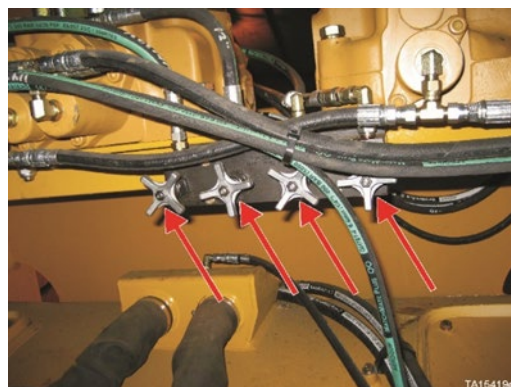
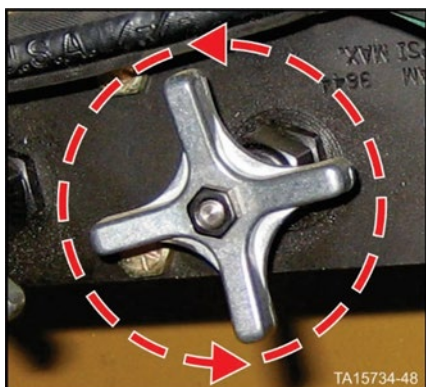


Figure 48. Pressure bleed down valves

- m. Following all local environmental rules and regulations, drain the hydraulic reservoir and any residual fluid in the hydraulic lines.

## NOTICE

When finished with the procedure, refill the hydraulic reservoir and follow all local rules and regulations to return the machine to operating condition.

## Setting the PVG 32 Inlet Relief

### NOTICE

**This relief must be bench-set.**

- a. Remove PVG 32 valve from machine.



1) PVG 32 valve

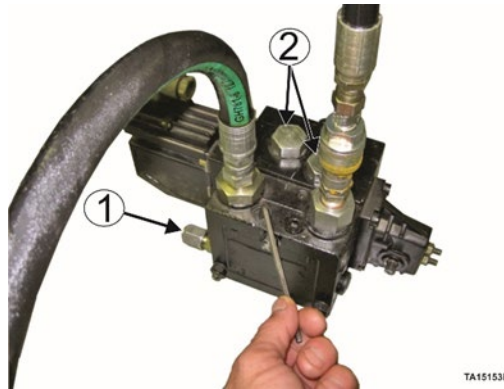
### WARNING

Skin injection hazard exists when around diesel fuel, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids. Always read the instructions and have appropriate training in the use of the test bench that is being used. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

- b. Connect a supply capable of at least 3.5 gpm (13.2 lpm) at 5000 psi (345 bar) to port "P" of valve and connect a gauge into the supply line.



- c. The "A" "B" and "LS" ports must be plugged.



1) Plug "LS" 2) Plug A and B port

- d. The "T" port should be connected to the supply reservoir.



- e. Activate pump. Pressure should read within specification. If incorrect, remove protective cap from relief valve and adjust as necessary.



**Increase**



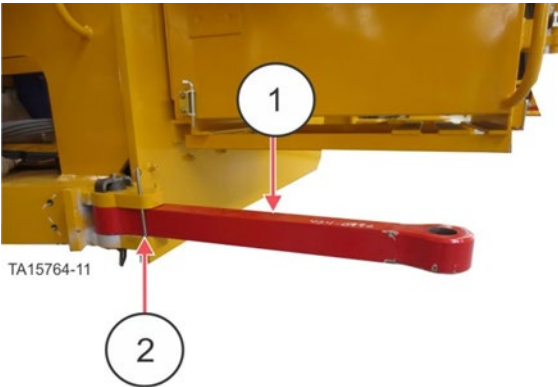
**Decrease**

- f. Re-install PVG 32 valve into machine.

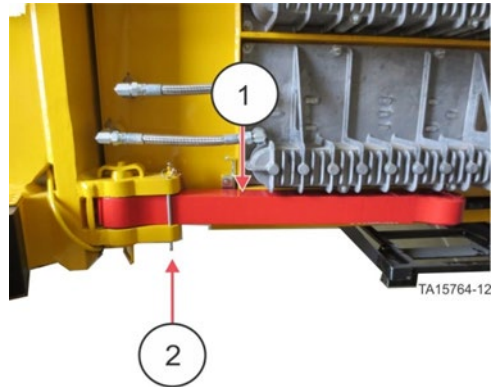


1) PVG 32 valve

- g. Remove frame lock and secure properly.



L-1350



L-1850 and L-2350

1) frame lock shown in carry position

2) retaining pin for carry position

#### Required Tools:

- Open-end wrenches
- Gauge 0 5000 psi (0 345 bar)
- Test Bench with 4gpm (15.14 lpm) flow rate at 5000 psi (344 bar)
- Various caps and plugs

#### Troubleshooting

If the pressure cannot be set, the following items need to be inspected, repaired, and or replaced.

- Relief valve
- PVG 32 valve

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## Procedure P (Not Used)

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## Procedure Q (Optional)

### Auxiliary Steering Relief Valve (L-1350/L-1850/ L-2350)

#### Safety Preparations

Follow all local safety rules for performing the following procedures. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.

The machine is not running for this setting.

#### WARNING

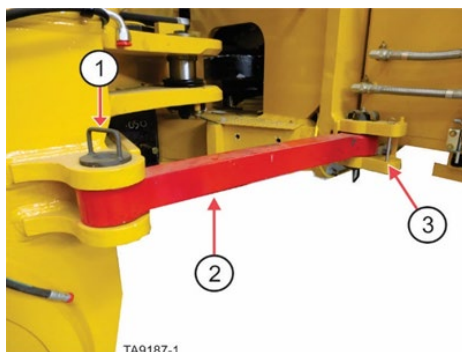
Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine must not be running during this procedure.

- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.

#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position  
3) Retaining pin bracket for un-locked position

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.
- f. Shut off the engine.



## WARNING

Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.

- f. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



**Figure 49. GEN 2 Battery Isolation Box – Battery isolation switch in OFF position with locks in place**

- g. Release the air from the hydraulic reservoir by using the hydraulic reservoir air valve (ball valve) on top of the reservoir. The supply line from main air system will be blocked and reservoir air will vent out the hose that runs down the outside of the hydraulic reservoir.
  - Turn the handle to the up position as shown

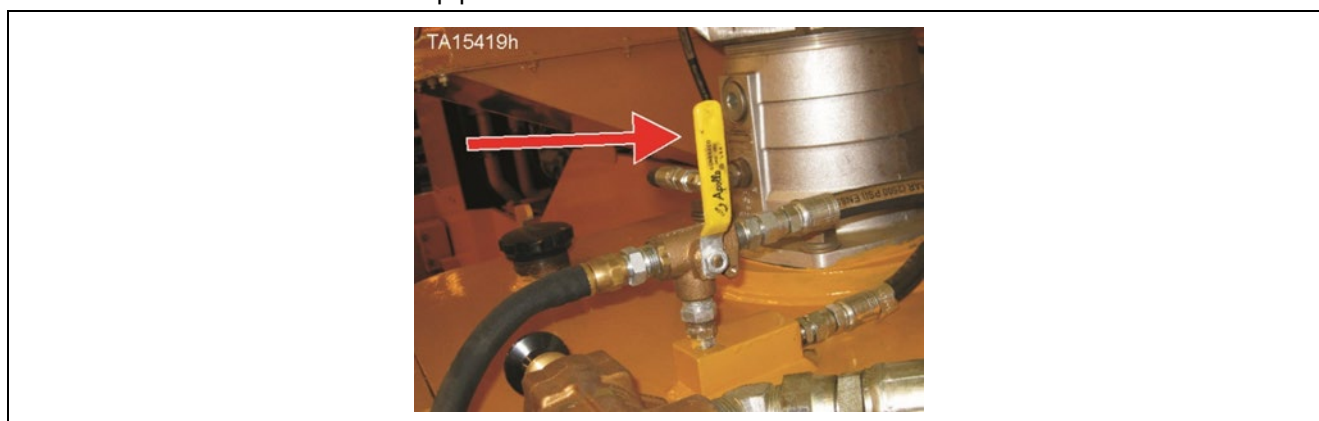


**Figure 50. Hydraulic reservoir air valve handle UP**

- h. Release the air from the various air storage reservoirs by opening all of the air bleed valves.

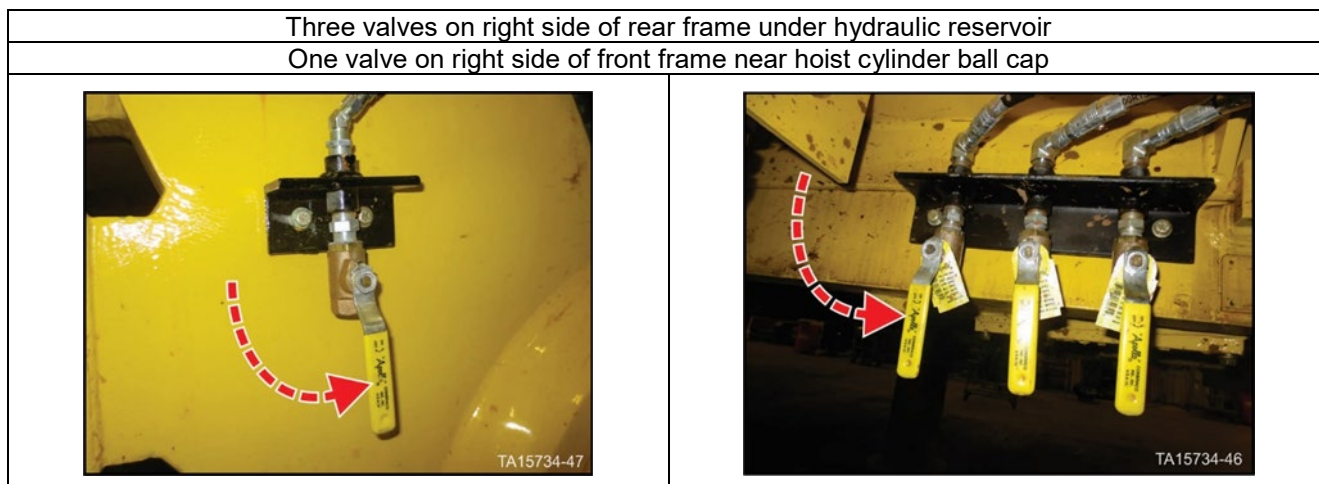


Figure 51. Open air reservoir bleed valves

## ⚠ WARNING

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual Bleed Valve Assembly, refer to “HYDRAULIC AND GREASE SYSTEMS”, “MANUAL BLEED VALVE ASSEMBLY”, in Section 04 of the Service Manual for additional operational and safety information. Operating the manual bleed valve may cause the lift arms and bucket to descend rapidly. All personnel around the bucket and lift arms area shall be removed from the area before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- i. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- j. Turn each valve slowly counter clockwise as shown below and allow the pressure to bleed down.
- k. Open the valve completely and leave it open during the repair of the manifold.

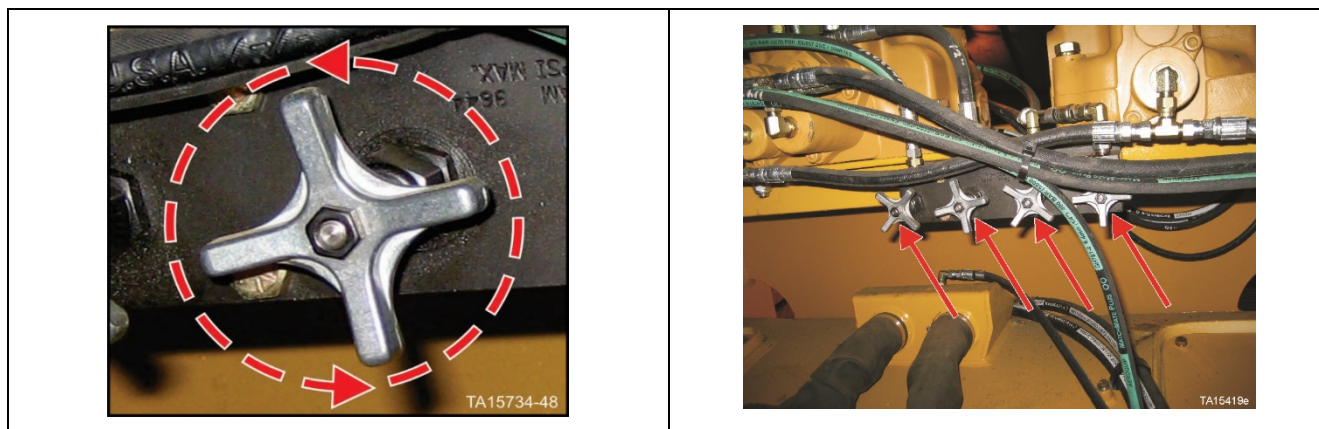


Figure 52. Pressure bleed down valves

- l. Following all local environmental rules and regulations, drain the hydraulic reservoir and any residual fluid in the hydraulic lines.

## Setting Procedure

- a. Disconnect vent line from relief valve and install gauge. Plug disconnected hose.



1) Outlet of the auxiliary steering pump output hose

## CAUTION

The electric steering pumps are not designed for continuous operation for long periods of time. Monitor the temperature of the motors on the pumps. If the motors become hot, discontinue testing until the motors have cooled off.

## NOTICE

Running auxiliary motors for an extended period of time will significantly discharge the batteries. It may be necessary to charge the batteries before trying to start the engine again.

- b. Boot LINCS and navigate to the LINCS menu and select Aux. Steering Test



Typical Auxiliary Steering Motor

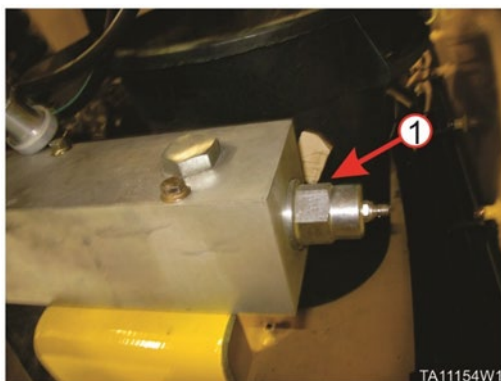
- c. Move steering joystick FULLY to the right. Read pressure gauge. Then move steering joystick FULLY to the left. Read pressure gauge. The pressures should be equal.

## NOTICE

If pressures are not the same in both directions, then a problem exists in one or more items listed at the end of the procedure.



- d. If pressure adjustment is necessary, loosen jam nut on relief valve adjusting screw. To increase pressure, turn clockwise, turn counter clockwise to decrease. Once desired pressure is obtained, re-tighten jam nut.

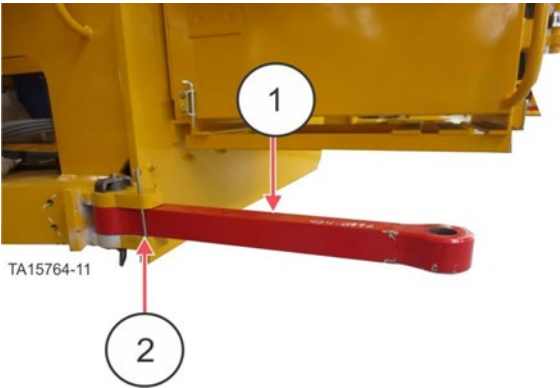
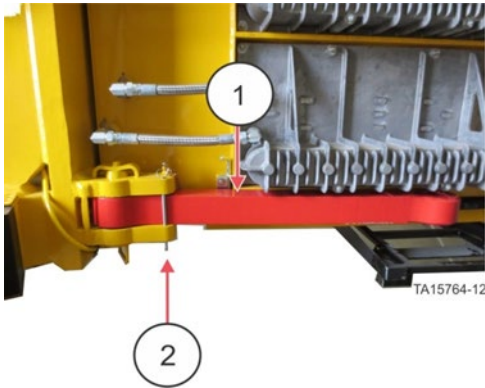


1) adjusting nut



- e. Remove the Pressure Gauge and reconnect the plugged hose.

- f. Follow all local rules and regulations to return the machine to operating condition.
- Remove the safety link between the frames and secure.

|                                                                                   |                                                                                    |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|  |  |
| <b>L-1350</b>                                                                     | <b>L-1850 and L-2350</b>                                                           |
| 1) frame lock shown in carry position, 2) retaining pin for carry position        |                                                                                    |

#### Required tools:

- 4mm Hex wrench
- 1/2" open-end wrench
- Gauge 0 5000 psi (0 345 bar)
- Various Open End wrenches

#### Troubleshooting

If the pressure cannot be set the following items need to be inspected, repaired, and or replaced.

- Relief Valve
- Auxiliary Steer Pumps Motors
- Left Hand Joystick
- Steering interface card
- PVG 32 Valve
- DANFOSS Flow Amplifier Main Relief
- DANFOSS Shock Suction Valves
- DANFOSS Flow Amplifier

## Procedure R (Not Used)

## Procedure S NOT USED

### Purging Air from the Steering System

Air will enter the steering system anytime it has been opened for repair. Before returning the loader to service, all hydraulic pumps must be primed and air purged from the steering system. The hydraulic pumps must be primed BEFORE purging air from the steering system. For pump priming instructions, refer to HYDRAULIC SYSTEM POST SERVICE REQUIREMENTS, located within this section of the Service Manual.



#### WARNING

Crush hazards exist if the machine is operated without purging air from the steering system. Do NOT operate the machine until air has been purged from the steering system. Erratic machine movement and loss of steering control could occur if air is not purged from the steering system. Purge air from the steering system before operating the machine. Failure to purge air from the steering system can cause crush hazards resulting in serious injury or death.

### Safety Preparations

Follow all local safety rules for performing the following procedure. Wear the locally required Personal Protective Equipment (PPE) while performing this procedure.



#### WARNING

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

The machine engine must be started and shut down during this procedure.

- Use appropriate hearing protection.
- Stay clear of all rotating equipment or components
- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.



#### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while

the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.

- d. Place wheel chocks in front and behind each wheel.
- e. Set the parking brakes.

## NOTICE

**DO NOT** operate the loader until air is purged from steering system.



## WARNING

Crush hazards exist in machine pivot area and area between the tires when purging air from the steering cylinders. The frame lock must be in the UNLOCKED position when purging air from the steering cylinders. **DO NOT** allow personnel in the area between the tires or in the pivot area of the machine. Allowing personnel in the area between the tires or in the pivot area can cause crush hazards resulting in serious injury or death.



## WARNING

Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. **DO NOT** tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.



## WARNING

Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. **DO NOT** tighten or loosen hydraulic fluid hoses without first relieving the pressure. **DO NOT** make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.



## WARNING

Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, **NEVER** use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. **DO NOT** tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly

pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

## CAUTION

While purging air from steering system, have a person monitor the hydraulic reservoir fluid level sight glass. Shut machine down immediately if the level drops below the lower sight glass.

### Purging Air from the Steering System

- a. Fill hydraulic reservoir to the top of the upper sight glass.
- b. Start engine and place engine select switch in the LOW position.
- c. Move steering joystick to steer the loader left and right from stop to stop as rapidly as possible.
- d. Shut off the engine and check the oil level in the sight gauge. Add oil to hydraulic reservoir as necessary.
- e. Start the engine again and repeatedly steer left and right from stop to stop. Air will leave the system only at the hydraulic reservoir. Therefore, the oil must be circulated in both directions repeatedly until the air is purged out.

## NOTICE

The oil in the lines to the steering cylinder reaches a “dead end” at the piston. The oil in the cylinder does not flow in a circuit. As the piston moves back and forth, the oil moves back and forth in the lines. Therefore, air in these lines and the cylinders may be slow moving into the hydraulic reservoir.

- f. When the oil in the hydraulic reservoir is clear (not cloudy or creamy), the system is free of air.
- g. Make a final check of the oil level in the hydraulic reservoir and ensure the oil is at the 3/4 level of the sight glass.
- h. Follow all local rules and regulations to return the machine to operating condition.

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