# Bobcat®

# Service Manual


## Compact Excavator

**E145 S/N B4WU11001 & Above**

7387076enUS (07-20) (B)

Printed in U.S.A.

High-pressure oil that is released can cause a hose to whip or oil to spray. Fluid penetration can result in death or serious injury. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

Obey all local laws and regulations for disposal of liquids.

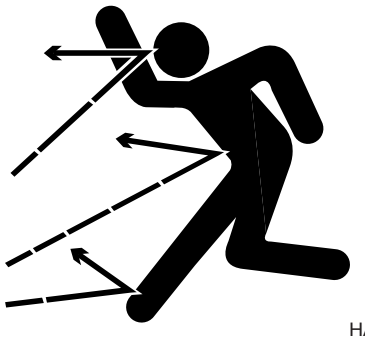
To prevent hot coolant from spraying out, stop engine and wait for coolant to cool. Using gloves, slowly loosen cap to relieve pressure.

## Flying or Falling Objects

On work sites where there is a potential hazard that flying or falling objects can hit operator's cabin, select and use a guard to match operating conditions for additional operator protection.

Working in mines, tunnels, deep pits, and loose or wet surfaces, could produce hazard of falling rocks or flying objects. Additional protection for operator's cabin could be required such as an Operator Protection Guard (OPG) or window guards. Contact your Bobcat dealer for information on available protective guards.

To prevent bystanders from being struck by flying objects, keep bystanders out of work area.



HAOA110L

**Figure 2**

HAOA100L

**Figure 3**

## Work Site

Before starting operations, thoroughly check work area for any hazards, such as underground utility lines, overhead electrical lines, unstable ground, excessive slopes, etc.

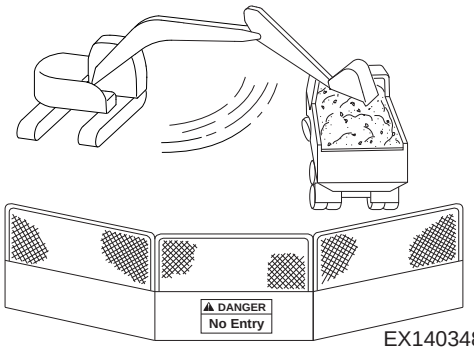
Before starting engine and moving machine, make sure that no one is underneath machine, around machine, or on machine.

Know width and length of your machine and work equipment to maintain proper clearance when you operate machine or work equipment near fences or near boundary obstacles.

Know appropriate work site hand signals and site crew that are authorized to give hand signals. Follow hand signals from only one person.

If you need to operate on a street, protect pedestrians and cars by designating a person for work site traffic duty or by erecting fences and posting "No Entry" signs around work site.

Erect barricades or fences, post "No Entry" signs, and take other steps to prevent bystanders from coming close to or entering work site. If bystanders come too close to a moving machine, they may be struck or caught by machine, and this can result in death or serious injury.



EX1403489

**Figure 20**

## Engine Stop

Turn engine starter switch to "O" (OFF) position and remove engine starter switch key.

Before lowering any equipment with engine stopped, clear area around equipment of all bystanders.

Do not stop engine immediately after the machine has been operated under load. This can cause overheating and accelerated wear of engine components.

After the machine is parked, allow engine to run for five minutes before stopping the engine. This allows hot areas of engine to cool gradually.

- Do not leave operator's seat when there is a raised load.

## Parking Machine

Park machine on firm and level ground away from traffic and away from high walls, drop-offs and any area of potential water accumulation or runoff.
If parking on inclines is unavoidable, block crawler tracks to prevent movement. Lower bucket or other working attachment completely to ground.

When parking on public roads, provide fences, signs, flags, or lights, and put up any other necessary signs to ensure that passing traffic can see machine clearly. Park machine so machine, flags, signs and fences do not obstruct traffic.

After front attachment has been lowered to an overnight storage position and all switches and operating controls are in "OFF" position, safety lever must be moved to "LOCK" position. This will disable all pilot control functions.

Always close door of operator's cabin and lock all equipment to prevent any unauthorized person from operating the machine.

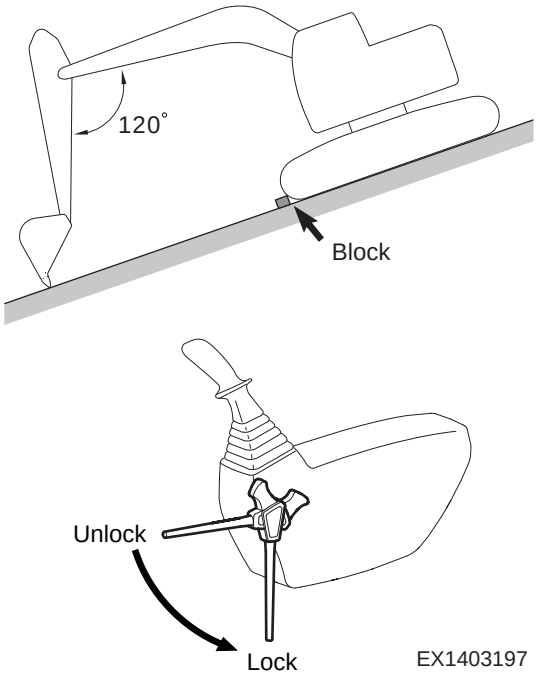



**Figure 35**

The hydraulic system remains pressurized provided the accumulator is charged even when engine is not running. Accumulator pressure should decrease in a short time (approximately one minute). While hydraulic system maintains a charge, hydraulic work tools and machine controls remain functional.

Always move safety lever to "LOCK" position before stopping off engine or immediately after engine stops running.

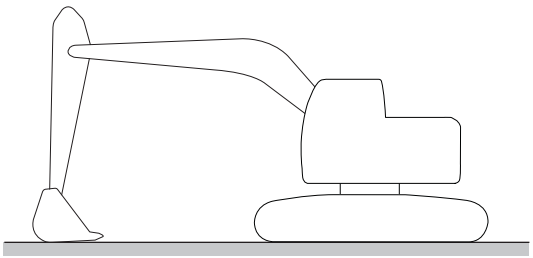



**Figure 36**

## Underground Operation

If excavation is in an underground location or in a building, make sure there is adequate overhead clearance, and adequate ventilation.

Special equipment and engines may be required in some countries. Contact your Bobcat dealer for more information.

Check that there is sufficient room for machine and load.

Move slowly.

Make sure that authorities or companies responsible for underground cables, utilities, and electrical lines have been contacted and that their instructions are followed. Also check which rules apply to ground crew regarding exposing cables, utilities and electrical lines.

Consider all electrical cables as live.

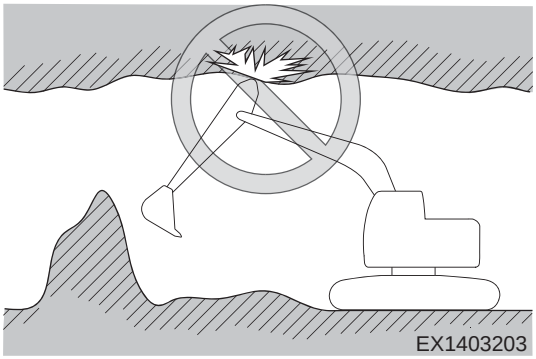



**Figure 49**

## Working in Water

# IMPORTANT

**Do not exceed maximum permissible water depth. The water level must not reach higher than centerline of upper track roller(s) (1, Figure 50).**

After working in water, lubricate all lubrication points on undercarriage, which have been underwater so water is removed. Check that no water has entered travel gearboxes and undercarriage components.

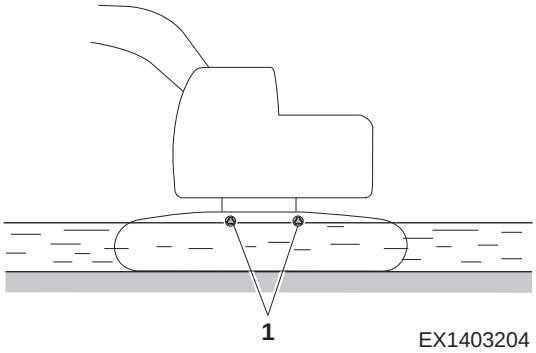
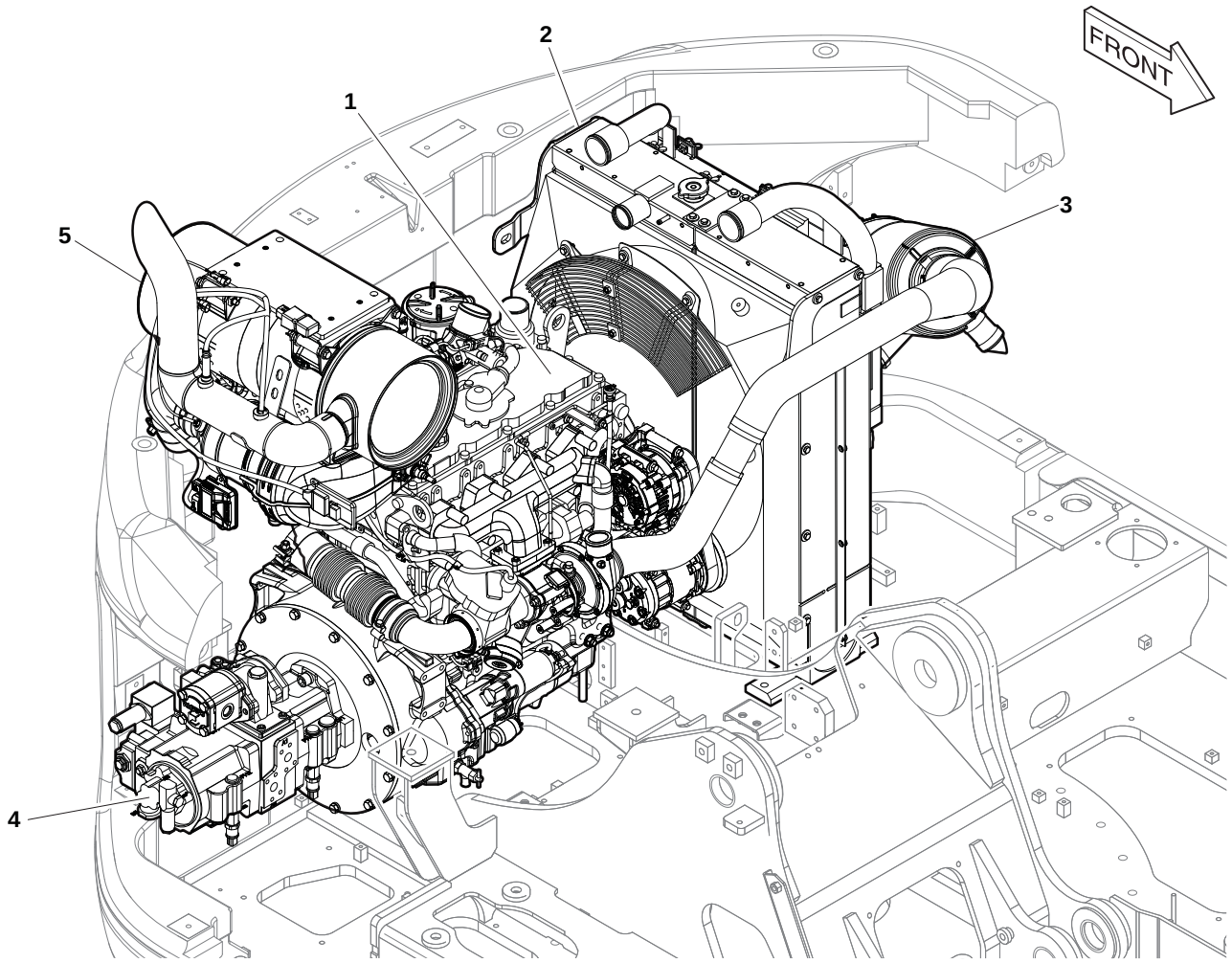



**Figure 50**

## Working in Contaminated Environment

When working within area which is contaminated or where there is a health risk, check local regulations and contact your Bobcat dealer for assistance with identifying what additional safety precautions need to be taken.




EX1500578_BCT

**Figure 2**

| Reference Number | Description |
|---|---|
| 1 | Engine |
| 2 | Radiator |
| 3 | Air Cleaner |

| Reference Number | Description |
|---|---|
| 4 | Main Pump |
| 5 | SCR Muffler |

# OPERATIONAL PERFORMANCE TEST

## Hydraulic Cylinder Cycle Time

### Summary

1. Check the overall operational performance of the front attachment hydraulic system (between the hydraulic pumps and each cylinder) by measuring the cycle time of the boom, arm, bucket, and bucket dump (open/close) cylinders with the empty bucket.
2. Bucket must be empty.

### Preparation

1. Maintain the hydraulic oil temperature at 50 ±5 °C (122 ±41 °F).

| Engine Control Dial | Power Mode Switch | Work Mode | Auto-idle Switch |
|---|---|---|---|
| High Idle | Power Plus Mode | Digging Mode | OFF |

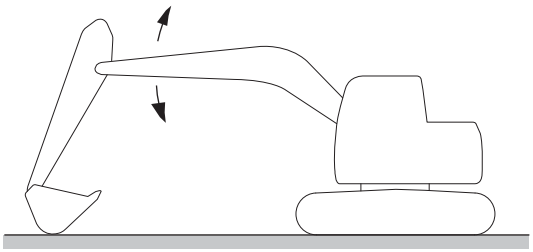
2. Position the front attachment as described in the following. Then, measure the operating time until cylinder reaches the stroke end by fully moving the control lever.
   A. Boom cylinder
      1) Boom up speed

         Rapidly operate the bucket from the ground, and measure the time it takes for the boom to reach the end point.

      2) Boom down speed

         Rapidly operate the bucket with the boom reached the end point, and measure the time it takes for the bucket to reach the ground.

      3) Measuring available displacement of the cylinder: Measure and record the extension of the cylinder rod from when the bucket is resting on the ground to when the boom cylinder is extended to its maximum length.



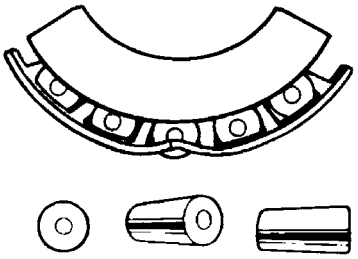
EX1403531

**Figure 8**

# General Maintenance Instructions

**Edition 1**

Replace bearing.



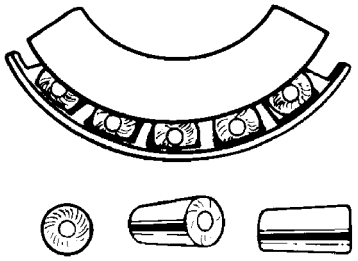
HASA470S

**Figure 4**

**Galling**

Metal smears on roller ends because of overheat, lubricant failure or overload.

Replace bearing - check seals and check for proper lubrication.



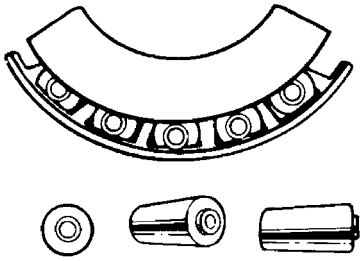
HASA480S

**Figure 5**

**Abrasive Step Wear**

Pattern on roller ends caused by fine abrasives.

Clean all parts and housings, check all parts and housings, check seals and bearings and replace if leaking, rough or noisy.



HASA490S

**Figure 6**

# TYPE 8 PHOSPHATE COATED HARDWARE

This chart provides tightening torque for general purpose applications using original equipment standard hardware as listed in the Parts Manual for the machine involved. **DO NOT SUBSTITUTE**. In most cases, original equipment standard hardware is defined as Type 8, coarse thread bolts, nuts and thru hardened flat washers (Rockwell "C" 38 - 45), all phosphate coated and assembled without supplemental lubrication (as received) condition.

The torques shown below also apply to the following:

1. Phosphate coated bolts used in tapped holes in steel or gray iron.
2. Phosphate coated bolts used with phosphate coated prevailing torque nuts (nuts with distorted threads or plastic inserts).
3. Phosphate coated bolts used with copper plated weld nuts.

Markings on bolt heads or nuts indicate material grade ONLY and are NOT to be used to determine required torque.

| Nominal Thread Diameter | Standard Torque ±10% | |
|---|---|---|
| | Kilogram.meter (kg.m) | Foot pounds (ft lb) |
| 1/4" | 1,1 | 8 |
| 5/16" | 2,2 | 16 |
| 3/8" | 3,9 | 28 |
| 7/16" | 6,2 | 45 |
| 1/2" | 9,7 | 70 |
| 9/16" | 13,8 | 100 |
| 5/8" | 19,4 | 140 |
| 3/4" | 33,2 | 240 |
| 7/8" | 53,9 | 390 |
| 1" | 80,2 | 580 |
| 1 - 1/8" | 113,4 | 820 |
| 1 - 1/4" | 160,4 | 1160 |
| 1 - 3/8" | 210,2 | 1520 |
| 1 - 1/2" | 279,4 | 2020 |
| 1 - 3/4" | 347,1 | 2510 |
| 2" | 522,8 | 3780 |

Open Cooling System

Ensure that all cooling drain plugs have been opened. Allow the coolant to drain. Install the drain plugs. Place a vapor phase inhibitor into the system.

The coolant system must be sealed once the vapor phase inhibitor has been introduced. The effect of the vapor phase inhibitor will be lost if the cooling system is open to the atmosphere.

Monthly Checks

The crankshaft must be rotated in order to change the spring loading on the valve train. Rotate the crankshaft more than 180 degrees. Visibly check for damage or corrosion to the engine and aftertreatment.

Ensure that the engine and aftertreatment are covered completely before storage. Log the procedure in the record for the engine.

**Aftertreatment**

The engine must be allowed to perform a Diesel Exhaust Fluid (DEF) purge before the battery disconnect switch is turned off. Disconnecting the battery power too soon may prevent purging of the DEF fluid system.

The exhaust outlet of the aftertreatment must be capped. In order to prevent damage to the exhaust outlet connection during storage, the weight of the CEM must not act on the exhaust outlet.

DEF in Tank Storage

DEF must be drained and replenished if the application is left idle for 2 months or longer at 40°C (104°F).

DEF must be drained and replenished if the application is left idle for 4 months or more at 25°C (77°F).

1. Ensure normal engine shutdown, allow the DEF to be purged. Disconnecting the battery power too soon may prevent purging of the DEF fluid system.
2. Ensure that all DEF lines and electrical connection are connected prior to prevent crystal from forming.
3. Ensure that the DEF filler cap is correctly installed.

22. Use the suitable lifting device to lift cylinder head (34) carefully off the cylinder block.

    **NOTE:** *Do not use a lever to separate the cylinder head from the cylinder block. Take care not to damage the machined surfaces of the cylinder head during the removal procedure.*

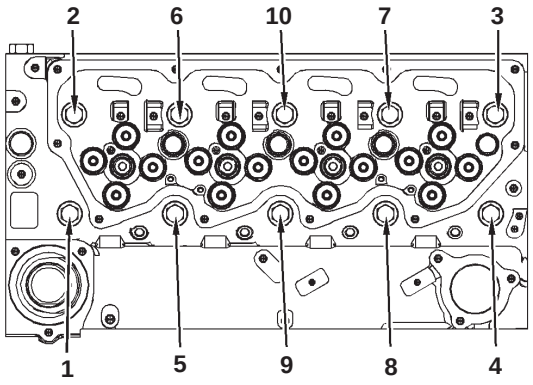
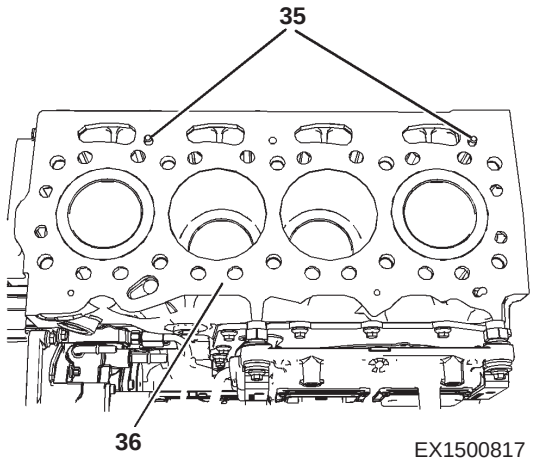



**Figure 32** EX1500813

# IMPORTANT

**Place the cylinder head on a surface that will not scratch the face of the cylinder head.**

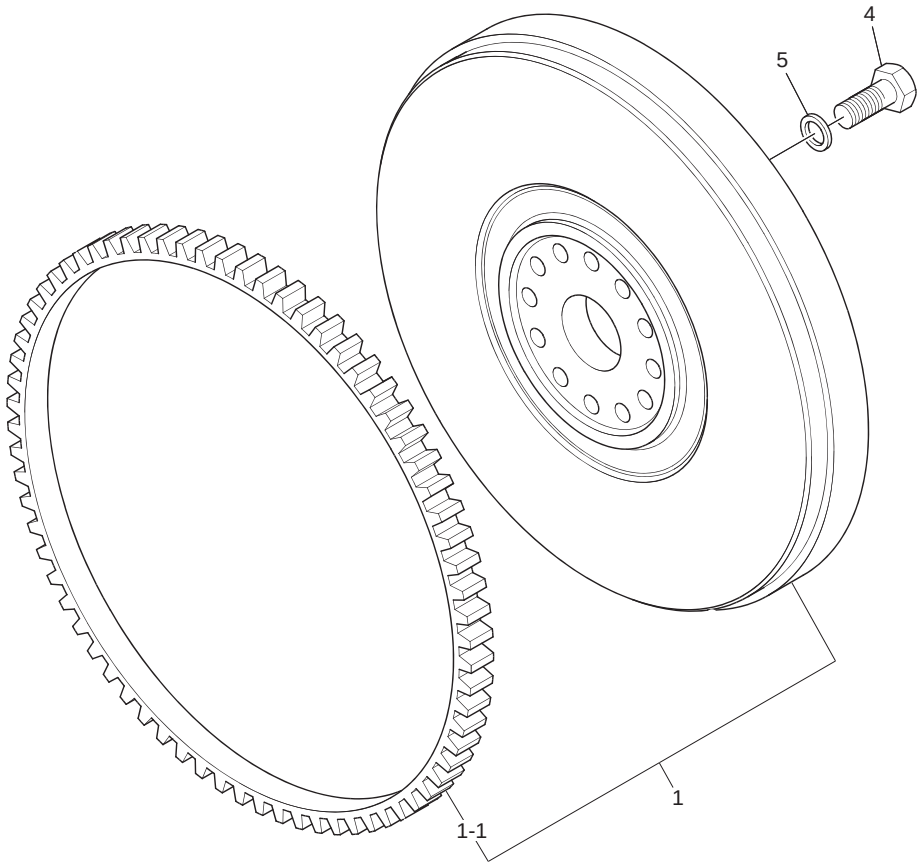
23. Remove cylinder head gasket (36).
24. Note the position of dowels (35) in the cylinder block.
25. If necessary, remove water temperature regulator from the cylinder head. Refer to "Water Temperature Regulator - Remove" or the correct procedure.




EX1500817

**Figure 33**

Flywheel




EX1501082

**Figure 55**

| Reference Number | Description |
|---|---|
| 1 | Flywheel Assembly |
| 1-1 | Gear; Starter Ring |

| Reference Number | Description |
|---|---|
| 4 | Screw |
| 5 | Washer |

**Piston and Rings - Specification**

1. Top compression ring (1, Figure 80)
   - The shape of the top compression ring: Keystone
   - Ring gap: 0.25 ~ 0.35 mm (0.00984 ~ 0.01378 inch)

   **NOTE:** *When you install a new top compression ring, make sure that the word "TOP" is facing the top of the piston. New top piston rings have a black identification mark. The identification mark must be on the left of the ring end gap when the top piston ring is installed on an upright piston.*

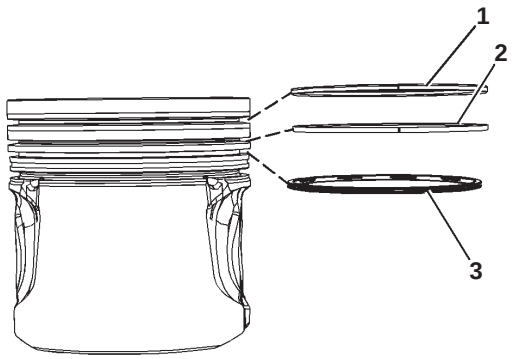
2. Intermediate compression ring (2, Figure 80)
   - The shape of the intermediate compression ring: Internal bevel in the bottom edge with a tapered face
   - Width of intermediate compression ring: 2.47 ~ 2.495 mm (0.0972 ~ 0.0982 inch)
   - The clearance between a new intermediate compression ring and the piston groove in a new piston: 0.065 ~ 0.110 mm (0.00256 ~ 0.00433 inch)
   - Ring gap: 0.65 ~ 0.85 mm (0.0256 ~ 0.0335 inch)

   **NOTE:** *When you install a new intermediate compression ring, make sure that the word "TOP" is facing the top of the piston. New intermediate rings have a blue identification mark. The identification mark must be on the left of the ring end gap when the top piston ring is installed on an upright piston.*

3. The oil control ring (3, Figure 80)
   - Width of oil control ring: 2.79 ~ 3.00 mm (0.10984 ~ 0.11811 inch)
   - The clearance between a new oil control ring and the groove in a new piston: 0.05 ~ 0.10 mm (0.00197 ~ 0.00394 inch)
   - Ring gap: 0.30 ~ 0.55 mm (0.0118 ~ 0.0216 inch)

   **NOTE:** *When you install a new oil control ring, make sure that the word "TOP" is facing the top of the piston. New oil control rings have a red identification mark. The identification mark must be on the left of the ring end gap when the top piston ring is installed on an upright piston. The oil control ring is a twopiece ring that is spring loaded. A pin is used in order to hold both ends of the spring of the oil control ring in position. The ends of the spring of the oil control ring must be installed opposite the end gap of the oil control ring.*

   **NOTE:** *Ensure that the ring end gaps of the piston rings are spaced 120 degrees from each other.*




EX1500854

**Figure 80**

**Crankshaft - Specification**

- Maximum permissible temperature of the gear for installation on the crankshaft: 180°C (356°F)
- The end play of a new crankshaft:
  0.1 ~ 0.41 mm (0.00394 ~ 0.01614 inch)
- Standard thickness of thrust washer:
  2.69 ~ 2.75 mm (0.10591 ~ 0.10827 inch)
- Oversize thickness of thrust washer:
  2.89 ~ 2.95 mm (0.11378 ~ 0.11614 inch)

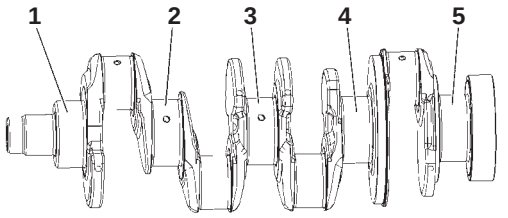
Refer to table for the run out of the crankshaft journals.

| Journal | Run Out of the Journals |
|---|---|
| 1 | Mounting |
| 2 | 0.08 mm (0.0031 inch) |
| 3 | 0.15 mm (0.0059 inch) |
| 4 | 0.08 mm (0.0031 inch) |
| 5 | Mounting |

Inspect the crankshaft for wear or for damage. For more information regarding the servicing of the crankshaft, contact the Global Technical Support Center.

Refer to "Connecting Rod Bearing Journal" for more information on the connecting rod bearing journals and connecting rod bearings.

Refer to "Main Bearing Journal" for information on the main bearing journals and for information on the main bearings.




EX1500870

**Figure 98**

# IMPORTANT

**Keep all parts clean from contaminants.**

**Contaminants may cause rapid wear and shortened component life.**

**NOTE:** *Bobcat does not recommend the checking of the actual clearances of the bearing shells particularly on small engines. Checking of the actual clearances of the bearing shells is because of the possibility of obtaining inaccurate results and of damaging the bearing shell or the journal surfaces. Each bearing shell is quality checked for specific wall thickness.*

**NOTE:** *The measurements must be within specifications and the correct bearings must be used. If the crankshaft journals and the bores for the block and the rods were measured during disassembly, no further checks are necessary.*
*However, if the technician still wants to measure the bearing clearances, a suitable tool is an acceptable method.*

# IMPORTANT

**Lead wire, shim stock or a dial bore gauge can damage the bearing surfaces.**

The technician must use tools correctly. The following points must be remembered:

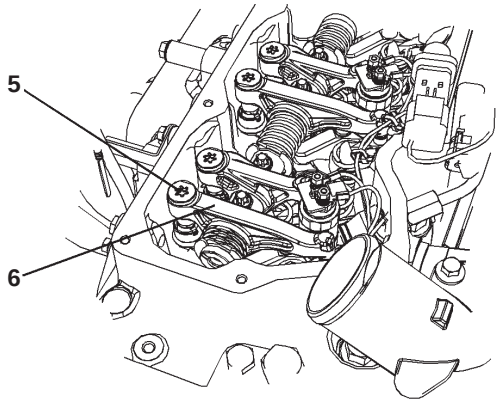
- Ensure that the backs of the bearings and the bores are clean and dry.
- Ensure that the bearing locking tabs are properly seated in the tab grooves.
- The crankshaft must be free of oil at the contact points of tools.

1. Put a piece of tool on the crown of the bearing that is in the cap.

   **NOTE:** *Do not allow tool to extend over the edge of the bearing.*

6. Use a suitable tool in order to loosen threaded inserts (5) on all rocker arms (6). Unscrew threaded inserts (5) on all rocker arms (6) until all valves are fully closed.

   **NOTE:** *Failure to ensure that ALL threaded inserts are fully unscrewed can result in contact between the valves and pistons.*




EX1501000

**Figure 149**

7. Mark plate (8) in order to show orientation.

   **NOTE:** *Identification will ensure that the plate can be installed in the original orientation.*

8. Remove bolts (7).
9. Remove plate (8).
10. Remove assembly of idler gear (4).
11. Remove hub (9) from the recess in the front housing.

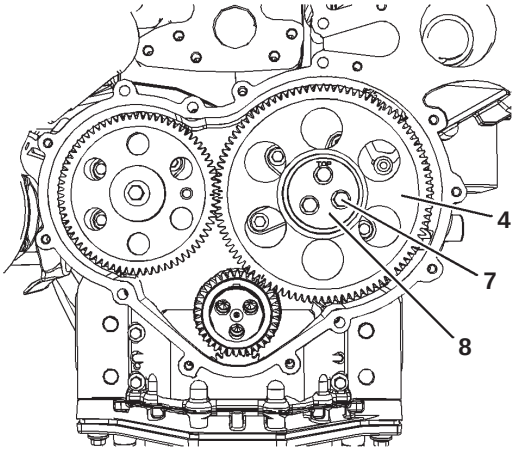
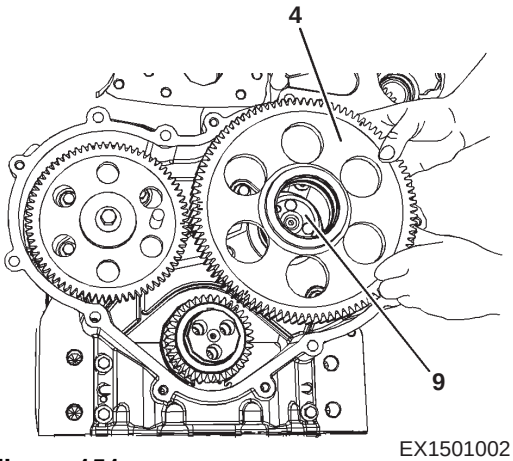



**Figure 150** EX1501001




EX1501002

**Figure 151**

**Camshaft - Remove**

Start By:

Remove rocker shaft and pushrods. Refer to "Rocker shaft and Pushrod - Remove" for the correct procedure.

Remove front housing. Refer to "Housing (Front) - Remove" for the correct procedure.

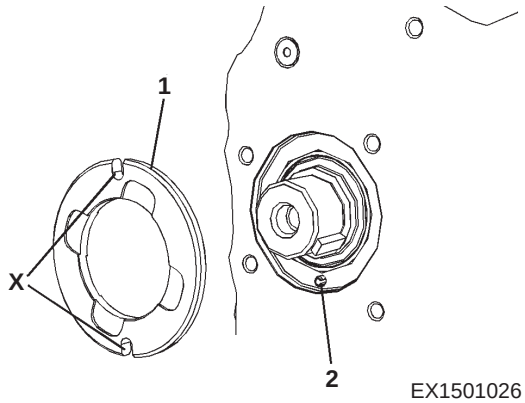
# IMPORTANT

**Keep all parts clean from contaminants.**

**Contaminants may cause rapid wear and shortened component life.**

1. The engine must be mounted on a suitable stand and placed in the inverted position.
2. Remove thrust washer (1) from the cylinder block. Do not remove dowel (2) from the cylinder block unless the dowel is damaged

   **NOTE:** *The thrust washer can have one or two Slots (X).*



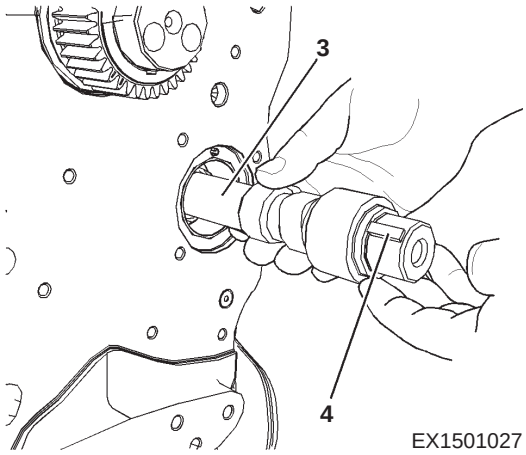
EX1501026

**Figure 182**

# IMPORTANT

**Do not damage the lobes or the bearings when the camshaft is removed or installed.**

3. Carefully remove camshaft (3) from the cylinder block.
4. If necessary, remove key (4) from camshaft (3).



EX1501027

**Figure 183**

1. Make an identification mark on each rocker arm assembly in order to show the location.

   **NOTE:** *The components must be reinstalled in the original location. Do not interchange components.*

2. Remove Torx screws from the rocker shaft assembly. Note position of different length Torx screws for assembly purposes.

3. Remove retaining clip (2) from rocker shaft (6). Remove spring (3) from the rocker shaft.

4. Remove rocker arm assembly (4) for the inlet valve from rocker shaft (6). Remove rocker arm assembly (5) for the exhaust valve from rocker shaft (6).

   **NOTE:** *The rocker arm assembly for the inlet valve is longer than the rocker arm assembly for the exhaust valve.*

5. Remove retaining clip (7) from rocker shaft (6). Remove spring (8) from the rocker shaft.

6. Remove rocker arm assembly (4) for the exhaust valve from rocker shaft (6). Remove rocker arm assembly (5) for the inlet valve from rocker shaft (6).

7. Repeat Step 5 through Step 6 in order to remove remaining rocker arms from rocker shaft (6).

8. If necessary, follow Step 8.A. through Step 8.B. in order to remove threaded inserts (1) from the rocker arms.

   A. Make a temporary identification mark on each threaded inserts (1) in order to show the location.

      **NOTE:** *The components must be reinstalled in the original location. Do not interchange components.*

   B. Remove threaded inserts (1) from the rocker arms.

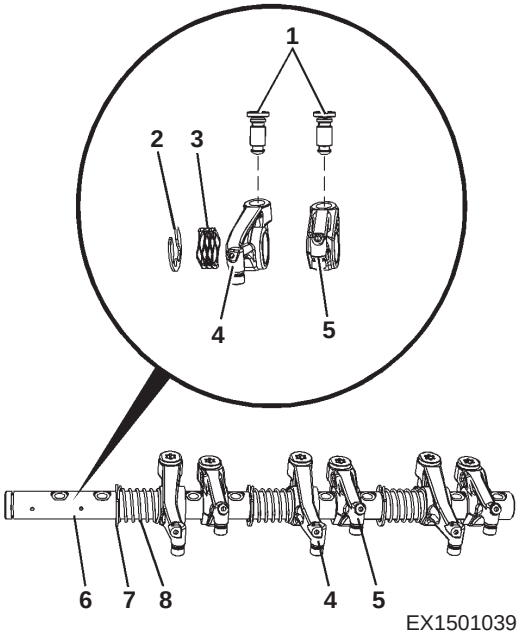
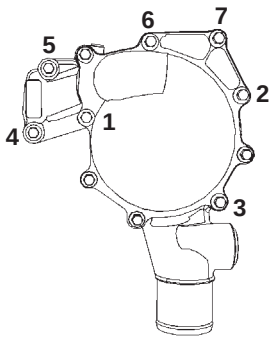



**Figure 207**

| Reference Number | Description |
|---|---|
| 1 | Pan, Oil |
| 2 | Gasket; Sump |
| 3 | Piece; Bridge |
| 4 | Screw |
| 5 | Screw |
| 6 | Screw |
| 7 | Screw |
| 10 | Pipe; Oil Suction |
| 11 | Gasket |
| 12 | Screw |
| 20 | Dipstick Assembly |
| 20-1 | Tube |

| Reference Number | Description |
|---|---|
| 20-2 | Clip |
| 20-3 | Dipstick |
| 20-4 | Seal, O-ring |
| 21 | Bracket |
| 22 | Screw |
| 23 | Seal, O-ring |
| 24 | Plug |
| 30 | Plug |
| 31 | Seal, O-ring |
| 32 | Plug |
| 33 | Plug; O-ring |




EX1501071

**Figure 253**

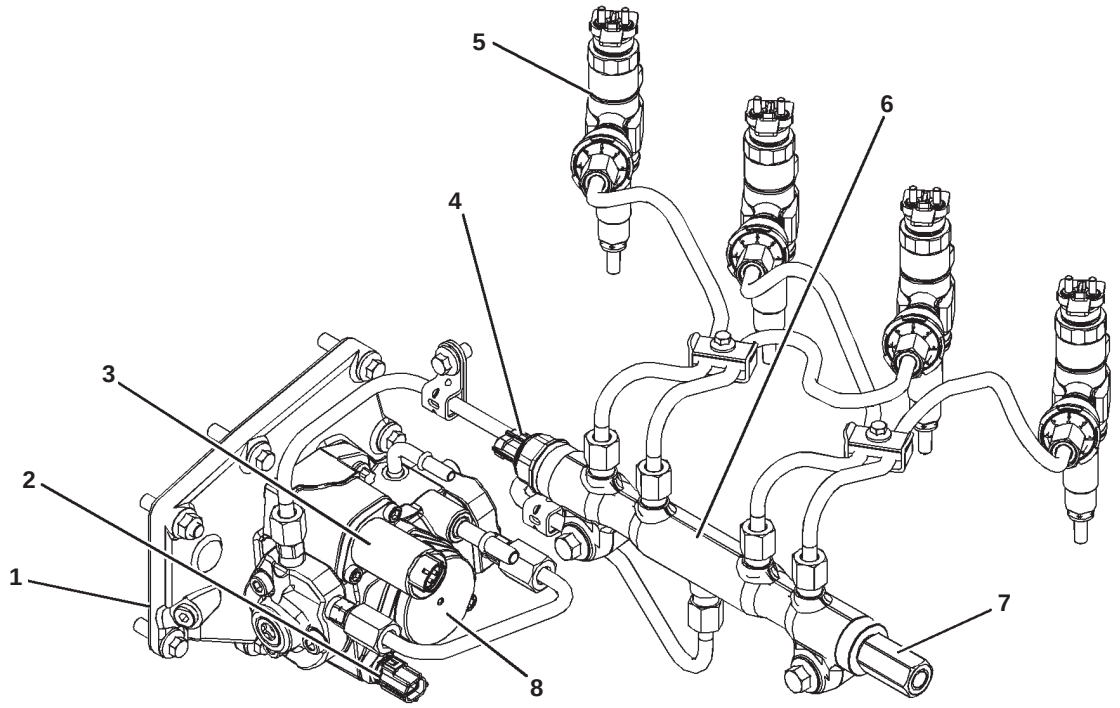
**Water Pump - Inspect**

1. Inspect the water pump for leaks at vent hole. The water pump seal is lubricated by coolant in the cooling system. A normal condition is for a small amount of leakage to occur as the engine cools down and the parts contract.
2. Refer to "Water Pump - Remove", "Water Pump - Install" for the correct procedures to remove and install the water pump.
3. Inspect the water pump shaft for unusual noise, excessive looseness and/or vibration of the bearings.

# High-pressure Fuel System

The fuel injection pump (1) feeds fuel to the high-pressure fuel manifold (rail) (6). The fuel is at a pressure of 2,000 bar (29,000 psi). A pressure sensor (4) in the high-pressure fuel manifold (rail) (6) monitors the fuel pressure in the high-pressure fuel manifold (rail) (6). The ECM controls a suction control valve (3) in the fuel injection pump (1) in order to maintain the actual pressure in the high-pressure fuel manifold (6) at the desired level. The high-pressure fuel is continuously available at each injector.

The ECM determines the correct time for activation of the correct electronic unit injector (5) which allows fuel to be injected into the cylinder. The leak off fuel from each injector passes into a drilling which runs along the inside of the cylinder head. A pipe is connected to the rear of the cylinder head in order to return the leak off fuel to the fuel tank.




EX1501091

**Figure 274**

| Reference Number | Description |
|---|---|
| 1 | Fuel Injection Pump |
| 2 | Fuel Temperature Sensor |
| 3 | Suction Control Valve for the Fuel Injection Pump |
| 4 | Fuel Pressure Sensor |

| Reference Number | Description |
|---|---|
| 5 | Electronic Unit Injector |
| 6 | Fuel Manifold (Rail) |
| 7 | Pressure Relief Valve |
| 8 | Fuel Transfer Pump |

19. Connected harness assembly (15) to the engine oil pressure sensor. Refer to "Engine Oil Pressure Sensor - Install" for the correct procedure.
20. Tighten bolt (4) and bolt (9) (not shown) to a torque of 9 N.m (0.9 kg.m, 6.6 ft lb).
21. Remove caps from connections for the plastic tube assemblies on fuel injection pump (13).
    Remove plugs from plastic tube assembly (6) and plastic tube assembly (8).
22. Connect plastic tube assembly (6) and plastic tube assembly (8) to fuel injection pump (13).
23. Remove tool from the cylinder block.
24. Install a new O-ring seal (24) to plug (23). Install the plug into the cylinder block. Tighten plug (23) to a torque of 21 N.m (2.1 kg.m, 15.5 ft lb).
25. Turn the fuel supply to the "ON" position.
26. Turn the battery disconnect switch to the "ON" position.
27. Install crankcase breather canister and plastic tube assemblies. Refer to "Crankcase Breather - Install" for the correct procedure.
28. Remove air from the fuel system. Refer to "Fuel System - Prime" for the correct procedure.
29. After replacement of the fuel injection pump, the fuel injection pump must be calibrated. Use the electronic service tool to perform "High-pressure Fuel Pump Calibration".

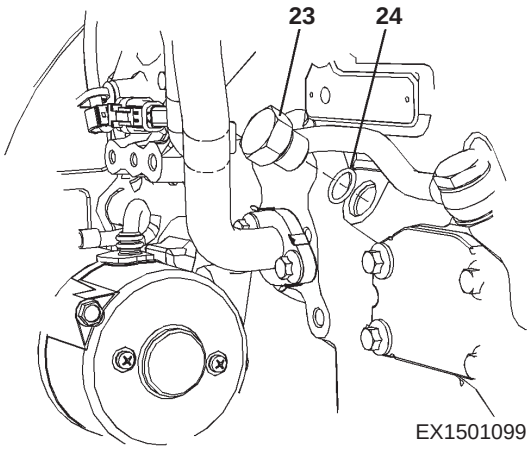



**Figure 291**

# Fuel Injectors

### Overview

**NOTE:** *If a replacement electronic unit injector is installed, the correct injector code must be programmed into the electronic control module. The code that is required is located at position (X). Record code (X) before the electronic unit injector is installed.*

The fuel injectors contain no serviceable parts apart from the O-ring seal and the combustion washer. The clamp and setscrew are serviced separately. The pressurized fuel from the fuel manifold is injected into the combustion chamber by the electronic unit injector. The desired injection timing, injection quantity and injection pattern are controlled by the ECM depending on engine operating conditions.

The injection process is controlled using a two-way valve. The supply of electrical current to the solenoid controls the two-way valve. When the two-way valve is not energized the out orifice is closed and there is no fuel leak. In this condition the pressure in the control chamber and the pressure at the nozzle needle are the same. In this condition the spring pressure on the command piston keeps the needle closed.

When an injection of fuel is required, the electrical current from the ECM charges the solenoid, which in turn energizes the two-way valve and lifts the valve.

When the valve lifts the valve uncovers the out orifice. The fuel starts to flow and reduces the pressure in the control chamber. When the pressure difference at the nozzle needle exceeds the combined pressure of the control chamber pressure and the spring pressure, the nozzle lifts to start the injection process. The fuel coming out of the nozzle is atomized and injected as a very fine spray.

When the injection needs to be stopped the electrical current to the solenoid is cut off and the pressure difference in the control chamber starts increasing. The increased pressure difference stops the injection process when the combined pressure exceeds the nozzle pressure.

The electronic unit injectors can be instructed to inject fuel multiple times during the combustion process.

A close pilot injection occurs before the main injection.

The close pilot injection helps to reduce NOx and noise. The main injection period helps to increase the torque of the engine. The after injection period helps to reduce the amount of smoke that is produced.

| Reference Number | Description |
|---|---|
| 1 | Electrical Connections |
| 2 | Bolt |
| 3 | Clamp |
| 4 | Combustion Washer |
| 5 | O-ring |
| 6 | Fuel Inlet |

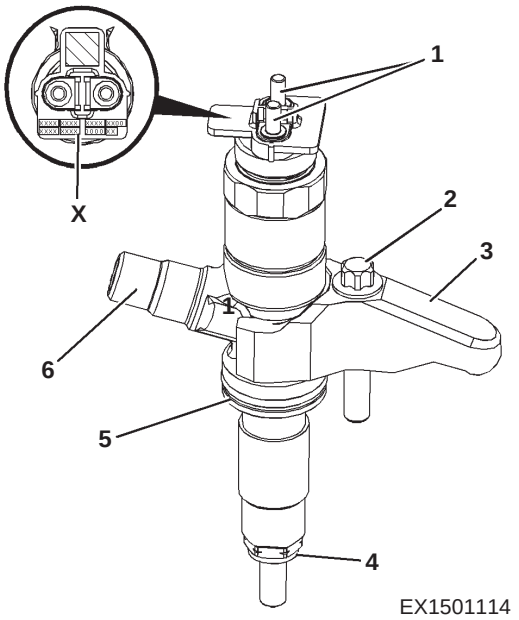



**Figure 313**

## Fuel System - Prime

**NOTE:** *Refer to "Cleanliness of Fuel System" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.*
*Ensure that all adjustments and repairs are performed by authorized personnel that have had the correct training.*

# IMPORTANT

**Do not crank the engine continuously for more than 30 seconds. Allow the starting motor to cool for two minutes before cranking the engine again.**

Air enters the fuel system, the air must be purged from the fuel system before the engine can be started. Air can enter the fuel system when the following events occur:

- The fuel tank is empty or the
- The low-pressure fuel lines are disconnected.
- A leak exists in the low-pressure fuel system.
- The fuel filter has been replaced.

Use the following procedure in order to remove air from the fuel system:

1. Ensure that the fuel system is in working order.
   Check that the fuel supply valve (if equipped) is in the "ON" position.
2. Turn the key switch to the "RUN" position.
3. The key switch will allow the electric priming pump to operate. Operate the electric priming pump for 2 minutes.
4. Turn the key switch to the "OFF" position.
   The fuel system should now be primed and the engine must be able to start.
5. Operate the engine starting motor and crank the engine. After the engine has started, operate the engine at low idle for a minimum of 5 minutes.
   Ensure that the fuel system is free from leaks.

   **NOTE:** *Operating the engine for this period will help ensure that the fuel system is free of air.*
   *DO NOT loosen the high-pressure fuel lines in order to purge air from the fuel system.*
   *This procedure is not required.*

After the engine has stopped, you must wait for 10 minutes in order to allow the fuel pressure to be purged from the high-pressure fuel lines before any service or repair is performed on the engine fuel lines.

**Wastegate Solenoid - Remove**

1. Loosen hose clamps and remove hose assembly from connection (12).
2. Remove plastic tube assembly (2) from the valve mechanism cover and the crankcase breather canister.
3. Slide locking tab (13) into the unlocked position.
   Disconnect harness assembly (5) from the harness assembly for wastegate solenoid (3).
4. Slide the harness assembly for wastegate solenoid (3) from bracket (4).
5. Remove bolts (9) from tube assembly (1).
6. Remove banjo bolt (11) and remove sealing washers (10) (not shown).
7. Cut cable straps (8) from harness assembly (5).
   Position harness assembly (5) away from NRS induction mixer.
8. Remove nut (7) and bolts (14).
9. Remove assembly of inlet connection (12) from the NRS induction mixer assembly.
10. Remove gasket (6) (not shown) and gasket (15) (not shown).
11. Remove allen head bolts (15) from wastegate solenoid (3). Remove bracket (4).
12. Remove wastegate solenoid (3) from inlet connection (12).
13. Plug inlet connection (12) and cap wastegate solenoid (3) with new plugs and caps.

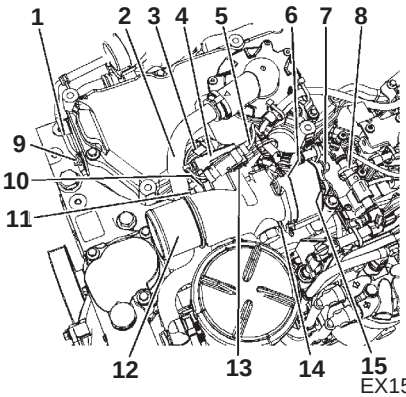



**Figure 361**

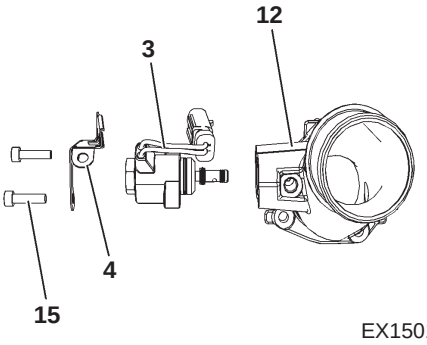



**Figure 362**

18. Tighten nut (14) to a torque of 18 N.m (1.8 kg.m, 13 ft lb). Tighten bolts (5) and bolt (13) to a torque of 22 N.m (2.2 kg.m, 16.2 ft lb).

19. Fill the cooling system with coolant.

**Exhaust Elbow - Remove**

1. If necessary, remove exhaust back pressure valve (1) from exhaust elbow (2). Refer to "Exhaust Back Pressure Valve - Remove" for the correct procedure.

2. Loosen allen head bolt on V-band clamp (4).

   **NOTE:** *If the V-band clamp (4) remain tight on the flanges, apply releasing fluid on the V-band clamps in order to assist removal. Lightly tap the bolts on the V-band clamps with a soft faced hammer in order to assist removal. Do not use a prybar in order to remove V-band clamps.*

3. Remove V-band clamp (4) from turbocharger (5) and exhaust elbow (2).

4. Remove bolts (3) and spacers. Remove exhaust elbow (2) from turbocharger (5).

   **NOTE:** *Support the weight of the exhaust elbow as the bolts are removed.*

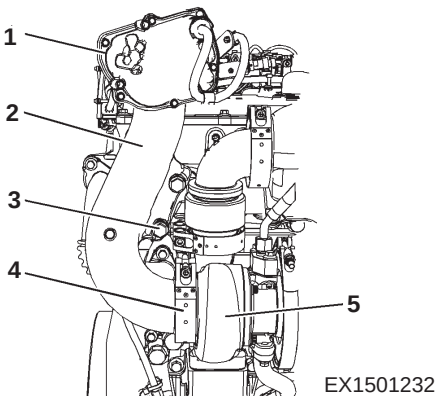



**Figure 384**

**Exhaust Elbow - Install**

1. Ensure that the exhaust elbow and the outlet of the turbocharger are free from damage. Replace any components that are damaged.

2. Use a suitable tool to lubricate the threads of the allen head bolt for V-band clamp (4).

3. Loosely position V-band clamp (4) onto turbocharger (5).

4. Position exhaust elbow (2) onto turbocharger (5). Install V-band clamp (4) onto exhaust elbow (2) and hand tighten the allen head bolt on the V-band clamp.

   **NOTE:** *Support the weight of the exhaust elbow as the V-band clamp is installed.*

5. Install the spacers and bolts (3) hand tight. Ensure that exhaust elbow (2) is correctly positioned onto turbocharger (5) and is correctly aligned.

6. Tighten the allen head bolt for V-band clamp (4) to a torque of 12 N.m (1.2 kg.m, 8.9 ft lb).

7. Tighten bolts (3) to a torque of 44 N.m (4.5 kg.m, 33 ft lb).

8. If necessary, install exhaust back pressure valve (1) to exhaust elbow (2). Refer to "Exhaust Back Pressure Valve - Install" for the correct procedure

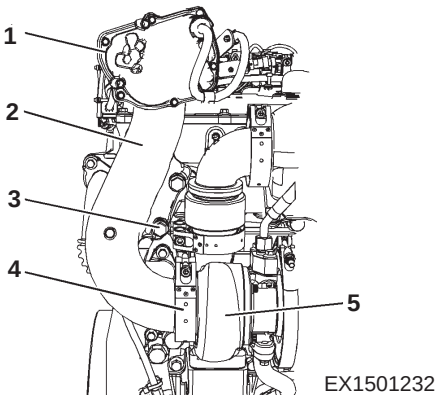



**Figure 385**

4. Check the rocker arms for an engine valve lash.
   There must be no engine valve lash.

5. If there is an engine valve lash at any position the engine valve lash may be caused by a normal leak down of the hydraulic lifter. Push the affected rocker arm (1) against the pushrod. The rocker arm (1) should rotate as the pushrod is pushed up by the recovery of the hydraulic lifter. Once all motion has ceased test again for an engine valve lash. There must be no engine valve lash.

6. Remove Tool from the crankshaft. Use a suitable tool to rotate the crankshaft in a clockwise direction.
   The crankshaft must be rotated 360 degrees. Install a suitable tool to the crankshaft.

7. Check the rocker arms for an engine valve lash.
   There must be no engine valve lash.

8. If there is an engine valve lash at any position the engine valve lash may be caused by a normal leak down of the hydraulic lifter. Push the affected rocker arm (1) against the pushrod. Monitor the rocker arm (1) for movement.
   The rocker arm (1) should rotate as the pushrod is pushed up by the recovery of the hydraulic lifter. Once all motion has ceased test again for an engine valve lash. There must be no engine valve lash.

9. If an engine valve lash is found in any position, examine the valve mechanism components for excessive wear or damage. This includes the hydraulic lifters.

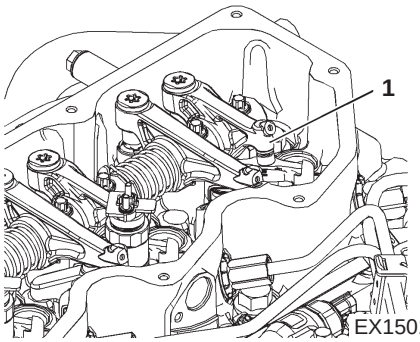



**Figure 400** One electronic unit injector is not shown for clarity.

**Valve Depth - Inspect**

1. Ensure that the face of the valves are clean.
   Ensure that the bottom face of the cylinder head is clean. Ensure that the cylinder head is not distorted. Refer to "Cylinder Head - Inspect" for the procedure to measure flatness of the cylinder head.

2. Use a suitable tool to check the depths of the inlet valves and the exhaust valves below the face of the cylinder head.

3. For the minimum and maximum limits for a new engine for the inlet valves and the exhaust valves, refer to, "Cylinder Head - Specification".

4. Service wear occurs on an engine which has been in operation. If the valve depth below the cylinder head face on a used engine exceeds the specification for service wear, the following components must be replaced.

   - Valves
   - Valve inserts

   For the wear limits for the inlet valves and exhaust valves, refer to "Cylinder Head - Specification".

5. Check each valve for cracks. Check the stems of the valves for wear. Ensure that the valves are the correct fit in

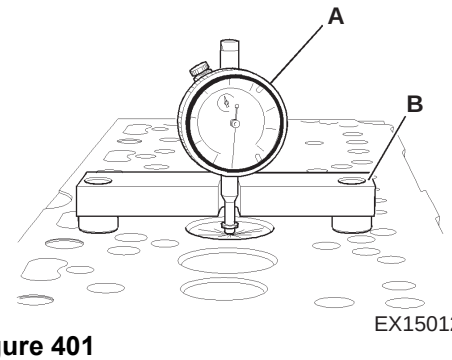



**Figure 401**

2. Ensure that the area around DEF fluid pump (1) is clean and free dirt and debris. If necessary, clean the area around the DEF injector. Clean the area around the DEF fluid pump.
3. Disconnect harness assembly (3).
4. Make temporary marks on DEF lines for installation purposes. Remove DEF line from connection (5) and the DEF line from connection (6) from DEF fluid pump (1). Refer to "Diesel Exhaust Fluid Lines - Remove" for the correct procedure.
5. Use a suitable tool to plug the DEF lines.
   Tool to cap connection (5) and connection (6).
6. Remove bolts (7) from DEF pump (1). Support the weight of the DEF pump as the bolts are removed.
   Remove DEF pump.
7. If necessary, remove DEF filter (2) (not shown).
   Refer to Operation and Maintenance Manual.

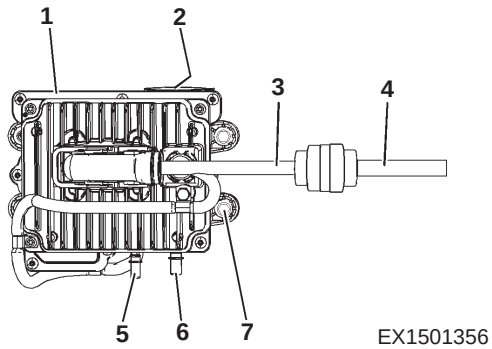


**Figure 412**

**Diesel Exhaust Fluid Pump - Install**

1. Ensure that the DEF pump is free from wear or damage. Replace the DEF pump as an assembly if any component of the DEF pump is not free from wear or damage
2. If necessary, install a new DEF filter (2) (not shown).
   Refer to "Diesel Exhaust Fluid Filter - Clean/Replace" for the correct procedure.
3. Install DEF pump (1) and install bolts (7) to diesel exhaust fluid pump. Support the weight of the DEF pump as the bolts are installed. Tighten the bolts to a torque of 16 N.m (1.6 kg.m, 11.8 ft lb).
4. Remove plugs from the DEF lines. Remove caps from connection (5) and connection (6).
5. Install the DEF line to connection (5) and the DEF line to connection (6). Refer to "Diesel Exhaust Fluid Lines - Install" for the correct procedure.

   **NOTE:** *Ensure that the DEF lines are connected into the correct positions.*
6. Connect harness assembly (3) to harness assembly (4).
7. After the installation of the DEF lines on to the DEF pump. Follow Step 7.A. through Step 7.K. in order to flush DEF supply line (8) at DEF injector (9).
   A. Ensure that the area around DEF injector (9) is clean and free dirt and debris. If necessary, clean the area around the DEF injector. Clean the area around the DEF injector with a suitable tool.
   B. Disconnect DEF line (8) from DEF injector (9).
   C. Use a suitable tool to cap DEF injector (9) and DEF line (8).

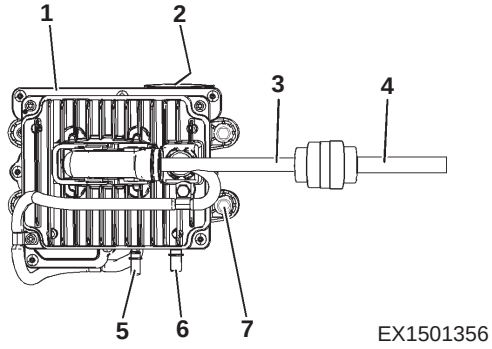


**Figure 413**

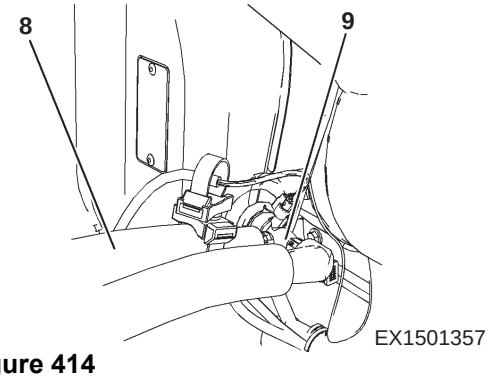


**Figure 414**

**Aftertreatment System with a DOC, and DEF system**

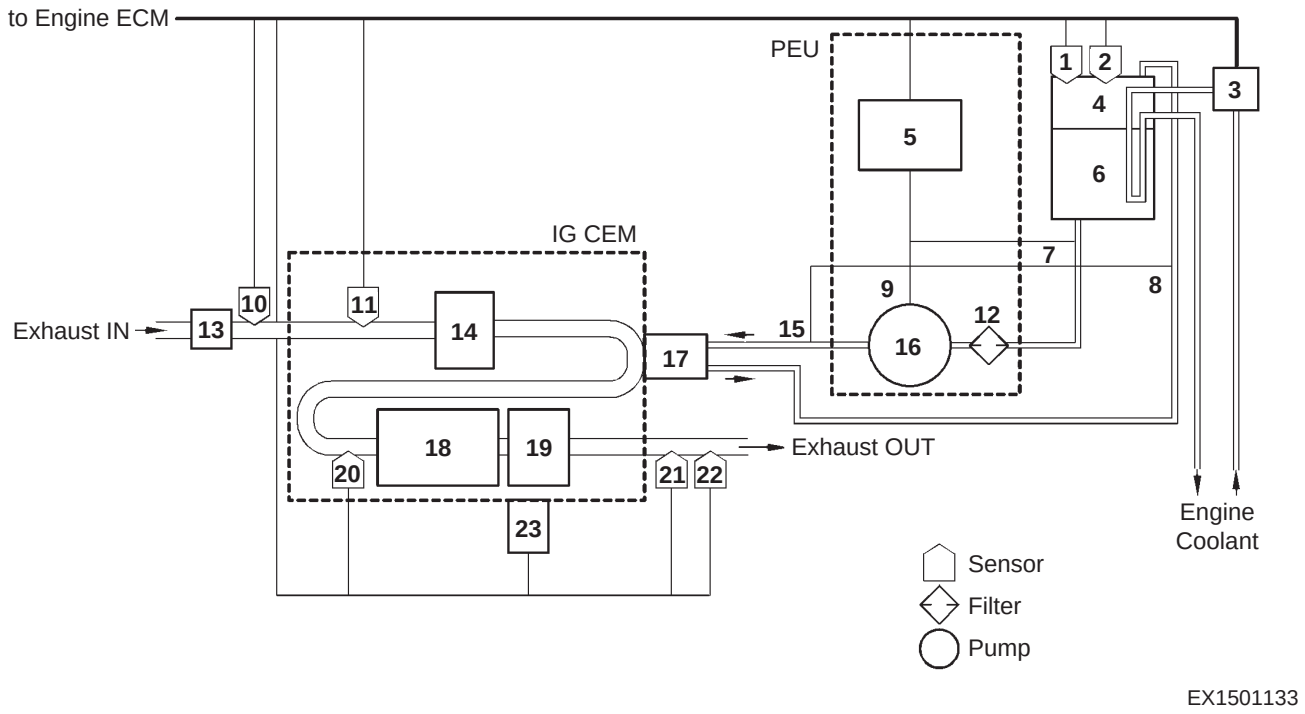



**Figure 432** Block Diagram for the Aftertreatment System with a DOC and DEF System

| Reference Number | Description |
|---|---|
| 1 | Diesel Exhaust Fluid (DEF) Level Sensor |
| 2 | DEF Temperature Sensor |
| 3 | Coolant Diverter Valve |
| 4 | DEF Header Unit |
| 5 | Dosing Control Unit (DCU) |
| 6 | DEF Tank |
| 7 | Heated DEF Line |
| 8 | Heated DEF Line |
| 9 | DEF Pump Heater |
| 10 | Inlet NOx Sensor |
| 11 | Diesel Oxidation Catalyst (DOC) Inlet Temperature Sensor |
| 12 | DEF Filter |

| Reference Number | Description |
|---|---|
| 13 | Exhaust Back Pressure Regulator (EBPR) |
| 14 | Diesel Oxidation Catalyst (DOC) |
| 15 | Heated DEF Line |
| 16 | DEF Dosing Pump |
| 17 | DEF Injector |
| 18 | Selective Catalytic Reduction (SCR) Catalyst |
| 19 | Ammonia Oxidizing (AMOX) Catalyst |
| 20 | SCR Inlet Temperature Sensor |
| 21 | Outlet NOx Sensor |
| 22 | Ammonia Sensor |
| 23 | Identification Module |

**Nitrogen Oxide Sensor - Install**

1. Ensure that the nitrogen oxide sensor is free from wear or damage. Replace the nitrogen oxide sensor as an assembly if worn or damaged.
2. Check the threads of the mounting point for nitrogen oxide sensor in the exhaust elbow.
   Replace the elbow if the mounting point is worn or damage.
3. If necessary, follow Step 3.A. through Step 3.C. in order to install nitrogen oxide sensor ECM (2).
   A. Position nitrogen oxide sensor ECM (2) onto bracket (5). Ensure that the nitrogen oxide sensor ECM is correctly orientated onto the bracket.
   B. Install bolts (4) to nitrogen oxide sensor ECM (2). Support the nitrogen oxide sensor ECM as the bolts are installed. Tighten the bolts to a torque of 10 N.m (1 kg.m, 7.4 ft lb).
   C. Connect harness assembly (3) to nitrogen oxide sensor ECM (2).

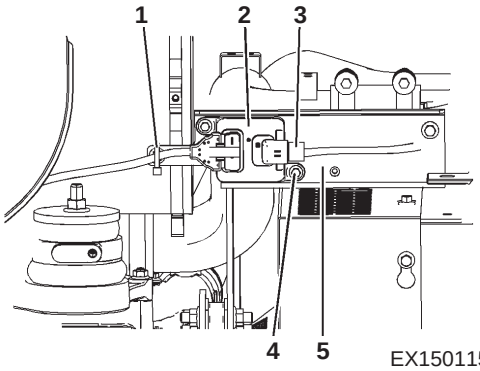



**Figure 451**

4. New nitrogen oxide sensor (6) are pre-lubricated.
   When installing an existing nitrogen oxide sensor (6), lightly lubricate the thread of the nitrogen oxide sensor with a tool.

   **NOTE:** *Ensure that the nitrogen oxide sensor is not contaminated.*

5. Remove probe of nitrogen oxide sensor (6) from the plastic bag. Install the nitrogen oxide sensor to exhaust tube assembly (7). Ensure that the harness assembly is not damaged as the nitrogen oxide sensor is installed.
6. 6. Use a suitable tool to tighten nitrogen oxide sensor (6) to a torque of 50 N.m (5 kg.m, 36.9 ft lb).
7. Install new cable straps (1) to the harness assembly. Ensure that the cable straps are installed into the original position.
8. Turn the battery disconnect switch to the "ON" position.

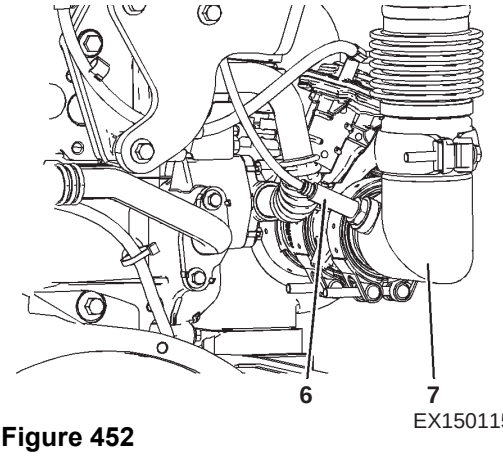



**Figure 452**

# IMPORTANT

**Keep all parts clean from contaminants.**

**Contaminants may cause rapid wear and shortened component life.**

1. Slide locking tab (2) into the unlocked position.
2. Disconnect harness assembly (1) from boost pressure sensor (3).

   **NOTE:** *The boost pressure sensor has a three-wire plug.*
3. Use a deep socket to remove boost pressure sensor (3) from the cylinder head.
4. Remove O-ring seal (4) from the boost pressure sensor (3).

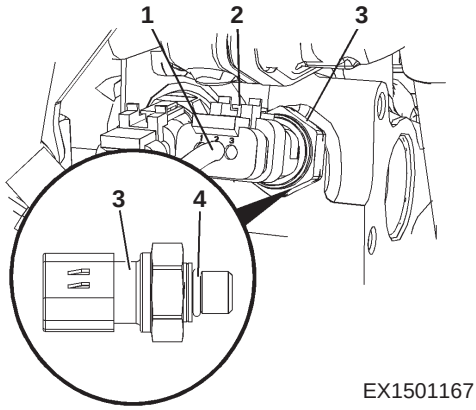



**Figure 478**

## Boost Pressure Sensor - Install

1. Install the new O-ring seal (4) onto boost pressure sensor (3).

   **NOTE:** *Do not lubricate the O-ring seal.*
2. Use a deep socket to install boost pressure sensor (3) to the cylinder head. Tighten the boost pressure sensor to a torque of 10 N.m (1 kg.m, 7.4 ft lb).
3. Connect harness assembly (1) to boost pressure sensor (3).
4. Slide locking tab (2) into the locked position.

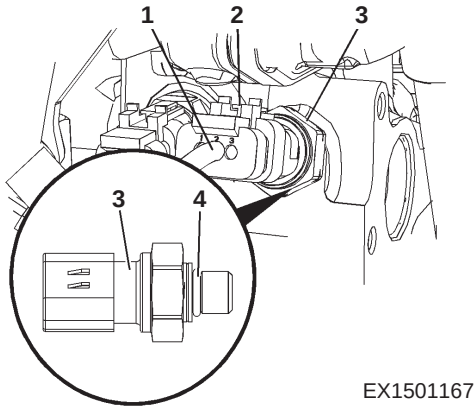



**Figure 479**

**Electric Starting Motor - Install**

1. If necessary, install studs (5) into flywheel housing (1).
   Tighten M10 studs to a torque of 18 N.m (1.8 kg.m, 13 ft lb).
2. Position electric starting motor (3) onto the studs in flywheel housing (1).
3. Install nuts (2).
   Tighten M10 nuts to a torque of 44 N.m (4.5 kg.m, 33 ft lb).
4. Connect the harness assembly to the electric starting motor and the solenoid.
5. Turn the battery disconnect switch to the "ON" position.

C. Remove rubber and screws, remove cover (1, Figure 16) from stand upper cover, and disconnect the connector of harness which connect with switches.

- Tool: Phillips screwdriver

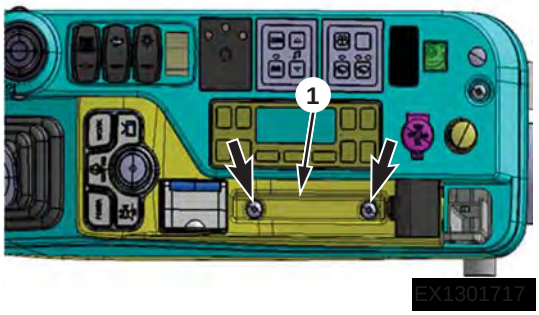



**Figure 16** Stand RH

D. Remove socket bolt (1, Figure 17) with grip (2).

E. Remove screw (3) with cover (4) from stand upper cover, and disconnect the connector of harness which connect with switches.

- Tool: 4 mm ( ), phillips screwdriver

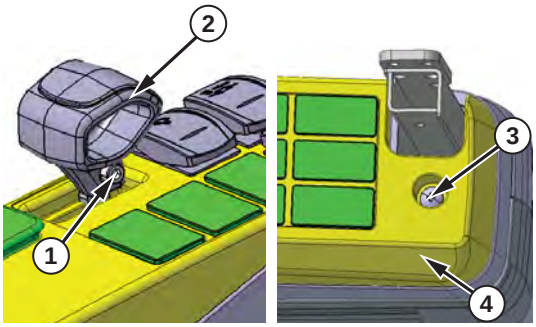



**Figure 17** Stand LH

F. Remove screws (Figure 18) (4 ea), remove upper cover (1, Figure 18) from bracket, and disconnect the connector of harness which connect with switches.

Left side is same.

- Tool: Phillips screwdriver

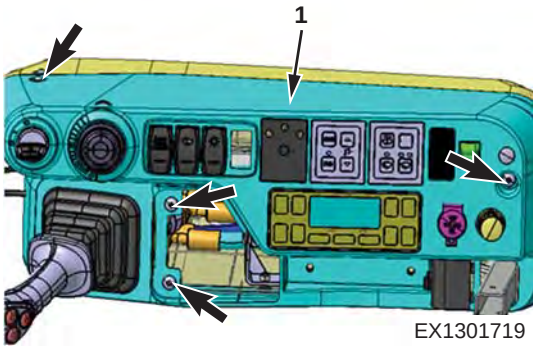



**Figure 18** Stand RH

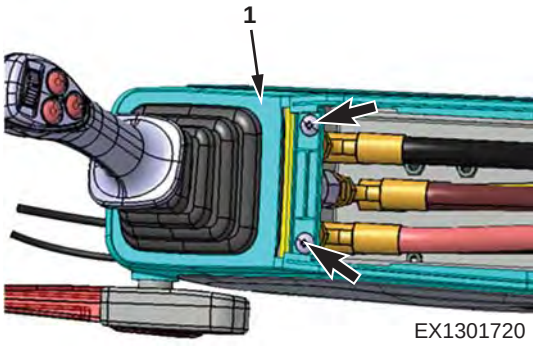
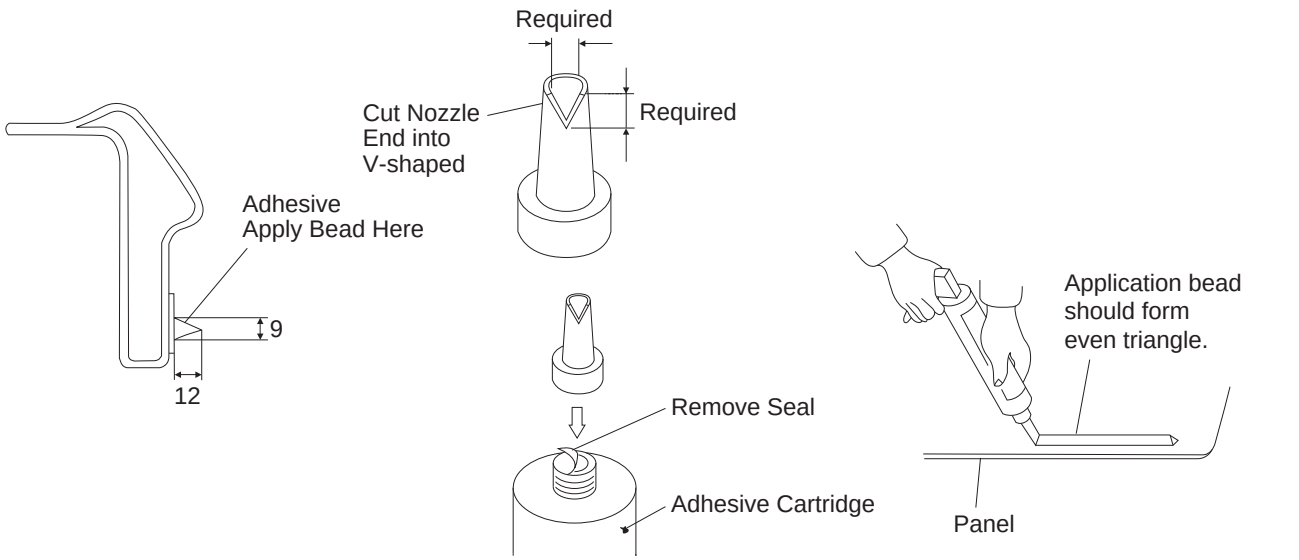



**Figure 19** Stand LH




EX1401037

**Figure 48**

**NOTE:** *Unit: mm (1 mm = 0.039 in)*

10. The required amount (just for reference) of adhesive and primer.

| | | **Painted Surface or Adhesive Surface** | **Glass Surface** |
|---|---|---|---|
| | **Adhesive Sika Tack-drive 310 ml Cartridge** | **Primer Sika Activator DM-1 250 ml Can** | **Primer Sika Primer 206G+P 30 ml Bottle** |
| Upper Front Glass | 310 ml | 0.75 ml | 0.67 ml |
| Lower Glass of Door | 150 ml | 0.50 ml | 0.45 ml |
| Rear Left-hand Glass | 250 ml | 0.65 ml | 0.60 ml |
| Rear Right-hand Glass | 100 ml | 1.00 ml | 0.90 ml |
| Rear Glass | 210 ml | 0.50 ml | 0.45 ml |

# Table of Contents

## Hydraulic Oil Tank

6. Location of air breather (1) must be as Figure 26 when assembling cover (2).

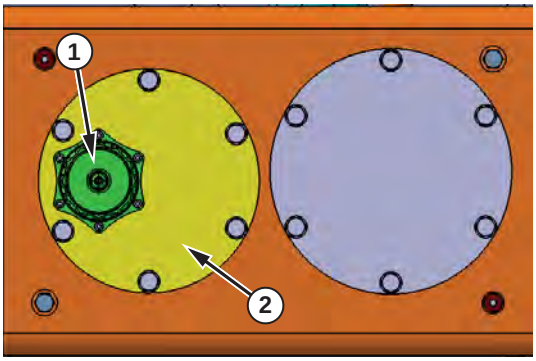
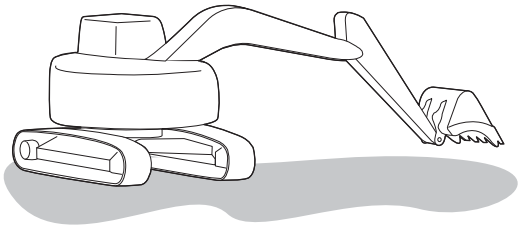



**Figure 26** EX1501818

# COMPLETING WORK

1. Hydraulic oil tank volume:
   - Approximately: 130 L (34.3 U.S. gal)
   - Effective level: 85 L (22.5 U.S. gal)
2. Adjusting standard for hydraulic oil level
   A. Front position: Extend the arm and dump the bucket until both cylinders are fully retracted. Lower the boom until the bucket rests on the ground.
   B. Engine condition: Low idle
   C. Fill hydraulic oil until fluid in level gauge is positioned between low and high marks. If hydraulic oil level is too high, drain excess hydraulic oil from tank by removing drain plug located on bottom of tank.

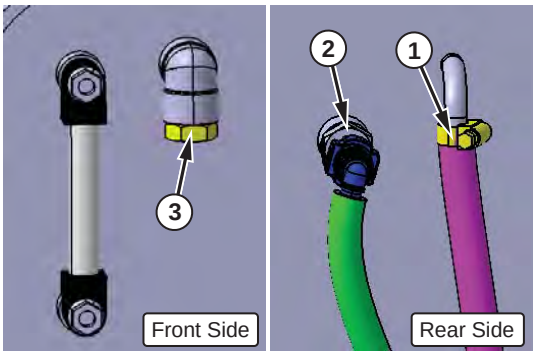


EX1403017

**Figure 27**

26. Remove hose from fuel tank.

    - Tool for clip (1): ⊖ Driver




EX1501835

**Figure 20**

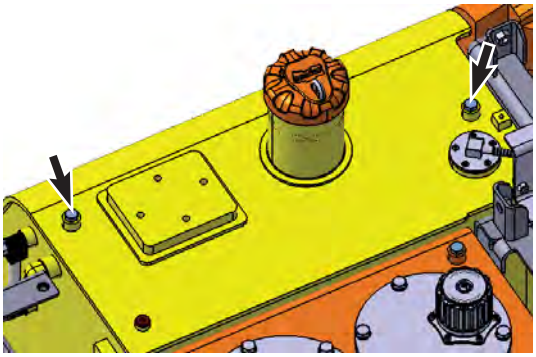
    - Fittings

| Port | Name | Plug/Flange Size (Hose) | (mm) | Torque | | |
|---|---|---|---|---|---|---|
| | | | | N.m | kg.m | ft lb |
| 2 | Adapter | PF 1/4" | 22 | 39.2 | 4 | 28.9 |
| 3 | Plug | PF 1/2" | 27 | 93.1 | 9.5 | 68.7 |

27. Install eyebolts (2 ea) on the fuel tank.

    And tie the rope to the bolts to lift tank.

    - Thread of hole: M10 x 1.5
    - Fuel tank weight: 172 kg (380 lb)



EX1501836

**Figure 21**

28. Remove hose from fuel tank

    - Tool for clip (1): Driver

29. Remove fuel tank mounting bolts and spacers (3, Figure 22) (4 ea) from the main frame.

    - Tool: 24 mm ( )
    - Torque: 264.6 N.m (27 kg.m, 195.2 ft lb)

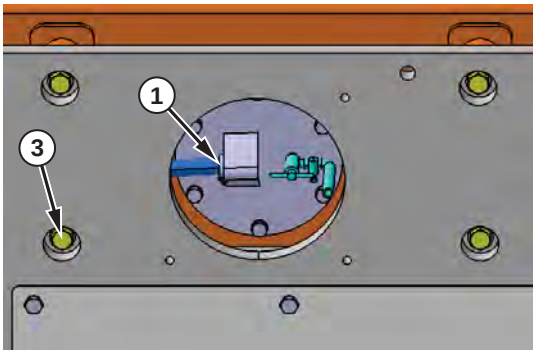
30. Lift tank 25 mm and make sure it is balanced.

31. Make sure there are no other electrical wires or hoses connected to tank.

32. Completely remove tank after inspection

    - Fuel tank weight: 172 kg (380 lb)

    **NOTE:** *The clear level gauge on the side of the tank is easily damaged. Be careful of obstacles and wind gusts.*

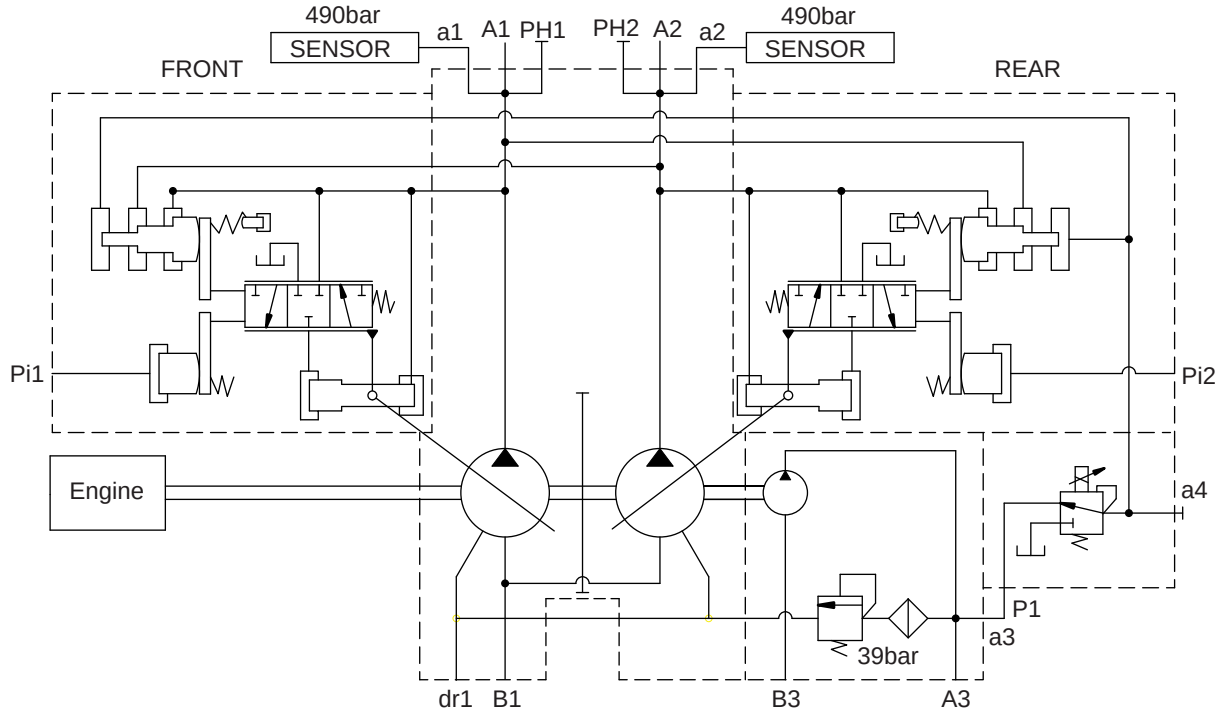



EX1501837

**Figure 22**

| Port | Name | Size | Location |
|---|---|---|---|
| A1, A2 | Delivery | SAE 6,000 psi 3/4" | Body |
| B1 | Suction | SAE 2,500 psi 2 $^{1}/_{2}$" | Body |
| Dr1 | Drain | PF1/2-19 | Body |
| a1, a2 | Pressure Sensor | PF3/8-17 | Body |
| Pi1, Pi2 | Pilot | PF1/4-15 | Regulator (Front, Rear) |
| P1 | Primary Pressure | PF1/4-13 | EPPR Valve Block |
| A3 | Gear Pump Delivery | PF1/2-19 | Gear Pump |
| B3 | Gear Pump Suction | PF3/4-20.5 | Gear Pump |
| a3 | Gauge | PF1/4-15 | Gear Pump |

## Hydraulic Circuit

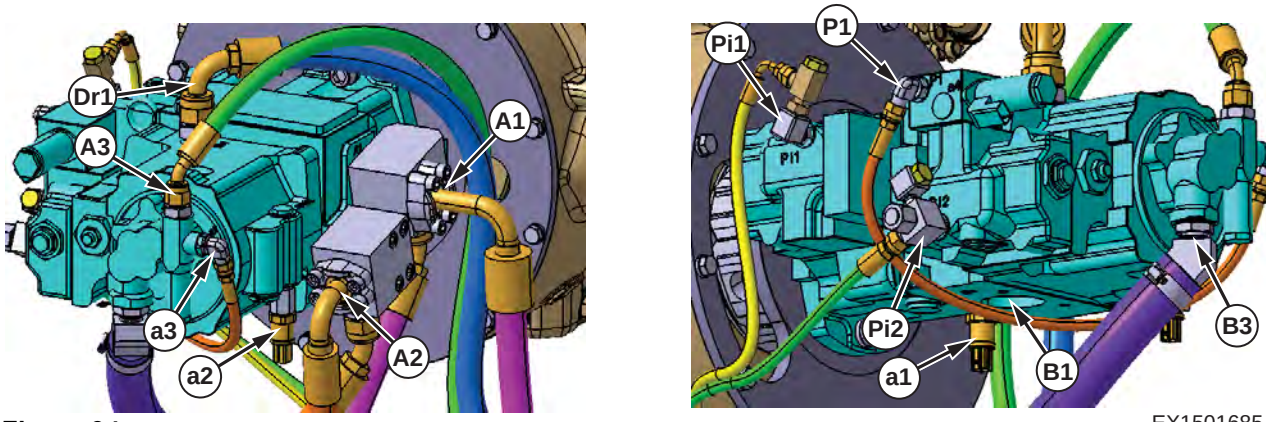



EX1501425

**Figure 5**

25. Disconnect the hoses and adapters from bottom to top of pump.

**NOTE:** *Attach identification tags to the removed hoses for reassembling*
*After disconnecting hoses from pump, plug them to prevent dirt or dust from entering.*




EX1501685

**Figure 34**

- Hoses and plugs ports

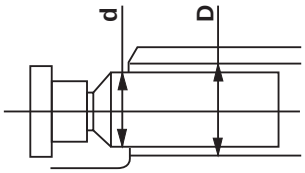
| Port | Name | Plug/Flange Size (Hose) | (mm) | (mm) | Torque | | |
|---|---|---|---|---|---|---|---|
| | | | | | N.m | kg.m | ft lb |
| A1 | to Control Valve "P1" | SAE 3/4", D19 | | 8 | 56.8 | 5.8 | 41.9 |
| | Dummy | UNF 1 3/16"-12-2B | 36 | | 124.5 | 12.7 | 91.8 |
| A2 | to Control Valve "P2" | SAE 3/4", D19 | | 8 | 63.7 | 6.5 | 47.0 |
| | Dummy | UNF 1 3/16"-12-2B | 36 | | 124.5 | 12.7 | 91.8 |
| A3 | to Pilot Filter (Gear Pump Delivery) | UNF 13/16"-16-2B | 24 | | 55.9 | 5.7 | 41.2 |
| B3 | Gear Pump Suction | | | | | | |
| a3 | Connect with "P1" | UNF 9/16"-16-2B | 19 | | 25.5 | 2.6 | 18.8 |
| Dr1 | to Oil Tank (Drain) | UNF 1 3/16"-12-2B | 36 | | 124.5 | 12.7 | 91.8 |
| P1 | Connect with "a3" | UNF 9/16"-16-2B | 19 | | 25.5 | 2.6 | 18.8 |
| Pi1 | from Control Valve "ps1" | UNF 9/16"-16-2B | 19 | | 25.5 | 2.6 | 18.8 |
| Pi2 | from Control Valve "ps2" | UNF 11/16"-16-2B | 22 | | 38.2 | 3.9 | 28.2 |
| a1, a2 | Pressure sensor | PF 3/8" | 27 | | 6.0 | 0.6 | 4.4 |

### Replacement Standard of Worn Parts

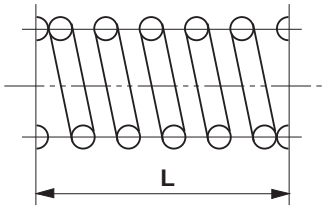
When a part exceeds any of the following criteria, replace or readjust it. Always replace a part when it is appears seriously damaged.

| Part Name and Inspection Item | Standard Dimension/ Recommended Replacement Value | Countermeasures |
|---|---|---|
| Clearance between piston and cylinder bore (D-d) | 0.032 / 0.056 | Replace piston or cylinder. |
| Play between piston and shoe caulking section (δ) | 0 ~ 0.1 / 0.3 | Replace assembly of piston and shoe. |
| Thickness of shoe (t) | 3.9 / 3.7 | Replace assembly of piston and shoe. |
| Free height of cylinder spring (L) | 41.1 / 40.3 | Replace cylinder spring. |
| Combined height of set plate and spherical bushing (H-h) | 17.0 / 15.8 | Replace retainer or set plate. |

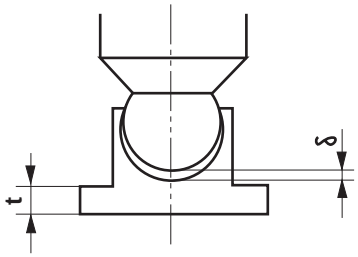
**NOTE:** *Unit: mm (1 mm = 0.039 in)*



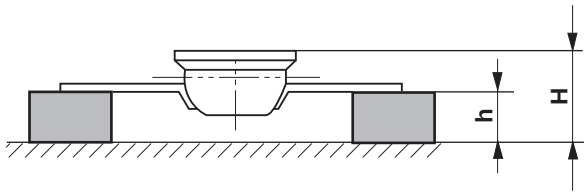

Clearance between Piston & Cylinder Bore : D-d




Free Height of Cylinder Spring : L




Play between Piston & Shoe : δ
Thickness of Shoe : t




Combined Height of Set Plate & Spherical Bush : H-h

WL1400364

**Figure 62**

### Correction Criteria for Cylinder, Valve Plate and Swash Plate (Shoe Plate)

| | | |
|---|---|---|
| Surface roughness for valve plate (sliding face), swash plate (shoe plate area) and cylinder (sliding face) | Surface roughness necessary to be corrected. | 3-Z |
| | Standard surface roughness (Corrected value). | 0.4-Z or lower (Lapping) |

| Reference Number | Description |
|---|---|
| 412 | Screw, Hex.S.H.C |
| 413 | Screw, Hex.S.H.C |
| 418 | Screw, Hex.S.H.C |
| 437 | Screw, Hex.S.H.C |
| 438 | Screw, Hex.S.H.C |
| 439 | Screw, Hex.S.H.C |
| 496 | Plug |
| 497 | Plug |
| 601 | Casing |
| 611 | Lever, Feedback |
| 612 | Lever (1) |
| 613 | Lever (2) |
| 614 | Plug, Center |
| 615 | Plug, Adjust |
| 616 | Plug, Preventation |
| 621 | Piston, Compensator |
| 622 | Case, Piston |
| 623 | Rod, Compensator |
| 624 | Seat, Spring |
| 625 | Spring, Outer |
| 626 | Spring, Inner |
| 627 | Stem, Adjust |
| 628 | Screw, Adjust |
| 629 | Cover |
| 630 | Nut, Lock |
| 631 | Sleeve, PF |
| 641 | Cover, Pilot |
| 643 | Piston, Pilot |

| Reference Number | Description |
|---|---|
| 644 | Seat, Spring |
| 645 | Stem, Adjust |
| 646 | Spring, Pilot |
| 651 | Sleeve |
| 652 | Spool |
| 653 | Seat, Spring |
| 654 | Spring, Return |
| 655 | Spring, Set |
| 656 | Casing; Valve |
| 708 | O-ring |
| 724 | Square Ring |
| 726 | O-ring |
| 728 | O-ring |
| 730 | O-ring |
| 734 | O-ring |
| 753 | O-ring |
| 755 | O-ring |
| 757 | O-ring |
| 801 | Nut |
| 802 | Nut |
| 814 | Ring, Snap |
| 836 | Ring, Snap |
| 874 | Pin |
| 875 | Pin |
| 887 | Pin |
| 897 | Pin |
| 898 | Pin |
| 924 | Screw, Set |

| Reference Number | Description | Qty. | Torque |
|---|---|---|---|
| 1 | Hub | 1 | |
| 2 | Element | 1 | |
| 3 | Insert A | 4 | |
| 4 | Insert R | 4 | |
| 5 | Socket Bolt | 8 | 206 ~ 226 N.m (21 ~ 23 kg.m, 152 ~ 166 ft lb) |
| 7 | Clamping Screw | 2 | 98 ~ 118 N.m (10 ~ 12 kg.m, 72 ~ 87 ft lb) |
| 8 | Spring Pin | 12 | |
| 9 | Support Plate | 1 | |
| 10 | Bolt | 2 | 264 N.m (27 kg.m, 195 ft lb) |
| 11 | Pump Shaft | 1 | |
| 12 | Flywheel | 1 | |

| Symbol | Dimension | Remarks |
|---|---|---|
| H | 3.5 mm (0.14 in) | Distance between from Pump Shaft to Coupling Hub |

## Tools

| Name | Description |
|---|---|
| Allen Wrench | 8 mm, 14 mm, 17 mm |
| Plastic Hammer | One Plastic Hammer |

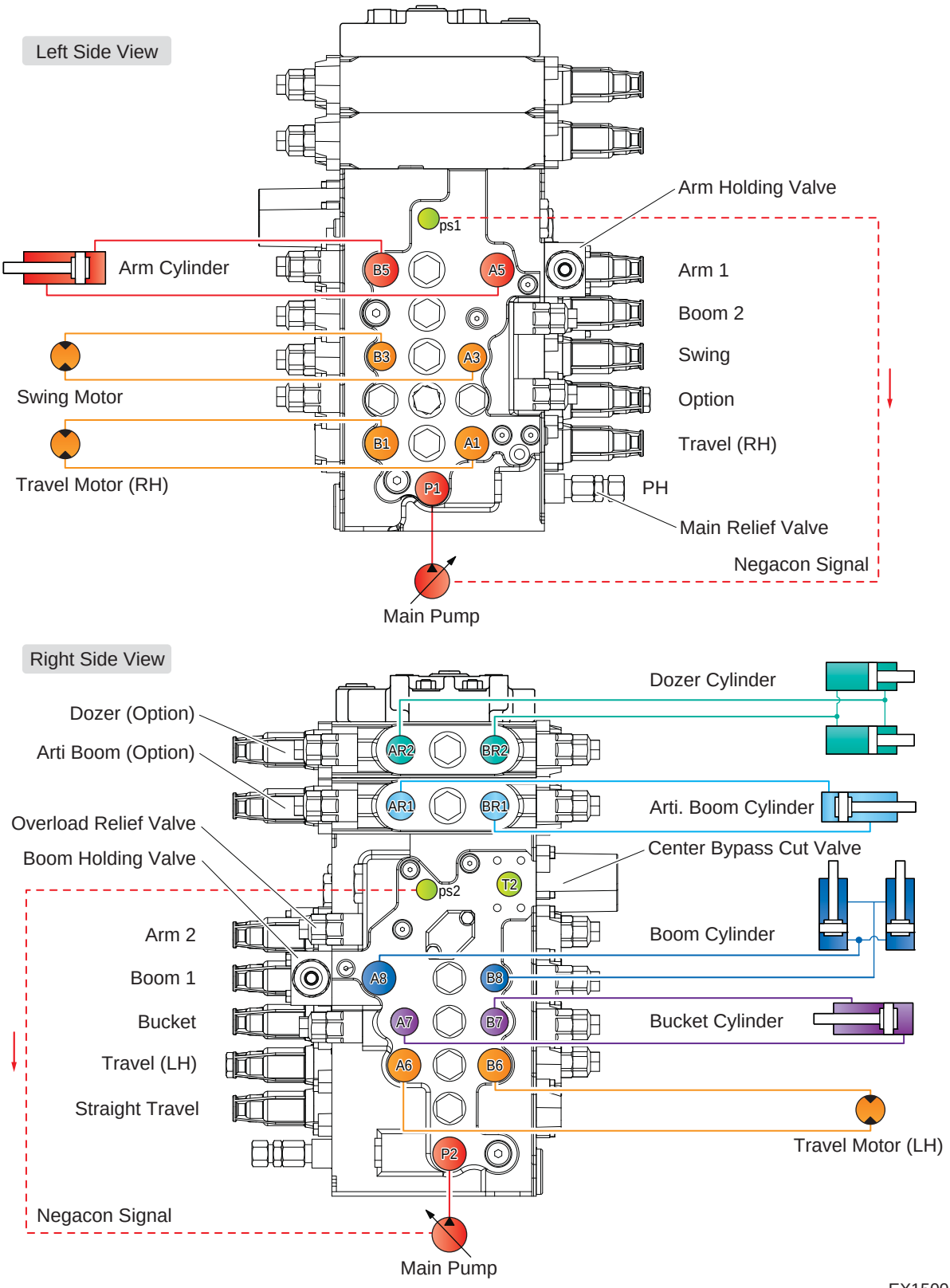

Left Side View
Arm Holding Valve
ps1
Arm Cylinder
B5
A5
Arm 1
Boom 2
B3
A3
Swing
Swing Motor
Option
B1
A1
Travel (RH)
Travel Motor (RH)
P1
PH
Main Relief Valve
Negacon Signal
Main Pump
Right Side View
Dozer Cylinder
Dozer (Option)
Arti Boom (Option)
AR2
BR2
AR1
BR1
Arti. Boom Cylinder
Overload Relief Valve
Boom Holding Valve
Center Bypass Cut Valve
ps2
T2
Arm 2
Boom Cylinder
Boom 1
A8
B8
Bucket
A7
B7
Bucket Cylinder
Travel (LH)
A6
B6
Straight Travel
Travel Motor (LH)
P2
Negacon Signal
Main Pump
EX1500145

**Figure 3**

Bucket Spool Shift

When the bucket spool is moved by being pressurized through the pilot port (pb7) (pa7) of the bucket the neutral path (R1) will be closed.

The oil supplied through port (P2) flows from the parallel path (R3) to port (B7) (A7) by the load check valve (S7-1) path (S7-2) and spool head.

Lubricant oil returns to the tank path (Ta) from (A7) (B7) by spool head.

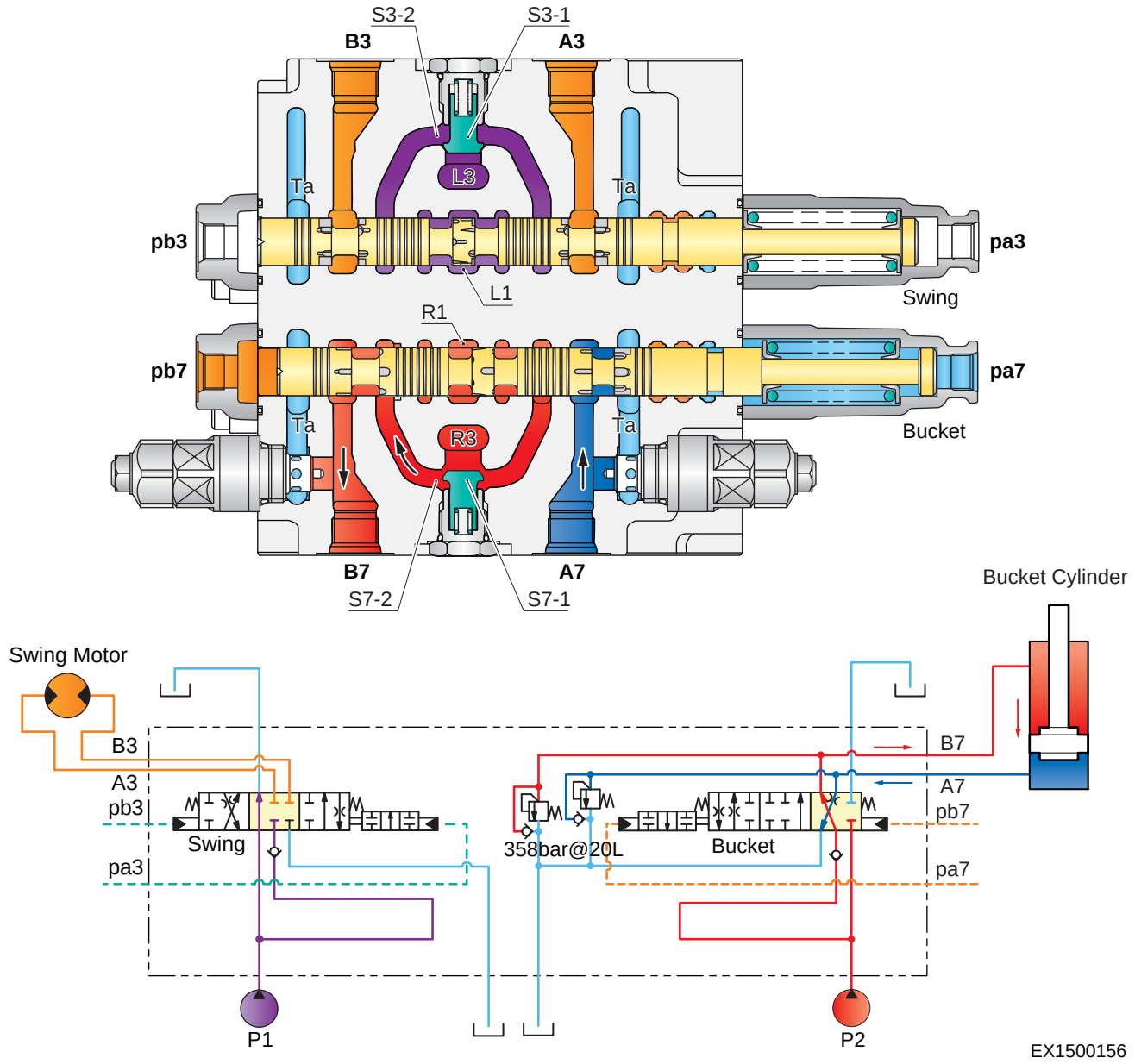



**Figure 15**

# PRECAUTION

Lower the work equipment to the ground and stop engine.

Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping

Loosen the breather slowly to release the pressure inside the hydraulic tank.

Escaping fluid under pressure can penetrate the skin causing serious injury.

When pipes and hoses are disconnected, catch the oil with an oil pan.

• Fitting

| Port | Name | Size | | (mm) | Torque | | |
|---|---|---|---|---|---|---|---|
| | | A | B (C) | | N.m | kg.m | ft lb |
| pa1, pa6, pa7 | Elbow | PF 3/8" | UNF 11/16"-16 | 22 | 58.8 | 6 | 43.4 |
| pa3, pa9 | Adapter | PF 3/8" | UNF 11/16"-16 | 22 | 58.8 | 6 | 43.4 |
| pa4, pa5 | Tee | PF 3/8" | UNF 11/16"-16 | 22 | 58.8 | 6 | 43.4 |
| pa8 | Tee | PF 3/8" | UNF 11/16"-16 (with PF 1/4" port) | 22 | 58.8 | 6 | 43.4 |
| | Elbow | PF 1/4" | PF 1/4" | 17 | 39.2 | 4 | 28.9 |
| par1 | Elbow | PF 1/4" | UNF 9/16"-18 | 19 | 34.3 | 3.5 | 25.3 |
| DR | Adapter | PF 1/4" | PF 1/4" | 19 | 34.3 | 3.5 | 25.3 |
| | Tee | PF 1/4" | UNF 9/16"-18 | 19 | 39.2 | 4 | 28.9 |
| PP | Reducer Filter | PF 1/4" | PF 1/4" | 19 | 34.3 | 3.5 | 25.3 |
| | Tee | PF 1/4" | UNF 9/16"-18 | 19 | 39.2 | 4 | 28.9 |
| PH | Adapter | PF 1/4" | UNF 9/16"-18 | 19 | 34.3 | 3.5 | 25.3 |
| pa1, pa3, pa4, pa5, pa6, pa7, pa9 | O-ring | S8000145 (4D P14) | S8030061 (1B F-06) | | | | |
| pa8 | O-ring | S8000145 (4D P14) | S8000115 (4D P11), S8030061 (1B F-06) | | | | |
| par1, DR, PP, PH | O-ring | S8000115 (4D P11) | 2180-1216D11 (ID:7.65, W:1.78, 1B) | | | | |

* A: Opposite side of hose, B (C): Hose side

# REASSEMBLY

## Caution on Assembly

### Caution on Handling O-ring

1. DO NOT use the O-ring which has a cut or hangnail.
2. Put grease on O-ring and the place which O-ring attached enough to lubricate for reassembly.
3. DO NOT stretch O-ring as it changes original shape.
4. Attach O-ring without twist.
   Twisted O-ring may lose its seal function.

### Caution on Handling Spool

1. Apply recommended torque on thread.
   Excessive torque may cause the movement trouble.
2. Each part must be combined as it was.

### Spreading Adhesive on Thread

1. Washing
   Clean the thread in vapor wash by acetate rayon or ether.
2. Dry
   Dry the thread out by compressed air, to get firm joint.
3. Adhesive application
   Put proper quantity of adhesive "Loctite® #638 equivalent" 2 or 3 rolls on near edge of external thread.
   Be careful that adhesive is not put on spring sheet.

**CAUTION**

**AVOID INJURY**

**When working with Loctite®, work in a place that is well ventilated.**

4. Interval of hardening
   To get firm joint, leave tightened parts following hours in the air.
   - Atmosphere temperature 40°C: over 3 hours
   - Atmosphere temperature 22°C: over 8 hours
   - Atmosphere temperature 5°C: over 24 hours

3. Turn the adjuster clockwise until desired pressure is reached.

   212 bar (216 kg/cm$^2$, 3,074 psi) of pressure is increased by each turn of the adjuster.

4. When the specified pressure is reached, press the adjuster so it does not rotate, and tighten the locknut.

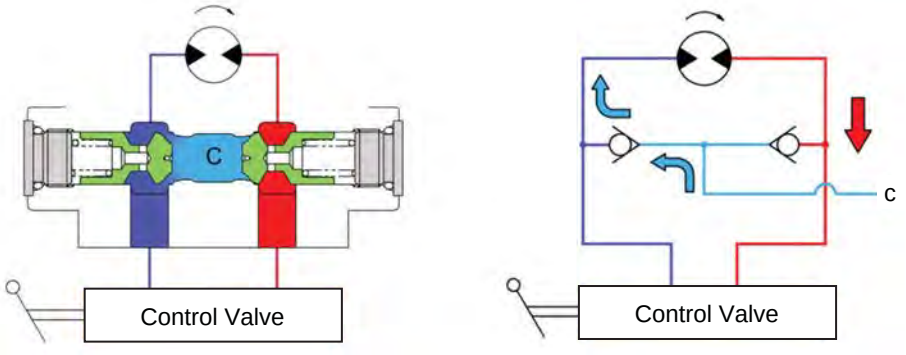
   - Torque: 27 ~ 31 N.m (2.8 ~ 3.2 kg.m, 19.9 ~ 22.9 ft lb)

5. Raise the pressure again to check the rated pressure has been obtained.

**Valve Casing**

1. Anticavitation check valve

   This motor has no valve which has counterbalance function, the motor may rotate exceeding the feed oil flow. To prevent cavitation, suck in deficient oil through the check valve.

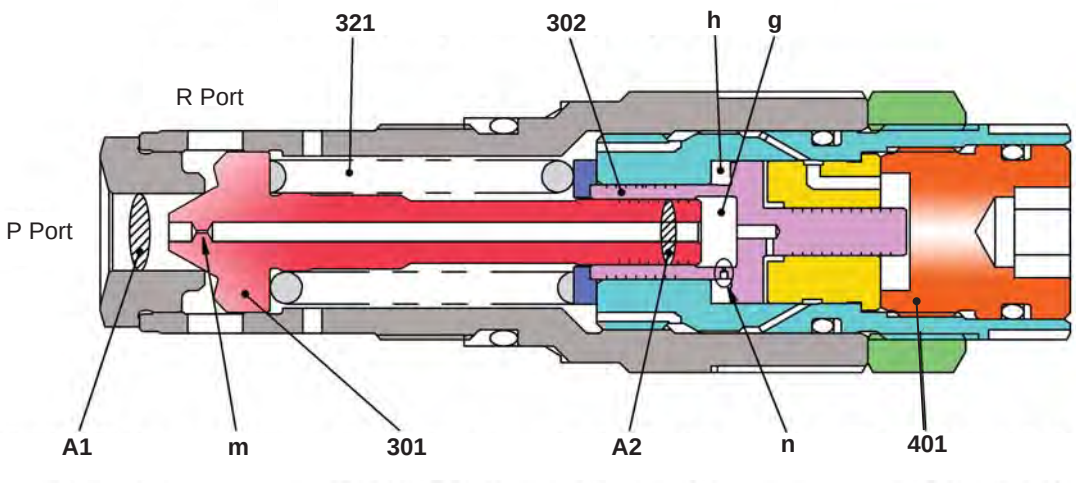



EX1301686

**Figure 6**

2. Relief valve

   Lets assume that port P is pressurized from the tank pressure. Initially, ports P and R are at tank pressure.




EX1403242

**Figure 7**

When the two forces; the force defined by the product of the area (A1) of plunger (301) receiving pressure and pressure P1; and the force defined by the product of spring (321) force (Fsp) and pressure-receiving area (A2) of plunger (301) by the pressure Pg in the chamber g; become the same, the relief valve starts to function.

16. Remove hoses and adapters from swing device.

**NOTE:** *Attach an identification tags to the removed hoses for reassembling.*
*After disconnecting hoses, plug them to prevent dirt or dust from entering.*
*Disconnect the hoses from the bottom to top of swing device.*

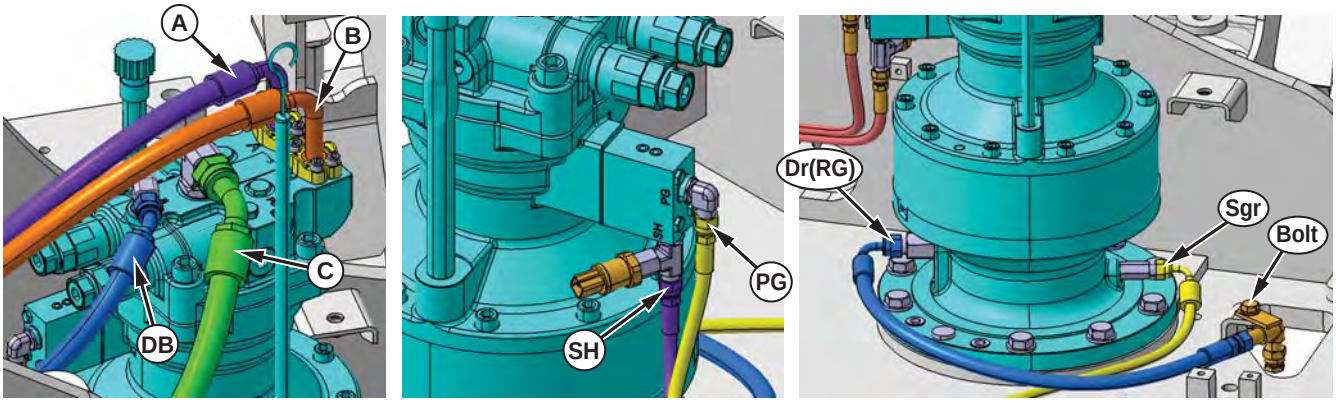



**Figure 30** EX1501751

- Hoses and plugs ports

| Port | Name | Plug/Flange Size (Hose) | (mm) | (mm) | Torque | | |
|---|---|---|---|---|---|---|---|
| | | | | | N.m | kg.m | ft lb |
| A | Main Port (from MCV "B3") | SAE 1/2", D13 | | 6 | 29.4 | 3 | 21.7 |
| B | Main Port (from MCV "A3") | SAE 1/2", D13 | | 6 | 29.4 | 3 | 21.7 |
| C | Make-up Port (from MCV "T1") | UNF 1 3/16"-12-2B | 36 | | 124.5 | 12.7 | 91.8 |
| DB | Drain Port (Connect with Center Joint) | UNF 13/16"-16-2B | 24 | | 55.9 | 5.7 | 41.2 |
| PG | Brake Release Port (from MCV "PP") | UNF 9/16"-16-2B | 19 | | 25.5 | 2.6 | 18.8 |
| SH | Brake Release Signal (from MCV "PA") | UNF 9/16"-16-2B | 19 | | 25.5 | 2.6 | 18.8 |
| | Pressure Sensor | PF 1/4" | 27 | | 5.9 | 0.6 | 4.3 |
| Sgr | Grease Inlet Port | PF 1/4" | 19 | | 39.2 | 4 | 28.9 |
| Bolt | Bolt | M10 x 1.5 | 17 | | 49.0 | 5 | 36.2 |
| Dr (RG) | Drain (Reduction Gear) | PF 3/8" | 22 | | 49.0 | 5 | 36.2 |

- Fitting

| Port | Name | Size | | (mm) | Torque | | |
|---|---|---|---|---|---|---|---|
| | | A | B (C) | | N.m | kg.m | ft lb |
| C | Elbow | PF 3/4" | UNF 1 3/16"-12 | 36 | 166.6 | 17 | 122.9 |
| DB | Elbow | PF 3/8" | UNF 13/16"-16 | 22 | 73.5 | 7.5 | 54.2 |
| PG | Elbow | PF 1/4" | UNF 9/16"-18 | 19 | 36.3 | 3.7 | 26.8 |
| SH | Tee | PF 1/4" | UNF 9/16"-18, PF 1/4" | 19 | 36.3 | 3.7 | 26.8 |
| | Reducer | PF 1/4" | PF 1/4" | 19 | 39.2 | 4 | 28.9 |
| Sgr | Adapter | PT 1/8" | PF 1/4" | 17 | 13.7 | 1.4 | 10.1 |
| Dr (RG) | Adapter | PT 1/2" | PF 3/8" | 27 | 44.1 | 4.5 | 32.5 |
| A, B | Ring Seal | DS2856001 (1/2", ID:18.9, OD:25.9, 1B) | | | | | |
| C | O-ring | S8000235 (4D P22.4) | S8030125 (4D F-12) | | | | |
| DB | O-ring | S8000145 (4D P14) | S8030081 (1B F-08) | | | | |
| PG | O-ring | S8000115 (4D P11) | 2180-1216D11 (ID:7.65, W:1.78, 1B) | | | | |
| SH | O-ring | S8000115 (4D P11) | 2180-1216D11 (ID:7.65, W:1.78, 1B) | | | | |

* A: Opposite side of hose, B (C): Hose side

13. Remove spherical roller bearing (3) and cover (6) from pinion shaft (2).

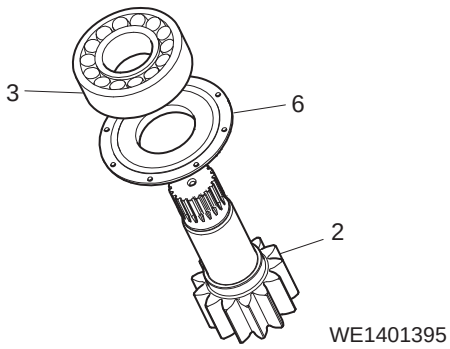



**Figure 68**

14. Remove oil seal (5).

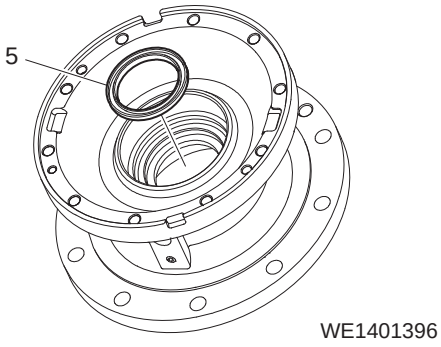



**Figure 69**

Now, disassembling has been completed. Check that all the parts are in good condition.

6. Oil leak

1) Leak at oil seal

| Symptom | Possible Cause | Corrective Action |
|---|---|---|
| Leak at oil seal | 1. The lip is damaged by dust. | 1. Replace the oil seal. |
| | 2. Worn or damaged shaft. | 2. Change the relative position of the lip and shaft, or replace the lip. |
| | 3. Oil seal lip is overturned because of excessively high-pressure in the casing. | 3. Repair clogged pipeline. |
| | 4. Rusted shaft. | 4. Disassemble and correct it. |

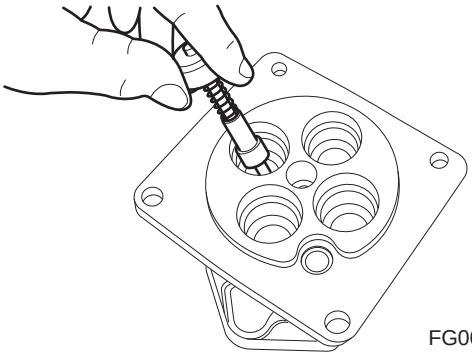
2) Oil leak at joint surface

| Symptom | Possible Cause | Corrective Action |
|---|---|---|
| Oil leak at joint surface | 1. O-ring is missing. | 1. Insert correctly and reassemble |
| | 2. O-ring is damaged. | 2. Replace. |
| | 3. Seal surface is damaged. | 3. Disassemble and correct it |
| | 4. Loose or damaged bolt. | 4. Tighten at specified torque or replace the bolt |

| Reference Number | Description |
|---|---|
| 1 | Case |
| 2 | Plug |
| 3 | Bushing |
| 4 | Spool |
| 5 | Shim |
| 6 | Spring |
| 7 | Spring Seat |
| 8 | Stopper |
| 9 | Spring |
| 10 | Stopper |
| 11 | Spring |
| 12 | Push Rod |
| 13 | Spring |
| 14 | Spring Seat |
| 15 | Stopper |
| 16 | Plug |

| Reference Number | Description |
|---|---|
| 17 | O-ring |
| 18 | Rod Seal |
| 19 | Plate |
| 20 | Boot |
| 21 | Joint Assembly |
| 22 | Swash Plate |
| 23 | Nut |
| 24 | Nut |
| 25 | Joystick (LH) |
| | Joystick (RH) |
| 25-1 | Push Button Switch |
| 25-2 | Thumb Switch |
| 26 | Handle Bar |
| 28 | Bellows |
| 29 | Bushing |
| 30 | Washer |

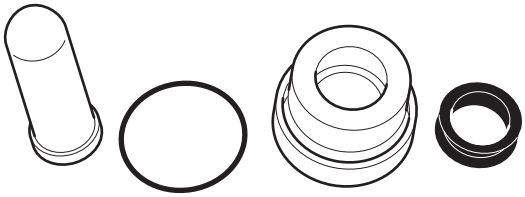
5. Install spool kit assembly into case (1). (The same way is used for four parts.)



FG000821

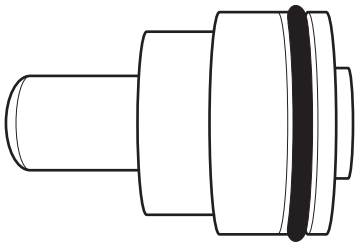
**Figure 50**

6. Assemble plug kit insert rod seal (18), O-ring (17), and push rod (2) into plug (16) in proper order.



FG000822

**Figure 51**

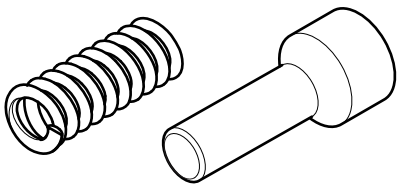


FG000810

**Figure 52**

7. Assemble four springs (11) and stoppers (10) and insert assembled set in case (1) to form a plug kit assembly.

   **NOTE:** *Pay attention to measurement specifications of stoppers (1 and 3, 2 and 4).*



FG000809

**Figure 53**

### Function

It is used to reduce the primary pressure delivered from the pilot gear pump to the secondary pressure level to control the control valve dozer spool.

1. Neutral position

   While the dozer valve is in the neutral position, the spring seat (5-1), spool (5-2) and push rod (6-4) have been pushed upwards by the spring (4).

   The oil with the primary pressure flowed into the dozer valve through the port P.

   Keeps blocked by the spool (5-2).

   The operating ports (1 and 2) are connected to the port T.

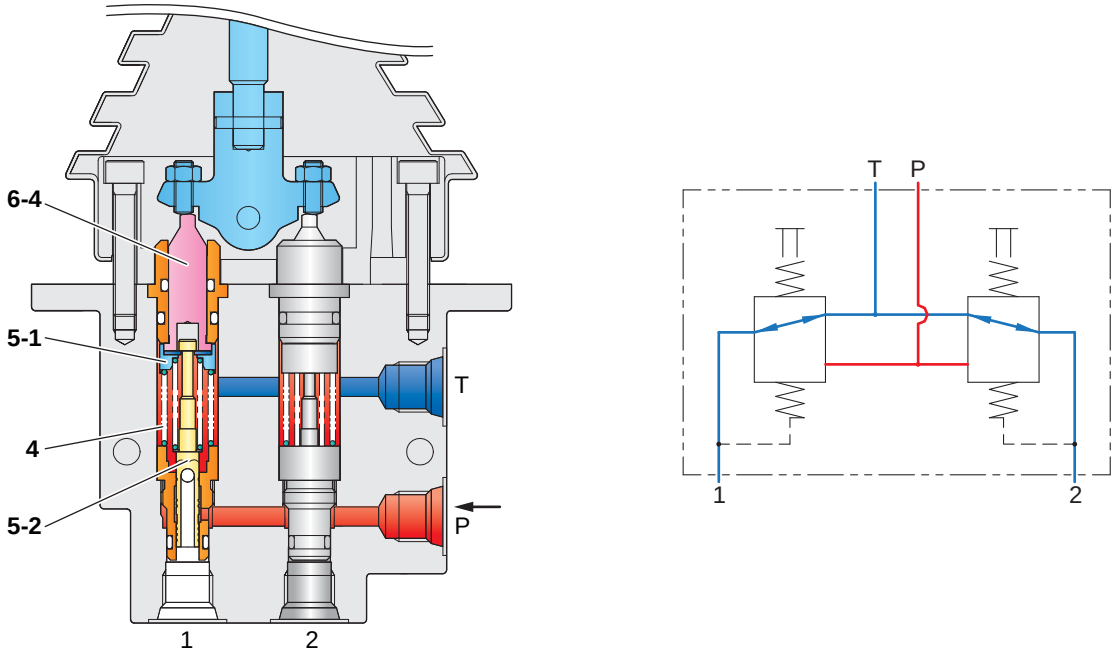



**Figure 5**

EX1403273

7. Assemble cover (14) in the body (1) with wrench bolt.


**Figure 38**

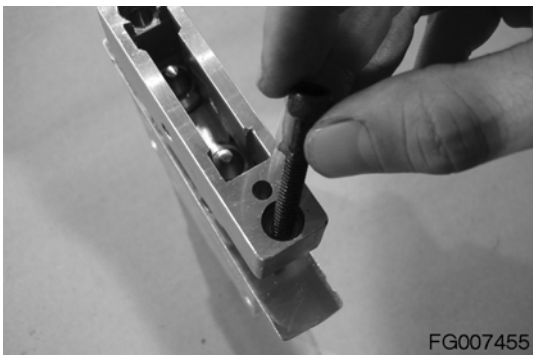



**Figure 39**

8. Assemble wrench bolt (15) in the body (1) with torque wrench.

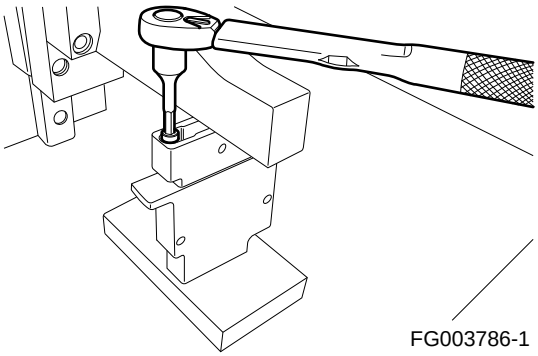



**Figure 40**

9. Assemble socket bolt (18) and nut (19) in the guide (16).

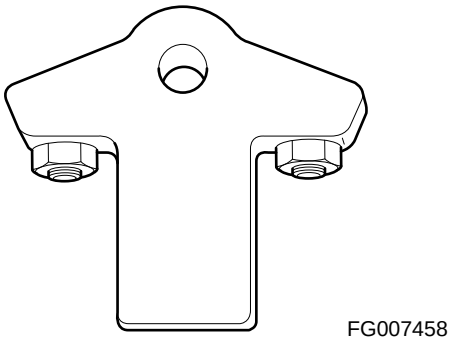



**Figure 41**

2. Operation When Operating Lever In Neutral Condition
Climbing restoring force acting on push rod, raises piston in oil pressure prevention chamber and compresses upper oil pressure prevention chamber. This compression operation of upper oil pressure prevention chamber prevents the push rod from quickly rising by restoring spring, and the damping force is generated.

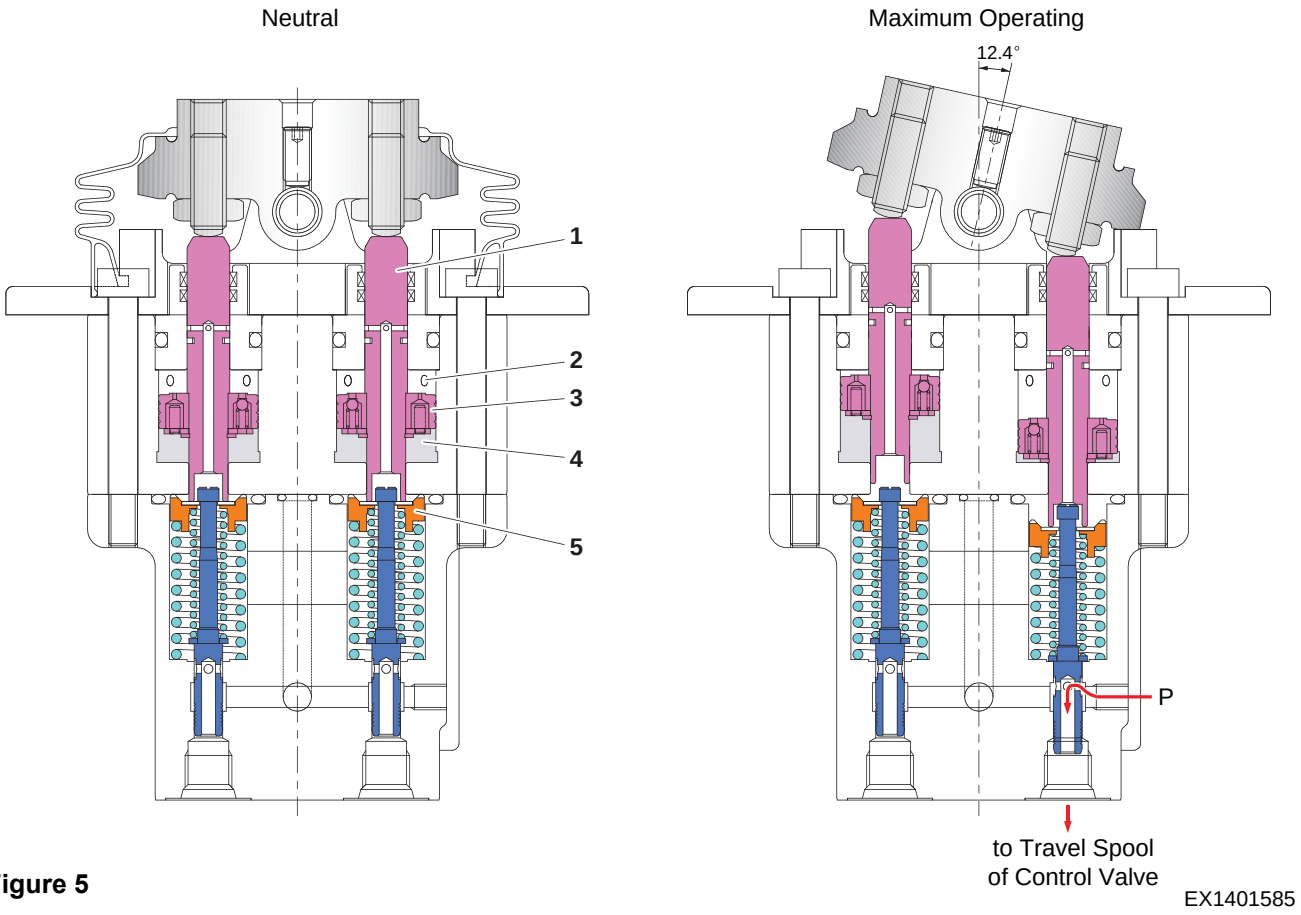



**Figure 5**

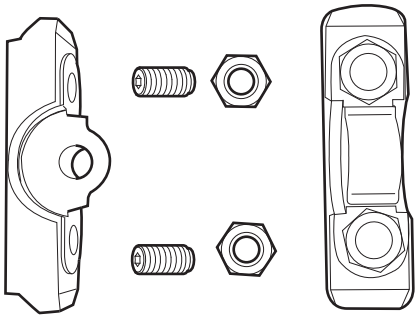
| Reference Number | Description |
|---|---|
| 1 | Push Rod |
| 2 | Orifice |
| 3 | Piston |

| Reference Number | Description |
|---|---|
| 4 | Piston Chamber |
| 5 | Plug |

## Tools and Torques

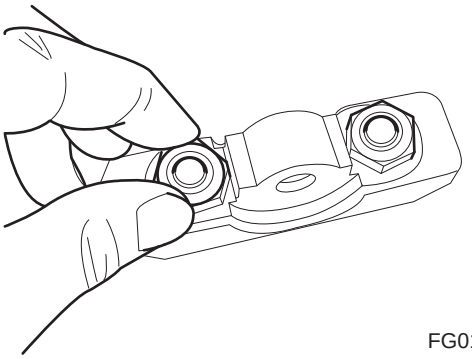
| Reference Number | Description | Size | Torque | | | Tool |
|---|---|---|---|---|---|---|
| | | | Nm | kg.m | ft lb | |
| 25 | Socket Bolt | M6 | 29.4 | 3 | 6 | 5 mm ( ) |
| 31 | Nut | M10 | 43.1 | 4.4 | 32 | 17 mm ( ) |

11. Install set screws (30) and hex nut (31) into cam (26) and tighten it.



FG013555

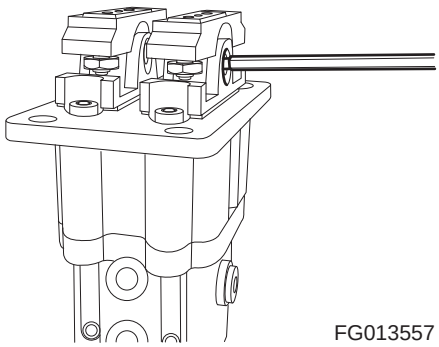
**Figure 44**



FG013556

**Figure 45**

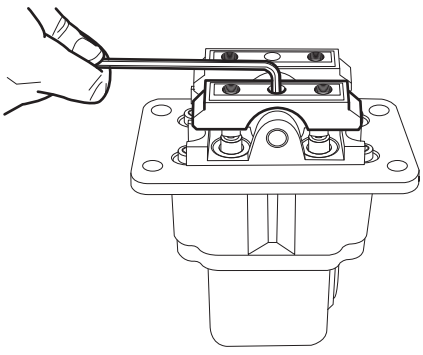
12. Position cam (26) on cover (24) and insert camshaft (29) using hammer.



FG013557

**Figure 46**

13. Install set screw (29) in cam (26) and tighten it using torque wrench.



FG013558

**Figure 47**

# TROUBLESHOOTING

| Symptoms | Causes | How to Check | Solutions |
|---|---|---|---|
| Malfunction of solenoid valve | Foreign substance, dirt and dust in solenoid valve. | Disassemble the solenoid valve and check if there is any contamination such as a foreign substance and sludge between the case and the spool. | Remove contaminant, wash, and assemble components. |
| | Tube or retainer of solenoid valve damaged. | Disassemble the solenoid valve and check if there is any deformation (bending or reduction) in the tube or the retainer. | Replace solenoid valve. |
| | Coil broken, short, or burned. | Disassemble the solenoid valve and check the coil resistance.<br>Spec: 26.7Ω @ 20°C<br>Disconnection: ∞<br>Short: Low or excessive resistance<br>Disassemble the solenoid valve and check the outside of the coil to see if its casing is burned and melted. | Replace coil. |
| | Connector terminal ground defect. | Check if the connector (valve side) and housing (where harness is attached) are grounded properly. | Replace coil or housing. |
| Pilot pressure fails to generate; | Pilot pressure. | Remove plug of the "P2" port, install a pressure gauge, and check the pilot pressure discharged from the pilot pump when operating the pilot cut-off valve (C1). | Refer to "Causes" and "How to Check" of the solenoid valve above. |
| | Pilot relief valve. | Check if the relief valve installed in the pilot line operates properly.<br>• Check if pressure is bypassing because of the presence of foreign substance. | Remove foreign substance, reassemble, and replace the relief valve. |
| | Pilot pump. | Check if the pilot pump works properly. | Replace the pilot pump. |
| Poor Actuator Performance | Pilot system. | Check any defect of the pilot system considering findings from "Pilot pressure fails to generate;" category. | Repair defect(s) accordingly. |
| | Solenoid valve. | Install a pressure gauge at each outlet port of the solenoid valve (H0, TR2 and PH ports) and check the pressure value discharged from the pilot pump when operating the solenoid valve. | Refer to "Causes" and "How to Check" of the solenoid valve above. |
| | Main control valve. | Check if main control valve of each component works properly. | Repair according to findings. |
| | Other components. | Check if each component works properly. | Repair according to findings. |

# SAFETY INSTRUCTIONS

## WARNING

**AVOID DEATH OR SERIOUS INJURY**

**Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.**

# GENERAL

The accumulator is a gas-charged storage device designed to hold a reserve quantity of hydraulic fluid under pressure. Accumulators are used in hydraulic circuits in much the same way that condensers (or capacitors) are used to collect, store and maintain electrical charge in a circuit.

In a hydraulic circuit, minor variations or lags in pump output that might otherwise cause unsteady or irregular operation are made up from the supply of pressurized oil in the accumulator.

| Reference Number | Description |
|---|---|
| 1 | Screw Plug |
| 2 | Steel Pressure Vessel |
| 3 | Diaphragm |
| 4 | Fluid Valve |

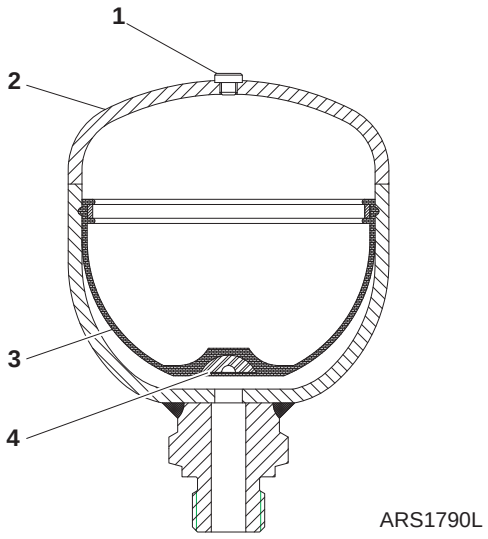



**Figure 1**

Accumulators are solidly constructed to resist the high operating pressures of the fluids they contain. There are only three main moving parts: a plug at the top allows precharging or expelling gas from the compressible, precharged upper chamber; a valve assembly at the bottom of the accumulator for passing hydraulic fluid in and out, and an elastic diaphragm to separate the two chambers. The flexible diaphragm changes shape to conform to the changing pressures and volumes of the two fluids in the upper and lower chambers.

3. Install retaining ring in groove.

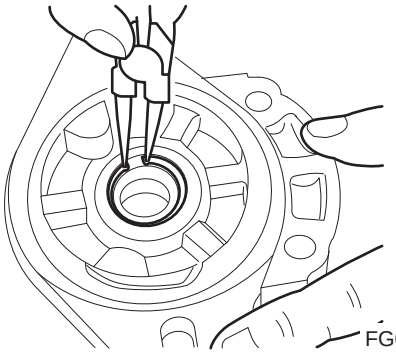



**Figure 16**

4. Install O-ring on both sides of rear section of body.

   **NOTE:** *Coat O-rings with grease to hold O-rings in body.*

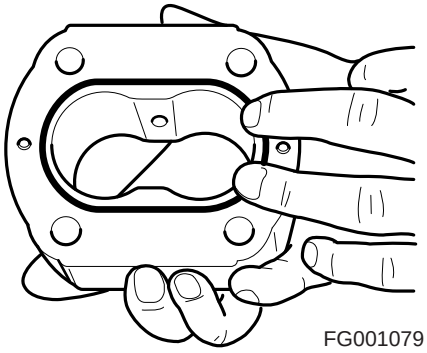



**Figure 17**

5. Install rear section body on rear cover.

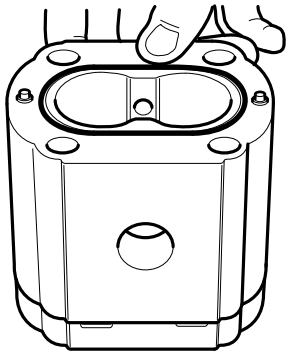



**Figure 18**

6. Install seals in pressure plate (s) groove. Then install backup ring in groove with seals. Coat seals with grease.

   **NOTE:** *The front and rear pressure plates and seals and backup rings are the same.*

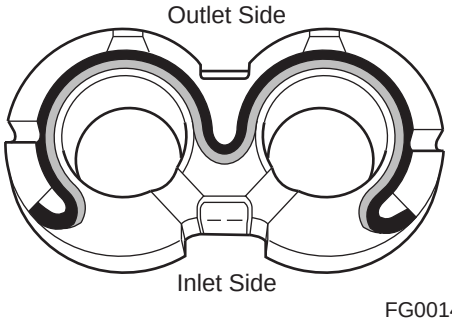



**Figure 19**

2. Removing Spool

After fixing the main body and removing the return spring and the spring seat first, pull the spool in the horizontal direction (parallel to the spool hole) to remove it from the main body.

Too much impressed force for disassembly may damage the spool. When the spool is stuck, therefore, push it back smoothly and try to pull the spool while rotating it.

While removing the spool, check which end has the mark.


**Figure 8**

3. Assembling Spool

Insert the spool into the fixed main body. (Overloaded force may damage the main body or the spool. When the spool is stuck, pull it back and press it smoothly while rotating it.)

Check the direction of the mark, identified during the disassembly operation.

Assemble the spring seat and the spring.

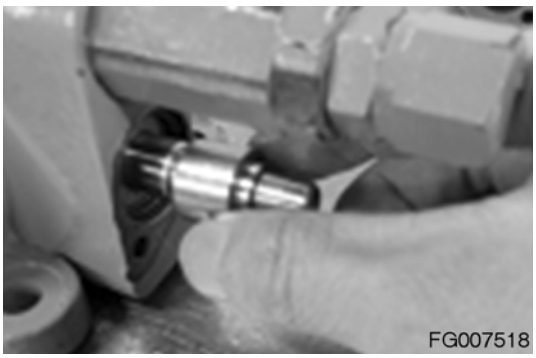



**Figure 9**


**Figure 10**

4. Assembling Pilot Cap (on Return Spring Side)

Cover the pilot cap on the return spring of the spool, previously assembled to the main body, and fasten it with two bolts at the specified standard torque using a torque wrench (5mm). Check if there is the O-ring on the contacting surface.

- Torque: 10.8 N.m (1.1 kg.m, 8 ft lb)

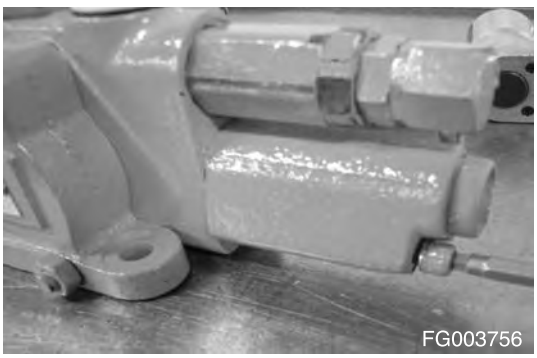



**Figure 11**

### Operating Recommendation

The service life of the swing bearing may be extended if a daily effort is made to equalize usage over both ends of the excavator. If the excavator is used in the same operating configuration day in and day out (for example, with the travel motors always under the counterweight, or with the attachment over one side of the machine more than the other), the bearing's service life could be reduced. Repositioning the excavator during the work shift, to work the opposite end of the bearing, will provide a more even and gradual rate of wear and extended service life.

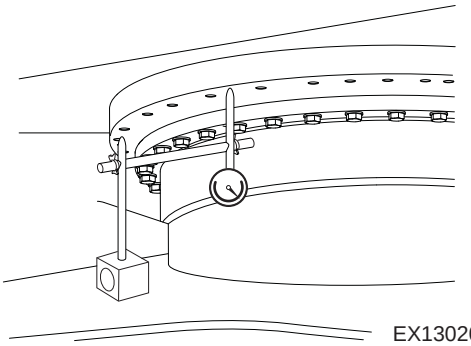



**Figure 2**

### Measuring Swing Bearing Axial Play

Regular checks of bearing displacement must be made at least twice a year. Use a dial indicator. With the arm cylinders fully retracted and the bucket cylinders fully extended, position the arm tip pin height is flush with the boom foot pin height. (Figure 3)

Push the attachment against the ground to lift up the excavator above the ground and take measurements at 4 points, 90° apart, around the circumference of the bearing.

Record and keep all measurements. Play in the bearing should increase minimally from one inspection to the next.

Eventually, however, as the bearing begins to approach the limit of its service life, clearance increases become much more pronounced and the actual measured play in the bearing could exceed twice the value that was measured when the machine was new.

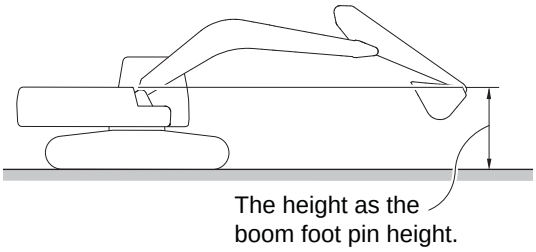



**Figure 3** Measurement (h1)

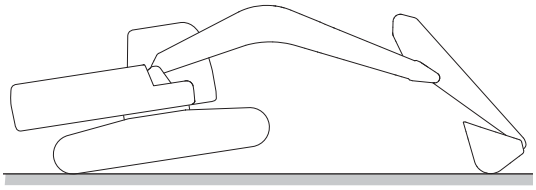



**Figure 4** Measurement (h2)

### Measuring Bearing Lateral Play

When vertical checks are made, the side to side play in the bearing can be checked by fully retracting the arm and bucket cylinders and extending the tip of the bucket as far forward as it will go. With the excavator parked on a flat, level surface and the bucket tip just off the ground, push against the bucket sideways to take up all the lateral clearance in the bearing. (Less than 100 lb of force must be required to move the bucket over all the way.) Check lateral play in both directions and record the values. When the bearing is beginning to approach the end of its service life, the measured lateral clearance should start to show increase in value.

12. Remove bolts (1, Figure 9) (4 ea) with under covers (2) from frame.

    - Tool: 19 mm ( )
    - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
    - Under cover weight: about 9 kg (19.8 lb)

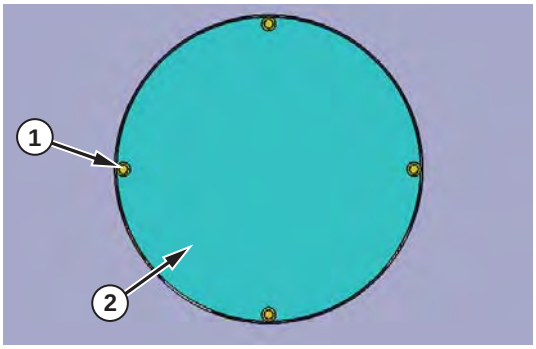



**Figure 9** Bottom of Track Frame EX1403118

13. Remove hoses and adapters (Figure 10) from center joint.

    **NOTE:** *Attach identification tags to the removed hoses for reassembling.*

    *After disconnecting hoses, plug them to prevent dirt or dust from entering.*

    *Disconnect the hoses from the bottom to top of center joint.*

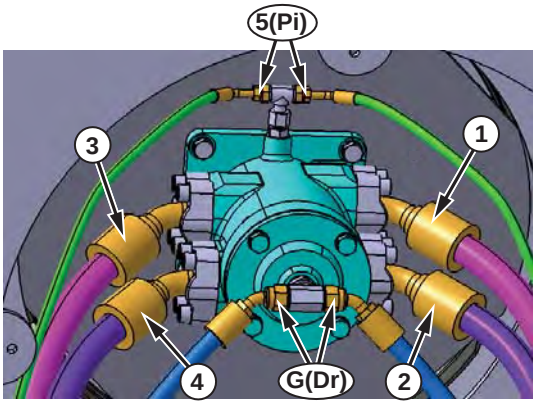



**Figure 10** Hub of Center Joint EX1501819

- Hoses and plugs ports

| Port | Name | Plug/Flange Size (Hose) | (mm) | (mm) | Torque | | |
|---|---|---|---|---|---|---|---|
| | | | | | N.m | kg.m | ft lb |
| G (Dr) | Drain | UNF 13/16"-16-2B | 24 | | 55.9 | 5.7 | 41.2 |
| | | UNF 13/16"-16-2B | 24 | | 55.9 | 5.7 | 41.2 |
| 1 | to Travel Motor (LH) "P1" | SAE 1", D24.5 | | 10 | 97.0 | 9.9 | 71.6 |
| 2 | to Travel Motor (LH) "P2" | SAE 1", D24.5 | | 10 | 97.0 | 9.9 | 71.6 |
| 3 | to Travel Motor (RH) "P2" | SAE 1", D24.5 | | 10 | 97.0 | 9.9 | 71.6 |
| 4 | to Travel Motor (RH) "P1" | SAE 1", D24.5 | | 10 | 97.0 | 9.9 | 71.6 |
| 5 (Pi) | Pilot (2-speed) | UNF 9/16"-16-2B | 19 | | 25.5 | 2.6 | 18.8 |
| | | UNF 9/16"-16-2B | 19 | | 25.5 | 2.6 | 18.8 |

- Fitting

| Port | Name | Size | | (mm) | Torque | | |
|---|---|---|---|---|---|---|---|
| | | A | B (C) | | N.m | kg.m | ft lb |
| G (Dr) | Tee | PF 1/2" | UNF 13/16"-16 | 27 | 84.3 | 8.6 | 62.2 |
| 5 (Pi) | Tee | UNF 9/16"-18 | UNF 9/16"-18 | 19 | 25.5 | 2.6 | 18.8 |
| | Adapter | PF 1/4" | UNF 9/16"-18 | 19 | 35.3 | 3.6 | 26.0 |
| G (Dr) | O-ring | S8000185 (4D P18) | S8030081 (1B F-08) | | | | |
| 1, 2, 3, 4 | Ring Seal | DS2856003 (1", ID:33.2, OD:40.2, 1B) | | | | | |
| 5 (Pi) | O-ring | S8000115 (4D P11) | 2180-1216D11 (ID:7.65, W:1.78, 1B) | | | | |

* A: Opposite side of hose, B (C): Hose side

# SAFETY INSTRUCTIONS

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# GENERAL

## General Description

The center joint is designed to allow hydraulic oil from the upper structure to flow to components in the lower structure.

It is capable of allowing continuous 360° rotation of the upper structure in relationship to the lower structure.

And this center joint has a function to operate the dozer through the dozer cylinder.

# REASSEMBLY

## IMPORTANT

**Apply a very light film of white grease inner surface of the hub.**

1. Assemble the slipper seal (7, Figure 22) (9 ea), O-ring (8) (1 ea), O-ring (9) (1 ea) and dust seal (19) (1 ea) into the hub.

## CAUTION

**AVOID INJURY**

**After assembling the slipper seal, a manual test must be performed to ensure that every part is assembled properly.**

## IMPORTANT

**For any slipper seal which is protruded, press it with finger to seat it in its position. Care must be taken when using a driver or a metal tool, which can cause damage the seal.**

## IMPORTANT

**Applying oil to the surface of the spindle will help prevent damage to the slipper seal.**

2. Fix the position of the spindle and press the hub carefully into spindle with both being parallel each other. (Figure 23)
3. Use a plastic (or rubber) hammer to tap the hub until it is inserted completely.

## IMPORTANT

**Tap the Hub in a zigzag pattern so it does not tilt to one side.**

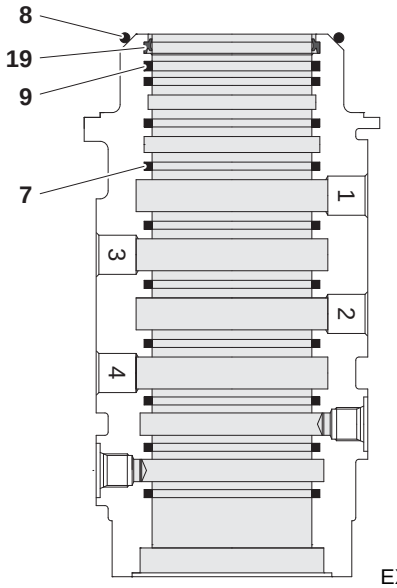



**Figure 22**

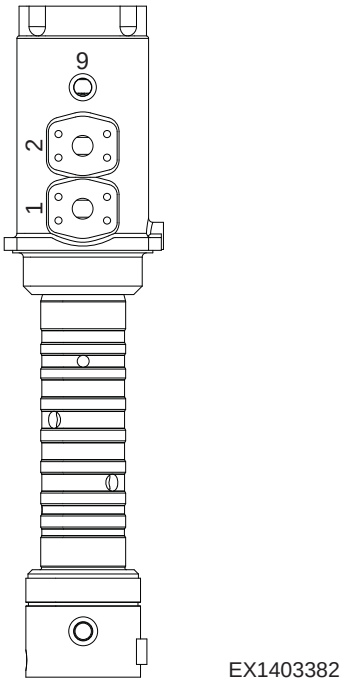



**Figure 23**

| Reference Number | Description |
|---|---|
| 1 | Spindle |
| 2 | Seal, Floating |
| 3 | Hub |
| 4 | Ring, O |
| 5 | Ring, Snap |
| 6 | Bearing, Angular |
| 7 | Seal, Ring |
| 8 | Nut, Ring |
| 9 | Plug; Hex. Socket |
| 10 | Washer, Thrust |
| 11 | Collar |
| 12 | Bearing, Needle |
| 13 | Gear; Planetary |
| 14 | Plate, Thrust |
| 15 | Screw |
| 16 | Gear, Sun |

| Reference Number | Description |
|---|---|
| 17 | Ring, Snap |
| 18 | Holder |
| 19 | Bushing |
| 20 | Bearing, Needle |
| 21 | Gear; Planetary |
| 22 | Plate, Thrust |
| 23 | Bolt M8 x 1.25 x 16 |
| 24 | Gear, Drive |
| 25 | Cover |
| 26 | Plate; Thrust |
| 27 | Washer; Thrust |
| 28 | Plug |
| 29 | O-ring |
| 30 | Bolt; Socket M10 x 1.5 x 25 |
| 64 | Ring, O |
| * | Seal Kit; Travel Motor |

*: 4, 64

# REMOVAL

## WARNING

**AVOID DEATH OR SERIOUS INJURY**

**Contact with hydraulic fluid can harm your health. (e.g. eye injuries, skin damage or poisoning, if inhaled).**

- **While performing removal and installation, wear safety gloves, safety glasses and suitable working clothes.**
- **If hydraulic fluid should come into contact with your eyes or penetrate your skin, consult a doctor immediately.**

## WARNING

**FIRE CAN CAUSE SERIOUS INJURY OR DEATH**

**Hydraulic fluid is highly flammable.**

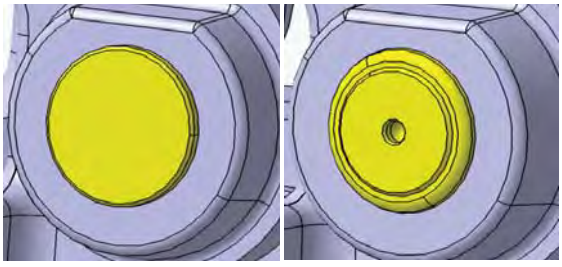
- **Keep open flames and ignition sources away from the workplace.**

## IMPORTANT

**Fluid such as engine oil, hydraulic fluid, coolants, grease, etc. must be disposed of in an environmentally safe manner. Some regulations require that certain spills and leaks on the ground must be cleaned in a specific manner. See local, state and federal regulations for the correct disposal.**

1. Position machine on a smooth level surface with adequate space. Move machine until master pin is positioned at approximately 4 o'clock.

**NOTE:**



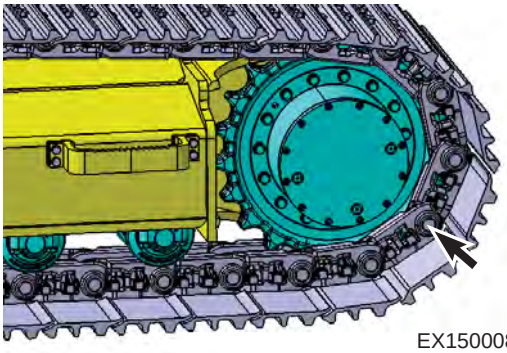
Regular Pin Master Pin

EX1400095

## CAUTION

**AVOID INJURY**

**Pressure of grease in adjuster cylinder is too high. Take precautions in opening valve against valve bounce or grease vent.**



EX1500081

**Figure 16**

20. Remove RO plug (45) from the rear flange (31).

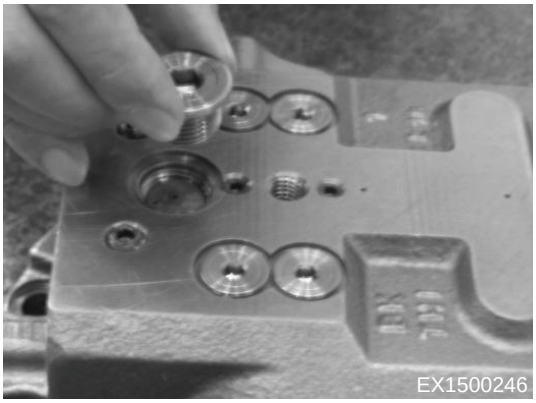



**Figure 49**

21. Remove 2-speed spool (47) and spring (44) from the rear flange (31).

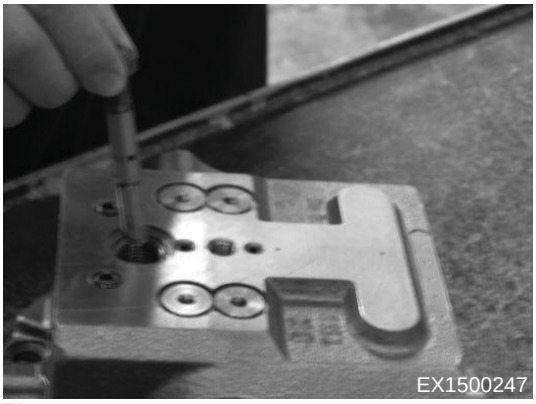



**Figure 50**

22. Press the valve seat with a steel bar, and insert a tapping bar into the opening of the T-valve ring (58) to remove the T-valve ring (58) from the rear flange (31).

    **NOTE:** *Remove T-valve ring (58) only to replace the T-valve (54).*

    *Do not reuse the removed T-valve ring (58), T-valve seat (56) and O-ring (57).*

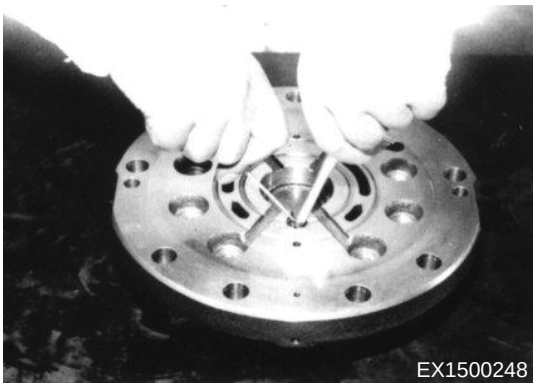



**Figure 51**

23. Plug the hole of the T-valve seat (56) and blow compressed air through the oil passage hole to remove the T-valve seat (56) from the rear flange (31).

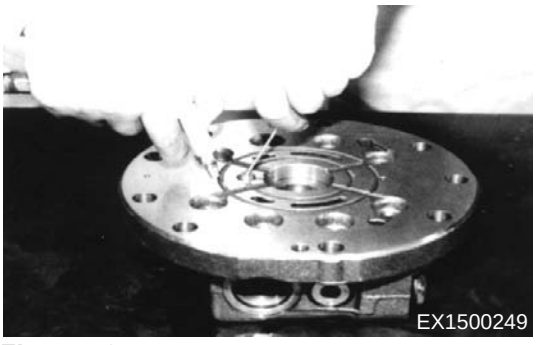



**Figure 52**

30. After installing the check plug (42), tighten it with a hex. wrench.

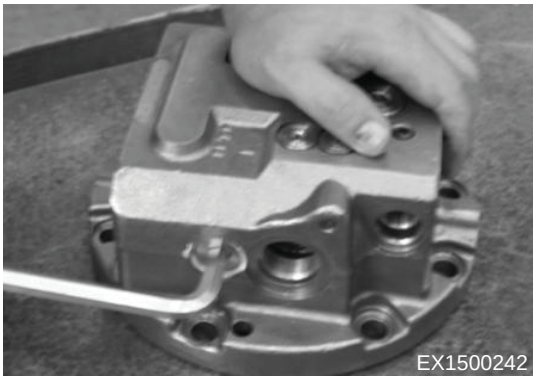



**Figure 100**

31. Install the main spool (32) to the rear flange (31).

    **NOTE:** *Before installing the main spool (32), apply operating oil to the main spool (32) and be careful not to damage the sliding surface of the main spool (32) and the inner surface of the rear flange (31).*

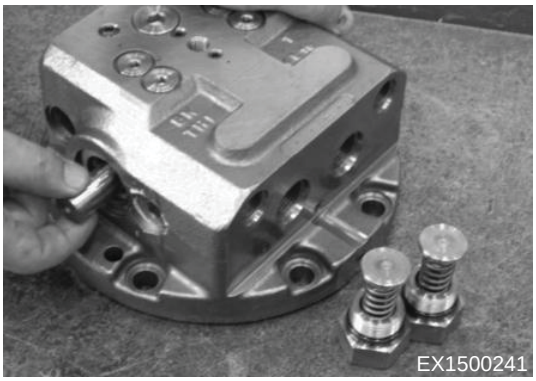



**Figure 101**

32. Install the O-ring (39) to the main plug (38).

    **NOTE:** *Apply grease onto the O-ring.*

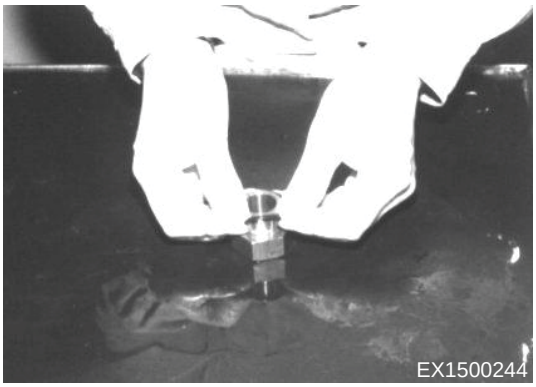



**Figure 102**

33. Install the stopper assembly and spring (37) to the main plug (38).
34. Install the plugs (38) (2 ea) to the rear flange (31).
35. Tighten the main plugs (38) with a spanner.

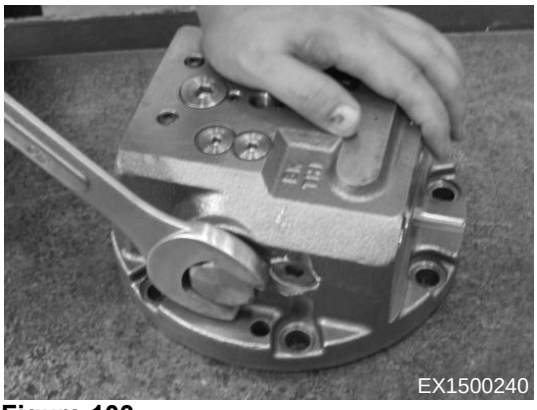



**Figure 103**

# SAFETY INSTRUCTIONS

## WARNING

**AVOID DEATH OR SERIOUS INJURY**

**Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.**

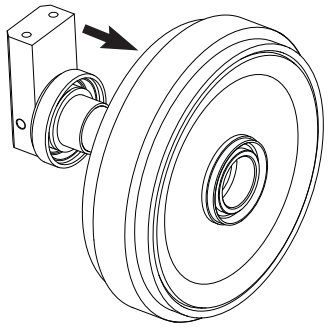
# GENERAL

The track assembly is composed of the following major components:

1. Track
2. Front Idler
3. Upper Roller
4. Lower Roller
5. Track Spring and Track Adjuster

7. Using the assembling jig, assemble floating seal (5-2E, Figure 15) at the front on which bushing has been assembled.
8. Apply oil to the lapped surface of the floating seal (5-2E, Figure 15) which was assembled with the bearing.

   **NOTE:** *Use gear oil (ISO VG 220EP) or higher grade.*
9. Assemble bearing subassembly with the front to which the bushing and floating seal have been assembled (Figure 24).



FG022552

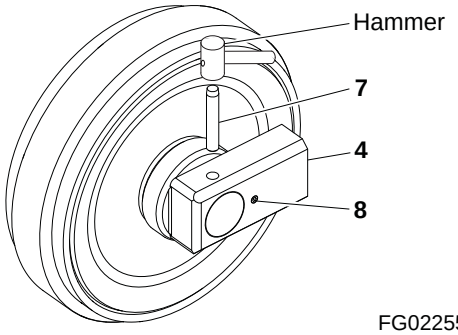
**Figure 24**

10. Assemble shaft (3, Figure 19) with O-ring (6, Figure 19). Apply oil to O-ring to prevent damage when assembling bearing.
11. Assemble the support (4, Figure 25) on which the floating seal has been assembled.
12. Insert pin (7, Figure 25).
13. Rotate bearing 3 rounds to left and right.
14. Install plug (8, Figure 25) to the support (4, Figure 25) on one side.
    - Tool: 6 mm ( )
    - Torque: 19.6 N.m (2 kg.m, 14.5 ft lb)
15. Inject oil through the plug hole.

    **NOTE:** *Oil quantity: 320 cc (10.8 oz) ±20 cc*
16. Assemble idler assembly with track spring assembly (Figure 26).

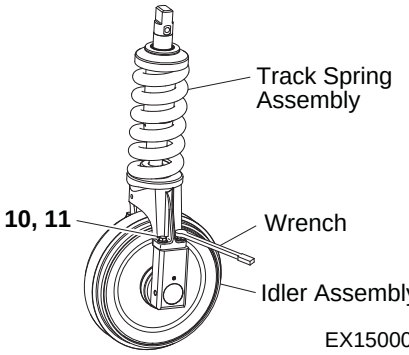
    Install bolt and washer (10 and 11, Figure 26).

    **NOTE:** *Apply Loctite® #243 to the bolt and washer (10 and 11, Figure 26).*
    - Tool: 24 mm ( )
    - Torque: 264.8 N.m (27 kg.m, 195.3 ft lb)




FG022553

**Figure 25**




EX1500015

**Figure 26**

# Front

# Bucket

Edition 1

# SAFETY INSTRUCTIONS

## WARNING

**AVOID DEATH OR SERIOUS INJURY**

**Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.**

# GENERAL

## General Description

Two essentially similar types of hydraulic cylinders are used on the excavator. The cylinder that is used to operate the excavator boom or bucket is equipped with a rod stopper, which acts as a cushion only when the cylinder rod is fully retracted (and the bucket is pulled close to the arm). This type of cylinder is shown in the below drawing. Arm cylinders have a cushion or stopper for operation in both directions.

## Specification

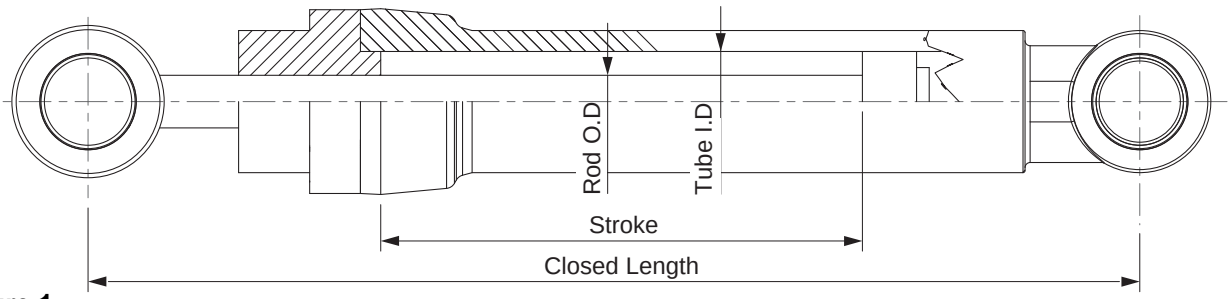



**Figure 1**

EX1400068

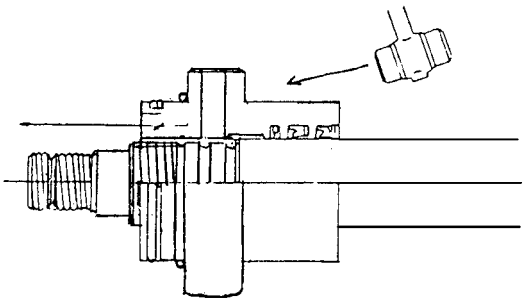
| | Boom (Mono) | Arm (Boom 4.6 m) | Bucket | Boom (Arti) | Arti Boom |
|---|---|---|---|---|---|
| Quantity | 2 | 1 | 1 | 2 | 1 |
| Tube I.D | ø110 | ø115 | ø100 | ø110 | ø140 |
| Rod O.D | ø75 | ø80 | ø70 | ø75 | ø85 |
| Stroke (mm) | 1,103 | 1,108 | 900 | 965 | 720 |
| Closed Length (mm) | 1,580 | 1,665 | 1,375 | 1,590 | 1,175 |
| Head End Cushion | X | O | X | X | X |
| Rod End Cushion | O | O | O | O | O |
| Weight (kg) | 120 | 143 | 86.5 | 121 | 150 |

| Reference Number | Description |
|---|---|
| 1 | Tube Assembly |
| 2 | Bush; Steel |
| 3 | Rod Assembly |
| 4 | Bush; Steel |
| 5 | Cover; Rod |
| 6 | DU-Bush |
| 7 | Ring, Retaining |
| 8 | Seal; Step |
| 9 | U-packing |
| 10 | Dust Wiper |
| 11 | Ring, Retaining |
| 12 | O-ring |
| 13 | Backup Ring |
| 14 | O-ring |

| Reference Number | Description |
|---|---|
| 15 | Washer |
| 16 | Piston |
| 17 | Seal; Slipper |
| 18 | Ring, Wear |
| 19 | Ring; Dust |
| 20 | O-ring 1BG-60 |
| 21 | Ring; Backup |
| 22 | Nut; Piston |
| 23 | Ring; Lock |
| 24 | Nipple; Grease |
| 25 | Valve; Check |
| 26 | Bolt, Socket |
| * | Seal Kit; Dozer Cylinder |

*: 8, 9, 10, 12, 13, 14, 17, 18, 19, 20, 21

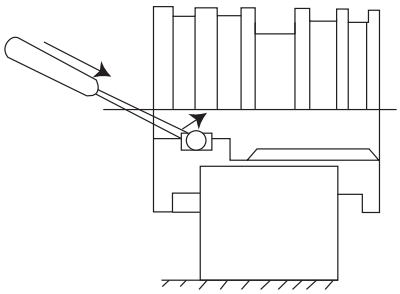
11. Use a plastic hammer to evenly pull off rod cover (5) from end of piston rod. Be careful not to damage rod bushing (6) and dust wiper, U-packing and other seals.



HAOF350S

**Figure 31**

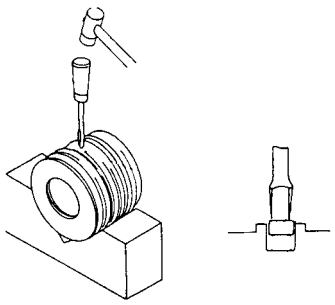
12. Use a dull, rounded tip tool to pry off O-ring (13) and backup ring (14).



HAOF37OL

**Figure 32**

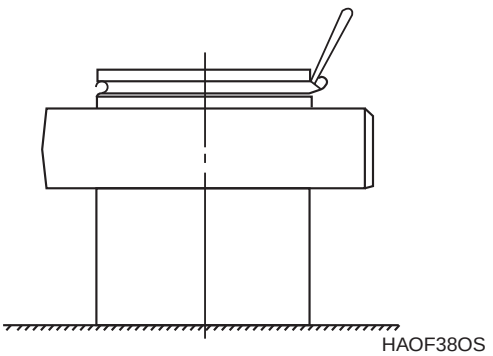
13. Find a screwdriver with an appropriate width tip to facilitate removal of slipper seal (18), wear ring (19) and slide ring (20) from piston (17).



0345

**Figure 33**

14. Remove O-ring (21) and backup ring (22) from cylinder head.



HAOF38OS

**Figure 34**

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## Hydraulic System

1. 1st speed

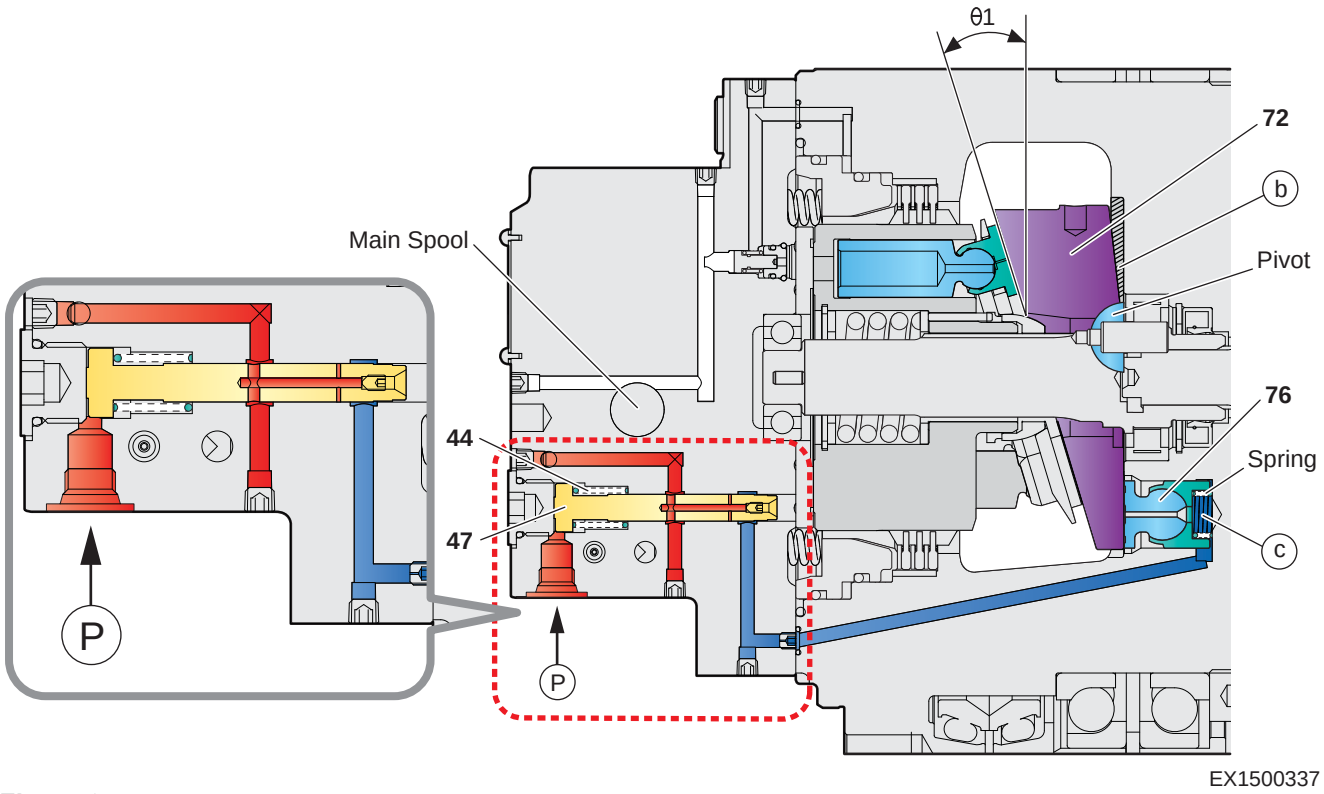


**Figure 9**

2. 2nd speed

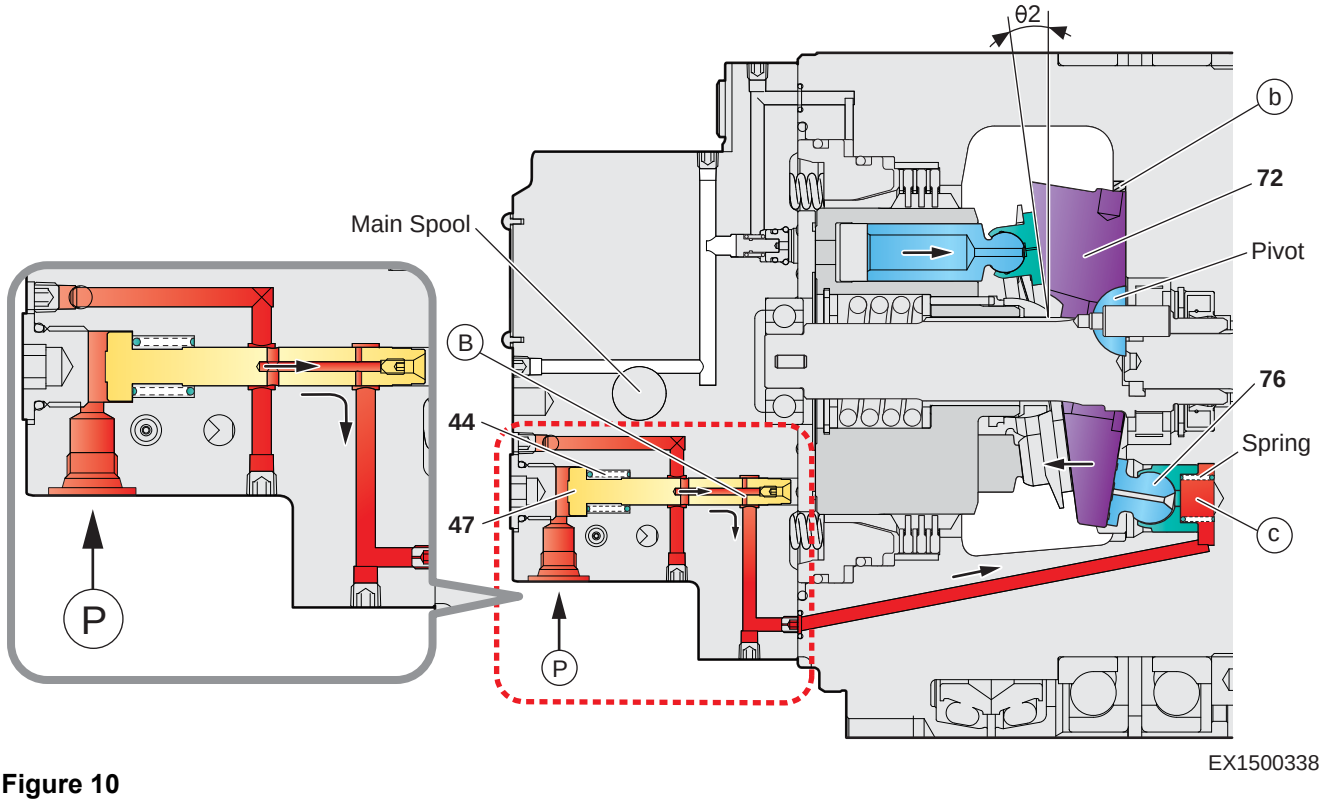


**Figure 10**

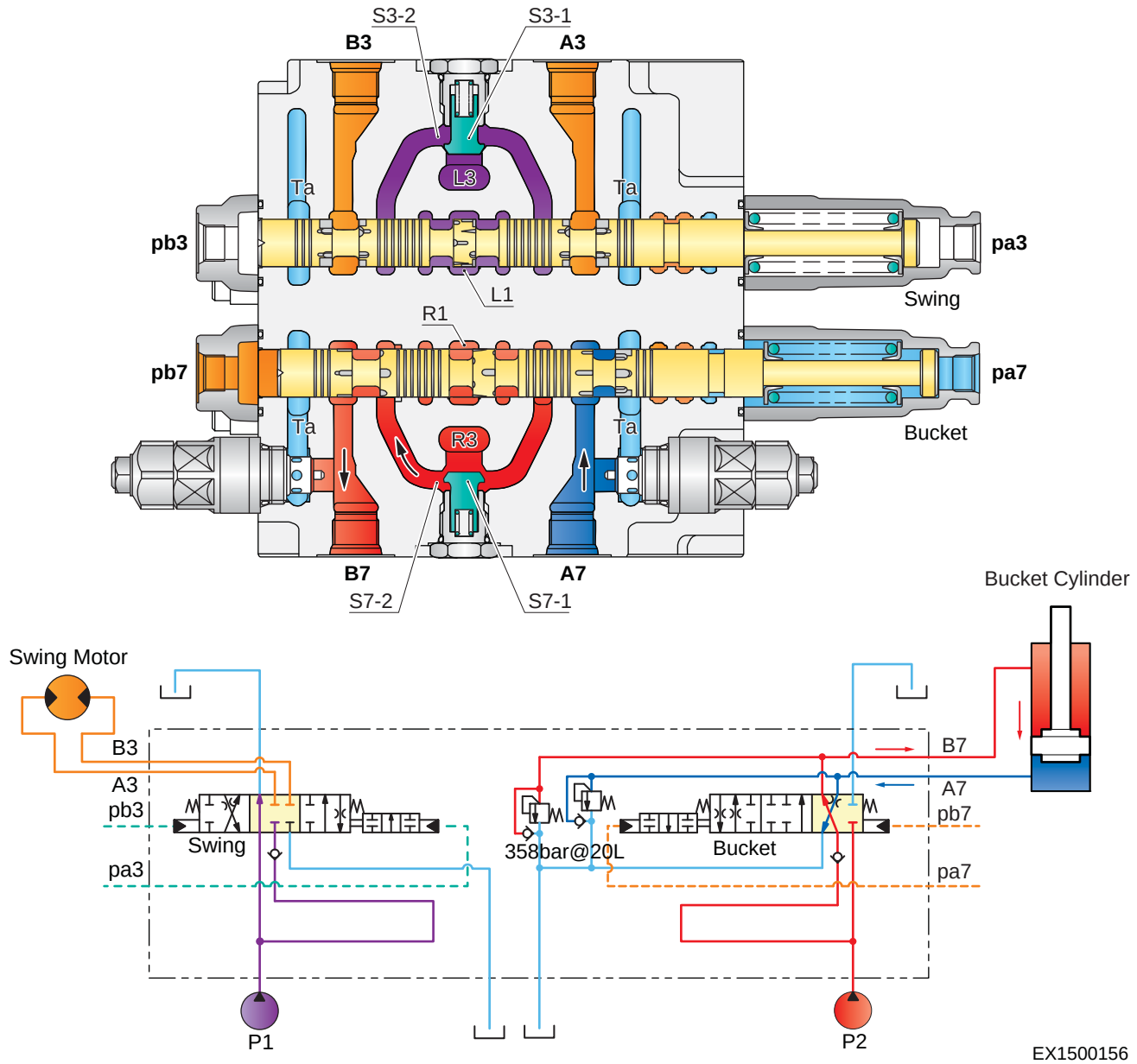
S3-2
S3-1
B3
A3
L3
Ta
Ta
pb3
pa3
L1
Swing
R1
pb7
pa7
Ta
Ta
R3
Bucket
B7
A7
S7-2
S7-1
Bucket Cylinder
Swing Motor
B3
A3
pb3
Swing
pa3
B7
A7
pb7
358bar@20L
Bucket
pa7
P1
P2
EX1500156

**Figure 24**

# POWER MODE VALVE

## Current Signal and Hydraulic Pressure Adjustments

### WARNING

**AVOID DEATH OR SERIOUS INJURY**

**This procedure must be done with two people. To reduce the chance of accidental movement of the excavator, one person should properly seated at the operator's control stand while checks and adjustments are made.**

The electromagnetic pressure proportioning control (EPPR) "power mode" valve is on the underside of the pumps (not visible in the harness connections drawing, because it is underneath the assembly), near the engine/pump flexible coupling, adjacent to the pump return line. To test and adjust power shift current and pressure through the power mode valve a multilead jumper harness is required. The jumper harness (which is available through Bobcat After Sales Service, or could be spliced together from commonly available, purchased parts) has extra leads so a VOM meter can be connected to the circuit. To set up the testing equipment, stop engine and disconnect the single electrical lead from the power mode valve. Attach the jumper harness to the terminal on the valve, connect the test leads of the multimeter to the extra leads on the harness and reconnect the valve electrical lead.

Vent the lever on top of the hydraulic tank to relieve pressure and connect an in-line "T-style" adapter to the valve pressure port. Install a 60 bar (61.2 kg/cm$^2$, 870 psi) test gauge in the adapter.

Restart the engine and increase engine rpm by turning the speed control to the maximum speed setting. Warm up the engine and hydraulic system until hydraulic oil temperature is at least 45°C (113°F). Select Power Mode on the Instrument Panel. Check current readings (in milliamps) on the VOM meter and hydraulic pressure gauge readings and make sure both conform to the values in the table below.

**NOTE:** *If recorded values do not conform to the specified current or pressure in the table, back off the locknut on the end of the valve, turn the adjusting screw 1/4 turn and recheck current and pressure. Repeat adjustment as required to obtain specified performance and retighten the valve locknut.*

| Mode | Engine Speed | | Input Current (mA) | Secondary Pressure (bar (kgf/cm$^2$)) |
|---|---|---|---|---|
| | Condition | rpm | | |
| Power+ | High Idle | 2,060 | 150 | 0 |
| | Rated | 2,000 | | |

# Table of Contents

## Hydraulic System Troubleshooting

# TROUBLESHOOTING – SWING GEARBOX

| Problem | Possible Cause | Remedy |
|---|---|---|
| Swing motor fails to operate and: | | |
| Three pressure tests at motor, brake or makeup valve show low reading (s). | Swing relief valve defective. Brake release valve defective. Motor makeup valve defective. | Adjust pressure to recommended range in affected valve.<br>OR<br>Disassemble and clean valve assembly. Replace all valve components that show damage. |
| All three pressure checks are OK but left travel also fails to run. | Exchange front and rear pump inlet and outlet hoses to test pump function. | If swing and left travel are restored but right travel stops working, replace or repair P1 pump. |
| All three pressure tests are OK, but machine fails to swing at all. | Brake assembly or motor friction plate failing to release. | Check for binding. Disassemble and repair. |
| | Pilot (control) pressure low or swing control valve stuck. | Disassemble/Repair pilot pressure swing spool (305) and/or swing control valve. |
| | Swing motor defective. | Test motor drain rate. Replace/Repair motor. |
| | Gear train defective. | Refer to "Swing Gear Troubleshooting" procedure. |
| Swing functions but only at reduced rpm. | Causes listed above could also produce dragging swing, OR hot or wrong oil OR worn-out parts. | Check above list; then replace oil, test motor drain rate and check for "03" reading (EPOS self-test). |
| Left travel speed is also reduced. | Low output at P1 pump or external pilot piping leaks/is clogged. | Clean and repair piping or repair or replace pump P1. |
| Swing control movement is reversed. | Inlet/outlet piping reversed. | Reset controls or reverse piping. |
| Machine swings but continues moving past stopping point. | Swing control valve spool not centered. | Replace return spring; clean/ repair valve piston and spool. |
| | Pilot pressure may be outside range. | Disassemble, clean or replace pilot relief valve or pilot valve. |
| | Swing relief valve may be faulty. | Repair/Replace swing relief valve. |
| Swing movement is in one direction only. | Check to see that pilot pressure is the same right and left. | If pilot pressure is unequal, clean or repair piping or repair/replace valve. |
| | Swing control valve spool may be stuck. | Repair/Replace the swing control valve. |
| | Swing relief valve may be faulty. | Repair/Replace the swing relief valve. |
| No rotation and: | | |
| Pressure at swing motor inlet increases. | Swing brake not releasing. | Check brake engagement and disengagement; check release pressure. |
| | Internal damage to gearbox drivetrain. | Replace broken gears and drivetrain assemblies. |
| | Overload. | Reduce load weight. |

# SAFETY INSTRUCTIONS

## WARNING

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# INTRODUCTION

The electrical system for this equipment is DC 24 volts. The rated voltage for all electric components is 24 volts with the exception of the stereo and the air-conditioning control actuator. The system contains two 12 volt batteries connected in series and a three phase AC generator with a rectifier. The electrical wiring used in the system is easily identifiable by the insulator color. The color symbols used in the electrical system are listed in the following chart.

**Electrical Wire Color**

| Symbol | Color |
|---|---|
| W | White |
| G | Green |
| Or | Orange |
| B | Black |
| L | Blue |
| Lg | Light green |
| R | Red |
| Gr | Gray |
| P | Pink |
| Y | Yellow |
| Br | Brown |
| V | Violet |

**NOTE:** *RW: Red wire with White stripe*

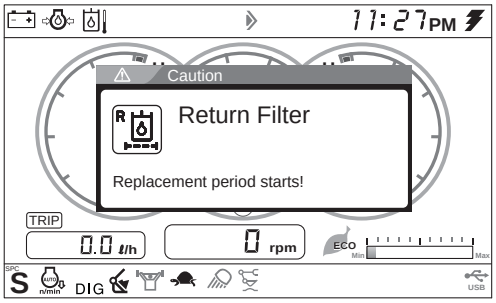
*R - Base Color, W - Stripe Color*

**NOTE:** *0.85G: Nominal sectional area of wire core less insulator = 0.85 $mm^2$*

| Reference Number | Description |
|---|---|
| 1 | Instrument Panel |
| 2 | Pilot Buzzer |
| 3 | Light Switch |
| 4 | Starter Switch |
| 5 | Front Pump Pressure Sensor |
| 6 | Rear Pump Pressure Sensor |
| 7 | Hydraulic Oil Temperature Sensor |
| 8 | Fuel Sensor |
| 9 | Pedal Pressure Switch (Optional) |
| 10 | Air Cleaner Indicator |
| 11 | Return Filter Switch |

| Reference Number | Description |
|---|---|
| 12 | Alternator |
| 13 | EPOS Controller |
| 14 | Battery |
| 15 | Battery Relay |
| 16 | Circuit Breaker 2 |
| 17 | Circuit Breaker 1 |
| 18 | Fuse Box |
| 19 | Check Connector |
| 20 | Engine Controller |
| 21 | Rearview Camera |
| 22 | WIF Sensor |
| 23 | Master Switch |

If the remaining time for filter/oil replacement is less than 10 hours, this pop-up window will be created. Press the ESC button or the jog switch to allow the pop-up window to disappear.




EX1301047

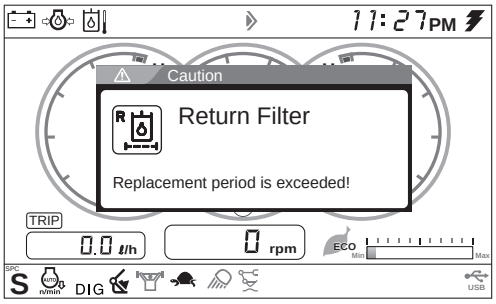
**Figure 23**

If the filter/oil replacement period is exceeded, this pop-up window will be created. Press the ESC button or the jog switch to allow the pop-up window to disappear.

**WARNING**

**AVOID DEATH OR SERIOUS INJURY**

**Do not use vehicle state menu when traveling or operating.**




EX1301048

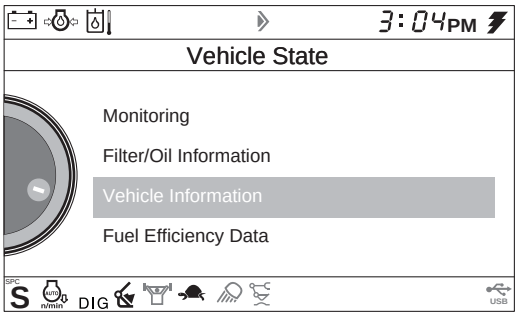
**Figure 24**

C. Vehicle Information

This is used to check the vehicle name, engine type and attachment options.

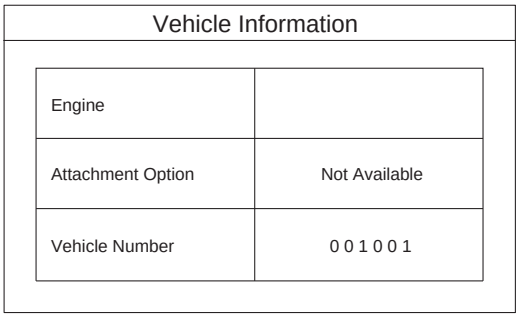
At the vehicle state, if the cursor is placed on the vehicle information, click the jog switch to access the vehicle information screen.

Click the ESC button to return to the previous screen.




EX1402168

**Figure 25**

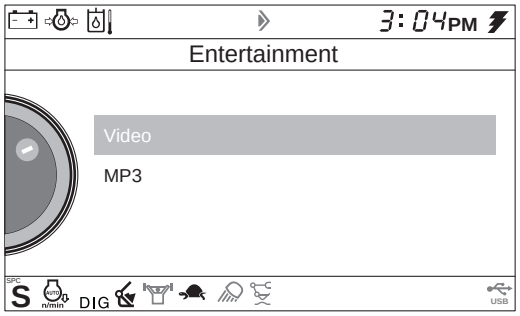



EX1301411

**Figure 26**

A. Video

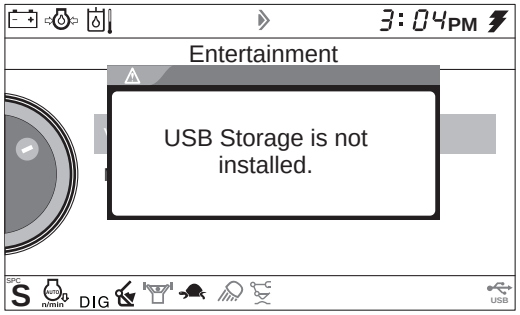
From the entertainment screen, select video to access it.




EX1301041

**Figure 61**

When there is no USB storage system, a pop-up window is displayed for 3 seconds, saying "USB" Storage is not installed". and the video is not played.

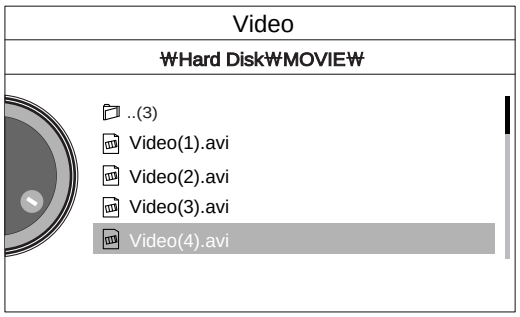



EX1301044

**Figure 62**

When initially accessing the video player, the USB storage system file tree is displayed on the screen, operate the jog switch clockwise/counterclockwise to select and play a video.

If there is a video file that played last, it will automatically be replayed.




FG018511

**Figure 63**

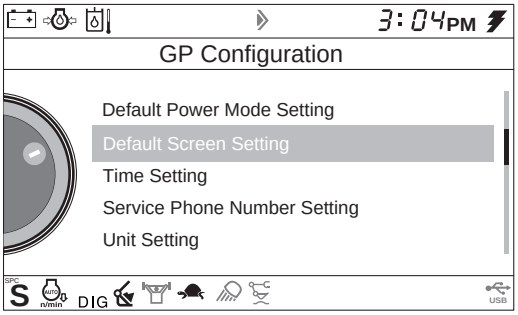
If the format is not supported, a pop-up window is displayed for 3 seconds, saying "This file is not available!" and the video is not played.


EX1301451

**Figure 64**

D. Default Screen Setting

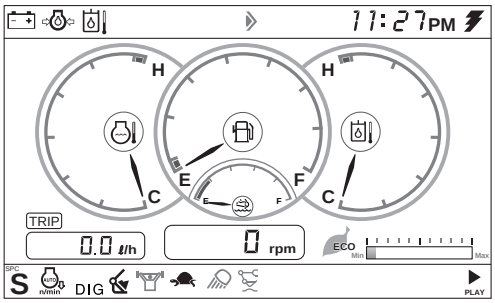
Sets the main screen display on the instrument panel.




EX1402181

**Figure 109**

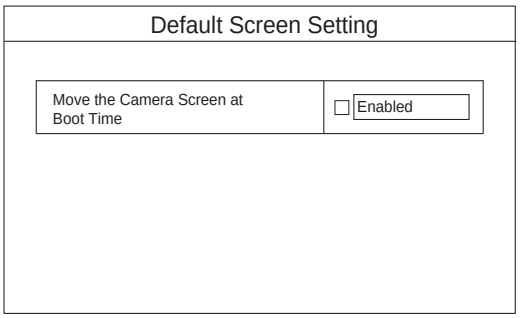
The initial screen shows basic information, including the fuel level, coolant temperature and hydraulic oil temperature.




EX1301432

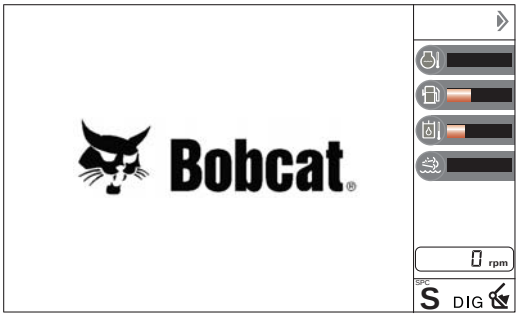
**Figure 110**

Enter the "Default Screen Setting" menu and select "Enable" for this function. Then, the main screen shows the camera view next time the starter switch is turned to the ON position.




EX1402182

**Figure 111**




EX1402183_BCT

**Figure 112**

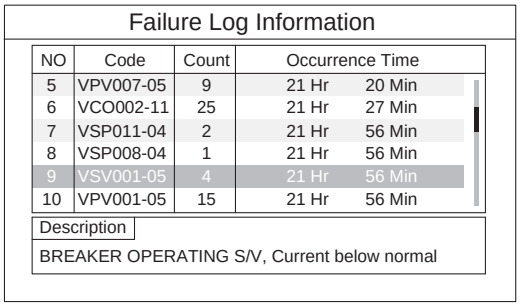
B. Past failure information

Memorized record of past failure is displayed (Failure code, fault contents).

When several faults are produced, failure information can be checked using the jog switch (1, Figure 126).

**NOTE:** *"Count: xxx": "xxx" means that totally counted number of the same* fault*.*

*"Occurrence Time": It indicates the period for which machine has operated until a* fault *takes place. (For more than two occurrences of the same* fault*, until first occurrence time.)*




EX1301619

**Figure 143**

| GP Display Code | Index (from EPOS to GP) | Index (Hex) | DTC Code | | FMI | GP Display Description | Severity | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | HEX | DEC | | | | |
| E000653-05 | 125 | 7D | 28D | 653 | 5 | Engine Injector Cylinder #03: Current Below Normal | 2 | |
| E000653-06 | 125 | 7D | 28D | 653 | 6 | Engine Injector Cylinder #03: Current Above Normal | 2 | |
| E000654-02 | 126 | 7E | 28E | 654 | 2 | Engine Injector Cylinder #04: Erratic, Intermittent, or Incorrect | 1 | |
| E000654-05 | 126 | 7E | 28E | 654 | 5 | Engine Injector Cylinder #04: Current Below Normal | 2 | |
| E000654-06 | 126 | 7E | 28E | 654 | 6 | Engine Injector Cylinder #04: Current Above Normal | 2 | |
| E000676-05 | 127 | 7F | 2A4 | 676 | 5 | Engine Glow Plug Relay: Current Below Normal | 2 | |
| E000676-06 | 127 | 7F | 2A4 | 676 | 6 | Engine Glow Plug Relay: Current Above Normal | 2 | |
| E000678-03 | 128 | 80 | 2A6 | 678 | 3 | ECU 8 Volts DC Supply: Voltage Above Normal | 2 | |
| E000678-04 | 128 | 80 | 2A6 | 678 | 4 | ECU 8 Volts DC Supply: Voltage Below Normal | 2 | |
| E000723-08 | 129 | 81 | 2D3 | 723 | 8 | Engine Speed Sensor #2: Abnormal Frequency, Pulse Width, or Period | 1 | |
| E001075-05 | 130 | 82 | 433 | 1075 | 5 | Engine Electric Lift Pump for Engine Fuel Supply: Current Below Normal | 2 | |
| E001075-06 | 130 | 82 | 433 | 1075 | 6 | Engine Electric Lift Pump for Engine Fuel Supply: Current Above Normal | 2 | |
| E001076-05 | 131 | 83 | 434 | 1076 | 5 | Engine Fuel Injection Pump Fuel Control Valve: Current Below Normal | 2 | |
| E001076-06 | 131 | 83 | 434 | 1076 | 6 | Engine Fuel Injection Pump Fuel Control Valve: Current Above Normal | 2 | |
| E001184-03 | 132 | 84 | 4A0 | 1184 | 3 | Engine Turbocharger 1 Turbine Output Temperature Voltage Above Normal | 2 | |
| E001184-04 | 132 | 84 | 4A0 | 1184 | 4 | Engine Turbocharger 1 Turbine Output Temperature Voltage Below Normal | 2 | |
| E001184-08 | 132 | 84 | 4A0 | 1184 | 8 | Engine Turbocharger 1 Turbine Outlet Temperature Abnormal Frequency, Pulse Width or Period | 2 | |
| E001188-05 | 133 | 85 | 4A4 | 1188 | 5 | Engine Turbocharger 1 Wastegate Drive: Current Below Normal | 2 | |
| E001188-06 | 133 | 85 | 4A4 | 1188 | 6 | Engine Turbocharger 1 Wastegate Drive: Current Above Normal | 2 | |
| E001231-09 | 134 | 86 | 4CF | 1231 | 9 | J1939 Network #2: Abnormal Update Rate | 2 | |
| E001231-14 | 134 | 86 | 4CF | 1231 | 14 | J1939 Network #2: Special Instruction | 2 | |
| E001235-09 | 135 | 87 | 4D3 | 1235 | 9 | J1939 Network #3: Abnormal Update Rate | 2 | |
| E001235-14 | 135 | 87 | 4D3 | 1235 | 14 | J1939 Network #3: Special Instruction | 2 | |
| E001239-00 | 136 | 88 | 4D7 | 1239 | 0 | Engine Fuel Leakage 1: High - Most Severe (3) | 4 | |
| E001761-01 | 137 | 89 | 6E1 | 1761 | 1 | Catalyst Tank Level: Low - Most Severe (3) | 4 | |
| E001761-12 | 137 | 89 | 6E1 | 1761 | 12 | Catalyst Tank Level: Failure | 2 | |
| E001761-17 | 137 | 89 | 6E1 | 1761 | 17 | Catalyst Tank Level: Low - Least Severe (1) | 2 | |
| E001761-18 | 137 | 89 | 6E1 | 1761 | 18 | Catalyst Tank Level: Low - Moderate Severity (2) | 2 | |
| E002659-07 | 138 | 8A | A63 | 2659 | 7 | Engine Exhaust Gas Recirculation (EGR) Mass Flow Rate: Not Responding Properly | 2 | |

| Reference Number | Description |
|---|---|
| 1 | Instrument Panel |
| 3 | Engine Controller |
| 4 | EPOS Controller |
| 10 | EPPR Valve (Electromagnetic Proportional Pressure Reducing) |
| 17 | Engine Control Dial |
| 22 | Aux Mode Switch |
| 23 | Aux Mode Resistor |
| 24 | Battery |

| Reference Number | Description |
|---|---|
| 25 | Battery Relay |
| 26 | Fuse |
| 27 | Circuit Breaker 1 |
| 28 | Starter Switch |
| 32 | Jog Switch Control Panel |
| 33 | Engine Emergency Stop Switch |
| 34 | Circuit Breaker 2 |
| 35 | Check Connector |
| 36 | Master Switch |

# POWER BOOST MODE

## Operation

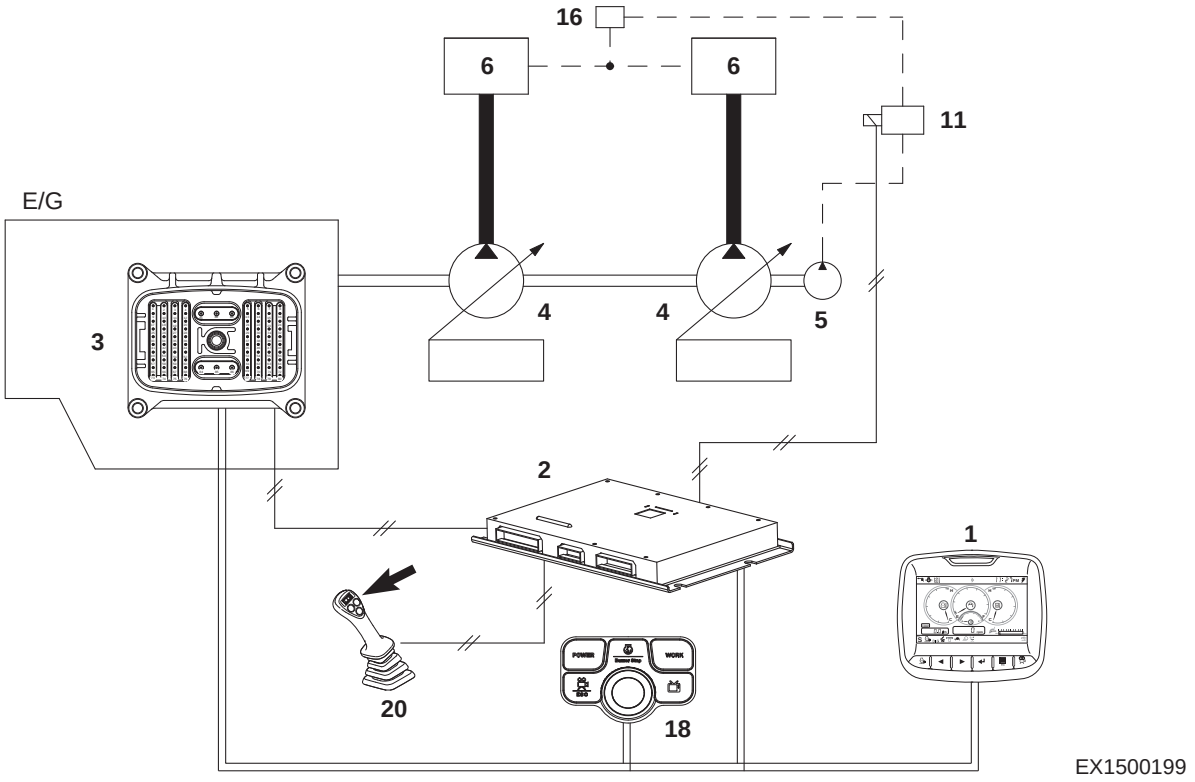



**Figure 175**

| Reference Number | Description |
|---|---|
| 1 | Instrument Panel |
| 2 | EPOS Controller |
| 3 | Engine Controller |
| 4 | Main Pump |
| 5 | Aux Pump |
| 6 | Control Valve |

| Reference Number | Description |
|---|---|
| 11 | Solenoid Valve (Boost) |
| 16 | Main Relief Valve |
| 18 | Jog Switch Control Panel |
| 20 | Power Boost Switch (Top of Right Work Lever) |

The Power Boost function is used to temporarily increase the main relief pressure to enhance excavation ability. When the Work Mode is set to "BOOST" by the jog switch control panel and the power boost button on the right-hand work lever (joystick) is pressed during work, the EPOS controller will activate the power boost solenoid valve and increase the relief valve pressure from 323 ~ 343 bar (4,684 ~ 4,974 psi) for 7 seconds. The excavation ability is increased by approximately 6%. When the power boost function is in activated, a power boost symbol appears on the information display department of instrument panel.

**NOTE:** *Do not use this switch for more than 10 seconds.*

# Air Conditioner/Heater Unit

### Airflow Diagram and Main Components

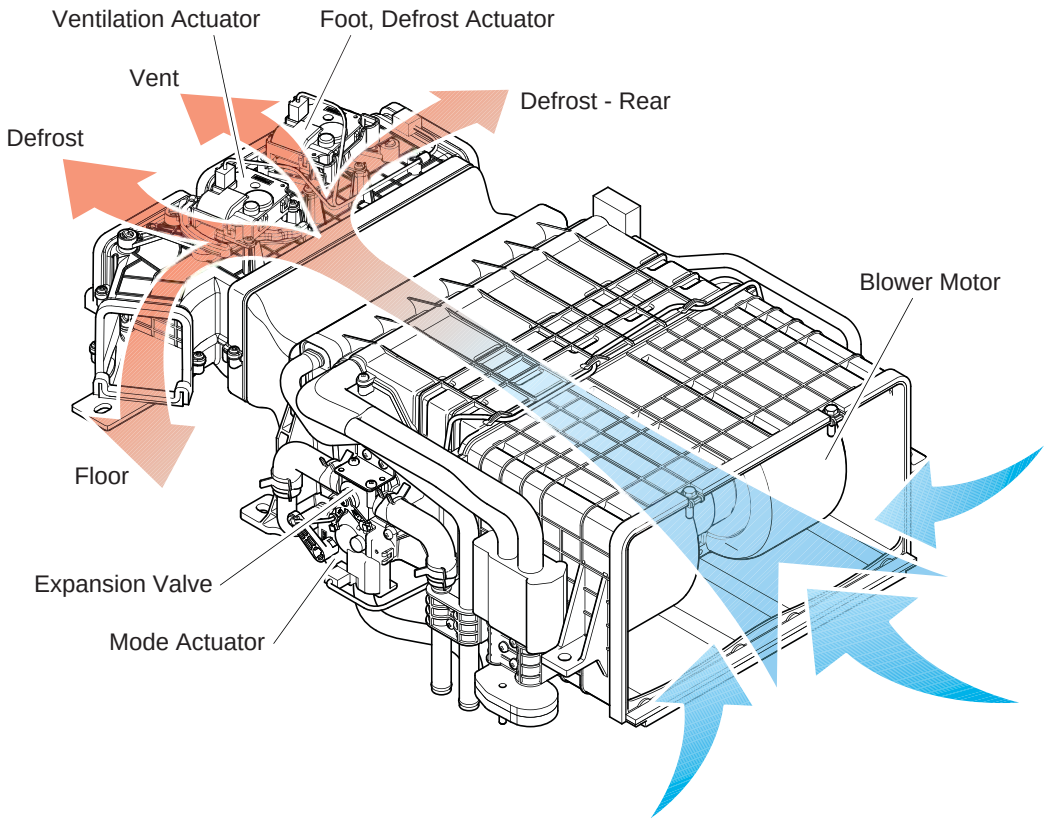



**Figure 186**

### Door Open by Vent Modes

Unit: %

| Mode / Out | Internal | External | | | |
|---|---|---|---|---|---|
| | Cool | 1/2 Cool | Warm | | |
| | Vent | Bi-level | Floor | Defrost/Foot | Defrost |
| Vent | 80 | 20 | 0 | 85 | 0 |
| Floor | 0 | 30 | 100 | 0 | 0 |
| Defrost | 0 | 0 | 0 | 15 | 100 |
| Defrost - Rear | 20 | 50 | 0 | 0 | 0 |

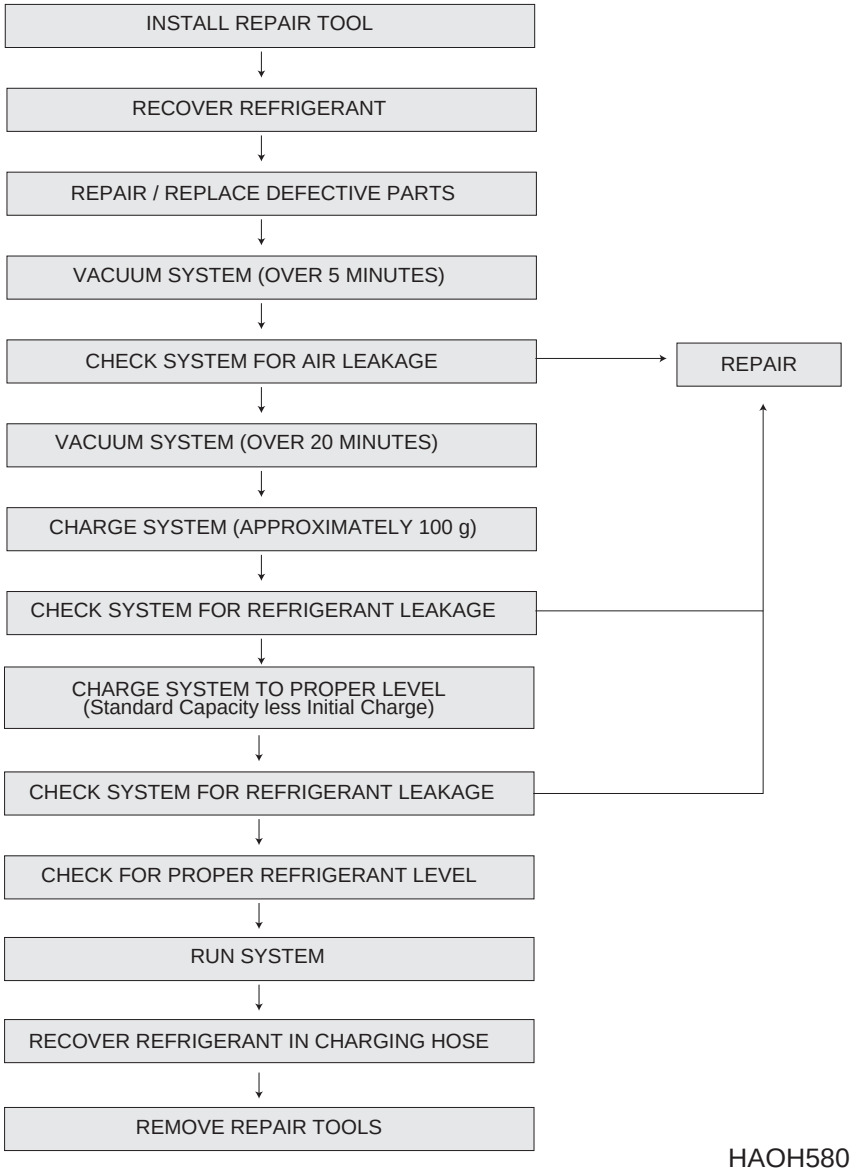

INSTALL REPAIR TOOL
RECOVER REFRIGERANT
REPAIR / REPLACE DEFECTIVE PARTS
VACUUM SYSTEM (OVER 5 MINUTES)
CHECK SYSTEM FOR AIR LEAKAGE
REPAIR
VACUUM SYSTEM (OVER 20 MINUTES)
CHARGE SYSTEM (APPROXIMATELY 100 g)
CHECK SYSTEM FOR REFRIGERANT LEAKAGE
CHARGE SYSTEM TO PROPER LEVEL
(Standard Capacity less Initial Charge)
CHECK SYSTEM FOR REFRIGERANT LEAKAGE
CHECK FOR PROPER REFRIGERANT LEVEL
RUN SYSTEM
RECOVER REFRIGERANT IN CHARGING HOSE
REMOVE REPAIR TOOLS
HAOH580

**Figure 195**

# Options

| Reference Number | Description |
|---|---|
| 1 | Pipe |
| 2 | Pipe |
| 3 | Pipe |
| 4 | Pipe |
| 5 | Rubber; Pipe |
| 6 | O-ring |
| 7 | Bolt; Socket |
| 8 | O-ring |

| Reference Number | Description |
|---|---|
| 11 | Clamp, Pipe |
| 12 | Clamp, Pipe |
| 13 | Bolt |
| 14 | Washer; Spring |
| 15 | Clamp, Pipe |
| 16 | Bolt |
| 17 | Flange |
| 18 | Bolt; Socket |