

# SHOP MANUAL

**KOMATSU**

**D61EX-15**

**D61PX-15**

MACHINE MODEL

SERIAL NUMBER

**D61EX-15**

**B40001 and up**

**D61PX-15**

**B40001 and up**

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require. Materials and specifications are subject to change without notice.
- D61-15 mount the SA6D114E-2 engine.

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## Bulldozer

# D61EX-15

# D61PX-15

| Model | Serial Number |
|-------|---------------|
|-------|---------------|

|          |         |
|----------|---------|
| D61EX-15 | B40001- |
| D61PX-15 | B40001- |

# General

|               |   |
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### Standard tightening torque

#### Standard tightening torque table (when using torque wrench)

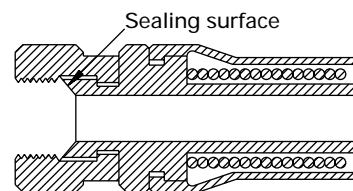
★ In the case of metric nuts and bolts for which there is no special instruction, tighten to the torque given in the table below.

| Thread diameter of bolt | Width across flats | Tightening torque |             |
|-------------------------|--------------------|-------------------|-------------|
|                         |                    | Nm                | kgm         |
| mm                      | mm                 |                   |             |
| 6                       | 10                 | 11.8 – 14.7       | 1.2 – 1.5   |
| 8                       | 13                 | 27 – 34           | 2.8 – 3.5   |
| 10                      | 17                 | 59 – 74           | 6 – 7.5     |
| 12                      | 19                 | 98 – 123          | 10 – 12.5   |
| 14                      | 22                 | 153 – 190         | 15.5 – 19.5 |
| 16                      | 24                 | 235 – 285         | 23.5 – 29.5 |
| 18                      | 27                 | 320 – 400         | 33 – 41     |
| 20                      | 30                 | 455 – 565         | 46.5 – 58   |
| 22                      | 32                 | 610 – 765         | 62.5 – 78   |
| 24                      | 36                 | 785 – 980         | 80 – 100    |
| 27                      | 41                 | 1150 – 1440       | 118 – 147   |
| 30                      | 46                 | 1520 – 1910       | 155 – 195   |
| 33                      | 50                 | 1960 – 2450       | 200 – 250   |
| 36                      | 55                 | 2450 – 3040       | 250 – 310   |
| 39                      | 60                 | 2890 – 3630       | 295 – 370   |

| Thread diameter of bolt | Width across flats | Tightening torque |           |
|-------------------------|--------------------|-------------------|-----------|
|                         |                    | Nm                | kgm       |
| mm                      | mm                 |                   |           |
| 6                       | 10                 | 5.9 – 9.8         | 0.6 – 1.0 |
| 8                       | 13                 | 13.7 – 23.5       | 1.4 – 2.4 |
| 10                      | 14                 | 34.3 – 46.1       | 3.5 – 4.7 |
| 12                      | 27                 | 74.5 – 90.2       | 7.6 – 9.2 |

#### Table of tightening torques for flared nuts

★ In the case of flared nuts for which there is no special instruction, tighten to the torque given in the table below.



SAD00483

| Thread diameter | Width across flats | Tightening torque |           |
|-----------------|--------------------|-------------------|-----------|
|                 |                    | Nm                | kgm       |
| mm              | mm                 |                   |           |
| 14              | 19                 | 24.5 ± 4.9        | 2.5 ± 0.5 |
| 18              | 24                 | 49 ± 19.6         | 5 ± 2     |
| 22              | 27                 | 78.5 ± 19.6       | 8 ± 2     |
| 24              | 32                 | 137.3 ± 29.4      | 14 ± 3    |
| 30              | 36                 | 176.5 ± 29.4      | 18 ± 3    |
| 33              | 41                 | 196.1 ± 49        | 20 ± 5    |
| 36              | 46                 | 245.2 ± 49        | 25 ± 5    |
| 42              | 55                 | 294.2 ± 49        | 30 ± 5    |

## Units

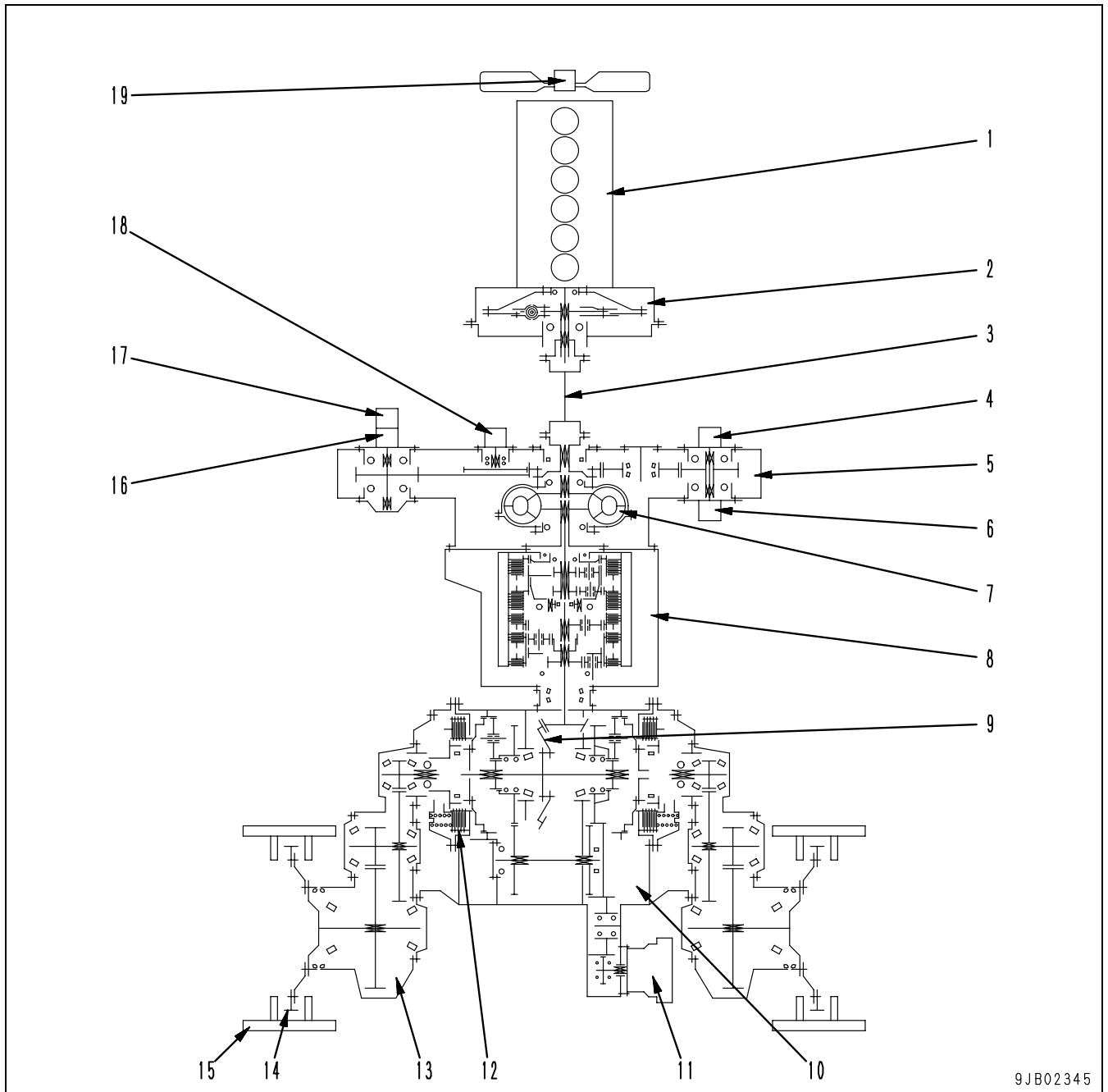
In this manual, the measuring units are indicated with International System of units (SI).  
As for reference, conventionally used Gravitational System of units are indicated in parentheses { }.

### Example:

N {kg}  
Nm {kgm}  
MPa {kg/cm<sup>2</sup>}  
kPa {mmH<sub>2</sub>O}  
kPa {mmHg}  
kW/rpm {HP/rpm}  
g/kWh {g/HPh}



## Power train skeleton



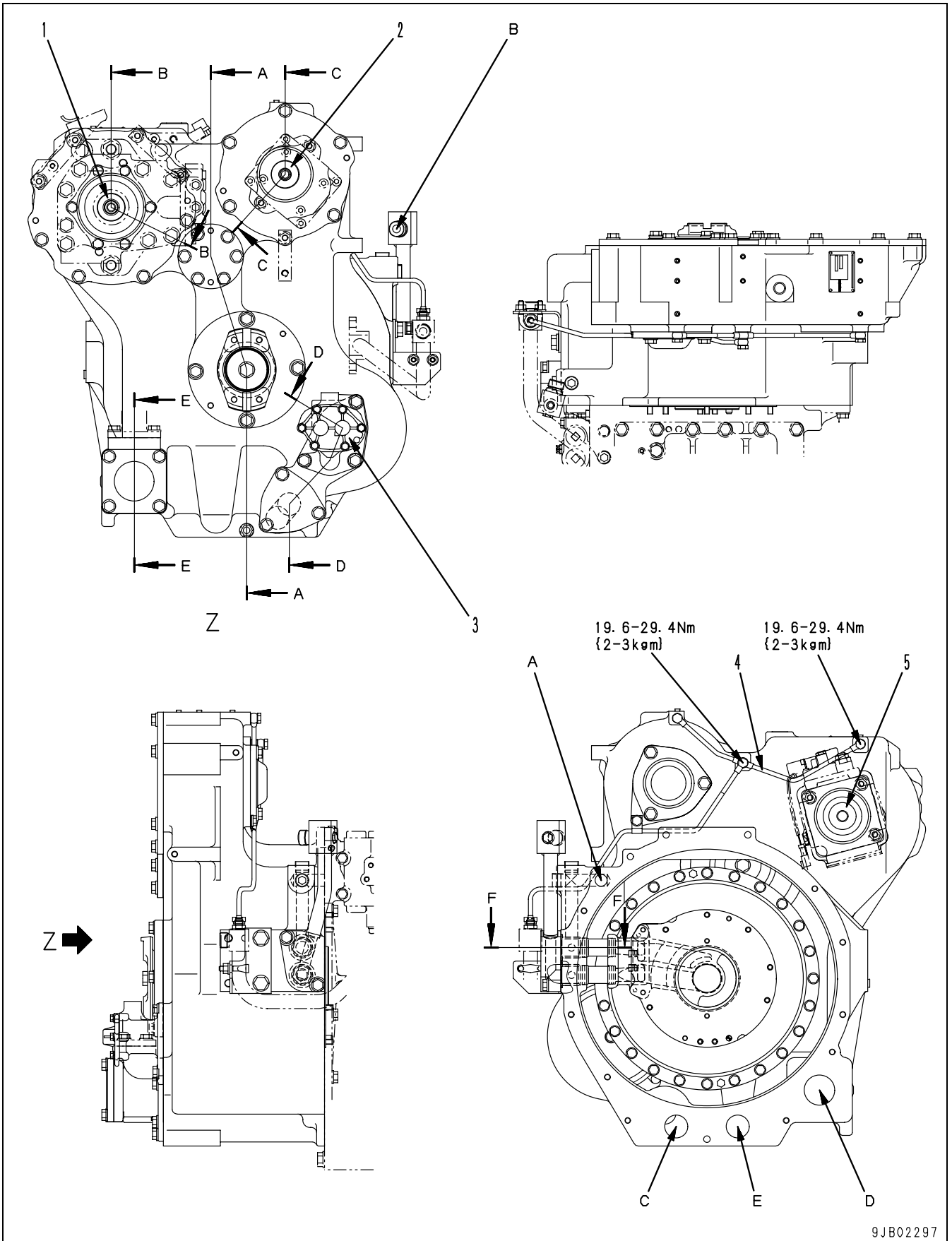
9JB02345

- |                     |                          |
|---------------------|--------------------------|
| 1. Engine           | 11. HSS motor            |
| 2. Damper           | 12. Brake                |
| 3. Universal joint  | 13. Final drive          |
| 4. HSS pump         | 14. Sprocket             |
| 5. PTO              | 15. Track shoe           |
| 6. Cooling fan pump | 16. Power train pump     |
| 7. Torque converter | 17. Lubricating oil pump |
| 8. Transmission     | 18. Scavenging pump      |
| 9. Bevel gear       | 19. Cooling fan motor    |
| 10. HSS unit        |                          |

# Power transmitting system

## Torque converter and PTO

★ PTO: Abbreviation for Power Take Off



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Unit: mm

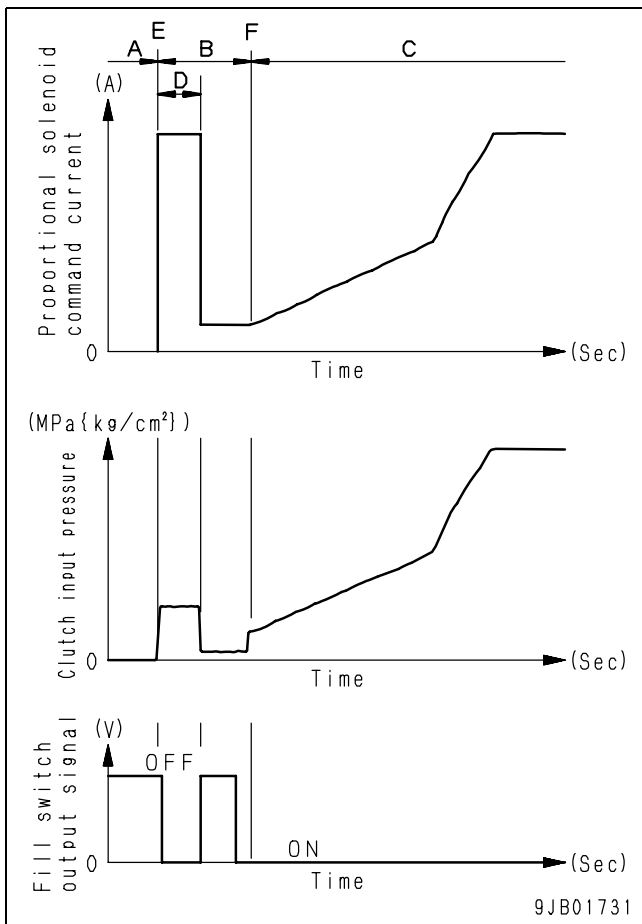
| No. | Check item  |           | Criteria      |                  |                      |             | Remedy             |
|-----|---|-----------|---------------|------------------|----------------------|-------------|--------------------|
|     |   |           | Standard size |                  | Repair limit         |             |                    |
| 1   | R clutch spring (5 pieces)  |           | Free length   | Installed length | Installed load       | Free length | Installed load     |
|     |   |           | 69.5          | 58.7             | 233.2 N<br>{23.8 kg} | 65.3        | 198 N<br>{20.2 kg} |
| 2   | F clutch spring (5 pieces)  |           | 77.0          | 63.6             | 95.2 N<br>{9.7 kg}   | 72.4        | 81 N<br>{8.2 kg}   |
| 3   | 3rd clutch spring (5 pieces)                                      |           | 59.0          | 44.1             | 146.0 N<br>{14.9 kg} | 55.5        | 125 N<br>{12.7 kg} |
| 4   | 2nd clutch spring (5 pieces)                                      |           | 59.0          | 44.5             | 142.1 N<br>{14.5 kg} | 55.5        | 121 N<br>{12.3 kg} |
| 5   | 1st clutch spring (5 pieces)                                      |           | 59.0          | 44.3             | 144.1 N<br>{14.7 kg} | 55.5        | 123 N<br>{12.5 kg} |
| 6   | Total assembly thickness of 5 discs and 6 plates of R clutch      |           | Standard size | Tolerance        | Repair limit         |             |                    |
|     |   |           | 36.2          | ±0.33            | 32.2                 |             |                    |
| 7   | Total assembly thickness of 7 discs and 8 plates of F clutch      |           | 49.4          | ±0.39            | 43.8                 |             |                    |
| 8   | Total assembly thickness of 4 discs and 5 plates of 3rd clutch    |           | 29.6          | ±0.30            | 26.4                 |             |                    |
| 9   | Total assembly thickness of 4 discs and 5 plates of 2nd clutch    |           | 29.6          | ±0.30            | 26.4                 |             |                    |
| 10  | Total assembly thickness of 3 discs and 4 plates of 1st clutch    |           | 23.0          | ±0.26            | 20.6                 |             |                    |
| 11  | Thickness of clutch disc  |           | 3.4           | ±0.1             | 2.6                  |             |                    |
| 12  | Thickness of clutch plate   |           | 3.2           | ±0.1             | 2.9                  |             |                    |
| 13  | Wear of seal ring of transmission input shaft                     | Width     | 3.0           | -0.01<br>-0.03   | 2.70                 |             |                    |
|     |   | Thickness | 2.3           | ±0.10            | 2.15                 |             |                    |
| 14  | Backlash between R, F, 2nd and 1st sun gears and planetary pinion |           | 0.11 - 0.30   |                  |                      |             |                    |
| 15  | Backlash between 3rd sun gear and planetary pinion                |           | 0.11 - 0.29   |                  |                      |             |                    |
| 16  | Backlash between planetary pinion and internal teeth of ring gear |           | 0.12 - 0.33   |                  |                      |             |                    |
| 17  | Backlash between R carrier and internal teeth of ring gear        |           | 0.14 - 0.44   |                  |                      |             |                    |
| 18  | Backlash between F carrier and internal teeth of ring gear        |           | 0.14 - 0.38   |                  |                      |             |                    |
| 19  | Backlash between 1st carrier and internal teeth of ring gear      |           | 0.14 - 0.39   |                  |                      |             |                    |

Replace

**Outline of ECMV**

- The ECMV consists of a pressure regulator valve and a fill switch.
- **Pressure control valve**  
Converts a current sent from the transmission controller to the proportional solenoid valve, to an oil pressure.
- **Fill switch**  
Detects that the clutch is filled with oil. It has the functions below.
  - 1) When the clutch is filled with oil, a signal (the fill signal) is sent to the controller to notify that filling is finished.
  - 2) While oil pressure is being applied to the clutch, a signal (the fill signal) is sent to the controller to notify that oil pressure is being applied.

A range: Before shifting gear (when drained)  
 B range: Filling  
 C range: Pressure regulation  
 D range: Filling (triggering)  
 E point: Start of filling  
 F point: Finish of filling

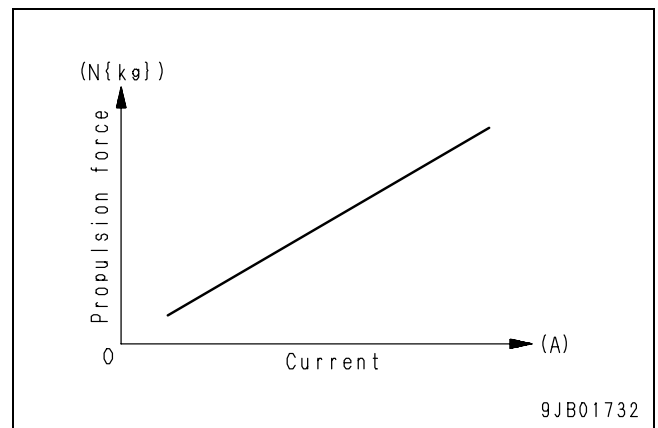


★ The logic is such that the controller does not recognize finish of filling even if the fill switch is turned "ON" during the triggering operation (D range).

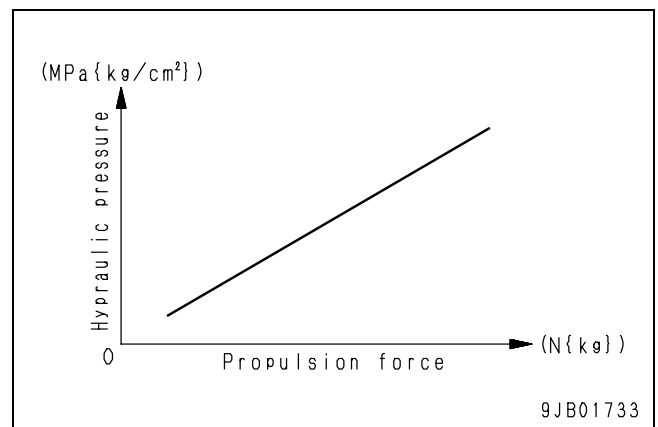
**ECMV and proportional solenoid**

- One proportional solenoid is installed for one ECMV.  
After receiving the command current from the controller, it produces thrust shown in the graph below.  
By making the proportional solenoid-produced thrust act on the pressure control valve spool, it produces an oil pressure shown in the graph below. By controlling the amount of command current, the thrust is changed to operate the pressure control valve, controlling the oil flow and oil pressure.

**Current-Thrust characteristics of proportional solenoid**



**Thrust-Oil pressure characteristics of proportional solenoid**



**ECMV and fill switch**

- One fill switch is installed for one ECMV.  
If the clutch finishes filling, the fill switch is turned "ON" by the pressure of the clutch. By this signal, the oil pressure starts build-up.

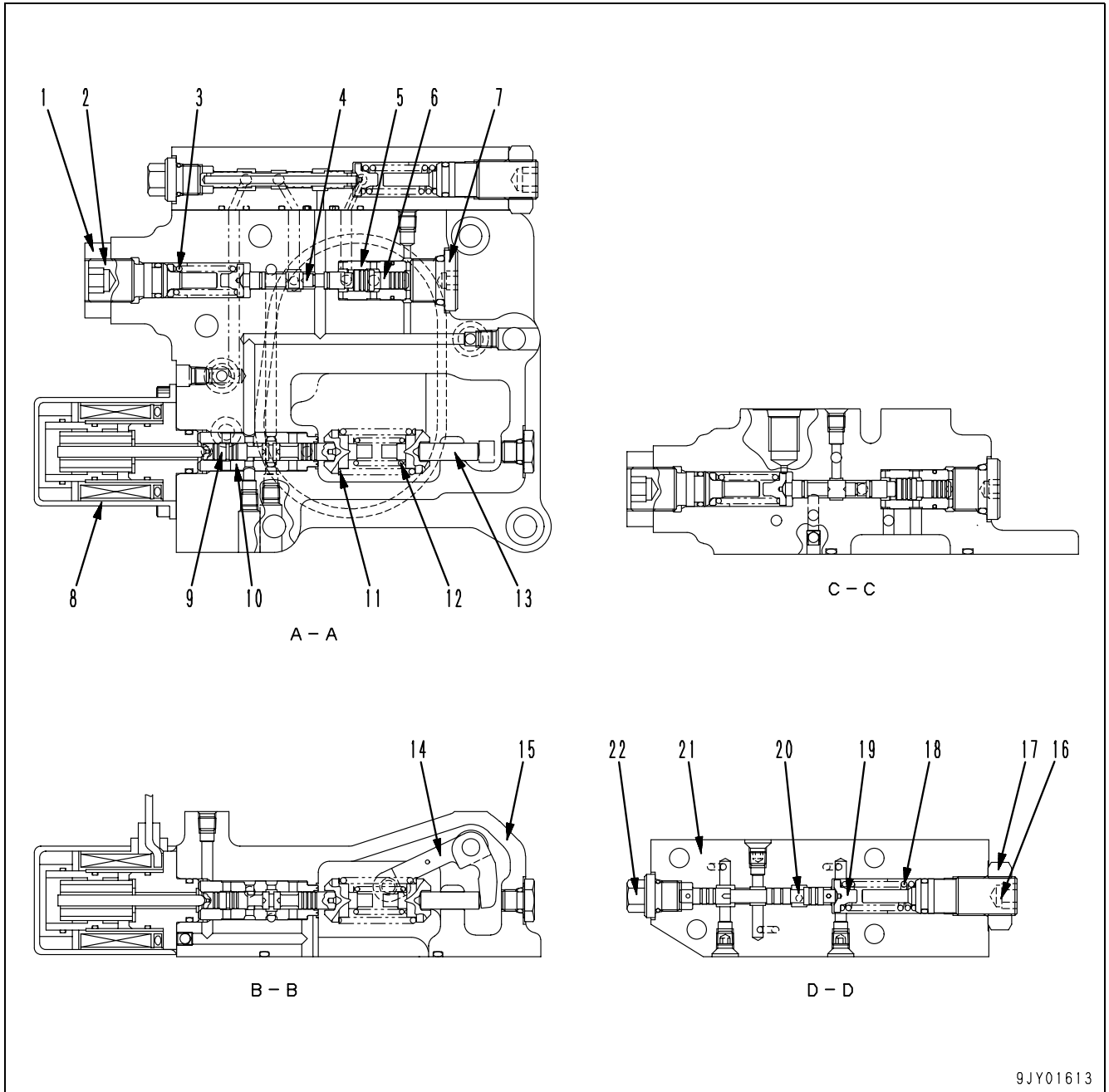
1. Directional/steering/gearshift lever (PCCS lever)
2. Transmission and steering controller
3. Control valve
4. EPC valve
5. HSS pump
6. Servo valve
7. HSS motor
8. HSS circuit
9. Engine
10. Final drive
11. Sprocket
12. Hydraulic tank

**Input and output signals**

- a. Directional signals
- b. Steering signal
- c. Engine control information
- d. Work equipment oil pressure signal

**Outline**

- The HSS system consists of control valve (3), HSS pump (5), and HSS motor (7). It can turn the machine continuously without lowering the travel speed by making a difference in speed between the right and left tracks.
- Transmission and steering controller (2) controls the revolving direction and speed of HSS motor (7) with EPC valve (4) of control valve (3) accordingly to the operating direction and distance of directional/steering/gearshift lever (1).  
HSS motor (7) works on the planetary gear mechanism of the bevel gear shaft to make a difference in speed between both sprockets (11) and turn the machine.
- Transmission and steering controller (2) senses the engine speed and oil pressure at each part and controls HSS pump (5) and control valve (3) so that engine (9) will not stall.



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**LS valve**

- 1. Locknut
- 2. Plug
- 3. Spring
- 4. Spool
- 5. Sleeve
- 6. Piston
- 7. Plug

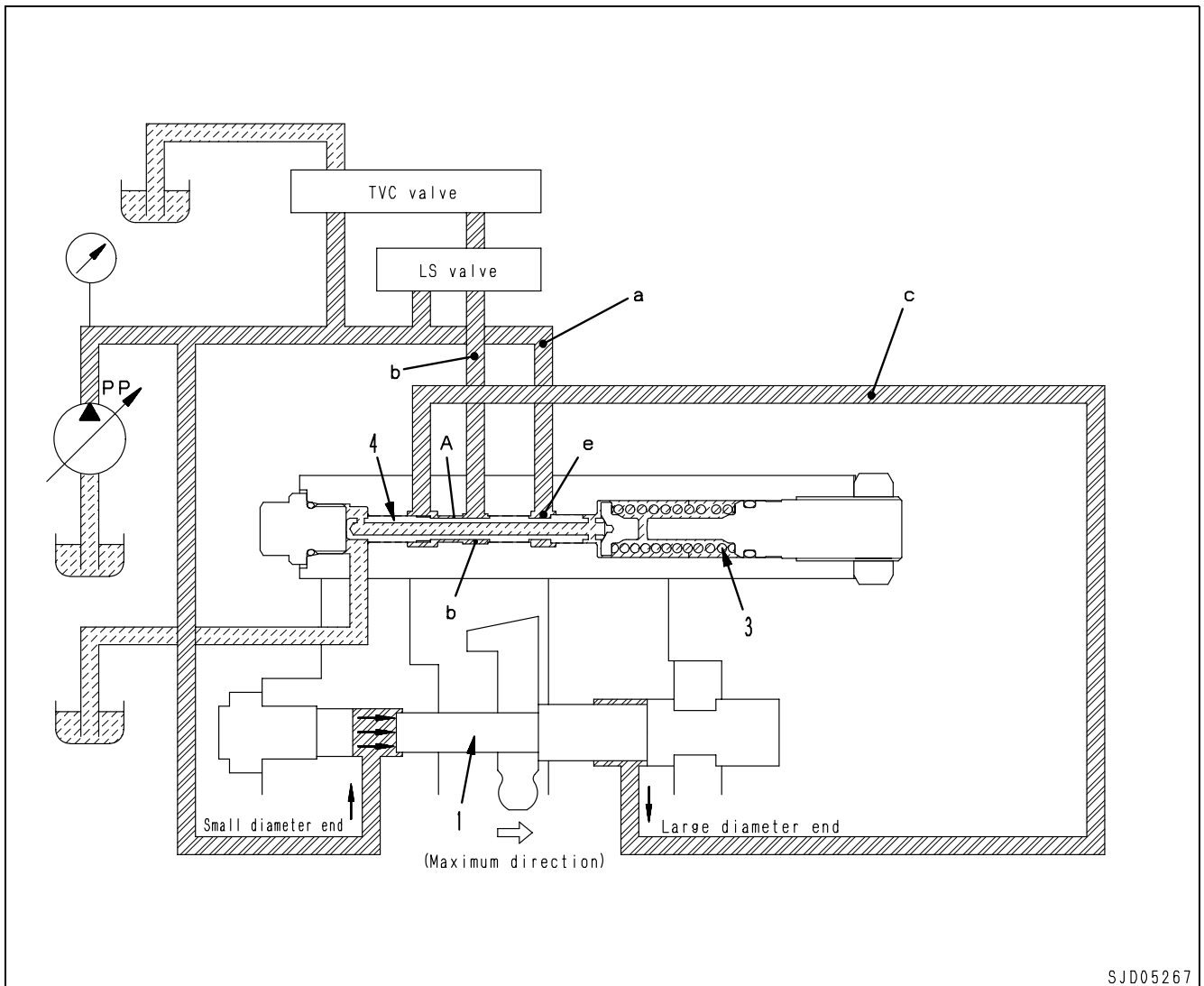
**TVC valve**

- 8. Solenoid
- 9. Piston
- 10. Sleeve
- 11. Spring
- 12. Spring
- 13. Piston
- 14. Lever
- 15. Valve body

**Variable throttle valve**

- 16. Screw
- 17. Locknut
- 18. Spring
- 19. Seat
- 20. Spool
- 21. Block
- 22. Plug

### 3. Variable throttle valve



**1) Operation in maximum direction for pump discharge amount**

- Main pump pressure PP enters the variable throttle valve through port a.

**1] When main pump pressure PP is high**

- If the pressure becomes higher than the force of spring (3) because of the difference in sectional area of spool (4) in chamber e, spool (4) moves to the right.
- If spool (4) moves to the right, the opening area between ports c and b is reduced by the notch at part A. Accordingly, less oil flows from the large diameter end of servo piston (1) and the moving speed of servo piston (1) is lowered.

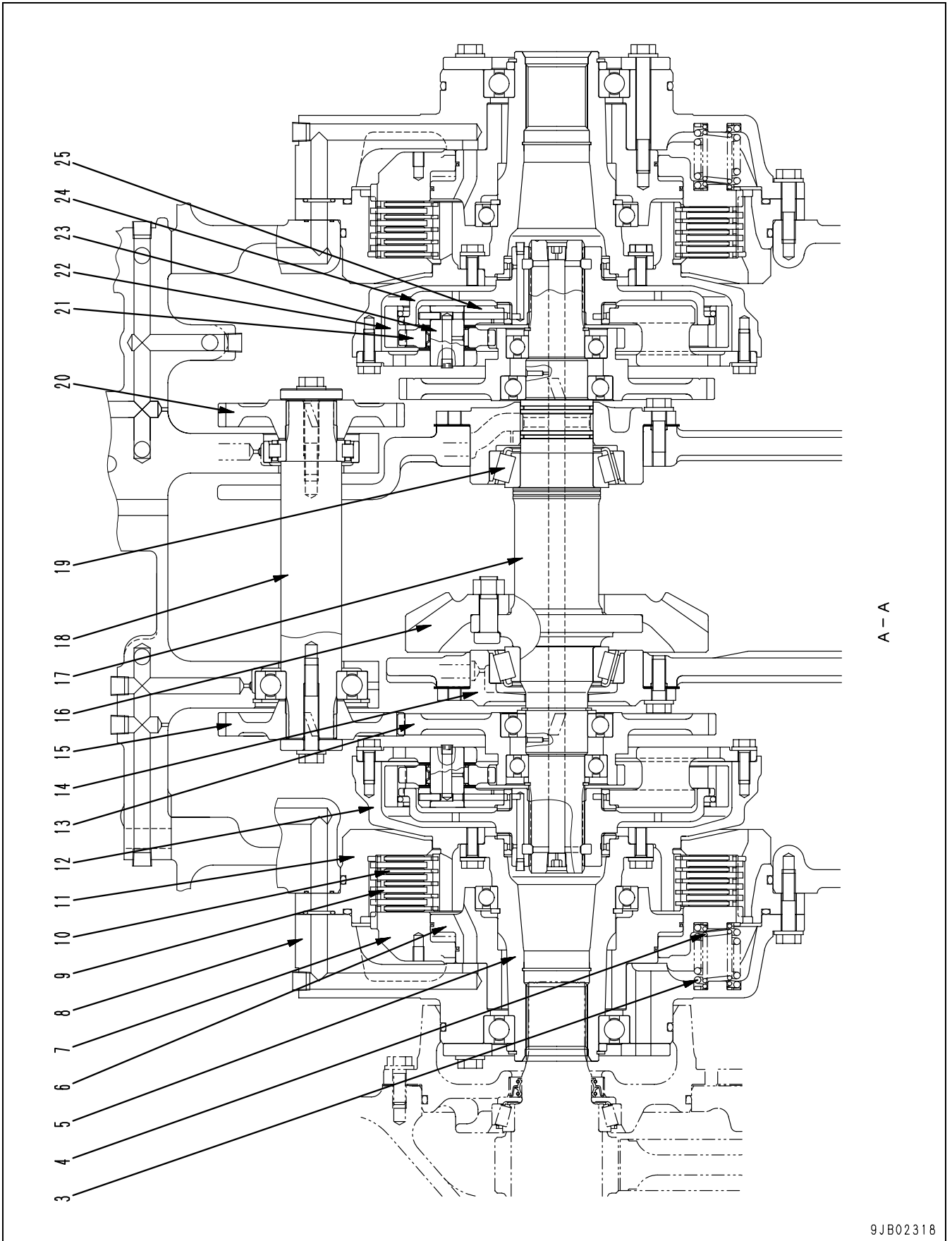
**2] When main pump pressure PP is low**

- Even if main pump pressure PP enters chamber e through port a, spool (4) pushes spring (3) less strongly and moves to the right for shorter distance.

- At this point, the opening area of part A increases and the oil flowing from the large diameter end of servo piston (1) through port c to port b is not limited and the moving speed of servo piston (1) is heightened.

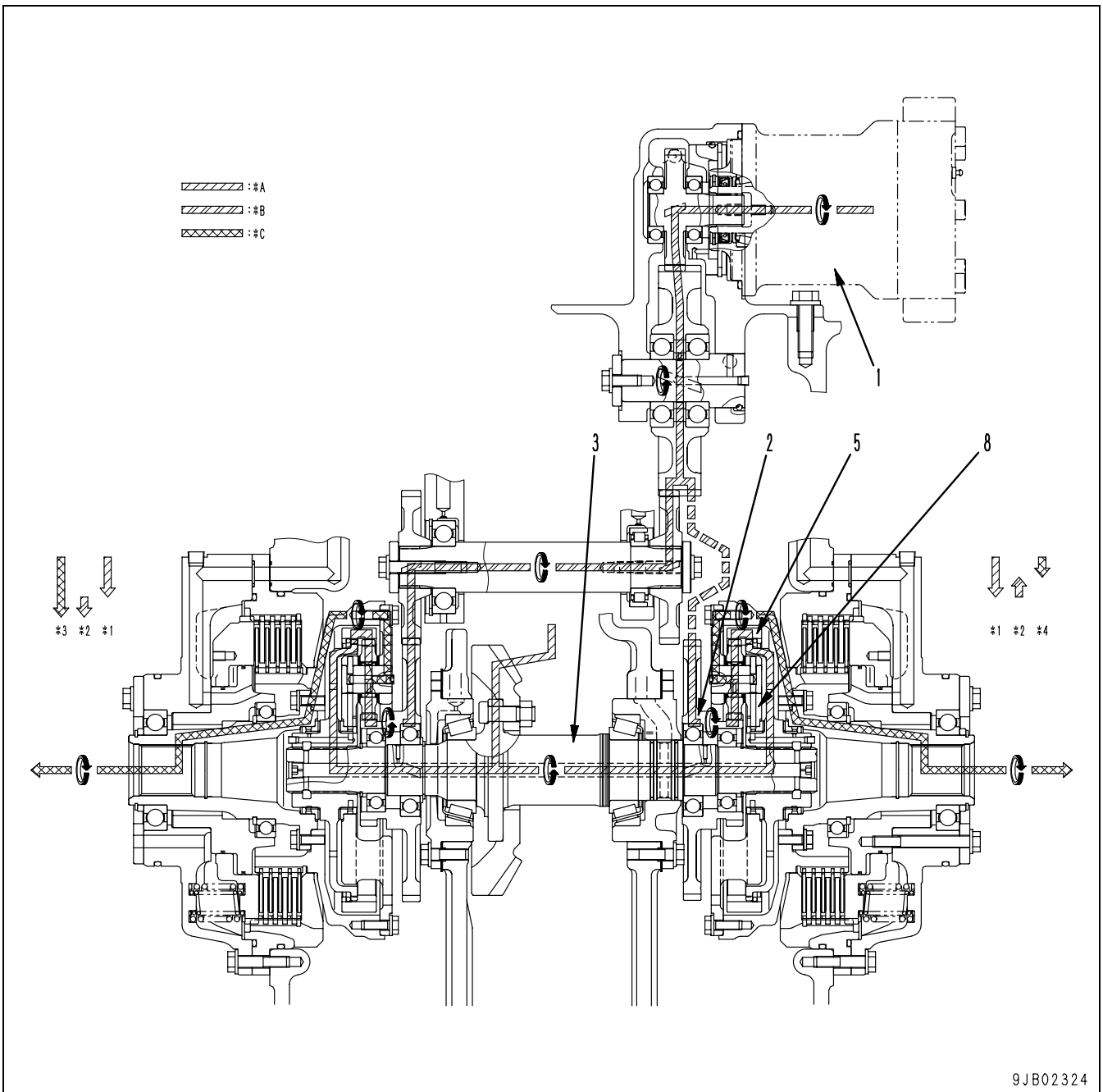
**2) Operation to reduce pump discharge**

- The hydraulic oil flows from port b through port c to the large diameter side of servo piston (1).
- Spool (4) operates accordingly to main pump pressure PP as explained in the above section.



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When machine is steered to "Right" (reverse)



- \*A: Transmission power
- \*B: HSS motor power
- \*C: Resultant power

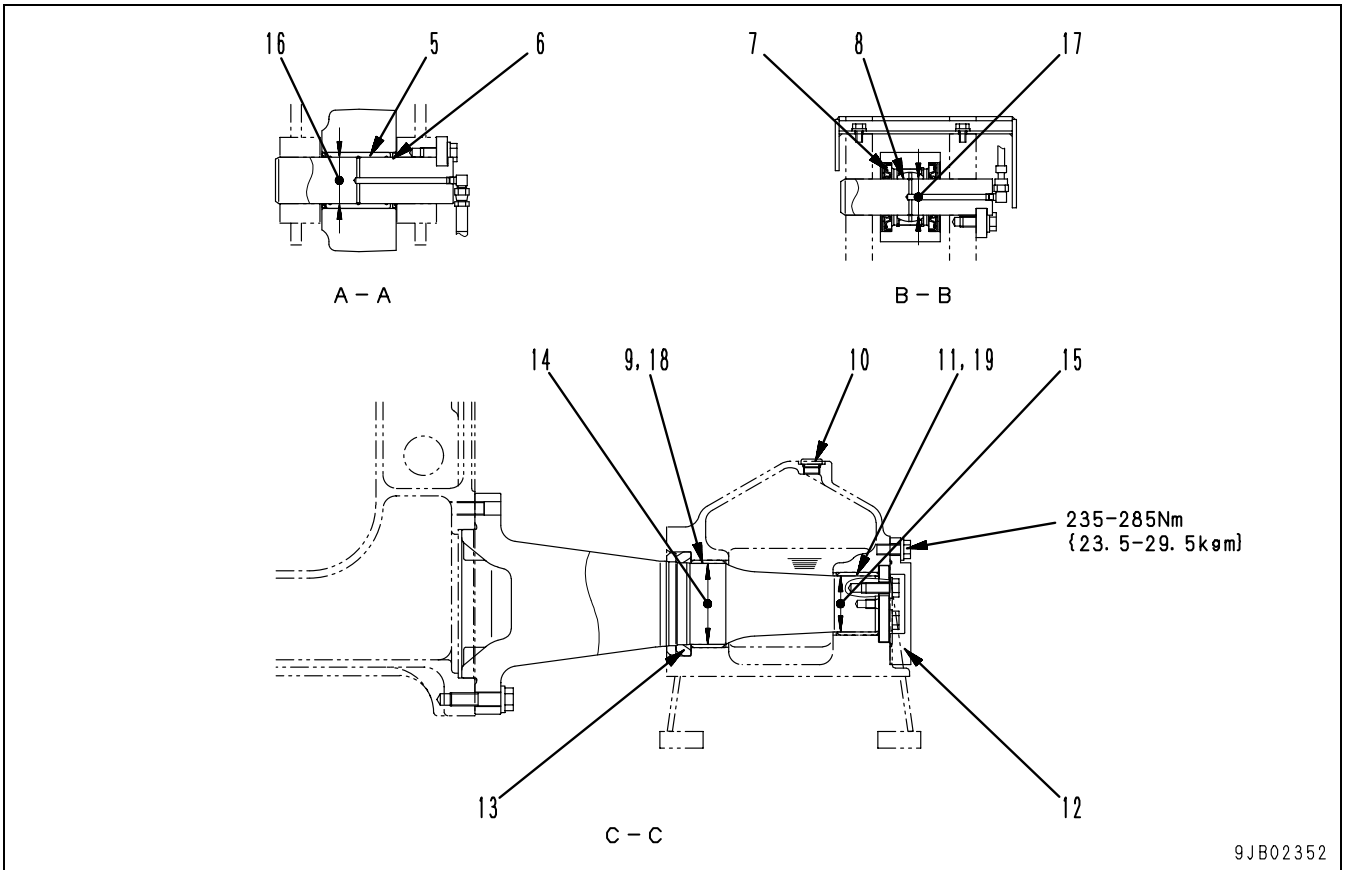
- \*1. Transmission output speed
- \*2. HSS motor output speed
- \*3. Left bevel gear shaft output speed (\*1 + \*2)
- \*4. Right bevel gear shaft output speed (\*1 - \*2)

- While the machine is traveling in reverse, with the PCCS lever in the "Turn to the right" position while the machine is traveling forward, from the left side of the chassis you will see the HSS motor (1) rotate to the right, left gear A (2) rotates to the left, and right gear A (2) rotates to the right, when they are seen from the left side of the chassis.

- Bevel gear shaft (1) and ring gear (5) connected to rotate counterclockwise as seen from the left side of the machine.
- Accordingly, because of the difference in the rotating speed between both planetary gear units, the rotating speed of left carrier (8) is higher than when traveling straight in reverse by the amount of the power of HSS motor. On the other hand, the rotating speed of right carrier (8) is lower than when traveling straight in reverse. As a result, the machine travels in reverse and turns to the right, where the output speed is lower.



★ The diagram shows D65EX-15.



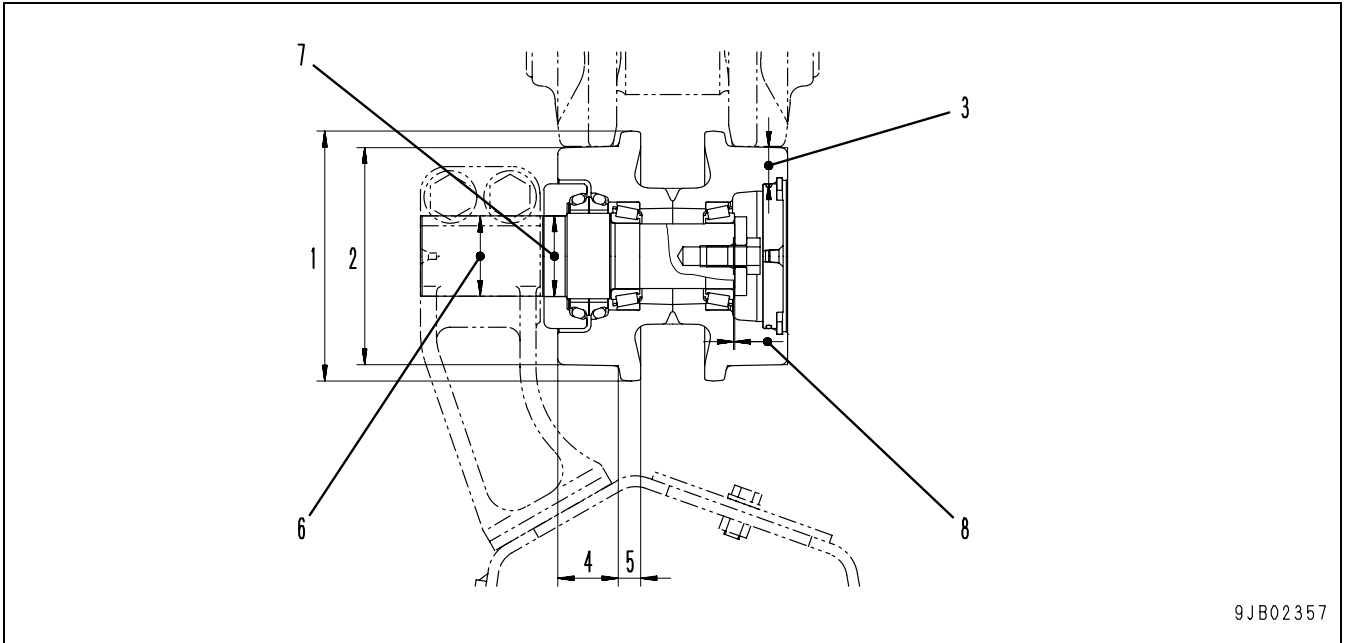
1. Equalizer bar
2. Center pin
3. Side pin
4. Pivot shaft
5. Bushing
6. Seal
7. Seal
8. Bushing
9. Bushing (large)
10. Plug (oil filler)
11. Bushing (small)
12. Cover
13. Seal

**Outline**

- The track frame moves the front part of the track frame up and down around pivot shaft (4) in its rear.
- Equalizer bar (1) rocks around center pin (2) and is connected to both track frames by side pin (3).

|   |          | D61EX-15 | D61PX-15 |
|---|----------|----------|----------|
| Displacement at center of equalizer bar side pin (mm) | Upward   | 46.1     | 49.7     |
|   | Downward | 46.1     | 49.7     |

### Carrier roller



9JB02357

Unit: mm

| No. | Check item                                | Criteria           |           |                 |                       | Remedy                                |
|-----|---|--------------------|-----------|-----------------|-----------------------|---------------------------------------|
|     |   | Standard size      |           | Repair limit    |                       |                                       |
| 1   | Outside diameter of flange                | ø190               |           | -               |                       | Repair by build-up welding or replace |
| 2   | Outside diameter of tread                 | ø165               |           | ø143            |                       |                                       |
| 3   | Thickness of tread                        | 27.5               |           | 16.5            |                       |                                       |
| 4   | Width of tread                            | 45.5               |           | 51.5            |                       |                                       |
| 5   | Width of flange                           | 17                 |           | 11              |                       |                                       |
| 6   | Clearance between shaft and support       | Standard size      | Tolerance |                 | Standard clearance    | Clearance limit                       |
|     |   | ø61                | Shaft     | Hole            |                       |                                       |
| 7   | Interference between shaft and seal guard | Standard size      | Tolerance |                 | Standard interference | Interference limit                    |
|     |   | ø61.5              | Shaft     | Hole            |                       |                                       |
|     |   |                    |           |                 |                       |                                       |
| 8   | Axial play of roller                      | Standard clearance |           | Clearance limit |                       |                                       |
|     |   | 0 - 0.32           |           | -               |                       |                                       |

1. Work equipment lock lever
2. PPC lock switch
3. Blade PPC valve
4. Blade control lever
5. Ripper control lever (if equipped: D61EX-15)
6. Ripper PPC valve (if equipped: D61EX-15)
7. PPC lock solenoid valve
8. Accumulator (if equipped)

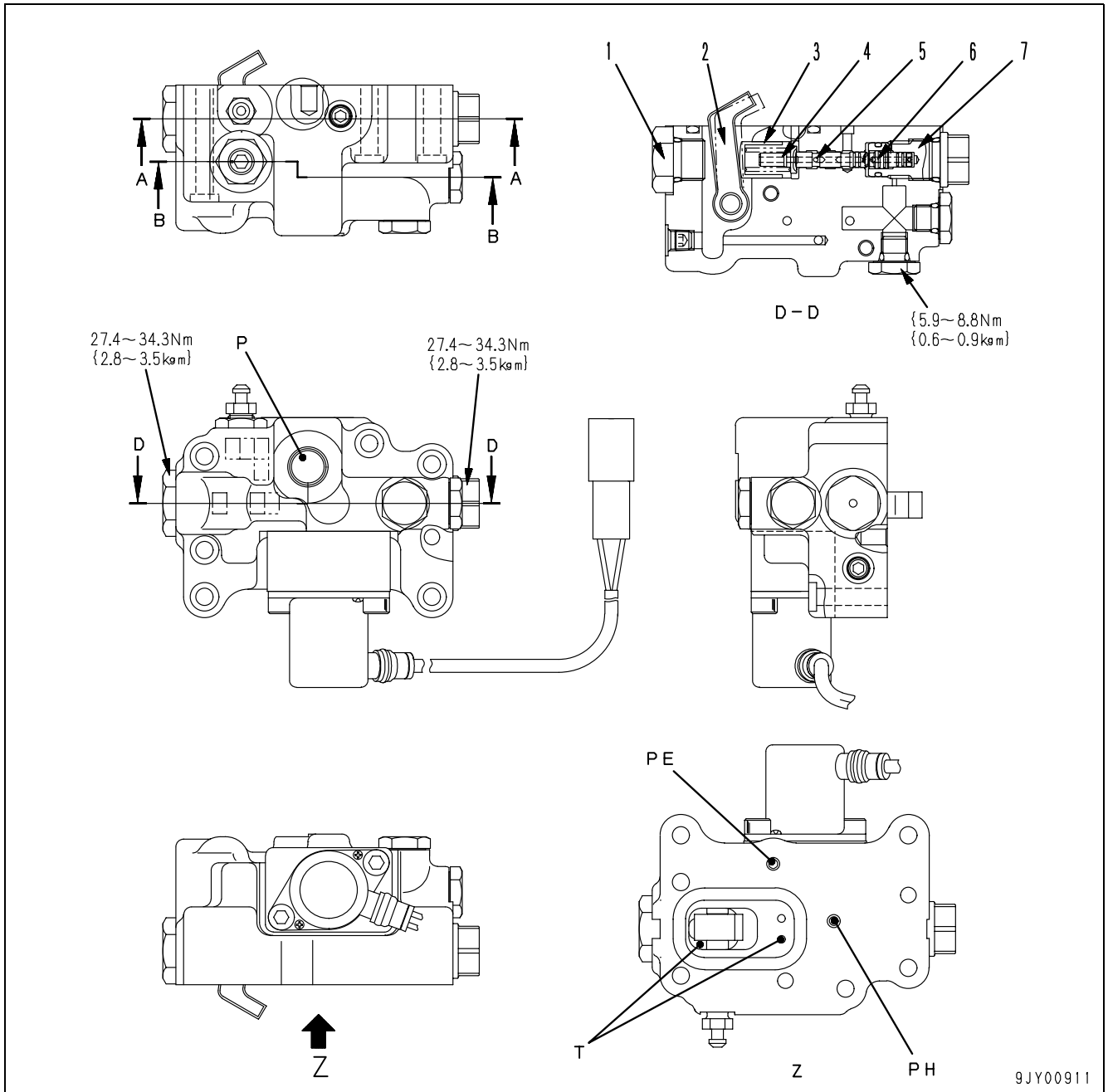
#### Outline

- The work equipment is controlled by the PPC method. Each spool of the control valve is moved by operating blade PPC valve (3) with blade control lever (4) or by operating ripper PPC valve (6) with ripper control lever (5).
- If work equipment lock lever (1) is set in the "Lock" position PPC lock switch (2) is turned "ON" and PPC lock solenoid valve (7) operates. Then, blade control lever (4) and ripper control lever (5) can be moved but the work equipment cannot be operated.
- When blade control lever (4) is in the "Float" position, the hydraulic detent of blade PPC valve (3) operates and blade control lever (4) can hold itself. If work equipment control lever (1) is set in the "Lock" position, the hydraulic detent is reset and blade control lever (4) returns to the "Hold" position by itself.
- When the engine is stopped, the hydraulic detent does not operate and blade control lever (4) returns to the "Hold" position by itself, even if blade control lever (4) is in the "Float" position.

Unit: mm

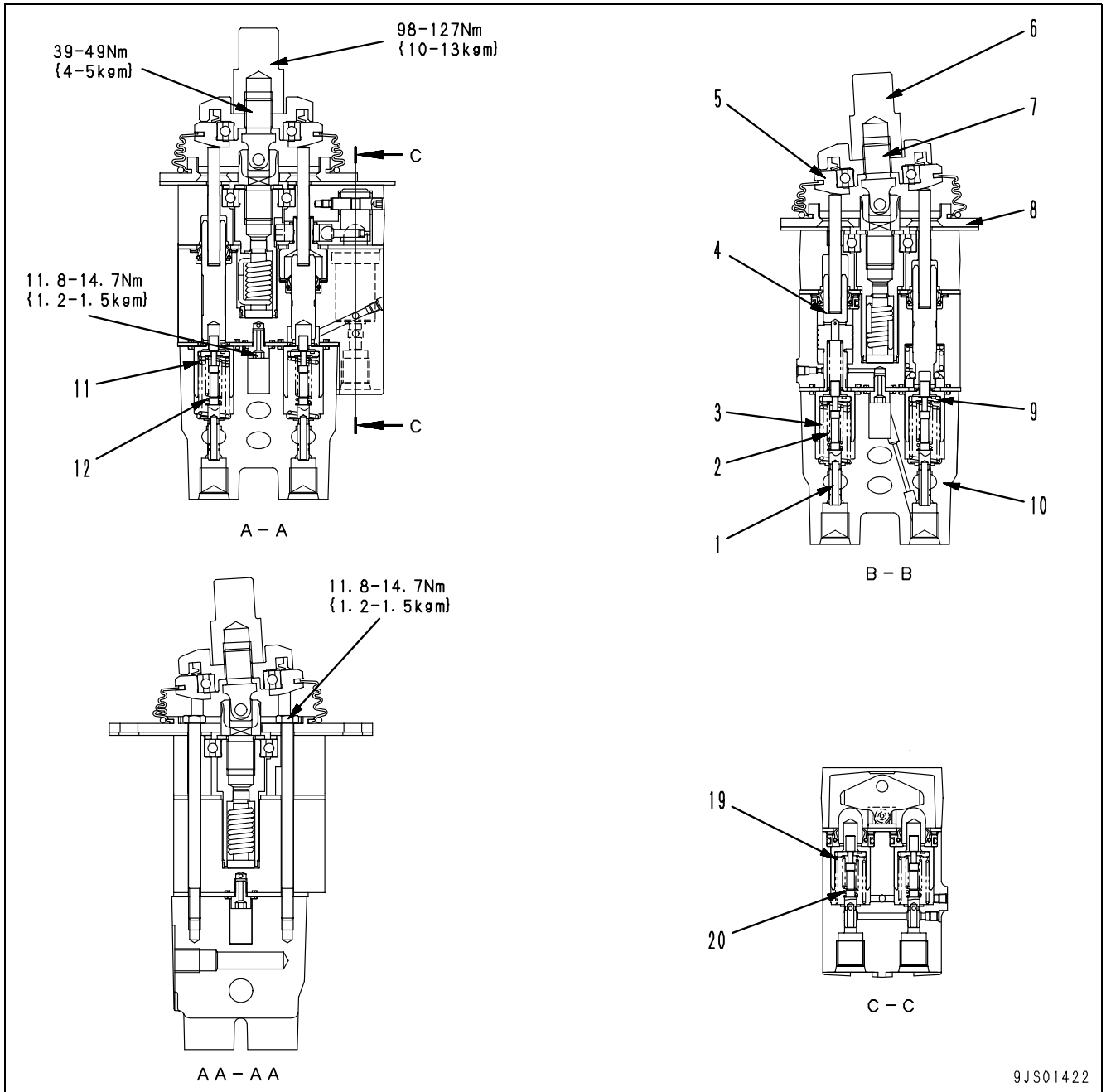
| No. | Check item  | Criteria | Criteria  |                  |                  |                 | Remedy    |                        |
|-----|---|----------|---|------------------|------------------|-----------------|-----------|------------------------|
|     |   |          | Cylinder name   | Standard size    | Tolerance        |                 |           | Standard clearance     |
|     |   |          |   | Shaft            | Hole             |                 |           |                        |
| 1   | Clearance between piston rod and bushing                    | Lift     | ø55   | -0.030<br>-0.076 | +0.151<br>-0.006 | 0.024-<br>0.227 | 0.527     | Replace bushing        |
|     |   | Tilt     | ø70   | -0.030<br>-0.076 | +0.259<br>+0.063 | 0.093-<br>0.335 | 0.635     |                        |
|     |   | Ripper   | ø70   | -0.030<br>-0.076 | +0.259<br>+0.063 | 0.093-<br>0.335 | 0.635     |                        |
| 2   | Clearance between piston rod support shaft and bushing      | Lift     | ø60   | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130-<br>0.250 | 1.0       | Adjust shim or replace |
|     | Clearance between piston rod and ball of bracket            | Tilt     | Sø70 (shaft)<br>Sø71 (hole)                           | -0.1<br>-0.3     | +1.0<br>0        | 0.2-0.5         | 2.0       |                        |
|     | Clearance between piston rod support shaft and bushing      | Ripper   | ø75   | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130-<br>0.250 | 1.0       |                        |
| 3   | Clearance between cylinder bottom support shaft and bushing | Lift     | ø60   | -0.025<br>-0.064 | +0.174<br>+0.100 | 0.125-<br>0.238 | 1.0       | Replace bushing        |
|     |   | Tilt     | ø50   | -0.200<br>-0.400 | +0.142<br>+0.080 | 0.280-<br>0.542 | 1.0       |                        |
|     |   | Ripper   | ø75   | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130-<br>0.250 | 1.0       |                        |
| 4   | Tightening torque of cylinder head                          | Lift     | 932±93.2Nm {95.0±9.5kgm}                              |                  |                  |                 | Retighten |                        |
|     | Tightening torque of cylinder head mounting bolt            | Tilt     | 162±14.7Nm {16.5±1.5kgm}                              |                  |                  |                 |           |                        |
|     |   | Ripper   | 162±14.7Nm {16.5±1.5kgm}                              |                  |                  |                 |           |                        |
| 5   | Tightening torque of cylinder piston clamping nut           | Lift     | 1.42±0.14kNm {145±14.5kgm} (width across flats: 55mm) |                  |                  |                 |           |                        |
|     |   | Tilt     | 3.97±0.40kNm {405±40.5kgm} (width across flats: 80mm) |                  |                  |                 |           |                        |
|     |   | Ripper   | 3.97±0.40kNm {405±40.5kgm} (width across flats: 80mm) |                  |                  |                 |           |                        |

Servo valve



P: EPC valve main pressure  
 T: Drain  
 PE: Control piston pressure  
 PH: Pump discharge pressure

1. Plug
2. Lever
3. Retainer
4. Seat
5. Spool
6. Piston
7. Sleeve



P: From control pump

T: To hydraulic tank

P1: To blade tilt valve (left tilt)

P2: To blade tilt valve (right tilt)

P3: To blade lift valve (raise)

P4: To blade lift valve (lower)

P5: To blade angle valve (right angle)

P6: To blade angle valve (left angle)

1. Spool

2. Metering spring

3. Centering spring

4. Piston

5. Disc

6. Cap (for connecting lever)

7. Joint

8. Plate

9. Retainer

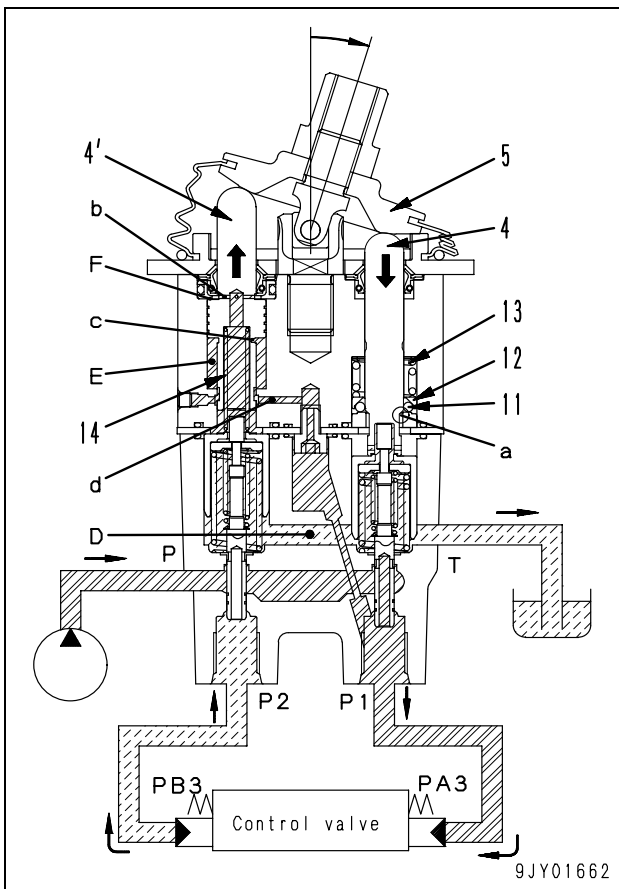
10. Body

**5. When blade is operated to "Float"**

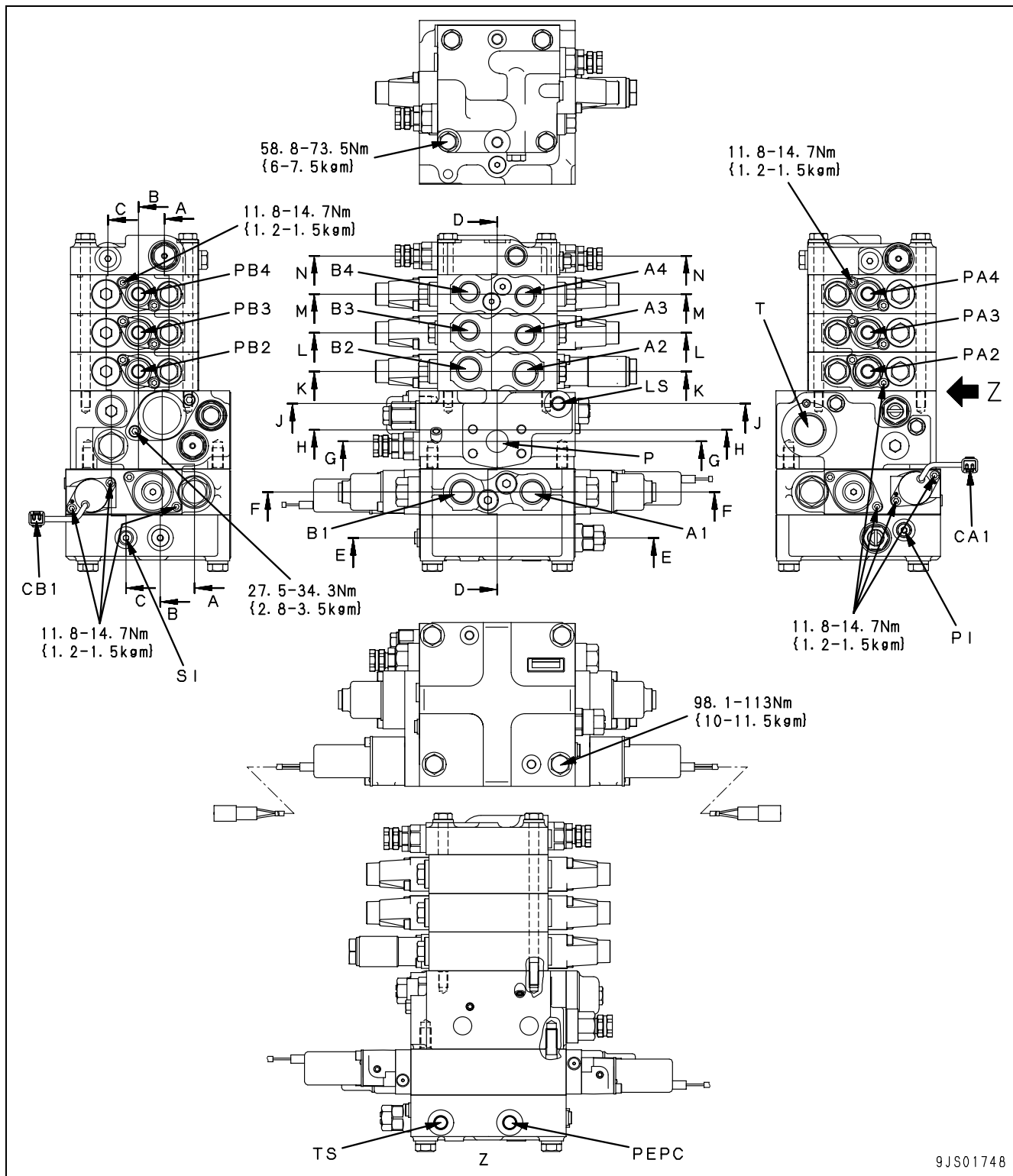
- When piston (4) at the port P1 "Lower" side is pushed by disc (5) and moves down, ball (11) contacts protrusion a of the piston during the stroke (detent starts to act).
- When piston (4) is pushed in further, ball (11) pushes up collar (12), which is being held by detent spring (13). While pushing up collar (12), it escapes to the outside and passes over protrusion a of the piston.
- When this happens, piston (4') on the opposite side is pushed up by spring (14).
- As a result, the oil inside chamber F passes through b and c, and flows to chamber E, and piston (4') follows disc (5). Passage d is connected to port P1, so more or less the same pressure is applied as is applied to port P1.
- Chamber E is normally connected to drain chamber D, but if ball (11) passes over protrusion a of the piston, passage d and chamber E, which were shut off, are connected and the pressure oil flows.
- At the same time, the control valve also moves to the "Float" position and the circuit is set to the "Float" condition.
- Piston (4') is being pushed up by the oil pressure inside chamber E, so even if the lever is released, it is held at the "Float" position.

**6. When blade is released from "Float"**

- When disc (5) is returned from the "Float" position, it is pushed down by a force greater than the hydraulic force in chamber E.
- As a result, chamber E is shut off from passage d and is connected to the drain chamber. Therefore, the oil pressure inside chamber E is lost, and the "Float" position is canceled.



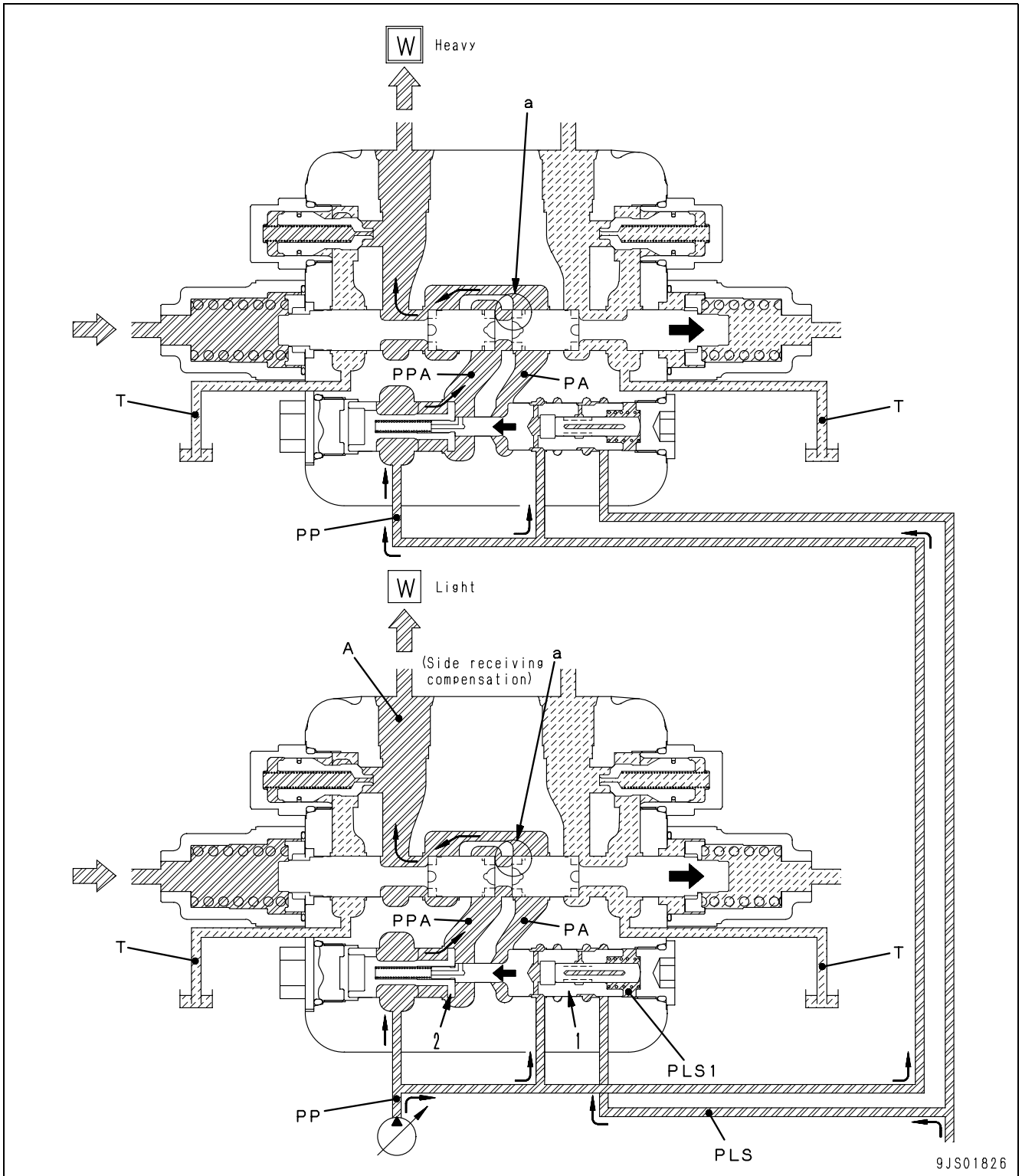
4-spool valve  
(lift + tilt + angle + steering)



9JS01748



Pressure compensation valve

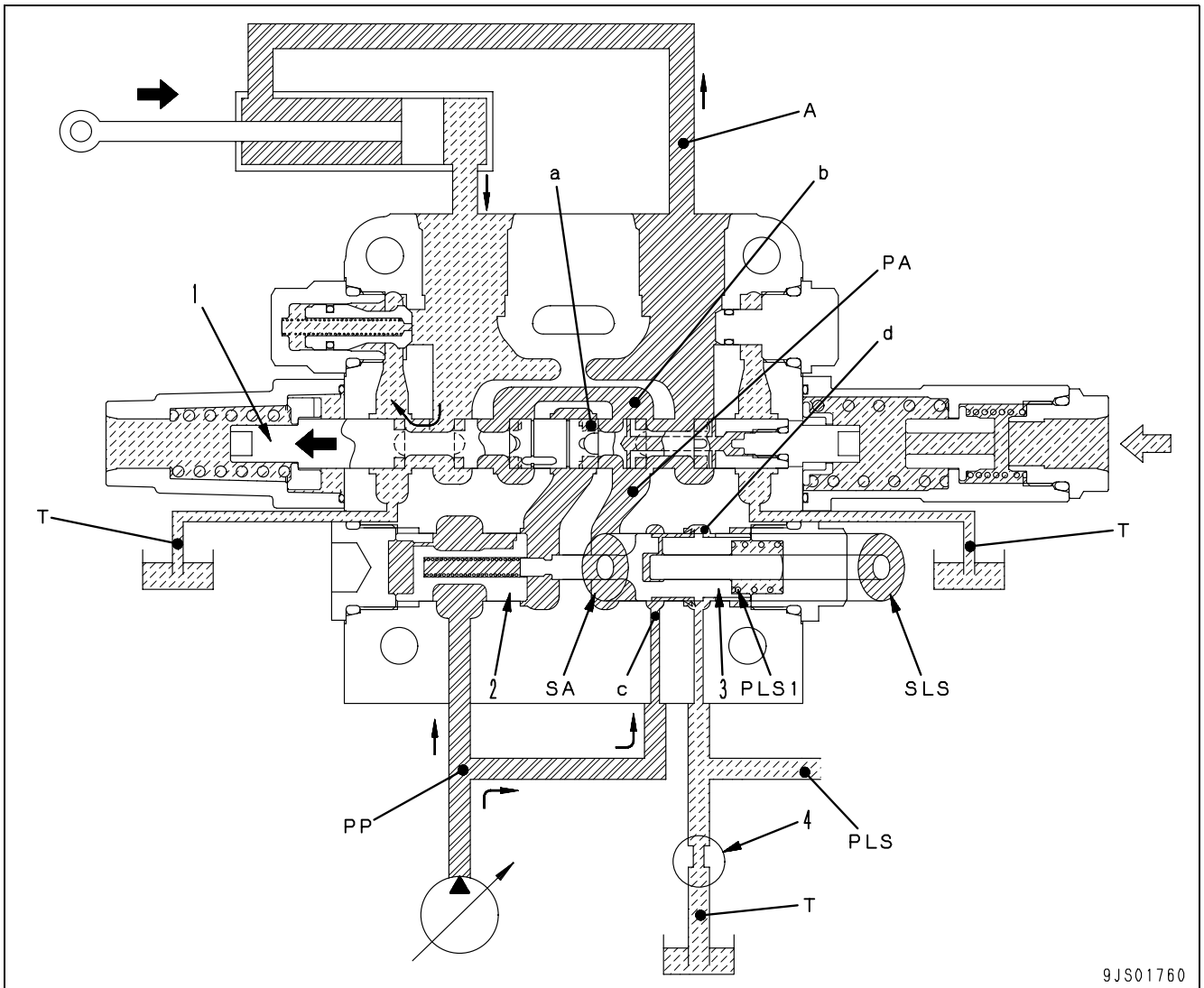


Function

- If the load pressure is lower than the pressure in the other actuator and the flow rate starts increasing during compound operation, the pressure compensation valve compensates the pressure (at this time, the load pressure in the other actuator operated for the compound operation (on the upper side) is higher than the load pressure on this side (lower side)).

## Work equipment valve (lift, tilt, angle, ripper)

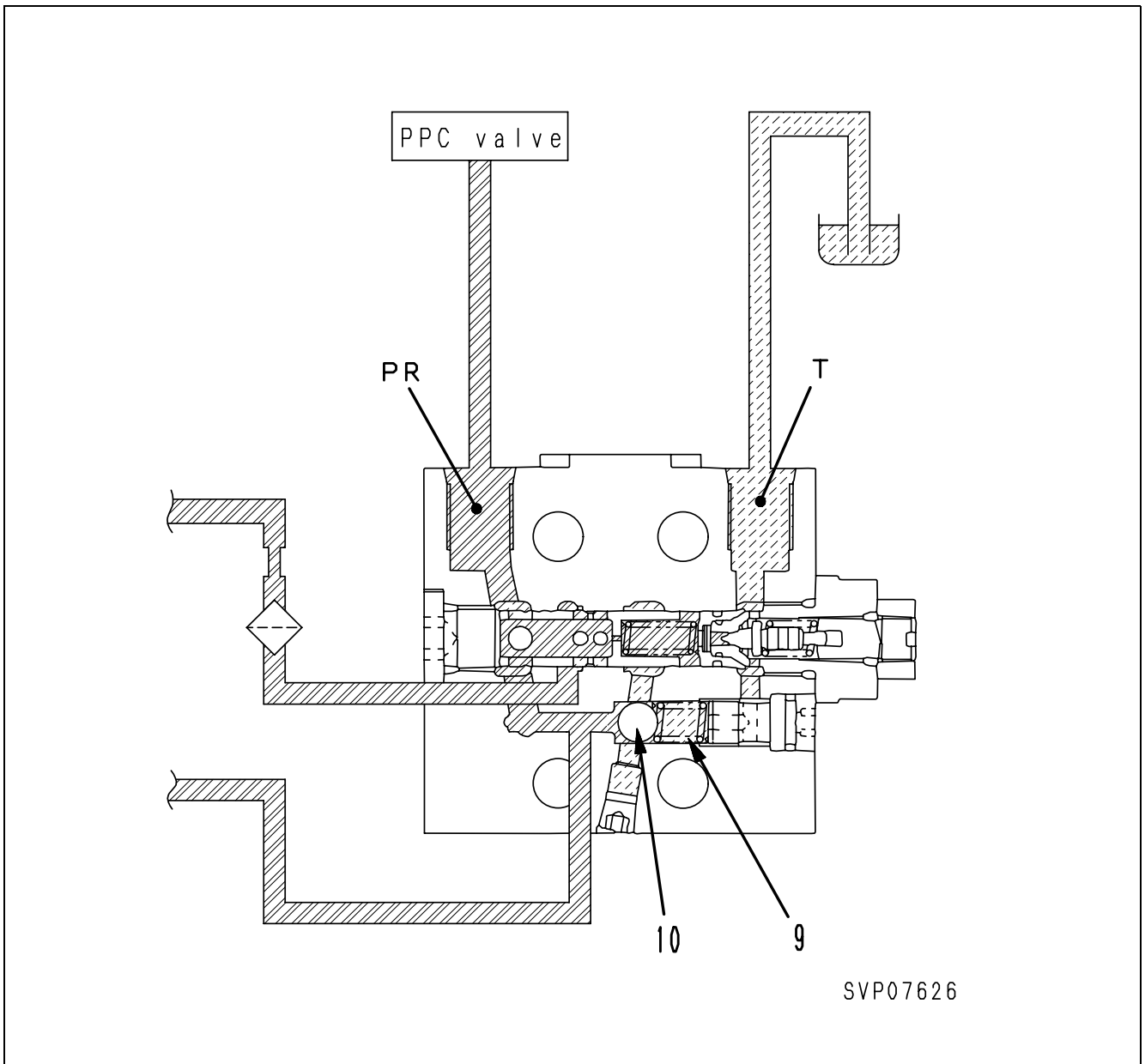
### 1. When blade is "Raised"



#### Operation

- If spool (1) is operated, pump discharge pressure PP flows through flow control valve (2), cut a of the spool, and bridge circuit b to actuator circuit A.
- Since pressure reducing valve (3) also moves to the right at this time, pump discharge pressure PP introduced through passage c is reduced by the pressure loss in cut d and introduced to LS circuit PLS, and then further led to spring chamber PLS1.
- At this time, LS circuit PLS is connected to tank circuit T through LS bypass plug (4).
- Both ends of pressure reducing valve (3) has the same area ( $SA = SLS$ ). Actuator circuit pressure  $PA (= A)$  is applied to the SA side and reduced pump discharge pressure PP is applied to the SLS side.
- Accordingly, pressure reducing valve (3) is balanced at a position where actuator circuit pressure PA and the pressure in spring chamber PLS1 are the same. Pump discharge pressure PP reduced by cut d is introduced as actuator circuit pressure A to LS circuit PLS.

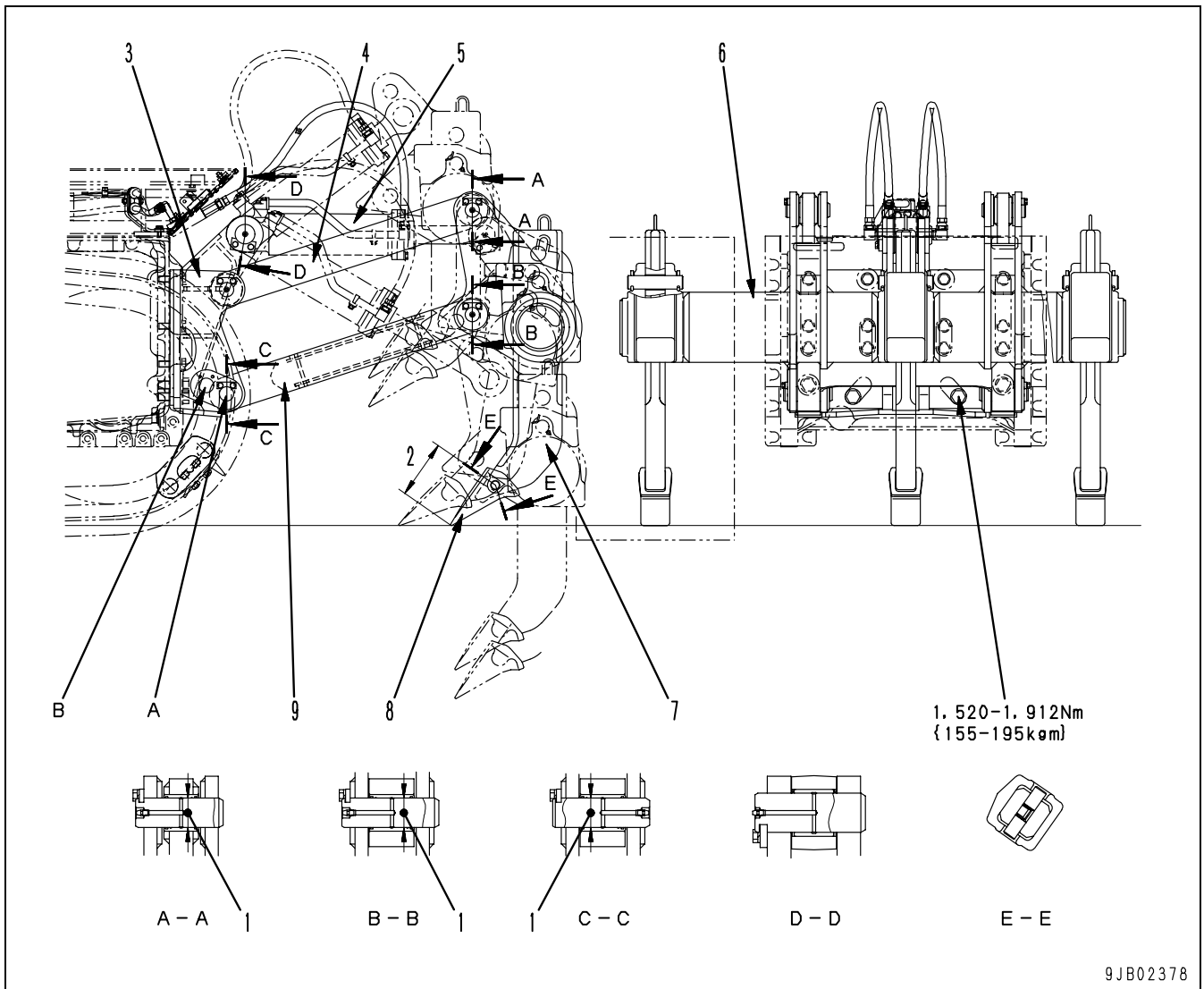
4. At occurrence of abnormal high pressure



- When the PR pressure of the self pressure reducing valve rises abnormally high, the ball (10) will separate from the seat against the spring (9) force to flow the hydraulic oil to the output ports PR → T so as to reduce the PR pressure. Then, the equipment (PPC valve, solenoid valve, etc.), to which the oil pressure is supplied, is protected from the abnormal high pressure.

# Ripper

**D61EX-15**  
(if equipped)



9JB02378

|     |                                   | Unit: mm      |           |              |                    |        |                 |
|-----|-----------------------------------|---------------|-----------|--------------|--------------------|--------|-----------------|
| No. | Check item                        | Criteria      |           |              |                    | Remedy |                 |
|     |                                   | Standard size | Tolerance |              | Standard clearance |        | Clearance limit |
| 1   | Clearance between pin and bushing |               | ø56       | Shaft        |                    | Hole   |                 |
|     |                                   | -0.030        |           | +0.299       |                    |        |                 |
| 2   | Wear of point                     | Standard size |           | Repair limit |                    |        |                 |
|     |                                   | 222           |           | 152          |                    |        |                 |

- 3. Bracket
- 4. Upper link
- 5. Ripper cylinder
- 6. Beam
- 7. Shank
- 8. Point
- 9. Lower link

A: Pin hole A (point digging angle: 55 deg.)  
B: Pin hole B (point digging angle: 45 deg.)

**Outline**

- The transmission and steering controller monitors the coolant, power train oil, and hydraulic oil temperatures and controls the fan speed accordingly to those temperatures.

**Function**

**Fan speed control**

- The transmission and steering controller controls the discharge of the cooling fan to set the fan speed properly accordingly to the information from the coolant, power train oil, and hydraulic oil temperature sensors.
- The transmission and steering controller selects the maximum target fan speed obtained from the coolant, power train oil, and hydraulic oil temperatures and outputs it as the pump control signal to the cooling fan pump.
- The cooling fan pump changes its swash plate angle to controls its oil discharge for the cooling fan motor.

**Selection of fan rotation mode**

- While the starting switch is in the "ON" position and the engine is stopped, the fan speed mode can be selected by operating the fan speed selector switch.

There are the following speed modes.

- 1) Forward rotation mode
- 2) Reverse rotation mode
- 3) Cleaning mode

The transmission and steering controller operates the reverse solenoid valve of the cooling fan motor to change the rotation direction of the fan accordingly to the selected mode.

1) Forward rotation mode

In this mode, the reverse solenoid valve does not operate and the fan rotates forward. The fan speed varies with the temperature sensor signal. This mode is selected normally.

2) Reverse rotation mode

In this mode, the reverse solenoid valve operates and the fan rotates in reverse. The fan can warm the operator's cab as a substitute for a reversible fan. Since the cooling efficiency is low in this mode, the engine overheats easily. Accordingly, this mode should be used only in cold weather.

3) Cleaning mode

In this mode, the fan rotates in reverse at high speed to blow off dirt from the radiator fins, regardless of the temperature sensor signals. If this mode is used periodically, the cleaning interval of the radiator fins can be expanded.

**Interlock for changing rotation mode**

- If the rotation direction of the fan is changed while the fan is rotating, the fan drive circuit is broken. To prevent this, the fan rotation selector switch signal is ignored while the engine is running. In this case, the fan operation pilot lamp on the monitor panel flashes.

**Processing by monitor panel (common to all specifications)**

**Display of monitor panel**

| Contents and conditions of processing   | Method     | Flow of signals   |
|---|------------|---|
| 1. Display of travel direction and gear speed <ul style="list-style-type: none"> <li>• Signals (F1, R3, etc.) are sent to the monitor panel accordingly to the information of the transmission and steering controller.</li> </ul>  | CAN signal | Each sensor/solenoid<br>↓<br>Controller<br>↓<br>Monitor panel |
| 2. Display of gauges of engine speed, coolant temperature, hydraulic oil temperature, power train oil temperature, and fuel level <ul style="list-style-type: none"> <li>• Sensor signals are processed, replaced with the gauge No., and sent to the monitor panel by the controller.</li> </ul>   | CAN signal |   |
| 3. Display of troubles <ul style="list-style-type: none"> <li>• If the machine has trouble, the signal of the corresponding error code is sent to the monitor panel.</li> <li>• The command to sound the caution buzzer or flash the caution lamp is sent accordingly to the contents of the trouble.                             <ol style="list-style-type: none"> <li>1) When normal<br/>Action code is displayed</li> <li>2) In failure history display mode<br/>Error code (6-digit code) and                                     <ul style="list-style-type: none"> <li>• Elapsed time after first occurrence</li> <li>• Elapsed time after last occurrence</li> <li>• Number of occurrences etc. are displayed.</li> </ul> </li> </ol> </li> </ul> | CAN signal |   |

**Monitoring display**

| Contents and conditions of processing   | Method     | Flow of signals                                      |
|---|------------|--|
| 1. Display of communicating condition of each sensor, each solenoid, and CAN signal <ul style="list-style-type: none"> <li>• Item No. and condition of each device are sent as signals to the monitor panel.</li> </ul> | CAN signal | Each sensor<br>↓<br>Controller<br>↓<br>Monitor panel |
| 2. Selection of each item with information switch, buzzer cancel switch, and Up/Down switch of steering/directional/gear shift lever<br>(when using the mode for servicing, turn the service switch "ON")               | CAN signal |  |

★ For details of the operation method, etc., see Testing and adjusting, Special functions of monitor panel (EMMS).

**Other items**

| Contents and conditions of processing   | Method     | Flow of signals                                      |
|---|------------|--|
| 1. Filter and oil maintenance mode<br>2. Pm clinic auxiliary mode<br>3. Error code display mode<br>4. Adjustment mode (user)<br>5. Maintenance interval change mode<br>6. Electrical system error code display mode<br>7. Mechanical system error code display mode<br>8. Adjustment mode (service)<br>9. Load saving display mode<br>10. Real-time monitoring mode<br>11. Dual display monitoring mode | CAN signal | Each sensor<br>↓<br>Controller<br>↓<br>Monitor panel |

★ For details of the operation method, etc., see Testing and adjusting, Special functions of monitor panel (EMMS).

# Bulldozer

## **D61EX-15**

## **D61PX-15**

**Machine Model**

**Serial Number**

D61EX-15

B40001 and up

D61PX-15

B40001 and up

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## **Standard value table**

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|  |   |
|--|---|
| Standard value table for engine.....   | 2 |
| Standard value table for chassis ..... | 3 |

| Machine model         |                      |   |   | D61PX-15      |                                     |                     |          |
|-----------------------|----------------------|---|---|---------------|-------------------------------------|---------------------|----------|
| Category              | Item                 | Measurement conditions  |   | Unit          | Standard value for new machine      | Service limit value |          |
| Work equipment        | Work equipment speed | Blade lift  | ★See figure A<br>• Hydraulic oil temperature: 45 - 55°C<br>• Apply no load to blade.<br>• Between ground level and rising end of blade<br>• Engine high idling  |               | Raise                               | 2.5±0.2             | 3.0      |
|                       |                      |   |   |               | Lower                               | 1.8±0.2             | 2.1      |
|                       |                      | Blade tilt  | ★See figure B<br>• Hydraulic oil temperature: 45 - 55°C<br>• Apply no load to blade.<br>• Between left tilt end and right tilt end<br>• Engine high idling  | Left tilt     | Power angle and Power tiltdozer     | 2.5±0.2             | 3.0      |
|                       |                      |   |   | Right tilt    | Straight tiltdozer and semi-U dozer | 2.5±0.2             | 3.0      |
|                       |                      | Blade angle   | ★See figure D<br>• Hydraulic oil temperature: 45 - 55°C<br>• Blade edge 300mm above the ground<br>• Body level on the flat ground<br>• Left angle end -Right angle end<br>• Engine high idling                    | Angle (L.H.)  |                                     | 3.5±0.3             | 4.4      |
|                       | Angle (R.H.)         |   |   | 3.5±0.3       | 4.4                                 |                     |          |
|                       | Time lag             | Blade   | • Hydraulic oil temperature: 45 - 55°C<br>• Set lever to full stroke<br>• Lower blade from max. rising position and measure time after blade comes in contact with ground until idler is lifted.<br>• High idling |               |                                     | Max. 1.0            | Max. 1.5 |
| Work equipment        | Hydraulic drift      | Hydraulic drift of lifted blade   |   | mm/<br>15 min | Max. 100                            | Max. 100            |          |
|                       |                      | Hydraulic drift of tilted blade   | ★See figure E<br>• Hydraulic oil temperature: 45 - 55°C<br>• Engine stopped<br>• Height of the lower edge of blade <b>h</b><br>hydraulic drift  |               |                                     |                     |          |
|                       |                      |   | Left tilt   |               |                                     |                     | Max. 200 |
|                       | Right tilt           | Max. 200  | Max. 200  |               |                                     |                     |          |
| Leakage from cylinder | Blade tilt cylinder  | • Engine high idling<br>• Hydraulic oil temperature: 45 - 55°C<br>• Relieve cylinder and measure leakage for 1 minute.                              |   | cc/min        | 4                                   | 16                  |          |
|                       | Blade lift cylinder  |   |   |               | 4                                   | 16                  |          |
| HSS motor             | Leakage              | • Hydraulic oil temperature: 45 - 55°C<br>• Steering lever: Full<br>• Transmission lever: Neutral<br>• Brake pedal: Pressed<br>• Engine high idling |   | ℓ/min         | Max. 15                             | 30                  |          |

### Measuring intake air pressure (boost pressure)

★ Measuring instruments for intake air pressure (boost pressure)

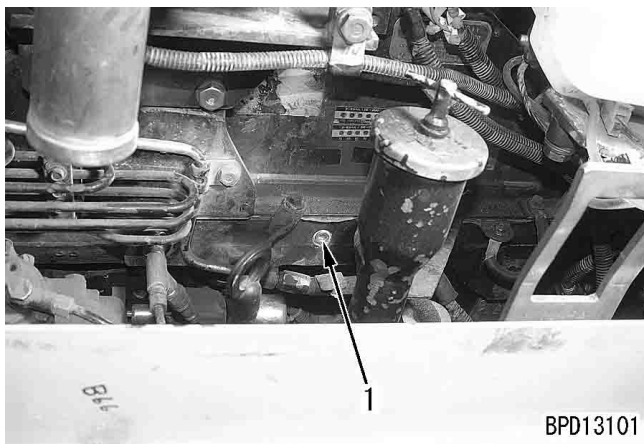
| Symbol | Part No. | Part Name                     |
|--------|----------|-------------------------------|
| A      | 1        | 799-101-5002 Hydraulic tester |
|        | 2        | 799-201-2202 Boost gauge kit  |

**⚠ When installing or removing the measuring instrument, take care not to touch a hot part of the engine.**

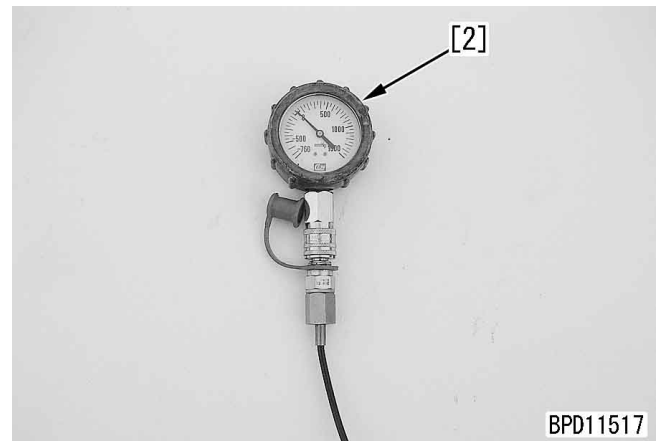
★ Measure the intake air pressure (boost pressure) under the following conditions.

- Engine coolant temperature: Within operating range
- Power train oil temperature: Within operating range
- Hydraulic oil temperature: Within operating range

1. Open the left side cover of the engine.
2. Remove air intake connector boost pressure pick-up plug (PT 1/4) (1).



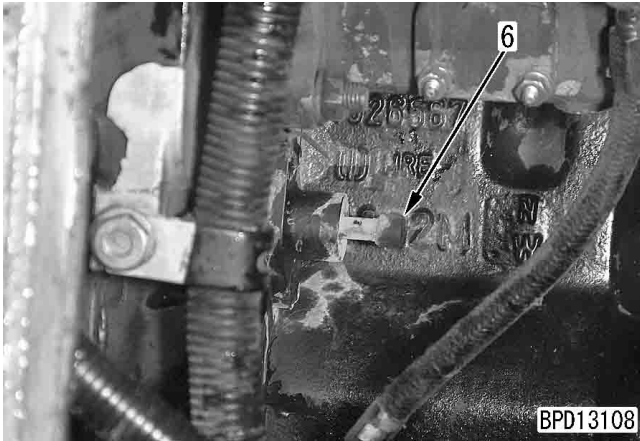
3. Install nipple (R 1/4) of hydraulic tester **A1**, and connect gauge [2] of boost gauge kit **A2** to the tester.
4. Run the engine at a medium or higher speed and drain the oil from the hose.
  - ★ Insert the joint of the gauge and hose half way and open the self-seal on the hose side repeatedly, and the oil will be drained.
  - ★ If Pm kit (A) is available, the air-bleeding coupling (790-261-1130) in the kit may be used.
  - ★ If any oil is left in the hose, the gauge does not work. Accordingly, be sure to drain the oil.
5. Measure the intake air pressure (boost pressure) when the torque converter is stalled with the engine in high idling.
  - ★ For the procedure for stalling the torque converter, see "Measuring engine speed".
  - ★ Normally, the intake air pressure (boost pressure) should be measured while the engine is operated at the rated output. In the field, however, an approximate value can be obtained by stalling the torque converter.



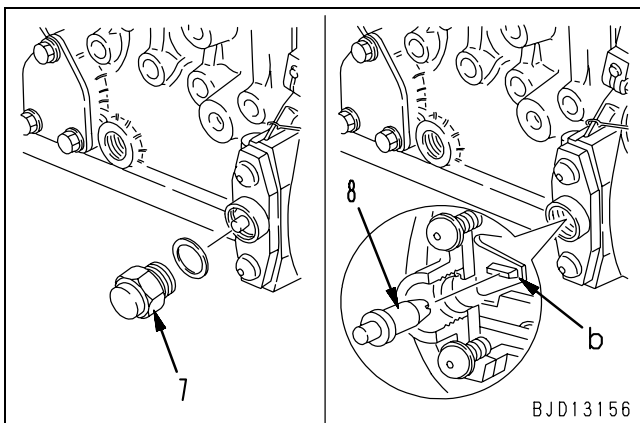
6. After finishing measurement, remove the measuring instruments and return the removed parts.

**Adjusting**

- ★ If the fuel injection timing is not correct, adjust it according to the following procedure.
1. Check that the fuel injection timing of the drive gear is fixed with timing pin (6).
    - ★ If the timing pin is returned after testing, insert it again according to the testing procedure.



2. Remove the fuel injection pump.
  - ★ See DISASSEMBLY AND ASSEMBLY, Removal and installation of fuel injection pump assembly.
3. Turn over and insert timing pin (8) of the fuel injection pump, and turn the shaft until the cut of the pin fits to a projection (b) in the pump.
  - ★ After adjusting the timing pin of the fuel injection pump, tighten and fix plug (7).



4. Install the fuel injection pump.
  - ★ See DISASSEMBLY AND ASSEMBLY, Removal and installation of fuel injection pump assembly.
5. After finishing adjustment, remove the adjusting instruments and return the removed parts.
  - ⚠ **Return timing pin (6) of the drive gear and timing pin (8) of the fuel injection pump without fail.**

- 1) Measuring transmission forward clutch pressure
  - 1] Remove oil pressure pickup plug (6) and connect oil pressure gauge [1] of hydraulic tester **J1** to the plug hole.
    - ★ Use an oil pressure gauge of 5.9 MPa {60 kg/cm<sup>2</sup>}.
  - 2] Start the engine and set the parking brake lever in the FREE position.
  - 3] While pressing the brake pedal, set the PCCS lever in the Forward and the 3rd gear position.
  - 4] Measure the oil pressure when the engine is running at high idling.
    - ⚠ **To stall the torque converter, hold the brake pedal pressed securely.**
  - 5] After finishing measurement, remove the measuring instruments and return the removed parts.
- 2) Measuring transmission reverse clutch pressure
  - 1] Remove oil pressure pickup plug (7) and connect oil pressure gauge [1] of hydraulic tester **J1** to the plug hole.
    - ★ Use an oil pressure gauge of 5.9 MPa {60 kg/cm<sup>2</sup>}.
  - 2] Start the engine and set the parking brake lever in the Free position.
  - 3] While pressing the brake pedal, set the PCCS lever in the Reverse and the 3rd gear position.
  - 4] Measure the oil pressure when the engine is running at high idling.
    - ⚠ **To stall the torque converter, hold the brake pedal pressed securely.**
  - 5] After finishing measurement, remove the measuring instruments and return the removed parts.
- 3) Measuring transmission 1st clutch pressure
  - 1] Remove oil pressure pickup plug (8) and connect oil pressure gauge [1] of hydraulic tester **J1** to the plug hole.
    - ★ Use an oil pressure gauge of 5.9 MPa {60 kg/cm<sup>2</sup>}.
  - 2] Start the engine and set the parking brake lever in the Free position.
  - 3] While pressing the brake pedal, set the PCCS lever in the Forward and the 1st gear position.
  - 4] Measure the oil pressure while the engine is running at low idling.
    - ⚠ **To stall the torque converter, hold the brake pedal pressed securely.**
    - ⚠ **Do not raise the engine speed to high idling during the measurement.**
- 5] After finishing measurement, remove the measuring instruments and return the removed parts.
- 4) Measuring transmission 2nd clutch pressure
  - 1] Remove oil pressure pickup plug (9) and connect oil pressure gauge [1] of hydraulic tester **J1** to the plug hole.
    - ★ Use an oil pressure gauge of 5.9 MPa {60 kg/cm<sup>2</sup>}.
  - 2] Start the engine and set the parking brake lever in the Free position.
  - 3] While pressing the brake pedal, set the PCCS lever in the Reverse and the 2nd gear position.
  - 4] Measure the oil pressure when the engine is running at low idling.
    - ⚠ **To stall the torque converter, hold the brake pedal pressed securely.**
    - ⚠ **Do not raise the engine speed to high idling during the measurement.**
  - 5] After finishing measurement, remove the measuring instruments and return the removed parts.
- 5) Measuring transmission 3rd clutch oil pressure
  - 1] Remove oil pressure pickup plug (10) and connect oil pressure gauge [1] of hydraulic tester **J1** to the plug hole.
    - ★ Use an oil pressure gauge of 5.9 MPa {60 kg/cm<sup>2</sup>}.
  - 2] Start the engine and set the parking brake lever in the Free position.
  - 3] While pressing the brake pedal, set the PCCS lever in the Forward and the 3rd gear position.
  - 4] Measure the oil pressure when the engine is running at low idling.
    - ⚠ **To stall the torque converter, hold the brake pedal pressed securely.**
    - ⚠ **Do not raise the engine speed to high idling during the measurement.**
  - 5] After finishing measurement, remove the measuring instruments and return the removed parts.

## Adjusting idler clearance

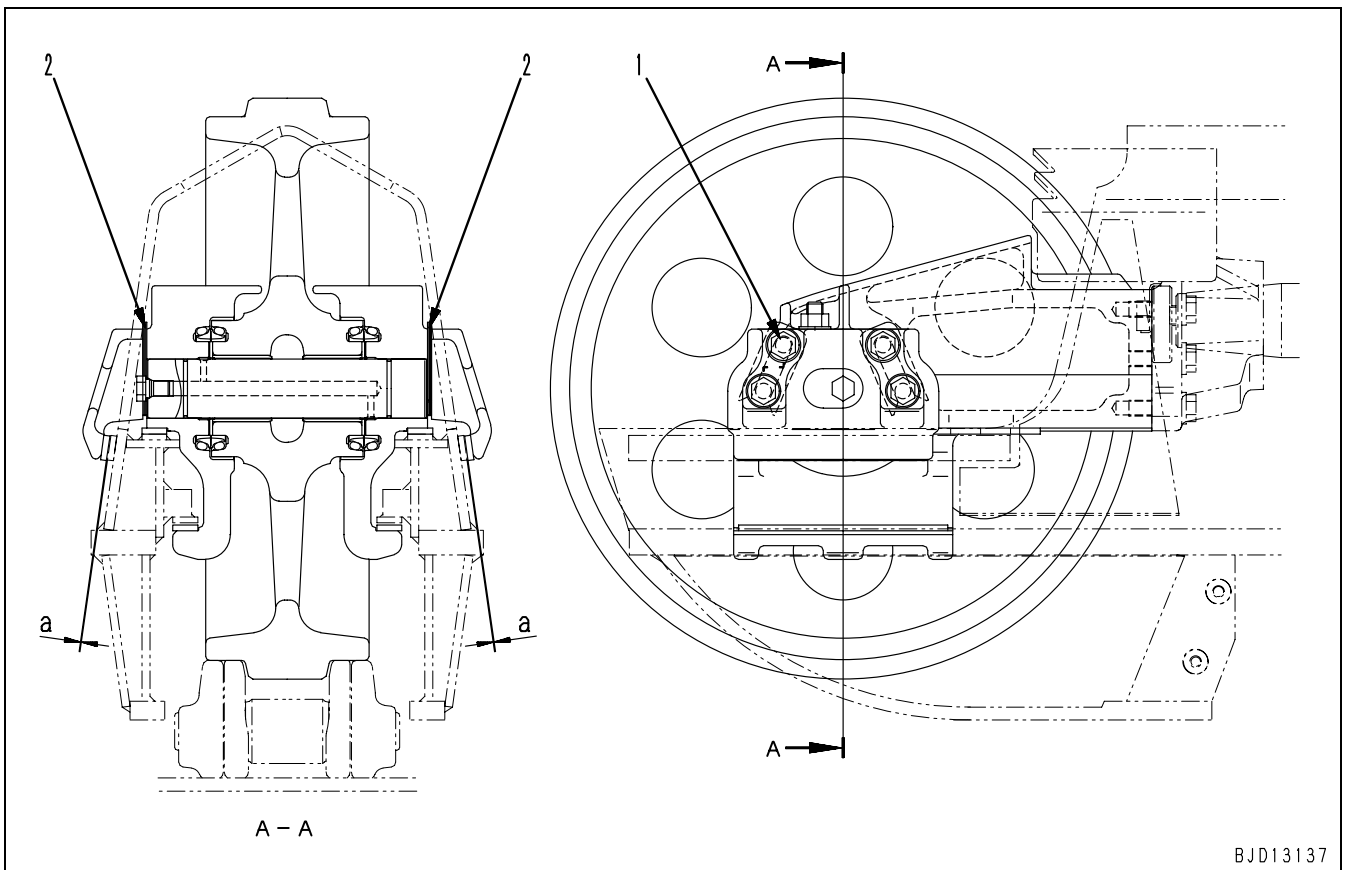
- ★ If the lateral guide plates of the idler are so worn that the idler runs out or slants, adjust the idler clearance according to the following procedure.

### Adjustment procedure

- 1) Drive the machine 1 - 2 m on the flat ground, then measure clearance (a) between the track frame and guide plate (at 4 places on both sides, inside, and outside).
- 2) If clearance (a) is larger than 4 mm, adjust the clearance by loosening bolt (1) and reducing shim (2).
  - Standard clearance (a) on each side:  
0.5 - 1.0 mm
  - Shim thickness: 1.0 mm

## Inspecting wear of sprocket

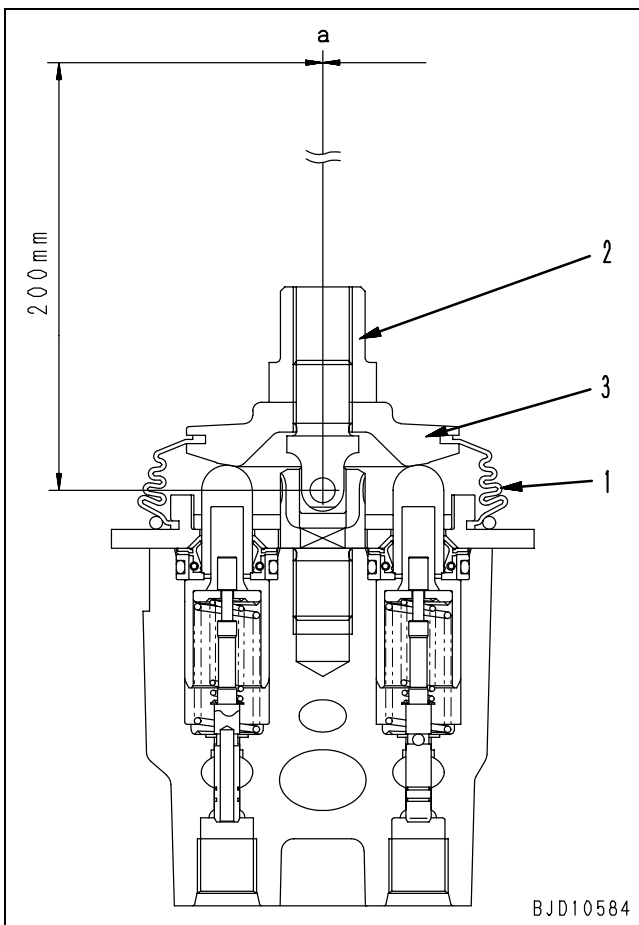
- ★ Use "Full-scale drawing of sprocket teeth profile" as the gauge to measure the worn sprocket. See "Sprocket" in Structure and function, Maintenance Standard Section.
- ★ Make a copy of the "Full-scale drawing of sprocket teeth profile" on a transparent paper or other sheet and apply it directly to the sprocket to see if the sprocket is appropriate for use.



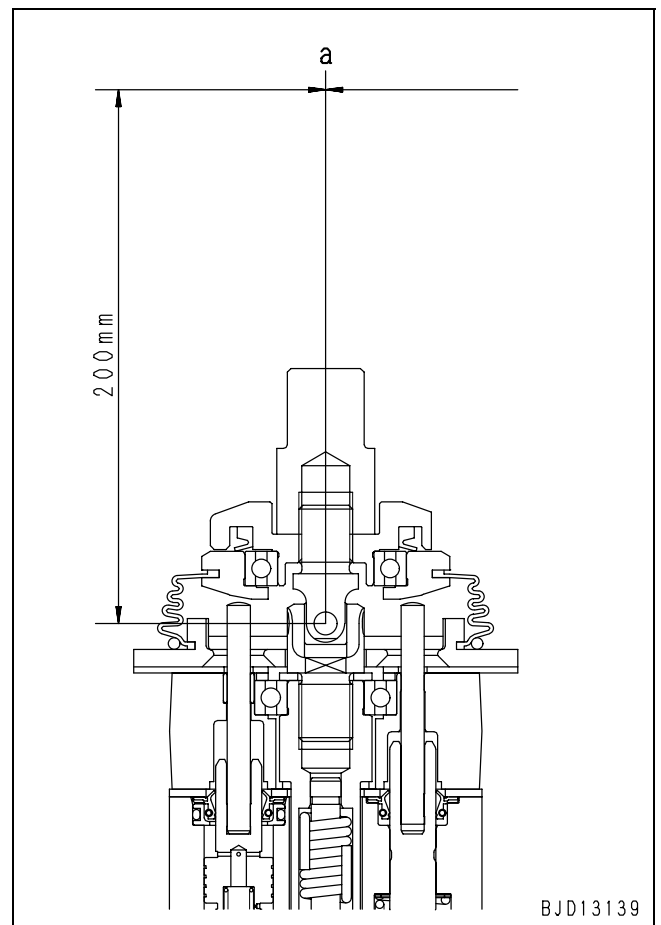
## Adjusting play of work equipment PPC valve

- ★ The ripper valve is not adjustable.
  - ★ If the play of the blade lever end is excessive, adjust it on the PPC valve side according to the following procedure.
- Standard play (a):  
0.5 - 3.0 mm at 200 mm from revolution center of lever (in both longitudinal and lateral directions)
1. Remove boots (1).
  2. Loosen locknut (2), and turn disc (3) to adjust the play.
    - ★ Do not move the piston at this time.
  3. Fix the position of disc (3) and tighten locknut (2).
    - 🔧 Locknut: **98 - 127 Nm {10 - 13 kgm}**
  4. Install boots (1).

### For straight-tiltdozer



### For power angle-tiltdozer and power tiltdozer



- 2] Adjusting height of latch and striker
  - a. After tightening temporarily the mounting bolt of striker (4), open and close the door a few times, and align the centers of latch (3) and striker (4).
  - b. Check the engagement of latch (3) and striker (4).
  - c. Tighten securely the mounting bolt of striker (4).
  - d. Open and close the door, and check that the door lock can be released smoothly. If the door lock cannot be released smoothly (e.g. knob requires greater force to turn), repeat adjustment from the beginning.

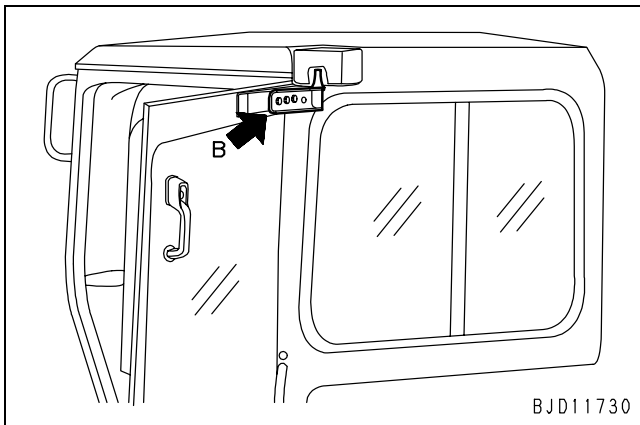
★ Force to turn knob:  
 $49 \pm 19.6 \text{ N} \{5 \pm 2 \text{ kg}\}$

- 3] Apply grease (G2-LI) to latch (3).
  - ★ If the grease in latch (3) is depleted, the knob requires greater force. Accordingly, apply the grease sufficiently.

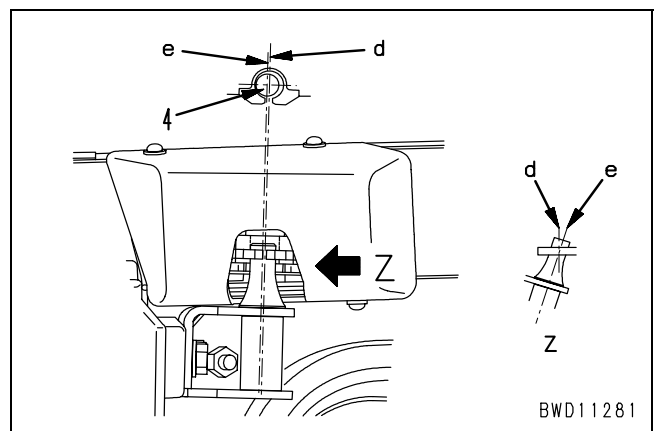
**4. Testing open lock**

Lock the door open and check the relationship between the operator's cab and door. If there is any fault, repair it.

- 1) Check of condition
  - 1] Check the relation between open lock latch (3) and striker (4) from direction B.

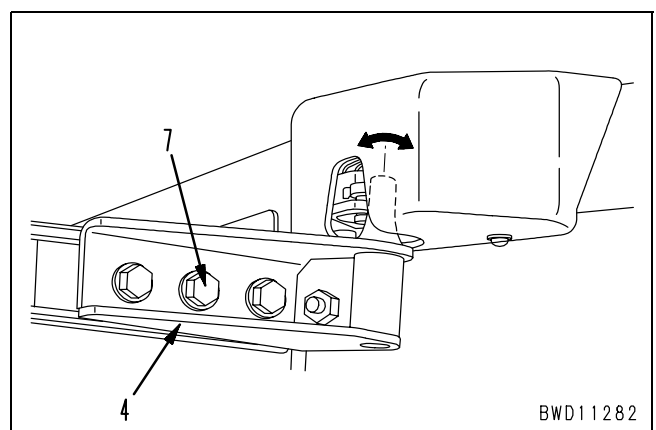


- ★ Move the door in the opening direction to check the engagement of the latch and striker.
- 2] Check the installed height of stopper rubber. (Check 2 points on each side.)
  - a. Shake the door in open lock to and fro, and check if any play is found.
  - b. Check if the operation of the unlock lever requires greater force.
  - c. Check if striker (4) slants against center (d) of the latch.
  - d. Check if the center (e) of latch and striker is unaligned.
- Normal: Difference at (e) is 0.5 mm or less.



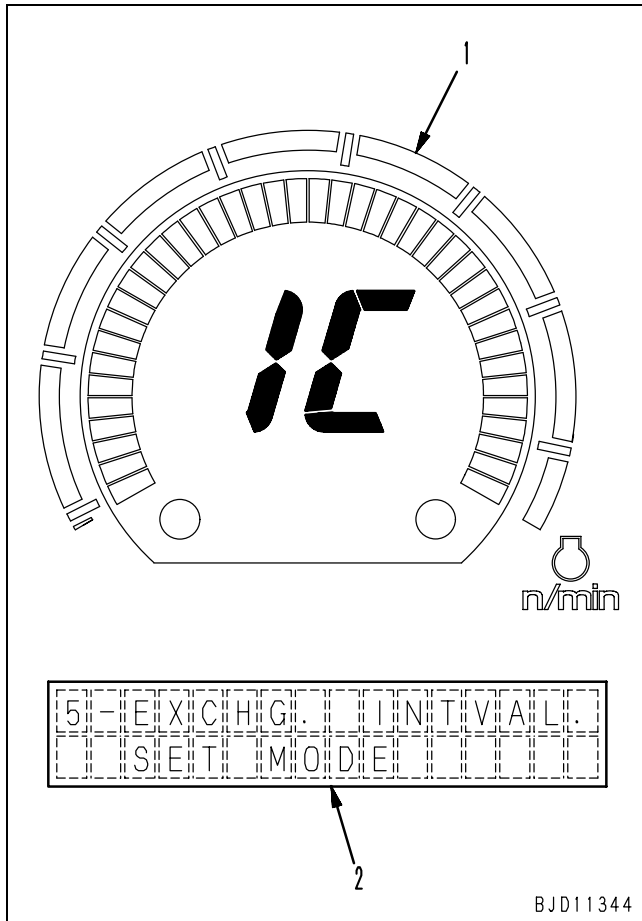
**2) Adjusting**

- 1] Adjusting latch and striker
  - Loosen mounting bolt (7) of striker (4), adjust striker (4) upright, and tighten the bolt.



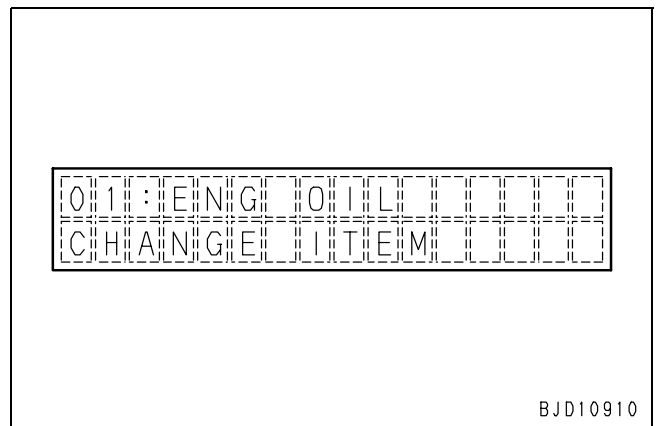
**5. Maintenance interval change mode (5-EXCHG. INTVAL. SET MODE)**

In this mode, you can check and set the maintenance interval times of various filters and oils which are the bases of the maintenance display function in the operator mode.



- 1) Selecting and executing mode
  - 1] Select "Maintenance interval change mode" on the mode selection screen.
    - ★ If the mode is selected, code [1C] is displayed on gear speed section (1) and the title is displayed on multi-information section (2).
  - 2] Display the maintenance item selection screen by operating buzzer cancel switch (4).
    - [◇] : Execute mode.

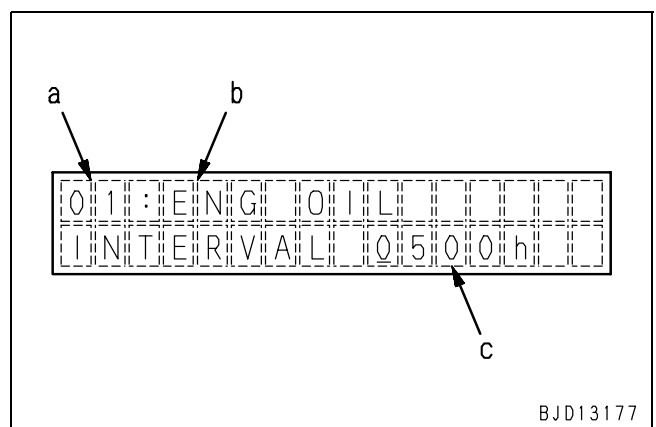
- 2) Selecting and displaying maintenance item
  - 1] Operate information switch (5) on the maintenance item selection screen to select a maintenance item.
    - [>] : Next code
    - [<] : Previous code
  - 2] Display the maintenance item selection screen by operating buzzer cancel switch (4).
    - [◇] : Execute item.



- 3) Contents of information screen
 

The following items are displayed on the information screen.

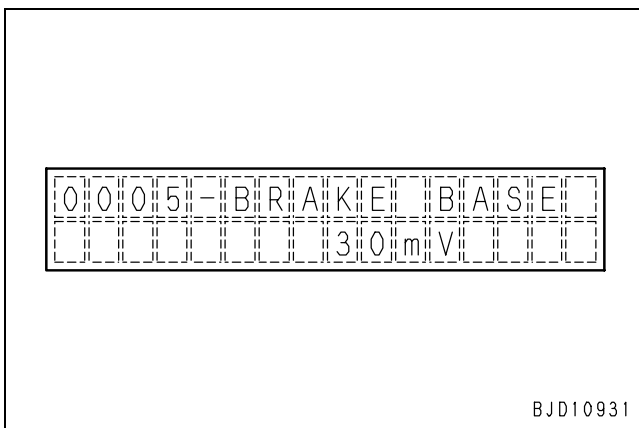
  - (a) : Code
  - (b) : Maintenance item
  - (c) : Replacement interval time (Set time)
  - ★ The items shown below are examples.
  - ★ If the replacement interval does not need to be changed, finish the operation on this screen.
  - ★ If the replacement interval needs to be changed, go to step 4).



- Adjustment method:
  - ★ Since this code is reset when "Steering and transmission controller specification set" is executed, adjust it after that.
  - 1) Select the machine specification code by operating shift-up switch (6).
  - 2) Set buzzer cancel switch (4) in the [◇] position and check that the caution buzzer sounds.
  - ⚠ If the machine specification is different from the setting in the controller, the machine may move abnormally or an error may occur. Accordingly, be sure to match the setting to the machine specification.
  - ★ Even if this code is turned off, the setting is effective.

**[0005]: Brake potentiometer zero point adjustment**

- This code is used to adjust the zero point of the potentiometer of the brake pedal.
- The deviation from the standard is displayed by voltage on the lower line (Display range: -2500 - 2500).



BJD10931

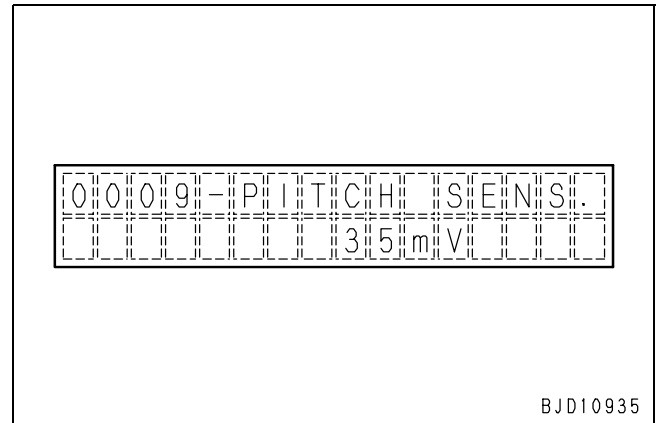
- Adjustment method:
  - With the brake pedal released, set buzzer cancel switch (4) in the [◇] position and check that the caution buzzer sounds.
  - ★ The display of the lower line does not change after adjustment.
  - ★ Even if this code is turned off, the setting is effective.
  - ★ This code is not for adjustment of the braking performance.

**[0007]: Engine decelerator cut mode**

- ★ Since the auto-deceleration function is not available on this machine, the high idling speed does not change before and after this code is displayed.

**[0009]: Pitch angle sensor initial set**

- This code is used to adjust the zero point and installation error of the pitch angle sensor.
- The deviation from the neutral position to the standard is displayed by voltage on the lower line (Display range: -2500 - 2500).

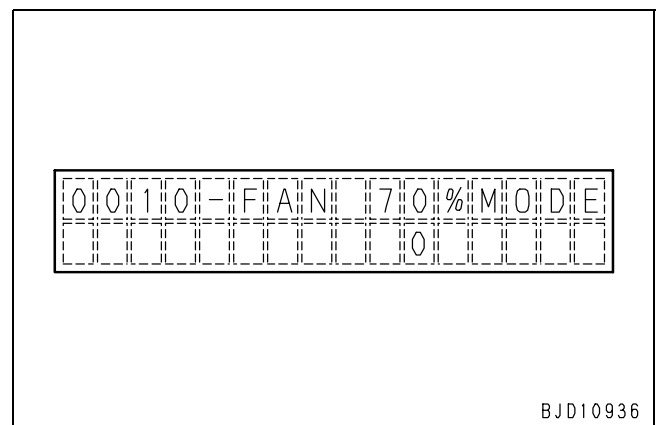


BJD10935

- Adjustment method:
  - Stop the machine on level ground, then set buzzer cancel switch (4) in the [◇] position and check that the caution buzzer sounds.
  - ★ The display of the lower line does not change after adjustment.
  - ★ Even if this code is turned off, the setting is effective.

**[0010]: Fan 70% speed mode**

- This code forcedly sets the rpm of cooling fan at approximately 70% of the maximum speed.
- The lower part displays data for adjustment.

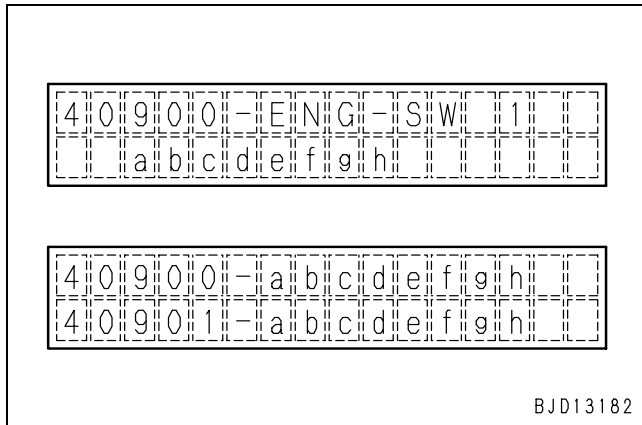


BJD10936

- How to use:
  - The function is enabled with this code displayed to control the rpm of cooling fan to approximately 70% of the maximum speed.
  - ★ Ending this code disables the function.

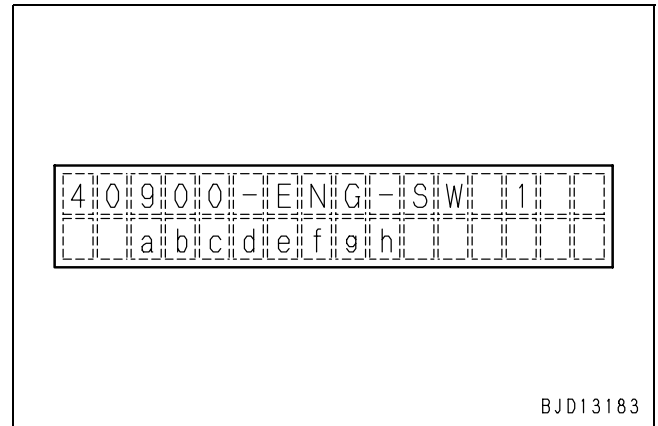
**Examples of display of bit information**

- ★ The display position of the bit information in the "Real-time monitoring mode (Display of only 1 item)" is different from that in the "Dual display monitoring mode (Simultaneous display of 2 items)".
- ★ The bit information is displayed by [ \_ ] for OFF and [o] for ON in the places (a) - (h).
- ★ The state of each item shown below is the condition for turning on the bit.



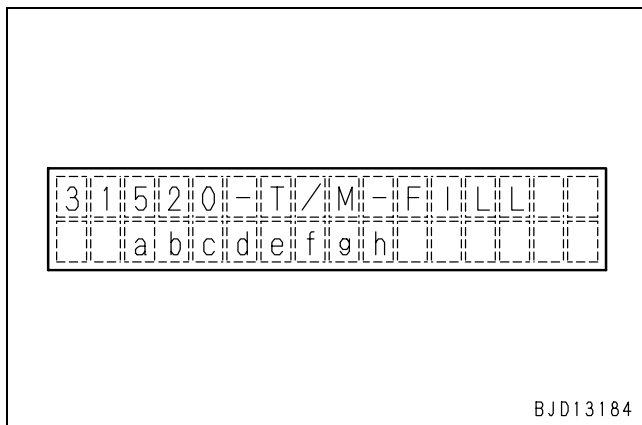
**[40900]: Engine-related controller input signal 1**

- (a) : Starting switch signal C : Input
- (b) : (Unused)
- (c) : (Unused)
- (d) : Engine oil pressure switch : ON
- (e) : (Unused)
- (f) : (Unused)
- (g) : (Unused)
- (h) : (Unused)



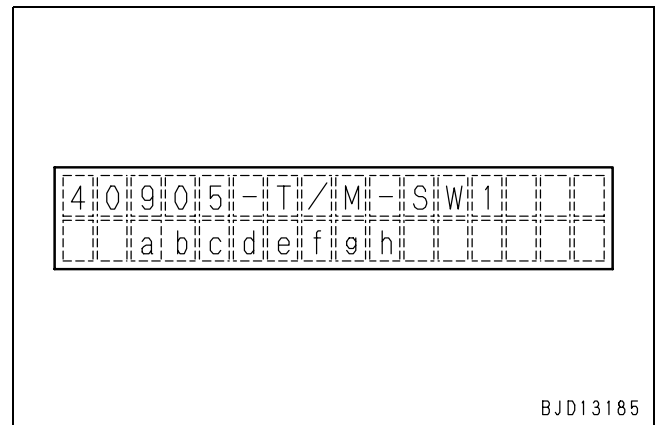
**[31520]: Transmission-related fill switch input state**

- (a) : Forward clutch fill switch :ON,
- (b) : Reverse clutch fill switch : ON,
- (c) : 1st clutch fill switch : ON,
- (d) : 2nd clutch fill switch : ON,
- (e) : 3rd clutch fill switch : ON,
- (f) : (Unused)
- (g) : (Unused)
- (h) : (Unused)

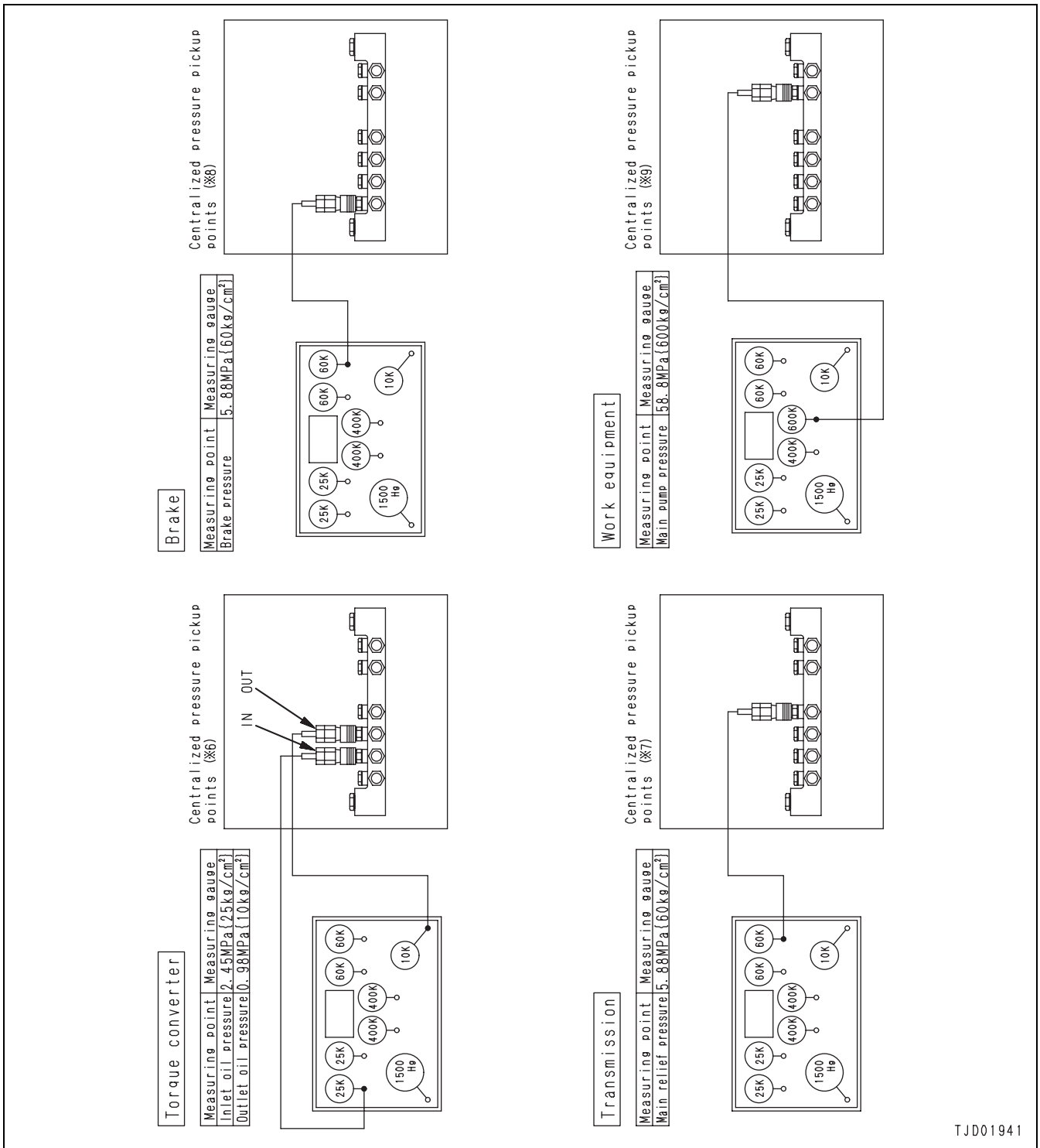


**[40905]: Transmission-related controller input signal 1**

- (a) : Shift-up switch : OFF
- (b) : Shift-up switch : ON
- (c) : Shift-down switch : OFF
- (d) : Shift-down switch : ON
- (e) : (Unused)
- (f) : (Unused)
- (g) : (Unused)
- (h) : (Unused)



Pm-clinic measuring points (2/2)



Reference page for measurement procedure

- \*6. Items related to torque converter : Pages D0100-25
- \*7. Items related to transmission : Pages D0100-26
- \*8. Items related to steering brake : Pages D0100-24
- \*9. Items related work equipment and HSS : Pages D0100-39

# Bulldozer

## D61EX-15

## D61PX-15

| <b>Machine Model</b> | <b>Serial Number</b> |
|----------------------|----------------------|
| D61EX-15             | B40001 and up        |
| D61PX-15             | B40001 and up        |

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# Troubleshooting

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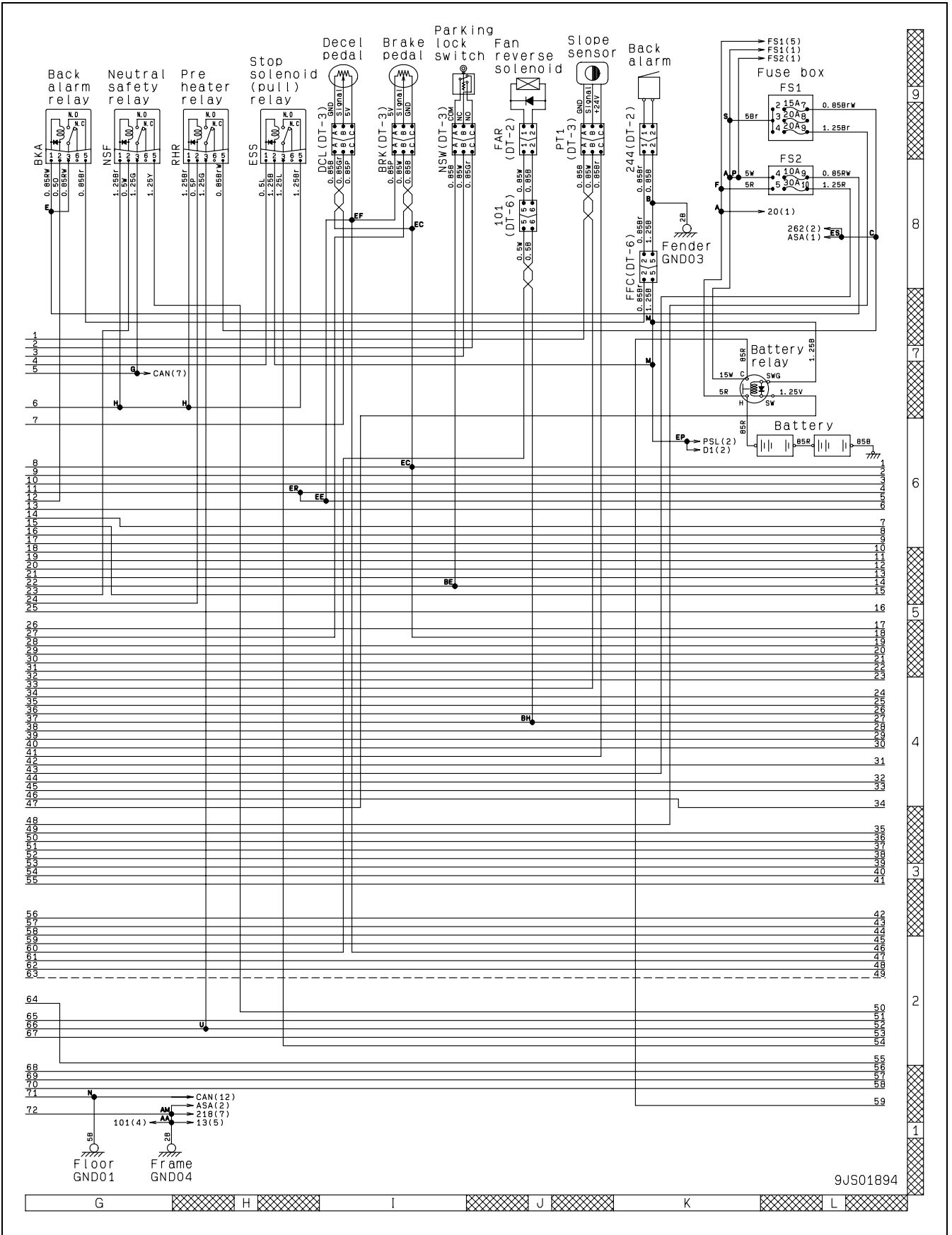
|   |    |
|---|----|
| Preface .....   | 2  |
| Points to remember when troubleshooting .....                                   | 2  |
| Troubleshooting procedure .....   | 3  |
| Points to remember when carrying out maintenance .....                          | 4  |
| Checks before troubleshooting .....   | 11 |
| Classification and procedures of troubleshooting .....                          | 12 |
| Connector arrangement drawing and electric circuit diagram of each system ..... | 15 |

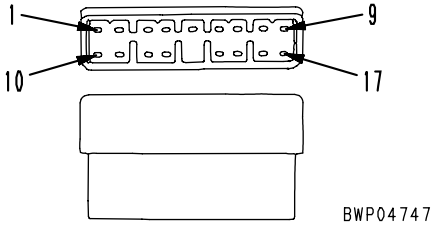
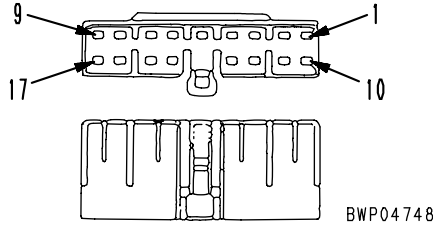
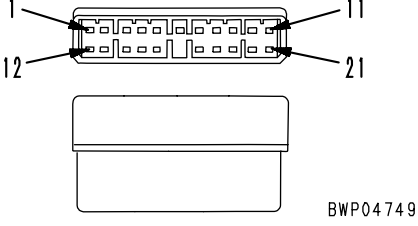
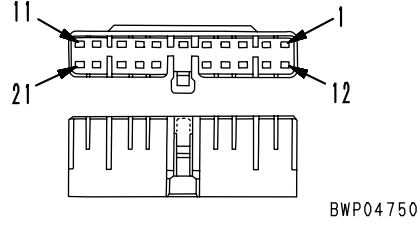
## Checks before troubleshooting

|                                    | Item  | Judgment value   | Action                           |
|------------------------------------|---|--|----------------------------------|
| Lubricating<br>oil, coolant        | 1. Check fuel level, type of fuel   | -  | Add oil                          |
|                                    | 2. Check for impurities in fuel   | -  | Clean, drain                     |
|                                    | 3. Check engine oil pan level, type of oil  | -  | Add oil                          |
|                                    | 4. Check coolant level  | -  | Add coolant                      |
|                                    | 5. Check air cleaner for clogging   | -  | Clean or replace                 |
|                                    | 6. Check hydraulic oil level, type of oil   | -  | Add oil                          |
|                                    | 7. Check damper case oil level.   | -  | Add oil                          |
|                                    | 8. Check hydraulic oil filter for clogging  | -  | Replace                          |
| Electrical<br>equipment            | 1. Check for looseness, corrosion of battery terminal, wiring   | -  | Tighten or replace               |
|                                    | 2. Check for looseness, corrosion of alternator terminal, wiring  | -  | Tighten or replace               |
|                                    | 3. Check for looseness, corrosion of starting motor terminal, wiring  | -  | Tighten or replace               |
| Hydraulic, mechanical<br>equipment | 1. Check for abnormal noise, smell  | -  | Repair                           |
|                                    | 2. Check for oil leakage  | -  | Repair                           |
|                                    | 3. Carry out air bleeding   | -  | Bleeding air                     |
|                                    | 4. Check travel of brake pedal  | -  | Adjusting                        |
| Electrics, electrical<br>equipment | 1. Check battery voltage (engine stopped)   | 20 - 30 V  | Add or replace                   |
|                                    | 2. Check battery electrolyte level  | -  | Add or replace                   |
|                                    | 3. Check for discolored, burnt, exposed wiring  | -  | Replace                          |
|                                    | 4. Check for missing wiring clamps, hanging wiring  | -  | Repair                           |
|                                    | 5. Check for water leaking on wiring (Pay particularly careful attention to water leaking on connectors or terminals) | -  | Disconnect connector and dry it. |
|                                    | 6. Check for disconnection, corrosion of fusible links and fuses  | -  | Replace                          |
|                                    | 7. Check alternator voltage<br>(engine running at 1/2 throttle or above)  | After running for<br>several minutes:<br>27.5 - 29.5 V | Replace                          |
|                                    | 8. Check operating sound of battery relay<br>(when switch is turned ON/OFF)   | -  | Replace                          |

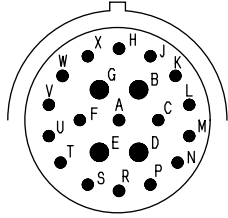
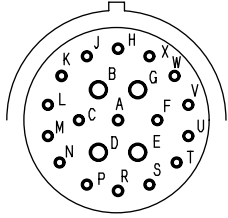
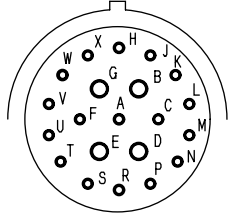
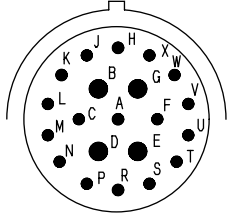
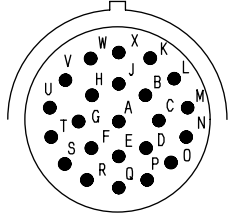
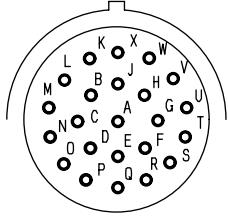
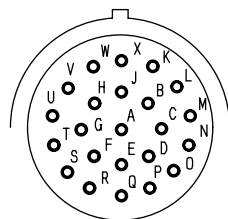
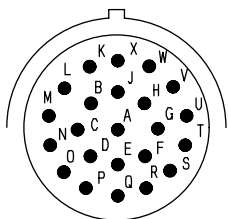


★ This circuit diagram was drawn by extracting the steering and transmission controller system from the general electric circuit diagram. ("Connector No. and pin No." from each branching/merging point indicate the ends of branch or source of merging within the parts of the same wiring harness.)



| No. of pins | MIC type connector  |  |                    |
|-------------|---|--|--------------------|
|             | Male (female housing)   | Female (male housing)  | T-adapter Part No. |
| 17          |  <p>BWP04747</p> |  <p>BWP04748</p> | 799-601-2730       |
|             | <p>Body part No.: 79A-222-2730 (Q'ty: 2)</p>  |  |                    |
| 21          |  <p>BWP04749</p> |  <p>BWP04750</p> | 799-601-2740       |
|             | <p>Body part No.: 79A-222-2750 (Q'ty: 2)</p>  |  |                    |
|             | <p>Terminal part No.: 79A-222-2770 (Q'ty: 50)</p>   |  | —                  |
|             | <p>Terminal part No.: 79A-222-2760 (Q'ty: 50)</p>   |  |                    |

[The pin No. is also marked on the connector (electric wire insertion end)]

| Type<br>(shell size<br>code)  | HD30 Series connector   |   |                       |
|---|---|---|-----------------------|
|   | Body (plug)   | Body (receptacle)   | T-adapter<br>Part No. |
| 24-21<br>(7)  | Pin (male terminal)   | Pin (female terminal)   | 799-601-9270          |
|   |            |           |                       |
|   | Part No.:08191-71201, 08191-71202,<br>08191-71205, 08191-71206                              | Part No.:08191-74101, 08191-74102,<br>08191-74105, 08191-74106                              |                       |
|   | Pin (female terminal)   | Pin (male terminal)   | 799-601-9270          |
|   |          |   |                       |
|   | Part No.:08191-72201, 08191-72202,<br>08191-72205, 08191-72206                              | Part No.:08191-73101, 08191-73102,<br>08191-73105, 08191-73106                              |                       |
| 24-23<br>(8)  | Pin (male terminal)   | Pin (female terminal)   | 799-601-9280          |
|   |          |         |                       |
|   | Part No.:08191-81201, 08191-81202,<br>08191-81203, 08191-81204,<br>08191-81205, 08191-80206 | Part No.:08191-84101, 08191-84102,<br>08191-84103, 08191-84104,<br>08191-84105, 08191-84106 |                       |
|   | Pin (female terminal)   | Pin (male terminal)   | 799-601-9280          |
|  |         |   |                       |
|   | Part No.:08191-82201, 08191-82202,<br>08191-82203, 08191-82204,<br>08191-82205, 08191-82206 | Part No.:08191-83101, 08191-83102,<br>08191-83103, 08191-83104,<br>08191-83105, 08191-83106 |                       |

|   |     |
|---|-----|
| Error code [DGE2KX] (Engine coolant temperature sensor (for high temperature):<br>Input signal is out of normal range) .....  | 69  |
| Error code [DGE3L6] (Engine coolant temperature sensor:<br>Signals of engine coolant temperature sensor are inconsistent<br>with operation state or stop state.)..... | 71  |
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| Error code [DK10KX] (Fuel control dial: Input signal is out of normal range).....   | 74  |
| Error code [DK12KX]<br>(Deceleration pedal potentiometer: Input signal is out of normal range) .....  | 76  |
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| Error code [DK30KX]<br>(Steering potentiometer 1: Input signal is out of normal range).....   | 82  |
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| Error code [DK40KB] (Brake potentiometer: Disconnection) .....  | 91  |
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| Error code [DK55KZ]<br>(Forward-reverse potentiometer 1: Disconnection or short circuit).....   | 96  |
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| Error code [DLF1KA] (Transmission output speed sensor: Disconnection) .....   | 110 |
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| Error code [DW5AKA] (Pitch control solenoid: Disconnection).....  | 112 |
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| Error code [DW7BKA] (Fan reverse solenoid: Disconnection).....  | 114 |
| Error code [DW7BKB] (Fan reverse solenoid: Short circuit) .....   | 115 |
| Error code [DWN1KA] (HSS EPC solenoid right: Disconnection).....  | 116 |
| Error code [DWN1KB] (HSS EPC solenoid right: Short circuit) .....   | 117 |
| Error code [DWN2KA] (HSS EPC solenoid left: Disconnection).....   | 118 |
| Error code [DWN2KB] (HSS EPC solenoid left: Short circuit).....   | 119 |
| Error code [DWN5KA] (Fan pump TVC solenoid: Disconnection) .....  | 120 |
| Error code [DWN5KB] (Fan pump TVC solenoid: Short circuit).....   | 121 |
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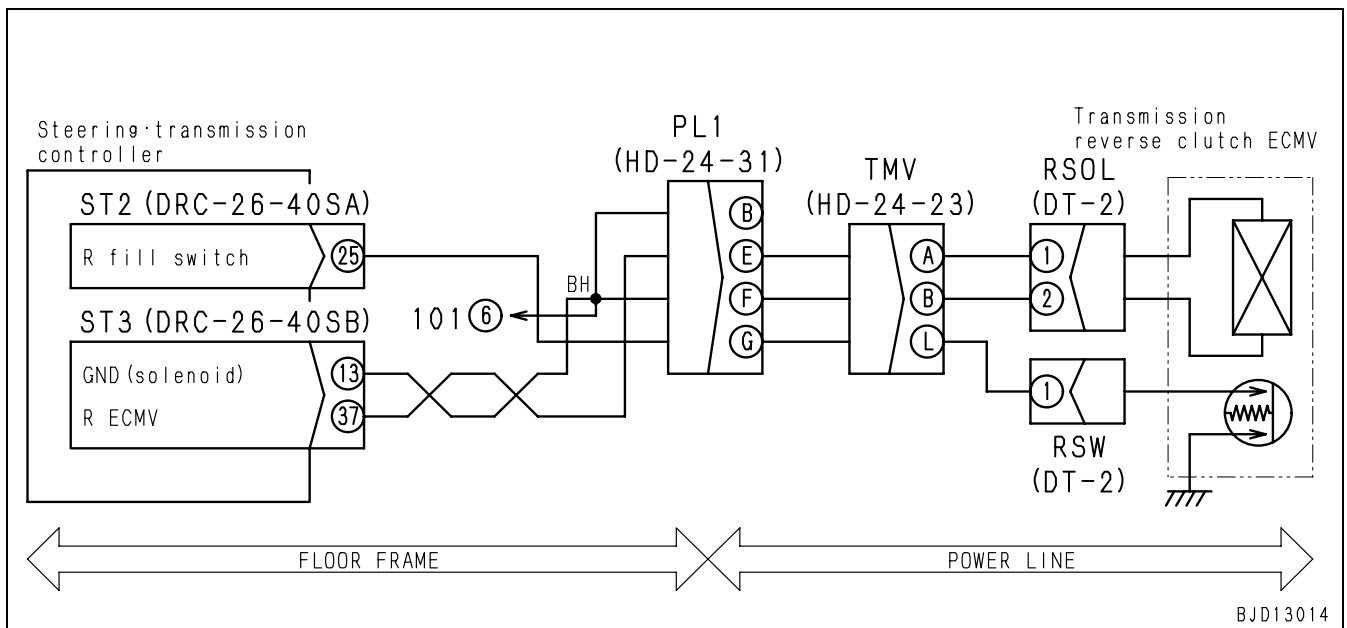
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### Error code [15SBL1] (Reverse clutch: Fill signal is ON when command current is OFF.)

|                                 |  |         |   |
|---------------------------------|--|---------|---|
| Action code                     | Error code   | Trouble | Reverse clutch: Fill signal is ON when command current is OFF.<br>(Steering and transmission controller system) |
| <b>CALL E03</b>                 | <b>15SBLH</b>  |         |   |
| Contents of trouble             | <ul style="list-style-type: none"> <li>Fill switch signal is not set off at output stop of transmission reverse clutch solenoid circuit.</li> </ul>  |         |   |
| Action of controller            | <ul style="list-style-type: none"> <li>Flashes warning lamp and turns on caution buzzer.</li> <li>Decides that engine speed is neutral (N) at reverse operation.</li> <li>Limits operation of engine and transmission.</li> </ul>  |         |   |
| Problem that appears on machine | <ul style="list-style-type: none"> <li>Once machine is stopped, engine speed is limited to medium (half).</li> <li>Once machine is stopped, travel is limited to R1.</li> </ul>  |         |   |
| Related information             | <ul style="list-style-type: none"> <li>Input state (ON/OFF) from reverse clutch fill switch can be checked in monitoring mode. (Code <b>31520</b>: Input state of transmission fill switch)</li> <li>Method of reproducing error code: Start engine and drive machine reverse, and then travel lever to neutral</li> </ul> |         |   |

| Possible causes and standard value in normal state | Cause |   | Standard value in normal state/Remarks on troubleshooting  |  |            |
|--|-------|---|--|--|------------|
|  |       | 1   | Defective forward clutch fill switch (Internal short circuit)  | ★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. |            |
| RSW (male)   |       |   |  | PCCS lever   | Resistance |
| Between (1) - chassis ground                       |       |   |  | N  | Min. 1 MΩ  |
|  |       |   |  | R (Reverse)  | Max. 1 Ω   |
| 2  |       | Defective harness grounding (Contact with ground circuit) | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.  |  |            |
|  |       |   | Between ST2 (female) (25) - RSW (female) (1) wiring harness and chassis ground   | Resistance   | Min. 1 MΩ  |
|  |       |   |  |  |            |
| 3  |       | Defective steering and transmission controller            | ★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.   |  |            |
|  |       |   | ST2  | PCCS lever   | Voltage    |
|  |       |   | Between (25) - chassis ground  | N  | 5 - 11 V   |
|  |       |   |  | R (Reverse)  | Max. 1 V   |
| 4  |       | Defective hydraulic pressure system                       | When no fault is detected in electric system, hydraulic pressure system is assumed to be abnormal. Carry out related troubleshooting (H mode). |  |            |

#### Circuit diagram related to transmission reverse clutch ECMV

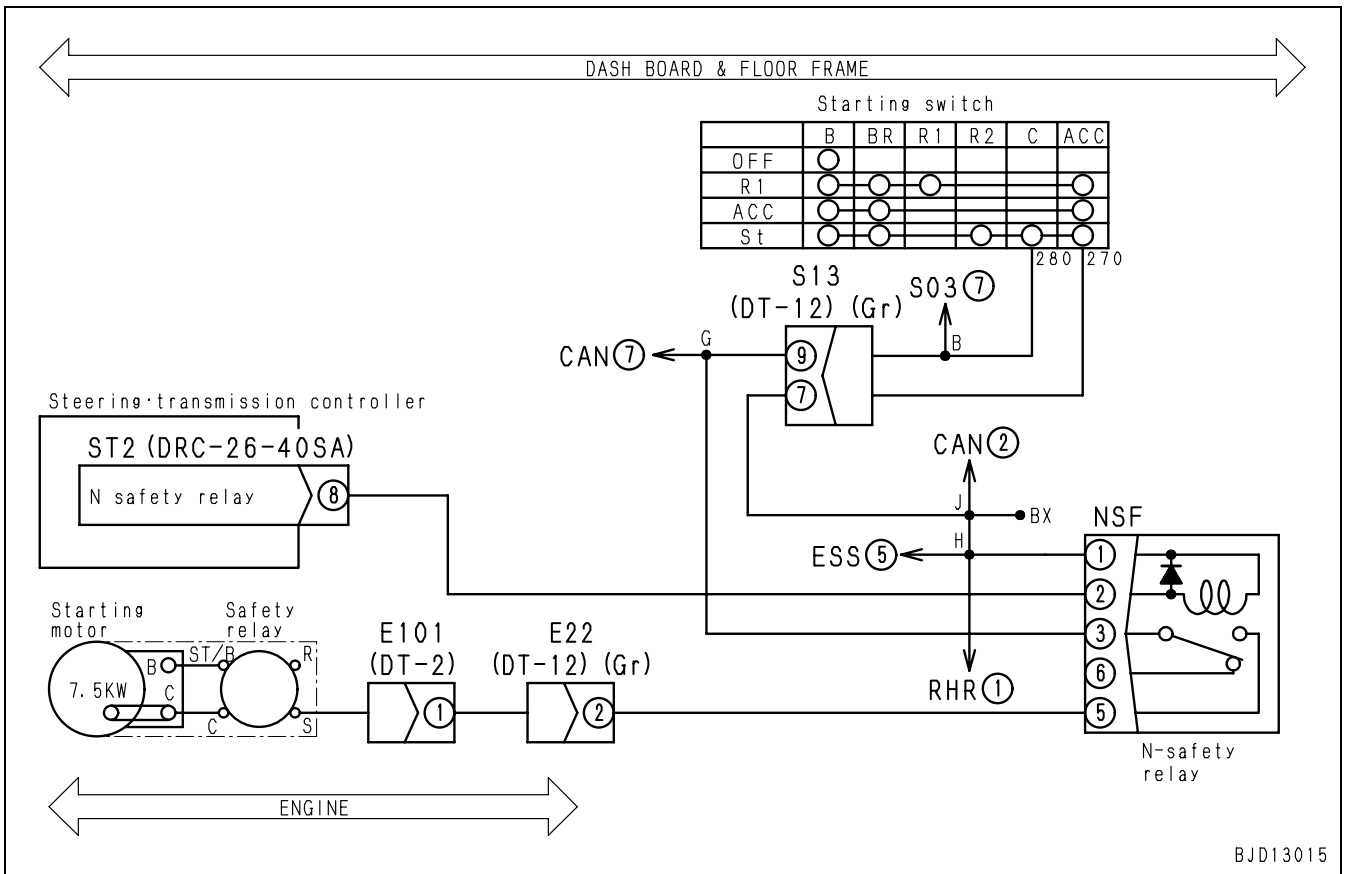


**Error code [B@BAZG] (Engine oil: Oil pressure reduction)**

|                                 |   |         |   |
|---------------------------------|---|---------|---|
| Action code                     | Error code  | Trouble | Engine oil: Oil pressure reduction<br>(Mechanical system) |
| -                               | <b>B@BAZG</b>   |         |   |
| Contents of trouble             | <ul style="list-style-type: none"> <li>• During rotation of engine, engine oil pressure warning lamp flashes.</li> </ul>        |         |   |
| Action of controller            | <ul style="list-style-type: none"> <li>• Flashes warning lamp and sounds caution buzzer (Function of monitor panel).</li> </ul> |         |   |
| Problem that appears on machine | <ul style="list-style-type: none"> <li>• If machine is operated as it is, engine may be damaged.</li> </ul>                     |         |   |
| Related information             | <ul style="list-style-type: none"> <li>• Method of reproducing error code: Start engine</li> </ul>                              |         |   |

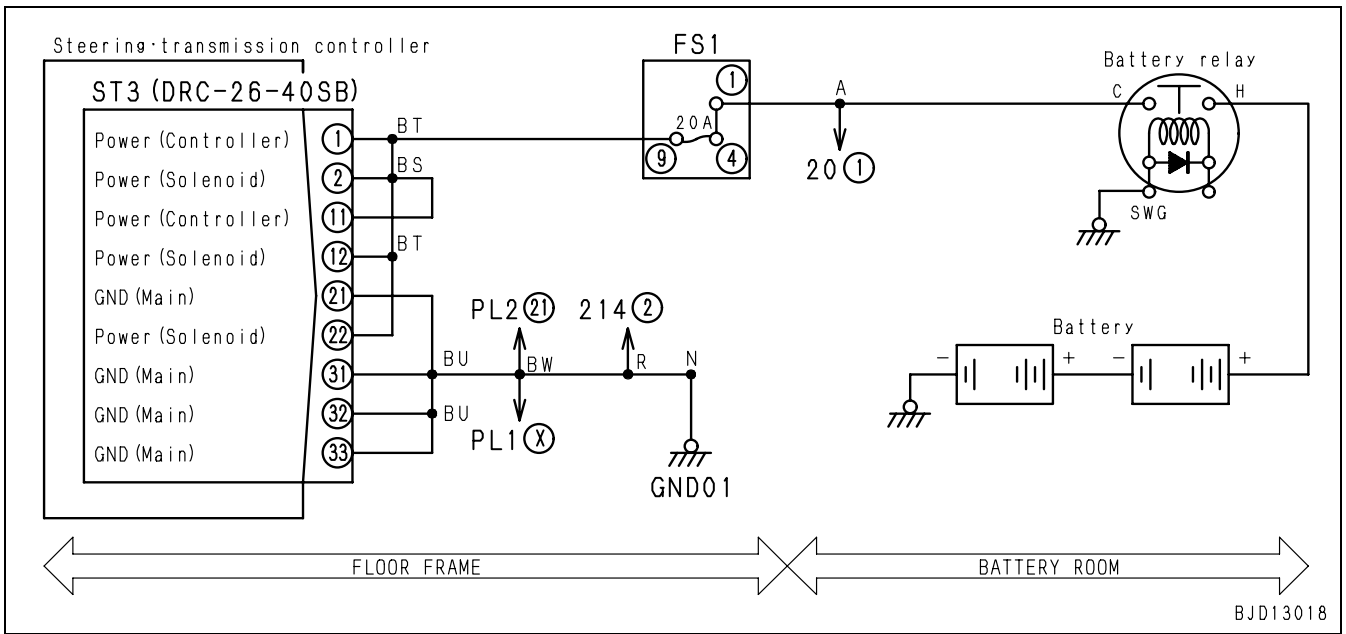
| Possible causes and standard value in normal state | Cause   |   | Standard value in normal state/Remarks on troubleshooting   |
|--|---|---|---|
|  | 1   | Engine oil pressure reduction<br>(When system is in normal) |   |
| 2  | Defective engine oil pressure warning lamp system |   | Carry out troubleshooting of engine oil pressure warning lamp system in accordance with "During running of engine, emergency warning item flashes" in E mode. |

Circuit diagram related to neutral safety relay

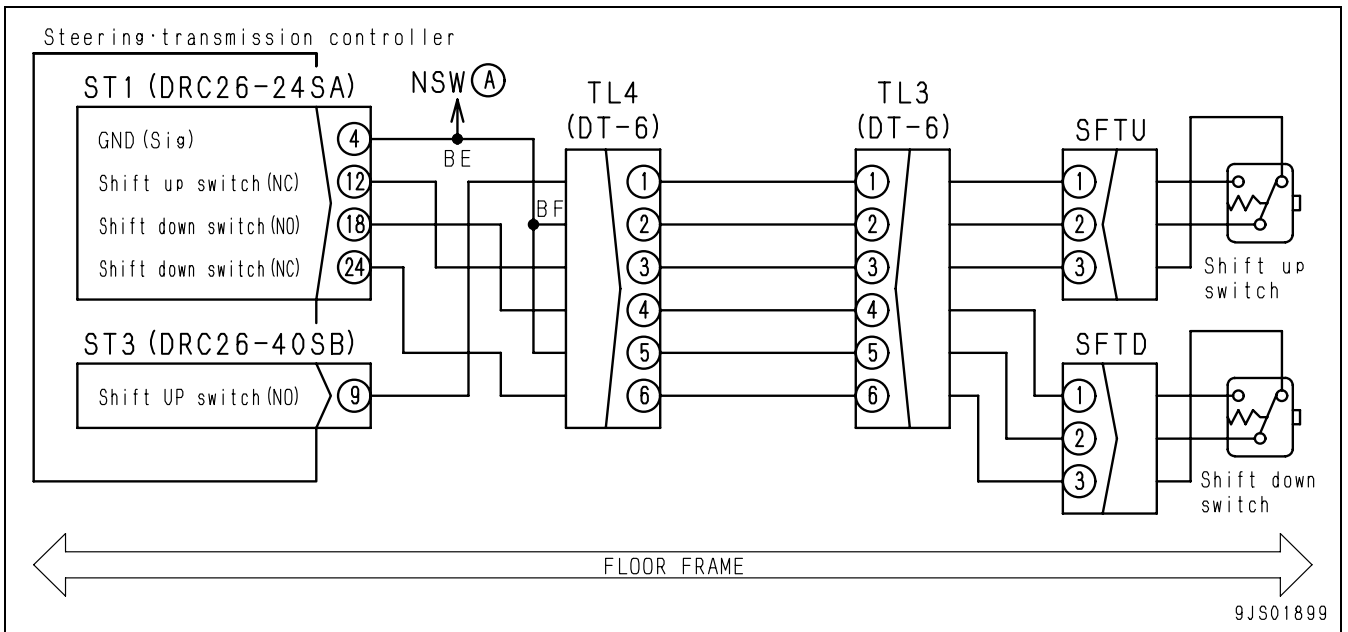


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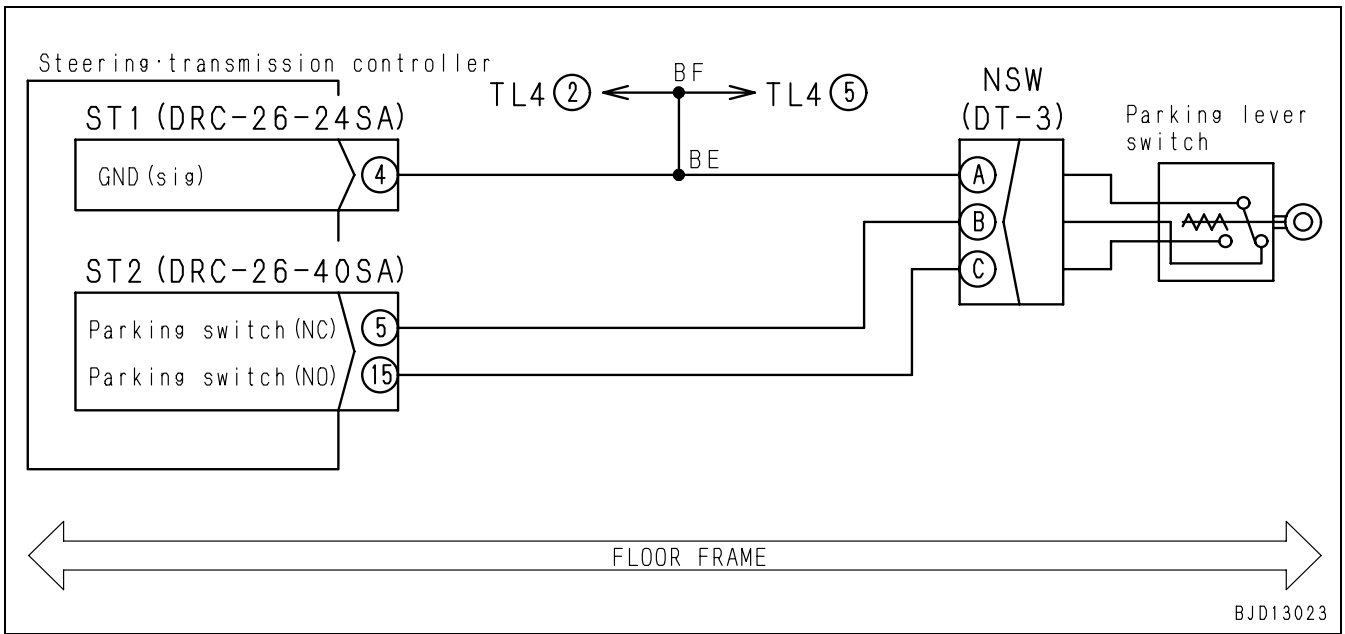
Circuit diagram related to steering and transmission controller power supply



Circuit diagram related to shift up switch and shift down switch



Circuit diagram related to travel lock switch (Parking brake lever switch)

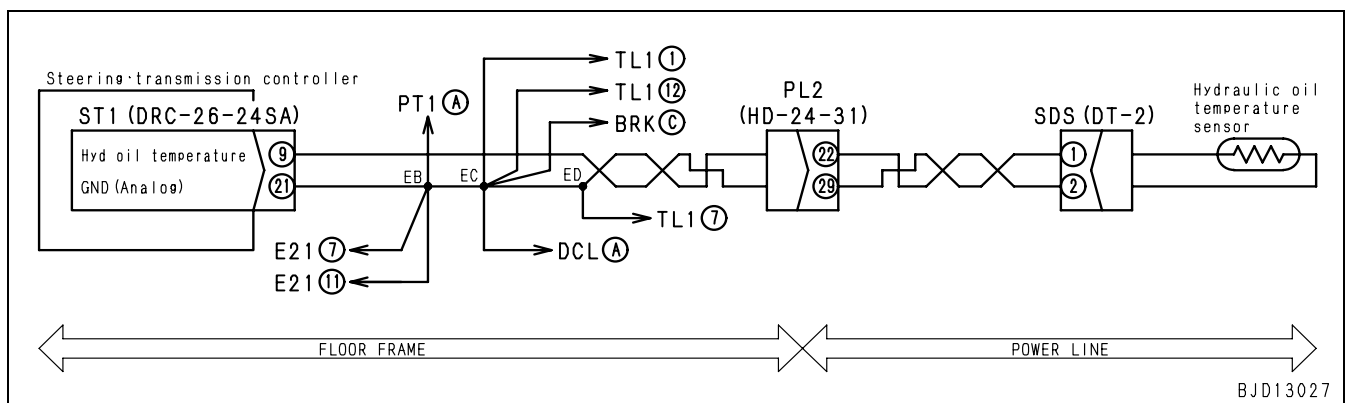


### Error code [DGS1KX] (Hydraulic oil temperature sensor: Input signal is out of normal range)

|                                 |  |         |   |
|---------------------------------|--|---------|---|
| Action code                     | Error code   | Trouble | Hydraulic oil temperature sensor: Input signal is out of normal range (Steering and transmission controller system) |
| -                               | <b>DGS1KX</b>  |         |   |
| Contents of trouble             | <ul style="list-style-type: none"> <li>Hydraulic oil temperature sensor signal is out of normal range.</li> </ul>  |         |   |
| Action of controller            | <ul style="list-style-type: none"> <li>Saves trouble but does not make any alarm.</li> </ul>   |         |   |
| Problem that appears on machine | <ul style="list-style-type: none"> <li>Hydraulic oil temperature of monitor panel is not displayed normally.</li> <li>Fan speed is limited to half.</li> </ul>   |         |   |
| Related information             | <ul style="list-style-type: none"> <li>When this failure occurs, hydraulic oil overheating [<b>B@HANS</b>] is also displayed and recorded simultaneously.</li> <li>Hydraulic oil temperature state (temperature) can be checked in monitoring mode (Code <b>04401</b>: Hydraulic oil temperature)</li> <li>Method of reproducing error code: Turn starting switch ON or Start engine.</li> </ul> |         |   |

| Possible causes and standard value in normal state | Cause |   | Standard value in normal state/Remarks on troubleshooting                            |   |           |
|--|-------|---|--|---|-----------|
|  |       | 1   | Defective hydraulic oil temperature sensor (Internal disconnection or short circuit) | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF. |           |
| SDS (male)   |       |   |  | Resistance  |           |
| Between (1) - (2)                                  |       |   |  | 3.5 k - 90 kΩ (10 - 100°C)  |           |
| Between (1), (2) - chassis ground                  |       |   |  | Min. 1 MΩ   |           |
| 2  |       | Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector) | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.    |   |           |
|  |       |   | Wiring harness between ST1 (female) (9) - SDS (female) (1)                           | Resistance  | Max. 1 Ω  |
|  |       |   | Wiring harness between ST1 (female) (21) - SDS (female) (2)                          | Resistance  | Max. 1 Ω  |
| 3  |       | Short circuit with chassis ground in wiring harness (Contact with ground circuit)                   | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.    |   |           |
|  |       |   | Wiring harness between ST1 (female) (9) - SDS (female) (1) with chassis ground       | Resistance  | Min. 1 MΩ |
| 4  |       | Hot short circuit in wiring harness (Contact with 24 V circuit)                                     | ★ Prepare with starting switch OFF, then turn it ON and carry out troubleshooting.   |   |           |
|  |       |   | Wiring harness between ST1 (female) (9) - SDS (female) (1) with chassis ground       | Voltage   | Max. 1 V  |
| 5  |       | Defective steering and transmission controller  | ★ Prepare with starting switch OFF, then turn it ON and carry out troubleshooting.   |   |           |
|  |       |   | ST1  | Voltage   |           |
|  |       |   | Between (9) - (21)   | 2.0 - 4.8 V (10 - 100°C)  |           |

#### Circuit diagram related to hydraulic oil temperature sensor



## Error code [DK30KZ] (Steering potentiometer 1: Disconnection or short circuit)

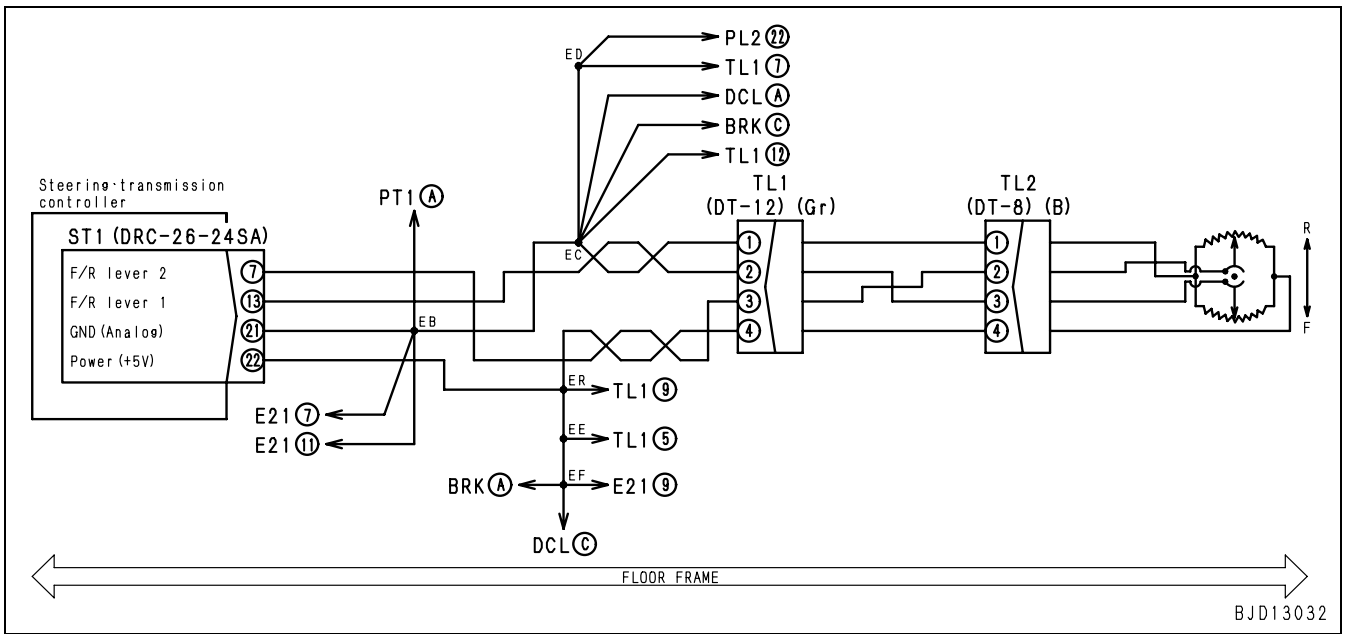
|  |  |   |   |
|--|--|---|---|
| Action code  | Error code   | Trouble   | Steering potentiometer 1: Disconnection or short circuit<br>(Steering and transmission controller system) |
| <b>CALL E04</b>                                    | <b>DK30KZ</b>  |   |   |
| Contents of trouble                                | <ul style="list-style-type: none"> <li>• Either of steering potentiometer systems 1 and 2 is abnormal when starting switch is turned ON, and then either of error codes [DK30KA] and [DK30KB], and either of error codes [DK31KA] and [DK31KB] are turned ON simultaneously in those systems.</li> </ul>   |   |   |
| Action of controller                               | <ul style="list-style-type: none"> <li>• Flashes warning lamp and turns on caution buzzer.</li> <li>• Limits operation of engine and transmission.</li> <li>• Controls machine with the position signal received just before the trouble occurs until PCCS lever is set in NEUTRAL position.</li> </ul>  |   |   |
| Problem that appears on machine                    | <ul style="list-style-type: none"> <li>• Once machine is stopped, engine speed is limited to medium (half).</li> <li>• Once machine is stopped, it cannot travel any more.</li> </ul>  |   |   |
| Related information                                | <ul style="list-style-type: none"> <li>• Inputting from steering potentiometer (Voltage) can be checked in monitoring mode.<br/>(Code <b>50300</b>: Voltage of steering potentiometer 1)<br/>(Code <b>50301</b>: Voltage of steering potentiometer 2)</li> <li>• Method of reproducing error code: Turn starting switch ON and (operate PCCS lever (steering)).</li> </ul> |   |   |
| Possible causes and standard value in normal state | Cause  | Standard value in normal state/Remarks on troubleshooting |   |
|  | Carry out troubleshooting for error codes [DK30KA], [DK30KB], [DK31KA], and [DK31KB].  |   |   |

### Error code [DK54KZ] (Governor motor potentiometer: Disconnection or short circuit)

|                                 |   |         |  |
|---------------------------------|---|---------|--|
| Action code                     | Error code  | Trouble | Governor motor potentiometer: Disconnection or short circuit (Steering and transmission controller system) |
| <b>E02</b>                      | <b>DK54KZ</b>   |         |  |
| Contents of trouble             | <ul style="list-style-type: none"> <li>Signal voltage of governor motor feedback potentiometer circuit is below 0.4 V or above 4.7 V.</li> </ul>  |         |  |
| Action of controller            | <ul style="list-style-type: none"> <li>Flashes warning lamp and turns on caution buzzer.</li> <li>Controls engine rotation without signals from governor motor feedback potentiometer.</li> </ul>   |         |  |
| Problem that appears on machine | <ul style="list-style-type: none"> <li>Precision of engine rotation control becomes lower.</li> </ul>   |         |  |
| Related information             | <ul style="list-style-type: none"> <li>Inputting from governor motor feedback potentiometer (Voltage) can be checked in monitoring mode. (Code <b>03100</b>: Voltage of governor motor feedback potentiometer)</li> <li>Method of reproducing error code: Turn starting switch ON and operate fuel control dial.</li> </ul> |         |  |

| Possible causes and standard value in normal state | Cause |   | Standard value in normal state/Remarks on troubleshooting                          |  |
|--|-------|---|--|--|
|  |       | 1   | Defective 5 V sensor power source system   | See if error code [DAQ5KK] or [DB35KK] is displayed. If it is displayed, carry out troubleshooting for it first. |
| 2  |       | Defective governor motor feedback potentiometer (Internal disconnection or short circuit)           | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.  |  |
|  |       |   | E62 (male)   | Resistance   |
|  |       |   | Between (A) - (C)  | 4.0 - 6.0 kΩ   |
|  |       |   | Between (A) - (B)  | 5.2 - 1.9 kΩ (High - Low idling)   |
| 3  |       | Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector) | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.  |  |
|  |       |   | Wiring harness between ST1 (female) (22) - E62 (female) (A)                        | Resistance Max. 1 Ω  |
|  |       |   | Wiring harness between ST1 (female) (20) - E62 (female) (B)                        | Resistance Max. 1 Ω  |
| 4  |       | Short circuit with chassis ground in wiring harness (Contact with ground circuit)                   | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.  |  |
|  |       |   | Wiring harness between ST1 (female) (22) - E62 (female) (A) with chassis ground    | Resistance Min. 1 MΩ   |
|  |       |   | Wiring harness between ST1 (female) (20) - E62 (female) (B) with chassis ground    | Resistance Min. 1 MΩ   |
| 5  |       | Hot short circuit in wiring harness (Contact with 24 V circuit)                                     | ★ Prepare with starting switch OFF, then turn it ON and carry out troubleshooting. |  |
|  |       |   | Wiring harness between ST1 (female) (20) - E62 (female) (B) with chassis ground    | Voltage Max. 1 V   |
|  |       |   | Wiring harness between ST1 (female) (21) - E62 (female) (C) with chassis ground    | Voltage Max. 1 V   |
| 6  |       | Defective steering and transmission controller  | ★ Prepare with starting switch OFF, then turn it ON and carry out troubleshooting. |  |
|  |       |   | ST1  | Voltage  |
|  |       |   | Between (20) - (21)  | 0.6 - 2.7 V (High - Low idling)  |

Circuit diagram related to forward-reverse potentiometer



BJD13032

**Error code [DW5AKB] (Pitch control solenoid: Short circuit)**

|                                 |  |         |  |
|---------------------------------|--|---------|--|
| Action code                     | Error code   | Trouble | Pitch control solenoid: Short circuit<br>(Steering and transmission controller system) |
| <b>E02</b>                      | <b>DW5AKB</b>  |         |  |
| Contents of trouble             | <ul style="list-style-type: none"> <li>Abnormal current flowed when power is output to pitch control solenoid circuit.</li> </ul>  |         |  |
| Action of controller            | <ul style="list-style-type: none"> <li>Flashes warning lamp and turns on caution buzzer.</li> </ul>  |         |  |
| Problem that appears on machine | <ul style="list-style-type: none"> <li>None in particular.</li> </ul>  |         |  |
| Related information             | <ul style="list-style-type: none"> <li>This error code is not used since pitch-function-equipped work equipment is not installed on this machine.</li> <li>Method of reproducing error code: Turn starting switch ON.</li> </ul> |         |  |

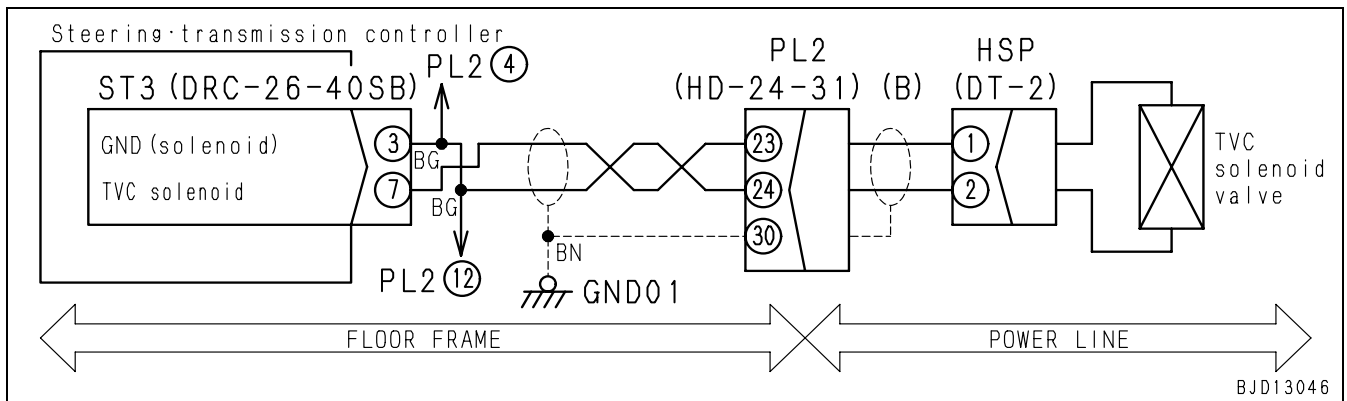
| Possible causes and standard value in normal state | Cause  |   | Standard value in normal state/Remarks on troubleshooting   |
|--|--|---|---|
|  | 1  | Defective adjustment of steering and transmission controller  | If error code lights up (to indicated restoration), system is normal. <ul style="list-style-type: none"> <li>Adjustment code: <b>0004</b>: Machine specification set</li> </ul> |
| 2  | Defective steering and transmission controller | If no problem is found in above cause 1, it is suspected that steering and transmission controller is defective.<br>(Troubleshooting cannot be carried out since it is internal defect..) |   |

### Error code [DXA0KB] (HSS pump TVC solenoid: Short circuit)

|                                 |   |         |   |
|---------------------------------|---|---------|---|
| Action code                     | Error code  | Trouble | HSS pump TVC solenoid: Short circuit<br>(Steering and transmission controller system) |
| <b>E01</b>                      | <b>DXA0KB</b>   |         |   |
| Contents of trouble             | <ul style="list-style-type: none"> <li>When signal is output to HSS and hydraulic pump TVC solenoid circuit, an abnormal current flows.</li> </ul>  |         |   |
| Action of controller            | <ul style="list-style-type: none"> <li>Stops outputting to HSS and hydraulic pump TVC solenoid.</li> </ul>  |         |   |
| Problem that appears on machine | <ul style="list-style-type: none"> <li>Engine stalls when a load is applied under low engine speed.</li> </ul>  |         |   |
| Related information             | <ul style="list-style-type: none"> <li>Output (Current) to HSS and hydraulic pump TVC solenoid can be checked in monitoring mode. (Code <b>01300</b>, <b>01301</b>: TVC solenoid output current)</li> <li>Method of reproducing error code: Turn starting switch ON.</li> </ul> |         |   |

| Possible causes and standard value in normal state | Cause |   | Standard value in normal state/Remarks on troubleshooting  |   |            |
|--|-------|---|--|---|------------|
|  |       | 1   | Defective HSS and hydraulic pump TVC solenoid (Internal short circuit)                             | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF. |            |
| HSP (male)   |       |   |  | Resistance  |            |
| Between (1) - (2)                                  |       |   |  | 9 - 19 Ω  |            |
| Between (1) - chassis ground                       |       |   |  | Min. 1 MΩ   |            |
| 2  |       | Short circuit with chassis ground in wiring harness (Contact with ground circuit) | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.                  |   |            |
|  |       |   | Wiring harness between ST3 (female) (7) - HSP (female) (1) with chassis ground                     | Resistance Min. 1 MΩ  |            |
| 3  |       | Defective short circuit in wiring harness (Short circuit in wiring harness)       | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.                  |   |            |
|  |       |   | Wiring harness between ST3 (female) (7) - HSP (female) (1) and ST3 (female) (3) - HSP (female) (2) | Resistance Min. 1 MΩ  |            |
| 4  |       | Defective steering and transmission controller                                    | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.                  |   |            |
|  |       |   | ST3 (female)   |   | Resistance |
|  |       |   | Between (7) - (3)  |   | 9 - 19 Ω   |
|  |       |   | Between (7) - chassis ground   |   | Min. 1 MΩ  |

#### Circuit diagram related to HSS pump TVC solenoid

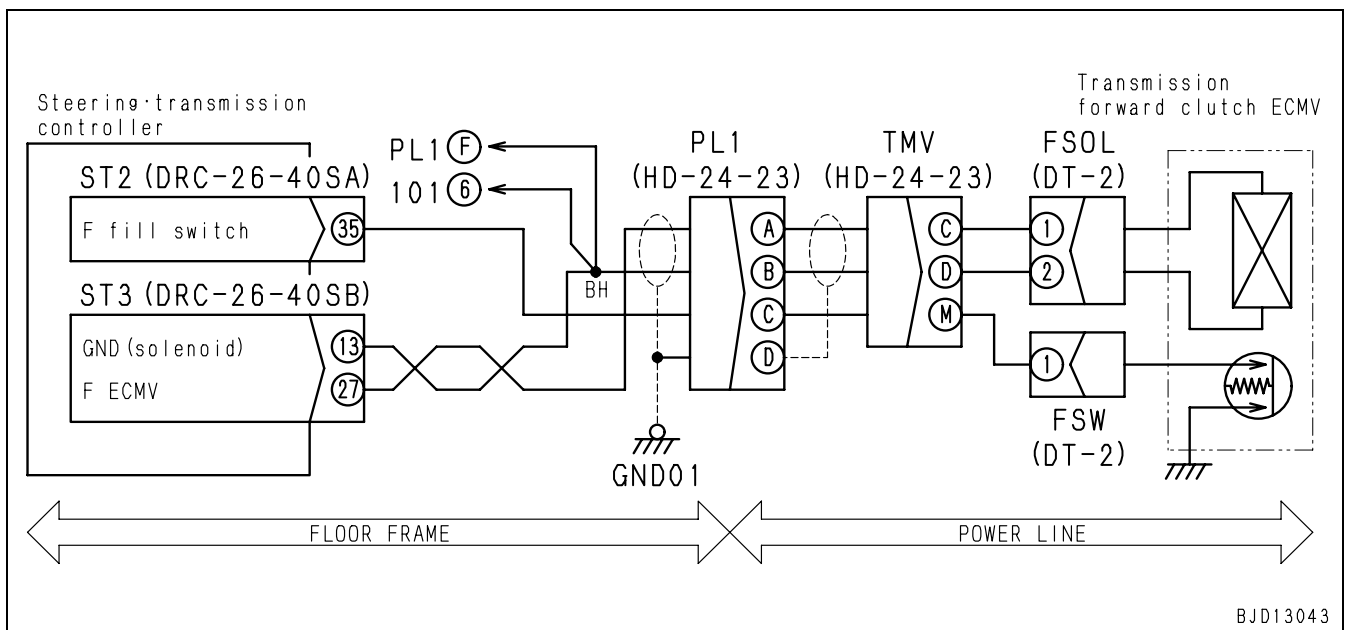


### Error code [DXH8KB] (Forward clutch ECMV: Short circuit)

|                                 |  |         |   |
|---------------------------------|--|---------|---|
| Action code                     | Error code   | Trouble | Forward clutch ECMV: Short circuit<br>(Steering and transmission controller system) |
| <b>CALL E03</b>                 | <b>DXH8KB</b>  |         |   |
| Contents of trouble             | <ul style="list-style-type: none"> <li>When signal is output to transmission forward clutch ECMV circuit, an abnormal current flows.</li> </ul>  |         |   |
| Action of controller            | <ul style="list-style-type: none"> <li>Flashes warning lamp and turns on caution buzzer.</li> <li>Stops outputting to transmission forward clutch ECMV circuit.</li> <li>Limits operation of engine and transmission.</li> </ul>   |         |   |
| Problem that appears on machine | <ul style="list-style-type: none"> <li>Once machine is stopped, engine speed is limited to medium (half).</li> <li>Once machine is stopped, travel is limited to R1.</li> </ul>  |         |   |
| Related information             | <ul style="list-style-type: none"> <li>Output (Current) to forward clutch ECMV can be checked in monitoring mode.<br/>(Code <b>31608</b>, <b>31622</b>: Output current of forward clutch ECMV)</li> <li>Method of reproducing error code: Start engine and drive machine forward.</li> </ul> |         |   |

| Possible causes and standard value in normal state | Cause |  | Standard value in normal state/Remarks on troubleshooting  |   |            |
|--|-------|--|--|---|------------|
|  |       | 1  | Defective forward clutch ECMV<br>(Internal short circuit)  | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF. |            |
| FSOL (male)  |       |  |  | Resistance  |            |
| Between (1) - (2)                                  |       |  |  | 5 - 25 Ω  |            |
| Between (1) - chassis ground                       |       |  |  | Min. 1 MΩ   |            |
| 2  |       | Short circuit with chassis ground in wiring harness<br>(Contact with ground circuit) | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.                      |   |            |
|  |       |  | Wiring harness between ST3 (female) (27) - FSOL (female) (1) with chassis ground                       | Resistance Min. 1 MΩ  |            |
| 3  |       | Defective short circuit in wiring harness<br>(Short circuit in wiring harness)       | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.                      |   |            |
|  |       |  | Wiring harness between ST3 (female) (27) - FSOL (female) (1) and ST3 (female) (13) - FSOL (female) (2) | Resistance Min. 1 MΩ  |            |
| 4  |       | Defective steering and transmission controller                                       | ★ Prepare with starting switch OFF and carry out troubleshooting with switch OFF.                      |   |            |
|  |       |  | ST3 (female)   |   | Resistance |
|  |       |  | Between (27) - (13)  |   | 5 - 25 Ω   |
|  |       |  | Between (27) - chassis ground  |   | Min. 1 MΩ  |

#### Circuit diagram related to transmission forward clutch ECMV



BJD13043

# Bulldozer

## D61EX-15

## D61PX-15

| <b>Machine Model</b> | <b>Serial Number</b> |
|----------------------|----------------------|
| D61EX-15             | B40001 and up        |
| D61PX-15             | B40001 and up        |

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# Troubleshooting

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|   |    |
|---|----|
| Troubleshooting of electrical system (E-mode) .....   | 3  |
| Before troubleshooting electrical system (E-mode) .....                                     | 3  |
| Information described in troubleshooting list .....   | 5  |
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| E-2 Preheater does not operate.....   | 11 |
| E-3 No monitor panel lamps light at all when starting switch is turned ON.....              | 14 |
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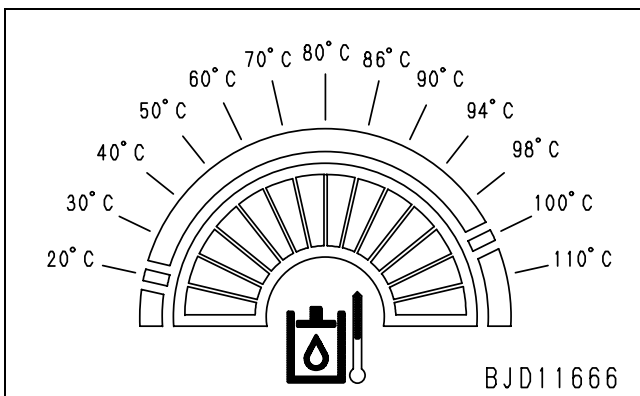
## E-2 Preheater does not operate

|                     |   |
|---------------------|---|
| Trouble             | <ul style="list-style-type: none"> <li>Preheater does not operate.</li> </ul>   |
| Related information | <ul style="list-style-type: none"> <li>★ This troubleshooting covers procedure to be followed if electrical intake air heater mounting section is not preheated by automatic or manual preheating function. (If only preheating lamp does not light, carry out troubleshooting of "Preheating lamp does not come on".)</li> <li>Both "Automatic Preheating Function" and "Manual Preheating Function" are provided for preheating. Preheating lamp comes on even if either of functions is operating.</li> <li>If "the monitor panel does not come on" or "the battery relay does not cause operating sound" when starting switch is turned ON, main electric power supply may have failed. Inspect main electric power supply system.</li> </ul> |

| Possible causes and standard value in normal state | Cause   |   | Standard value in normal state or remarks on troubleshooting   |  |            |
|--|---|---|--|--|------------|
|  |   | 1   | Defective starting switch (Internal disconnection)   | ★ Prepare with starting switch OFF, then carry out troubleshooting by holding starting switch OFF. |            |
| Starting switch                                    |   |   |  | Switch position  | Resistance |
| Between 250 (B) - 255 (R1) terminals               |   |   |  | OFF  | Min. 1 MΩ  |
|  |   |   |  | HEAT   | Max. 1 Ω   |
| 2  |   | Defective fuse (Fuse, FS1 or FS2)   | If fuse has blown, a grounding error of the circuit may have occurred.   |  |            |
| 3  |   | Defective preheating relay (Internal disconnection)   | ★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.  |  |            |
|  |   |   | Turn starting switch OFF, disconnect coolant sensor E131, and replace it with another relay. If preheating starts when starting switch is turned ON, preheater relay RHR is defective. |  |            |
| 4  |   | Defective heater relay (Internal defect)  | ★ Prepare with starting switch OFF, then set the starting switch to HEAT and carry out troubleshooting.  |  |            |
|  |   |   | Heater relay   |  | Voltage    |
|  |   |   | Power supply: Between terminal E82 (B) - chassis ground  |  | 20 - 30 V  |
|  |   |   | Signal: Between terminal E83 (C) - chassis ground  |  | 20 - 30 V  |
|  |   |   | If both power supply and signal voltages are normal and if no operating sound is heard, heater relay is defective.   |  |            |
| 5  |   | Defective electrical intake air heater (Internal defect)                                    | ★ Prepare with starting switch OFF, then carry out troubleshooting by holding starting switch OFF.   |  |            |
|  |   |   | Electrical intake air heater   | Continuity   |            |
|  |   |   | Between terminals  | Conductive   |            |
| 6  |   | Disconnection in wiring harness (Disconnection in wiring or defective contact in connector) | ★ Prepare with starting switch OFF, then carry out troubleshooting by holding starting switch OFF.   |  |            |
|  |   |   | Wiring harness between starting switch 255 (R1) - RHR (female) (3) and E83 (C)   | Resistance   | Max. 1 Ω   |
|  |   |   | Wiring harness between RHR (female) (5) - FS1 (7)  | Resistance   | Max. 1 Ω   |
|  | Wiring harness between battery relay C - E102 and E82 terminal                      |   | Resistance   | Max. 1 Ω   |            |
|  | Wiring harness between heater relay E81 (A) terminal - electrical intake air heater |   | Resistance   | Max. 1 Ω   |            |

|                     |   |
|---------------------|---|
| Trouble             | (4) Hydraulic oil temperature warning lamp flashes.   |
| Related information | <ul style="list-style-type: none"> <li>If an error is detected when engine is running, hydraulic oil temperature warning lamp flashes and caution buzzer sounds.</li> <li>Hydraulic oil temperature warning lamp flashes or goes out as it links with indication on hydraulic oil temperature gauge.</li> <li>Input status (temperature) from hydraulic oil temperature sensor can be checked in monitoring mode. (Code <b>04401</b>: Hydraulic oil temperature)</li> </ul> |

| Possible causes and standard value in normal state | Cause  |   | Standard value in normal state or remarks on troubleshooting   |                       |
|--|--|---|--|-----------------------|
|  | 1  | Overheated hydraulic oil temperature (when system is normal)  | Check hydraulic oil temperature as its overheating has been detected. (Warning lamp flashes and buzzer sounds if hydraulic oil temperature exceeds 110°C, but only warning lamp flashes if temperature reaches 100°C.) |                       |
| 2  | Defective hydraulic oil temperature sensor system (Steering and transmission controller) | Oil temperature gauge   | ★ Oil temperatures are guides for selecting indications.   |                       |
|  |  | Oil temperature lamp  | White range or green range<br>Off  | Red range<br>Flashing |
| 3  | Defective monitor panel  | If trouble is NOT by Cause 1 or Cause 2, monitor panel may be defective. (You cannot troubleshoot monitor panel as its internal system has failed.) |  |                       |



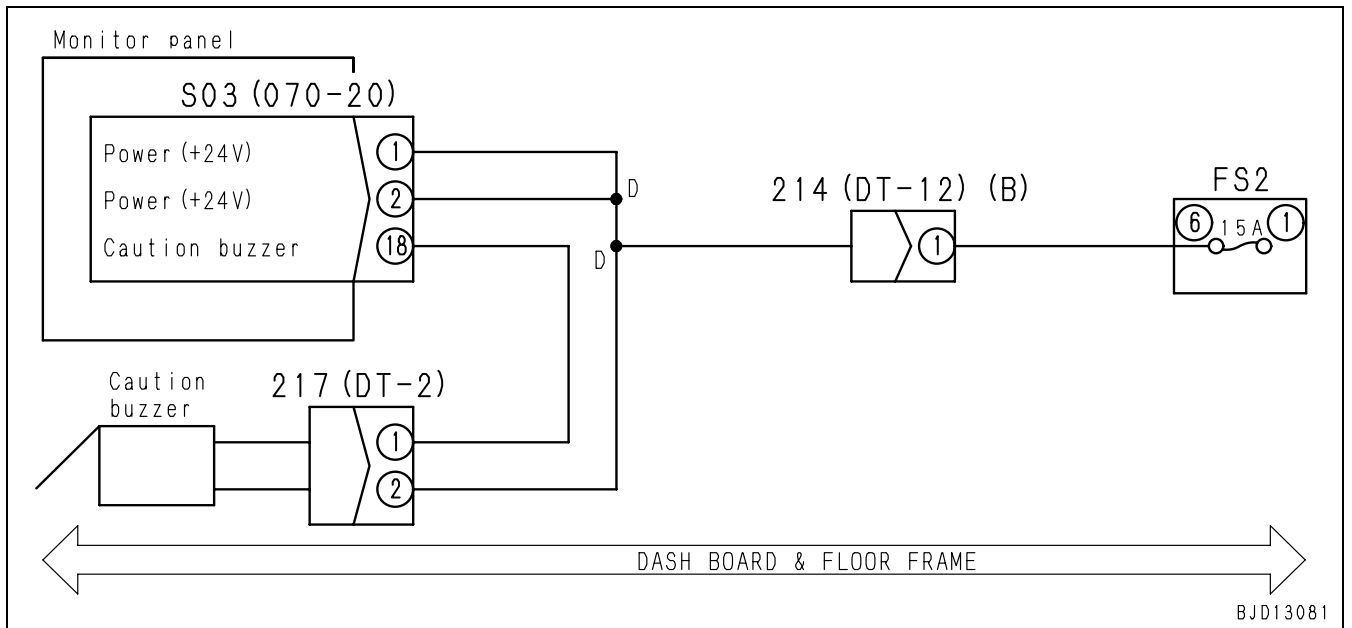
Indication of hydraulic oil temperature gauge (★ Hydraulic oil temperatures are guides for selecting indications.)

### E-17 Caution buzzer does not sound or does not stop

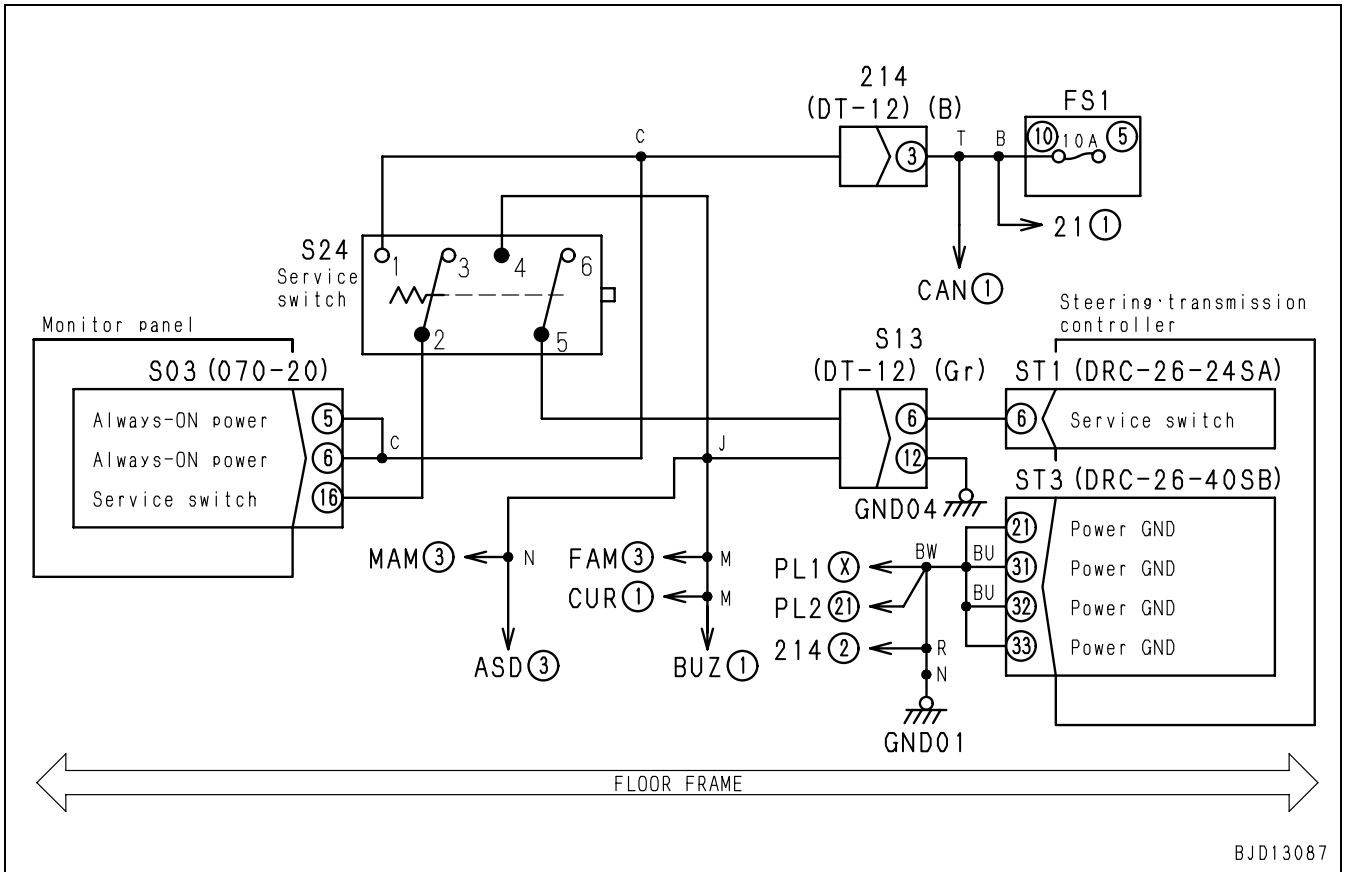
|                     |  |
|---------------------|--|
| Trouble             | • Caution buzzer does not sound or does not stop.  |
| Related information | • If a short-circuit has occurred in caution buzzer system, error code [DV00KB] is displayed. However, no error codes are displayed if another error has occurred. |

| Possible causes and standard value in normal state | Cause |   | Standard value in normal state or remarks on troubleshooting                                       |   |           |
|--|-------|---|--|---|-----------|
|  |       | 1   | Defective fuse FS2-(6)   | If fuse (6) of FS2 has blown, a grounding error of the circuit may have occurred. |           |
| 2  |       | Defective caution buzzer (Internal disconnection or short circuit)                          | ★ Prepare with starting switch OFF, then carry out troubleshooting by holding starting switch OFF. |   |           |
|  |       |   | 217 (male) terminal  | Resistance  |           |
|  |       |   | Between terminals (2) - (1)  | Min. 1 kΩ   |           |
| 3  |       | Disconnection in wiring harness (Disconnection in wiring or defective contact in connector) | ★ Prepare with starting switch OFF, then carry out troubleshooting by holding starting switch OFF. |   |           |
|  |       |   | Wiring harness between S03 (female) (18) - 217 (female) (1)  | Resistance  | Max. 1 Ω  |
| 4  |       | Short circuit with chassis ground in wiring harness (Contact with ground circuit)           | ★ Prepare with starting switch OFF, then carry out troubleshooting by holding starting switch OFF. |   |           |
|  |       |   | Between SF2 (6) - 217 (female) (2) wiring harness and ground                                       | Resistance  | Min. 1 MΩ |
|  |       |   | Between 217 (female) (1) - S03 (female) (18) wiring harness and ground                             | Resistance  | Min. 1 MΩ |
| 5  |       | Defective monitor panel (Gauge lamp module)   | ★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.    |   |           |
|  |       |   | S03 terminal   | Caution buzzer  | Voltage   |
|  |       |   | Between terminal (18) - chassis ground   | Stopped   | 20 - 30 V |
|  |       |   |  | Operated (Sounding)   | Max. 3 V  |

**Circuit diagram related to caution buzzer**

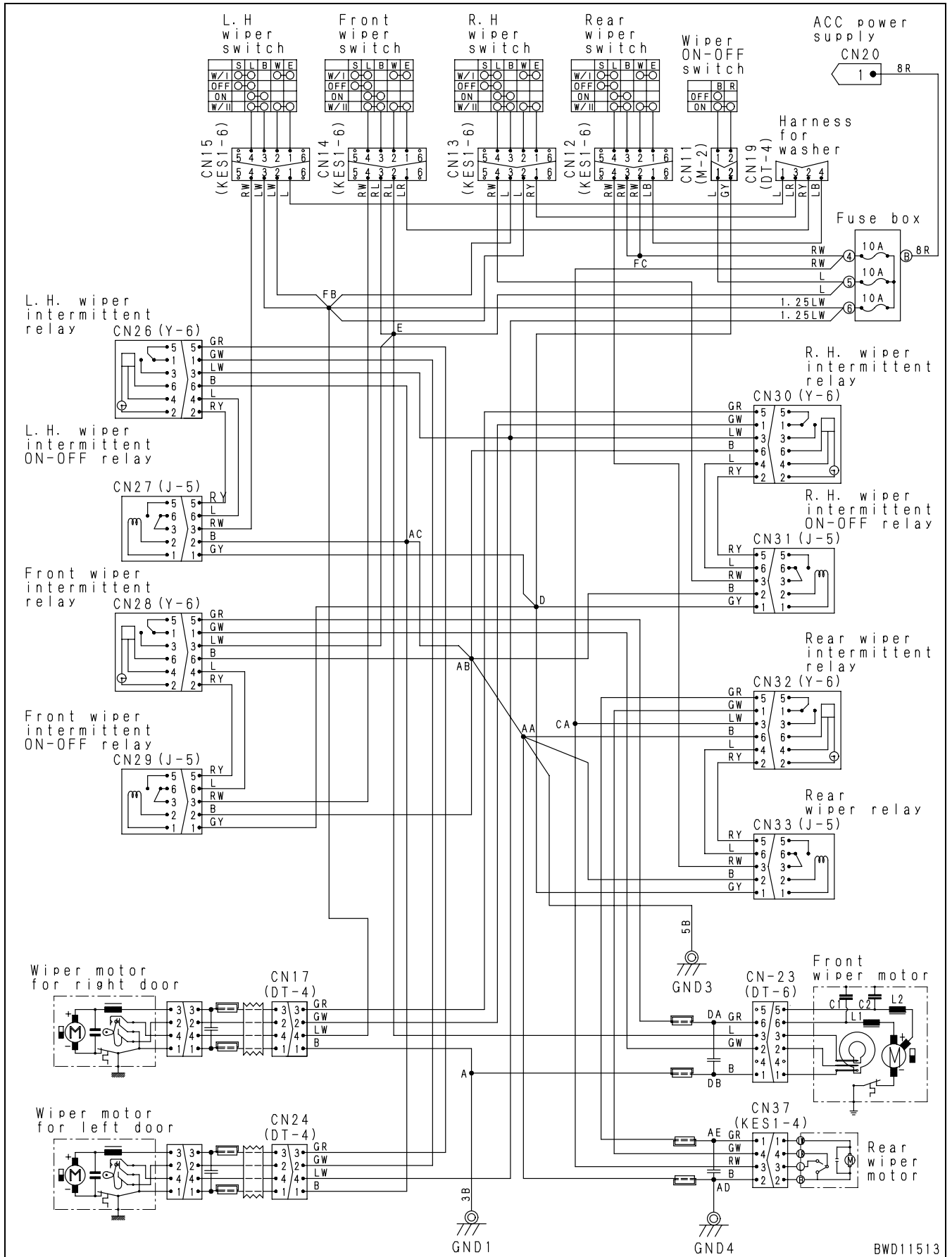


Circuit diagram related to service switch



BJD13087

Circuit diagram related to wiper system



BWD11513

### E-29 Washing water does not come out

|                     |  |
|---------------------|--|
| Trouble             | (1) Washing water of front washer does not come out.   |
| Related information | <ul style="list-style-type: none"> <li>If front wipers operate normally:<br/>(If wiper does not operate either, carry out troubleshooting in E-28 Wiper malfunction first.)</li> </ul> |

| Possible causes and standard value in normal state   | Cause |   | Standard value in normal state or remarks on troubleshooting                                       |  |            |
|--|-------|---|--|--|------------|
|  |       | 1   | Defective front washer motor   | ★ Prepare with starting switch OFF, then carry out troubleshooting by holding starting switch OFF. |            |
| Wiring harness between 11 (female) (1) - chassis ground  |       |   |  | Resistance   | Max. 1 Ω   |
| ★ Prepare with starting switch OFF, then turn starting switch ON (at W/I switch position) and carry out troubleshooting. |       |   |  |  |            |
| Between 11 (2) - chassis ground  |       |   |  | Voltage  | 20 - 30 V  |
| 2  |       | Defective front wiper switch  | ★ Prepare with starting switch OFF, then carry out troubleshooting by holding starting switch OFF. |  |            |
|  |       |   | CN14 (female) terminal   | Switch position  | Resistance |
|  |       |   | Between terminals (2) - (1)  | W/I or W/II  | Max. 1 Ω   |
| 4  |       | Disconnection or incorrect grounding of wiring harness<br>(Line disconnection, poor connector contact, or incorrect contact to GND circuit) | ★ Prepare with starting switch OFF, then carry out troubleshooting by holding starting switch OFF. |  |            |
|  |       |   | Wiring harness between fuse (5) - CN14 (female) (2)  | Resistance   | Max. 1 Ω   |
|  |       |   | Between fuse (5) - CN14 (female) (2) wiring harness and chassis ground                             | Resistance   | Min. 1 MΩ  |
|  |       |   | Wiring harness between CN14 (female) (1) - 19 (3) - 13 (3) - 11 (female) (2)                       | Resistance   | Max. 1 Ω   |
|  |       |   | Between CN14 (female) (1) - 19 (3) - 13 (3) - 11 (female) (2) wiring harness and chassis ground    | Resistance   | Min. 1 MΩ  |
|  |       |   | Wiring harness between 11 (female) (1) - chassis ground  | Resistance   | Max. 1 Ω   |

# Bulldozer

## D61EX-15

## D61PX-15

| <b>Machine Model</b> | <b>Serial Number</b> |
|----------------------|----------------------|
| D61EX-15             | B40001 and up        |
| D61PX-15             | B40001 and up        |

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# Troubleshooting

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|   |    |
|---|----|
| Troubleshooting of hydraulic and mechanical system (H-mode) .....                           | 3  |
| Information described in troubleshooting list .....   | 3  |
| H-1 No travel power (No drawbar pull).....  | 4  |
| H-2 Machine does not move (At 2nd or 3rd speed) .....                                       | 5  |
| H-3 Machine does not move in any speed range.....   | 6  |
| H-4 Machine travels only in one direction forward or in reverse .....                       | 7  |
| H-5 When gear is shifted or travel direction is changed, large time lag is made.....        | 8  |
| H-6 Machine does not turn (Not turned rightward or leftward) .....                          | 9  |
| H-7 Steering speed or power is low .....  | 10 |
| H-8 Brake does not work.....  | 11 |
| H-9 Overheat of power train oil temperature .....   | 12 |
| H-10 Abnormal sound comes out from around HSS<br>and work equipment pump or HSS motor ..... | 13 |
| H-11 All work equipment speeds are slow .....   | 14 |
| H-12 Work equipment does not move.....  | 15 |

## H-8 Brake does not work

|                     |  |
|---------------------|--|
| Trouble             | • Brake does not work.   |
| Related information | • Confirm that oil quantity on power train is normal before troubleshooting.<br>• Confirm that transmission main relief pressure is normal before troubleshooting. (See H-1) |

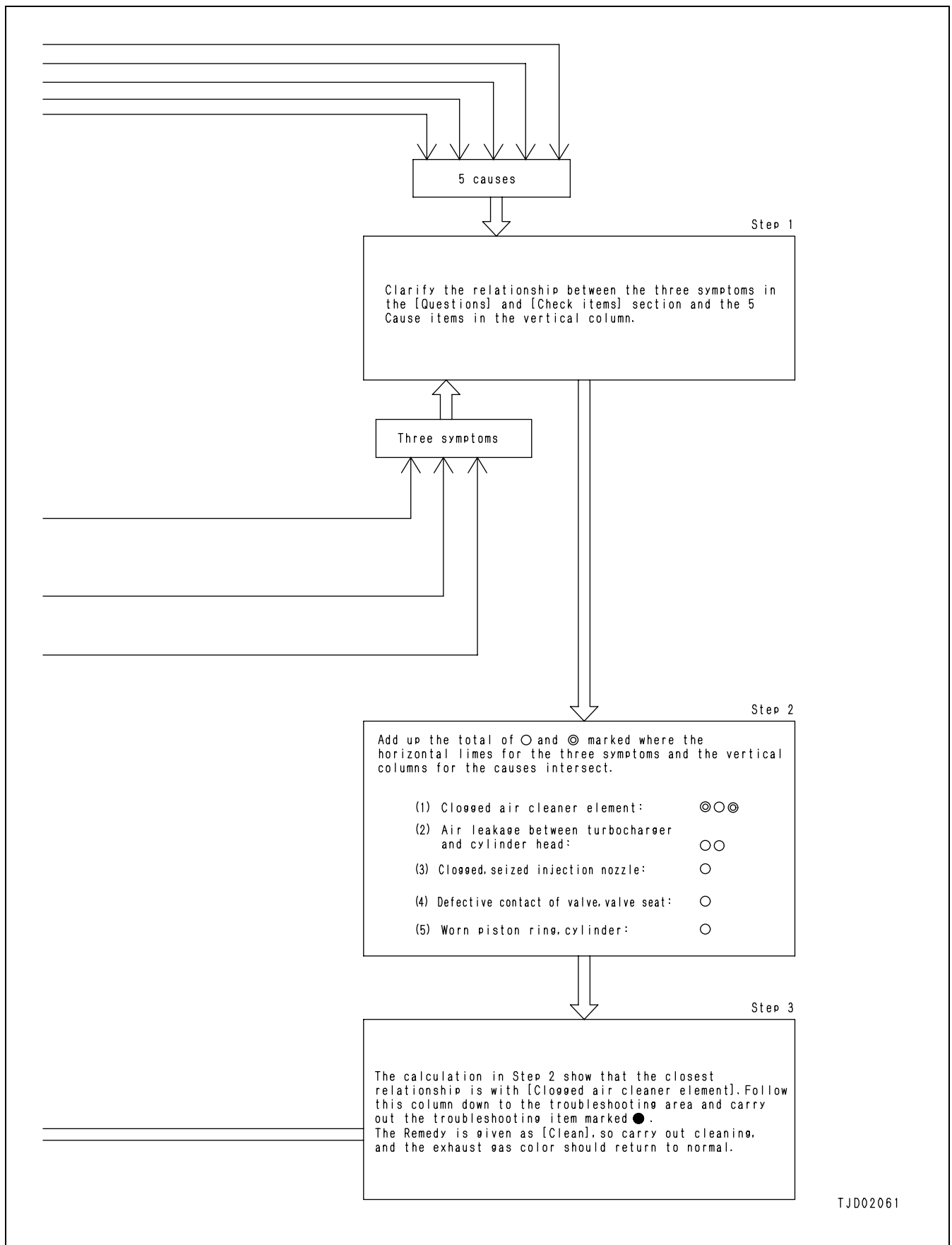
| Possible causes and standard value in normal state | Cause  |  | Standard value in normal state/Remarks on troubleshooting |  |
|--|--|--|---|--|
|  | Possible causes and standard value in normal state | 1  | Defective brake valve function                            | ★ Prepare with starting switch OFF, then drive engine in high idling mode for troubleshooting. |
| Brake pedal  |  |  |   | Brake hydraulic pressure   |
| Released   |  |  |   | Min. 2.55 MPa {Min. 26 kg/cm <sup>2</sup> }  |
| At pedaling  |  |  |   | 0 MPa {0 kg/cm <sup>2</sup> }  |
| 2  | Defective adjustment of brake pedal linkage        | If troubleshooting in cause 1 is abnormal, the adjustment of brake pedal linkage is assumed to be abnormal; directly check it. |   |  |
| 3  | Defective brake seal                               | If troubleshooting in cause 1 is abnormal, rake seal is assumed to be defective; directly check it.                            |   |  |
| 4  | Slipped or abrasive brake disc plate               | Brake disc plate is assumed to be slipped or abrasive; directly check it.  |   |  |

## H-18 Excessive hydraulic drift of blade tilt

|                     |   |
|---------------------|---|
| Trouble             | <ul style="list-style-type: none"> <li>Hydraulic drift of tilting blade is large</li> </ul>   |
| Related information | <ul style="list-style-type: none"> <li>Confirm whether the blade is remodeled.</li> <li>Confirm that no oil leaks circuits in work equipment before troubleshooting.</li> </ul> |

| Possible causes and standard value in normal state   | Cause                                 |  | Standard value in normal state/Remarks on troubleshooting                         |  |
|--|---------------------------------------|--|---|--|
|  | 1                                     | Defective seal of blade tilt control valve (spool)                         | ★ Prepare with starting engine, then carry out troubleshooting when engine stops. |  |
| 1. Fully extend blade tilt cylinder.<br>2. Disconnect hose on cylinder head side and block it.<br>3. Measure hydraulic drift of blade tip. |                                       |  |   |  |
| Blade tilt   |                                       |  | Hydraulic drift   |  |
| Block blade tilt circuit   |                                       |  | 200 mm/15 min   |  |
| 2  | Defective seal of blade tilt cylinder | Seal of blade tilt cylinder is assumed to be defective; directly check it. |   |  |

If we look from these three symptoms to find the causes, we find that there is a relationship with five causes. Let us explain here the method of using this causal relationship to pinpoint the most probable cause.



### S-8 Oil consumption is excessive (or exhaust gas color is blue)

★ Do not keep idling the engine for more than 20 minutes.

(for both low idling and high idling)

General causes why oil consumption increases

- Abnormal combustion of oil
- Oil leak to outside
- Wear of lubrication system

|                 |   | Cause                    |                                  |                                   |                                     |                         |                             |                                       |                   |              |         |                                   |                                  |         |
|-----------------|---|--------------------------|----------------------------------|-----------------------------------|-------------------------------------|-------------------------|-----------------------------|---------------------------------------|-------------------|--------------|---------|-----------------------------------|----------------------------------|---------|
|                 |   | Broken piston ring       | Worn piston ring, cylinder liner | Clogged breather or breather hose | Leakage from oil filter, oil cooler | Leakage from oil piping | Leakage from oil drain plug | Leakage from oil pan or cylinder head | Broken oil cooler | Turbocharger |         | Dust sucked in from intake system | Worn, broken valve (stem, guide) |         |
| Questions       | Confirm recent repair history   |                          |                                  |                                   |                                     |                         |                             |                                       |                   |              |         |                                   |                                  |         |
|                 | Degree of use of machine  | Operated for long period | △                                |                                   |                                     |                         |                             |                                       |                   | △            | △       |                                   |                                  | △       |
|                 | Oil consumption suddenly increased  |                          | ○                                |                                   |                                     |                         |                             |                                       | ○                 |              |         |                                   |                                  |         |
|                 | Engine oil must be added more frequently  |                          | ○                                |                                   |                                     |                         |                             |                                       | ○                 |              |         |                                   |                                  |         |
|                 | Engine oil becomes contaminated quickly   |                          | ○                                | ○                                 | ○                                   |                         |                             |                                       |                   |              |         |                                   |                                  |         |
|                 | Exhaust smoke is blue under light load  |                          | ○                                | ○                                 |                                     |                         |                             |                                       |                   |              |         |                                   |                                  |         |
|                 | Amount of blow-by gas   | Excessive                | ○                                | ○                                 |                                     |                         |                             |                                       |                   |              | ○       |                                   |                                  | ○       |
|                 |   | None                     |                                  |                                   | ○                                   |                         |                             |                                       |                   |              |         |                                   |                                  |         |
|                 | Outside of engine is dirty with oil   |                          |                                  |                                   | ○                                   | ○                       | ○                           | ○                                     |                   |              |         |                                   |                                  |         |
|                 | There is oil in engine cooling water  |                          |                                  |                                   |                                     |                         |                             |                                       | ○                 |              |         |                                   |                                  |         |
| Check items     | When exhaust pipe is removed, inside is found to be dirty with oil                    |                          |                                  |                                   |                                     |                         |                             |                                       | ○                 |              |         |                                   | ○                                |         |
|                 | Inside of turbocharger air supply pipe is dirty with oil                              |                          |                                  |                                   |                                     |                         |                             |                                       |                   | ○            |         |                                   |                                  |         |
|                 | Oil level in damper chamber rises   |                          |                                  |                                   |                                     |                         |                             |                                       |                   |              | ○       |                                   |                                  |         |
|                 | Loose piping clamp in air intake system   |                          |                                  |                                   |                                     |                         |                             |                                       |                   |              |         | ○                                 |                                  |         |
|                 |   |                          |                                  |                                   |                                     |                         |                             |                                       |                   |              |         |                                   |                                  |         |
| Troubleshooting | When compression pressure is measured, it is found to be low                          | ●                        | ●                                |                                   |                                     |                         |                             |                                       |                   |              |         |                                   |                                  |         |
|                 | When breather element is inspected directly, it is found to be clogged with oil stain |                          |                                  | ●                                 |                                     |                         |                             |                                       |                   |              |         |                                   |                                  |         |
|                 | There is external leakage of oil from engine  |                          |                                  |                                   | ●                                   | ●                       | ●                           | ●                                     |                   |              |         |                                   |                                  |         |
|                 | Pressure-tightness test of oil cooler shows there is leakage                          |                          |                                  |                                   |                                     |                         |                             |                                       | ●                 |              |         |                                   |                                  |         |
|                 | Excessive play of turbocharger shaft  |                          |                                  |                                   |                                     |                         |                             |                                       |                   | ●            | ●       |                                   |                                  |         |
|                 | Check rear oil seal directly  |                          |                                  |                                   |                                     |                         |                             |                                       |                   |              |         | ●                                 |                                  |         |
|                 | When intake manifold is removed, dust is found inside                                 |                          |                                  |                                   |                                     |                         |                             |                                       |                   |              |         |                                   | ●                                |         |
|                 | When intake manifold is removed, inside is found to be extremely dirty with oil       |                          |                                  |                                   |                                     |                         |                             |                                       |                   |              |         |                                   |                                  | ●       |
|                 |   |                          |                                  |                                   |                                     |                         |                             |                                       |                   |              |         |                                   |                                  |         |
|                 | Remedy  | Replace                  | Replace                          | Clean                             | Correct                             | Correct                 | Correct                     | Correct                               | Replace           | Replace      | Replace | Correct                           | Correct                          | Correct |

# Bulldozer

## **D61EX-15**

## **D61PX-15**

| <b>Machine Model</b> | <b>Serial Number</b> |
|----------------------|----------------------|
| D61EX-15             | B40001 and up        |
| D61PX-15             | B40001 and up        |

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# **Disassembly and assembly**

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|   |    |
|---|----|
| Preface.....                                | 2  |
| How to read this manual .....               | 2  |
| Standard tightening torque table.....       | 4  |
| Precautions when performing operation ..... | 7  |
| List of coatings.....                       | 12 |
| Special tool list .....                     | 14 |
| Sketches of special tools .....             | 18 |

**4. Precautions when completing the operations**

- If the engine coolant water has been drained, tighten the drain valve, and add coolant water to the specified level. Run the engine to circulate the coolant water through the system. Then check the coolant water level again.
- If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- If the hydraulic equipment was removed, bleed air from each part referring to the relevant section in Testing and adjusting.
- Add the specified amount of grease (molybdenum disulphide grease) to the work equipment related parts.

# Bulldozer

## D61EX-15

## D61PX-15

### Machine Model

### Serial Number

D61EX-15

B40001 and up

D61PX-15

B40001 and up

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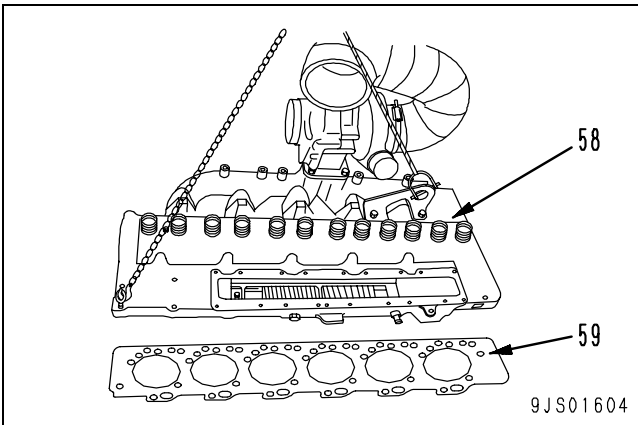
# Disassembly and assembly

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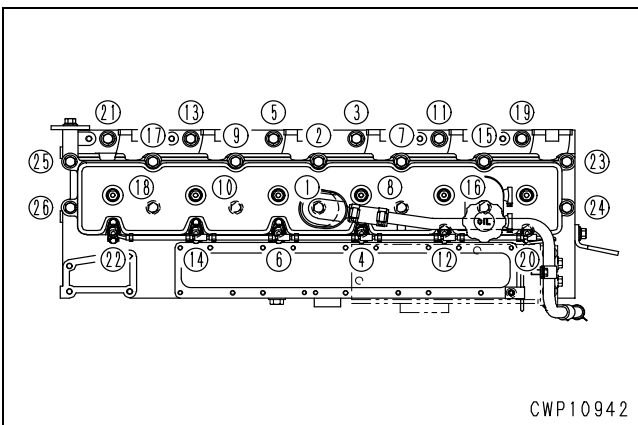
|   |    |
|---|----|
| Engine related procedures .....   | 2  |
| Removal and installation of fuel injection pump assembly.....               | 2  |
| Removal and installation of cylinder head assembly .....                    | 7  |
| Removal and installation of engine front seal .....                         | 14 |
| Removal and installation of engine rear seal .....                          | 15 |
| Removal and installation of engine assembly .....                           | 19 |
| Removal and installation of damper assembly .....                           | 22 |
| Removal and installation of radiator guard assembly .....                   | 26 |
| Removal and installation of radiator and hydraulic oil cooler assembly..... | 30 |
| Removal and installation of fan drive assembly.....                         | 33 |
| Removal and installation of fan motor assembly .....                        | 34 |
| Removal and installation of engine hood assembly .....                      | 35 |
| Removal and installation of fuel tank assembly .....                        | 36 |

**Installation**

- Install the rocker arm assembly and cylinder head assembly according to the following procedure.
- ★ Check that there is not dirt or foreign matter on the mounting face of the cylinder head or in the cylinder.
  - 1) Set cylinder head gasket (59) to the cylinder block.
    - ★ Check that the gasket is aligned with the hole in the block.
  - 2) Lift off cylinder head/exhaust manifold/turbo-charger assembly (58) to set it to the cylinder block.



- 3) Tighten the mounting bolts for the cylinder heads using the sequence shown in the figure.
  - ★ Do not reuse any bolt whose head has five punch marks that identify the number of times it was used.
  - Apply engine oil (SAE15W-40) to the threads and seats of the mounting bolts.
  - Cylinder head mounting bolt:
    - 1st time: Tighten the bolts with a torque of  $70 \pm 5$  Nm  $\{7.1 \pm 0.51$  kgm} in numbered sequence [1] - [26].
    - ★ Check that all bolts have been tightened with a torque of  $70 \pm 5$  Nm  $\{7.1 \pm 0.51$  kgm} in the same sequence.

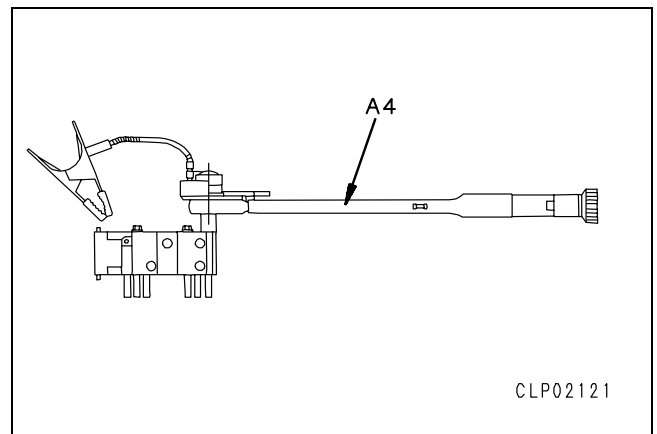


- 2nd time: Further tighten the bolts with a torque of  $145 \pm 10$  Nm  $\{14.8 \pm 1.0$  kgm} in the following sequence: [1], [2], [7], [8], [9], [10], [15], [16], [18], [23], [24], [25], and [26].

- ★ Check that these bolts have been tightened with a torque of  $145 \pm 10$  Nm  $\{14.8 \pm 1.0$  kgm} in the same sequence as above.

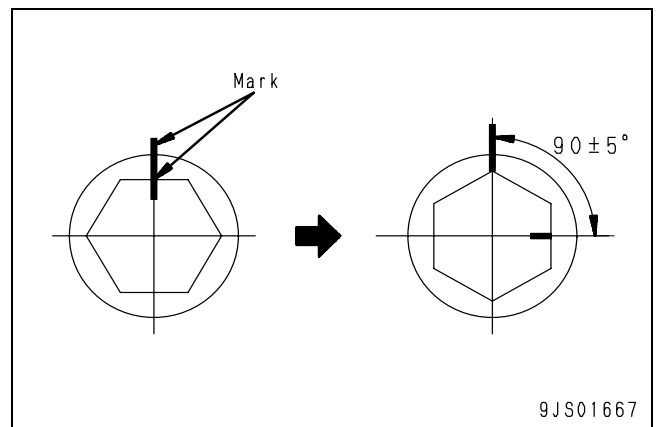
- 3rd time: Retighten all bolts with a torque of  $90 \pm 5^\circ$  in numbered sequence [1] - [26].

1] When using tool A4:



2] When not using tool A4:

- Using a felt pen or the like, mark each bolt and head with aligning marks before retighten them with a torque of  $90 \pm 5^\circ$ .

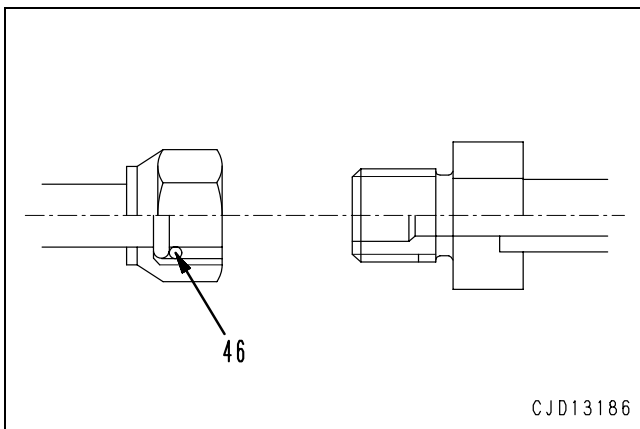



**Installation**

- Carry out installation in the reverse order to removal.

[\*1]

- ★ Install each hose so that it will not be twisted.
- ★ When installing the air conditioner hoses, take care that dirt, dust, water, etc. will not enter them.
- ★ When tightening each joint of the air conditioner hose, check that O-ring (46) is fitted to it.
- ★ Apply an appropriate amount of compressor oil (Showa-Shell Suniso 4G, 5G or equivalent) to each O-ring.




 Tightening torque of air conditioner refrigerant piping

| Thread size | Tightening torque          |
|-------------|----------------------------|
| 16 x 1.5    | 11.8-14.7 Nm {1.2-1.5 kgm} |
| 22 x 1.5    | 19.6-24.5 Nm {2.0-2.5 kgm} |
| 24 x 1.5    | 29.4-34.3 Nm {3.0-3.5 kgm} |


[\*2]

- ★ Adjust the fuel control linkage. For details, see Testing and adjusting, Adjusting fuel control linkage.


[\*3]

 Engine ground terminal:  
**98-123 Nm {10-12.5 kgm}**



[\*4]

 Fuel hose joint bolt:  
**29.5±4.5 Nm {3.01±0.46 kgm}**

[\*5]


 Starting motor + terminal:  
**19.6-25.5 Nm {2.0-2.6 kgm}**

[\*6]

 Universal joint mounting bolt: **LT-2**  
 Universal joint mounting bolt:  
**98-123 Nm {10-12.5 kgm}**


- **Refilling with water**

- ★ Add water through the water filler to the specified level. Run the engine to circulate the water. Then, check the water level again.

 Total amount of coolant: **Approximately 44 ℓ**

- **Refilling with oil (hydraulic tank)**

- ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

 Hydraulic tank: **55 ℓ(EO10-CD)**

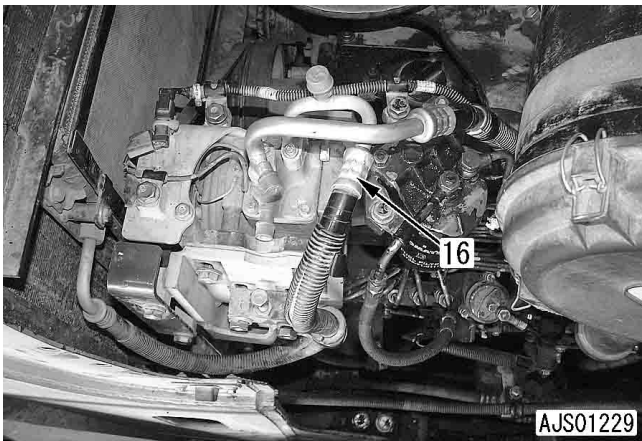
- **Bleeding air from fan pump and work equipment cylinder**

- ★ Bleed air from the fan pump circuit, referring to the section of "Bleeding air from fan pump" in Testing and adjusting.
- ★ Bleed air from the work equipment cylinder circuit, referring to the section of "Bleeding air from work equipment cylinder circuit" in Testing and adjusting.

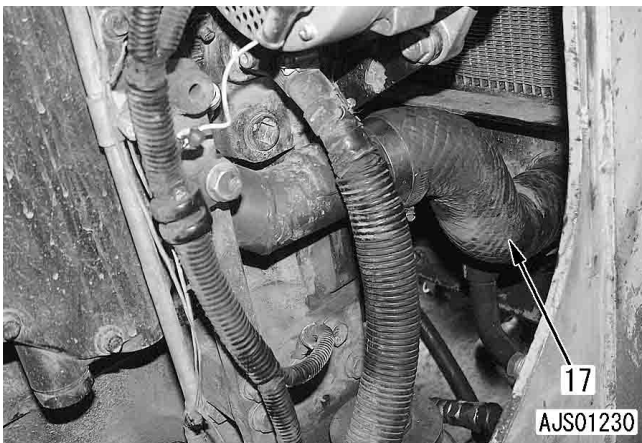
- **Charging air conditioner with refrigerant**

Using tool **X2**, charge the air conditioner circuit with air conditioner refrigerant (R134a). (1000±50g)

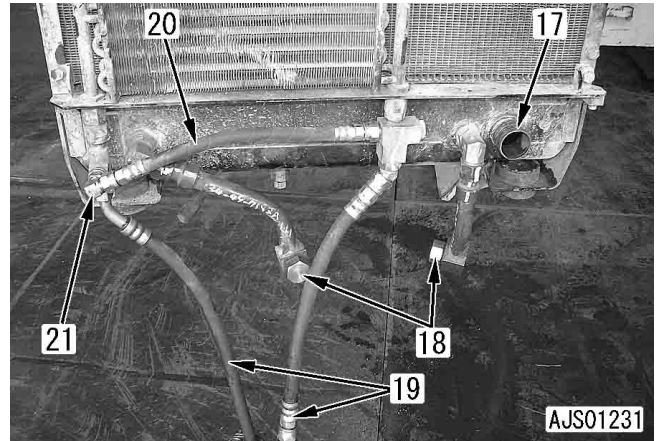
16. Disconnect air compressor hose (16).  
 ★ Be sure to disconnect the clips, too.



17. Disconnect radiator outlet hose (17). [\*1]




18. Disconnect radiator hoses (18).
19. Disconnect oil cooler hoses (19).  
 ★ Prepare a plug before disconnecting these hoses.
20. Disconnect oil cooler hose (20) and remove elbow (21) to prevent it from interfering with the movement during the lifting up.



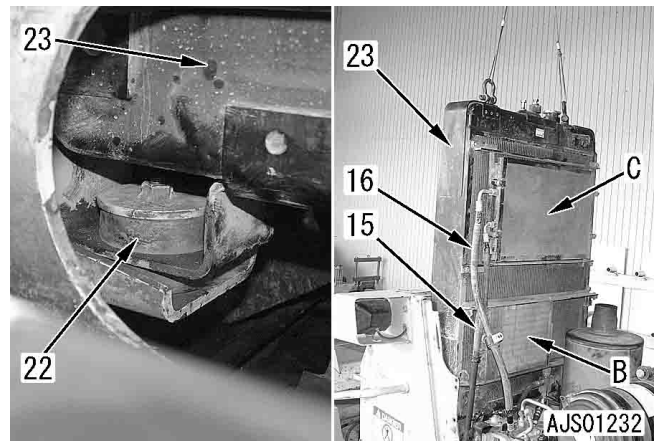
21. Remove mount (22) for the radiator and hydraulic oil cooler assembly.

22. Lift off radiator and hydraulic oil cooler assembly (23) to remove it.

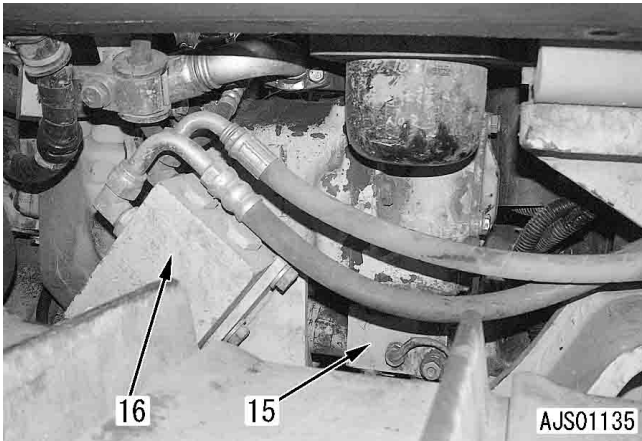
- ★ Take care not to allow any part of assembly to catch on air compressor hoses (15) and (16) when lifting the assembly up.

 Radiator and hydraulic oil cooler assembly: **150 kg**


- ★ B: Hydraulic oil cooler, C: Air conditioner condenser

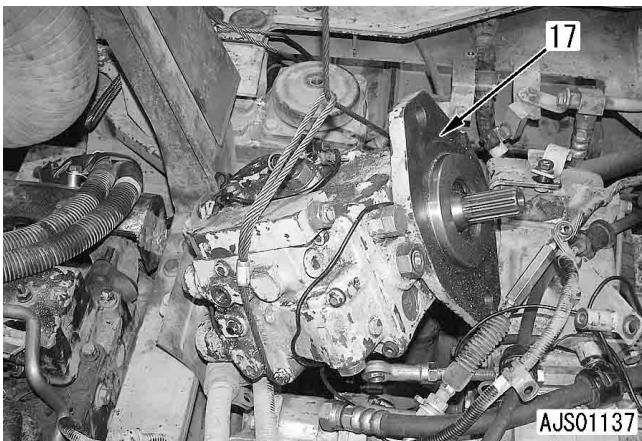


- (15): Suction pipe  
(connected from hydraulic tank)
- (16): Block



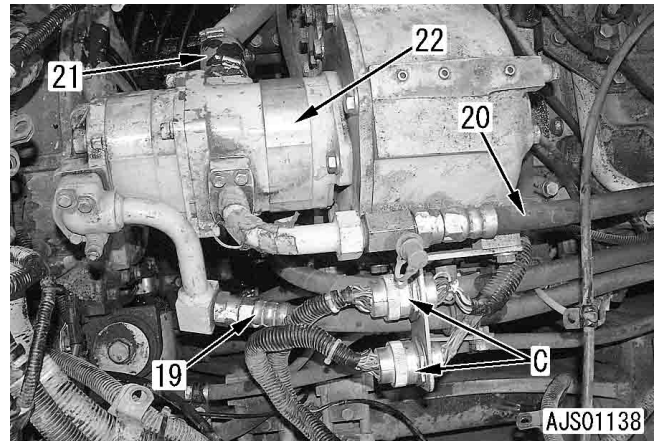
- 3) Lift off HSS and hydraulic pump assembly (17) to remove it. [\*1]

 HSS and hydraulic pump assembly (17):  
70 kg



- ★ Connector C: PL1 and PL2 have been disconnected when the floor frame assembly was removed.

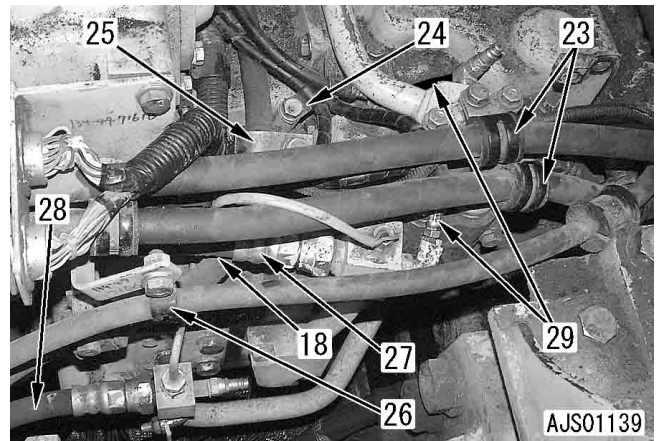
13. Power train and lubricating oil pump assembly (22)
  - 1) Disconnect the following pipes.
    - (19): Pump discharge hose  
(connected to HSS lubrication)
    - (20): Pump discharge pressure hose  
(connected to power train filter)
    - (21): Suction pipe  
(connected from pipe)
  - 2) Remove power train and lubricating oil pump assembly (22). [\*2]



14. Disconnect clips (23), (24), (25) and (26) on the left hand side.

15. Disconnect connector (18).

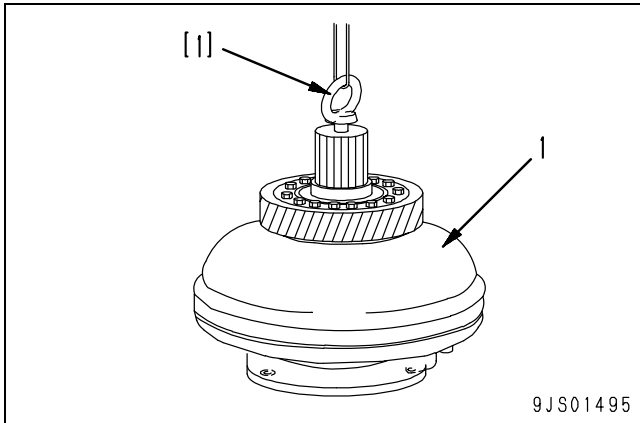
16. Disconnect power train oil cooler hoses (27) and (28) and disconnect oil pressure pickup hose (29).



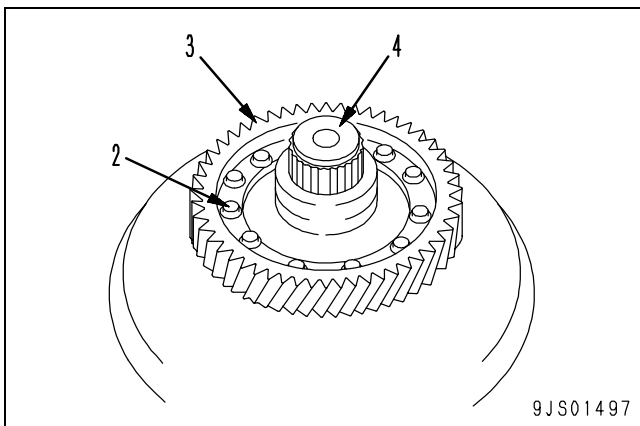
## Disassembly and assembly of torque converter assembly

### Disassembly

1. Remove 24 bolts from the bottom of the assembly. Lift off case, turbine assembly (1) using eyebolts [1] to remove it.

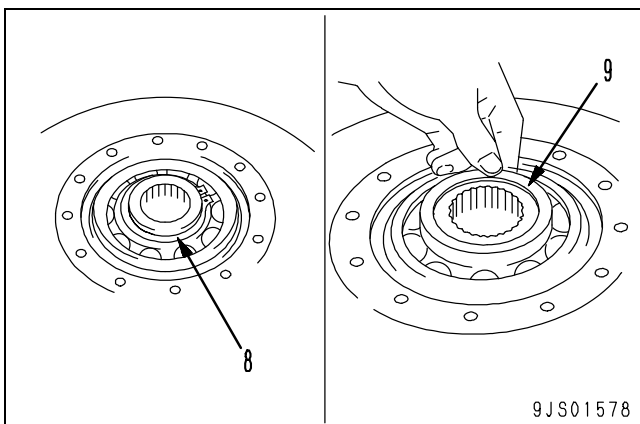


2. Remove bolts (2) to remove gear (3) and input shaft (4).

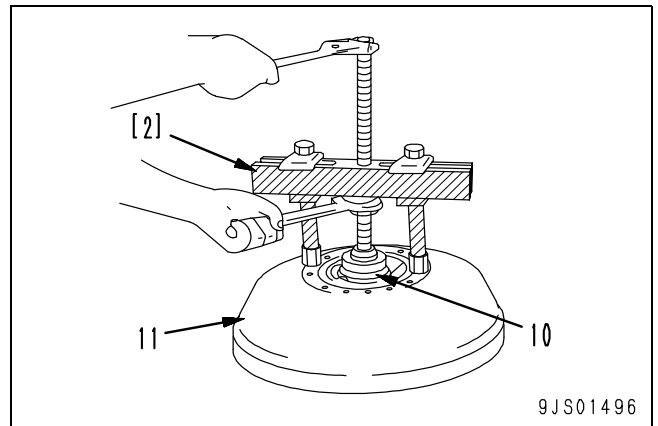


### 3. Case

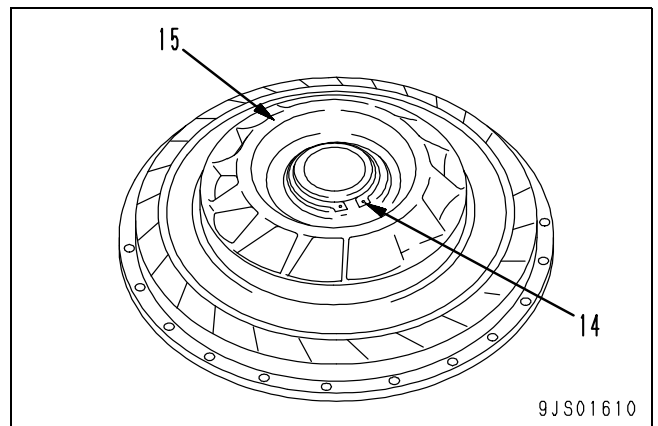
- 1) Remove snap ring (8).
- 2) Remove spacer (9).



- 3) Using puller [2], disconnect case assembly (10) from turbine (11).

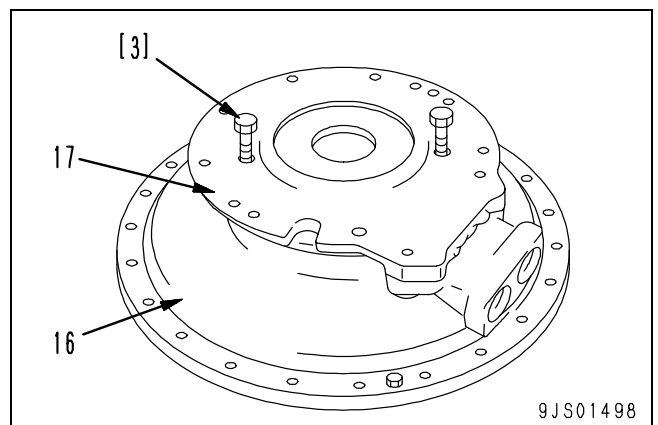


4. Remove snap ring (14) to remove stator (15).



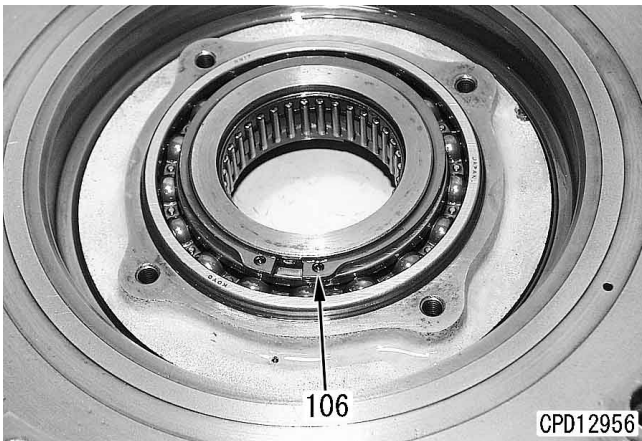
### 5. Pump assembly

- 1) Using forcing screws [3] on the stator shaft end, remove pump assembly (16) from stator shaft (17).

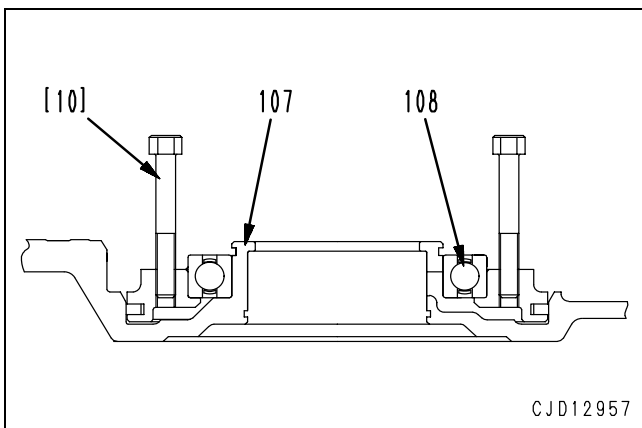


**26. Cage (for fixing No. 5 carrier)**

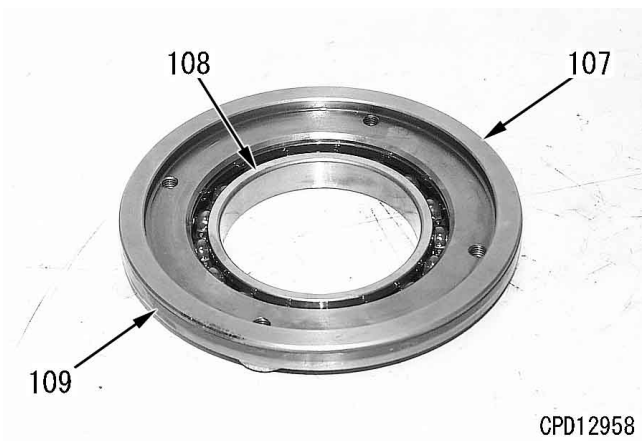
- 1) Remove snap ring (106).



- 2) Using forcing screws [10], remove cage (107) and bearing (108) as a single unit.

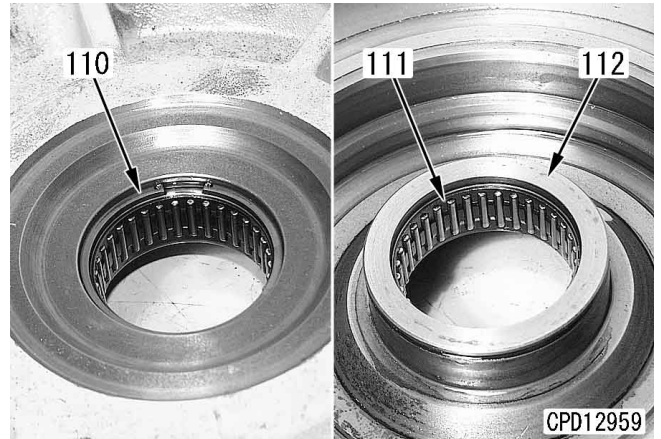


- 3) Remove seal ring (109) and bearing (108) from cage (107).



**27. Output shaft bearing**

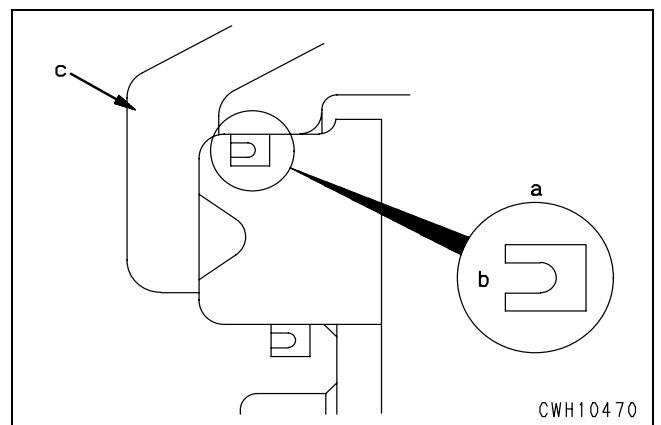
- 1] Remove snap ring (110).
- 2] Remove bearing (111) from housing (112).



**Assembly**

● **Precautions for assembly**

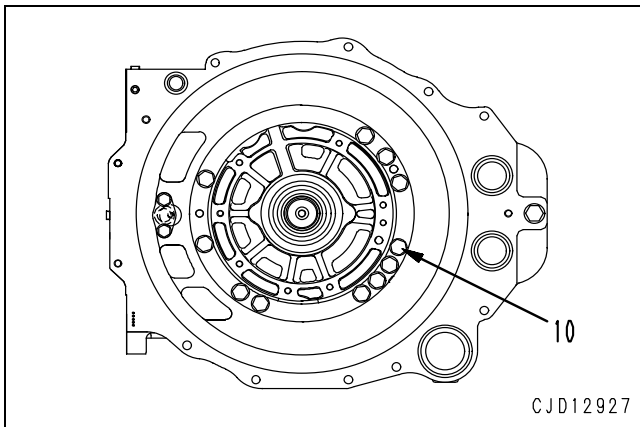
- ★ Clean the all parts and check them for dirt or damage before assembling them.
- ★ Coat the sliding surfaces of each part with engine oil before assembling.
- ★ Install seal ring (a) for the piston and piston housing with power receiving side (b) facing to housing (c) as shown in the figure.
- ★ Apply grease (G2-LI) to the seal ring and install it evenly.
- ★ Before cooling the bearing in dry ice, etc. for expansion fit, apply approximately 6 cc of engine oil (EO10-CD or EO30-CD) to the bearing and rotate it ten turns.



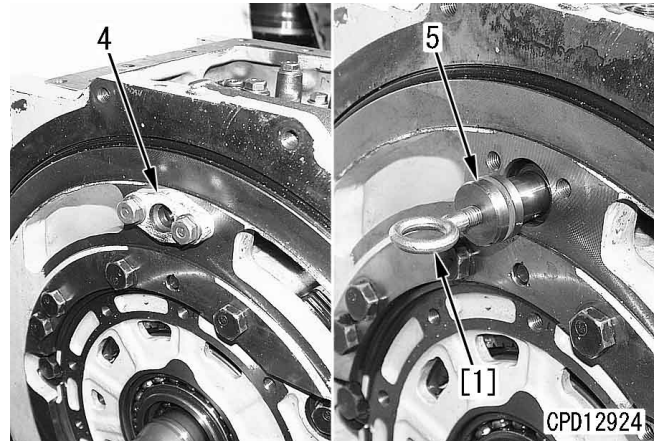
- 2) Tighten eleven tie bolts (10) (to secure the transmission case).

 Tie bolts

**156.9-176.5Nm{16.0-18.0 kgm}**




- 5) Fit the O-ring and install sleeve (5) using eye-bolt [1].
- 6) Install flange (4).

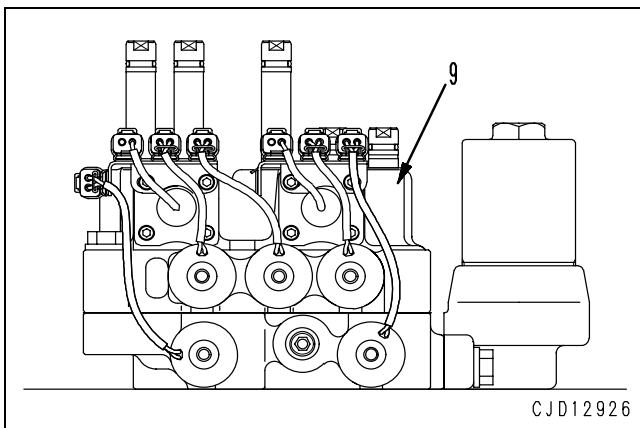


**30. Control valve**


- 1) Set the transmission assembly on its side.
- 2) Fit the O-ring and install control valve assembly (9).

 Mounting bolt:

**44.1-53.9Nm{4.5-5.5 kgm}**




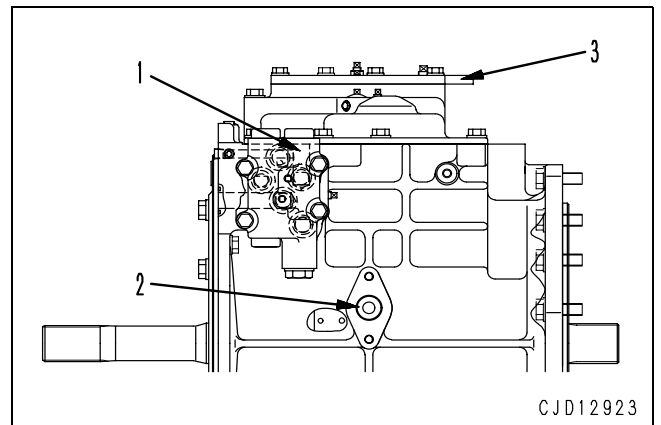
- 7) Install cover (3).

 Cover: Gasket sealant (LG-6)

31. Install sleeve (2).

32. Install relief valve assembly (1).

 Mounting bolt: **44.1-53.9Nm{4.5-5.5 kgm}**

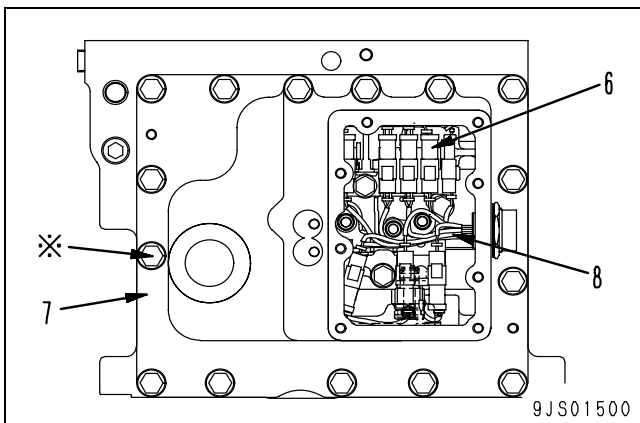


- 3) Install cover (7) and wiring harness (8) as a single unit.

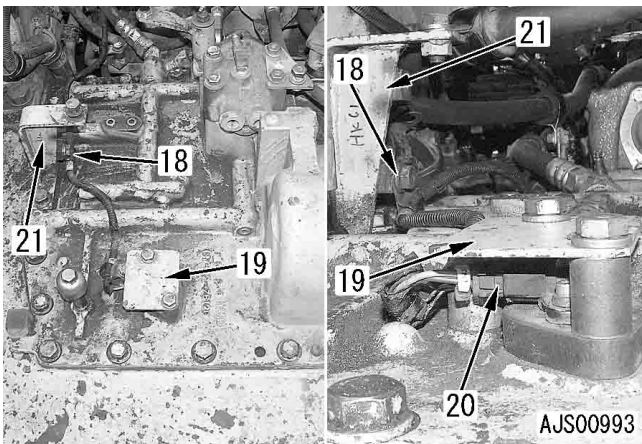
 Cover: **Gasket sealant (LG-6)**

 One bolt marked with an asterisk (\*):  
**Gasket sealant (LG-6)**


- 4) Connect ten ECMV connectors (6).

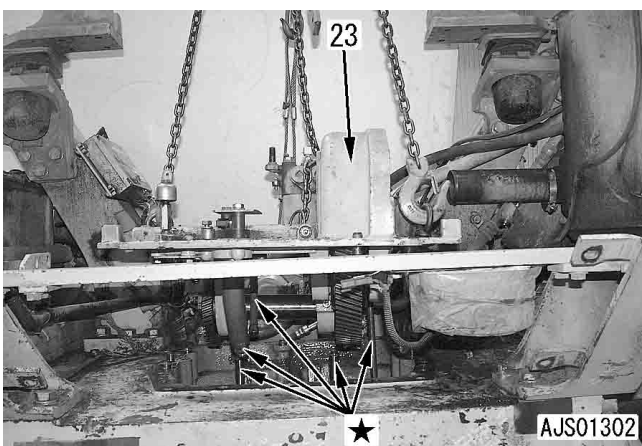
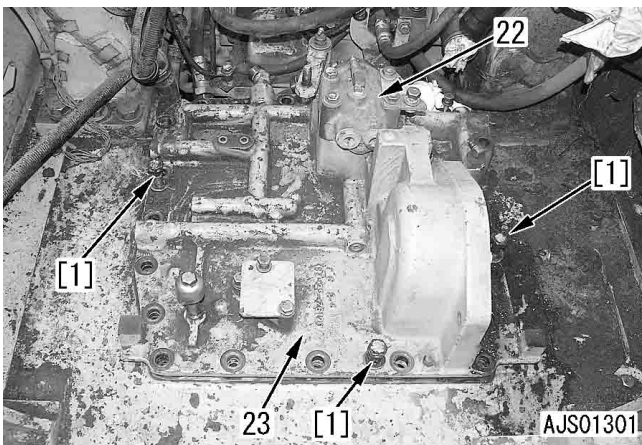


- 13) Disconnect clip (18).
- 14) Remove cover (19) and disconnect connector (20).
- 15) Remove bracket (21).



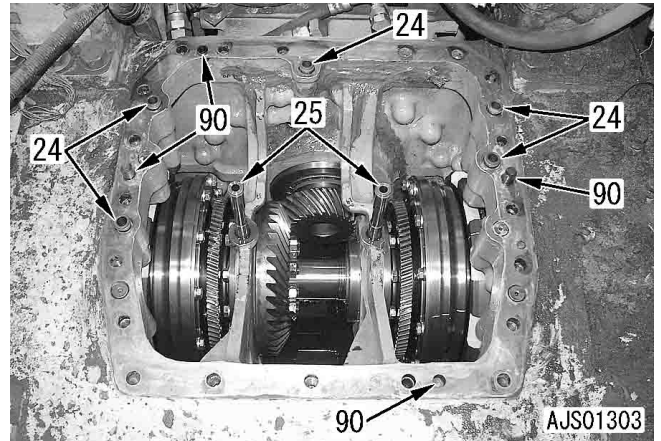
- 16) Remove brake valve assembly (22).
- 17) Remove cover assembly (23) mounting bolt.
- 18) Using forcing screw [1], remove the pilot portion and lift off upper cover assembly (23).

★ Slowly raise horizontally as there are sleeves, tubes, etc.  
 Upper cover assembly (23): 140 kg



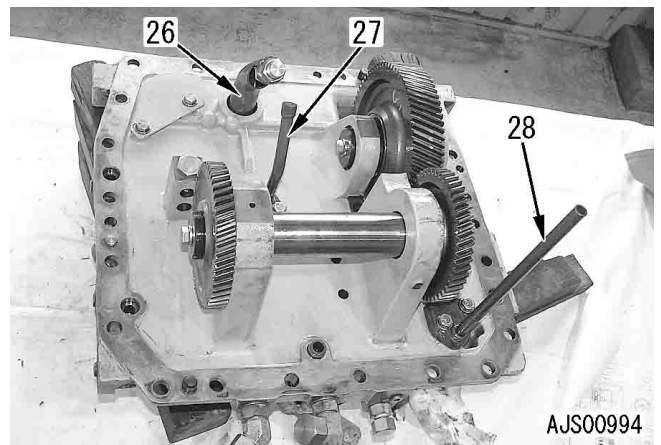
- 19) Remove five sleeves (24) and two sleeves (25) from the HSS case.
- 20) Remove four dowel pins (90) from the HSS case (as they may be left in the cover).

⚠ Be sure to remove four dowel pins (90). Failure to do so could damage sleeves (24) and (25) and cut the O-ring when assembling.

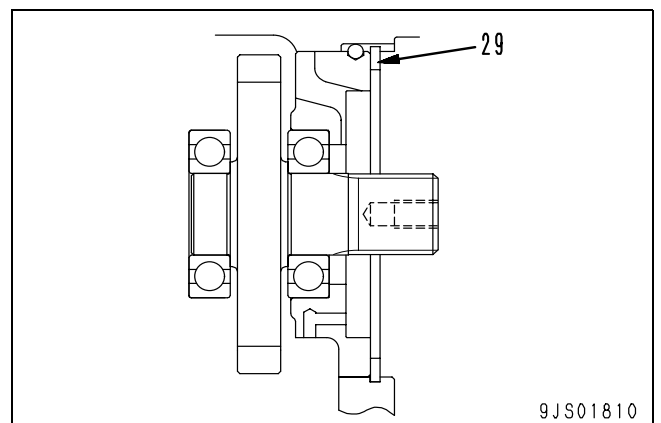


**2. Disassembly of upper cover assembly**

- 1) Remove oil temperature sensor (26), tubes (27) and (28).



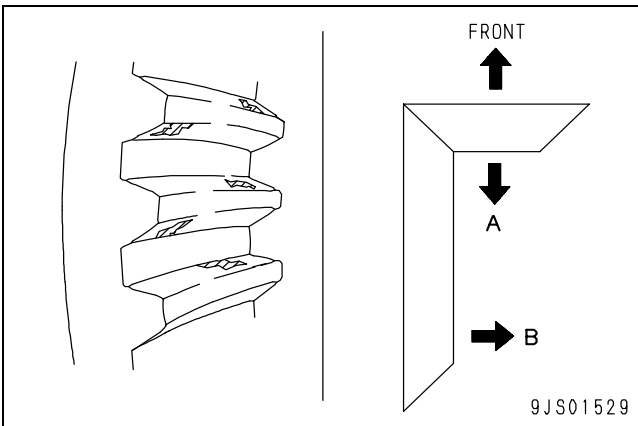
- 2) Input gear assembly
  - 1] Remove snap ring (29).




**Adjusting**

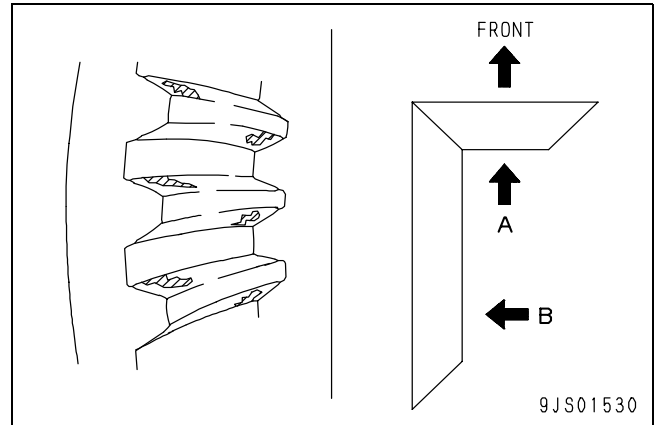
If the tooth contact pattern is not proper, adjust the tooth contact using the following procedure.

- 1] If the bevel pinion is too far from the center line of the bevel gear, the contact is at the small end of the bevel gear tooth faces curved outward and at the large end of the bevel gear tooth faces curved inward.
  - In this case, adjust the tooth contact using the following procedure.  
Adjust the thickness of the shims on the bevel pinion side to move the bevel pinion in the direction A. Move the bevel gear in the direction B, then check the tooth contact pattern and backlash again.



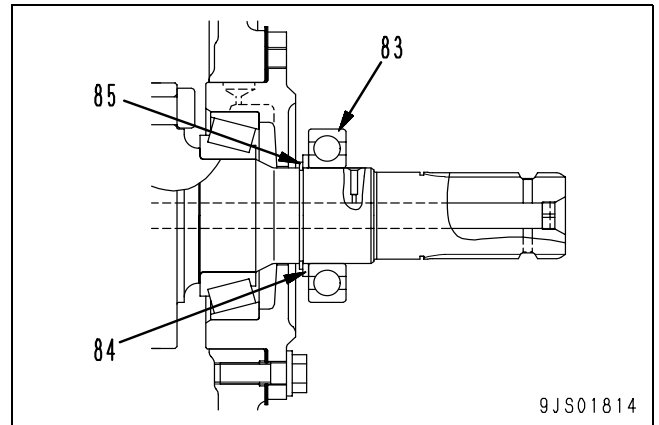
- 2] If the bevel pinion is too close to the center line of the bevel gear, contact is at the large end of the bevel gear tooth faces curved outward and the small end of the bevel gear tooth faces curved inward.
    - In this case, adjust the tooth contact using the following procedure.  
Adjust the thickness of the shims on the bevel pinion side to move the bevel pinion in the direction A. Move the bevel gear in the direction B, then check the tooth contact pattern and backlash again.
- ★ Do not change the total thickness of the shims on both sides.
- 3] When adjustment is finished, tighten the mounting bolts of the cage and bevel pinion assembly to the specified torque.

 Mounting bolts of cage and bevel pinion assembly: **98 - 123 Nm {10 - 12.5 kgm}**

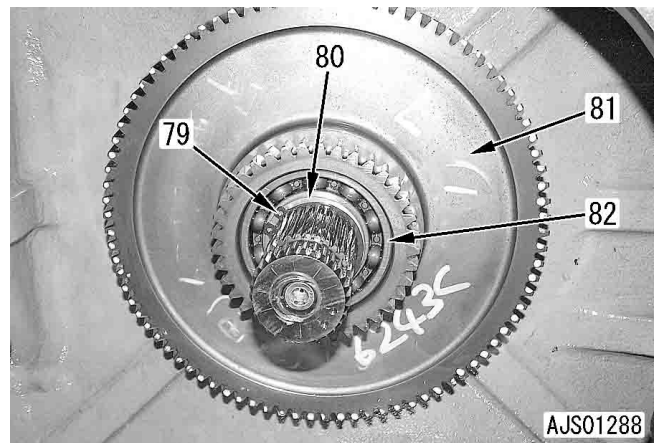


**4. Sun gear**

- 1) Install snap ring (85) to the shaft.
  - ★ Perform this work only for the right side of the machine.
- 2) Install collar (84).
- 3) Install bearing (83) with a push tool.



- 4) Install sun gear (81).
- 5) Install bearing (82) with the push tool.
  - ★ Press fit the inner race and outer race simultaneously.
- 6) Install collar (80) and snap ring (79).

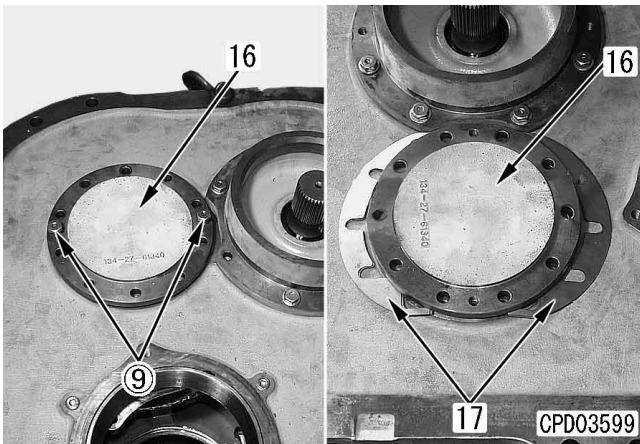


4. No.2 pinion

- 1) Remove No.2 pinion cover (15).



- 2) Remove No.2 pinion cage and outer race assembly (16) and shim (17).
  - ★ Use forcing screw [9] to remove these assembly and shim.
  - ★ Check the thickness, quantity, and location of the shim.

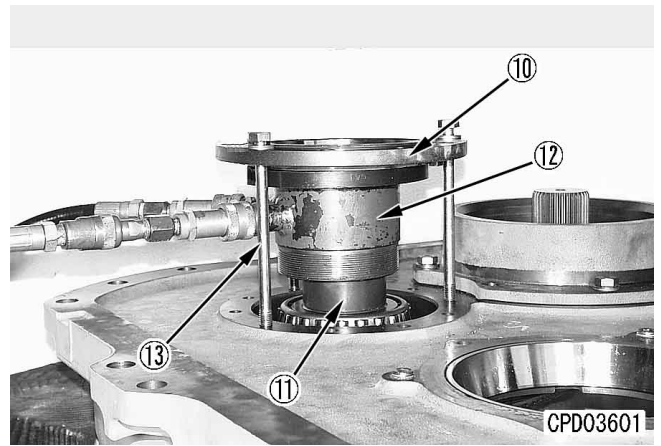


- 3) Remove outer race (18) from No.2 pinion cage (19).

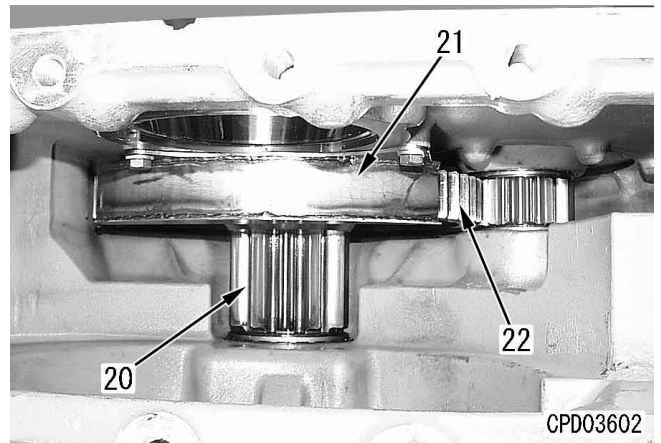


- 4) Using plates [10] and [11], puller [12] and three bolts [13], push out and remove No.2 pinion and bearing assembly (20).

★ The No. 2 pinion and bearing assembly is removed together with the bearing (on the HSS side) and outer race (on the sprocket side).

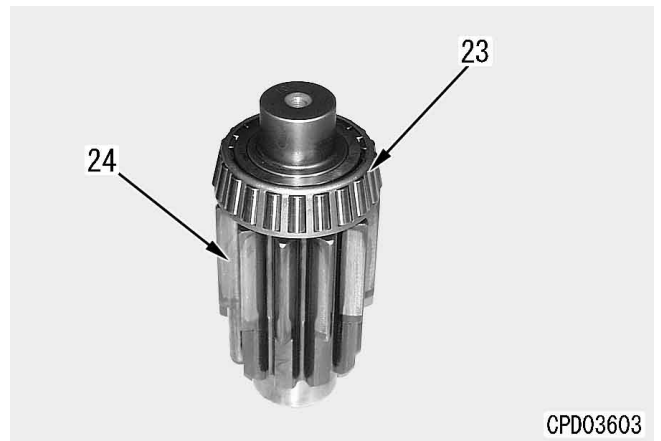


- 5) Remove gear cover (21).
- 6) Remove No.1 gear (22).

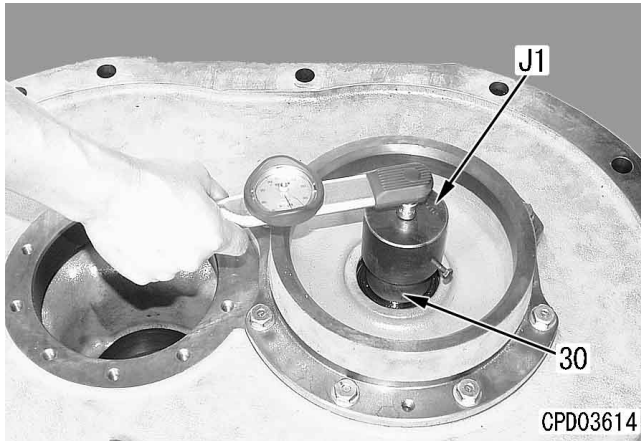


- 7) Disassemble No.2 pinion and bearing assembly.

- 1) Remove bearing (23) from No.2 pinion (24).




- 2) Using tool **J1**, measure the rotation torque of No.1 pinion (30).
  - Standard rotation torque: Rotation torque measured in 9-2) + 0 to 5 Nm {+ 0 to 0.5 kgm}
  - ★ If the rotation torque is outside the standard value, select shims again as in step 1) above.

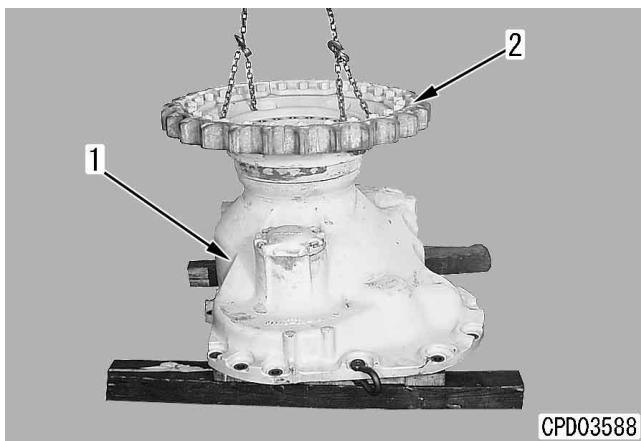


### 11. Sprocket assembly

- 1) Turn over case assembly to set No.1 pinion spline down.
- 2) Sling and install sprocket assembly (2).


 Mounting bolt:

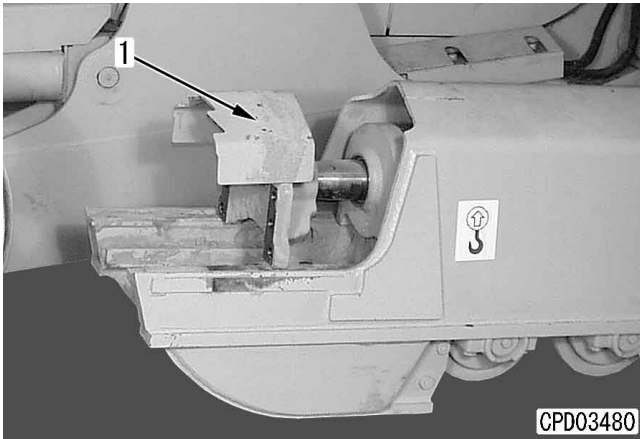
**1,010-1,157Nm {103-118kgm}**



## Removal and installation of recoil spring assembly

### Removal

1. Remove the idler assembly. For details, see Removal of idler assembly.
  2. Lift off recoil spring assembly (1). [\*1]
    - ★ Take care not to damage the grease fitting.
-  Recoil spring assembly: **350 kg (one side)**



### Installation

- Carry out installation in the reverse order to removal.

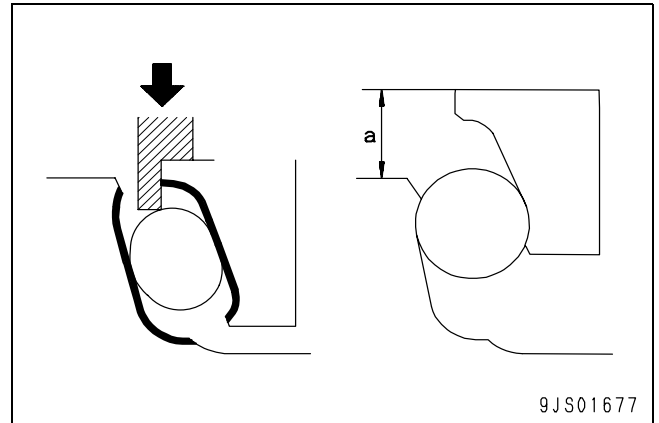
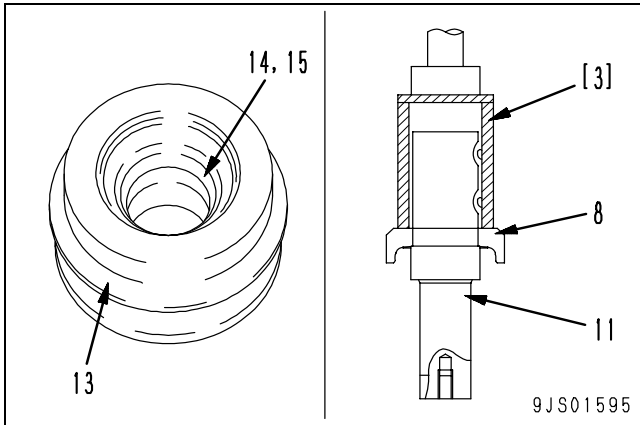
[\*1]

- ★ After inserting recoil spring assembly (1), slightly raise it on the lubricator side and push in the idler until the recoil spring is housed fully.



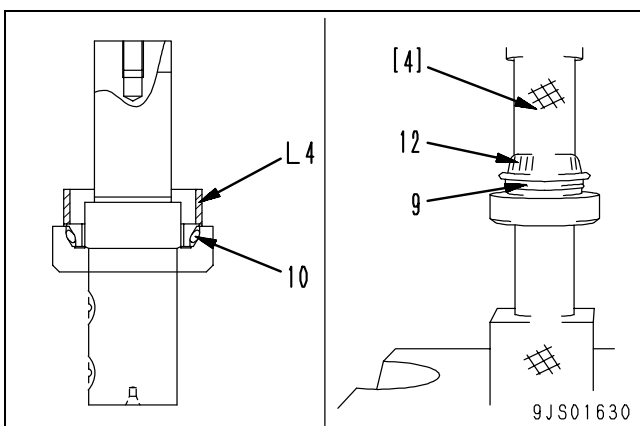
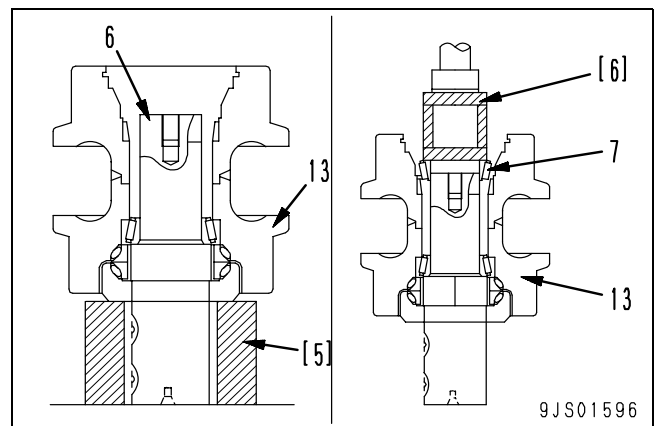
**Assembly**

1. Press fit outer races (15) and (14) to roller (13).
2. Disassemble the shaft assembly according to the following procedure.
  - 1) Using push tool [3], press fit collar (8) to shaft (11).

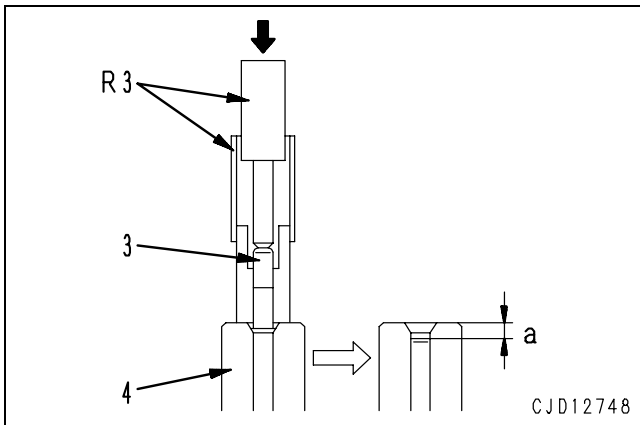


3. Set shaft assembly (6) to block [5] and install roller (13).
4. Using push tool [6], install bearing (7) and press fit it.
  - ★ Rotate the roller when press fitting the bearing, and press fit until the rotation of the roller starts to become heavy.

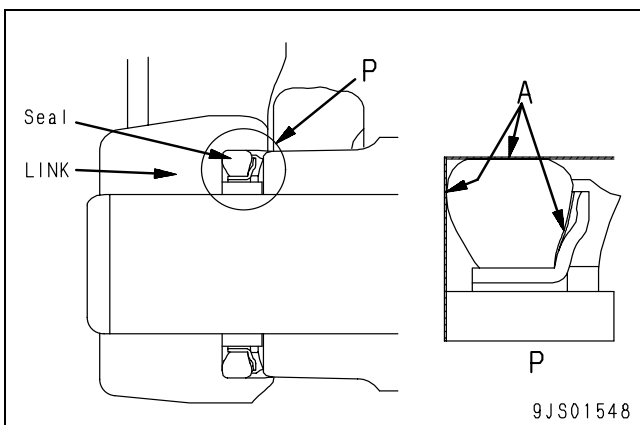
- 2) Using tool L4, install floating seal (10).
  - ★ When assembling the floating seal, clean the thick line portion (O-ring and O-ring contact surface), remove all oil and grease, and dry it.
- 3) Install floating seal (9) and using push tool [4], press fit bearing (12).
  - ★ When assembling the floating seal, clean the thick line portion (O-ring and O-ring contact surface), remove all oil and grease, and dry it.
  - ★ Check that its inclination is 1 mm maximum.
  - ★ After fitting the floating seal, check that its projection (a) is 7 to 11 mm.



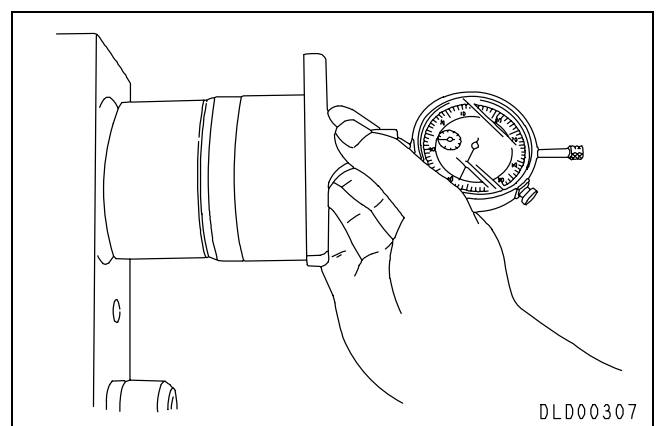
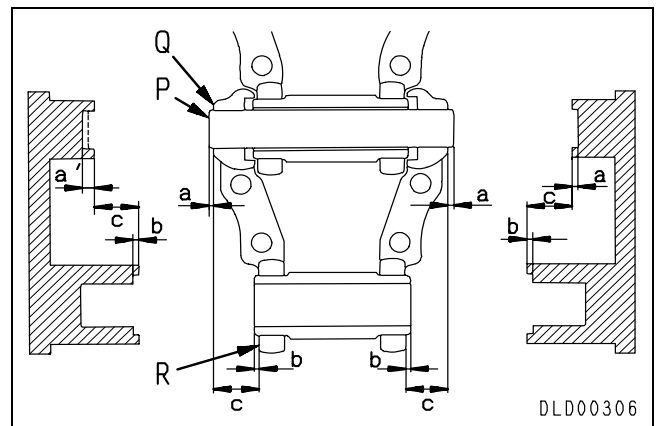
- (5) Using tools **R3**, drive in large plugs (3).
- ★ Coat the outside circumference of large plug (3) with GO90 and knock in the smaller diameter part first.
  - i) Insert large plug (3) into the guide hole through the plug insertion window.
  - ii) Push the bar of tool **R3** with the hand until the large plug stops.
  - iii) Push large plug (3) with the bar of **R3** and push the pin to the guide itself.
  - iv) Drive in the bar with a hammer.
    - ★ Driving distance (a) from pin end:  $6 \pm 2$  mm
    - ★ If the chamfered part of the pin hole has been worn, chamfer it with a small-sized grinder (grindstone tip angle:  $45^\circ - 60^\circ$ ) so that the plug will not be damaged.



- (6) Installation of seal assembly
- F5 type seal
    - When reusing the link and replacing the seal with a new part, clean the link counterbore (section A) then push the seal in fully to the bottom.
    - ★ If oil or grease is sticking to the counterbore portion of the link and seal assembly, the seal will turn and its sealing performance will lower. Accordingly, do not apply any oil or grease to that portion. In addition, be careful not to let oil get into the counterbore portion of the seal when pushing in.





- (7) Adjust the dimensions of the press fitting jig of the link press to keep the projection of the pin and bushing constant and keep the installed dimensions of the seal within the standard range.
- ★ For details of the standard dimensions, see PRESS-FITTING JIG DIMENSION TABLE FOR LINK PRESS.
  - ★ To leave a small space for the pin when assembling, ensure that the dimension (dimension (a')) is greater than dimension (a) at the pin pushing portion of the left press-fitting jig.
    - When assembling in order of [1] press fitting left link and [2] press fitting right link, provide the extra space for the pin on the right press-fitting jig.
    - ★ If the pin end (part P) or link sides (parts Q and R) are worn, add the dimensions of the worn parts to the standard dimension when adjusting the dimension of the press-fitting jig so that the projections of the left and right pins and bushings on both sides will be even.



**4) Connecting to make 1/2 assembly**

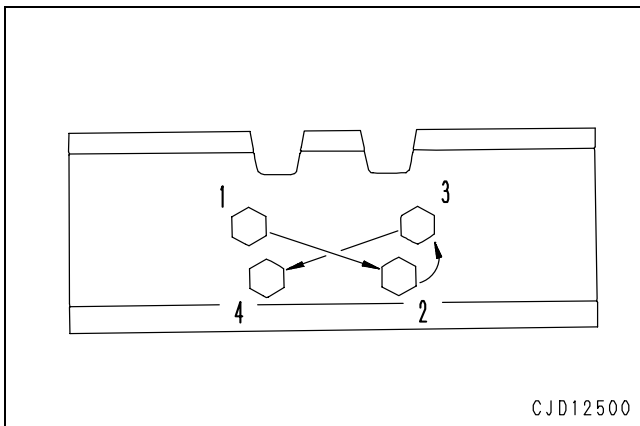
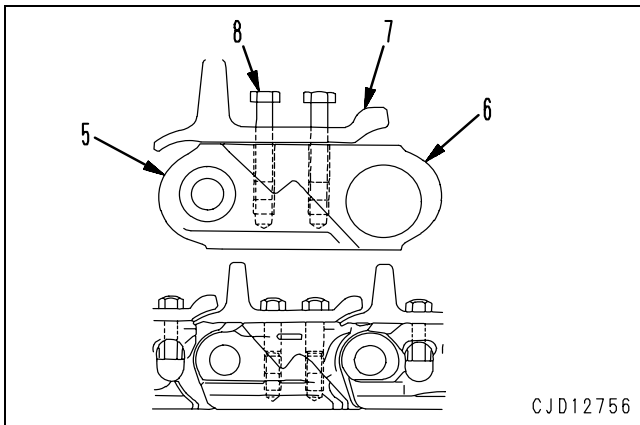
Set two completely assembled portions of shoe on a flat surface in a straight line with the shoes facing up. Pull master link (5) at the pin end to master link (6) at the bushing end, and set them at the mating surfaces. Then put shoe (7) on top, check that shoe bolt (8) goes in easily by hand, and connect the two parts with the master bolt.

 Shoe bolt: **Lubricant containing molybdenum disulfide (LM-P)**

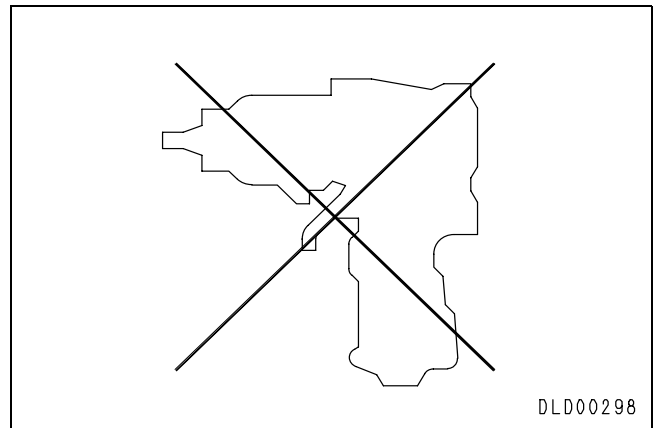
 Shoe bolt: **(Master link)**  
Initial torque: **343±39 Nm {35±4 kgm}**

Tightening angle: **180<sup>+0</sup><sub>-20</sub>**

★ Tighten the bolts in the order of 1 - 4.




★ Do not use an impact wrench for the master link.



## Installation

- Carry out installation in the reverse order to removal.

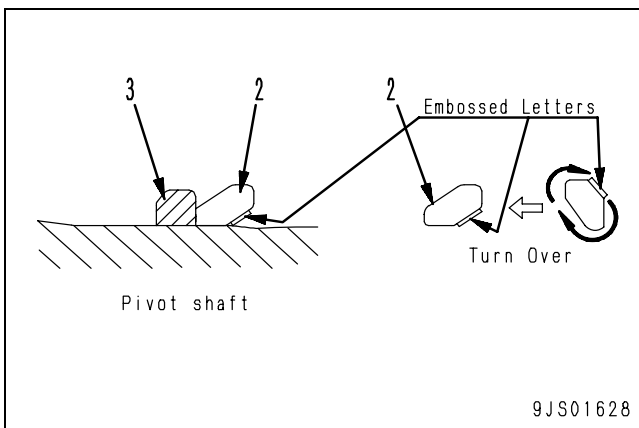
[\*1]

 Pivot shaft mounting bolt:  
**455-565Nm{46.5-58kgm}**

[\*2]

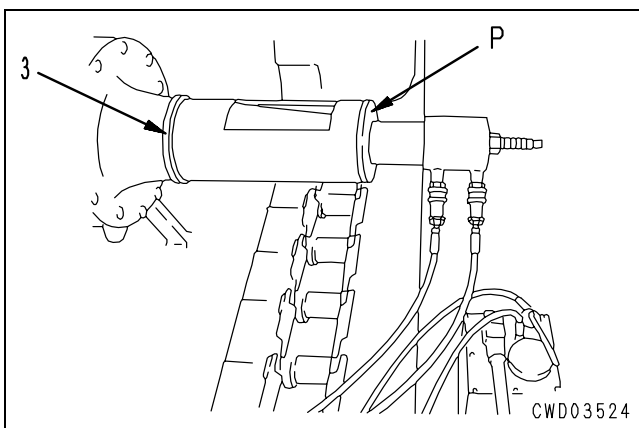
★ Assemble the seal as follows. (See diagram below.)

- 1) Turn over the seal so that the embossed letters on the seal are on the inside. (Turn Over)
- 2) With the seal turned over, insert seal (2) on the shaft.
  - ★ Insert seal (2) to ring (3).
  - ★ When inserting the seal, be careful not to damage the surface.



[\*3]

- ★ Press fit ring (3) using tool P.
- ★ Press fitting force: 18.6 kN {1.9 tons}




## Removal and installation of cooling fan pump assembly

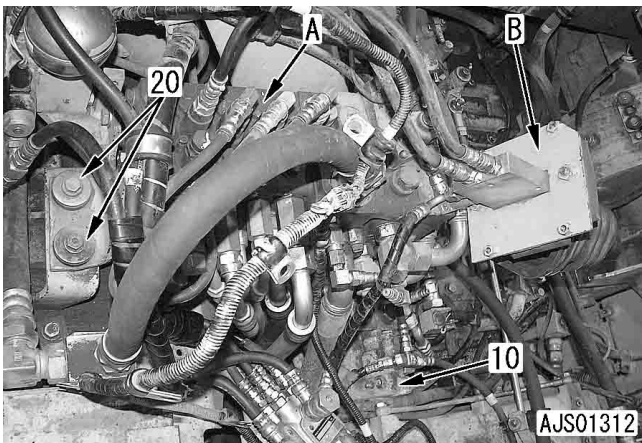
### Removal

**⚠** Disconnect the cable from the negative (-) terminal of the battery.

1. Drain the hydraulic oil.


 Hydraulic tank: approx. 55 ℓ

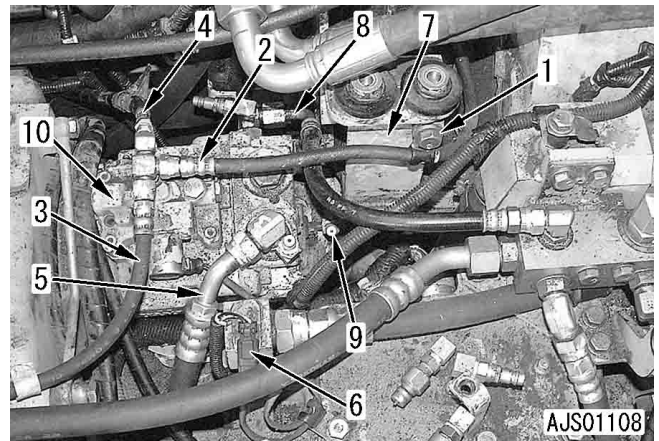
2. Remove the floor frame assembly. For details, see Removal and installation of floor frame assembly.
3. Remove both mounting bolts (20) of control valve assembly (A) and retain the assembly (A) in floated condition using blocks, etc.
  - ★ (10) is the cooling fan pump assembly.
  - ★ (B): Ripper control lever assembly (If equipped)



4. Disconnect clip (1).
5. Disconnect PPC basic pressure hoses (2) and (3) from fan pump assembly (10).
6. Disconnect pressure pick-up hose (4).
7. Disconnect pump discharge hose (5).
8. Disconnect connector FAC (6).
9. Remove bracket (7) of main control valve assembly.
10. Disconnect drain hose (8).
11. Remove the right fender lower cover (upper side).
12. Remove the suction tube under the fan pump and suction hose (9).

13. Remove cooling fan pump assembly (10).


 Cooling fan pump assembly: 25 kg



### Installation


- Carry out installation in the reverse order to removal.

[\*1]

 Hose clamp:  $8.8 \pm 0.5 \text{ Nm}$  { $90 \pm 5 \text{ kgcm}$ }

- **Refilling oil (hydraulic oil tank)**


Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the piping system. Then, check the oil level again.

 Hydraulic oil tank: 55 ℓ (EO10-CD)

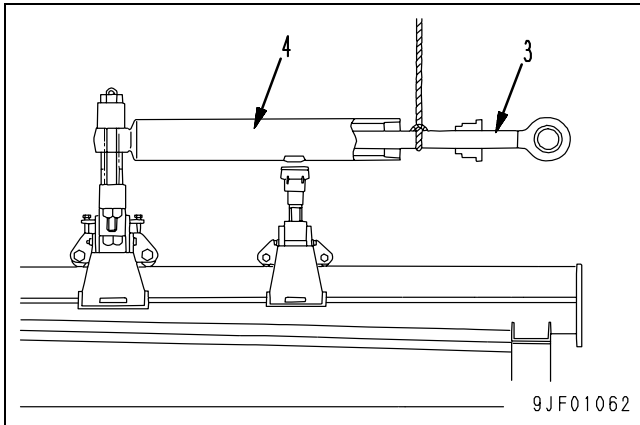
- **Air bleeding**


★ Bleed air from the circuit by referring to the section of "Bleeding air from fan pump" in Testing and adjusting.

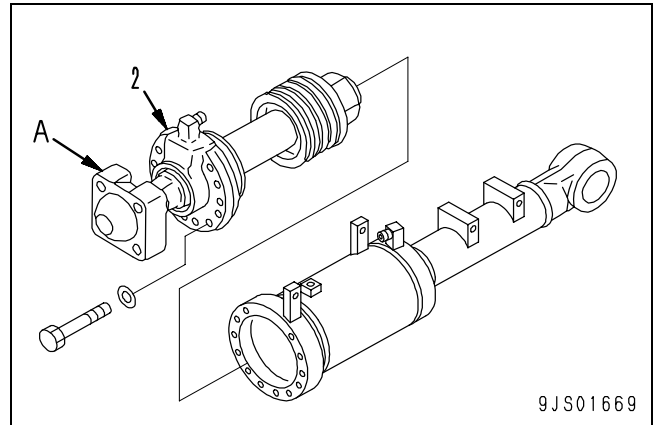
- ★ Thoroughly clean the thread of the piston rod and remove all oil and grease before assembling the nut.

 Rod thread: Liquid adhesive  
(Loctite No. 262 or equivalent)

- 2) Set cylinder (1) to tool **U1**, and assemble piston rod assembly (3) in cylinder (4).



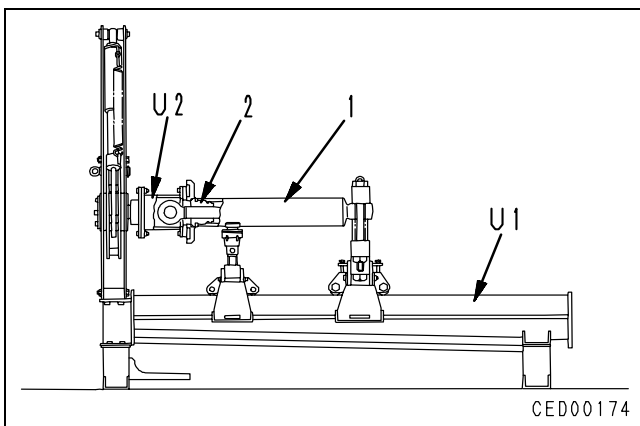
- 4) Tighten mounting bolt of cylinder head (2).
  - ★ Ripper cylinder, tilt cylinder (straight tilt, semi-U dozer specifications)
  -  Mounting bolt:  
**162±14.7 Nm {16.5±1.5 kgm}**
  - ★ Portion A is not installed to the ripper cylinder.



- 3) Using hydraulic pump or power wrench, tighten cylinder head assembly (2) with tool **U2**.

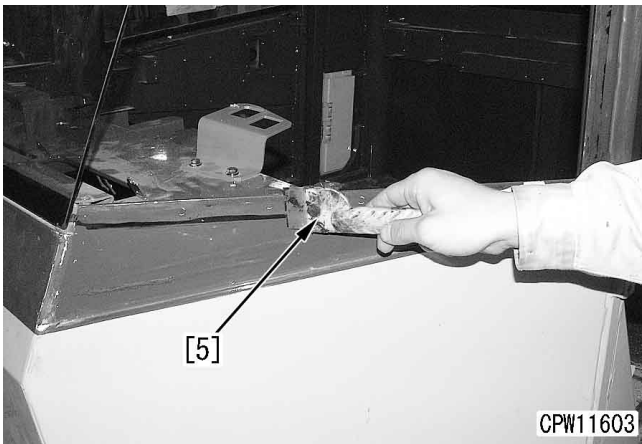
- ★ Perform 4) for ripper cylinder and tilt cylinder (straight tilt, semi-U dozer specifications).

| Name of cylinder        | Cylinder head tightening torque                      |
|-------------------------|--|
| Blade lift              | 932±93.2 Nm {95±95 kgcm}                             |
| Blade angle             | 1st time: Tighten with torque of 1,225 Nm {125 kgm}. |
|                         | 2nd time: Loosen to 0 Nm {0 kgm}.                    |
|                         | 3rd time: Tighten with torque of 1,225 Nm {125 kgm}. |
| Blade tilt (inside PAT) | 1.03±0.10 kNm {105±10.5 kgm}                         |

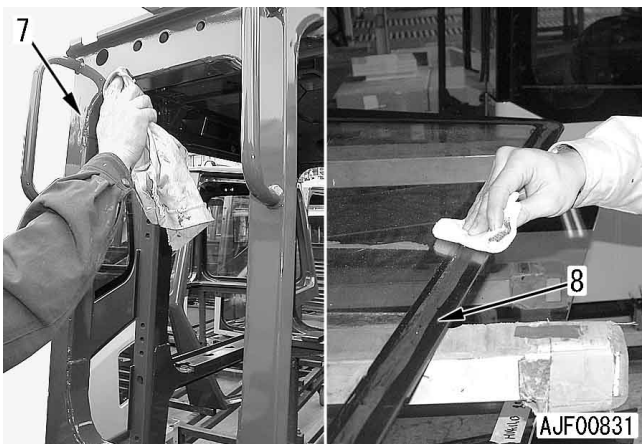


**Installation**

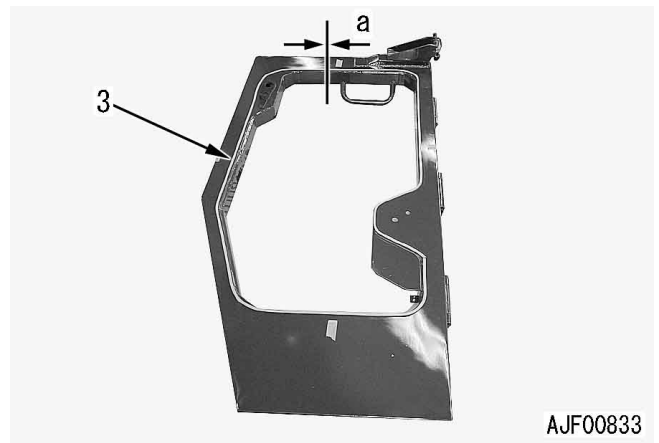
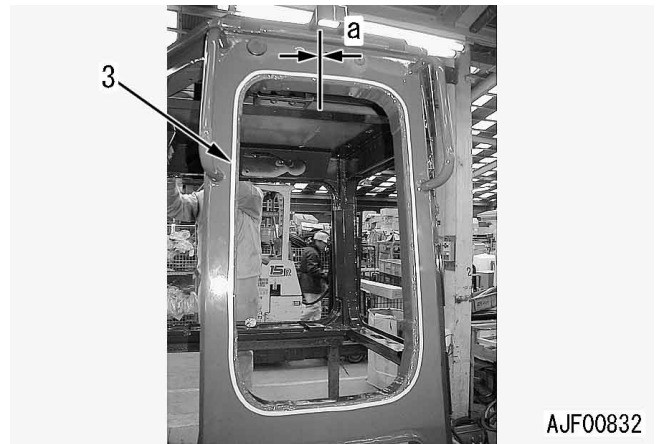
1. Using the cutter knife and scraper [5], remove residual adhesive and dam rubber on the sheet metal side (adhesion face) of operator's cab.
  - ★ Residual adhesive and dam rubber on the sheet metal surface may be removed to a state that does not give adverse effect on newly applied adhesive. Take care not to damage coated surface by excessive scraping. (Damaged coated surface causes deterioration of adhesive force.) (The diagram below shows an operator's cab on a wheel loader.)



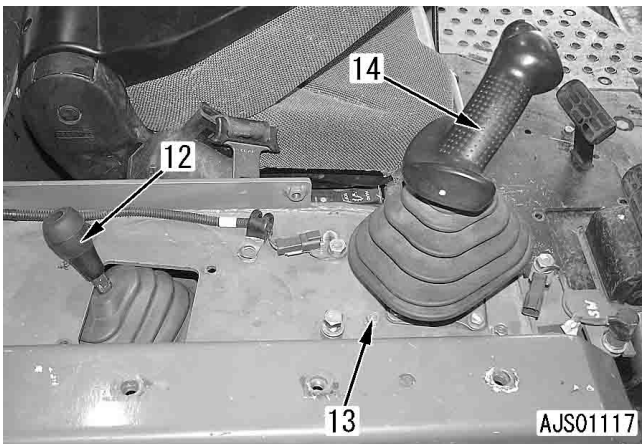
2. Remove oil, grease, dust, contamination, etc. on the adhesion surfaces on cab (7) and window glass (8) with white gasoline.
  - ★ Clean thoroughly as incomplete cleaning causes defective adhesion.
  - ★ Wholly clean the rear black portion of the window glasses.
  - ★ After cleaning, let glasses dry spontaneously for over 5 minutes.




3. Install dam rubber (double adhesive tape) (3) along the inner edges of the front window glass, left and right window glasses mounting section.
  - ★ Do not remove the tape from the glass adhesion side of dam rubber before installing glass.
  - ★ When installing dam rubber, avoid touching the cleaned surfaces as much as possible.
  - ★ Regarding adhesion of dam rubber to the corners, special care should be taken not to allow dam rubber to float.
  - ★ Install dam rubber (3) so that it will not overlap each other at the joint portion where the starting and ending dam rubbers meet. Or provide the mating portion (a) with a clearance of approx. 5 mm.



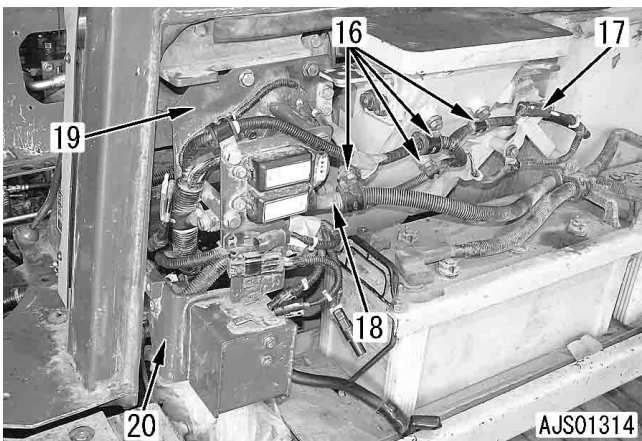
- 10. Disconnect ripper control lever (12). (If equipped)
- 11. Remove mounting bolts (13) and remove blade control lever (14).



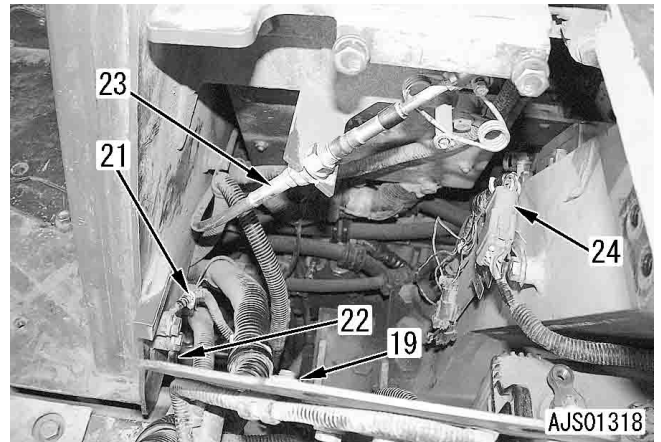
- 12. Remove cover assembly (15).  
 Cover assembly (15): **55 kg**



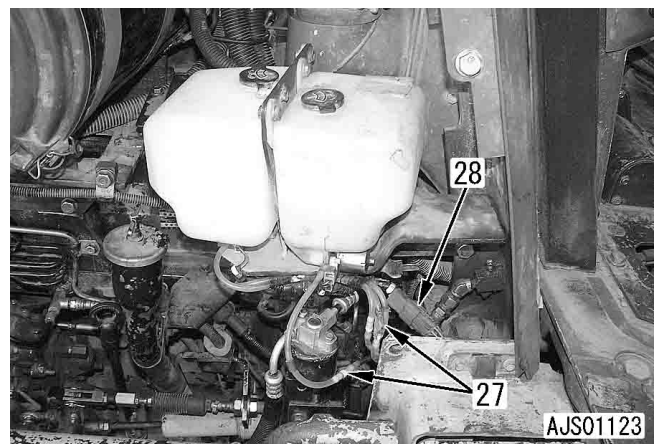
- 13. Disconnect clip (16) and connector FFC (17).
- 14. Disconnect the cable from the battery relay terminal (18).
- 15. Disconnect plate assembly (19) and bracket assembly (20).



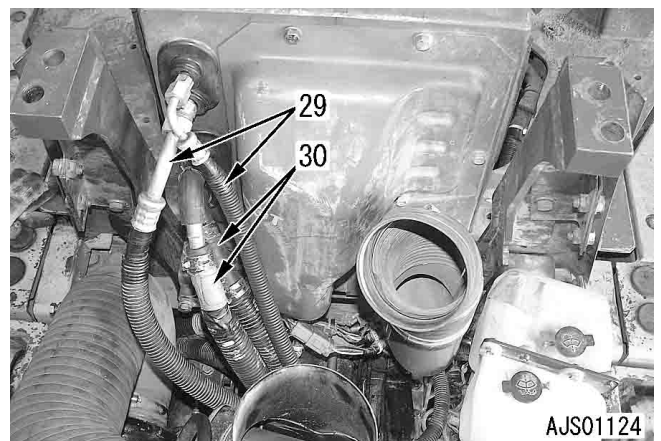
- 16. Disconnect grounding (21) and (22).
- 17. Disconnect parking brake cable (23).[\*1]
- 18. Disconnect connector CAN (24).



- 19. Disconnect washer hose (27).
- 20. Disconnect connector CN21 (28).  
 ★ Disconnect the clips, too.



- 21. Disconnect air compressor hose (29). [\*2]
- 22. Disconnect heater hose (30).





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