SEN02269-11

Shop Manual

ARTICULATED
DUMP TRUCK

HM300-2R

SERIAL NUMBERS 7001 and up

KOMATSU

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90 Diagrams and drawings

2. Standard clearance and standard value

- The clearance made when new parts are assembled is called the “standard clearance“, which is indicated by the range from the minimum clearance to the maximum clearance.
- When some parts are repaired, the clearance is generally adjusted to the standard clearance.
- A value of performance and function of new products or equivalent is called the “standard value“, which is indicated by a range or a target value.
- When some parts are repaired, the value of performance/function is set to the standard value.

3. Standard interference

- When the diameter of a hole of a part shown in the given standard size and tolerance table is smaller than that of the mating shaft, the difference between those diameters is called the “interference”.
- The range (A – B) from the difference (A) between the minimum size of the shaft and the maximum size of the hole to the difference (B) between the maximum size of the shaft and the minimum size of the hole is the “standard interference”.
- After repairing or replacing some parts, measure the size of their hole and shaft and check that the interference is in the standard range.

4. Repair limit and allowable value or allowable dimension

- The size of a part changes because of wear and deformation while it is used. The limit of changed size is called the “repair limit”.
- If a part is worn to the repair limit, it must be replaced or repaired.
- The performance and function of a product lowers while it is used. A value which the product can be used without causing a problem is called the “allowable value” or “allowable dimension”.
- If a product is worn to the allowable value, it must be checked or repaired. Since the permissible value is estimated from various tests or experiences in most cases, however, it must be judged after considering the operating condition and customer's requirement.

5. Clearance limit

- Parts can be used until the clearance between them is increased to a certain limit. The limit at which those parts cannot be used is called the “clearance limit”.
- If the clearance between the parts exceeds the clearance limit, they must be replaced or repaired.

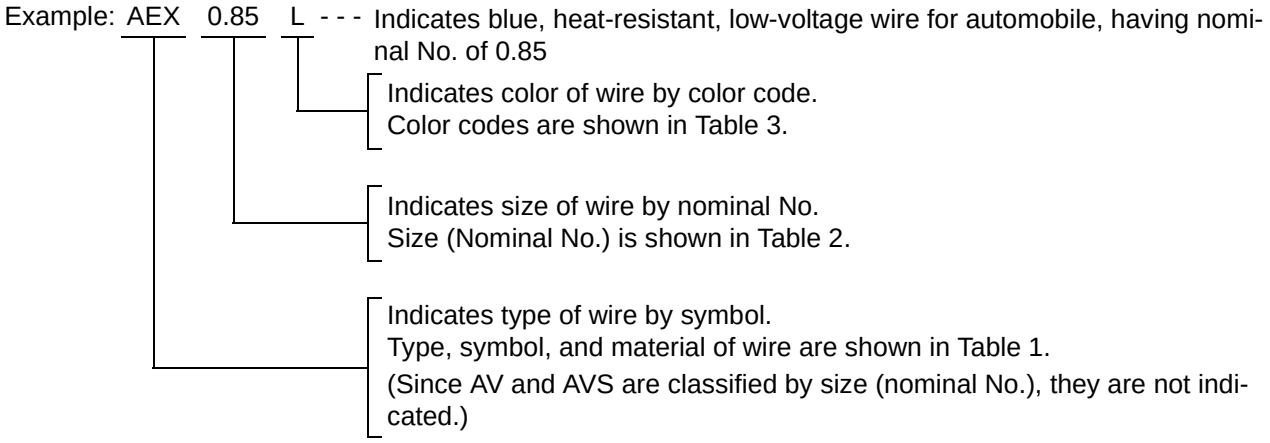
6. Interference limit

- The allowable maximum interference between the hole of a part and the shaft of another part to be assembled is called the “interference limit”.
- The interference limit shows the repair limit of the part of smaller tolerance.
- If the interference between the parts exceeds the interference limit, they must be replaced or repaired.

How to read electric wire code

★ The information about the wires unique to each machine model is described in Troubleshooting section, Relational information of troubleshooting.

In the electric circuit diagram, the material, thickness, and color of each electric wire are indicated by symbols. The electric wire code is helpful in understanding the electric circuit diagram.



1. Type, symbol, and material

AV and AVS are different in only thickness and outside diameter of the cover. AEX is similar to AV in thickness and outside diameter of AEX and different from AV and AVS in material of the cover.

(Table 1)

Type	Symbol	Material		Using temperature range (°C)	Example of use
Low-voltage wire for automobile	AV	Conductor	Annealed copper for electric appliance	–30 to +60	General wiring (Nominal No. 5 and above)
		Insulator	Soft polyvinyl chloride		
Thin-cover low-voltage wire for automobile	AVS	Conductor	Annealed copper for electric appliance		General wiring (Nominal No. 3 and below)
		Insulator	Soft polyvinyl chloride		
Heat-resistant low-voltage wire for automobile	AEX	Conductor	Annealed copper for electric appliance	–50 to +110	General wiring in extremely cold district, wiring at high-temperature place
		Insulator	Heat-resistant crosslinked polyethylene		

Conversion table

Method of using the conversion table

The conversion table in this section is provided to enable simple conversion of figures. For details of the method of using the conversion table, see the example given below.

Example: Method of using the conversion table to convert from millimeters to inches

1. Convert 55 mm into inches.

1) Locate the number 50 in the vertical column at the left side, take this as (A), and then draw a horizontal line from (A).
2) Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
3) Take the point where the 2 lines cross as (C). This point (C) gives the value when converting from millimeters to inches. Therefore, 55 mm = 2.165 inches.

2. Convert 550 mm into inches.

1) The number 550 does not appear in the table, so divide it by 10 (move the decimal point one place to the left) to convert it to 55 mm.
2) Carry out the same procedure as above to convert 55 mm to 2.165 inches.
3) The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

Millimeters to inches

(B)

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
						(C)				
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

(A)

Capacity \ Reservoir		Engine oil pan	Transmission case (Incl. brake system tank)	Hydraulic tank	Front suspension (each)	Rear suspension (each)	Front differential Case
Specified	ℓ	44	165	171	3	2.2	14.0
	US gal	11.62	43.59	45.18	0.79	0.58	3.70
Refill	ℓ	37	77.5	120	3	2.2	14.0
	US gal	9.78	20.48	31.70	0.79	0.58	3.70

Capacity \ Reservoir		Front final drive case (each)	Center differential case	Center final drive case (each)	Rear differential case	Rear final drive case (each)	Fuel tank	Cooling system
Specified	ℓ	4.5	25	4.0	25	5.0	384	65
	US gal	1.19	6.61	1.06	6.61	1.32	101.45	17.17
Refill	ℓ	4.0	24.5	3.5	25	4.5	–	59
	US gal	1.06	6.47	0.92	6.61	1.19	–	15.59

Notice
Always use diesel oil for the fuel.
To ensure good fuel consumption characteristics and exhaust gas characteristics, the engine mounted on this machine uses an electronically controlled high-pressure fuel injection device. This device requires high precision parts and lubrication, so if low viscosity fuel with low lubricating ability is used, the durability may drop markedly.

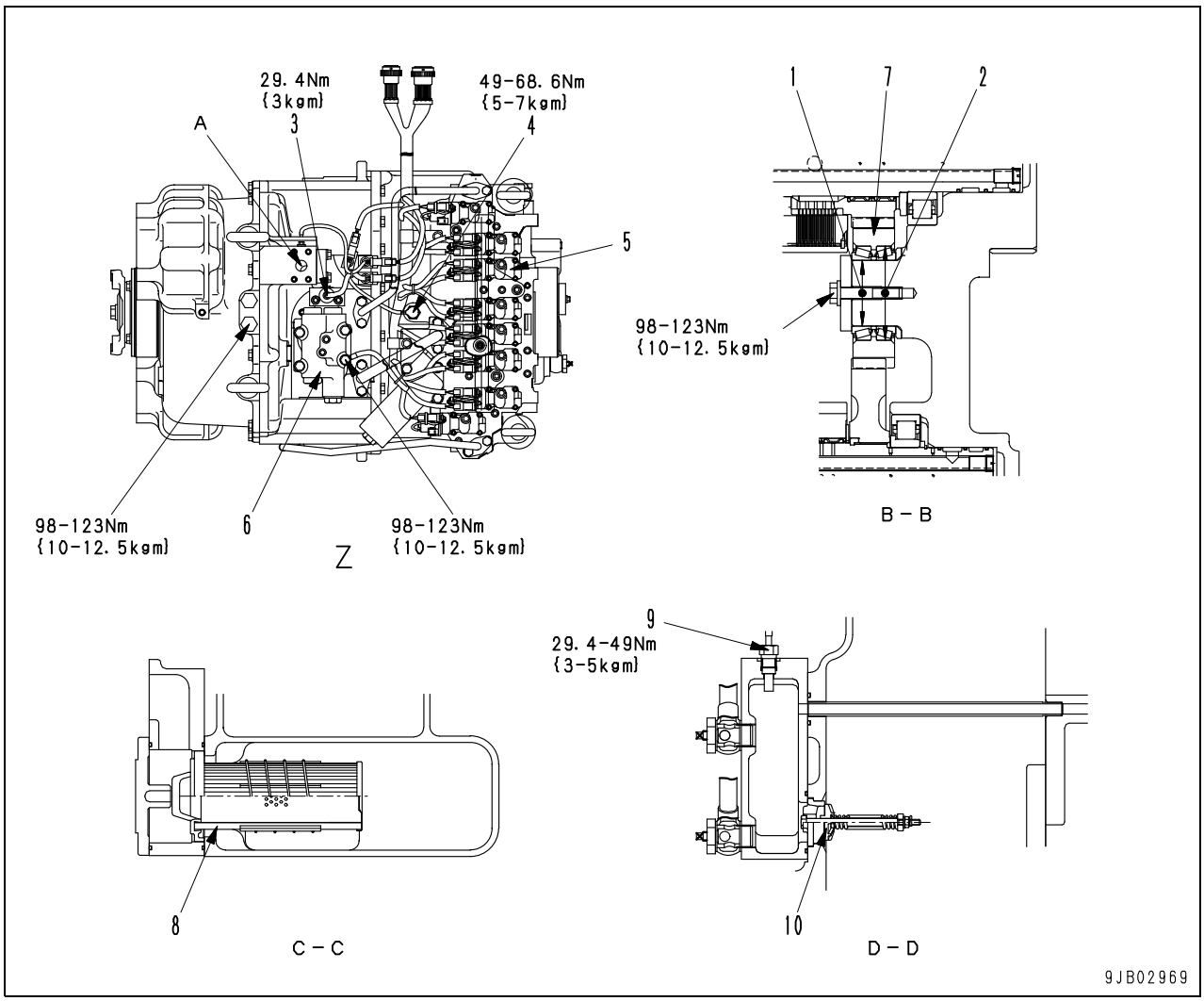
Note 1: HTHS (High-Temperature High-Shear Viscosity 150?), specified by ASTM D4741 must be equal to or higher than 3.5 mPa-S. Komatsu EOS0W30 and EOS5W40 are the most suitable oils.

Note 2: Powertrain oil has different properties from engine oil. Be sure to use the recommended oils.

Note 3: Hyper grease (G2-T, G2-TE) has a high performance.
When it is necessary to improve the lubricating ability of the grease in order to prevent squeaking of pins and bushings, the use of G2-T or G2-TE is recommended.

Note 4: Supercoolant (AF-NAC)
1) Coolant has the important function of anticorrosion as well as antifreeze.
Even in the areas where freezing is not an issue, the use of antifreeze coolant is essential.
Komatsu machines are supplied with Komatsu Supercoolant AF-NAC. Komatsu Supercoolant AF-NAC has excellent anticorrosion, antifreeze and cooling propertiesand can be used continuously for 2 years or 4000 hours.
Komatsu Supercoolant AF-NAC is strongly recommended wherever available.
2) For details of the ratio when diluting super coolant with water, see "Mixing rate of water and antifreeze".
Supercoolant AF-NAC may be supplied in premix. In this case, always top off with premix solution. (never dilute with water)
3) To maintain the anticorrosion properties of Supercoolant AF-NAC, always keep the density of Supercoolant between 30% and 68%.

1. Engine
2. Oil cooler
3. Center brake cooling and brake system pump (SDR(30)80+SA(1)18)
4. Torque converter
5. Transmission
6. Transmission oil filter
7. Brake system tank
8. Power train, front brake cooling pump (SDR(30)75)
9. Transmission oil filter
10. Brake cooling oil control valve (center)
11. Brake cooling oil control valve (front)



Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between bearing and case	70	+0.032 +0.002	0 -0.015	-0.047– -0.002	—	Replace
2	Clearance between R idler gear and bearing	100	0 -0.015	-0.049 -0.073	-0.073 – -0.034	—	

3. Torque converter intermediate oil pressure sensor
4. Transmission input shaft speed sensor
5. Transmission control valve
6. Main relief, torque converter relief valve
7. R idler gear (number of teeth: 33)
8. Strainer
9. Power train lubricating oil temperature sensor
10. Lubricating oil relief valve

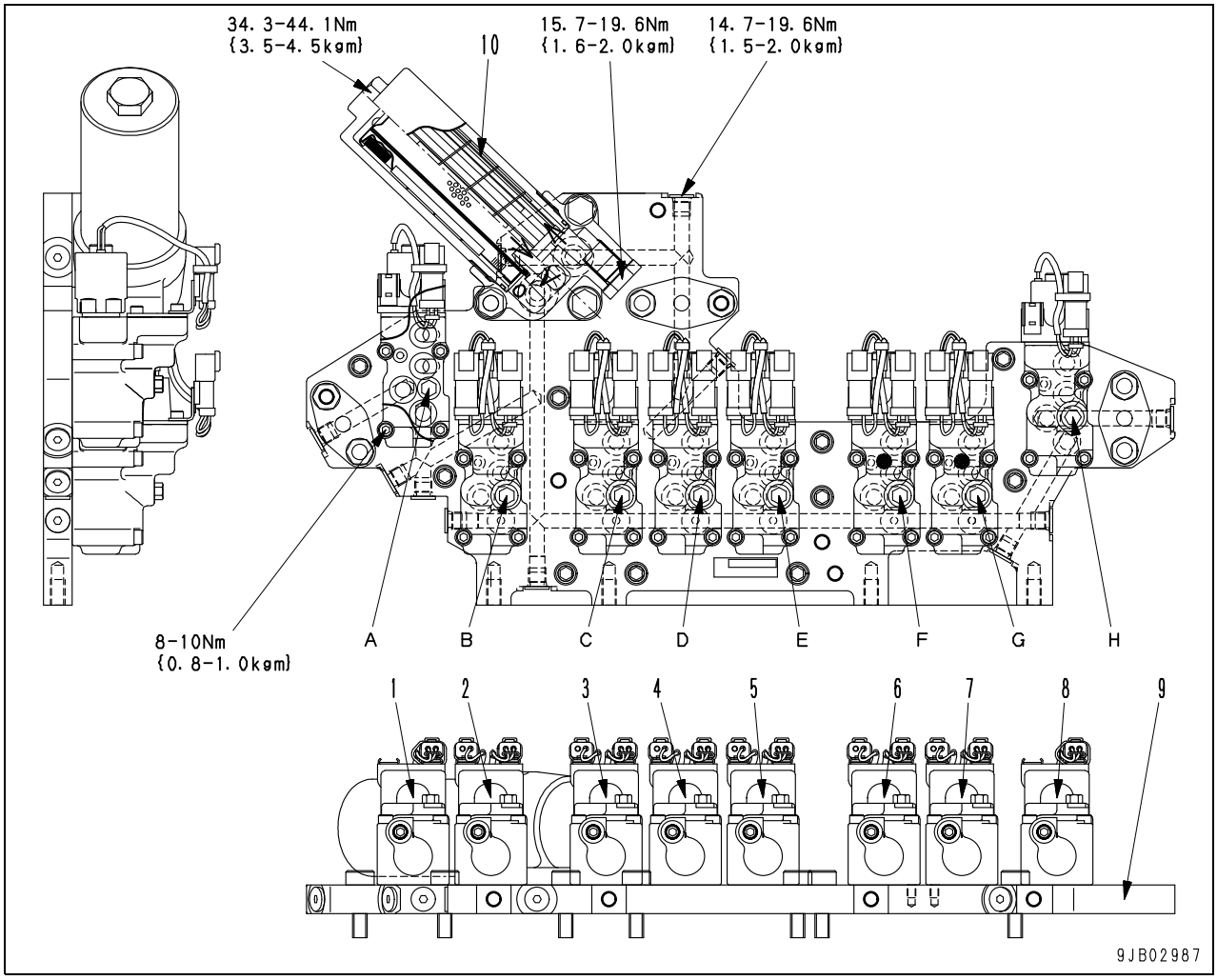
A: To front brake

FL clutch (4) and 1st clutch (12) are fixed hydraulically.

The power from the torque converter
↓
Input shaft (1)
↓
FL and R cylinders (2)
↓
FL clutch (4)
↓
FL clutch gear (6)
↓
FL and 1st cylinders (9)
↓
1st clutch (12)
↓
1st clutch gear (13)
↓
2nd and 3rd cylinders (15)
↓
Output gear (20)
(The operation when differential lock is turned "OFF" is explained below)
↓
Carrier (21)
↓
Planetary gear (25) → ↓
↓ Ring gear (27)
Sun gear (26) ↓
↓ Rear output shaft (29)
Front output shaft (28)

★ If the differential lock is "on", see Forward 2nd speed.

Transmission control valve



A: Differential lock clutch oil pressure pick-up port
B: FH clutch oil pressure pick-up port
C: 1st clutch oil pressure pick-up port
D: FL clutch oil pressure pick-up port
E: R clutch oil pressure pick-up port
F: 3rd clutch oil pressure pick-up port
G: 2nd clutch oil pressure pick-up port
H: Lockup clutch oil pressure pick-up port

1. Differential lock clutch ECMV
2. FH clutch ECMV
3. 1st clutch ECMV
4. FL clutch ECMV
5. R clutch ECMV
6. 3rd clutch ECMV
7. 2nd clutch ECMV
8. Lockup clutch ECMV
9. Seat
10. Last chance filter

Operation table of ECMV

ECMV / Gear speed	FL	FH	R	1st	2nd	3rd	L/U	D/L
F1	○			○			○	○
F2		○		○			○	○
F3	○				○		○	○
F4		○			○		○	
F5	○					○	○	
F6		○				○	○	
R1			○	○				○
R2			○		○			○
N								○

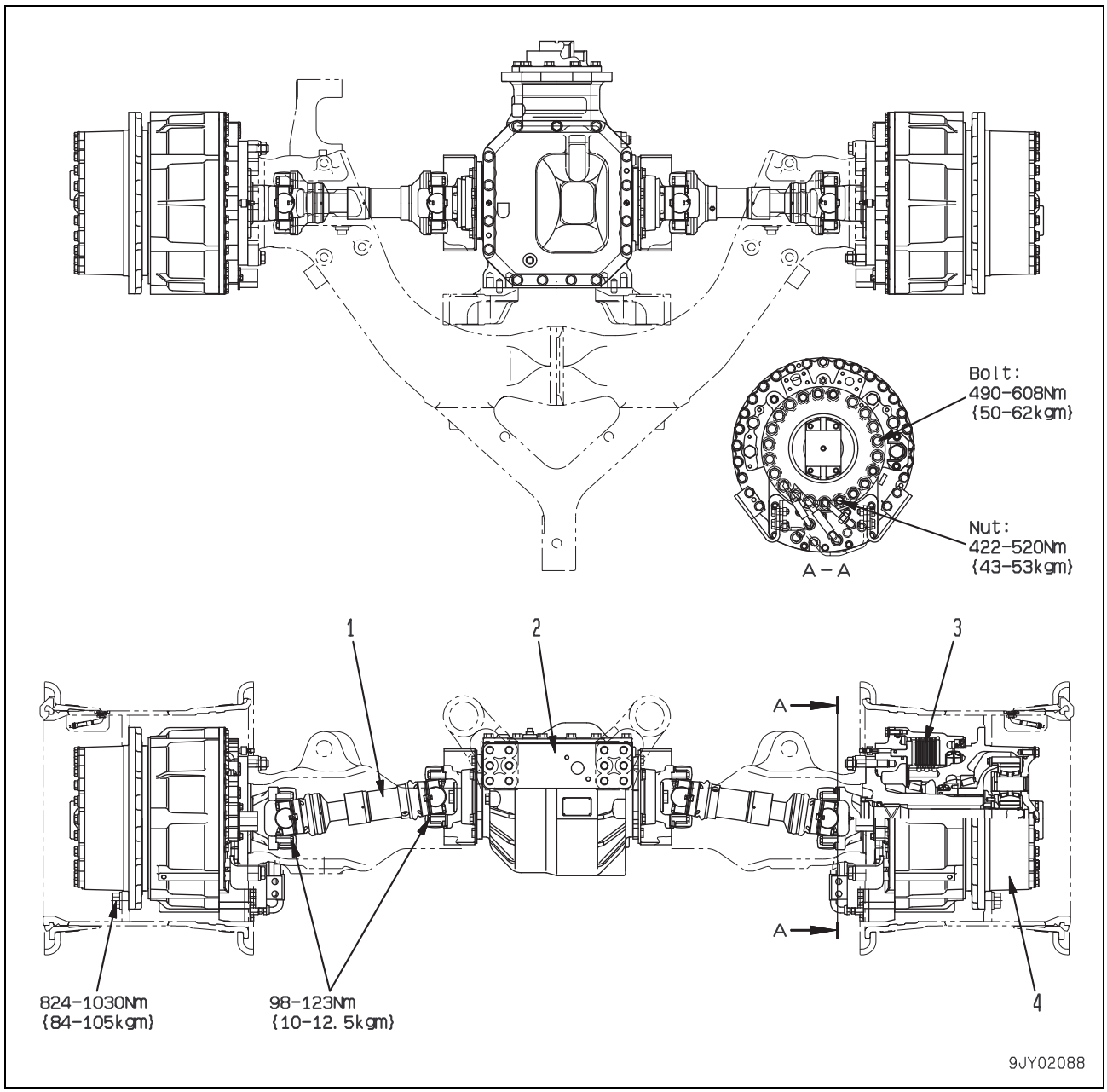
L/U: Lockup clutch ECMV
D/L: Differential lock clutch ECMV

Outline

- Lockup clutch ECMV operates when traveling forward at the speed higher than the set speed of transmission controller.
- Differential lock clutch ECMV operates in the 3rd or lower gear speeds.

Axle

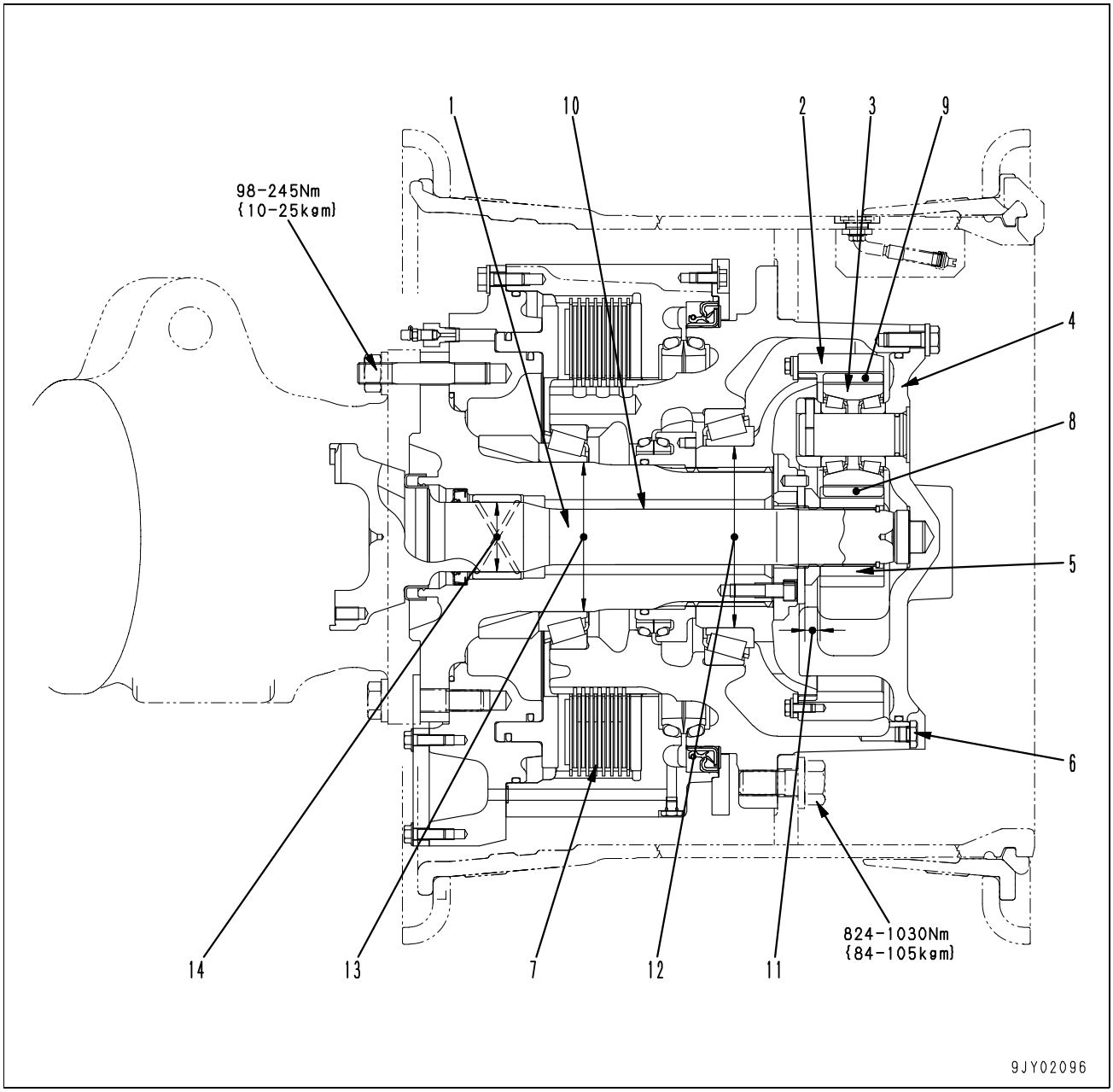
Front



1. Drive shaft
2. Front differential
3. Brake
4. Final drive

Final drive

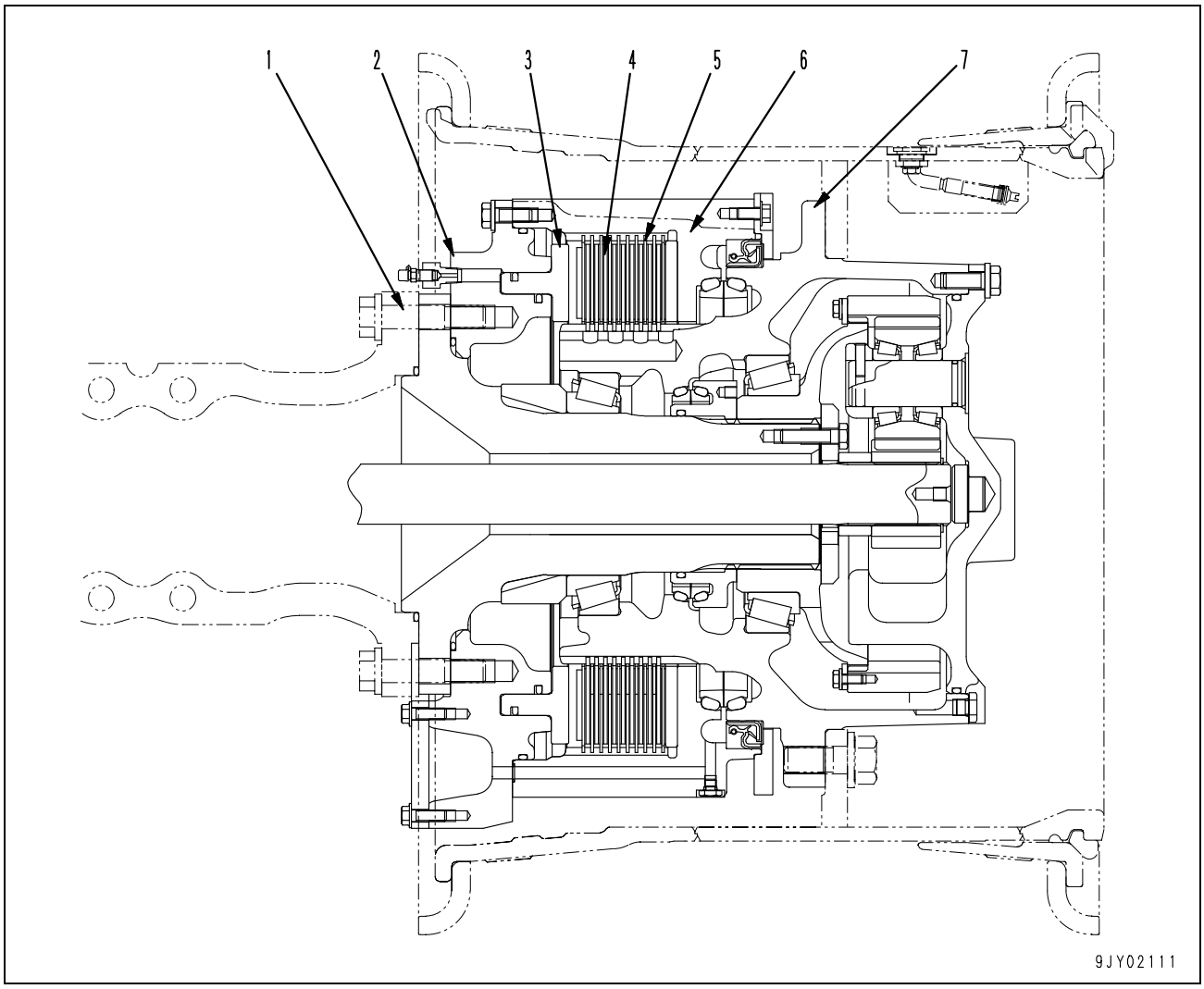
Front



1. Shaft
2. Ring gear (No. of teeth: 66)
3. Planetary gear (No. of teeth: 23)
4. Planetary carrier
5. Sun gear (No. of teeth: 18)
6. Drain plug
7. Brake

1. Slack adjuster (Front)
2. Shuttle valve
3. Slack adjuster (center)
4. Proportional reducing valve
5. Accumulator (for center)
6. Accumulator (for front)
7. Parking brake solenoid valve
8. Brake system tank
9. Accumulator charge valve
10. Brake valve
11. Brake filter

Center



1. Bolt
2. Cylinder
3. Brake piston
4. Disc
5. Plate
6. Outer gear (No. of teeth: 148)
7. Hub gear (No. of teeth: 96)

ARTICULATED DUMP TRUCK

HM300-2R

Machine model	Serial number
HM300-2R	7001 and up

10 Structure, function and maintenance standard

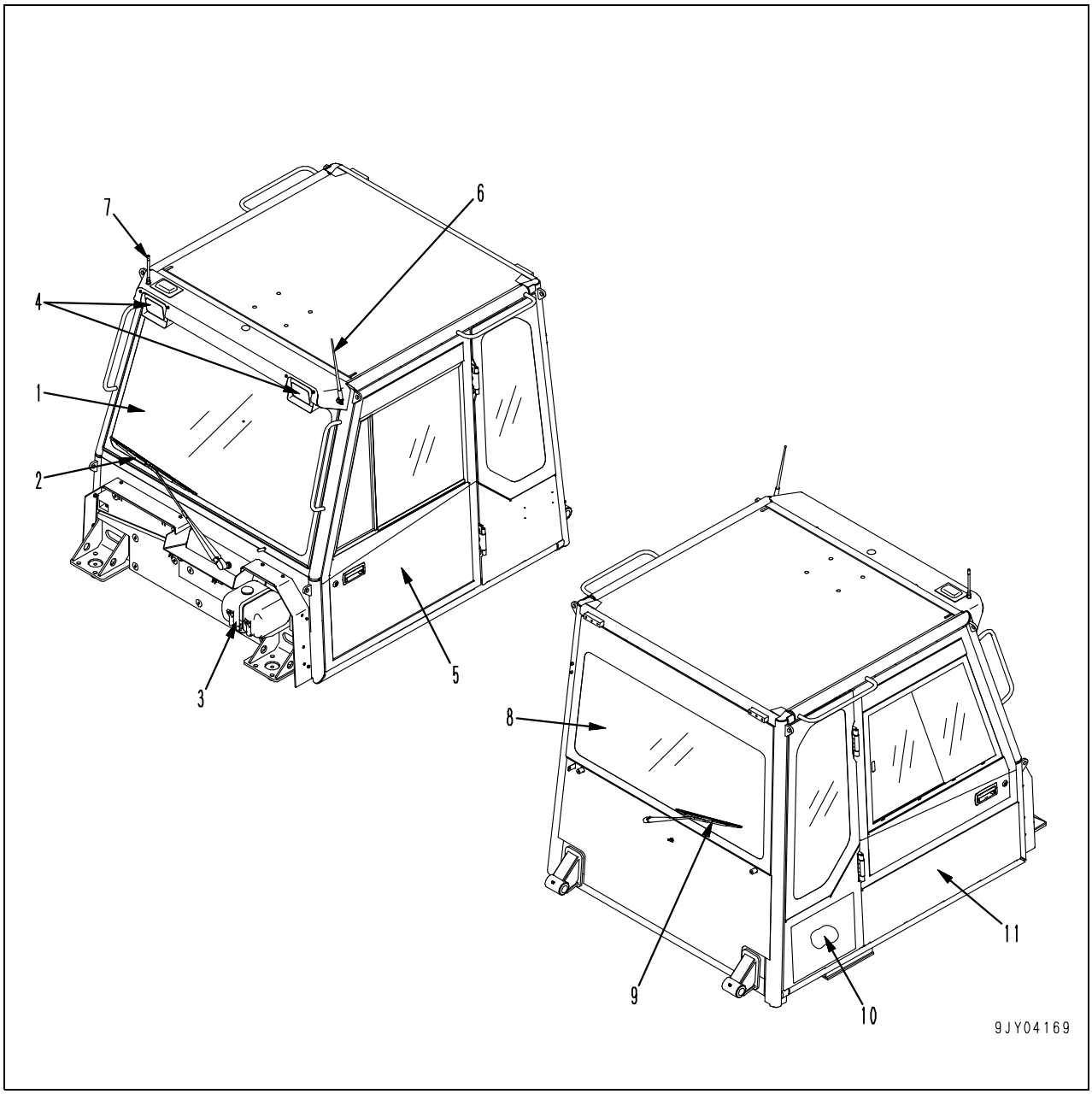
Undercarriage and frame

Suspension 2
Suspension cylinder 8
Oscillation hitch 10

HM300-2R Articulated dump truck

Form No. SEN02669-00

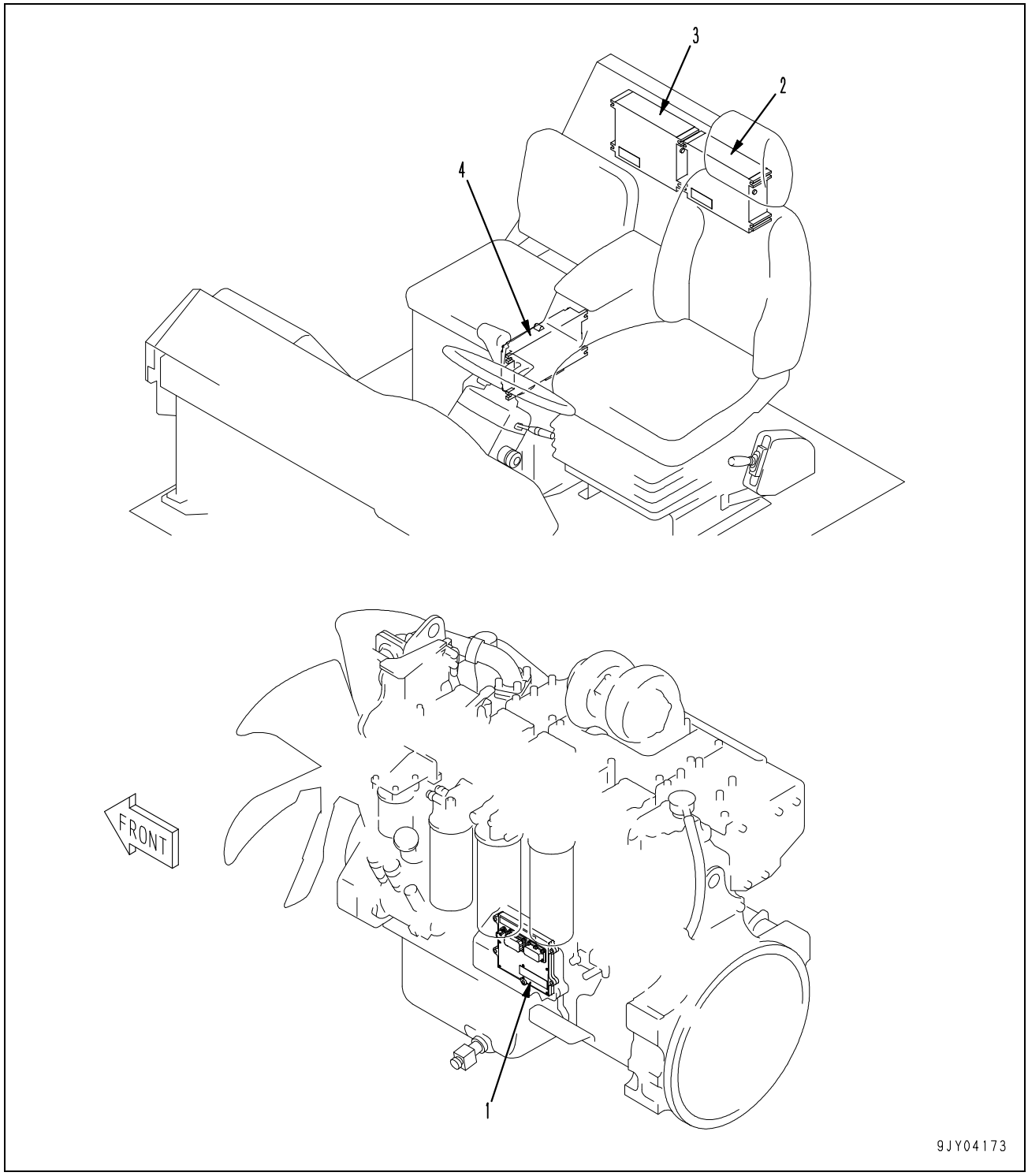
ROPS cab



1. Front glass
2. Front wiper
3. Washer tank
4. Front working lamp
5. Door (left)
6. Radio antenna
7. KOMTRAX GPS antenna (if equipped)
8. Rear glass
9. Rear wiper
10. Air conditioner fresh air filter
11. Door (right)

Controller related

Controller layout



1. Engine controller
2. Transmission controller
3. Retarder controller
4. KOMTRAX controller (if equipped)

No.		HM series monitor panel				Specification
		CN	PIN	I/O	A/D	
29		CN2A	9	—	—	GND
30		CN2A	10	I	D	D_IN_1 (+24 V, 5mA, PULL DOWN)
31		CN2A	11	I	D	D_IN_3 (+24 V, 5mA, PULL DOWN)
32		CN2A	12	I	D	D_IN_5 (+24 V, 5mA, PULL DOWN)
33		CN2A	13	I	D	D_IN_7 (+24 V, 5mA, PULL DOWN)
34		CN2A	14	I	D	D_IN_9 (+24 V, 5mA, PULL DOWN)
35		CN2A	15	I	D	D_IN_11 (+24 V, 5mA, PULL DOWN)
36	*1	CN2A	16	I	D	D_IN_13 (NSW+24 V, 5mA, PULL DOWN)
37	*1	CN2A	17	I	D	D_IN_15 (NSW+24 V, 5mA, PULL DOWN)
38		CN2A	18	I	A	A_IN_0 (0 – 30 V)
39	*2	CN2B	1	I	D	D_IN_16 (GND, 5mA, PULL UP)
40	*2	CN2B	2	I	D	D_IN_18 (GND, 5mA, PULL UP)
41	*2	CN2B	3	I	D	D_IN_20 (GND, 5mA, PULL UP)
42	*2	CN2B	4	I	D	D_IN_22 (GND, 5mA, PULL UP)
43		CN2B	5	I	D	D_IN_24 (+24 V, 5mA, PULL DOWN)
44		CN2B	6	—	—	GND
45	*2	CN2B	7	I	D	D_IN_17 (GND, 5mA, PULL UP)
46	*2	CN2B	8	I	D	D_IN_19 (GND, 5mA, PULL UP)
47	*2	CN2B	9	I	D	D_IN_21 (GND, 5mA, PULL UP)
48	*2	CN2B	10	I	D	D_IN_23 (GND, 5mA, PULL UP)
49		CN2B	11	I	D	D_IN_25 (+24 V, 5mA, PULL DOWN)
50		CN2B	12	I	A	A_IN_1 (0 – 30 V)
51		CN3A	1	I	D	D_IN_26 (+24 V, 5mA, PULL DOWN)
52		CN3A	2	I	D	D_IN_28 (+24 V, 5mA, PULL DOWN)
53		CN3A	3	I	D	D_IN_30 (+24 V, 5mA, PULL DOWN)

*1: NSW +24V input port is active even if the setting is made to KEY OFF when power is supplied directly from battery.
*2: Setting is made to PULL UP.

Outline

- The transmission controller receives the shift position signal for the gear shift lever, the accelerator position signal for the accelerator pedal, the speed signal for the transmission, and the other signals from the switches and sensors. It then automatically controls the transmission and shifts it to the optimum speed range.
- In addition to the shift control, the transmission controller also controls the torque converter lock-up solenoid and operates the brake, the inter-axle differential lock, the hoist, and the others to prevent overrun.
  Each clutch pack of the each transmission clutch and torque converter lock-up clutch is equipped with an electronically controlled modulation valve, and each clutch pack is independently controlled.
  By this operation, the initial pressure, build-up ratio and torque-off time of each clutch are controlled according to the machine condition to reduce the gear shift shock, prevent gear shift hunting and improve the durability of the clutch.
- The hoist EPC valve (proportional solenoid valve) and hoist selector valve (ON/OFF valve) are controlled to operate the body according to the dump control lever position.
- The transmission shift controller uses the signals from the switches and sensors to operate the machine monitor displays and caution and pilot lamps, and transmits these data to the network.

Data items transmitted from transmission controller to network.

RTCDB1 (Machine monitor, retarder controller, and others) (Updated every 10 msec.)

No.	Item
1	Transmission output shaft speed
2	Brake command value (front wheel)
3	Brake command value (rear wheel)

RTCDB1 (special to +83) (Updated every 10 msec.)

No.	Item
1	Throttle correction value
2	Throttle lower limit
3	Throttle upper limit
4	2nd method throttle
5	HSI line / brake point speed
6	Torque curve select
7	ABS reference type
8	Droop switch
9	ABS droop trim

RTCDB2 (Machine monitor, retarder controller, and others) (Updated every 100 msec.)

No.	Item
1	Gear speed
2	Shift lever position
3	Torque converter oil temperature
4	Emergency escape state
5	Overrun alarm command
6	Neutral safety alarm command
7	Lockup operation state
8	Transmission controller option setting abnormality state
9	Transmission controller model setting abnormality state
10	KEY SW C terminal state
11	Alternator R terminal state
12	Emergency steering operation state
13	Accumulator oil pressure drop state (front, rear)
14	Engine speed
15	Engine coolant temperature
16	Float caution command
17	Body seating state
18	Parking brake operation state
19	Retarder brake operation state
20	RCM controller option setting abnormality state
21	RCM controller model setting abnormality state
22	Shift hold state
23	Rear tipping alarm command
24	Inter-axle differential lock operation state
25	Right and left differential lock operation command
26	Engine preheat
27	Body positioner voltage
28	Momentary fuel consumption
29	Input shaft speed
30	Output shaft speed
31	L/U clutch command
32	HL clutch engagement command
33	HL clutch release command
34	SP clutch engagement command
35	SP clutch release command

RTCDB2 (special to engine controller) (Updated every 100 msec.)

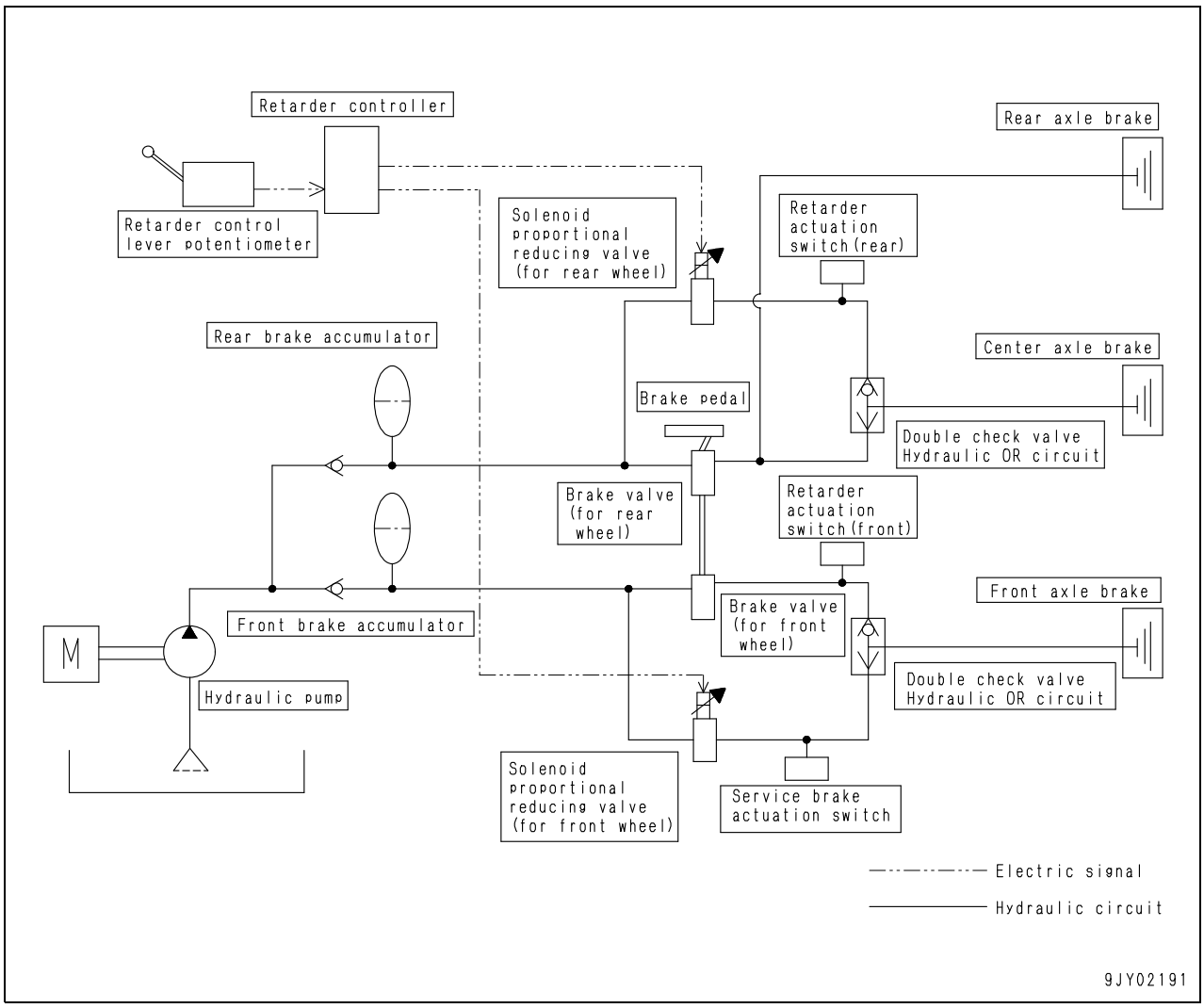
No.	Item
1	Automatic warm cancel flag

No.	Item	ID number	Displayed spec.	Data contents
19	Solenoid output (L)	31601	ECMV L DIR	ECMV output command current to LOW clutch is output
20	Solenoid output (1st)	31602	ECMV 1 DIR	ECMV output command current to 1st clutch is output
21	Solenoid output (2nd)	31603	ECMV 2 DIR	ECMV output command current to 2nd clutch is output
22	Solenoid output (3rd)	31604	ECMV 3 DIR	ECMV output command current to 3rd clutch is output
23	Solenoid output (R)	31606	ECMV R DIR	ECMV output command current to REV clutch is output
24	Solenoid output (L/U)	31609	ECMV LU DIR	ECMV output command current to L/U clutch is output
25	Solenoid output (DIFF)	31607	ECMV D DIR	ECMV output command current to differential is output
26	Angle sensor	32900	ANGLE SENSOR	Angle sensor input (A_IN_8) angle conversion value is output
27	Angle sensor	32902	ANGLE SENSOR	Angle sensor input (A_IN_8) voltage is output
28	Brake output (front wheel) command value	33807	BK OUTP DIR F	
29	Brake output (Rear wheel) command value	33808	BK OUTP DIR R	
30	Throttle modified value	36000	THROTTLE MOD	Throttle modified value to be sent to engine controller is output
31	Body positioner	34603	BODY POSITION	A_IN_6

Data range	Remarks
0***: Emergency steering not operated (HM400) Always0 (HM300, HM350) **1*****: Emergency steering operated (HM400) ****1***: Cranking *****0**: Emergency steering not operated *****1**: Emergency steering operated ******0*: Shift hold SW=OFF ******1*: Shift hold SW=ON *******1: Shift lever N	D_IN_2: Emergency steering relay 2 (HM400 only) D_IN_4: C terminal signal D_IN_5: Emergency steering relay 1 D_IN_6: Shift hold SW D_IN_7: Shift lever N
*1******: L fill **1*****: H fill ***1****: 1ST fill ****1***: 2nd fill *****1**: 3rd fill ******1*: R fill Example 01010000: When in F1 00001010: When in R2 00000000: When in N 00100100: When in F6	D_IN_9: Fill signal L D_IN_10: Fill signal H D_IN_11: Fill signal 1st D_IN_12: Fill signal 2nd D_IN_13: Fill signal 3rd D_IN_14: Fill signal R
10000000: Shift lever R2 01000000: Shift lever R1 00100000: Shift lever D 00010000: Shift lever 5 00001000: Shift lever 4 00000100: Shift lever 3 00000010: Shift lever 2 00000001: Shift lever 1	D_IN_16: Shift range R2 D_IN_17: Shift range R1 D_IN_18: Shift range D D_IN_19: Shift range 5 D_IN_20: Shift range 4 D_IN_21: Shift range 3 D_IN_22: Shift range 2 D_IN_23: Shift range 1

Retarder control function

Retarder control system diagram



Retarder lever control

- The operating angle of the retarder lever is detected by the potentiometer and a current corresponding to this is output to the solenoid proportional reducing valve for the front and rear wheels to actuate the retarder.

- Overrun prevention, retarder control when there is transmission abuse
- The solenoid proportional reducing valve for the front and rear wheels is controlled based on the command (Analog command) from the transmission controller and actuates the retarder by a fixed amount.

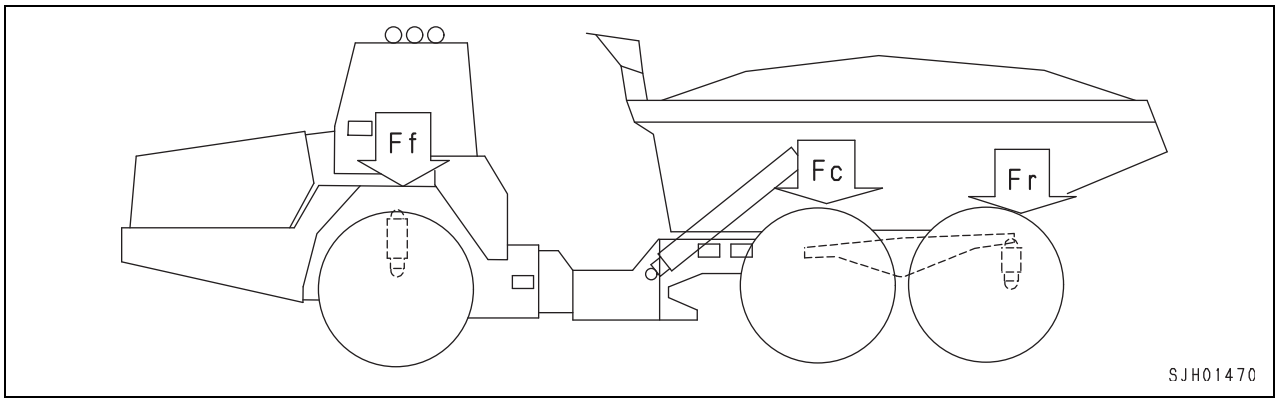
Principle of calculation

1. Outline

The articulate dump truck is suspended by 6 wheels, front, central and rear pair of wheels. The front & rear wheels are suspended by hydro-pneumatic suspension cylinder. The force Fr, which the rear wheel suspends is equal as the force Fc, which the central wheel suspends because the central and rear wheels are suspended by the equalizer bar.

The suspended force F = Ff + Fc + Fr = Ff + 2 × Fr

The force Ff = Af × Pf (Af: Suspension cylinder cross section, Pf: Suspension gas pressure)



2. Measurement of weight when empty (calibration)

Drive the empty truck in the second gear at full throttle for 30 seconds. The payload meter measures the average of supported load F (empty truck) and uses it as the weight when empty.

The reason why the weight is measured while the truck is traveling is that the frictional resistance of the suspension cylinders must be averaged by driving the truck and extracting and retracting the cylinders. The weight measured when empty is saved as a calibration data in the memory in the controller.

3. Measurement of weight when full

Payload is measured by subtracting the suspended force F (empty) when empty from the suspended force F (loaded) when loaded.

The payload meter has 3 measurement methods in which the timing to measure the payload is different.

1) Loading (during loading)
2) Traveling (during traveling)
3) Dumping (just before dumping)

These 3 methods are executed for each cycle. The result of the one method can be recorded for the cycle data. The method to be recorded can be selected by the switch operation (service check mode). Which method to be selected has to be considered the site conditions and the customer's needs.

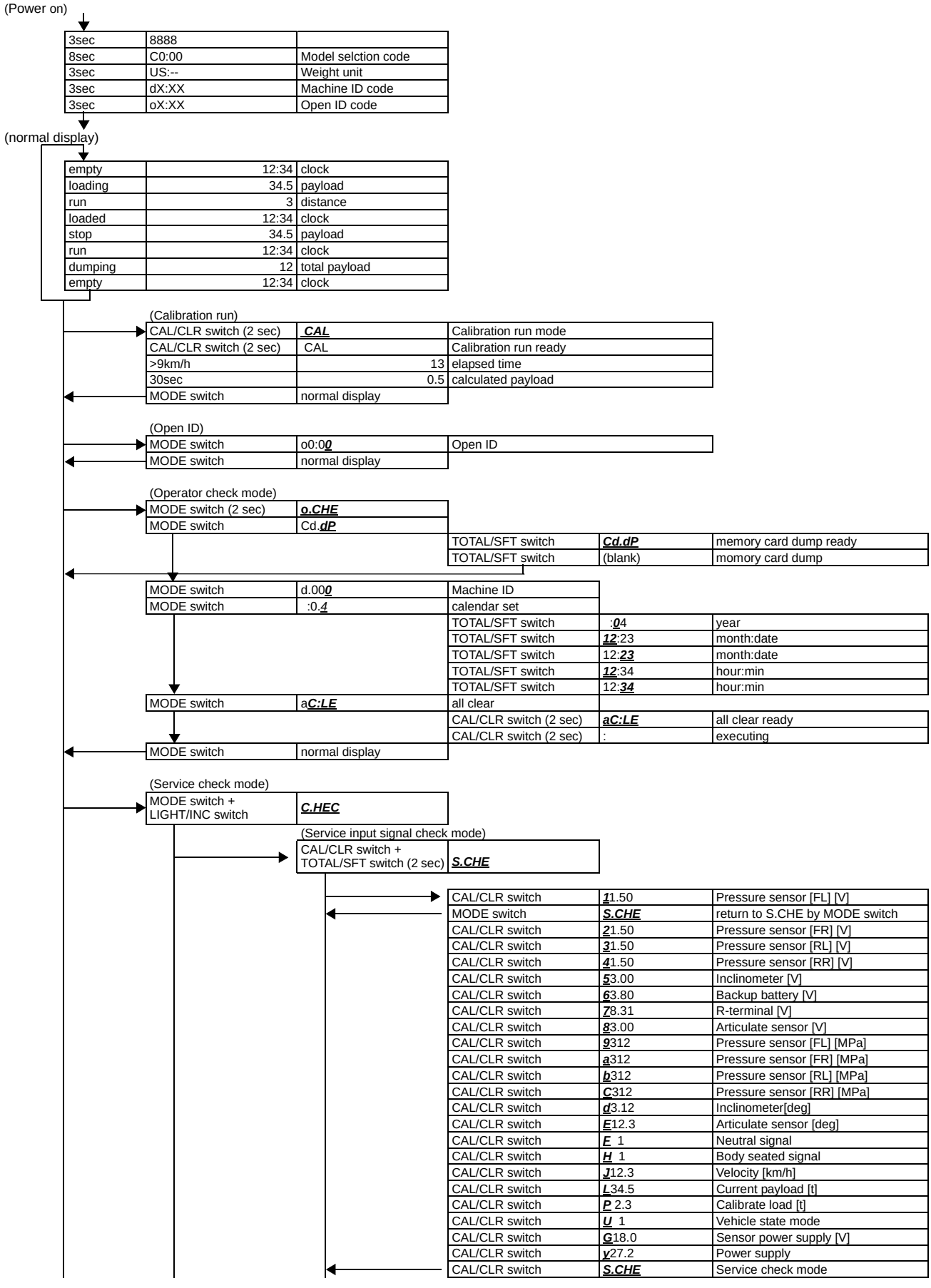
Basically the accuracy of traveling method (default setting) is the best for normal conditions.

4. Correction on slope

If the dump truck is loaded on a slope, the measured weight is different from the weight measured on a level ground. To solve this problem, the longitudinal inclination of the dump track is measured and measured weight is corrected according to the inclination angle. Correction range of inclination angle: ± 5°

Key operation

The chart below describes the key operation tree.



5) Press [CAL/CLR] switch. The display is '3X . XX' ('3' is flashed). The right 3 digit shows the voltage of rear left suspension pressure sensor. Write down the value on the check sheet.). If the value is out of range, check the wiring or sensor install.

6) Press [CAL/CLR] switch. The display is '4X . XX' ('4' is flashed). The right 3 digit shows the voltage of rear right suspension pressure sensor. Write down the value on the check sheet.). If the value is out of range, check the wiring or sensor install.

7) Press [CAL/CLR] switch. The display is '5X . XX' ('5' is flashed). The right 3 digit shows the voltage of Inclinometer.). If the value is out of range, check the wiring or sensor install.

8) Press [CAL/CLR] switch. The display is '6X . XX' ('6' is flashed). The right 3 digit shows the voltage of the backup battery. Write down the value on the check sheet.). If the value is out of range, the backup battery has to be replaced to new one.

9) Press [CAL/CLR] switch. The display is '7X . XX' ('7' is flashed). The right 3 digit shows the voltage of R terminal. The voltage of R terminal has to be more than 24V, but the maximum value of this display is around 8.3V. If the display is around 8.3V, it's OK. If the value is out of range, check the wiring.

10) Press [CAL/CLR] switch. The display is '8X . XX' ('8' is flashed). The right 3 digit shows the voltage of articulate sensor. (write down the value on the check sheet.). If the value is out of range, check the wiring or sensor install.

11) Press [CAL/CLR] switch 6 times. The display is 'F_ _ 1' ('F' is flashed). The most right digit shows the neutral signal (1 : neutral, 0 : other). Move the shift lever to 'D' range. The display on payload meter has to be 'F_ _ 0'. Return the shift lever to 'N' range. The display on payload meter has to be 'F_ _ 1'. (Check on the check sheet.). If the value is not correct, check the wiring.

12) Press [CAL/CLR] switch. The display is 'H_ _ 1' ('H' is flashed). The most right digit shows the body seated signal (1 : seated, 0 : not seated). Raise the dump body and the display on payload meter has to be 'H_ _ 0'. Lower the dump body and the display on payload meter has to become 'H_ _ 1'. (Check on the check sheet.). If the value is not correct, check the wiring or sensor install.

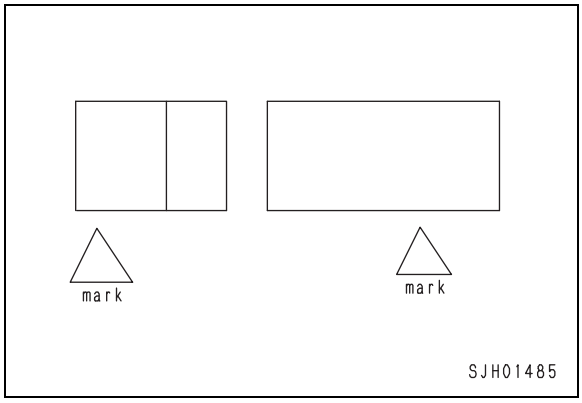
13) Press [CAL/CLR] switch. The display is 'J_ _.0' ('J' is flashed). The most right digit shows the velocity. Put the shift lever to 2nd position and move the vehicle with full throttle pedal. The display on payload meter has to be around 12 km/h. (Check on the check sheet.). If the value is not correct, check the wiring.

14) Press [MODE] switch. The display flashes 'CHEC'. Press [Mode] switch again. Display 2 error codes, 'F.ICL(inclinometer is not calibrated)' and 'F.CAL(calibration run is not executed)' alternately. 'F-.FL' might be flashed, it's no problem.

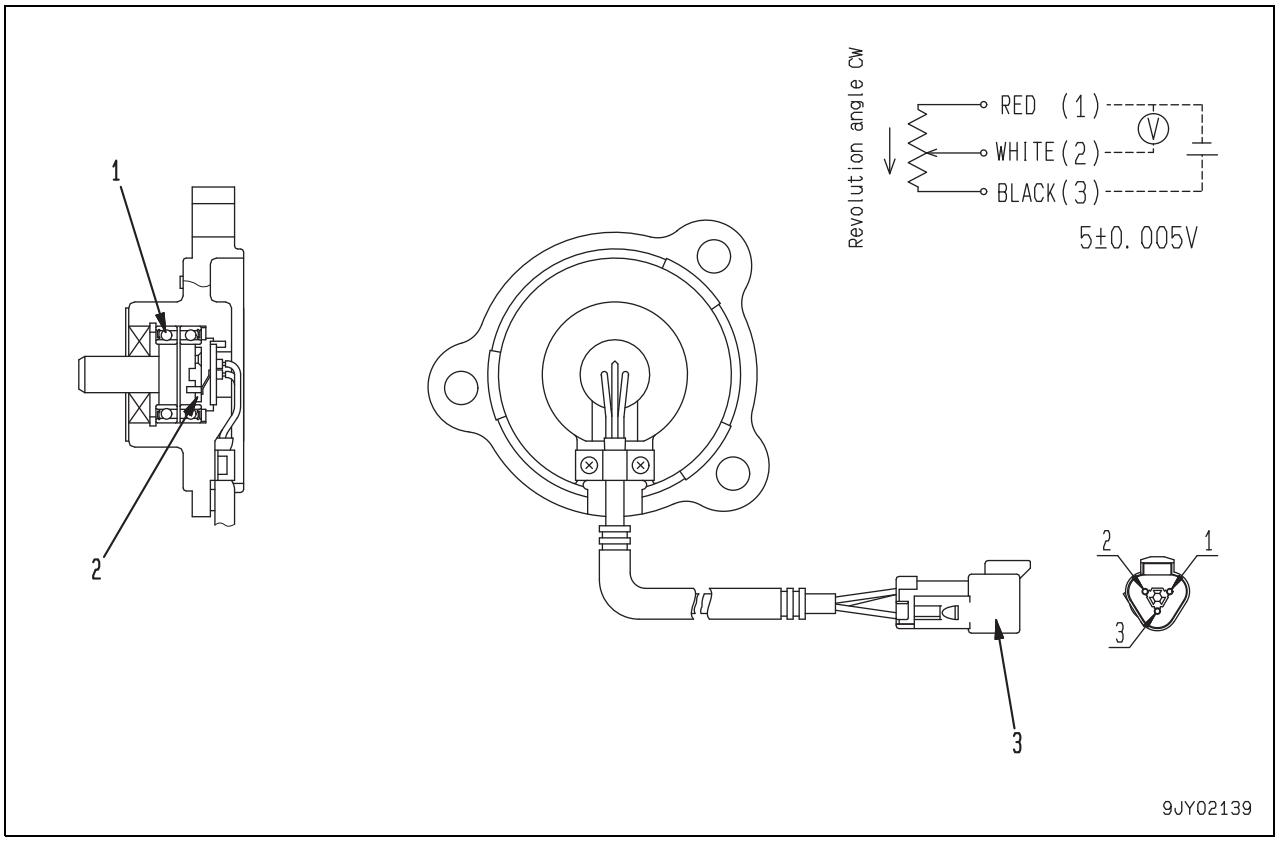
6. Inclinometer & articulate sensor calibration

1) Start engine.

2) Inclinometer will be calibrated by measuring 2 opposite direction of the vehicle and by averaging sensor inputs of these 2 times. The longitudinal incline of the ground must be canceled. But the more horizontal the ground is, the more accurate. Please find the flat and horizontal area for this calibration. The accuracy of the inclinometer impacts the accuracy of payload meter. This process has to be done very carefully.



Body position sensor



1. Bearing
2. Brush assembly
3. Connector

Function

- The body position sensor is installed to the rear of the chassis. When the angle of the dump body changes, the shaft rotates through the link installed to the dump body, and the dump body angle is detected.

Machine model				HM300-2R	
Cate-gory	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Dump	Dump pilot relief pressure	• Hydraulic oil temperature: 45 – 55? • Engine speed: High idle	MPa {kg/cm^2}	3.4 ± 0.49 {35 ± 5}	3.4 ± 0.49 {35 ± 5}
		• Hydraulic oil temperature: 45 – 55? • Engine speed: Low idle (Reference value)		2.6 ± 0.49 {27 ± 5}	2.6 ± 0.49 {27 ± 5}

Measuring exhaust temperature

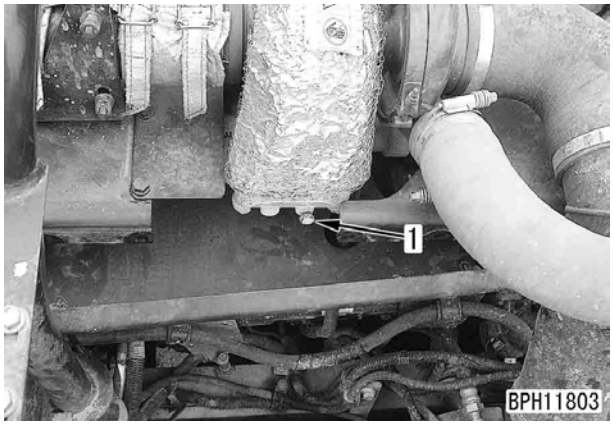
★ Measuring instrument for exhaust temperature

Symbol	Part No.	Part name
B	799-101-1502	Digital thermometer

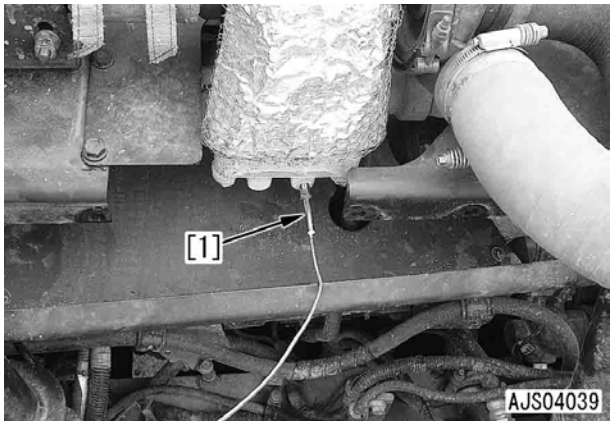
⚠ **Install and remove the measuring instrument after the exhaust manifold is cooled.**

1. Open the engine hood and remove the turbocharger heat insulation cover.

2. Remove exhaust temperature measurement plug (1).

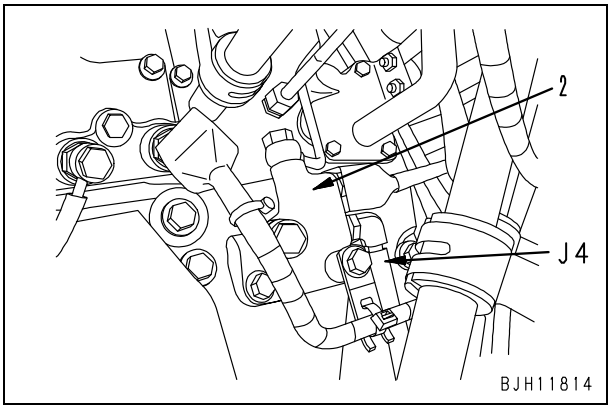


3. Install sensor [1] and connect it to digital thermometer **B**.
   ★ Clamp the wiring harness of the temperature gauge at a suitable place to prevent it from touching any hot part.



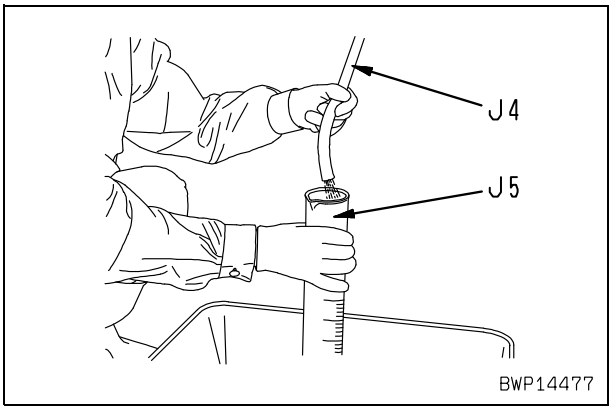
4. When measuring the exhaust temperature at torque converter stall, implement below procedure.
   ★ To prevent the torque converter from overheating, use the full stall (torque converter stall + hydraulic relief) to stabilize the exhaust temperature, then stall only the torque converter and measure the temperature.
   1) Start the engine and raise the temperature of the coolant to the operating range.
   2) Turn the parking brake switch ON, depress the brake pedal, then set the gear shift lever to the D position.
      ⚠ **If the gear shift lever is operated to any position other than the D position, the machine may move off even if the brake is being depressed, so always measure at the D position.**
   3) Depress the accelerator pedal gradually, run the engine at high idle and stall the torque converter. At the same time, operate the dump lever to the LOWER position and relieve the oil pressure (full stall).
      ★ Continue until the exhaust temperature reaches the standard value of 650°C.
      ⚠ **There is danger of damage to the internal parts of the transmission, so never operate the gear shift lever to any position other than the D position during the stall operation.**
   4) When the temperature stabilizes at near the target temperature, return the dump lever to NEUTRAL and measure the temperature with only the torque converter stalled.
      ★ The exhaust temperature will start to go down from the full stall condition, so measure the temperature when it stabilizes.
      ★ If the exhaust temperature does not go down but rises, make the set temperature at full stall higher.
      ★ After completing the measurement, lower the engine speed to low idle, then return the gear shift lever to the N position.

2) Connect inspection hose **J4** to return block (2) side.
   ★ Bind connecting portion with wire so that the inspection hose should not come off.
3) Adjust the route of inspection hose **J4** to remove its sag and insert the hose end into the oil pan (receiver).



4) Referencing “Measuring engine speed“, set up the condition necessary for checking the engine speed.
5) Start the engine and run the engine at the rated output.
6) When the engine speed is stabilized, check the return amount per minute with measuring cylinder **J5**.
   ★ It also can be judged by testing for 20 seconds and triples its return amount.
   ★ If the supply pump is not supplying fuel, the engine speed may not rise. In this case, record the engine speed, too, during the test.
   ★ If the return rate (spill) from the injector is in the following range, it is normal.

Rated output speed (rpm)	Return (Spill) limit (cc/min)
1,600	960
1,700	1,020
1,800	1,080
1,900	1,140
2,000	1,200



7) When the testing is completed, stop the engine.

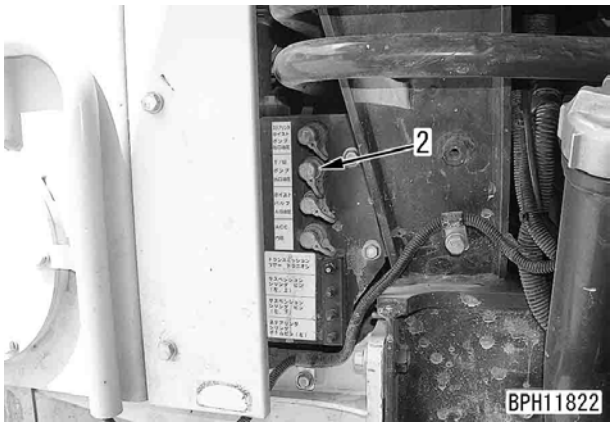
4. Operations after completion of testing
If all the tests are completed, remove the instruments and set to the original condition.

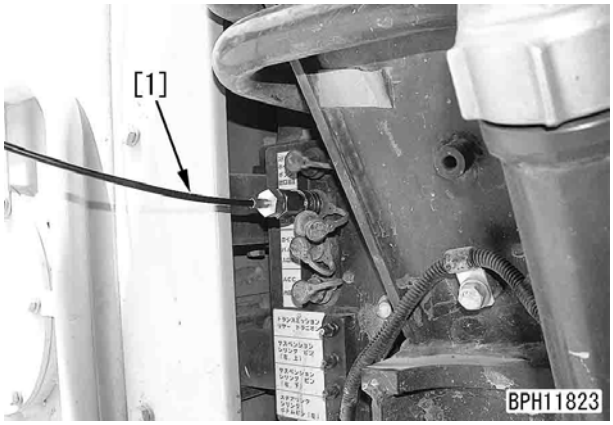
7) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

Torque converter related

2. Measuring torque converter inlet pressure

1) Attach hose [1] for oil pressure measurement to hydraulic oil pressure measuring coupler (2).

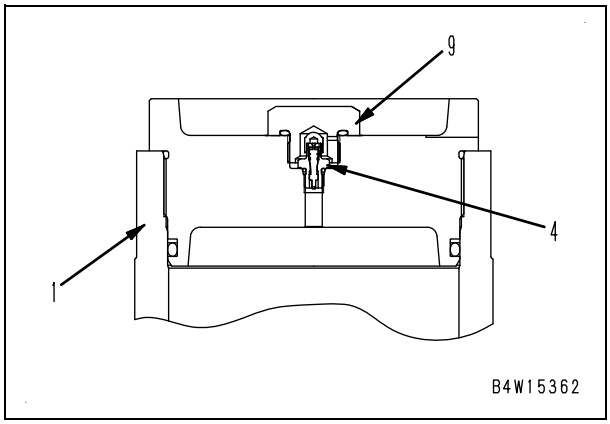




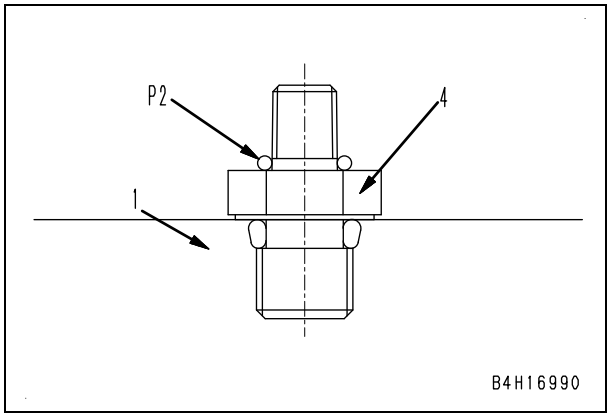
2) Connect oil pressure gauge **K**.
3) Start the engine and raise the temperature of the torque converter oil to the operating range.
4) While keeping the gear shift lever at the N position, measure the oil pressure at high idle.

5) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

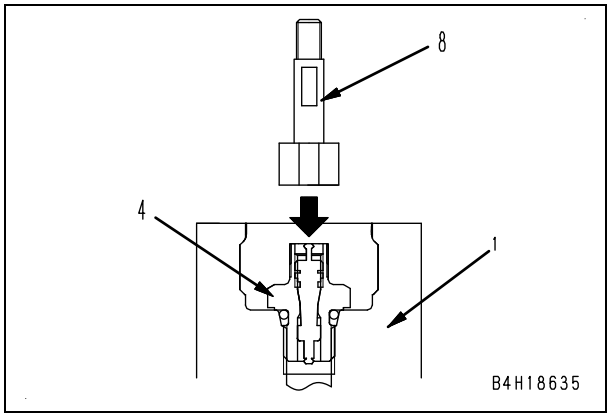
3. Remove plug (9) from accumulator (1).
(New type accumulator)



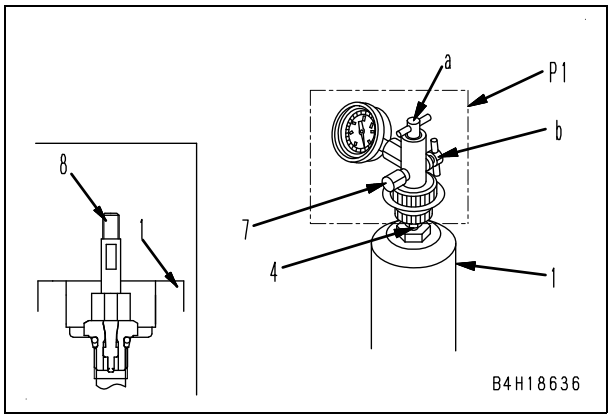
4. Connect gas charging tool **P1** to gas valve (4) of accumulator (1) according to the following procedure.
   1) Install attached O-ring **P2** to gas valve (4).
   (Old type accumulator)



   2) Install extension (8) attached to gas charge tool **P1**, to gas valve (4).
   (New type accumulator)
   ★ Do not attach O-ring **P2**.



   3) Fully turn handle (a) of gas charging tool **P1** counterclockwise until it stops (to close piping between accumulator (1) and gas charging tool **P1**), and fully turn handle (b) clockwise to close, then connect them.
   ★ Since valve (7) on the hose connection side of gas charging tool **P1** is a check valve (one-way valve), gas does not leak from the hose connection port into the atmosphere.
   4) Connect gas charging tool **P1** to gas valve (4) of accumulator (1) or extension (8).
   5) Cover valve (7) to prevent entry of rain, snow, sand, or dust.



Reference

- Handle (a): Turn counterclockwise to close the valve, and clockwise to open the valve (to connect the charge valve and accumulator)
  ★ This valve is opened when tightened
- Handle (b): Turn counterclockwise to open the valve (to open to the atmosphere), and clockwise to close the valve (to disconnect from the atmosphere)
  ★ This valve is closed when tightened

5. Slowly turn handle (a) of gas charging tool **P1** clockwise, and read the gauge value.
   ★ Check the gas pressure by referring to the following table, since the display varies depending on the temperature at measurement.
   (The unit of values in the formula is °C)
   Specified gas pressure =
   Standard gas pressure x ((273 + t)/(273 + 20))
   t: Gas temperature at measurement (°C)
   Reference: "t" can be assumed to be the ambient temperature.

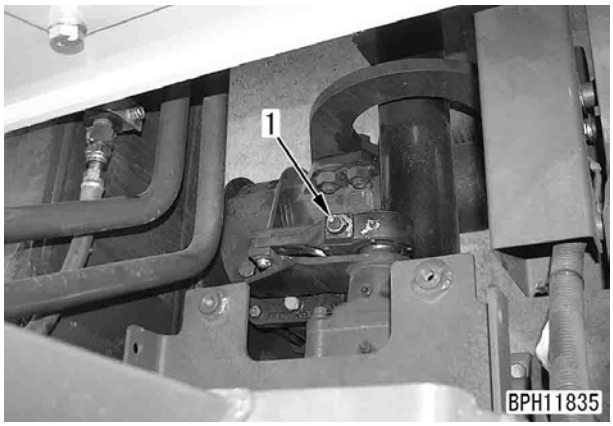
Method for emergency release of parking brake

★ If any problem occurs in the electrical system or hydraulic system of the parking brake and the parking brake is not released, it is possible to release the brake temporarily as follows.

⚠ **If any problem occurs in the hydraulic system, there is a strong possibility that the wheel brake will not work properly, so after releasing the parking brake, always tow the machine at low speed to a safe place.**

⚠ **When carrying out the operation to release the parking brake, stop the machine on level ground and check that the surrounding area is safe before starting the operation. If the parking brake must be released on a slope in an emergency or other unavoidable situation, set chocks to the tires securely.**

1. In order to create a gap between the pad and disc, turn the parking brake adjustment nut (1) clockwise while pushing down the lock of the nut.



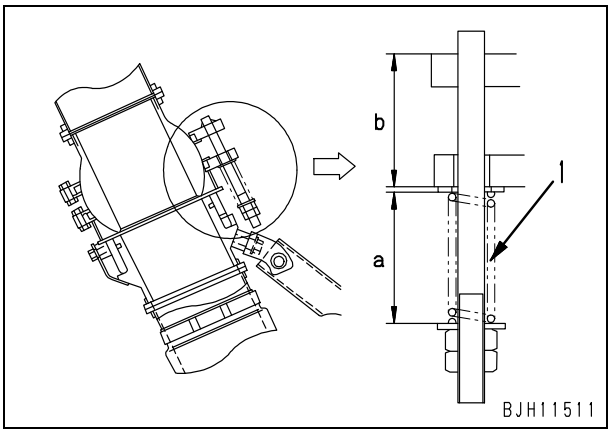
2. Tow the machine to a safe place.
   ⚠ **After moving the machine, set chocks securely to the tires.**

Procedure for adjusting length of spring in body heating spherical joint

★ If the body heating bellows does not move smoothly while the machine is steered or oscillated, or if the bellows is replaced, adjust the length of the spring according to the following procedure.

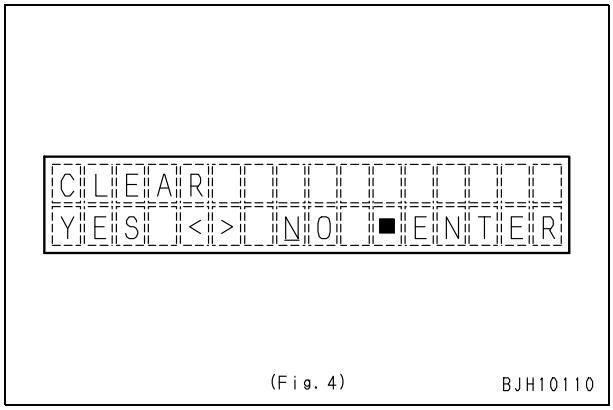
1. Adjust length **a** of spring (1) to be 60 ± 1 mm. (On both front side and rear side)
   At this time, check that dispersion of dimension **b** of each stud is 1 mm or less.
   ★ Standard dimension **b** of stud: 58 mm (reference)

2. After completing the adjustment
   1) Check for a leakage of exhaust gas.
   2) Check that the spherical joint swivels smoothly without any sticking or scuffing.



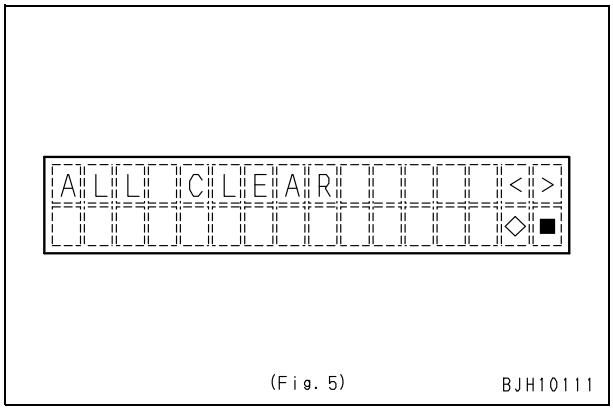
Deletion of electric system failure history information (3-1)

1) Press the [◇] switch once when the failure history information you wish to delete is displayed, and display the individual deletion screen (Fig. 4).
   - [◇] switch: Display the deletion screen
2) Execute the switch operation following the display screen. (Fig. 4).
   - [<] switch: Select YES
   - [>] switch: Select NO
   - [■] switch: Execute
   - ★ An information which is active currently (display is flashing) cannot be deleted.



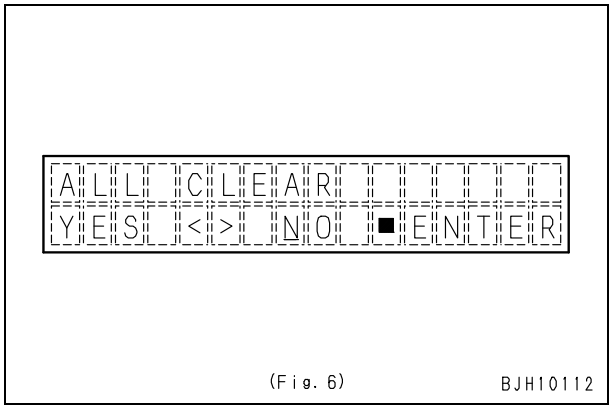
(Fig. 4) BJH10110

- Deletion of all the failure history information
  1) Press the [>] or [<] switch when the failure history information is displayed, and display all the deletion menu screen (Fig. 5).
  2) Press the [◇] switch once and display all deletion screen (Fig. 6).
     - [◇] switch: Implement all deletion menu.



(Fig. 5) BJH10111

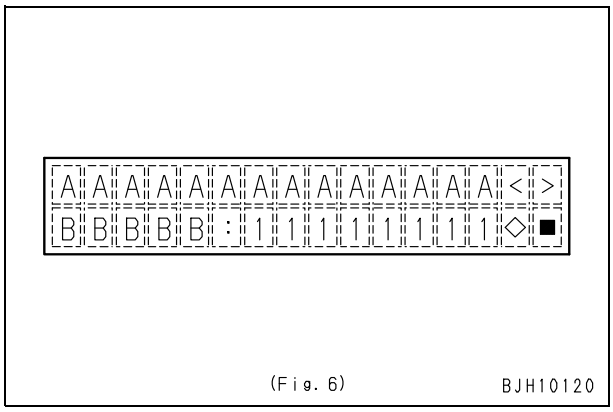
3) Implement the switch operation following the display (Fig. 6).
   - [<] switch: Select YES
   - [>] switch: Select NO
   - [■] switch: Execute
   - ★ An information which is active currently (display is flashing) cannot be deleted.



(Fig. 6) BJH10112

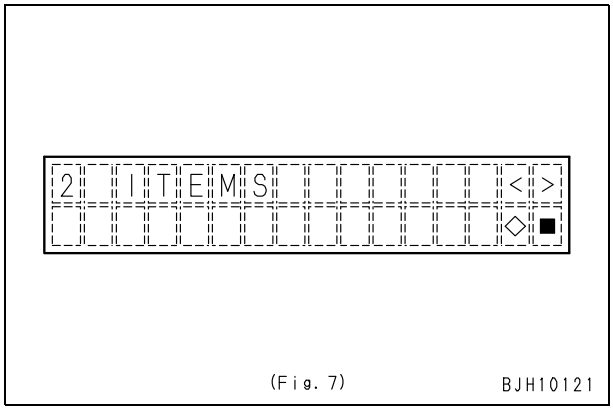
Failure codes table

Failure code	Failed section	Symptom of failure	Applicable equipment	Action code	History classification
1500L0	Dual engagement		TM	E03	Mechanical system
15B0NX	Transmission oil filter	Clogging	TM	E01	Mechanical system
15F0KM	R → F gear shift abuse 1	Operational error or incorrect setting	TM	—	Mechanical system
15F0MB	R → F gear shift abuse 2	Functional deterioration	TM	—	Mechanical system
15F7KM	Forward clutch disc abuse	Operational error or incorrect setting	TM	—	Mechanical system
15G0MW	Slipping R clutch	Slipping	TM	E03	Electrical system
15G7KM	Reverse clutch disc abuse	Operational error or incorrect setting	TM	—	Mechanical system
15H0MW	Hi clutch	Slipping	TM	E03	Electrical system
15J0MW	Lo clutch	Slipping	TM	E03	Electrical system
15K0MW	1st clutch	Slipping	TM	E03	Electrical system
15L0MW	2nd clutch	Slipping	TM	E03	Electrical system
15M0MW	3rd clutch	Slipping	TM	E03	Electrical system
15SBL1	R clutch solenoid	Fill signal is ON when command current is OFF	TM	E03	Electrical system
15SBMA	R clutch solenoid	Malfunction	TM	E03	Electrical system
15SCL1	Hi clutch solenoid	Fill signal is ON when command current is OFF	TM	E03	Electrical system
15SCMA	Hi clutch solenoid	Malfunction	TM	E03	Electrical system
15SDL1	Lo clutch solenoid	Fill signal is ON when command current is OFF	TM	E03	Electrical system
15SDMA	Lo clutch solenoid	Malfunction	TM	E03	Electrical system
15SEL1	1st clutch solenoid	Fill signal is ON when command current is OFF	TM	E03	Electrical system
15SEMA	1st clutch solenoid	Malfunction	TM	E03	Electrical system
15SFL1	2nd clutch solenoid	Fill signal is ON when command current is OFF	TM	E03	Electrical system
15SFMA	2nd clutch solenoid	Malfunction	TM	E03	Electrical system
15SGL1	3rd clutch solenoid	Fill signal is ON when command current is OFF	TM	E03	Electrical system
15SGMA	3rd clutch solenoid	Malfunction	TM	E03	Electrical system
15SJMA	Lockup solenoid	Malfunction	TM	E03	Electrical system
15SKMA	Inter axle differential lock pressure control valve	Malfunction	TM	E01	Electrical system
2F00KM	Parking brake	Operational error or incorrect setting	TM	—	Mechanical system
2G42ZG	Front accumulator	Oil pressure too low	BK	E03	Mechanical system
2G43ZG	Rear accumulator	Oil pressure too low	BK	E03	Mechanical system
989A00	Engine overrun prevention command signal	Prevention function activated	MON	E02	—
989D00	Rear section turnover alarm	Prevention function activated	MON	—	—
AA10NX	Air cleaner	Clogging	MON	E01	Mechanical system
AB00MA	Alternator	Malfunction	MON	E03	Mechanical system
B@BAZK	Engine oil level	Low too low	TM	E01	Mechanical system
B@BCNS	Engine overheated	Overheat	ENG	E02	Mechanical system



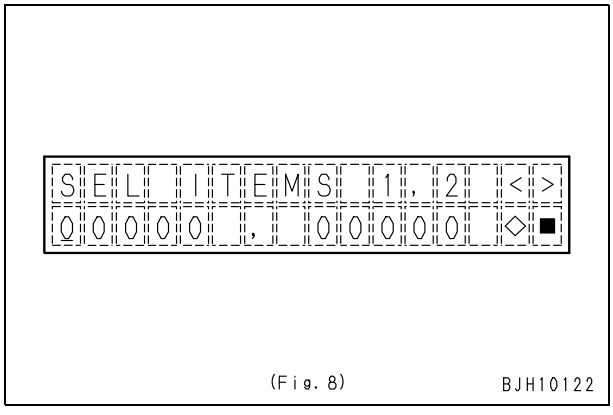
(Fig. 6) BJH10120

6) Setting 2 items simultaneous monitoring
   1] Select the 2 items display on the sub menu screen (Fig. 6).
   2] With the sub menu selected, press the [◇] button and display the monitoring code input screen (Fig. 7).
      - [◇] button: Runs sub menu



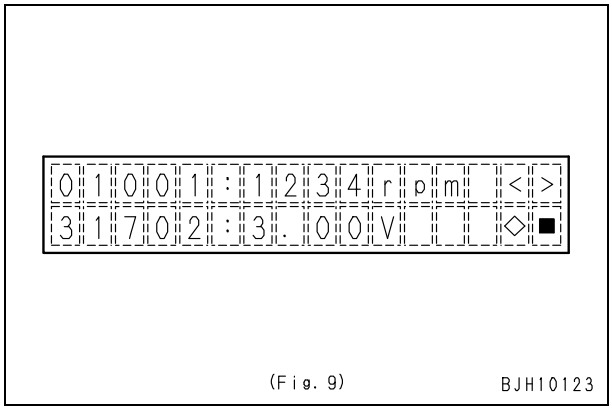
(Fig. 7) BJH10121

   3] Operate each button and input the monitoring codes for the 2 monitoring items directly.
      - [>] button:
        Number at cursor goes up
      - [<] button:
        Number at cursor goes down
      - [◇] button:
        Number at cursor is confirmed
      - [■] button:
        Returns to code input screen



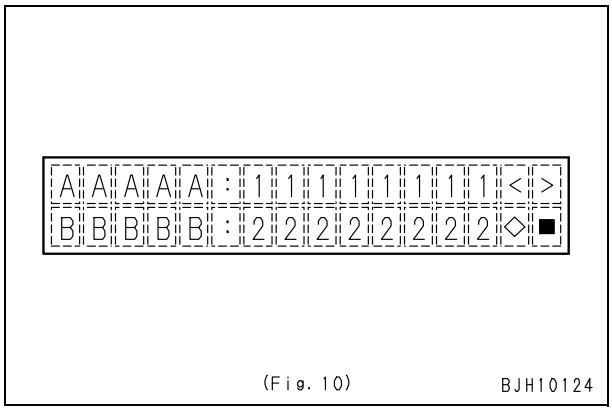
(Fig. 8) BJH10122

   4] When both of the monitoring codes have been confirmed, the screen switches to the 2 items display screen (Fig. 9: example).
      ★ To hold or cancel monitoring data:
      If the [◇] button is pressed during monitoring, the monitor data is held and the [◇] mark flashes. If the [◇] button is pressed again, it becomes active again.



(Fig. 9) BJH10123

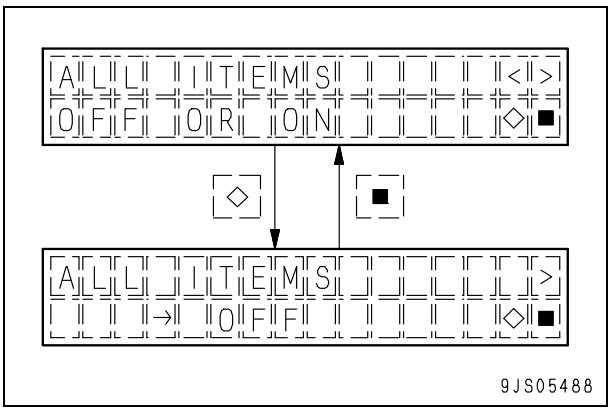
7) Display data for 2 items simultaneous monitoring
   On the 2 items simultaneous monitoring screen, the following data are displayed (Fig. 10).
   A: Monitoring code 1
   1: Monitoring data 1 (including unit)
   B: Monitoring code 2
   2: Monitoring data 2 (including unit)
   ★ For details, see “Monitoring code table“.



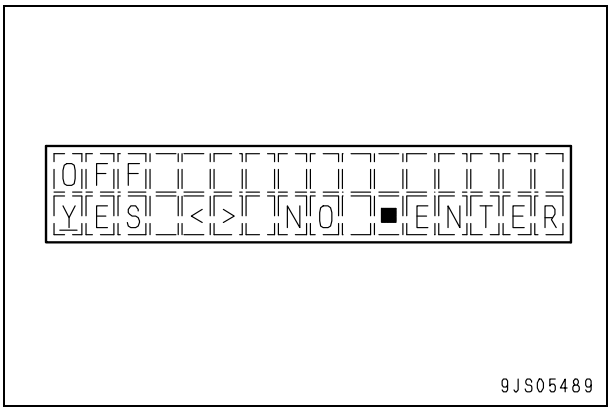
(Fig. 10) BJH10124

7) Selecting deactivation or activation of timer for all items

1] Press the [◇] button on the screen for selecting deactivation or activation of the timer for all the items, and the display changes to the “timer deactivation for all the items“ screen.



2] If the deactivation for all the items is to be selected, press the [◇] button on the screen in step 1] to display the following screen, and select YES with the [>] and [<] buttons.



★ When deactivation for all items is executed
If the [■] button is pressed, the timer function for all the items is deactivated, and the display returns to the maintenance monitor selection screen.
The individual setting for each item is also set to “deactivated“.

★ When cancelled
The operation is cancelled and the display returns to the maintenance monitor selection screen.

3] If the activation for all the items is to be selected, select the "all items ON" screen with the [>] and [<] buttons from the screen in step 1], and confirm it with the [◇] button.

4] Select YES or NO with the [<] and [>] buttons.
The cursor (_) flashes at the selected side.

★ The cursor initially shows NO (not change) in order to prevent reset by mistake.

★ When activation for all items is executed
When the [■] button is pressed, the remaining interval times for all the items become invalid regardless of individual activation or deactivation settings.The timer remaining time for each item is reset to the initial interval time.
However, the number of resets is kept intact with no incrementation, and the display returns to the maintenance screen.
(The individual setting for each item is also set to “activated“.)

★ When cancelled
The operation is cancelled and the display returns to the maintenance monitor selection screen.

HM300-2R Articulated dump truck

Form No. SEN03421-02

ARTICULATED DUMP TRUCK

HM300-2R

Machine model	Serial number
HM300-2R	7001 and up

40 Troubleshooting

General information on troubleshooting

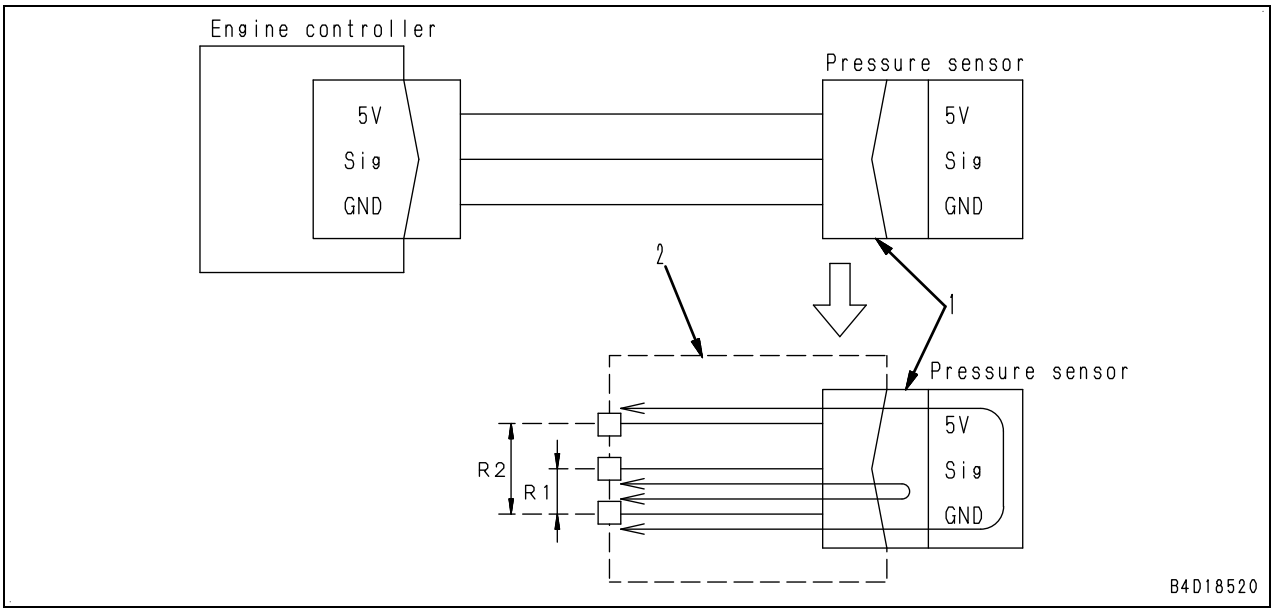
Precautions before work 2
Points to remember when performing troubleshooting 3
How to proceed in troubleshooting 5
Checks before troubleshooting 7
Classification and procedures of troubleshooting 8
Information in troubleshooting table 12
Troubleshooting method for disconnecting wiring harness of pressure sensor system 14
Connection table for connector pin numbers 17
T-branch box and T- branch adapter table 53

Troubleshooting method for disconnecting wiring harness of pressure sensor system

★ Since pressure sensor consists not only of resistors but also electronic circuits such as amplifiers, it may have the differences among the resistances measured and its own polarities. So troubleshooting must be performed carefully.

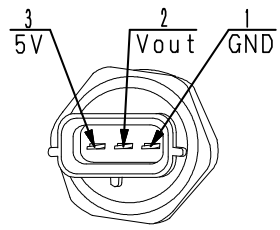
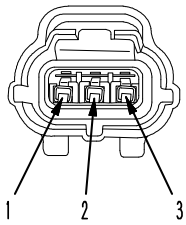
Failure codes applicable to this diagnosis
- CA122: Charge Air Pressure Sensor High Error
- CA123: Charge Air Pressure Sensor Low Error
- CA221: Ambient Pressure Sensor High Error
- CA222: Ambient Pressure Sensor Low Error

Procedure
1. Measure and record resistance of pressure sensor unit.
   1) Disconnect pressure sensor connector (1) and connect socket (2) to the sensor.
   2) Measure resistances R1 and R2 between pins.
      ★ If tester probes polarities to apply are reversed, measured values may change. Therefore, when measuring resistances, apply the same tester probe polarities to the pressure sensor in steps 1 and 2.
      ★ If measured value is infinite, take measurements with tester probes polarities exchanged each other and record the finite value obtained as a measured value.
      ★ Since measured values may be different from each other, take several measurements. Cause of the differences appears to be that the sensor may be charged by the tester. Take several measurement in both steps 1 and 2. Take the fact into consideration this differences when determining whether the wiring harness is disconnected in step 3.

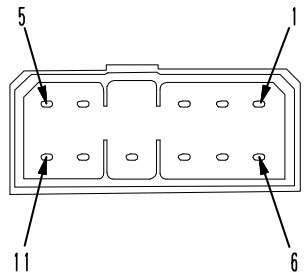
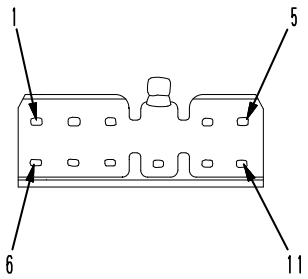


2. Measure and record resistance with wiring harness between pressure sensor and engine controller connected
   1) Since 5 V power supply to pressure sensor is supplied to other sensors, disconnect the other sensor connectors first.(*)
   2) Connect the pressure sensor to be measured, disconnect connector (3) on engine controller side, and connect T-adapter (4) to wiring harness side.
   3) Connect T-box (5) to T-adapter (4) and measure respective pins for resistances R1' and R2'.

AMP connetor

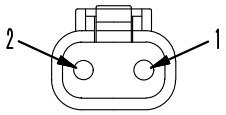
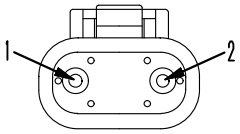
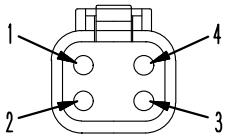
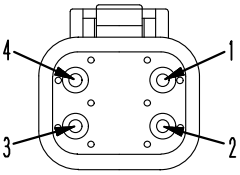
No. of pins	Oil pressure sensor		
	Sensor side (blue)	Harness side (receptacle)	Testing connection use special tool Part No.
3			799-601-9420 (T-adapter) (kit:799-601 -4101) (kit:799-601 -4201)
	—	—	

YAZAKI connector

No. of pins	WIPER INTERMITTENT UNIT		
	Male pin (female housing)	Female pin (male housing)	
11			—
	—	—	

B4D18200

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

No. of pins	DTP Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
	Pin(female terminal)	Socket(male terminal)	
2			–
	–	–	
4			799-601-4260 (T-adapter)
	Part No. :6261-81-2810	–	

B4D18413

T-branch box and T- branch adapter table (Rev. 2009.03)

★ The vertical column indicates a part number of T-branch box or T-branch adapter while the horizontal column indicates a part number of harness checker assembly.

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit														Out of kit
				799-601-2500	799-601-2700	799-601-2800	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	799-601-4101	799-601-4201	
799-601-2600	T-box (for ECONO)	21		●		●		●	●		●							
799-601-3100	T-box (for MS)	37																●
799-601-3200	T-box (for MS)	37																●
799-601-3380	Plate for MS (14-pin)																	●
799-601-3410	Adapter for BENDIX (MS)	24	MS-24P															●
799-601-3420	Adapter for BENDIX (MS)	24	MS-24P															●
799-601-3430	Adapter for BENDIX (MS)	17	MS-17P															●
799-601-3440	Adapter for BENDIX (MS)	17	MS-17P															●
799-601-3450	Adapter for BENDIX (MS)	5	MS-5P															●
799-601-3460	Adapter for BENDIX (MS)	10	MS-10P															●
799-601-3510	Adapter for BENDIX (MS)	5	MS-5P															●
799-601-3520	Adapter for BENDIX (MS)	17	MS-17P															●
799-601-3530	Adapter for BENDIX (MS)	19	MS-19P															●
799-601-2910	Adapter for BENDIX (MS)	14	MS-14P															●
799-601-3470	Case																	●
799-601-2710	Adapter for MIC	5	MIC-5P	●	●				●									
799-601-2720	Adapter for MIC	13	MIC-13P	●	●				●									
799-601-2730	Adapter for MIC	17	MIC-17P	●	●	●		●	●		●							
799-601-2740	Adapter for MIC	21	MIC-21P	●	●	●		●	●		●							
799-601-2950	Adapter for MIC	9	MIC-9P				●	●	●		●							
799-601-2750	Adapter for ECONO	2	ECONO2P	●	●													
799-601-2760	Adapter for ECONO	3	ECONO3P	●	●													
799-601-2770	Adapter for ECONO	4	ECONO4P	●	●													
799-601-2780	Adapter for ECONO	8	ECONO8P	●	●													
799-601-2790	Adapter for ECONO	12	ECONO12P	●	●													
799-601-2810	Adapter for DLI	8	DLI-8P	●	●													
799-601-2820	Adapter for DLI	12	DLI-12P	●	●													
799-601-2830	Adapter for DLI	16	DLI-16P	●	●													
799-601-2840	Extension cable (ECONO type)	12	ECONO12P	●	●				●									
799-601-2850	Case			●														
799-601-4350	T-box (for DRC 60, ECONO)	60														●		
799-601-4360	Case															●		
799-601-7010	Adapter for X (T-adapter)	1							●		●							
799-601-7020	Adapter for X	2	X2P				●	●	●		●							
799-601-7030	Adapter for X	3	X3P				●	●	●		●							
799-601-7040	Adapter for X	4	X4P				●	●	●		●							
799-601-7050	Adapter for SWP	6	SW6P				●	●	●									
799-601-7060	Adapter for SWP	8	SW8P				●	●	●									
799-601-7310	Adapter for SWP	12	SW12P															●
799-601-7070	Adapter for SWP	14	SW14P						●		●							
799-601-7320	Adapter for SWP	16	SW16P															●
799-601-7080	Adapter for M (T-adapter)	1							●		●							
799-601-7090	Adapter for M	2	M2P				●	●	●		●							
799-601-7110	Adapter for M	3	M3P				●	●	●		●							

Failure code [15G7KM] Transmission reverse clutch abuse

Action code	Failure code	Trouble	Transmission reverse clutch abuse (Transmission controller system)
—	**15G7KM**		
Contents of trouble	• Shifting from neutral or forward to reverse was detected 10 times in total while engine speed was above 1,800 rpm.		
Action of controller	• None in particular.		
Problem that appears on machine	• If abnormal operation is repeated, machine may be broken.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Wrong operation of gearshift lever	Gearshift lever may have been operated wrongly (Transmission may have been set in reverse while engine was running higher than set speed). Teach operator correct operation. (Transmission must be set to reverse while engine is running at low idle.)
	2	Defective transmission controller	If cause 1 is not detected, transmission controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Circuit diagram related

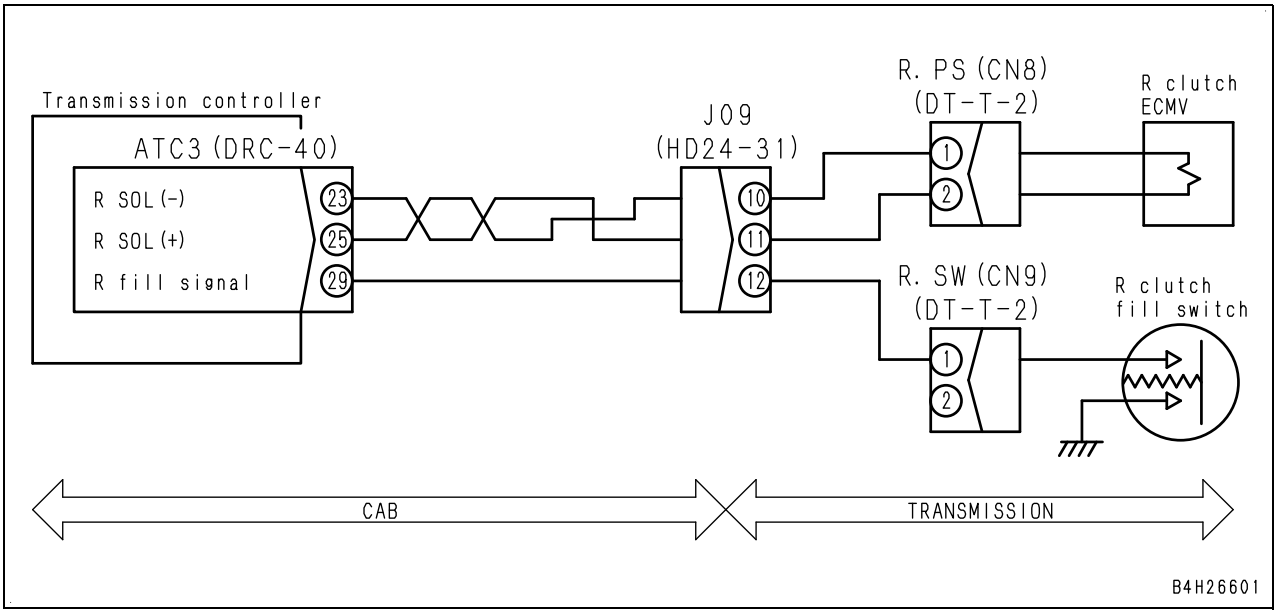
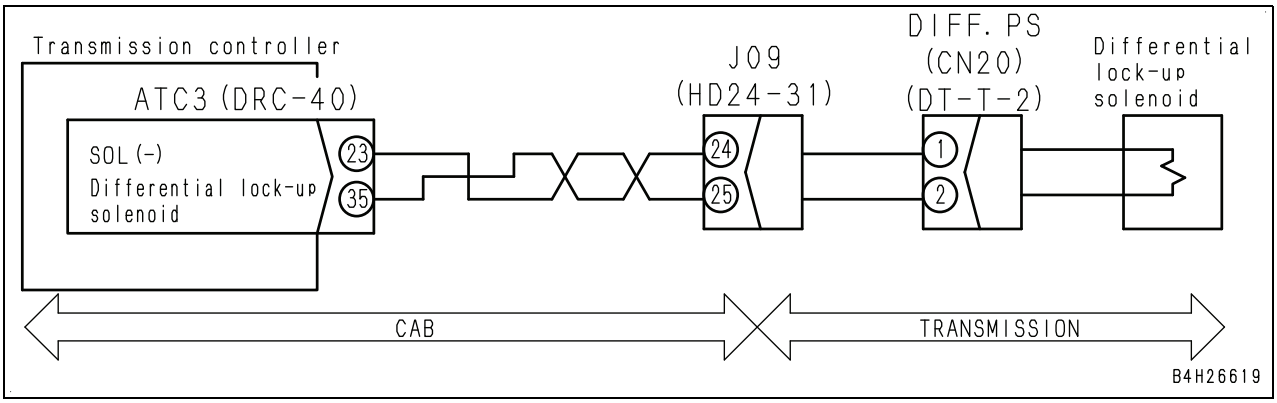


Table 2

Gear speed before trouble		Clutch having trouble	Remedy against trouble		
			Action of controller (Selected clutch and gear speed)		ON/OFF state of lockup clutch
F6	3rd Hi	2nd	OFF	NEUTRAL	OFF
		1st	OFF	NEUTRAL	OFF
		Reverse	OFF	NEUTRAL	OFF
		Lo	OFF	NEUTRAL	OFF
F5	3rd Lo	2nd	OFF	NEUTRAL	OFF
		1st	OFF	NEUTRAL	OFF
		Reverse	OFF	NEUTRAL	OFF
		Hi	3H	F6	OFF
F4	2nd Hi	3rd	3L	F5	OFF
		1st	OFF	NEUTRAL	OFF
		Reverse	OFF	NEUTRAL	OFF
		Lo	3L	F5	OFF
F3	2nd Lo	3rd	3L	F5	OFF
		1st	OFF	NEUTRAL	OFF
		Reverse	OFF	NEUTRAL	OFF
		Hi	2H	F4	OFF
F2	1st Hi	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	NEUTRAL	OFF
		Lo	2L	F3	OFF
F1	1st Lo	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	NEUTRAL	OFF
		Hi	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	NEUTRAL	OFF
		1st	OFF	NEUTRAL	OFF
		Hi	OFF	NEUTRAL	OFF
		Lo	OFF	NEUTRAL	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	NEUTRAL	OFF
		Hi	OFF	NEUTRAL	OFF
		Lo	OFF	NEUTRAL	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		Hi	OFF	NEUTRAL	OFF
		Lo	OFF	NEUTRAL	OFF
N		ANY	NONE	No reaction	—

Circuit diagram related

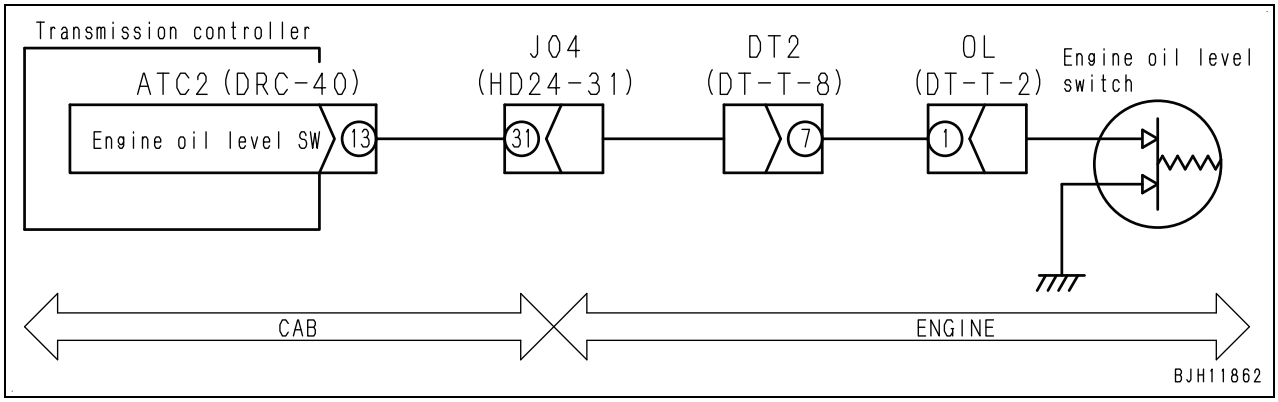


Failure code [B@BAZK] Lowering of engine oil level

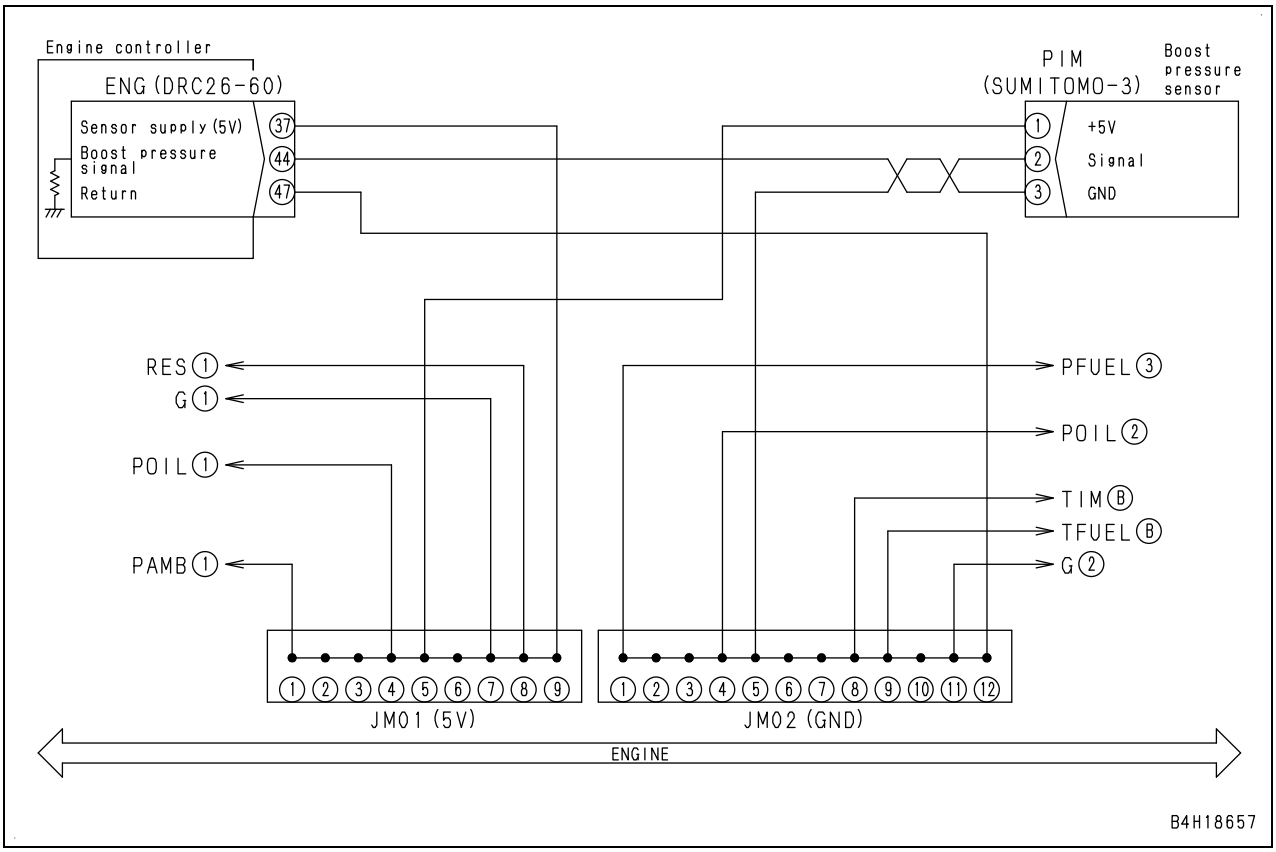
Action code	Failure code	Trouble	Lowering of engine oil level (Transmission controller system)
E01	**B@BAZK**		
Contents of trouble	• Engine oil level switch signal circuit has become "OPEN" (disconnected from chassis ground) while engine stops.		
Action of controller	• Operates with normal control system. • Turns maintenance caution lamp ON.		
Problem that appears on machine	• If machine is used as it is, engine may be seized.		
Related information	• This failure code is not detected if engine coolant temperature is more than 60 ºC. • This failure code is canceled with starting engine. • State of engine oil level switch can be checked with monitoring function. (Monitoring code: TRANSMISSION - D-IN-24-----31 - 40908 bit 28: 1 (lowering) / 0 (normal)) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Lowering of engine oil level (When system is normal)	Check engine oil level and add new oil if necessary.			
			★ If engine oil level is low, check around engine for oil leakage before adding oil.			
	2	Defective engine oil level switch (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between 0L (male) (1) and chassis ground	Engine oil level: Between H – L levels	Resistance	Max. 1 Ω
				Engine oil level: L level	Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between ATC2 (female) (13) and 0L (female) (1)		Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Starting switch OFF, then insert T-adapter into connector ATC2, and carry out troubleshooting with starting switch ON.			
			Between ATC2 (13) and chassis ground	Engine oil level: Between H – L levels	Voltage	Max. 1 V
				Engine oil level: L level	Voltage	Min. 7 V

Circuit diagram related



Circuit diagram related to charge pressure sensor



Failure code [CA145] Coolant temperature sensor low error

Action code	Failure code	Failure	Coolant Temp Sens Low Error (Engine controller system)
E02	**CA145**		
Detail of failure	• Low voltage was detected in engine coolant temperature sensor signal circuit.		
Action of controller	• Sets coolant temperature to fixed temperature (90 °C), and allows for operation.		
Problem on machine	• Engine does not start easily at low temperature. • Overheat prevention function does not work.		
Related information	• Signal voltage from engine coolant temperature sensor can be checked with monitoring function (Code: 04104 (V)). • Temperature sensed by engine coolant temperature sensor can be checked by using monitoring function. (Code: 04104 (°C)) • Method of reproducing failure code: Turn starting switch to ON position. • If temperature sensor connector is disconnected, this failure code is not displayed but failure code [**CA144**] for "High Error" is displayed.		

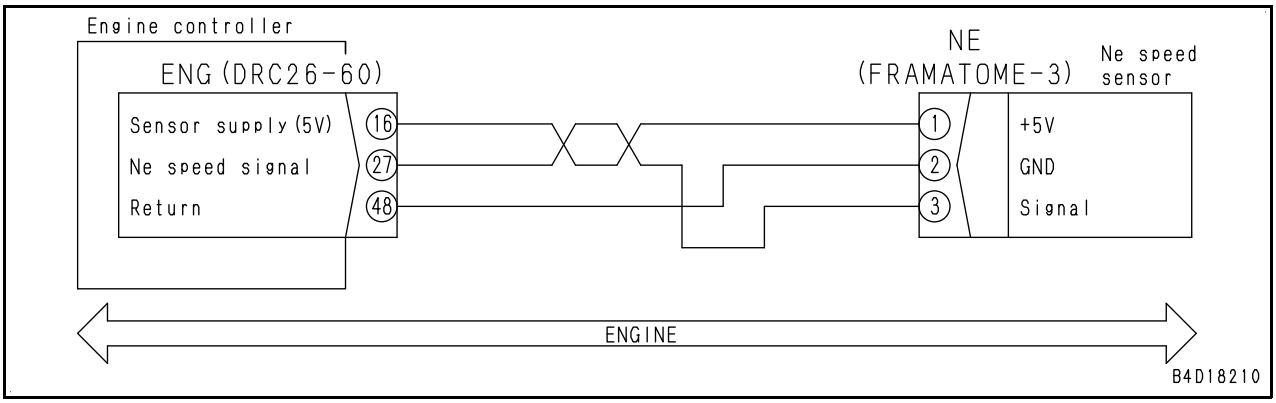
Cause		Procedure, measuring location, criteria and remarks			
1	Defective wiring harness connector	See descriptions of wiring harness and connectors in "Electrical equipment" in "Checks before troubleshooting" of "General information on troubleshooting", and check them.			
2	Defective coolant temperature sensor	1. Turn starting switch to OFF position. 2. Disconnect connector TWTR and connect socket to male side of connector. ★ If coolant temperature sensor has resistance of 700 Ω - 37 kΩ with coolant temperature above 0 °C, regard coolant temperature sensor as normal.			
		Between TWTR (male) (A) and (B) ★ Coolant temperature - Resistance characteristics	0 °C	Resistance	30 –37 kΩ
			25 °C	Resistance	9.3 – 10.7 kΩ
			50 °C	Resistance	3.2 – 3.8 kΩ
			80 °C	Resistance	1.0 – 1.3 kΩ
			95 °C	Resistance	700 – 800 Ω
		Between (B) and ground	All coolant temperature range	Resistance	Min. 1 MΩ
3	Short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector ENG and connect T-adapter to female side.			
		Between ENG (female) (15) and (38) (Coolant temperature: Min. 0 °C) ★ Use "coolant temperature -Resistance characteristics" table shown above as resistance criteria.		Resistance	700 Ω – 37 kΩ
4	Ground fault in wiring harness (Contact with ground circuit)	1. Turn starting switch to OFF position. 2. Disconnect connectors ENG and TWTR, and connect T-adapter to female side of ENG.			
		Between ENG (female) (15) and ground		Resistance	Min. 1 MΩ
5	Defective engine controller	If no abnormality is found by above checks, engine controller is defective. (Since failure is in it, troubleshooting cannot be performed.)			

Failure code [CA238] Ne speed sensor power supply error

Action code	Failure code	Failure	Ne Speed Sens Supply Volt Error (Engine controller system)
E03	**CA238**		
Detail of failure	• Abnormality occurred in Ne speed sensor power supply (5 V) circuit.		
Action of controller	• Controls engine by using signals from Bkup speed sensor. • Limits engine output and continues operation.		
Problem on machine	• Engine output drops. • Engine stops during operation (When engine Bkup speed sensor is also defective). • Engine cannot be started if it is stopped. (When engine Bkup speed sensor is also defective)		
Related information	• Method of reproducing failure code: Turn the starting switch to ON position.		

Cause		Procedure, measuring location, criteria and remarks		
1	Defective wiring harness connector	See descriptions of wiring harness and connectors in "Electrical equipment" in "Checks before troubleshooting" of "General information on troubleshooting", and check them.		
2	Defective sensor or wiring harness	1. Turn starting switch to OFF position. 2. Disconnect following connectors one by one and turn starting switch to ON position each time. 3. After troubleshooting, return to 1.		
		If this failure code is not displayed when a connector is disconnected, that sensor or engine wiring harness is defective. ★ Other failure codes are displayed, too. This is because the connector is disconnected. Ignore failure codes other than [**CA238**].		
		Sensor, harness	Connector	
		Ne speed sensor	NE	
		Engine harness	ENG	
3	Defective engine controller	1. Turn starting switch to OFF position. 2. Disconnect connector ENG and connect T-adapter to male side. 3. Turn starting switch to ON position with engine wiring harness disconnected.		
		Between ENG (male) (16) and (48)	Voltage	4.75 to 5.25 V

Circuit diagram related to Ne speed sensor



Failure code [CA324] Injector #3 open/short error

Action code	Failure code	Failure	Injector #3(L#3) open /short circuit error (Engine controller system)
E03	**CA324**		
Detail of failure	• Disconnection or short circuit was detected in injector #3 circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem on machine	• Engine output drops. • Engine speed does not stabilize.		
Related information	• Method of reproducing failure code: Start engine. • While engine is running normally, approximately 70 V of pulse voltage is applied to injector (positive) side. But it is pulse voltage and cannot be measured by using multimeter.		

Cause		Procedure, measuring location, criteria and remarks		
1	Defective wiring harness connector	See descriptions of wiring harness and connectors in "Electrical equipment" in "Checks before troubleshooting" of "General information on troubleshooting", and check them.		
2	Defective injector #3	1. Turn starting switch to OFF position. 2. Disconnect connector CN3 and connect T-adapter to male side.		
		Between CN3 (male) (1) and (2)	Resistance	0.4 – 1.1 Ω
		Between CN3 (male) (1) and ground	Resistance	Min. 1 MΩ
3	Open circuit or ground fault of wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector ENG and connect T-adapter to female side.		
		Between ENG (female) (55) and (52)	Resistance	0.4 – 1.1 Ω
		Between ENG (female) (55) and ground	Resistance	Min. 1 MΩ
4	Open circuit in wiring harness (Open circuit in wiring or defective contact in connector)	★ If no abnormality is found in checks on cause 3, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors ENG and CN3, and connect T-adapters to each female side.		
		Between ENG (female) (55) and CN3 (female) (1)	Resistance	Max. 1 Ω
		Between ENG (female) (52) and CN3 (female) (2)	Resistance	Max. 1 Ω
5	Ground fault in wiring harness (Contact with ground circuit)	★ If no abnormality is found in checks on cause 3, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors ENG and CN3, and connect T-adapter to female side of either one of them.		
		Between ENG (female) (55) or CN3 (female) (1) and ground	Resistance	Min. 1 MΩ
6	Short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connectors ENG and CN3, and connect T-adapter to female side of ENG. ★ Check with circuit tester in continuity mode.		
		Between ENG (female) (55) and each pin other than (55)	No continuity (No sound is heard)	
		Between ENG (female) (52) and each pin other than (52)	No continuity (No sound is heard)	
7	Defective other cylinder injectors or wiring harness	1. If failure codes for other injectors are displayed, perform troubleshooting for them, too. 2. Confirm that injector wiring harnesses (H) of all cylinders are in good condition by referring to the following page.		
8	Defective engine controller	If no abnormality is found by above checks, engine controller is defective. (Since failure is in it, troubleshooting cannot be performed.)		

Failure code [CA351] Injectors drive circuit error

Action code	Failure code	Failure	Injectors drive circuit error (Engine controller system)
E03	**CA351**		
Detail of failure	• Abnormality has occurred in injector drive circuit.		
Action of controller	• Limits engine output for travel (Limits common rail pressure) and allows engine to run • Turns the centralized warning lamp and alarm buzzer ON.		
Problem on machine	• Engine output drops.		
Related information	• Method of reproducing failure code: Start engine.		

Cause		Procedure, measuring location, criteria and remarks
1	Defect in related system	Check whether other failure code (failure code related to injector system) are displayed together. If another code is displayed, perform troubleshooting for it.
Perform troubleshooting for failure code [**CA111**]		

Failure code [CA451] Common rail pressure sensor high error

Action code	Failure code	Failure	Common rail pressure sensor signal voltage is too high. (Engine controller system)
E03	**CA451**		
Detail of failure	● High voltage was detected in signal circuit of common rail pressure sensor.		
Action of controller	● Limits engine output (limits common rail pressure) and allows engine to run.		
Problem on machine	● Engine output drops.		
Related information	● Signal voltage from common rail pressure sensor can be checked with monitoring function (Code: 36401 (V)). ● Common rail pressure sensed by common rail pressure sensor can be checked with monitoring function (Code: 36400 (MPa)). ● This failure code is displayed if common rail pressure sensor connector is disconnected. ● Method of reproducing failure code: Turn the starting switch to ON position.		

Cause		Procedure, measuring location, criteria and remarks			
1	Defective wiring harness connector	Check wire harness and connectors by referring to "Electrical equipment" described in "Check before troubleshooting" of "General information on troubleshooting".			
2	Defective common rail pressure sensor power supply line	★ If failure code [**CA352**] (Ground fault in sensor power supply line) or [**CA386**] is displayed, perform troubleshooting for it first.			
		1. Turn starting switch to OFF position. 2. Disconnect connector PFUEL and connect T-adapter to female side. 3. Turn starting switch to ON position.			
		Between PFUEL (female) (1) and (3)	Power supply input	Voltage	4.75 – 5.25V
3	Open circuit in wiring harness (wire breakage or defective contact of connector)	1. Turn starting switch to OFF position. 2. Disconnect connectors PFUEL and ENG and connect T-adapters to each female side.			
		★ If power supply input in checks on cause 2 is normal, this check is not required. Between ENG(female) (33) and PFUEL (female) (1)		Resistance	Max. 1 Ω
		★ If power supply input in checks on cause 2 is normal, this check is not required. Between ENG (female) (47) and PFUEL (female) (3)		Resistance	Max. 1 Ω
		Between ENG (female) (25) and PFUEL (female) (2) (Sensor output)		Resistance	Max. 1 Ω
4	Short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connectors PFUEL and ENG 3. Connect T-adapter to female side of ECM.			
		Between ENG (female) (25) and (33)		Resistance	Min. 1 MΩ
5	Hot short in wiring harness (Contact with 24 V circuit)	1. Turn starting switch to OFF position. 2. Disconnect connectors PFUEL and insert T-adapter into connector ECM. 3. Turn starting switch to ON position (with connector PFUEL disconnected). ★ ENG (25) pin is connected to 5V source through resistor in engine controller.			
		Between ENG (25) and (47)		Voltage	Approx. 5V
6	Defective common rail pressure sensor (Improper input voltage to engine controller)	★ If causes 1 – 5 are not cause of failure and check result of cause 6 is abnormal, sensor is defective. 1. Turn starting switch to OFF position. 2. Insert T-adapter into connector ENG. 3. Turn starting switch to ON position.			
		Between ENG (25) and (47)	Sensor output	Voltage	0.2 – 4.6V
7	Defective engine controller	If no abnormality is found by the above checks, the engine controller is defective. (Since this is an internal failure, troubleshooting cannot be performed.)			

Failure code [CA757] All continuous data lost error

Action code	Failure code	Failure	All engine controller data lost error (Engine controller system)
E03	**CA757**		
Detail of failure	• All data in engine controller are lost.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem on machine	• Engine continues running, but it may stop during operations or may not restart once it is in stopped.		
Related information	• Method of reproducing failure code: Turn starting switch to ON position.		

Cause	Procedure, measuring location, criteria and remarks
Perform troubleshooting for failure code [**CA111**].	

Failure code [CA2556] Intake air heater relay short circuit error

Action code	Failure code	Failure	Intake air heater relay short circuit (Engine controller system)
E01	**CA2556**		
Detail of failure	• Short circuit is detected in drive circuit (primary circuit) of preheat relay.		
Action of controller	• None in particular		
Problem on machine	• Intake air heater does not work (degraded starting performance at low temperature and emission of white smokes)		
Related information	• Temperature sensed by engine coolant temperature sensor can be checked by using monitoring function. (Code: 04104 (°C)) • Method of reproducing failure code: Turn starting switch to ON position (Coolant temperature: Max. -5 °C) • Troubleshooting for this failure code covers circuit starting from engine controller to primary (coil) side of preheat relay R07.		

Cause		Procedure, measuring location, criteria and remarks		
1	Defective harness connector	See the descriptions of harness and connectors in "Electrical equipment" of "Checks before troubleshooting" in "General information on troubleshooting", and check them.		
2	Defective preheat relay	1. Turn starting switch to OFF position. 2. Disconnect relay R07, and connect T-adapter to male side.		
		Between R07 (male) (1) and (2)	Resistance	200 – 400 Ω
		1. Turn starting switch to OFF position. 2. Replace relay R07 with another one. 3. Turn starting switch to ON position.		
		If this failure code disappears, original preheat relay R07 is defective.		
3	Ground fault in harness	1. Turn starting switch to OFF position. 2. Disconnect connector J2P and relay R07, and connect T-adapters to either female side.		
		Between J2P (female) (40) or R07 (female) (1) and ground	Resistance	Min. 1 MΩ
4	Short circuit in harness	1. Turn starting switch to OFF position. 2. Disconnect connector J2P and relay R07, and connect T-adapter to female side of J2P. ★ Check by using multimeter in continuity mode.		
		Between J2P (female) (40) and each pin other than (40)	No continuity (No sound is heard)	
5	Defective engine controller	If no abnormality is found by above checks, engine controller is defective. (Since this is an internal failure, troubleshooting is impossible.)		

Failure code [DAQRMA] (Transmission controller option setting: Malfunction)

Action code	Failure code	Trouble	Transmission controller option setting: Malfunction (Machine monitor-transmission controller) (Machine monitor system)
E03	**DAQRMA**		
Contents of trouble	• Option setting signals inputted from machine monitor with the starting switch ON are different from the option settings that controller memorizes.		
Action of controller	• Holds the gear speed in neutral. • Controls with the option setting that the controller memorizes. • It does not return normal unless the starting switch is turned OFF.		
Problem that appears on machine	• The gear speed becomes neutral and the machine cannot move off again.		
Related information	• Perform initial setting and initial adjustment as when transmission controller is replaced.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Defective option setting of machine monitor or internal defect of monitor

Failure code [DB10KT] (Retarder controller nonvolatile memory: Abnormality in controller)

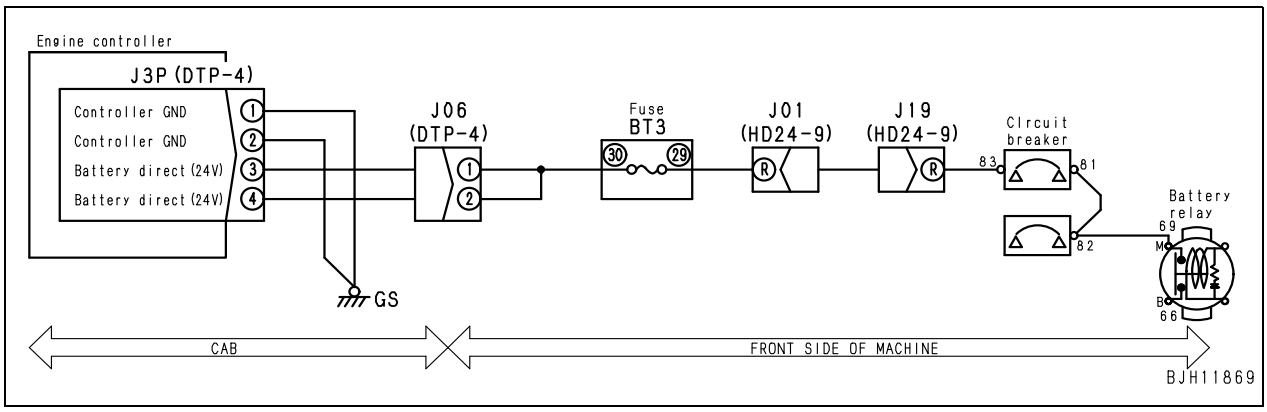
Action code	Failure code	Trouble	Retarder controller nonvolatile memory: Abnormality in controller (Retarder controller system)
E01	**DB10KT**		
Contents of trouble	• An abnormality has occurred in the nonvolatile memory inside the controller.		
Action of controller	• Control the model selection and option setting with default value. • Even if the cause of the failure has been eliminated automatically, the machine does not return to normal unless once resetting the starting switch OFF.		
Problem that appears on machine	• Machine parameter may change and power may increase or decrease.		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective retarder controller	(Since this is an internal defect, it cannot be diagnosed.) (It is no problem to keep using controller unless any visible trouble symptom appears on machine.)

Contents of trouble	• The transmission controller cannot recognize the engine controller in the CAN communication. 2) Abnormality in input power supply circuit for engine controller.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective circuit breaker (83) terminal	If a circuit breaker is tripped, the circuit probably has a ground fault. (See cause 4.)		
	2	Blowout of fuse	1) Turn the starting switch to OFF position. 2) Remove from the bottom of BT3.		
			Between fuse terminals	Continuity	
	3	Disconnection in wiring harness (Wire breakage or defective contact of connector)	1) Turn the starting switch to OFF position and disconnect the battery ground cable. 2) Perform troubleshooting with the switch turned OFF.		
			Between (83) terminal and BT3 (29)	Resistance	Max. 1 Ω
			Between BT3 (30) and J3P (female) (3) or (4)	Resistance	Max. 1 Ω
			Between J3P (female) (1), (2) and ground (GS)	Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Contact with ground circuit)	1) Turn the starting switch to OFF position and disconnect the battery ground cable. 2) Disconnect connector J3P and J19. 3) Perform troubleshooting with the switch turned OFF.		
			Between ground and J3P (female) (3) or (4)	Resistance	Min. 1 Ω

Circuit diagram related



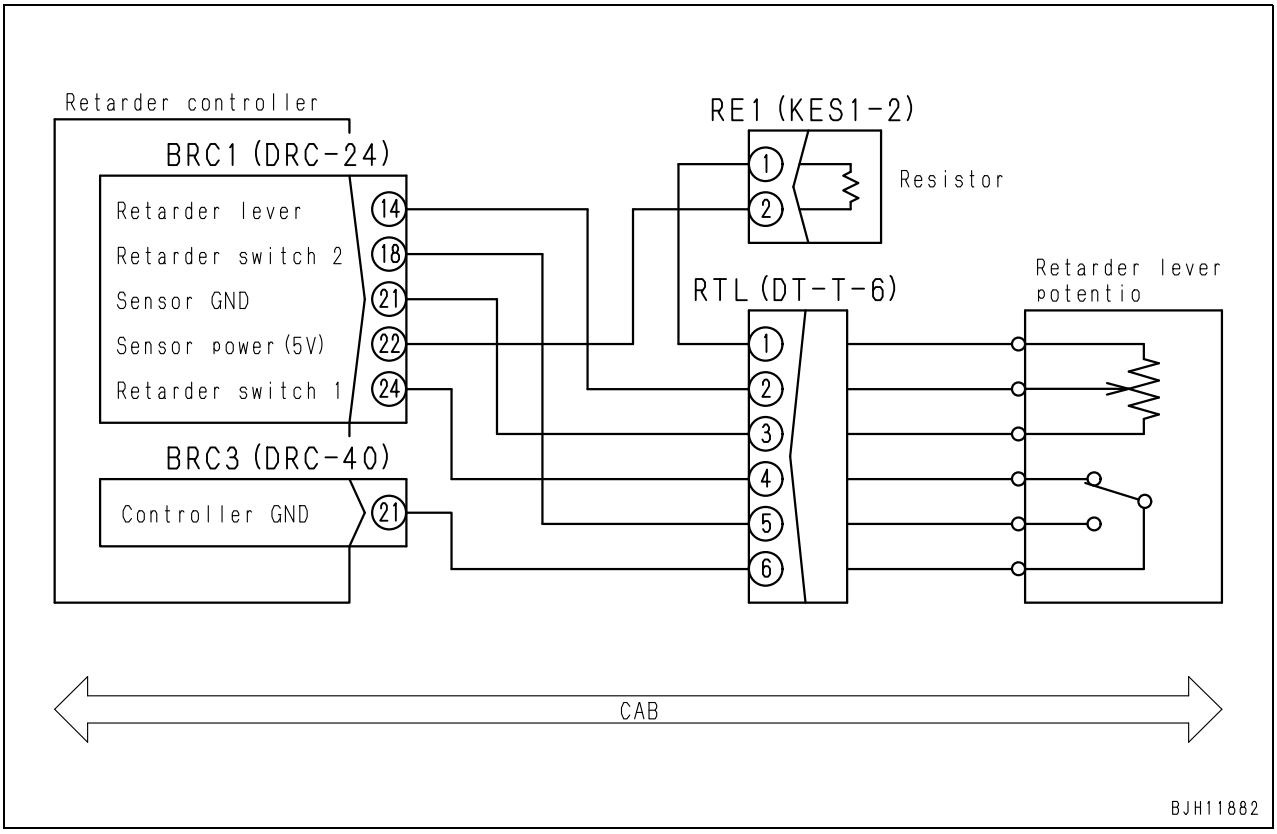
Failure code [DGT1KX] Torque converter oil temperature sensor: Input signal out of range

Action code	Failure code	Trouble	Torque converter oil temperature sensor: Input signal out of range (Transmission controller system)
E01	**DGT1KX**		
Contents of trouble	• Signal circuit voltage of torque converter oil temperature sensor has become below 0.97 V (more than 150°C), or the sensor signal is greatly inconsistent with transmission valve oil temperature signal.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Torque converter oil temperature gauge does not indicate properly.		
Related information	• Input signal from oil temperature sensor can be checked with monitoring function (codes: **30100** and **30101**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective torque converter oil temperature sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between T/C.T (CN23) (male) (1) and (2)	Oil temperature: 25°C	Resistance	37 – 50 kΩ
				Oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC1 (female) (9) and T/C.T (CN23) (female) (1)		Resistance	Max. 1 Ω
			Between ATC1 (female) (21) and T/C.T (CN23) (female) (2)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	1) Turn starting switch to OFF position. 2) Disconnect connector ATC1 and T/C.T(CN23), and connect T-adapter to either female side.			
			Between ground and wiring harness between ATC1 (female) (9) and T/C.T (CN23) (female) (1)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (a contact with 24V circuit)	1) Turn starting switch to OFF position. 2) Disconnect connector T/C.T(CN23), and connect T-adapter to female side. 3) Turn starting switch to ON position.			
			Between T/C.T (CN23) (female) (1) and (2)		Voltage	Approx. 5 V
	5	Defective transmission controller	If no failure is found by above checks, transmission controller is defective.			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	5	Defective retarder lever potentiometer	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between RTL (1) – (3)	Voltage	4.1 – 4.8 V	
			Between RTL (2) – (3)	Voltage	0.3 – 4.7 V	
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between RTL (male) (4) – (6)	Released lever position	Resistance	Max. 1 Ω
				Operating lever position	Resistance	Min. 1 MΩ
			Between RTL (male) (5) – (6)	Released lever position	Resistance	Min. 1 MΩ
				Operating lever position	Resistance	Max. 1 Ω
	6	Defective retarder controller	★ If no failure is found by above checks, retarder controller is defective.			

Circuit diagram related

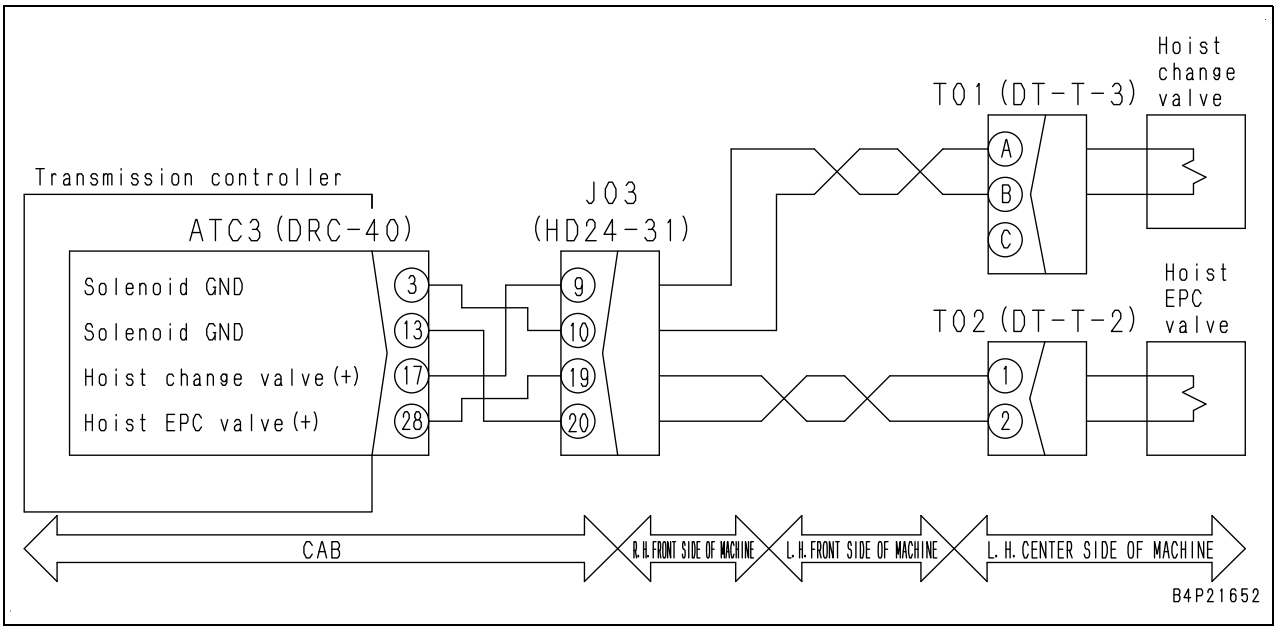


Failure code [DLF2KA] Transmission intermediate shaft speed sensor: Disconnection

Action code	Failure code	Trouble	Transmission intermediate shaft speed sensor: Disconnection (Transmission controller system)
E03	**DLF2KA**		
Contents of trouble	• There is a disconnection in signal circuit of transmission intermediate shaft speed sensor and no signal is inputted.		
Action of controller	• Holds gear speed during traveling. • Holds neutral when gear shift lever is set to “N“. • Even if cause of failure is eliminated, system does not return to normal unless starting switch is once turned OFF.		
Problem that appears on machine	• Lockup is released and gear cannot be shifted. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Signal from intermediate shaft speed sensor can be checked with monitoring function (Code: **31300 (rpm)**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Improper adjustment of the transmission intermediate shaft speed sensor	• Screw the sensor gently until it bottoms to the speed detection gear, then turn it back by 1/2 – 1 turn. ★ See Testing and adjusting “Adjusting transmission speed sensor“ for details.		
	2	Defective transmission intermediate shaft speed sensor	1) Turn the starting switch to OFF position. 2) Disconnect connector N2 (CN4), and connect T-adapter to male side.		
			Between N2 (CN4) (male) (1) and (2)	Resistance	500 – 1,000 Ω
			Between N2 (CN4) (male) (1), (2) and ground	Resistance	Min. 1 MΩ
	3	Disconnection or short circuit in wiring harness	1) Turn the starting switch to OFF position. 2) Disconnect connector ATC2, and connect T-adapter to female side.		
			Between ATC2 (female) (20) and (39)	Resistance	500 – 1,000 Ω
	4	Disconnection in wiring harness (Disconnection or defective contact)	★ If no abnormality is found in checks on cause 3, this check is not required. 1) Turn the starting switch to OFF position. 2) Disconnect connectors ATC2, N2 (CN4), and connect T-adapters to each female side.		
			Between ATC2 (female) (20) and N2 (CN4) (female) (1)	Resistance	Max. 1 Ω
			Between ATC2 (female) (39) and N2 (CN4) (female) (2)	Resistance	Max. 1 Ω
	5	Defective transmission controller	If causes are not found by above checks, transmission controller is defective. (Since this is an internal failure, troubleshooting can not be performed.)		

Circuit diagram related

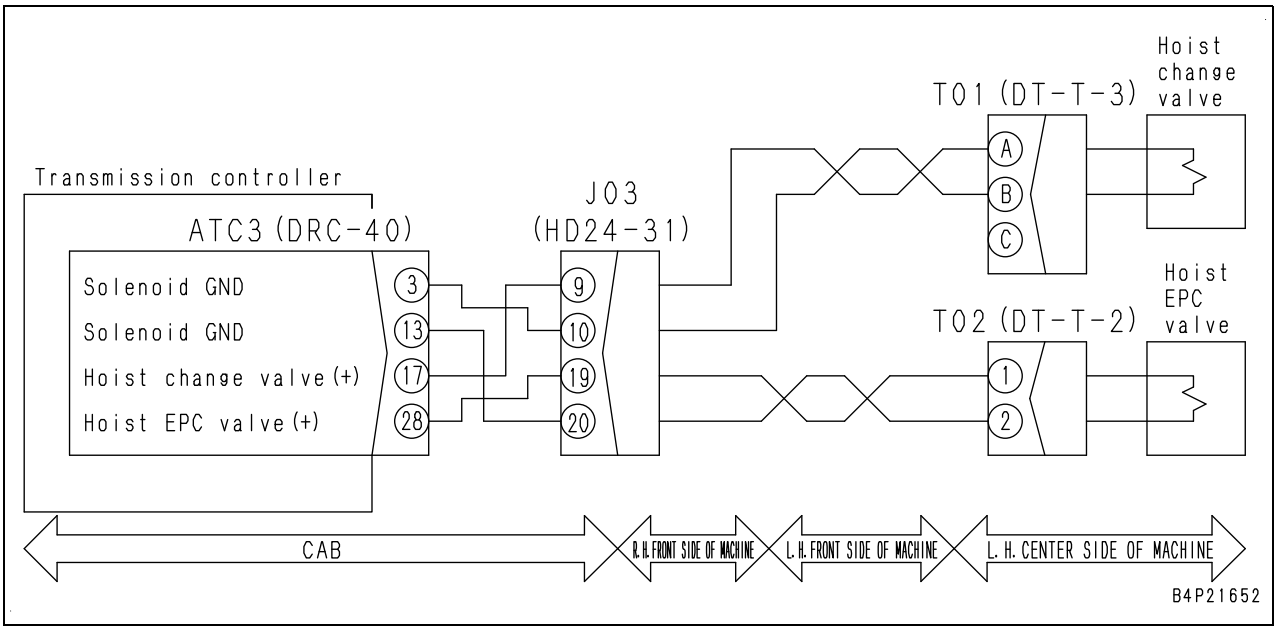


Failure code [DX12K4] Front brake proportional pressure reducing solenoid valve: Out of control

Action code	Failure code	Trouble	Front brake proportional pressure reducing solenoid valve: Out of control (Retarder controller system)
E03	**DX12K4**		
Contents of trouble	• When output to retarder proportional pressure reducing valve (front) is turned OFF, signal from retarder oil pressure switch (front) is kept ON.		
Action of controller	• Continues control of retarder control lever. • Continues control of overrun prevention retarder and accelerator-linked retarder.		
Problem that appears on machine	• If solenoid is defective, front brake drags. • If switch is defective or switch circuit has ground fault, gear is difficult to shift up and easy to shift down.		
Related information	• Condition of front retarder oil pressure switch can be checked with monitoring function. (Monitoring code: BRAKE - D-IN--0------7 - 40932 bit 2: 1 (ON) / 0 (OFF)) • Method of reproducing failure code: Start engine + operate retarder control lever to apply brake and return the lever.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	If failure code [**DX12KY**] is displayed, perform troubleshooting for [**DX12KY**] first.				
	2	Defective retarder oil pressure switch (front) (Internal defect)	★ Prepare with starting switch OFF, after starting engine, turn starting switch OFF.			
			Between B16 (male) (1) – (2)		Resistance	Min. 1 MΩ
	3	Ground fault in wiring harness (Short circuit with GND circuit)	1) Turn the starting switch to OFF position. 2) Disconnect connectors BRC1, B16 and D13, and connect T-adapters to female side of BRC1 and B16.			
			Between BRC1 (female) (11) and ground		Resistance	Min. 1 MΩ
			Between B16 (female) (1) and ground		Resistance	Min. 1 MΩ
	4	Defective front brake hydraulic circuit or mechanical system of retarder proportional pressure reducing valve (front)	1) Check that front brake operation oil pressure is normal with operating retarder control lever, referring to Testing and adjusting, "Testing and adjusting brake oil pressure". 2) While the testing tools are as they are, return retarder control lever. If front brake oil pressure exceeds following standard value, front brake proportional pressure reducing solenoid valve is defective.			
			Front brake	Retarder control lever: "return"	Oil pressure	Max. 0.6MPa {Max. 6kg/cm^2}
	5	Defective retarder controller	★ If cab is chilting, lower the cab. 1) Turn the starting switch to OFF position. 2) Insert T-adapters into connector BRC1and BRC3. 3) Start engine.			
			Between BRC1 (11) and BRC3 (21), (31), (32), (33)		Voltage	Min. 7 V
			If no failure is found by the above checks, the retarder controller is defective. (Since trouble is in controller, troubleshooting cannot be carried out.)			

Circuit diagram related



Failure code [DXH2KA] Hi clutch solenoid output circuit: Disconnection

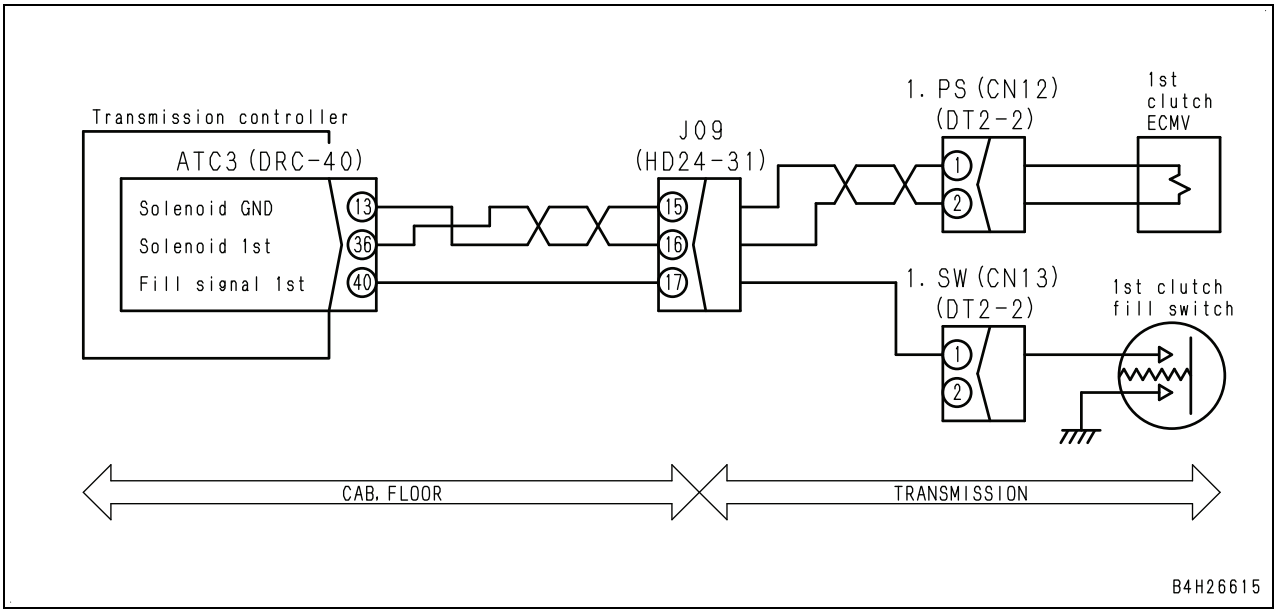
Action code	Failure code	Trouble	Hi clutch solenoid output circuit: Disconnection (Transmission controller system)
E03	**DXH2KA**		
Contents of trouble	• No electric current flows when the output to Hi clutch ECMV is ON.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off again until it stops.		
Related information	• Output current to Hi clutch ECMV solenoid valve can be checked with monitoring function. (Monitoring code: TRANSMISSION - ECMV H DIR - 31600 (mA)) • Method of reproducing failure code: Turning starting switch ON + wait 5 seconds.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Hi clutch ECMV solenoid valve (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between H.PS (CN10) (male) (1) and (2)	Resistance	5 – 15 Ω
			Between H.PS (CN10) (male) (1), (2) and chassis ground	Resistance	Min. 1 MΩ
	2	Disconnection or short circuit in wiring harness	1) Turn the starting switch to OFF position. 2) Disconnect connector ATC3, and connect T-adapter to female side.		
			Between ATC3 (female) (26) and (13)	Resistance	5 – 15 Ω
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ If no failure is found by the above checks, this check is not required. ★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between ATC3 (female) (26) and H.PS (CN10) (female) (1)	Resistance	Max. 1 Ω
			Between ATC3 (female) (13) and H.PS (CN10) (female) (2)	Resistance	Max. 1 Ω
	4	Defective transmission controller	If no failure is found by the above checks, the transmission controller is defective.		

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH6KB] 3rd clutch solenoid output circuit: Short circuit

Action code	Failure code	Trouble	3rd clutch solenoid output circuit: Short circuit (Transmission controller system)
E03	**DXH6KB**		
Contents of trouble	• Abnormally excessive current flows while output to 3rd clutch ECMV is ON.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off again until it stops.		
Related information	• Output current to 3rd clutch ECMV solenoid valve can be checked with monitoring function. (Monitoring code: TRANSMISSION - ECMV 3 DIR - 31604 (mA)) • Method of reproducing failure code: Turning starting switch ON + wait 5 seconds.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 3rd clutch ECMV solenoid valve (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between 3.PS (CN16) (male) (1) and (2)	Resistance	5 – 15 Ω
			Between 3.PS (CN16) (male) (1) or (2) and chassis ground	Resistance	Min. 1 MΩ
	2	Ground fault in wiring harness (Short circuit with GND circuit)	1) Turn the starting switch to OFF position. 2) Disconnect connectors ATC3 and 3.PS (CN16), and connect T-adapter to either female side.		
			Between ATC3 (female) (15) or 3.PS (CN16) (female) (1) and ground	Resistance	Min. 1 MΩ
	3	Short circuit in wiring harness (with another wiring harness)	1) Turn the starting switch to OFF position. 2) Disconnect connectors ATC3 and 3.PS (CN16), and connect T-adapter to either female side.		
			Between ATC3 (female) (15) and (23) or between 3.PS (CN16) (female) (1) and (2)	Resistance	Min. 1 MΩ
	4	Defective transmission controller	If no failure is found by above checks, transmission controller can be defective.		

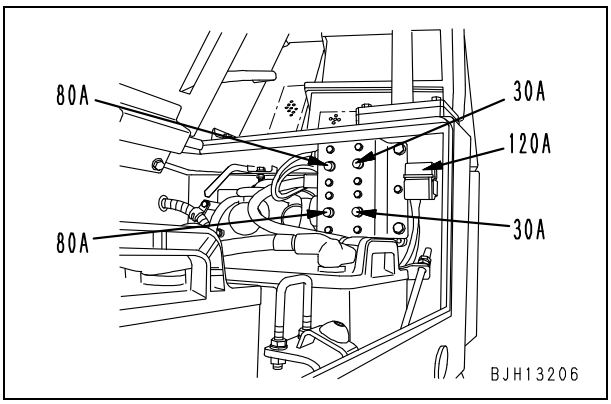
Before troubleshooting of electrical system

Wiring table for circuit breaker and slow blow fuse

★ This wiring table shows the components which are supplied with power by each power source of the circuit breaker or the slow blow fuse.
(Switched power source refers to the power source supplied with the starting switch ON, and constant power source refers to the power source supplied with the starting switch OFF.)

★ When proceeding to a troubleshooting by failure code, first of all, inspect the circuit breaker or slow blow fuse to check if the power source is supplied properly.

Type of power source	Breaker name	Capacity	Destinations of electric power distribution
Power source of switch (Terminal M of battery relay)	80 A (Terminals No. 65, 64)	80A	• Fuse (BT3) (inlet terminal No.) (3), (5), (7), (9), (11), (13), (15), (17), (19) (21), (23), (25), (27)
	80 A (Terminals No. 62, 63)	80A	• Fuse (BT1) (inlet terminal No.) (1), (3), (13), (15), (17), (19) • Fuse (BT2) (inlet terminal No.) (11), (13) • Fuse (BT3) (inlet terminal No.) (1) • Fuse (BT4) (inlet terminal No.) (1), (3), (5), (7), (9), (13), (15), (17), (19)
Constant power source (Terminal B of battery relay)	30A (Terminals No. 81, 83)	30A	• Fuse (BT3) (inlet terminal No.) (29)
	30A (Terminals No. 82, 84)	30A	• Fuse (BT2) (inlet terminal No.) (15), (17), (19), (21), (23), (25), (27), (29) • Fuse (BT4) (inlet terminal No.) (11)
Power source of switch (Terminal M of battery relay)	Slow blow fuse	120A	• Engine intake air heater relay

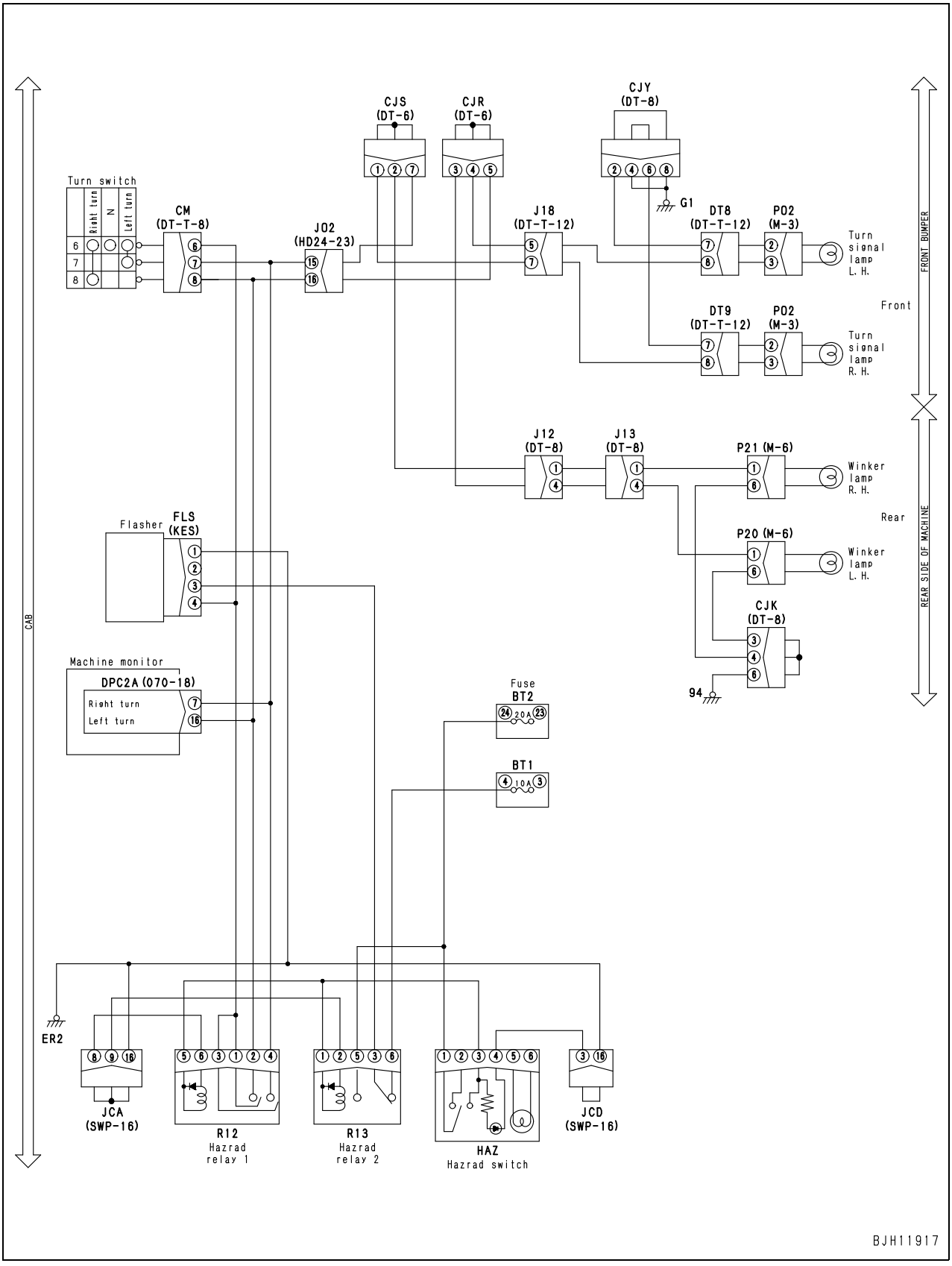


E-4 Machine monitor does not operate when starting switch is OFF

Trouble	Service meter and travel distance integrating meter, turn signal pilot lamp, and high beam pilot lamp do not flash, if the switches are operated with starting switch OFF.
Related information	• When the machine related failure code is not displayed (if displayed, troubleshooting the code first.)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT2 (16) or defective circuit breaker (30A)	When the fuse BT2 (16) is blown or the circuit breaker (30 A) is shut off, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 3).		
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between DPC1 (female) (4), (5) – fuse BT2 (16)	Resistance	Max. 1 Ω
			Wiring harness between circuit breaker (30A) – fuse BT2 (15)	Resistance	Max. 1 Ω
			Wiring harness between DPC1 (female) (9), (10) – ground ER	Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between DPC1 (female) (4), (5) – fuse BT2 (16)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between circuit breaker (30A) – fuse BT2 (15)	Resistance	Min. 1 MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between DPC1 (4), (5) – (9), (10)	Voltage	20 – 30 V

Circuit diagram related



E-14 Dump lever does not operate normally

Trouble	Hoist lever does not operate normally. (1) Dump lever is not fixed at RAISE position. (2) Dump lever raise fixing device (detent) is not reset before body raising position.
Related information	• Failure code [**DW72KZ**] checks kick-out solenoid and [**DK54KX**] checks body positioner sensor. Accordingly, if these codes are not displayed, it is judged that there is not breakage in solenoid coil or disconnection/short circuit in sensor and wiring is normal. • If detent is not reset, dump lever kick-out is judge to be normal (solenoid is turned ON and OFF normally). It should be judged that signal from body positioner sensor is not sent to controller normally. If body is not hoisted at all, see failure codes [**DK52KX**] and [**DK53L8**] (Troubleshooting for dump lever potentiometer sensor). • If kick-out solenoid is defective, replace dump lever.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective hoist lever kick-out	1) Turn starting switch OFF and insert T-adapter in LK0. 2) Start engine. 3) Set hoist lever in RAISE position and check.		
			LK0	Voltage	
			Between (1) – (2)	20 – 30 V	
	2	Defective body positioner sensor	1) Turn starting switch OFF and insert T-adapter in ATC1 (or in connector on route to body positioner sensor). 2) Start engine. 3) Set hoist lever in RAISE position and check until body is raised.		
			Between ATC1 (2) – (21)	Voltage	Change between 0 – 5 V
	3	Defective transmission controller	If causes 1 – 2 are not detected, transmission controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

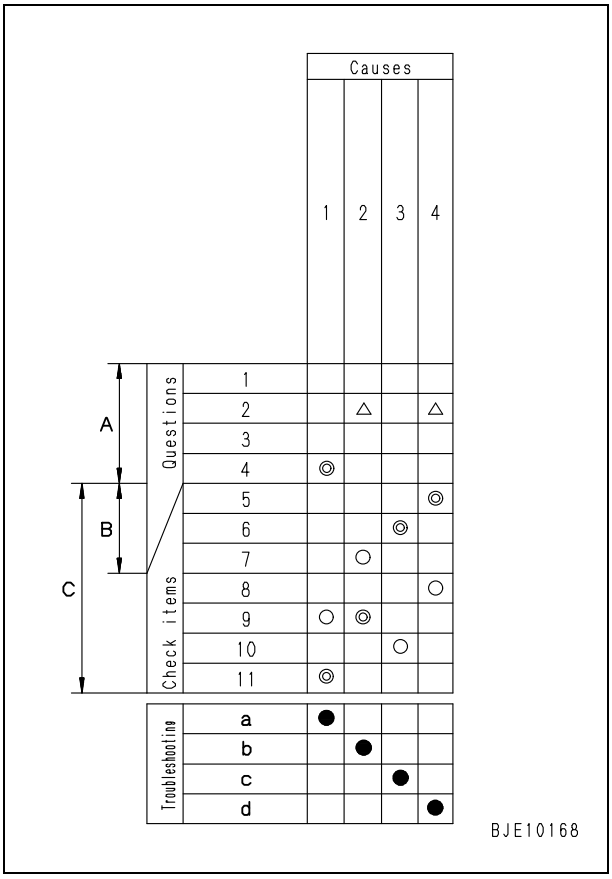
H-8 Torque converter oil temperature is high

Trouble	Torque converter oil temperature is high.
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • If the oil temperature goes up when the torque converter is stalled and goes down when the transmission is returned to the neutral position, the machine is normal and overload operation is a cause of the problem.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective power train pump strainer	The power train pump strainer is suspected to be clogged, check it directly.		
	2	Air sucked in at the suction side of the power train pump	Since the air can be suspected to be sucked in from the suction piping of the power train pump, check it directly.		
	3	Defective power train pump line filter	The filter can be suspected to be clogged; visually check it.		
	4	Defective power train pump main relief valve	★ Prepare with the engine stopped and troubleshooting with engine running at low idle and high idle.		
			Relief oil pressure	Low idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
				High idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
	5	Defective power train pump	• If a defect is found in the item 4, the power train pump can be suspected to be defective. Check for aluminum worn powder etc. residing on the line filter.		
	6	Defective torque converter relief valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Torque converter inlet pressure		0.91 ± 0.1 MPa {9.3 ± 1.0 kg/cm²}
	7	Defective torque converter	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Torque converter inlet pressure		0.91 ± 0.1 MPa {9.3 ± 1.0 kg/cm²}
			Torque converter outlet pressure		0.54 ± 0.1 MPa {5.5 ± 1.0 kg/cm²}

How to use a troubleshooting chart

The troubleshooting chart consists of "questions", "check items", "causes", and "troubleshooting" blocks.
The "questions" and "check items" narrow down the causes to highly probable "causes" by simple inspection or from symptoms without using a diagnostic tool.
Then, the final verifications of "causes" are carried out by checking the narrowed down "causes" in the order of their probability with diagnostic tools or by direct inspection following the "troubleshooting" procedure.



[Questions]

Information to be obtained by questioning the user or operator, and which corresponds to the sections **A** and **B** in the right chart.
Section **A** includes basic information, and section **B** contains items which can be obtained depending on the level of the user or operator.

[Check items]

Items checked by the serviceman in order to narrow down the causes, section **C** of the right chart is corresponding to them.

[Causes]

Items to be narrowed down by the questions and check items.
The serviceman narrows down the causes to highly probable causes according to the information from **A**, **B** and **C**.

[Troubleshooting]

Items to be verified at the end in order to check if the narrowed down causes are the true factors causing the failure. The verification is carried out by applying diagnostic tools or implementing direct inspection in the order of probability.

This troubleshooting chart marks the content of the questions and check items with △, ○ or ◎ according to their closer relationship with the causes.

△: A cause that can be referred to in relation to the question or check item.
○ : A cause that is related the question or check item.
◎ : A cause particularly probable among those marked with ○ above.

★ Count the priority level of each marking as ◎ > ○ when determining the cause.
Don't count △ when determining the cause. The item with this marking may be counted, however, if no difference is present than this and the cause cannot be determined.

S-9 Oil gets contaminated prematurely

General causes why oil gets contaminated prematurely:

- Entry of exhaust gas into oil due to internal wear
- Clogging of lubrication passage
- Use of improper fuel
- Use of improper oil
- Operation under excessive load

			Causes									
			Defective seal at turbocharger turbine end	Worn valve or valve guide	Worn piston ring or cylinder liner	Clogged breather or breather hose	Clogged oil cooler	Clogged oil filter	Defective oil filter safety valve	Clogged turbocharger lubrication drain tube	Exhaust gas color is bad
Questions / Check items	Confirm recent repair history				△						
	Degree of use of machine	Operated for long period	△	△	△						
	Non-specified fuel is being used							○			
	More engine oil is required for refill than before				◎						
	Even when engine oil temperature rises, oil filter clogging monitor displays clogging (if monitor is installed)							◎	○		
	Metal particles are observed when oil in oil filter is drained			○	○			◎			
	Inside of exhaust pipe has been smeared with oil			◎							
	Engine oil temperature rises quickly						◎				
	Color of exhaust gas is	Blue under light load			◎						
		Black									◎
	Amount of blow-by gas	Excessive	○	○	◎					○	
		No				◎					
Troubleshooting	Excessive play of turbocharger shaft		●		●						See S-7
	When compression pressure is measured, it is found to be low			●	●						
	Inspect breather and breather hose visually					●					
	Inspect oil cooler visually						●				
	Inspect oil filter visually							●			
	Spring of oil filter safety valve is hitched or broken								●		
	Inspect turbocharger lubrication drain tube visually									●	
	Remedy		Replace	Replace	Replace	Clean	Clean	Replace	Replace	Clean	—

How to read this manual

(Rev. 2009.01)

1. Removal and installation of assemblies

Special tools

- Special tools which are necessary for removal or installation of parts are described as **A1**,**•••X1** etc. and their parts numbers, part names and quantities are described in the special tool list.
- Also the following information is described in the special tool list.

1) Necessity
   - ■ : Special tools that cannot be substituted and should always be used
   - ● : Special tools that will be useful if available and are substitutable with tools available on the market
2) Distinction of new and existing special tools
   - N : Tools newly developed for this model. They have a new part number respectively.
   - R : Tools made available by redesigning the existing tools which were developed for other models. Each of them has a new part number assigned by setting forward the part number of the existing tool.
   - Blank: Tools already available for other models. They can be used without any modification.
3) Circle mark ○ in sketch column:
   - The sketch of the special tool is presented in the section of "Sketches of special tools".
   - Part No. of special tools starting with 79*T-***-****:
     means that they are not available from Komatsu Ltd. (i.e. tools to be made locally).

Removal

- In "Removal" section, the work procedures, precautions and know-how to do the work, and the amount of oil and coolant to be drained are described.
- Common tools that are necessary for removal are described as [1], [2] ••• etc. and their part numbers, part names and quantities are not described.
- Various symbols used in "Removal" section are explained and listed below.

⚠ : Precautions related to work safety

★: Guidance or precautions for the work

[*1] : This mark shows that instructions or precautions for parts installation work are given in "Installation" section.

: Amount of oil or coolant to be drained

: Weight of part or component

Installation

- Unless otherwise instructed, installation of parts is to be done in the reverse order to removal.
- Instructions and precautions for parts installation is shown with the mark ([*1], [*2]...) which corresponds to the mark in "Removal" section.
- Common tools that are necessary for installation are described as [1], [2] ••• etc. and their part numbers, part names and quantities are not described.
- Marks shown in the "Installation" section stand for the following.

⚠ : Precautions related to work safety

★: Guidance or precautions for the work

: Type of coating material

: Tightening torque

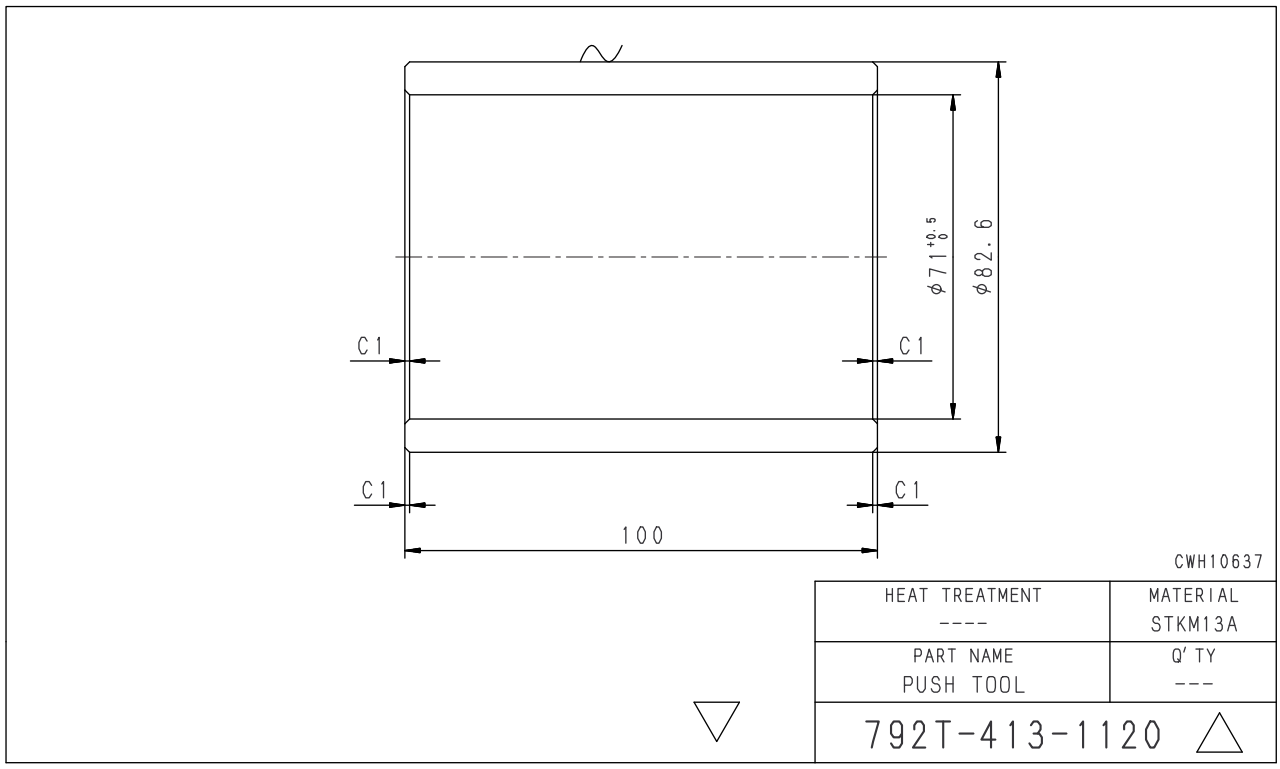
: Amount of oil or coolant to be replenished

Sketches of special tools

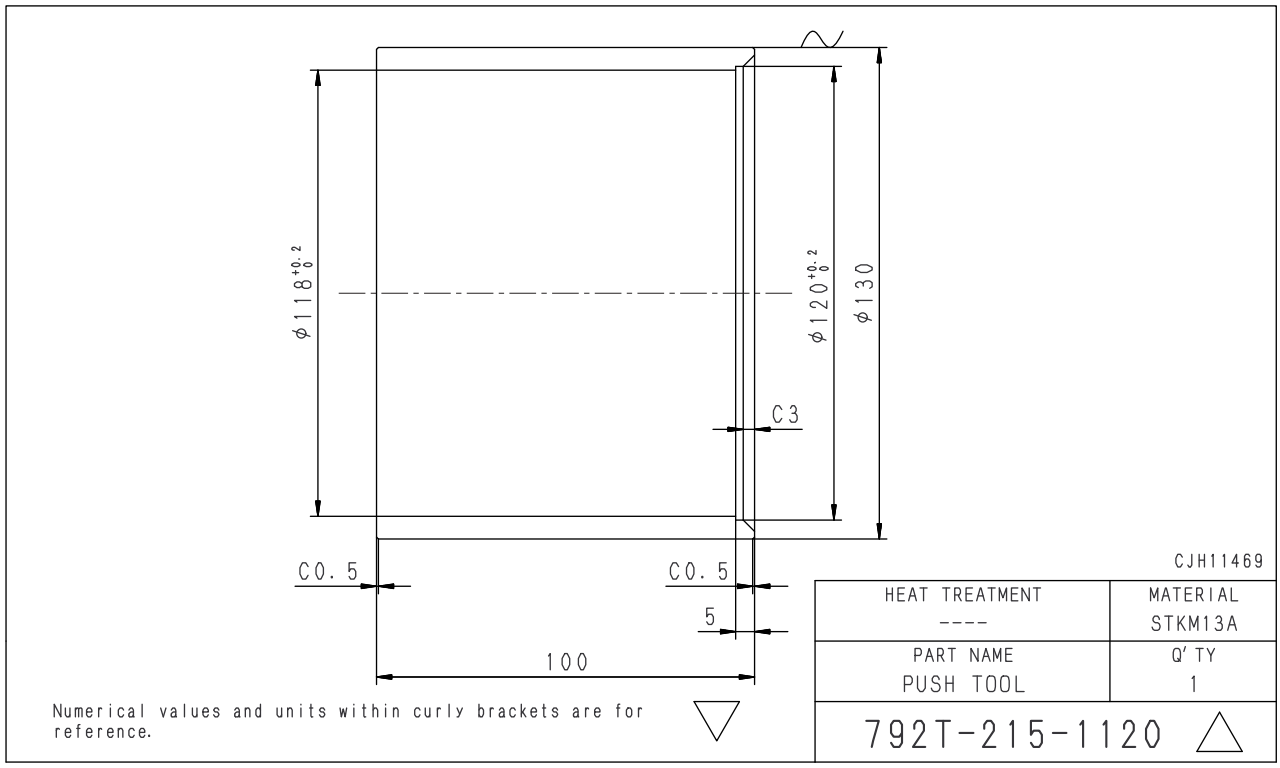
- Various special tools are illustrated for the local manufacture.

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

D7 Push tool

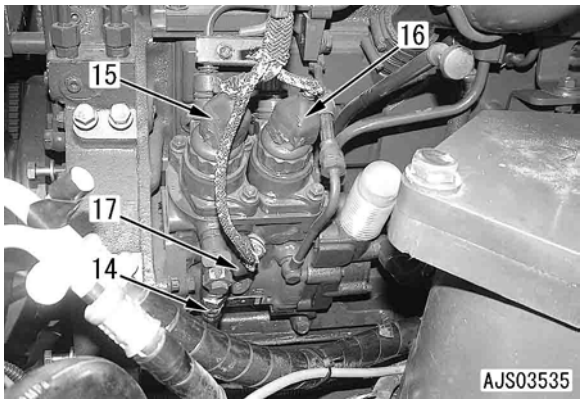


D8 Push tool



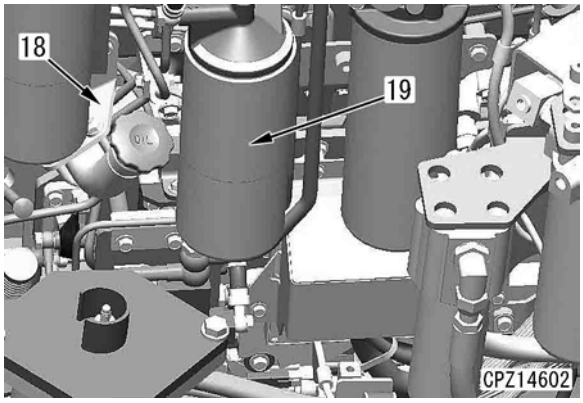
15. Disconnect fuel return hose (14). [*2]

16. Disconnect connectors PCV1 (15), PCV2 (16), and G (17).



17. Disconnect bracket (18). [*3]

18. Remove fuel filter (19).
★ Use a filter wrench, etc. to remove the filter.



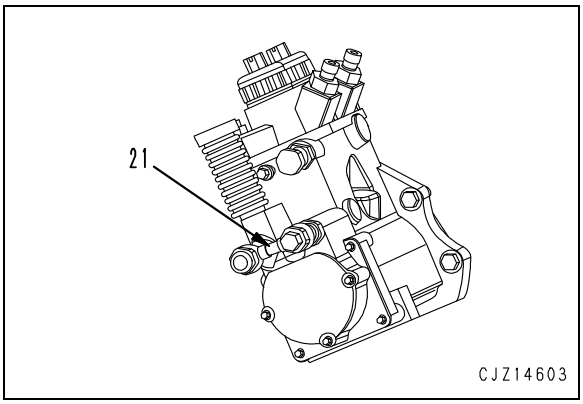
19. Remove fuel tubes (21) and (22). [*4]

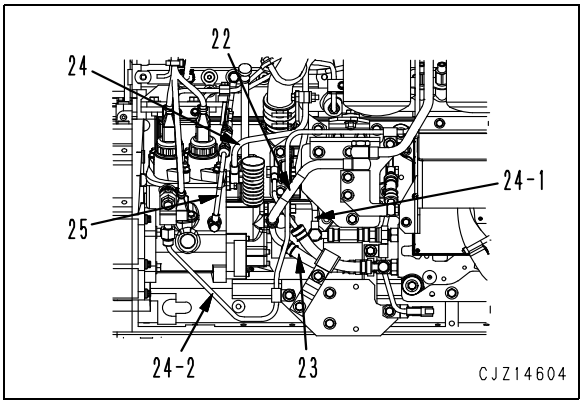
20. Disconnect fuel hose (23). [*5]

21. Remove fuel tubes (24), (24-1) and clamp assembly. [*6]

22. Remove over flow tube (24-2). [*7]

23. Remove lubrication tube (25).



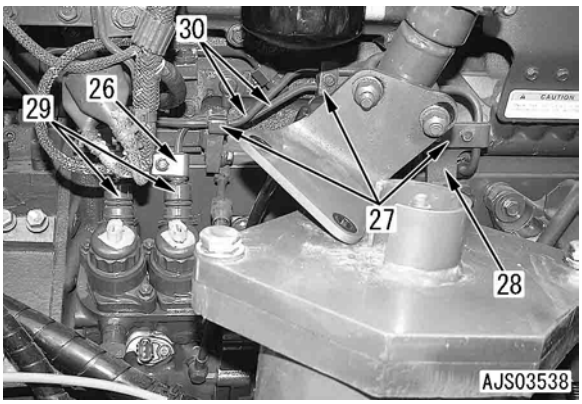


24. Disconnect clamps (26) and (27).

25. Disconnect bracket (28).

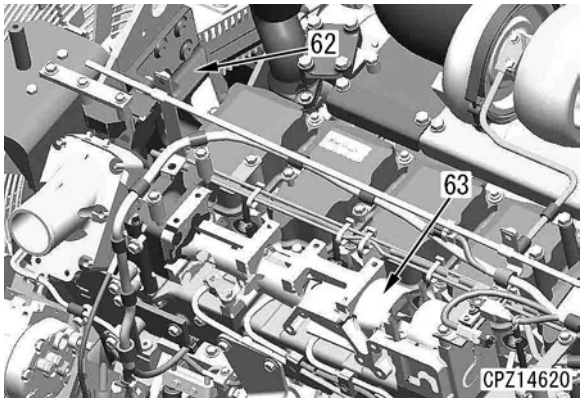
26. Remove right and left bellows (29).

27. Remove high-pressure pipe assembly (30).

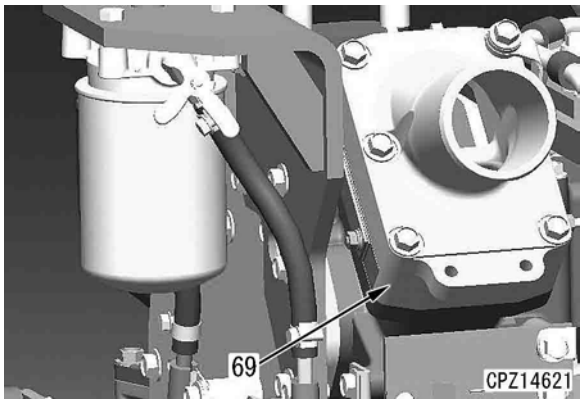


39. Remove bracket (62).

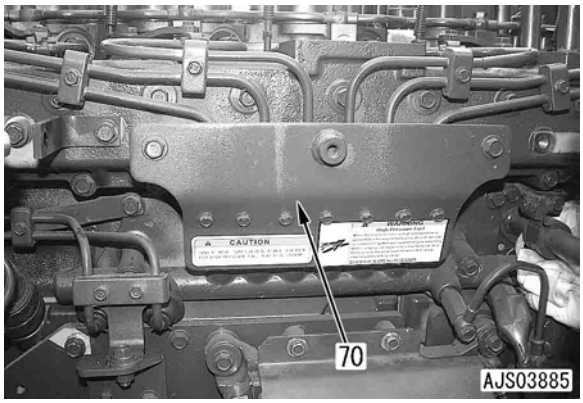
40. Remove diffuser and pump assembly (63).
Diffuser and pump assembly: **25 kg**



41. Remove air housing (69).

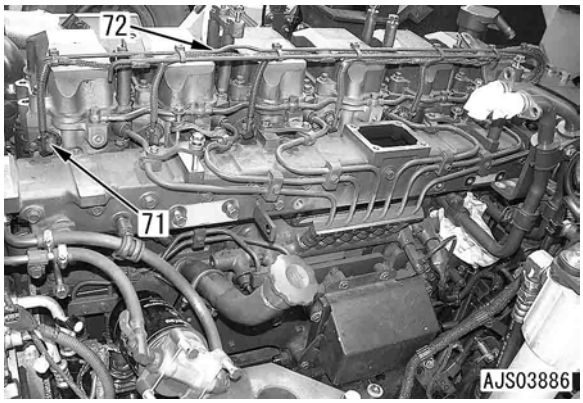


42. Remove bracket (70).



43. Disconnect 6 injector connectors (71).

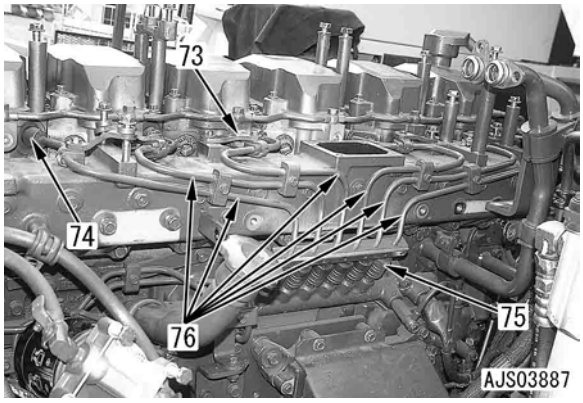
44. Disconnect wiring harness and bracket assembly (72).



45. Disconnect 6 clamps (73). [*11]

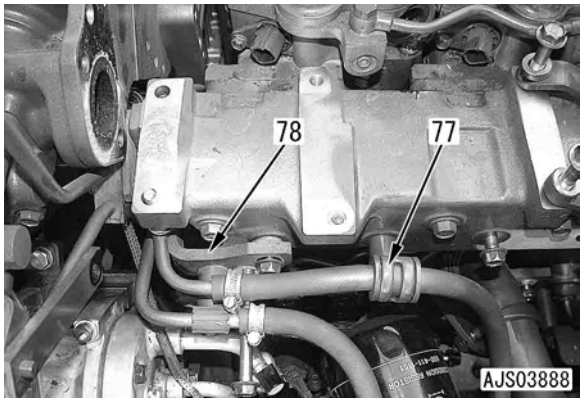
46. Remove 6 bellows (74) and 6 bellows (75). [*11]

47. Remove high-pressure pipe assembly (76). [*11]

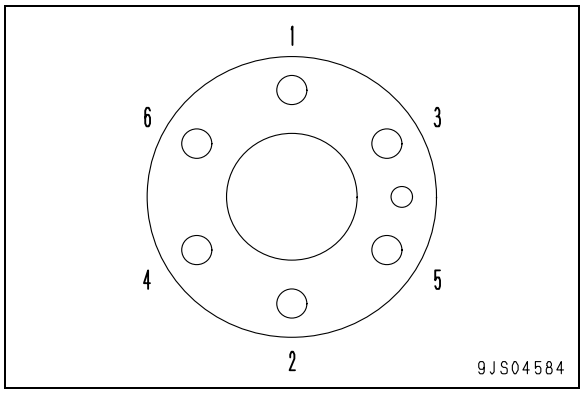


48. Disconnect clamp (77).

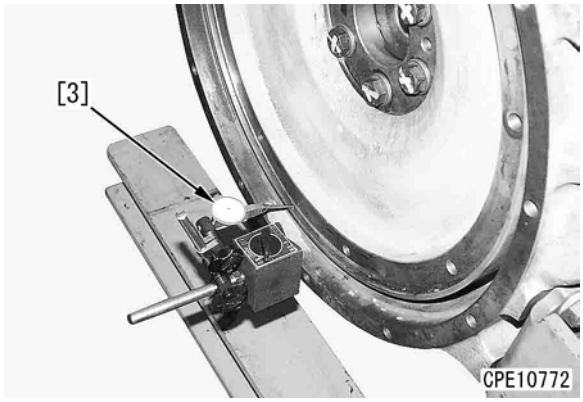
49. Disconnect bracket (78).



[*1]
Flywheel
1. Tighten the mounting bolts twice in the numeric order shown below.
   Mounting bolt: **Engine oil (EO30-DH)**
   Mounting bolt
   1st time: **147 ± 19.6 Nm {15 ± 2.0 kgm}**
   2nd time: **289.1 ± 19.6 Nm {29.5 ± 2.0 kgm}**



2. Using dial gauge [3], measure the facial runout and radial runout.
   ★ Facial runout: **Max. 0.20 mm**
   ★ Radial runout: **Max. 0.15 mm**



Installation

- Carry out installation in the reverse order to removal.

[*1]

★ Set the tightening portions of the 2 clamps on the exactly opposite side to each other so that they can be tightened from the same direction.

Clamp : **10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}**

[*2], [*3]

Radiator hose clamp:
10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}

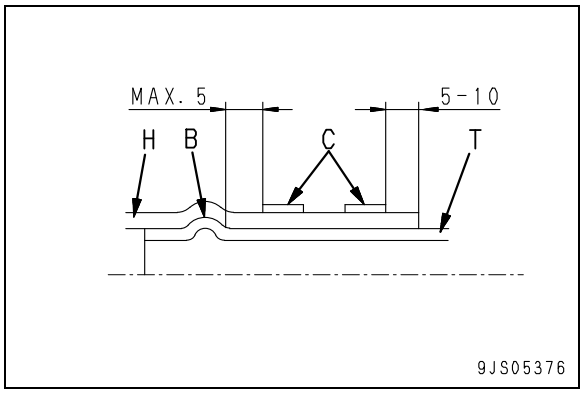
★ If there are 2 clamps, set their tightening portions on the exactly opposite side to each other so that they can be tightened from the same direction.

Positions of hose clamps

- B: Bulge
- C: Clamp
- H: Hose
- T: Tube

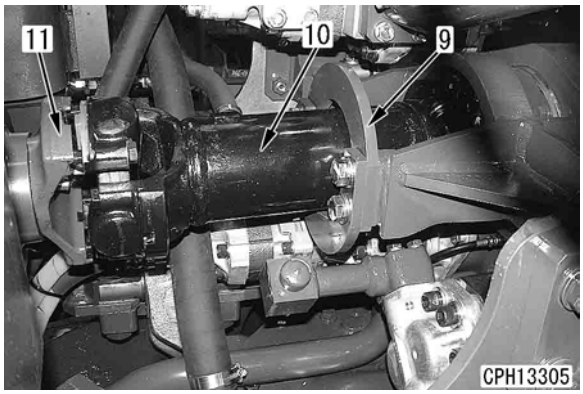
★ Between bulge and inside clamp:
Max. 5 mm

★ Between hose end and outside clamp:
5 – 10 mm

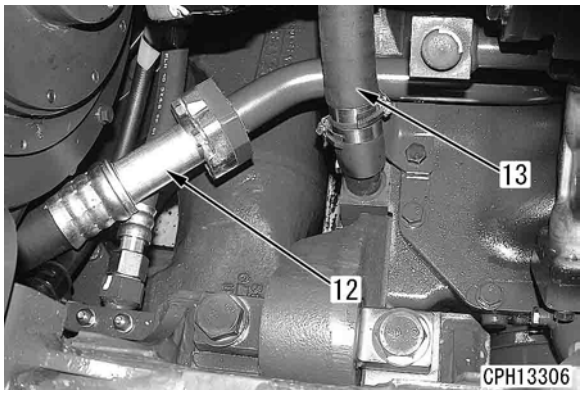


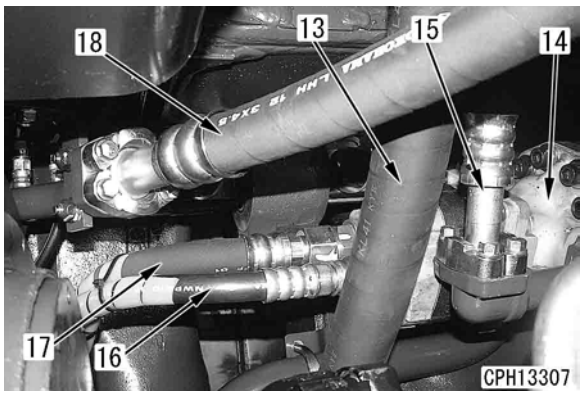
- **Refilling with coolant**
  Add coolant through the coolant filler to the specified level. Run the engine to circulate the coolant through the system. Then, check the coolant level again.
  Coolant: **59** ℓ

4) Remove upper and lower drive shaft guards (9), and then remove drive shaft (10) between the engine and transmission. [*1]
   Drive shaft: **25 kg**
5) Remove coupling (11) on the output shaft side. [*2]

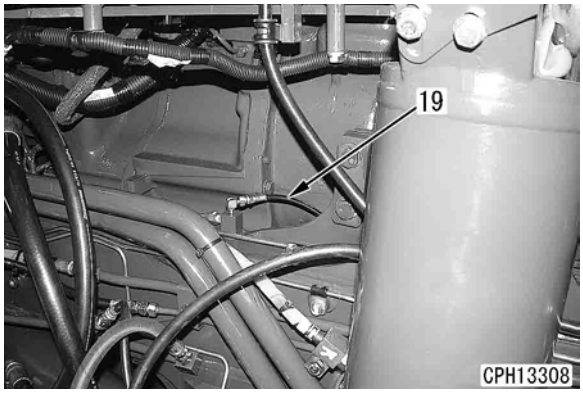


6) Disconnect transmission lubrication circuit inlet hoses (12).
7) Disconnect front differential breather hose (13).
8) Disconnect 3 discharging hoses (15), (16) and (17) from the rear brake cooling and brake actuating pump assembly (14).
9) Disconnect hose (18).

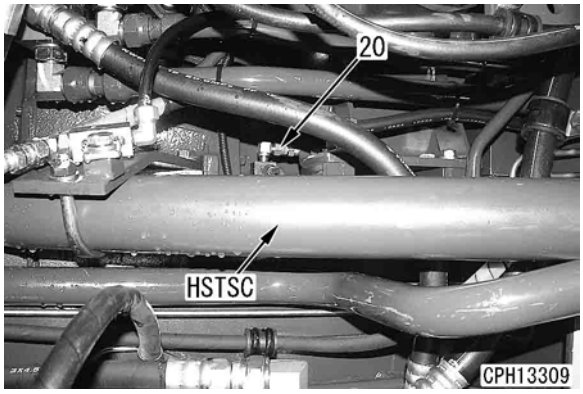




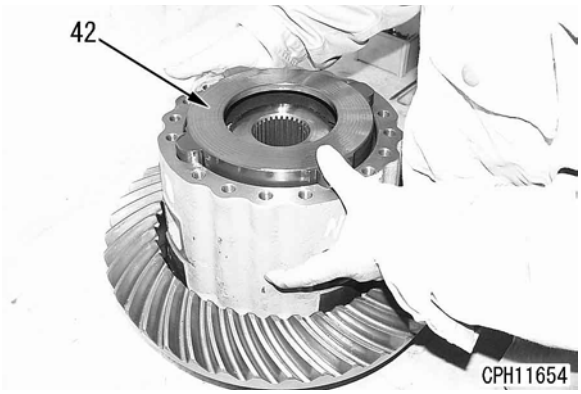
7. Disconnect grease hose (19) from the frame right side.



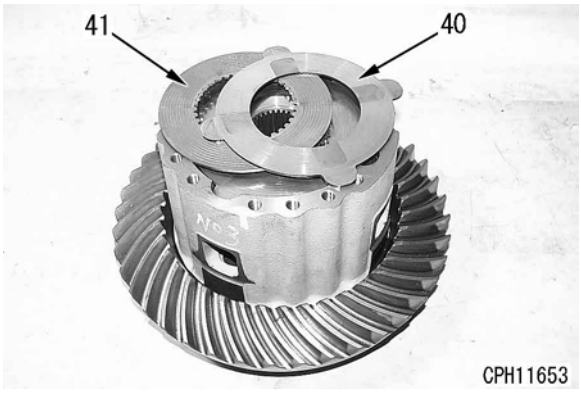
8. Disconnect grease hose (20) from frame left side.
★ HSTSC: Hydraulic tank suction tube



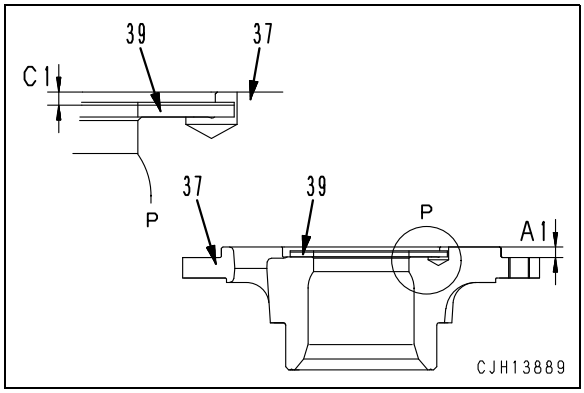
12) Install pressure ring (42).



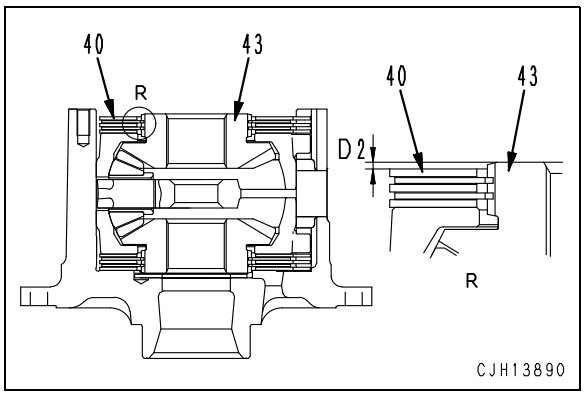
13) Assemble 3 plates (40) and 2 discs (41).
★ Immerse the discs and plates in the following oil before assembling.
Disc and plate: **Axle oil (AXO80)**



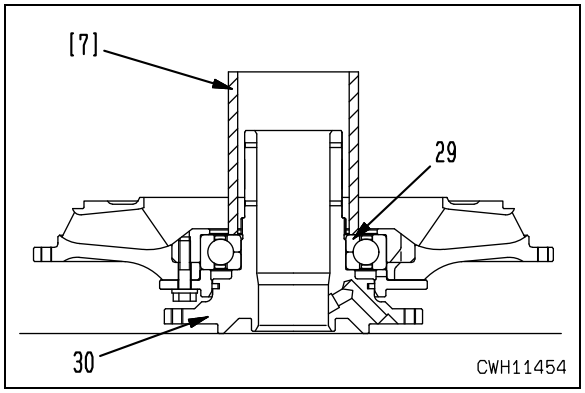
14) Adjustment of clearance.
i) Using the depth gauge, measure level difference **A1** of case (37) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **A1** = Total of values measured at 4 places / 4
ii) Set washer (39) on case (37).
★ Direct the lined face toward the gear.
iii) Using the depth gauge, measure level difference **C1** between case (37) and washer (39) at 4 places equally spaced on the periphery.
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **C1** = Total of values measured at 4 places / 4



iv) Using the depth gauge, measure level difference **D2** between gear (43) and plate (40) at 4 places equally spaced on the periphery.
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **D2** = Total of values measured at 4 places / 4



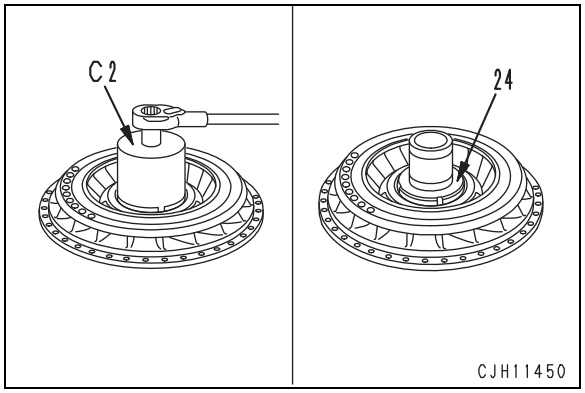
v) While pressing the disc and plate with a force of **686 N {70 kg}**, perform steps vi) and vii).
vi) Using the depth gauge, measure level difference **A2** between case (54) and plate (40) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **A2** = Total of values measured at 4 places / 4
vii) Using the depth gauge, measure level difference **D1** between gear (43) and plate (40) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **D1** = Total of values measured at 4 places / 4



iii) Drip approx. 6 cc of **powertrain oil (TO10 or TO30)** on the bearing and rotate it by 10 turns.

5) Set pump and stator shaft assembly on tool **C1**.

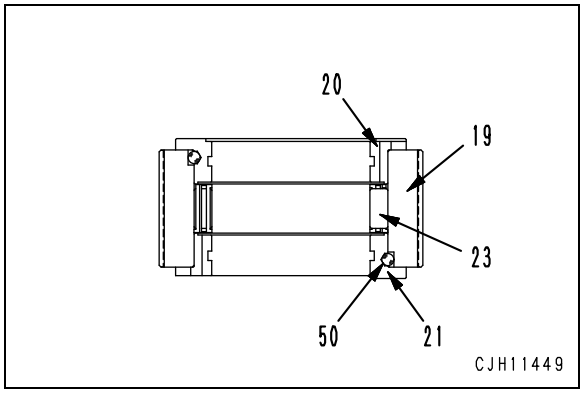
6) Nut
Install nut (24), using tool **C2**.
Nut thread portion
: Liquid adhesive (LT-2)
Nut
: 441.3 – 490.3 Nm {45 – 50 kgm}



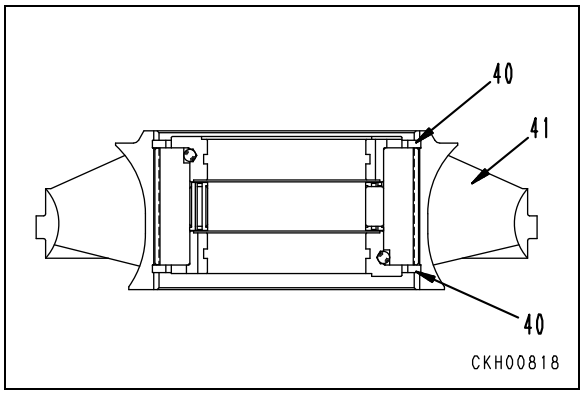
2. Subassembly of stator assembly

1) One-way clutch and race
Install one-way clutch (23) to race (19).
★ Install the one-way clutch so that an arrow shown on the cage edge faces the input side, and check the stator rotation direction as viewed from the input side.
Clockwise: **No load**
Counter-clockwise: **Lock**
Sliding surface
: Powertrain oil (TO10 or TO30)

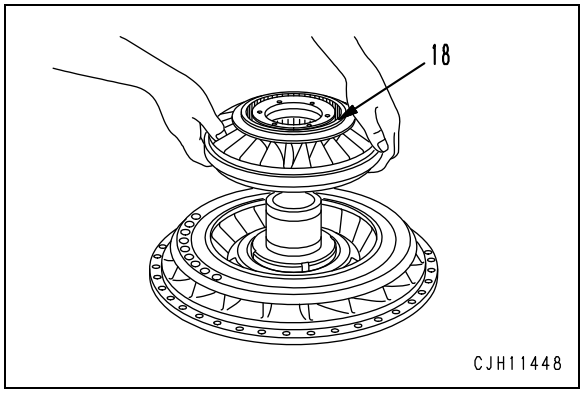
2) Bushing
Expansion-fit bushings (20) and (21) with ball (50) into race (19).
Sliding surface
: Powertrain oil (TO10 or TO30)



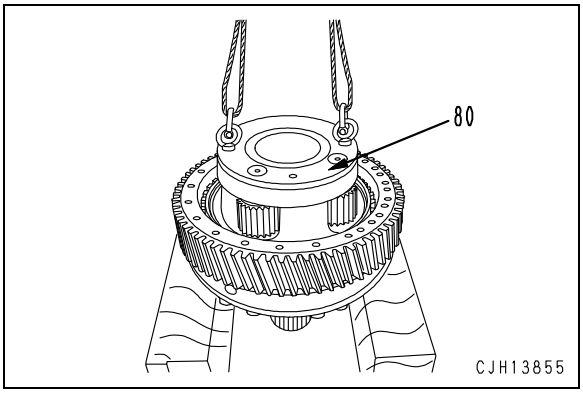
3) Stator
Install stator (41) with snap rings (40).



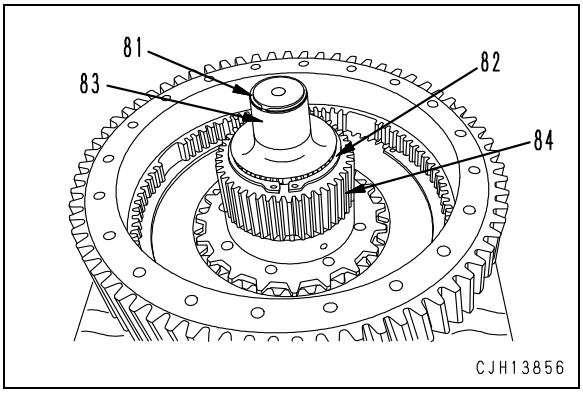
3. Stator assembly
Install stator assembly (18).



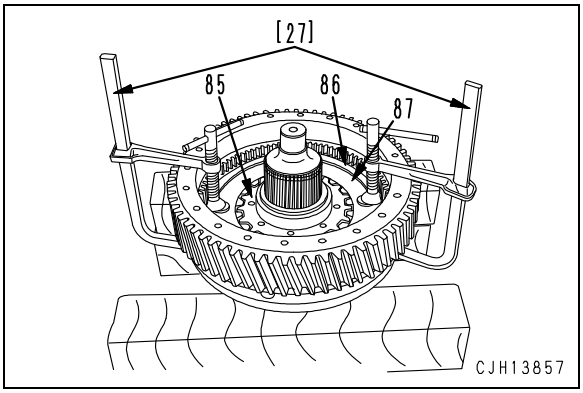
5) Remove carrier assembly (80).
   ★ For further disassembly of the carrier assembly, refer to the section 15).



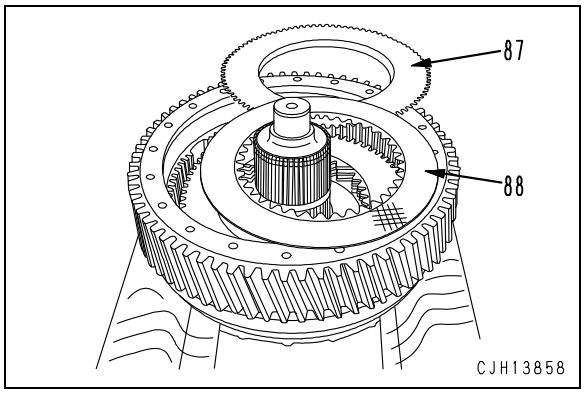
6) Remove snap ring (81) and remove inner race (83).
7) Remove snap ring (82).
8) Remove sun gear (84).



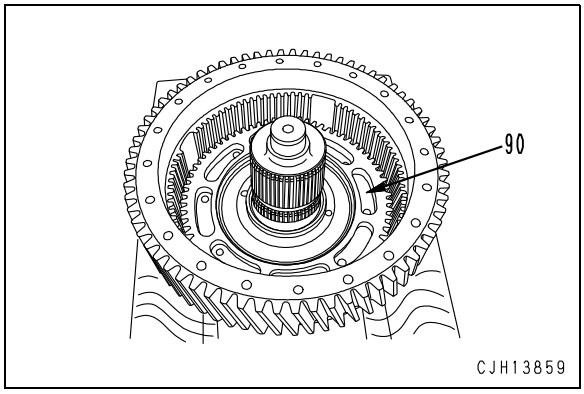
9) Remove clutch hub (85).
10) Compress the spring by pushing plate (87), using tools [27], and remove snap ring (86).



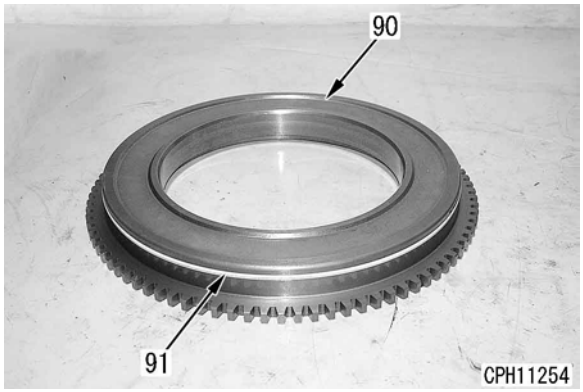
11) Remove 6 plates (87) and 5 discs (88).



12) Remove piston (90).
   ★ Use the tapped holes for slinging.

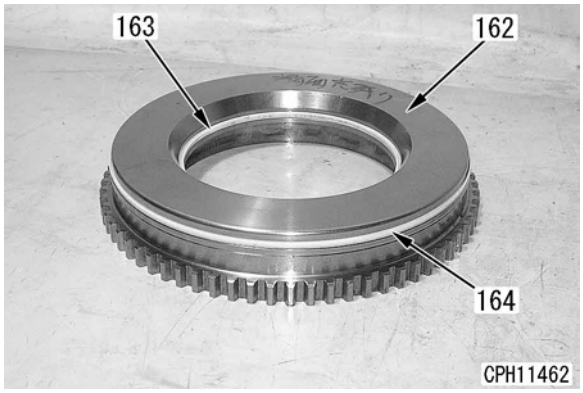


13) Remove seal ring (91) from piston (90).

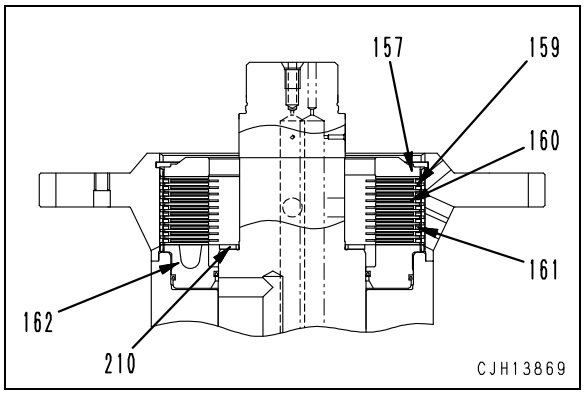


4. Subassembly of FH and 1st clutch assembly (FH clutch side)

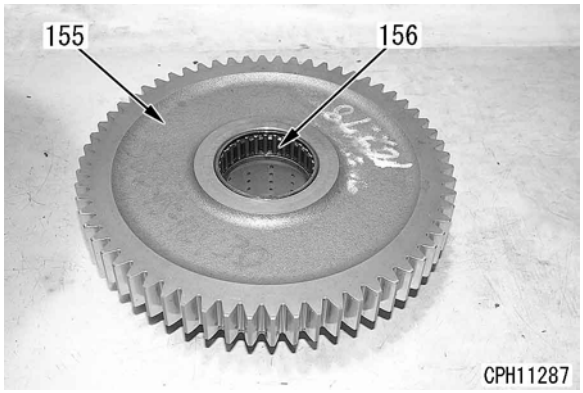
1) Install seal rings (163) and (164) to piston (162).
   ★ Install the seal rings with their pressure-receiving side facing the housing.



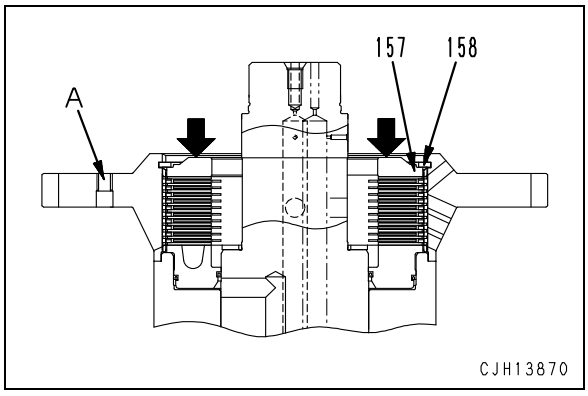
2) Install piston (162).
   Seal ring periphery and sliding surface: **Powertrain oil (TO10)**
3) Install thrust washer (210).
4) Install each of 11 plates (159), 10 discs (160) and 10 springs (161) alternately from the bottom to the top.
   ★ Immerse the discs in clean powertrain oil (TO10) for more than 2 minutes before assembling.
5) Install end plate (157).



6) Install bearing (156) to FH gear (155).

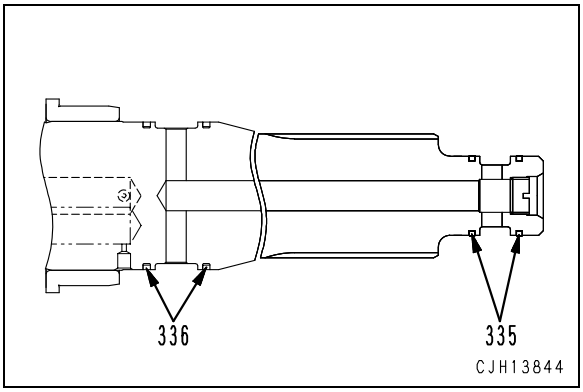


7) Install FH gear (155) to the clutch assembly temporarily, and match disc tooth.
   ★ Turn the gear to the left and right, while pressing it down, and push the gear in gradually, avoiding interference with the disc tooth.
8) Remove FH gear (155) once.
9) Compress the spring by pushing end plate (157) with C clamp, and install snap ring (158).
   ★ Take care so that the plate will not get caught in the snap ring groove.
   ★ Make sure that the snap ring settles in the groove completely.

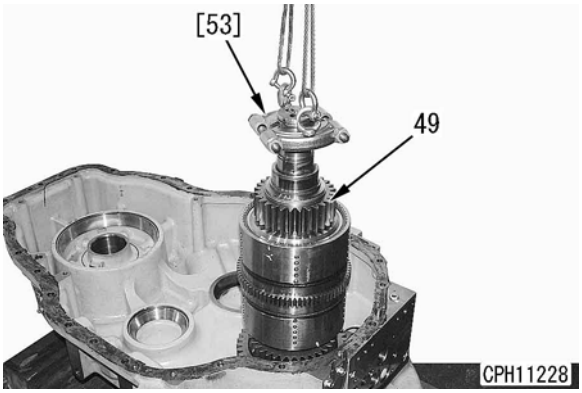


15. Clutch assembly

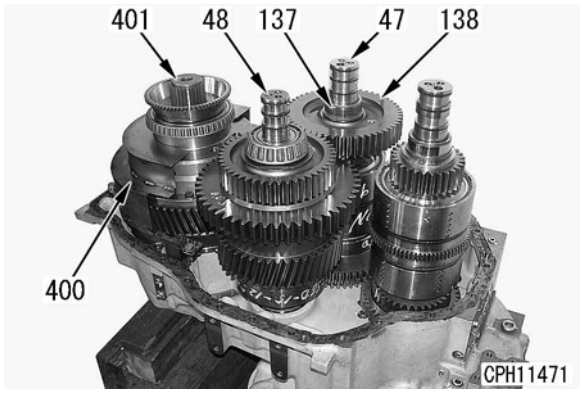
1) Install seal rings (335) and (336) on the FL clutch side.
   ★ Check that the seal ring on the FL clutch side has not enlarged at the abutment.
   Seal ring: **Grease (G2-LI)**



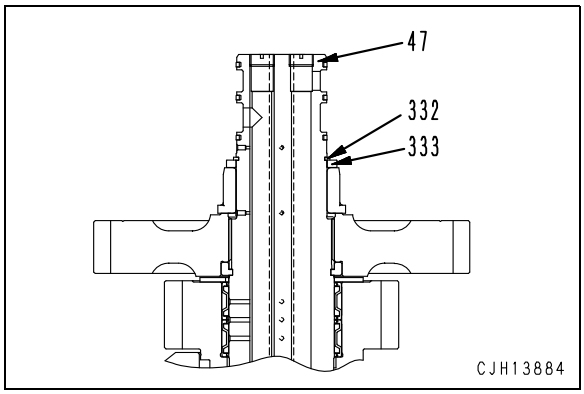
2) Install FL and R clutch assembly (49).
   ★ Tool [53] is shown just as an example.



3) Install FH and 1st clutch assembly (47).
   ★ Install this assembly without idler gear (138) and inner race (137).
4) Sling differential lock clutch assembly (401), and set shroud (400) to its setting position.
   ★ The shroud cannot be installed after the differential lock clutch assembly is installed.
5) Install differential lock clutch assembly (401) after it is lowered.
6) Put shroud (400) to the differential clutch assembly and tighten the mounting bolts in a position 1 mm away from the assembly.
7) Install 2nd and 3rd clutch assembly (48).
8) Install idler gear (138) to FH and 1st clutch assembly (47), and shrink-fit inner race (137).
   • Shrink-fit temperature
     : For 30 minutes at approx. 120°C

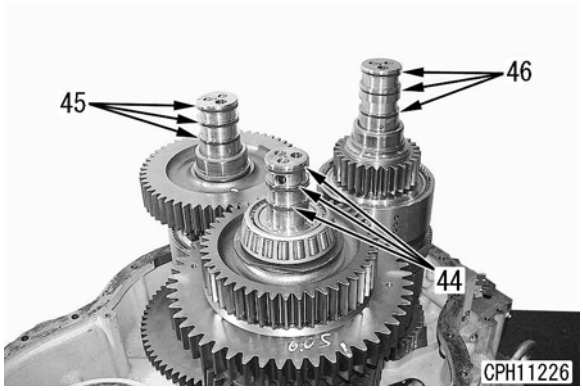


9) Install spacer (333) and snap ring (332) to FH and 1st clutch assembly (47).



16. Seal ring

Install seal rings (44), (45) and (46).
Seal ring: **Grease (G2-LI)**



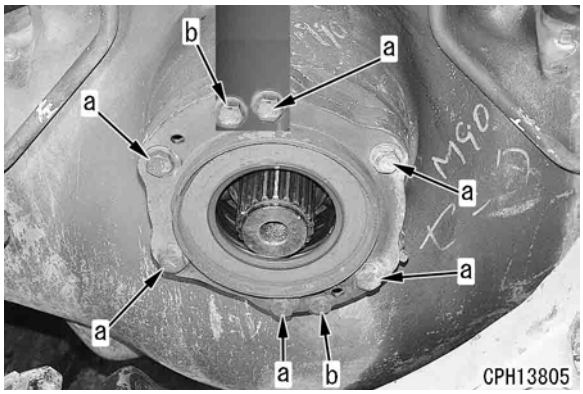
17. Subassembly of rear transmission case assembly

1) Install collar (41).
   ★ Be careful of the installing direction. (Refer to the figure below.)
2) Press-fit bearing (40), using tool **D7**.

[*7]

Transfer output shaft spline portion
: Extreme-pressure grease containing molybdenum disulfide

Bearing cage assembly mounting bolt
a: 98 – 123 Nm {10 – 12.5 kgm}
b: 54 – 64 Nm {5.5 – 6.5 kgm}



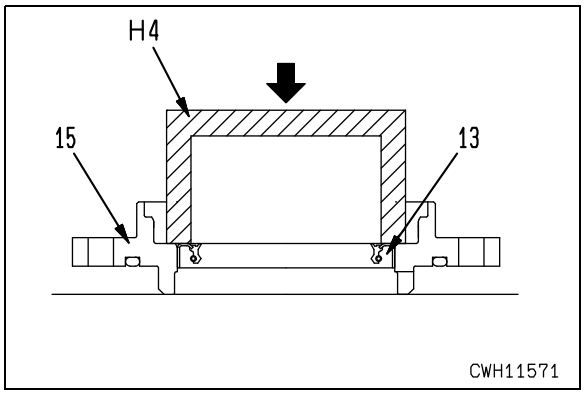
★ When disassembling the bearing cage assembly, press-fit oil seal (13) and side seal (14) into cage (15) in the following manner.

i) Press-fit oil seal (13) into cage (15), using tool **H4**.

★ Keep press-fitting until the oil seal periphery surface is flush with the cage end surface.

Oil seal periphery
: Seal end 242 or equivalent

Oil seal lip face**: Grease (G2-LI)**

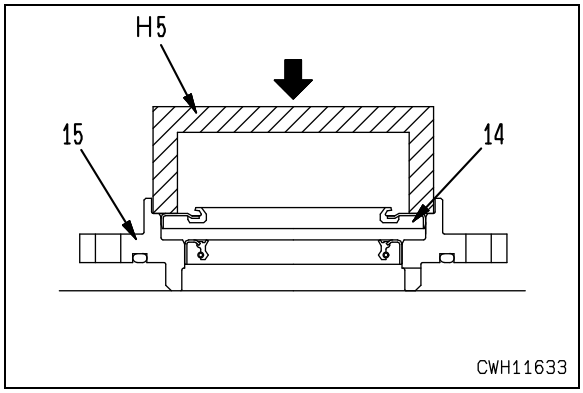


ii) Press-fit side seal (14) into cage (15), using tool **H5**.

★ Keep press-fitting until the side seal periphery surface is flush with the cage end face.

Side seal periphery**: Seal end 242**

Side seal lip face**: Grease (G2-LI)**



[*8]

Center differential mounting bolt
: 157 – 196 Nm {16 – 20 kgm}
[Target value: 177 Nm {18 kgm}]

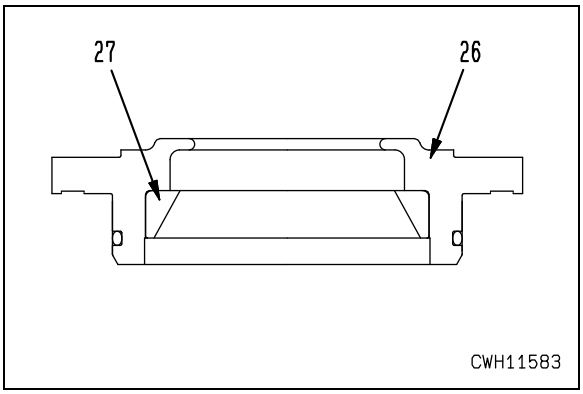
• Refilling with oil (center differential case and center final drive case)
Refill with oil through the oil filler ports of the center differential case and left and right final drive cases up to the specified level.

Center differential case
: 25ℓ Axle oil (AXO80)

Center final drive case
: 4ℓ (one side) Axle oil (AXO80)

9. Cage assembly

1) Install outer race (27) to cage (26).

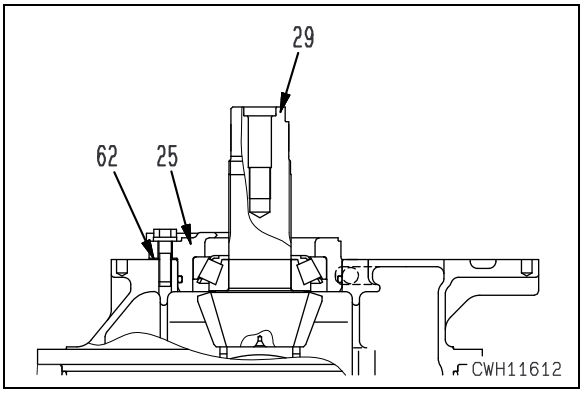


2) Install cage assembly (25).
   - ★ Assemble shims (62), whose thickness, number in use and installed location were confirmed at the time of disassembling, in cage assembly (25), and install the cage assembly.
   - ★ Determine thickness and number in use of shims after carrying out "Tooth contact and backlash adjustment" in the subsequent section of 12.

   Mounting bolt
   : 157 – 196 mm {16 – 20 kgm}

Table 1

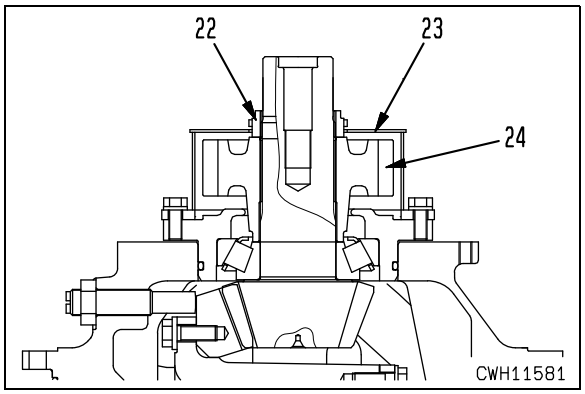
MD shim thickness range (mm)	Spacer part No.	Letter notched on spacer	Dimension of spacer width (mm)
1.07 – 1.16	56D-23-16900	A	24.765 ± 0.025
1.17 – 1.26	56D-23-16910	B	24.665 ± 0.025
1.27 – 1.36	56D-23-16920	C	24.565 ± 0.025
1.37 – 1.46	56D-23-16930	D	24.465 ± 0.025
1.47 – 1.56	56D-23-16940	E	24.365 ± 0.025
1.57 – 1.66	56D-23-16950	F	24.265 ± 0.025
1.67 – 1.76	56D-23-16960	G	24.165 ± 0.025
1.77 – 1.86	56D-23-16970	H	24.065 ± 0.025
1.87 – 1.96	56D-23-16980	I	23.965 ± 0.025
1.97 – 2.06	56D-23-16990	J	23.865 ± 0.025



10. Spacer and input gear

1) Assemble in input gear (24).
2) Install cover (23).

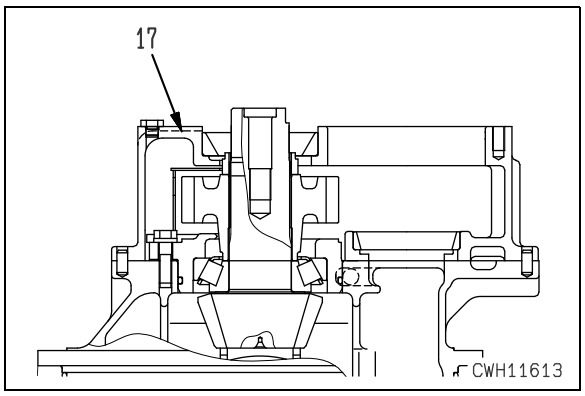
   Mounting bolt
   : 98 –123 Nm {10 – 12.5 kgm}
3) Assemble spacer (22) in.
   - ★ When changing thickness of the shims as a result of carrying out "Tooth contact and backlash adjustment" in the subsequent section of 12, change the spacers, too, in reference to Table 1 above.



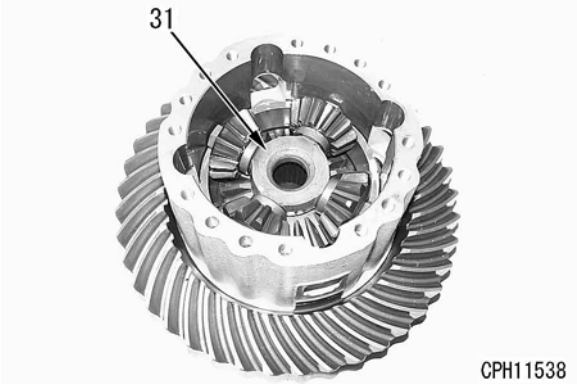
4) Sling transfer case assembly (17) to install.

   Case mating face
   : Gasket sealant (LT-515 or equivalent)

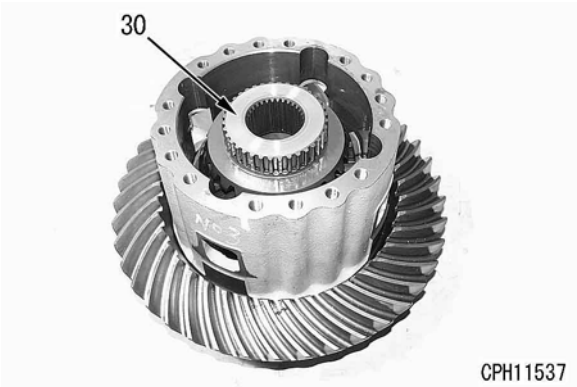
   Mounting bolt
   : 98 – 123 Nm {10 – 12.5 kgm}



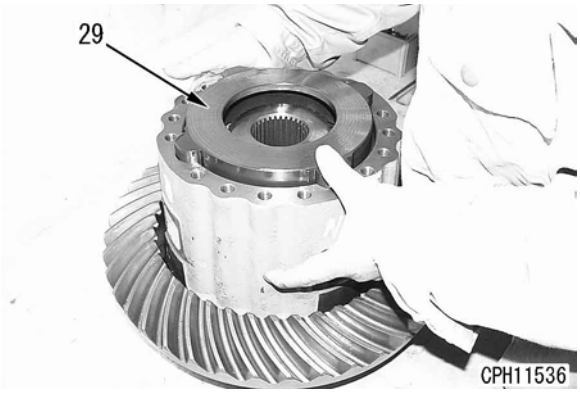
10) Install pinion gear assembly (31) in one piece.



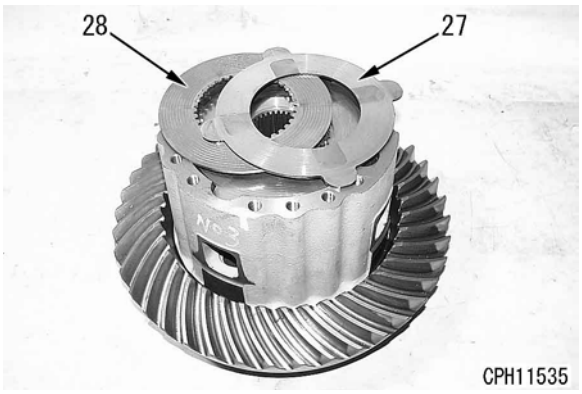
11) Install differential gear (30).



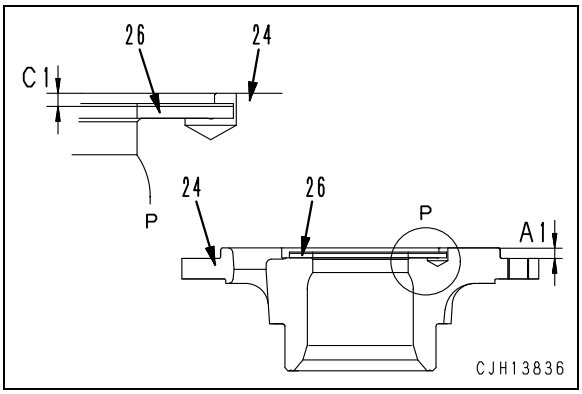
12) Install pressure ring (29).



13) Assemble 3 plates (27) and 2 discs (28).
★ Immerse the discs and plates in the following oil before installing.
Disc and plate: **Axle oil (AXO80)**



14) Adjustment of clearance.
i) Using the depth gauge, measure level difference **A1** of case (24) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **A1** = Total of values measured at 4 places / 4
ii) Set washer (26) on case (24).
★ Direct the lined face toward the gear.
iii) Using the depth gauge, measure level difference **C1** between case (24) and washer (26) at 4 places equally spaced on the periphery.
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **C1** = Total of values measured at 4 places / 4



Disassembly and assembly of front final drive and brake assembly

Special tools

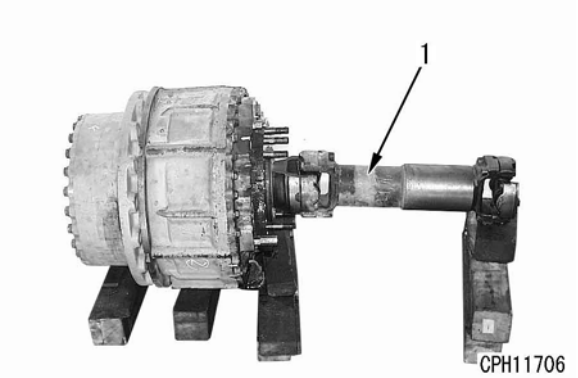
Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
J		792T-227-1120	Fixture	■	3		○
		792T-223-1140	Plate	■	3		○
		01010-61240	Bolt	■	3		
	1	01643-31232	Washer	■	3		
		01580-01210	Nut	■	3		
		01010-61245	Bolt	■	3		
		01010-62440	Bolt	■	3		
	2	792T-222-1220	Push tool	■	1		○
		792T-227-1130	Push tool	■	1		○
	3	790-101-5221	Grip	■	1		
		01010-81225	Bolt	■	1		
	4	791-580-1520	Installer	■	1		
	5	791-580-1510	Installer	■	1		
		793T-622-1110	Push tool	■	1		○
	6	790-101-5421	Grip	■	1		
		01010-81240	Bolt	■	1		
	7	797T-622-1240	Push tool	■	1		○
	9	01010-62050	Bolt	■	1		

Disassembly

1. Drive shaft

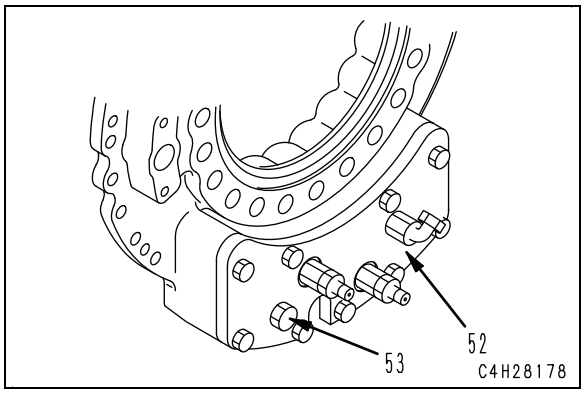
Remove drive shaft (1).

★ Take care so that the drive shaft cap (yoke) will not slip off.



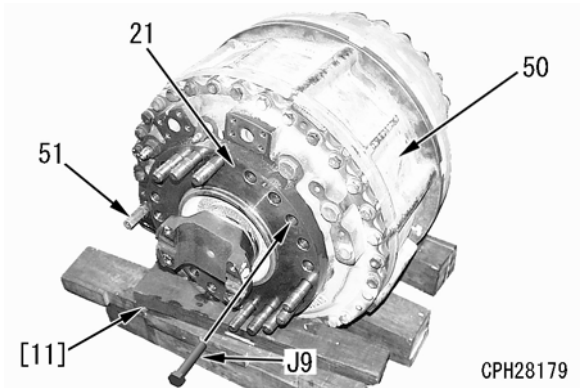
2. Cover and temporary fixing of tube

1) Remove drain plug (53).
   ★ Drain the oil remaining in the case.
2) Remove cover (52).



3) Fix tube assembly (21) to brake assembly (50) temporally by using bolt **J9** (M20, stem length: 50 mm) (1 piece).

⚠ **Be sure to fix tube assembly (21) to brake assembly (50) temporally with bolt J9 (1 piece) in order to prevent it from falling off unexpectedly.**



4) Support block [11] on the end face of tube assembly (21) (described above), and set brake assembly (50).
   ★ Use block [11] at least 10 cm high, since bolt **J9** needs to be removed later from underside.
   ★ After setting, check that stud bolts (51) (described above) receive no load.

Finall drive and brake assembly: **420 kg**

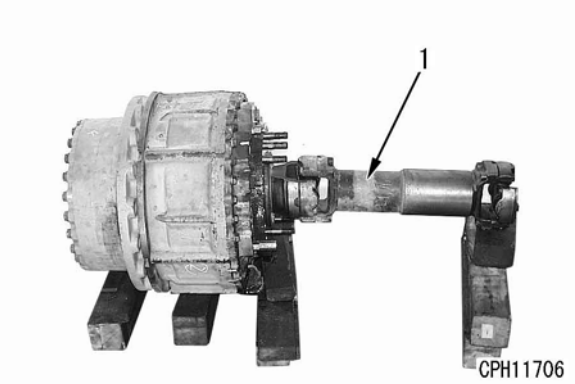
15. Drive shaft

Install drive shaft (1).

Mounting bolt: **Liquid adhesive (LT-2)**

Mounting bolt

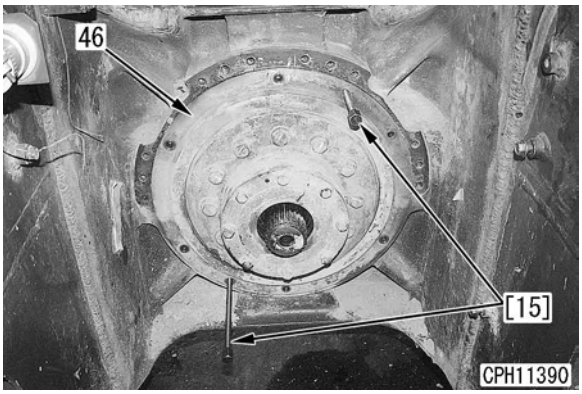
: 98 – 123 Nm {10 – 12.5 kgm}



HM300-2R Articulated dump truck

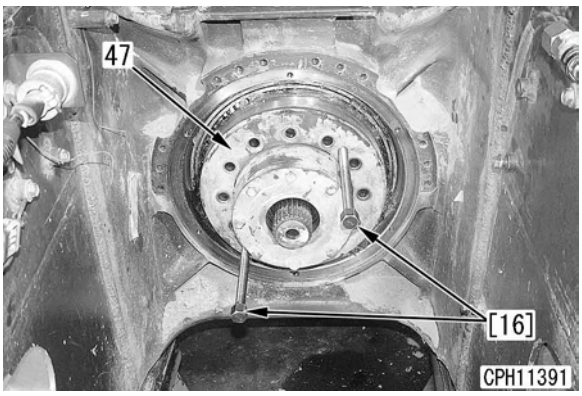
Form No. SEN04034-02

29. Remove retainer (46), using forcing screws [15]. [*11]



30. Remove retainer (47), using forcing screws [16]. [*12]

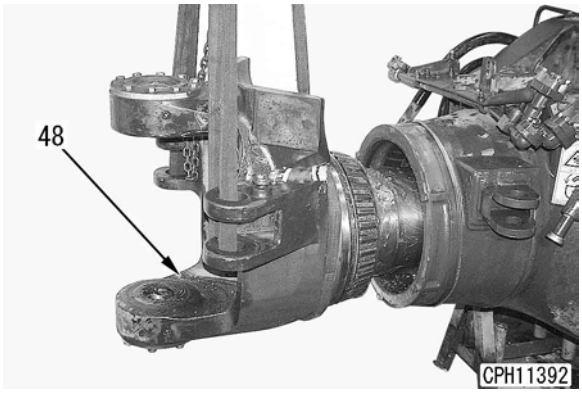
★ Shims are provided, so check their thickness, number in use and installed locations beforehand.

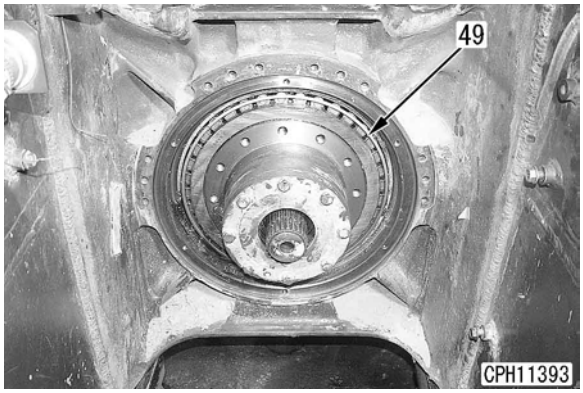


31. Sling hitch frame assembly (48) to remove. [*13]

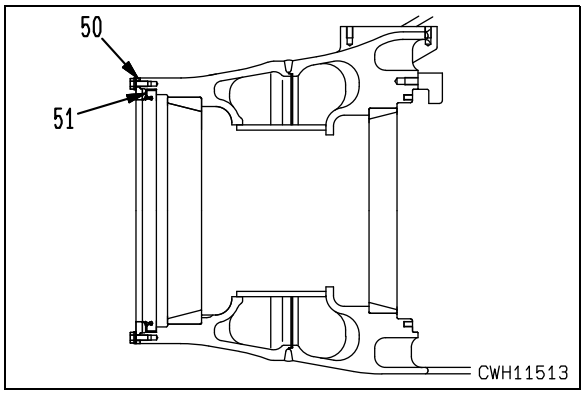
Hitch frame assembly: **600 kg**

★ Bearing (49) may fall off from the rear frame, so secure it to prevent fall-off.





32. Remove retainer (50) and dust seal (51) from the rear frame. [*14]



ARTICULATED DUMP TRUCK

HM300-2R

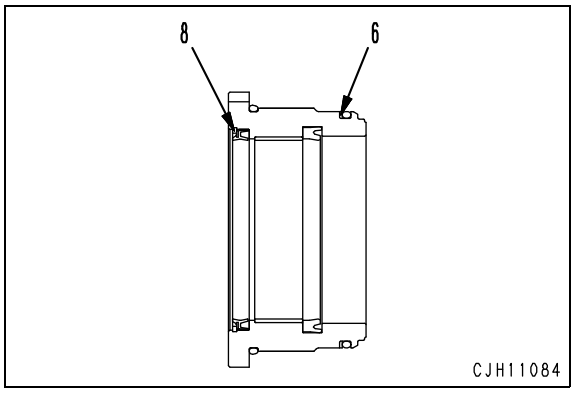
Machine model	Serial number
HM300-2R	7001 and up

50 Disassembly and assembly

Hydraulic system

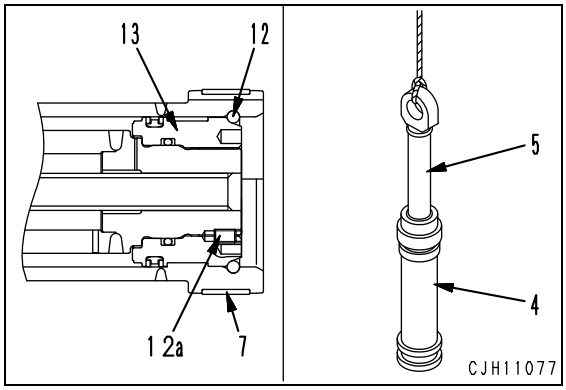
Removal and installation of flow amp valve 2
Removal and installation of hoist valve assembly 4
Disassembly and assembly of steering cylinder assembly 7
Disassembly and assembly of hoist cylinder assembly 11

4) Fit snap ring (8), O-ring and backup ring (6).

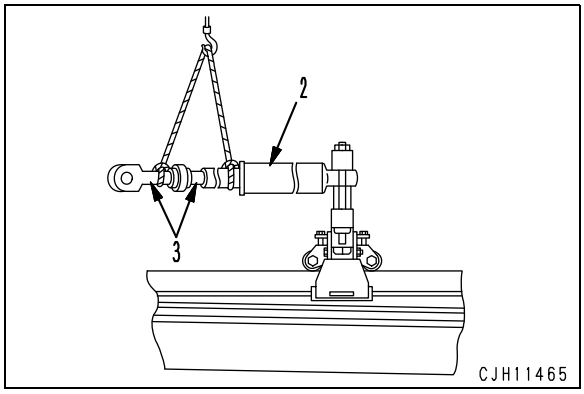


4. Rod assembly

1) Fit wear ring (7) to cylinder Ⅱ (4).
2) Tighten piston assembly (13), using tool **U7**.
   Piston assembly
   : 294 ± 29.4Nm {30 ± 3.0kgm}
3) Sling rod (5) and assemble it into the cylinder Ⅱ (4).
4) Tighten screw (12a).
   ★ When using a new part for either or both of piston assembly (13), or rod (5), make a drill hole for screw.
   Hole depth: **27 mm**
   Tap depth: **20 mm**
   Tap used: **10 x 1.5**
   ★ Degrease the threads of the screw sufficiently.
   Screw
   : Liquid adhesive (Loctite #262)
   Screw
   : 27.5 – 34.3Nm {2.8 – 3.5kgm}
5) Fit snap ring (12).



6) Assemble the cylinder Ⅱ • rod assembly into the cylinder Ⅰ (2).
   Cylinder Ⅱ • rod assembly: **140 kg**



7) Install cylinder head assembly (1) to cylinder Ⅰ (2), using tool **U2**.
   Cylinder head assembly
   : 1.23 ± 0.12kNm {125 ± 12.5kgm}