5 Steering system

5.1 Steering system layout

The steering hydraulic system uses operator input and hydraulic flow to two cylinders to change the direction of travel. There is no mechanical linkage between the steering wheel and the steering cylinders.

Steering control is based on the load sensing. Main components of the system are:

- Pressurized oil from the variable displacement pump
- Closed the center steering unit
- Double acting steering cylinders

The steering unit is supplied buy the piston pump and the steering priority valve. When the steering wheel is turned, required oil flow is sent to relevant side of the steering cylinder. Excess flow not required by the cylinders is routed to the implement system by the priority valve, or back to oil reservoir.

In case of a failure of the engine or piston pump, the steering unit acts as a hand operated pump so that the steering can be controlled.

The steering system uses the same hydraulic flow as the implement system. The steering system has priority over the implement system. The two cylinders, mounted on each side of the machine pivot, work in tandem to change the direction of travel.

There are two steering systems available for the machine, standard steering and electronically enhanced steering systems. The electronically enhanced steering system utilizes the steering anlge sensor on the steering shaft to control the electric selenoids in the steering priority valve to direct the hydraulic flow. Electronically enhanced system offers a smoother, more accurate steering system. The elctronically enhanced system is required for all machines equipped with a guidance system.

1. Hydraulic oil reservoir
2. Steering unit
3. Variable displacement piston pump
4. Load sense blocking valve
5. Steering priority valve
6. Steering cylinders
7. Steering cylinder test ports
8. Suction screen
9. Articulation position sensor

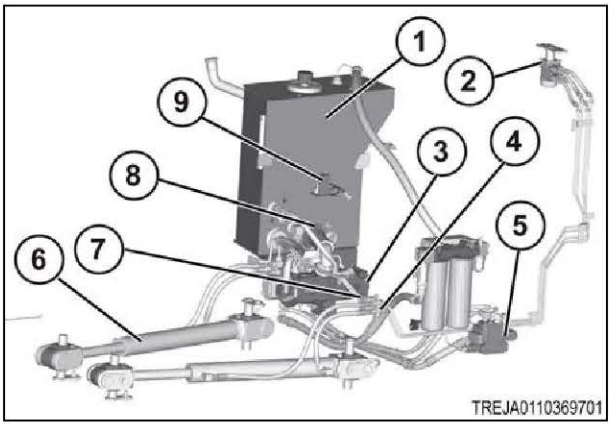

Fig. 1

Oil from the reservoir (1) is pulled into piston pump (3) and sent to steer/priority valve (5).

The operator starts the turning of the machine by turning the steering wheel. Turning the steering wheel turns the shaft of the steering unit (2) which turns the spool valve which directs the flow from the steering priority valve to the appropriate right-hand or left-hand port.

The hydraulic flow then goes back to the priority valve and moves the directional spool in steer valve appropriate direction. This allows flow from the piston pump to activate the corresponding steering cylinder (6). As one cylinder is extending, the other is retracting the same amount.

The circuit is protected by two shock valves and two suction valves placed in the L and R ports of the steer valve. Schock valves operate at 260 bar (3771 psi) to protect the circuit between the steering cylinders and steering valve from wheel impact. The suction valves allows the oil released by the shock valves to the flow from the right-hand channel to the left-hand channel or vice versa depending on the cylinder ram position.

In neutral, spool valve in steer unit is centered with respect to the sleeve by springs. This blocks flow from the left-hand or right-hand ports.

Turning to the left-hand or right-hand direction creates an angular shift between the spool valve and sleeve in the steering unit. This allows the oil to flow through the internal channels to the stator and rotor. The rotor is rotated and supplies the steer valve with a signal indicating which direction the operator wishes to turn. The more the steering wheel and connected rotor is turned, the greater the signal to the steer valve. Springs in the steer motor once again center spool and sleeve, stopping the flow to the steer valve.

5.2 Steering system components

5.2.1 Implement hydraulic pump

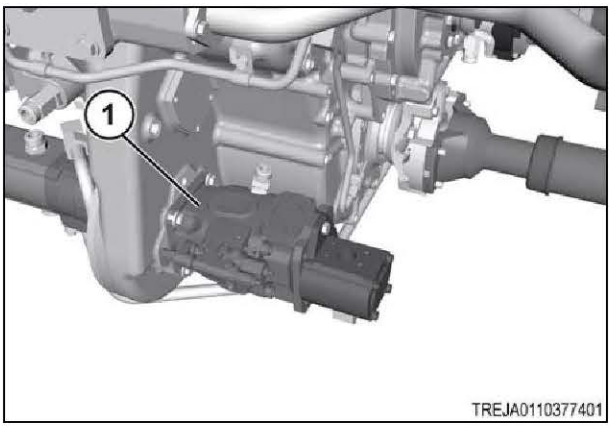

Fig. 2

The implement hydraulic pump (1) is located on the left-hand side of the machine, mounted to the rear of the transmission.

The standard implement hydraulic pump is 63 cm^3 (3.8 in^3) and can of produce a maximum flow of 165 liters/min (43.5 gal/min).

A 85 cm^3 (5.2 in^3) implement hydraulic pump is standard on special application machines. The pump is also available as an option on agricultural machines. The flow rate of the implement hydraulic pump is 223 liters/min (59 gal/min).

The implement hydraulic pump is a variable displacement axial piston pump. The pump has load sensing and pressure compensation. The pump delivers a maximum output pressure of 200 to 206 bar (2900 to 2988 psi).

The hydraulic pump supplies oil to the following components:

- Steering
- Hydraulic control valves
- Hydraulic power beyond (if equipped)
- Hydraulic trailer brakes system (if equipped)

The compensator valve (1) is fastened to the side of the hydraulic pump.

The compensator controls the pump output flow in response to the following systems:

- Load sensing signal (2)
- Implement valve reference signal (3)

The compensator valve also acts as a backup for limiting maximum system pressure.

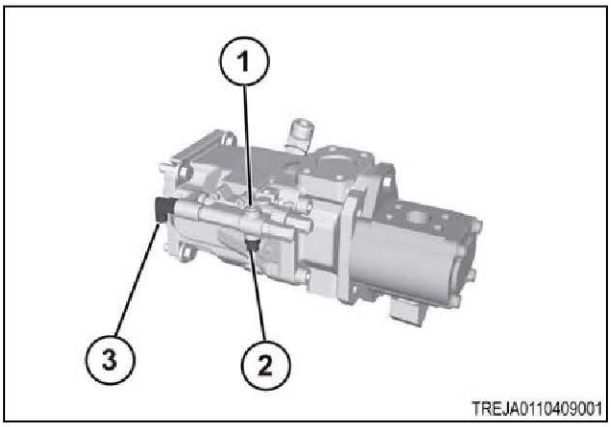

Fig. 3

5.2.2 Steering - priority valve

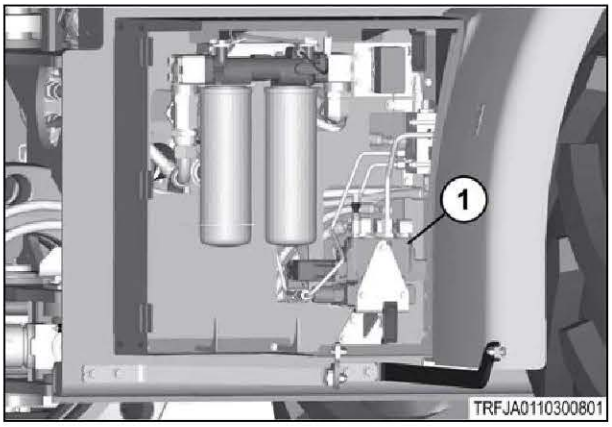

Fig. 4

The steering/priority valve is both a steering and a priority valve built into one unit. The hydraulic flow enters the pressure port at the priority valve portion of the unit. The priority valve directs the flow between the steering and implement circuits. The valve receives a pilot signal from the steering motor, if the flow is required to direct vehicle motion. If there is no signal from the pilot line, the flow is directed out the excess flow port. The hydraulic oil then is directed to the implement system. If there is a signal from the pilot line, the flow continues to the steering valve portion of the unit.

The steering portion of the valve routes the flow from the steering motor to the appropriate steering cylinder. The pilot signal from the incoming hydraulic flow, shuttles the valve to direct the remaining flow toward the steering cylinders. In the electronically enhanced units, the electrical signals operate the solenoids that assist hydraulics in the shuttling spool valve. This directs the flow to the appropriate steering cylinder.

5.2.3 Steering unit

The steering unit (1) is fastened under the front edge of the the cab.

The steering unit is a closed center distribution valve that is connected to the steering wheel in the machine through the steering column. When the operator turns the steering wheel, the unit sends the appropriate signals to steering valve. The flow from the steering unit to the steering cylinders changes the direction of travel.

The flow from the steering/priority valve enters through the P-port. As the steering wheel is turned, The spool is turned in the sleeve. This permits the hydraulic flow to be directed out the corresponding port to the steering valve.

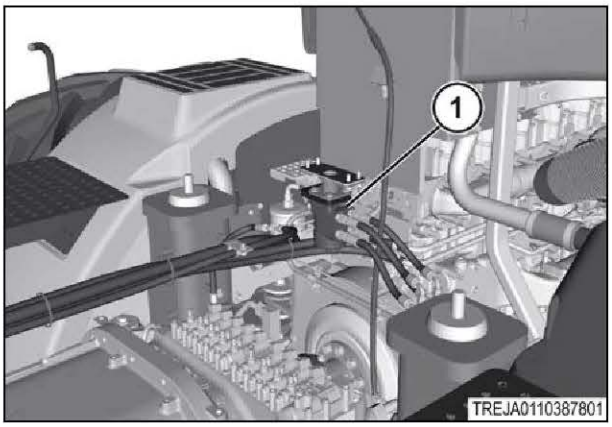

Fig. 6

The electronically enhanced steering systems have a steering angle sensor (1) mounted between the steering unit (2) and the mounting plate (3).

As the steering wheel is turned, the sensor is turned and the electrical signals are sent to the steering valve. The signals control the solenoids which control the flow to the directional spool. The directional spool directs the hydraulic flow to the steering cylinders.

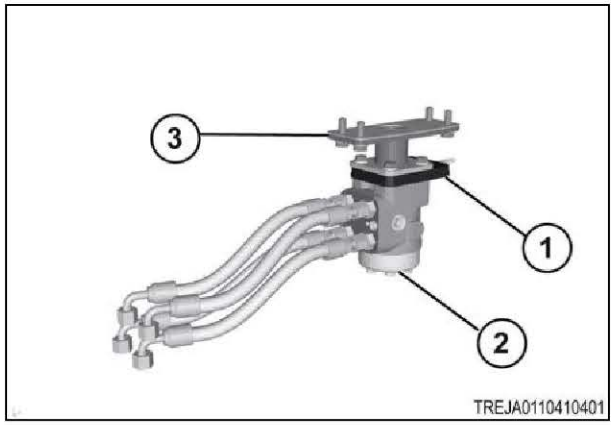

Fig. 7

5.2.4 Hydraulic oil reservoir

The oil reservoir (1) is located on the left side of the front section of the machine. The oil reservoir holds filtered oil for the hydraulic pump for steering and implement hydraulic system.

The hydraulic oil reservoir is shared by the following systems:

- Implement hydraulic system
- Steering hydraulic system
- Trailer brake hydraulic system

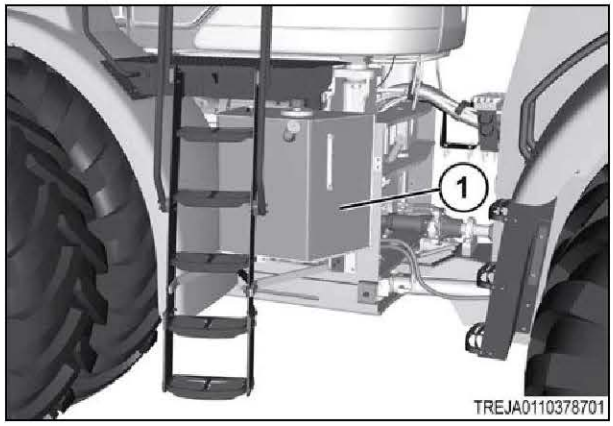

Fig. 8

The oil reservoir consists of the following components:

- Filler cap
- Breather
- Level switch
- Magnets
- Strainer
- Drain plugs
- Reservoir
- Sensor

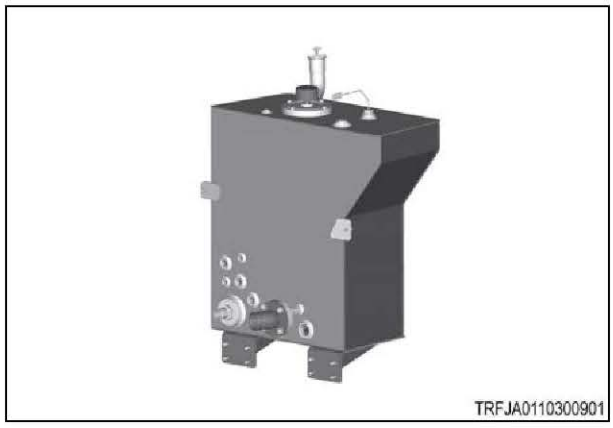

Fig. 9

The reservoir has two sections. The front is filtered and the rear is not filtered. The oil circulates through the oil cooler and the oil filter by the implement charge gear pump. The hydraulic oil is pulled from the not filtered side by the implement charge pump. The hydraulic oil returns to the filtered side for use by the implement piston pump.

The hydraulic oil reservoir provides system oil for steering, implement and trailer brake hydraulic systems on the machine.

5.2.5 Breather

The breather (1) is located in the top of the hydraulic oil reservoir.

The breather lets air move in and out of the hydraulic oil reservoir.

The breather will filter particles larger than 2 microns.

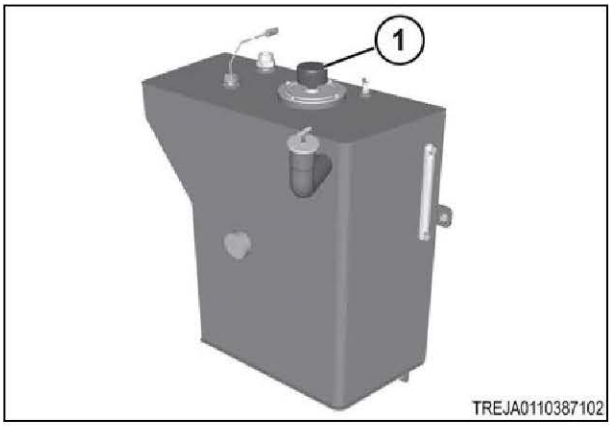

Fig. 10

5.2.6 Magnets

Two magnets (1)are located near the drain plugs in the hydraulic oil reservoir with one magnet in each section.

The magnets will collect small metallic debris in the hydraulic oil.

NOTE:
The image is a cut away view of the reservoir.

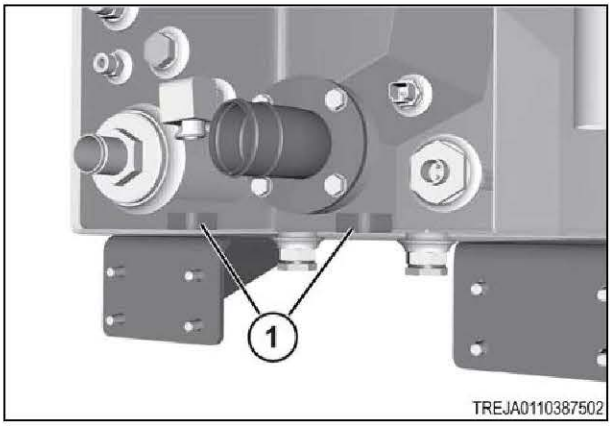

Fig. 11

5.2.7 Oil drain plugs

The hydraulic oil is drained from the reservoir by removing the drain plugs (1).

The drain plugs are located in the bottom of the reservoir. The front drain plug will drain the filtered section, and the rear drain plug will drain the unfiltered section.

See the information for changing the hydraulic oil.

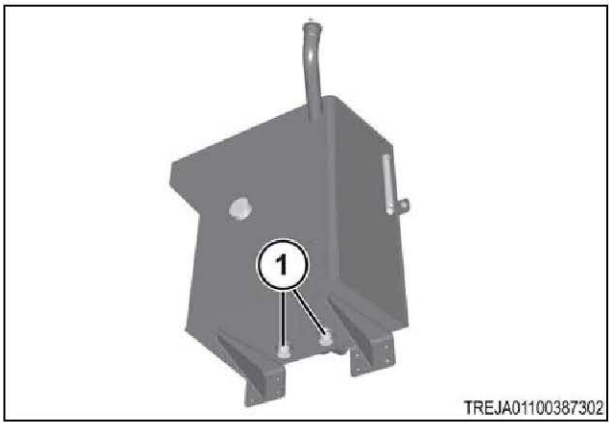

Fig. 12

5.2.8 Oil level switch

The oil level switch (1) is mounted in the top of the reservoir and sends a signal to the tractor management center to notify the machine operator if the oil level drops too low.

NOTE:
The image is a cut away view of the reservoir.

If the alarm sounds, there is a small amount of oil in the oil reservoir. This switch protects the hydraulic pump if there is a loss of oil, by notifying the operator.

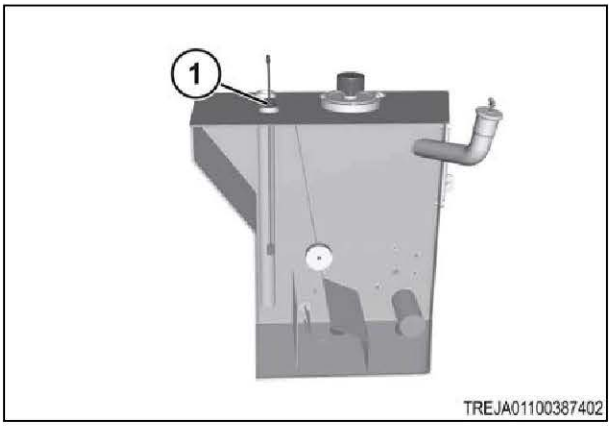

Fig. 13

5.2.9 Oil temperature sensor

The oil temperature sensor (1) is located in the filtered section of the oil reservoir.

The sensor sends a signal to the tractor management center showing the oil temperature to the operator.

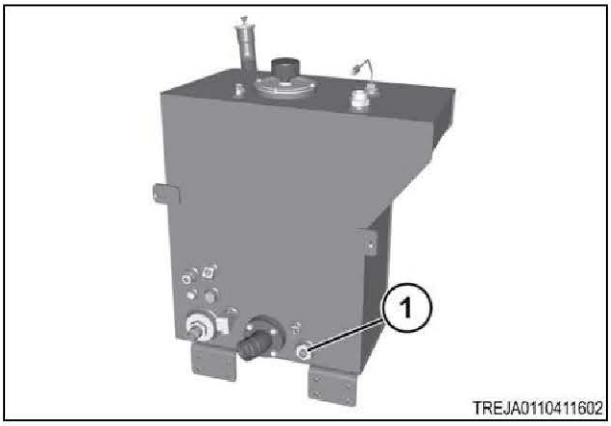

Fig. 14

5.2.10 Sight gauge

(1)

The sight gauge is located at the rear of the reservoir.

NOTE:
If operating the machine on a steep slope, the hydraulic oil level must be maintained at the FULL mark.

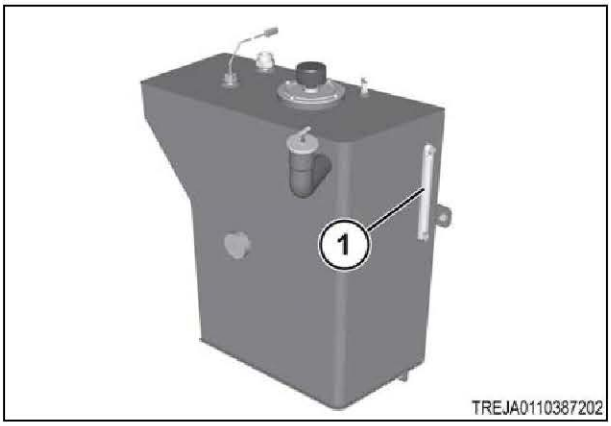

Fig. 15

5.2.11 Suction screen (charge pump)

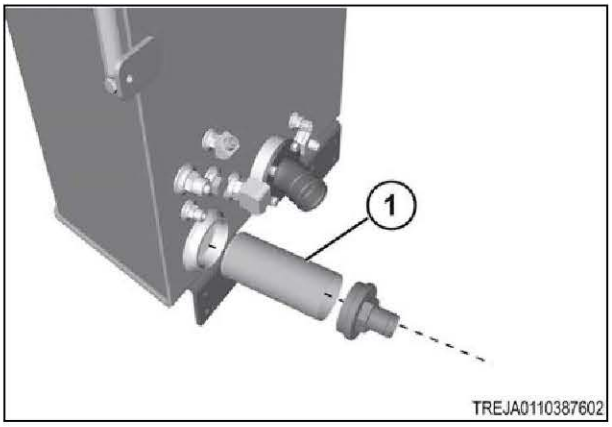

Fig. 16

The 20.7 kPa (3 psi) bypass valve (1) is located at the end of the suction screen (2). If oil is cold during the initial starting, unfiltered oil is allowed to bypass the suction screen.

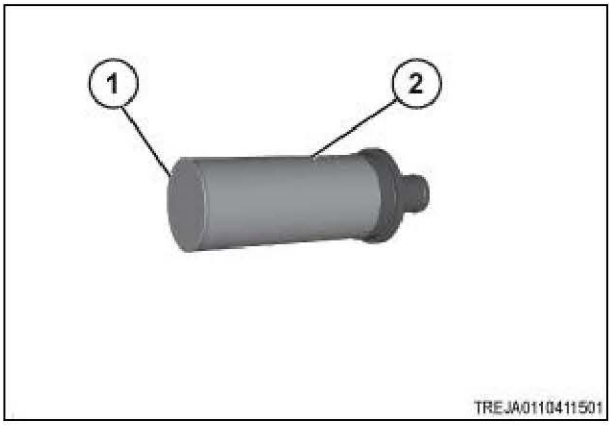

Fig. 17

5.2.12 Suction screen (implement pump)

The suction screen (1) for the implement charge pump is located in the rear section of the hydraulic oil reservoir.

The suction screen will filter particles larger than 200 microns. The suction screen filters all the oil before the oil is routed to the inlet of the charge pump.

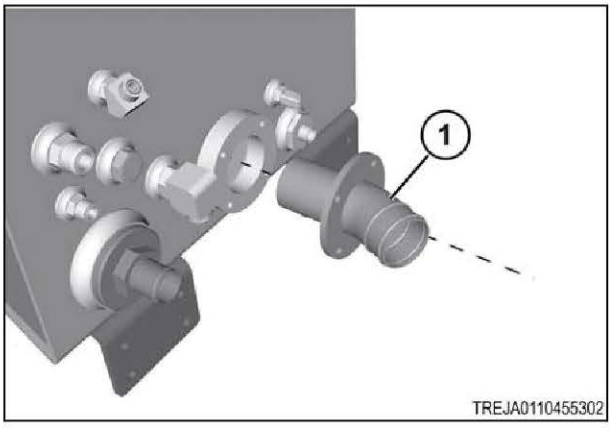

Fig. 18

5.2.13 Load sense blocking valve

The load sense blocking valve (1) is located on the inside front frame section on the right-hand side of the machine. The load sense blocking valve is mounted on the inside of the frame near the oil filter.

The load sense blocking valve prevents the steering/priority valve from being active during the engine starting. This keeps the hydraulic pump for the implement hydraulic system at a low pressure reserve during the engine starting.

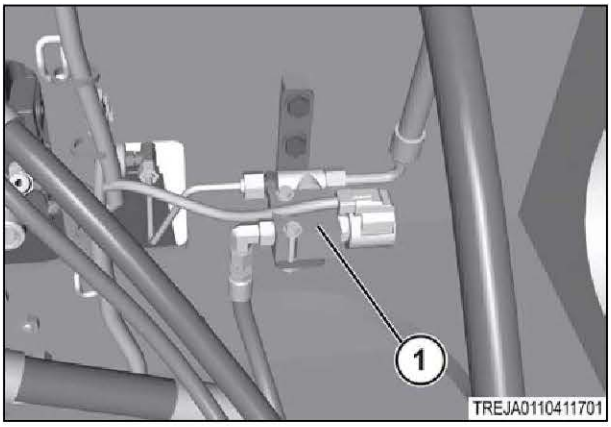

Fig. 19

5.2.14 Steering cylinder test ports

(1)(2)

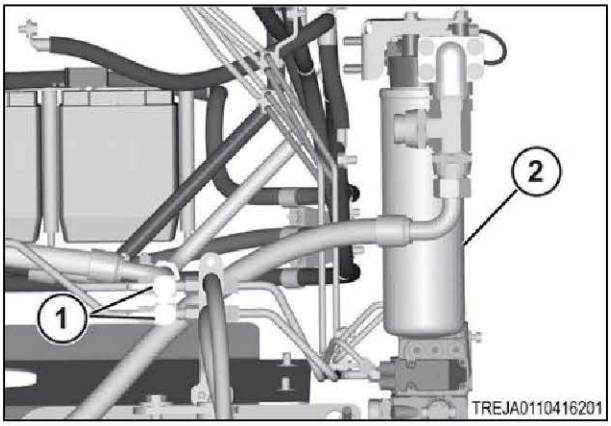

Fig. 20

5.2.15 Articulation position sensor

The articulation position sensor (1) is mounted on the upper articulation link and the front frame section.

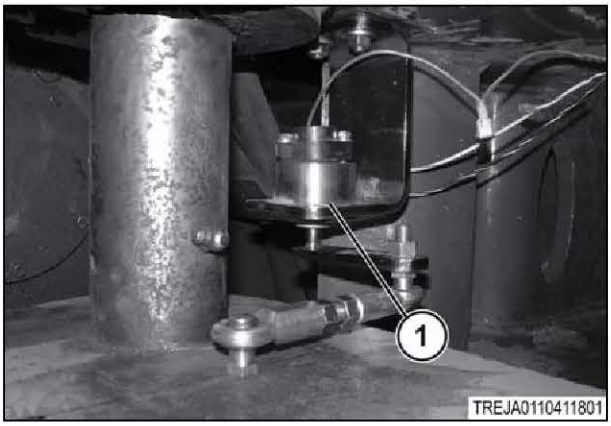

Fig. 21

5.2.16 Steering angle sensor

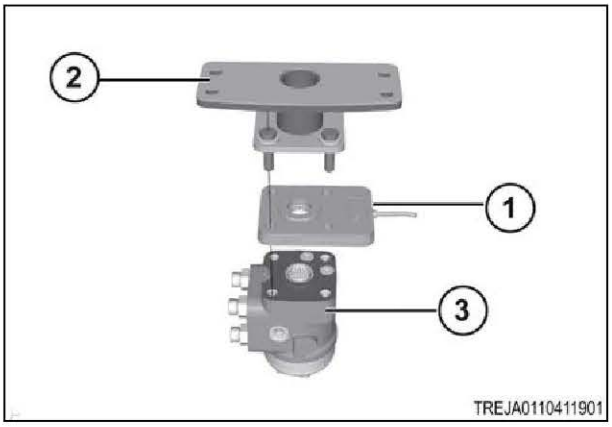

Fig. 22

5.2.17 Tractor management center

The tractor management center (TMC) (1) is on the console in front of the hydraulic control levers.

The TMC lets the operator adjust the following operations for the 3-point linkage system:

- Raising speed
- Lowering speed
- Maximum height
- Draft control
- Slip control

See the operator's manual for a detailed description of the TMC screens for the 3-point linkage system.

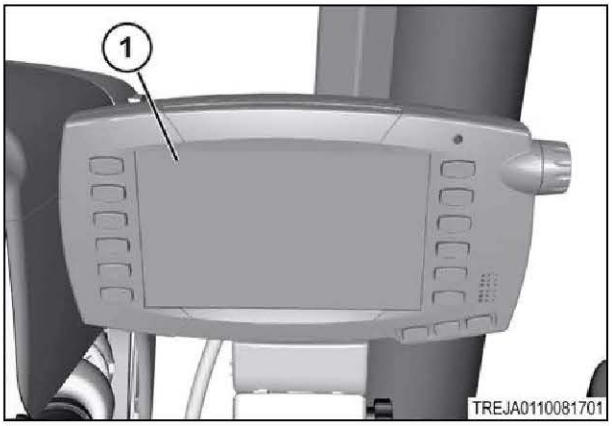

Fig. 23

5.2.18 Transmission module

The transmission module (1) is located in the floor of the cab. The transmission module communicates with the armrest module, the dash cluster, and the Tractor Management Center (TMC) through the controller area network (CAN) BUS network.

The transmission module controls the following components:

- Transmission
- Steering
- Parking brake
- Power take off (PTO)

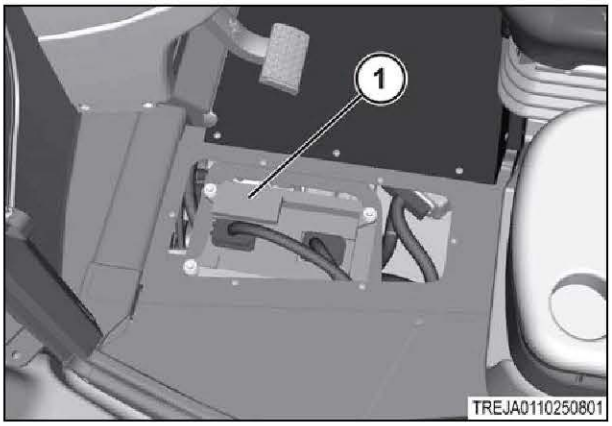

Fig. 24

5.2.19 Armrest module

The armrest module (1) is located in the console below the armrest. The switches and levers located in the console communicate directly to the armrest module. The armrest module then communicates to the transmission module, the dash cluster, and the Tractor Management Center (TMC) using the powertrain controller area network (CAN) BUS network.

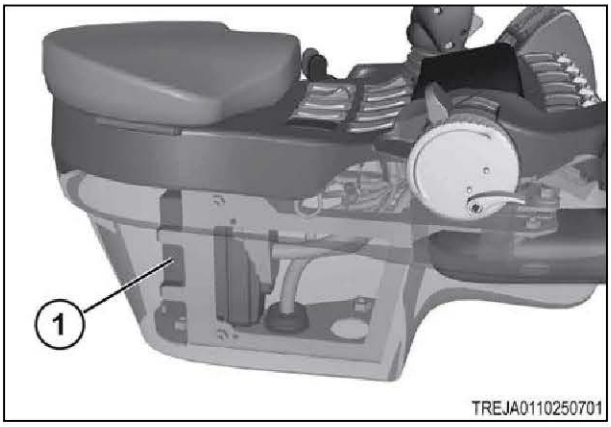

Fig. 25

5.2.20 Dash cluster

The dash cluster (1) contains warning lamps that show the operator the current condition of the machine.

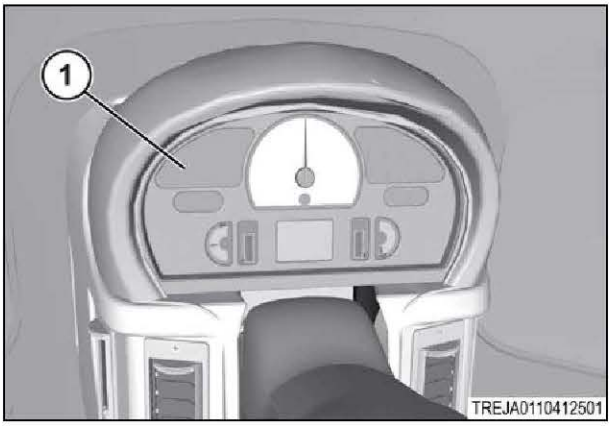

Fig. 26

5.2.21 CAN data link

There are three controller area network (CAN) busses in the machine. The connectors to these busses are:

1 Powertrain bus
2 Auxiliary bus
3 ISO bus

The CAN data link is located in the wire harness. The connectors for the CAN data link are located in the cab wall on the right-hand side of the seat. The CAN data link communicates with the following components:

- Armrest module
- Transmission module
- Display module for the Tractor Management Center (TMC)
- Dash panel cluster
- Other electronic components

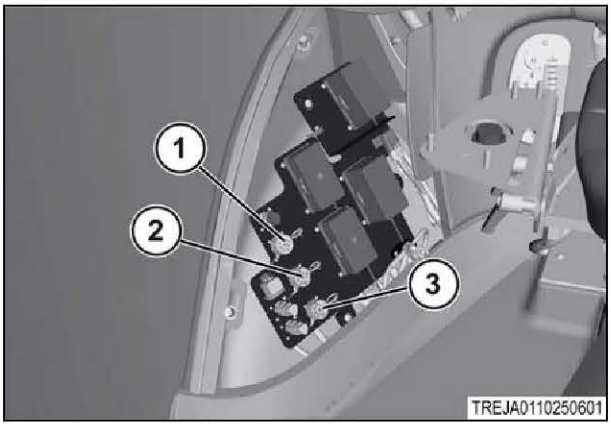

Fig. 27

5.2.22 Implement filter bypass switch

The implement filter bypass switch (1) is located on the right-hand side of the machine on the front section of the machine.

The bypass switch is mounted on the filter base.

The switch signals the module that the implement filter is restricted. A warning will be shown on the tractor management center. An audible alert and warning signal on the dash cluster will be activated.

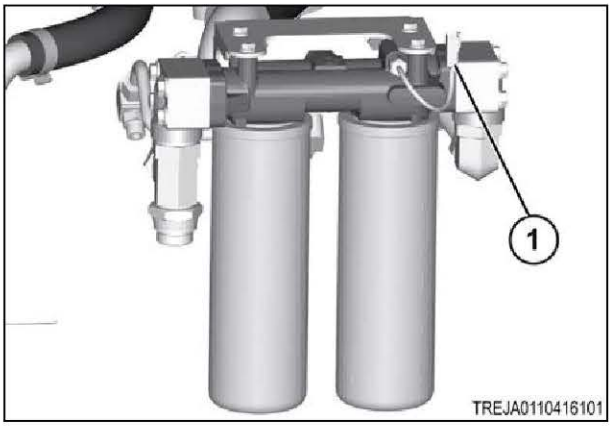

Fig. 28

5.3 Steering system operation

5.3.1 Standard steering system - left-hand turn

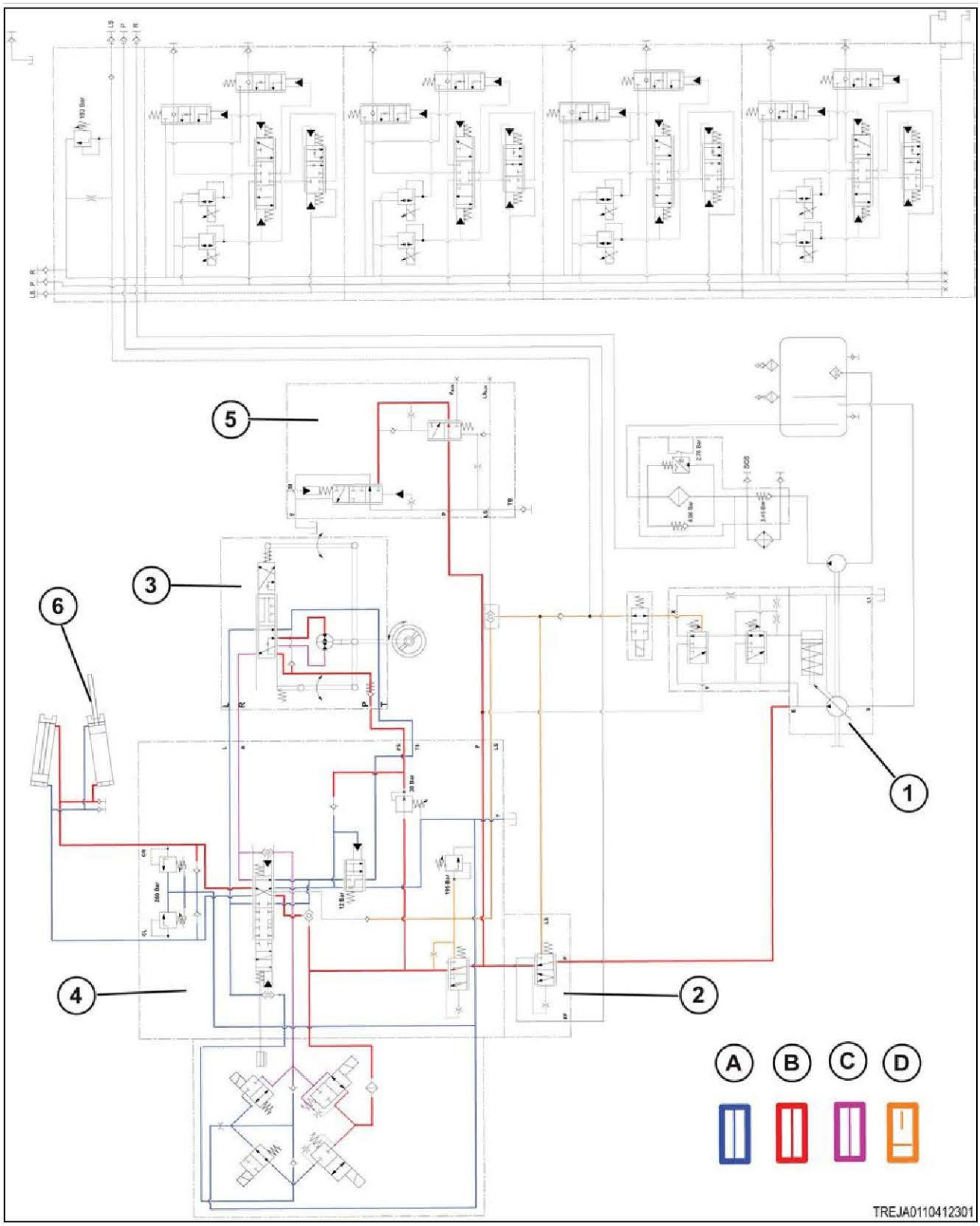

Fig. 29

The pump flow (B) is routed from the implement pump (1) through the priority valve (2) and sent to the steering unit (3), steering valve (4), and the trailer brake valve (5).

In the standard units, when the operator turns the wheel to the left-hand side, the spool valve in the steering unit spins in the sleeve. This routes the flow (C) to the steering valve. The oil flow shifts the directional spool to let the pump flow to the steering cylinder (6). This extends the right-hand cylinder and retracts the left-hand cylinder. This will turn the machine to the left-hand side.

The displaced cylinder oil (A) is routed back through the steering valve and sent to the unfiltered side of the oil reservoir.

A load sense signal (D) is sent from the steering valve, to the compensator valve on the implement pump. This controls the pressure sent into the circuit.

5.3.2 Standard steering system - right-hand turn

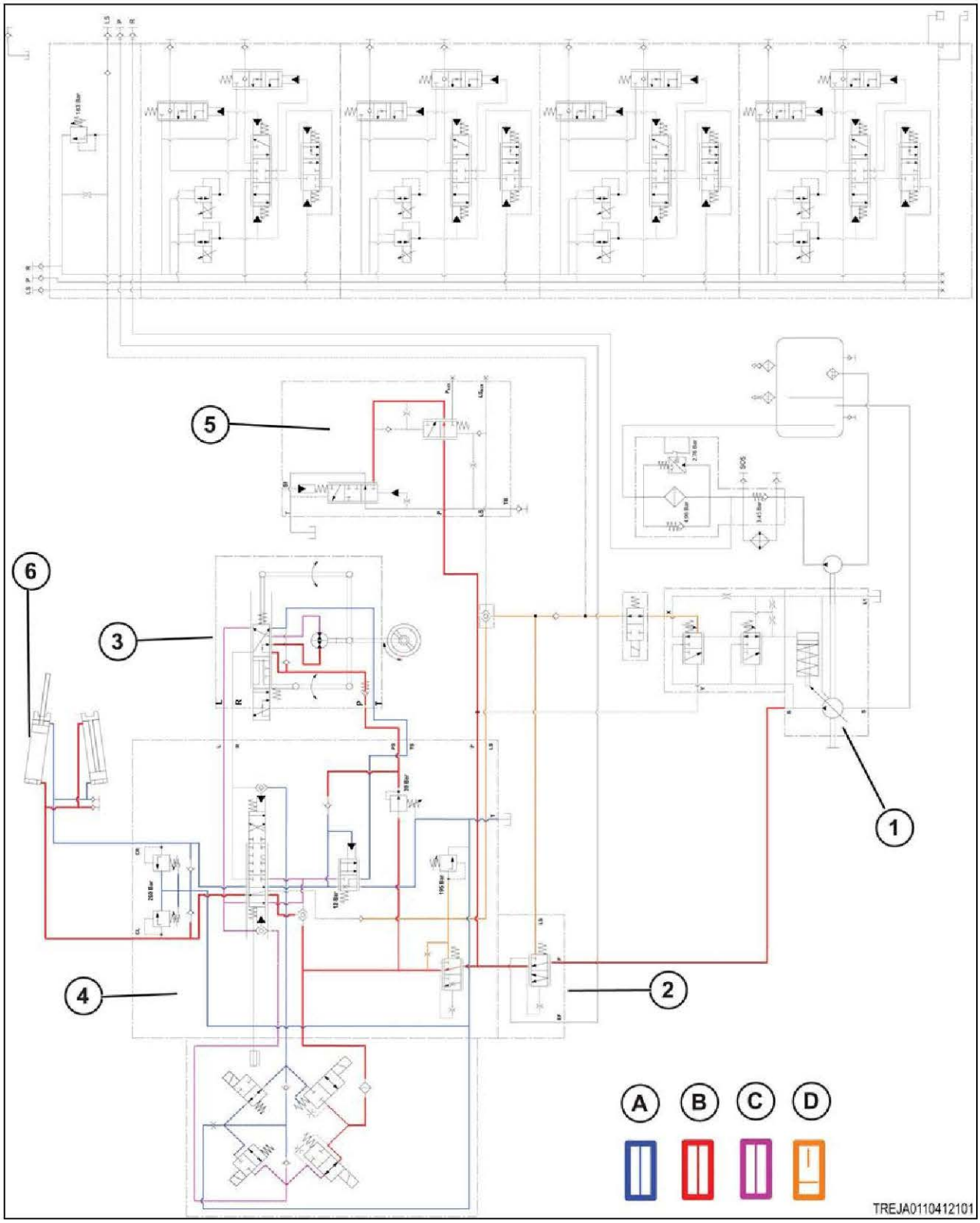

Fig. 30

The pump flow (B) is routed from the implement pump (1) through the priority valve (2) and sent to the steering unit (3), steering valve (4), and the trailer brake valve (5).

In the standard units, when the operator turns the wheel to the right-hand side, the spool valve in the steering unit spins in the sleeve. This routes the flow (C) to the steering valve. The oil flow shifts the

directional spool to let the pump flow to the steering cylinder (6). This extends the left-hand cylinder and retracts the right-hand cylinder. This will turn the machine to the right-hand side.

The displaced cylinder oil (A) is routed back through the steering valve and sent back to the unfiltered side of the oil reservoir.

A load sense signal (D) is sent from the steering valve, to the compensator valve on the implement pump. This controls the pressure sent into the circuit.

5.3.3 Electronic steering system - left-hand turn

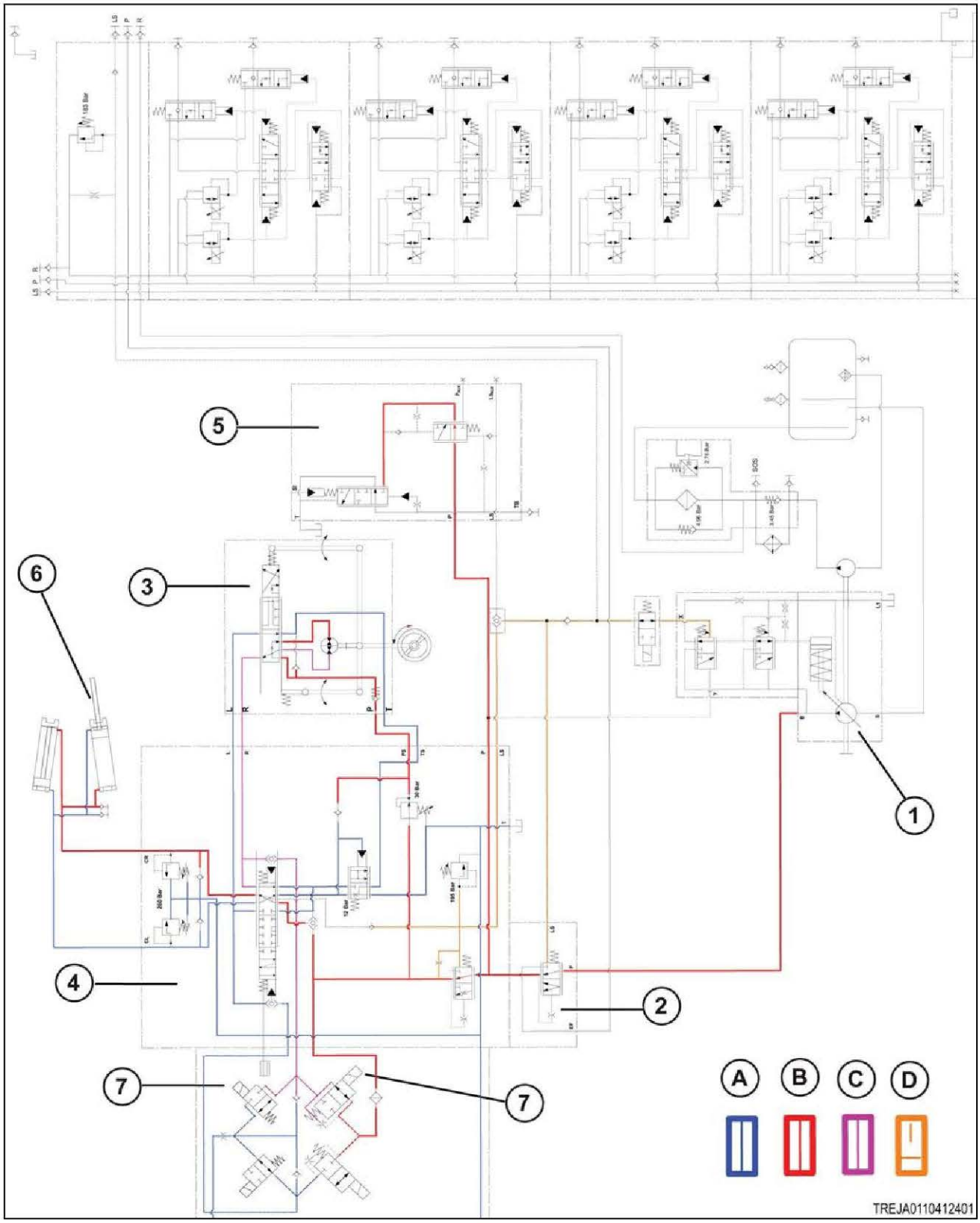

Fig. 31

The pump flow (B) is routed from the implement pump (1) through the priority valve (2) and sent to the steering unit (3), steering valve (4), and the trailer brake valve (5).

In the electronically enhanced units, when the operator turns the wheel to the left-hand side, the steering angle sensor in the steering unit sends a signal to the solenoids in the steering valve. The two solenoids (7)

shift and let the hydraulic flow to the steering cylinder (6). This extends the right-hand cylinder and retracts the left-hand cylinder. This will turn the machine to the left-hand side.

The displaced cylinder oil (A) is routed back through the steering valve and sent to the unfiltered side of the oil reservoir.

A Load sensor signal (D) is sent from the steering valve to the compensator valve on the implement pump. This controls the pressure sent into the circuit.

5.3.4 Electronic steering system - right-hand turn

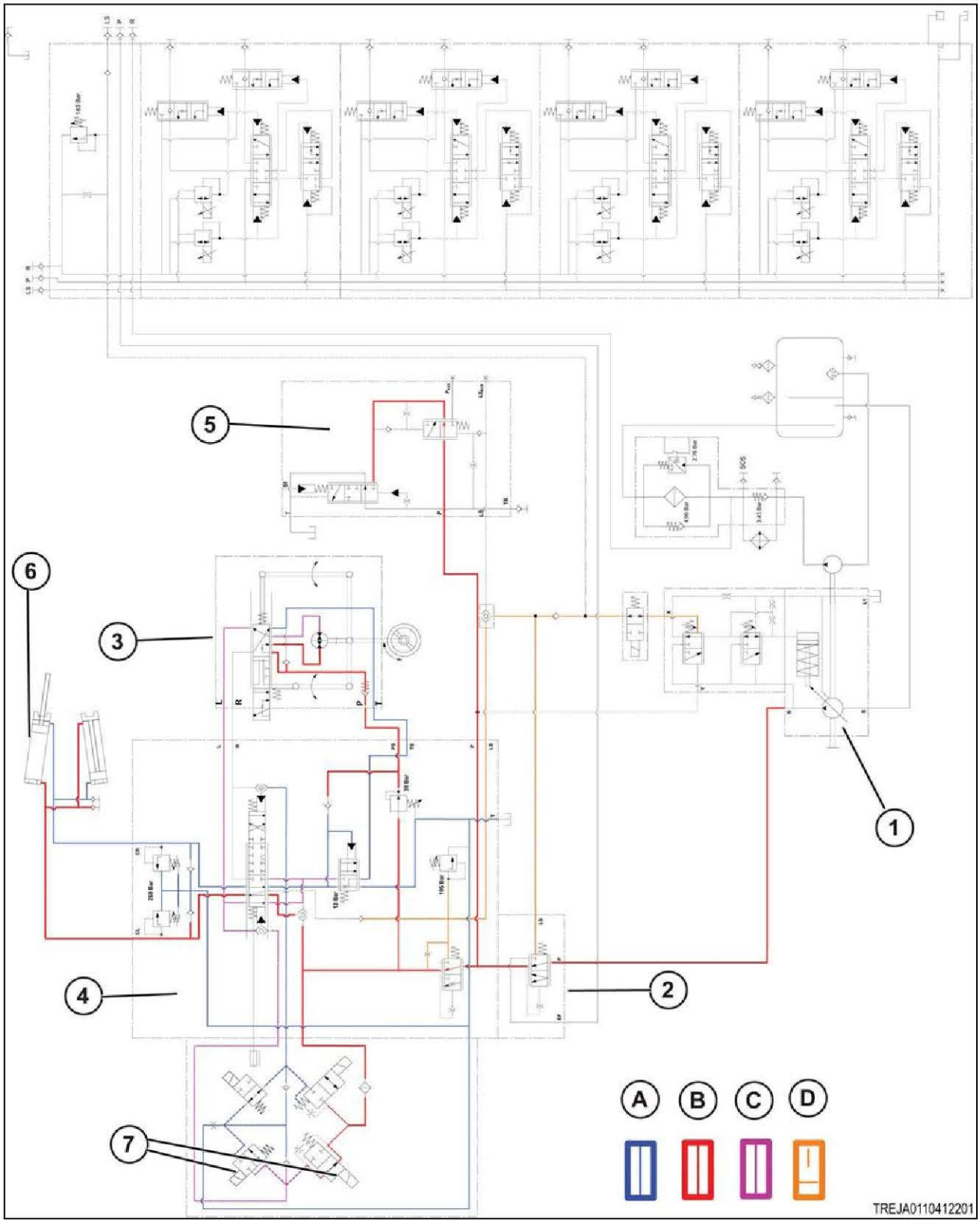

Fig. 32

The pump flow (B) is routed from the implement pump (1) through the priority valve (2) and sent to the steering unit (3), steering valve (4), and the trailer brake valve (5).

In the electronically enhanced units, when the operator turns the wheel to the right-hand side, the steering angle sensor in the steering unit sends a signal to the solenoids in the steering valve. The two solenoids (7)

shift and let the hydraulic flow to the steering cylinder (6). This extends the left-hand cylinder and retracts the right-hand cylinder. This will turn the machine to the right-hand side.

The displaced cylinder oil (A) is routed back through the steering valve and sent to the unfiltered side of the oil reservoir.

A Load sensor signal (D) is sent from the steering valve to the compensator valve on the implement pump. This controls the pressure sent into the circuit.

5.3.5 Standard steering - priority valve - right turn

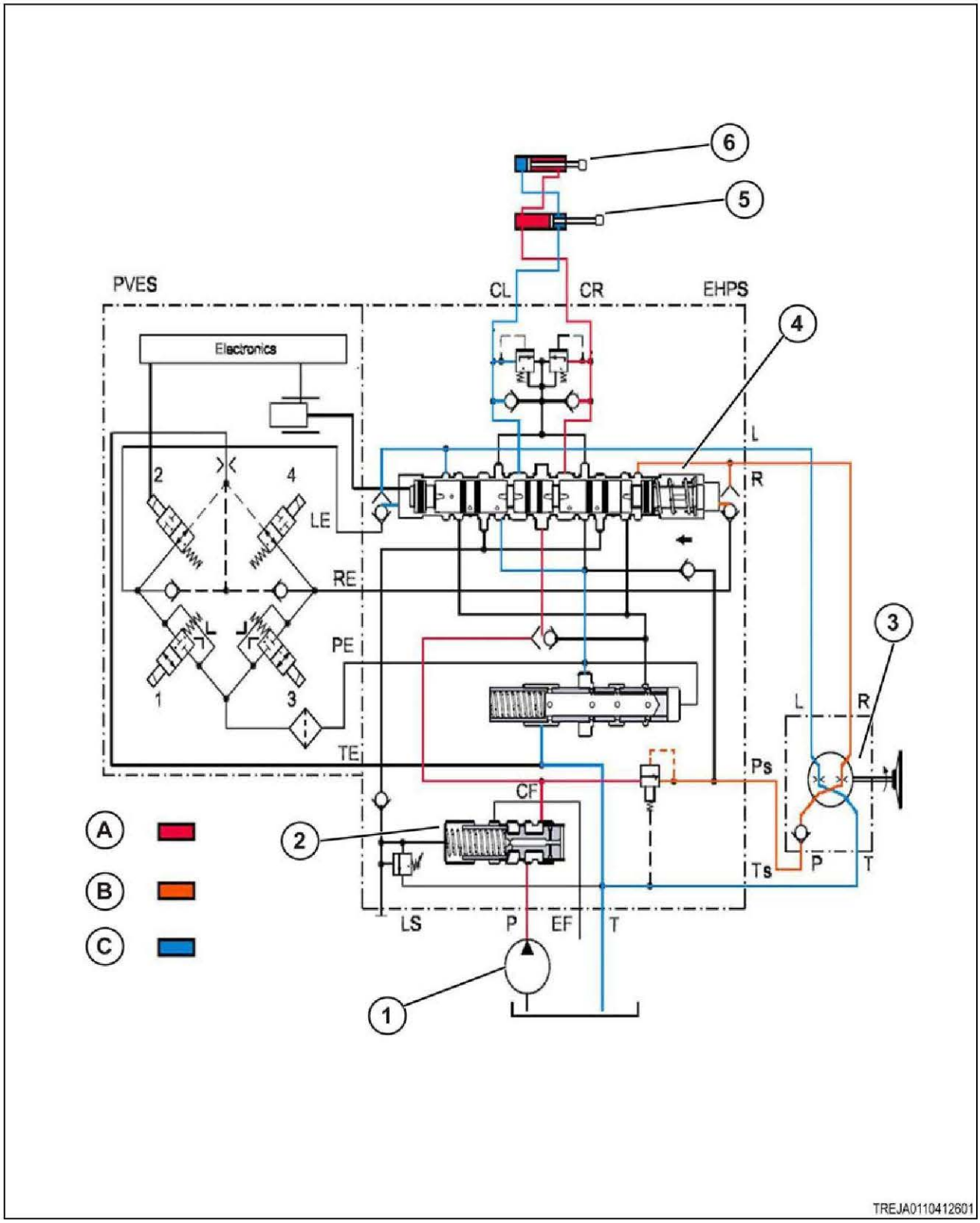

Fig. 33

Implement pump (1) sends hydraulic flow (A) into the priority valve (2) in the steering/priority valve. When the operator turns the wheel to the right-hand side, a load sense signal shifts the priority valve to send the hydraulic flow out of the control flow (CF) port.

This hydraulic flow is sent to the steering unit (3). The steering units direct the flow (B) out of the right-hand port. This hydraulic flow is sent to the right-hand end of the directional spool (4) and shifts to the left-hand side.

With the dirctional spool shifted to the left-hand side, the hydraulic flow can pass through the CR passage. The hydraulic flow then passes to the extended left-hand cylinder (5) while retracting the right-hand cylinder (6). This turns the machine to the right-hand side. The displaced hydraulic oil (C) is returned to the oil reservoir.

5.3.6 Standard steering - priority valve - left turn

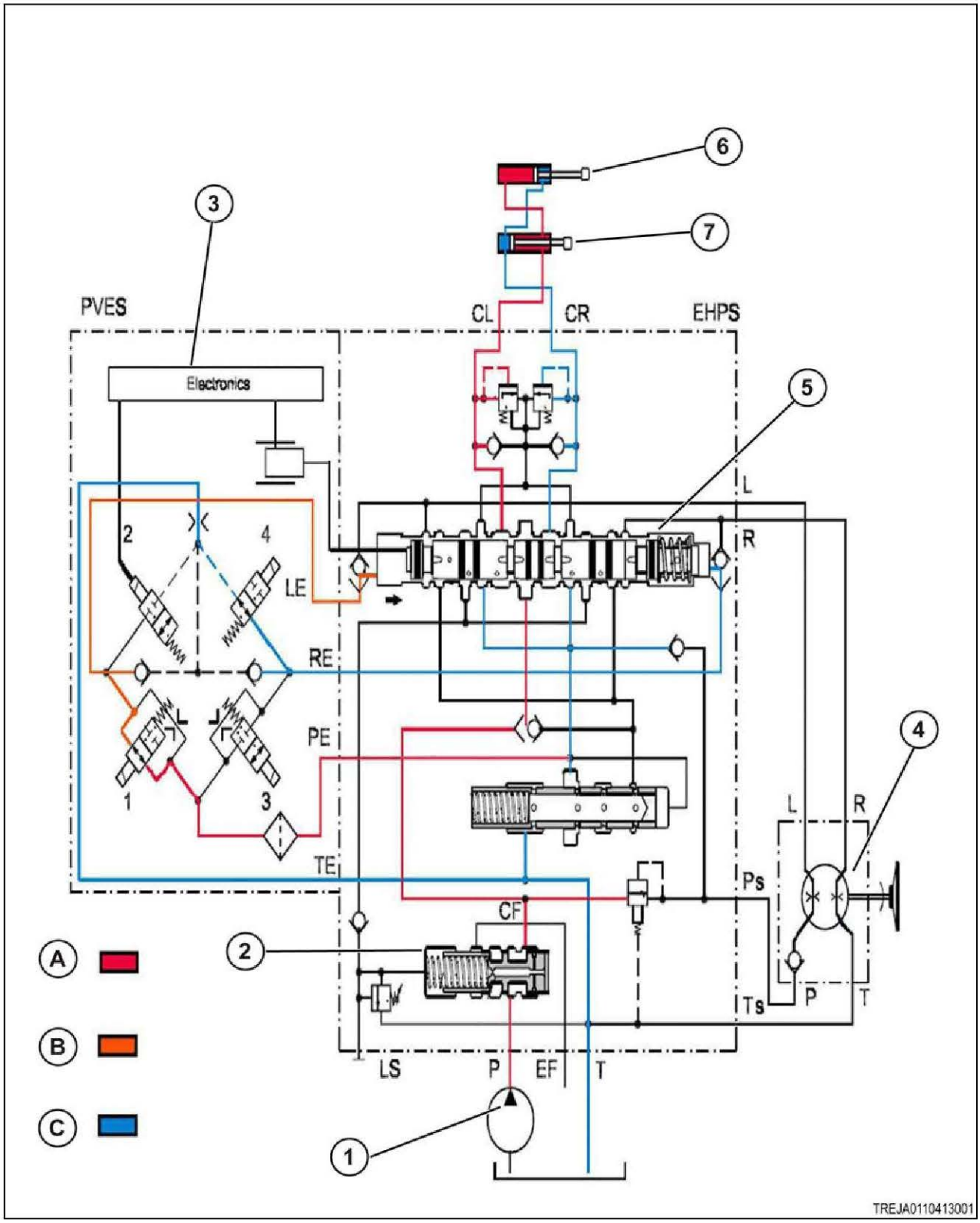

Fig. 34

The implement pump (1) sends hydraulic flow (A) into the priority valve (2) in the steering/priority valve. When the operator turns the wheel to the left, a load sense signal shifts priority valve. This send the hydraulic flow out of the control flow (CF) port.

Pilot pressure is sent to the electrical actuation PVES(3). When the steering unit (4) is turned, the steering angle sensor on the shaft communicates change in the direction to the PVES. The solenoids 1 and 2 are activated to send the hydraulic flow (B) to the left-hand side of the directional spool (5) in the steering valve. This hydraulic flow shifts the spool to the right-hand side.

With the directional spool shifted to the right-hand side, the hydraulic flow can pass through the CL passage. The hydraulic flow then passes to the extended right-hand cylinder (6) while retracting the left-hand cylinder (7). This turns the machine to the left-hand side. The displaced hydraulic oil (C) is returned to the oil reservoir.

5.3.7 Electronic steering - priority valve - right turn

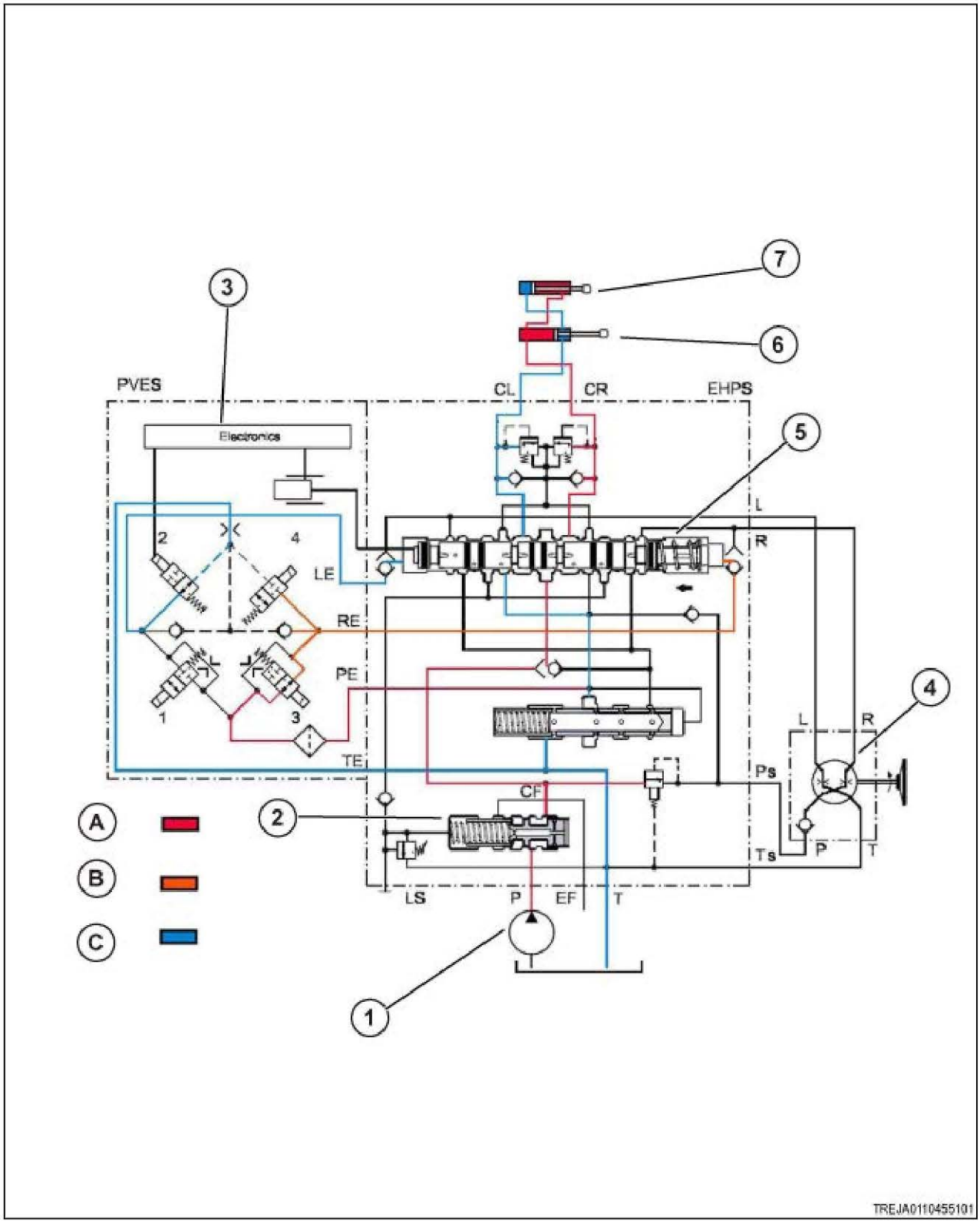

Fig. 35

The implement pump (1) sends the hydraulic flow (A) into the priority valve (2) in the steering/priority valve. When the operator turns the wheel to the right-hand side, a load sense signal shifts the priority valve. This sends the hydraulic flow out of the control flow (CF) port.

The pilot pressure is sent to the electrical actuation PVES (3) . When the steering unit (4) is turned, the steering angle sensor on the shaft communicates the change in the direction to the PVES. The solenoids 3 and 4 are activated to send the hydraulic flow (B) to the right-hand side of the directional spool (5) in the steering valve. This hydraulic flow shifts the spool to the left-hand side.

With the directional spool shifted to the left-hand side, the hydraulic flows through the CR passage. This will extend the left-hand cylinder (6) while the retracting right-hand cylinder (7). This turns the machine to the right-hand side of the machine. The displaced hydraulic oil (C) is returned to the oil reservoir.

5.3.8 Electronic steering - priority valve - left turn

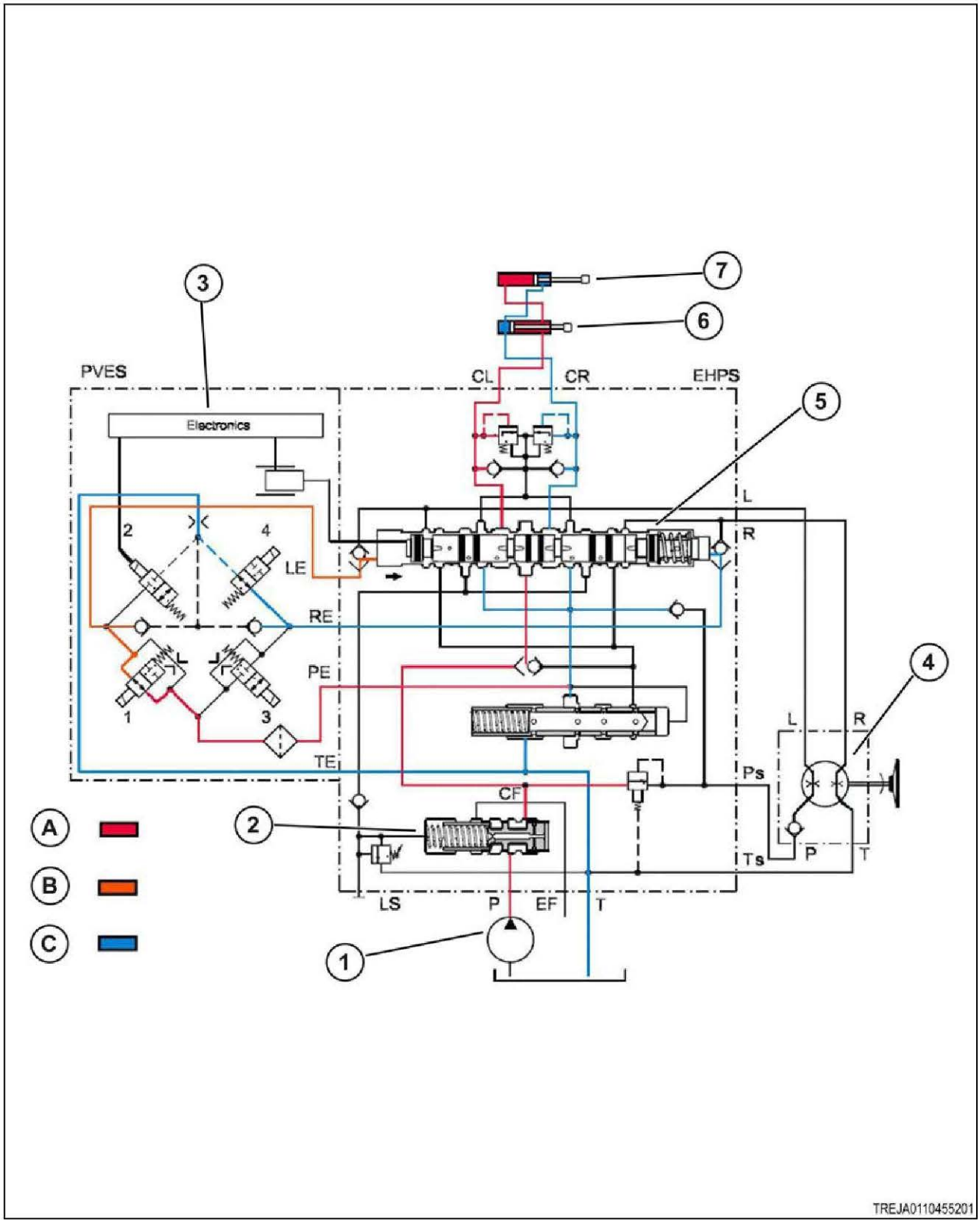

Fig. 36

The implement pump (1) sends the hydraulic flow (A) into the priority valve (2) in the steering/priority valve. When the operator turns the wheel to the left-hand side, a load sense signal shifts the priority valve. This sends the hydraulic flow out of the control flow (CF) port.

The pilot pressure is sent to the electrical actuation PVES (3) . When the steering unit (4) is turned, the steering angle sensor on the shaft communicates the change in the direction to the PVES. The solenoids 1 and 2 are activated to send the hydraulic flow (B) to the left-hand side of the directional spool (5) in the steering valve. This hydraulic flow shifts the spool to the right-hand side.

With the directional spool shifted to the right-hand side, the hydraulic flows through the CR passage. This will extend the right-hand cylinder (6) while the retracting the left-hand cylinder (7). This turns the machine to the left-hand side of the machine. The displaced hydraulic oil (C) is returned to the oil reservoir.

5.3.9 Steering - priority valve - neutral

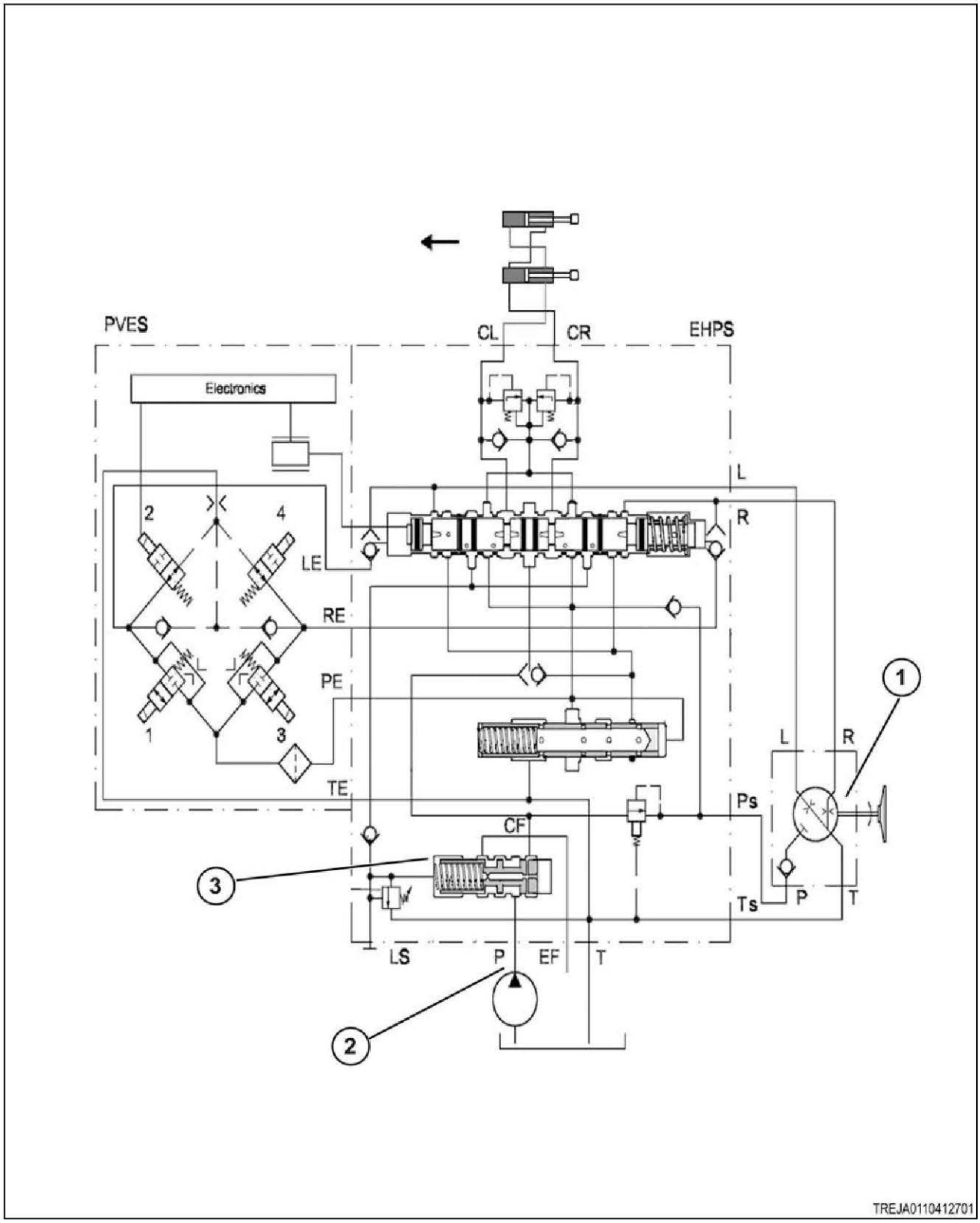

Fig. 37

The steering unit (1) is a closed center. The pump (2) flow is blocked when the operator is not turning the steering wheel.

Unused pump flow is directed out of the excess flow (EF) port by the priority valve (3). The EF-port flow is sent to implement valves.

The solenoids 1 and 3 are blocking hydraulic flow to the directional spool.

5.3.10 Steering unit neutral position

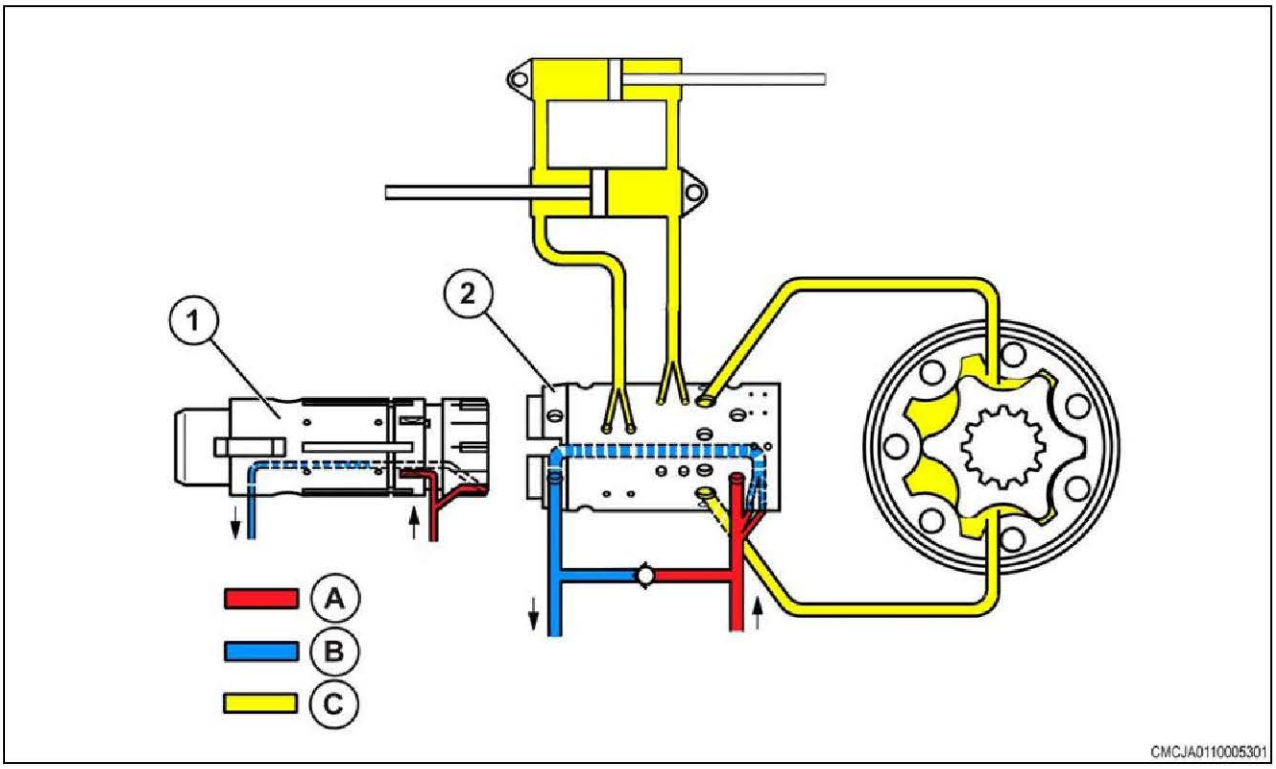

Fig. 38

(1) Spool valve
(2) Sleeve
(A) Pump pressure
(B) Return flow
(C) Caught oil

Hydraulic oil flow from the priority valve is routed to the pressure port on the steering unit. With no operator input, the spool valve (1) moves to the center of the sleeve (2) by springs. Oil flow is blocked to the directional spool in the steering valve.

5.3.11 Steering unit right-hand turn position

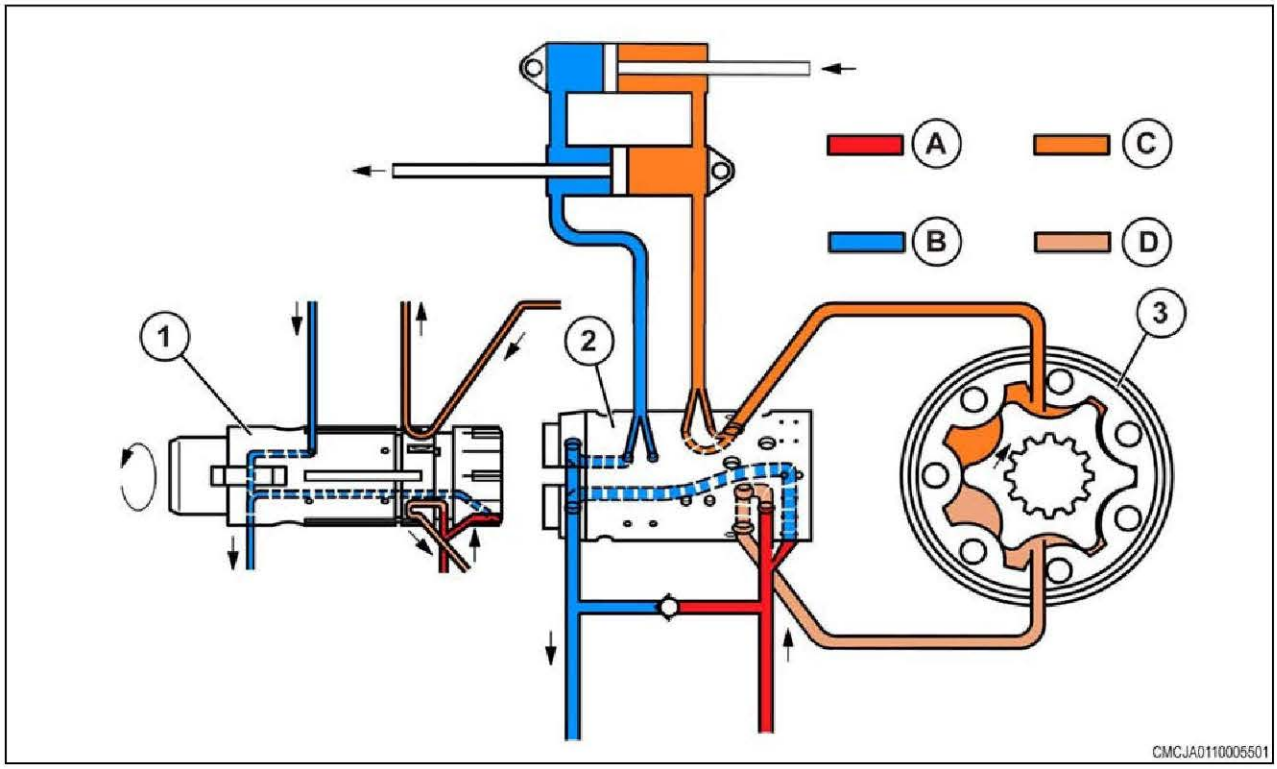

Fig. 39

(1) Spool valve
(2) Sleeve
(3) Rotor and stator
(A) Pump pressure
(B) Return flow
(C) Directional flow
(D) Directional supply oil

Hydraulic oil flow from the priority valve is routed to the pressure port on the steering unit. When the operator turns the steering wheel to the right, the spool valve (1) rotates in the sleeve (2). Oil flows to the rotor and stator (3). Oil then flows to the appropriate steering cylinders.

When the steering wheel stops turning, springs connecting the spool valve and the sleeve center the spool in the sleeve. This centering blocks off the passages to the steering cylinders.

If the machine loses power or hydraulic pressure, the machine can be steered manually. Power aid is no longer provided.

In this example, turning the steering wheel compresses the centering springs and the rotor and stator are driven mechanically. The operator must turn the steering wheel as a hand pump that pumps oil into the system. Oil returning from the steering cylinders is routed to the pressure passage. The oil pulled into the rotor and stator, compressed, and sent to the steering valve. The pressure made by turning the steering wheel is proportional to the torque applied on the steering wheel. A large amount of force on the steering wheel is required to turn the machine.

5.3.12 Steering unit left-hand turn position

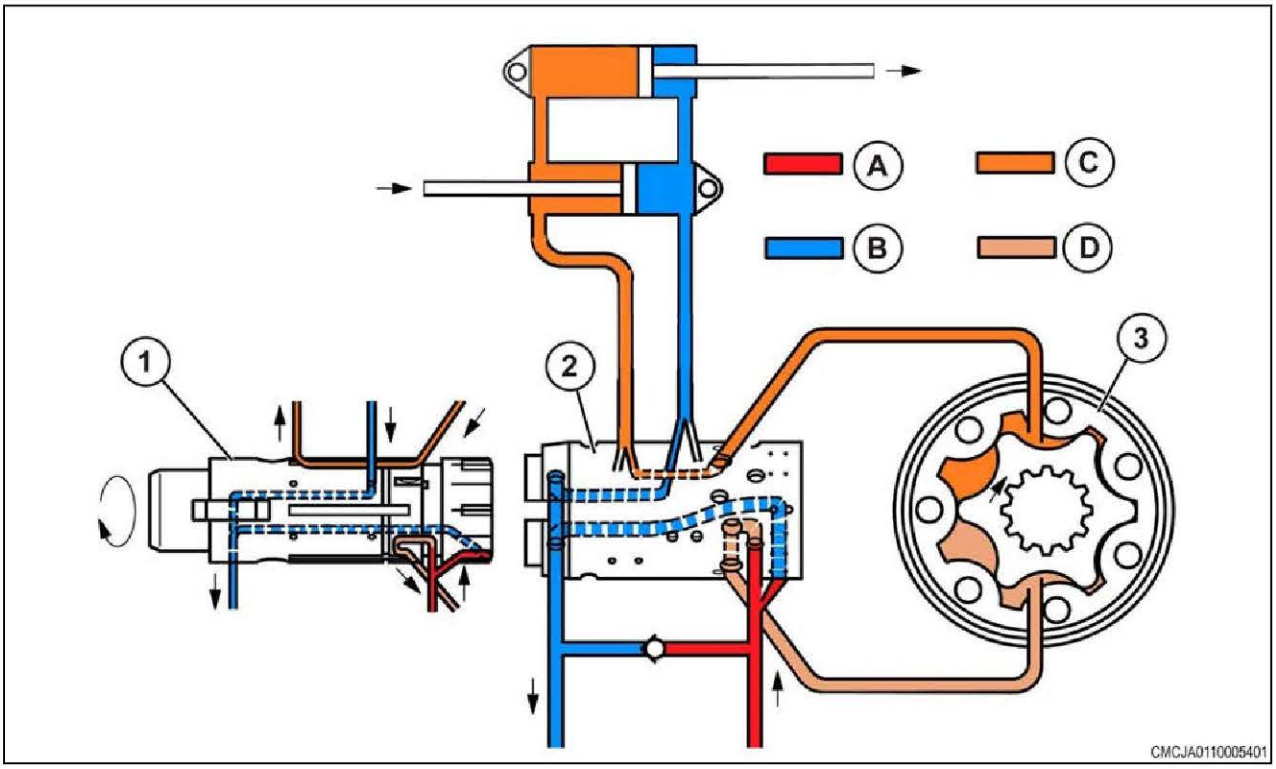

Fig. 40

(1) Spool valve
(2) Sleeve
(3) Rotor and stator
(A) Pump pressure
(B) Return flow
(C) Directional flow
(D) Directional supply oil

Hydraulic oil flow from the priority valve is routed to the pressure port on the steering unit. When the operator turns the wheel to the left, the spool valve (1) rotates in the sleeve (2). Oil flows to the rotor and stator (3). The oil then flows to the appropriate steering cylinders.

When the steering wheel stops turning, springs connecting the spool valve and the sleeve center the spool in the sleeve. This centering blocks off the passages to the steering cylinders.

If the machine loses power or hydraulic pressure, the machine can be steered manually. Power aid is no longer provided.

In this example, turning the steering wheel compresses the centering springs and the rotor and stator are driven mechanically. The operator must turn the steering wheel as a hand pump that pumps oil into the system. Oil returning from the steering cylinders is routed to the pressure passage. The oil is pulled into the rotor and stator, compressed, and sent to the steering valve. The pressure made by turning the steering wheel is proportional to the torque applied on the steering wheel. A large amount of force on the steering wheel is required to turn the machine.

5.3.13 Hydraulic pump (implement)

Implement hydraulic pump is on the rear of pump drive. The pump drive is on left-hand side of machine.

Implement hydraulic pump has following characteristics:

- variable displacement
- load sensing
- compensation for pressure
- compensation for flow

This type of piston pump has variable flow and variable pressure. Flow and pressure are dependent on system demands sensed by the pressure and the flow compensator valve.

Implement hydraulic pump has the following components:

- Cylinder barrel assembly – Cylinder barrel contains nine pistons. Cylinder barrel assembly rotates when engine is operating. Pistons move oil into barrel and out of the barrels.
- Drive shaft -- Rotation of the pump is counterclockwise when seen from the drive end. The cylinder barrel assembly is splined to drive shaft.
- Bias spring -- If there is no pressure behind actuator piston, the bias spring will hold the swash plate at maximum angle.
- Swash plate -- The angle of the swash plate controls the displacement of pump. The angle of swash plate causes the pistons to move in and out of the rotating barrel.
- Actuator piston – When oil pressure increases behind the actuator piston, the actuator piston will overcome force of bias spring. This reduces the angle of swash plate.
- Pressure and flow compensator valve -- The pressure and flow compensator valve controls the delivery and the return of oil to the actuator piston.

When engine is off, the pressure and the flow compensator valve does not receive a load sensing signal. The margin spring pushes the flow compensator spool completely to the right-hand side. Any pressure behind the actuator piston goes to case drain across the flow compensator spool.

When there is no pressure behind the actuator piston, the bias spring can hold the swash plate at maximum angle.

With the engine started, drive shaft starts to rotate. Oil flows into piston bore from pump inlet. As the cylinder barrel assembly rotates oil fliows out of the pump outlet and into the system.

5.3.14 Compensator valve

The compensator valve (1) is on the top of the hydraulic pump.

The compensator valve regulates the pump output flow in response to the following signals:

- Load sensing signal
- Implement valve reference signal

The compensator valve also is a backup to limit the system pressure.

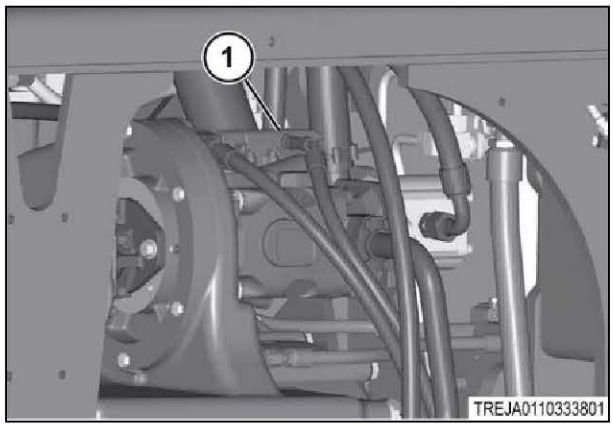

Fig. 41 Hydraulic implement pump 58 gpm

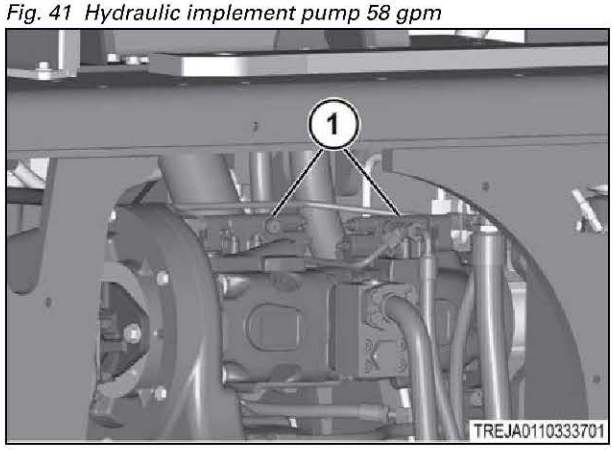

Fig. 42 Hydraulic implement pump 85 gpm

5.3.15 Low pressure standby

Low pressure standby is the the pressure at the pump outlet. Low pressure standby is approximately 2415 kPa (350 psi) .

Low pressure standby is higher than margin pressure. This is because of a higher back pressure made by oil blocked at the center valves in the hold position.

Low pressure standby is not adjustable. Low pressure standby can vary from one machine to another machine. Also, low pressure standby can vary in the same hydraulic pump as system leakage increases.

The amount of the system leakage and the flow compensator spool adjustments can cause margin pressure to equal low pressure standby. Margin pressure can never be higher than low pressure standby.

When hydraulic pump is at low pressure standby, the implement valve signal pushes the flow compensator spool to top. This procedure will compress the margin spring. An increased amount of supply oil from pump outlet will flow to actuator piston. This procedure will destroke the hydraulic pump.

5.3.16 Upstroke

When an implement hydraulic circuit requires flow, the pump outlet reduces pressure. Reduced pump output causes the force of the margin spring and the load sensing signals to be more than implement valve signal. This force is on the top end of the flow compensator spool. Force is more than the pump supply pressure and implement valve reference signal at bottom end of spool.

The spool moves to block the flow of oil to the actuator piston. The actuator piston releases oil to the case drain across the flow compensator spool. Which lets the bias spring to move swashplate to a higher angle.

Pump now has more flow. This condition is upstroking.

Following conditions can cause an upstroking pump:

- The implement hydraulic circuit moves from low pressure reserve and the load sensing signal increases pump output flow. The control valve is in the position that demands oil.
- When the hydraulic control valve is in a given position, the pump will upstroke to adjust for system leakage.
- Hydraulic pump will upstroke when demand increases from changing position of the main control spool in a hydraulic control valve.
- When any additional implement hydraulic circuit is engaged, there is a need for increased pump flow.
- The hydraulic pump will upstroke when engine speed decreases, if demand on the implement system remains constant or increases.
- If accumulator for service brakes needs charging, there is a need for increased pump flow.

5.3.17 Constant flow

When a constant flow of oil is required by the steering circuit or an implement hydraulic circuit, supply oil pressure from pump outlet will increase at the flow compensator spool.

Following pressures will react on the top end of the flow compensator spool:

- Margin spring
- Load sensing signal

Following pressure will react on bottom end of flow compensator spool:

- Implement valve reference signal

Once pressures become equal on each end of spool, the flow compensator spool will meter oil to the actuator piston and the system will become stable.

The swash plate holds a constant angle to hold required flow.

5.3.18 Destroke

The hydraulic pump destrokes when reduced flow is necessary. Hydraulic pump destrokes when the pressure of the implement valve becomes more than the pressure of the load sense and the margin spring.

Flow compensator spool moves to the top which lets more oil flow to actuator piston. Pressure on the actuator piston has now increased.

Increased pressure overcomes the force of the bias spring which moves the swash plate to a reduced angle. When the pressure of the implement valve is the same as the total pressure of the load sense and the margin spring, the flow compensator spool moves to a metering position. The hydraulic pump will return to a constant flow.

Following conditions result in destroking hydraulic pump:

- When a control spool for a hydraulic control valve is in the hold position the hydraulic pump will destroke.
- The hydraulic pump destrokes if a control is in a position that does not require as much flow.
- The hydraulic pump will destroke when there is a reduction in demand from any one of hydraulic control valves.
- If there is a small reduction in highest operating pressure, or there is a reduction in the installed system leakage.
- If engine speed increases, hydraulic pump destrokes.
- When accumulator for service brakes finishes charging, hydraulic pump destrokes.

When hydraulic pump destrokes, supply oil pressure from pump outlet decreases on bottom side of the flow compensator spool.

Once forces become equal on each end of spool, flow compensator spool will measure oil to the actuator piston.

5.3.19 High pressure stall

At a high pressure stall, the pressure of the load sense and the margin spring is equal to the pressure of the implement valve.

The load sensing relief valve limits maximum system pressure at any pump displacement. The load sensing relief valve will be at a pressure of 178 to 186 bar (2580 to 2698 psi).

A margin pressure of 20 to 22 bar (290 to 320 psi) above load sense while at a high pressure stall.

If the hydraulic pump is at a high pressure stall, maximum system pressure will be 200 to 206 bar (2900 to 2988 psi).

If the load sensing relief valve is not adjusted correctly, the pressure compensator spool serves as a backup to protect hydraulic system.

The hydraulic pump is now at minimum flow and the supply oil at pump outlet is at maximum pressure. These conditions are for a single implement in a stall condition.

With multiple implement hydraulic circuits activated, the hydraulic pump still produces flow while one of circuits is at a high pressure stall. This flow meets the needs of the other circuits at a lower work port pressure. The hydraulic pump will be producing maximum flow while the pressure of supply oil from the pump outlet is at maximum.

5.3.20 High pressure cutoff

When the hydraulic pump destrokes, supply oil pressure from the pump outlet decreases on bottom side of the flow compensator spool.

Once forces become equal on each end of the spool, the flow compensator spool will measure oil to the actuator piston.

The pressure compensator spool is in parallel with the flow compensator spool. The pressure compensator spool serves as a backup for protecting the hydraulic system if the load sensing relief valve adjustment is not correct. The p-ressure compensator spool limits maximum system pressure at any pump displacement.

The cutoff spring pushs the pressure compensator spool to the bottom of the valve during normal operation. The cutoff spring has a spring force value of 225 to 235 bar (3265 to 3405 psi).

The total pressure of the load sense and the margin spring forces the flow compensator spool to the bottom of the valve. This total pressure must be a minimum 225 to 235 bar (3265 to 3405 psi). When the flow compensator spool moves to the bottom of the valve, a passage will be normally be open. This movement of the spool permits oil holding the actuator piston to be released to case drain. This change will cause implement hydraulic pump to upstroke until system pressure is 212 bar (3075 psi).

5.4 Steering system disassembly and assembly

5.4.1 Remove the gear pump

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

IMPORTANT:
Before removal, fasten identification tags on the components for correct installation at assembly. Put caps and plugs on all hoses, fittings, and ports to prevent contamination from entering the system.

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Disassemble the components on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the parking brake, and take the key with you.

2. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

   NOTE:
   The battery disconnect switch is shown in the off position.

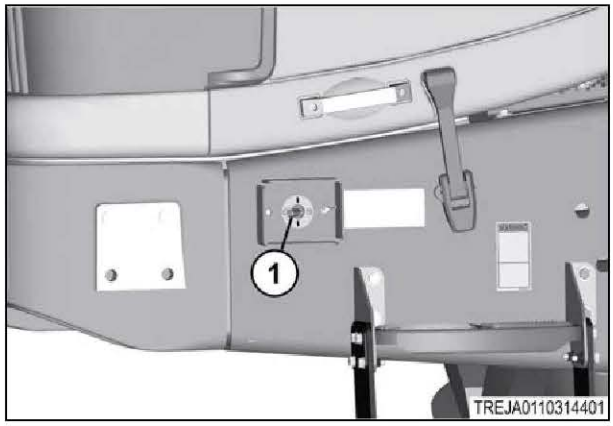

Fig. 43

3. Remove the battery disconnect switch key (1).

4. Relieve all pressure from the hydraulic system.

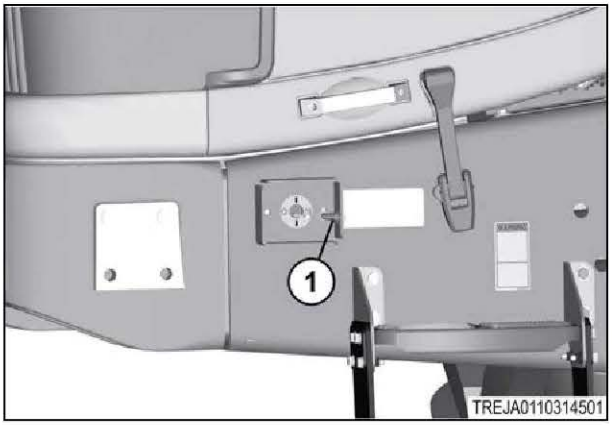

Fig. 44

5. Remove the hardware (1), and the cover plate (2).

6. Set a correct container below the hydraulic tank drain plugs.

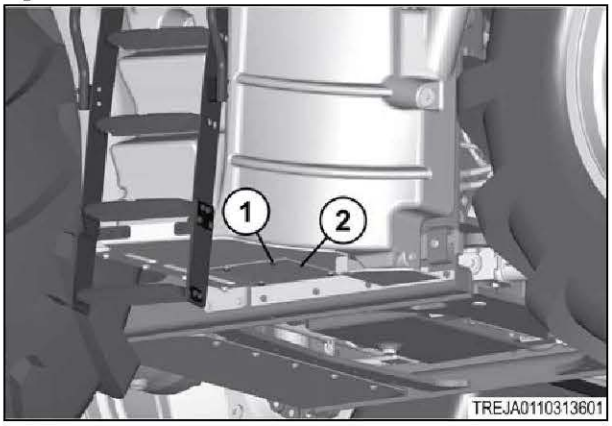

Fig. 45

7. Remove the two drain plugs (1) from the bottom of the hydraulic oil reservoir (2).

8. Drain the hydraulic oil.

9. Install the drain plugs when the reservoir is empty.

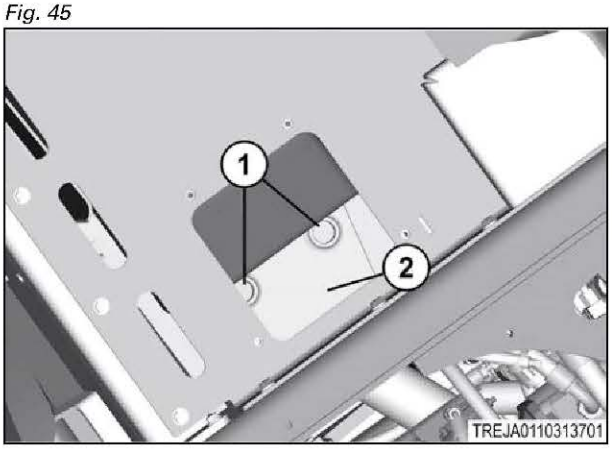

Fig. 46

10. If the machine is equipped with a transmission guard, use correct lifting equipment to support the transmission guard.

    IMPORTANT:
    The weight of the transmission guard is approximately 57 kg (125 lb).

11. Remove the hardware (2).

12. Loosen the hardware (3).

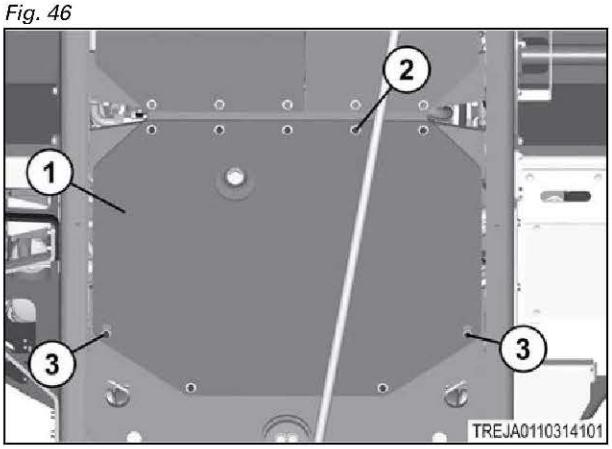

Fig. 47

13. Let the transmission guard (1) rest on the hardware (2).

14. Slide the transmission guard so the large holes are over the hardware (2).

15. Use the correct lifting equipment to remove the transmission guard.

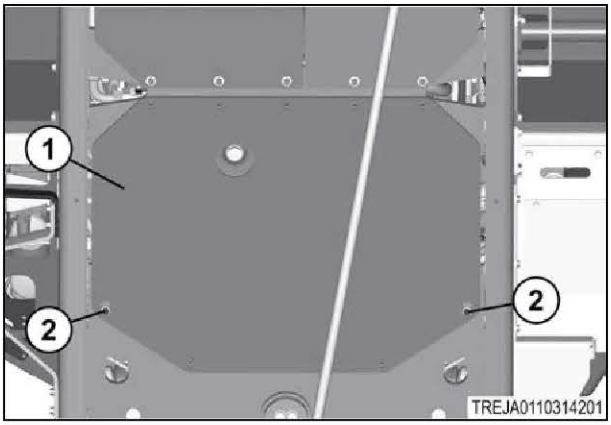

Fig. 48

16. Loosen the hose clamp (1) and disconnect the hydraulic hose (2).

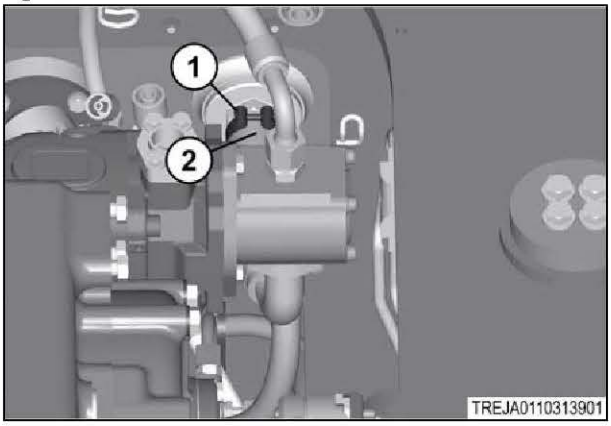

Fig. 49

17. Disconnect the hydraulic hose (1).

18. Remove the hardware (2) and the hydraulic hose fitting (3).

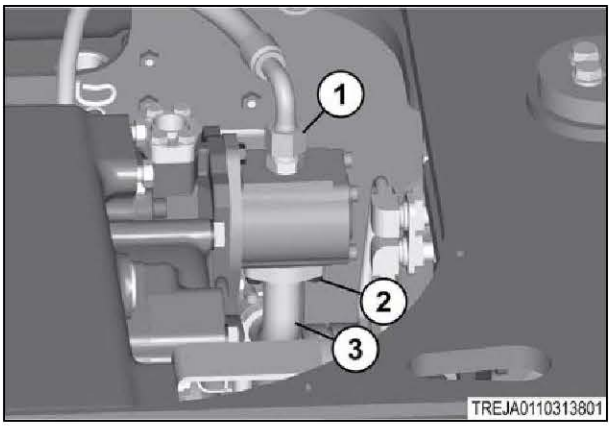

Fig. 50

19. Remove the hardware (1), and the gear pump (2).

20. Remove the O-ring.

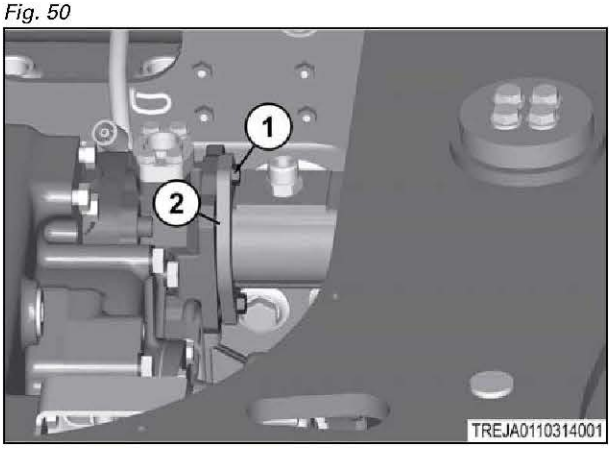

Fig. 51

5.4.2 Disassembling the gear pump

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

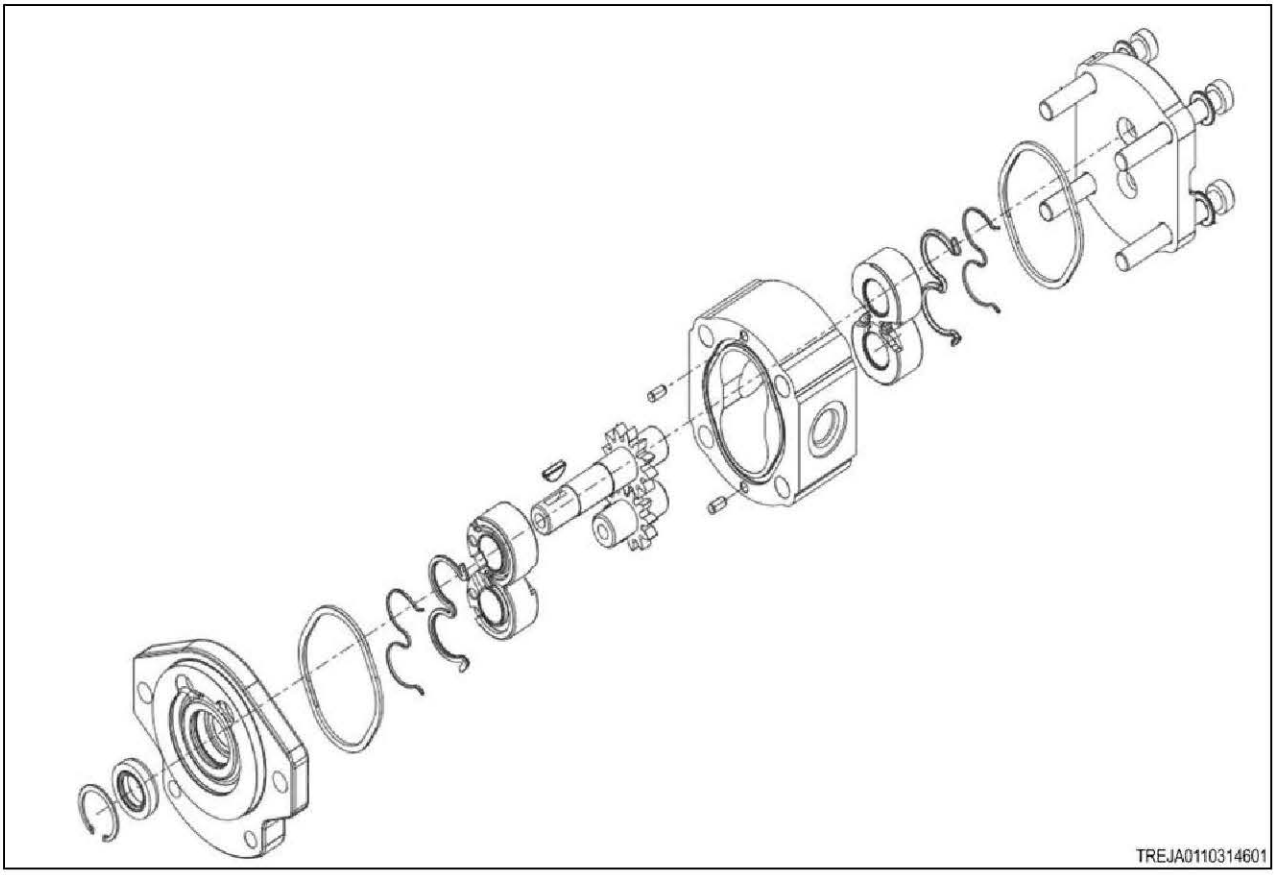

Fig. 52

1. Exploded view of the gear pump.

2. Clean the outside of the pump completely. Make alignment marks on the body and the covers to help in assembly.

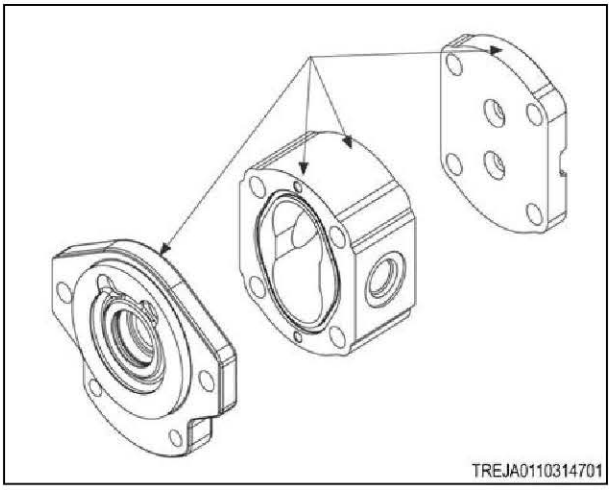

Fig. 53

3. Mount the gear pump in a vise with light pressure on the front cover ears with the shaft pointing down. Remove the four bolts from the rear cover.

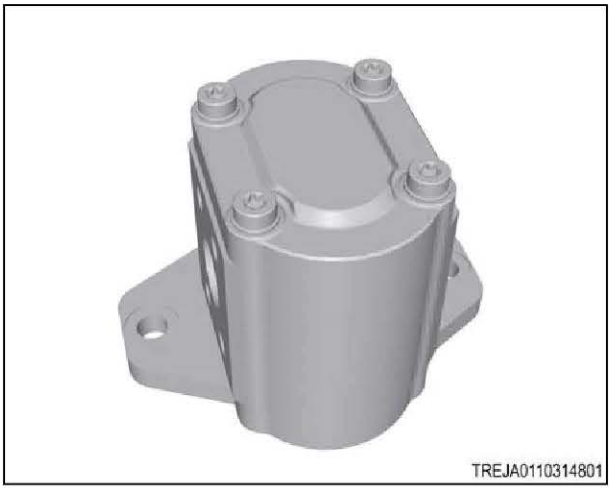

Fig. 54

4. Disconnect the rear cover (1) from the body (2).

NOTE:
The marks must line up for assembly.

5. Remove the seal (3) and discard.

6. Put a mark on each bearing block (4) with a marker to identify the correct position in the body(2).

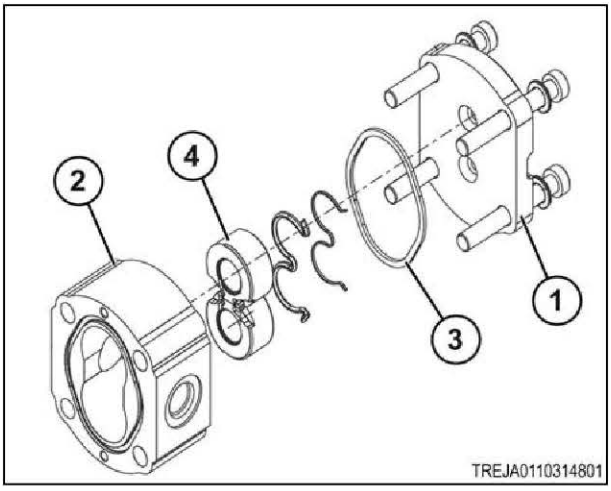

Fig. 55

7. Remove the clip (1) and lift out the bearing block (2), the drive gear (3), and the driven gear (4).

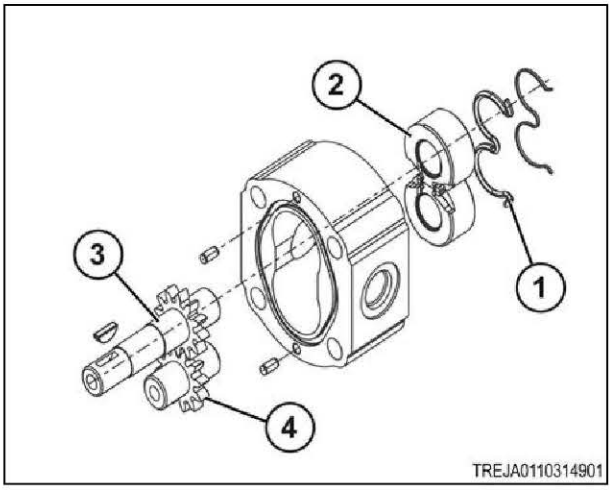

Fig. 56

8. Disconnect the body (1) from the front cover (2). Remove and discard static seal (3). Put a mark on each bearing block (4) with a marker to identify the position in the body.

NOTE:
The marks must line up for assembly.

CAUTION:
When disconnecting the body from the front cover, put one hand under the body in case the front bearing block falls out.

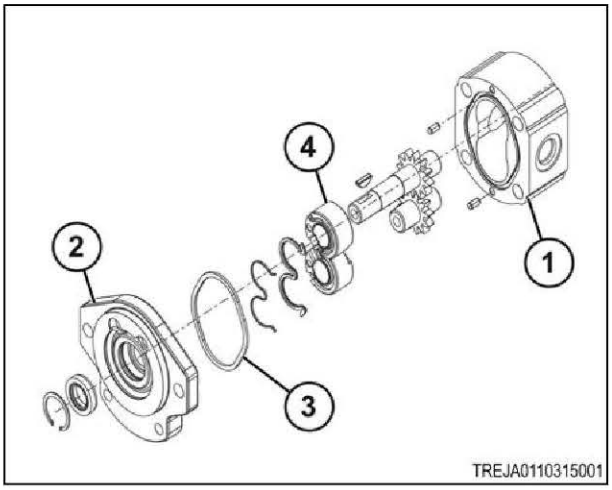

Fig. 57

9. Remove the snap ring (1) from the front cover (2).

10. Remove the shaft seal (3) by carefully removing with a screwdriver. Discard the shaft seal.

CAUTION:
Take care not to damage the shaft seal bore when removing the shaft seal. A damaged seal bore will cause seal leakage.

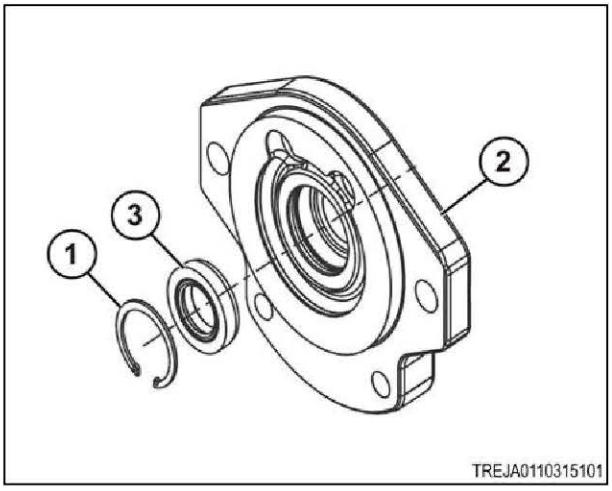

Fig. 58

11. Remove and discard the anti-extrusion seal (1) and pressure loading seal (2) from each bearing block (3).

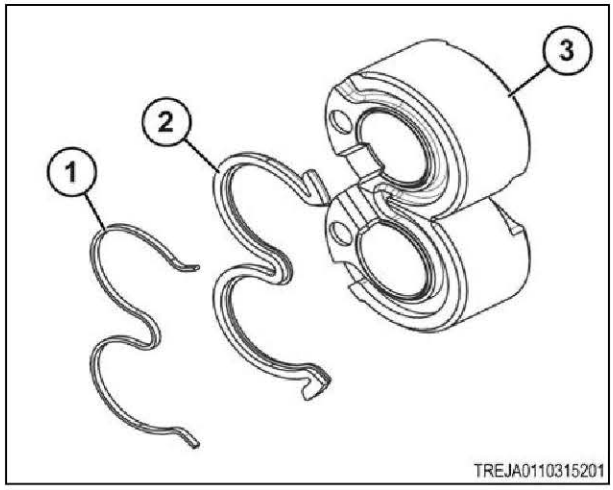

Fig. 59

5.4.3 Assemble the gear pump

NOTE:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Rotate the front cover (1) so the shaft seal bore is on top.

2. Press the shaft seal (2) in the bore.

CAUTION:
Take care not to damage the shaft seal bore when installing the shaft seal. A damaged seal bore will cause seal leakage.

3. Fill the area between the two lips of the seal with compatible grease.

4. Install the snap ring (3) into the groove of the front cover.

5. Install the dowel pins in the front cover holes.

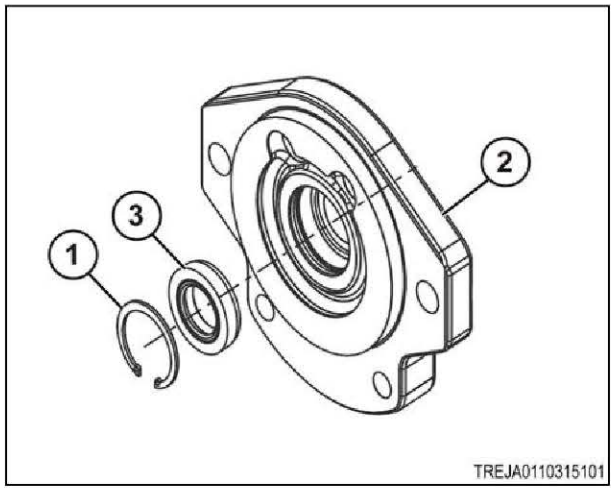

Fig. 60

6. Apply a small amount of grease in the static seal groove of the body.

7. Install a new static seal (1) into the groove.

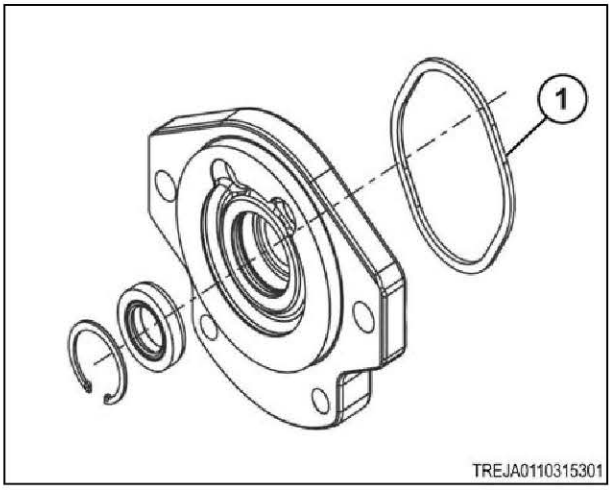

Fig. 61

8. Apply a small amount of grease to the seal groove of the front bearing block (3).

9. Install the new pressure loading seal (2) and the new anti-extrusion seal (1) in the groove.

10. Insert the bearing block in the body. Make sure the load seal and the anti-extrusion seal are installed correctly.

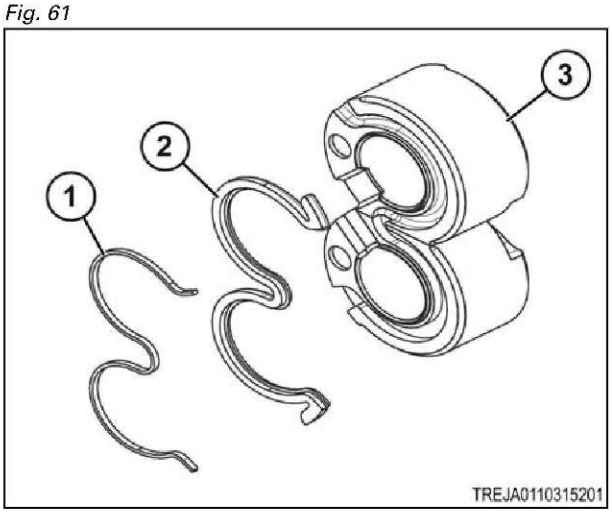

Fig. 62

11. Install the front cover (2) on the body (1).

    NOTE:
    Align the marks for assembly.

12. Align the dowel pins with the holes in the cover and the body.

    NOTE:
    The marks made during disassembly must line up during assembly.

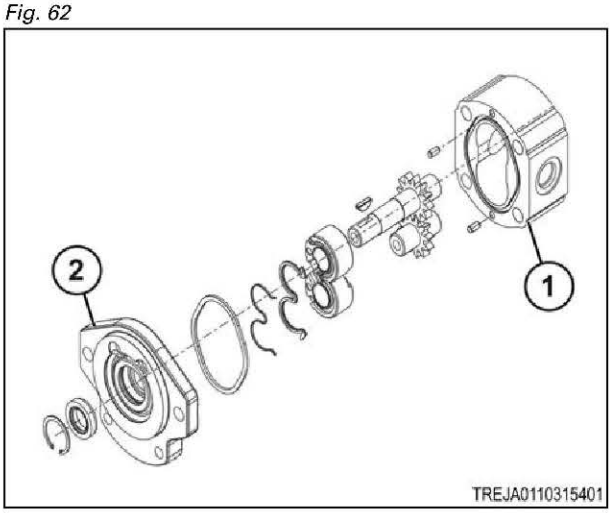

Fig. 63

13. Install the drive gear (1), and the bearing block (2). Do not damage the shaft seal (3).

14. Install the driven gear (4).

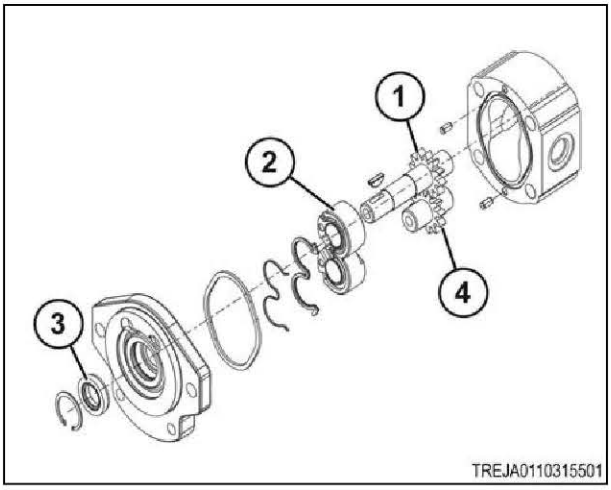

Fig. 64

15. Put a small amount of grease in the seal groove of the rear bearing block (3).

16. Install the pressure loading seal (2) and the anti-extrusion seal (1) in the groove.

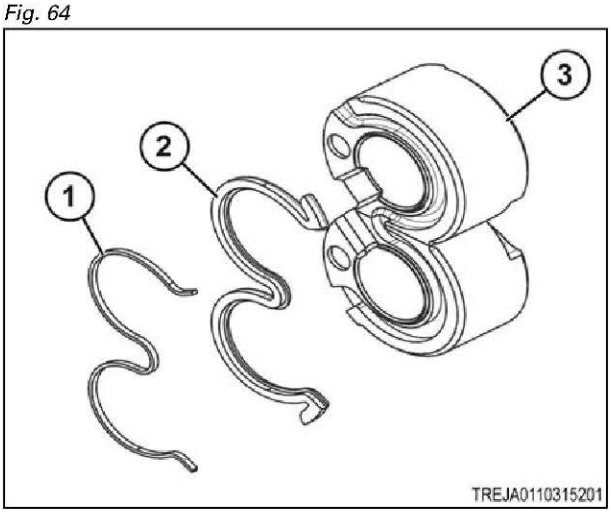

Fig. 65

17. Insert the rear bearing block (1) in the body (2).

NOTE:
Make sure the load seal and the anti-extrusion seal are positioned correctly.

NOTE:
The marks made during disassembly must line up during assembly.

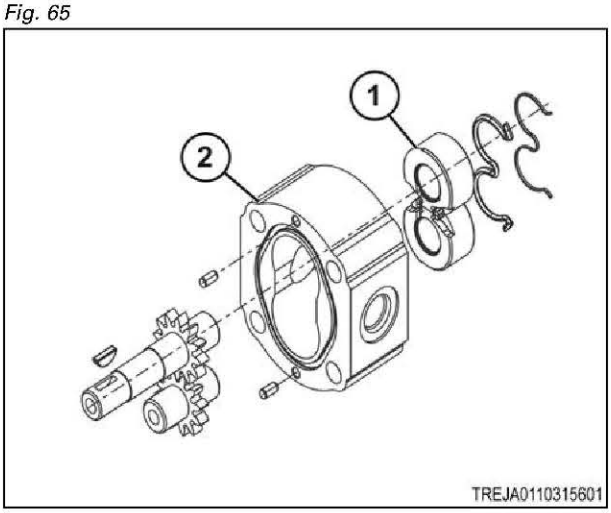

Fig. 66

18. Install the new static seal (1) in the seal groove on the rear side of the body (2).

19. Set the rear cover (3) on the body.

20. Align the marks on the body and the rear cover.

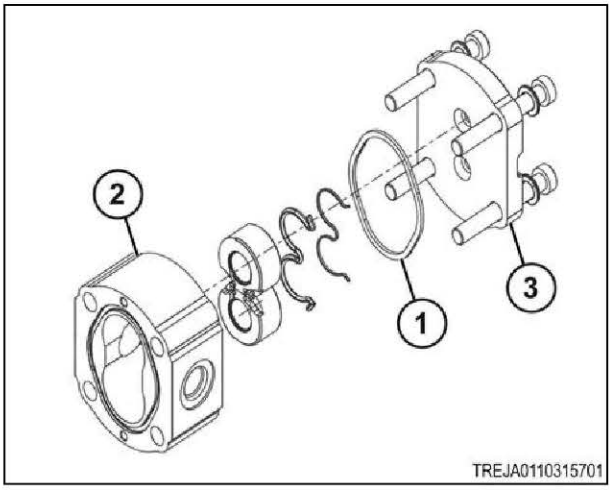

Fig. 67

21. Mount the gear pump in a vise, with the shaft pointing down. Apply light pressure on the front cover ears. Install the four bolts on the rear cover.

Tighten to 55 to 63 Nm (41 to 46 lbf ft).

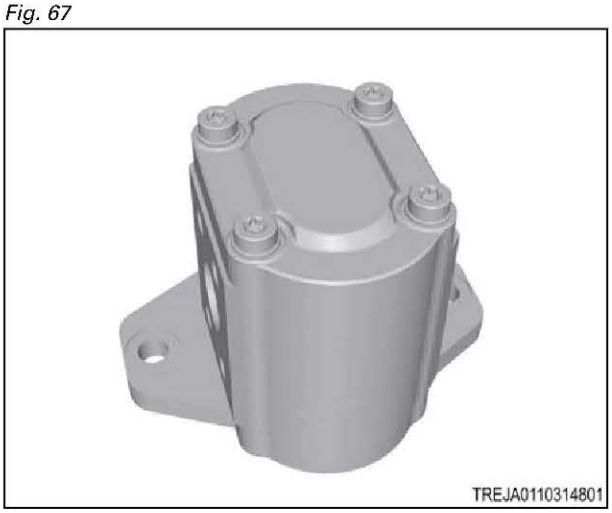

Fig. 68

5.4.4 Install the gear pump

Procedure

1. Install the O-ring on the gear pump (2).

2. Install the gear pump (2) with the hardware (1).

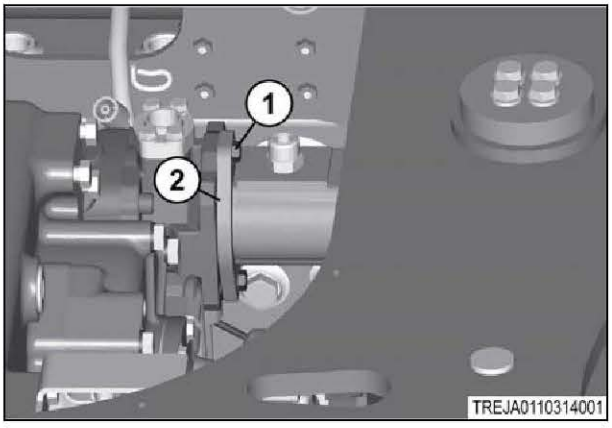

Fig. 69

3. Connect the hydraulic hose (1).

4. Install the hydraulic hose fitting (3) with the hardware (2).

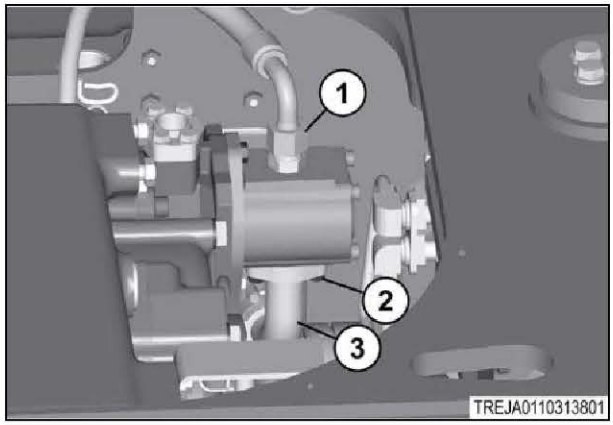

Fig. 70

5. Connect the hydraulic hose (2) with the hose clamp (1).

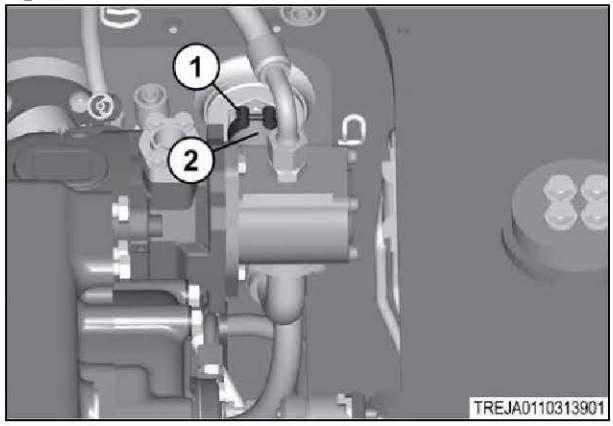

Fig. 71

6. If the machine is equipped with a transmission guard, use correct lifting equipment to put the transmission guard in position. Align the large holes are over the hardware (2).

IMPORTANT:
The weight of the transmission guard is approximately 57 kg (125 lb).

7. Slide the transmission guard (1) onto the hardware (2).

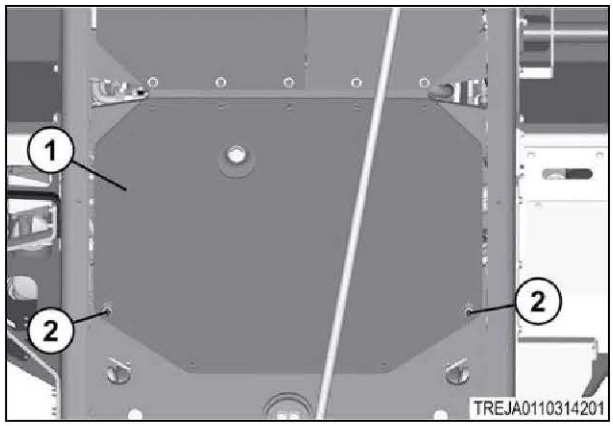

Fig. 72

8. Install the transmission guard (1) with the hardware (2, 3).

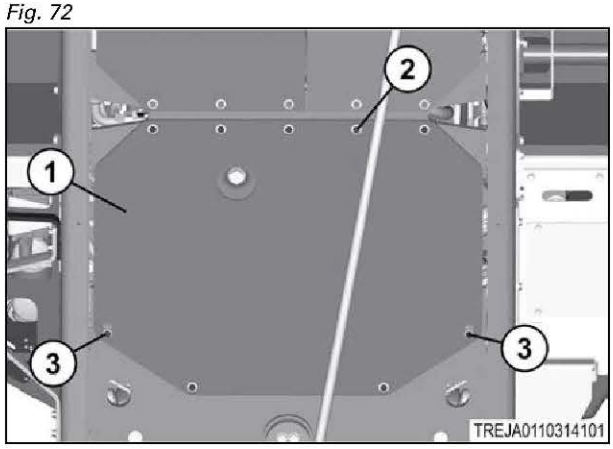

Fig. 73

9. Install the two drain plugs (1) to the bottom of the hydraulic oil reservoir (2).

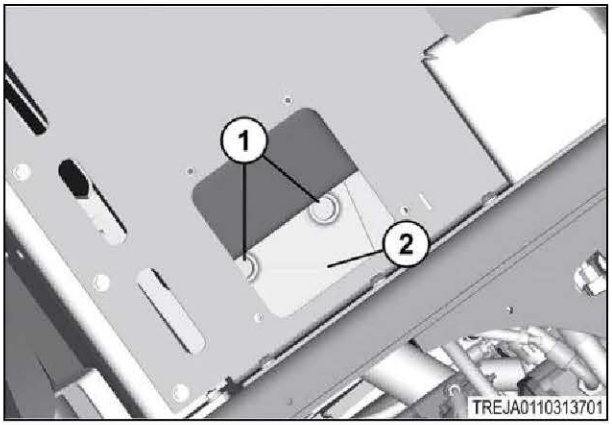

Fig. 74

10. Install the cover plate (2) with the hardware (1).

11. Fill the hydraulic reservoir with the correct type and the correct amount of hydraulic oil.

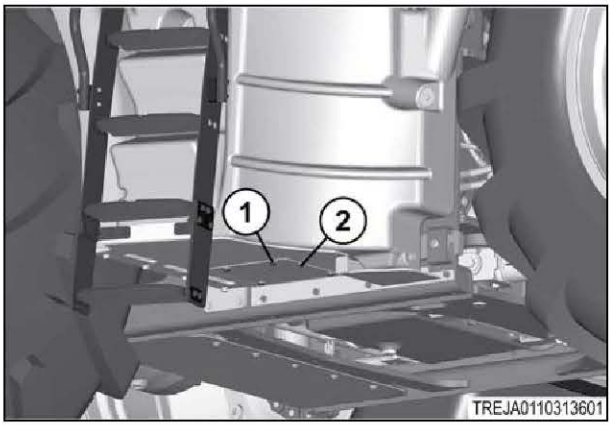

Fig. 75

12. Install the battery disconnect switch key (1).

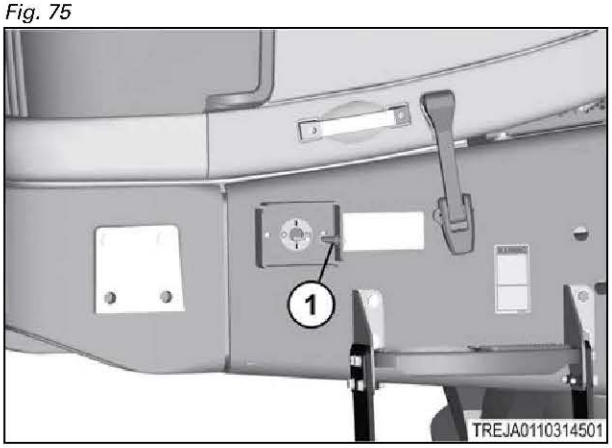

Fig. 76

13. Turn the battery disconnect switch key (1) clockwise to connect the battery power.

NOTE:
The battery disconnect switch is shown in the on position.

14. Check for leaks. Check the hydraulic reservoir for the correct oil level.

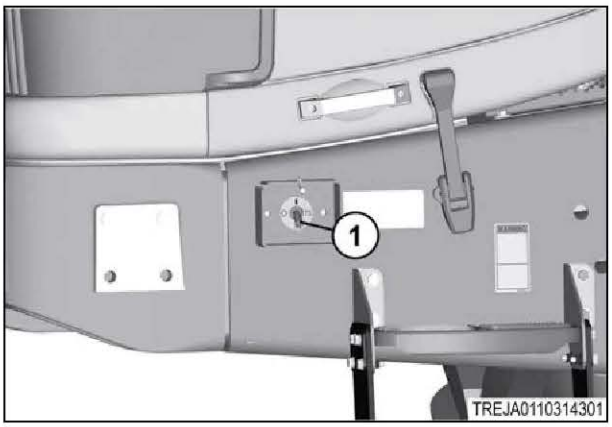

Fig. 77

Related Links

Lubricant viscosities page 1-18

5.4.5 Remove the steering and implement pump

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

IMPORTANT:
Before removal, fasten identification tags on the components for correct installation at assembly. Put caps and plugs on all hoses, fittings, and ports to prevent contamination from entering the system.

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the parking brake, and take the key with you.

2. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

   NOTE:
   The battery disconnect switch is shown in the off position.

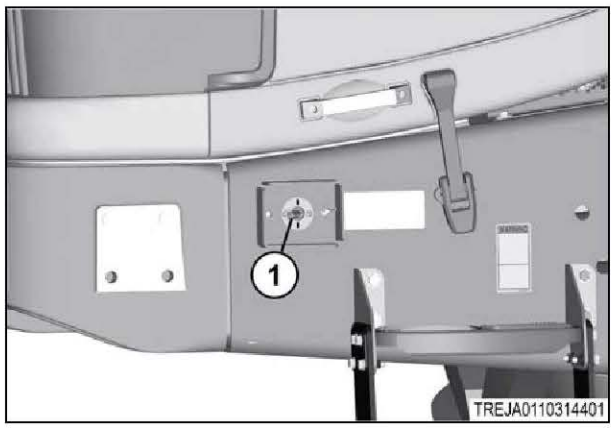

Fig. 78

3. Remove the battery disconnect switch key (1).

4. Relieve all pressure from the hydraulic system.

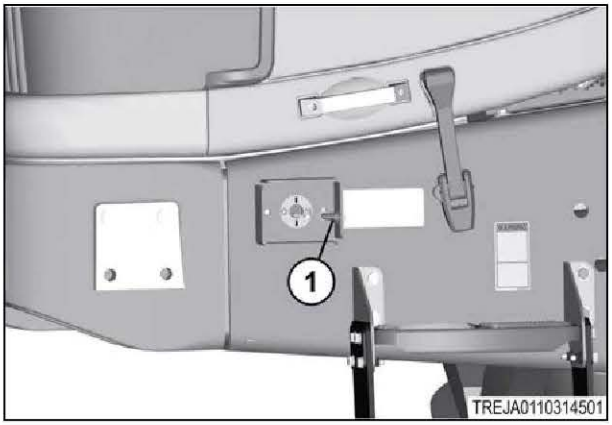

Fig. 79

5. Remove the hardware (1), and the cover plate (2).

6. Set a correct container below the hydraulic tank drain plugs.

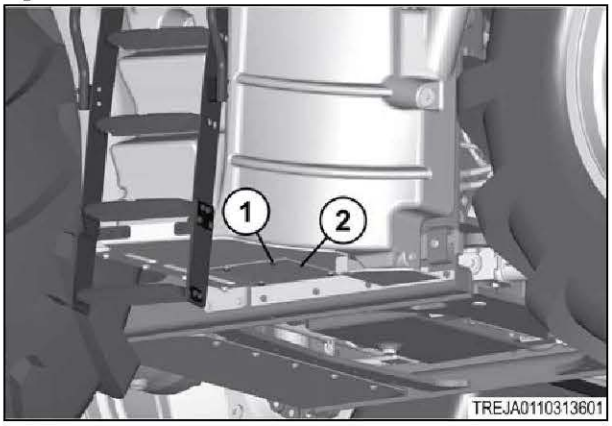

Fig. 80

7. Remove the two drain plugs (1) from the bottom of the hydraulic oil reservoir (2).

8. Drain the hydraulic oil.

9. Install the drain plugs when empty.

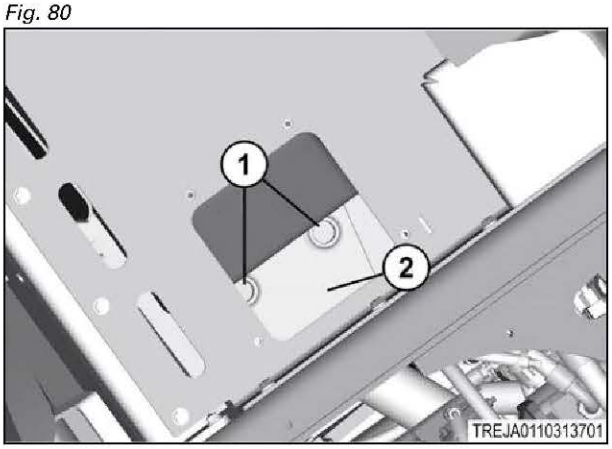

Fig. 81

10. If the machine is equipped with a transmission guard (1) support the transmission guard with correct lifting equipment.

    IMPORTANT:
    The weight of the transmission guard is approximately 57 kg (125 lb).

11. Remove the hardware (2).

12. Loosen the hardware (3).

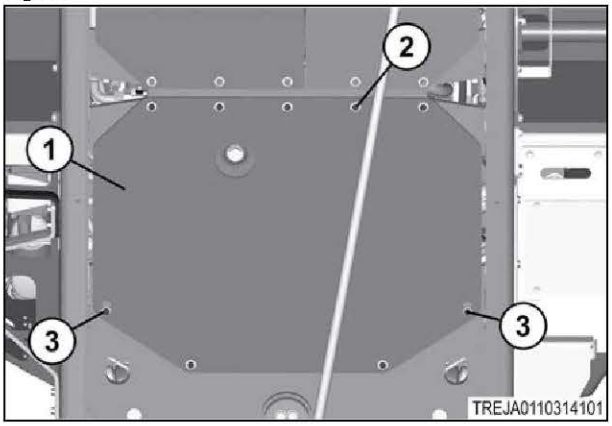

Fig. 82

13. Let the transmission guard (1) rest on the hardware (2) and the correct lifting equipment.

14. Slide the transmission guard so the large holes are over the hardware (2) and remove the transmission guard.

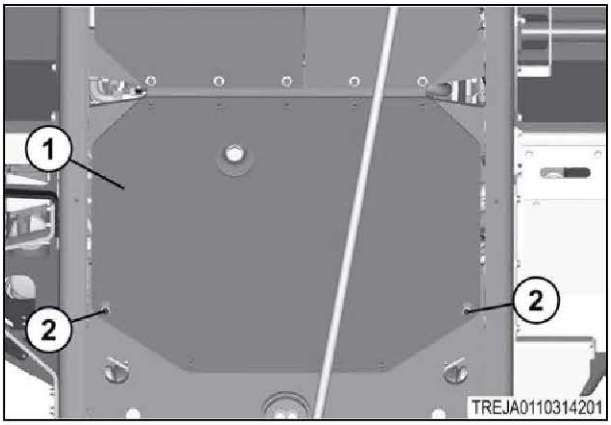

Fig. 83

15. Loosen the hose clamp (1) and disconnect the hydraulic hose (2).

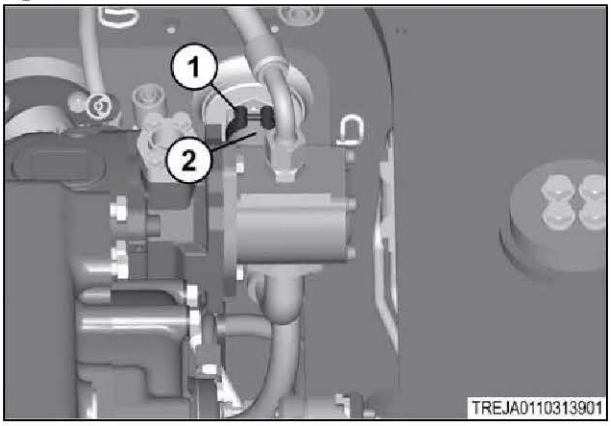

Fig. 84

16. Disconnect the hydraulic hose (1).

17. Remove the hardware (2) and the hydraulic hose fitting (3).

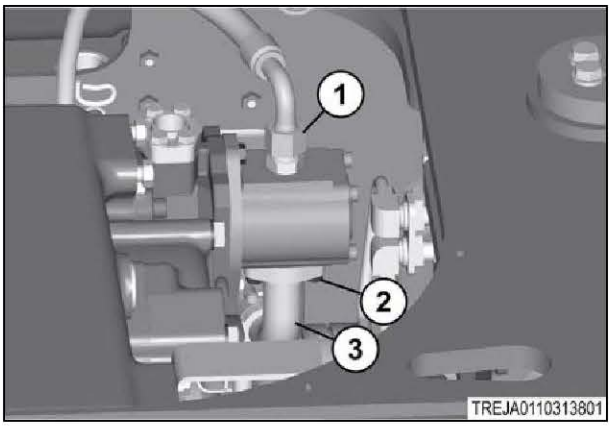

Fig. 85

18. Remove the hardware (1) and the gear pump (2).

19. Remove the O-ring.

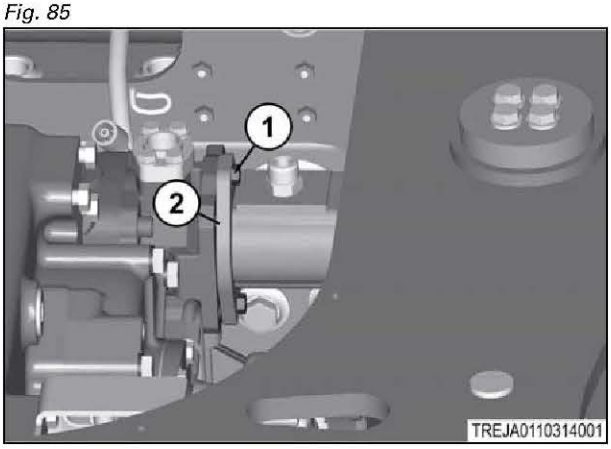

Fig. 86

20. Remove the hardware (1) and the fitting (2).

21. Remove the hose (3).

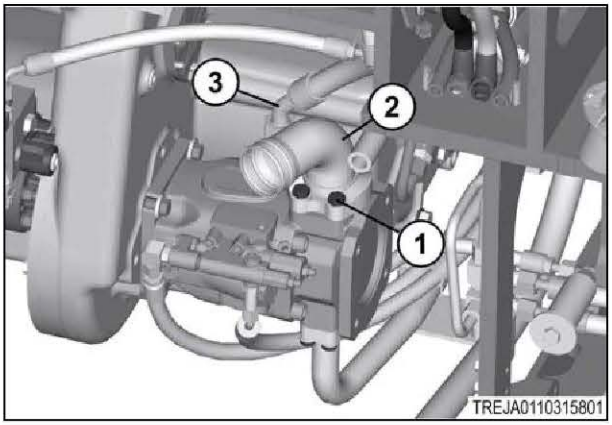

Fig. 87

22. Remove the hardware (1) and the fitting (2).

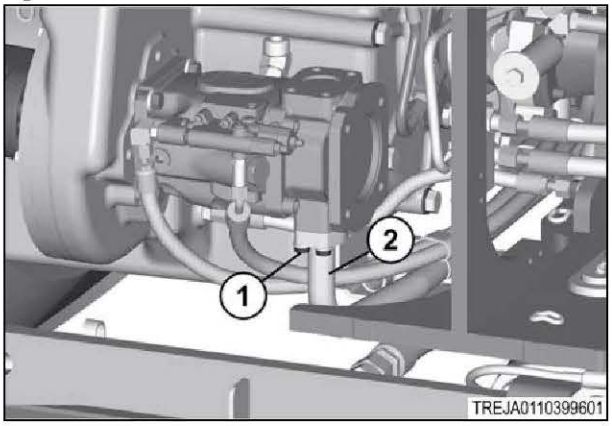

Fig. 88

23. Remove the hardware (1) and the fitting (2).

24. Support the implement pump with correct lifting equipment.

IMPORTANT:
The weight of the implement pump is approximately 46 kg (102 lb).

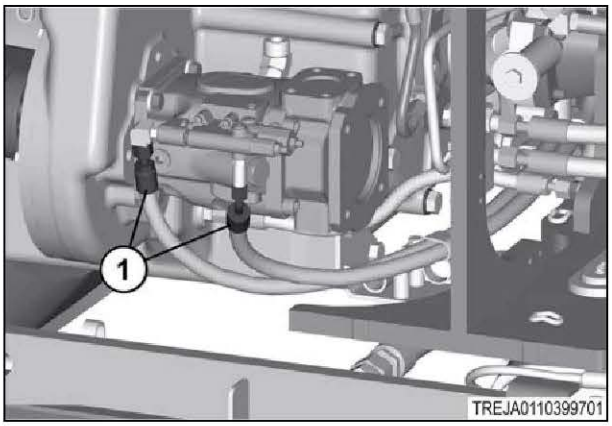

Fig. 89

25. Remove the hardware (1) and the implement pump (2).

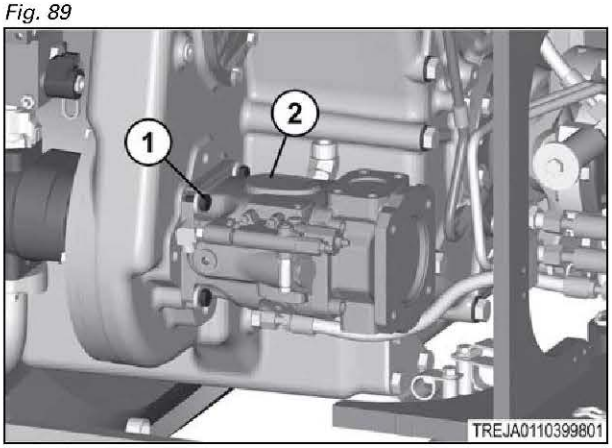

Fig. 90

5.4.6 Install the steering - implement pump

IMPORTANT:
Fully clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Check the driveshaft splines for damage, and for a flat and clean mounting surface.
2. Place the O-ring on the implement pump (2).
3. Support the implement pump with correct lifting equipment.

   IMPORTANT:
   The weight of the implement pump is approximately 46 kg (102 lb).
4. Slide the implement pump (2) on the drive shaft splines.
5. Fasten with the hardware (1).
   Tighten the hardware to 100 Nm (74 lbf ft).

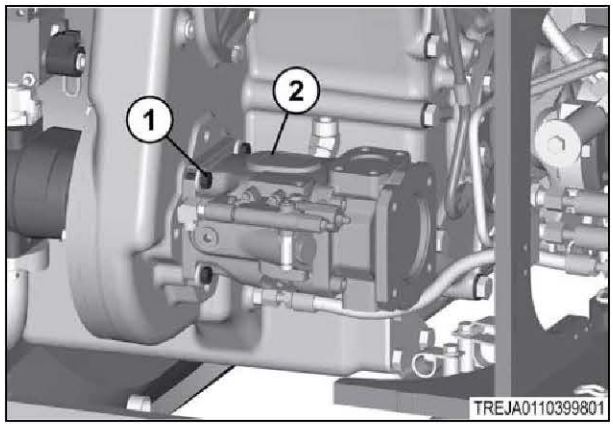

Fig. 91

6. Connect the hydraulic hoses (1).

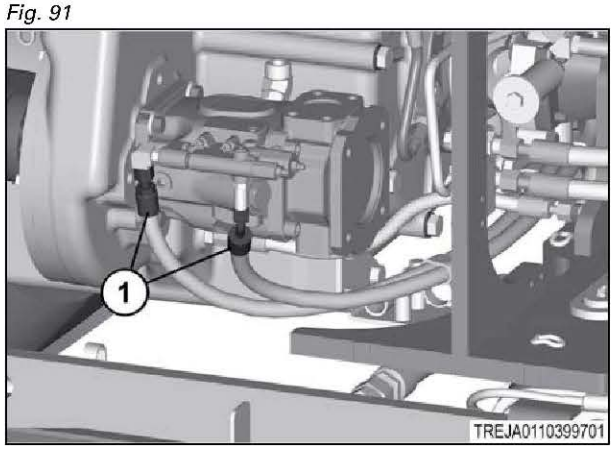

Fig. 92

7. Connect the fitting (2) with the hardware (1).

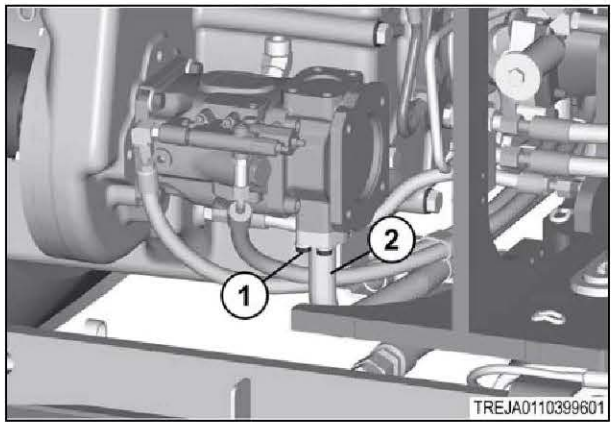

Fig. 93

8. Install the O-ring.
9. Connect the fitting (2) with the hardware (1).
10. Connect the hose (3).

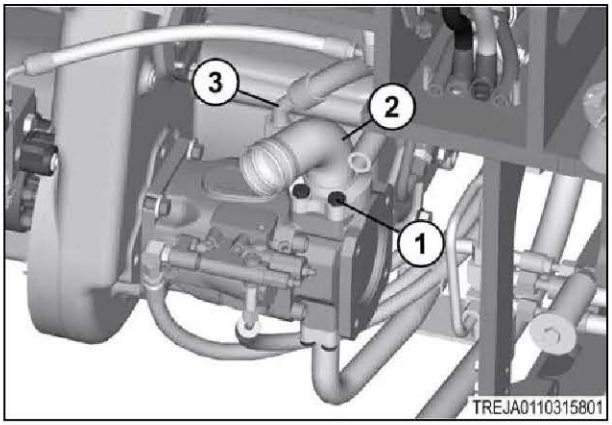

Fig. 94

11. Install the O-ring.

    IMPORTANT:
    Make sure the splines engage correctly before forcing the pumps together.

12. Slide the gear pump in to engage the splines.
13. Fasten the gear pump (2) with the hardware (1).

    Tighten the hardware to 100 Nm (74 lbf ft).

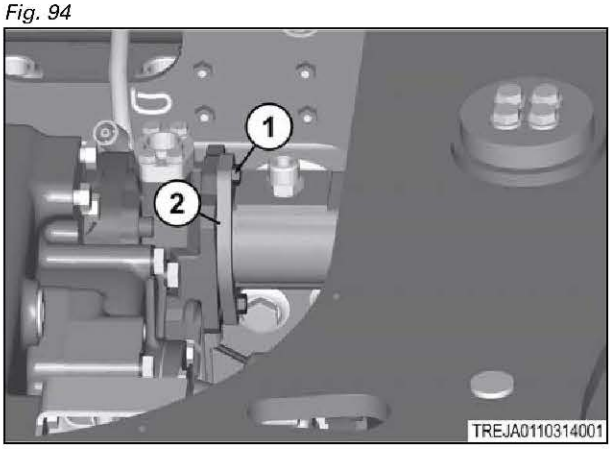

Fig. 95

14. Connect the hydraulic hose (1).
15. Connect the hose fitting (3), with the hardware (2).

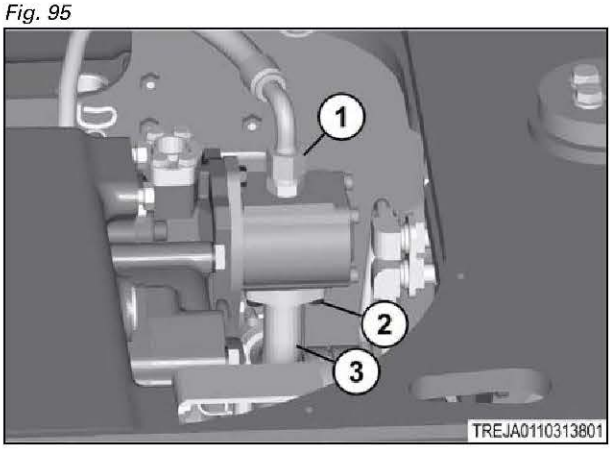

Fig. 96

16. Connect the hydraulic hose (2), with the hose clamp (1).

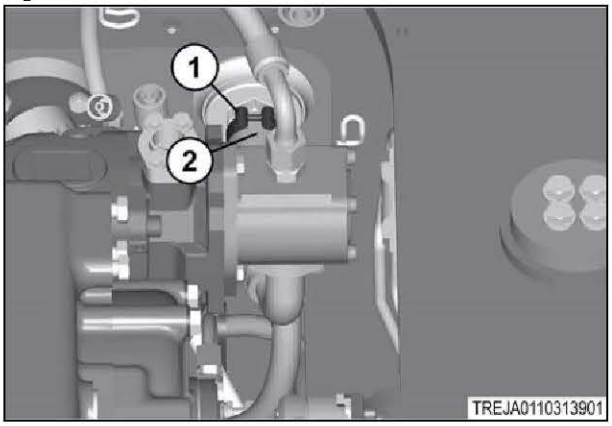

Fig. 97

17. If the machine is equipped with a transmission guard, install the two bolts (2) and leave the hardware loose.

18. Use correct lifting equipment to support the transmission guard.

IMPORTANT:
The weight of the transmission guard is approximately 57 kg (125 lb).

19. Slide the transmission guard (1) over the two bolts (2).

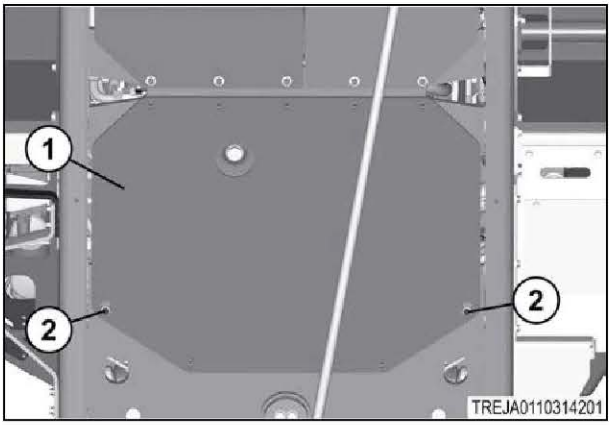

Fig. 98

20. Install the bolts (2) for the transmission guard (1).

21. Tighten the hardware (2, 3).
Tighten the hardware to 100 Nm (74 lbf ft).

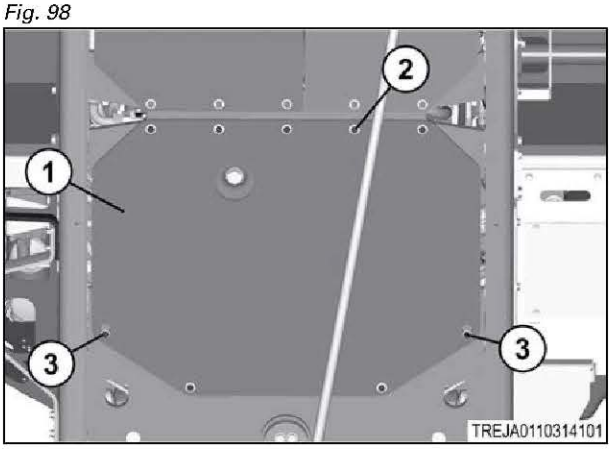

Fig. 99

22. Install the two drain plugs (1) with O-rings to the bottom of the hydraulic oil reservoir (2).

23. Fill the hydraulic reservoir with hydraulic oil.

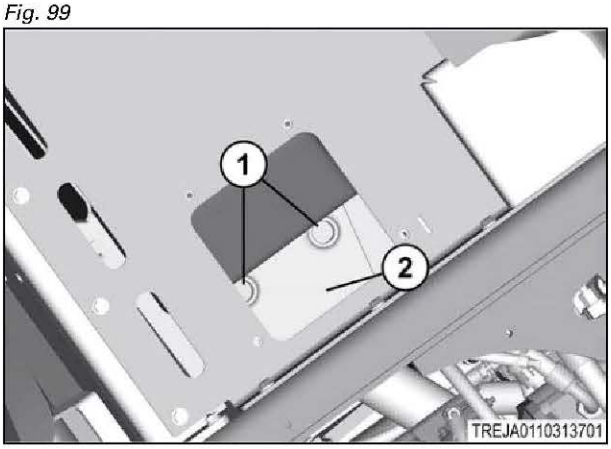

Fig. 100

24. Install the cover plate (2) with the hardware (1).

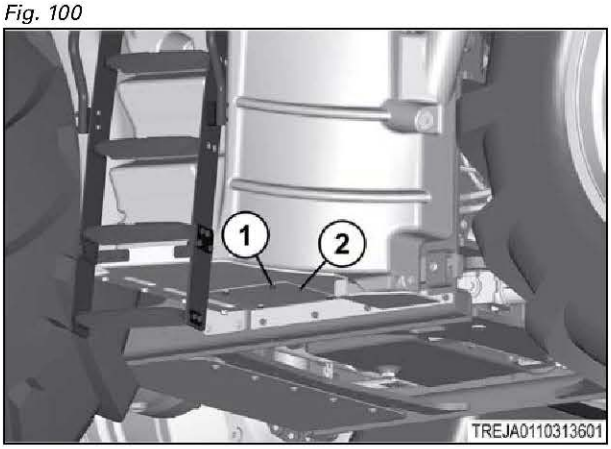

Fig. 101

25. Install the battery disconnect switch key (1).

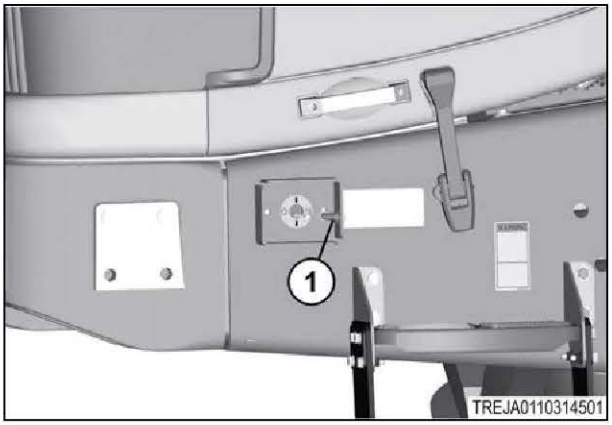

Fig. 102

26. Turn the battery disconnect switch key (1) clockwise to connect the battery power.

NOTE:
The battery disconnect switch is shown in the on position.

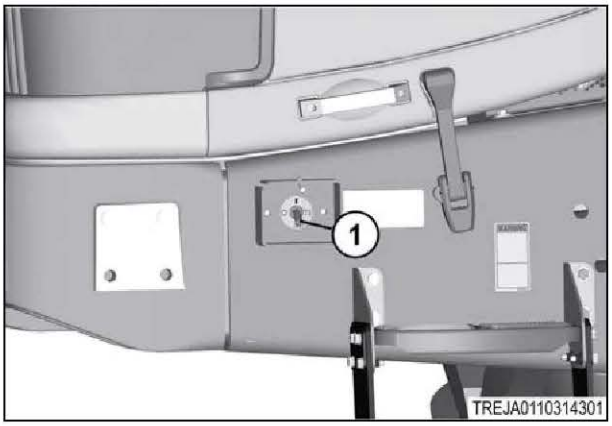

Fig. 103

27. Check for leaks.

28. Check the hydraulic reservoir for the correct oil level.

Related Links

Lubricant viscosities page 1-18

5.4.7 Remove the steering and priority valve

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

IMPORTANT:
Before removal, fasten identification tags on the components for correct installation at assembly. Put caps and plugs on all hoses, fittings, and ports to prevent contamination from entering the system.

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the parking brake, and take the key with you.

2. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

   NOTE:
   The battery disconnect switch is shown in the off position.

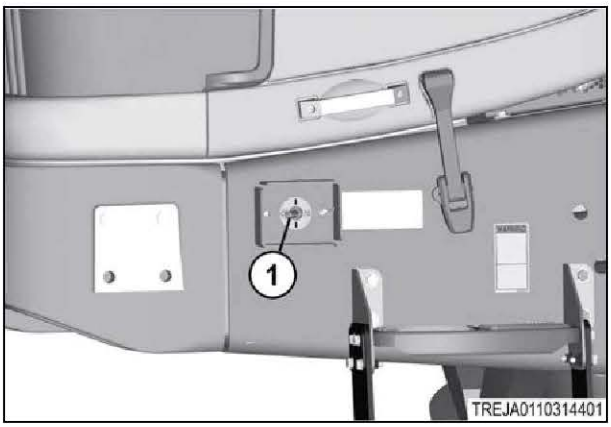

Fig. 104

3. Remove the battery disconnect switch key (1).

4. Relieve all pressure from the hydraulic system.

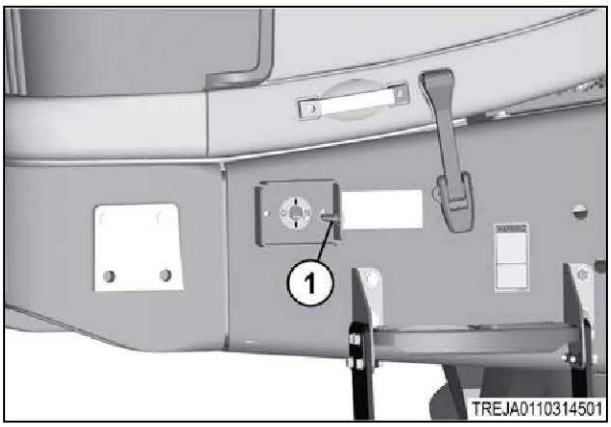

Fig. 105

5. Remove the hardware (1), and the cover plate (2).

6. Set a correct container below the hydraulic tank drain plugs.

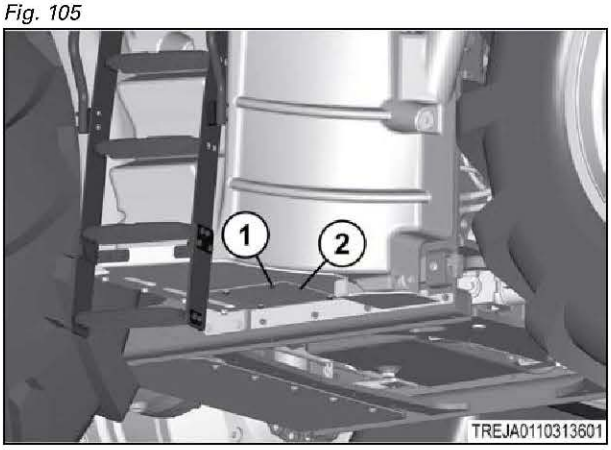

Fig. 106

7. Remove the two drain plugs (1) from the bottom of the hydraulic oil reservoir (2).

8. Drain the hydraulic oil.

9. Install the drain plugs when the hydraulic reservoir is empty.

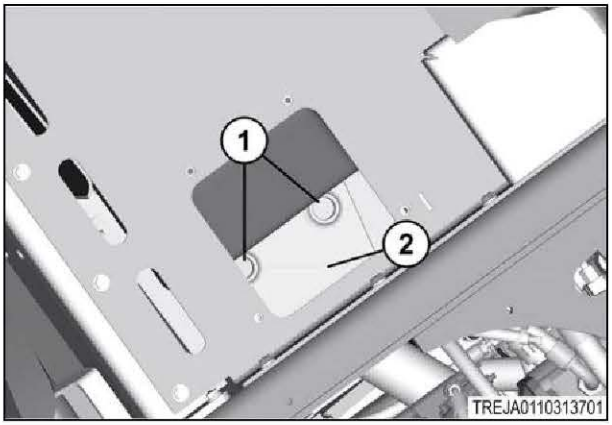

Fig. 107

10. If the machine is equipped with a transmission guard, support the transmission guard with correct lifting equipment.

    IMPORTANT:
    The weight of the transmission guard is approximately 57 kg (125 lb).

11. Remove the hardware (2).

12. Loosen the hardware (3).

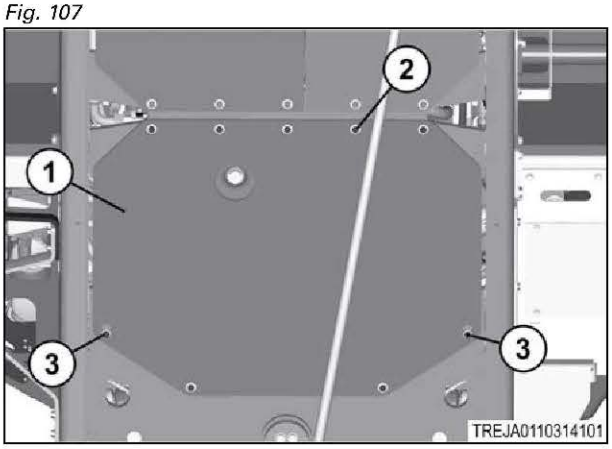

Fig. 108

13. Let the transmission guard (1) rest on the hardware (2).

14. Slide the transmission guard so the large holes are over the hardware (2). Use the lifting equipment to remove the transmission guard.

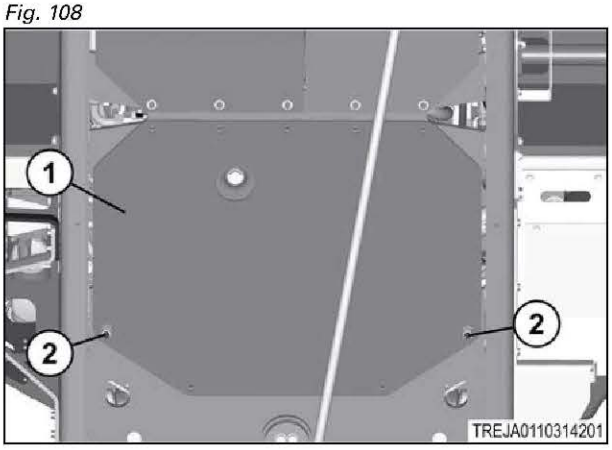

Fig. 109

15. Disconnect the hydraulic hoses (1).

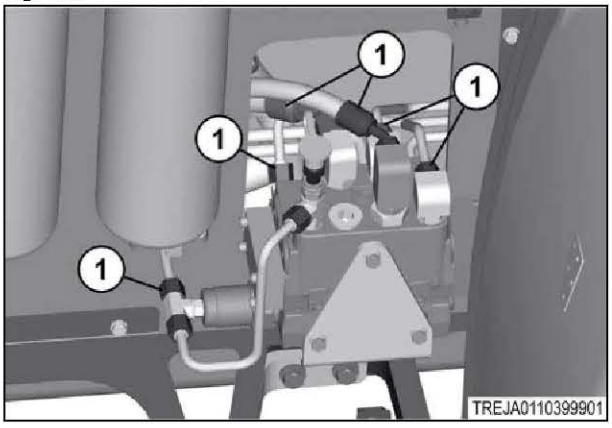

Fig. 110

16. Disconnect the hydraulic hoses (1).

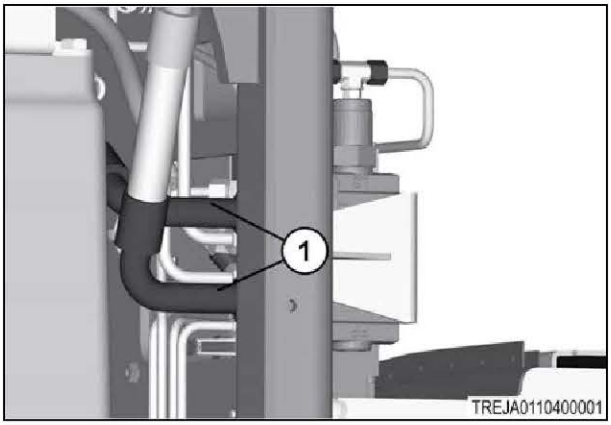

Fig. 111

17. Disconnect the hydraulic hoses (1).

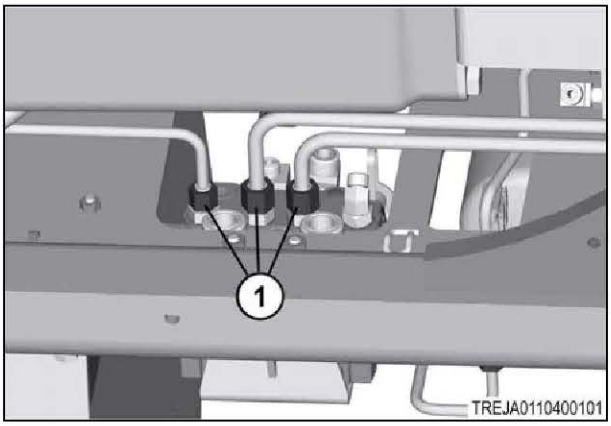

Fig. 112

18. Remove the hardware (1) and the steering and priority valve.

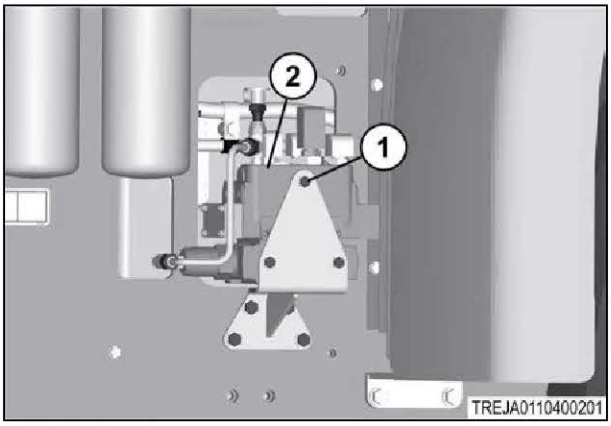

Fig. 113

19. Remove the hardware (1) and the mounting bracket (2).

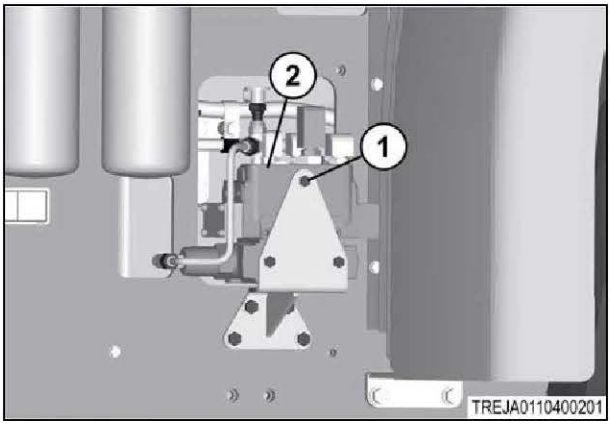

Fig. 114

5.4.8 Install the steering and priority valve

Procedure

1. Install the mounting bracket (2) with the hardware (1).

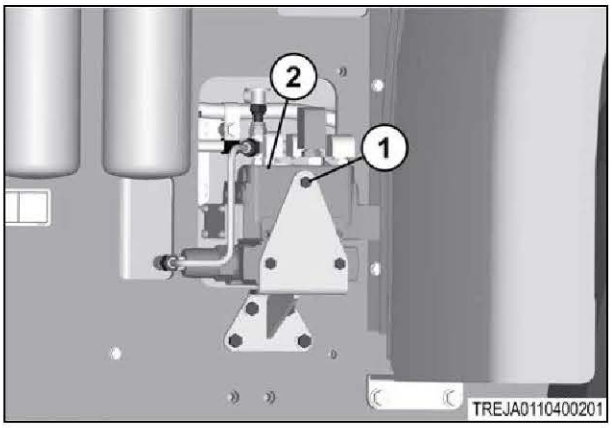

Fig. 115

2. Install the steering and priority valve (2) with the hardware (1).

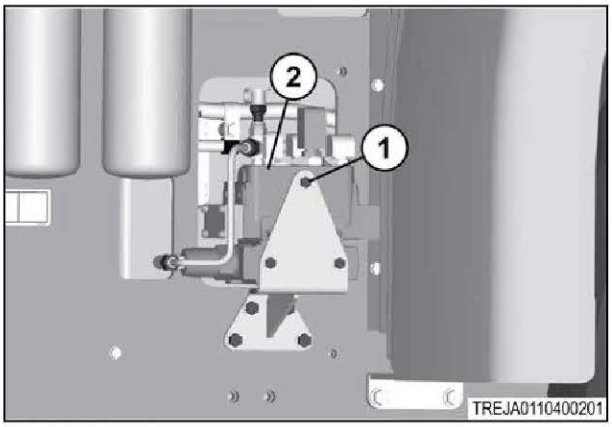

Fig. 116

3. Connect the hydraulic hoses (1).

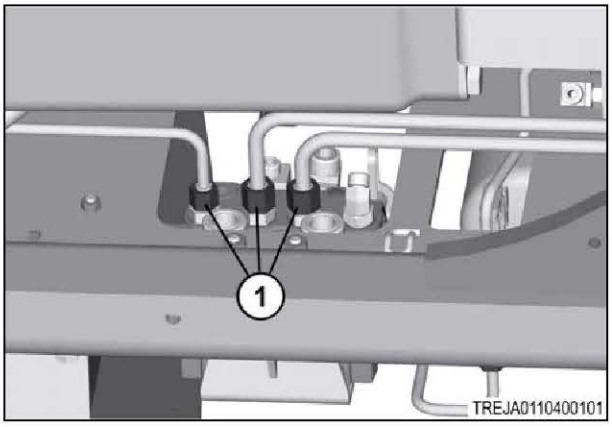

Fig. 117

4. Connect the hydraulic hoses (1).

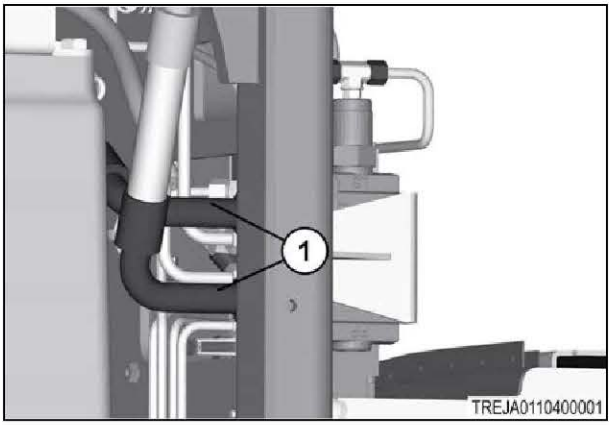

Fig. 118

5. Connect the hydraulic hoses (1).

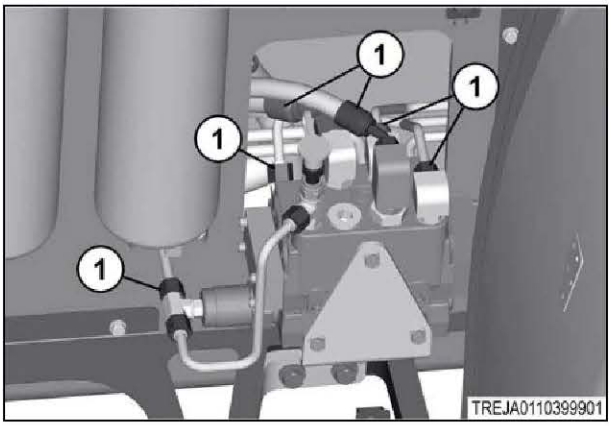

Fig. 119

6. If the machine is equipped with a transmission guard (1), support the transmission guard with the correct lifting equipment.

IMPORTANT:
The weight of the transmission guard is approximately 57 kg (125 lb).

7. Install the large holes in the transmission guard over the hardware (2).

8. Slide the transmission guard onto the bolts.

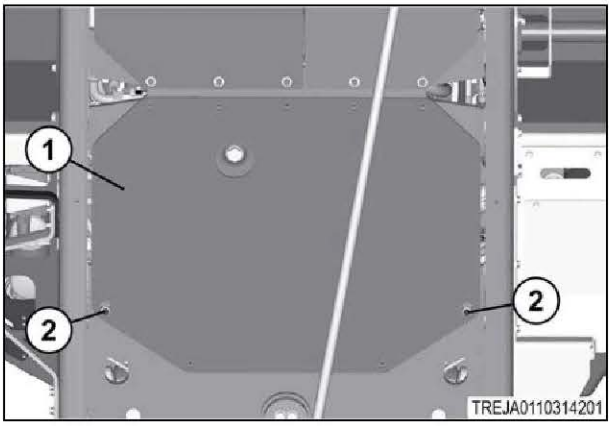

Fig. 120

9. Install the hardware (2) and tighten the hardware (2, 3) on the transmission guard (1).

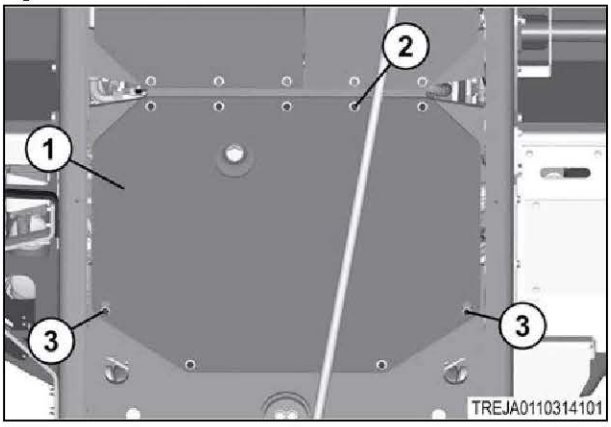

Fig. 121

10. Install the two drain plugs (1) in the hydraulic oil reservoir (2).

11. Fill the hydraulic oil reservoir with the correct type and the correct amount of hydraulic oil.

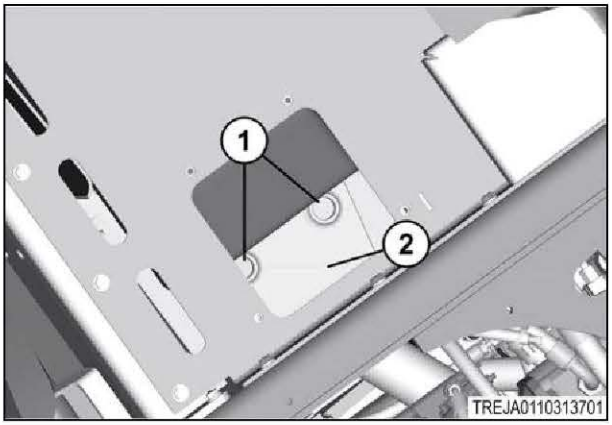

Fig. 122

12. Install the cover plate (2) with the hardware (1).

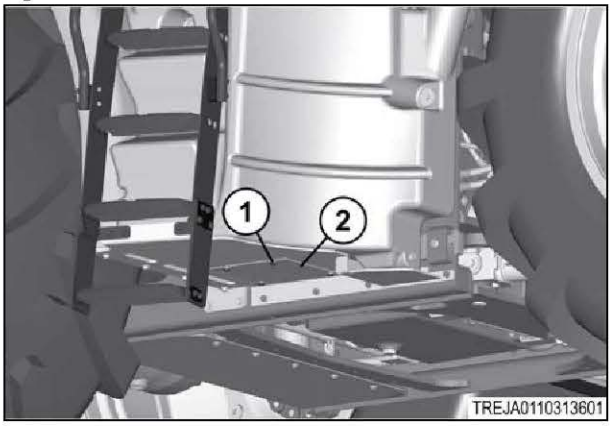

Fig. 123

13. Install the battery disconnect switch key (1).

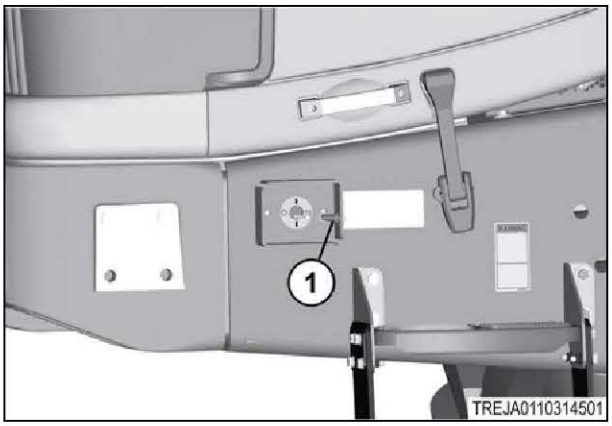

Fig. 124

14. Turn the battery disconnect switch key (1) clockwise to connect the battery power.

NOTE:
The battery disconnect switch is shown in the on position.

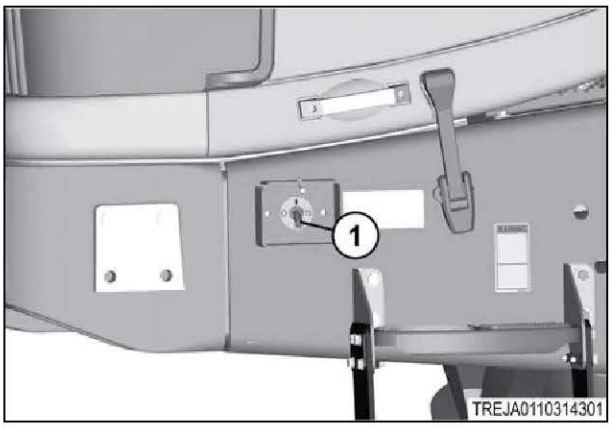

Fig. 125

Related Links

Lubricant viscosities page 1-18

5.4.9 Remove the steering unit

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

IMPORTANT:
Before removal, fasten identification tags on the components for correct installation at assembly. Put caps and plugs on all hoses, fittings, and ports to prevent contamination from entering the system.

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

NOTE:
Some parts have been removed for clarity.

Before starting the procedure

There are two different types of steering units in this procedure. The standard hydraulic steering unit and the optional electric-hydraulic system. The electric-hydraulic system uses a steering angle sensor with the electric solenoids on the steering valve.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the park brake, and take the key with you.

2. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

   NOTE:
   The battery disconnect switch is shown in the off position.

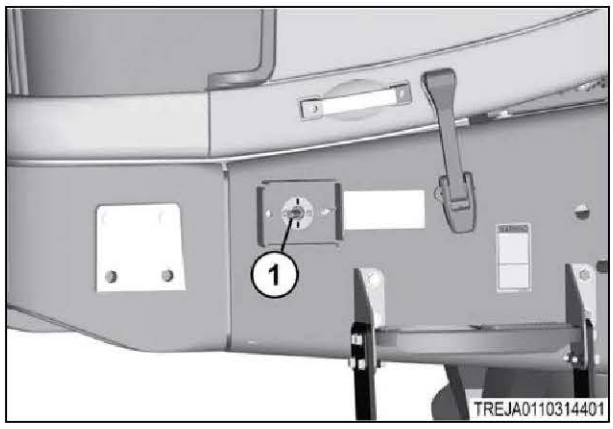

Fig. 126

3. Remove the battery disconnect switch key (1).

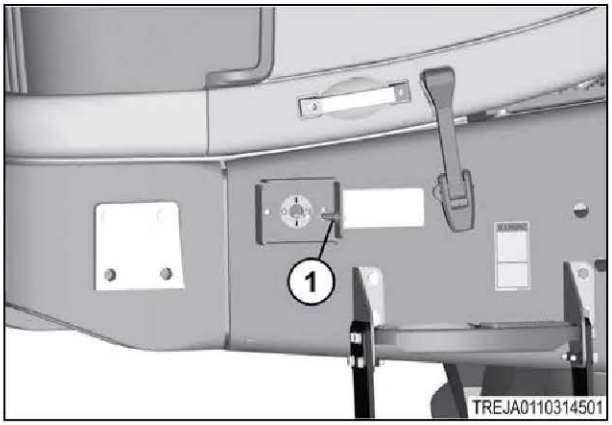

Fig. 127

4. Remove the hydraulic hoses (1).

5. Disconnect the wire (2) to the steering angle sensor (hydraulic-electric equipped units only).

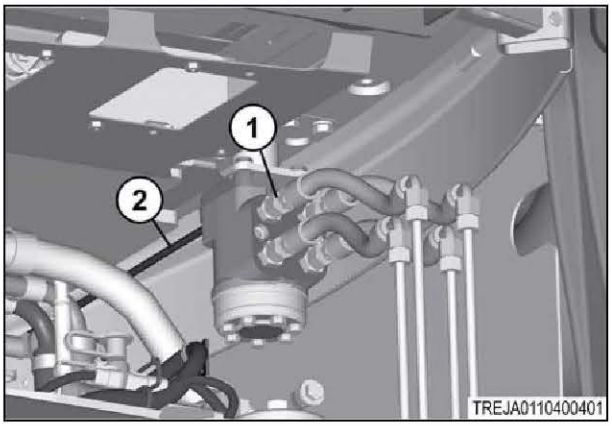

Fig. 128

6. Remove the hardware (1) from the steering unit (2).

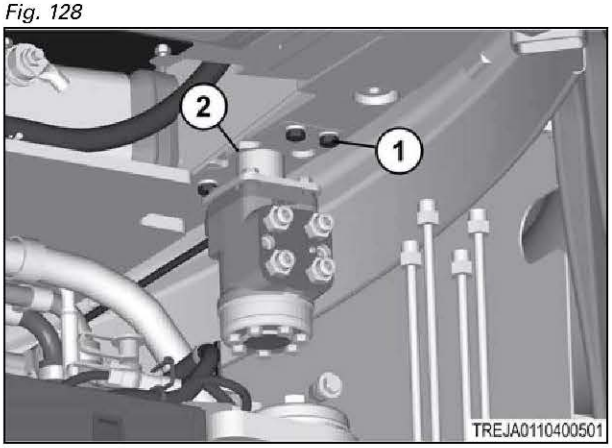

Fig. 129

7. Lower the steering unit (1) to disconnect the steering shaft splines (2).

8. Remove the steering unit, the gasket (3), and the plate (4).

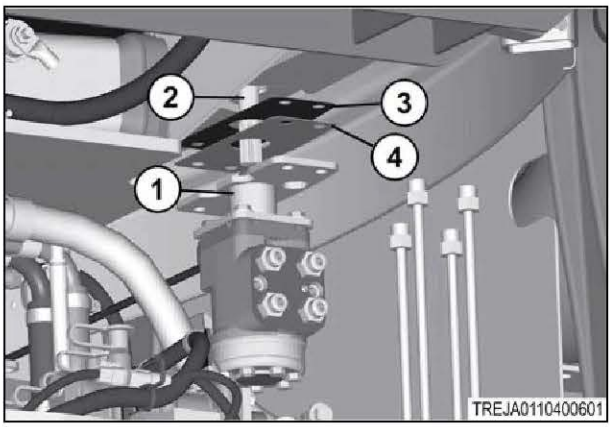

Fig. 130

5.4.10 Install the steering unit

Before starting the procedure

There are two different types of steering units in this procedure. The standard hydraulic steering unit and the optional electric-hydraulic system. The electric-hydraulic system uses a steering angle sensor with the electric solenoids on the steering valve.

Procedure

1. Steering unit port view. The P-port (4) signifies the pressure hose. The T-port (3) signifies the tank hose. The L-port (1) signifies the left cylinder hose. The R-port (2) signifies the right cylinder hose.

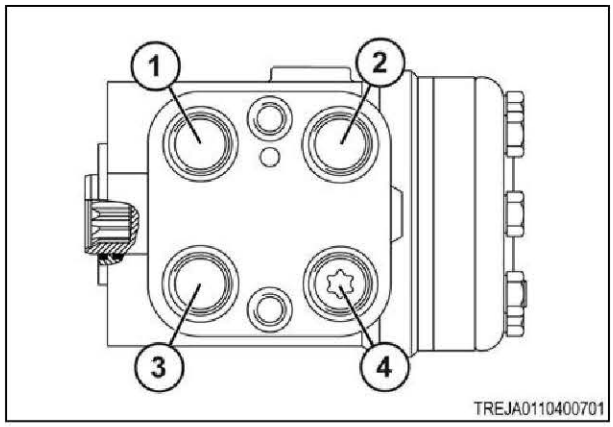

Fig. 131

2. Install the four connectors (1) to the steering unit ports.

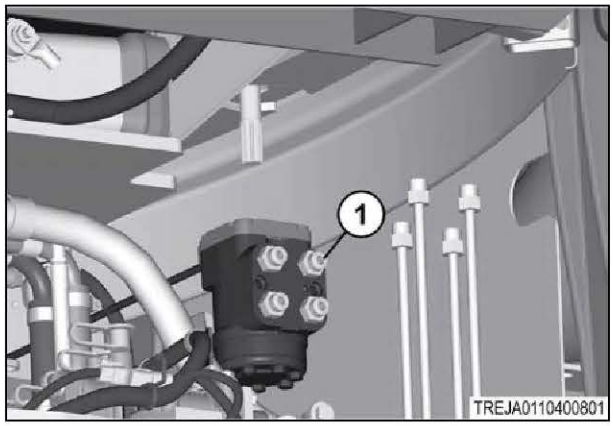

Fig. 132

3. For the standard steering system installation, install the mount (1) to the steering unit (2) with the hardware (3).

   IMPORTANT:
   Fasten the mount to the steering unit as in the illustration. Align the longest flange parallel with the fittings. The shortest flange mounts to the left of the unit and the intermediate flange mounts to the right.

   Tighten the hardware to 47 Nm (35 lbf ft).

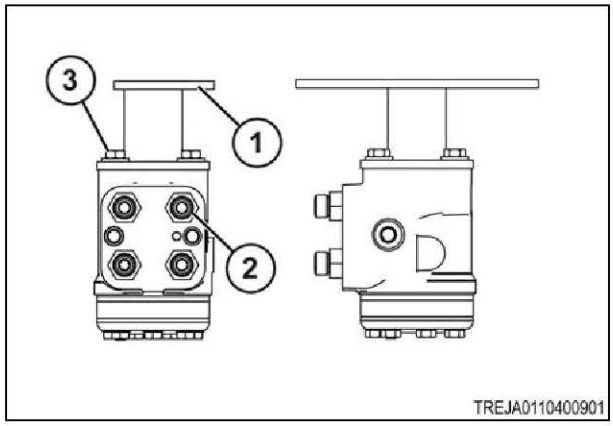

Fig. 133

4. For the hydraulic-electric steering system installation, install the steering angle sensor (1) on the shaft splines.

   IMPORTANT:
   Put the connector on the steering angle sensor as in the illustration. Wires must point the opposite direction of the ports.

5. Install the mount (2) to the steering unit (3) with the hardware through the steering angle sensor.

   Tighten the hardware to 47 Nm (35 lbf ft).

6. Install the gasket (3) and the plate (4) on the steering unit (1).

7. Install the steering shaft (2) on the splines of the steering unit.

8. Install the steering unit (2) with the hardware (1).

   Tighten the hardware to 55 Nm (41 lbf ft).

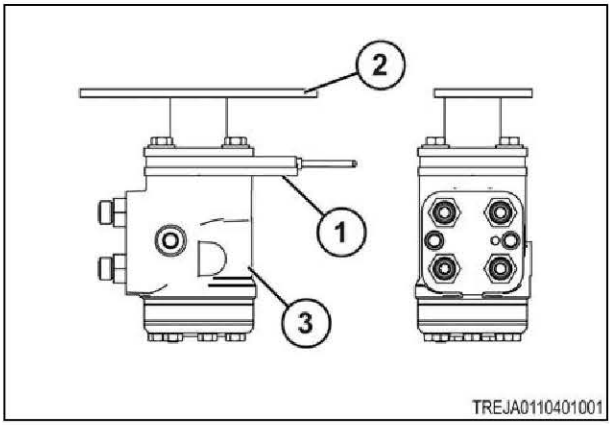

Fig. 134

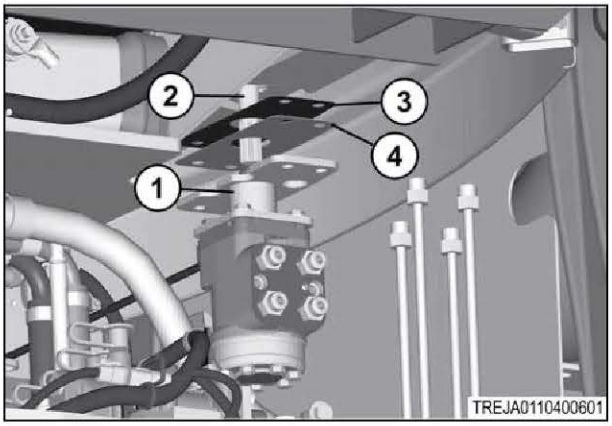

Fig. 135

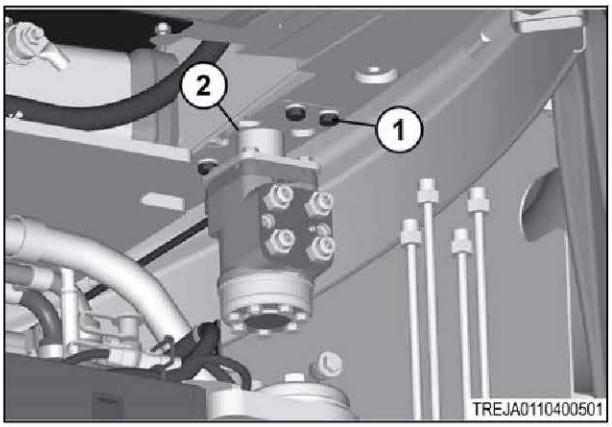

Fig. 136

9. Install the hydraulic hoses (1).

WARNING:
Make sure to connect the hydraulic lines to the correct ports. Hose connections that are not correct can cause machine to turn in the wrong direction.

10. Connect the wire (2) to the steering angle sensor (hydraulic-electric equipped units only).

11. Check the hydraulic oil level in the hydraulic reservoir and fill as necessary.

12. Install the battery disconnect switch key (1).

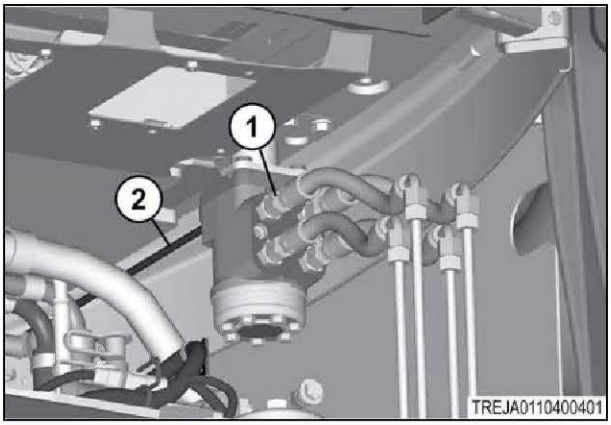

Fig. 137

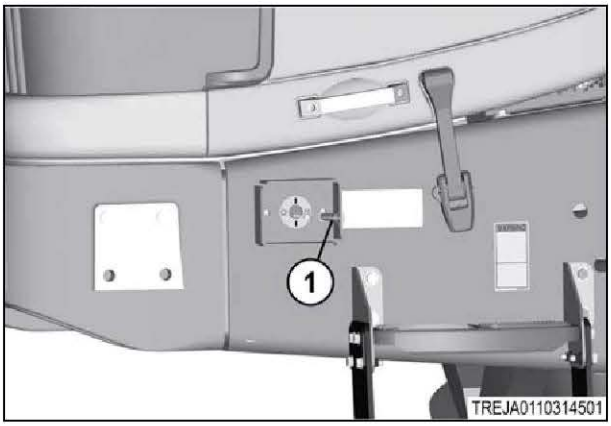

Fig. 138

13. Turn the battery disconnect switch key (1) clockwise to connect the battery power.

NOTE:
The battery disconnect switch is shown in the on position.

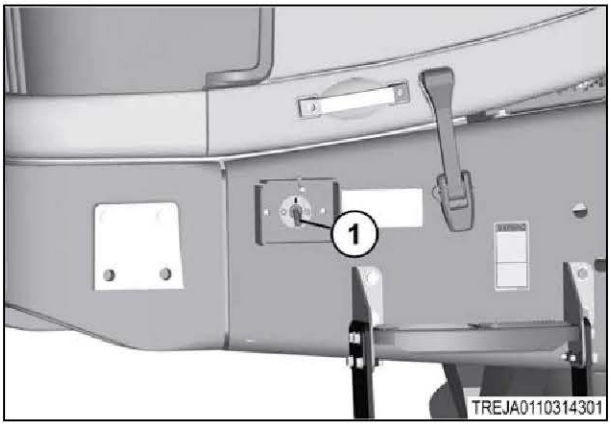

Fig. 139

Related Links

Lubricant viscosities page 1-18

5.4.11 Remove the steering cylinders

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

IMPORTANT:
Before removal, fasten identification tags on the components for correct installation at assembly. Put caps and plugs on all hoses, fittings, and ports to prevent contamination from entering the system.

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Fully clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Complete the disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

NOTE:
Some parts have been removed for clarity.

Procedure

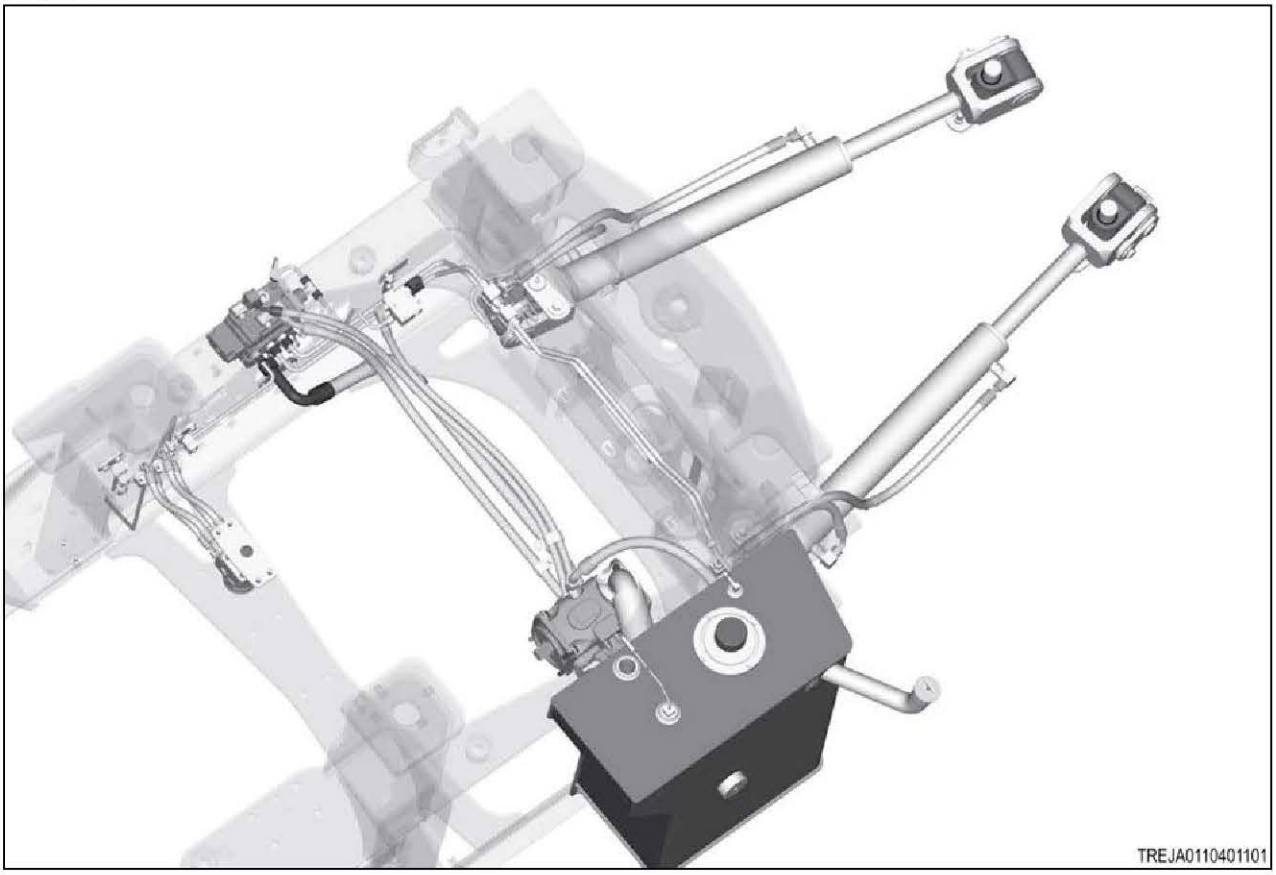

Fig. 140

1. The following diagram shows the hydraulic hose routing from the steering unit to the steering cylinders.

2. Park the machine on a solid, level surface. Stop the engine, apply the park brake, and take the key with you.

3. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

NOTE:
The battery disconnect switch is shown in the off position.

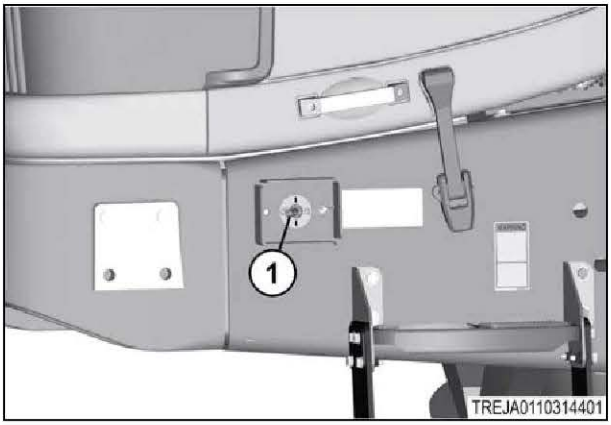

Fig. 141

4. Remove the battery disconnect switch key (1).

5. Relieve all pressure from the hydraulic system.

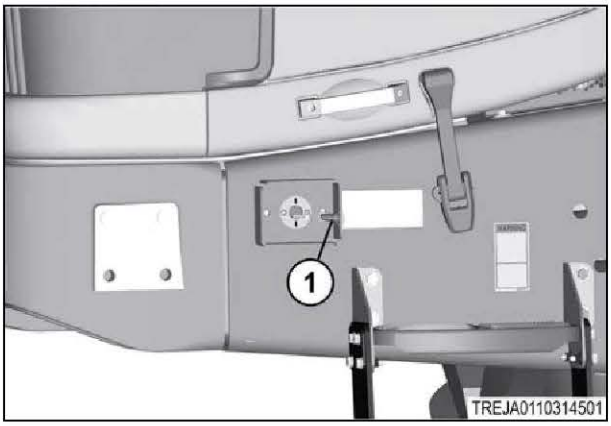

Fig. 142

6. Remove the hardware (1), and the cover plate (2).

7. Set a correct container below the hydraulic tank drain plugs.

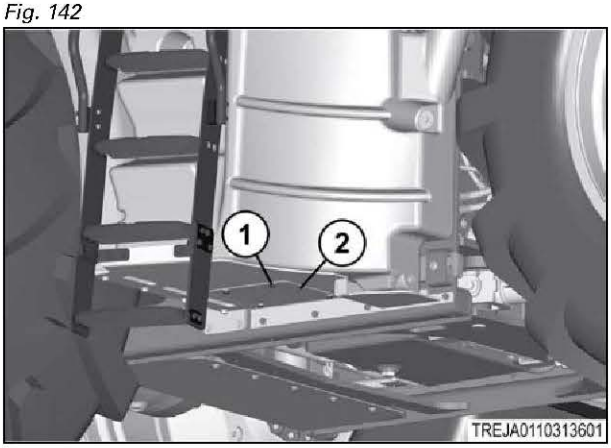

Fig. 143

8. Remove the two drain plugs (1) from the bottom of the hydraulic oil reservoir. (2)

9. Drain the hydraulic oil.

10. Install the drain plugs when the reservoir is empty.

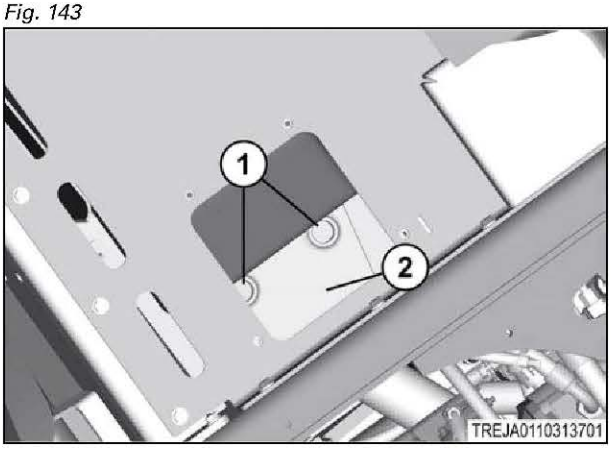

Fig. 144

11. Install the articulation lock (1) between the front and the rear sections of the machine.

DANGER:
Make sure to install the articulation lock between the front section and the rear section before working on cylinders. An articulating machine can kill or seriously injure anyone in the pivot region.

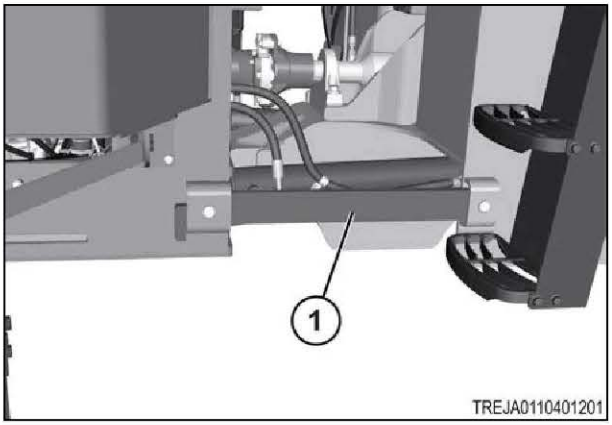

Fig. 145

12. Disconnect the hoses (1) from the cylinder ports.

13. Remove the hardware (2) and the hose clamp (3).

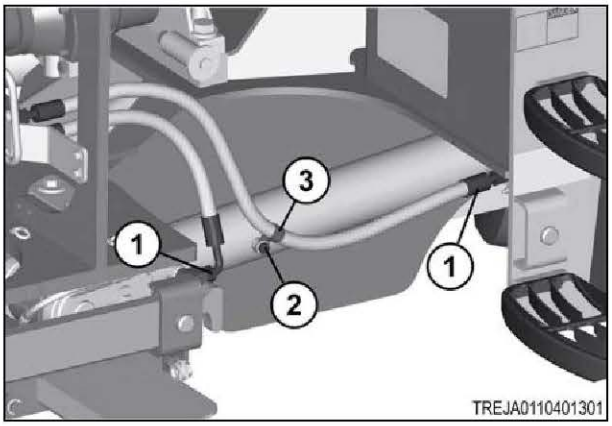

Fig. 146

14. Remove one bolt (3) per grease hose.

15. Disconnect the hoses from the steering cylinders and the brackets (2).

16. Remove the grease hoses (1).

17. Support a steering cylinder with correct lifting equipment.

IMPORTANT:
The weight of each steering cylinder assembly is approximately 70 kg (154 lb).

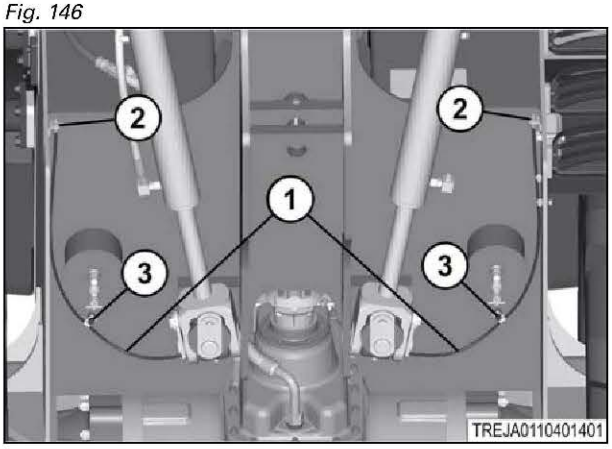

Fig. 147

18. Remove the hardware (1), the yoke pin (2) and the rod end of the steering cylinder (3).

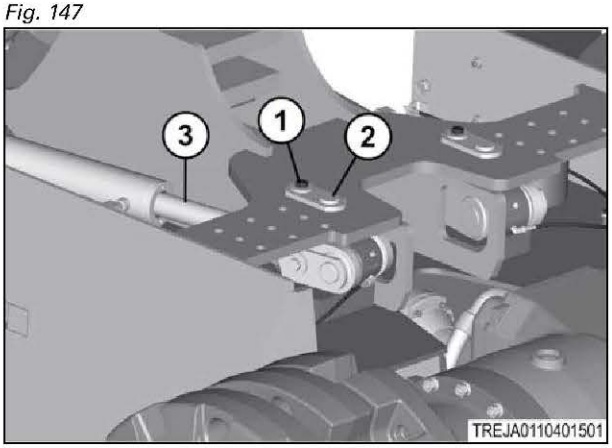

Fig. 148

19. Remove the hardware (1), the yoke pin (2), and the yokes (3) from the base end of the steering cylinder.

20. Remove the steering cylinder.

21. Repeat the procedure to remove the other steering cylinder.

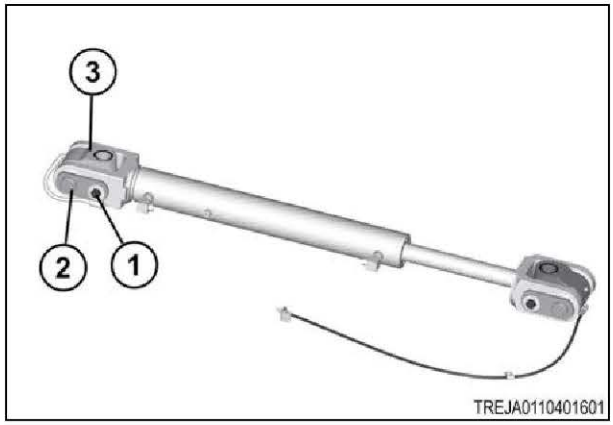

Fig. 149

5.4.12 Install the steering cylinder

IMPORTANT:
Fully clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Complete the disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

NOTE:
Some parts have been removed for clarity.

NOTE:
Use the correct sealant on all bolts.

NOTE:
Use the correct sealant on all NPTF threads.

Procedure

1. Install the hose fittings (1) to the ports on the steering cylinder.

Tighten the fittings to 55 to 61 Nm (41 to 45 lbf ft).

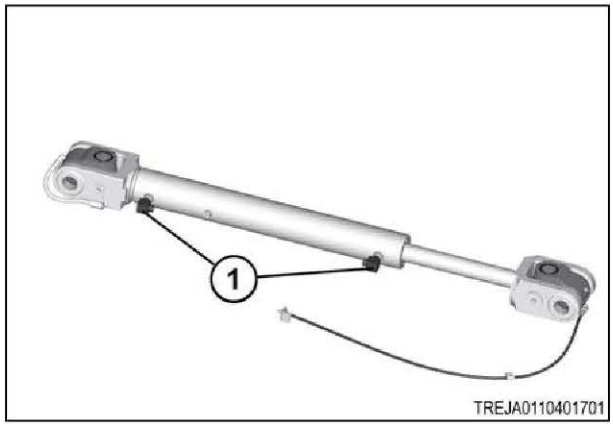

Fig. 150

2. Install the elbow (1), the hose (2), and the clamp (3) to the yoke (6).

   NOTE:
   Install the elbows so the grease hose mounts toward the outside of the cylinder.

3. Install the coupler (4), and the grease fitting (5) to the hose. Complete for both ends of each cylinder.

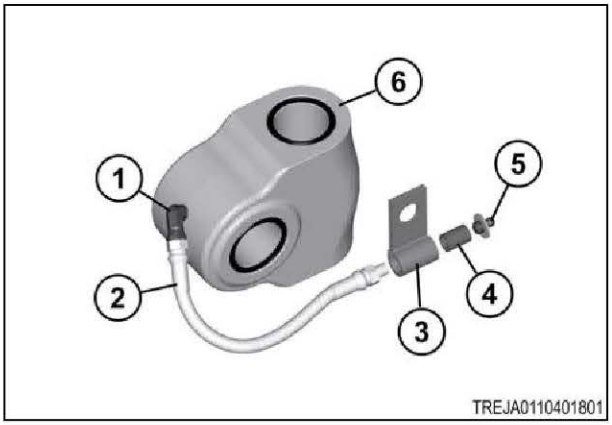

Fig. 151

4. Install the yokes (3), and the yoke pins (2), with the hardware (1) to each steering cylinder end.

   Tighten the bolt to 240 to 280 Nm (177 to 207 lbf ft).

5. Connect correct lifting equipment to a steering cylinder.

   IMPORTANT:
   The weight of each steering cylinder assembly is approximately 70 kg (154 lb).

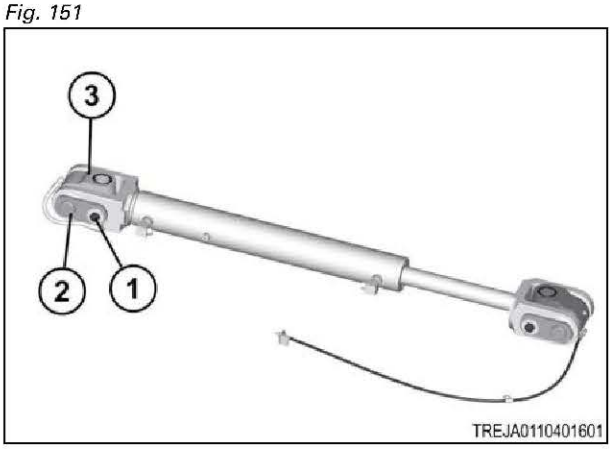

Fig. 152

6. Install the steering cylinder (3) and the yoke pin (2) with the hardware (1).

   Tighten the bolts to 240 to 280 Nm (177 to 207 lbf ft).

7. Repeat the procedure to install the other steering cylinder.

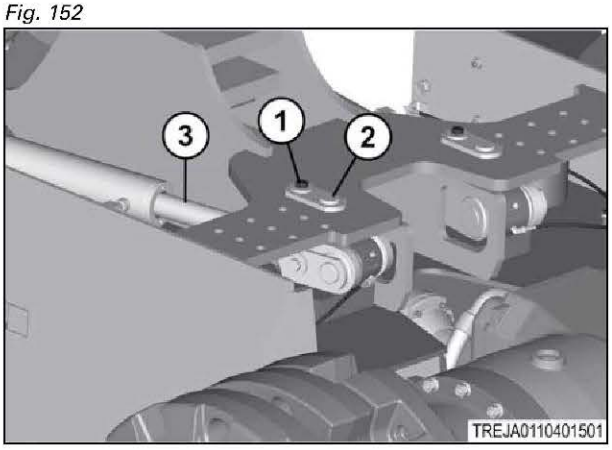

Fig. 153

8. Connect the grease hoses (1) to the brackets (2) and to the frame.

9. Install the hose clamp (3) and the hardware (2).

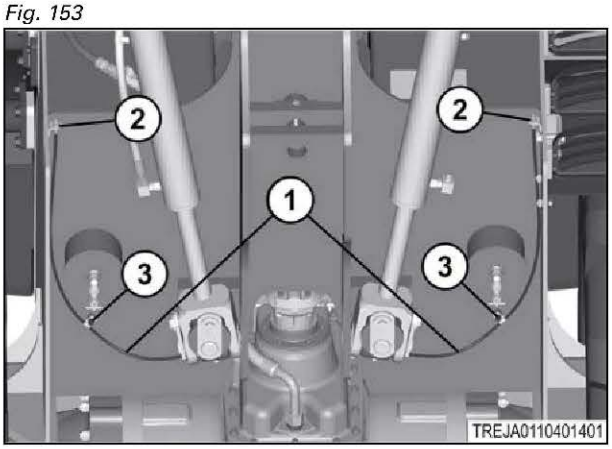

Fig. 154

10. Connect the hoses (1) to the cylinder ports.

11. Install the hose clamp (3) with the hardware (2).

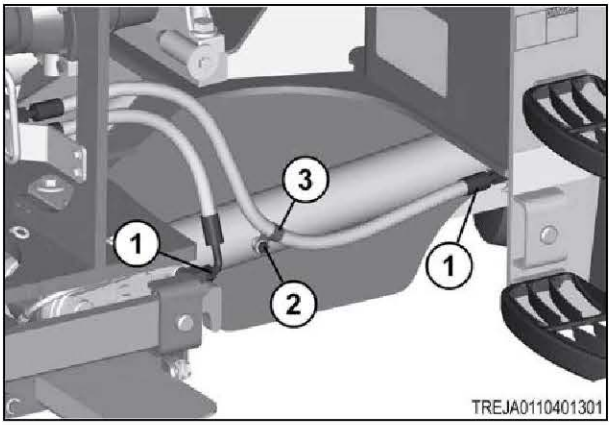

Fig. 155

12. Remove the articulation lock (1) between the front and the rear sections of the machine.

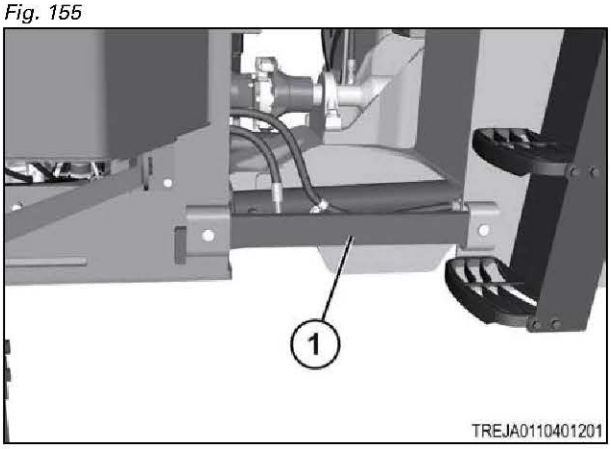

Fig. 156

13. Install the two drain plugs (1) in the bottom of the hydraulic oil reservoir (2).

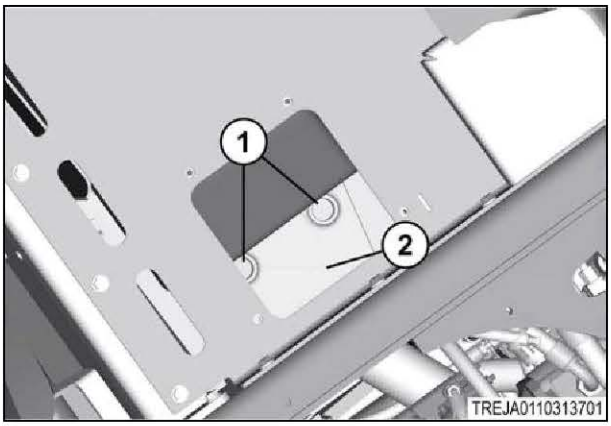

Fig. 157

14. Install the cover plate (2) with the hardware (1).

15. Fill the hydraulic system with hydraulic oil.

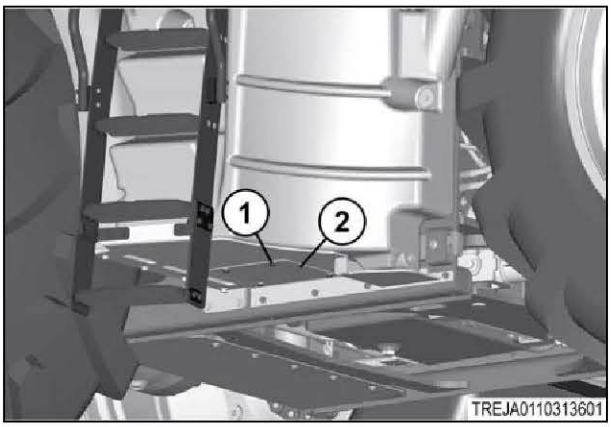

Fig. 158

16. Install the battery disconnect switch key (1).

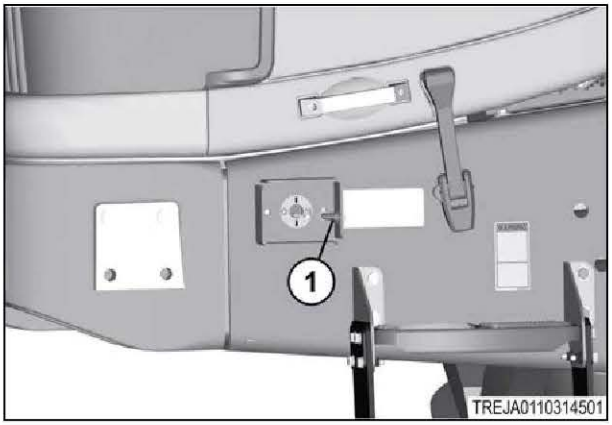

Fig. 159

17. Turn the battery disconnect switch key (1) clockwise to connect the battery power.

NOTE:
The battery disconnect switch is shown in the on position.

18. Check for leaks.

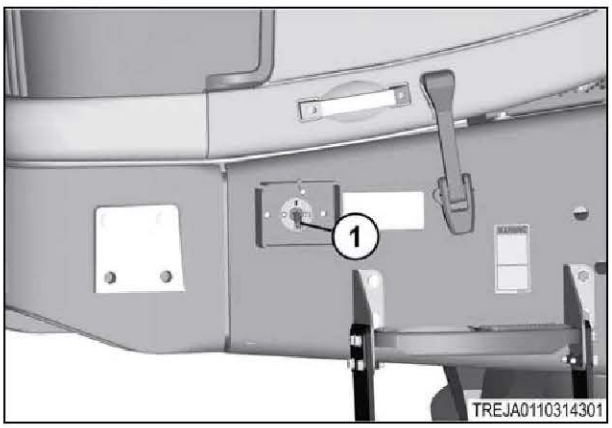

Fig. 160

Related Links

Lubricant viscosities page 1-18

5.4.13 Remove the hydraulic oil reservoir

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

IMPORTANT:
Before removal, fasten identification tags on the components for correct installation at assembly. Put caps and plugs on all hoses, fittings, and ports to prevent contamination from entering the system.

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the parking brake, and take the key with you.

2. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

   NOTE:
   The battery disconnect switch is shown in the off position.

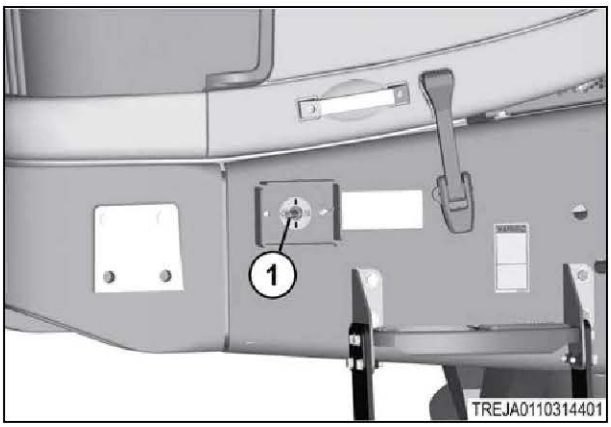

Fig. 161

3. Remove the battery disconnect switch key (1).

4. Relieve all pressure from the hydraulic system.

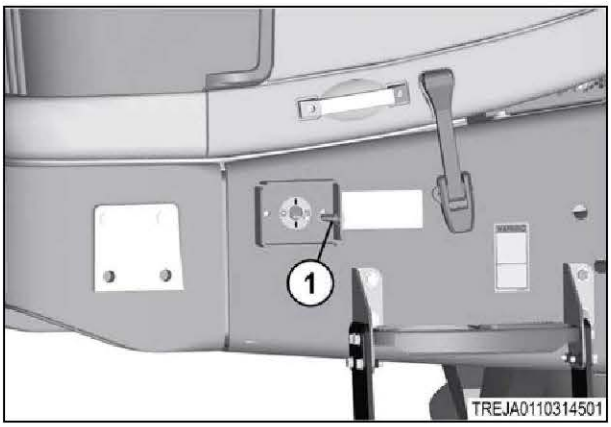

Fig. 162

5. Remove the hardware (1), and the cover plate (2).

6. Set a correct container below the drain plugs on the hydraulic reservoir.

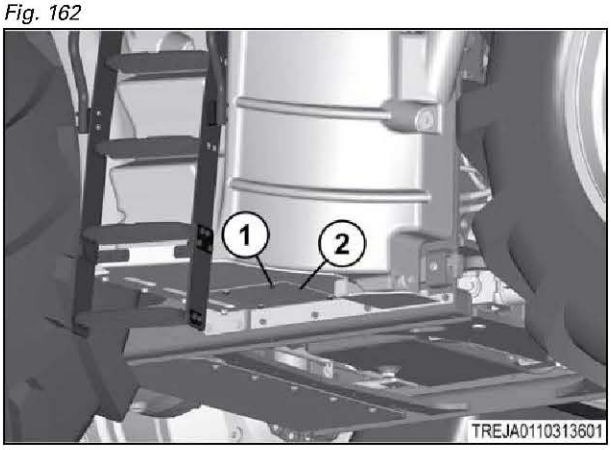

Fig. 163

7. Remove the two drain plugs (1) from the bottom of the hydraulic oil reservoir (2).

8. Drain the hydraulic oil.

9. Install the drain plugs when the reservoir is empty.

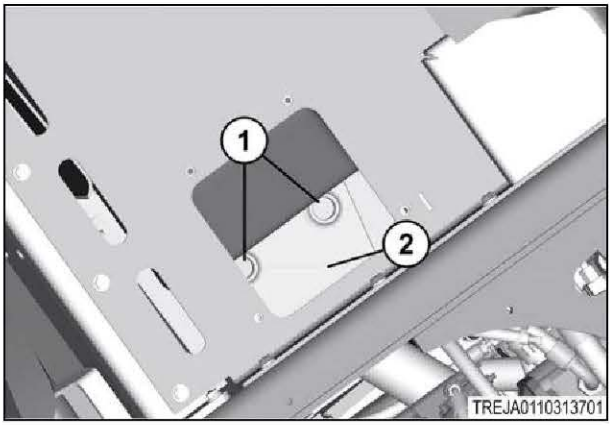

Fig. 164

10. If the machine is equipped with a transmission guard (1) support the transmission guard with correct lifting equipment.

    IMPORTANT:
    The weight of the transmission guard is approximately 57 kg (125 lb).

11. Remove the hardware (2).

12. Loosen the hardware (3).

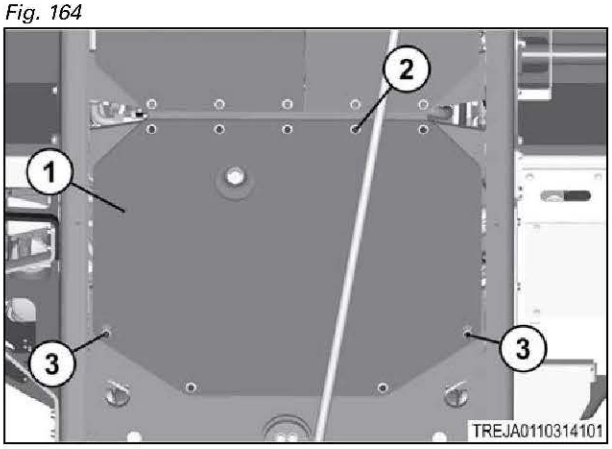

Fig. 165

13. Slide the transmission guard (1) so the large holes are over the hardware (2) and remove the transmission guard.

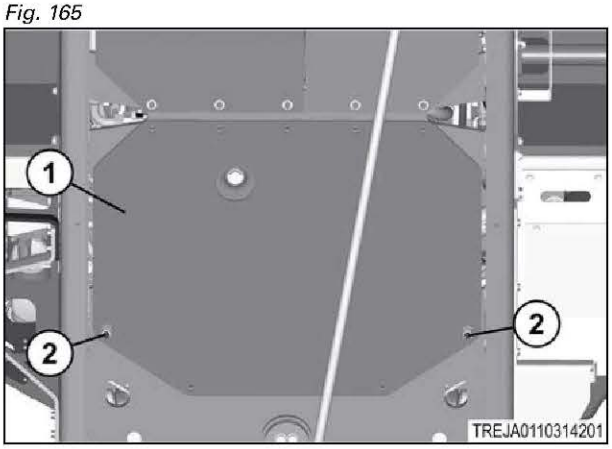

Fig. 166

14. Disconnect all hoses and the electrical connections from the hydraulic oil reservoir.

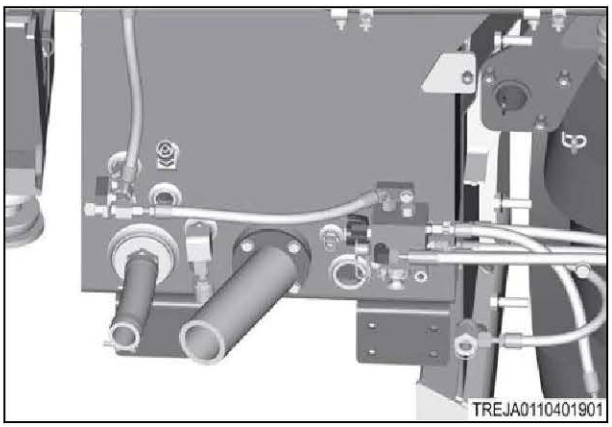

Fig. 167

15. Support the hydraulic oil reservoir (2) with correct lifting equipment and remove the hardware (1).

IMPORTANT:
The weight of the hydraulic oil reservoir is approximately 84 kg (185 lb).

16. Use the lifting equipment and remove the hydraulic reservoir.

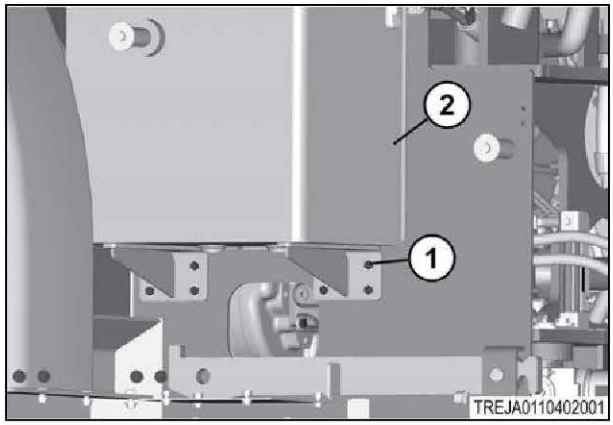

Fig. 168

5.4.14 Disassemble the hydraulic oil reservoir

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Complete the disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Remove the two drain plugs (1) from the bottom of the hydraulic oil reservoir.

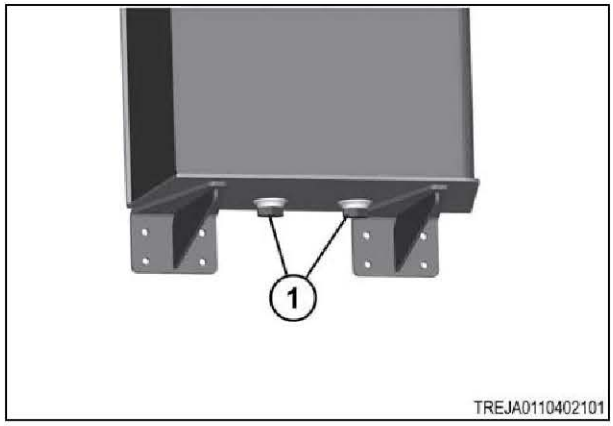

Fig. 169

2. Remove the breather (1) from the cover (2).

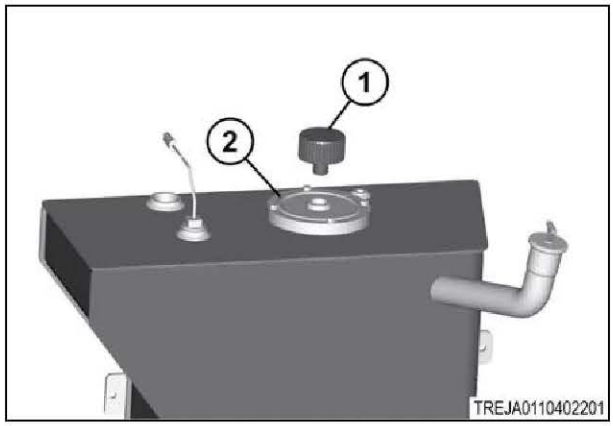

Fig. 170

3. Remove the fill cap (1) from the fill tube.

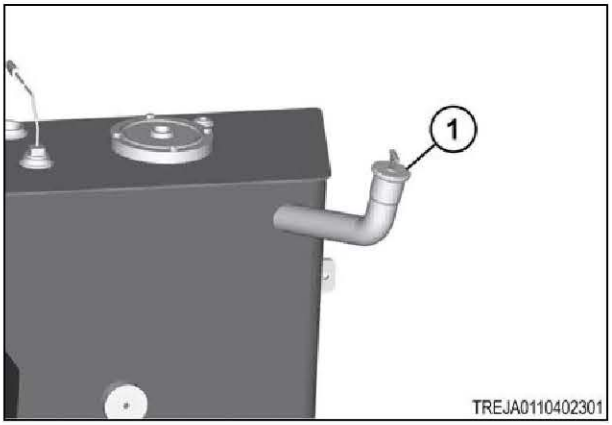

Fig. 171

4. Remove the hardware (1) and the sight gauge (2).

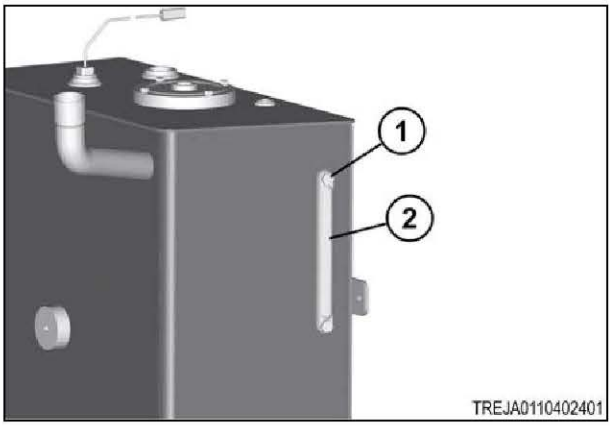

Fig. 172

5. Remove the oil level switch (1).

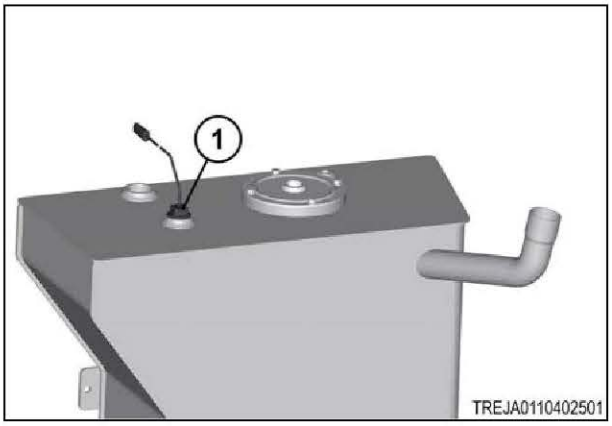

Fig. 173

6. Remove the hardware (1), the cover (2), and the O-ring.

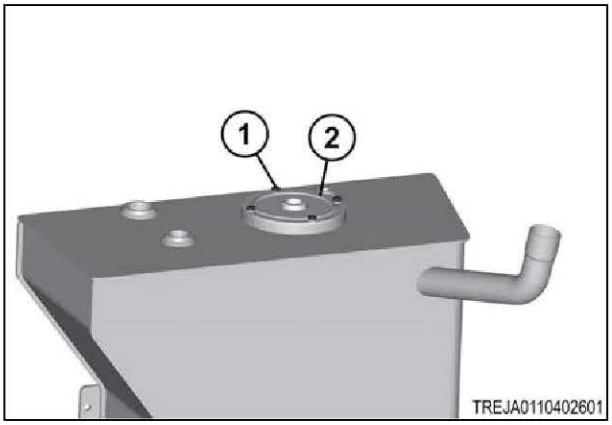

Fig. 174

7. Remove the plug (1) and the connector (2).

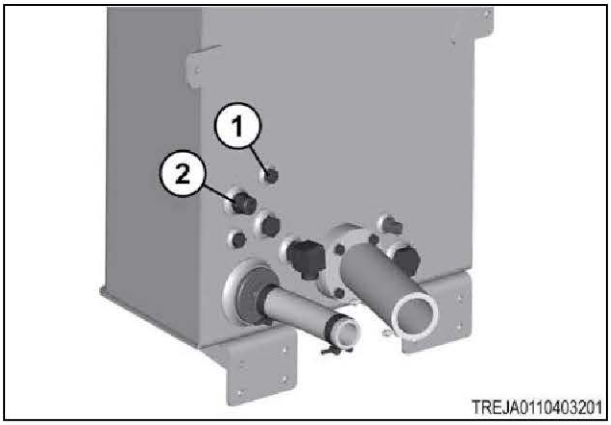

Fig. 175

8. Remove the plugs (1) and the elbow (2).

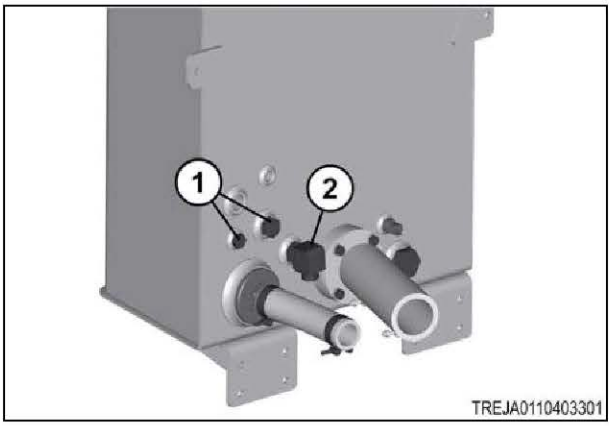

Fig. 176

9. Remove the plug (1).

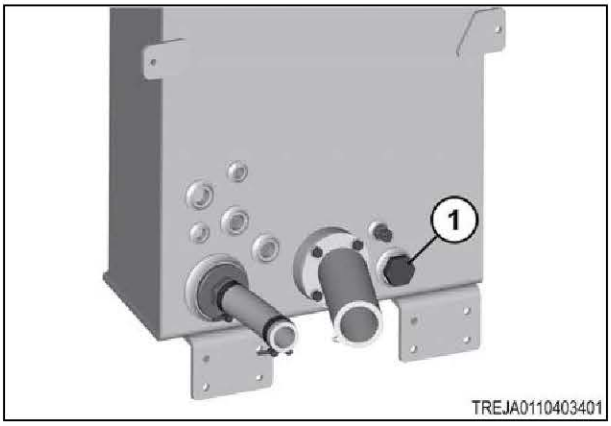

Fig. 177

10. Remove the hydraulic oil temperature sensor (1).

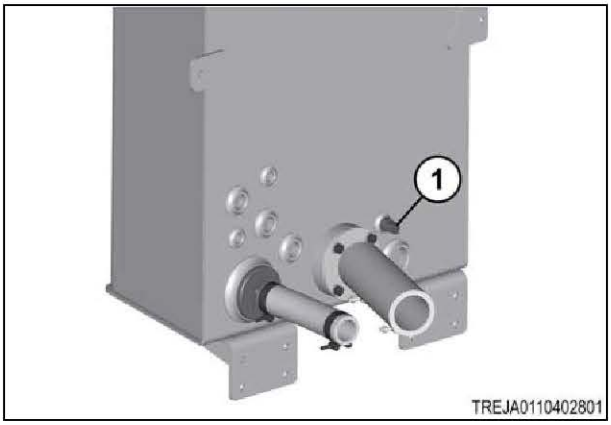

Fig. 178

11. Remove the hardware (1) and the tube fitting (2).

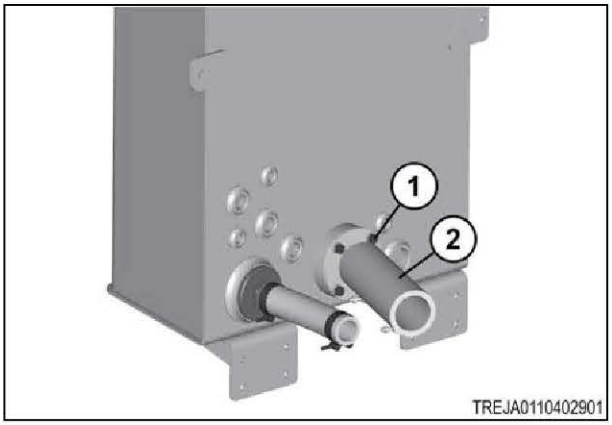

Fig. 179

12. Remove the fitting (1) and the oil suction screen (2).

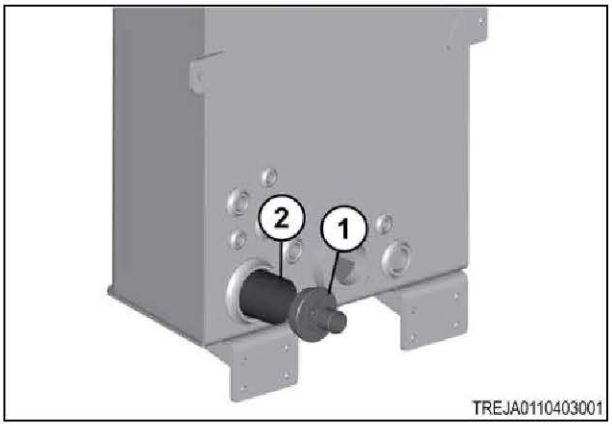

Fig. 180

13. Remove the two magnets (1) from inside the hydraulic oil reservoir. Remove the magnets through the two large fitting ports.

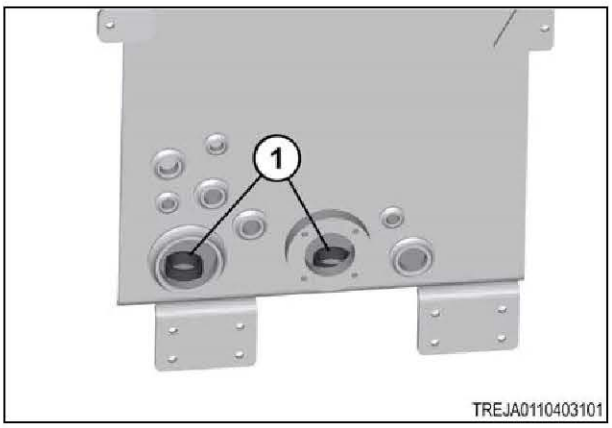

Fig. 181

5.4.15 Assemble the hydraulic oil reservoir

Procedure

1. Install the two magnets (1) to the bottom of the hydraulic oil reservoir.

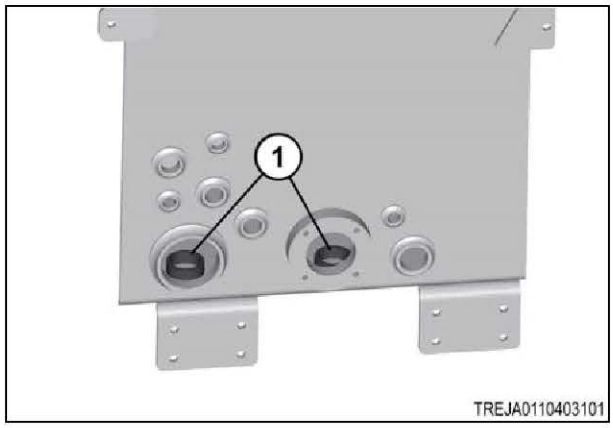

Fig. 182

2. Install the oil suction screen (2) and the fitting (1).

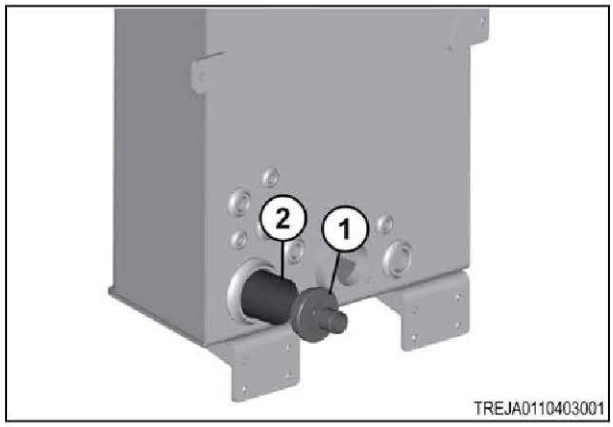

Fig. 183

3. Install a new O-ring. Install the tube fitting (2) with the hardware (1).

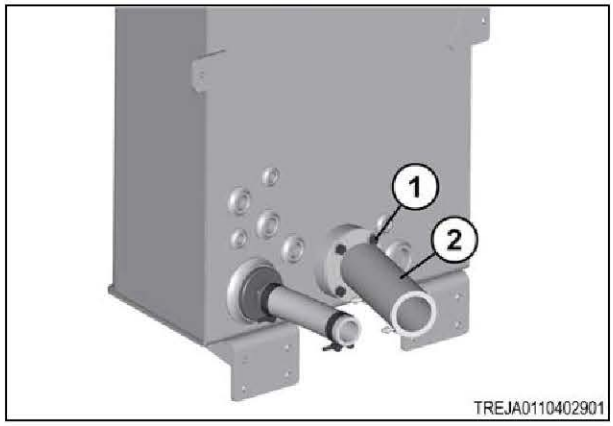

Fig. 184

4. Apply thread locking compound to the threads of the temperature sensor.

5. Install the temperature sensor (1).

NOTE:
Tighten the temperature sensor to approximately 15 to 25 Nm (11 to 19 lbf ft).

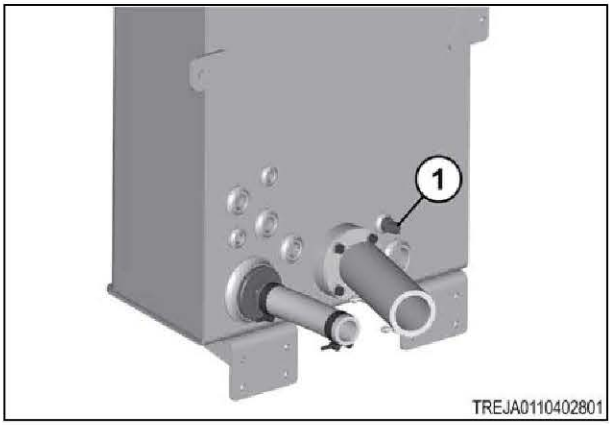

Fig. 185

6. Install the plug (1).

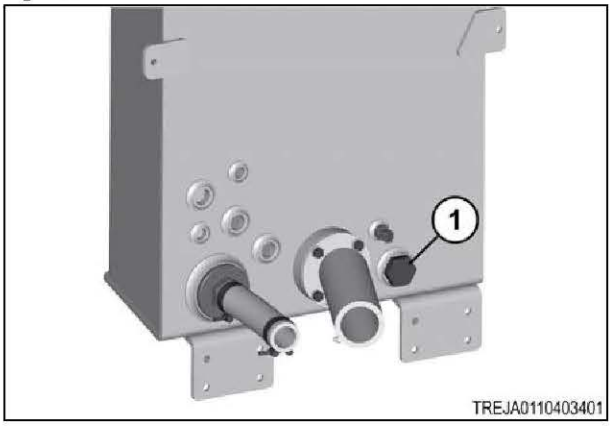

Fig. 186

7. Install the plugs (1) and the elbow (2).

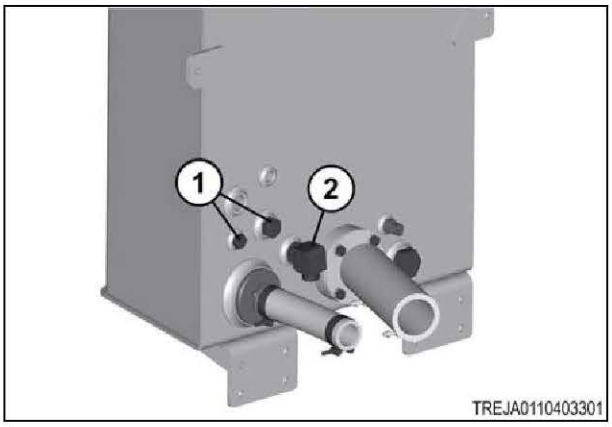

Fig. 187

8. Install the plug (1) and the connector (2).

Tighten the plug to 126 to 154 Nm (93 to 113 lbf ft).

Tighten the connector to 54 to 66 Nm (40 to 48 lbf ft).

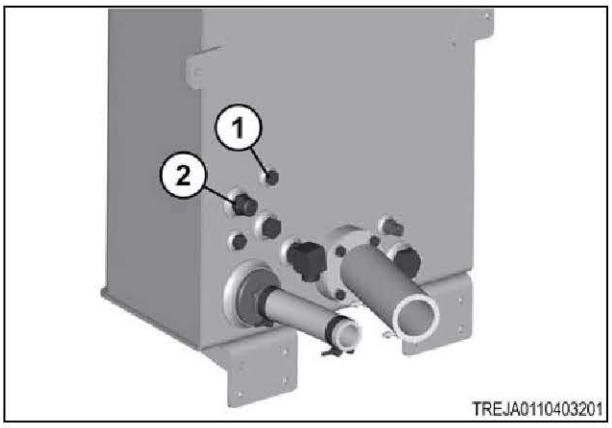

Fig. 188

9. Install the sight gauge (2) with the hardware (1).

Tighten the hardware to 5.4 Nm (4 lbf ft).

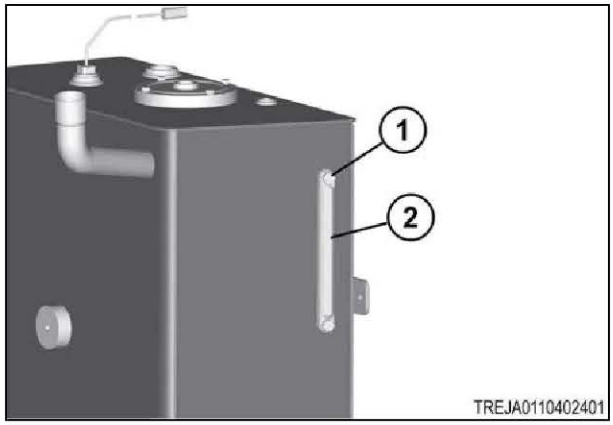

Fig. 189

10. Install a new O-ring on the cover. Install the cover (2) with the hardware (1).

Tighten the hardware to 21 to 35 Nm (16 to 26 lbf ft).

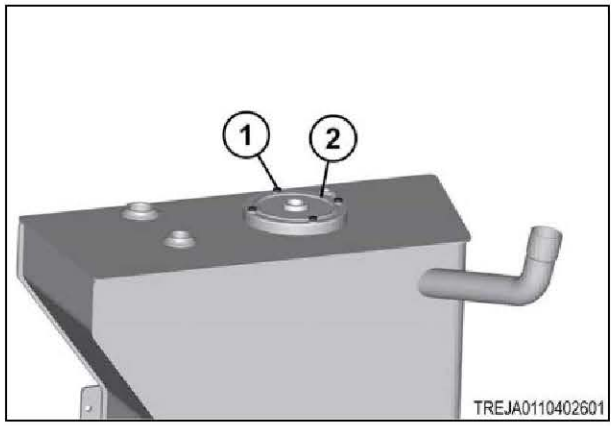

Fig. 190

11. Install the oil level switch (1).

Tighten the switch to 48 Nm (35 lbf ft).

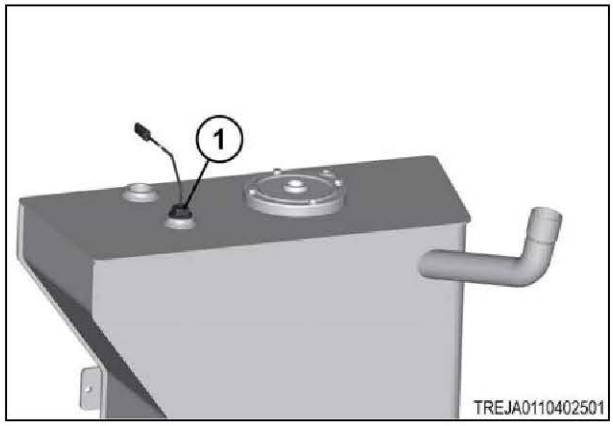

Fig. 191

12. Install the fill cap (1) to the fill tube.

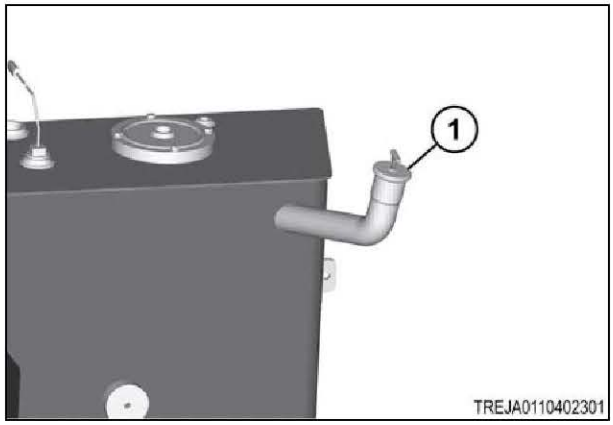

Fig. 192

13. Install the breather (1) to the cover (2).

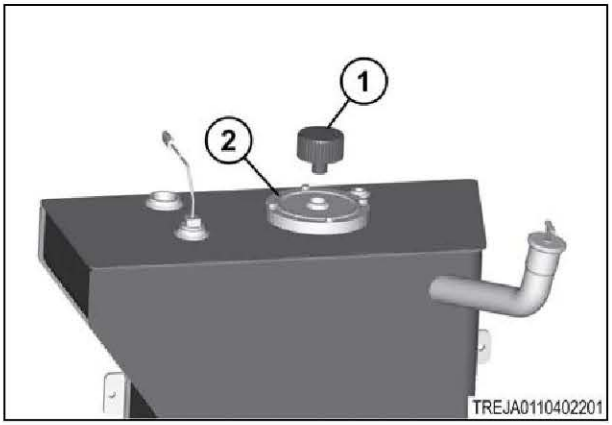

Fig. 193

14. Install the two drain plugs (1) to the bottom of the hydraulic oil reservoir.

Tighten the drain plugs to 190 to 230 Nm (140 to 170 lbf ft).

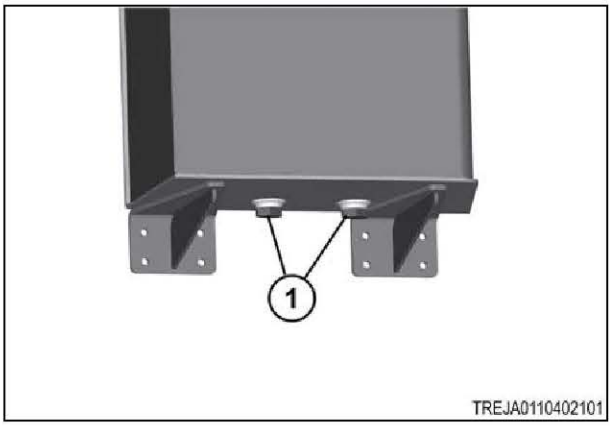

Fig. 194

5.4.16 Install the hydraulic oil reservoir

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

NOTE:
Make sure the hydraulic oil reservoir is free of water and solvent.

Procedure

1. Put the hydraulic oil reservoir (2) into position using correct lifting equipment. Install the hardware (1).

IMPORTANT:
The weight of the hydraulic oil reservoir is approximately 84 kg (185 lb).

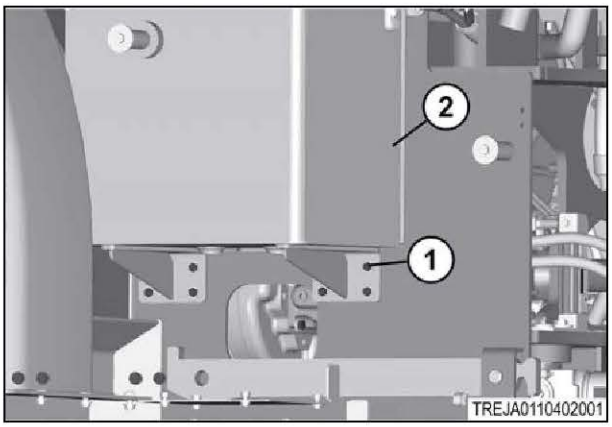

Fig. 195

2. Connect all the hoses and the electrical connections to the hydraulic oil reservoir.

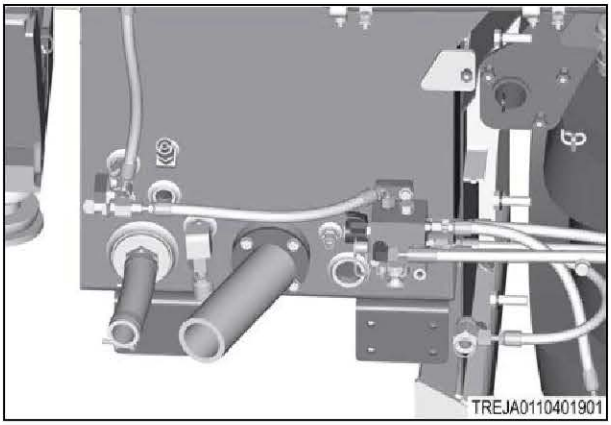

Fig. 196

3. If the machine is equipped with a transmission guard (1), use correct lifting equipment to put the transmission guard into position. Make sure the large holes are over the hardware (2).

IMPORTANT:
The weight of the transmission guard is approximately 57 kg (125 lb).

4. Slide the transmission guard (1) onto the hardware (2).

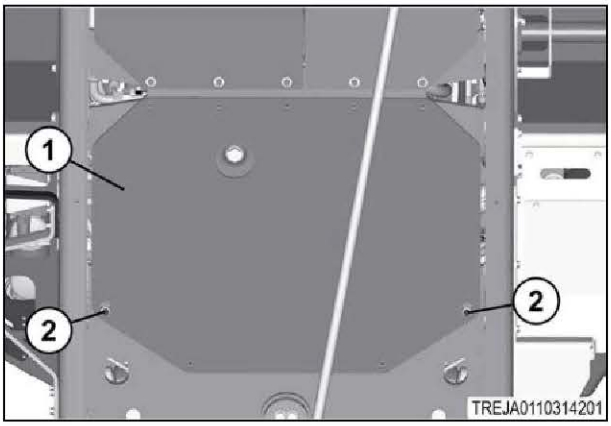

Fig. 197

5. Install the transmission guard (1) with the hardware (2, 3).

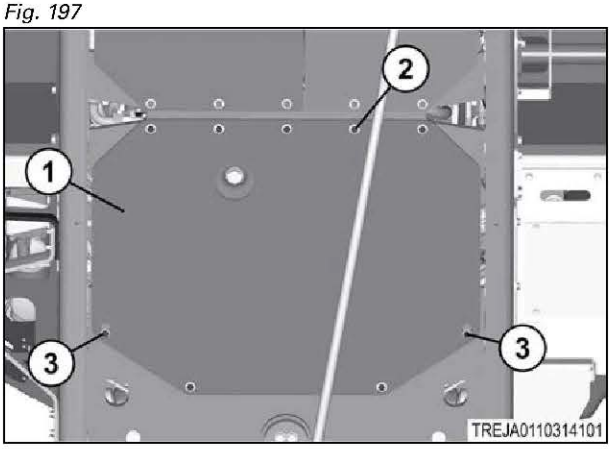

Fig. 198

6. Install the two drain plugs (1) to the bottom of the hydraulic oil reservoir (2).

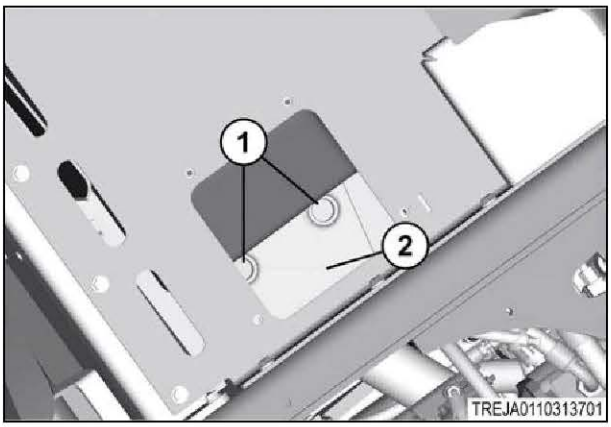

Fig. 199

7. Install the cover plate (2) with the hardware (1).

8. Fill the hydraulic oil reservoir with hydraulic oil.

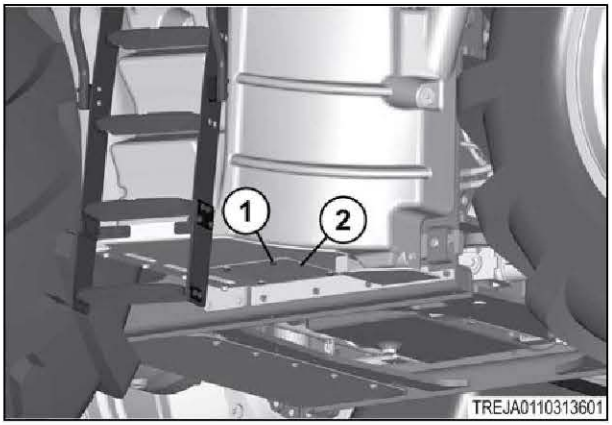

Fig. 200

9. Install the battery disconnect switch key (1).

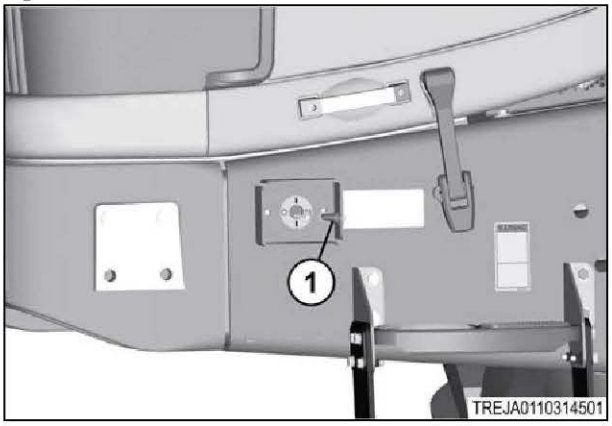

Fig. 201

10. Turn the battery disconnect switch key (1) clockwise to connect the battery power.

    NOTE:
    The battery disconnect switch is shown in the on position.

11. Check for leaks.

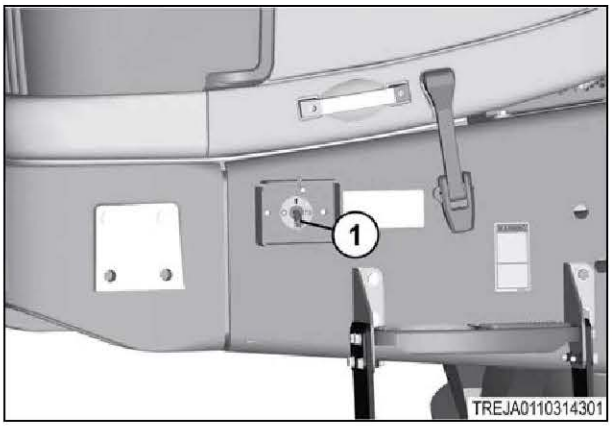

Fig. 202

Related Links

Lubricant viscosities page 1-18

5.4.17 Remove the hydraulic oil filter manifold (steering - implement)

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

NOTE:
Before removal, fasten identification tags on the components for correct installation at assembly. Put caps and plugs on all hoses, fittings, and ports to prevent contamination from entering the system.

NOTE:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

NOTE:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the parking brake, and take the key with you.

2. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

   NOTE:
   The battery disconnect switch is shown in the off position.

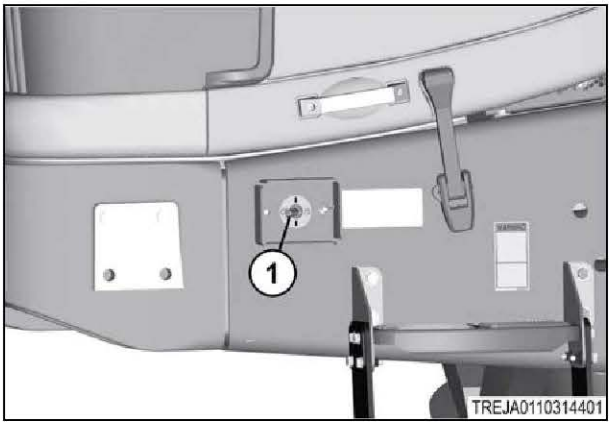

Fig. 203

3. Remove the battery disconnect switch key (1).

4. Relieve all pressure from the hydraulic system.

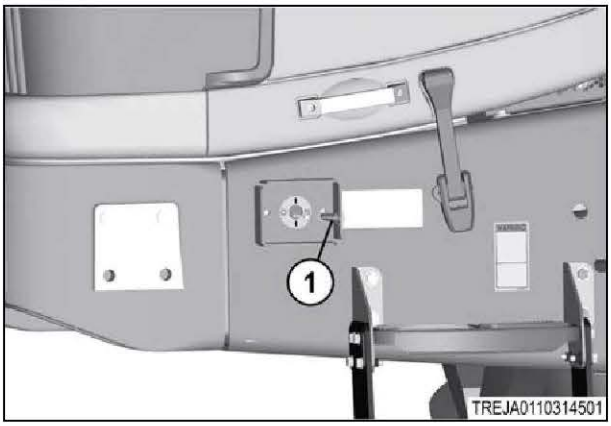

Fig. 204

5. If the machine is equipped with a transmission guard (1), remove the hardware (2), and loosen the hardware (3).

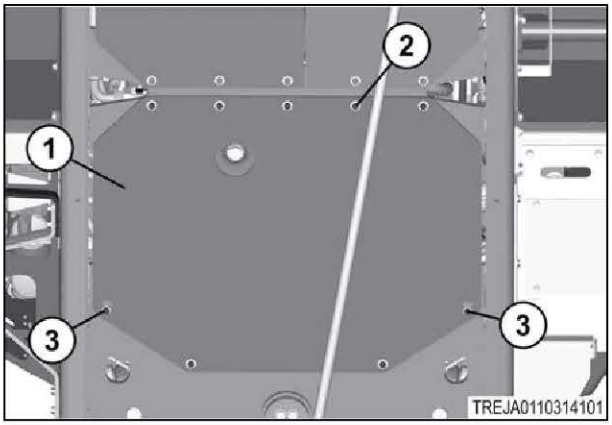

Fig. 205

6. Let the transmission guard (1) rest on the hardware (2).

IMPORTANT:
The weight of the transmission guard is approximately 57 kg (125 lb).

7. Slide the transmission guard so the large holes are over the hardware (2) and remove the transmission guard.

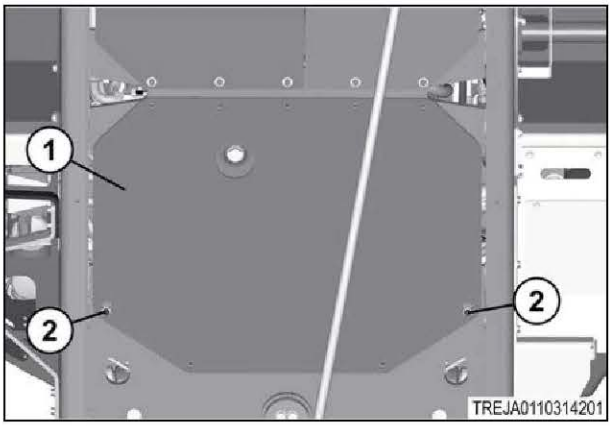

Fig. 206

8. Remove the implement cooler return hose (1).

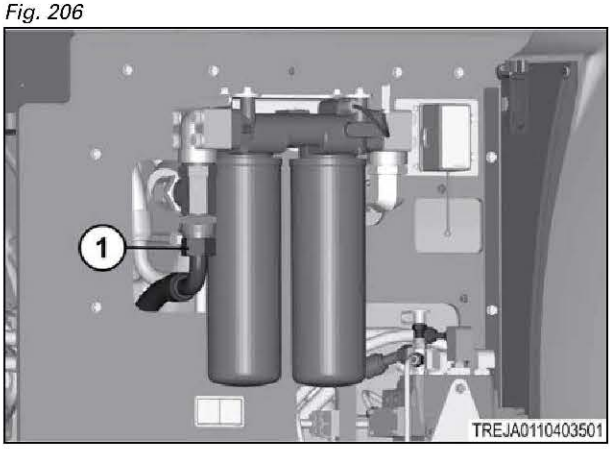

Fig. 207

9. Remove the implement valve return hose (1).

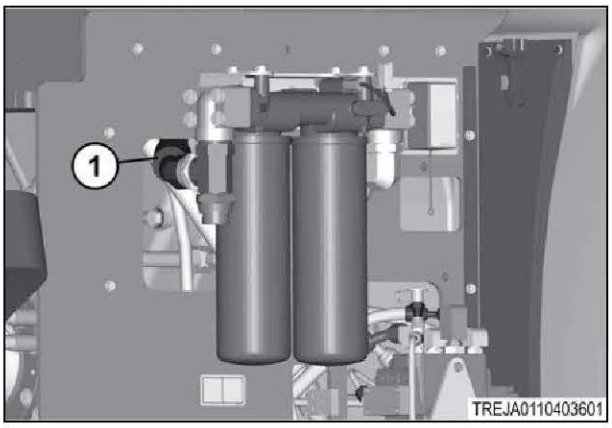

Fig. 208

10. Remove the implement filter return hose (1).

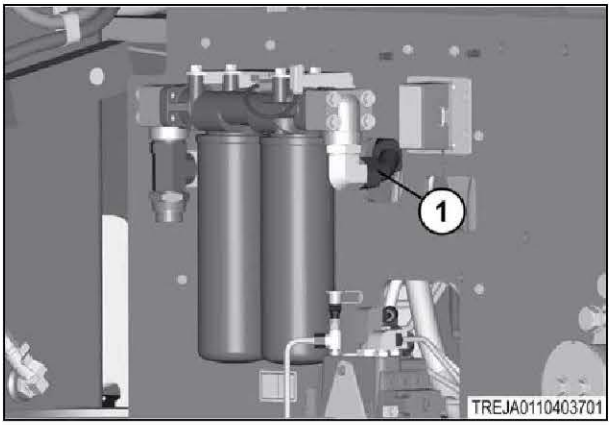

Fig. 209

11. Disconnect the pressure switch wire harness (1).

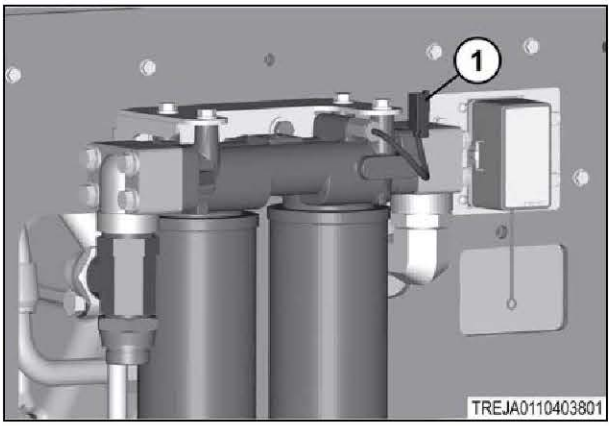

Fig. 210

12. Remove the hardware (1) and the hydraulic oil filter manifold.

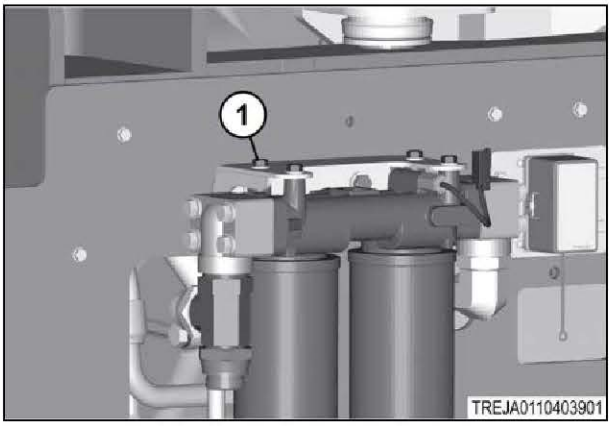

Fig. 211

13. Remove the hardware (1) and the mounting bracket (2).

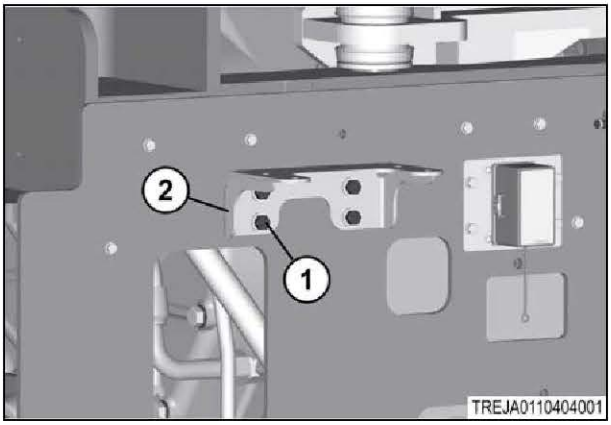

Fig. 212

5.4.18 Install the hydraulic oil filter manifold (steering - implement)

NOTE:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Install the mounting bracket (2) with the hardware (1).

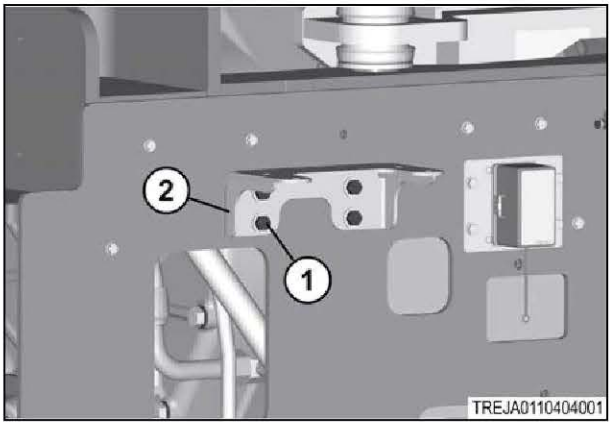

Fig. 213

2. Install the hydraulic oil filter manifold with the hardware (1).

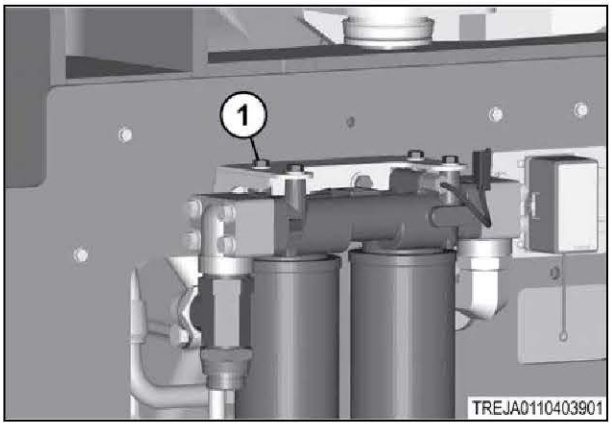

Fig. 214

3. Connect the pressure switch wire harness (1).

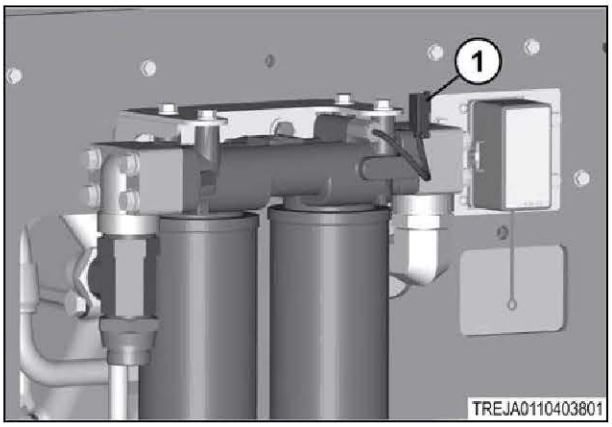

Fig. 215

4. Install the implement filter return hose (1).

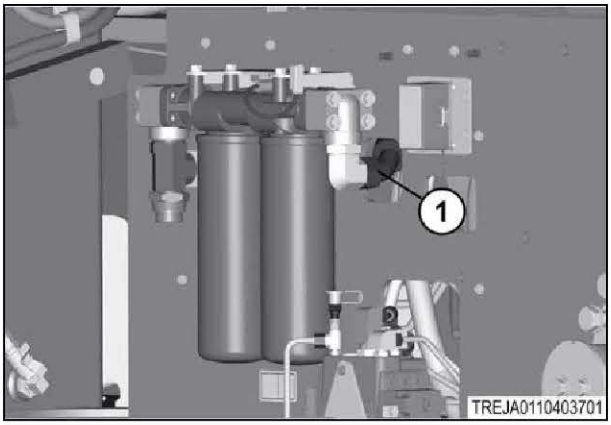

Fig. 216

5. Install the implement valve return hose (1).

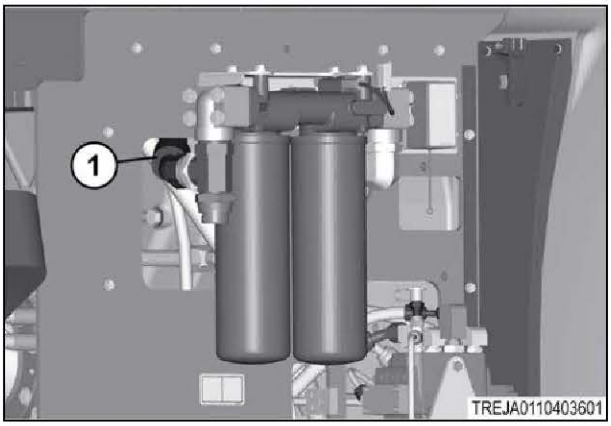

Fig. 217

6. Install the implement cooler return hose (1).

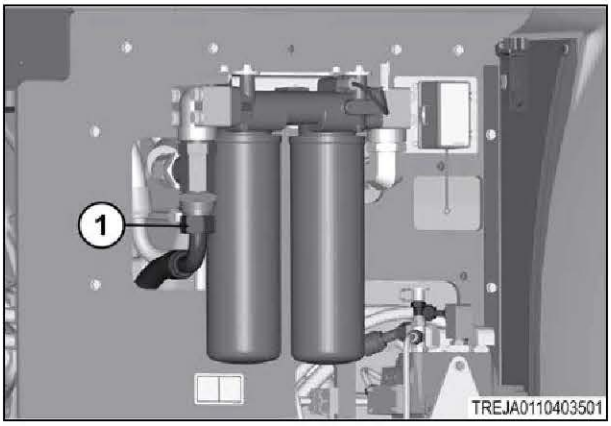

Fig. 218

7. Install the transmission guard so the large holes are over the hardware (2).

IMPORTANT:
The weight of the transmission guard is approximately 57 kg (125 lb).

8. Slide the transmission guard (1) onto the hardware (2).

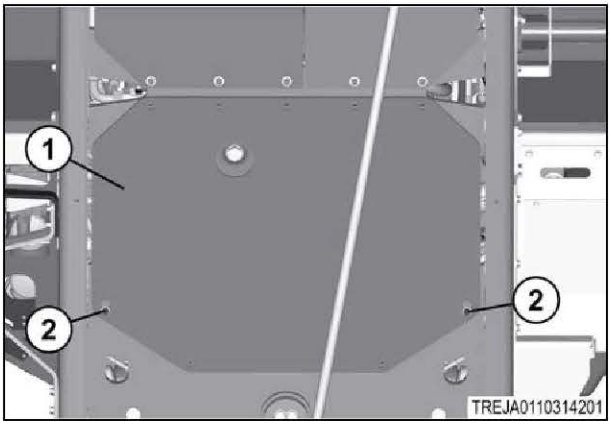

Fig. 219

9. Install the transmission guard (1) with the hardware (2, 3).

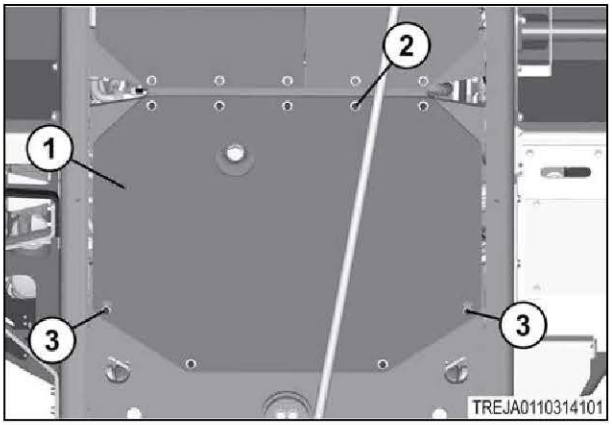

Fig. 220

10. Fill the hydraulic oil reservoir with the correct type and the correct amount of hydraulic oil.

11. Install the battery disconnect switch key (1).

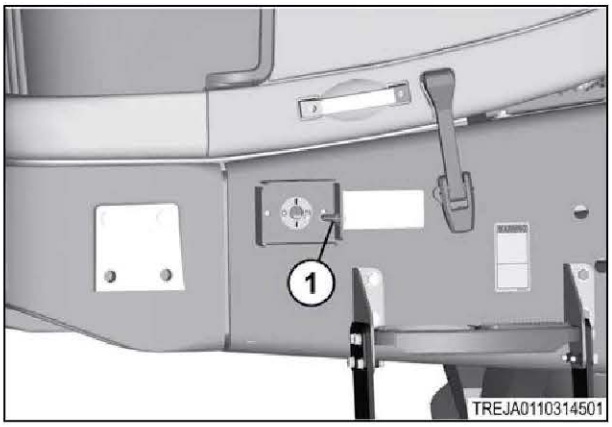

Fig. 221

12. Turn the battery disconnect switch key (1) clockwise to connect the battery power.

NOTE:
The battery disconnect switch is shown in the on position.

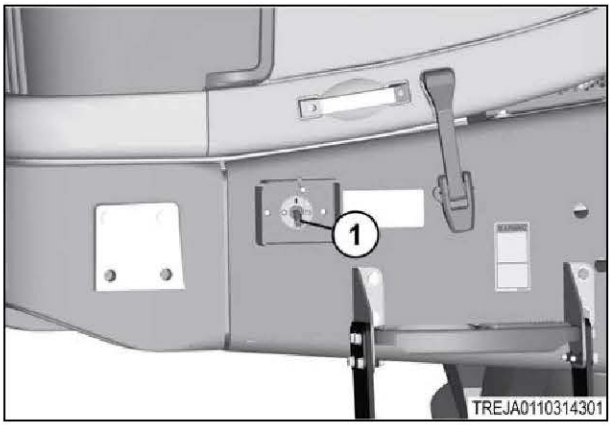

Fig. 222

5.4.19 Remove the load sense blocking valve

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

IMPORTANT:
Before removal, fasten identification tags on the components for correct installation at assembly. Put caps and plugs on all hoses, fittings, and ports to prevent contamination from entering the system.

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the parking brake, and take the key with you.

2. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

   NOTE:
   The battery disconnect switch is shown in the off position.

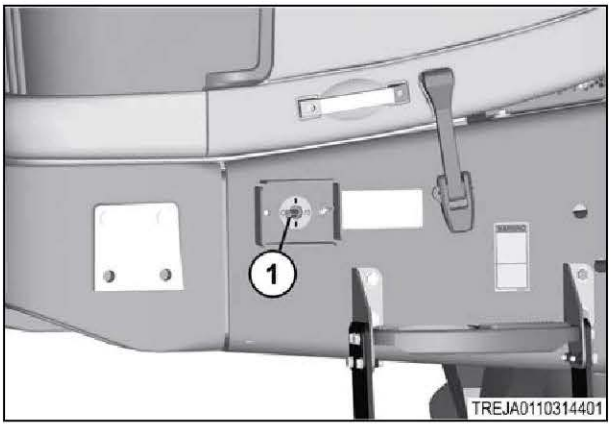

Fig. 223

3. Remove the battery disconnect switch key (1).

4. Relieve all pressure from the hydraulic system.

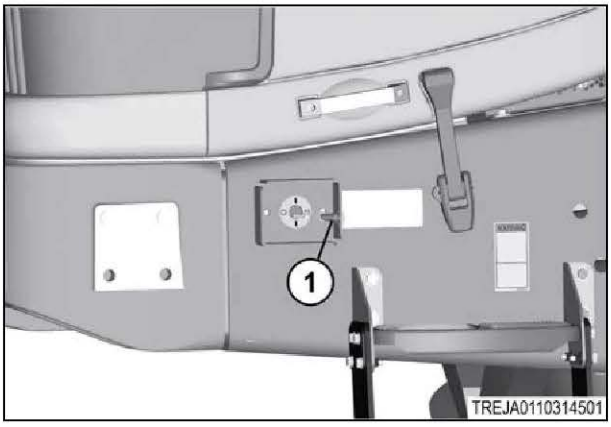

Fig. 224

5. If the machine is equipped with a transmission guard (1), support the transmission with correct lifting equipment.

   IMPORTANT:
   The weight of the transmission guard is approximately 57 kg (125 lb).

6. Remove the hardware (2).

7. Loosen the hardware (3).

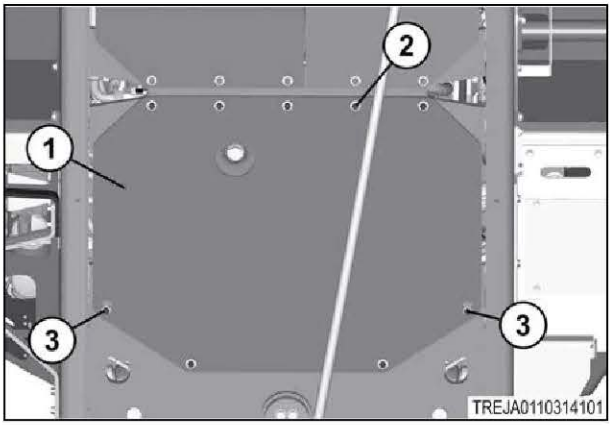

Fig. 225

8. Let the transmission guard (1) rest on the hardware (2).

9. Slide the transmission guard so the large holes are over the hardware (2) and remove the transmission guard.

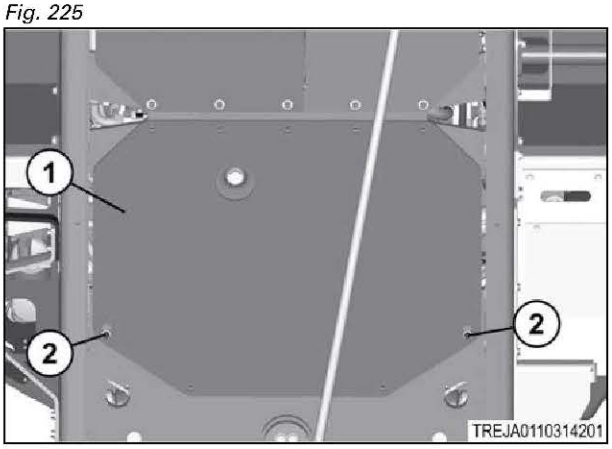

Fig. 226

10. Disconnect the wire harness (1) from the solenoid.

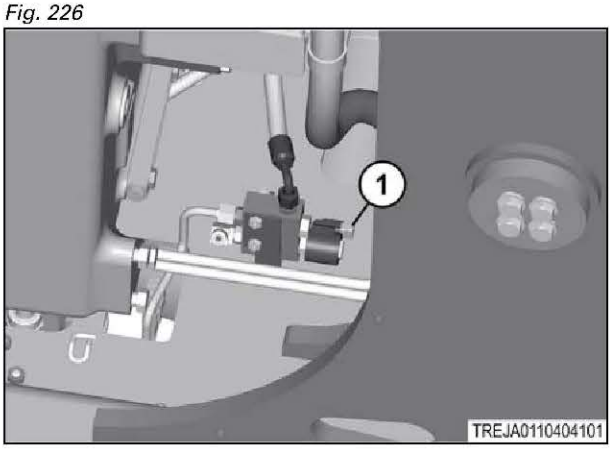

Fig. 227

11. Disconnect the steering and priority valve line (1).

12. Disconnect the pump LS hose (2) and the implement valve LS hose (3).

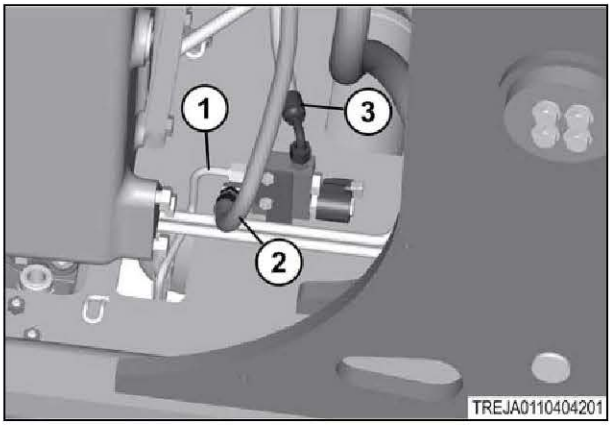

Fig. 228

13. Remove the hardware (1) and the load sense blocking valve (2).

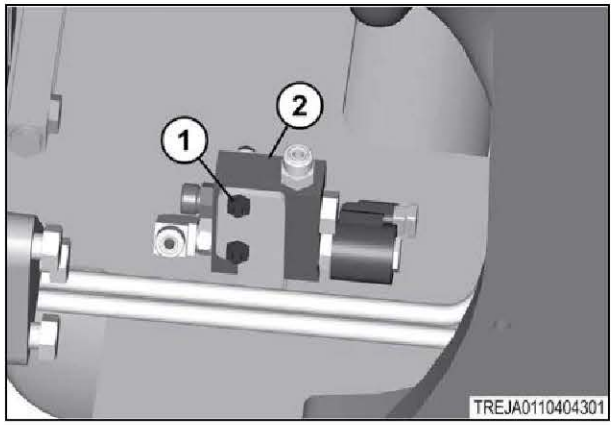

Fig. 229

14. Remove the hardware (1) and the mounting bracket (2).

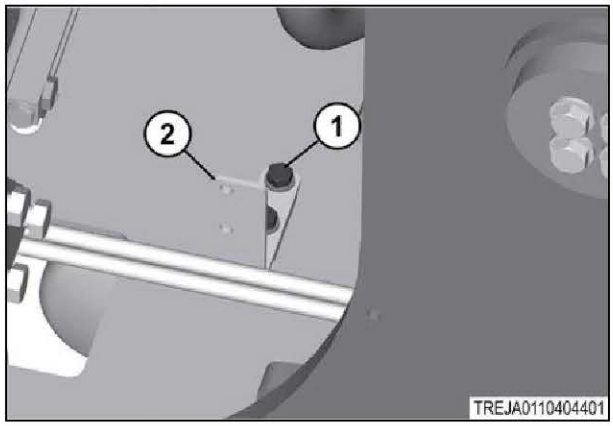

Fig. 230

5.4.20 Installing the load sense blocking valve

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Install the mounting bracket (2) with the hardware (1).

Tighten the hardware to 55 Nm (41 lbf ft).

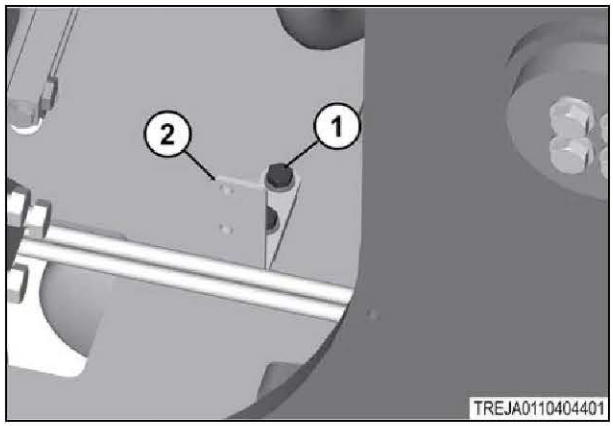

Fig. 231

2. Install the load sense blocking valve (2) with the hardware (1).

3. Connect the pump LS hose (2) and the implement valve LS hose (3).

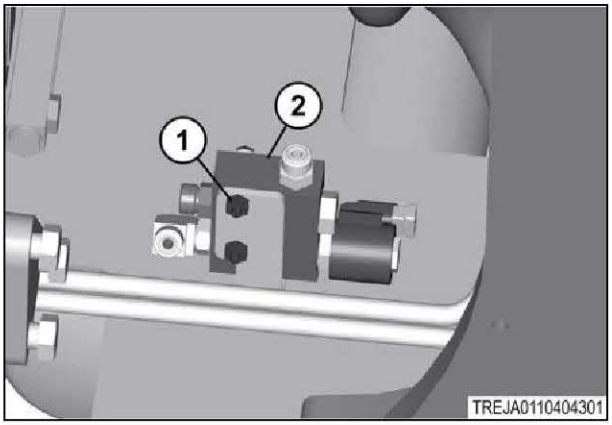

Fig. 232

4. Connect the steering/priority valve line (1).

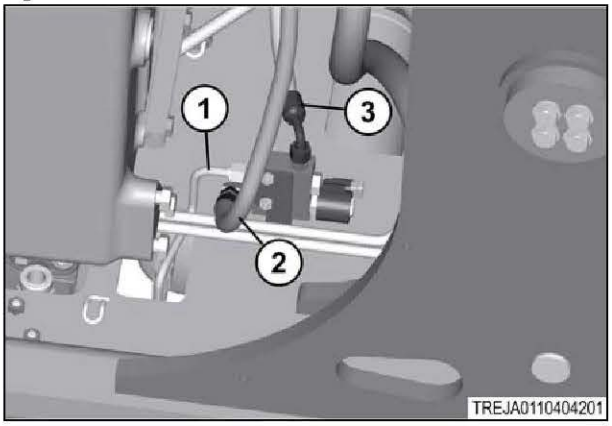

Fig. 233

5. Connect the wire harness (1) to the solenoid.

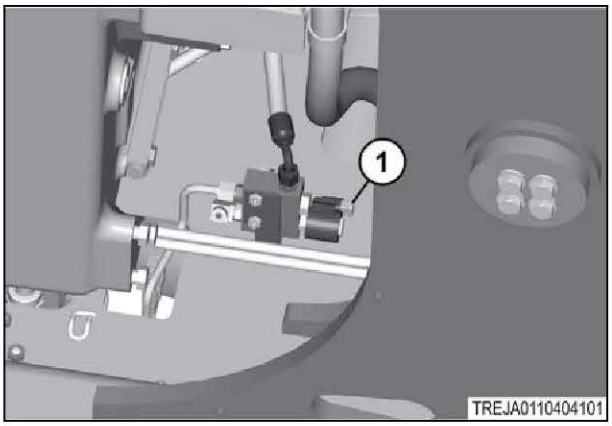

Fig. 234

6. If the machine is equipped with a transmission guard (1), support the transmission guard with correct lifting equipment. Install the transmission guard so the large holes are over the hardware (2).

   IMPORTANT:
   The weight of the transmission guard is approximately 57 kg (125 lb).

7. Slide the transmission guard (1) onto the hardware (2).

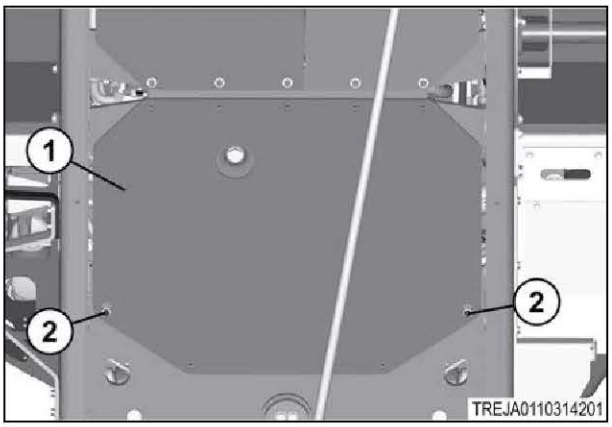

Fig. 235

8. Install the transmission guard (1) with the hardware (2, 3).

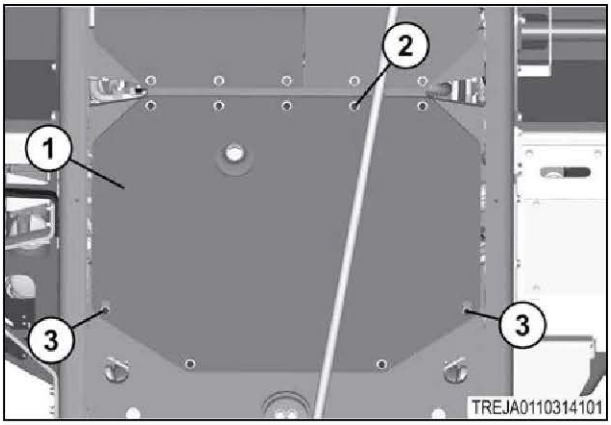

Fig. 236

9. Fill the hydraulic oil reservoir with the hydraulic oil.

10. Install the battery disconnect switch key (1).

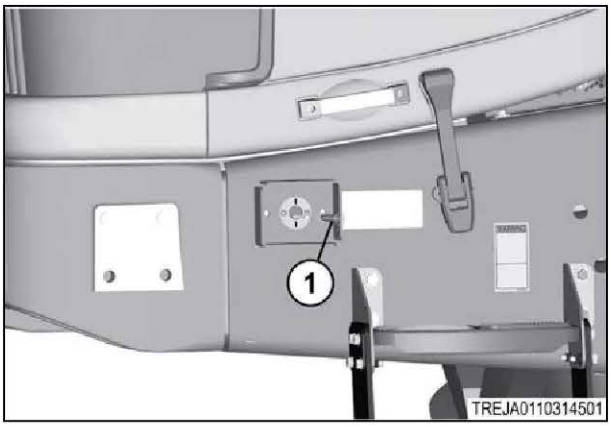

Fig. 237

11. Turn the battery disconnect switch key (1) clockwise to connect the battery power.

NOTE:
The battery disconnect switch is shown in the on position.

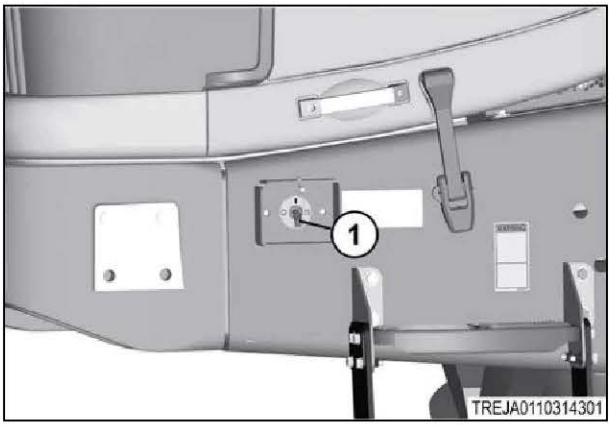

Fig. 238

Related Links

Lubricant viscosities page 1-18

5.5 Steering system test and adjust

5.5.1 Adjust the load sense relief valve for the steering valve

Before starting the procedure

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Pressurized gases or fluids can be hazards.

Personal injury can result.

Relieve the pressure from the system or component before disconnecting components.

IMPORTANT:

Make sure to contain all fluids during inspection, maintenance, testing, adjusting, and repair of the machine. Contain the fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard all fluids according to laws, regulations, and mandates.

Procedure

1. Park the machine on a solid, level surface.
2. Put the transmission in park.
3. Turn the key start switch to the off position and take the key with you.
4. Make sure the machine is cool.
5. Relieve all pressure from the hydraulic system.
6. Engage the articulation lock (1).

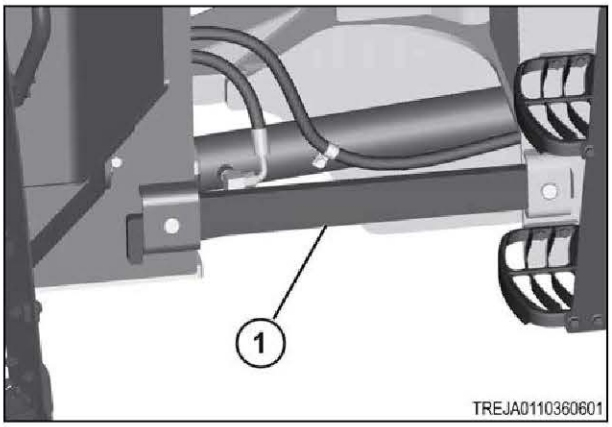

Fig. 239

7. Disconnect and cap the supply and the return hoses to the steering cylinders at the bulkhead fittings (1).

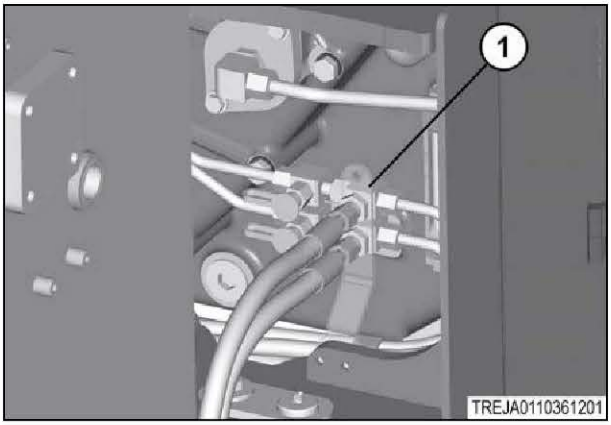

Fig. 240

8. Fasten a correct pressure gauge to the load sense pressure port (1).

9. Start the engine.

10. Heat the hydraulic oil to a minimum of 60 °C (140 °F).

11. Make sure all the implement valve control levers are in the hold position.

12. Set the engine speed to 2100 RPM.

13. Hold the steering wheel in the left-steer position and check the load sense relief pressure setting. Adjust if necessary.

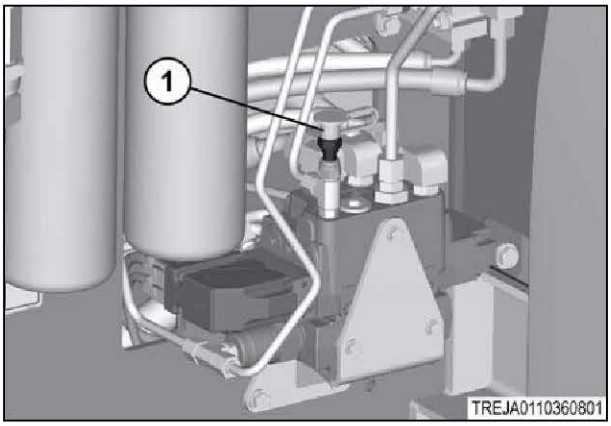

Fig. 241

The load sense relief pressure for the steering valve must be set at 17900 kPa (2596 psi). The permitted range is 17400 to 18400 kPa (2524 to 2669 psi)

14. To adjust the load sense relief pressure, remove the rubber plug (1). Use a 3/16 inch hex wrench to adjust the set screw. Install the rubber plug.

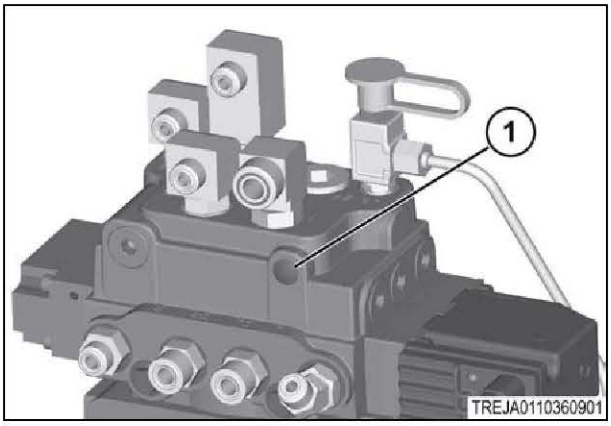

Fig. 242

15. Check the implement valve supply pressure (1).

    The implement valve supply pressure must be set to 20300 kPa (2944 psi). The permitted range is 20000 to 20600 kPa (2900 to 2988 psi).

16. If the pressure is out of the range, adjust the margin pressure.

17. Check the implement valve pilot pressure (2).

    The implement valve pilot pressure must be 3151 kPa (457 psi). The permitted range is 2800 to 3503 kPa (406 to 508 psi).

18. Check the implement valve load sense pressure (1).

    The implement valve load sense pressure must be 248 kPa (36 psi). The permitted range is 0 to 496 kPa (0 to 72 psi).

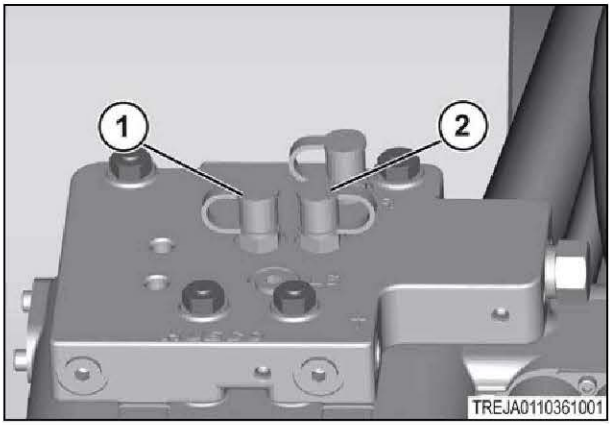

Fig. 243

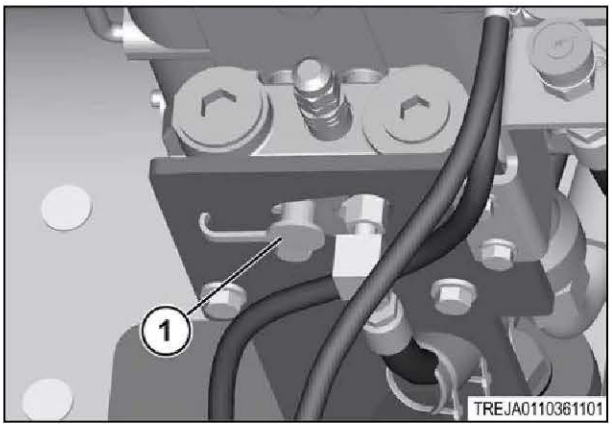

Fig. 244

Related Links

Adjust the margin pressure - standard pump page 9-130
Adjust the margin pressure - high flow pump page 9-132

5.5.2 Bleed the steering system

Before starting the procedure

CAUTION:
Steering movement of the machine can be erratic with air in the cylinders. Make sure there is enough space for the machine movement. Keep all persons at a safe distance from the machine during this procedure.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the parking brake, and take the key with you.
2. Make sure the cylinder ends have been lubricated.
3. Remove the articulation locking device.
4. Start the engine and set the engine speed to 1450 to 1550 RPM.
5. Slowly steer the machine to the left and the right through the full articulation range three times.

5.5.3 Do a check of the steering performance and pressure

Procedure

1. Park the machine on a solid, level surface.

2. Move the transmission control lever into the neutral position and engage the parking brake.
3. Turn the key start switch to the off position and take the key with you.
4. Relieve all pressure from the hydraulic system.
5. Connect the correct pressure gauges to the cylinder test ports(1).
6. Start the engine.
7. Set the engine speed to 1490 to 1510 rpm.
8. Make sure the hydraulic oil temperature is a minimum 18 °C (65 °F).
9. Move the transmission control lever to the neutral position.
10. Steer the machine to full lock to the left and hold the steering wheel in position.

    Cylinder pressure must be 18000 to 20000 kPa (2610 to 2900 psi).

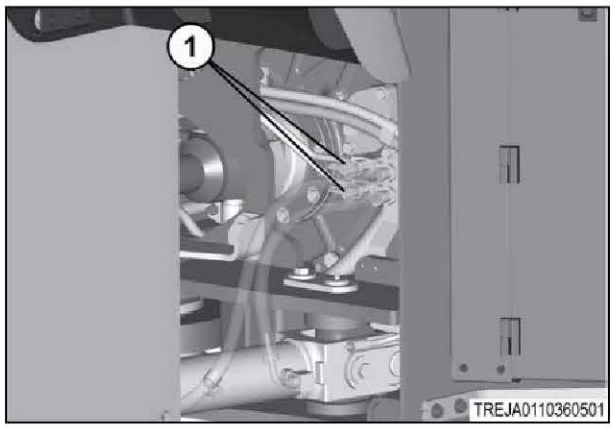

Fig. 245

11. Steer the machine to full lock to the right and hold the steering wheel in position.

    Cylinder pressure must be 18000 to 20000 kPa (2610 to 2900 psi).
12. Move the steering wheel to the center position.

    With no movement, the cylinder pressure must be 1100 to 3100 kPa (160 to 450 psi).
13. Slowly rotate the steering wheel at 20 to 30 RPM from the full left turn position to the full right turn position. Record the number of steering wheel revolutions during this procedure.

    The procedure must take 3 to 4 revolutions for the hydraulic-electric steering system

    The procedure must take 3.5 to 4.5 revolutions for the the standard steering system.

    NOTE:
    The test procedure must be done with single tires if the machine is stationary. If the test is done on concrete, the machine must be going slowly in forward or reverse to get the full steer range.
14. Measure the required force to turn the steering wheel through the complete steering range.

    The measured value must not be more than 2.25 Nm (2 lbf ft).

    NOTE:
    Use a torque wrench with a steering wheel adapter for this test.
15. Make sure the steering wheel goes to the original position after turning the steering wheel a small amount. Repeat at steering wheel orientations of 12:00, 3:00, 6:00, and 9:00.

5.5.4 Test the implement oil cooler bypass valve pressure

CAUTION: Machine movement hazard. Hydraulic pressure release.

Personal injury or machine damage can occur.

Stand clear of the machine and components when releasing hydraulic pressure.

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

NOTE:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

Procedure

1. Park the machine on a hard level surface.
2. Move the transmission control lever into the neutral position and engage the parking brake.
3. Warm the oil to a minimum temperature of 60° C (140° F).
4. Turn the key start switch to the off position and take the key with you.
5. Move all the hydraulic control levers through the float position to relieve hydraulic pressure.
6. Stop the engine and remove the key.
7. Disconnect and cap the oil cooler hoses (1) to the oil cooler.

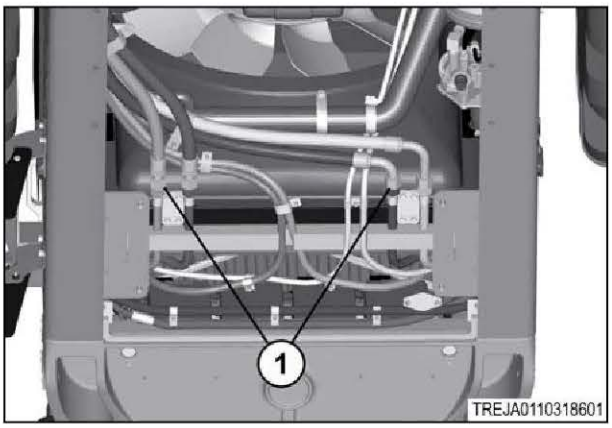

Fig. 246

8. Connect the correct tools to the quick disconnect pressure taps (1) and (2).
9. Start the engine. Run the engine at high idle.
10. Make sure all of the hydraulic control levers are in the hold position.
11. The difference between the gauges will be approximately 310 to 380 kPa (45 to 55 psi) if the hydraulic oil cooler bypass valve is operating correctly.

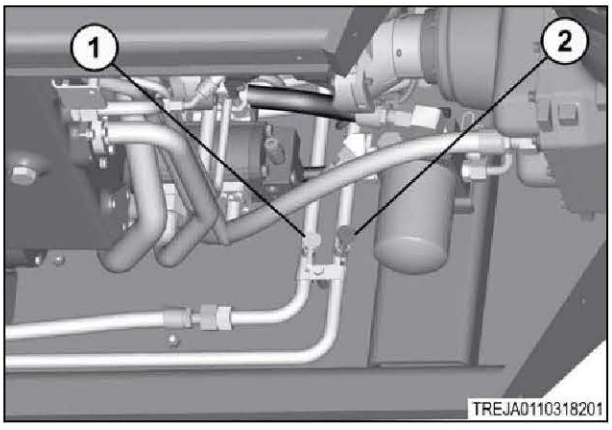

Fig. 247

5.6 Steering system maintenance

5.6.1 Remove the suction screen (charge pump)

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

NOTE:
Before removal, fasten identification tags on the components for correct installation at assembly. Put caps and plugs on all hoses, fittings, and ports to prevent contamination from entering the system.

NOTE:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

NOTE:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the parking brake, and take the key with you.

2. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

   NOTE:
   The battery disconnect switch is shown in the off position.

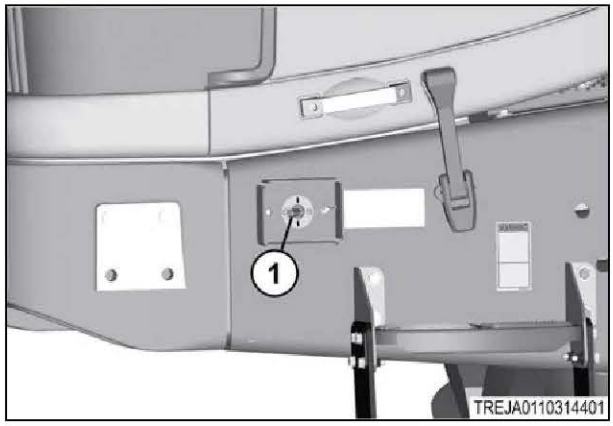

Fig. 248

3. Remove the battery disconnect switch key (1).

4. Relieve all pressure from the hydraulic system.

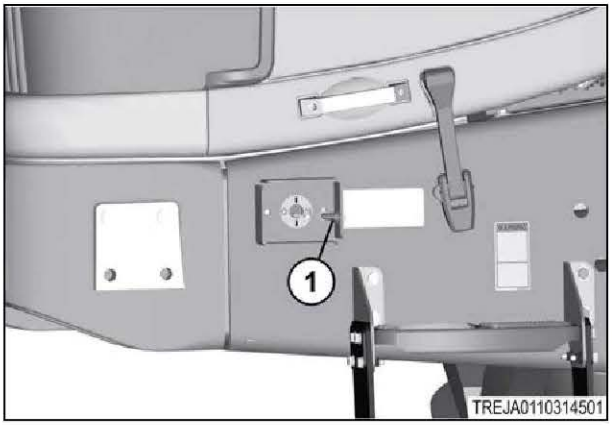

Fig. 249

5. Remove the hardware (1), and the cover plate (2).

6. Set a correct container below the drain plugs on the hydraulic reservoir.

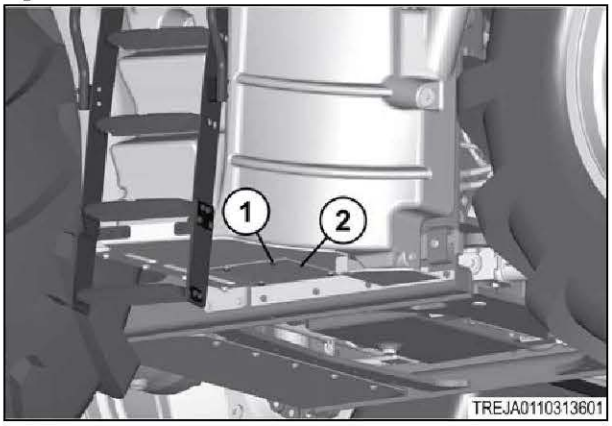

Fig. 250

7. Remove the two drain plugs (1) from the bottom of the hydraulic oil reservoir (2).

8. Drain the hydraulic oil.

9. Install the drain plugs when empty.

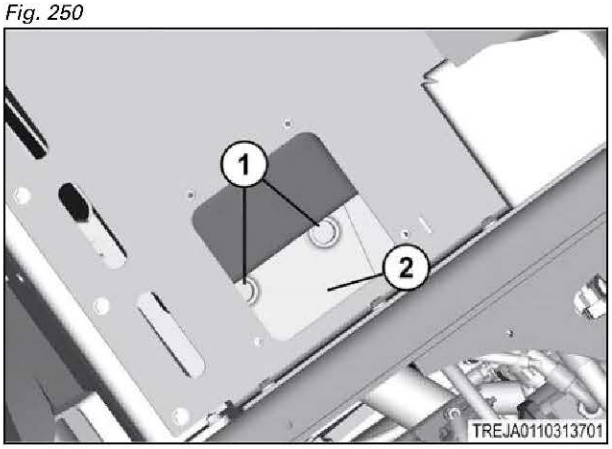

Fig. 251

10. If equipped, remove the transmission guard (1).

11. Remove the hardware (2).

12. Loosen the hardware (3).

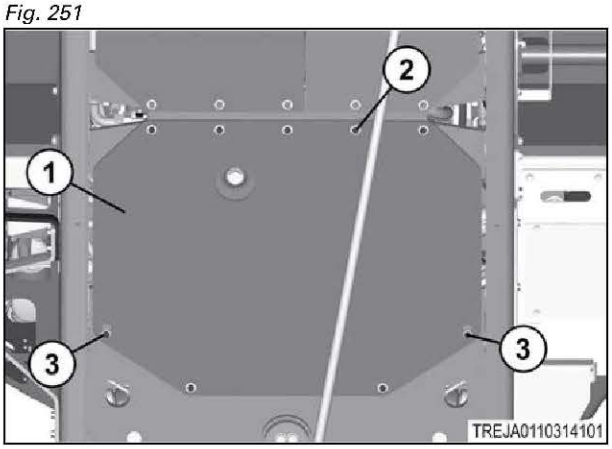

Fig. 252

13. Let the transmission guard (1) rest on the hardware (2).

IMPORTANT:
The weight of the transmission guard is approximately 57 kg (125 lb).

14. Slide the transmission guard so the large holes are over the hardware (2) and remove the transmission guard.

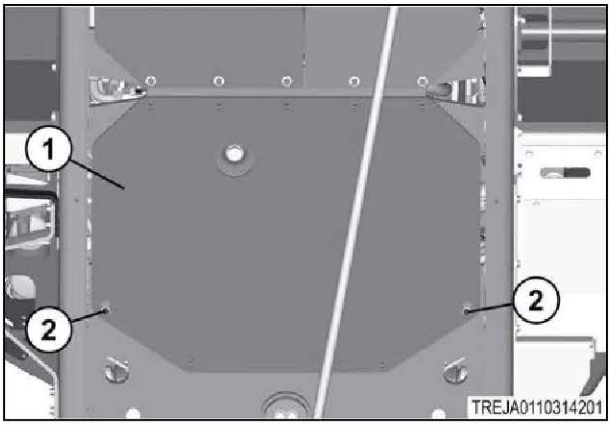

Fig. 253

15. Loosen the hose clamp (1) and disconnect the hose (2).

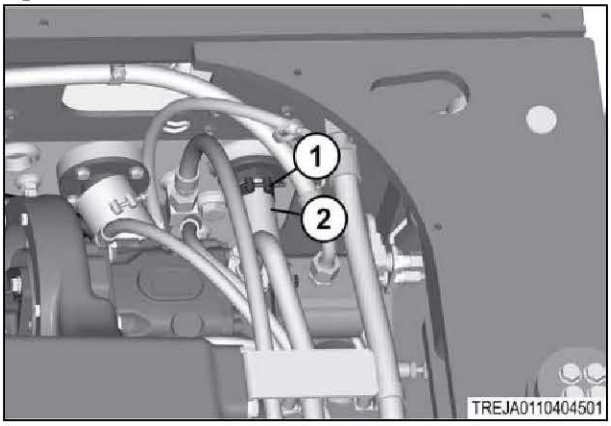

Fig. 254

16. Remove the fitting (1) and the oil suction screen (2).

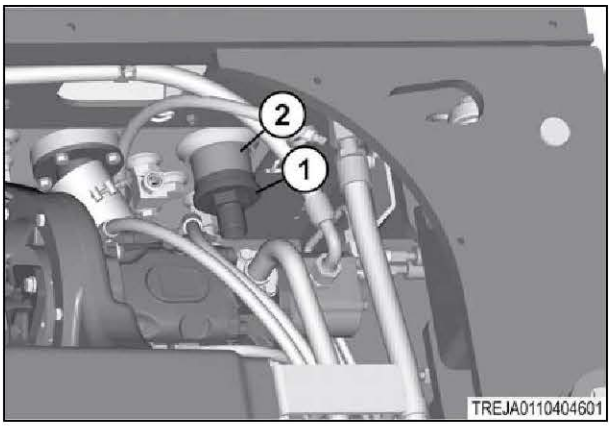

Fig. 255

5.6.2 Install the suction screen (charge pump)

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Install the oil suction screen (2) with the fitting (1).

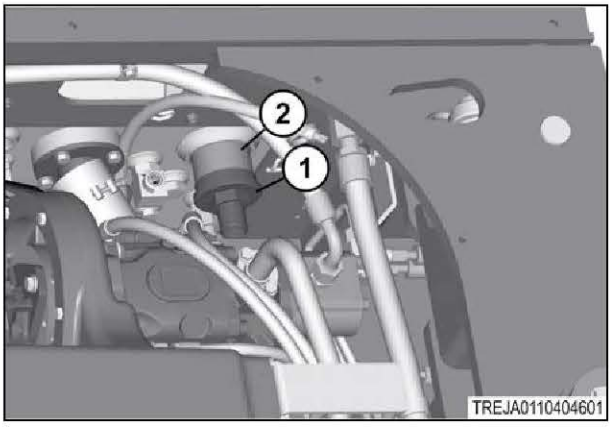

Fig. 256

2. Connect the hose (2) with the hose clamp (1).

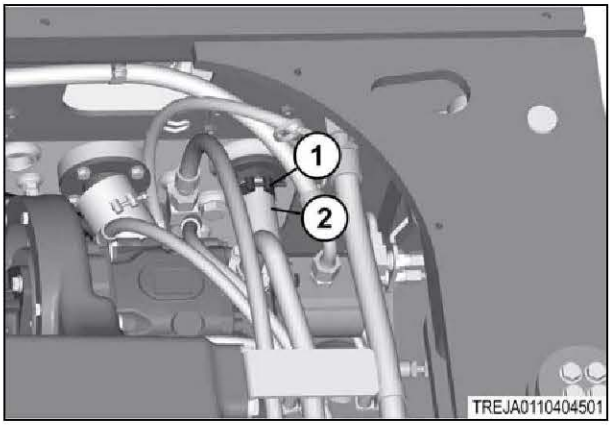

Fig. 257

3. If the machine is equipped with a transmission guard, support the transmission guard with correct lifting equipment.

   IMPORTANT:
   The weight of the transmission guard is approximately 57 kg (125 lb).

4. Install the transmission guard so the large holes are over the hardware (2).

5. Slide the transmission guard (1) onto the hardware (2).

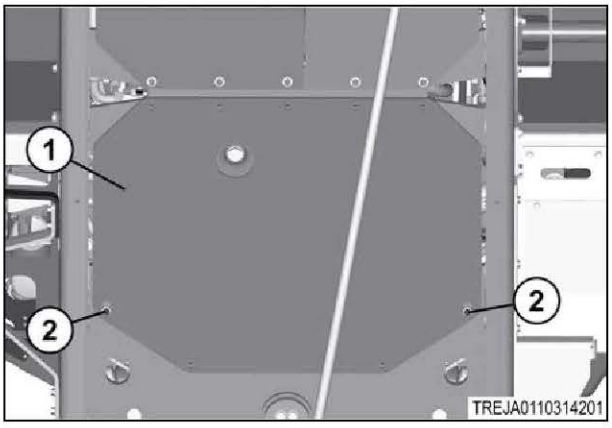

Fig. 258

6. Install the transmission guard (1) with the hardware (2, 3).

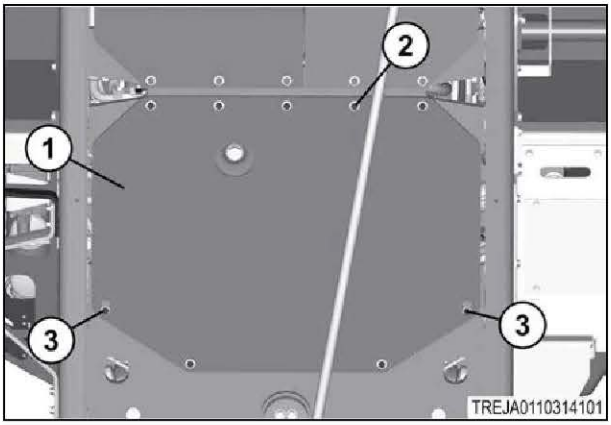

Fig. 259

7. Install the cover plate (2) with the hardware (1).

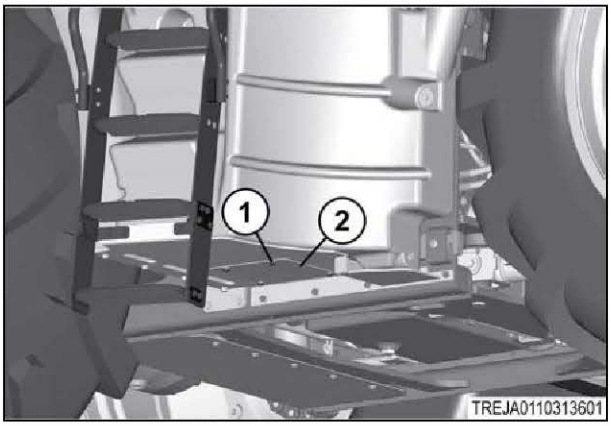

Fig. 260

8. Install the two drain plugs (1) in the bottom of the hydraulic oil reservoir (2).

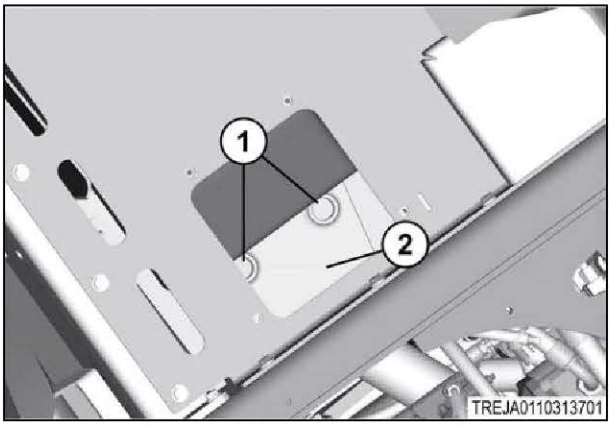

Fig. 261

9. Fill the hydraulic oil reservoir with hydraulic oil.

10. Install the battery disconnect switch key (1).

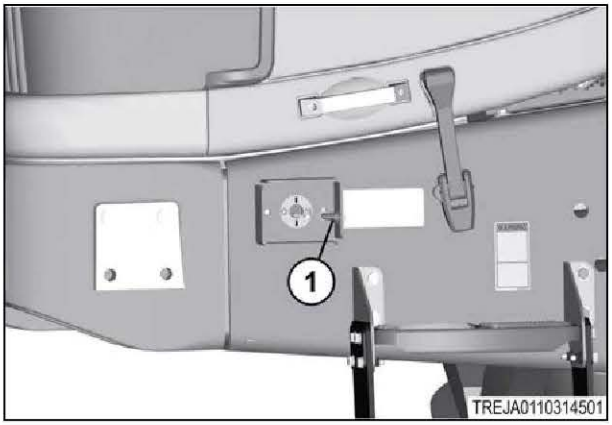

Fig. 262

11. Turn the battery disconnect switch key (1) clockwise to connect the battery power.

NOTE:
The battery disconnect switch is shown in the on position.

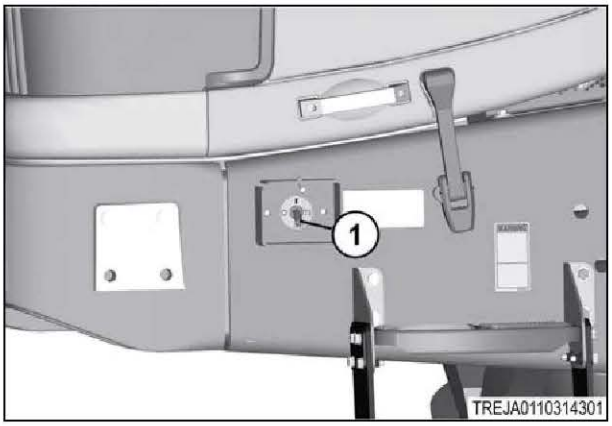

Fig. 263

Related Links

Lubricant viscosities page 1-18

5.6.3 Remove the suction screen (implement pump)

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

IMPORTANT:
Before removal, fasten identification tags on the components for correct installation at assembly. Put caps and plugs on all hoses, fittings, and ports to prevent contamination from entering the system.

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the parking brake, and take the key with you.

2. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

   NOTE:
   The battery disconnect switch is shown in the off position.

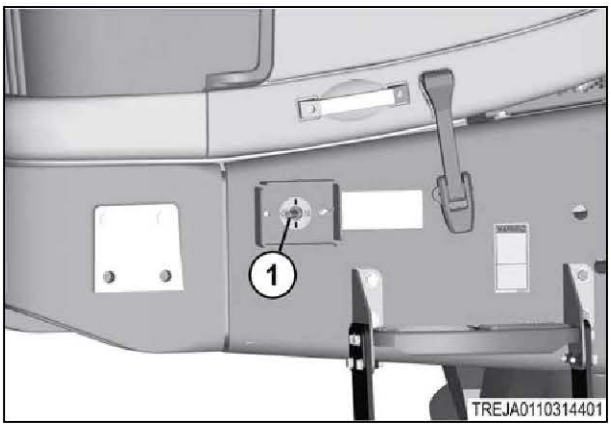

Fig. 264

3. Remove the battery disconnect switch key (1).

4. Relieve all pressure from the hydraulic system.

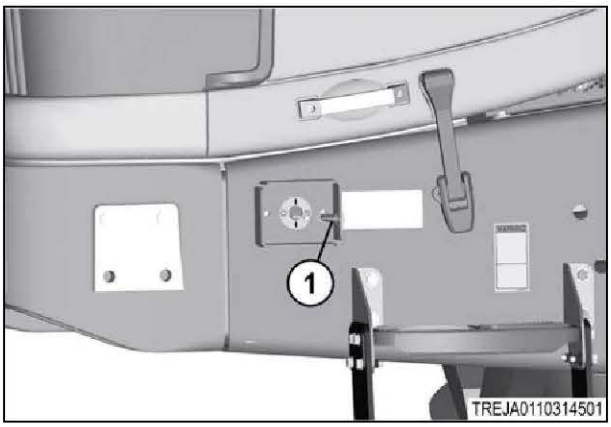

Fig. 265

5. Remove the hardware (1), and the cover plate (2).

6. Set a correct container below the drain plugs on the hydraulic reservoir.

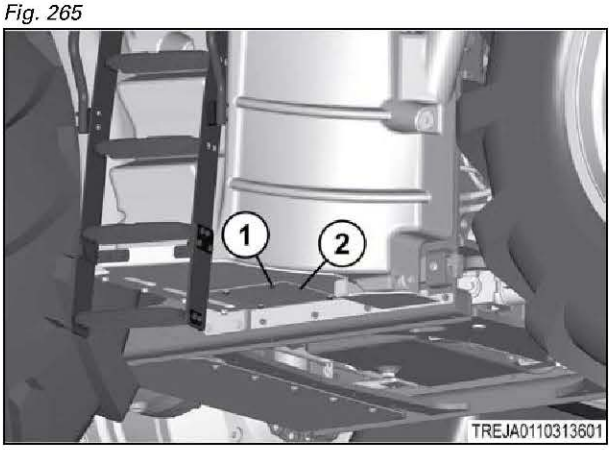

Fig. 266

7. Remove the two drain plugs (1) from the bottom of the hydraulic oil reservoir (2).

8. Drain the hydraulic oil.

9. Install the drain plugs when the hydraulic reservoir is empty.

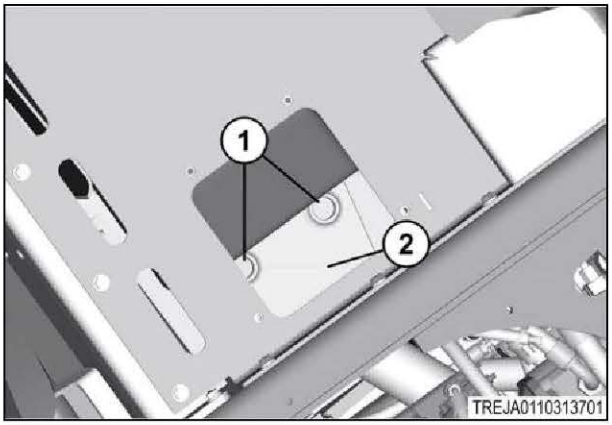

Fig. 267

10. If the machine is equipped with a transmission guard (1) support the transmission guard with correct lifting equipment.

    IMPORTANT:
    The weight of the transmission guard is approximately 57 kg (125 lb).

11. Remove the hardware (2).

12. Loosen the hardware (3).

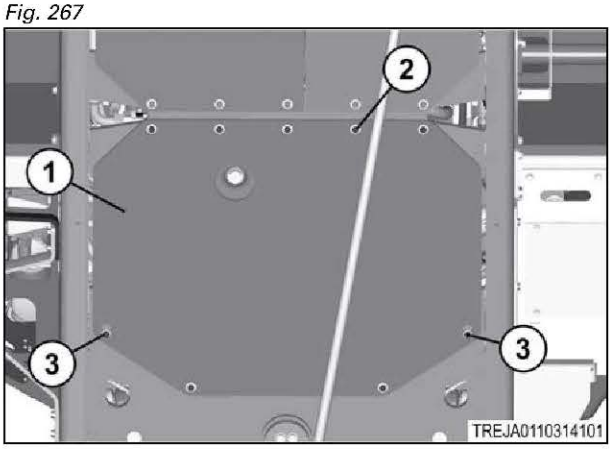

Fig. 268

13. Let the transmission guard (1) rest on the hardware (2).

14. Slide the transmission guard so the large holes are over the hardware (2) and remove the transmission guard.

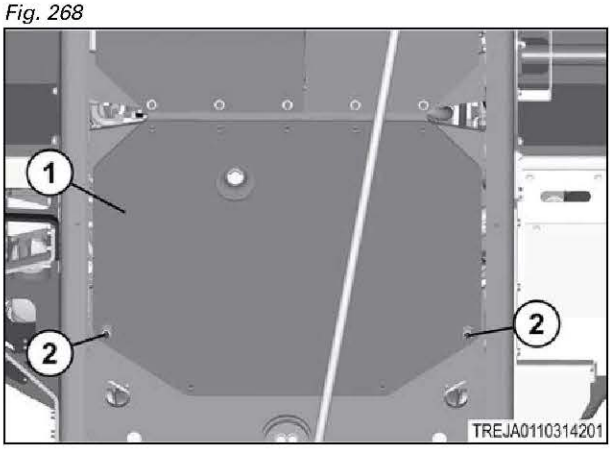

Fig. 269

15. Loosen the hose clamp (1) and disconnect the hose (2).

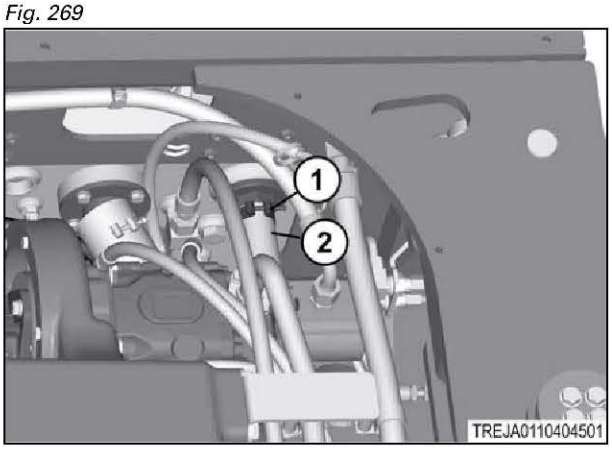

Fig. 270

16. Remove the fitting (1) and the oil suction screen (2).

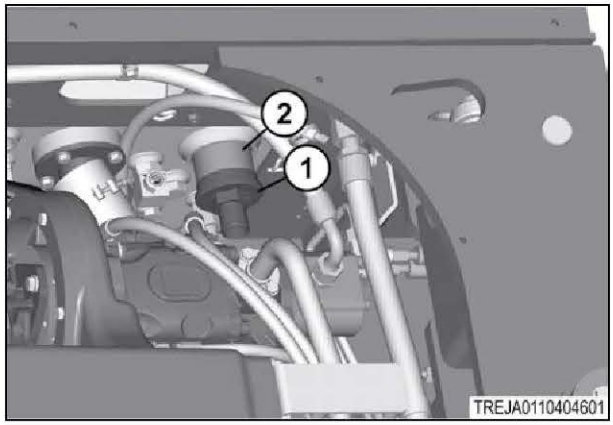

Fig. 271

5.6.4 Install the suction screen (implement pump)

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Install the oil suction screen (2) with the fitting (1).

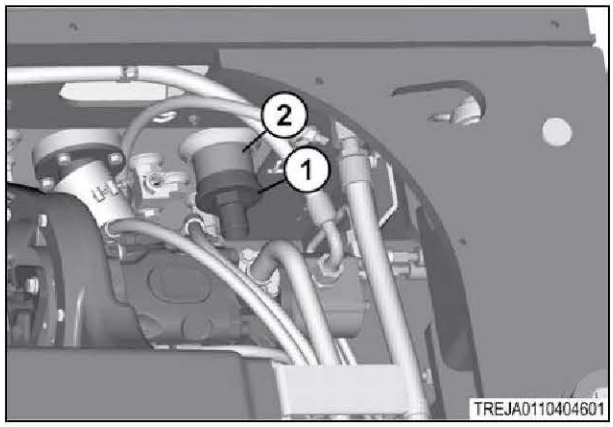

Fig. 272

2. Connect the hose (2) with the hose clamp (1).

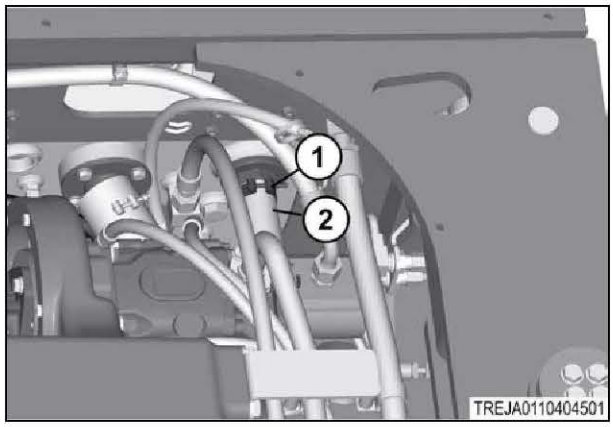

Fig. 273

3. If the machine is equipped with a transmission guard, support the transmission guard (1) with correct lifting equipment.

   IMPORTANT:
   The weight of the transmission guard is approximately 57 kg (125 lb).

4. Install the transmission guard so the large holes are over the hardware (2).

5. Slide the transmission guard (1) onto the hardware (2).

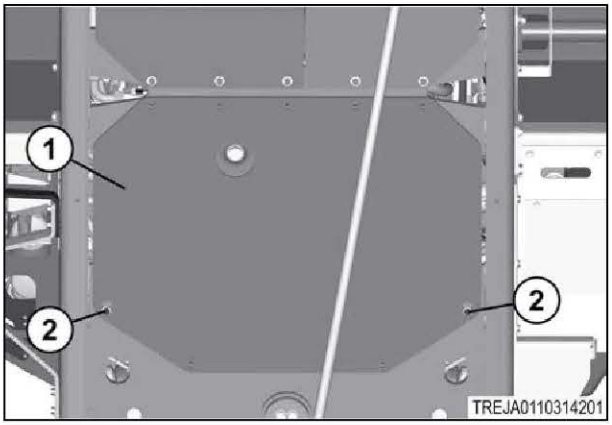

Fig. 274

6. Install the transmission guard (1) with the hardware (2, 3).

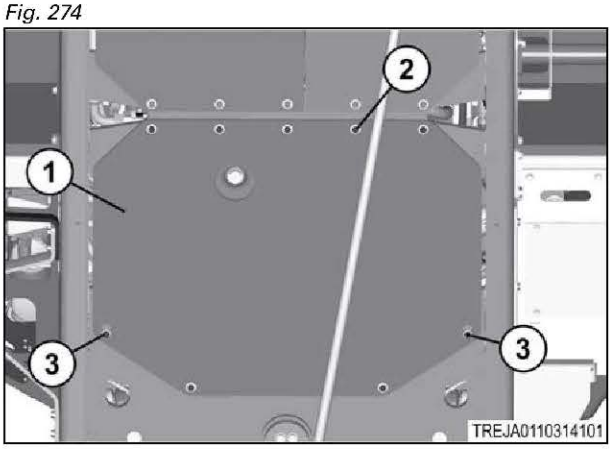

Fig. 275

7. Install the cover plate (2) with the hardware (1).

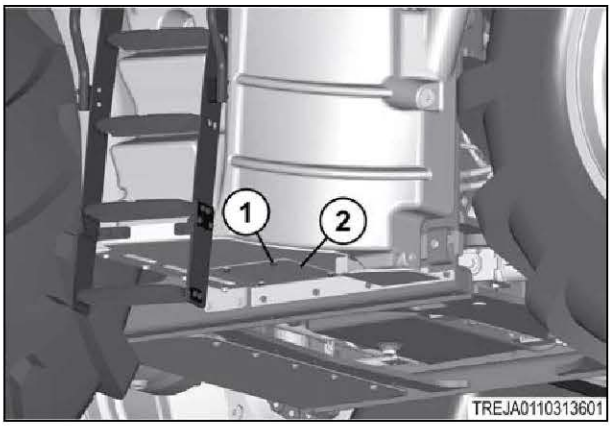

Fig. 276

8. Install the two drain plugs (1) in the bottom of the hydraulic oil reservoir (2).

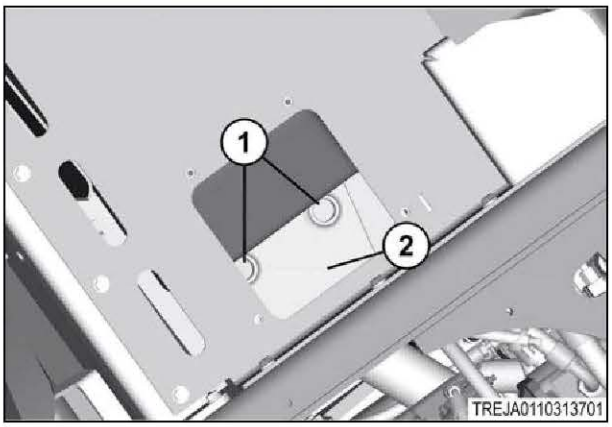

Fig. 277

9. Fill the hydraulic oil reservoir with hydraulic oil.

10. Install the battery disconnect switch key (1).

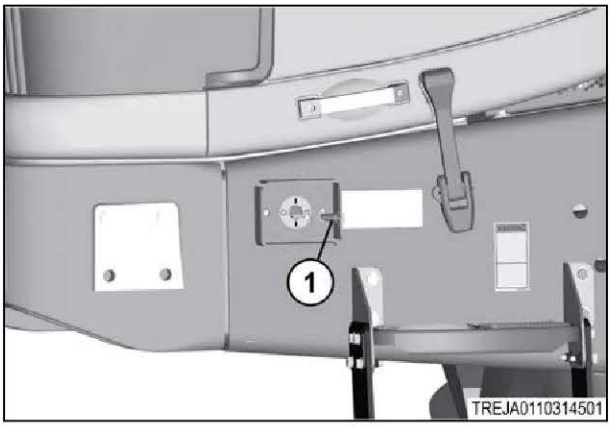

Fig. 278

11. Turn the battery disconnect switch key (1) clockwise to connect the battery power.

    NOTE:
    The battery disconnect switch is shown in the on position.

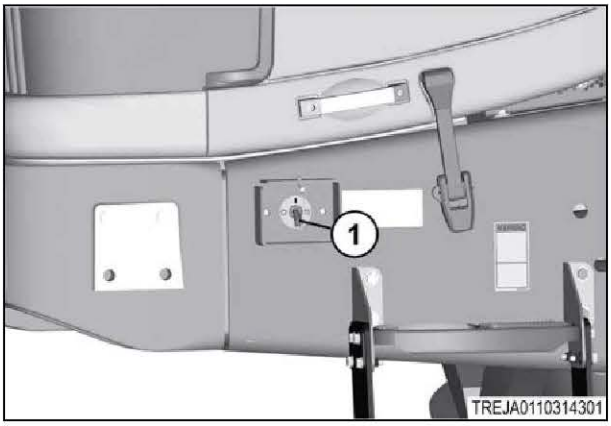

Fig. 279

Related Links

Lubricant viscosities page 1-18

5.6.5 Replace the hydraulic oil filters

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

IMPORTANT:
Contain all fluids during the performance of inspection, maintenance, doing tests, adjusting, and repair of the machine. Prepare to contain fluids with the correct containers before opening any compartment or disassembling any component containing fluids. Discard fluids according to the local regulations and the laws.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Park the machine on a solid, level surface. Stop the engine, apply the parking brake, and take the key with you.

2. Turn the battery disconnect switch key (1) counterclockwise to disconnect the battery power.

   NOTE:
   The battery disconnect switch is shown in the off position.

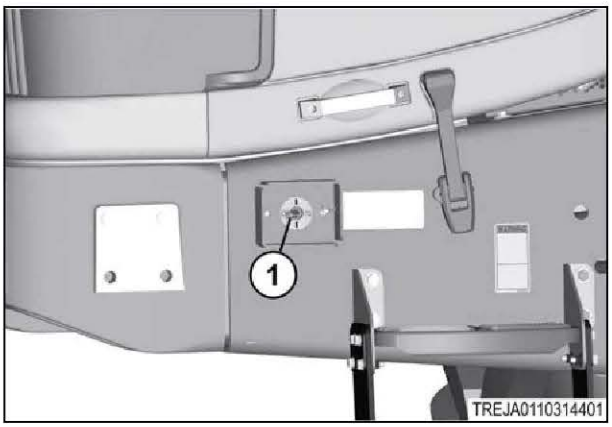

Fig. 280

3. Remove the battery disconnect switch key (1).

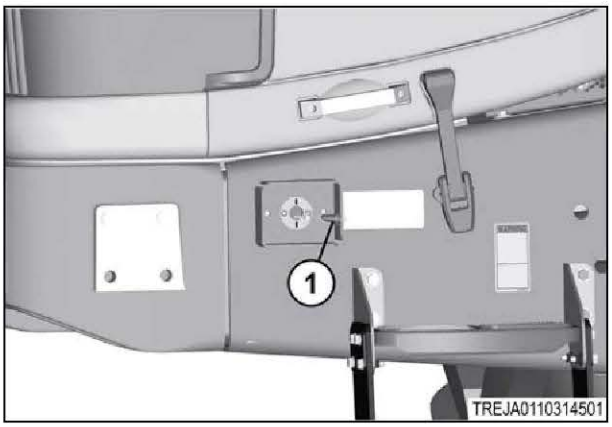

Fig. 281

4. Disconnect the latches (1) and lift the cabinet doors (2) to remove.

5. Put a correct drain pan under the hydraulic oil filters.

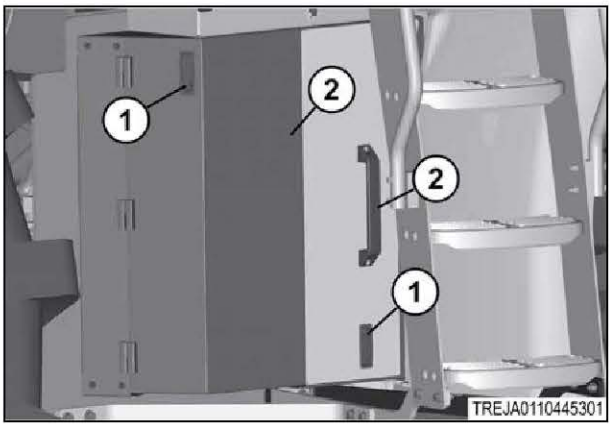

Fig. 282

6. Turn the hydraulic oil filters (1) counterclockwise to remove.

7. Inspect the groove in the filter head to make sure the groove is clear of a gasket.

8. Lightly lubricate the gasket on top of the hydraulic oil filter.

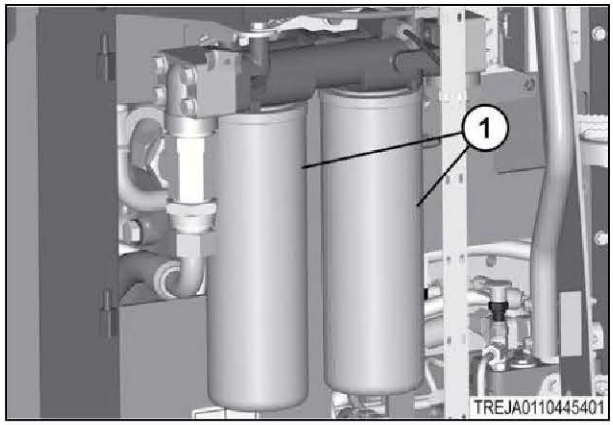

Fig. 283

9. Turn the new hydraulic oil filters (1) clockwise to install.

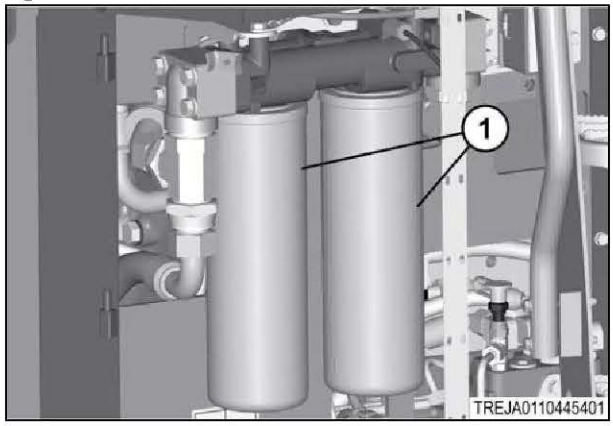

Fig. 284

10. Install the cabinet doors (2). Close the cabinet doors and connect the latches (1).

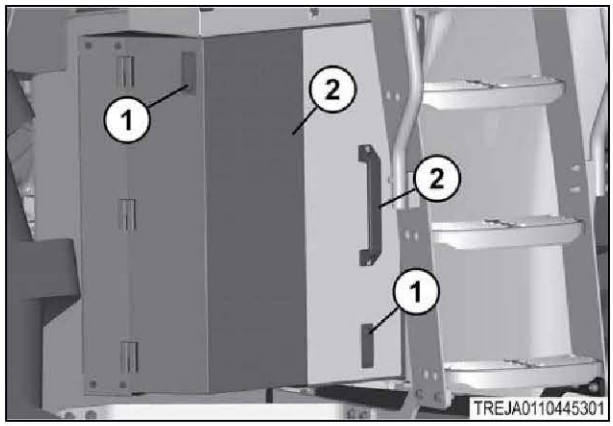

Fig. 285

5.6.6 Replace the hydraulic oil reservoir breather

WARNING: Hot components can burn.

Severe personal injury can result.

Let the engine and components cool before doing maintenance.

WARNING: Hydraulic fluid under pressure can penetrate the skin or eyes.

Serious personal injury, blindness, or death can occur.

Relieve the pressure from the system or component before disconnecting components. Wear personal protective gear while working on the machine or equipment. Use a piece of cardboard to check for leaks. Never use your hand.

IMPORTANT:
Completely clean all components to prevent contamination from entering the system. Contamination can damage the precision components. Perform disassembly procedures on a clean work surface. Put a clean cloth on top of the components.

Procedure

1. Turn the breather (1) counterclockwise to remove.

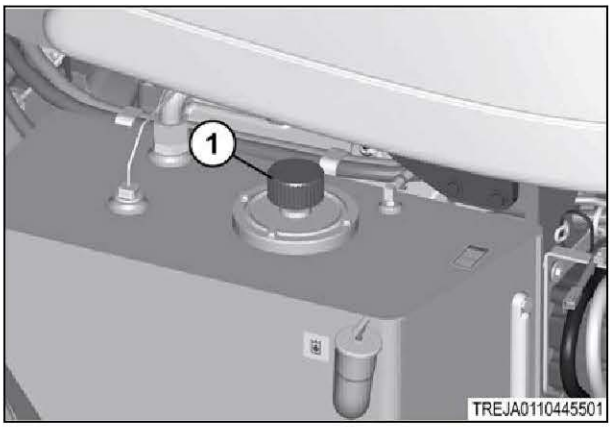

Fig. 286

2. Turn the breather (1) clockwise to install.

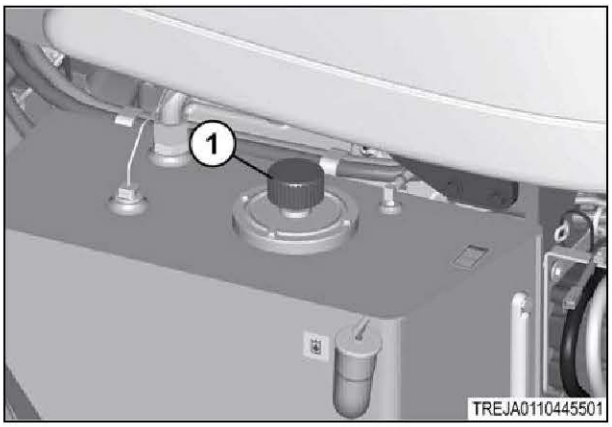

Fig. 287