CEBM022903

Shop Manual

WA500-6

WHEEL LOADER

SERIAL NUMBERS **WA500-6** **A93001** and UP

It is our policy to improve our products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time without incurring any obligation to install such changes on products sold previously.

Due to this continuous program of research and development, periodic revisions may be made to this publication. It is recommended that customers contact their distributor for information on the latest revision.

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SAFETY

SAFETY NOTICE

IMPORTANT SAFETY NOTICE

Proper service and repair is extremely important for the safe operation of your machine. The service and repair techniques recommended by Komatsu and described in this manual are both effective and safe. Some of these operations require the use of tools specially designed for the specific purpose.

To prevent injury to workers, the symbol ⚠ is used to mark safety precautions in this manual. The cautions accompanying this symbol should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety and take the necessary actions to deal with the situation.

General Precautions

Mistakes in operation are extremely dangerous. Read the *Operation & Maintenance Manual* carefully BEFORE operating the machine.

1. Before carrying out any greasing or repairs, read all the precautions given on the decals which are fixed to the machine. For the locations of the labels and detailed explanation of the precautions, see the *Operation & Maintenance Manual*.

2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes or clothes with buttons missing.

   - Always wear safety glasses when hitting parts with a hammer.
   - Always wear safety glasses when grinding parts with a grinder, etc.

3. If welding repairs are needed, always have a trained, experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, glasses, cap, and other clothes suited for welding work.

   ⚠ **WARNING!** Never modify, weld, cut, or drill on any part of a ROPS structure.

   Doing so may weaken the structure which could lead to possible failure in a rollover situation.

4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR warning signs on the controls in the operator's compartment.

5. Keep all tools in good condition and learn the correct way to use them.

6. Only qualified workers must carry out work and operations which require a license or qualification.

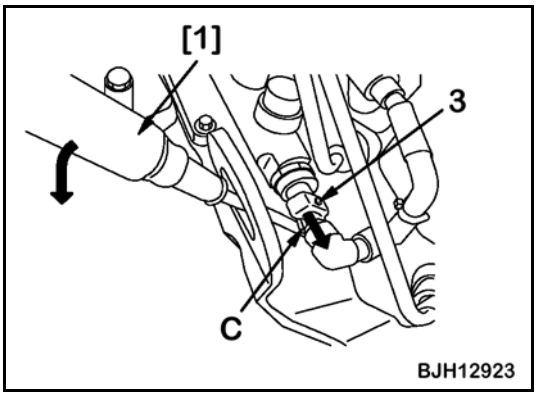
7. Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.

8. Avoid working for long hours and take rests at proper intervals to keep your body in good condition. Take rests in specified safe places.

Safety Points

1	Good arrangement
2	Correct work clothes
3	Following work standard
4	Making and checking signs
5	Prohibition of operation and handling by unlicensed workers
6	Safety check before starting work
7	Wearing protective goggles (for cleaning or grinding work)
8	Wearing shielding goggles and protectors (for welding work)
9	Good physical condition and preparation
10	Precautions against work which you are not used to or work with which you are too familiar

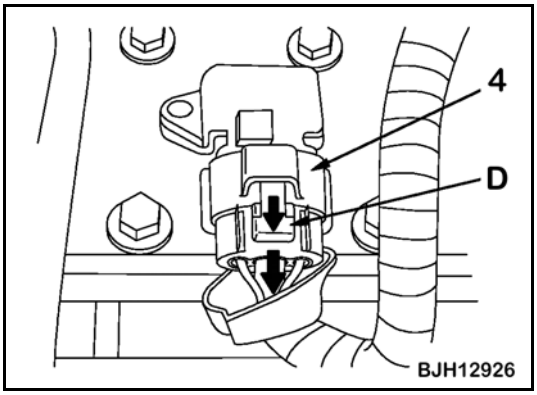
- While pressing up lock (C) of the connector with flat-head screwdriver [1], pull out connector (3) in the direction of the arrow.



★ 107, 114 engines

Connector	Sensor
SUMITOMO-04	Intake air pressure/temperature sensor in intake manifold

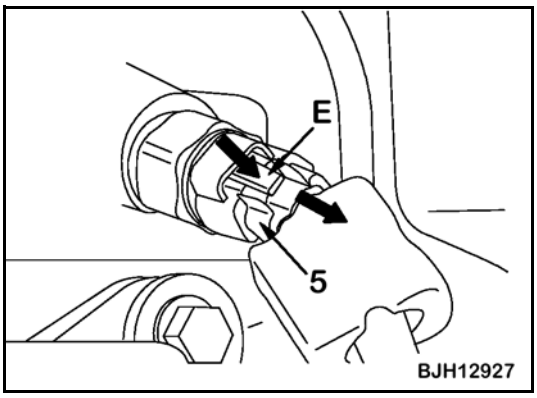
- While pressing lock (D), pull out connector (4) in the direction of the arrow.



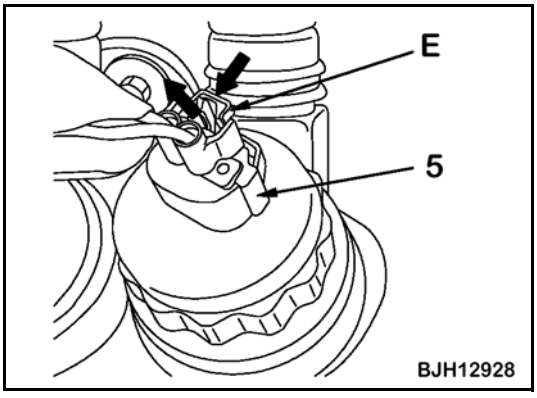
★ 95, 125 – 170, 12V140 engines

- While pressing lock (E) of the connector, pull out connector (5) in the direction of the arrow.

Connector	Sensor
AMP-3	Fuel pressure sensor in common rail: PFUEL, etc.



Connector	Valve
SUMITOMO-2	Injection pressure control valve of fuel supply pump: PCV



kg/cm^2 to lb/in^2 **1 kg/cm^2 = 14.2233lb/in^2**

	0	1	2	3	4	5	6	7	8	9
0	0	14.2	28.4	42.7	56.9	71.1	85.3	99.6	113.8	128.0
10	142.2	156.5	170.7	184.9	199.1	213.4	227.6	241.8	256.0	270.2
20	284.5	298.7	312.9	327.1	341.4	355.6	369.8	384.0	398.3	412.5
30	426.7	440.9	455.1	469.4	483.6	497.8	512.0	526.3	540.5	554.7
40	568.9	583.2	597.4	611.6	625.8	640.1	654.3	668.5	682.7	696.9
50	711.2	725.4	739.6	753.8	768.1	782.3	796.5	810.7	825.0	839.2
60	853.4	867.6	881.8	896.1	910.3	924.5	938.7	953.0	967.2	981.4
70	995.6	1010	1024	1038	1053	1067	1081	1095	1109	1124
80	1138	1152	1166	1181	1195	1209	1223	1237	1252	1266
90	1280	1294	1309	1323	1337	1351	1365	1380	1394	1408
100	1422	1437	1451	1465	1479	1493	1508	1522	1536	1550
110	1565	1579	1593	1607	1621	1636	1650	1664	1678	1693
120	1707	1721	1735	1749	1764	1778	1792	1806	1821	1835
130	1849	1863	1877	1892	1906	1920	19324	1949	1963	1977
140	1991	2005	2034	2048	2062	2077	2091	2105	2119	
150	2134	2148	2162	2176	2190	2205	2219	2233	2247	2262
160	2276	2290	2304	2318	2333	2347	2361	2375	2389	2404
170	2418	2432	2446	2460	2475	2489	2503	2518	2532	2546
180	2560	2574	2589	2603	2617	2631	2646	2660	2674	2688
190	2702	2717	2731	2745	2759	2773	2788	2802	2816	2830
200	2845	2859	2873	2887	2901	2916	2930	2944	2958	2973
210	2987	3001	3015	3030	3044	3058	3072	3086	3101	3115
220	3129	3143	3158	3172	3186	3200	3214	3229	3243	3257
230	3271	3286	3300	3314	3328	3343	3357	3371	3385	3399
240	3414	3428	3442	3456	3470	3485	3499	3513	3527	3542

Specifications

	Radiator	Hydraulic Oil Cooler (1)	Hydraulic Oil Cooler (2)	Aftercooler	Torque Converter Oil Cooler
Core type	Aluminum tube in 4-column	PTO-OL	PTO-OL	Straight fin 10-hole tube type	PTO-LS
Fin pitch mm (in)	4.0/2P (0.16/2P)	100 x 385 x 17 (3.9 x 15.2 x 0.7)	100 x 558 x 17 (3.9 x 22.0 x 0.7)	6.0/2P (0.24/2P)	150 x 620 x 20-stage (5.9 x 24.4 x 20-stage)
Total heat dissipation surface m^2 (ft^2)	59.90 (644.76)	1.2187 (13.118)	1.829 (19.687)	21.57 (232.18)	3.254 (35.026)
Cross-sectional area of flow cm^2 (in^2)	50.845 (7.881)	—	—	—	—
Pressure valve cracking pressure kg/cm² (psi)	0.714 ±0.153 (10 ±2)	—	—	—	—
Vacuum valve cracking pressure kg/cm² (psi)	0 – 0.051 (0 – 1)	—	—	—	—

1. Output shaft
2. Case
3. Thrust plate
4. Piston assembly
5. Cylinder block
6. Valve plate
7. End cover
8. Center spring
9. Check valve
10. Pilot valve
11. Reversible valve spool
12. Safety valve

No.	Check Item	Criteria					Remedy
		Standard Size			Repair Limit		
13	Spool return spring	Free Length x Outside Diameter mm (in)	Installed Length mm (in)	Installed Load	Free Length	Installed Load	If damaged or deformed, replace spring
		44.8 x 12.0 (1.76 x 0.47)	33.0 (1.30)	58.8 N (13.22 lbf)	—	47.1 N (10.59 lbf)	
14	Check valve spring	13.0 x 6.5 (0.51 x 0.26)	9.5 (0.37)	1.96 N (0.44 lbf)	—	1.57 N (0.35 lbf)	

Torque Values

Item	N•m	lbf in
D	9.8 – 12.7	87 – 112

Unit: mm (in)

No.	Check Item		Criteria			Remedy
1	Outside diameter of pilot		Standard Size: 80 (3.15)	Tolerance: -0.040 (-0.0016) -0.070 (-0.0028)	Repair Limit: 79.92 (3.15)	Repair by hard chromium-plating or replace
2	Inside diameter of sleeve seal ring contact surface		65 (2.56)	+0.030 (+0.0012) 0 (0)	65.1 (2.56)	
	Wear of output shaft seal ring	Width	3 (0.12)	-0.01 (-0.0004) -0.03 (-0.0012)	2.7 (0.11)	Replace
		Thickness	2.7 (0.11)	±0.1 (±0.0039)	2.55 (0.10)	
3	Inside diameter of PTO drive gear seal ring contact surface		170 (6.70)	+0.040 (+0.0016) 0 (0)	170.5 (6.71)	Repair by hard chromium-plating or replace
4	Tolerance for fitness of PTO idler gear bearing		Standard Size	Tolerance: Shaft	Tolerance: Hole	Replace
		Outside diameter	125 (4.92)	0 (0) -0.020 (-0.0008)	-0.028 (-0.0011) -0.068 (-0.0027)	
		Inside diameter	70 (2.76)	+0.012 (+0.0005) -0.007 (-0.0003)	0 (0) -0.015 (-0.0006)	
5	Tolerance for fitness of input transfer drive gear bearing (Large)	Outside diameter	150 (5.91)	0 (0) -0.020 (-0.0008)	-0.012 (-0.0005) -0.052 (-0.0020)	
		Inside diameter	85 (3.35)	+0.059 (+0.0023) +0.037 (+0.0015)	0 (0) -0.020 (-0.0008)	
6	Tolerance for fitness of input transfer drive gear bearing (Small)	Outside diameter	140 (5.51)	0 (0) -0.020 (-0.0008)	-0.012 (-0.0005) -0.052 (-0.0020)	
		Inside diameter	80 (3.15)	+0.051 (+0.0020) +0.032 (+0.0013)	0 (0) -0.015 (-0.0006)	
7	Tolerance for fitness of input transfer driven gear bearing	Outside diameter	125 (4.92)	0 (0) -0.020 (-0.0008)	-0.012 (-0.0005) -0.052 (-0.0020)	
		Inside diameter	80 (3.15)	+0.051 (+0.0020) +0.032 (+0.0013)	0 (0) -0.015 (-0.0006)	
8	Backlash between PTO drive gear and PTO idler gear		0.192 – 0.492 (0.0076 – 0.0194)			
9	Backlash between input transfer drive gear and driven gear		0.190 – 0.486 (0.0075 – 0.0191)			
10	Clearance between cage and case of input transfer drive gear		Standard Clearance: 0.40 – 1.60 (0.016 – 0.063) (Standard shim thickness: 1.0 (0.039))	Clearance Limit: —		
11	Clearance between cage and case of input transfer driven gear		0.60 – 1.80 (0.024 – 0.071) (Standard shim thickness: 1.0 (0.039))	—		

1. Transmission input shaft
2. Tie bolt
3. R ring gear (Hub)
4. R planetary pinion (Number of teeth: 24)
5. R ring gear (Number of teeth: 70)
6. F planetary pinion (Number of teeth: 23)
7. F ring gear (Number of inside teeth: 75)
8. 4th ring gear (Number of inside teeth: 73)
9. 4th planetary pinion (Number of teeth: 28)
10. 3rd planetary pinion (Number of teeth: 20)
11. 3rd ring gear (Number of inside teeth: 76)
12. 2nd ring gear (Number of teeth: 76)
13. 2nd planetary pinion (Number of teeth: 20)
14. 1st hub
15. Transmission output shaft (4th sun gear) (Number of teeth: 17)
16. Transfer input gear (Number of teeth: 50)
17. 2nd sun gear (Number of teeth: 36)
18. 1st clutch housing
19. 1st clutch piston
20. 2nd carrier
21. 3rd sun gear (Number of teeth: 36)
22. 1st piston return spring
23. 2nd clutch housing
24. 2nd piston return spring
25. 2nd clutch piston
26. 2nd clutch housing
27. 3rd and 4th carriers
28. 3rd piston return spring
29. 3rd clutch piston
30. 3rd and 4th clutch housings
31. 4th clutch piston
32. 4th piston return spring
33. F and 4th clutch cages
34. F piston return spring
35. F sun gear (Number of teeth: 29)
36. F carrier
37. F clutch piston
38. R and F clutch housings
39. R clutch piston
40. Washer spring
41. R piston return spring
42. R carrier
43. Clutch disc
44. Clutch plate
45. R clutch cage
46. R sun gear (Number of teeth: 22)

★ R ring gear (7) of R clutch and 1st hub (16) of 1st clutch are fixed hydraulically.

The power from torque converter

↓

Input shaft (1)

↓

R sun gear (5)

↓

R planetary pinion (6)

↓

R ring gear (9)
(R carrier (8) is fixed with R ring gear (7) = R ring gear (9) rotation direction is opposite to input shaft (1))

↓

F carrier (10)

↓

3rd and 4th carrier (11)

↓

3rd planetary pinion (12) → →

↓ ↓

3rd ring gear (13) 3rd sun gear (20)

↓

2nd carrier (14)

↓

1st clutch housing (15) ↓

↓

1st hub (16)

↓

Output shaft (23) ← ←

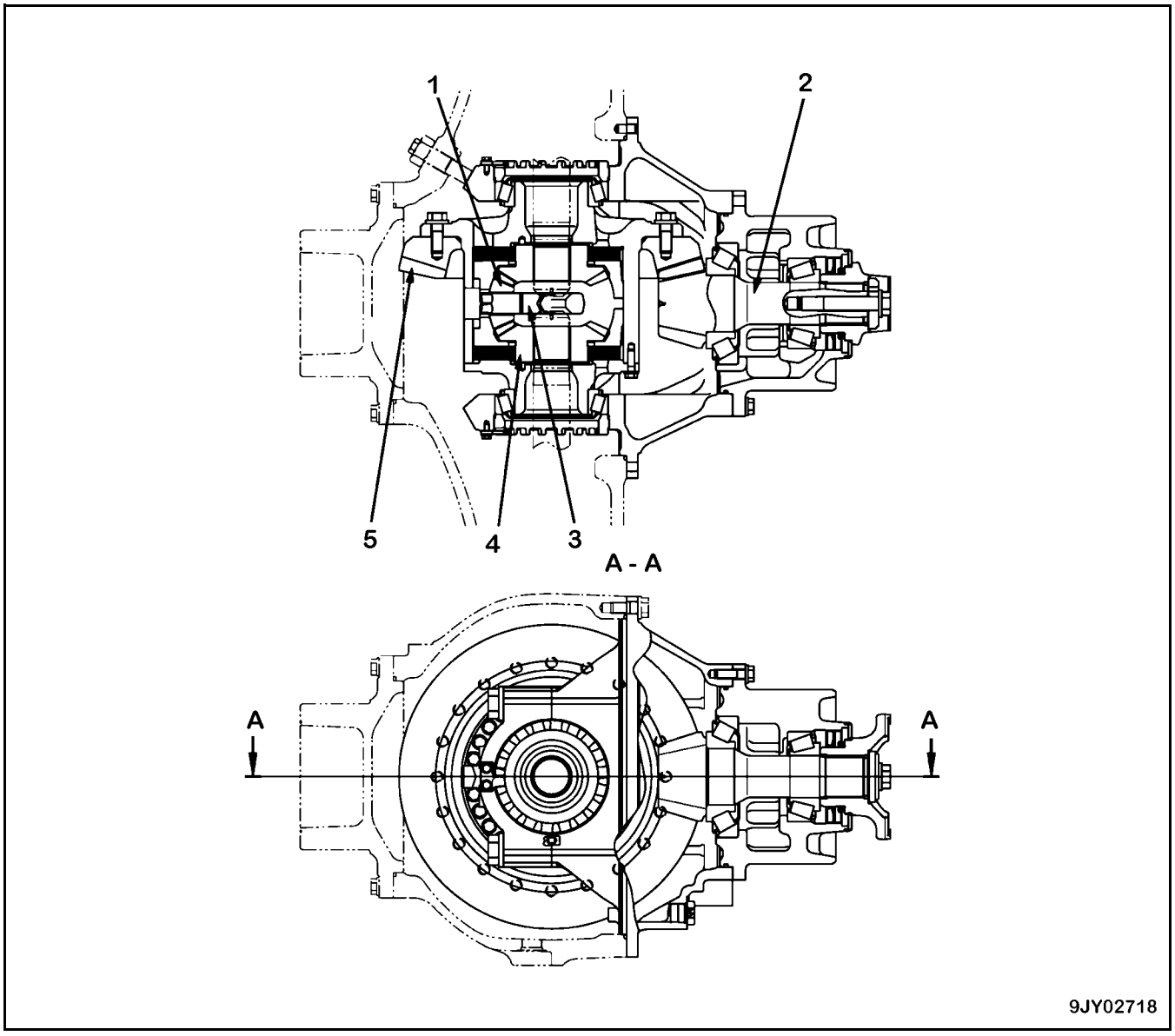
Unit: mm (in)

No.	Check Item	Criteria					Remedy
1	Clearance between main relief valve and valve body	Standard Size	Tolerance		Standard Clearance	Clearance Limit	Replace
			Shaft	Hole			
		28 (1.10)	-0.035 (-0.0014) -0.045 (-0.0018)	+0.013 (+0.0005) 0 (0)	0.035 – 0.058 (0.0014 – 0.0023)	0.078 (0.0031)	
2	Clearance between torque converter relief valve and valve body	22 (0.87)	-0.035 (-0.0014) -0.045 (-0.0018)	+0.013 (+0.0005) 0 (0)	0.035 – 0.058 (0.0014 – 0.0023)	0.078 (0.0031)	
3	Main relief valve spring (Outside)	Standard Size			Repair Limit		
		Free Length	Installed Length	Installed Load	Free Length	Installed Load	
		128 (5.04)	78.3 (3.08)	479.1 N (107.71 lbf)	124.2 (4.89)	456 N (102.51 lbf)	
4	Main relief valve spring (Inside)	108 (4.25)	78.3 (3.08)	365.5 N (82.17 lbf)	104.8 (4.13)	347 N (78.01 lbf)	
5	Torque converter relief valve spring	50 (1.97)	43 (1.69)	134.3 N (30.19 lbf)	48.5 (1.91)	127 N (28.55 lbf)	

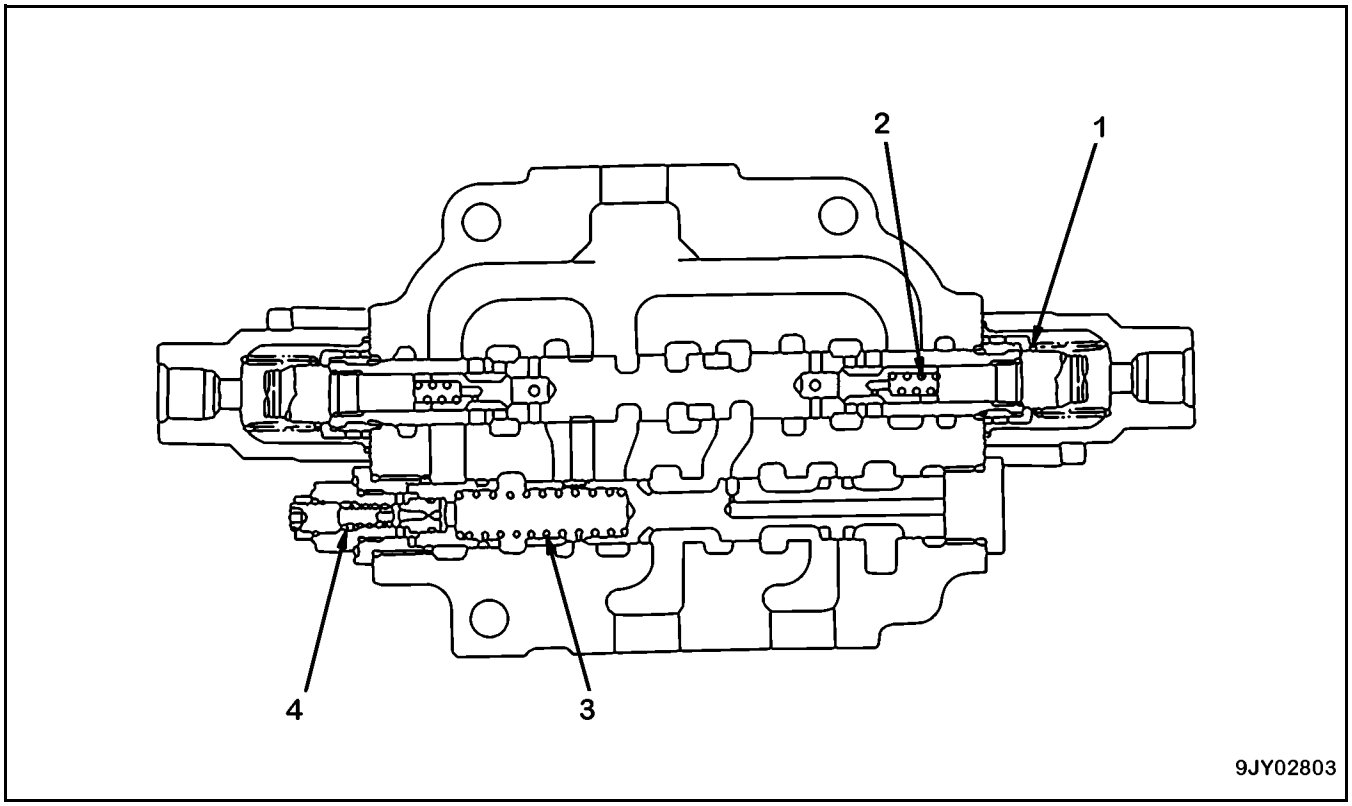
Torque Values

Designation	N•m	lbf ft	lbf in
AA	9.8 – 12.74	–	87 – 113
BB	44.1– 53.9	33 – 40	–

Rear Differential (with Limited Slip Differential)



1. Pinion gear (Number of teeth: 12)
2. Bevel pinion (Number of teeth: 9)
3. Shaft
4. Side gear (Number of teeth: 24)
5. Bevel gear (Number of teeth: 38)

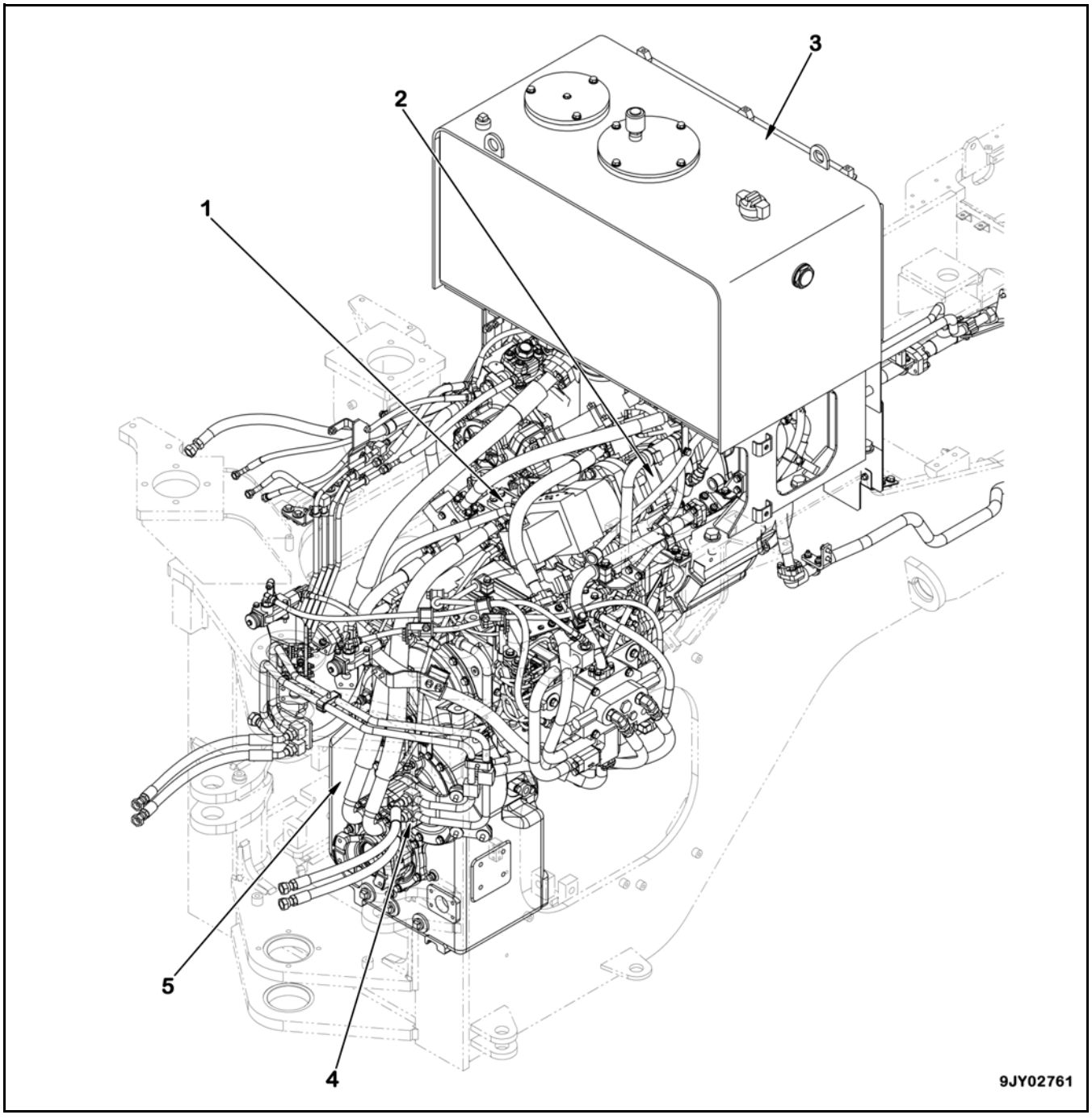


Unit: mm (in)

No	Check Item	Criteria					Remedy
		Standard Size			Repair Limit		
		Free Length	Installed Length	Installed Load	Free Length	Allowable Load	
1	Steering spool return spring	37.2 (1.46)	32.0 (1.26)	56.9 N (12.79 lbf)	—	45.1 N (10.14 lbf)	Replace
2	Load check valve spring	20.9 (0.82)	18.3 (0.72)	2.9 N (0.65 lbf)	—	2.5 N (0.56 lbf)	
3	Unload spool return spring	69.7 (2.74)	68.5 (2.70)	147.1 N (33.07 lbf)	—	120.6 N (27.11 lbf)	
4	Relief valve spring	24.0 (0.94)	22.19 (0.87)	182.4 N (41.01 lbf)	—	145.1 N (32.62 lbf)	

Emergency Steering (if equipped)

Piping Diagram

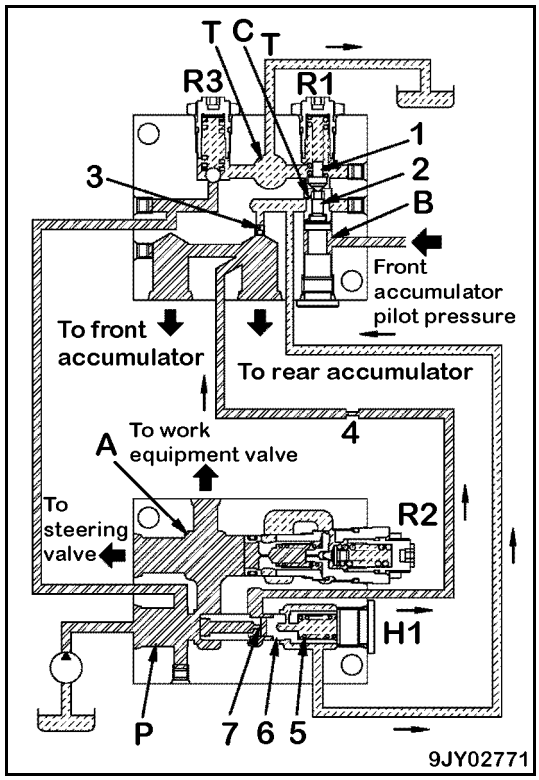


1. Diverter valve
2. Steering pump
3. Hydraulic tank
4. Emergency steering pump
5. Transmission

Operation

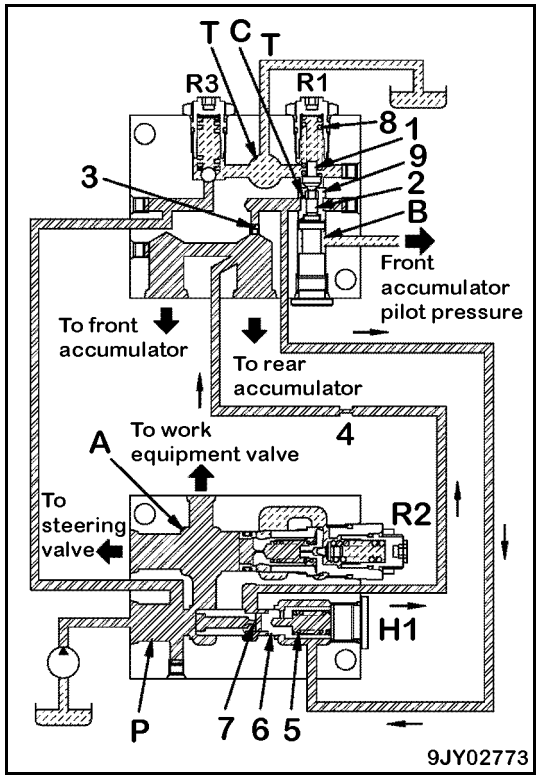
★ When oil is not supplied to accumulator (Cutout state)

- Since the pressure at port (B) is higher than the set pressure of relief valve (R1), piston (2) is forced to move upward by the hydraulic pressure of port (B). As this move opens poppet (1), port (C) and port (T) are connected.
- As the right-most spring chamber of spool (6) leads to port (C) of relief valve (R1), tank pressure prevails.
- Oil from the pump enters port (P) and pushes spool (6) to the right with a low pressure equivalent to the load of spring (5), and then flows from port (A) to the steering valve and the work equipment valve.
- At the same time, it flows to the tank through orifices (7), (4), and (3).



★ When oil is supplied to accumulator

1. Cut-in state
   - If the pressure at port (B) drops below the set pressure of relief valve (R1), piston (2) is returned downward by the tension of spring (8). This causes valve seat (9) to closely contact poppet (1) to disconnect port (C) from port (T).
   - The right-hand side spring chamber of spool (6) also gets shuttered off from port (T) to increase pressure, leading pressure at port (P) to rise as well.
   - When pressure at port (P) exceeds the pressure at port (B) (accumulator pressure), oil supply to the accumulator starts. This timing is determined by the area size of orifice (7) and the pressure differential before and after (equivalent to the load of spring (5)). A fixed amount of oil is supplied regardless of the engine speed; the remaining amount flows to port (A).



Unit: mm (in)

No.	Check Item	Criteria					Remedy
1	Clearance between hole and shaft on front support side (after press-fitting of bushing)	Standard Size	Tolerance		Standard Clearance	Clearance Limit	Replace (Bushing is adhered to support on both front and rear.)
			Shaft	Hole			
		310 (12.20)	-0.056 (-0.002) -0.137 (-0.005)	+0.489 (+0.019) 0 (0)	0.056 – 0.626 (0.002 –0.025)	1.6 (0.063)	
2	Clearance between hole and shaft on front support side (before press-fitting of bushing)	320.2 (12.61)	+2.300 (+0.091) +0.800 (+0.031)	+0.089 (+0.0035) 0 (0)	—	—	
3	Clearance between hole and shaft on rear support side (after press-fitting of bushing)	260 (10.24)	-0.056 (-0.002) -0.137 (-0.005)	+0.481 (+0.0189) -0.008 (-0.0003)	0.048 –0.618 (0.0019 – 0.0243)	1.6 (0.063)	
4	Clearance between hole and shaft on rear support side (before press-fitting of bushing)	270.2 (10.64)	+2.300 (+0.091) +0.800 (+0.031)	+0.089 (+0.0035) 0 (0)	—	—	
5	Thickness of thrust plate	Standard Size	Tolerance		Repair Limit		Replace
		22 (0.87)	-0.10 (-0.004) -0.25 (-0.010)		—		
6	Thickness of thrust washer	5 (0.20)	+0.1 (+0.004) -0.3 (-0.012)		—		
7	Thickness of rear bushing	5 (0.20)	±0.1 (±0.004)		—		
8	Thickness of front bushing	5 (0.20)	±0.1 (±0.004)		—		

Torque Values

Designation	N•m	lbf ft
A	1519 – 1911	1120 – 1409
B	245 – 309	181 – 228

LS Valve

PA. Pump pressure input

PE. Control piston pressure

PLS. LS pressure input

PPL. CO valve output pressure

PPLS. LS pump pressure input

CO Valve

PA. Pump pressure input

PPL. CO valve output pressure

T. Drain

Torque Values

Designation	N•m	lbf ft
DD	27.4 – 34.3	20 – 25
EE	29.4 – 39.2	22 – 29

Action of Spring

- The load of spring (4) at the PC valve is determined by the position of the swash plate.
- The spring load changes as servo piston (9) makes spring (4) elongate or contract.
- If the command current (X) to PC-EPC valve solenoid (1) changes, so does the force pushing piston (2).
- The load of spring (4) also changes according to the PC-EPC valve solenoid command current (X).
- Port (C) of the PC valve is connected to port (E) of the LS valve.
- Self-pressure (PP1) enters port (B) and the small diameter end of servo piston (9); other pump pressure (PP2) enters port (A).
- When pump pressures (PP1) and (PP2) are small, spool (3) is positioned in the left side.
- Ports (C) and (D) are connected; the pressure entering the LS valve becomes drain pressure (PT).
- If port (E) and port (G) of the LS valve are connected, the pressure entering the large diameter end of the piston from port (J) becomes drain pressure (PT), and servo piston (9) moves to the left side.
- The pump delivery is set to the increasing trend.
- Spring (4) extends as servo piston (9) moves and weakens the spring force.
- As the spring force is weakened, spool (3) moves to the right; the connection between port (C) and port (D) is shut off; and the pump discharge pressure ports (B) and (C) are connected.
- The pressure on port (C) rises and the pressure on the large diameter end of the piston also rises. Thus, the leftward move of servo piston (9) is stopped.
- Stop position of servo piston (9) (= pump delivery) is determined by a position where the press force generated by pressures (PP1) and (PP2) on spool (3) and the other press force by the PC-EPC valve solenoid are balanced with the force of spring (4).

Lift Arm Hi and Bucket Hi Valves

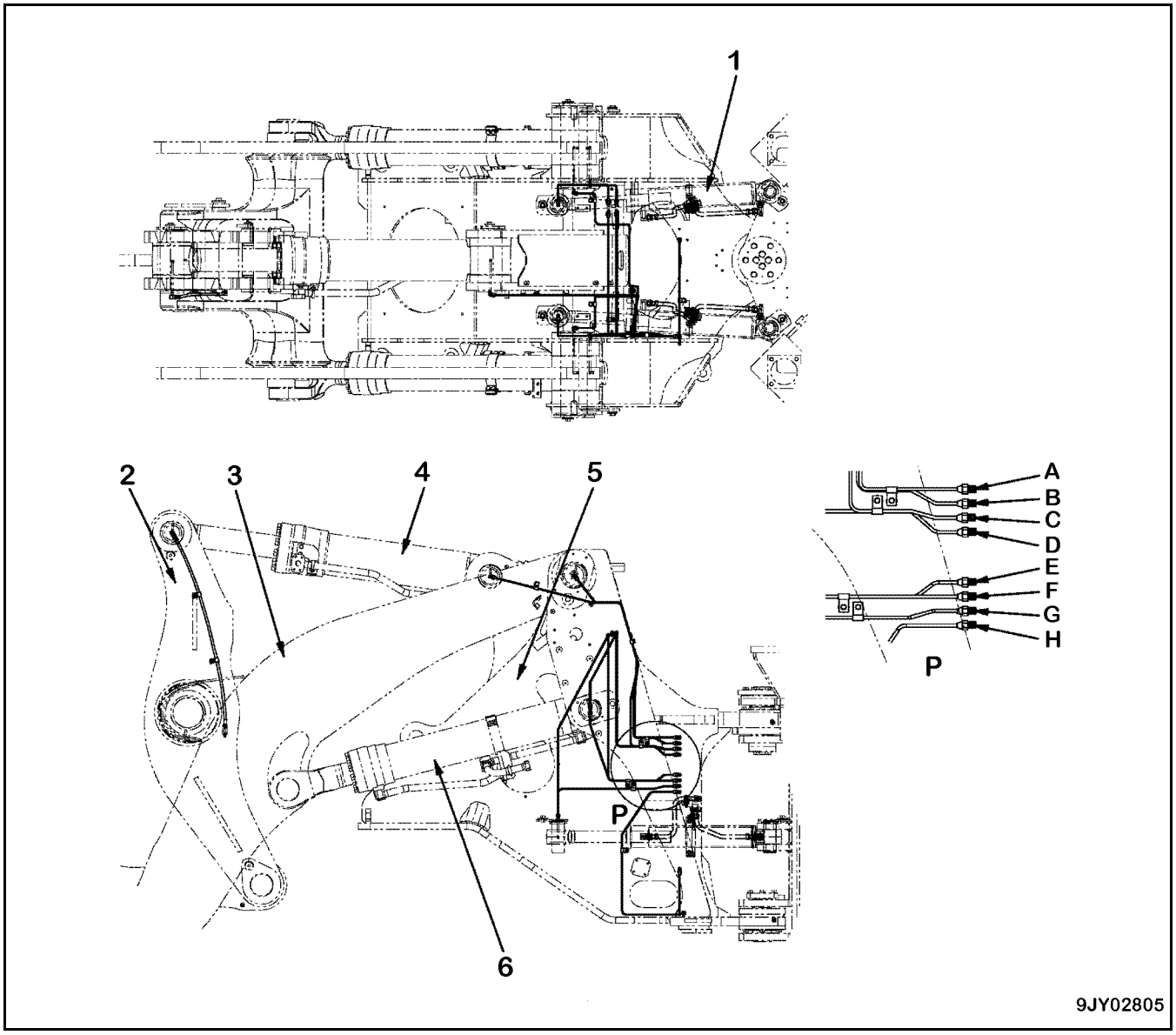
1. Load check valve (Lift arm Hi)
2. Spool (Lift arm Hi)
3. Load check valve (Bucket Hi)
4. Spool (Bucket Hi)
5. Suction valve (Bucket Hi)
6. Unload valve
7. Main relief valve
8. LS bypass valve

Torque Values

Designation	N•m	lbf ft
AA	19.6 – 24.5	15 – 18
BB	147.1 – 186.3	109 – 137
CC	65.7– 85.3	49 – 63
DD	49 – 58.5	36 – 43
EE	34.3 – 44.1	25 – 33

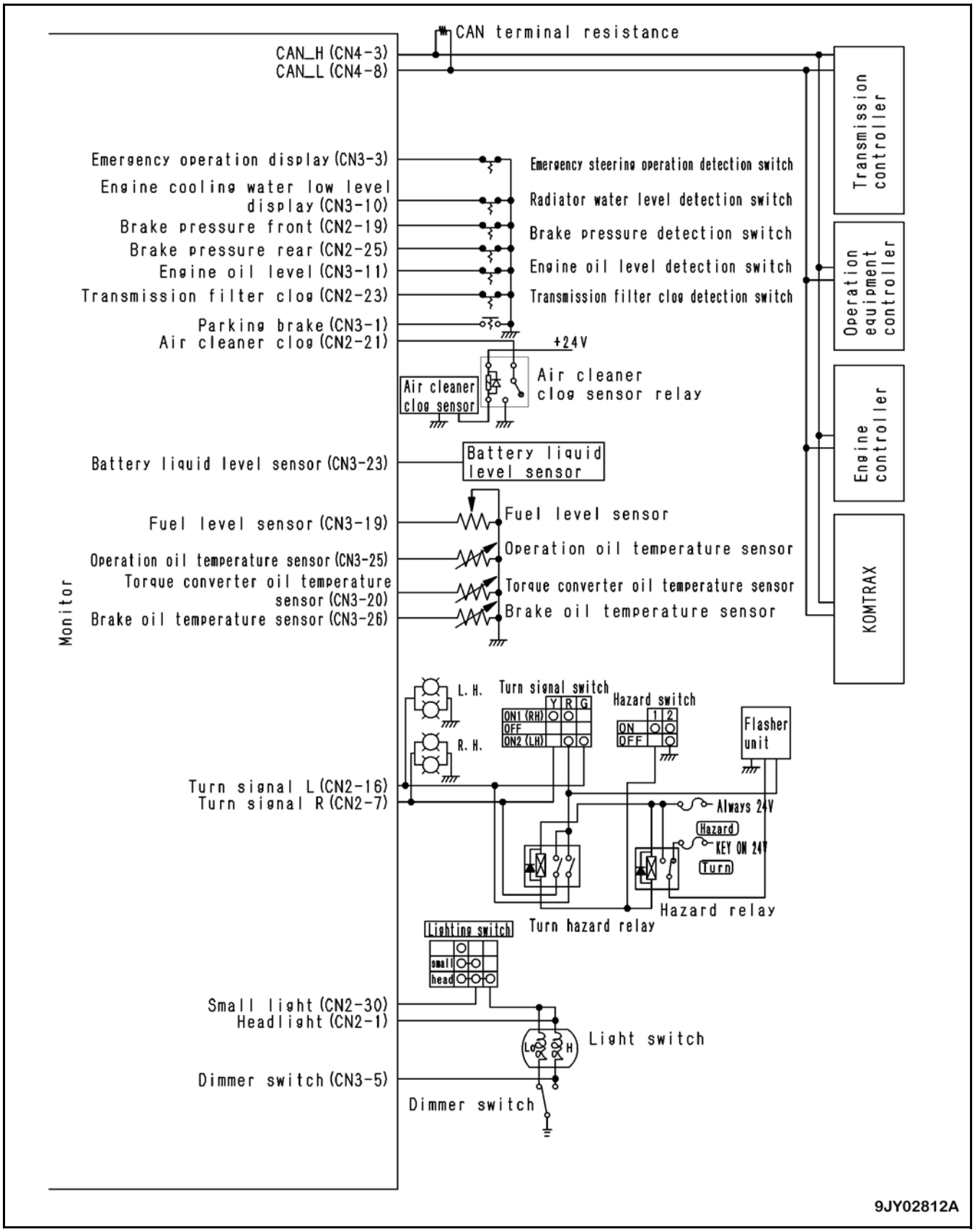
MEMORANDUM

Work Equipment Lubrication



1. Steering cylinder
2. Bell crank
3. Lift arm
4. Bucket cylinder
5. Front frame
6. Lift cylinder
7. Rear frame

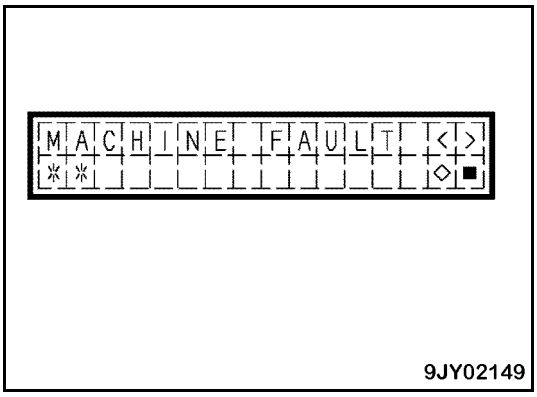
A. Lift cylinder pin left
B. Lift cylinder pin right
C. Bucket cylinder (bottom side)
D. Lift cylinder (bottom side) right
E. Lift cylinder (bottom side) left
F. Steering cylinder (rod side) right
G. Steering cylinder (rod side) left
H. Center support


CAN terminal resistance
CAN_H (CN4-3)
CAN_L (CN4-8)
Transmission controller
Operation equipment controller
Engine controller
KOMTRAX
Emergency operation display (CN3-3)
Emergency steering operation detection switch
Engine cooling water low level display (CN3-10)
Radiator water level detection switch
Brake pressure front (CN2-19)
Brake pressure detection switch
Brake pressure rear (CN2-25)
Engine oil level (CN3-11)
Engine oil level detection switch
Transmission filter clog (CN2-23)
Transmission filter clog detection switch
Parking brake (CN3-1)
Air cleaner clog (CN2-21)
+24V
Air cleaner clog sensor
Air cleaner clog sensor relay
Battery liquid level sensor (CN3-23)
Battery liquid level sensor
Fuel level sensor (CN3-19)
Fuel level sensor
Operation oil temperature sensor (CN3-25)
Operation oil temperature sensor
Torque converter oil temperature sensor (CN3-20)
Torque converter oil temperature sensor
Brake oil temperature sensor (CN3-26)
Brake oil temperature sensor
Monitor
L. H.
R. H.
Turn signal switch
Y R G
ON1 (RH)
OFF
ON2 (LH)
Hazard switch
1 2
ON
OFF
Flasher unit
Turn signal L (CN2-16)
Turn signal R (CN2-7)
Always 24V
Hazard
KEY ON 24V
Turn
Hazard relay
Turn hazard relay
Lighting switch
small
head
Small light (CN2-30)
Headlight (CN2-1)
Lo
H
Light switch
Dimmer switch (CN3-5)
Dimmer switch
9JY02812A

Mechanical System Failure History Display Function (MACHINE FAULT)

The ** field displays the total number of the failure history currently recorded (maximum of 20 histories can be stored).

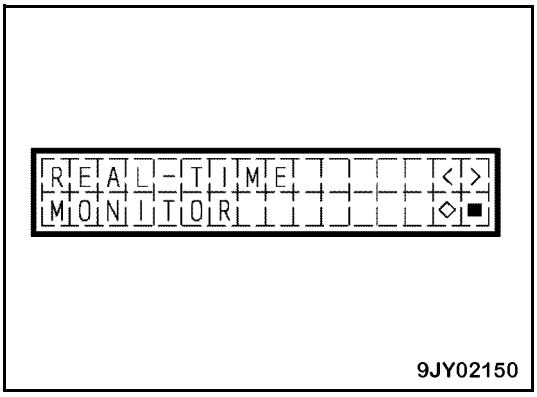
- This function is used to check the mechanical system failure history of each controller saved in the machine monitor.
- For the failure codes displayed in the mechanical system failure history, see the *Troubleshooting* section.
- For the operating procedure for this function, see *MACHINE MONITOR SYSTEM: Normal and Special Functions of Machine Monitor* in the *Testing and Adjusting* section.



9JY02149

Real-Time Monitoring Function (REAL-TIME MONITOR)

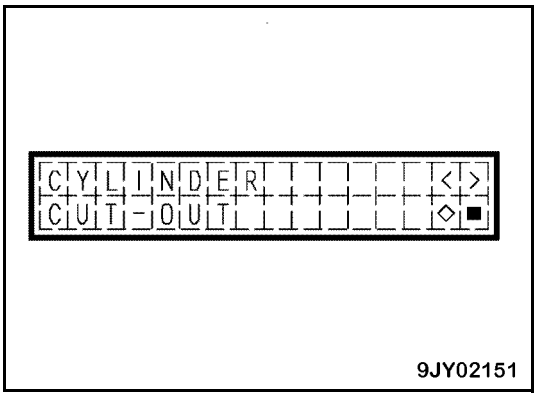
- This function is used to check the input and output signals, etc. recognized by each controller on the network.
- For the operating procedure for this function, see *MACHINE MONITOR SYSTEM: Normal and Special Functions of Machine Monitor* in the *Testing and Adjusting* section.



9JY02150

Engine Reduced-Cylinder Function (CYLINDER CUT-OUT)

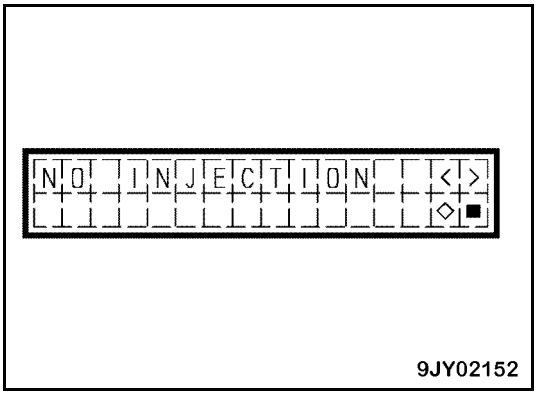
- This function is used to stop fuel injection to each cylinder from the fuel injector in order to determine the cylinder with defective combustion.
- For the operating procedure for this function, see *MACHINE MONITOR SYSTEM: Normal and Special Functions of Machine Monitor* in the *Testing and Adjusting* section.



9JY02151

No Injection Cranking Function (NO INJECTION)

- This function is used when lubricating the engine, with the engine stopped, when restarting the engine after long-term storage of the machine.
- For the operating procedure for this function, see *MACHINE MONITOR SYSTEM: Normal and Special Functions of Machine Monitor* in the *Testing and Adjusting* section.



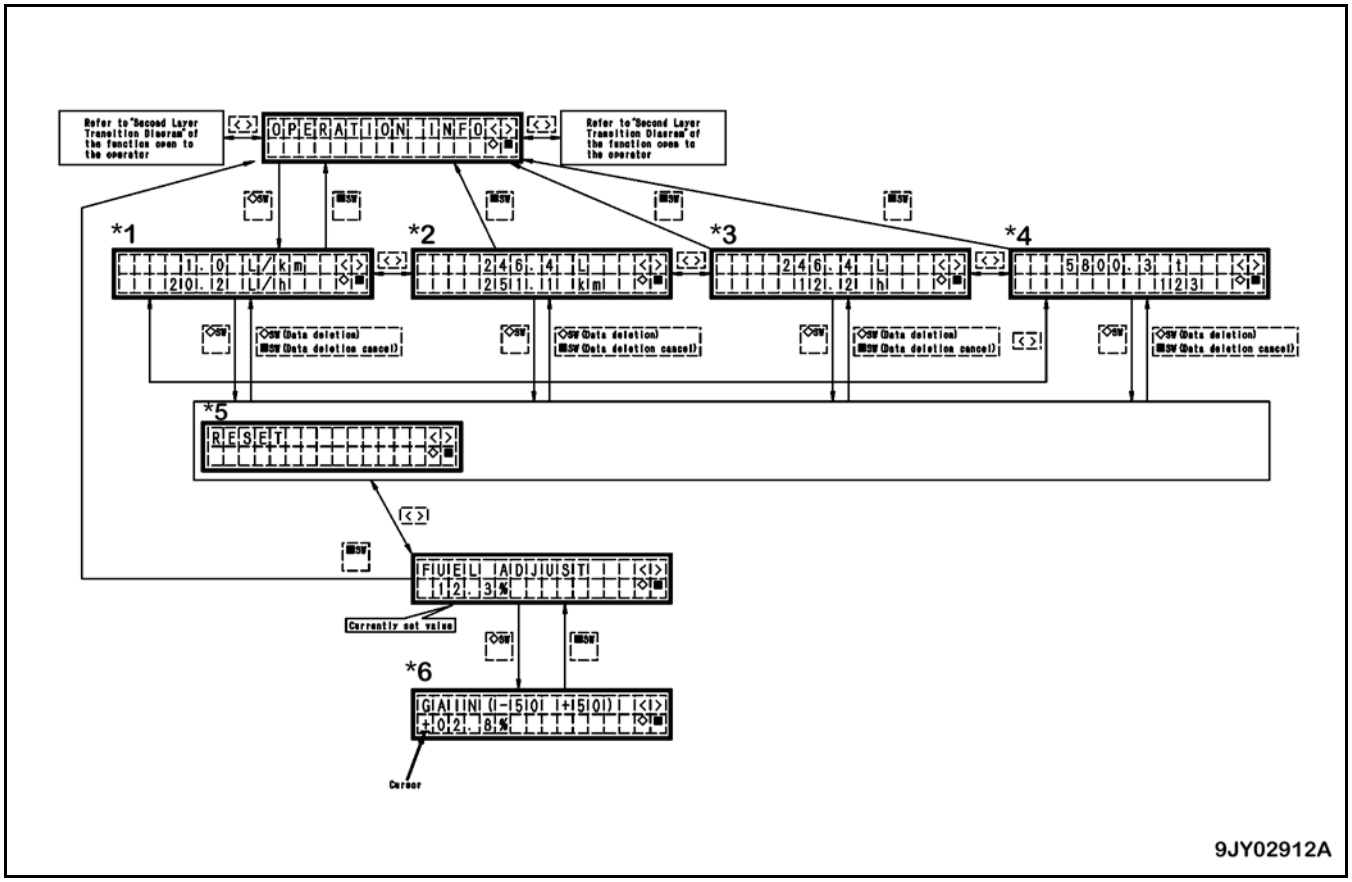
9JY02152

Operating Information Display Function

Outline

- The value of fuel consumption is obtained by adding the target injection amount sent from the engine controller.

  ★ This is not a measured but a calculated fuel consumption. Use it as a rough standard.



*1: The upper column displays fuel consumption [L/km or L/mile] per 1 km (or 1 mile) from the last reset.

- It is calculated from the fuel consumption and travel distance above.
- The unit km or mile is selected depending on that used on the odometer.
- Counting is stopped at 99999.9, the upper limit.

The lower column displays the average fuel consumption [L/h] from the last reset.

- Counting is stopped at 99999.9, the upper limit.

*2: The upper column displays the cumulative fuel consumption [L] from the last reset.

- Counting is stopped at 9999999.9, the upper limit.

The lower column displays the travel distance [km or mile] from the last reset.

- The unit km or mile is selected depending on that used on the odometer.
- Counting is stopped at 9999999.9, the upper limit.

*3: The upper column displays the cumulative fuel consumption [L] from the last reset.

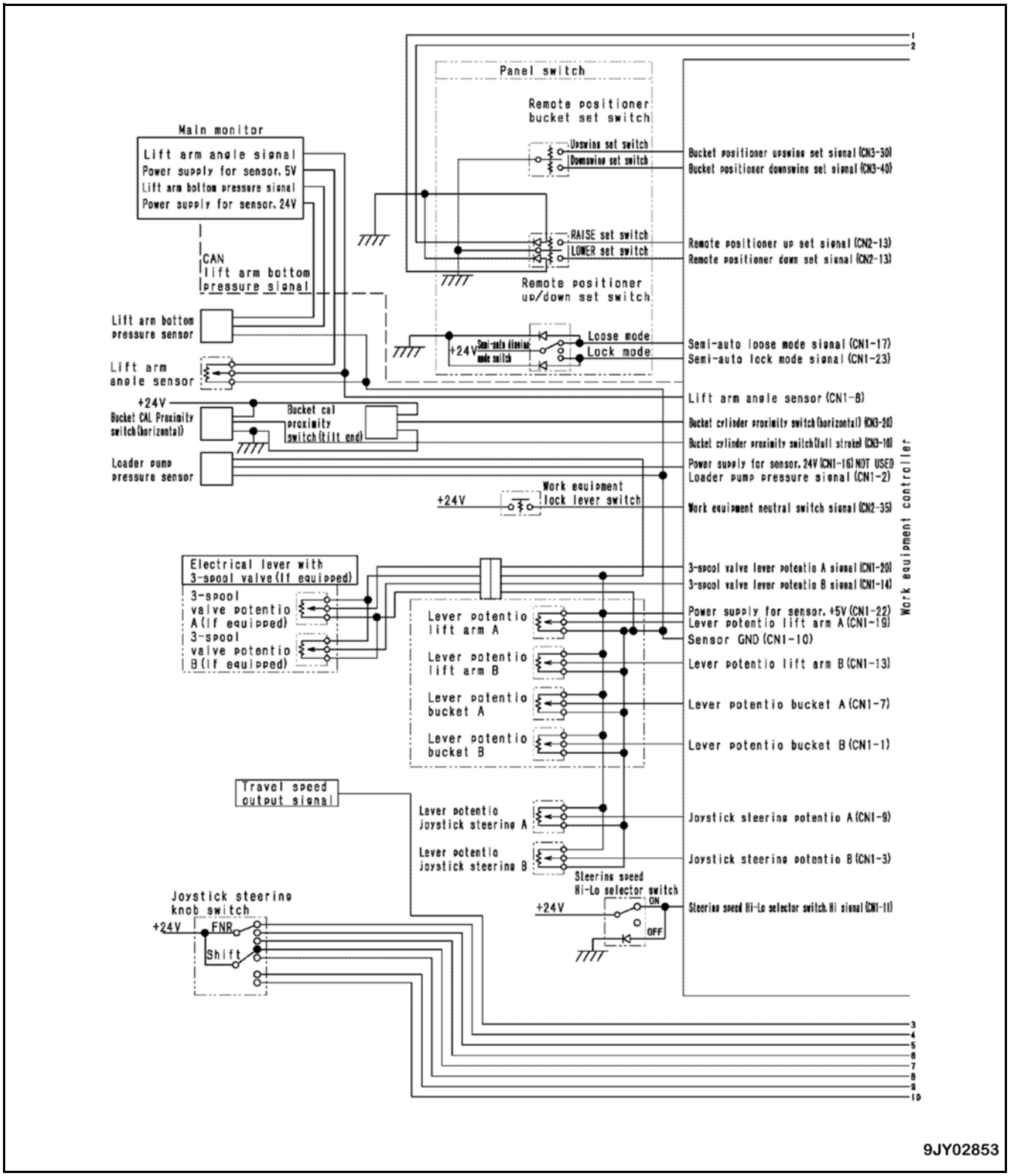
- Counting is stopped at 9999999.9, the upper limit.

The lower column displays the elapsed time [h] from the last reset.

- Counting is stopped at 9999999.9, the upper limit.

Work Equipment Control System

Work Equipment Controller

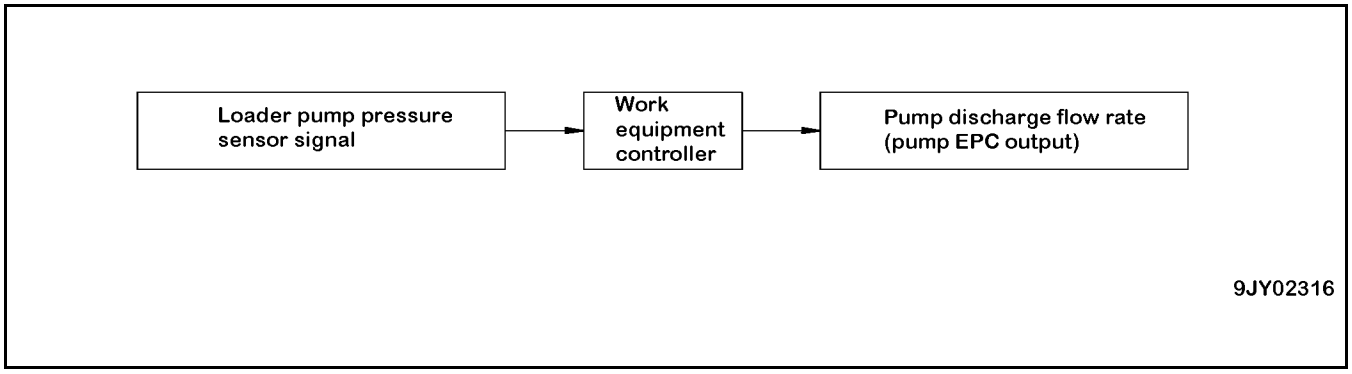


Pump Swash Plate Control

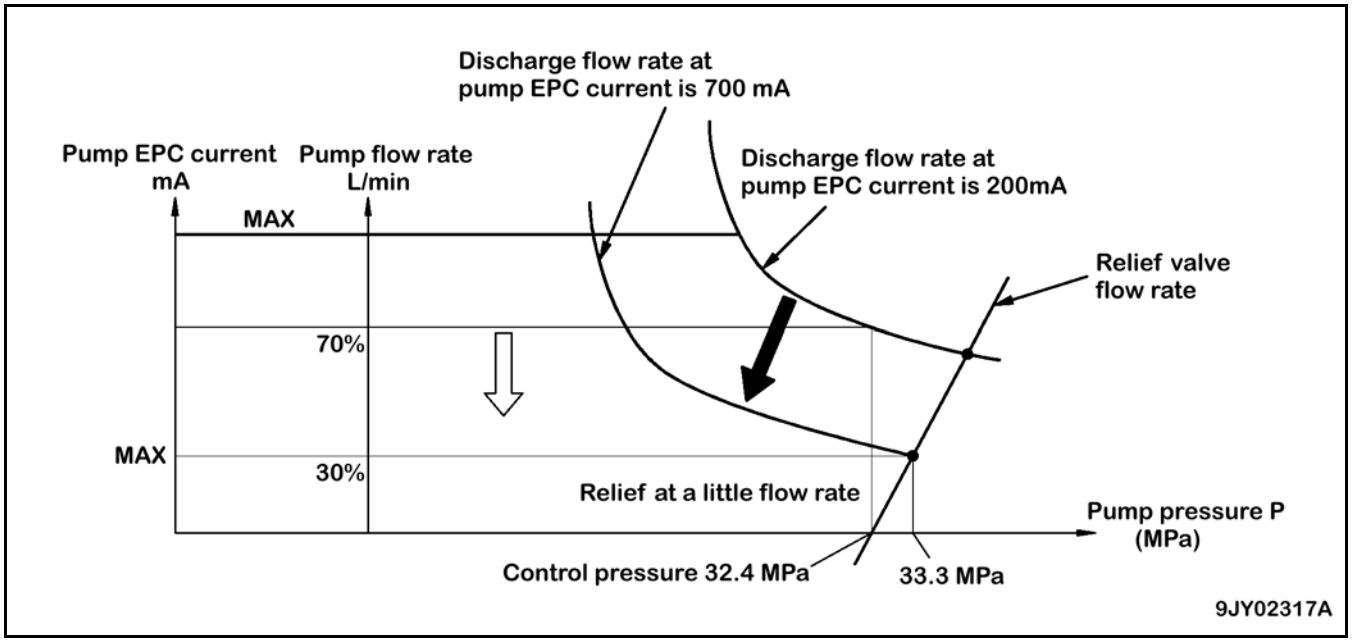
In pump swash plate control, “horsepower loss decrease function in pump relief” and “pickup auxiliary function when engine speed is low” are included. Based on calculation results of each function, data with less pump delivery (larger pump EPC current) will be selected.

★ Horsepower loss decrease function in pump relief

- Horsepower loss is decreased by controlling pump delivery in relief, changing the command value of the pump swash plate, when the work equipment pump is relieved.
- Output to pump EPC is changed with the input signal of the loader pump pressure sensor.



- The work equipment controller operates pump EPC in 200 mA until loader pump pressure reaches 326.31 kg/cm² (4641 psi). When it becomes 336.51 kg/cm² (4786 psi) or higher, the controller operates pump EPC in 700 mA.



Auto-Shift Points Table

The relationship among transmission output shaft speed, engine mode, shift switch, and gearshifting operation are shown in the following table.

Unit: rpm

		Engine Mode and Shift Switch			
		Power Mode		Economy Mode	
		Shift Switch H	Shift Switch L	Shift Switch H	Shift Switch L
Gearshifting operation	F1 → F2	395	395	362	362
	F2 → F2 (lockup)	560 – 660	560 – 660	540 – 632	540 – 632
	F2 → F2 (lockup) when hunting is prevented	692 – 824	692 – 824	659 – 744	659 – 744
	F2 → F3	632 – 922	501 – 922	573 – 896	481 – 896
	F2 → F3 when hunting is prevented	698 – 903	698 – 903	639 – 876	639 – 876
	F3 → F3 (lockup)	942 – 1120	942 – 1120	909 – 1054	909 – 1054
	F3 → F4	1166 – 1502	1120 – 1502	1080 – 1430	1034 – 1430
	F4 → F4 (lockup)	1614	1614	1548	1548
	F4 (lockup) → F4	1436	1436	1370	1370
	F4 → F3	1034 – 1436	988 – 1436	949 – 1370	903 – 1370
	F3 (lockup) → F3	850	850	817	817
	F3 → F2	501 – 850	329 – 850	441 – 817	270 – 817
	F3 → F2 when hunting is prevented	501 – 725	329 – 725	441 – 679	270 – 679
	F2 (lockup) → F2	514	514	494	494

★ The transmission output shaft speed of 1 rpm corresponds to 0.0145 km/h (0.009 mph).

★ The shifting down point of F4 → F2 and F3 → F2 is 66 rpm when the accelerator is idle.

Interlocking at Starting Engine (engine start inhibited)

- To prevent the machine from starting travel suddenly upon engine start, the starting motor C terminal signal is cut by actuating the neutral safety relay through the work equipment controller in case the joystick validity switch is at the ON position, the joystick lock lever is in the open state, and the joystick FNR switch is at other than the N (neutral) position. The starting motor signal is cut if the joystick indicator is in the flashing state.

- In case the joystick lever is operated when the joystick is in a valid state, the work equipment controller sends engine start inhibit information to actuate the neutral safety relay and cut the starting motor C terminal signal.

Joystick Setting

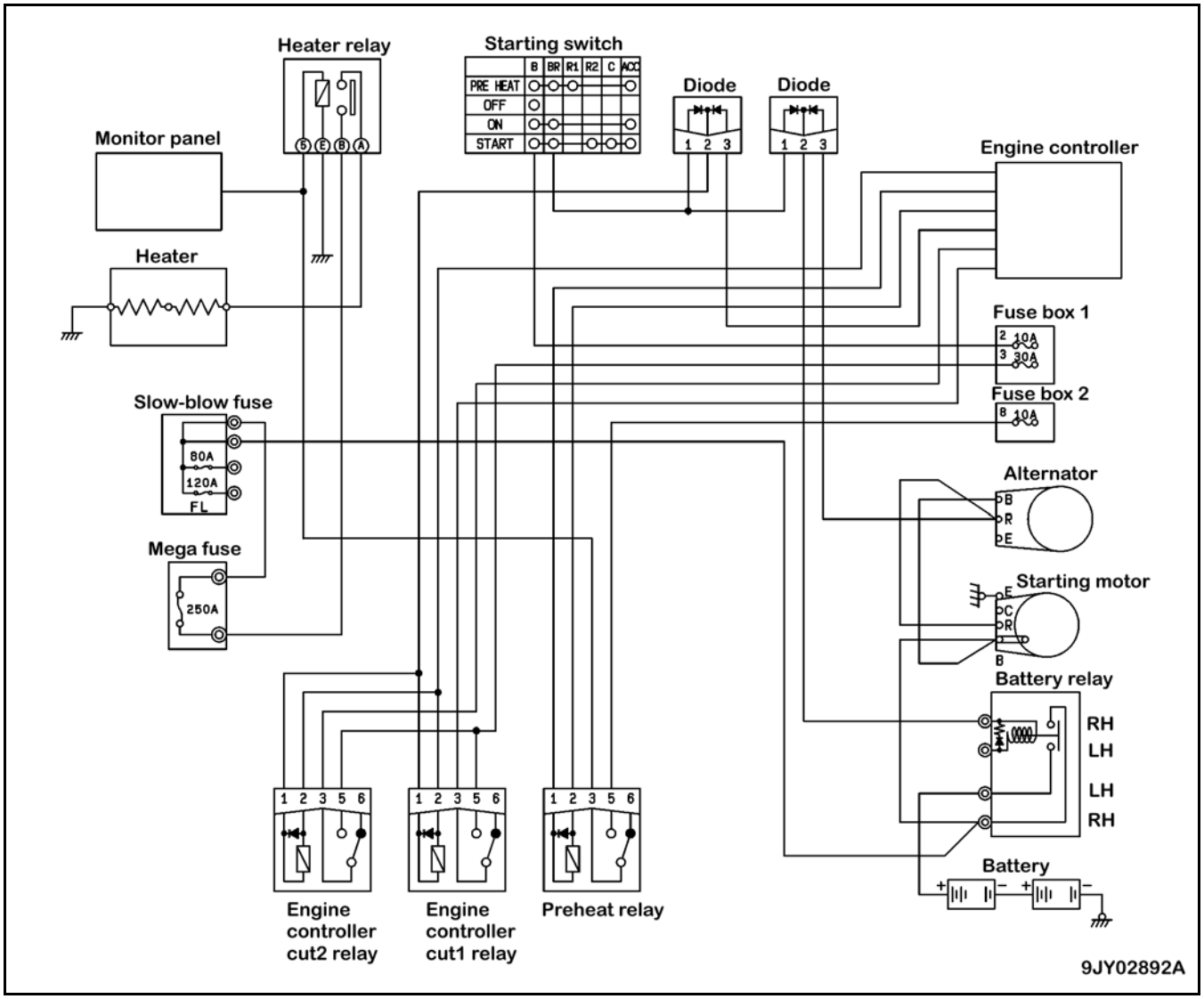
- Since the joystick is optional equipment, it does not work unless the joystick option setting is selected in the optional setting on the machine monitor.

- The joystick cannot be simultaneously installed with the right FNR switch.

★ For information about setting this option, see the Optional Device Installation Setting table in *MACHINE MONITOR SYSTEM: Service Mode: Optional Device Setting Function (OPTIONAL SELECT)* in the *Testing and Adjusting* section.

Preheating Circuit

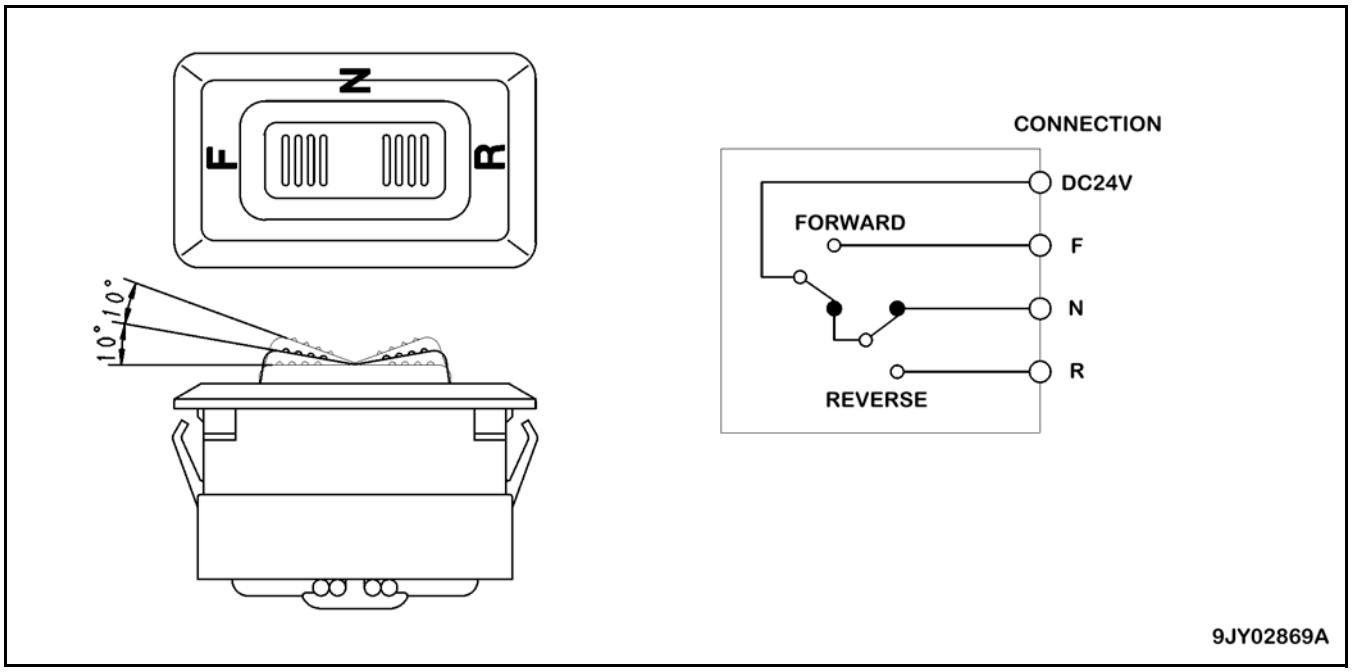
★ Automatic preheating system



Outline

- The automatic preheating system is installed so that the engine will start easily in a cold district. This system reduces and sets the preheating time according to the engine coolant temperature when the starting switch is operated.
- When the starting switch is set in the ON position, the current flows to the electrical intake air heater to preheat the intake air.
- The engine controller determines the preheating time according to the coolant temperature detected by the engine coolant temperature sensor.
- The preheater pilot lamp, on the main monitor, lights up during preheating. When the preheating is completed, the preheater pilot lamp goes out.

Right FNR Switch (if equipped)



Function

- The directional switch is held at a selected position.
- The transmission controller shifts gear according to the signal from the directional switch.

Standard Service Value Table for Chassis

Machine Model					WA500-6	
Category	Item		Measurement Conditions	Unit	Standard Value for New Machine	Service Limit Value
Directional lever	Operating effort	N → FORWARD, REVERSE	• Engine stopped • Measure at center of lever knob	N (lbf)	5.9 ±2.9 (1.33 ±0.65)	5.9 ±2.9 (1.33 ±0.65)
		FORWARD, REVERSE → N			5.9 ±2.9 (1.33 ±0.65)	5.9 ±2.9 (1.33 ±0.65)
Gearshift lever	Operating effort	1st → 2nd	• Engine stopped • Measure at center of lever knob	N (lbf)	5.9 ±2.9 (1.33 ±0.65)	5.9 ±2.9 (1.33 ±0.65)
		2nd → 3rd			5.9 ±2.9 (1.33 ±0.65)	5.9 ±2.9 (1.33 ±0.65)
		3rd → 4th			5.9 ±2.9 (1.33 ±0.65)	5.9 ±2.9 (1.33 ±0.65)
	Stroke	4th → 3rd			5.9 ±2.9 (1.33 ±0.65)	5.9 ±2.9 (1.33 ±0.65)
		3rd → 2nd			5.9 ±2.9 (1.33 ±0.65)	5.9 ±2.9 (1.33 ±0.65)
		2nd → 1st			5.9 ±2.9 (1.33 ±0.65)	5.9 ±2.9 (1.33 ±0.65)
Work equipment control lever	Operating effort	Lift arm: HOLD → RAISE (*2)	• Engine speed: Low idle (*1) • Hydraulic oil temperature: Within operating range	N (lbf)	Max. 10.8 (Max. 2.43)	Max. 16.2 (Max. 3.64)
		Lift arm: RAISE → HOLD			Max. 15.2 (Max. 3.42)	Max. 22.9 (Max. 5.15)
		Lift arm: HOLD → LOWER (*2)			Max. 10.8 (Max. 2.43)	Max. 16.2 (Max. 3.64)
		Lift arm: LOWER → HOLD			—	—
		Lift arm: LOWER → FLOAT			Max. 18.6 (Max. 4.18)	Max. 28.4 (Max. 6.38)
		Lift arm: FLOAT → HOLD			Max. 10.8 (Max. 2.43)	Max. 16.2 (Max. 3.64)
		Bucket: HOLD → DUMP			Max. 10.8 (Max. 2.43)	Max. 16.2 (Max. 3.64)
		Bucket: HOLD → TILT (*2)			Max. 10.8 (Max. 2.43)	Max. 16.2 (Max. 3.64)
		Bucket: TILT → HOLD			Max. 10.8 (Max. 2.43)	Max. 16.2 (Max. 3.64)

E. Set the transmission auto-shift and manual shift selector switch in the MANUAL position.

F. Set the gearshift lever to the 4th speed while keeping the directional lever, joystick steering directional switch, or right directional switch at the N (Neutral) position.

G. Release the parking brake.

H. While pressing the brake pedal, set the directional lever, joystick steering directional switch, or right directional switch to the F (forward) or R (reverse) position.

WARNING! Keep pressing the brake pedal securely

I. While running the engine at high idle, stall the torque converter and relieve the lift arm cylinder or bucket cylinder on the extraction side simultaneously. Measure the engine speed at this time.
   - Do not stall the torque converter for more than 20 seconds. Be careful that the torque converter oil temperature does not exceed 120° C (248° F).
   - Measure the full stall speed when the power mode and economy mode are turned on.

★ If the return rate (spill) from the injector is in the following range, it is normal.

Rated Output Speed (rpm)	Limit of Return Rate (spill) (cc/min)
1,600	960
1,700	1,020
1,800	1,080
1,900	1,140
2,000	1,200

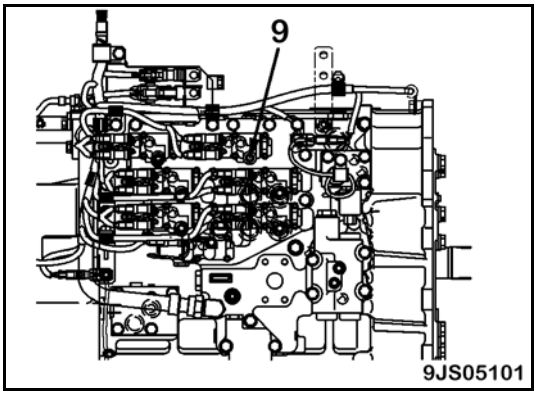
G. After finishing the test, stop the engine.

4. Work after finishing the test

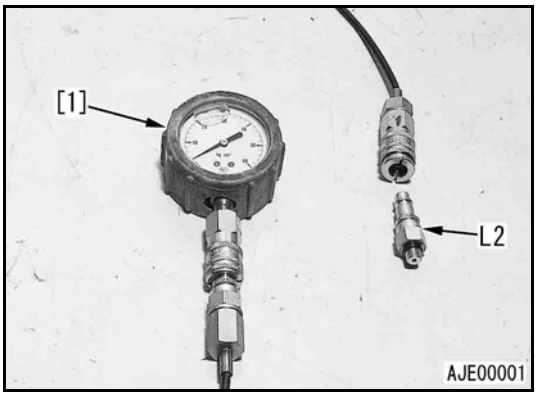
After completing the test, remove the testing tools and return the parts you removed.

3rd Clutch Pressure

1. Remove the 3rd clutch oil pressure pickup plug (9) (10 x 1.25 mm).



2. Connect nipple **L2** and oil pressure gauge [1] in hydraulic tester **L1**.
   ★ Use an oil pressure gauge with capacity of 61.18 kg/cm² (870 psi).



3. Set the transmission auto-shift and manual shift selector switch in the MANUAL position.

4. Press the brake pedal.

5. Start the engine and turn the parking brake switch OFF.

6. Set the gearshift lever to the 3rd speed while keeping the directional lever, joystick steering directional switch, or right directional switch at the N (Neutral) position.

7. Run the engine at low idle and while pressing the brake pedal, set the directional lever, joystick steering directional switch, or right directional switch to the F (forward) or R (reverse) position once and then return it to N (Neutral) again.

Keep pressing the brake pedal securely.

   ★ The above operation is required because moving the gearshift lever does not change the gear speed if the directional lever, joystick steering switch, or right directional switch is set at the N (neutral) position.

8. While running the engine at high idle, measure the 3rd clutch oil pressure.

9. After completing the measurement, remove the measurement tool and make sure that the machine is back to normal condition.

HYDRAULIC FAN

Special Tools Required

Symbol		Part Number	Part Name	Qty	Remarks
R	1	799-205-1100	Tachometer kit	1	Digital display: 6 – 99999.9 rpm
	2	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6, 40, 60 MPa (362.59, 870.23, 5,801.51, 8,702.26 psi)
		790-261-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa (8,702.26 psi)
	3	799-101-5220	Nipple (10 x 1.25 mm)	1	Size: 10 x 1.25 mm
		07002-11023	O-ring	1	–
	4	799-401-3500	Adapter (Size 06)	1	Size 06

WARNING! Stop the machine on level ground; lower the work equipment to the ground; and set chocks securely under the tires.

WARNING! When removing the oil pressure pickup plug and disconnecting the hose, loosen the oil filler cap of the hydraulic tank slowly to release the pressure inside the tank.

★ Measurement conditions:

Engine coolant temperature: . . . . . Min. 95°C (203°F)
Hydraulic oil temperature:. . . . . Min. 95°C (203°F)
Torque converter oil temperature:. . . . . Min. 105°C (221°F)

Measuring Fan Speed

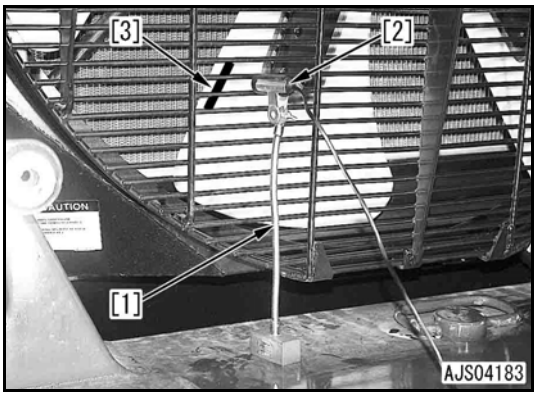
This procedure describes how to measure the fan speed.

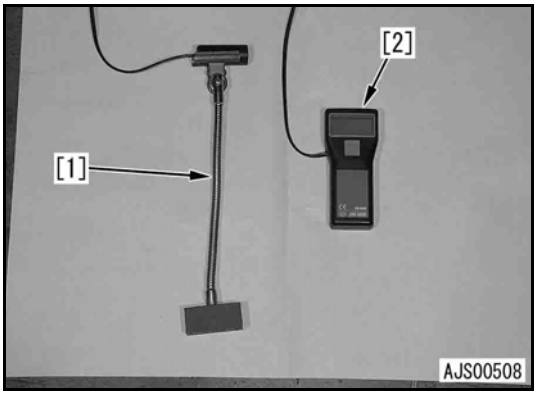
1. Set probe [2] to stand [1] of tachometer kit (**R1**) and stick reflective tape [3] to the fan.

   ★ See tachometer kit (**R1**) in the photo to the right.

2. While running the engine at high idle and low idle, measure the fan speed.

3. After completing the measurement, remove the measuring instruments and return the parts you removed.

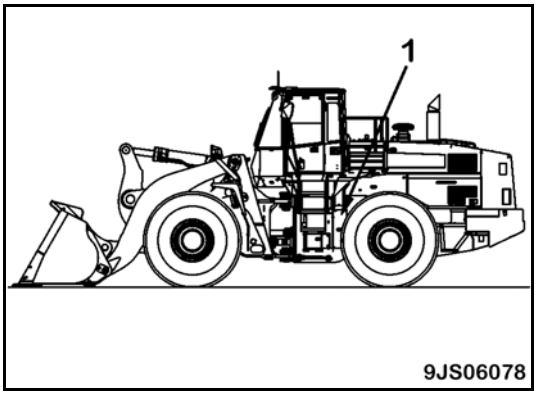




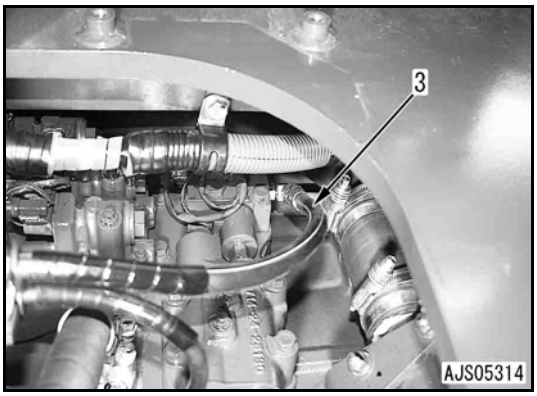
Parking Brake Emergency Release Valve Pilot Pressure

★ Transmission ECMV basic pressure

1. Open rear frame left side cover (1).

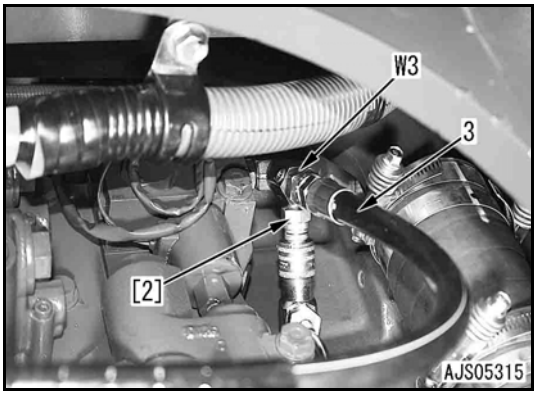


2. Disconnect parking brake emergency release valve pilot pressure hose (3).



3. Install adapter **W3** and connect parking brake pilot pressure hose (3).

4. Connect nipple [2] and oil pressure gauge [1] in hydraulic tester **W1**.
   ★ Use the oil pressure gauge with capacity of 61.18 kg/cm² (870 psi).



5. While running the engine at low idle, measure the parking brake pilot pressure.

WARNING! Keep pressing the brake pedal for safety.

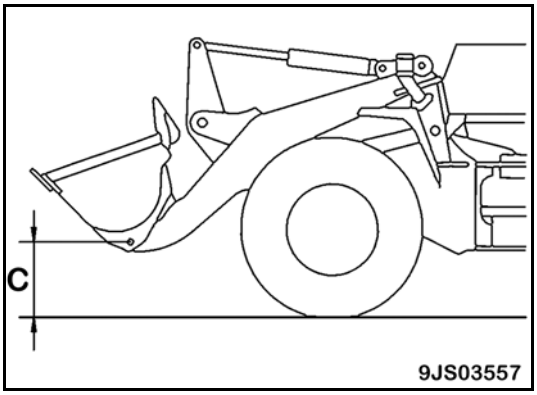
   ★ Measure the oil pressure when the parking brake is OFF.

6. After completing the measurement, remove the measurement tool and make sure that the machine is back to normal condition.

Adjusting Maximum Tilt-Detecting Proximity Switch

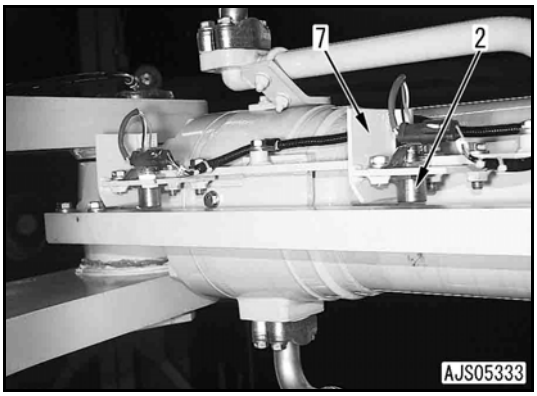
1. Set height (c) of the pin center of the lift arm end to 1,000 mm (39.37 in) from the ground surface.

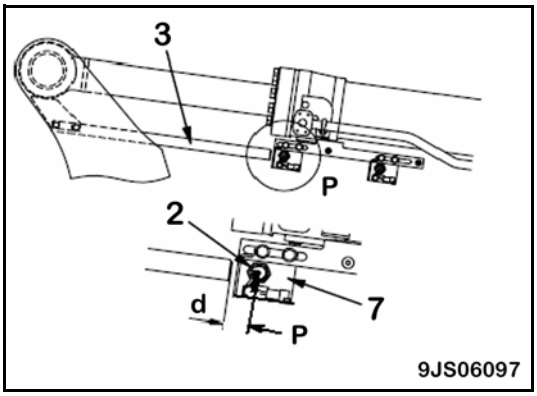
2. Tilt the bucket to the maximum position.

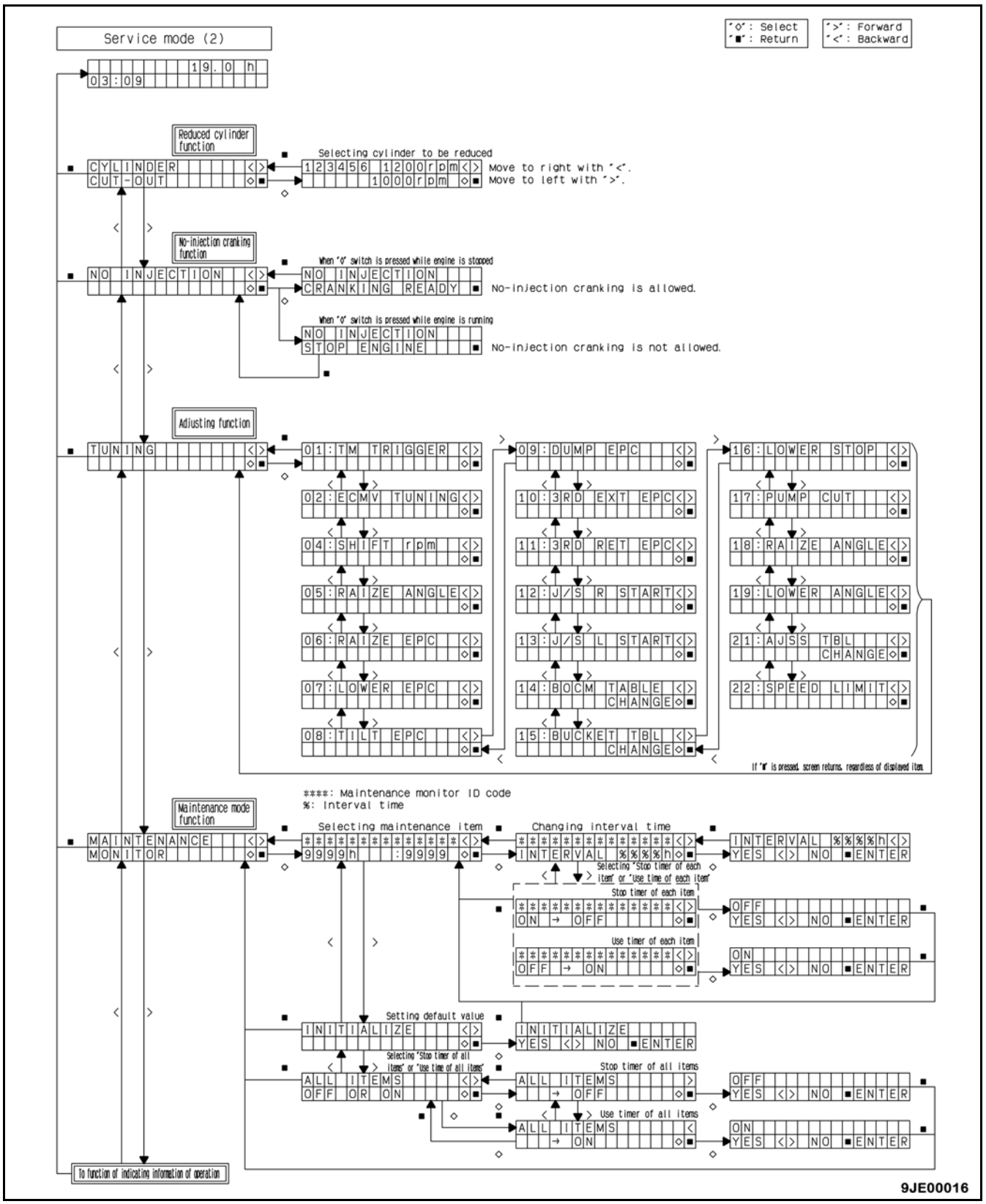


3. Loosen two mounting bolts of maximum tilt-detecting proximity switch bracket (7) to slide bracket (7) installing position and adjust it.
   ★ Set distance (d) from the end of detection bar (3) to the center line of proximity switch (2).

   Dimension: . . . . . .50 mm (1.97 in).





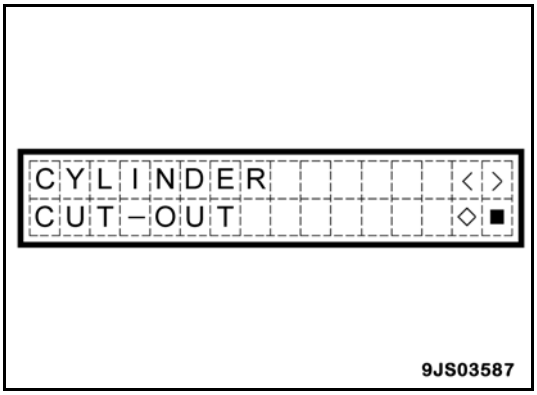

Service mode (2)
"◇": Select
"■": Return
">": Forward
"<": Backward
19.0 h
03:09
Reduced cylinder function
CYLINDER CUT-OUT
Selecting cylinder to be reduced
123456 1200rpm
1000rpm
Move to right with "<".
Move to left with ">".
No-injection cranking function
NO INJECTION
When "◇" switch is pressed while engine is stopped
NO INJECTION CRANKING READY
No-injection cranking is allowed.
When "◇" switch is pressed while engine is running
NO INJECTION STOP ENGINE
No-injection cranking is not allowed.
Adjusting function
TUNING
01:TM TRIGGER
02:ECMV TUNING
04:SHIFT rpm
05:RAIZE ANGLE
06:RAIZE EPC
07:LOWER EPC
08:TILT EPC
09:DUMP EPC
10:3RD EXT EPC
11:3RD RET EPC
12:J/S R START
13:J/S L START
14:BOOM TABLE CHANGE
15:BUCKET TBL CHANGE
16:LOWER STOP
17:PUMP CUT
18:RAIZE ANGLE
19:LOWER ANGLE
21:AJSS TBL CHANGE
22:SPEED LIMIT
If "■" is pressed, screen returns, regardless of displayed item.
****: Maintenance monitor ID code
%: Interval time
Maintenance mode function
MAINTENANCE MONITOR
Selecting maintenance item
Changing interval time
INTERVAL %%%%h
YES <> NO ■ENTER
Selecting "Stop timer of each item" or "Use time of each item"
Stop timer of each item
ON → OFF
OFF
Use timer of each item
OFF → ON
ON
Setting default value
INITIALIZE
Selecting "Stop timer of all items" or "Use time of all items"
ALL ITEMS OFF OR ON
Stop timer of all items
ALL ITEMS → OFF
Use timer of all items
ALL ITEMS → ON
To function of indicating information of operation
9JE00016

MON [Mechanical Monitor System]				
No.	**Monitoring Codes**	**Input/ Output Signal**	**Display Item**	**Description of ON/OFF Switch (Display: When ON = 1, when OFF = 0)**
4	40903	D-IN-24	Transmission filter clogging	No clogging = ON (GND)/OFF (OPEN)
		D-IN-25	–	–
		D-IN-26	Parking brake	Parking brake operation = ON (GND)/OFF (OPEN)
		D-IN-27	Engine coolant level	Normal coolant level = ON (GND)/OFF (OPEN)
		D-IN-28	–	–
		D-IN-29	Engine oil level	Normal oil level = ON (GND)/OFF (OPEN)
		D-IN-30	Operation of emergency steering motor (Applicable to a machine equipped with the optional emergency steering)	Emergency steering operation = ON (GND)/OFF (OPEN)
		D-IN-31	–	–
5	40904	D-IN-32	Load meter subtotal switch (Load meter specifications)	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-33	Load meter cancel switch (Load meter specifications)	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-34	High beam (dimmer switch)	High beam = ON (GND)/OFF (OPEN)
		D-IN-35	–	–
		D-IN-36	Service switch	ON = ON(GND)/OFF(OPEN)
		D-IN-37	> switch	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-38	< switch	Pressing of switch = ON (GND)/OFF (OPEN)
		D-IN-39	–	–
6	40952	D-OUT-0	Alarm buzzer	Output ON = ON (24 V)/OFF (OPEN)
		D-OUT-1	–	–
		D-OUT-2	–	–
		D-OUT-3	–	–

Cylinder Cutout Function (CYLINDER CUT-OUT) (5)

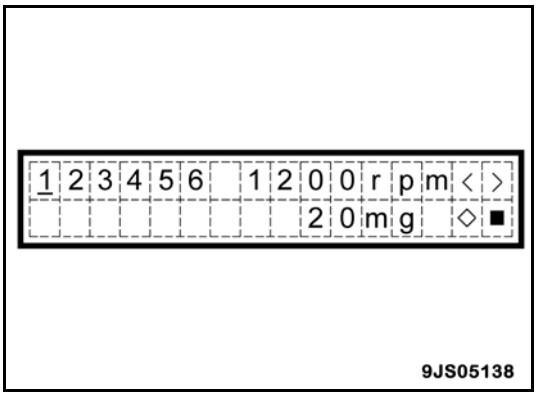
The engine reduced-cylinder function is used to set the injector of one or more cylinders electrically to the no-injection state and to turn on reduced-cylinder operation. When any engine cylinder is suspected of abnormal output (combustion), use this approach to pinpoint the failed cylinder.

1. Selecting the menu
   Display the CYLINDER CUT-OUT screen from the menu screen of the Service mode.



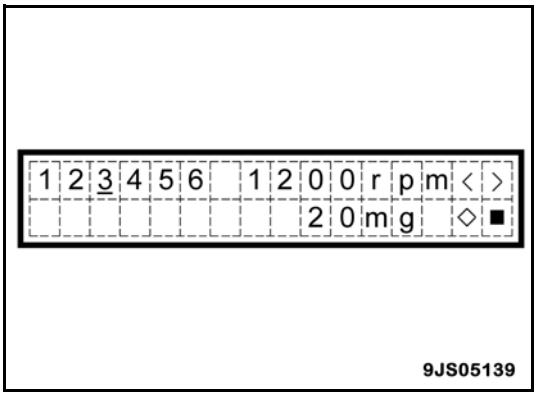
2. Displaying submenu
   Press the [◊] switch while the menu is selected to display the submenu.

   ★ The cylinder No. and engine speed (N): rpm are displayed on the upper line and the specified injection rate (Q): mg/stroke is displayed on the lower line.

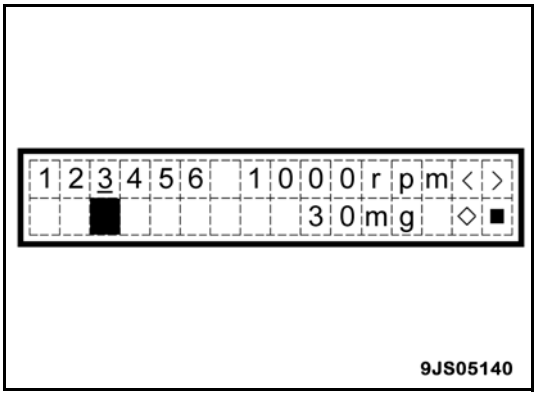


3. Selecting a cylinder to be reduced
   Using the [<] or [>] switch, select a cylinder to be reduced (from No. 1 – No. 6 cylinder) and then confirm this cylinder using the [◊] switch.

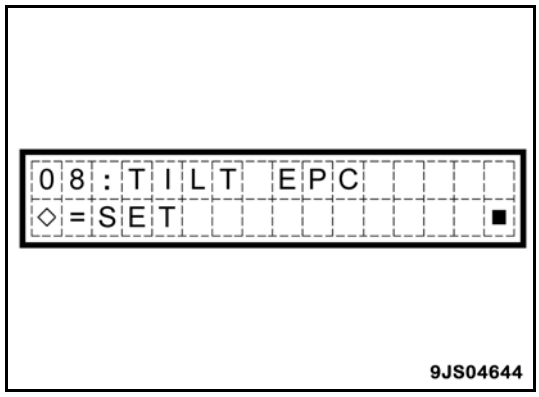
   ★ The cylinder to be reduced is selectable while the engine is running.
   ★ Any number of cylinders can be reduced – a single unit or two or more units.
      - [>] switch: Advances the cursor rightward
      - [<] switch: Advances the cursor leftward
      - [◊] switch: Confirms the cylinder to be reduced (the cursor starts flashing after the confirmation)
      - [■] switch: Restores the CYLINDER CUT-OUT screen



   ★ As the reduced-cylinder command is issued from the engine controller to the cylinder to be reduced, the bottom of the stopped cylinder number turns black.



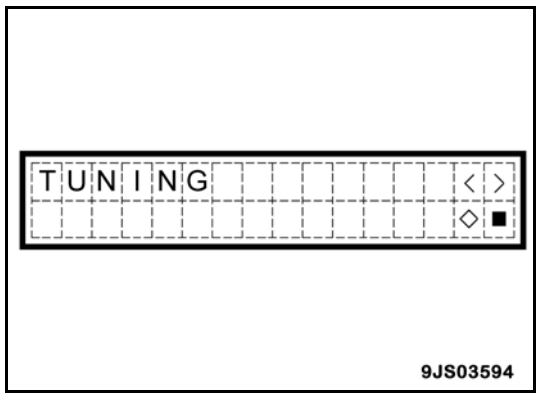
G. Pressing the [◊] switch turns on reading of the commanded value of EPC and then stores the difference between it and the standard value as the offset value.
   - ★ The setting is complete as the 08: TILT EPC screen is restored after the buzzer beeps twice.
   - ★ If the [◊] switch is pressed when the lever is at neutral, the adjusted value is cleared. In this case, the 08: TILT EPC screen is restored after the buzzer beeps twice.



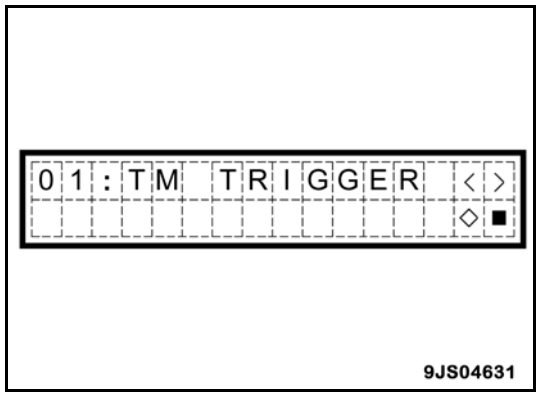
Adjustment of Bucket Dump EPC Starting Current (7-8)

★ Start the engine prior to the setup operation.

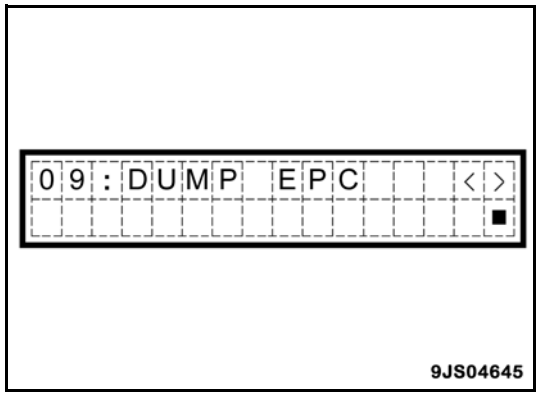
1. Display the TUNING screen from the menu screen of the Service mode.



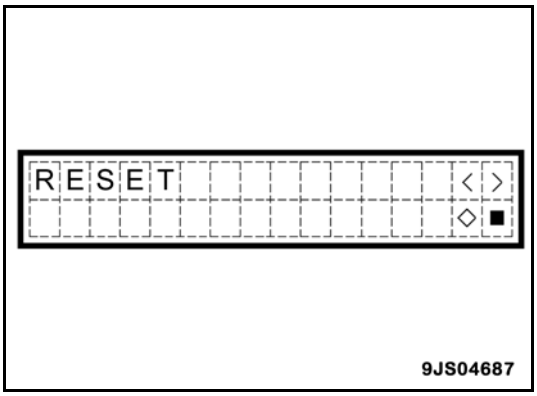
2. Hold down the [◊] switch for a minimum of five seconds to display the 01: TM TRIGGER screen.



3. Using the [<] or [>] switch, move the cursor to the 09: DUMP EPC item.
4. Set the bucket roughly horizontal without applying any load.
5. Start dumping the bucket gradually while maintaining the engine at high idle.
6. Return the lever through fine operation. As the bucket is stopped, maintain the lever at that position.



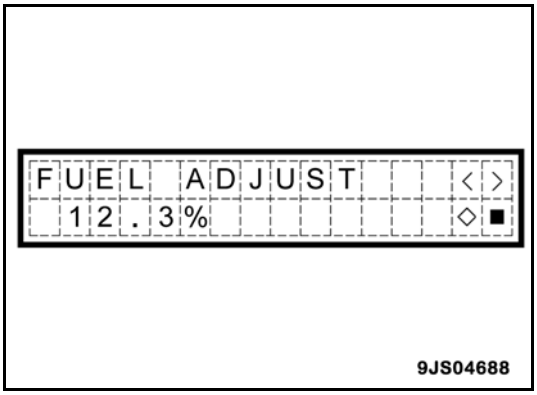
4. Deleting display data
   ★ Data on screens 3A to 3D allow deletion.
   • Select a desired item and then delete it using the [◊] switch.
   • Use the [■] switch when canceling deletion of data.



5. Setting gain correction
   ★ Gain correction means the function of correcting gain to cumulative fuel consumption.
   ★ Gain correction is available only from the Fuel Consumption Ratio and Average Fuel Consumption screen.

   A. After deleting data (RESET screen), press the [<] or [>] switch to display the current set value.

   B. Pressing the [◊] switch displays the correction screen.
      ★ Default value: 0.0%
      ★ This setting allows you to correct the cumulative fuel consumption in the range of -50.0 to +50.0.



   C. Move the cursor to [+] or [–].

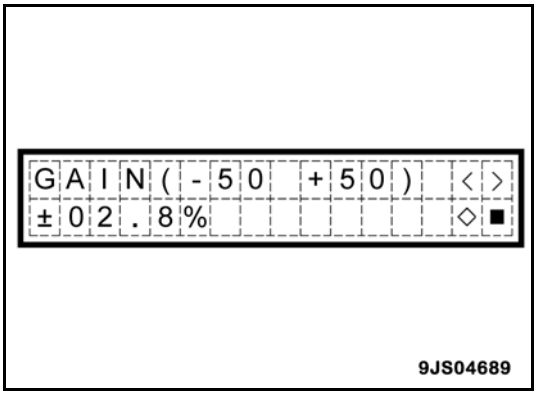
   D. Pressing the [<] or [>] switch alternately displays [+] and [–].

   E. Press the [◊] switch to confirm [+] or [–].
      ★ The cursor moves to the highest-order digit of the set value.

   F. Pressing the [<] or [>] switch changes the value of this digit in the range of 0 – 9.

   G. Press the [◊] switch when the intended value appears in order to select it as the set value.
      ★ The cursor moves to the 2nd digit.

   H. Set the values up to the lowest digit in the same manner and then press the [◊] switch to confirm.
      ★ As the selection is confirmed, the preceding screen is restored.
      ★ If the [■] switch is pressed before you finish entering the selection, the cursor moves to the [+] and [–] position. In this case, the value remains unchanged. Pressing the [■] switch again restores the preceding screen.
      ★ If the value is not in the -50 to +50 range, pressing the [◊] switch at the lowest digit just moves the cursor to the [+] and [–] position and the value remains as it is.



Color Codes Table

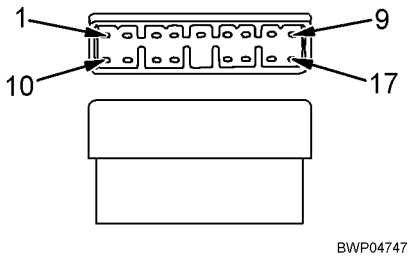
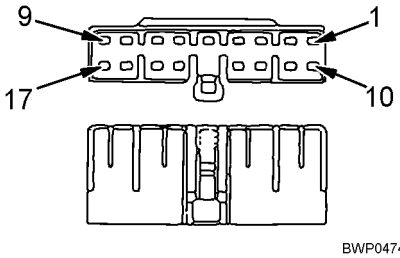
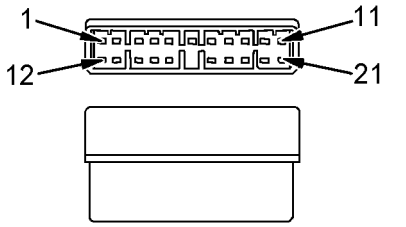
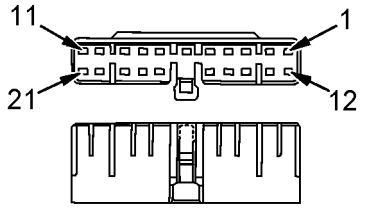
Table 3

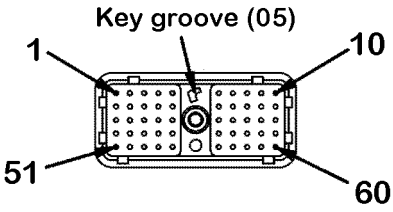
Color Code	Color of Wire		Color Code	Color of Wire
B	Black		LgW	Light green & White
Br	Brown		LgY	Light green & Yellow
BrB	Brown & Black		LR	Blue & Red
BrR	Brown & Red		LW	Blue & White
BrW	Brown & White		LY	Blue & Yellow
BrY	Brown & Yellow		O	Orange
Ch	Charcoal		P	Pink
Dg	Dark green		R	Red
G	Green		RB	Red & Black
GB	Green & Black		RG	Red & Green
GL	Green & Blue		RL	Red & Blue
Gr	Gray		RW	Red & White
GR	Green & Red		RY	Red & Yellow
GW	Green & White		Sb	Sky Blue
GY	Green & Yellow		Y	Yellow
L	Blue		YB	Yellow & Black
LB	Blue & Black		YG	Yellow &Green
Lg	Light green		YL	Yellow & Blue
LgB	Light green & Black		YR	Yellow & Red
LgR	Light green & Red		YW	Yellow & White

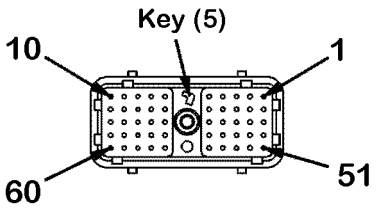
Remark

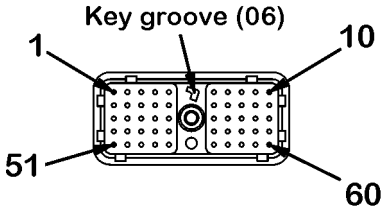
In a color code consisting of two colors, the first color is the color of the background and the second color is the color of the marking.

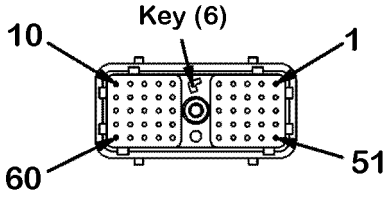
Example: “GW” means that the background is Green and marking is White.

MIC-Type Connectors			
Number of Pins	**Male (Female housing)**	**Female (Male housing)**	**T-adapter Part Number**
17	 BWP04747	 BWP04748	799-601-2730
	Body part number: 79A-222-2730 (Quantity: 2 pieces)	Body part number: 79A-222-2720 (Quantity: 2 pieces)	
21	 BWP04749	 BWP04750	799-601-2740
	Body part number: 79A-222-2750 (Quantity: 2 pieces)	Body part number: 79A-222-2740 (Quantity: 2 pieces)	
	Terminal part number: 79A-222-2770 (Quantity: 50 pieces)	Terminal part number: 79A-222-2760 (Quantity: 50 pieces)	

<table>
<tr><th colspan="4">DRC26 Series Connectors</th></tr>
<tr><th>Number of Pins</th><th>Male pin (Female housing)</th><th>Female pin (Male housing)</th><th>T-adapter Part Number</th></tr>
<tr><td rowspan="3">60
-05 ❉</td><td> 

BJD14063A</td><td> 

BJD14064B</td><td rowspan="3">799-601-4220
Kit:
799-601-4101</td></tr>
<tr><td>–</td><td>Part number: 08194-04104</td></tr>
<tr><td colspan="2">❉ -05: Key position</td></tr>
<tr><td rowspan="3">60
-06 ❉</td><td rowspan="2"> 

BJH13185A</td><td rowspan="2"> 

BJH13185B</td><td>Socket Part Number</td></tr>
<tr><td rowspan="2">799-601-4390</td></tr>
<tr><td>–</td><td>–</td><td></td></tr>
<tr><td colspan="2">❉ -06: Key position</td><td></td></tr>
</table>

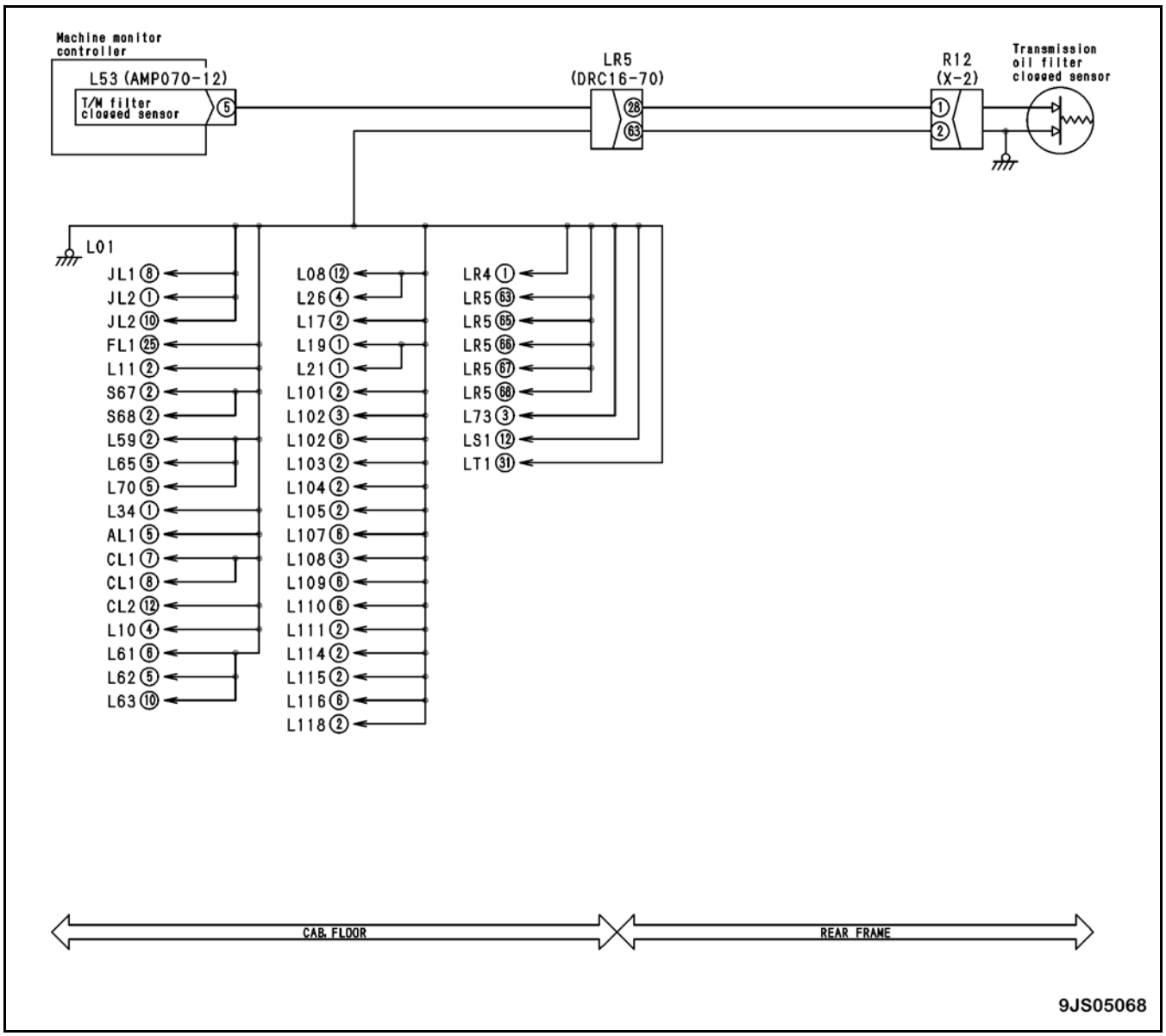
Possible causes and standard value in normal state	3 4	Possible causes of trouble is assumed to be detected. (The order number indicates a serial number, not a priority sequence.)	<Notes on troubleshooting> (1) Method of indicating connector number and handling T-branch For troubleshooting, insert or connect T-branch adapter as shown below unless specifically specified. • When male or female is not indicated for a connector number, disconnect the connector and insert the T-branch adapter in both the male and female. • When male and female is indicated for a connector number, disconnect the connector, and insert the T-branch adapter in only either the male or female. (2) Pin number description sequence and tester lead handling For troubleshooting, connect the plus (+) and minus (–) leads as shown below unless specifically specified. • Connect the plus (+) lead to a pin or harness indicated in the front. • Connect the minus (–) lead to a pin or harness indicated in the rear.

Circuit Diagram

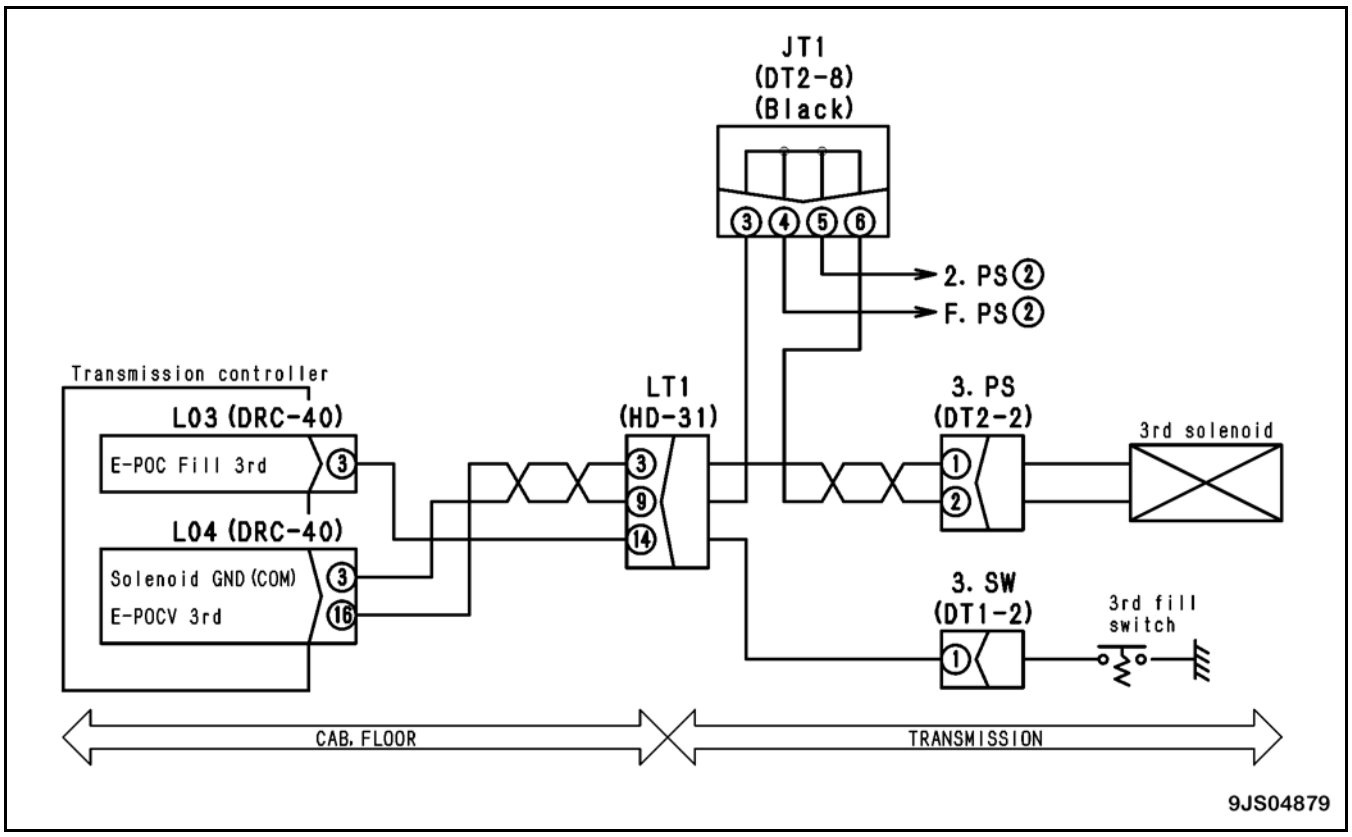
This is part of the circuit diagram which shows the portion where the failure occurred.

- Connector No.: Indicates (Model - number of a pin) (color).
- Connector No. and pin No. from each branching/merging point: Shows the ends of branch or source of merging within the parts of the same wiring harness.
- Arrow (↔): Roughly shows the location on the machine.

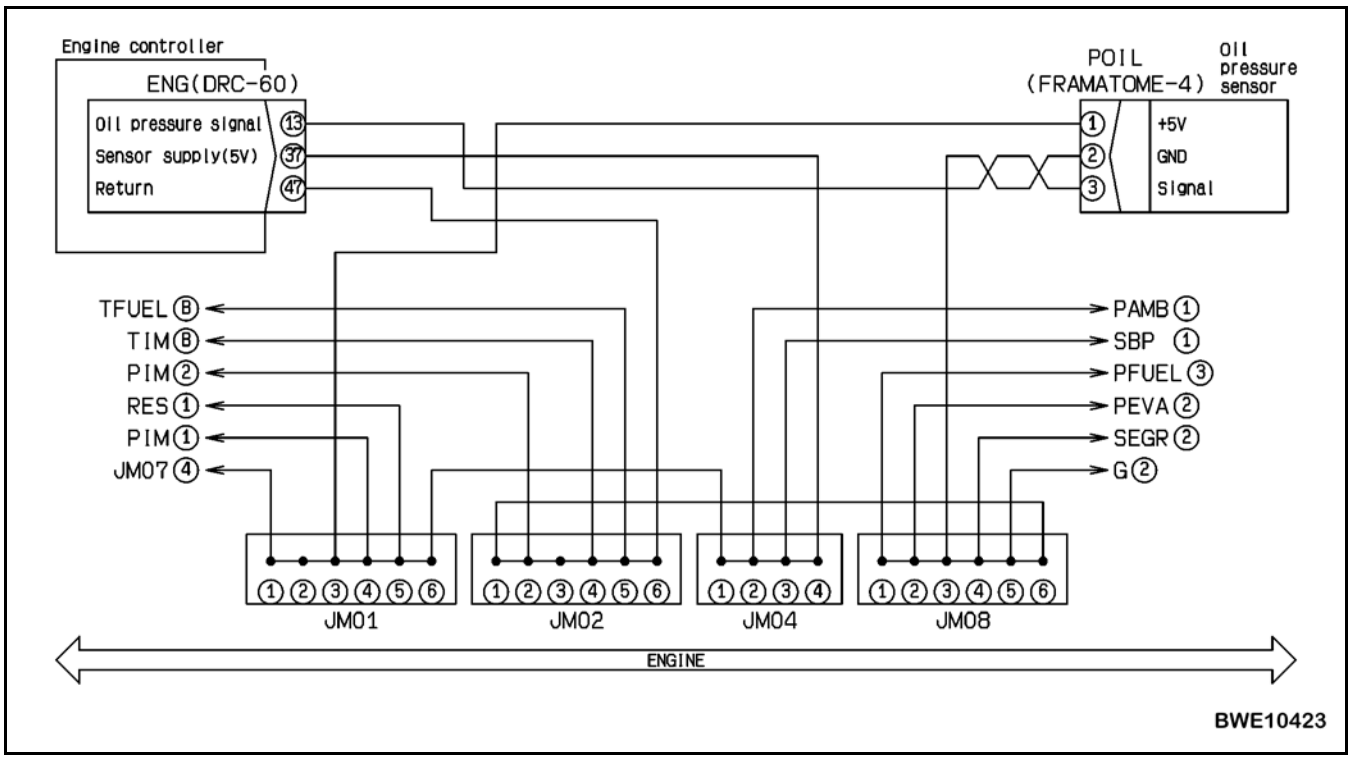
Related Circuit Diagram



Related Circuit Diagram



Related Circuit Diagram



CA115

Engine Ne or Bkup Speed Sensor Error

Action Code	Failure Code	Trouble	Engine Ne or Bkup speed sensor error (Engine controller system)
E03	**CA115**		
Contents of trouble	• Abnormality occurred in Ne and Bkup speed sensor circuits at the same time.		
Action of controller	• Stops the engine. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The engine does not start (if engine has been stopped). • Engine stops (if engine has been running).		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective Ne speed sensor system	Carry out troubleshooting for failure code [**CA689**].
	2	Defective Bkup speed sensor system	Carry out troubleshooting for failure code [**CA778**].
	3	Defective installation of Ne speed sensor	Ne speed sensor may be installed incorrectly. Check it directly. (Defective installation of sensor itself, internal defect of flywheel, etc.)
	4	Defective installation of Bkup speed sensor	Bkup speed sensor may be installed incorrectly. Check it directly. (Defective installation of sensor itself, internal defect of supply pump, etc.)
	5	Defective sensor connection (Improper connection)	Ne and Bkup speed sensors may be connected incorrectly (improper connection). Check them directly.
	6	Defective engine controller	If causes 1 – 5 are not the cause of the problem, the engine controller may be defective. (Since problem is in system, troubleshooting cannot be carried out.)

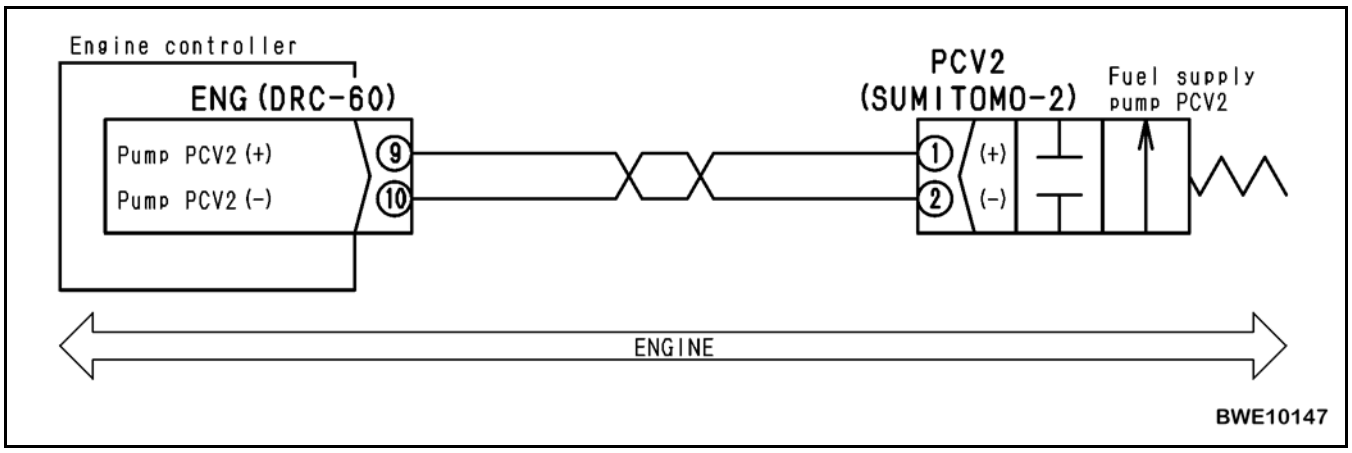
CA187

Sensor Power Supply 2 Low Error

Action Code	Failure Code	Trouble	Sensor power supply 2 voltage low error (Engine controller system)
E03	**CA187**		
Contents of trouble	• Sensor power supply 2 (5 V) circuit is abnormally low.		
Action of controller	• Bkup speed sensor operates with signal from Ne speed sensor. • Engine oil pressure sensor sets engine oil pressure to default (2.5 kg/cm² {36 psi}) and continues operation. • Atmospheric pressure sensor sets atmospheric pressure to default (0.53 kg/cm² {8 psi}) and continues operation. • Charge pressure sensor sets charge pressure to fixed value (4.1 kg/cm² {58 psi}) and continues operation. • EGR inlet pressure sensor sets EGR inlet pressure to default (1.04 kg/cm² {14 psi}) and limits output to continue operation. • EGR valve lift sensor limits output and closes EGR and bypass valves. • Bypass valve lift sensor limits output and closes EGR and bypass valves. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• 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	Carry out troubleshooting for failure code [**CA227**].	

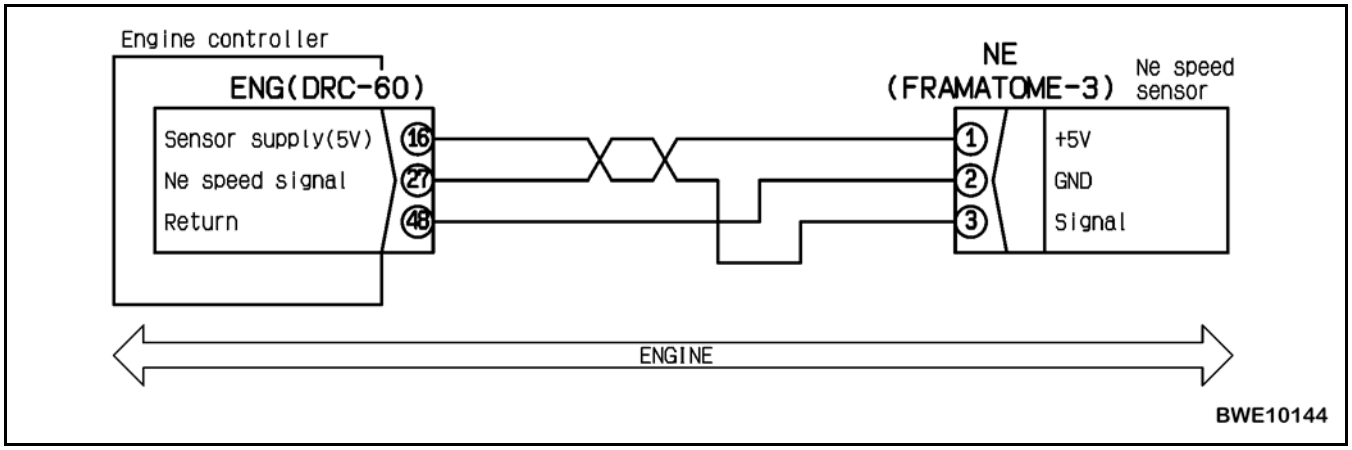
Related Circuit Diagram



MEMORANDUM

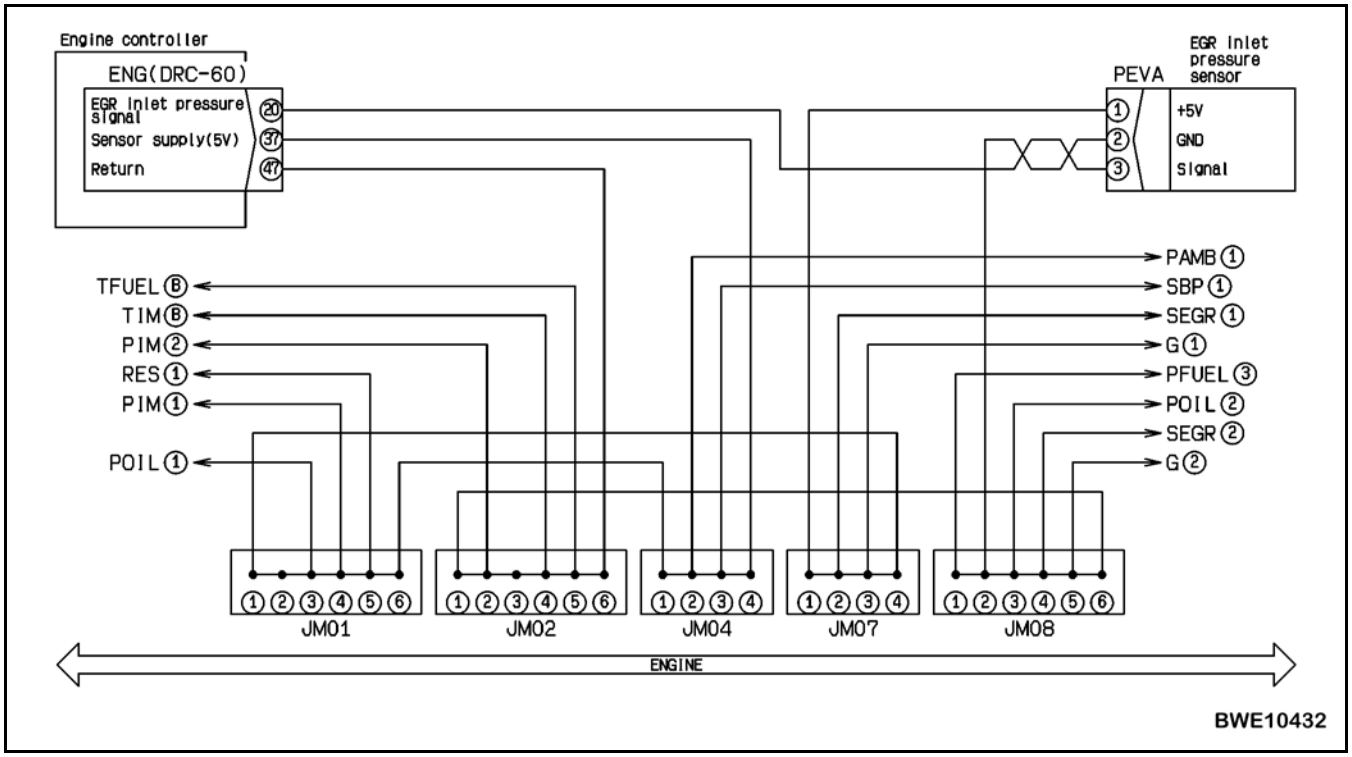
	Cause		Standard value in normal state/Remarks on troubleshooti
Possible causes and standard value in normal state	6	Defective engine Ne speed sensor	If causes 1 – 4 are not the cause of the problem, engine Ne speed sensor may be defective. (Since problem is in system, troubleshooting cannot be carried out.)
	7	Defective engine controller	If causes 1 – 4 are not the cause of the problem, engine controller may be defective. (Since problem is in system, troubleshooting cannot be carried out.)

Related Circuit Diagram

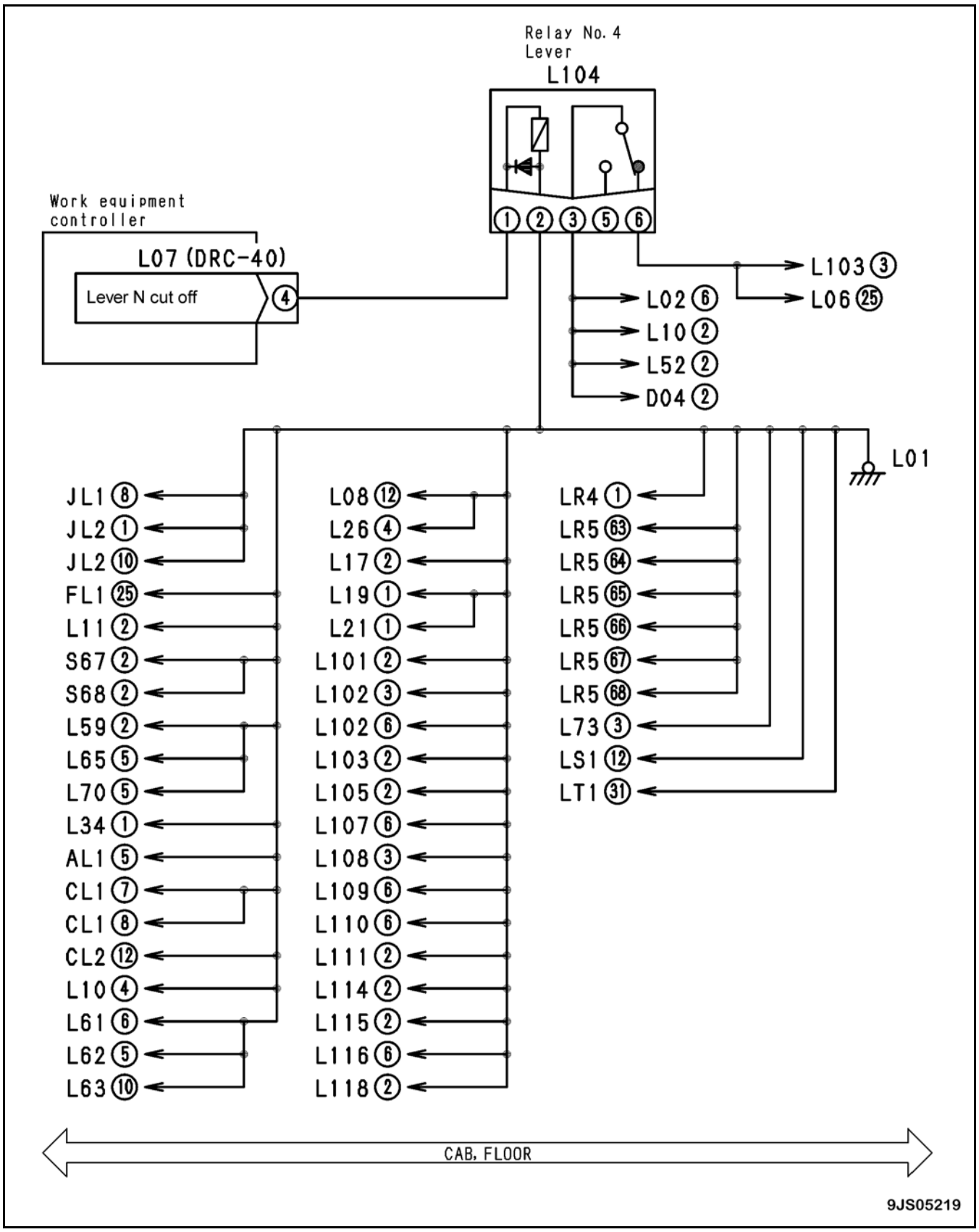


	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ENG (female) (37) – PEVA (female) (1) and between ENG (female) (47) – PEVA (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (37) – PEVA (female) (1) and between ENG (female) (20) – PEVA (female) (3)	Resistance	Min. 1 MΩ
			Wiring harness between ENG (female) (47) – PEVA (female) (2) and between ENG (female) (20) – PEVA (female) (3)	Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.		
			ENG	Voltage	
			Between (37) and (47)	4.75 – 5.25 V	

Related Circuit Diagram

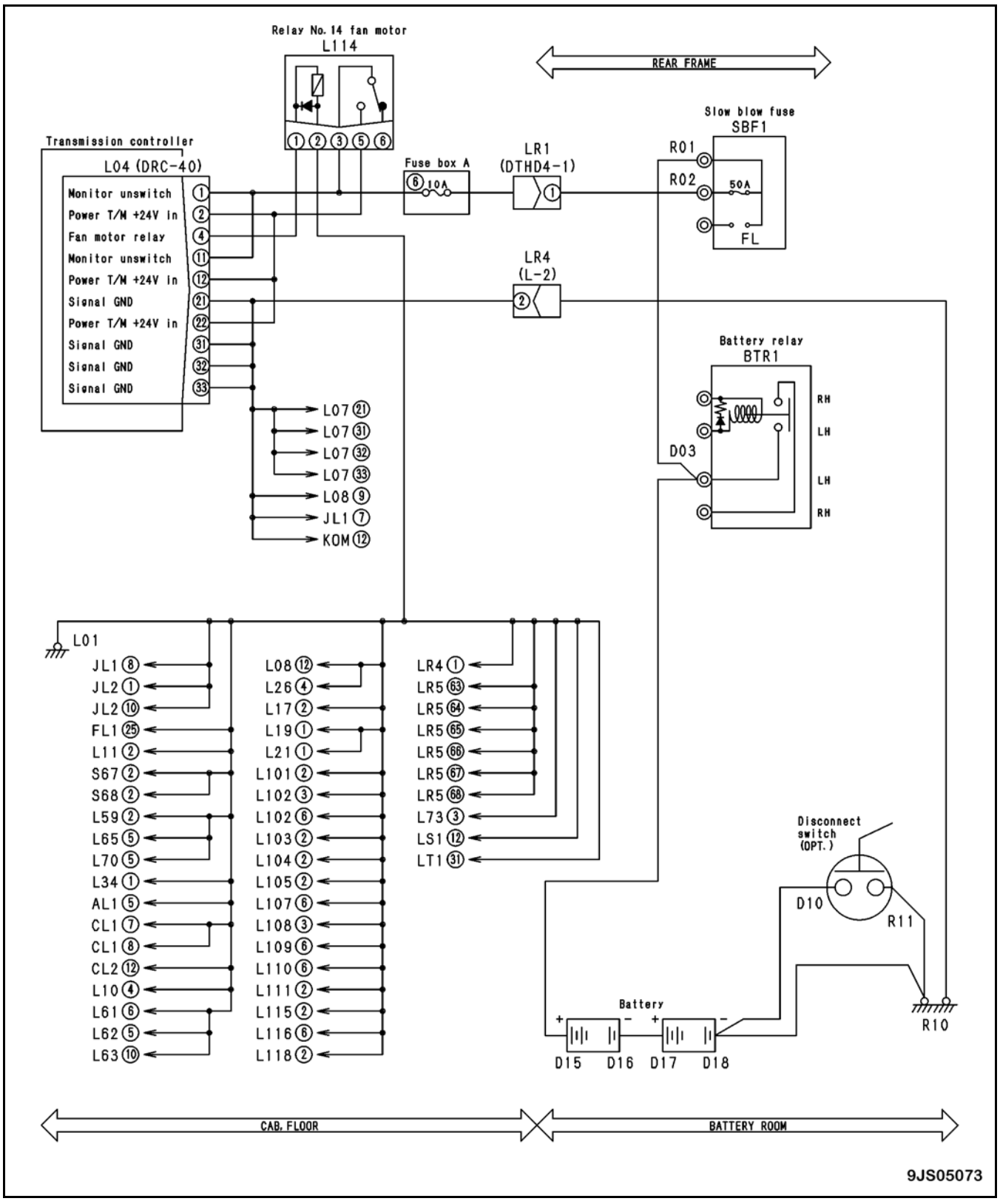


Related Circuit Diagram



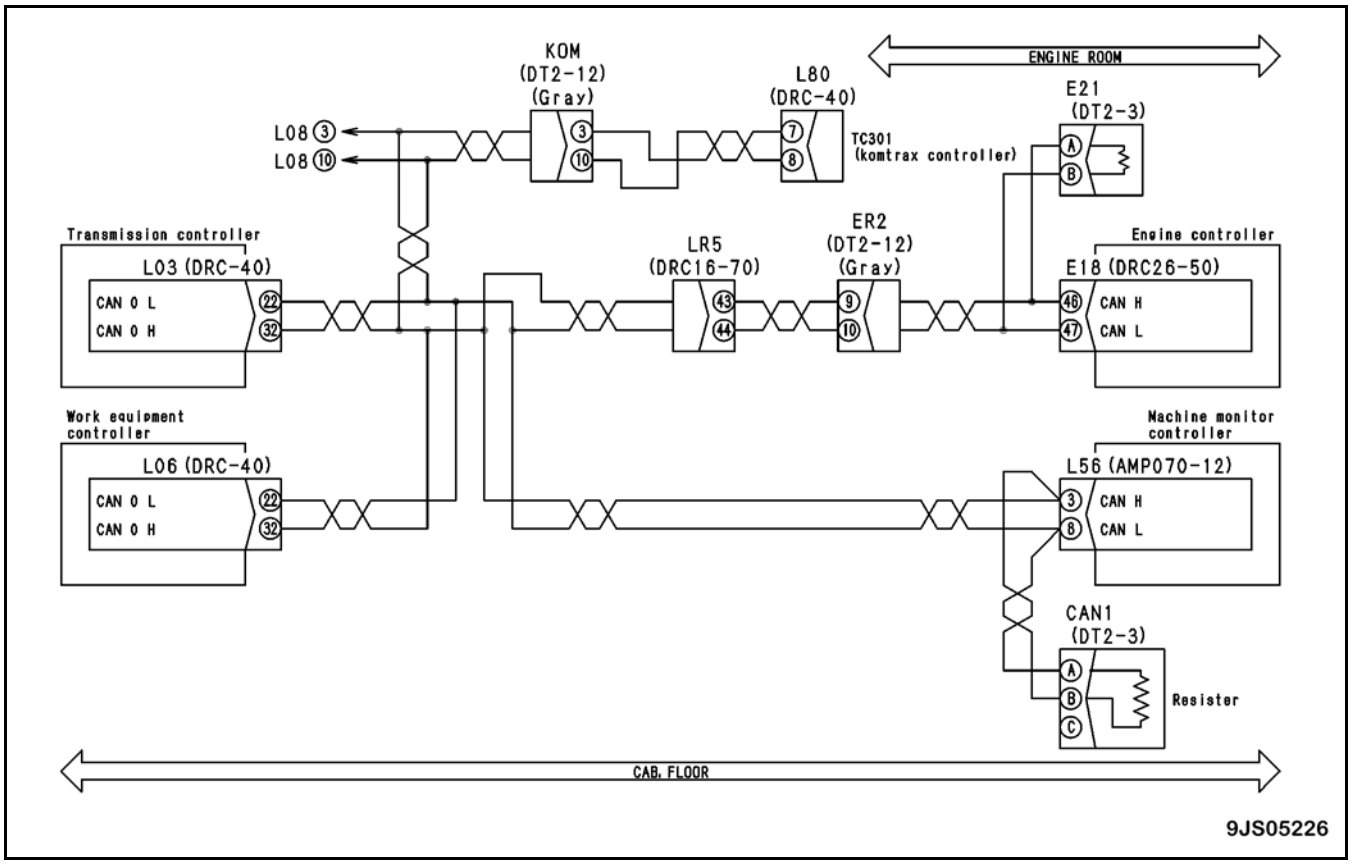
	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	6	Defective work equipment controller	★ Prepare with starting switch OFF, then turn starting switch ON, OFF or START and carry out troubleshooting		
			L06	Starting switch	Voltage
			Between (25) and chassis ground	START	20 – 30 V
				OFF, ON	Max. 1 V

Related Circuit Diagram

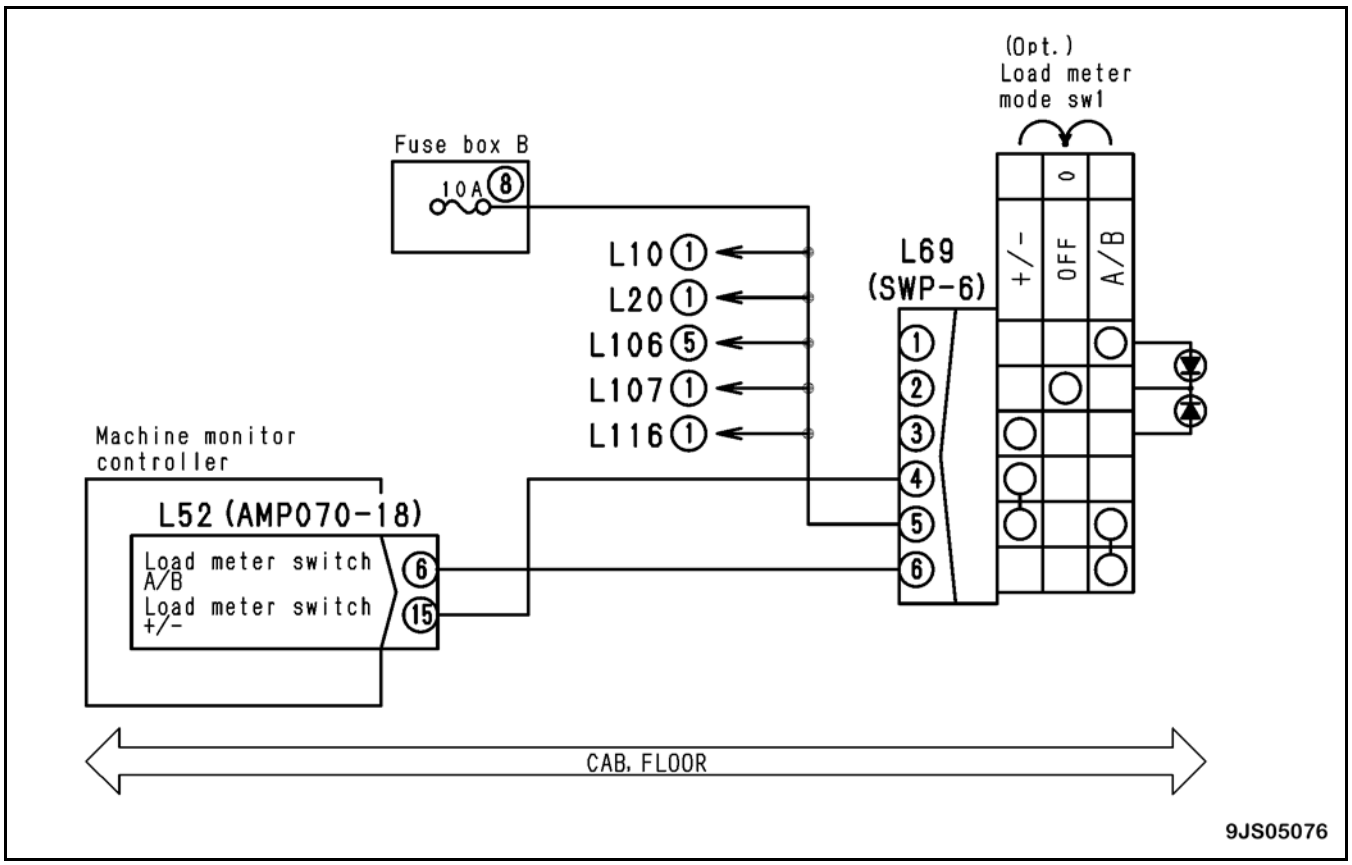


	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	6	Defective work equipment controller	If causes 1 – 5 are not the cause of the problem, the work equipment controller may be defective. (Since problem is in system, troubleshooting cannot be carried out.)

Related Circuit Diagram



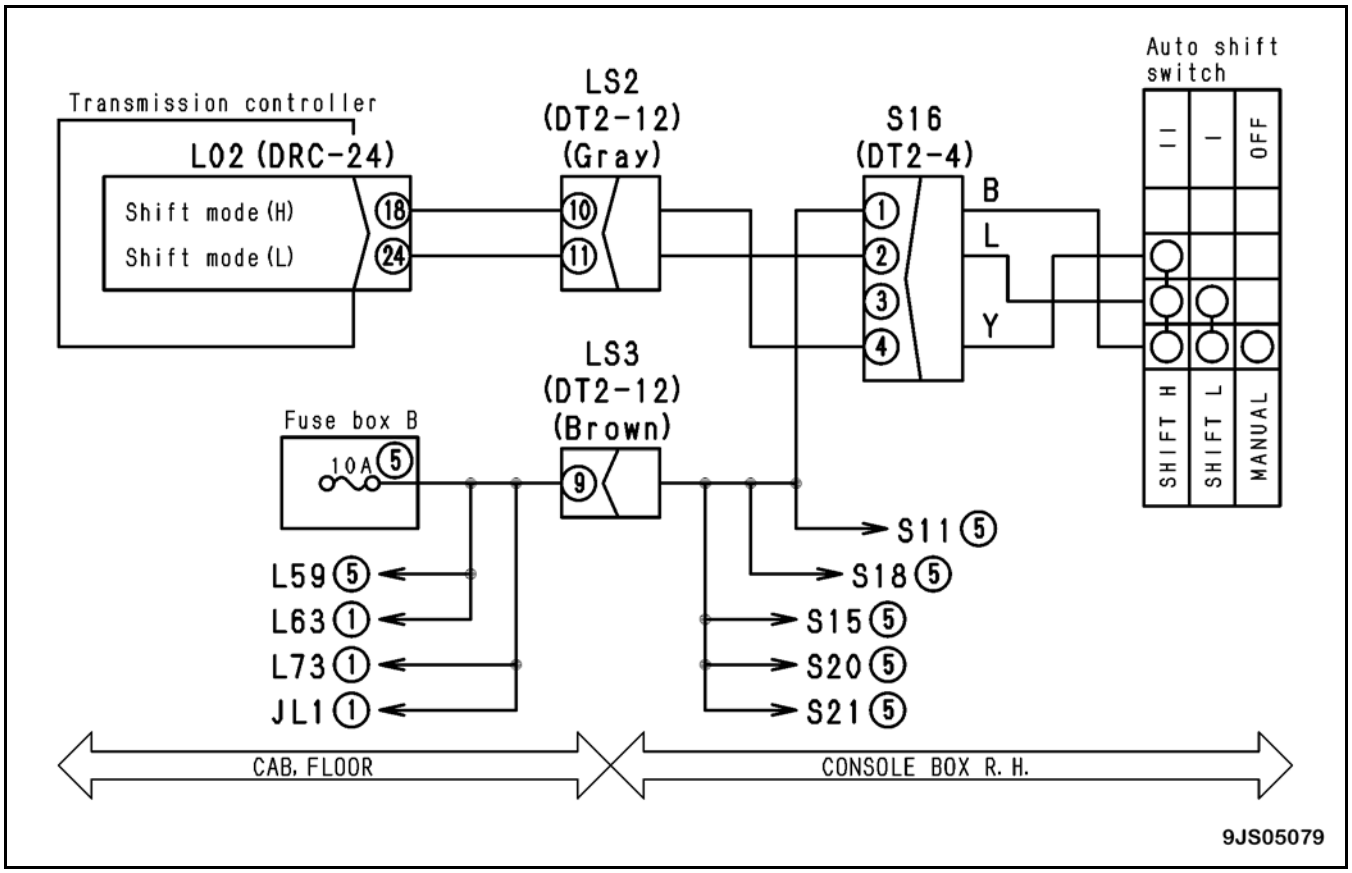
Related Circuit Diagram



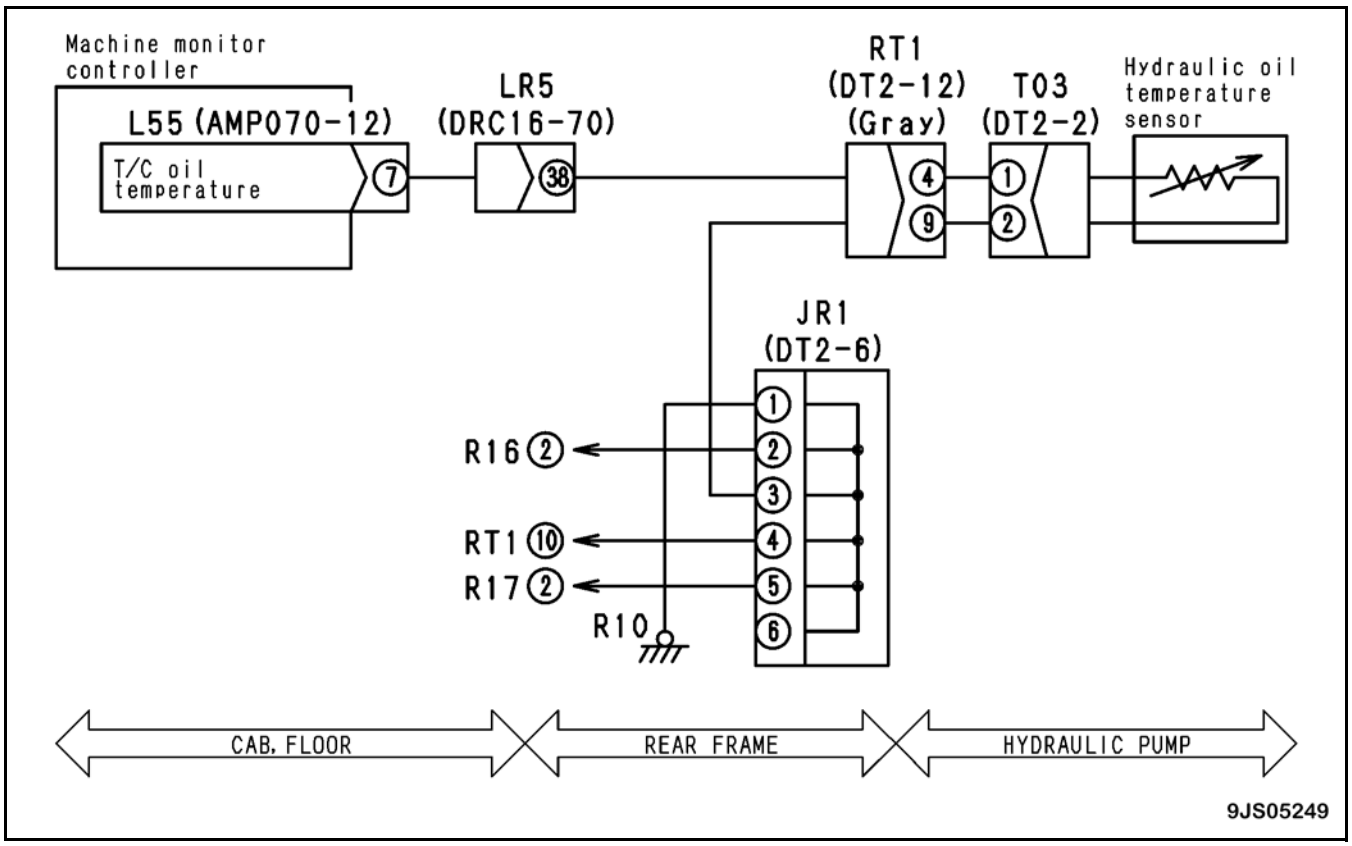
<table>
<tr><th></th><th colspan="2">Cause</th><th colspan="4">Standard value in normal state/Remarks on troubleshooting</th></tr>
<tr><td rowspan="10">Possible causes and standard value in normal state</td><td rowspan="4">3</td><td rowspan="4">Hot short in wiring harness (Contact with 24 V circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Wiring harness between L03(female) (28) – S09 (female) (3) and chassis ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td colspan="2">Wiring harness between L03 (female) (37) – S09 (female) (2) and chassis ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td colspan="2">Wiring harness between L03 (female) (38) – S09 (female) (4) and chassis ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Defective transmission controller</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.
• Directional selector ON/OFF switch ON</td></tr>
<tr><td>L03</td><td>Right FNR (directional) switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (37) and chassis ground</td><td>F (Forward)</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>Other than above</td><td colspan="2">7 – 10 V</td></tr>
<tr><td rowspan="2">Between (28) and chassis ground</td><td>N (Neutral).</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>Other than above</td><td colspan="2">7 – 10 V</td></tr>
<tr><td rowspan="2">Between (38) and chassis ground</td><td>R (Reverse)</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>Other than above</td><td colspan="2">7 – 10 V</td></tr>
</table>

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Defective transmission controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			L02	Shift mode	Voltage
			Between (18) and chassis ground	Manual shift	Max. 1 V
				Auto shift (L)	Max. 1 V
				Auto shift (H)	20 – 30 V
			Between (24) and chassis ground	Manual shift	Max. 1 V
				Auto shift (L)	20 – 30 V
				Auto shift (H)	20 – 30 V

Related Circuit Diagram

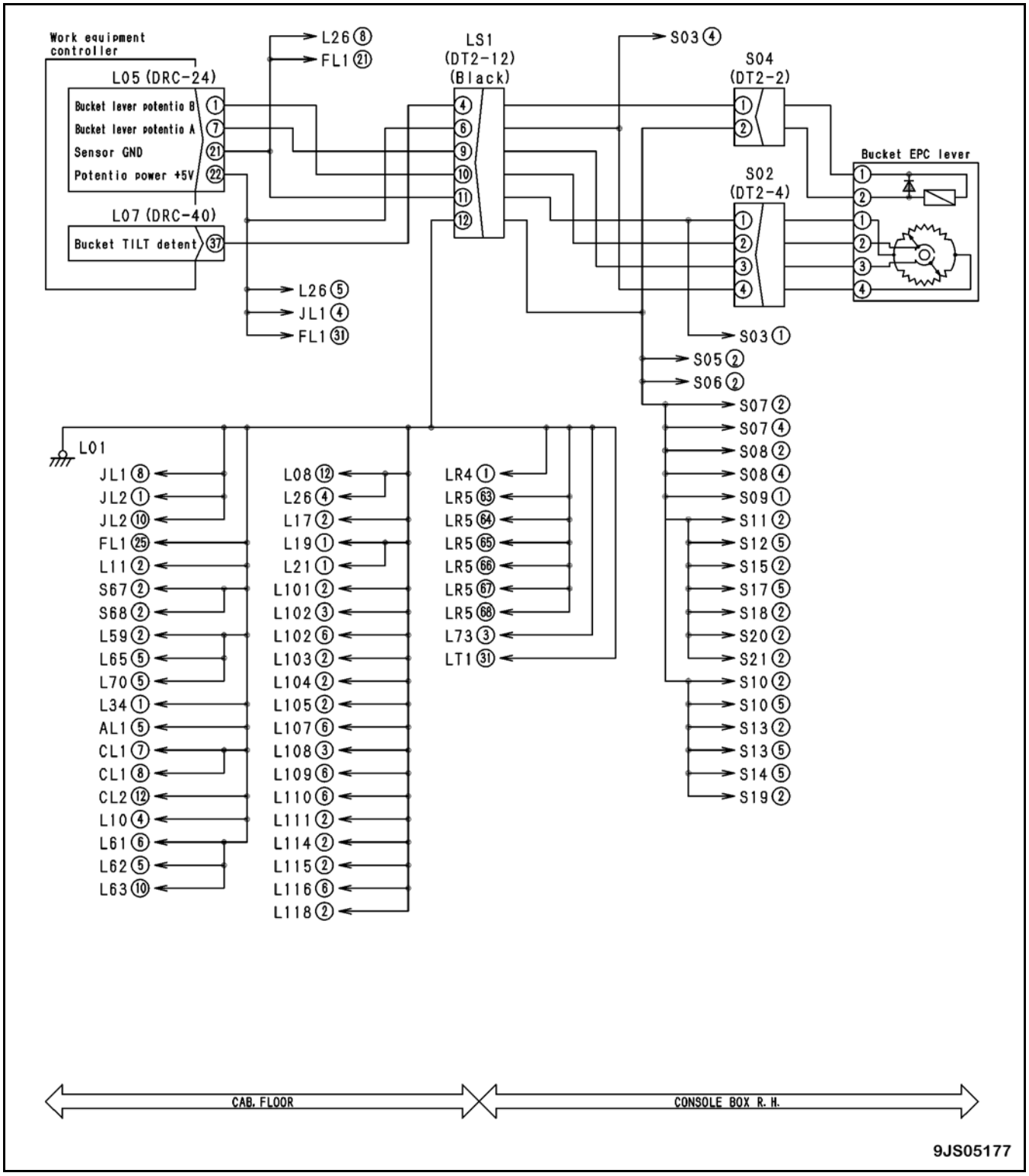


Related Circuit Design



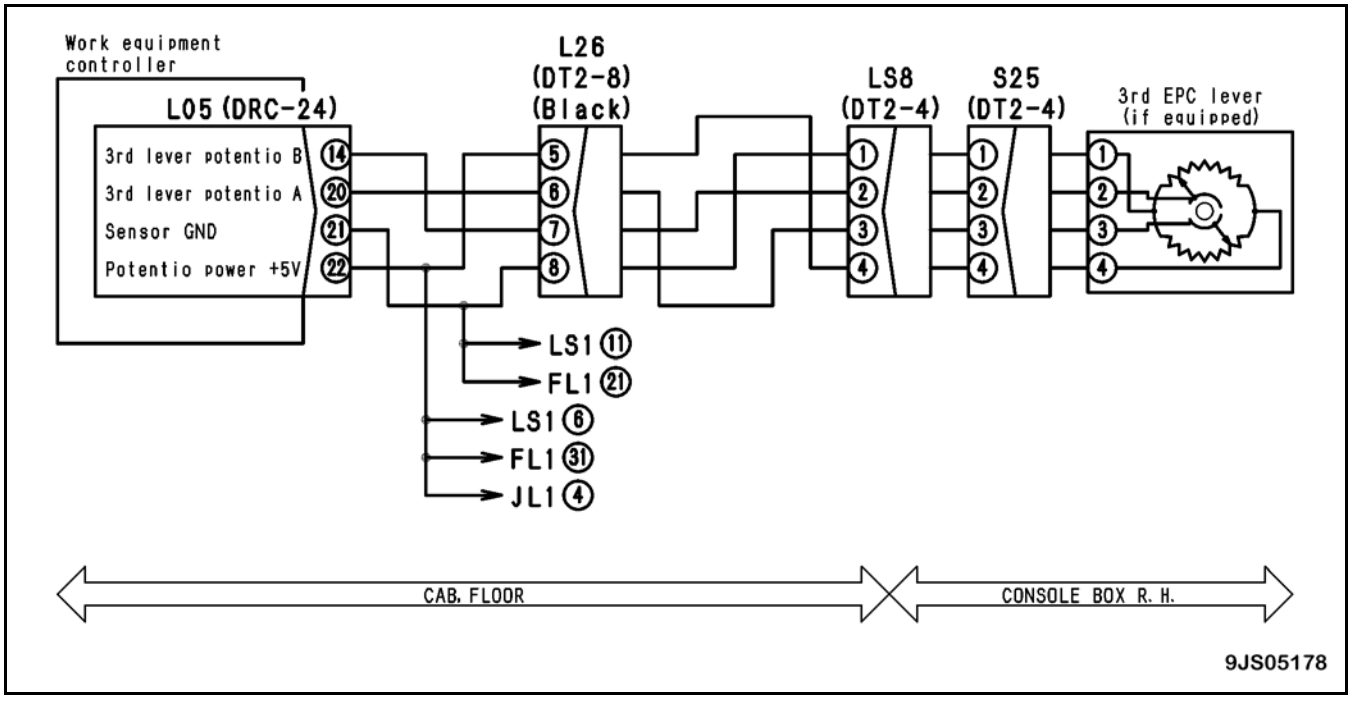
<table>
<tr><th></th><th colspan="2">Cause</th><th colspan="4">Standard value in normal state/Remarks on troubleshooting</th></tr>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td rowspan="2">3</td><td rowspan="2">Grounding fault in wiring harness
(Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between L05 (female) (19) – S03 (female) (3) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Between L05 (female) (22) – S03 (female) (4), – circuit branch end and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Defective work equipment controller</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.
• Work equipment lock lever: Lock</td></tr>
<tr><td>L05</td><td>Lift arm EPC lever</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (22) and (21)</td><td>Constant</td><td colspan="2">4.85 – 5.15 V</td></tr>
<tr><td rowspan="4">Between (19) and (21)</td><td>Lever in neutral</td><td colspan="2">2.40 – 2.60 V</td></tr>
<tr><td>Raise operation (Before detent)</td><td colspan="2">3.64 – 4.14 V</td></tr>
<tr><td>Raise operation (Detent position)</td><td colspan="2">3.86 – 4.36 V</td></tr>
<tr><td>Lower operation (Before detent)</td><td colspan="2">0.86 – 1.36 V</td></tr>
<tr><td></td><td>Float operation</td><td colspan="2">0.64 – 1.14 V</td></tr>
</table>

Related Circuit Diagram



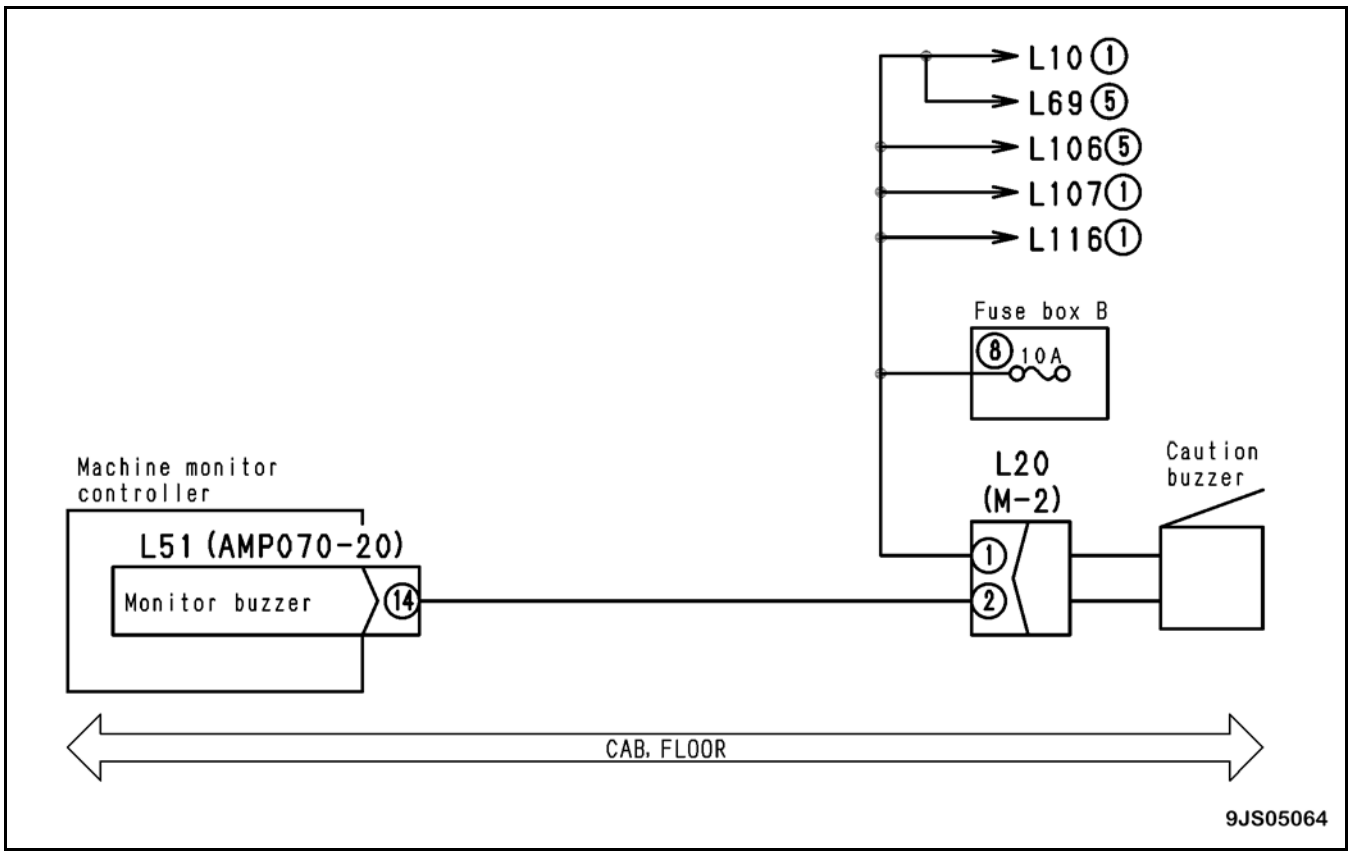
<table>
<tr><th></th><th colspan="2">Cause</th><th colspan="4">Standard value in normal state/Remarks on troubleshooting</th></tr>
<tr><td rowspan="10">Possible causes and standard value in normal state</td><td rowspan="3">2</td><td rowspan="3">Disconnection in wiring harness
(Disconnection in wiring harness or defective contact)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between L05 (female) (14) – S25 (female) (2)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L05 (female) (21) – S25 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Grounding fault in wiring harness
(Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between L05 (female) (14) – S25 (female) (2) and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between L05 (female) (22) – S25 (female) (4), – circuit branch end and chassis ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Defective work equipment controller</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.
• Work equipment lock lever: Lock</td></tr>
<tr><td>L05</td><td>3-spool valve (attachment) EPC lever</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (22) and (21)</td><td>Constant</td><td colspan="2">4.85 – 5.15 V</td></tr>
<tr><td rowspan="3">Between (14) and (21)</td><td>Lever in neutral</td><td colspan="2">2.40 – 2.60 V</td></tr>
<tr><td>Full extension operation</td><td colspan="2">0.64 – 1.14 V</td></tr>
<tr><td>Full retraction operation</td><td colspan="2">3.86 – 4.36 V</td></tr>
</table>

Related Circuit Diagram

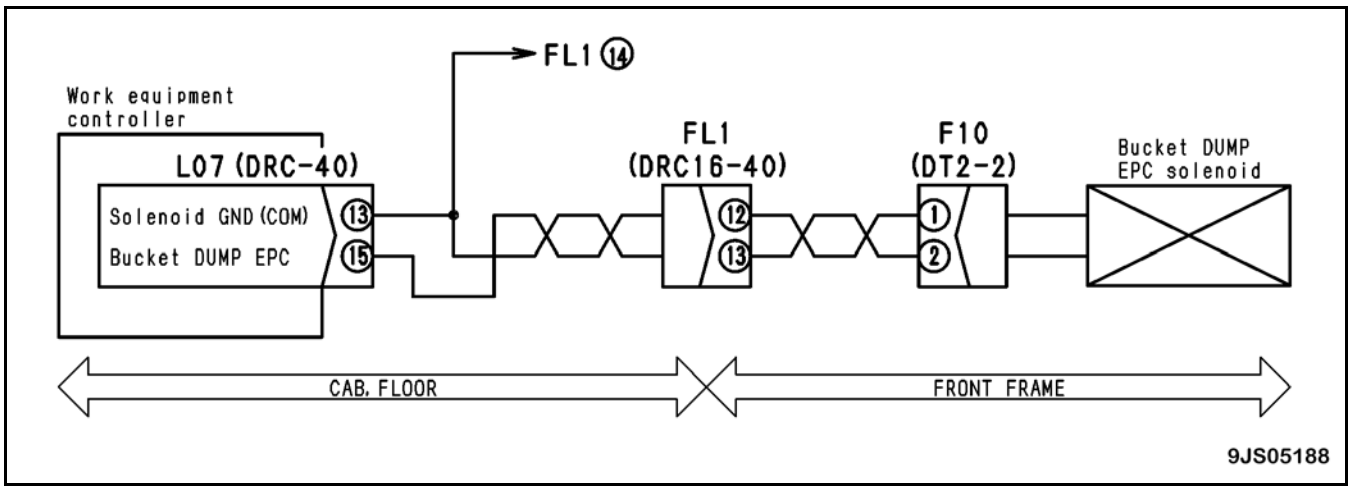


MEMORANDUM

Related Circuit Diagram



Related Circuit Diagram



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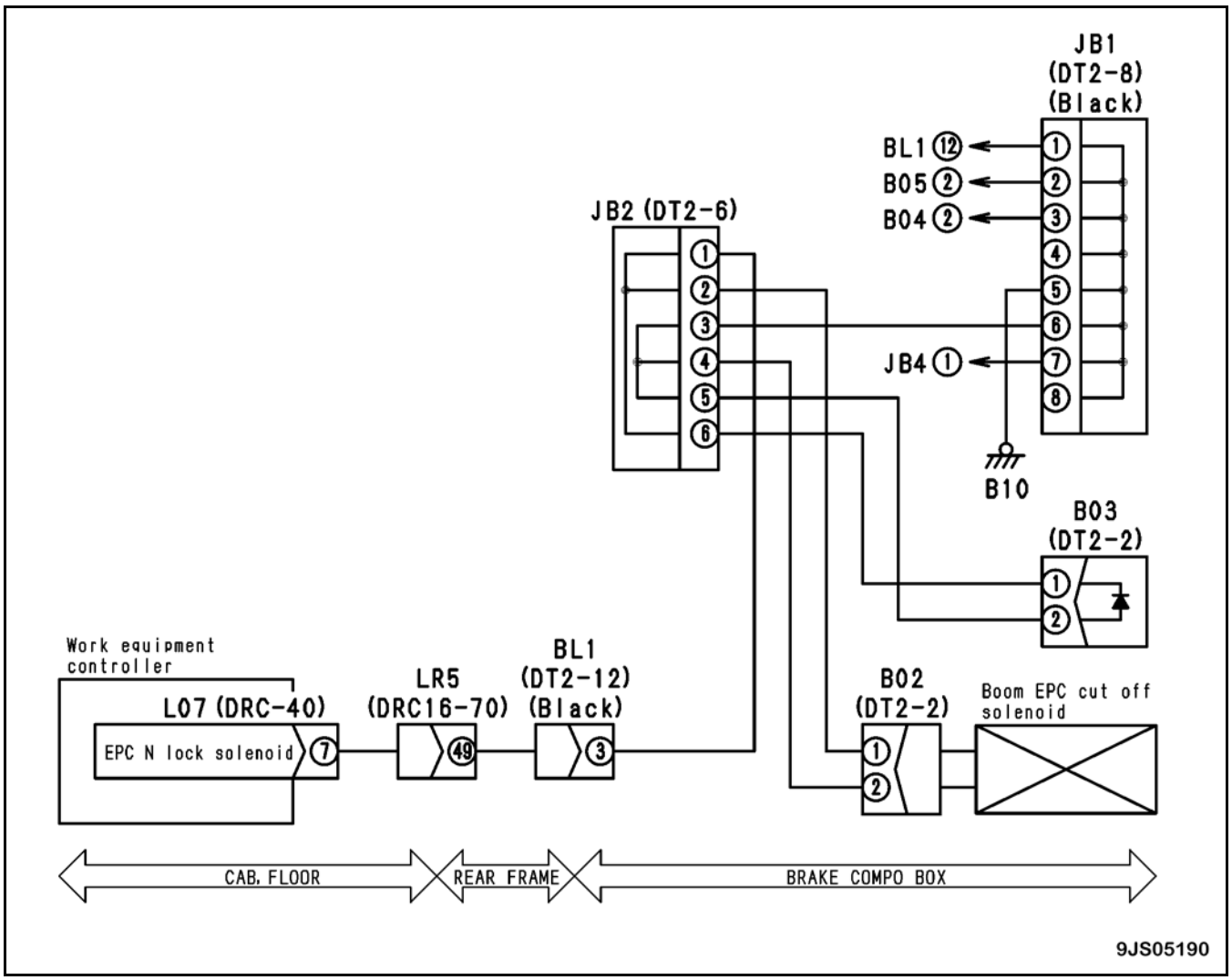


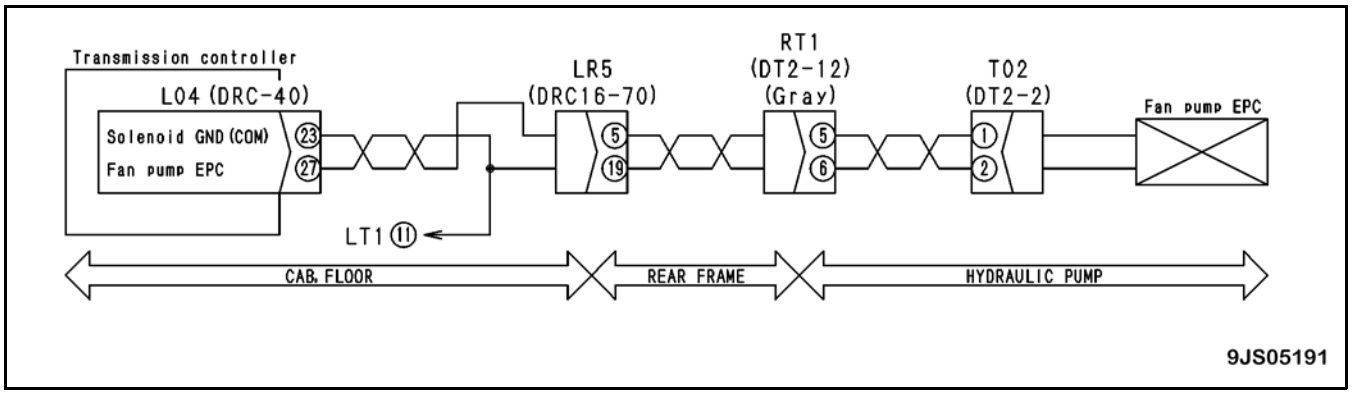
DX16KB

Fan Pump EPC Solenoid: Short Circuit

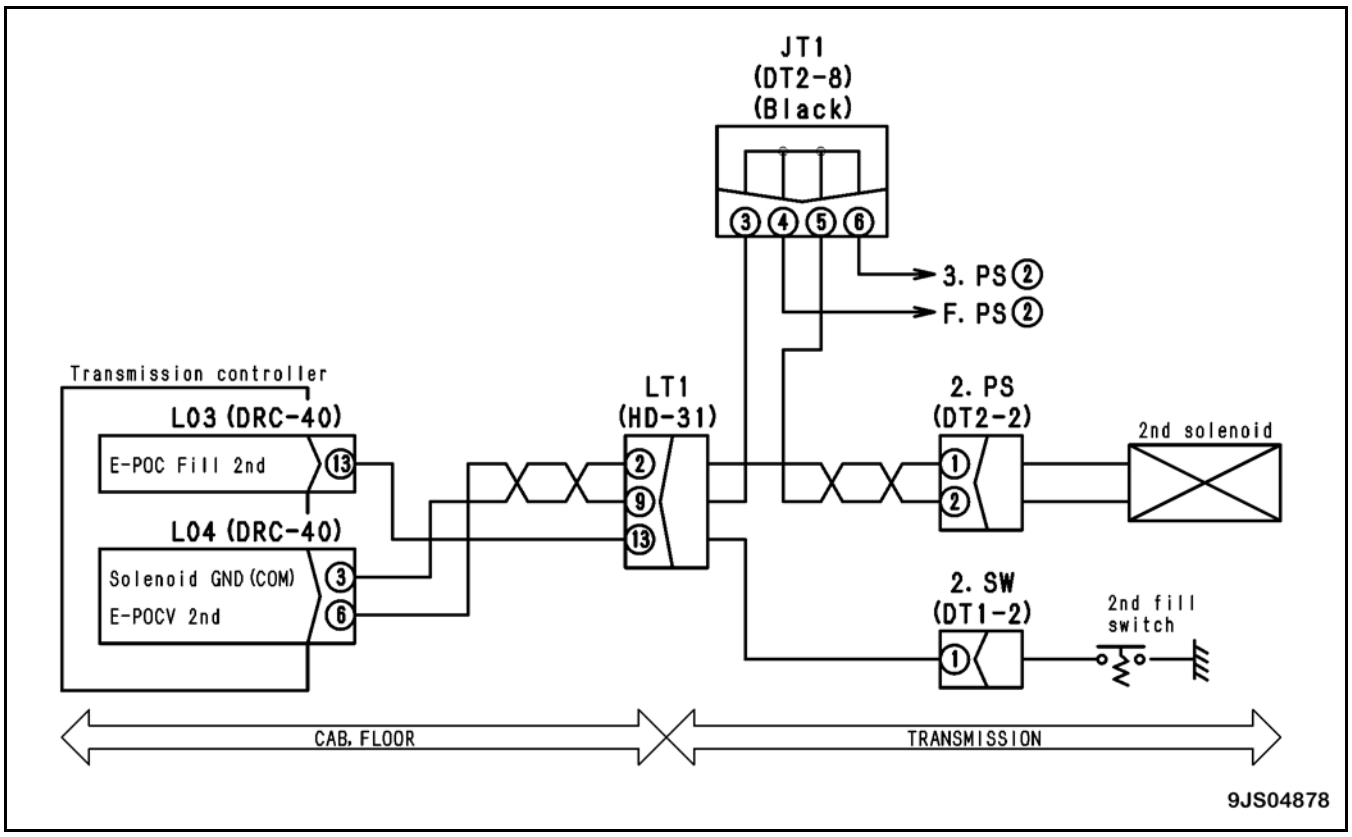
Action Code	Failure Code	Trouble	Fan pump EPC solenoid: Short circuit (Transmission controller system)
E01	**DX16KB**		
Contents of trouble	• Since the fan pump EPC solenoid system was shorted with the chassis ground, abnormal current flowed when the fan pump EPC solenoid output was ON.		
Action of controller	• Turns the output to the fan pump EPC solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• The fan speed is set to the maximum.		
Related information	• The output state (current) to the fan pump EPC solenoid can be checked with the monitoring function (Code: 41400 FAN EPC DIR). • 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	Defective fan pump EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			T02 (male)	Resistance		
			Between (1) and (2)	5 – 10 Ω		
			Between (1), (2) and chassis ground	Min. 1 MΩ		
	2	Grounding fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L04 (female) (27) – T02 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L04 (female)	Resistance		
			Between (23) and (27)	5 – 10 Ω		
			Between (23), (27) and chassis ground	Min. 1 MΩ		

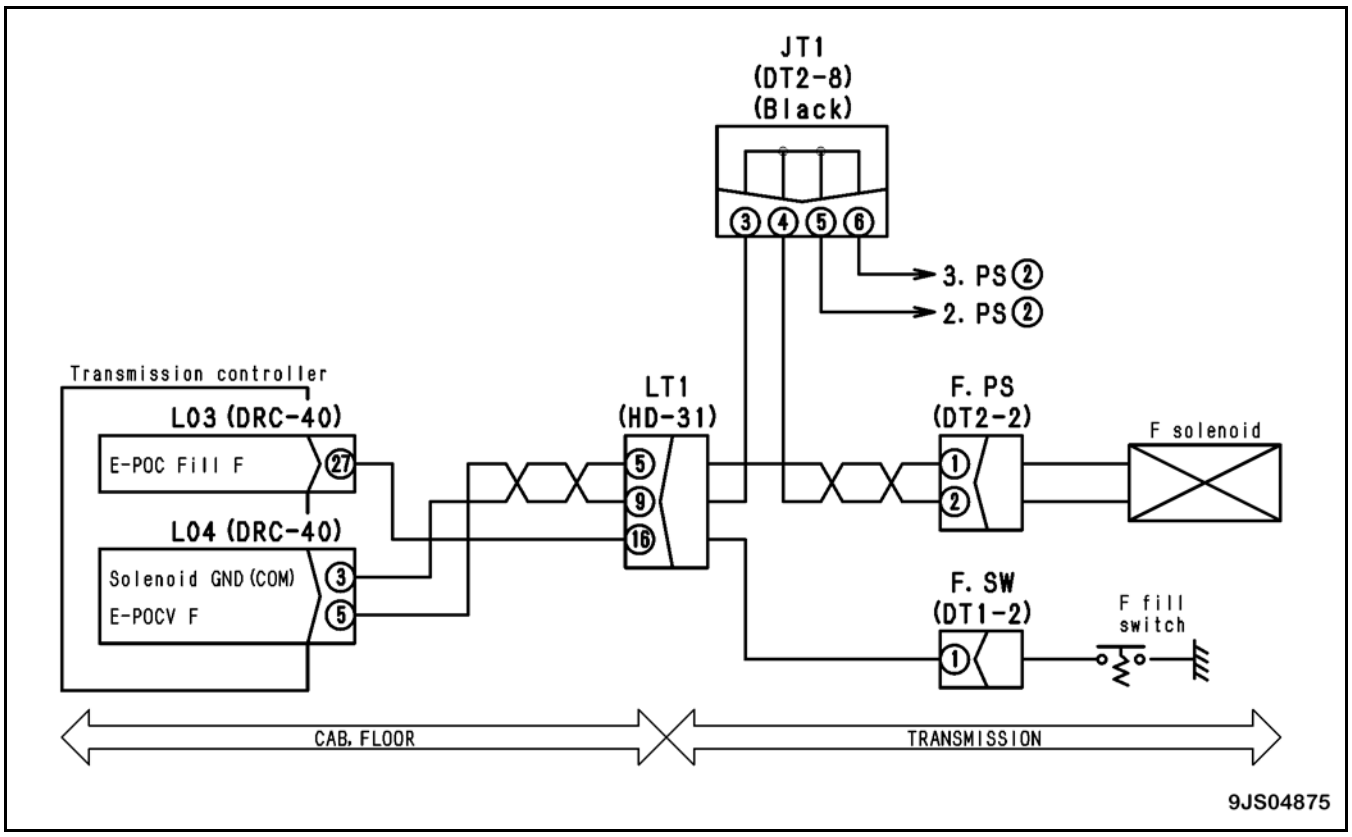
Related Circuit Diagram



Related Circuit Diagram



Related Circuit Diagram



DXHLKY

Joystick Steering Right EPC Solenoid: Short Circuit with Power Supply Line

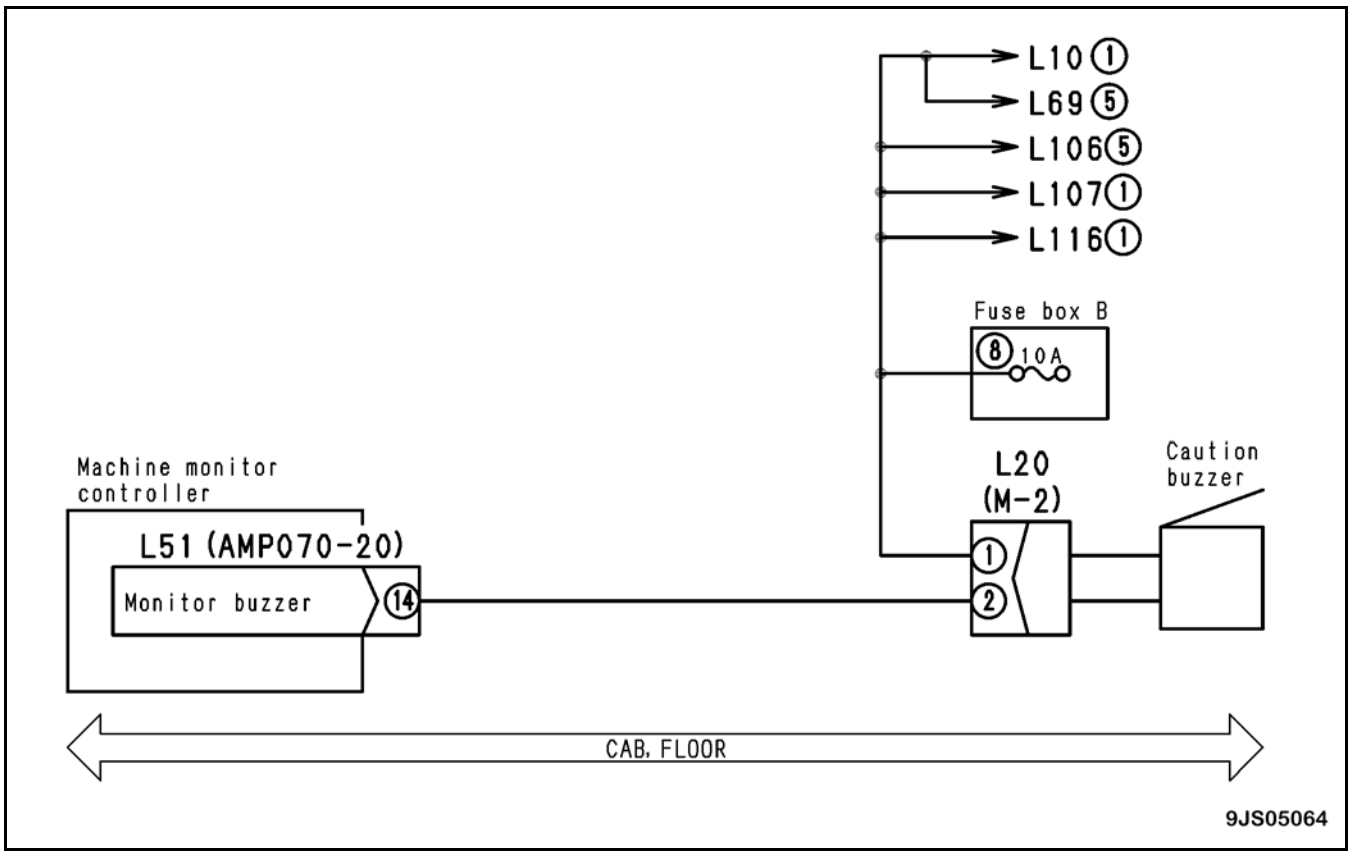
Action Code	Failure Code	Trouble	Joystick steering right EPC solenoid: Short circuit with power supply line (Work equipment controller system)
E03	**DXHLKY**		
Contents of trouble	• Since the joystick steering right EPC solenoid system was shorted with the power source, abnormal voltage was applied when the joystick steering right EPC solenoid output was OFF.		
Action of controller	• Stops the output to the joystick steering right and left EPC solenoids. • Stops the output to the joystick steering solenoid cut relay. • Turns the centralized warning lamp and alarm buzzer ON. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Joystick steering is inoperable (operable in handle mode).		
Related information	• The output state (current) to the joystick steering right EPC solenoid can be checked with the monitoring function (Code: 41904 J/S EPC DIR RH). • Method of reproducing failure code: Turn the starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective joystick steering right EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			JS5 (male)	Resistance	
			Between (1) and (2)	5 – 15 Ω	
			Between (1), (2) and chassis ground	Min. 1 MΩ	
	2	Defective joystick cutoff relay (L118) (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L118 (male)	Resistance	
			Between (1) and (2)	200 – 400 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			If joystick cutoff relay (L118) is replaced with a relay of the same type and the condition becomes normal, the joystick cutoff relay is defective.		
	3	Hot short in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between L07 (female) (28) – JS5 (female) (1) and chassis ground	Voltage	Max. 1 V

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	5	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L22 (female) (3) – L21 (female) (5)	Resistance	Max. 1 Ω
			Wiring harness between L22 (female) (5) – C12 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between L22 (female) (7) – fuse No. 9 of fuse box B, – circuit branch end	Resistance	Max. 1 Ω
			Wiring harness between L22 (female) (4) – C12 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between C12 (female) (3) and chassis ground	Resistance	Max. 1 Ω
			Wiring harness between L21 (female) (1) and chassis ground	Resistance	Max. 1 Ω
	6	Ground fault in wiring harness (Short circuit with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between L22 (female) (3) - L21 (female) (5) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L22 (female) (5) – C12 (female) (2) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L22 (female) (7) – fuse No. 9 of fuse box B, – circuit branch end and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between L22 (female) (4) – C12 (female) (1) and chassis ground	Resistance	Min. 1 MΩ

MEMORANDUM

Related Circuit Diagram



			Cause																		
			Torque converter charging pump			Regulator valve	Torque converter oil cooler		Torque converter			Main relief valve		ECMV	Transmission				Parking brake	Others	
			a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s
			Clogging of strainer	Clogging or air intake on pump suction side	Charging pump is defective	Defective operation of regulator valve	Clogging of oil cooler and piping (after torque converter outlet)	Breakage of oil cooler and piping (after torque converter outlet)	Oil leak inside torque converter	Internal breakage of torque converter	Defective operation of torque converter relief valve	Drop of main relief valve set pressure	Clogging of last chance filter	Defective operation of relevant ECMV	Internal breakage of transmission	Defective seal of relevant clutch piston	Defective seal of relevant clutch shaft	Clogging of breather	Defective seal of parking brake piston	Defective seal of work equipment and steering system hydraulic pump shaft (Mixing of hydraulic oil in transmission case)	Engine degradation
No.	**Diagnosis**	**Remedy**	❍ x	Δ x	x	Δ x	Δ x	x	Δ x	Δ x	Δ x	Δ x	x	*	Δ x	*	x	❍ x	x	Δ x	**Note**
10	When the ECMV output (clutch) oil pressure is measured	The oil pressure drops as the oil temperature rises.			❍											❍	❍		❍		
11		The oil pressure is low at all gear speeds.	❍	❍	❍							❍	❍		❍			❍	❍		❍
12		The oil pressure is low at specific gear speeds.												❍	❍	❍	❍				
13		The oil pressure does not become stable as the gauge fluctuates.	❍	❍																	
14	When the torque converter relief (inlet) oil pressure is measured, the oil pressure is low. (No. 11 - 13 are normal.)								❍	❍	❍										
15	When the oil pressure at the torque converter outlet is measured, the oil pressure is low. (No. 14 is normal.)							❍													

H-26

Bucket Speed is Low or Tilting-Back Force Is Insufficient

Checks before troubleshooting

- Is the stroke of the bucket control lever correct?
- Is the engine speed correct?

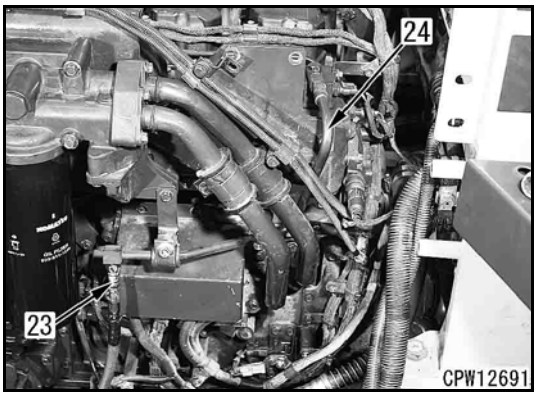
Check of abnormality

- Check by actual operation that the tilting back force is insufficient.
- Measure the operating speed of the bucket and check it in the *Standard Value* table.

No.	Diagnosis	Remedy	Cause: Tank – Work equipment pump			Cause: Work equipment valve						Cause: Cylinder
			a	b	c	e	f	g	h	i	j	k
			Clogging or air intake on pump suction side	Defective work equipment pump servo	Defective work equipment pump	Defective operation and defective adjustment of main relief valve	Defective operation of unload valve	Defective operation of ECSS charge valve	Defective operation of bucket bottom safety valve (Suction safety valve)	Defective operation of bucket bottom suction valve (Suction safety valve)	Internal wear or breakage of valve body (bucket spool)	Damaged bucket cylinder piston seal
			C Δ	Δ**x**	Δ **x**	**A** Δ **x**	Δ **x**	Δ **x**	Δ **x**	**C** Δ**x**	**x**	**x**
1	Rising force and speed of lift arm are abnormal and tilting-back force and speed of bucket are low.		❍	❍	❍	❍	❍	❍				
2	Rising force and speed of lift arm are normal and tilting-back force and speed of bucket are low.								❍	❍	❍	❍
3	After oil temperature rises, tilting back speed lowers more in Step 1.				❍							
4	Work equipment pump is making abnormal sounds.		❍		❍							
5	Hydraulic drift of the cylinder is large.								❍	❍	❍	❍
6	Relief oil pressure of relief valve of work equipment valve is low.					❍	❍	❍	❍	❍	❍	❍
7	When work equipment pump and servo assembly are replaced, bucket moves normally.			❍								

Work item	Symbol			Part No.	Part Name	Necessity	Qty	New/Remodel	Sketch	Nature of Work, Remarks
Press-fitting of upper hinge pin	K	1	1	793-520-2630	Bar	■	2			–
			2	793-520-2640	Push puller	■	1			–
			3	793-520-2550	Guide	■	1			–
			4	790-101-2300	Push puller	■	1			–
			5	790-101-2310	• Block		1			–
			6	02215-11622	• Nut		2			–
			7	790-101-2102	Puller (294 kN {30 ton})	■	1			–
			8	790-101-1102	Pump	■	1			–
Press-fitting of lower hinge pin		2	1	793-520-2530	Guide	■	1			–
			2	01010-31480	Bolt	■	2			–
			3	01643-31445	Washer	■	2			–
			4	793-520-2640	Push puller	■	1			–
			5	790-101-2102	Puller (294 kN {30 ton})	■	1			–
			6	790-101-1102	Pump	■	1			–
Disassembly and assembly of hydraulic cylinder assembly	U	1	1	790-502-1003	Repair stand	■	1			–
			2	790-101-1102	Pump		1			–
		2		790-102-4300	Wrench assembly	■	1			Removal and installation of piston
				790-102-4310	Pin	■	2			
		3		790-302-1290	Socket (Width across flats: 60 mm)	■	1			Removal and installation of steering cylinder nut
		4	1	790-201-1500	Push tool kit	■	1			Press-fitting of dust seal
			2	790-201-1590	• Plate	■	1			Steering cylinder
			3	790-201-1680	• Plate		1			Bucket cylinder
			4	790-101-5021	• Grip		1			All cylinders
			5	01010-50816	• Bolt		1			
		5	1	790-201-1702	Push tool kit	■	1			Press-fitting of roll bushing
			2	790-201-1781	• Push tool		1			Steering cylinder
			3	790-201-1871	• Push tool		1			Bucket cylinder
			4	790-101-5021	• Grip		1			All cylinders
			5	01010-50816	• Bolt		1			

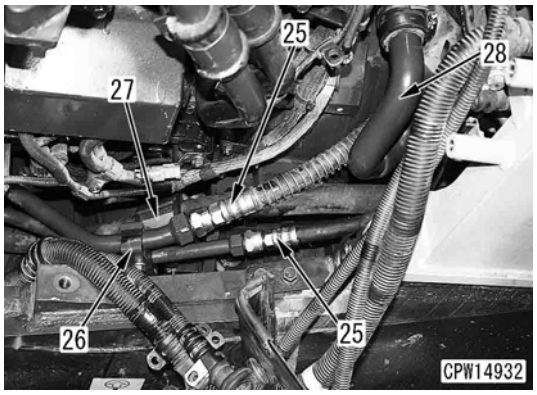
22. Disconnect hose (23); remove the clamp and fuel return tube (24). **[*4]**



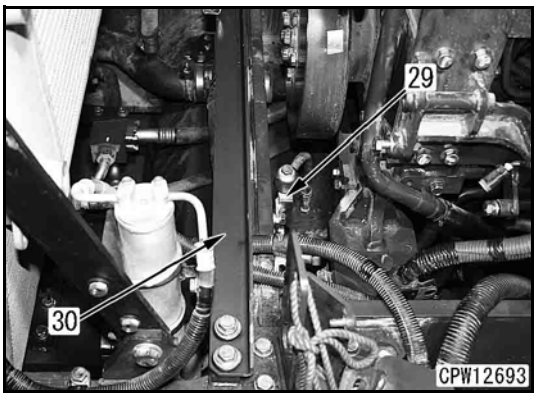
23. Disconnect fan drive motor hoses (25).

24. Remove fan drive motor tube clamp (26) and hose clamp (27) between the torque converter cooler and pump.

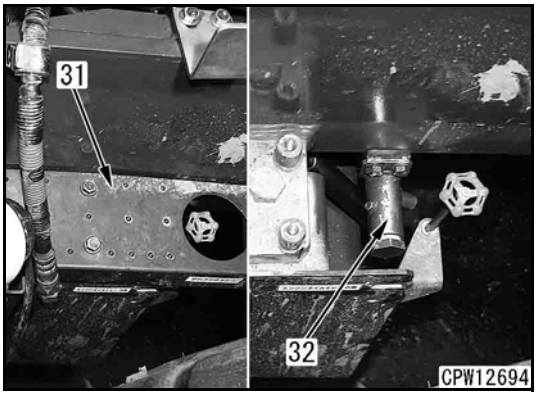
25. Remove fan pump tube (28).



26. Disconnect fuel tank breather (29) and remove crossbar (30).



27. Remove cover (31) and disconnect engine drain valve (32).



Engine Hood

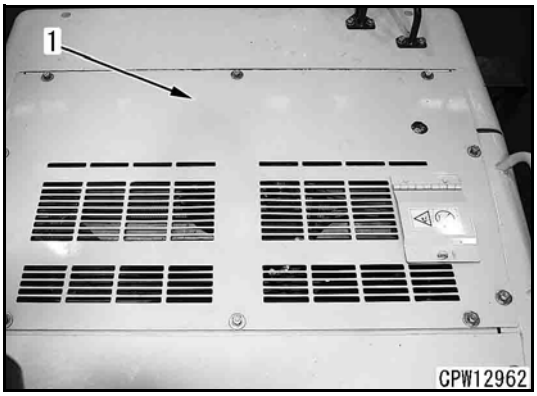
WARNING! Stop the machine on level ground and set the lock bar to the frame to lock the front and rear frames.

WARNING! Lower the work equipment to the ground; stop the engine; apply the parking brake; and put chocks under the tires.

WARNING! Disconnect the cable from the negative (-) battery terminal.

Removal

1. Remove rear hood (1).



2. Lift off front hood, muffler, and precleaner assembly (2).

Front hood, muffler, and precleaner assembly: 70 kg (154 lbs)

3. Remove right and left side panels (3).

Installation

★ Carry out installation in the reverse order of removal.

[*1]

Tube hose clamp: 10.5 N•m (93 lbf in)

★ When installing the clamp, direct it down.

[*2]

Air cleaner hose clamp: 8.8 ±0.5 N•m (78 ±4 lbf in)

[*3]

Tube joint bolt: 24.5 – 34.3 N•m (18 – 25 lbf ft)

[*4]

Tube joint bolt: 24.5 – 34.3 N•m (18 – 25 lbf ft)

[*5]

Tube joint bolt: 24.5 – 34.3 N•m (18 – 25 lbf ft)

Tube sleeve nut:

Centralized housing bracket side: 54 – 93 N•m (40 – 69 lbf ft)

Front cover side: 24 – 27 N•m (18 – 20 lbf ft)

[*6], [*7]

EGR valve mounting bolt: 59 – 74 N•m (44 – 55 lbf ft)

[*8]

Bracket mounting bolt: 9.8 ±1.0 N•m (87 ±9 lbf in)

High-pressure pipe clamp mounting bolt: 9.8 ±1.0 N•m (87 ±9 lbf in)

[*9]

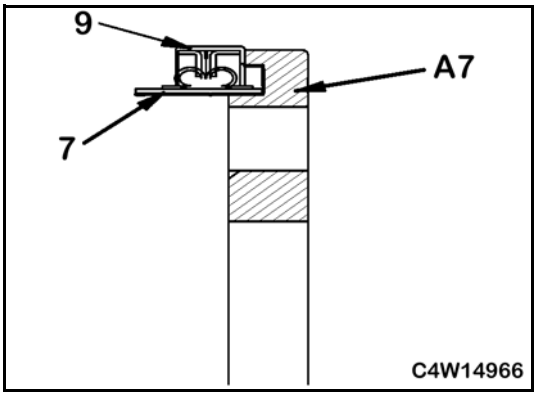
High-pressure pipe clamp mounting bolt: 9.8 ±1.0 N•m (87 ±9 lbf in)

Procedure for Installing Sleeved Seal

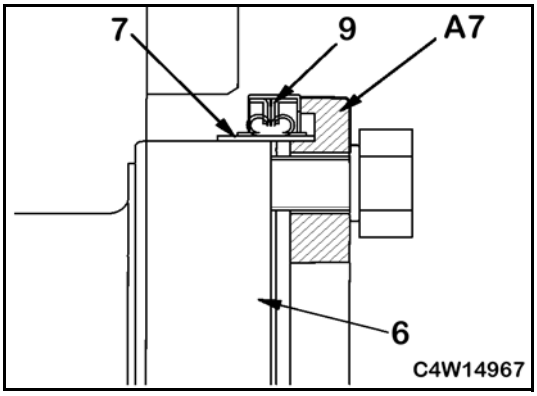
★ When installing the rear seal, do not apply oil or grease to the shaft, inside cylinder surface (C) of the sleeve (7), and seal lip.

1. Set sleeve and rear seal assembly (9) to tool **A7** (for fitting the sleeved seal).

   Sleeve inside cylinder surface (C): Gasket sealant (LG-7)



2. Set sleeve (7) of the rear seal to the end of crankshaft (6) and tighten the four bolts evenly to press-fit sleeve and rear seal assembly (9) until the end of tool **A7** reaches the end of crankshaft (6).
   ★ Tighten tool **A7** (for press-fitting the sleeved seal) until the bolt with a washer stops.



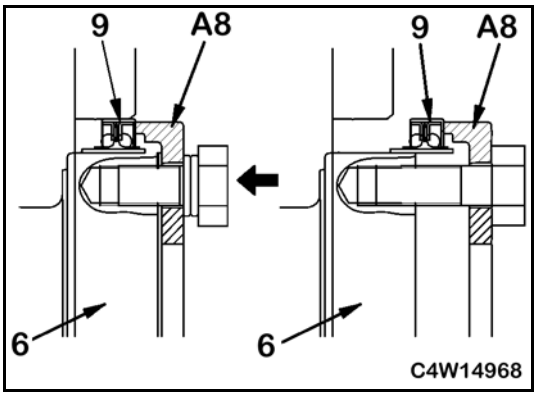
3. Remove tool **A7** (for press-fitting the sleeved seal) and install tool **A8** (for press-fitting the seal).

4. Tighten the four bolts evenly to press-fit sleeve and rear seal assembly (9) until the end of tool **A8** reaches the end of crankshaft (6).

   A. Tighten tool **A8** (for press-fitting the seal) first until the bolt without a washer stops and then tighten the bolt with two washers.

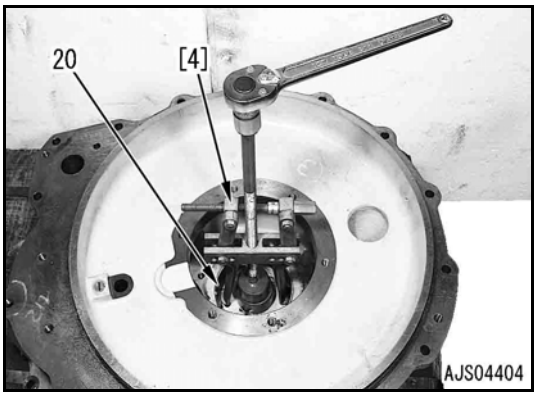
   B. After press-fitting the seal, remove the red sealant layer from its periphery.

      Rear seal driving depth . . . . . .
      . . . . . 13.2 ±0.2 mm (0.520 ±0.008 in)

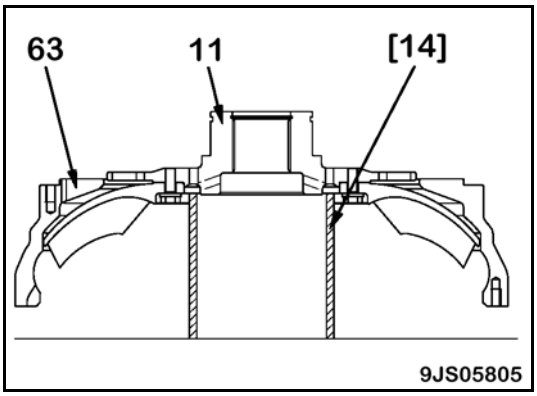


   C. When installing, set the dowel pin of the crankshaft to the dowel hole of the flywheel.

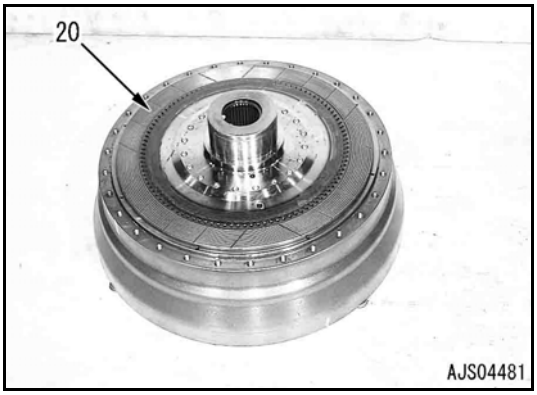
8. Outer race
   ★ Using puller [4], remove outer race (20) from the case.



B. Apply tool [14] (outside diameter: 150 mm [5.906 in], height: 129 mm [5.079 in]) to the bottom of turbine boss assembly (11) to hold the latter.
   ★ This secures a space for installing the disc to drive case (63).



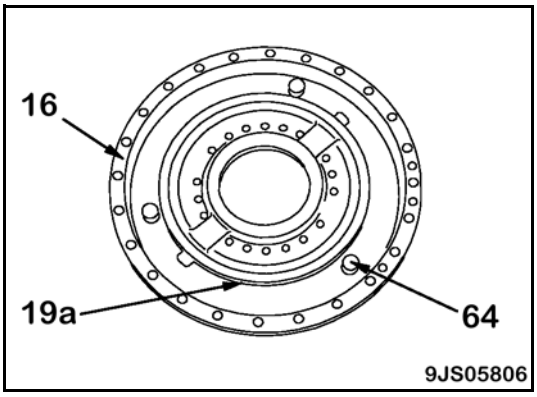
C. Install disc (20).



8. Piston housing assembly

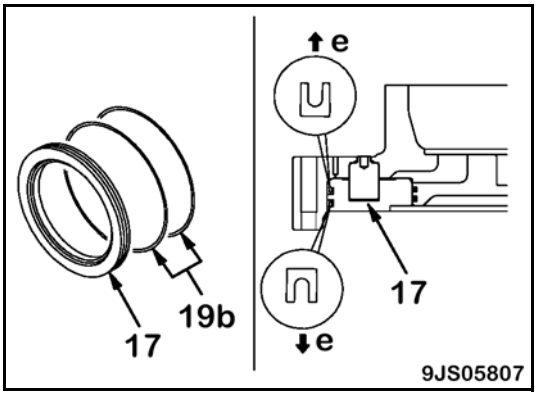
A. Install seal ring (19a) to piston housing complete (16).
   ★ Do not remove dowel pin (64) since it is a complete part.

Periphery of seal ring: Grease (G2-LI)



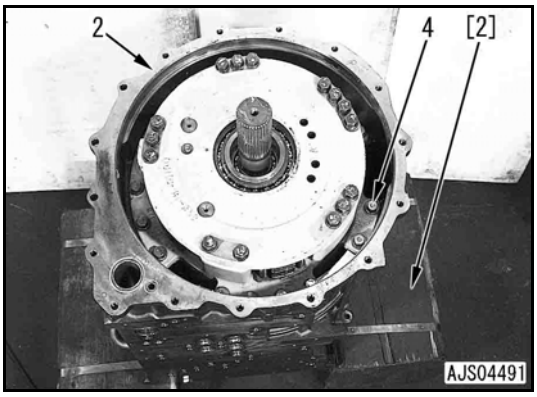
B. Install seal ring (19b) to piston (17).
   ★ Set pressure receiving side (e) of the seal ring in the arrow direction as shown in the figure.

Periphery of seal ring: Grease (G2-LI)



B. Set transmission assembly (2) on block [2].

C. Remove 18 mounting bolts (4) from the upper input shaft side.

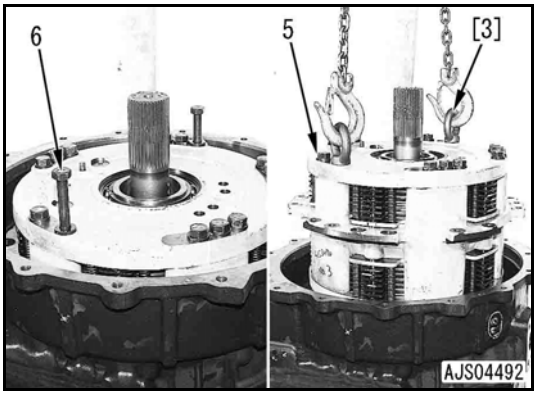


D. Remove two tie bolts (6).

E. Install eyebolts [3] to the holes of the removed tie bolts and remove transmission assembly (5).

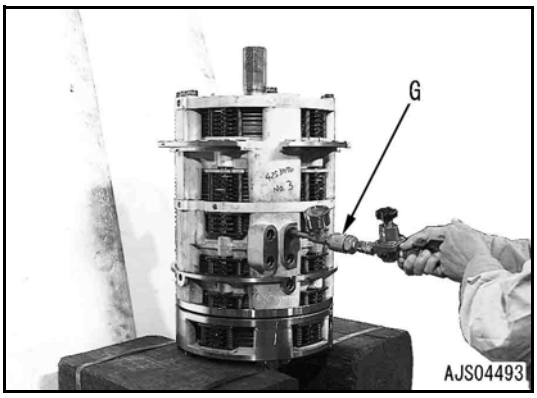
★ Do not use an impact wrench to loosen the tie bolts because it could damage the cushion sleeve and cause the tie bolts to seize.

Transmission assembly: 410 kg (904 lbs)



4. Check clutch piston operation.

★ Using tool **G**, check the operating condition of the piston before disassembling the transmission.

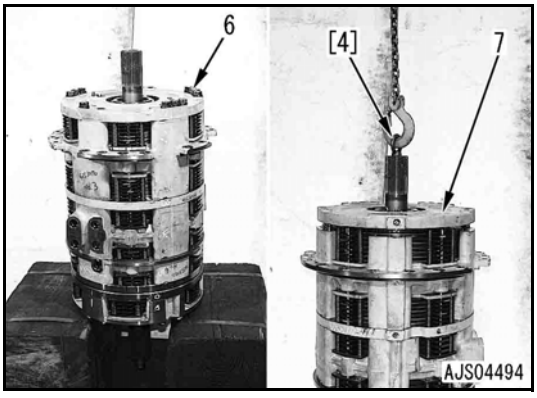


5. Input shaft and No. 1 carrier housing assembly

A. Remove 13 other tie bolts (6).

★ Do not use an impact wrench to loosen the tie bolts because it can damage the cushion sleeve.

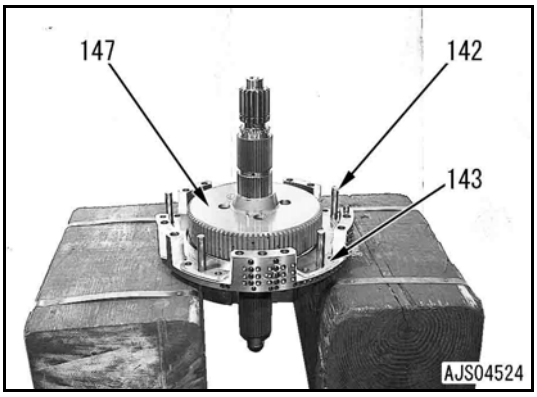
B. Using eyebolt [4], remove the input shaft and No. 1 carrier housing assembly (7).



5. Guide pin
   ★ Install five guide pins (142).

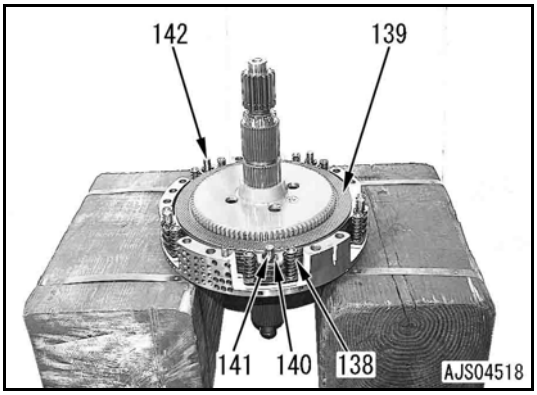
6. No. 6 pin
   ★ Install No. 6 piston (143).

7. No. 6 hub
   ★ Install No. 6 hub (147).

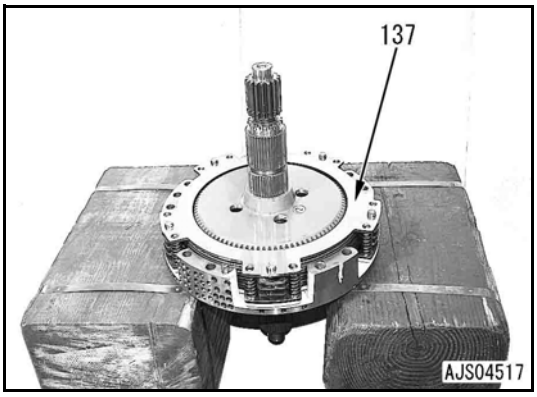


8. No. 6 plate, spring and No. 6 disc
   ★ Install three No. 6 plates (141), 20 springs (140), and four No. 6 discs (139).

9. No. 6 spring
   ★ Install ten No. 6 springs (138).



10. No. 6 plate
    ★ Install No. 6 upper plate (137).



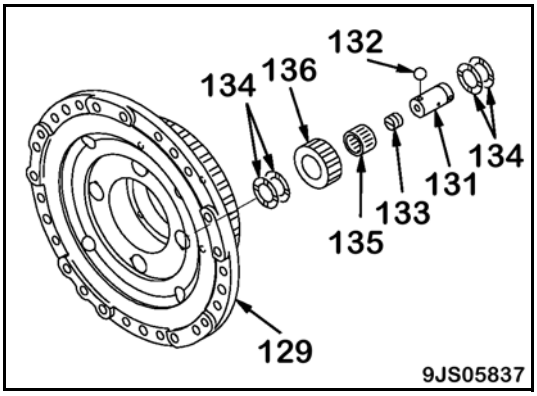
11. No. 5 carrier assembly

    A. Assemble No. 5 carrier assembly (129) according to the following procedure.

       i. Install needle roller bearing (135) to planetary gear (136).

       ii. Fit two thrust washers (134) each to both sides of planetary gear (136) and set them to the No. 5 carrier.
           • Align each part with the shaft hole.

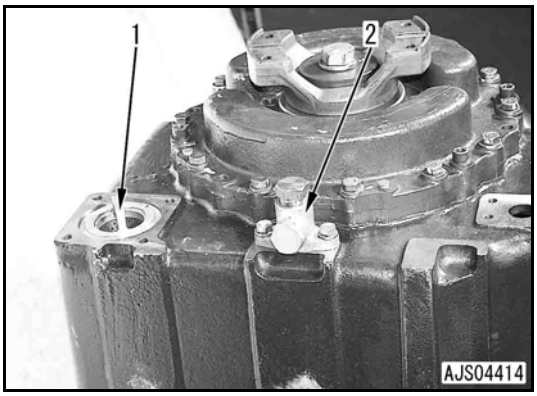
       iii. Fit plug (133) and ball (132) to shaft (131) and install them.
            ★ Check that the planetary gear rotates smoothly.



Disassembly

1. Disconnect the transfer and parking brake assembly from the power train unit.
   ★ For details, see *POWER TRAIN: Power Train* in this section.

2. Remove strainer (1) and drain valve (2).

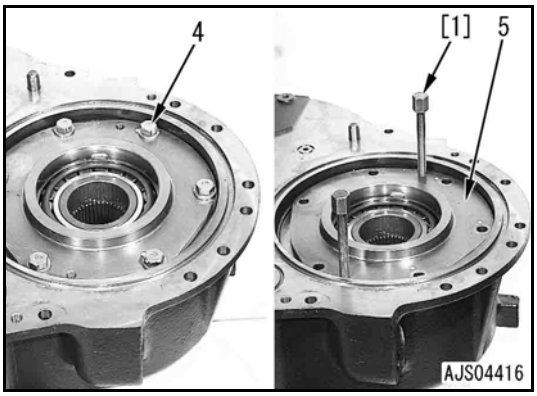


3. Remove speed sensor (3).

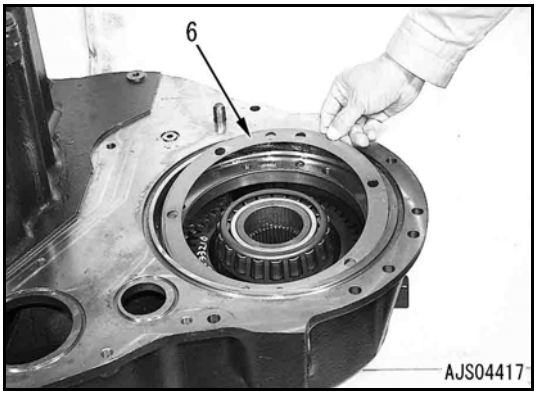
4. Input shaft bearing cage assembly

   A. Remove six mounting bolts (4).

   B. Using forcing screws [1], remove bearing cage assembly (5).



   C. Remove shim (6).
      ★ Check the thickness and quantity of the shims at each position; keep these shims.

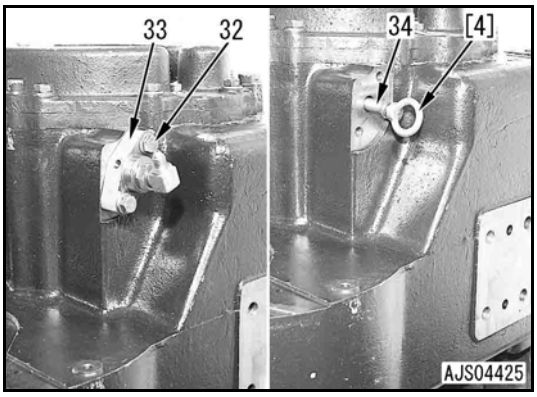


28. Sleeve

A. Fit O-ring (88) to sleeve (34).

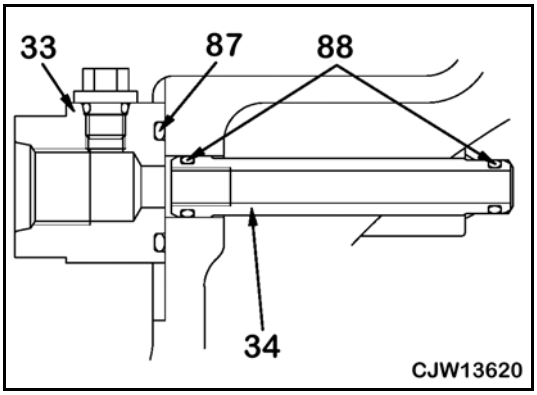
O-ring: Grease (G2-LI)

B. Using forcing screw [4], install sleeve (34).



C. Fit O-ring (87) and install parking brake emergency release valve (33).

O-ring: Grease (G2-LI)



29. Coupling (rear side)

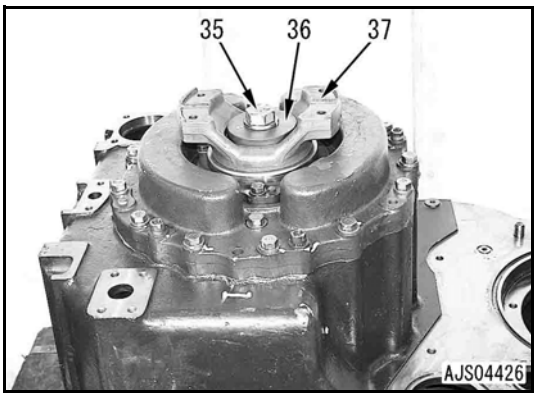
A. Fit the O-ring and install coupling (37), holder (36), and bolt (35).

B. Set coupling (37) to the position of the coupling on the opposite side.

O-ring: Grease (G2-LI)

Mounting bolt: Adhesive (LT-2)

Mounting bolt: 824 – 1,030 N•m (608 – 760 lbf ft)



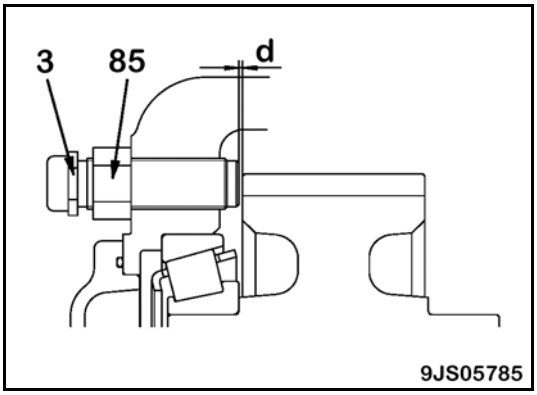
30. Speed sensor

A. Tighten speed sensor (3) until it touches the gear lightly and then return it by 1/2 - 1 turn to make clearance (d).

Clearance (d): . . . . . .0.75 – 1.5 mm (0.030 – 0.059 in)

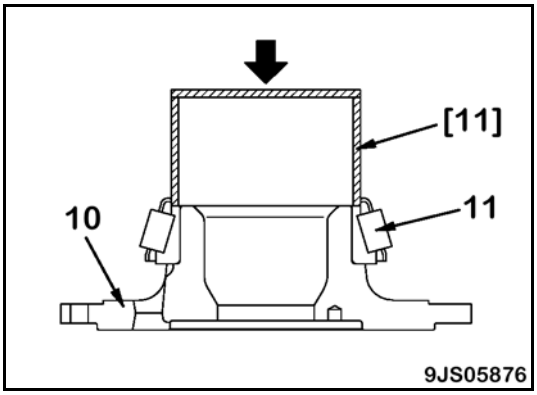
B. Tighten locknut (85).

Locknut: 49.0 – 68. 6 N•m (36 – 51 lbf ft)

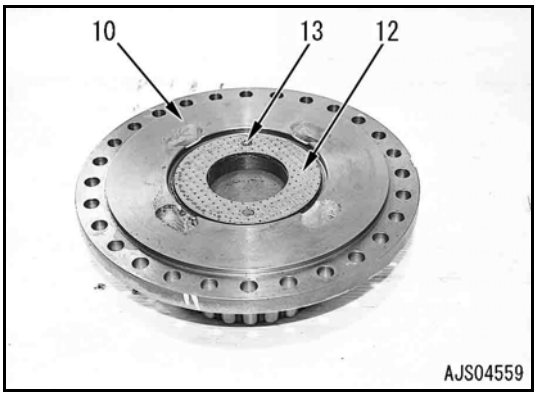


10. Gear case cover A

A. Using push tool [11] (inside diameter: 131 mm [5.158 in]), press-fit bearing (11) to gear case cover (A) (10).
★ Press-fit the inner race of the bearing.



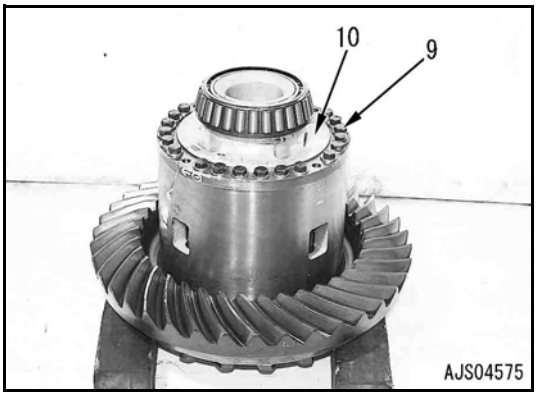
B. Install dowel pin (13) and thrust plate (12) to gear case cover A (10).
★ When installing, apply grease (G2-LI) thinly to the thrust plate to prevent it from falling.



C. Install gear case cover A (10).

D. Tighten 24 mounting bolts (9).

Mounting bolt: 98 – 123 N•m (72 – 91 lbf ft)



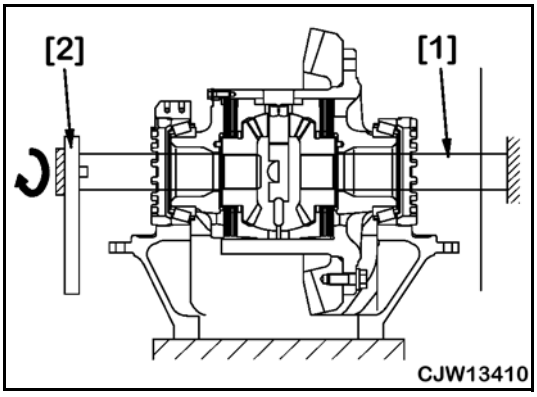
E. Measuring differential rotation torque

i. Using the bearing, cap, and nut, install the differential gear and case assembly temporarily to the differential carrier.

ii. Fix either side gear of the differential gear case assembly with shaft [1]. (Stop the rotation of the side gear.)

iii. Measure the rotation torque of the side gear on the opposite side with torque wrench [2].
★ Set the case so that it can rotate freely.
★ You can use a measuring instrument which satisfies the measurement condition and can be fixed to the side gear.

Differential rotation torque: Maximum 34 N•m (25 lbf ft)



D. Install shim (38) removed during the disassembly procedure.
Shim adjustment allowance: 0.71 – 2.21 mm (0.028 – 0.087 in)

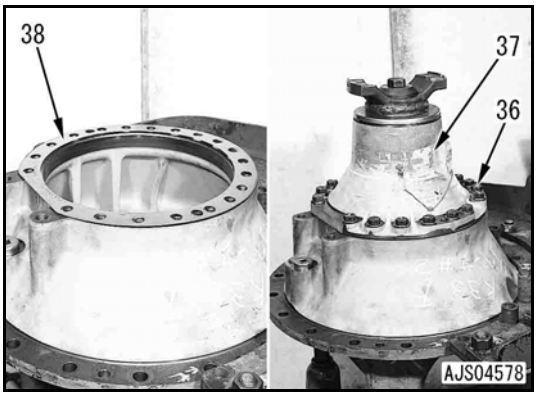
E. Fit the O-ring and install pinion assembly (37).

O-ring: Grease (G2-LI)

Pinion assembly: 110 kg (243 lbs)

F. Tighten 18 mounting bolts (36).

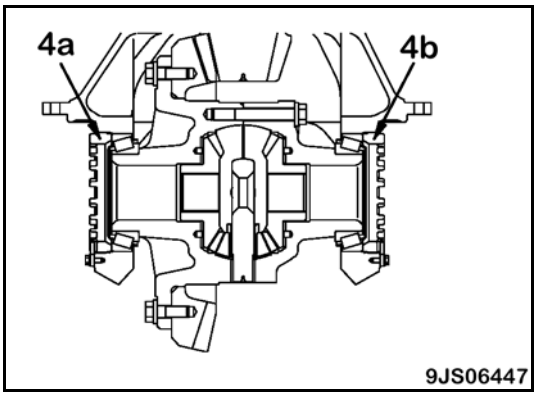
Mounting bolt: 245 – 309 N•m (181 – 228 lbf ft)



9. Adjusting tooth contact and backlash
★ Adjust the backlash and tooth contact simultaneously.

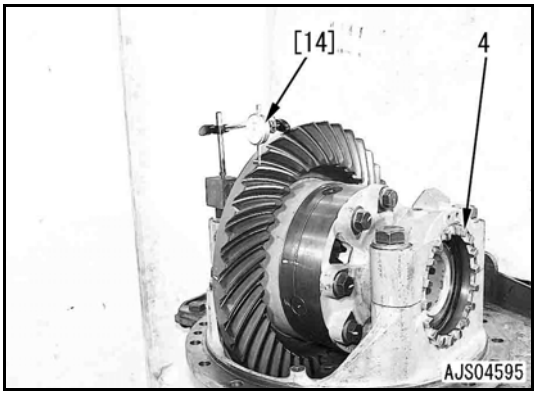
A. Adjust the backlash according to the following procedure.

i. Move the bevel gear with adjustment nuts (4a) and (4b).
★ Rotate adjustment nuts (4a) and (4b) by the same amount, in the same direction, so that the adjusted preload on the bearing does not change.

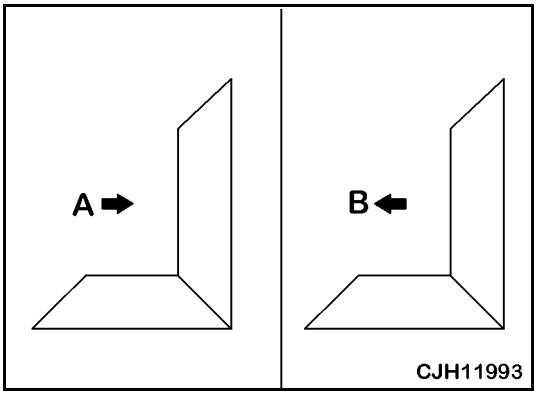


ii. Apply dial gauge [14] perpendicularly to the tooth surface on the reverse side at the outer end of the bevel gear.

iii. Adjust adjustment nut (4) so that dial gauge [14] indicates the following range (backlash).
★ Adjust the backlash at three to four places and measure it with the pinion gear fixed.
Standard backlash: . . .0.36 – 0.51 mm (0.014 – 0.020 in)



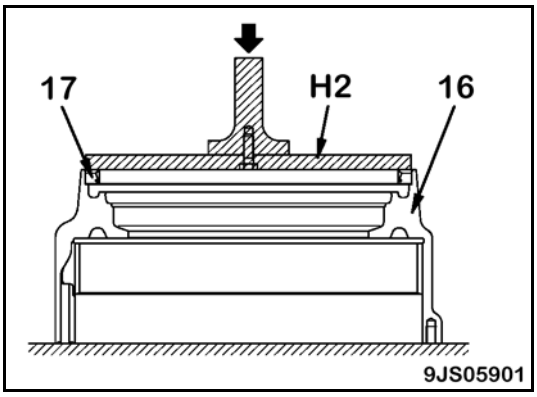
- When backlash is less than standard range:
  Loosen the adjustment nut on the bevel gear side and tighten the adjustment nut on the opposite side by the same angle (to move the bevel gear in direction (A)).
- When the backlash is above standard range:
  Loosen the adjustment nut on the opposite side and tighten the adjustment nut on the bevel gear side by the same angle (to move the bevel gear in direction (B)).



2. Outer gear

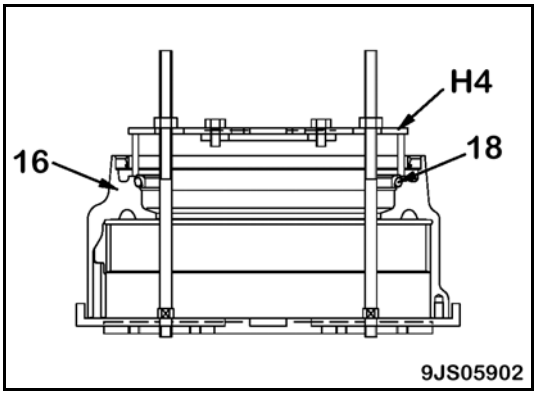
A. Using tool **H2**, install oil seal (17) to outer gear (16).

Seal lip surface: Grease (G2-LI)



B. Using tool **H4**, install floating seal (18) to outer gear (16).

i. Fit the O-ring to the floating seal.
★ Be careful not to twist the O-ring of the floating seal. Tighten tool **H4** evenly.

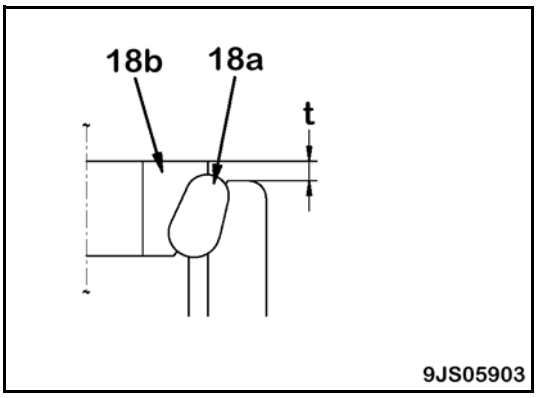


ii. Use alcohol to remove all of the white powder protecting the surface of O-ring (18a).

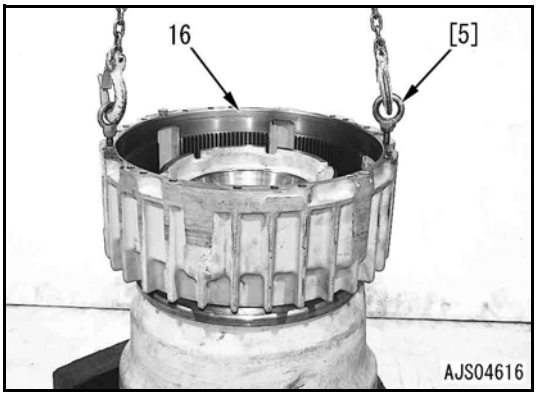
iii. Thoroughly degrease the floating seal and O-ring contact surface of the wheel hub.

iv. After press-fitting O-ring (18a) of the floating seal, measure height (t) at four places on the periphery and check that its dispersion is not larger than 1 mm (0.039 in).

v. Apply axle oil to the seal surface of floating seal (18b) to prevent dirt from sticking.



C. Using sling [5], install outer gear (16).



Cooling Pump

WARNING! Stop the machine on level ground and set the lock bar to the frame to lock the front and rear frames.

WARNING! Lower the work equipment to the ground; stop the engine; apply the parking brake; and put chocks under the tires.

WARNING! Operate the work equipment control lever two to three times to release the residual pressure in the work equipment circuit.

WARNING! Disconnect the cable from the negative (-) battery terminal.

Required

- Container to hold the coolant
- Container to hold the hydraulic oil

Removal

1. Drain the coolant.

   Coolant: 90 ℓ (24 gal)

2. Drain the hydraulic oil.

   Hydraulic oil: 337 ℓ (89 gal)

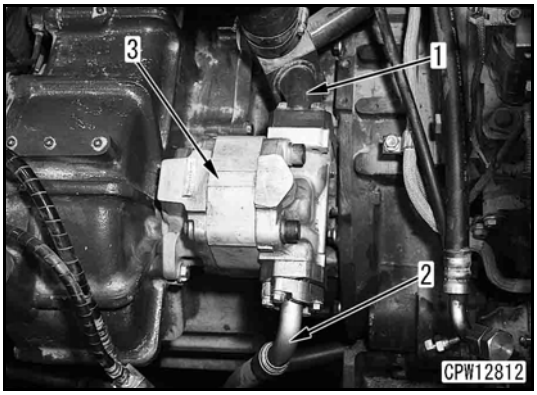
3. Remove the hood.
   ★ For details, see *ENGINE AND COOLING SYSTEM: Engine Hood* in this section.

4. Remove the operator cab and floor frame.
   ★ For details, see the *CAB AND ATTACHMENTS: Cab and Floor Frame* in this section.

5. Remove the hydraulic tank.
   ★ For details, see the *HYDRAULIC SYSTEM: Hydraulic Tank* in this section.

6. Disconnect pump inlet tube (1) and outlet hose (2).

7. Remove the two mounting bolts and cooling pump assembly (3). **[*1]**



Assembly

★ When assembling, coat the sliding surfaces of each part with engine oil and be careful not to damage the rod packings, dust seals, and O-rings.

1. Assembly of cylinder head assembly

   A. Using **U5**, press-fit bushing (23) to cylinder head (24).
      ★ When press-fitting, be extremely careful not to deform the bushing.

   B. Install buffer ring (19).

   C. Install rod packing (18).
      ★ Pay attention to the installed directions of rod packing (18) and buffer ring (19).

   D. Using the push tool, install dust seal (17) to cylinder head (24).

   E. Install snap ring (16).

   F. Install O-ring (22).

   G. Install backup ring (21) and O-ring (20).
      ★ Do not insert the backup ring forcibly; warm it in water at 50 – 60°C (122 – 140°F) and then insert it.

2. Assembly of piston assembly

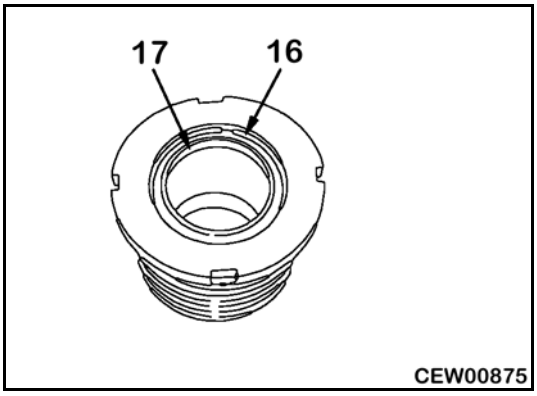
   A. Using tool **U6-1**, expand piston ring (10).

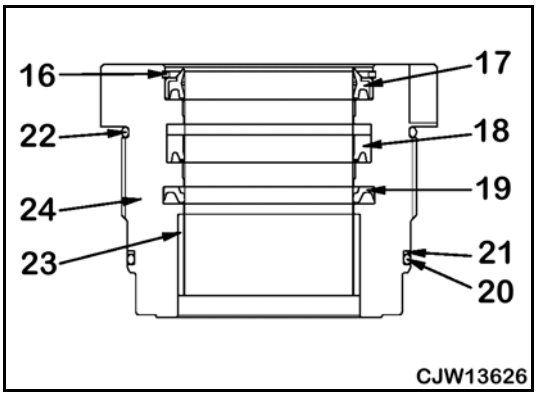
      ★ Set the piston ring to the tool and rotate the handle of the tool eight to ten turns to expand the piston ring.

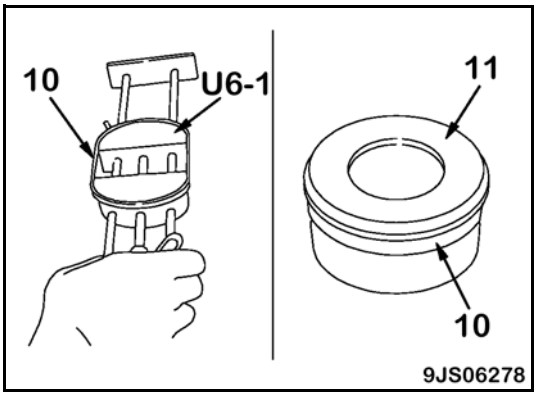
   B. Remove piston ring (10) from tool **U6-1** and install it to piston (11).

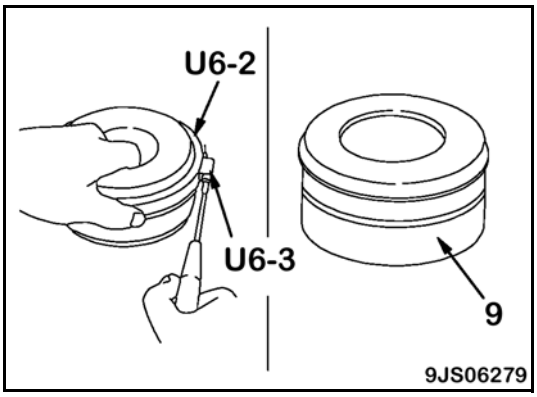
   C. Install tool **U6-2** to the piston ring and shrink the piston ring with clamp **U6-3**.

   D. Install wear ring (9).



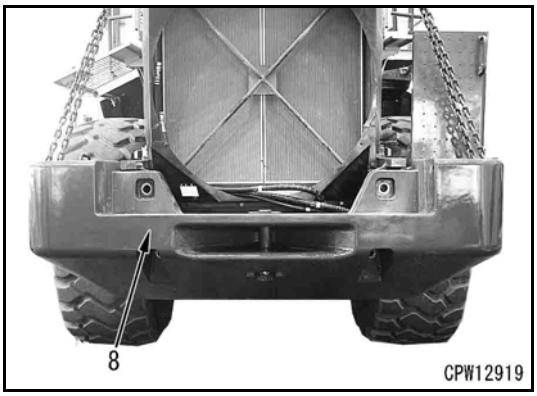






7. Sling counterweight assembly (8); remove its four mounting bolts; and lift it off. **[*1]**

Counterweight: 2,550 kg (5,622 lbs)



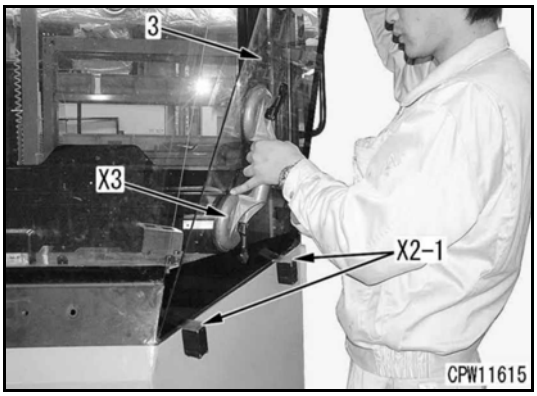
Installation

★ Carry out installation in the reverse order of removal.

[*1]

Counterweight mounting bolt: 1,372 – 1,764 N•m (1,012 – 1,301 lbf ft)

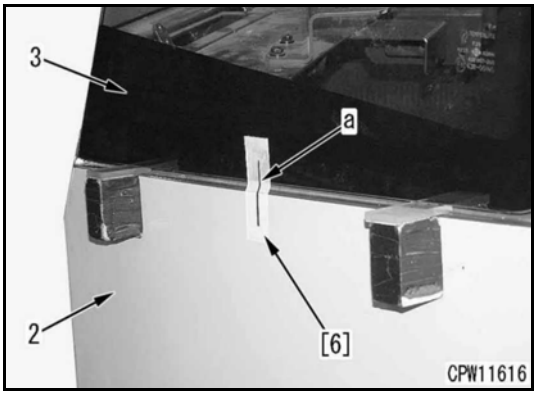
C. Using tool **X3** (suction cup), place window glass (3) on tool **X2-1** (5 mm (0.20 in) spacer) and match it to the cab.



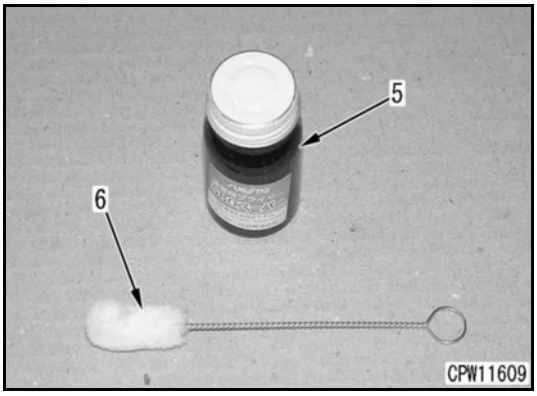
D. Check the clearance between window glass (3) and cab (2) on both sides and adjust it evenly.

E. Stick tape [6] between window glass (3) and cab (2) and draw positioning line (a) on the tape.

F. Cut the tape between window glass (3) and cab (2) with a knife and then remove the window glass.
   ★ Do not remove the tapes left on the window glass and cab before installing the window glass.



6. Apply primer.
   ★ The using limit of primer (5) is four months after the date of manufacture. Do not use primer (5) after this limit.
   ★ Use the primer within two hours after unpacking it.
   ★ Even if the primer is packed again just after it is unpacked, use it within 24 hours after it is unpacked for the first time.
   (Discard the primer 24 hours after it is packed.)



A. Stir the primers for paint and glass sufficiently before using them.
   ★ If the primer has been stored in a refrigerator, leave it at room temperature for at least half a day before stirring it.
   (If the primer is unpacked just after being taken out of the refrigerator, water will condense. Leave the primer at room temperature for a sufficient time.)

B. When reusing primer brush (6), wash it in white gasoline.
   ★ After washing the brush, check it again for dirt and foreign matter.
   ★ Prepare respective brushes for the paint primer and glass primer.

10. Mark the points where the Bowden pull wire (5) is fastened with the swinging structure (14) with the cable tie (8); take the cable tie (8) off.

11. Pull the fixation (12) off the vertical shock absorber (13).

12. Take the Bowden pull wire (5) off the bearing (9).

13. Remove the fixation (12) from the fork (11).

14. Take the Bowden pull wire (5) off the fork (11); remove the fork (11) and compression spring (10).

15. Mark the location of the mounting hole for the Bowden pull wire (5) in the upper part of the suspension (4); pull the Bowden pull wire (5) out of the upper part of the suspension (4); and then remove it.

Installation

1. Install handle (5) to holder (4), if removed.
   ★ When handle (5) is deformed, replace it.

2. Install Bowden pull wires (1) and (6) to the holder for Bowden wire (4).
   ★ Adjust the new Bowden pull wire to the length of the old one (excess length of the wire).

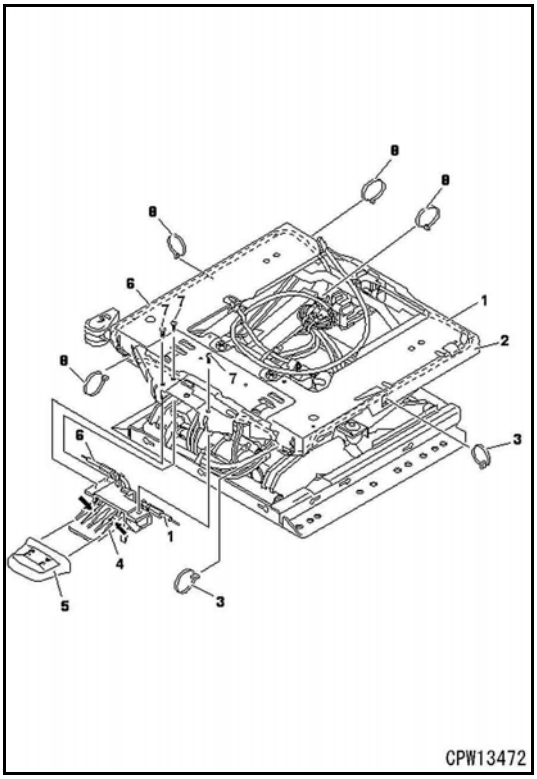
3. Install holder (4) to the upper part of suspension (2) and tighten three crosshead screws (7).

4. Install Bowden pull wire (6) to the height level controller.
   ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Suspension): Height Level Controller* in this section.

5. Install Bowden pull wire (1) to the height level controller.
   ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Suspension): Height Level Controller* in this section.

6. Fix Bowden pull wire (6) with two cable ties (8) at the marked points.
   ★ Loosely fix the Bowden pull wire with the cable ties at the marked points and make sure it is not distorted.

7. Fix Bowden pull wire (1) with two cable ties (3) at the marked points.
   ★ Loosely fix the Bowden pull wire with the cable ties at the marked points and make sure it is not distorted.



8. Install the bellows.
   ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Suspension): Bellows* in this section.

9. Install the top cover.
   ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Suspension): Top Cover* in this section.

10. Install the upper part of the seat.
    ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Upper Seat)* in this section.

★ Refer to the *Operator Seat (Suspension): Air Tank for Additional Air Supply* in this section.

11. Install the pneumatic spring.
    ★ Refer to the *Operator Seat (Suspension): Pneumatic Spring* in this section.

12. Install the Bowden pull wires for height level adjustment to the height level valve.
    ★ Refer to the *Operator Seat (Suspension): Bowden Pull Wires and Handle (Height Adjustment)* n this section.

13. Install the cable tie for the air input hoses of the height level controller and pull the air input hoses to the pneumatic spring.
    ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Suspension): Compressed-Air Hoses* in this section.

14. Install the webbing to the lower part of the suspension.
    ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Suspension): Height Level Controller* in this section.

15. Install the compressor.
    ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Suspension): Compressor* in this section.

16. Install the vertical shock absorber to the swinging structure.
    ★ Refer to the *Operator Seat (Suspension): Vertical Shock Absorber* in this section.

17. Install the Bowden pull wire for vertical shock absorber adjustment to the vertical shock absorber.
    ★ Refer to the *Operator Seat (Suspension): Bowden Pull Wires and Handle (Vertical Shock Absorber Adjustment)* in this section.

18. Install the bellows.
    ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Suspension): Bellows* in this section

19. Install the top cover.
    ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Suspension): Cover* in this section

20. Install the upper part of the seat.
    ★ Refer to *CAB AND ITS ATTACHMENTS: Operator Seat (Upper Seat)* in this section.