Hydraulic System Removal/Installation

Section 04-01-06

Komatsu has made every effort to make this manual as accurate as possible based on the information available at the time of publication and printing. Continuous improvement and advancement of product design may cause changes to machines, which may not have been included in this publication. Komatsu reserves the right to make changes and improvements at any time. To ensure the most current information, please contact your service center.

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Scope of This Publication, 04-01-06

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 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.**

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- **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 when removing and installing the hoist and bucket pumps. Removal and installation requires the use of a suitable hoisting device. DO NOT attempt to remove the pumps by hand They are heavy (approx. 300 lbs [136 kgs]). Failure to use adequate lifting devices and equipment could cause crush hazards resulting in serious injury or death.**
- **Crush hazard exists under rear of machine. Counter weight mounted under the radiator. Do not enter this area unless the counterweights have been externally supported to prevent falling. Do not loosen the bolts for the counterweight structure unless the structure has been externally supported of adequate support to hold the weight of the counter weights. Failure to support the counter weights before entering the 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.**

EXPLOSION HAZARDS

- **Explosion hazard exists if the hood structure has optional fire suppression devices. Certified personnel should be consulted prior to disconnecting or reconnecting fire suppression equipment. Serious injury and/or equipment damage is possible if the equipment is not disconnected or reconnected correctly. Failure to use trained personnel when working on the fire Component Weights**

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**

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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.**

NOTICE

Component weights are approximate and can vary widely depending on attachments, retained fluids, etc. Always allow a safety margin when selecting lifting equipment.

Component	LBS.	KGS.
Hoist and Bucket pump	300	137
Fan/Blower pump	250	114
Steering pump	250	114

Figure 1. Component weights

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Typical Pump Removal and Installation

Safety Preparations

⚠ 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. Stop the wheel loader on flat level ground.

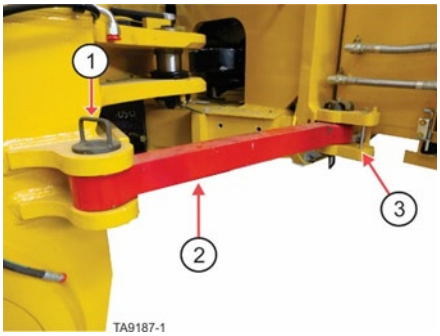
b. Set bucket flat and level on the ground.

c. Place wheel chocks in front and behind each wheel.

d. 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 2. Frame Lock

e. Set the parking brakes.

f. Shut off the engine.

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⚠ 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.

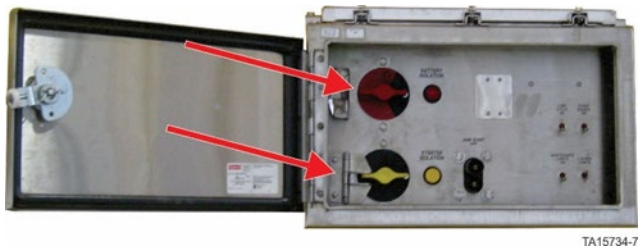

Figure 3. Battery Isolation Box – Battery isolation switch in OFF position with locks in place

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

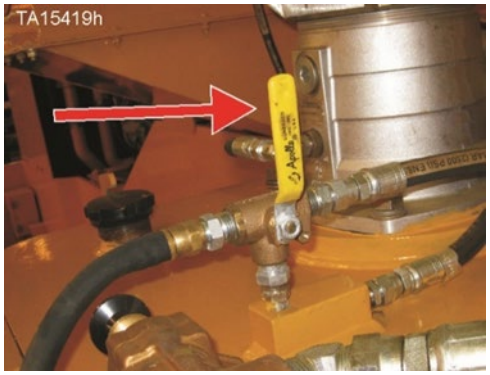

Figure 4. Hydraulic reservoir air valve handle UP

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

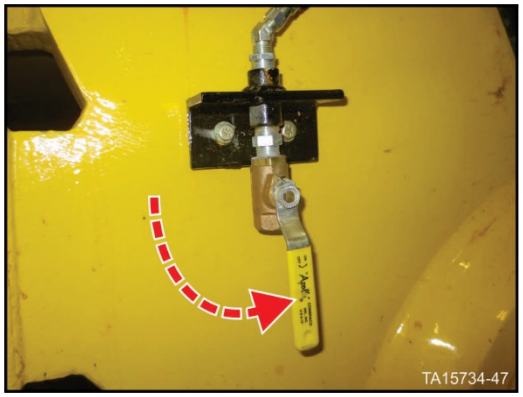
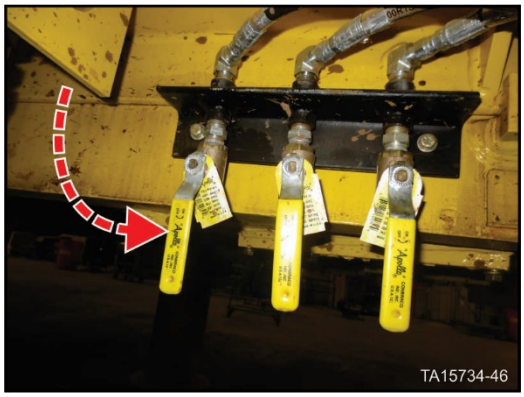
Three valves on right side of rear frame under hydraulic reservoir	
One valve on right side of front frame near hoist cylinder ball cap	
	

Figure 5. 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 counterclockwise as shown below and allow the pressure to bleed down.

- Open the valve completely and leave it open during this procedure.

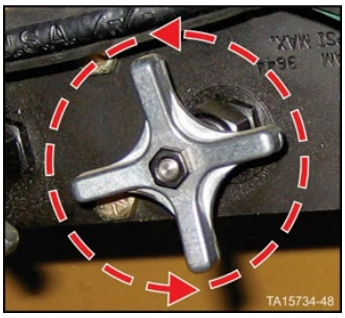
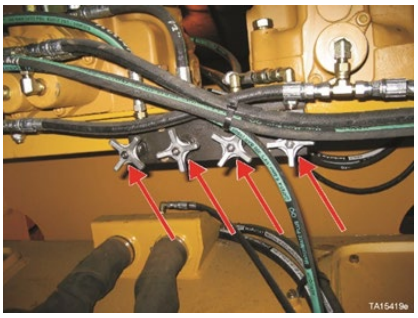
	

Figure 6. Pressure bleed down valves

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

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Removal of Typical Pumps

To remove the hoist and bucket pumps perform the following procedure:

⚠ 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

Crush hazards exist when removing and installing the hoist and bucket pumps. Removal and installation requires the use of a suitable hoisting device. DO NOT attempt to remove the pumps by hand! They are heavy (approx. 300 lbs [136 kgs]). Failure to use adequate lifting devices and equipment could cause crush hazards resulting in serious injury or death.

a. Remove the clamps securing the cables and hydraulic hoses to the bulkhead at the front of the tow unit. Push the cables and hoses aside and tie them out of the way. Exercise caution to avoid damaging the cables and hoses.

b. Remove the blower duct directly above the pump (if necessary).

c. Remove the pump pressure and suction hoses.

d. Remove the gauge block and case drain hose from the pump.

e. Cap all hydraulic lines.

f. Attach a lifting sling around the pump.

g. Tighten the hoist against the pump in sufficient force to handle the weight of the pump when it is unbolted from the gearbox.

h. Slowly loosen the mounting bolts alternately until they can be removed and the weight of the pump is supported by the hoist.

i. Pull the pump free of the gearbox and lower it through the bottom of the machine.

j. Cover the opening in the gearbox to prevent contamination.

k. Use a forklift to move the pump to a workbench.

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Installation of Typical Pumps

To install the hoist and bucket pumps perform the following procedure:

a. Remove protective covering from the opening in the gearbox.

b. Install O-ring to the pump and apply LUBRIPLATE assembly grease to the O-ring. Refer to illustration "APPLICATION OF ASSEMBLY GREASE TO PUMP O-RING AND PUMP".

Figure 7. Application of assembly grease to pump O-ring and pump

c. Attach a sling to the pump and hoist the pump into mounting position on the output bearing housing.

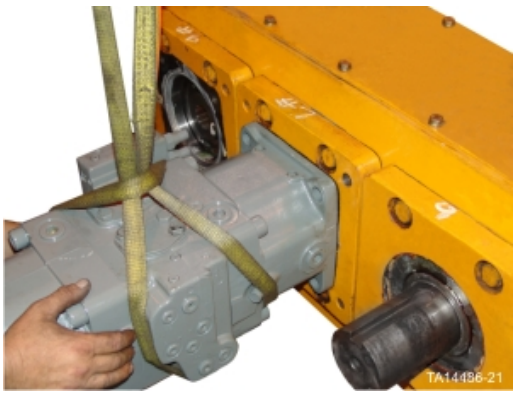

Figure 8. Attach a sling to the pump

d. Hoist the pump into position and insert the pump spline shaft into the gearbox. If the pump's spline shaft does not line up with the gearbox splines, rotate the pump shaft until the splines line up and the pump can be mated to the gearbox. DO NOT use the gearbox mounting bolts to draw the pump into the gearbox. Adjust the angle of the pump to the gearbox by raising or lowering the hoist or moving the pump from side-to-side by hand, while it is suspended from the hoist.

NOTICE

There will be a slight gap between the pump and the face of the output bearing housing when the pump is first put into mounting position. Installation of the pump retaining bolts will close this gap and provide proper sealing of the pump to the gearbox.

e. Lubricate pump retaining bolts on the threads and under the heads with 30W motor oil. Install retaining bolts and flatwashers and torque to Grade 8 specifications, per the "Capscrew and Bolt-Nut Torque Specifications".

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f. Start mounting bolts by hand and tighten alternately. Torque to Grade 8 specifications, per the “Capscrew and Bolt-Nut Torque Specifications”.

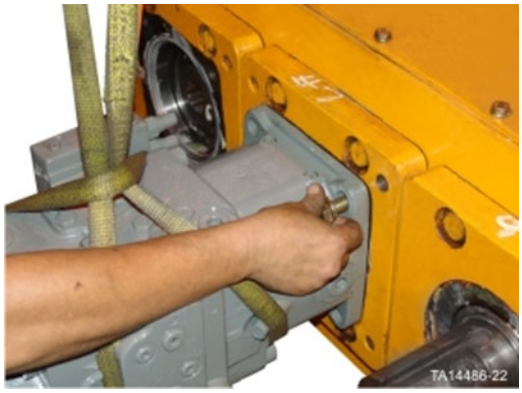

Figure 9. Installation of pumps retaining bolts and flatwashers

g. Replace the suction, pressure and case drain hoses and gauge block.

h. Refill hydraulic system, if necessary.

i. Bleed all hydraulic pumps before starting machine.

CAUTION

Failure to bleed all hydraulic pumps following hydraulic system service or repair could cause premature pump failure or shortened pump life due to a dry-start situation at machine start-up. Start engine and check for leaks with the engine at high throttle.

⚠ 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.

NOTICE

Set the parking brake and station an operator at the controls to ensure the machine does not move during inspection, service or repair.

⚠ WARNING

Crush hazards exist when removing and installing the hoist and bucket pumps. Removal and installation requires the use of a suitable hoisting device. DO NOT attempt to remove the pumps by hand! They are heavy (approx. 300 lbs [136 kgs]). Failure to use adequate lifting devices and equipment could cause crush hazards resulting in serious injury or death.

j. Follow all lockout tag out rules, local rules, and local regulations to return the machine back to service.

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Hydraulic Gearbox Removal and Installation

Safety Preparations

⚠ 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. Stop the wheel loader on flat level ground.

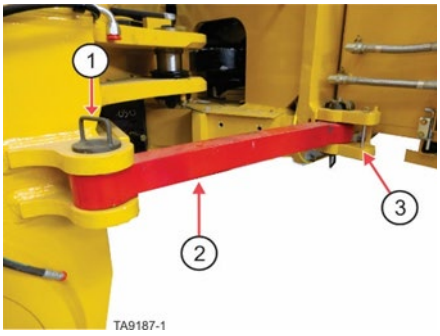
b. Set bucket flat and level on the ground.

c. Place wheel chocks in front and behind each wheel.

d. 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

Frame Lock

e. Set the parking brakes.

f. Shut off the engine.

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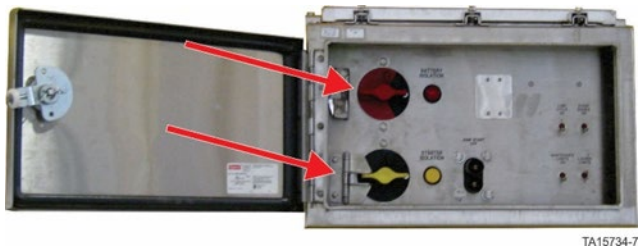
⚠ WARNING

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.

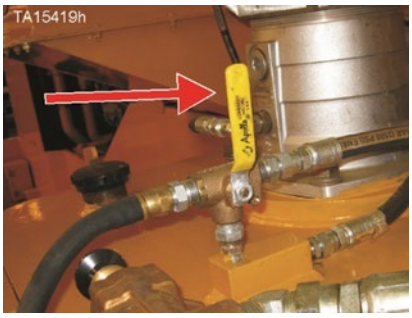
g. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



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



Hydraulic reservoir air valve handle UP

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

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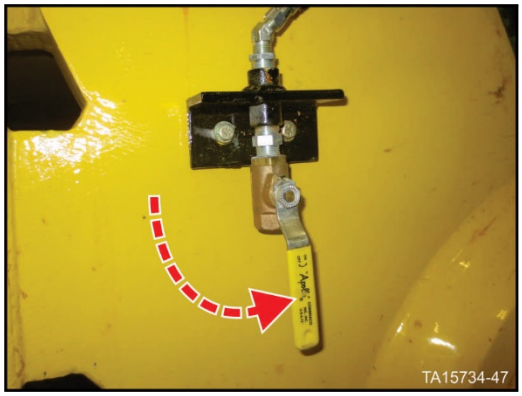
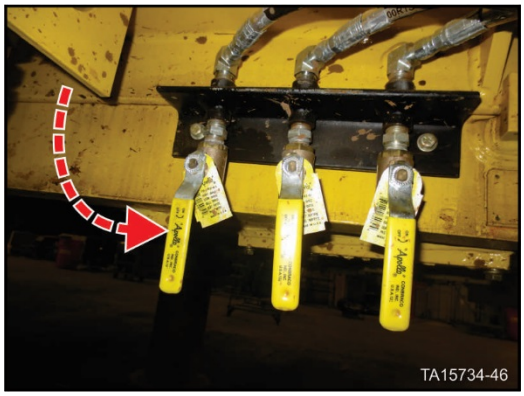
Three valves on right side of rear frame under hydraulic reservoir	
One valve on right side of front frame near hoist cylinder ball cap	
	

⚠ 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.

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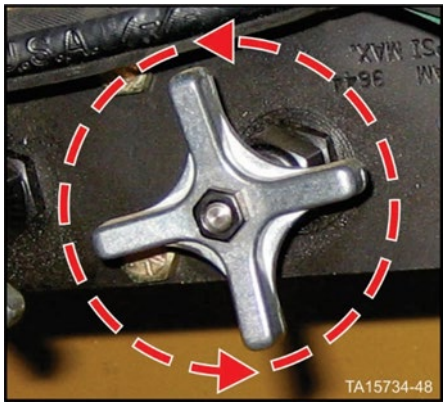
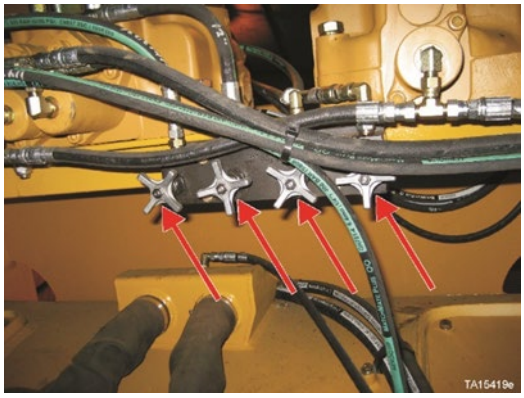
k. Turn each valve slowly counterclockwise as shown below and allow the pressure to bleed down.

- Open the valve completely and leave it open during this procedure.





Pressure bleed down valves

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

Components weights

NOTICE

Component weights are approximate and can vary widely depending on attachments, retained fluids, etc. Always allow a safety margin when selecting lifting equipment.

Component	LBS.	KGS.
Gearbox without pumps	2,100	953
Gearbox with pumps	5,100	2,313
Hoist and Bucket pump	300	137
Blower/air cleaner assembly	4,500	2,042

Figure 10. Component weights

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Removal

NOTICE

Removal and installation of the hydraulic pump gearbox requires either a truck-mounted or overhead crane of sufficient height and capacity to lift the hood assembly, cooling air system filtration unit, blower assembly, and gearbox with pumps attached. Refer to applicable component weight for the machine model located in Section 01 "SPECIFICATIONS AND OPERATION of the Service Manual.

a. Remove the catwalk grating and crossmember anchoring grating behind the operator's cab.

b. Remove the front hood structure. Refer to "Hoisting of hood assembly".

Figure 11. Hoisting of hood assembly

c. Remove central air blower assembly and KLENZ™ air filtration unit.

NOTICE

Wooden cribbing is required to support the KLENZ™ air filtration unit and blower to ensure no damage is done to housings or tubing when the units are removed from the machine. Remove the KLENZ™ air filtration and blower assembly as a unit. Position the assembly on wooden cribbing to ensure no damage occurs to tubing or housings. Securely cover all openings to prevent ingression of dirt or debris. Refer to illustration "Hoisting of KLENZ™ and blower assembly" and "KLENZ™ and blower assembly supported by cribbing 1 of 3".

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Figure 12. Hoisting of KLENZ™ and blower assembly

Figure 13. KLENZ™ and blower assembly supported by cribbing 1 of 3

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Figure 14. KLENZ™ and blower assembly supported by cribbing 2 of 3

Figure 15. KLENZ™ and blower assembly supported by cribbing 3 of 3

d. Disconnect drive shaft U-joint from hydraulic gearbox.

e. Tag and disconnect the hoses from the hydraulic pumps. Then cap the openings to prevent foreign material from entering.

f. Remove the bolts, flatwashers and lockwashers securing the mounting structures to the frame of the loader.

g. Attach a suitable hoist to the eye brackets and lift the gearbox clear of the loader and into a prepared area.

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Installing Gearbox

a. Hoist gearbox into mounting position in machine.

b. Attach gearbox mounts to machine with bolts and washers.

c. Ensure the HPD gearbox is filled with oil that meets factory specifications.

Installation and Alignment of Gearbox to Generator

CAUTION

Extreme caution must be exercised to ensure proper alignment of the gearbox to the generator or component damage could occur.

Numbers in parenthesis refer to illustration “Hydraulic gearbox drive shaft installation”.

a. Install the drive hub on the generator output shaft.

NOTICE

Insulated components. It is critically important to install insulated components as shown in “Generator insulated components”. Note that the laminated retainer key has a specific installation orientation. When installed in the proper orientation, the material is approximately the same strength as a steel key. Orientation of all insulated components is further illustrated in “Installed components cross section”.

b. Install the driven hub on the gearbox input shaft.

c. Attach hoisting device to lifting eyes and hoist gearbox into mounting position.

d. Temporarily place the driveshaft (2) between the drive hub (1) and the driven hub (6) to assure proper clearance.

e. Move the drive shaft (2) until the hubs are aligned.

f. Place a straight edge, of adequate length, over the top of each hub in the 12 o’clock position (refer to illustration “Hydraulic pump gearbox alignment”.

g. With a feeler gauge, check under the straight edge.

h. Adjust the gearbox vertically by screwing in or out on the bolts in the adjusting bars until there is 1/8” clearance or less at the 12 o’clock position.

i. Next, place the straight edge over the side of each hub at the 3 or 9 o’clock position.

j. Adjust the gearbox laterally by repositioning the mount structures to obtain 1/32” or less clearance at either the 3 or 9 o’clock position.

k. Recheck the 12 o’clock position to make certain that the original tolerance is maintained.

l. Install the gearbox mount bolts. Torque bolts to Grade 8 specifications per the “Capscrew and Bolt-Nut Torque Specifications”.

m. Lift the drive shaft (2) into position and move the driven hub (6) until it meets with the drive shaft end. Secure the driven hub in place.

n. Secure the U-joint bolts into the drive hub (1) and driven hub (6).Tighten the bolts to 90 ft-lbs, lubricated with 30-W motor oil on the threads and under the heads.

o. Double check the alignment by placing the straight edge and the 12 and 3 or 9 o’clock positions to see if the original tolerances were maintained. Adjust if required.

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p. Ensure the gearbox is filled with the correct oil.

Completing the Gearbox Installation

a. Attach hoisting device to lifting eye on the KLENZ™ filtration unit and blower assembly and hoist assembly into position.

b. Reinstall mount bolts, nuts and washers that secure blower assembly to adapter structure and air filtration unit to mount structure. Torque bolts to Grade 8 specifications per the “Capscrew and Bolt-Nut Torque Specifications”.

c. Install flex duct and hose clamp between filter assembly and blower assembly.

d. Reconnect hydraulic lines to blower motor.

e. Refill the hydraulic reservoir to the 3/4 mark on the reservoir sight gauge.

f. Turn on the battery disconnect switch and boot the LINCS system.

g. Close manual air release valve on the top of the hydraulic reservoir.

h. Bleed all hydraulic pumps.

CAUTION

Failure to bleed each hydraulic pump following service or repair of the hydraulic system can result in pump failure or shortened pump life due to a dry-start condition at machine start up.

i. Enable machine's starting capability with the maintenance lookout switch and start engine.

j. Recheck the HPD gearbox and hydraulic reservoir oil level.

k. Recheck flex hose and clamp between blower and filter assembly for leaks.

l. Check all hydraulic pumps and blower motor for hydraulic fluid leaks with engine at High throttle.

m. Reinstall the front hood structure.

n. Reinstall crossmember that anchors grating.

o. Reinstall grating.

p. Check for gearbox oil and hydraulic oil leaks.

q. Check all clamps and air ducts for proper positioning and air leaks.

r. Move frame lock to unlocked position.

s. Follow all lockout tag out rules, local rules, and local regulations to return the machine back to service.

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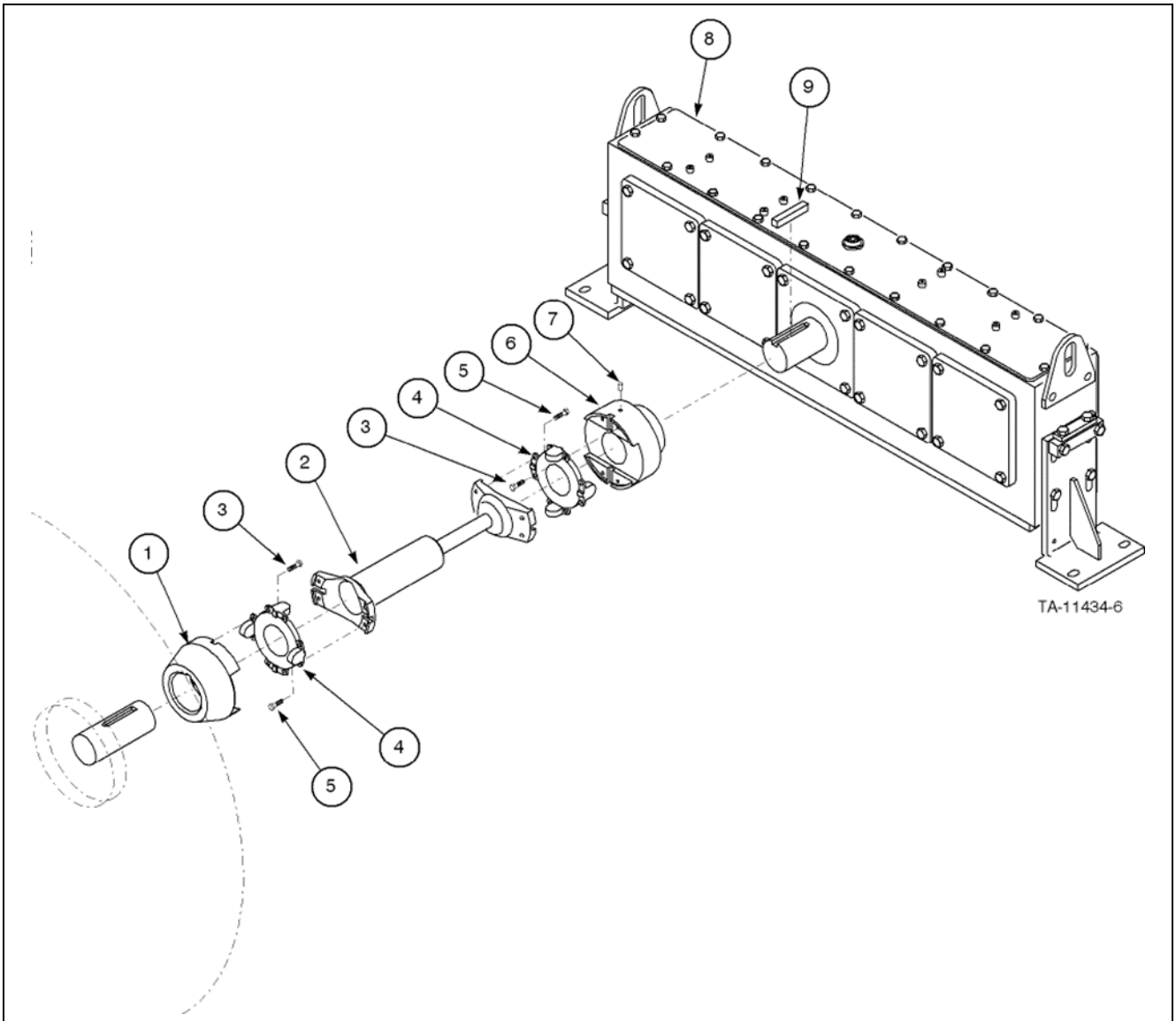

1 Hub, drive with keyway, insulated	**6** Hub, driven
2 Drive shaft	**7** Setscrew
3 Bolt	**8** Gearbox
4 Spider and bearing assembly (u-joint)	**9** Key
5 Bolt	

Figure 16. Hydraulic gearbox drive shaft installation (Typical)

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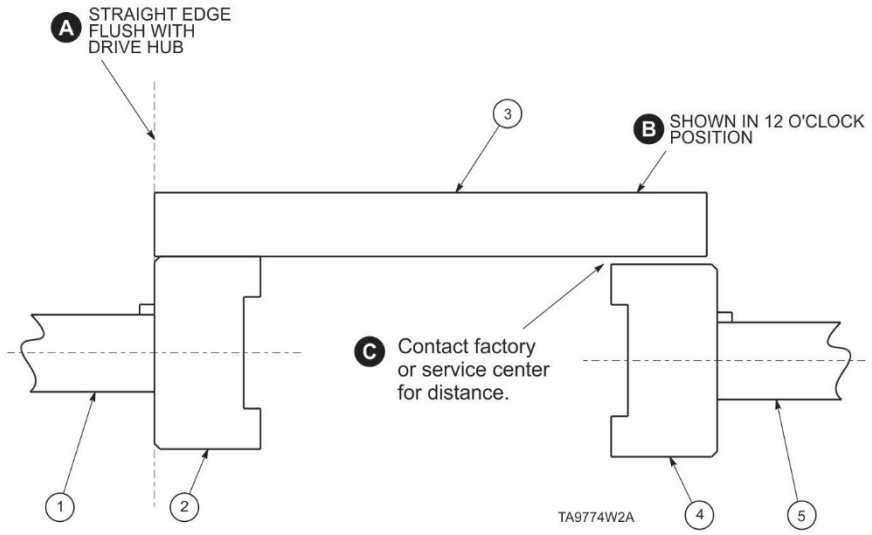
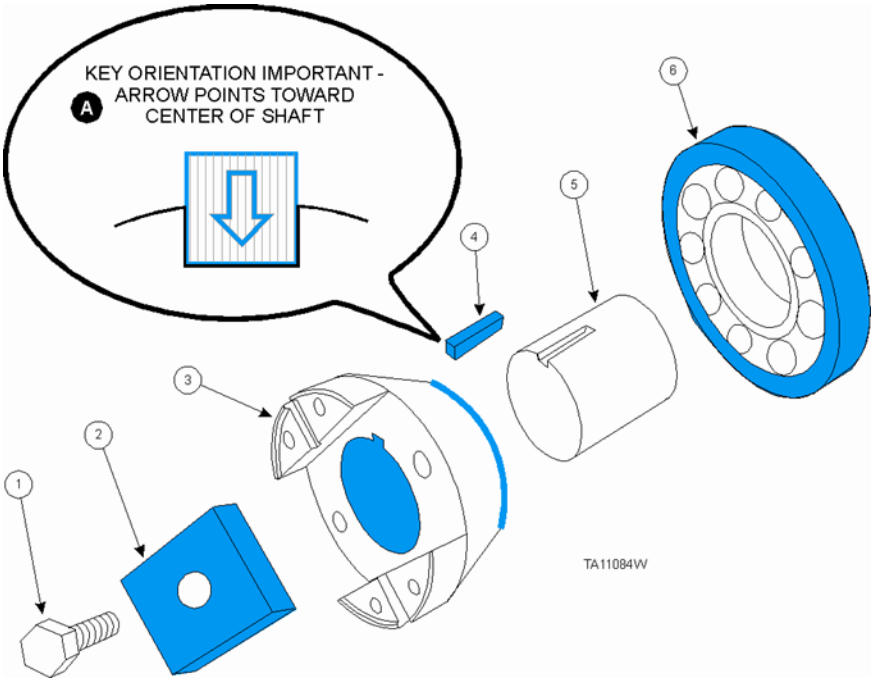


1) Generator output shaft, **2)** Drive hub, **3)** Straight edge, **4)** Drive hub, **5)** Gearbox input shaft

A) Straight edge flush with drive hub, **B)** Shown in 12 o'cock position, **C)** Contact the factory or service center for distance.

Figure 17. Hydraulic pump gearbox alignment



1) Retainer bolt, **2)** Insulated retainer plate, **3)** Insulated drive hub, **4)** Insulated retainer key, **5)** Generator drive shaft, **6)** Insulated bearing

A) Key orientation important arrow points toward center of shaft

Figure 18. Generator insulated components

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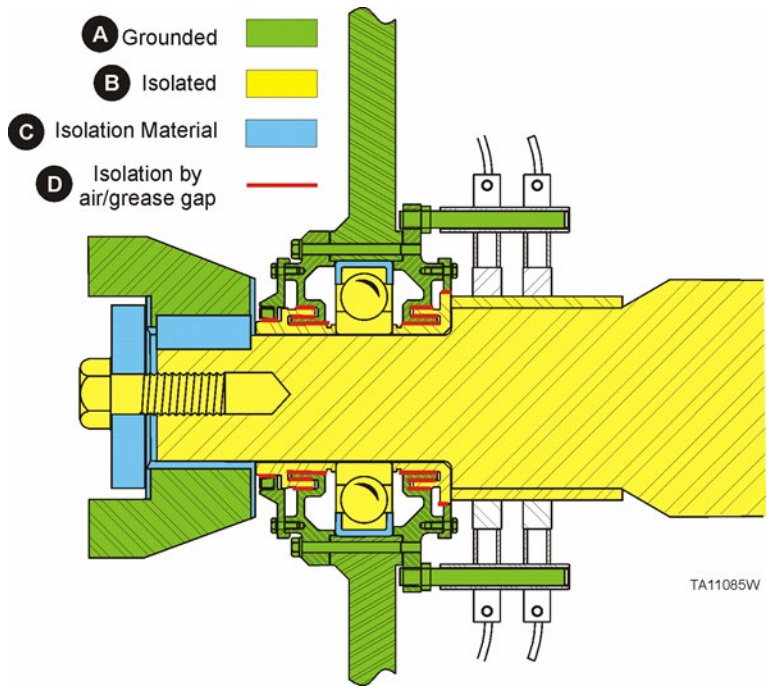

A) Grounded, **B)** Isolated, **C)** Isolation material, **D)** Isolation by air/grease gap

Figure 19. Installed components cross section

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Valve Removal (Flow Amplifier or PVG32)

Safety Preparations

⚠ 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. Stop the wheel loader on flat level ground.

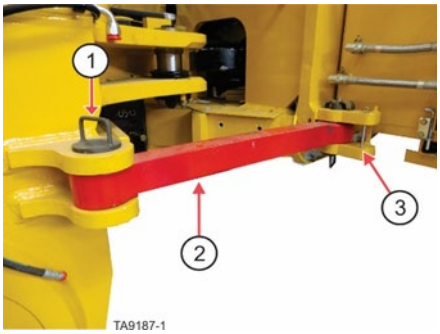
b. Set bucket flat and level on the ground.

c. Place wheel chocks in front and behind each wheel.

d. 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

Frame Lock

e. Set the parking brakes.

f. Shut off the engine.

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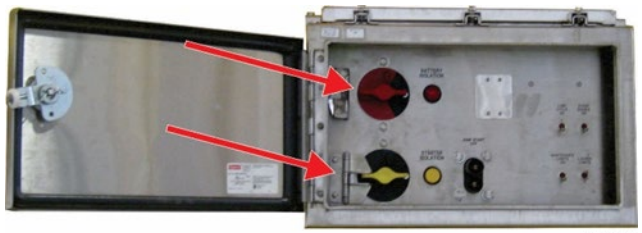
⚠ WARNING

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.

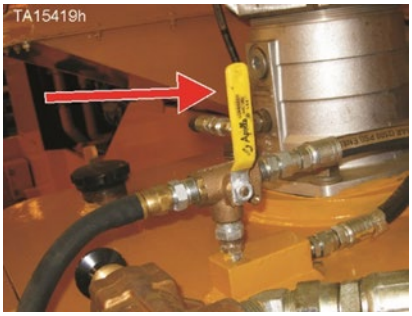
g. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



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



Hydraulic reservoir air valve handle UP

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

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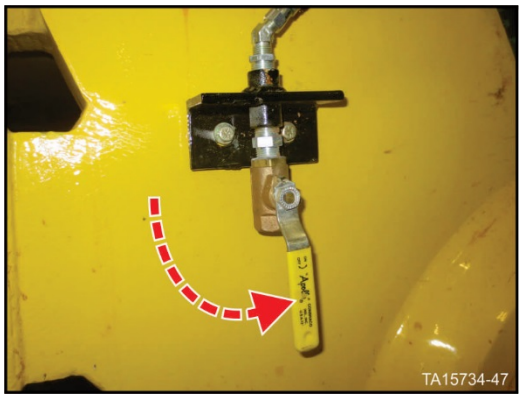
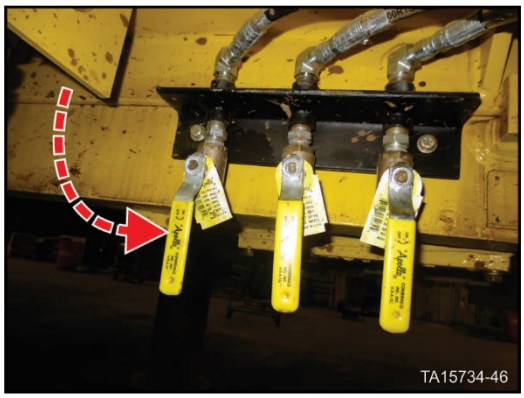
Three valves on right side of rear frame under hydraulic reservoir
One valve on right side of front frame near hoist cylinder ball cap





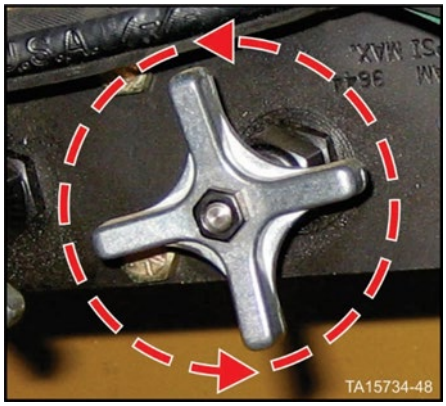
⚠ WARNING

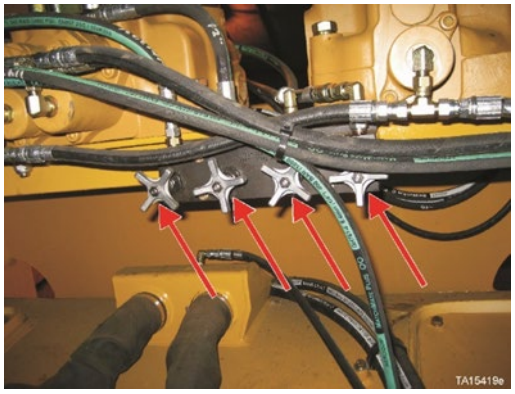
Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual 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 counterclockwise as shown below and allow the pressure to bleed down.

- Open the valve completely and leave it open during this procedure.





Pressure bleed down valves

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

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Component Weights

NOTICE

Component weights are approximate and can vary widely depending on attachments, retained fluids, etc. Always allow a safety margin when selecting lifting equipment.

Flow Amplifier Weight	PVG32 Weight
65 LBS. (30 KGS.)	20 LBS. (9 KGS.)

Figure 20. Component weights

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Removal

To remove the valve from the machine, perform the following procedures:

a. Clean the valve before disconnecting the hose lines.

- Ensure all exterior dirt is removed from the valve and hose fittings.

CAUTION

It is important that the steering system be kept free of dirt or foreign matter; therefore, cleanliness in servicing the valve is absolutely necessary.

b. Tag and remove all hoses, being careful not to spill hydraulic fluid.

c. Plug all hose openings immediately to keep out dirt.

d. Support the valve with a lifting device and remove the mounting bolts and lockwashers.

e. Remove the valve and move it to a suitable clean workbench for maintenance and inspection.

Installation

To install the valve, perform the following procedures:

a. With a suitable lifting device, lift valve in position and install mounting bolts and lockwashers.

b. Remove plugs from the valve and hoses and connect as tagged.

c. Purge air from the steering system.

d. Follow all lockout tag out rules, local rules, and local regulations to return the machine back to service.

CAUTION

DO NOT operate the loader until all hydraulic pumps have been primed and air is purged from the steering system.

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Hydraulic Cylinders

Safety Preparations

⚠ 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. Stop the wheel loader on flat level ground.

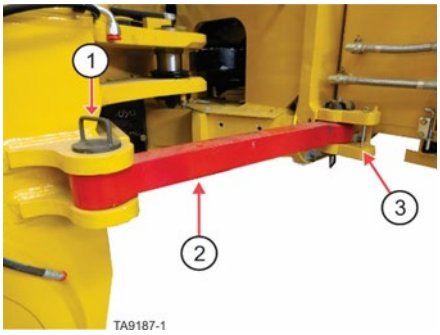
b. Set bucket flat and level on the ground.

c. Place wheel chocks in front and behind each wheel.

d. 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

Frame Lock

e. Set the parking brakes.

f. Shut off the engine.

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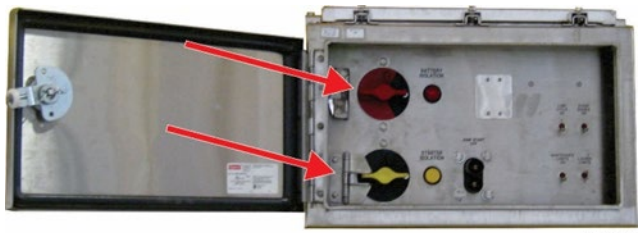
⚠ WARNING

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.

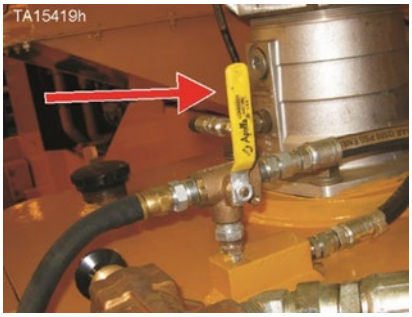
g. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



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



Hydraulic reservoir air valve handle UP

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

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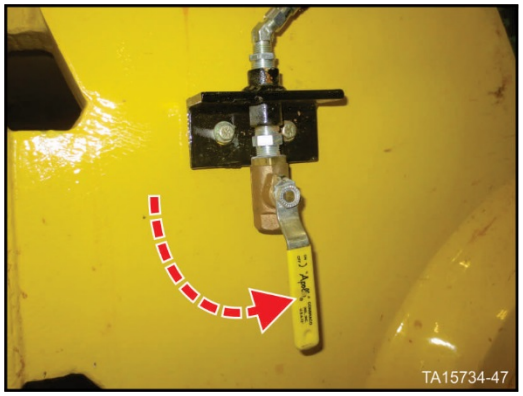
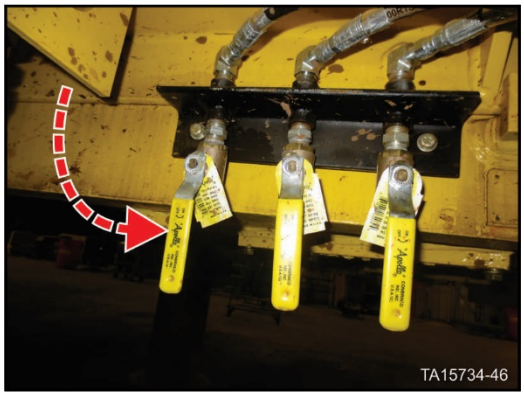
Three valves on right side of rear frame under hydraulic reservoir One valve on right side of front frame near hoist cylinder ball cap	
	

Open air reservoir bleed valves

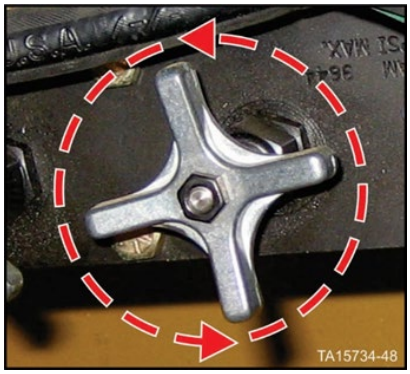
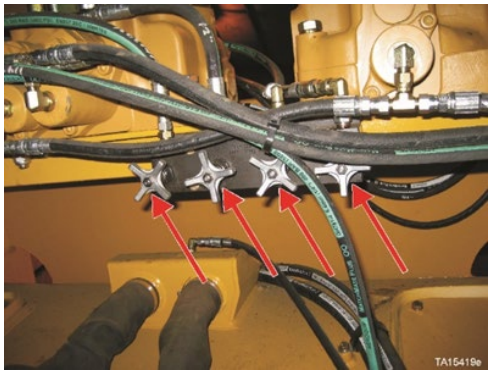
⚠ WARNING

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 counterclockwise as shown below and allow the pressure to bleed down.

- Open the valve completely and leave it open during this procedure.

Pressure bleed down valves

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

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Component Weights

NOTICE

Component weights are approximate and can vary widely depending on attachments, retained fluids, etc. Always allow a safety margin when selecting lifting equipment.

Machine Model	Component	Weight (LBS.)	Weight (KGS.)
1350	Hoist cylinder	4,200	1,906
1350	Bucket cylinder	3,000	1,361
1350	Steering Cylinder	800	363
1850	Hoist cylinder	5,660	2,567
1850	Bucket cylinder	3,300	1,497
1850	Steering Cylinder	800	363
2350	Hoist cylinder	5,660	2,567
2350	Bucket cylinder	3,300	1,497
2350	Steering Cylinder	1120	509

Figure 21. Component weights

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Hoist Cylinder

The Hoist hydraulic cylinders are extra-heavy welded steel construction. The hoist hydraulic cylinders employ a solid piston.

Removal

The lift arms should be completely lowered and the bucket flat on the ground before beginning this procedure.

a. Shut off engine.

b. With the engine NOT running, use the Manual Bleed Valve Assembly to relieve hydraulic system pressure in the hoist and bucket circuit.

c. Release air pressure from system.

d. Remove hoses from cylinder. Place clean plastic plugs in lines and cylinder ports to prevent oil loss as each line is removed.

e. Place suitable hoist sling around cylinder.

f. Loosen ball cap capscrews from pivot end of cylinder and remove ball cap and bronze liner.

g. Remove lockscrews, lockwashers and bushing pins from rod end of cylinder.

h. Hoist cylinder to prepared area.

Installation

a. Thoroughly clean the ball cap joints and liners. Pack and lubricate. Thoroughly clean pins and self-aligning bushings. Pack and lubricate. Hoist cylinder into mount position. Align piston end with ball cap and rod end with clevis mount.

b. Install ball cap ball seals, ball liner, shims, and spacer with lubed capscrews and torque to values provided in torque chart. Secure bushing pins with lockwashers and capscrews.

c. Clean around hose fittings and portholes in cylinder walls.

d. Remove plastic plugs and connect hoses to cylinder. Torque fittings to standard practice.

e. Fill reservoir with hydraulic oil.

f. Bleed hydraulic pumps.

g. Start engine, release park brake, and hoist the lift arms up and down, several times.

h. Check cylinder assembly for oil leaks and proper function.

i. Follow all lockout tag out rules, local rules, and local regulations to return the machine back to service.

CAUTION

COMPONENT DAMAGE

- **Failure to bleed each hydraulic pump following service or repair of the hydraulic system can result in pump failure or shortened pump life due to a dry-start condition at machine start up.**
- **DO NOT operate the loader until all hydraulic pumps have been primed and air is purged from the steering system.**

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Bucket Cylinder

Hydraulic cylinders are extra-heavy welded steel construction. This cylinder employs the solid piston.

Removal

a. Shut off engine.

b. Release air pressure from system.

c. Place drain pan under cylinder ports.

d. Remove hoses from cylinder. Place clean plastic plugs in lines and cylinder ports to prevent oil loss as each line is removed.

e. Place suitable hoist sling around cylinder.

f. Remove lockscrews, lockwashers and bushing pins from rod end of cylinder and pivot end of cylinder.

g. Hoist cylinder to prepared area.

Installation

a. Thoroughly clean pins and self-aligning bushings. Pack and lubricate.

b. Hoist cylinder into mount position. Align piston end with pivot clevis mount and rod eye end with clevis mount.

c. Secure bushing pins with lockwashers and capscrews.

d. Clean around hose fittings and portholes in cylinder walls.

e. Remove plastic plugs and connect hoses to cylinder. Torque fittings to standard practice.

f. Fill reservoir with hydraulic oil.

g. Bleed hydraulic pumps. Refill hydraulic tank.

h. Start engine, release park brake. Hoist the lift arms and move the bucket to roll back position and roll forward position, several times.

i. Check cylinder assembly for oil leaks and proper function.

CAUTION

COMPONENT DAMAGE

- **Failure to bleed each hydraulic pump following service or repair of the hydraulic system can result in pump failure or shortened pump life due to a dry-start condition at machine start up.**
- **DO NOT operate the loader until all hydraulic pumps have been primed and air is purged from the steering system.**

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Steering Cylinder

The steering hydraulic cylinders are made of extra-heavy welded steel construction. The cylinder piston is a solid piston. Check cylinder weight before preparing to hoist it.

Removal

a. Shut off engine.

b. Release air pressure from system.

c. Place drain pan under cylinder ports.

d. Remove hoses from cylinder. Place clean plastic plugs in lines and cylinder ports to prevent oil loss as each line is removed.

e. Place suitable hoist sling around cylinder.

f. Remove lockscrews, lockwashers and bushing pins from rod eye end of cylinder and pivot end of cylinder.

g. Hoist cylinder to prepared area.

Installation

Numbers in parenthesis refer to illustration “Steering cylinder pin installation cross section”.

a. Thoroughly clean pins and self-aligning bushings. Pack and lubricate.

b. Hoist cylinder into mount position. Align piston end with pivot clevis mount and rod eye end with clevis mount.

c. Install lower sawcut bushing (4) and hold in place by bolting on capture plate (18), using bolts (14), lockwashers (15), and flatwashers (13).

d. Install O-ring (12) as shown (use grease to hold them in place).

e. Position cylinder assembly with rod eye and base eye centered between frame structures. Support cylinder and use wedges to hold centered until bolts are torqued.

f. Install pin (10) with seal retainer sleeves (16) and O-rings (6) through ball bushing so that it rests on lower sawcut bushing (4). Lube hole must be 90º to line of action of cylinder.

g. Install upper sawcut bushing (4).

h. Install upper washer (5) and bolt (7).

i. Install bottom nut (17) on bolt and torque bolt on L-950 and L-1150 to 450 ft-lbs (610 N•m) lubed and L-1350, L-1850, and L-2350 to 850 ft-lbs (1153 N•m) lubed.

j. Bleed hydraulic pumps and purge air from steering system before returning machine to service.

k. Clean around hose fittings and portholes in cylinder walls.

l. Remove plastic plugs and connect hoses to cylinder. Torque fittings to standard practice.

m. Fill reservoir with hydraulic oil.

n. Start engine, release park brake, and articulate machine back and forth several times.

o. Check cylinder assembly for oil leaks and proper function.

CAUTION

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COMPONENT DAMAGE

- **Failure to bleed each hydraulic pump following service or repair of the hydraulic system can result in pump failure or shortened pump life due to a dry-start condition at machine start up.**
- **DO NOT operate the loader until all hydraulic pumps have been primed and air is purged from the steering system.**

Steering Pin Installation

Numbers in parenthesis refer to illustration “Steering cylinder pin installation cross section”.

a. Install lower sawcut bushing (4) and hold in place by bolting on capture plate (18), using bolts (14), lockwashers (15), and flatwashers (13).

b. Install O-ring (12) as shown (use grease to hold them in place).

c. Position cylinder assembly with rod eye and base eye centered between frame structures. Support cylinder and use wedges to hold centered until bolts are torqued.

d. Install pin (10) with seal retainer sleeves (16) and O-rings (6) through ball bushings so that it rests on lower sawcut bushing (4). Lube hole must be 90° to line of action of cylinder.

CAUTION

Proper orientation of the lube hole in the pin (90 degrees to the action of the cylinder) is critical. Component failure (including pin breakage) is possible.

e. Install upper sawcut bushing (4).

f. Install upper washer (5) and bolt (7).

g. Install bottom nut (17) on bolt and torque bolt to; L-950 and L-1150 450 ft-lbs (610 N•m) lubed or L-1350, L1850 and L-2350 850 ft-lbs (1153 N•m) lubed.

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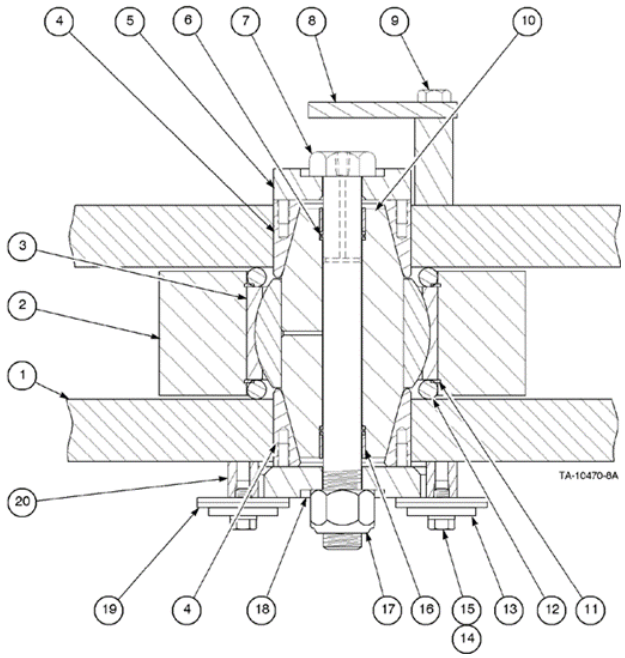
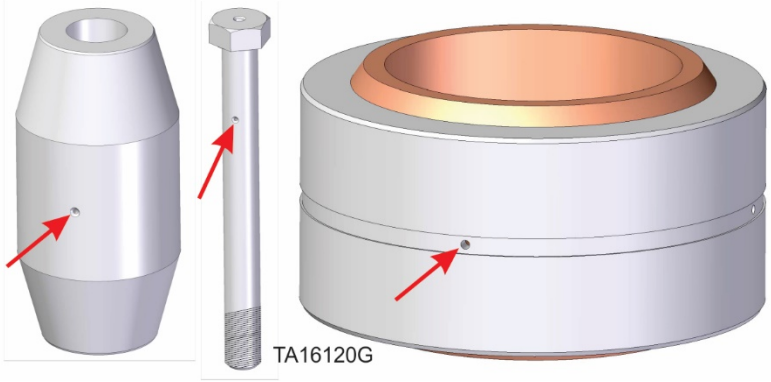


1.	Crossmember structure	**8.**	Pin lug cap	**15.**	Lockwasher
2.	Steer cylinder	**9.**	Bolt	**16.**	Seal retainer sleeve
3.	Self-aligning ball bushing	**10.**	Pin	**17.**	Locknut
4.	Sawcut bushing	**11.**	Retaining ring	**18.**	Capture plate
5.	Washer	**12.**	O-ring	**19.**	Flatwasher
6.	O-ring	**13.**	Washer	**20.**	Bolt block
7.	Steering pin retaining bolt	**14.**	Bolt		

Figure 22. Steering cylinder pin installation cross section



Grease passages in bolt, pin, and bearing

Figure 23. Grease passages

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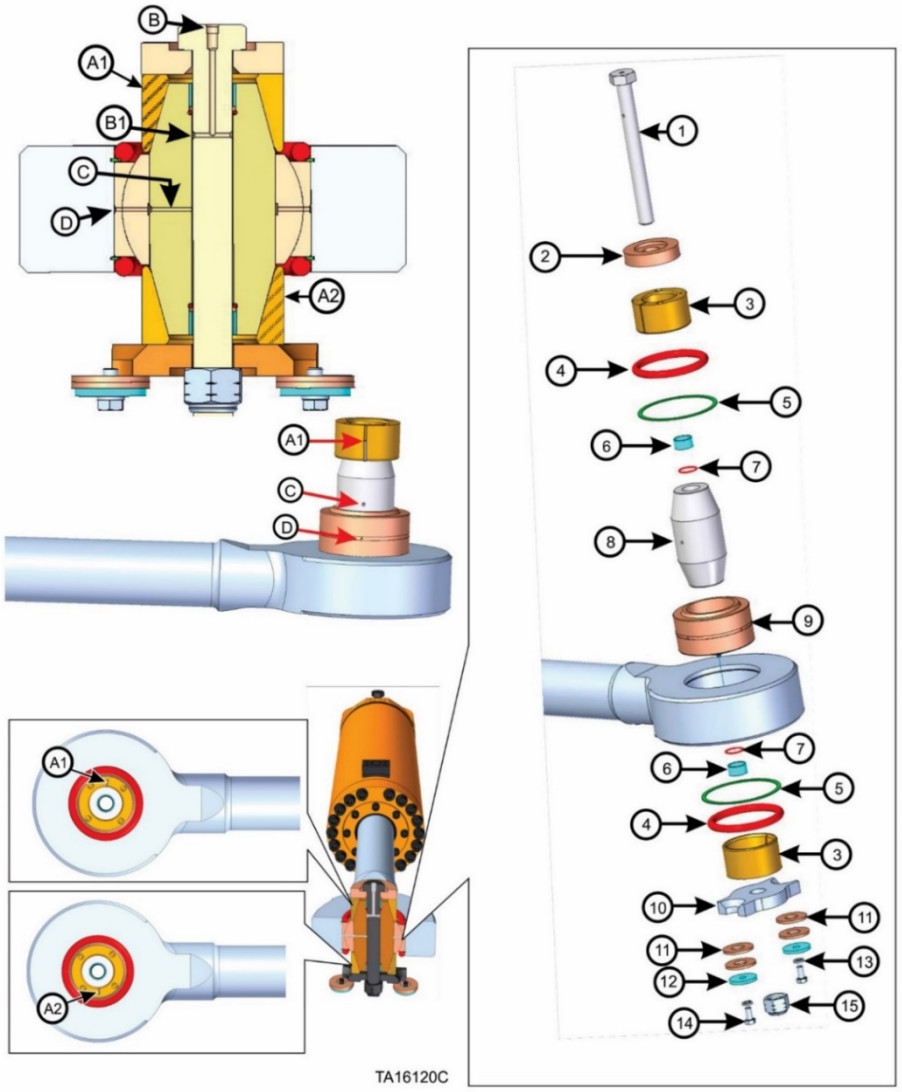
NOTICE

The bearing has grease passages in four (4) locations, 90 degrees apart. Any of the passages can be used to align 90 degrees from the action of the cylinder.



1. Bolt	**12**. Washer (1 each bolt)
2. Special countersunk washer.	**13**. Lock washer (1 each bolt)
3. Saw cut bushing	**14**. Bolt (2)
4. O-ring	**15**. Retaining nut
5. Retainer ring	**A1**. Cut in top sawcut bushing
6. Sleeve	**A2**. Cut in bottom sawcut bushing
7. O-ring	**B**. Grease passage in bolt.
8. Pin	**B1**. Horizontal grease passage in bolt.
9. Self-aligning bearing	**C**. Grease passage in pin.
10. Capture plate	**D**. Grease passage in self-aligning bearing.
11. Washer (2 each bolt)	

Figure 24. Steering pin installation for L-1350-L1850-L2350

h. Follow all lockout tag out rules, local rules, and local regulations to return the machine back to service.

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Radiator Fan Motor Removal and Installation

The radiator/fan assembly is located at the rear of the machine. The rear hood structure, braking grids, and rear cowl structure are in close proximity. The rear hood and rear cowl structures must be removed before removing the radiator/fan assembly.

Component Weights

NOTICE

Component weights are approximate and can vary widely depending on attachments, retained fluids, etc. Always allow a safety margin when selecting lifting equipment.

Machine	Hood/Grating		Radiator Cowl/Door		Fan/Motor/Mount		Motor/Fan	
	LBS.	KGS.	LBS.	KGS.	LBS.	KGS.	LBS.	KGS.
L-1350	2,200	998	3,600	1,633	3,800	1724	300	136
L-1850	2,200	998	3,600	1,633	3,800	1724	300	136
L-2350	2,200	998	3,600	1,633	3,800	1724	300	136

NOTICE

These weights are only approximate and provided as a guide for determining proper lifting procedures and equipment. In all cases, adequate equipment should be used to provide a good safety margin.

Table 1. Radiator/assembly/components weight chart

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Safety Preparations

⚠ 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. Stop the wheel loader on flat level ground.

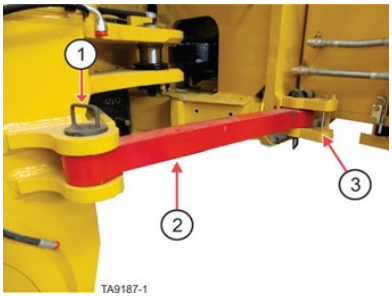
b. Set bucket flat and level on the ground.

c. Place wheel chocks in front and behind each wheel.

d. 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

Frame Lock

e. Set the parking brakes.

f. Shut off the engine.

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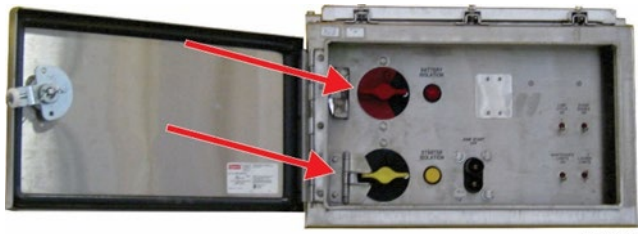
⚠ WARNING

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.

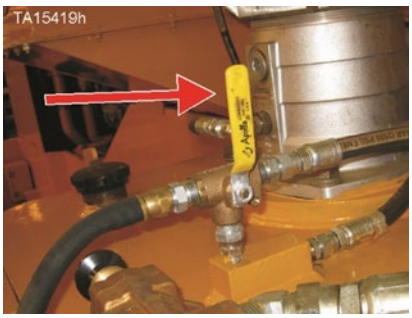
g. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



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



Hydraulic reservoir air valve handle UP

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

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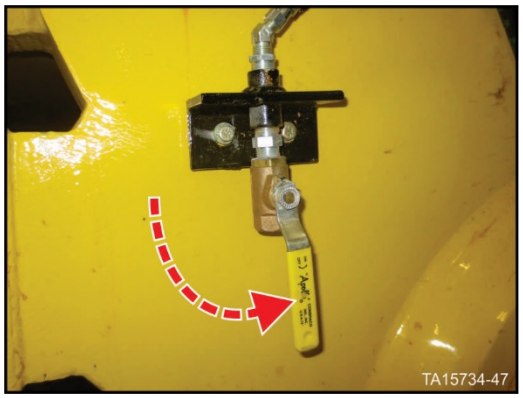
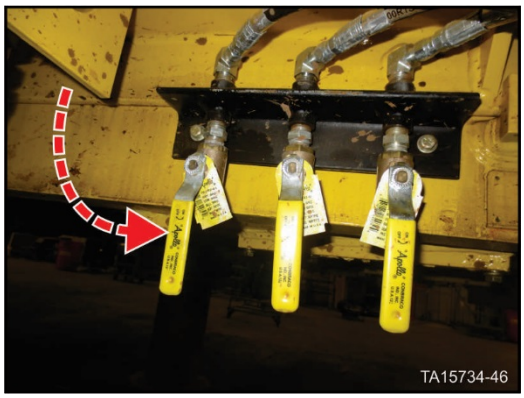
Three valves on right side of rear frame under hydraulic reservoir
One valve on right side of front frame near hoist cylinder ball cap





Open air reservoir bleed valves

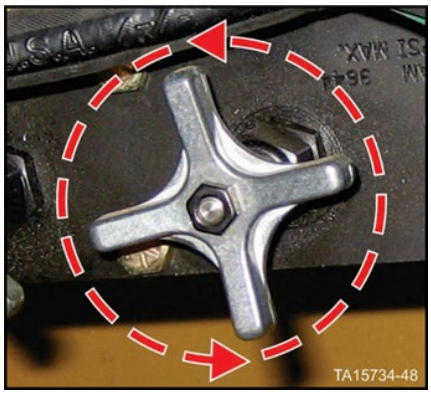
⚠ WARNING

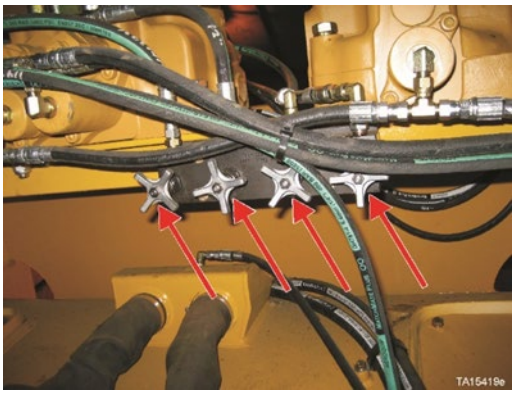
Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Assembly must be used only when the engine is NOT running. Before using the Manual 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 counterclockwise as shown below and allow the pressure to bleed down.

- Open the valve completely and leave it open during this procedure.





Pressure bleed down valves

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

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Radiator Fan Motor Removal Procedure

If the radiator fan motor assembly is still mounted in the machine, use the following procedure to remove it.

NOTICE

Follow the previously described safety preparations procedure before performing this procedure.

a. Following all local environmental rules and regulations,

- Drain the hydraulic reservoir and any residual fluid in the hydraulic lines.
- Drain the hydraulic oil cooler and lines.
- Drain the engine coolant.
- Drain the drive package coolant.
- Drain the HPD gearbox.
- Drain the engine fuel cooler if present.
- Drain the engine fuel filter system that is mounted on the cowling.

Hood Removal

a. Disconnect and tag all hoses and fittings on the radiator surge reservoir and drive packages surge reservoir.

b. Disconnect the wiring to the surge reservoirs.

c. Disconnect the wiring for all service lights mounted to the rear hood.

d. Remove the engine exhaust stacks.

e. Examine under the hood for any interference of the engine intake and exhaust lines and the hood.

f. Disconnect and tag the hoses (front and rear) connected to the drive package return line.

g. Remove any fire suppression system interconnection wiring and hoses between the hood and other parts of the machine.

⚠ WARNING

Explosion hazard exists if the hood structure has optional fire suppression devices. Certified personnel should be consulted prior to disconnecting or reconnecting fire suppression equipment. Serious injury and/or equipment damage is possible if the equipment is not disconnected or reconnected correctly. Failure to use trained personnel when working on the fire suppression system can cause explosion hazard resulting in serious injury or death.

h. Remove the rear hood structure.

Cowling Removal

a. Remove the cowl door structure.

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b. Remove the RCL1 and RCL2 cables going to the cowl light junction box inside the cowling.

c. Disconnect both ends of the fan motor speed sensor cable.

- One end is located at the sensor and could be secured to a pipe.
- The other end is located on the front corner of the cowling structure approximately 1 foot below the cowling.

d. Disconnect both ends of the drive package coolant sensor located in the surge reservoir.

- One end is located at the sensor and could be secured to a pipe.
- The other end is located on the front corner of the cowling structure approximately 1 foot below the cowling.

NOTICE

One end of each of the cables hangs approximately 1 to 2 feet below the cowling, in the right front and left front corners.

e. Disconnect the upper radiator mount links

- One on each side and one on the top.

f. Remove the rear cowl structure

Radiator Removal

a. Disconnect, cap and tag all the hoses and pipes from the radiator structure.

- hydraulic oil cooler hoses.
- Engine coolant hoses.
- Drive package coolant hoses.
- HPD gearbox oil cooling hoses.
- Radiator fan motor hoses

b. Attach a crane to the radiator structure.

⚠ WARNING

Crush hazard exists under rear of machine. Counter weight mounted under the radiator. Do not enter this area unless the counterweights have been externally supported to prevent falling. Do not loosen the bolts for the counterweight structure unless the structure has been externally supported of adequate support to hold the weight of the counter weights. Failure to support the counter weights before entering the area can cause crush hazards resulting in serious injury or death.

c. Remove the radiator mount bolts.

d. Lift the radiator assembly to a prepared work area.

e. Support the radiator so that it is positioned flat and level on the floor of the work area.

f. Lay the radiator with the fan motor positioned up.

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CAUTION

Use caution to protect the radiator from damage when positioning flat. Do not let the radiator tubes rest on any object as it may bend, puncture, or otherwise damage the tubes.

g. Mark the guards per orientation.

h. Remove the fan guards from the radiator assembly.

i. Remove the fan/motor/mount assembly.

j. Do not loosen the bolts that hold the support structure together.

- These are positioning bolts that set the radial and axial position of the fan motor and blade, with respect to the shroud.

k. Turn the fan/motor/mount assembly over for access to the fan drive hub.

l. Remove the fan, speed sensor gear, and drive hub from the motor.

m. Remove the fan motor from the support structure.

Radiator Fan Motor Installation Procedure

NOTICE

Follow the previously described safety preparations procedure before performing this procedure.

a. Install the fan motor onto the mount structure.

- Torque the bolts.
- Note the location of the bolt head and thread.
  - The nut must be on the motor side.
  - The head of the bolt is on the fan side.

a. Install the fan hub onto the motor shaft.

b. Install the split taper bushing using the following procedure:

1. Check all surfaces are free of burrs, paint, etc.
2. Position the fan motor so the keyway in the bore of the fan hub is aligned with the external (barrel) key in the bushing.
3. Align the shaft key seat with the bushing bore keyway and install the key.
4. Insert the cap screws through the non-threaded holes in the bushing flange and thread them by hand into the fan hub. Turn them in three or four turns.
5. The fan hub should be positioned with the bushing pulled tight against the shaft shoulder.
6. Using a torque wrench and appropriate socket, tighten the cap screws sequentially until each is tightened to 348 in-lbs (29 ft-lbs, 39.3 N•m). When the cap screw torque is at recommended torque, make at least two more sequential rounds to assure all cap screws are at the 348 in-lbs. (29 ft-lbs, 39.3 N•m) torque value.

c. Install the fan speed gear onto the motor shaft.

d. Install fan onto fan hub.

- Torque the ½" UNC bolts to 80 ft-lbs (109 Nm).

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e. Rotate the fan and verify that it does not make contact anywhere.

f. Mount the fan/motor/mount assembly on the radiator assembly.

- Properly torque the mount bolts.
- Inspect the axial and radial position of the fan blade relative to the shroud.
  - Rotate the fan to verify proper clearance.
  - The radial position should be within ¼" in all directions.
  - The axial position should be 2/3 of fan blade inside the shroud.

g. Install the fan guards onto the radiator assembly.

h. Attach a crane to the radiator structure.

Install Radiator

a. Lift the radiator assembly and place into the machine.

- Properly torque the radiator mount bolts.

⚠ WARNING

Crush hazard exists under rear of machine. Counter weight mounted under the radiator. Do not enter this area unless the counterweights have been externally supported to prevent falling. Do not loosen the bolts for the counterweight structure unless the structure has been externally supported of adequate support to hold the weight of the counter weights. Failure to support the counter weights before entering the area can cause crush hazards resulting in serious injury or death.

b. Connect all the hoses to the radiator structure.

- hydraulic oil cooler hoses.
- Engine coolant hoses.
- Drive package coolant hoses.
- HPD gearbox oil cooling hoses.
- Radiator fan motor hoses

c. Install the rear cowl.

d. Install the rear hood.

e. Connect the radiator surge reservoir hoses.

f. Connect the drive convertor package hoses.

g. Refill fluids.

- Drive convertor packages will need to be bled.
- Radiator lines will need to be bled.
- Hydraulic pumps must be bled.

h. Check for any leaks.

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⚠ WARNING

Explosion hazard exists if the hood structure has optional fire suppression devices. Certified personnel should be consulted prior to disconnecting or reconnecting fire suppression equipment. Serious injury and/or equipment damage is possible if the equipment is not disconnected or reconnected correctly. Failure to use trained personnel when working on the fire suppression system can cause explosion hazard resulting in serious injury or death.

i. Connect the fire suppression system if present.

j. Follow all local safety procedures to return the machine to operating condition.

- Turn on the battery isolation switch and starter isolation switch.
- Follow all lockout tagout procedures.

k. Start the machine and let run for a minute.

l. Recheck and top off any fluid levels.

- Hydraulic reservoir
- Drive package coolant reservoir
- Engine radiator
- Hydraulic Pump Drive (gearbox)

m. Verify that the radiator fan speed and pressures are correct.

n. Follow all lockout tag out rules, local rules, and local regulations to return the machine back to service.

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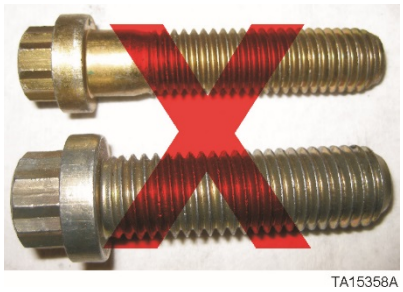
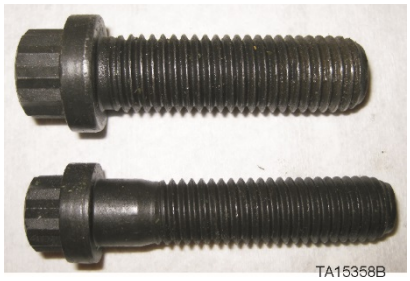
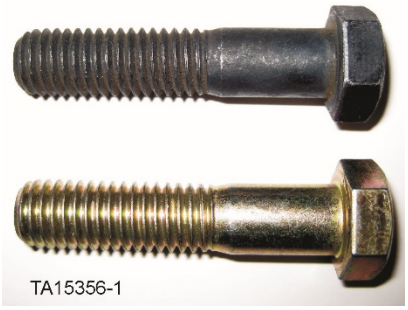
Capscrew and Bolt-Nut Torque Specifications

There are some exceptions to the torques provided on the following pages. Reduced torques are specified in the planetary drive rebuild manual, for the capscrews holding the planetary drive covers, due to a copper sealing washer under the head of the capscrew.

The torque specifications on this chart apply only to Grade 8 bolts, black or gold colored, and 12PT black-colored alloy steel capscrews. 12PT capscrews with gold-colored zinc chromate plating are excluded from these specifications and the zinc chromate 12PT capscrews should not be used on loaders or dozers. (except for planetary drive covers)

These torque values are for normal routine operations. If doing component rebuilds or any other abnormal machine component assembly/disassembly, please contact the factory for these values for specific instances.

 TA15358A	 TA15358B	 TA15356-1
Does not apply **X**	12PT Alloy Capscrew ✓	Grade 8 Bolt ✓

NOTICE

Please note the additional tables for exceptions to the torque values for items such as Lift Arm Ballcaps, Super Nuts and steering pin bolts with drilled grease passages.

Please direct any questions to Komatsu Product Support.

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Capscrew and Bolt-Nut Torque Specifications Chart

Standard SAE G8 and Alloy Steel and Hex Socket Capscrews

Size	Thread	GRADE 8 Fasteners		Alloy Steel 12PT. and Hex Socket Capscrews	
		USA Units lb-ft	Metric Units N-m	USA Units lb-ft	Metric Units N-m
		**Lubed	**Lubed	**Lubed	**Lubed
1/4 (0.25)	20 UNC	9	13	12	16
	28 UNF	10	14	14	19
5/16 (0.3125)	18 UNC	18	25	24	33
	24 UNF	20	27	27	37
3/8 (0.375)	16 UNC	33	45	45	61
	24 UNF	37	50	50	68
7/16 (0.4375) (* See Note below)	14 UNC	52	71	70	95
	20 UNF	58	79	79	107
1/2 (0.5) (* See Note below)	13 UNC	80	109	108	146
	20 UNF	90	122	122	165
5/8 (0.625)	11 UNC	159	216	203	275
	18 UNF	180	244	230	312
3/4 (0.75)	10 UNC	282	383	361	490
	16 UNF	315	427	403	546
1 (1.0) (*** See Note below)	8 UNC	682	925	872	1182
	14 UNS	764	1,036	977	1325
1-1/8 (1.125)	7 UNC	966	1310	1235	1674
	12 UNF	1083	1468	1385	1878
1-1/4 (1.25) (**** See Note below)	7 UNC	1,363	1,848	1744	2365
	12 UNF	1,509	2,046	1930	2617
1-1/2 (1.5)	6 UNC	2,371	3,215	3033	4113
	12 UNF	2,668	3,618	3413	4628

* **See Special Torque Specifications for ROPS super nut.**

** **See page 4 for specifications for "LUBED" – engine oil on threads and shoulder.**

*** **See Special Torque Specifications for 950/1150 steering pins.**

*** **This bolt is UNS (with 14 threads per inch), it is NOT UNF. It is a unique thread count bolt.**

**** **See Special Torque Specifications for loader lift arms and 1350/1850/2350 steering pins.**

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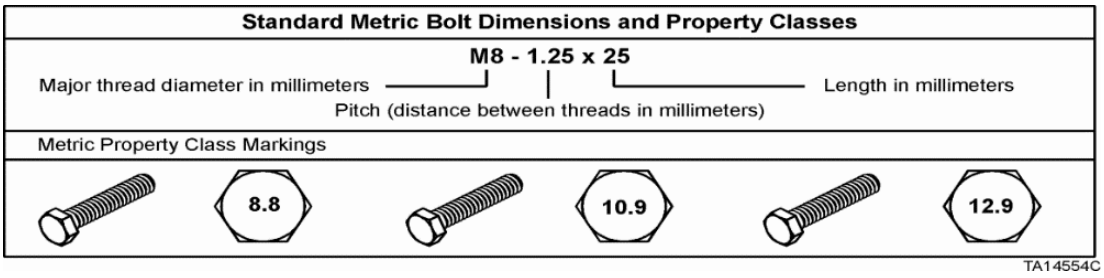
Standard Metric Bolts and Grades (SAE J1701M)

Size (mm)	Pitch (mm)	Property Class 8.8		Property Class 10.9		Property Class 12.9	
		USA Units lb-ft	Metric Units N-m	USA Units lb-ft	Metric Units N-m	USA Units lb-ft	Metric Units N-m
		** Lubed	** Lubed	** Lubed	** Lubed	** Lubed	** Lubed
6	1.00	6	8	8	11	10	13
7	1.00	10	13	14	19	16	22
8	1.25	14	19	20	27	24	32
10	1.50	28	38	40	54	47	63
12	1.75	49	66	70	94	81	110
14	2.00	77	105	111	150	130	176
16	2.00	121	164	173	235	202	274
18	2.50	167	226	239	324	279	378
20	2.50	244	331	337	458	394	535
24	3.00	422	572	584	791	682	925



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Capscrew and Bolt-Nut Torque Specifications

Special Torque Specifications

Alloy Steel 12pt. Capscrew for Wheel Loader Lift Arm Ballcaps

Size	Type	Thread	USA Units lb-ft	Metric Units N-m	Application
			**Lubed	**Lubed	
1-1/4 (1.250)	12PT. capscrew F-C on head	7 UNC	1900	2577	LHD, L-950, L-1150, L-1350, L-1850, and L-2350 (Lift arm ball caps only)
1-1/4 (1.250)	12PT. capscrew B-7 on head	12 UNF	1320	1790	L-1000-L-1100 (Lift arm ball caps only)

Steering Pins (Hex Head Bolt)

Size	Type	Thread	USA Units lb-ft	Metric Lubed N-m	Application
			** Lubed	** Lubed	
1 (1.0)	Bolt (drilled center)	8UNC	425	576	LHD, L-950, D-950, L-1150 (Steering Pins)
1-1/4 (1.250)	Bolt (drilled center)	7UNC	850	1152	L-1350, L-1850, L-2350 (Steering Pins)

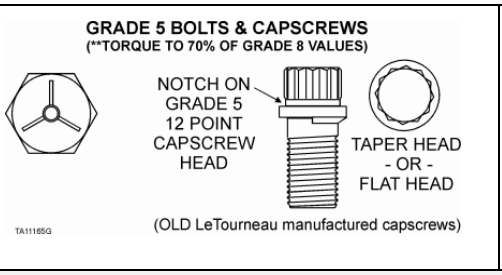
Aluminum 12pt. Capscrews used for Motor Pinion Balancing

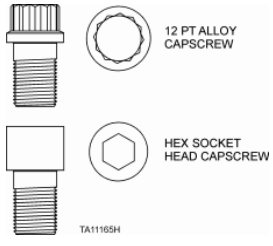
Size	Type	Thread	USA Units (lb-ft)		Metric Units (N-m)	
			Dry	**Lubed	Dry	**Lubed
¾ (0.75)	Aluminum	16 UNF	114	86	155	117
¾ (0.75)	Aluminum 2024-T4	16 UNF	150	113	203	153
15/16 (.9375)	Aluminum 6061 T6	12 NF	217	163	294	221
15/16 (.9375)	Aluminum 2024-T4	12 NF (2 START)	285	214	387	290

2-Thread (2-Start) Steel 12PT. Capscrews

Size	Type	Thread	USA Units lb-ft	Metric Units N-m
			** Lubed	** Lubed
3/8 (.3750)	12PT.	24 NF	25	34
9/16 (.5625)	12PT.	18 NF	87	119
15/16 (.9375)	12PT.	14 NF	428	584
1-5/16 (1.325)	12PT.	12 NF	1216	1660

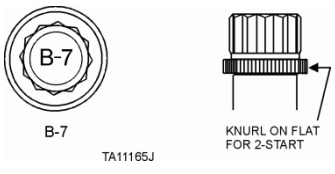
Bolt and Capscrew Markings on Head





Typical Markings on Alloy Capscrew Heads

Typical B-7, 2-Start



** See “Key Items” for specifications for “LUBED” – engine oil on threads and shoulder.

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Capscrew and Bolt-Nut Torque Specifications

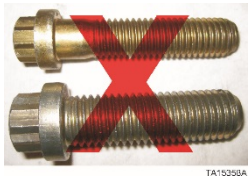
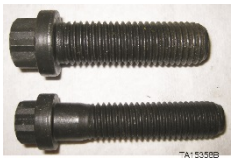
Key Items

- "LUBED" is defined as having the threads and under the head lubricated with engine oil. Engine oil is defined as SAE 30 or 40 weight oil, including multi viscosity grades 5W-30 through 15W-40. No other lubricant (such as anti-seize, MolyKote, copper coat, grease, etc.) is permitted unless specifically called out in a Komatsu procedure.

**LUBED = Lubricated with engine oil on threads and under head
(SAE 30 or 40 weight oil, including multi viscosity grades 5W-30 through 15W-40)

NOTE: No other lubricant (such as anti-seize, never seize, MolyKote, copper coat, grease, etc.) is permitted unless specifically called out in a Komatsu procedure.

- All capscrews and bolts should be started by hand until a minimum of three (3) threads are engaged prior to any air impact equipment being used.
- If a procedure in a Rebuild Manual, Repair and Overhaul or Operating and Service Manual calls for the use of Loctite® threadlocker on the threads, the torque specification for "lubed" should be used. The threads on both the fastener and mating part should be thoroughly cleaned with a proper solvent prior to use of Loctite®. The Loctite® thread sealant should only be used on the threads - not the head.
- Certain applications in components such as drivers or lift arm ball caps may specify a FERRY brand of capscrew. Use only FERRY brand capscrews in these applications.
- Komatsu, recommends that any old 12PT. Komatsu-fabricated (fabrication was stopped many years ago) capscrew (refer to illustration under BOLT AND CAPSCREW MARKINGS ON HEAD) be replaced at the time of repair with alloy capscrews. If new capscrews are not available, then the Komatsu-fabricated capscrews should only be torqued to Grade 5 specifications (70% of Grade 8 value - lubed).
- The torque specifications on the charts on page 2 only apply to Grade 8 bolts, metric bolts and 12PT. black-colored alloy steel capscrews. Capscrews with gold-colored zinc chromate plating are excluded from these specifications and these capscrews should not be used on loaders or dozers except for driver covers.

		
Does not apply X	**12PT Alloy Capscrew ✓**	**Grade 8 Bolt ✓**

CLEANING: It is mandatory to remove all paint, rust and debris from all mating surfaces, surfaces under the head of the bolt or capscrew and threads prior to installation and torquing of all bolts and capscrews.

	
Arrow indicates location to be cleaned	**Cleaning paint and rust prior to torquing**

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Super Nut Specifications

Bolt size	Jack bolt size	Jack bolt thread	USA Units lb-ft *****Lubed	Metric Units N-m *****Lubed	Application
1 ¾" - 5	7/16 (0.4375)	20 UNF	68	92	Hoist Cylinder Rod Pin
2 ¼" – 4.25	½ (0.50)	20 UNF	114	155	ROPS Pin
2 ¾" - 8	**NOTICE** **Refer to Authorized Cylinder Rebuild Center**				Steering Cylinder Piston
*****NOTE:** Supernut jackbolts require P/N 427-3753 Lube JL-G from Superbolt (do not use any substitute)					

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Capscrew and Bolt-Nut Torque Specifications

Helpful Tips for Supernuts®

Prior to Tightening:

1) **Check threads of main stud:** If possible, verify that the tensioners spin on prior to the installation date. If a tensioner is tight or will not thread on, try using lapping compound on the main thread and work the tensioner in a back and forth motion making small advances when the thread loosens up. If necessary, chase the studs with a die.
2) **Use of spacers:** Tensioners should be positioned at the ends of the studs to minimize exposed threads and facilitate easy access to the jackbolts. A spacer (or stacked washers) can be used beneath the special hardened washer to accomplish this. A spacer will also "step over" a damaged area on a stud where years of bolting have deformed the first few threads.
3) **Back the tensioner off before tightening to provide 1/16" (1.59mm) to 1/8" (3.175 mm) gap:** The additional jackbolt extension provides easy access for oiling the jackbolt tips prior to removal. This is especially beneficial for oiling when the tensioners are inverted. Note: There may be insufficient jackbolt stroke to allow this step when tensioning exceptionally long bolts or tie rods, or when closing a gap between flanges.
4) **For spinning the tensioner on and off the stud:** Custom "sockets" which grip the tensioner are available. Also, two deep well sockets inserted over two jackbolt hex's at 180º apart can serve as "handles" for spinning the tensioners on and off the studs.

For Tightening:

5) **To improve efficiency when using impacts:** Don't wait for the socket to stall completely on a specific jackbolt before advancing to the next jackbolt. It is faster, overall, to move quickly between jackbolts.
6) **Overshooting the target torque:** You may want to use 110 - 120% of the target torque for Step 3, Step 4, and for 1-2 rounds of Step 5. This may eliminate a tightening round. Be careful not to stabilize all of the jackbolts at this torque however. For long bolts or tie rods, you may want to experiment using even higher torque values. Call Superbolt before using more than 120% target torque.
7) **For gasketed joints:** During gasket compression, the load is transferred to the jackbolts (i.e. stud) being tightened. Don't be concerned if some jackbolts (or tensioners) become loose during the procedure. Continue following the procedure. Don't spin down tensioners that become loose during gasket compression.

Helpful Tips For Removal

8) **1/4 turn or less!:** Removing the jackbolts more than a 1/4 turn will increase the removal torque of the remaining jackbolts and you may get stuck. If this happens, you will have to retighten and start again.
9) **Stuck jackbolt removal:** If a jackbolt will not turn, remove, relube, and retighten a neighboring jackbolt and then try to turn it.

Air Impact Tool Selection (90 PSI (620 kPa) Air Pressure)

NOTICE

The jackbolt torque actually achieved by an air impact wrench is usually only 30 - 50% of its rated output. For minimum hand work, use an air impact with an output of 110% - 120% target torque. For maximum power, use the largest air line fitting.

Up to 70 lbs-ft (311 N•m): For 15-35 lbs-ft (67-155 N•m) use a right angle ratchet or light duty 3/8" impact. For 35-70 lbs-ft (155-311 N•m) use a heavy duty 3/8" impact.
70-100 lbs-ft (311-445 N•m): Use a light duty 1/2" impact at a reduced pressure or setting. (Be careful not to over tighten! Calibrate the impact before starting.)
100-170 lbs-ft (445-756 N•m): For 100-130 lbs-ft (445-578 N•m) use a light duty 1/2" impact. For 130–170 lbs-ft (578-756 N•m) use a heavy duty 1/2" impact.
170-200 lbs-ft (756-890 N•m): Use a light duty 3/4" impact on low setting. Some heavy duty 1/2" impacts will also reach this range.
Over 200 lbs-ft (890 N•m): For 200-300 lbs-ft (890-1334 N•m), use a light to medium duty 3/4" impact. Over 300 lbs-ft (1334 N•m), use a heavy duty 3/4" impact.
Calibrating an air impact wrench: Tighten one jackbolt until the socket rotation stops and check the jackbolt with a torque wrench. The torque required to move the jackbolt further is the output of the impact as measured on Superbolt® tensioners.

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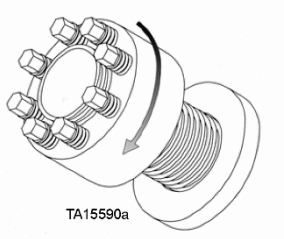
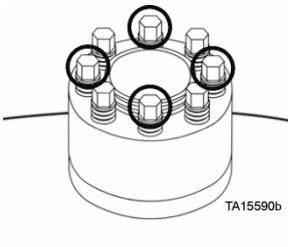
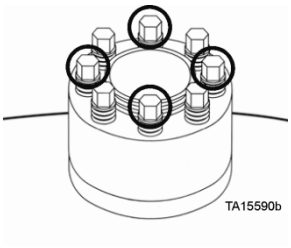
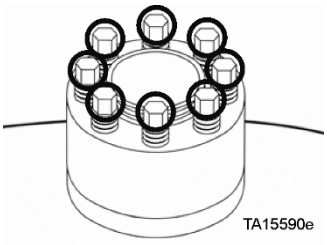
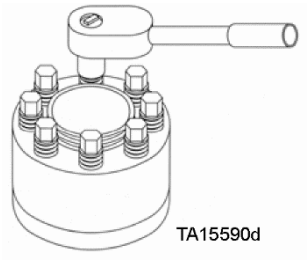
Capscrew and Bolt-Nut Torque Specifications

Installation Procedure for Supernuts

	**Step 1:** Spin the tensioner onto the main thread until it seats against the washer. You may want to back off the tensioner slightly as mentioned in Helpful Tip #3.
	**Step 2:** Tighten (4) jackbolts at 90º apart (12:00, 6:00, 9:00, and 3:00) on all studs with a partial torque (30-70%). This serves to seat the flange. If using an air impact, use a reduced setting or lightly pulse and trigger at the full setting.
	**Step 3:** At 100% target torque, tighten the same (4) jackbolts on all studs.
	**Step 4:** At 100% target torque, tighten all jackbolts in a circular pattern. Do this for all studs (1 round only). See Helpful Tip #7 about using up to 120% torque.
	**Step 5:** Repeat ‘STEP 4’ until all jackbolts are stabilized (less than 10º rotation). This usually requires 2-4 additional passes. If using air tools, switch to a torque wrench when socket rotation is small. Use the torque wrench to stabilize at the target torque.

NOTICE

Product with 4 or 6 jackbolts – use a star pattern for all steps.

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Capscrew and Bolt-Nut Torque Specifications

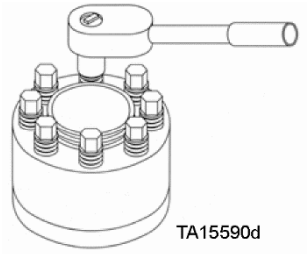
Removal Procedure for Supernuts

CAUTION

Jackbolts must be unloaded gradually. If some jackbolts are fully unloaded prematurely, the remaining jackbolts will carry the entire load and may be hard to turn. With extreme abuse, a jackbolt tip can deform, making removal difficult.

Service Under 250ºF (121ºC)

Preparation: Spray jackbolts with penetrating oil or hydraulic oil prior to start (especially if product is in corrosive environment)



Step 1: Loosen each jackbolt 1/8 turn following a circular pattern around the tensioner (1 round only). As you move around and get back to the first jackbolt, it will be tight again. Do this for all studs on the joint prior to the next step.

Step 2: Repeat a 2nd round as above for all studs, now loosening each jackbolt ¼ turn in a circular pattern.

Step 3. Continue loosening ¼ turn for 3rd and successive rounds until all jackbolts are loose.

NOTICE

Usually after the 3rd or 4th rounds, an impact can be used to completely extract the jackbolts, one by one. For long bolts or tie roads, additional rounds may be required before removing the jackbolts with an impact tool.

Step 4 Remove, clean and relubricate the jackbolts prior to next use with correct Superbolt lubricant (JL-G) Komatsu P/N 427-3753 (do not use any substitute).

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