

## 8 Compressed air system

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## 8.1 Air system operation

The air system on the machine is optional.

The air compressor is mounted to the right-hand side of the engine. The compressor is water-cooled and oil lubricated. Air is drawn into the compressor from the engine air intake and pushed to the air dryer.

Air flows to the air dryer mounted to the right-hand frame rail. The air dryer is connected to the main air reservoir and the regeneration reservoir. An air coupler is connected to the end of the main air reservoir. The air coupler is mounted to the front of the right-hand frame rail for the use of air tools.

### 8.1.1 Air system components

- 1 Air compressor
- 2 Air coupler
- 3 Air dryer
- 4 Main air reservoir
- 5 Air pressure sensor
- 6 Air regeneration reservoir

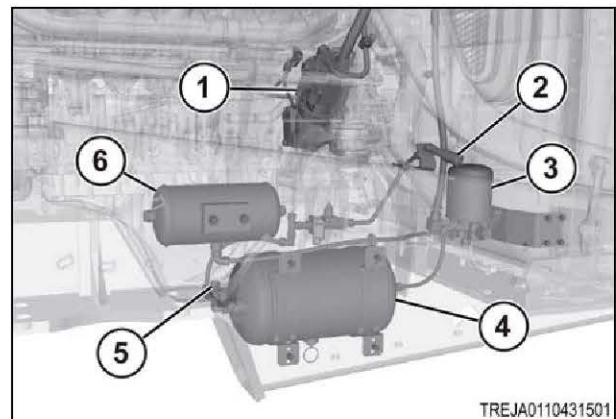


Fig. 1

## 8.2 Air system components

### 8.2.1 Remove the air compressor

#### Before starting the procedure



**WARNING: Pressurized gases or fluids can be hazards.**

**Personal injury can result.**

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



**WARNING: Hot components can burn.**

**Severe personal injury can result.**

**Let the engine and components cool before doing maintenance.**

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

#### Procedure

1. Park the machine on a solid, level surface.
2. Apply the parking brake, stop the engine, and take the key with you.
3. Turn off the battery disconnect switch key.
4. Remove the battery disconnect switch key.
5. Release the side latches and open the engine cover all the way.



**CAUTION:**

**Safely prop open the engine cover. Closing engine cover creates a pinch point that can cause serious bodily injury.**

6. Remove the hardware (1) and the cover plate (2).
7. Install a hose to the radiator drain valve (3) and put through the access hole.
8. Set a correct container under the hose.
9. Loosen the radiator drain valve (3) and drain the engine coolant.

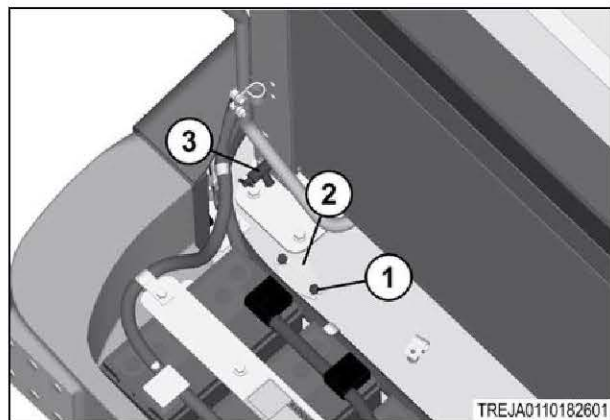


Fig. 2

10. Remove the hardware (1, 3) and the right fan guard (2).

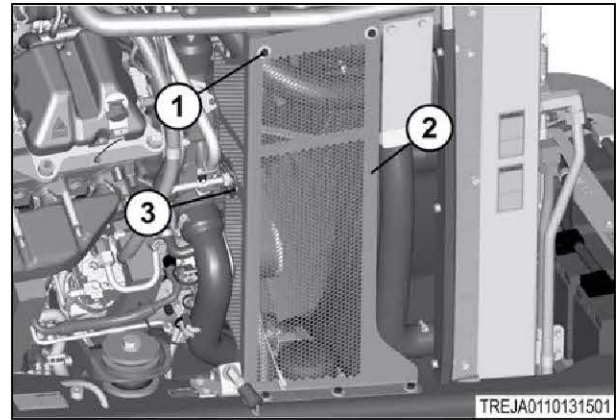


Fig. 3

11. Pull the drain valve loop (1) to release the air pressure from the reservoir.

**IMPORTANT:** Remove all compressed air from the system before disconnecting any air tubes.

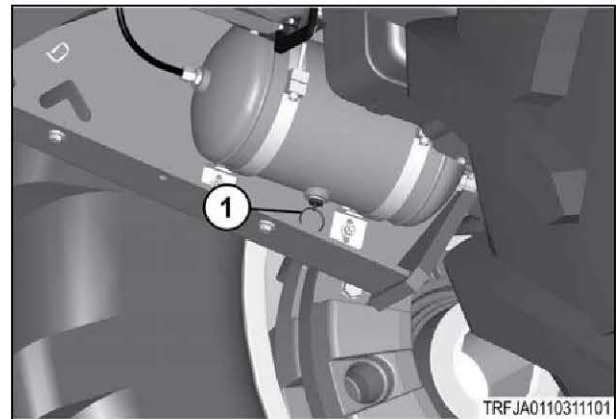


Fig. 4

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

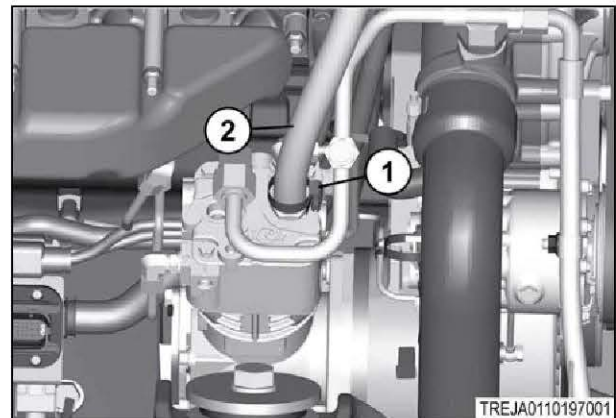


Fig. 5

13. Disconnect the discharge line (1).

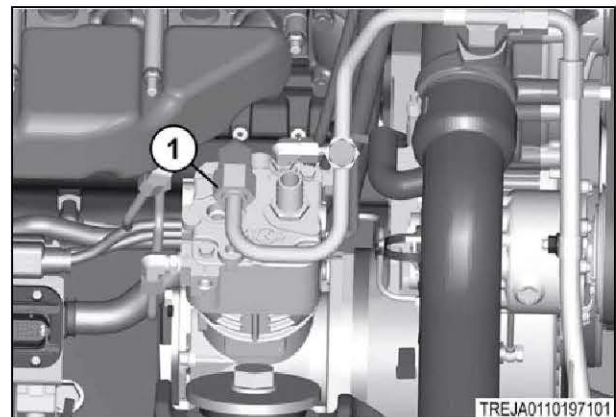


Fig. 6

- 14. Disconnect both coolant lines (1).

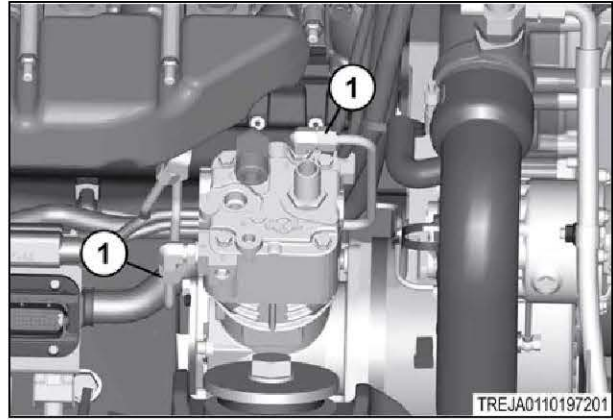


Fig. 7

- 15. Remove the hollow bolt (3) from the tube (4).
- 16. Remove the bolts (1) and pull the air compressor (2) out to remove.
- 17. Remove the O-rings (5).

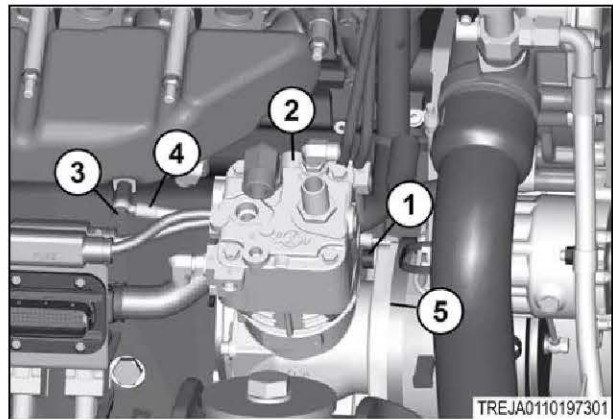


Fig. 8

- 18. Remove the tube (1), the coolant fittings (2), the discharge fitting (3), and the intake fitting (4).

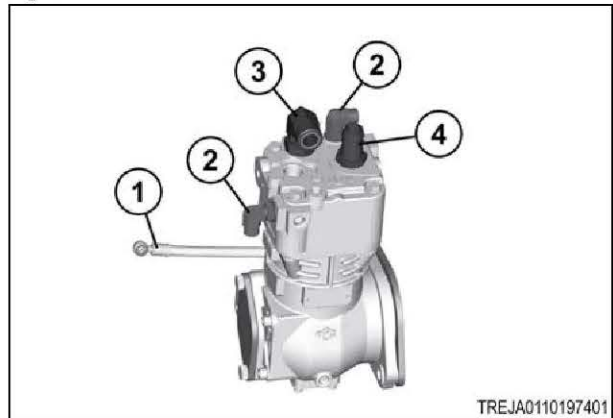


Fig. 9

## 8.2.2 Install the air compressor

### Procedure

1. Install the tube (1), the coolant fittings (2), the discharge fitting (3), and the intake fitting (4).
  
2. Install new O-rings (5) to both sides of the flange.
  
3. Use the hardware (1) to install the air compressor (2).
  
4. Use the hollow bolt (3) to install the tube (4).
  
5. Connect the coolant lines (1).

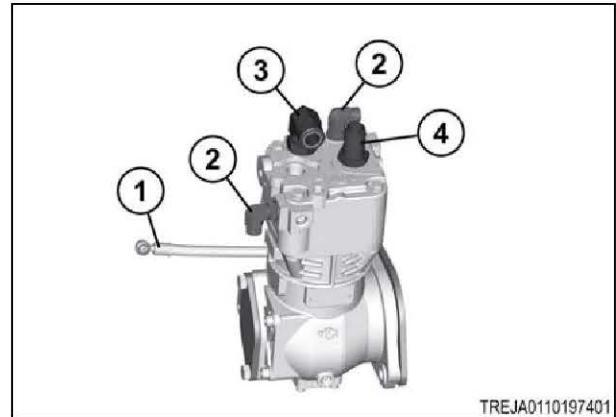


Fig. 10

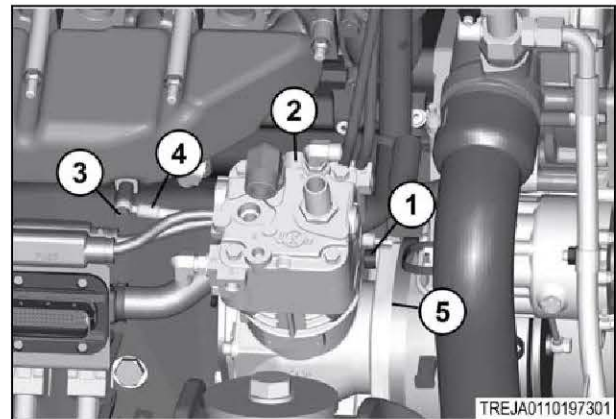


Fig. 11

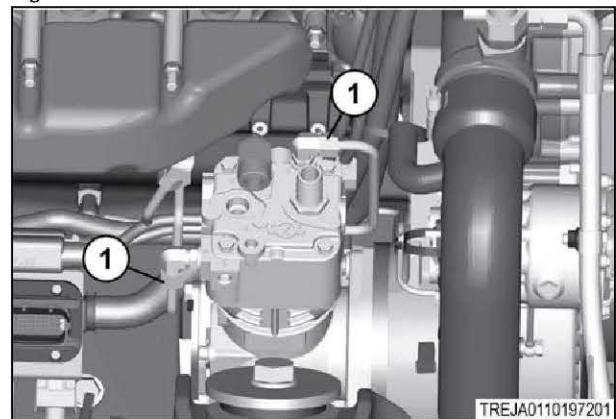


Fig. 12

6. Connect the discharge line (1).

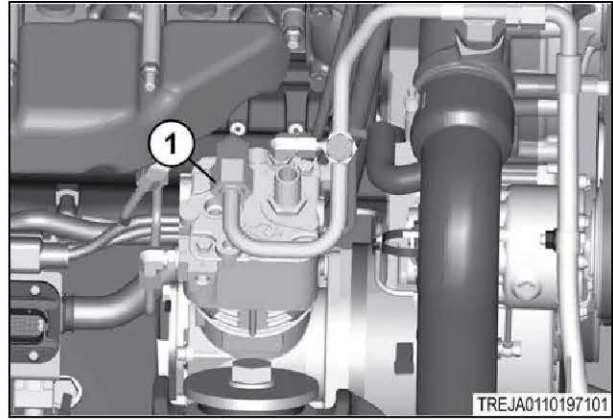


Fig. 13

7. Use the clamp (1) to connect the hose (2).

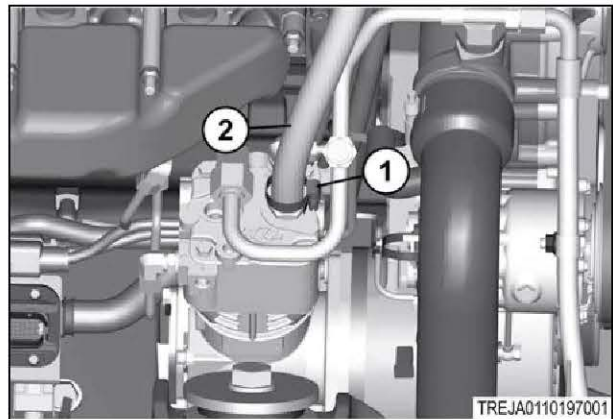


Fig. 14

8. Use the hardware (1, 3) to install the right fan guard (2).

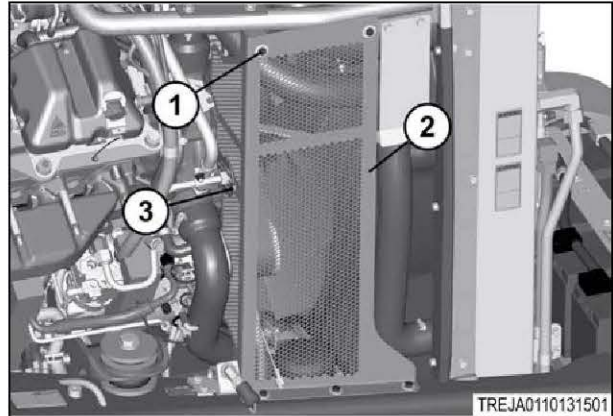


Fig. 15

9. Remove the drain hose and close the radiator drain valve (3).
10. Use the hardware (1) to install the cover plate (2).
11. Fill the radiator with the correct engine coolant.

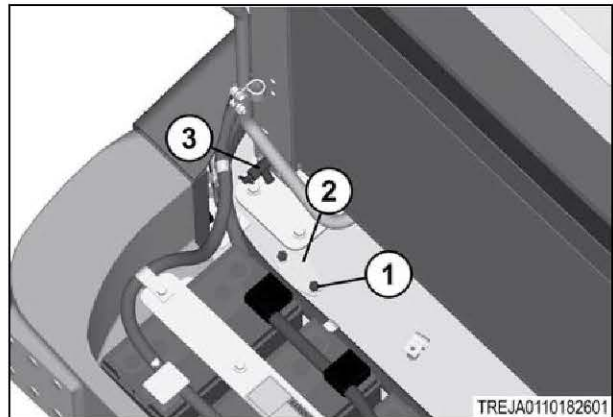


Fig. 16

12. Close the engine cover (2) all the way and connect both side latches (1).

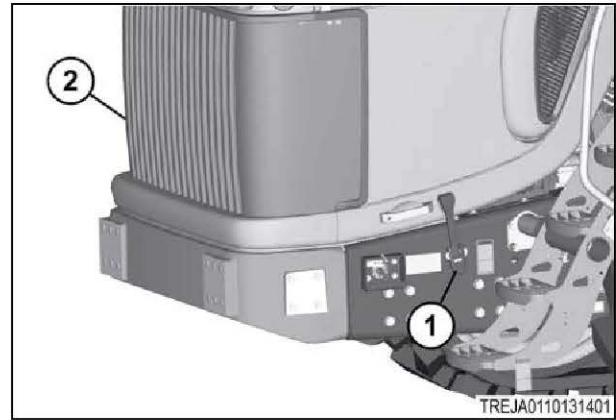


Fig. 17

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

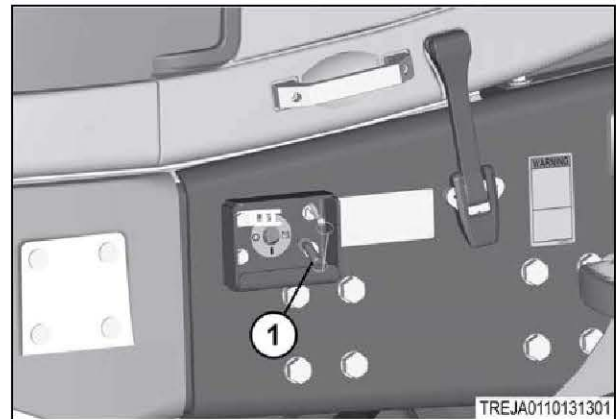


Fig. 18

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.

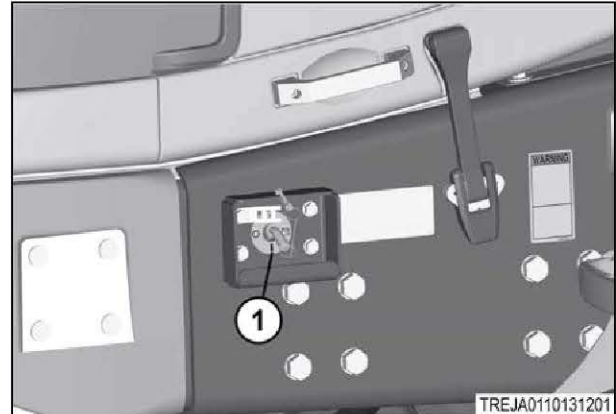


Fig. 19

### Related Links

[Lubricant viscosities](#) page 1-18

[Fill capacities](#) page 1-18

[Refill the cooling system](#) page 2-149

## 8.2.3 Remove the air dryer

### Before starting the procedure

#### NOTE:

Put identification marks on all hoses, hose assemblies, wires, and on all line assemblies for installation purposes. Close all engine openings such as a turbo charger, intake manifold ports, and coolant ports. This can prevent fluid loss and will prevent contaminants from entering the system.

**NOTE:**

Clean components are important. Before starting a disassembly procedure, completely clean all components. Contaminants can damage precision components. Do the assembly procedures on a clean work surface. Keep the components covered and protected always.

**Procedure**

1. Park the machine on a solid, level surface.
2. Move the transmission control lever into the neutral position and engage the park brake.
3. Turn the key start switch to the off position and take the key with you.



**WARNING: Hot components can burn.**

**Severe personal injury can result.**

**Let the engine and components cool before doing maintenance.**

4. Pull the loop on the drain valve to release the air pressure from the air system.
5. Remove the desiccant cartridge (1).

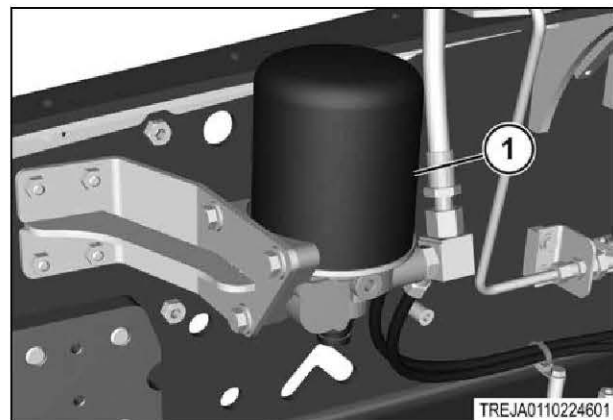


Fig. 20

6. Disconnect the air line (1). Disconnect the line to the regeneration reservoir (2). Disconnect the line to the main air reservoir (3).
7. Loosen the three bolts that hold the air dryer base to the frame.
8. Remove the air dryer.

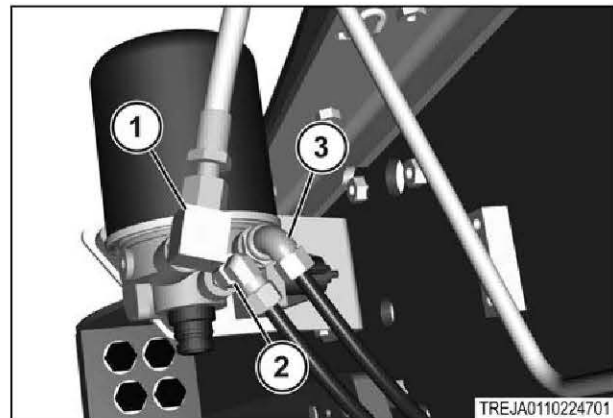


Fig. 21

## 8.2.4 Install the air dryer

### Before starting the procedure

#### 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.

#### NOTE:

Clean components are important. Before starting an assembly procedure, completely clean all components. Contaminants can damage precision components. Do the assembly procedures on a clean work surface. Keep the components covered and protected always.

### Procedure

1. Mount the air dryer base to the frame with the three bolts.
2. Connect the air inlet line (1). Connect the line to the regeneration reservoir (2). Connect the line to the main air reservoir (3).

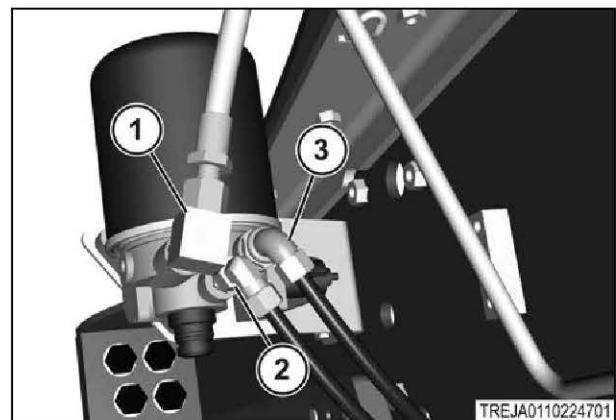


Fig. 22

3. Install the desiccant cartridge (1).
4. Make sure the air drain valve is seated.
5. Start the machine and check for leaks.

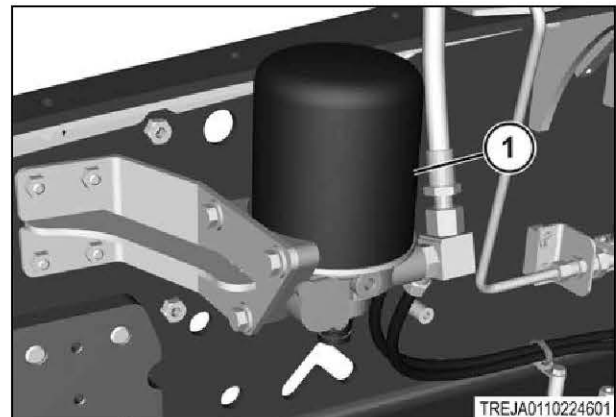


Fig. 23

## 8.2.5 Remove the main air reservoir

### Procedure

1. Remove the front deflector guard (1).

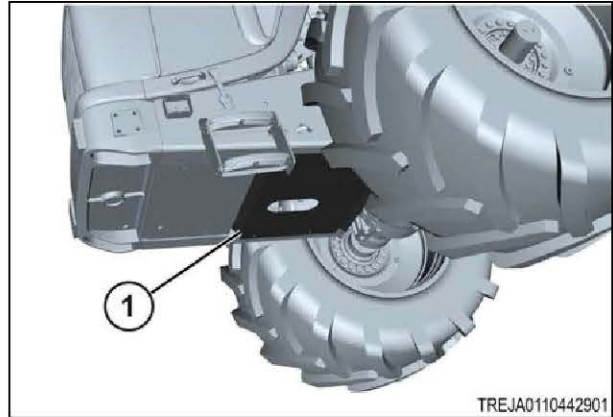


Fig. 24

2. Remove the nut (1) and the airline tubing (2).

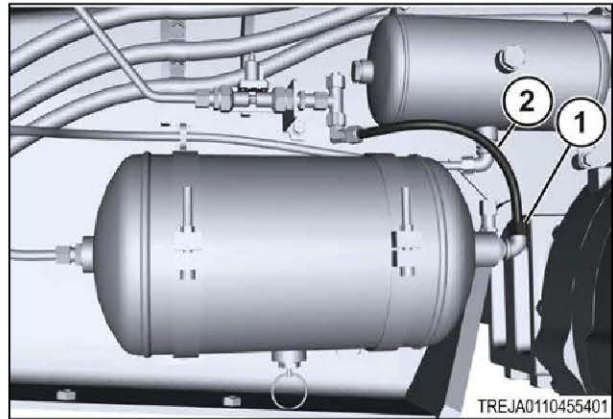


Fig. 25

3. Remove the nut (1) and the airline tubing (2).

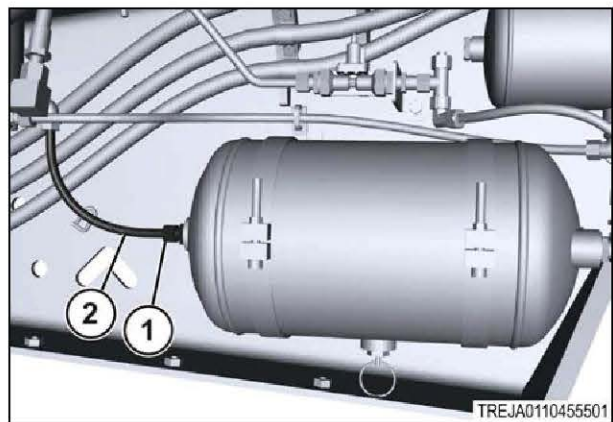


Fig. 26

4. Remove the bolts (1) and the nuts (2) from bracket (3).

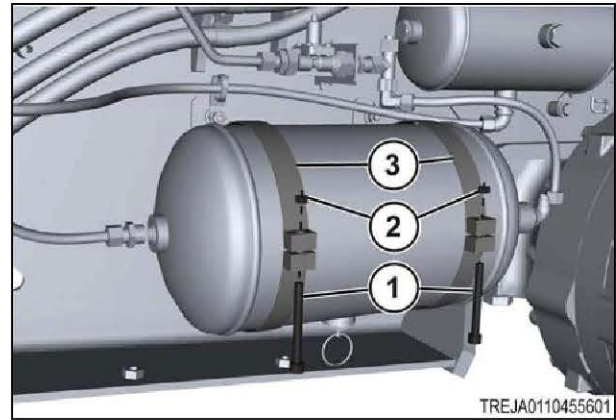


Fig. 27

### 8.2.6 Install the main air reservoir

#### Procedure

1. Put the main air reservoir into the brackets (3).
2. Install the bolts (1) and the nuts (2) to the brackets.
3. Install the airline tubing (2) and tighten the nut (1).

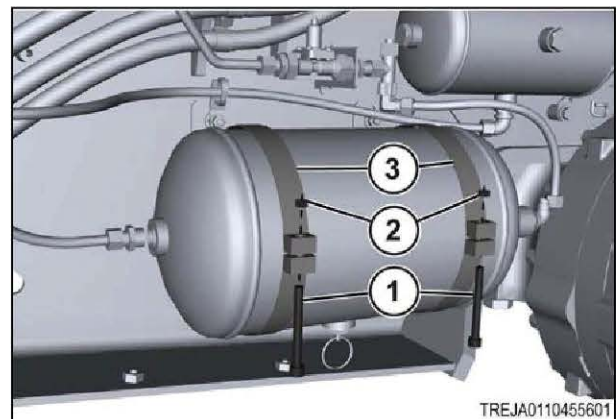


Fig. 28

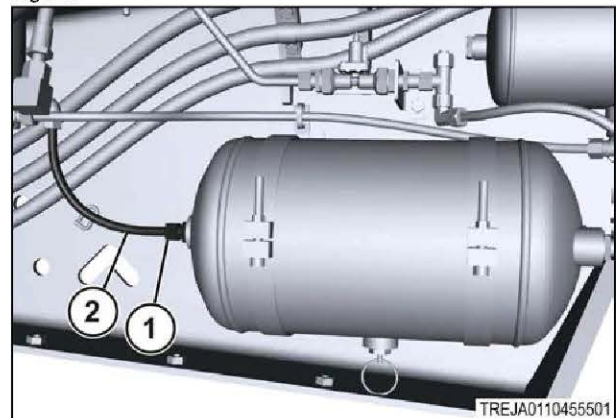


Fig. 29

4. Install the airline tubing (2) and tighten the nut (1).

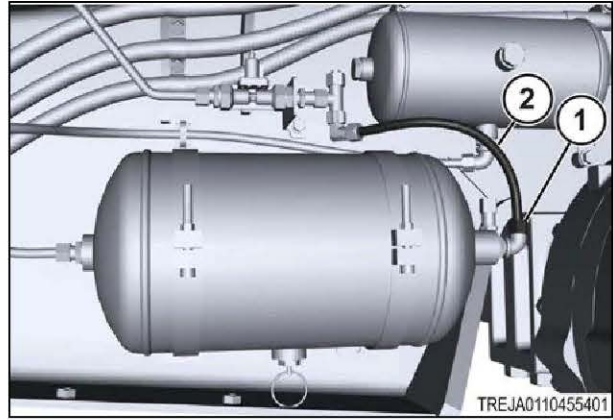


Fig. 30

### 8.2.7 Remove the air coupler

#### Procedure

1. Disconnect the tube (1).

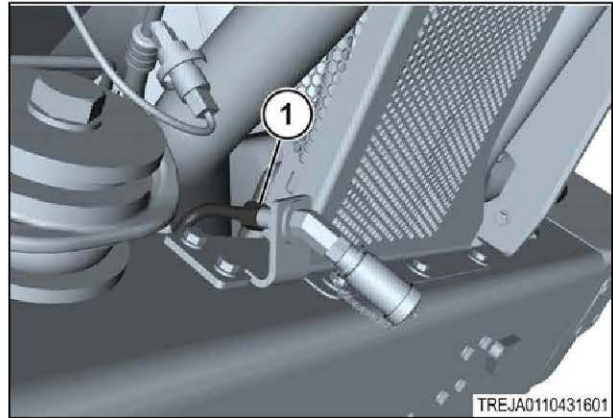


Fig. 31

2. Loosen the nut (1).

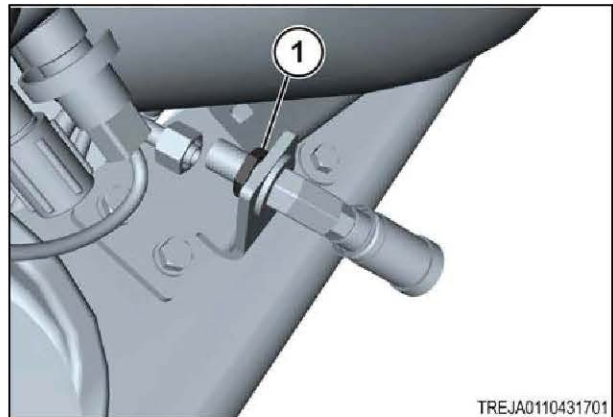


Fig. 32

3. Remove the nut (1), the washer (2), and the air coupler assembly (3).

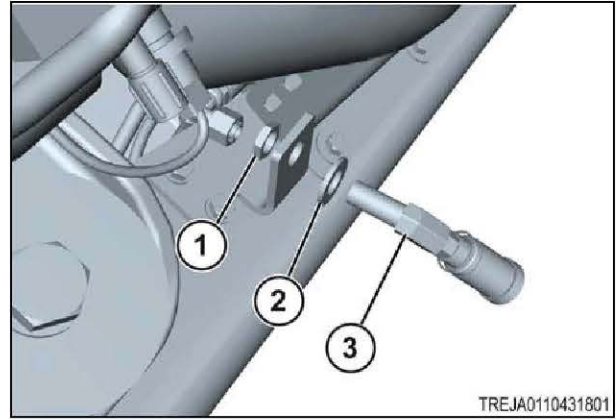


Fig. 33

4. Remove the adapter (1) from the air coupler (2).

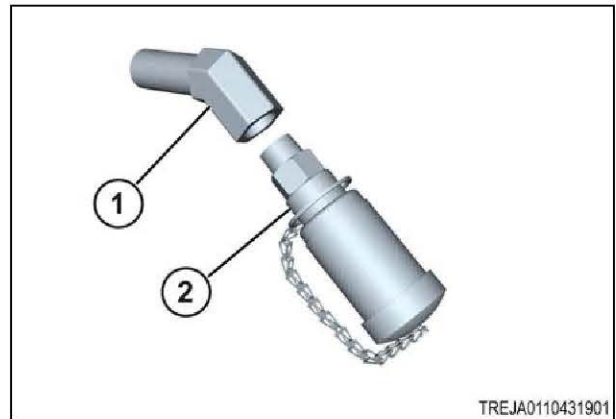


Fig. 34

### 8.2.8 Install the air coupler

#### Procedure

1. Put the adapter (1) on the air coupler (2).

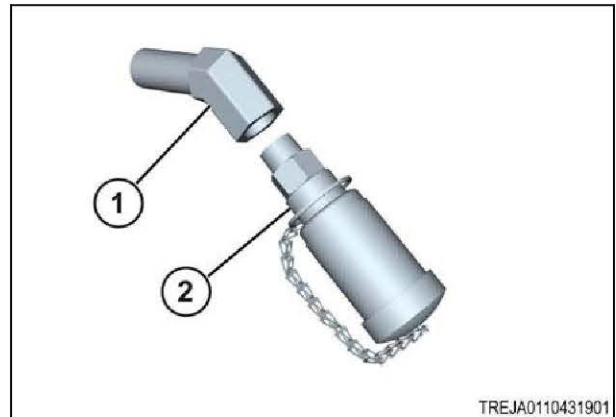


Fig. 35

- Put the washer (2) on the air coupler assembly (3).

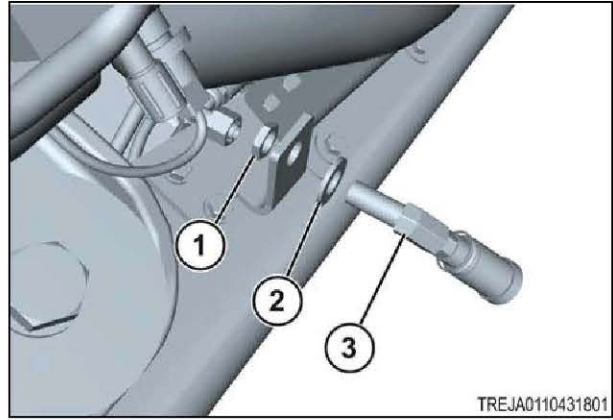


Fig. 36

- Install the air coupler assembly to the bracket and fasten the air coupler assembly with the nut (1).

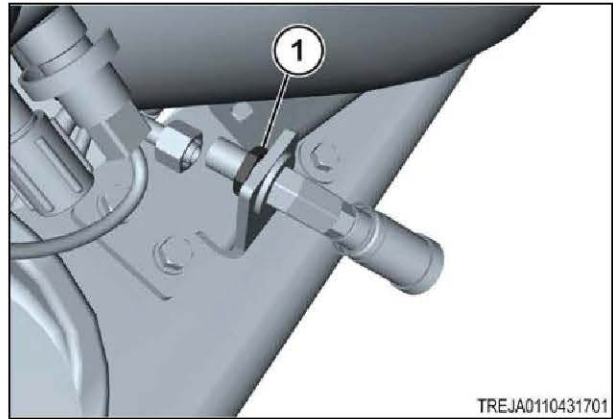


Fig. 37

- Connect the tube (1) to the adapter.

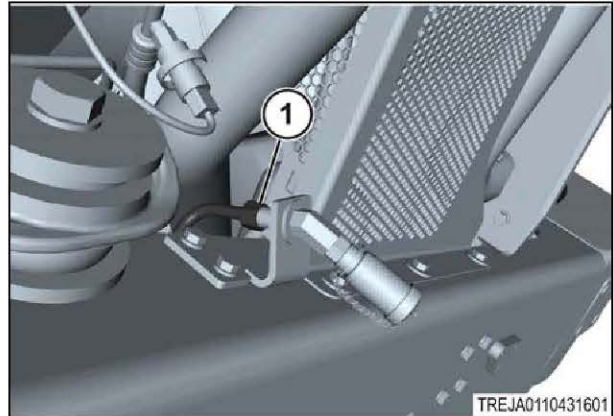


Fig. 38

## 8.2.9 Remove the regeneration reservoir

### Procedure

1. Remove the front deflector guard (1).

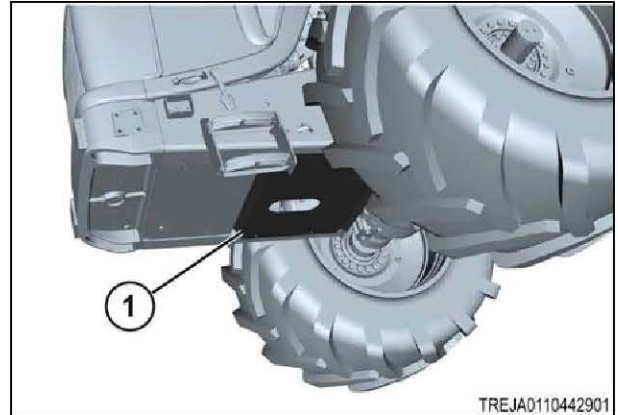


Fig. 39

2. Loosen the nut (2) and remove the airline tubing (1).

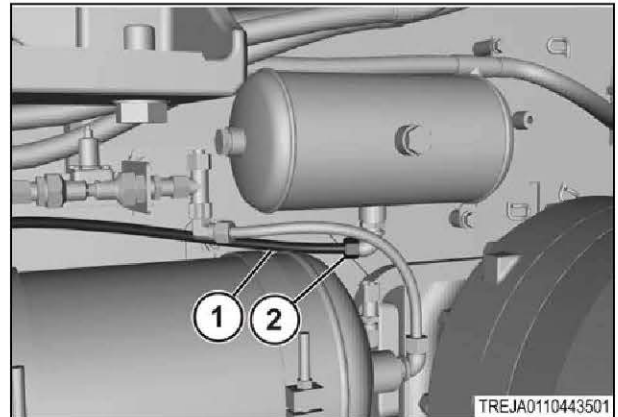


Fig. 40

3. Remove the fitting (1).

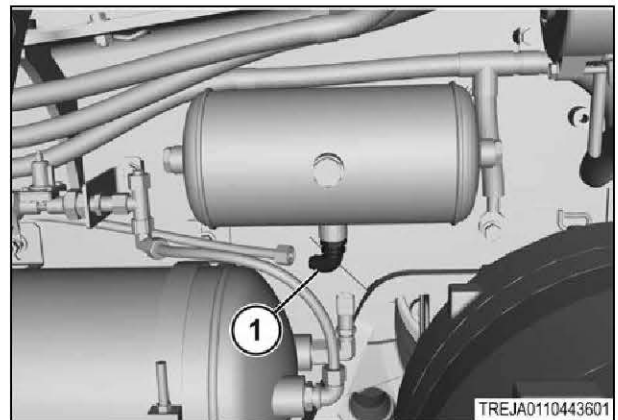


Fig. 41

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4. Remove the bolts and washers (1) from the right-hand frame rail and remove the regeneration reservoir.

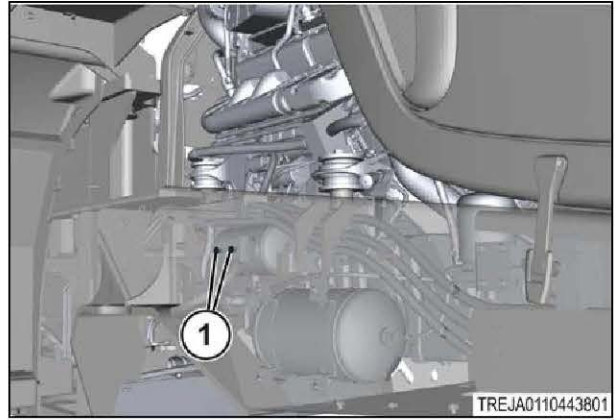


Fig. 42

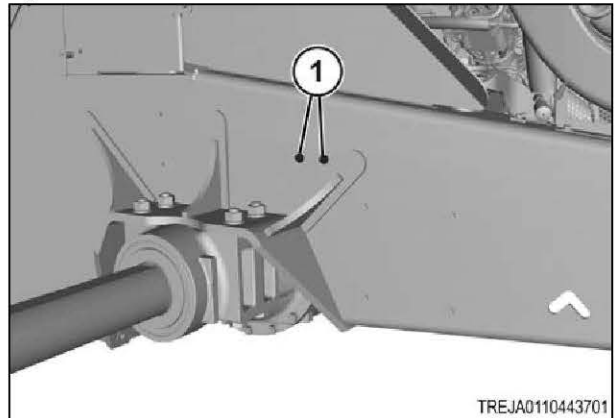


Fig. 43

### 8.2.10 Install the regeneration reservoir

**Procedure**

1. Install the bolts and washers (2) to fasten the regeneration reservoir to the right-hand frame rail.

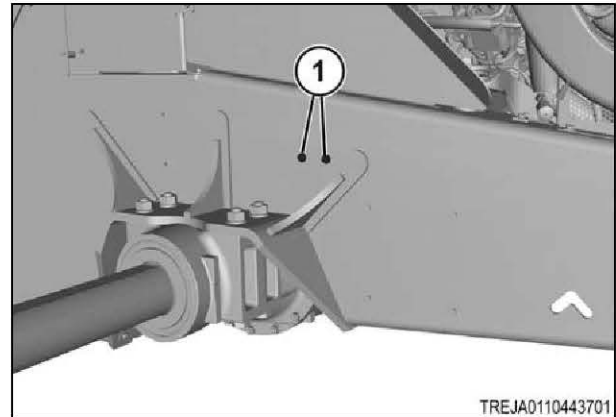


Fig. 44

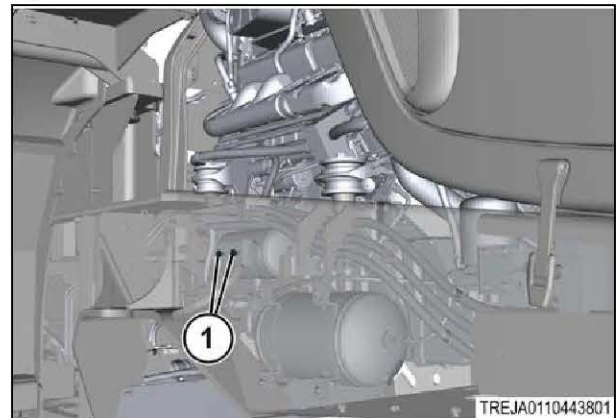


Fig. 45

2. Install the fitting (1) to the bottom of the regeneration reservoir.

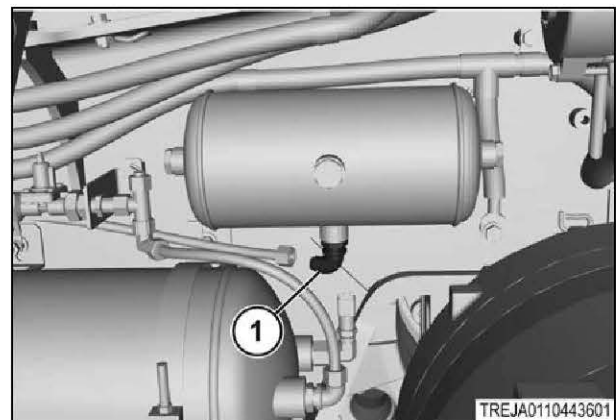


Fig. 46

3. Install the airline tubing (1) and tighten the nut (2).

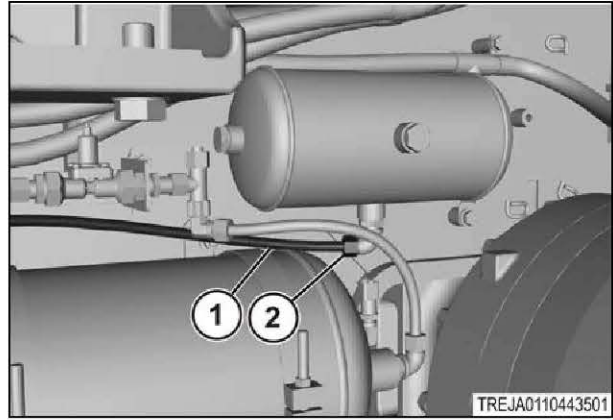


Fig. 47

### 8.2.11 Remove the charging valve

#### Procedure

1. Remove the front deflector guard (1).

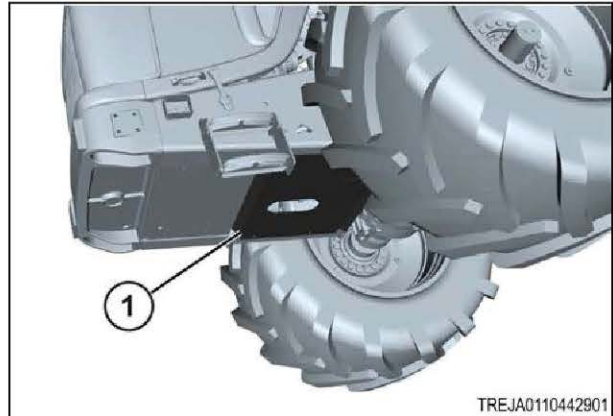


Fig. 48

2. Disconnect the tube (1) from the adapter connector.

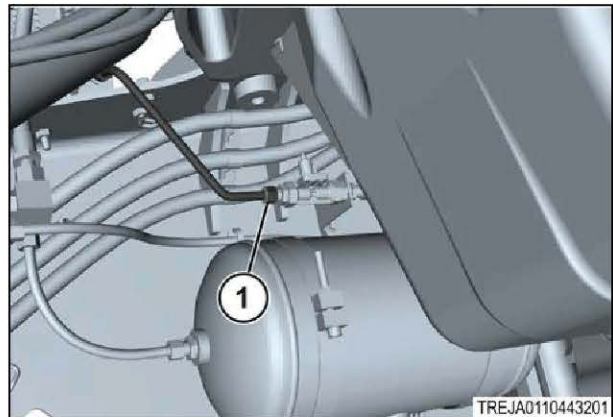


Fig. 49

3. Remove the adapter (1) connector from the charging valve.

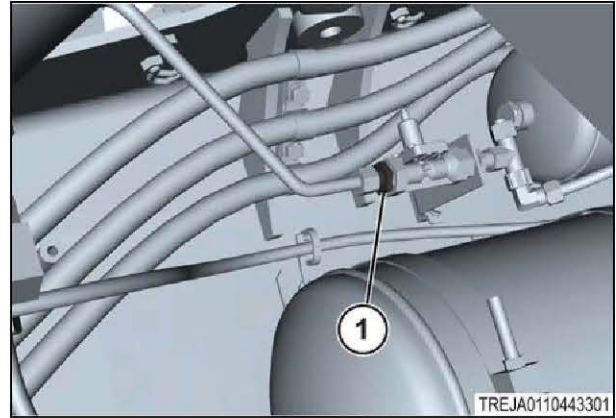


Fig. 50

4. Remove the charging valve (1) from the adapter connector (2) on the bracket.

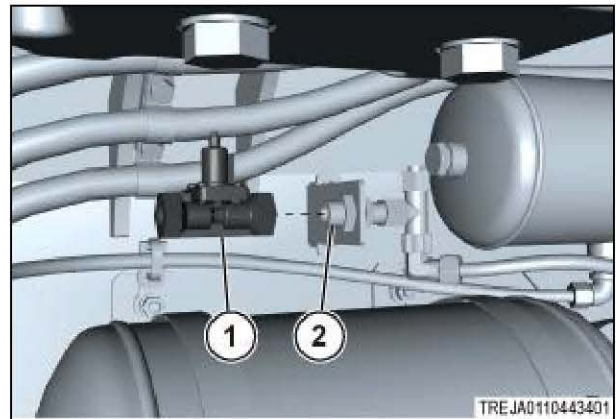


Fig. 51

### 8.2.12 Install the charging valve

#### Procedure

1. Install the charging valve (1) to the adapter connector (2) on the bracket.

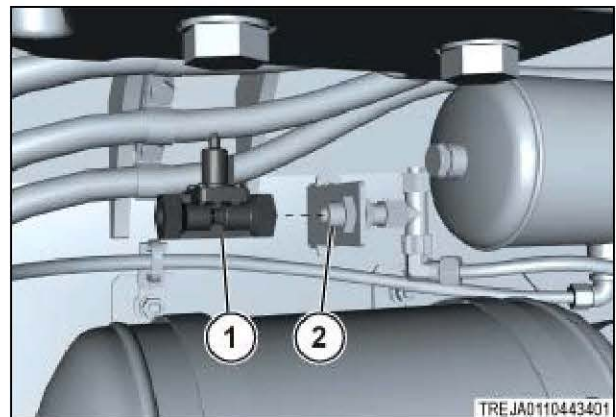


Fig. 52

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2. Install the adapter connector (1) to the charging valve.

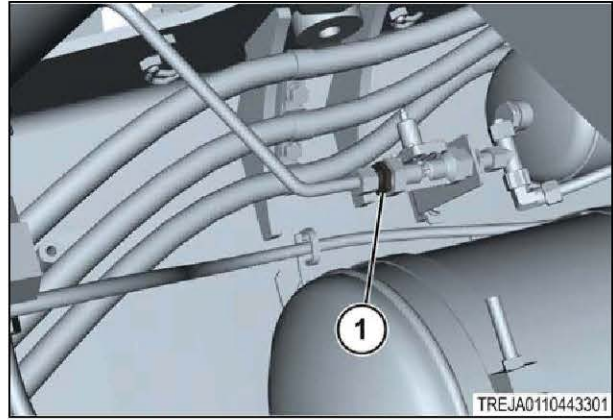


Fig. 53

3. Connect the tube (1) to the adapter connector on the charging valve.

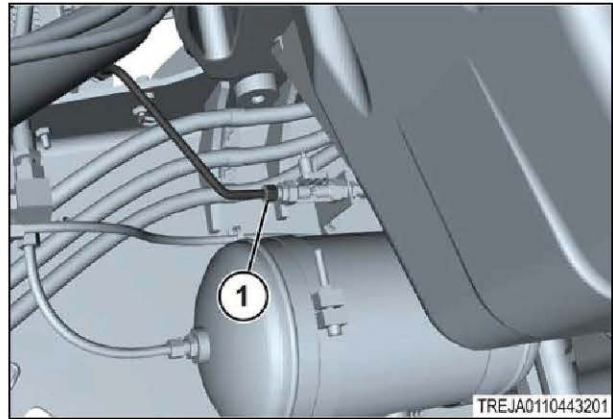


Fig. 54

### 8.2.13 Remove the air pressure sensor

**Procedure**

1. Remove the front deflector guard (1).

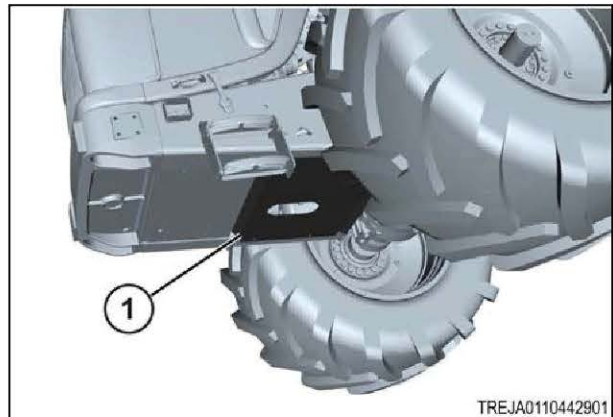


Fig. 55

2. Disconnect the wiring harness from the air pressure sensor (1).

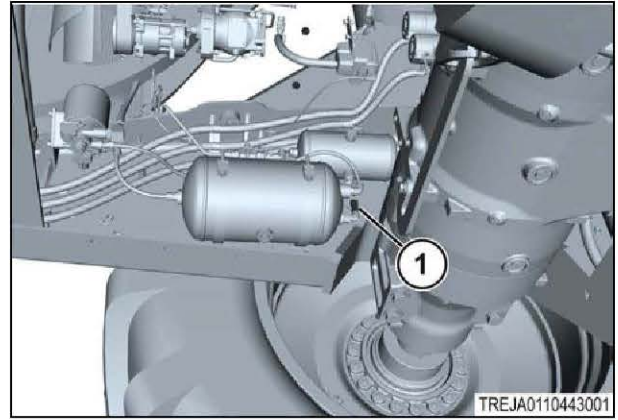


Fig. 56

3. Turn the air pressure sensor (1) counterclockwise to remove the air pressure sensor from the adapter.

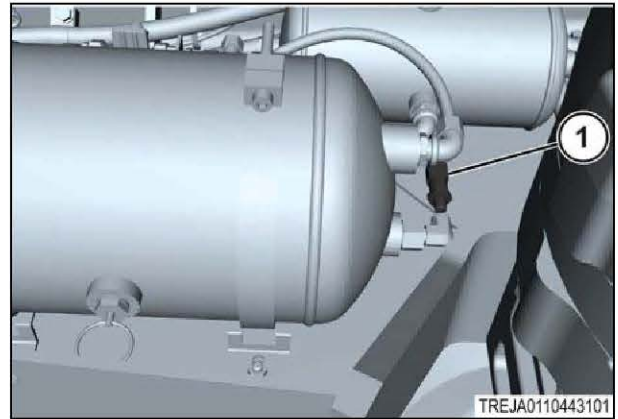


Fig. 57

### 8.2.14 Install the air pressure sensor

#### Procedure

1. Install the air pressure sensor (1) to the adapter.

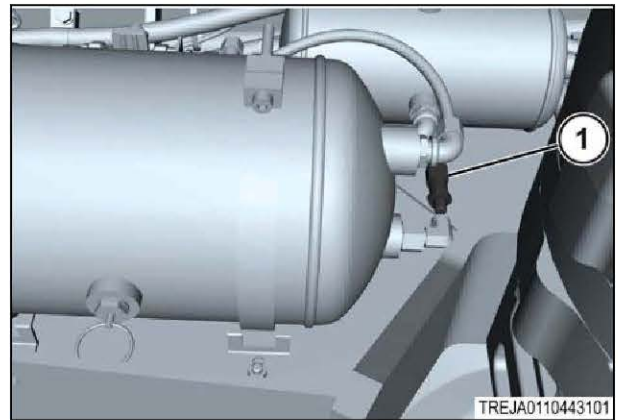


Fig. 58

8. Compressed air system

2. Connect the wiring harness to the air pressure sensor (1).

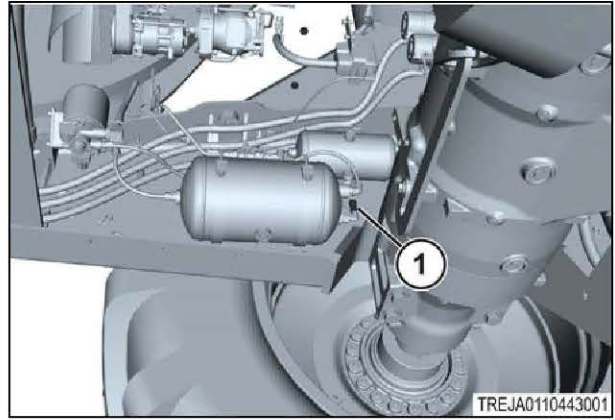


Fig. 59

### 8.3 Air system component specifications

#### 8.3.1 Main air reservoir

General	
Ports (four)	M22 x 1.5-12
Capacity	20 l (5.3 gal)
Air drain valve (2)	
Maximum working pressure	2200 kPa (319 psi)
Temperature range	-40° C to 80° C (-40° F to 176° F)
Air pressure sensor (1)	
Input voltage	8 V to 30 V
Output voltage	1 V to 5 V
Nominal pressure	1000 kPa (145 psi)
Overload pressure	3000 kPa (435 psi)
Temperature range	-40° C to 125° C (-40° F to 257° F)

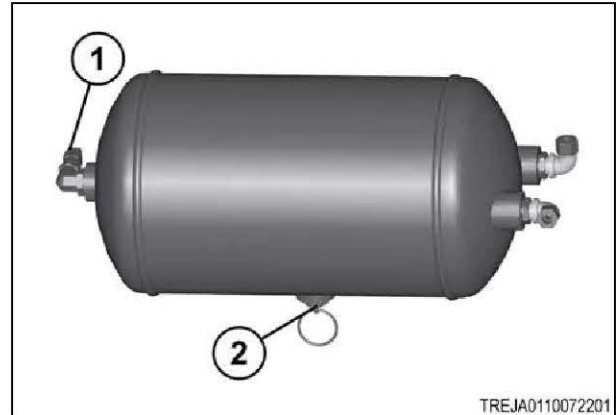


Fig. 60

#### 8.3.2 Air regeneration reservoir

General	
Ports (four)	M22 x 1.5
Capacity	5 l 1.3 gal
Temperature range	-50° C to 100° C
Maximum working pressure	1896 kPa 275 psi

#### 8.3.3 Air compressor

General	
Swept air displacement at 1250 rpm	444.6 l/min (15.7 ft <sup>3</sup> /min)
Maximum power required loaded at 1800 rpm	3.4 kW (4.6 hp)
Maximum power required unloaded at 1800 rpm	1.1 kW (1.5 hp)
Pressure relief valve (in output line)	1724 kPa (250 psi)
Ports	
Air inlet (1)	M26x1.5 THD

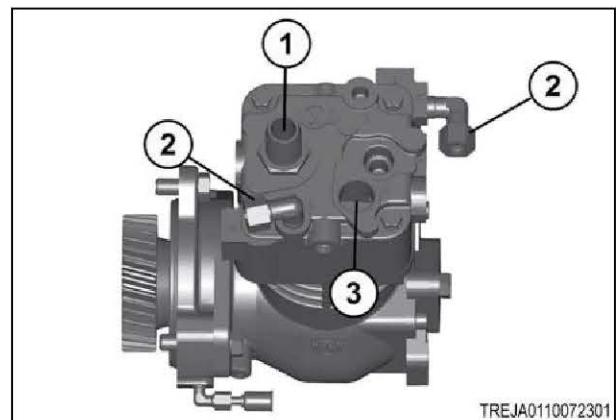


Fig. 61

8. Compressed air system

Air discharge (2)	M26x1.5 THD
Water ports (3)	M16x1.5-6H THD
Oil inlet	M10x1-6H THD

**8.3.4 Air dryer**

General	
Unloader valve setting	800 kPa (116 psi)
Temperature range	-40° C to 65° C (-40° F to 149° F)
Safety valve setting	1400 kPa (203 psi)
Desiccant cartridge (1)	Spin-on
Ports	
Compressor (2)	M22x1.5 THD
Main air reservoir (3)	M22x1.5 THD
Air regeneration reservoir (4)	M12x1.5 THD

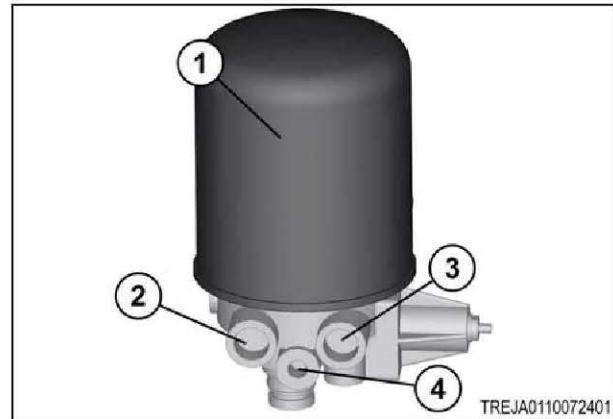


Fig. 62

## 8.4 Troubleshoot the air dryer

Dryer leaks from the purge valve during the compressor loaded cycle.	
Leak can cause the excessive compressor cycling or prevent system from the building air pressure.	
Cause(s)	Solution(s)
Purge valve frozen open (cold weather operation).	Check heater. Repair/replace if necessary.
Debris under purge valve seat, such as particles from fittings or air inlet line.	Remove and inspect purge valve and clean water/oil from top of piston. Disassemble and clean purge valve. Remove the cartridge and clean dryer sump area.
Purge valve washer installed upside-down.	Make sure the lip on aluminum washer faces down, away from the dryer.
Purge valve retainer ring not fully seated in groove.	Install the retainer ring fully into groove.

Slight leak from the purge valve.	
After 1-3 hours, supply tank can be empty.	
Cause(s)	Solution(s)
Outlet check valve not seating or regeneration valve not closing off regeneration airflow.	Remove, inspect and clean outlet check valve and regeneration valve diaphragm. Replace if worn or damaged.

Regeneration cycle too long (more than 30 seconds), accompanied by loss of pressure in the supply tank.	
Cause(s)	Solution(s)
Outlet check valve not seating.	Inspect and replace outlet check valve as necessary.
Regeneration valve not closing off regeneration airflow.	Replace the regeneration valve.

Regeneration cycle too short (less than 10 seconds)	
Cause(s)	Solution(s)
High air system demands during the compressor Unloaded cycle.	Increase air system capacity or reduce air demands.
Pressure control check valve not installed in system or not working correctly.	Check and replace pressure controlled check valve as necessary.
One-way check valve installed in system reservoir instead of, or with, pressure controlled check valve.	Remove one-way check valve. Make sure pressure controlled check valve correctly installed.
Regeneration valve not working.	Remove the regeneration valve and clean oil from the diaphragm. If no oil or other foreign contaminants are present, replace regeneration valve assembly.
Air governor not working correctly.	Inspect per manufacturer's instructions and repair/replace as necessary.

Rapid "spitting" of air from the purge valve in small amounts.	
Frequency varies with engine speed.	
Cause(s)	Solution(s)
Air dryer not replaced with the U-series air dryer.	Replace with correct model.

Air leak at turbo cut-off valve vent.	
Cause(s)	Solution(s)
Lip seal installed upside-down on piston. Lip must point up ( towards the dryer).	Install the lip seal correctly.
Valve bore worn too much.	Inspect valve bore for wear. If a new turbo cut-off valve does not seal in a clean, lubricated bore, replace the air dryer.

Air dryer is frozen (water accumulating in the base of the dryer is freezing)	
Cause(s)	Solution(s)
No electrical power to heater connector.	Check for blown fuse. Repair heater circuit. <b>NOTE:</b> <i>There must be power to heater connector the entire time the vehicle's ignition is on.</i>
Heater assembly not working.	Replace heater assembly. Resistance is 1.0 to 2.0 ohms for 12 volt system.

<b>No air pressure build-up in system.</b>	
<b>Cause(s)</b>	<b>Solution(s)</b>
Air dryer not plumbed correctly.	Make sure compressor discharge line plumbed to air dryer port-1 and air dryer port-21 connected to vehicle's supply tank.
Air governor not working correctly.	Inspect air governor per manufacturer's instructions. Repair or replace as necessary.
Air system leaks, such as compressor discharge line, air dryer, reservoirs, brake or the suspension valves, and so on.	Find leak(s) and repair.
Air dryer leaks from the purge valve.	See purge valve conditions in this chart.

<b>Water, oil or sludge in air system tanks.</b>	
<b>Cause(s)</b>	<b>Solution(s)</b>
Desiccant contaminated with oil.	Replace the desiccant. Inspect the compressor per manufacturer's instructions.

<b>No regeneration cycle.</b>	
<b>No airflow from the purge valve after initial purge blast (dryer decompression).</b>	
<b>Cause(s)</b>	<b>Solution(s)</b>
Air dryer not connected to the supply tank or connections reversed at dryer.	Make sure dryer installation is correct per system diagram.
Regeneration valve is not working.	Replace the regeneration valve.
Blocked/pinched line from the purge tank.	Clear/repair line.

<b>The air dryer does not purge when compressor unloads (no blast of air from the purge valve).</b>	
<b>Cause(s)</b>	<b>Solution(s)</b>
Purge valve stuck closed.	Replace the purge valve.
Air governor not working correctly.	Inspect air governor. Repair/replace per manufacturer's instructions.
Cut-out pressure never achieved by the air compressor.	Check for air leaks in system and repair as necessary.  Check compressor output. Repair/replace per manufacturer's instructions.

**Air dryer purges too frequently, perhaps as frequently as 15 seconds, along with excessive cycling of the compressor.**

Cause(s)	Solution(s)
Leak in line between supply tank and governor.	Repair airline.
Excessive air system leaks.	Repair leaks.
Excessive air system demands.	Increase air system capacity or reduce air demand.
Outlet check valve not seating.	Inspect and replace outlet check valve as necessary.
Regeneration valve not shutting off correctly.	Replace regeneration valve.
Air governor has set point less than 110 kPa range.	Replace air governor.

**Air flows out of purge valve entire time compressor is unloaded.**

Cause(s)	Solution(s)
Turbo cut off valve not sealing.	Replace turbo cut-off valve.
<b>NOTE:</b> <i>With U-series air dryers, compressor unloads through dryer, so a steady flow of air is normal.</i>	

## 8.5 Air system maintenance

### 8.5.1 Replace the desiccant cartridge

The desiccant cartridge is a cylindrical spin on steel housing containing filter elements and desiccant needed to filter and dry the system air.



**WARNING: Pressurized gases or fluids can be hazards.**

**Personal injury can result.**

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



**WARNING:**

**To prevent serious eye injury, always wear eye protection when performing vehicle maintenance or service.**

#### Procedure

1. Replace the desiccant cartridge (1) on the air dryer every year.
2. Turn the desiccant cartridge counterclockwise to remove from the air dryer. Use a strap wrench if necessary.
3. Remove and discard the O-ring from the dryer base.
4. Inspect and clean the seal seat.

**NOTE:** *If the seats are damaged and a tight seal cannot be maintained, replace the air dryer.*

5. Lubricate and install new O-ring on stem.
6. Lubricate the cartridge seal.
7. Thread the replacement desiccant cartridge on the base until the seal touches the base.
8. Tighten the desiccant cartridge one additional turn.

**IMPORTANT:** *Do not tighten too much.*

9. Repair any minor damage.

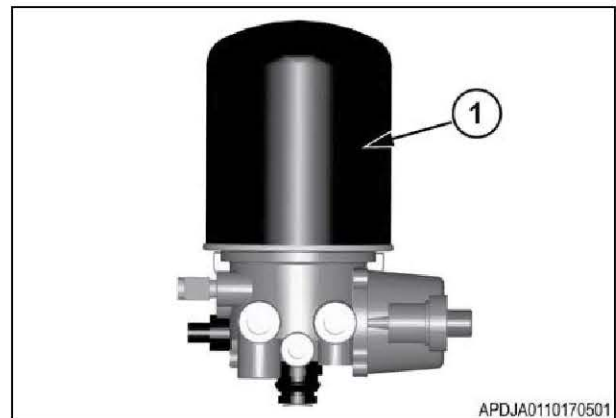


Fig. 63

### 8.5.2 Replace the air dryer purge valve

#### Procedure

1. Remove the retainer ring, valve head and spring.

**NOTE:**

*Use the grease included with the replacement kit to lubricate the O-rings and seals. DO NOT grease the rubber seat. If shims are included in the replacement kit, the shims must be installed above and below the spring. If shims are not included, the shims are not needed.*

2. Remove the piston assembly from the base.

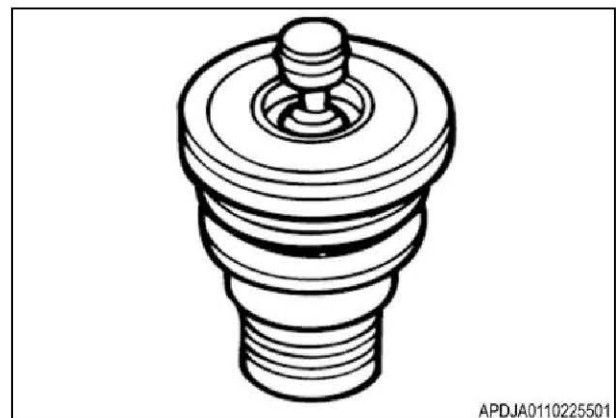


Fig. 64

## 8. Compressed air system

3. Remove the washer and O-rings from the base.
4. Clean and inspect the valve bore. If the valve bore is damaged so that a tight seal cannot be maintained, replace the air dryer.
5. Apply a thin layer of grease to the valve bore and to all O-rings.
6. Install a new washer and O-ring in the dryer base and on the valve head.
7. Assemble the piston assembly.
8. Install an O-ring in the groove on the piston head.
9. Install the piston seat in the groove on the piston base.
10. Install the washer on the piston.

**NOTE:**

*The lip on the washer must face the piston seat.*

11. Install the spring in the valve head; fit the valve head assembly into the bore and insert the retainer ring.

**NOTE:**

*Make sure the retainer ring is fully seated or the assembly will leak from the purge valve.*

### 8.5.3 Replace the air dryer regeneration valve

Regeneration valve assembly kit contains two different diaphragms to service the regeneration valve assembly. Air dryer models included are the System Saver 1000, 1200, or 1800 air dryers. Use the correct diaphragm for the type of regeneration valve housing.

**IMPORTANT:**

*Using incorrect parts will cause unsatisfactory purging of the desiccant cartridge and can cause excess water in the air system.*

**IMPORTANT:**

*The smooth, cylindrical regeneration valve housing uses the smooth diaphragm. The finned/ribbed die cast housing uses the speckled/dotted diaphragm. One assembly uses only one diaphragm. DO NOT GREASE THE DIAPHRAGM.*

**Procedure**

1. Remove the four mounting bolts and the valve housing assembly. Spring and cap will fall out.
2. Remove the rubber diaphragm.
3. Clean and inspect diaphragm lip groove. If the groove shows damage and cannot keep a tight seal, replace the air dryer.
4. Install the new diaphragm with its lip in the groove. DO NOT GREASE THE DIAPHRAGM.
5. Install the new spring and the cap. The cap lip must be facing out.
6. Install valve housing assembly with new lubricated O-ring and filter over orifice.
7. Install new mounting bolts and tighten to 6 Nm.

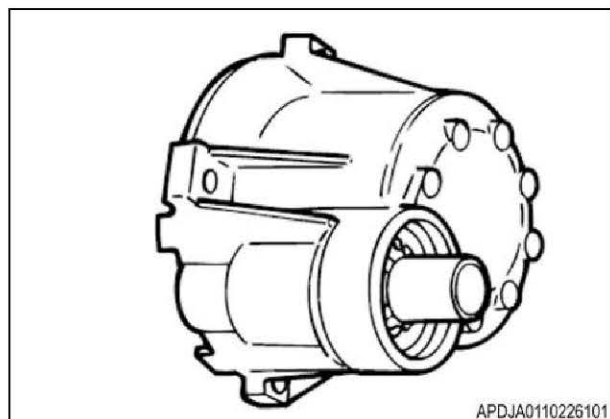


Fig. 65

### 8.5.4 Replace the turbo cut off valve in the air dryer

#### Procedure

1. To replace the turbo cut-off valve, remove the retainer ring. The cover and spring can fall out of the bore.
2. Remove the desiccant cartridge.
3. Push the piston spring and the cover out with a wood stick, if the components do not fall out.
4. Clean and inspect the valve bore. If the valve bore is damaged so that a tight seal cannot be maintained, replace the air dryer.
5. Install a new lip seal on the piston. The seal lip must face up, toward the top of the piston.
6. Install a new O-ring on the cover. Use grease supplied with the kit to apply a thin layer of grease to the valve bore and O-ring.
7. Install the new piston with the flat side toward the dryer.
8. Install the new spring, the cover, and the retainer ring to hold the components.
9. Install the plug.
10. Replace the desiccant cartridge.

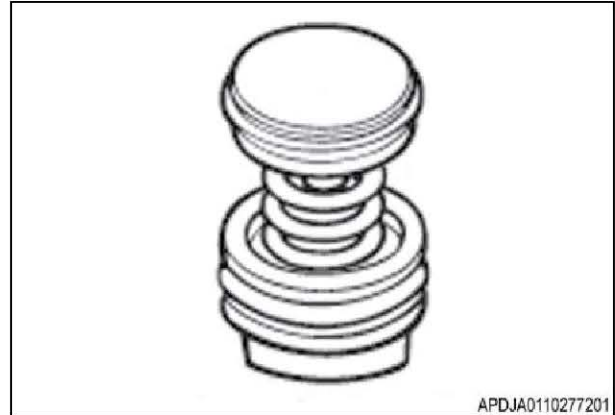


Fig. 66