SHOP MANUAL

KOMATSU

WA320-5H

MACHINE MODEL	SERIAL NUMBER
WA320-5H	**H50051 and up**

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require.
  Materials and specifications are subject to change without notice.
- WA320-5H mounts the SAA6D102E-2-A engine.
  For details of the engine, see the 102 Series Engine Shop Manual.

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CONTENTS

SAFETY
SAFETY NOTICE

IMPORTANT SAFETY NOTICE

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

To prevent injury to workers, the symbol ⚠ is used to mark safety precautions in this manual. The cautions accompanying these symbols 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 and 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.
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, hand shield, cap and other clothes suited for welding work.
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 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. 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.

PREPARATIONS FOR WORK

7. Before adding oil or making any repairs, park the machine on hard, level ground, and block the wheels or tracks to prevent the machine from moving.
8. Before starting work, lower blade, ripper, bucket or any other work equipment to the ground. If this is not possible, insert the safety pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.
9. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.
10. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

PRECAUTIONS DURING WORK

11. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out.
    Before disconnecting or removing components of the oil, water or air circuits, first remove the pressure completely from the circuit.
12. The water and oil in the circuits are hot when the engine is stopped, so be careful not to get burned.
    Wait for the oil and water to cool before carrying out any work on the oil or water circuits.
13. Before starting work, remove the leads from the battery. Always remove the lead from the negative (–) terminal first.
14. When raising heavy components, use a hoist or crane.
    Check that the wire rope, chains and hooks are free from damage.
    Always use lifting equipment which has ample capacity.
    Install the lifting equipment at the correct places.
    Use a hoist or crane and operate slowly to prevent the component from hitting any other part.
    Do not work with any part still raised by the hoist or crane.
15. When removing covers which are under internal pressure or under pressure from a spring, always leave two bolts in position on opposite sides. Slowly release the pressure, then slowly loosen the bolts to remove.
16. When removing components, be careful not to break or damage the wiring. Damaged wiring may cause electrical fires.
17. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips onto the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip, or can even start fires.
18. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.
19. Be sure to assemble all parts again in their original places.
    Replace any damaged parts with new parts.
    - When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is being operated.
20. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. Also, check that connecting parts are correctly installed.
21. When assembling or installing parts, always use the specified tightening torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
22. When aligning two holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
23. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurements.
24. Take care when removing or installing the tracks of track-type machines.
    When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

FOREWORD
GENERAL

This shop manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This shop manual mainly contains the necessary technical information for operations performed in a service workshop. For ease of understanding, the manual is divided into the following chapters; these chapters are further divided into the each main group of components.

STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.
In addition, this section may contain hydraulic circuit diagrams, electric circuit diagrams, and maintenance standards.

TESTING AND ADJUSTING

This section explains checks to be made before and after performing repairs, as well as adjustments to be made at completion of the checks and repairs.
Troubleshooting charts correlating "Problems" with "Causes" are also included in this section.

DISASSEMBLY AND ASSEMBLY

This section explains the procedures for removing, installing, disassembling and assembling each component, as well as precautions for them.

MAINTENANCE STANDARD

This section gives the judgment standards for inspection of disassembled parts.
The contents of this section may be described in STRUCTURE AND FUNCTION.

OTHERS

This section mainly gives hydraulic circuit diagrams and electric circuit diagrams.
In addition, this section may give the specifications of attachments and options together.

NOTICE

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Use the specifications given in the book with the latest date.

HOW TO READ THE SHOP MANUAL

VOLUMES

Shop manuals are issued as a guide to carrying out repairs. They are divided as follows:

Chassis volume: Issued for every machine model
Engine volume: Issued for each engine series
Electrical volume:
Attachments volume: } Each issued as one volume to cover all models

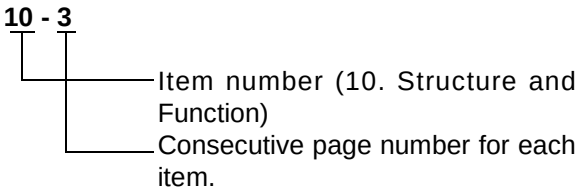
These various volumes are designed to avoid duplicating the same information. Therefore, to deal with all repairs for any model , it is necessary that chassis, engine, electrical and attachment volumes be available.

DISTRIBUTION AND UPDATING

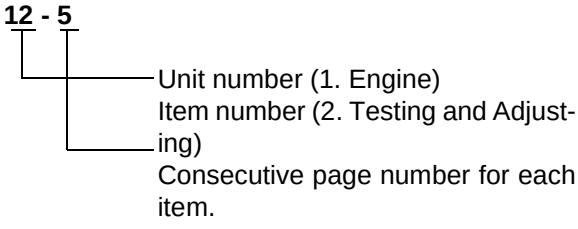
Any additions, amendments or other changes will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

FILING METHOD

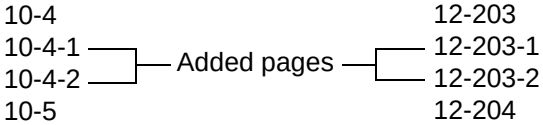
1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples show how to read the page number.
   Example 1 (Chassis volume):



   Example 2 (Engine volume):



3. Additional pages: Additional pages are indicated by a hyphen (-) and number after the page number. File as in the example.
   Example:



REVISED EDITION MARK

When a manual is revised, an edition mark ((1)(2)(3)....) is recorded on the bottom of the pages.

REVISIONS

Revised pages are shown in the LIST OF REVISED PAGES next to the CONTENTS page.

SYMBOLS

So that the shop manual can be of ample practical use, important safety and quality portions are marked with the following symbols.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing the work.
★	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing the work.
	Weight	Weight of parts of systems. Caution necessary when selecting hoisting wire, or when working posture is important, etc.
	Tightening torque	Places that require special attention for the tightening torque during assembly.
	Coat	Places to be coated with adhesives and lubricants, etc.
	Oil, water	Places where oil, water or fuel must be added, and the capacity.
	Drain	Places where oil or water must be drained, and quantity to be drained.

HOISTING INSTRUCTIONS

HOISTING

> ⚠ Heavy parts (25 kg or more) must be lifted with a hoist, etc. In the **DISASSEMBLY AND ASSEMBLY** section, every part weighing 25 kg or more is indicated clearly with the symbol

- If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:
  1) Check for removal of all bolts fastening the part to the relative parts.
  2) Check for existence of another part causing interference with the part to be removed.

WIRE ROPES

1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

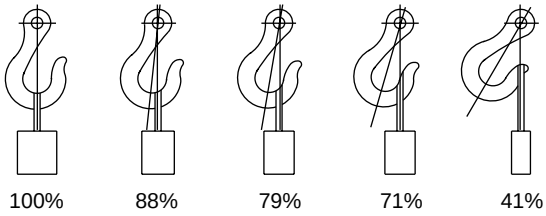
Wire ropes
(Standard "Z" or "S" twist ropes
without galvanizing)

Rope diameter	Allowable load	
mm	kN	tons
10	9.8	1.0
11.5	13.7	1.4
12.5	15.7	1.6
14	21.6	2.2
16	27.5	2.8
18	35.3	3.6
20	43.1	4.4
22.4	54.9	5.6
30	98.1	10.0
40	176.5	18.0
50	274.6	28.0
60	392.2	40.0

★ The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

2) Sling wire ropes from the middle portion of the hook.

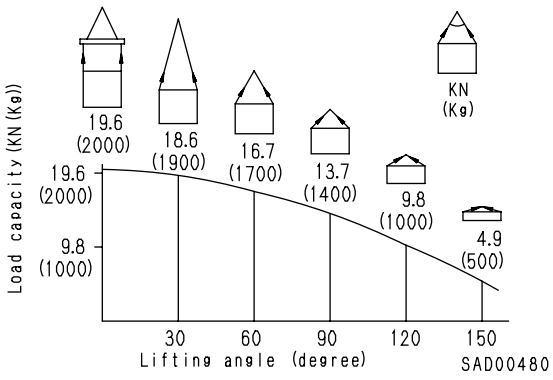
Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.



3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.

> ⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook.
When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load kN {kg} when hoisting is made with two ropes, each of which is allowed to sling up to 9.8 kN {1000 kg} vertically, at various hanging angles.
When two ropes sling a load vertically, up to 19.6 kN {2000 kg} of total weight can be suspended. This weight becomes 9.8 kN {1000 kg} when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 39.2 kN {4000 kg} if they sling a 19.6 kN {2000 kg} load at a lifting angle of 150°.



METHOD OF DISASSEMBLING, CONNECTING PUSH-PULL TYPE COUPLER

Before carrying out the following work, release the residual pressure from the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing residual pressure from hydraulic tank.

Even if the residual pressure is released from the hydraulic tank, some hydraulic oil flows out when the hose is disconnected. Accordingly, prepare an oil receiving container.

Disconnection

1) Release the residual pressure from the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing residual pressure from hydraulic tank.

2) Hold adapter (1) and push hose joint (2) into mating adapter (3). (See Fig. 1)
   - ★ The adapter can be pushed in about 3.5 mm.
   - ★ Do not hold rubber cap portion (4).

3) After hose joint (2) is pushed into adapter (3), press rubber cap portion (4) against (3) until it clicks. (See Fig. 2)

4) Hold hose adapter (1) or hose (5) and pull it out. (See Fig. 3)
   - ★ Since some hydraulic oil flows out, prepare an oil receiving container.

Connection

1) Hold hose adapter (1) or hose (5) and insert it in mating adapter (3), aligning them with each other. (See Fig. 4)
   - ★ Do not hold rubber cap portion (4).

2) After inserting the hose in the mating adapter perfectly, pull it back to check its connecting condition. (See Fig. 5)
   - ★ When the hose is pulled back, the rubber cap portion moves toward the hose about 3.5 mm. This does not indicate abnormality, however.

Type 1

Fig. 1

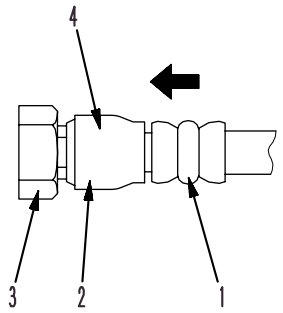


Fig. 2

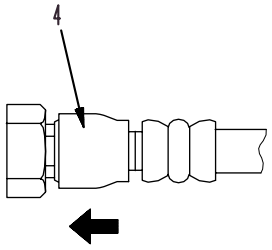


Fig. 3

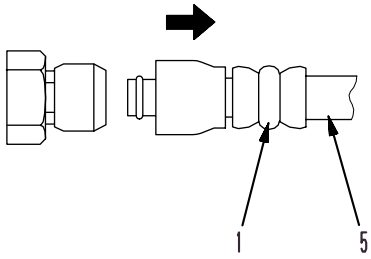


Fig. 4

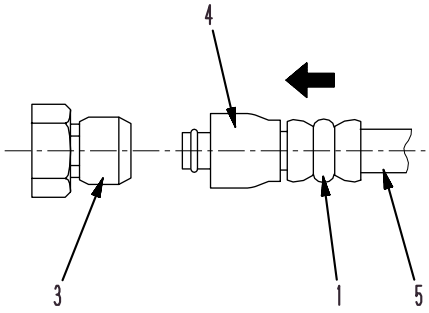
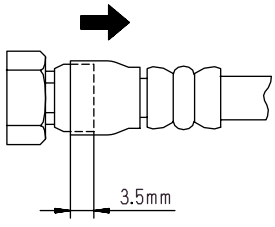


Fig. 5



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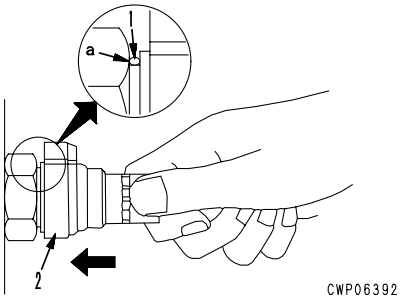
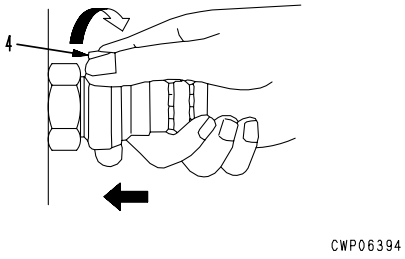
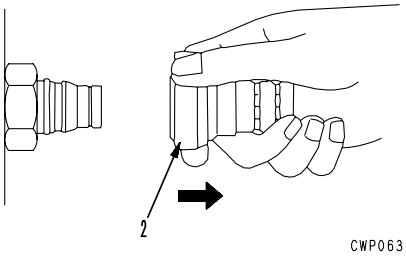
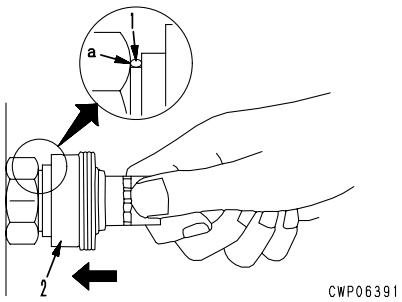
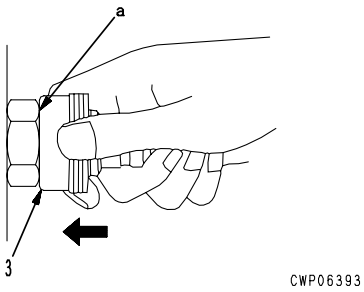
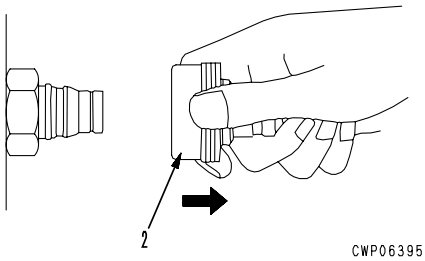
<table>
<tr><th></th><th>Type 2</th><th>Type 3</th></tr>
<tr><td>Disassembly</td><td>
1) Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end.


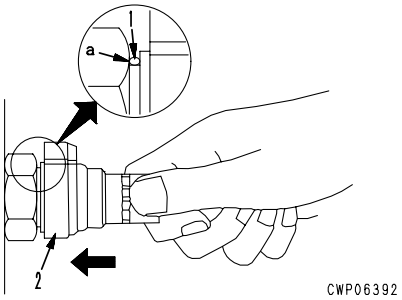
2) Hold in the condition in Step 1), and turn lever (4) to the right (clockwise).


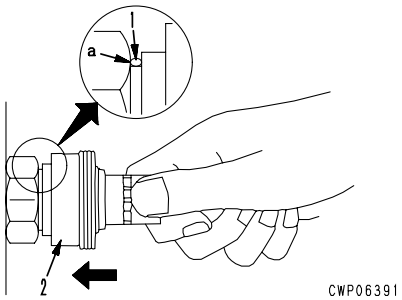
3) Hold in the condition in Steps 1) and 2), and pull out whole body (2) to disconnect it.


</td><td>
1) Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end.


2) Hold in the condition in Step 1), and push until cover (3) contacts contact surface a of the hexagonal portion at the male end.


3) Hold in the condition in Steps 1) and 2), and pull out whole body (2) to disconnect it.


</td></tr>
<tr><td>Connection</td><td>
• Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end to connect it.


</td><td>
• Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end to connect it.


</td></tr>
</table>

COATING MATERIALS

★ The recommended coating materials such as adhesives, gasket sealants and greases used for disassembly and assembly are listed below.
★ For coating materials not listed below, use the equivalent of products shown in this list.

Category	Komatsu code	Part No.	Q'ty	Container	Main applications, featuresr
Adhesives	LT-1A	790-129-9030	150 g	Tube	• Used to prevent rubber gaskets, rubber cushions, and cock plug from coming out.
	LT-1B	790-129-9050	20 g (2 pcs.)	Polyethylene container	• Used in places requiring an immediately effective, strong adhesive. Used for plastics (except polyethylene, polyprophylene, tetrafluoroethlene and vinyl chloride), rubber, metal and non-metal.
	LT-2	09940-00030	50 g	Polyethylene container	• Features: Resistance to heat and chemicals • Used for anti-loosening and sealant purpose for bolts and plugs.
	LT-3	790-129-9060 (Set of adhesive and hardening agent)	Adhesive: 1 kg Hardening agent: 500 g	Can	• Used as adhesive or sealant for metal, glass and plastic.
	LT-4	790-129-9040	250 g	Polyethylene container	• Used as sealant for machined holes.
	Holtz MH 705	790-126-9120	75 g	Tube	• Used as heat-resisting sealant for repairing engine.
	Three bond 1735	790-129-9140	50 g	Polyethylene container	• Quick hardening type adhesive • Cure time: within 5 sec. to 3 min. • Used mainly for adhesion of metals, rubbers, plastics and woods.
	Aron-alpha 201	790-129-9130	2 g	Polyethylene container	• Quick hardening type adhesive • Quick cure type (max. strength after 30 minutes) • Used mainly for adhesion of rubbers, plastics and metals.
	Loctite 648-50	79A-129-9110	50 cc	Polyethylene container	• Resistance to heat, chemicals • Used at joint portions subject to high temperatures.
Gasket sealant	LG-1	790-129-9010	200 g	Tube	• Used as adhesive or sealant for gaskets and packing of power train case, etc.
	LG-5	790-129-9070	1 kg	Can	• Used as sealant for various threads, pipe joints, flanges. • Used as sealant for tapered plugs, elbows, nipples of hydraulic piping.
	LG-6	790-129-9020	200 g	Tube	• Features: Silicon based, resistance to heat, cold • Used as sealant for flange surface, tread. • mab Used as sealant for oil pan, final drive case, etc.

Category	Komatsu code	Part No.	Q'ty	Container	Main applications, featuresr
Adhesives	LG-7	790-129-9070	1 g	Tube	• Ftures: Silicon based, quick hardening type • Used as sealant for flywheel housing, intake manifold, oil an, thermostat housing, etc.
	Three bond 1211	790-129-9090	100 g	Tube	• Used as heat-resisting sealant for repairing engine.
Molybdenum disulphide lubricant	LM-G	09940-00051	60 g	Can	• Used as lubricant for sliding portion (to prevent from squeaking).
	LM-P	09940-00040	200 g	Tube	• Used to prevent seizure or scuffling of the thread when press fitting or shrink fitting. • Used as lubricant for linkage, bearings, etc.
Grease	G2-LI	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA-160CNLI	Various	Various	• General purpose type
	G2-CA	SYG2-400CA SYG2-350CA SYG2-400CA-A SYG2-160CA SYGA-160CNCA	Various	Various	• Used for normal temperature, light load bearing at places in contact with water or steam.
	Molybdenum disulphide lubricant	SYG2-400M	400 g (10 per case)	Belows type	• Used for places with heavy load

STANDARD TIGHTENING TORQUE

STANDARD TIGHTENING TORQUE TABLE (WHEN USING TORQUE WRENCH)

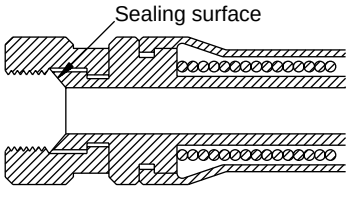
★ In the case of metric nuts and bolts for which there is no special instruction, tighten to the torque given in the table below.

Thread diameter of bolt	Width across flats	 CDL00372	
mm	mm	Nm	kgm
6	10	13.2 ± 1.4	1.35 ± 0.15
8	13	31 ± 3	3.2 ± 0.3
10	17	66 ± 7	6.7 ± 0.7
12	19	113 ± 10	11.5 ± 1
14	22	177 ± 19	18 ± 2
16	24	279 ± 30	28.5 ± 3
18	27	382 ± 39	39 ± 4
20	30	549 ± 59	56 ± 6
22	32	745 ± 83	76 ± 8.5
24	36	927 ± 103	94.5 ± 10.5
27	41	1320 ± 140	135 ± 15
30	46	1720 ± 190	175 ± 20
33	50	2210 ± 240	225 ± 25
36	55	2750 ± 290	280 ± 30
39	60	3290 ± 340	335 ± 35

Thread diameter of bolt	Width across flats	 CDL00373	
mm	mm	Nm	kgm
6	10	7.85 ± 1.95	0.8 ± 0.2
8	13	18.6 ± 4.9	1.9 ± 0.5
10	14	40.2 ± 5.9	4.1 ± 0.6
12	27	82.35 ± 7.85	8.4 ± 0.8

TABLE OF TIGHTENING TORQUES FOR FLARED NUTS

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



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

TABLE OF TIGHTENING TORQUES FOR SPLIT FLANGE BOLTS

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

Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
10 12 16	14 17 22	65.7 ± 6.8 112 ± 9.8 279 ± 29	6.7 ± 0.7 11.5 ± 1 28.5 ± 3

TABLE OF TIGHTENING TORQUES FOR O-RING BOSS PIPING JOINTS

★ Unless there are special instructions, tighten the O-ring boss piping joints to the torque below.

Norminal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
02 03, 04 05, 06 10, 12 14	14 20 24 33 42	Varies depending on type of connector.	34.3 ± 4.9 93.1 ± 9.8 142.1 ± 19.6 421.4 ± 58.8 877.1 ± 132.3	3.5 ± 0.5 9.5 ± 1 14.5 ± 2 43 ± 6 89.5 ± 13.5

TABLE OF TIGHTENING TORQUES FOR O-RING BOSS PLUGS

★ Unless there are special instructions, tighten the O-ring boss plugs to the torque below.

Norminal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
08	08	14	7.35 ± 1.47	0.75 ± 0.15
10	10	17	11.27 ± 1.47	1.15 ± 0.15
12	12	19	17.64 ± 1.96	1.8 ± 0.2
14	14	22	22.54 ± 1.96	2.3 ± 0.2
16	16	24	29.4 ± 4.9	3 ± 0.5
18	18	27	39.2 ± 4.9	4 ± 0.5
20	20	30	49 ± 4.9	5 ± 0.5
24	24	32	68.6 ± 9.8	7 ± 1
30	30	32	107.8 ± 14.7	11 ± 1.5
33	33	n	127.4 ± 19.6	13 ± 2
36	36	36	151.9 ± 24.5	15.5 ± 2.5
42	42	n	210.7 ± 29.4	21.5 ± 3
52	52	n	323.4 ± 44.1	33 ± 4.5

TIGHTENING TORQUE FOR 102 ENGINE SERIES

1) BOLT AND NUTS

Use these torques for bolts and nuts (unit: mm) of Cummins Engine.

Thread diameter	Tightening torque	
mm	Nm	kgm
6	10 ± 2	1.02 ± 0.20
8	24 ± 4	2.45 ± 0.41
10	43 ± 6	4.38 ± 0.61
12	77 ± 12	7.85 ± 1.22

2) EYE JOINTS

Use these torques for eye joints (unit: mm) of Cummins Engine.

Thread diameter	Tightening torque	
mm	Nm	kgm
6	8 ± 2	0.81 ± 0.20
8	10 ± 2	1.02 ± 0.20
10	12 ± 2	1.22 ± 0.20
12	24 ± 4	2.45 ± 0.41
14	36 ± 5	3.67 ± 0.51

3) TAPERED SCREWS

Use these torques for tapered screws (unit: inch) of Cummins Engine.

Thread diameter	Tightening torque	
inch	Nm	kgm
1 / 16	3 ± 1	0.31 ± 0.10
1 / 8	8 ± 2	0.81 ± 0.20
1 / 4	12 ± 2	1.22 ± 0.20
3 / 8	15 ± 2	1.53 ± 0.41
1 / 2	24 ± 4	2.45 ± 0.41
3 / 4	36 ± 5	3.67 ± 0.51
1	60 ± 9	6.12 ± 0.92

TIGHTENING TORQUE TABLE FOR HOSES (TAPER SEAL TYPE AND FACE SEAL TYPE)

★ Tighten the hoses (taper seal type and face seal type) to the following torque, unless otherwise specified.

★ Apply the following torque when the threads are coated (wet) with engine oil.

Nominal size of hose	Width across flats	Tightening torque (Nm {kgm})		Taper seal type	Face seal type	
		Range	Target	Thread size (mm)	Nominal thread size - Threads per inch, Thread series	Root diameter (mm) (Reference)
02	19	35 - 63 {3.5 - 6.5}	44 {4.5}	14	$\frac{9}{16}$ - 18UNF	14.3
03	22	54 - 93 {5.5 - 9.5}	74 {4.5}	–	$\frac{11}{16}$ - 16UN	17.5
	24	59 - 98 {6.0 - 10.0}	78 {8.0}	18	–	–
04	27	84 - 132 {8.5 - 13.5}	103 {10.5}	22	$\frac{13}{16}$ - 16UN	20.7
05	32	128 - 186 {13.0 - 19.0}	157 {16.0}	24	1 - 14UNS	25.4
06	36	177 - 245 {18.0 - 25.0}	216 {22.0}	30	$1\frac{3}{16}$ - 12UNF	30.3
(10)	41	177 - 245 {18.0 - 25.0}	216 {22.0}	33	–	–
(12)	46	197 - 294 {20.0 - 30.0}	245 {25.0}	36	–	–
(14)	55	246 - 343 {25.0 - 35.0}	294 {30.0}	42	–	–

ELECTRIC WIRE CODE

In the wiring diagrams, various colors and symbols are employed to indicate the thickness of wires.
This wire code table will help you understand WIRING DIAGRAMS.
Example: 5WB indicates a cable having a nominal number 5 and white coating with black stripe.

CLASSIFICATION BY THICKNESS

Norminal number	Copper wire			Cable O.D. (mm)	Current rating (A)	Applicable circuit
	Number of strands	Dia. of strands (mm^2)	Cross section (mm^2)			
0.85	11	0.32	0.88	2.4	12	Starting, lighting, signal etc.
2	26	0.32	2.09	3.1	20	Lighting, signal etc.
5	65	0.32	5.23	4.6	37	Charging and signal
15	84	0.45	13.36	7.0	59	Starting (Glow plug)
40	85	0.80	42.73	11.4	135	Starting
60	127	0.80	63.84	13.6	178	Starting
100	217	0.80	109.1	17.6	230	Starting

CLASSIFICATION BY COLOR AND CODE

Priority	Classification \ Circuits		Charging	Ground	Starting	Lighting	Instrument	Signal	Other
1	Primary	Code	W	B	B	R	Y	G	L
		Color	White	Black	Black	Red	Yellow	Green	Blue
2	Auxiliary	Code	WR	—	BW	RW	YR	GW	LW
		Color	White & Red	—	White & Black	Red & White	Rellow & Red	Green & White	Blue & White
3		Code	WB	—	BY	RB	YB	GR	LR
		Color	White & Black	—	Black & Yellow	Red & Black	Yellow & Black	Green & Red	Blue & Yellow
4		Code	WL	—	BR	RY	YG	GY	LY
		Color	White & Blue	—	Black & Red	Red & Yellow	Yellow & Green	Green & Yellow	Blue & Yellow
5		Code	WG	—	—	RG	YL	GB	LB
		Color	White & Green	—	—	Red & Green	Yellow & Blue	Green & Black	Blue & Black
6		Code	—	—	—	RL	YW	GL	—
		Color	—	—	—	Red & Blue	Yellow & White	Green & Blue	—

CONVERSION TABLE

METHOD OF USING THE CONVERSION TABLE

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

EXAMPLE

- Method of using the Conversion Table to convert from millimeters to inches

1. Convert 55 mm into inches.
   (1) Locate the number 50 in the vertical column at the left side, take this as (A), then draw a horizontal line from (A).
   (2) Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
   (3) Take the point where the two lines cross as (C). This point (C) gives the value when converting from millimeters to inches. Therefore, 55 mm = 2.165 inches.
2. Convert 550 mm into inches.
   (1) The number 550 does not appear in the table, so divide by 10 (move the decimal point one place to the left) to convert it to 55 mm.
   (2) Carry out the same procedure as above to convert 55 mm to 2.165 inches.
   (3) The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

Millimeters to inches

(B)

1 mm = 0.03937 in

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

Millimeters to Inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
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80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Liter to U.S. Gallon

1ℓ = 0.2642 U.S. Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

Liter to U.K. Gallon

1ℓ = 0.21997 U.K. Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.969	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

kgm to ft. lb

1 kgm = 7.233 ft. lb

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

kg/cm² to lb/in²

1kg/cm² = 14.2233 lb/in²

	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	1934	1949	1963	1977
140	1991	2005	2020	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

Temperature

Fahrenheit-Centigrade Conversion ; a simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice versa is to enter the accompanying table in the center or boldface column of figures.

These figures refer to the temperature in either Fahrenheit or Centigrade degrees.

If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.

If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

1°C = 33.8°F

°C		°F	°C		°F	°C		°F	°C		°F
–40.4	**–40**	–40.0	–11.7	**11**	51.8	7.8	**46**	114.8	27.2	**81**	117.8
–37.2	**–35**	–31.0	–11.1	**12**	53.6	8.3	**47**	116.6	27.8	**82**	179.6
–34.4	**–30**	–22.0	–10.6	**13**	55.4	8.9	**48**	118.4	28.3	**83**	181.4
–31.7	**–25**	–13.0	–10.0	**14**	57.2	9.4	**49**	120.2	28.9	**84**	183.2
–28.9	**–20**	–4.0	–9.4	**15**	59.0	10.0	**50**	122.0	29.4	**85**	185.0
–28.3	**–19**	–2.2	–8.9	**16**	60.8	10.6	**51**	123.8	30.0	**86**	186.8
–27.8	**–18**	–0.4	–8.3	**17**	62.6	11.1	**52**	125.6	30.6	**87**	188.6
–27.2	**–17**	1.4	–7.8	**18**	64.4	11.7	**53**	127.4	31.1	**88**	190.4
–26.7	**–16**	3.2	–7.2	**19**	66.2	12.2	**54**	129.2	31.7	**89**	192.2
–26.1	**–15**	5.0	–6.7	**20**	68.0	12.8	**55**	131.0	32.2	**90**	194.0
–25.6	**–14**	6.8	–6.1	**21**	69.8	13.3	**56**	132.8	32.8	**91**	195.8
–25.0	**–13**	8.6	–5.6	**22**	71.6	13.9	**57**	134.6	33.3	**92**	197.6
–24.4	**–12**	10.4	–5.0	**23**	73.4	14.4	**58**	136.4	33.9	**93**	199.4
–23.9	**–11**	12.2	–4.4	**24**	75.2	15.0	**59**	138.2	34.4	**94**	201.2
–23.3	**–10**	14.0	–3.9	**25**	77.0	15.6	**0**	140.0	35.0	**95**	203.0
–22.8	**–9**	15.8	–3.3	**26**	78.8	16.1	**61**	141.8	35.6	**96**	204.8
–22.2	**–8**	17.6	–2.8	**27**	80.6	16.7	**62**	143.6	36.1	**97**	206.6
–21.7	**–7**	19.4	–2.2	**28**	82.4	17.2	**63**	145.4	36.7	**98**	208.4
–21.1	**–6**	21.2	–1.7	**29**	84.2	17.8	**64**	147.2	37.2	**99**	210.2
–20.6	**–5**	23.0	–1.1	**30**	86.0	18.3	**65**	149.0	37.8	**100**	212.0
–20.0	**–4**	24.8	–0.6	**31**	87.8	18.9	**66**	150.8	40.6	**105**	221.0
–19.4	**–3**	26.6	0	**32**	89.6	19.4	**67**	152.6	43.3	**110**	230.0
–18.9	**–2**	28.4	0.6	**33**	91.4	20.0	**68**	154.4	46.1	**115**	239.0
–18.3	**–1**	30.2	1.1	**34**	93.2	20.6	**69**	156.2	48.9	**120**	248.0
–17.8	**0**	32.0	1.7	**35**	95.0	21.1	**70**	158.0	51.7	**125**	257.0
–17.2	**1**	33.8	2.2	**36**	96.8	21.7	**71**	159.8	54.4	**130**	266.0
–16.7	**2**	35.6	2.8	**37**	98.6	22.2	**72**	161.6	57.2	**135**	275.0
–16.1	**3**	37.4	3.3	**38**	100.4	22.8	**73**	163.4	60.0	**140**	284.0
–15.6	**4**	39.2	3.9	**39**	102.2	23.3	**74**	165.2	62.7	**145**	293.0
–15.0	**5**	41.0	4.4	**40**	104.0	23.9	**75**	167.0	65.6	**150**	302.0
–14.4	**6**	42.8	5.0	**41**	105.8	24.4	**76**	168.8	68.3	**155**	311.0
–13.9	**7**	44.6	5.6	**42**	107.6	25.0	**77**	170.6	71.1	**160**	320.0
–13.3	**8**	46.4	6.1	**43**	109.4	25.6	**78**	172.4	73.9	**165**	329.0
–12.8	**9**	48.2	6.7	**44**	111.2	26.1	**79**	174.2	76.7	**170**	338.0
–12.2	**10**	50.0	7.2	**45**	113.0	26.7	**80**	176.0	79.4	**175**	347.0

UNITS

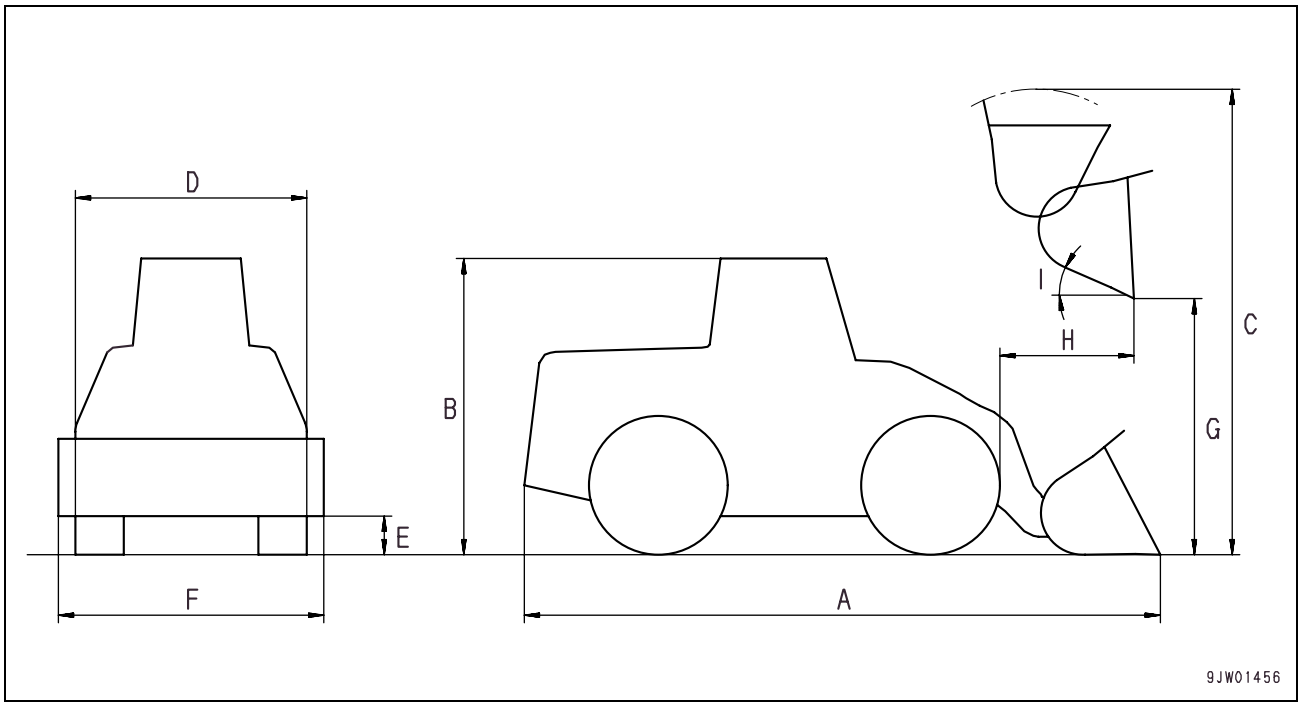
In this manual, the measuring units are indicated with Internatinal System of units (SI).
As for reference, conventionally used Gravitational System of units are indicated in parentheses { }.

Example:

N {kg}
Nm {kgm}
MPa {kg/cm^2}
kPa {mmH_2O}
kPa {mmHg}
kW/rpm {HP/rpm}
g/kWh {g/HPh}

01 GENERAL

GENERAL ASSEMBLY DRAWINGS



	Item		Unit	WA320-5H
	Operating weight		kg	13,585
	Rated load		kg	4,480
	Bucket capacity (piled)		m^3	2.8
	Engine model		—	KOMATSU SAA6D102E-2-A Diesel engine
	Flywheel horse power		kW {HP} / rpm	124{166} / 2,000
A	Overall length		mm	7,450
B	Overall height		mm	3,200
C	Overall height when bucket is raised		mm	5,325
D	Overall width		mm	2,575
E	Min. ground clearance		mm	425
F	Bucket width		mm	2,740
G	Dumping clearance	(Tip of cutting edge/Tip of BOC)	mm	2,935 / 2,850
H	Dumping reach	(Tip of cutting edge/Tip of BOC)	mm	995 / 1,035
I	Bucket dump angle		deg.	45
	Min. turning radius	Tip of cutting edge/Tip of BOC	mm	6,025 / 6,090
		Center of outside wheel	mm	5,160
	Travel speed	F1	km / h	4.0 – 13.0
		F2	km / h	13.0
		F3	km / h	18.0
		F4	km / h	38.0
		R1	km / h	4.0 – 13.0
		R2	km / h	13.0
		R3	km / h	18.0
		R4	km / h	38.0

SPECIFICATIONS

Machine model				WA320-5H
Serial No.				H50051 and up
Weight	Operating weight		kg	13,585
	Distribution (front) SAE travel posture		kg	6,030
	Distribution (rear) SAE travel posture		kg	7,555
Performance	Bucket capacity (piled)		m^3	2.8
	Rated load		kg	4,480
	Travel speed	FORWARD 1st	km / h	4.0 – 13.0
		FORWARD 2nd	km / h	13.0
		FORWARD 3rd	km / h	18.0
		FORWARD 4th	km / h	38.0
		REVERSE 1st	km / h	4.0 – 13.0
		REVERSE 2nd	km / h	13.0
		REVERSE 3rd	km / h	18.0
		REVERSE 4th	km / h	38.0
	Max. rimpull	FORWARD	kN {kg}	120 {12,200}
		REVERSE	kN {kg}	120 {12,200}
	Gradeability		deg.	25
	Min. turning radius	(Center of outside wheel)	mm	5,160
	Min. turning radius (Tip of cutting edge/Tip of BOC)	[SAE travel posture]	mm	6,025 / 6,090
Dimensions	Overall length (with BOC)		mm	7,450
	Overall width (chassis)		mm	2,575
	Bucket width (with BOC)		mm	2,740
	Overall height (top of cab)		mm	3,200
	Overall height (Bucket approx. raised to max.)		mm	5,325
	Wheel base		mm	3,030
	Tread		mm	2,050
	Min. ground clearance		mm	425
	Max. height of bucket hinge pin		mm	3,905
	Dumping clearance (Tip of cutting edge/Tip of BOC)		mm	2,935 / 2,850
	Dumping reach (Tip of cutting edge/Tip of BOC)		mm	995 / 1,035
	Steering angle		deg.	40
	Bucket tilt angle (travel posture)		deg.	49
	Bucket tilt angle (max. height)		deg.	62
	Bucket dump angle (max. height)		deg.	45
	Digging depth (10° dump) (Tip of cutting edge/Tip of BOC)		mm	250 / 295

Machine model				WA320-5H
Serial No.				H50051 and up
Engine	Model			SAA6D102E-2-A
	Type			4-cycle, water-cooled, in-line, 6-cylinder, direct injection with turbocharger, aftercooler
	No. of cylinders - bore x stroke		mm	6 – 102 x 120
	Piston displacement		ℓ {cc}	5.88 {5,880}
	Flywheel horsepower		kW / rpm	124 / 2,000
			{HP / rpm}	{166 / 2,000}
	Maximum torque		Nm / rpm	647 / 1,400
			{kgm / rpm}	{66 / 1,400}
	Min. fuel consumption ratio		g / kWh {g / HPh}	224 {167}
	High idling speed		rpm	2,225
	Low idling speed		rpm	900
	Starting motor			24 V 5.5 kW
	Alternator			24 V 60 A
	Battery			24 V 110 Ah x 2 pcs.
Power train	HST pump			Variable displacement swash plate-type piston pump
	HST motor 1			Variable displacement swash plate-type piston motor
	HST motor 2			Variable displacement swash plate-type piston motor
	Transfer			Multiple shaft planetary compound-type, spur gear constant mesh-type, 2 alternative power systems
	Reduction gear			Spiral bevel gear, splash lubrication type
	Differential			Straight bevel gear type, torque portioning
	Final drive			Planetary gear 1-stage, splash lubrication type
Axle	Drive type			Front and rear wheel drive
	Front axle			Fixed to frame, semi-floating type
	Rear axle			Center pin support, semi-floating type
Tire	Tire size			20.5R25
	Rim size			25x17.00–1.7
	Inflation pressure	Front tire	kPa {kg / cm²}	325 {3.3}
		Rear tire	kPa {kg / cm²}	275 {2.8}
Brakes	Main brake	Braking system		4 wheel braking, Front and rear wheel independent system control
		Brake type		Enclosed wet multiple disc type
		Operation method		Hydraulically controlled
		Control method		Hydraulic power servo assisted brake
	Parking brake	Braking system		Transmission gear output shaft braking
		Brake type		Wet multiple disc type
		Operation method		Mechanical type
		Control method		Hand lever type

Machine model				WA320-5H
Serial No.				H50051 and up
Steering control	Type			Articulated steering
	Control			Hydraulic control
Hydraulic system	Hydraulic pump	Steering pump • Type		Gear type
		• Delivery	ℓ / min	167
		Work equipment pump • Type		Gear type
		• Delivery	ℓ / min	58
		Brake and cooling fan pump • Type		Gear type
		• Delivery	ℓ / min	31
		Transfer lubrication pump • Type		Gear type
		• Delivery	ℓ / min	22
	Cylinder	Steering cylinder Type		Reciprocating piston type
		Cylinder inner diameter	mm	70
		Piston rod diameter	mm	40
		Stroke	mm	453
		Max. length between pins	mm	1,271
		Min. length between pins	mm	818
		Lift cylinder Type		Reciprocating piston type
		Cylinder inner diameter	mm	140
		Piston rod diameter	mm	75
		Stroke	mm	740
		Max. length between pins	mm	1,969
		Min. length between pins	mm	1,229
		Bucket cylinder Type		Reciprocating piston type
		Cylinder inner diameter	mm	160
		Piston rod diameter	mm	80
		Stroke	mm	532
		Max. length between pins	mm	1,559
		Min. length between pins	mm	1,027

Machine model				WA320-5H
Serial No.				H50051 and up
Hydraulic system	Control valve	Work equipment control valve • Type		2-spool type
		• Set pressure	MPa {kg / cm²}	20.6 {210}
		Steering valve • Type		Orbit-roll type
		• Set pressure	MPa {kg / cm²}	20.6 {210}
	Motor	Cooling fan motor • Type		Fixed displacement piston type
Work equipment	Link type			Single link
	Bucket edge type			Flat blade with top BOC

WEIGHT TABLE

★ This weight table is a guide for use when transporting or handling components.

Unit: kg

Machine model	WA320-5H
Serial Numbers	H50051 and up
Engine (without coolant and oil)	550
Cooling assembly (without coolant)	70
Cooling fan motor	6
Damper	3
HST pump	80
HST motor 1	60
HST motor 2	60
Transfer	247
Front drive shaft	18
Rear drive shaft	7
Front axle	714
Rear axle	666
Axle pivot (rear axle)	97
Wheel (each)	120
Tire (each)	223
Orbit-roll valve	8
Priority valve	6
Steering cylinder assembly (each)	18
Brake valve	10
Hydraulic tank (without hydraulic oil)	70
4-gear pump unit	30
Work equipment PPC valve	3
Work equipment control valve	65
Lift cylinder assembly (each)	109
Bucket cylinder assembly	124
Engine hood (with side panel)	196
Front frame	1,100
Rear frame	967

Unit: kg

Machine model	WA320-5H
Serial Numbers	H50051 and up
Lift arm (including bushing)	920
Bucket (2.8m^2, including BOC)	1,234
Bell crank	253
Bucket link	43
Counterweight	1,950
Fuel tank (without fuel)	94
Battery (each)	49
Operator’s Cab (including air conditioner and interior parts)	755
Operator’s seat	41

PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS

WA320-5H	LUBRICANTS, FUELS AND FILLING CAPACITIES					
	Lubricant and operating medium	**Short code / cask lettering**	**Quality grade**	**Temperature range**	**Viscosity range**	**Filling capacitiy in litres**
Engine	Engine oil	EO 0030A EO 0540A EO 10 EO 30 EO 1030A EO 1540A	CCMC D4 or, if not available: API CD or API CE or API CF -4	-30° up to 40° C -25° up to 40° C -20° up to 10° C 0° up to 40° C -20° up to 40° C - 15° up to 50° C	SAE 0W-30 SAE 5W-40 SAE 10 SAE 30 SAE 10W-30 SAE 15W-40 *)	20 (19,5 **)
Transfer case	Engine oil	EO 10	CCMC D4 or, if not available: API CD or API CE or API CF -4	-30° up to 40° C	SAE 10W*)	8,0 (6,5 **)
Hydraulic system	Hydraulic oil	HYD 0530	HVLP, HVLP D	-30° up to 40° C	ISO VG46 *) (1)	175 (89**)
Axle with standard differential	Axle oil	AXO 80 (*2) AXO	Fuchs: TITAN HYDRA ZF 20W-40	-30° up to 40°C -10° up to 45° C	80W SAE 20W-40 *)	each 24 (each 24**)
	or Engine oil	EO 30	CCMC D4 or, if not available: API CD or API CE or API CF -4	0° up to 40° C	SAE 30	
Axle with limited-slip differential (*3)	Axle oil (*4)	AXO	Shell: DONAX TD 5W-30*** Esso: TORQUE FLUID56**** Mobil: MOBILFLUID 424 Fuchs: TITAN HYDRA ZF 20W-40		SAE 5W-30 SAE 20W-40 *)	
Fuel tank	Diesel fuel	ASTM D975 No.1 ASTM D975 No.2 DIN-EN 590	CFPP class B CFPP class D CFPP class F	-30° up to -10° C -10° up to 40° C 0° up to 40° C -10° up to 40° C -20° up to 40° C	-----	228
Grease nip-pels	Multi purpose grease on a lithium base	MPG-A	KP2N-20	-30° up to 40° C	NLGI-No. 2	---
Grease box of central lubrica-tion unit	Multi purpose grease on a lithium base	MPG-A	KP2N-20	-30° up to 40° C	NLGI-No. 2	---
Cooling system	Water and coolant	SP-C	Add antifreeze with corrosion resistor			20
Air conditioner	Coolant	NRS	R134a (CFC-free)			860 g

* Work filling
** Top-up quantity
*** North American manufacted DONAX TD 20W-40 must not be used.
**** North American manufacted TORQUE FLUID 56 must not be used.

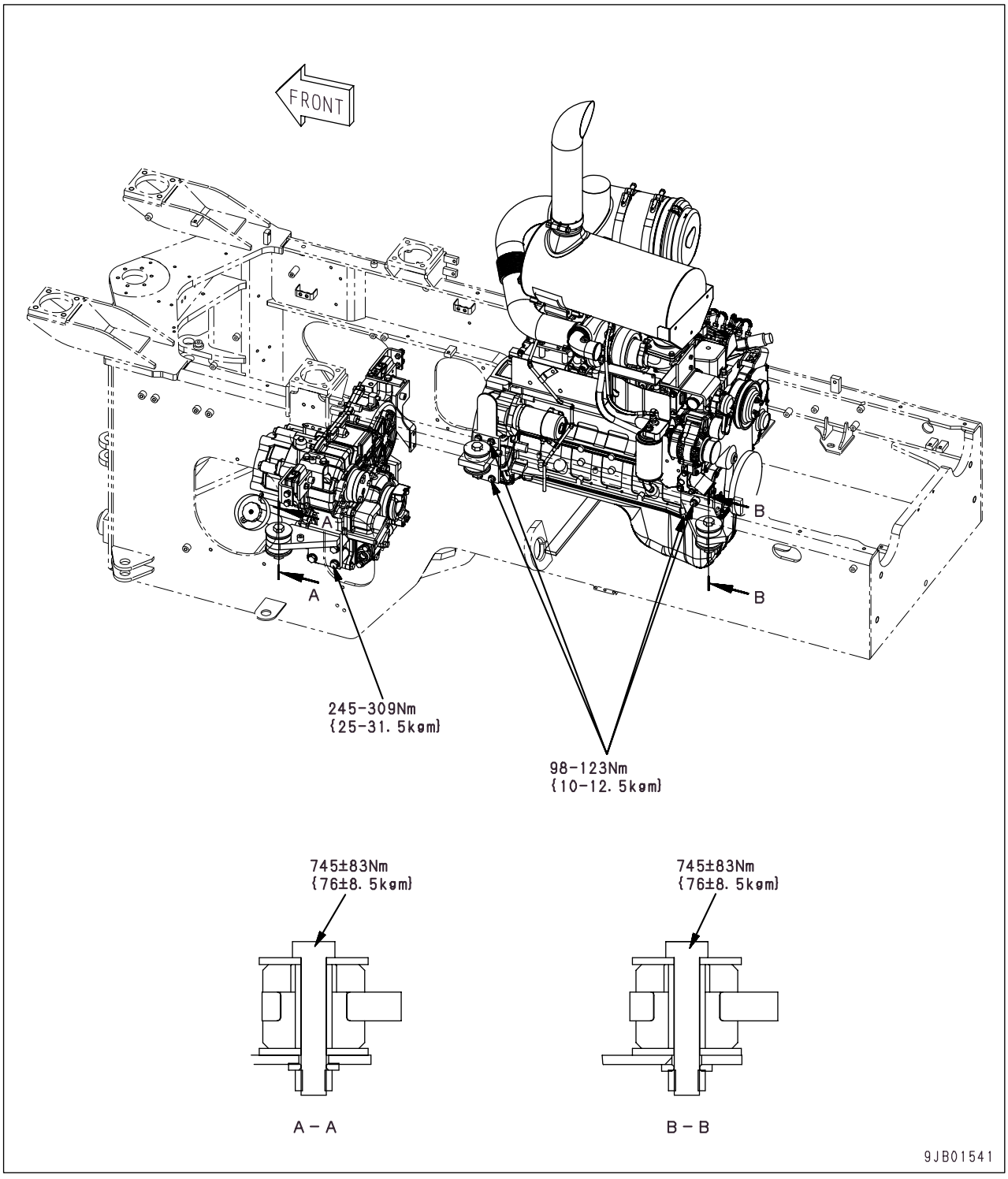
(1): Please use SAE10W30 for the oil in the hydraulic system. If Komatsu genuine oil is not available, select the oil from the table below.

Supplier	Engine oil (The 15W40 oil marked * is CE.)
BP	Vanellus C3 (15W40)
EXXON(ESSO)	Essolube D3, *Essolube XD-3, *Essolube XD-3 Extra, *Essolube heavy duty, Exxon heavy duty
GULF	Super duty motor oil, *Super duty plus
MOBIL	Delvac 1300, *Delvac super (10W-30, 15W-40)
SHELL	Rimura X, Rotella T 10W30

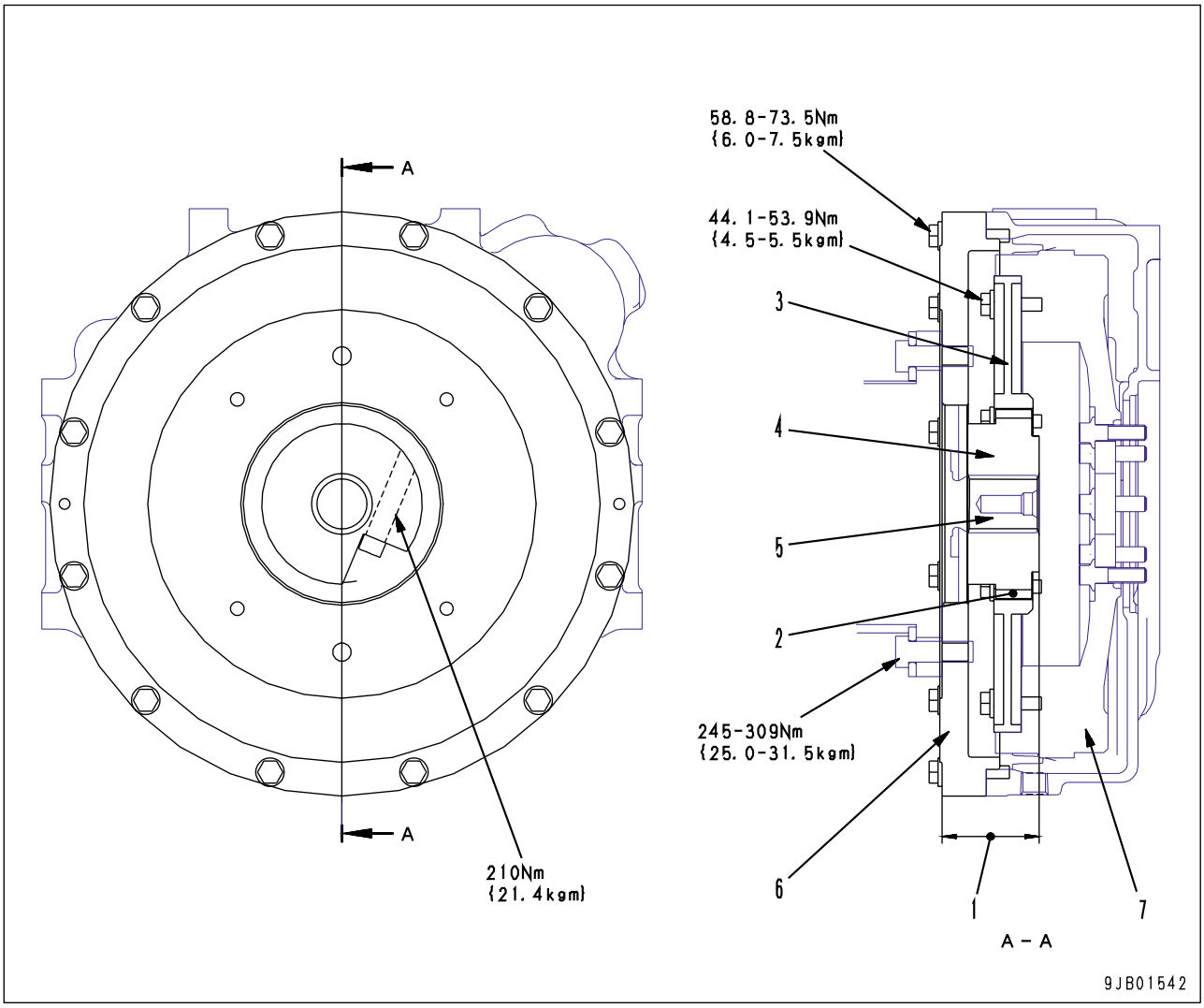
(2): For the standard differential, except for “AXO80“, the oil for machines equipped with the limited-slip differential in the table below and E030 can be used. However, in the case of “E030“, depending on conditions such as the way the brakes are used and the oil temperature, the brakes may squeal just before the machine stops, but there is no problem with the brake performance or durability.
(3): The letters “ASD“ are stamped on the name plate of machines equipped with the limited-slip differential axle.
(4): For machines equipped with the limited-slip differential axle, select from the oil given in the table below.
Never use any oil except the oil listed in the table below.

10 STRUCTURE, FUNCTION AND MAINTENANCE STANDARD

ENGINE MOUNT AND TRANSFER MOUNT



DAMPER



Unit: mm

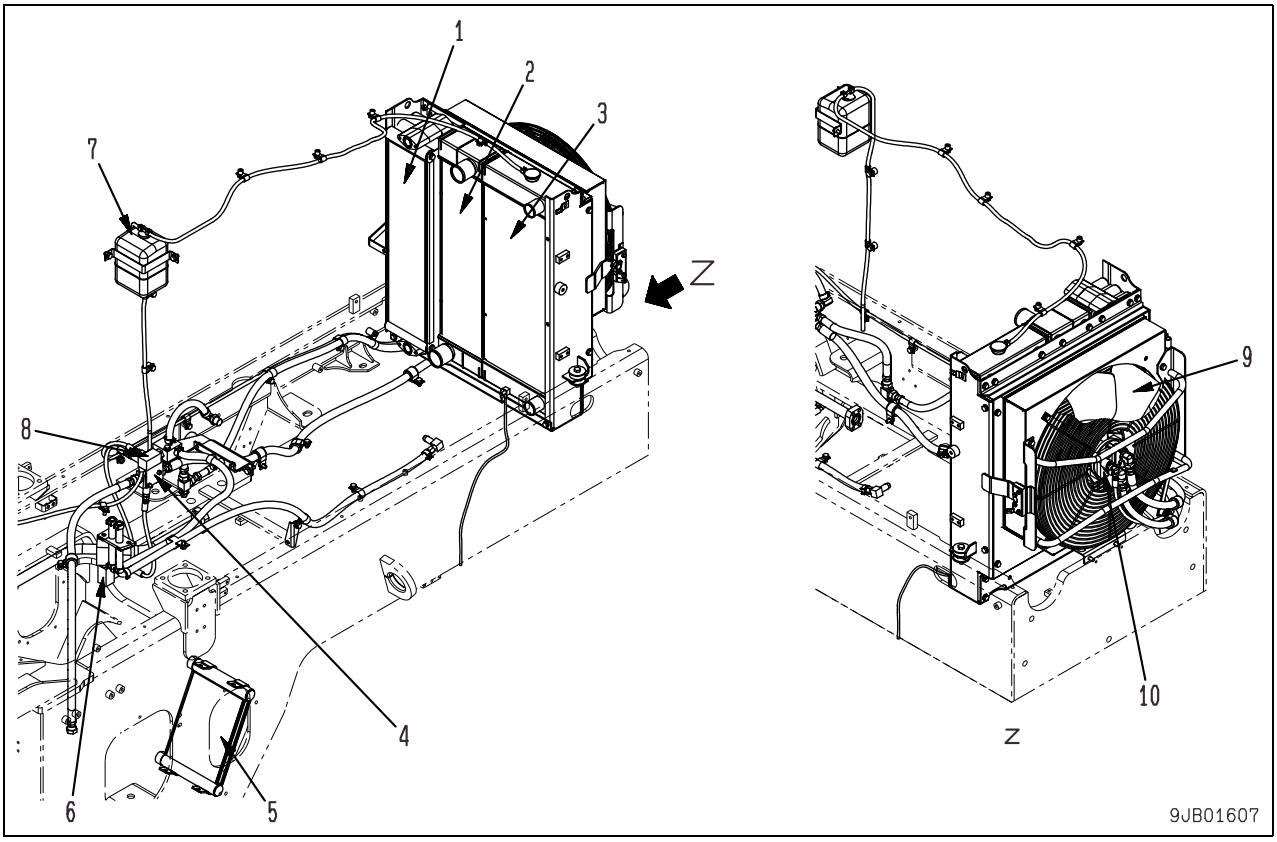
No.	Check item	Criteria		Remedy
1	Distance between HST pump mounting face and tip of boss	Standard size	Repair limit	Adjust
		74.9	± 0.8	
2	Wear of internal teeth of coupling (plastic)	Repair limit: 1.0		Replace

3. Coupling
4. Boss
5. HST pump input shaft
6. Cover
7. Flywheel

Outline

- The damper reduces the torsional vibration caused by fluctuation of the engine torque to protect the drive system after the engine from the torsional vibration.
- The power from the engine is transmitted through flywheel (7) to coupling (3), which absorbs the torsional vibration, and then transmitted through boss (4) to the HST pump.

COOLING SYSTEM

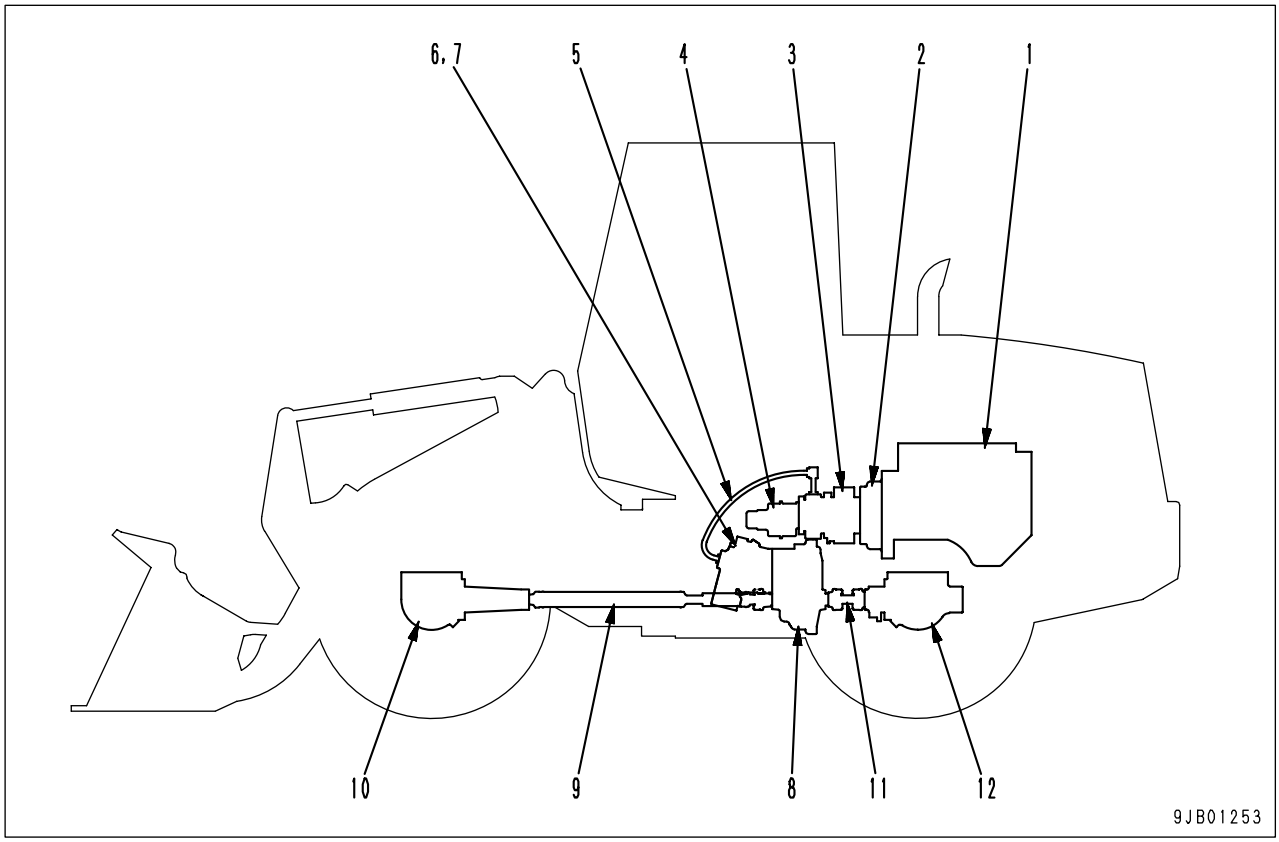


25. Hydraulic oil cooler
26. Charge air cooler
27. Radiator
28. Priority valve
29. Transfer oil cooler
30. Thermal relief valve (HST oil temprature)
31. Reservoir tank
32. Thermal relief valve (Coolant temprature)
33. Cooling fan
34. Cooling fan motor

Specification

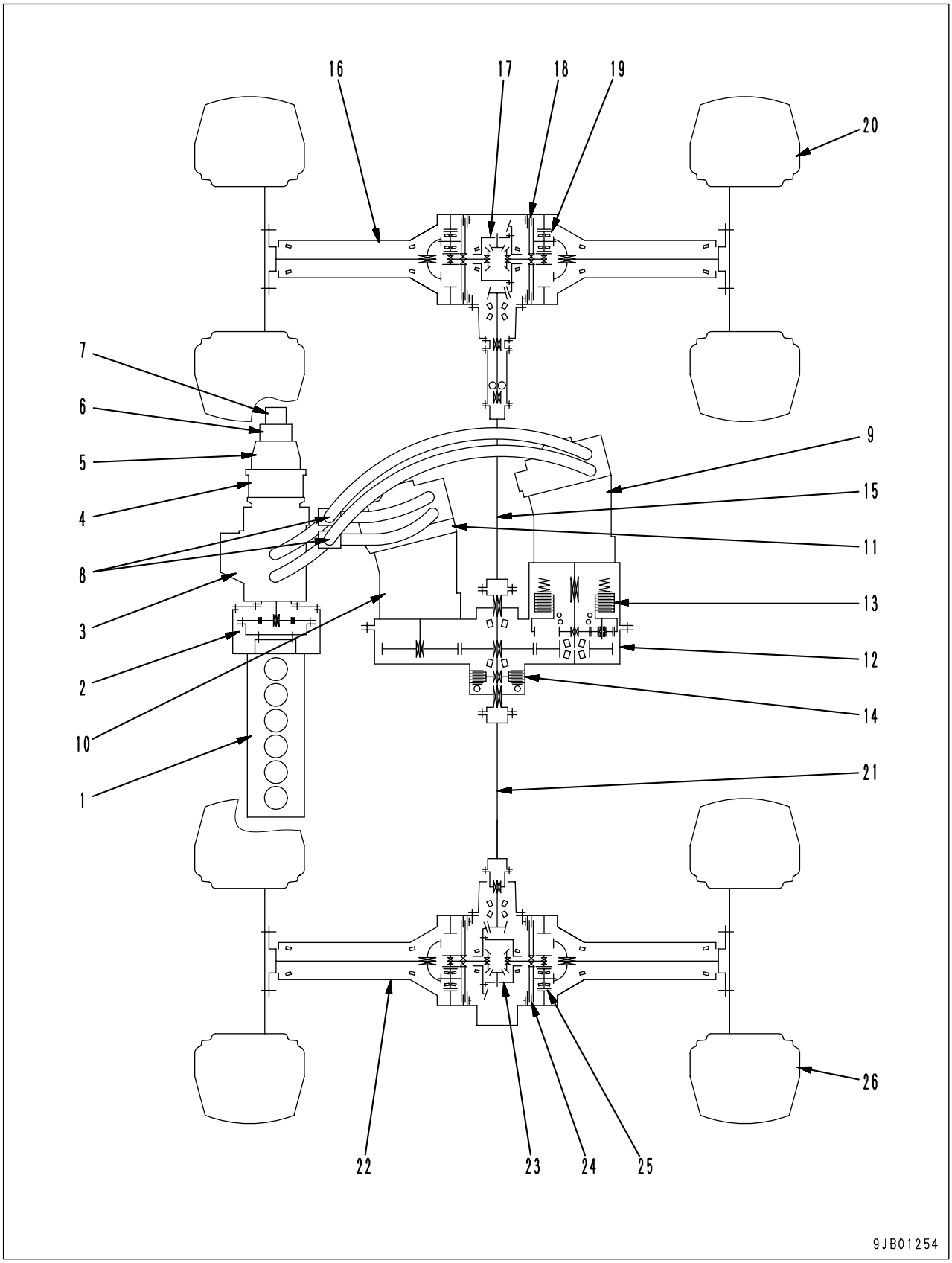
	Radiator	Hydraulic oil cooler	Charge air cooler	Transfer oil cooler
Core type	AL WAVE–4	CF40–1		CF40-1
Fin pitch (mm)	3.5 / 2	3.5 / 2	4.0 / 2	4.5 / 2
Total heat radiating area (m^2)	29.86	4.15	10.78	1.87
Pressure valve opening pressure (kPa {kg/cm^2})	70 ± 15 {0.7 ± 0.15}	—	—	
Vacuum valve opening pressure (kPa {kg/cm^2})	0 – 5 {0 – 0.05}	—	—	

POWER TRAIN



1. Engine
2. Damper
3. HST pump
4. 4-gear pump unit
5. High-pressure hose
6. HST motor 1
7. HST motor 2
8. Transfer
9. Front drive shaft
10. Front axle
11. Rear drive shaft
12. Rear axle

POWER TRAIN SYSTEM DIAGRAM

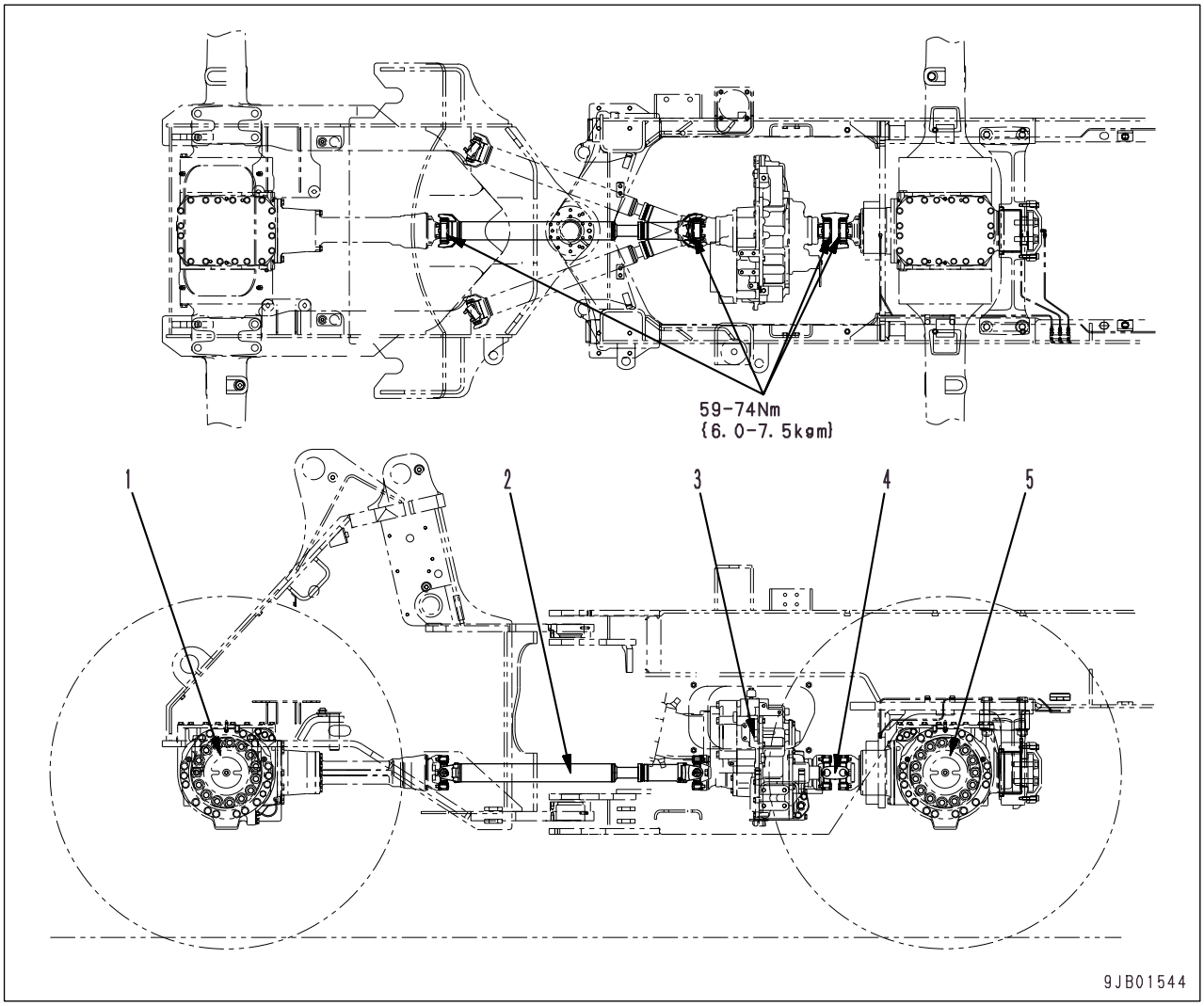


1. Engine
2. Damper
3. HST pump
4. Steering pump
5. Work equipment pump
6. Brake and cooling fan pump
7. Transfer lubricating oil pump
8. High-pressure hose
9. HST motor 1
10. HST motor 2
11. Emergency steering valve
12. Transfer
13. Transfer clutch
14. Parking brake
15. Front drive shaft
16. Front axle
17. Differential
18. Wet multiple disc brake
19. Final drive
20. Front tire
21. Rear drive shaft
22. Rear axle
23. Differential
24. Wet multiple disc brake
25. Final drive
26. Rear tire

Outline

- The power of engine (1) is transmitted to HST pump (3) through damper (2) which is installed to the flywheel and which absorbs the torsional vibration of the power,
- The power of engine (1) is also transmitted to HST pump (3), HST charge pump built in HST pump (3), steering pump (4) connected to HST pump (3), work equipment pump (5), brake and cooling fan pump (6), and transfer lubricating oil pump (7).
- HST pump (3) is equipped with the forward-reverse shifting valve and servo piston, which changes the discharge direction and discharge rate of HST pump (3) continuously by changing the swash plate angle.
- HST motors (9) and (10) are installed to transfer (12) and connected to HST pump (3) by high-pressure hose (8).
- The turning direction and speed of HST motors (9) and (10) are changed by the hydraulic power of HST pump (3) to control the travel direction and travel speed of the machine.
- The power of HST motor 1 (9) is transmitted through transfer clutch (13) in transfer (12) to the output shaft.
  The power of HST motor 2 (10) is transmitted through the gear in transfer (12) to the output shaft.
- Parking brake (14) is installed on the rear side in transfer (12). It operates the wet multiple disc brake to stop the machine according to the operation of the parking brake lever.
- The power for the front side is transmitted through front drive shaft (15) to front axle (16).
  The power for the rear side is transmitted through rear drive shaft (21) to rear axle (22).
- The power transmitted to axles (16) and (22) is reduced in speed by the pinion gears of differentials (17) and (23), and then transmitted through the sun gear shaft to the sun gear.
- The power of the sun gear is reduced in speed by the planetary mechanisms of final drives (19) and (25), and then transmitted through the axle shaft and wheels to tires (20) and (26).

DRIVE SHAFT (PROPELLER SHAFT)

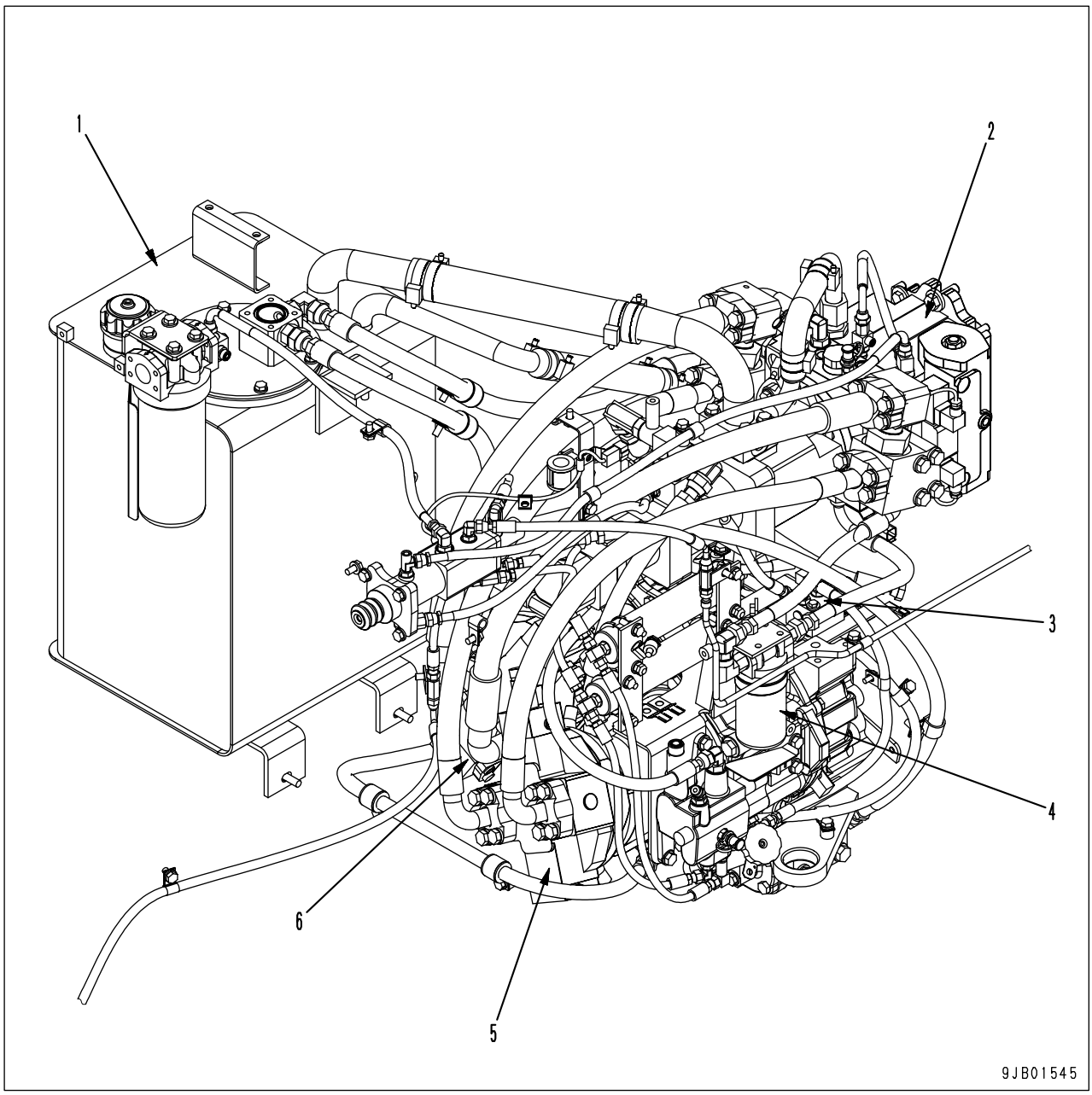


1. Front axle
2. Front drive shaft
3. Transfer
4. Rear drive shaft
5. Rear axle

Outline

- The power from the output shaft of the transfer is transmitted through front drive shaft (2) and rear drive shaft (4) to front axle (1) and rear axle (5).
- When the machine is articulated or it receives an impact from the road during travel or a working impact, the positions of the transfer and front and rear axles change. The drive shafts can change their angles and lengths by means of the universal joints and sliding joints so that the power will be transmitted without damaging any part even when the positions of the components change because of the impacts.

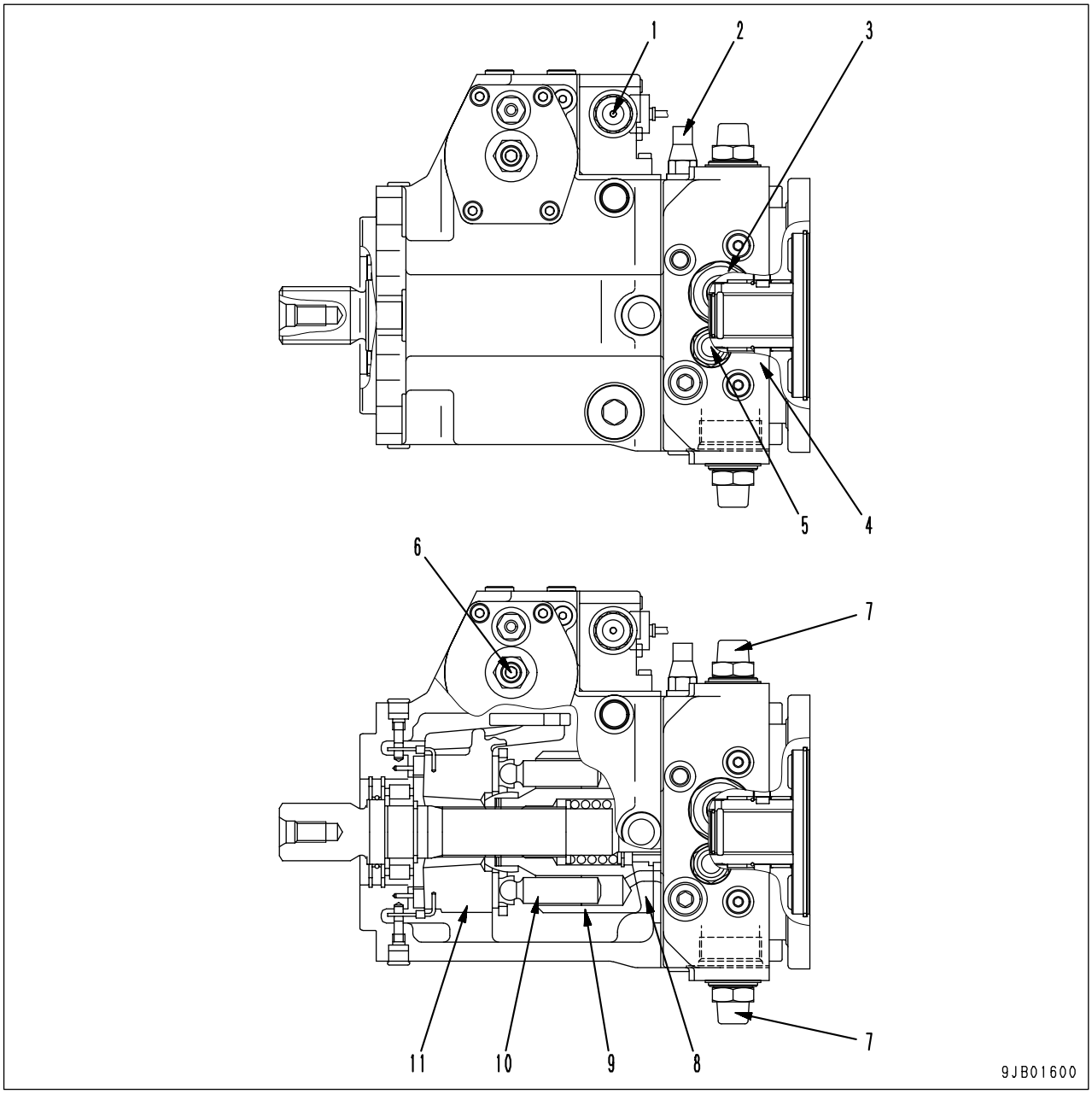
HST HYDRAULIC PIPING DIAGRAM



1. Hydraulic tank
2. HST pump
3. Clutch solenoid valve
4. HST oil filter
5. HST motor 1
6. HST motor 2

HST PUMP

★ HST: Abbreviation for Hydro Static Transmission



1. Forward-reverse shifting solenoid valve
2. High-pressure cut-off valve
3. Speed-related valve (DA valve)
4. Charge pump
5. Low-pressure relief valve
6. Servo cylinder
7. High-pressure relief valve
8. Control plate
9. Cylinder block
10. Piston
11. Swash plate

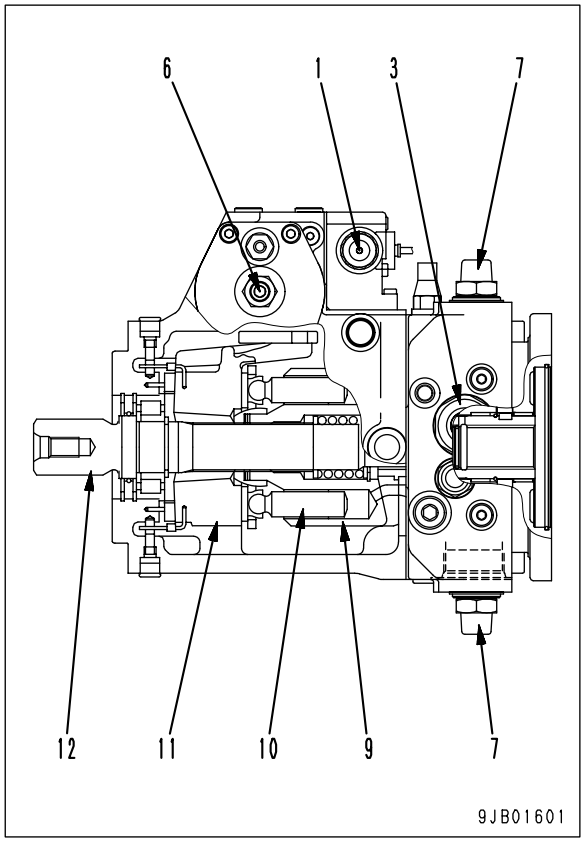
Specifications

Model	A4VG125DA
Type	Variable displacement swash plate-type piston pump
Theoretical capacity (cc / rev)	0 – 110
Set pressure of high-pressure relief valve (MPa {kg/cm^2})	44.1 {450}
Set pressure of high-pressure cut-off valve (MPa {kg/cm^2})	Effective differential pressure 41.2 {420}
Set pressure of low-pressure relief valve (MPa {kg/cm^2})	2.94 {30}

Operation

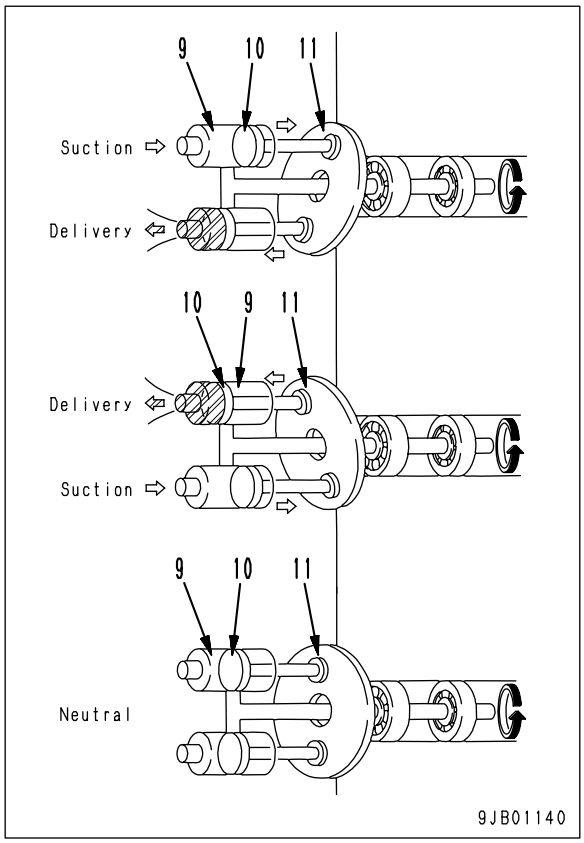
Flow of power

- The HST pump is installed to the coupling which is installed to the engine flywheel.
- The power of the engine is transmitted from the flywheel through the coupling to the HST pump.
- The HST pump is equipped with forward-reverse shifting solenoid valve (1) and servo cylinder (6). If the operator operates for forward or reverse travel, forward-reverse shifting solenoid valve (1) operates and swash plate (11) in the HST pump slants to reverse the oil flow.
- Cylinder block (9) and pistons (10) in it rotate together with drive shaft (12) and the tips of pistons (10) slide on swash plate (11) which does not rotate. The pump has 9 pistons (10) in it.

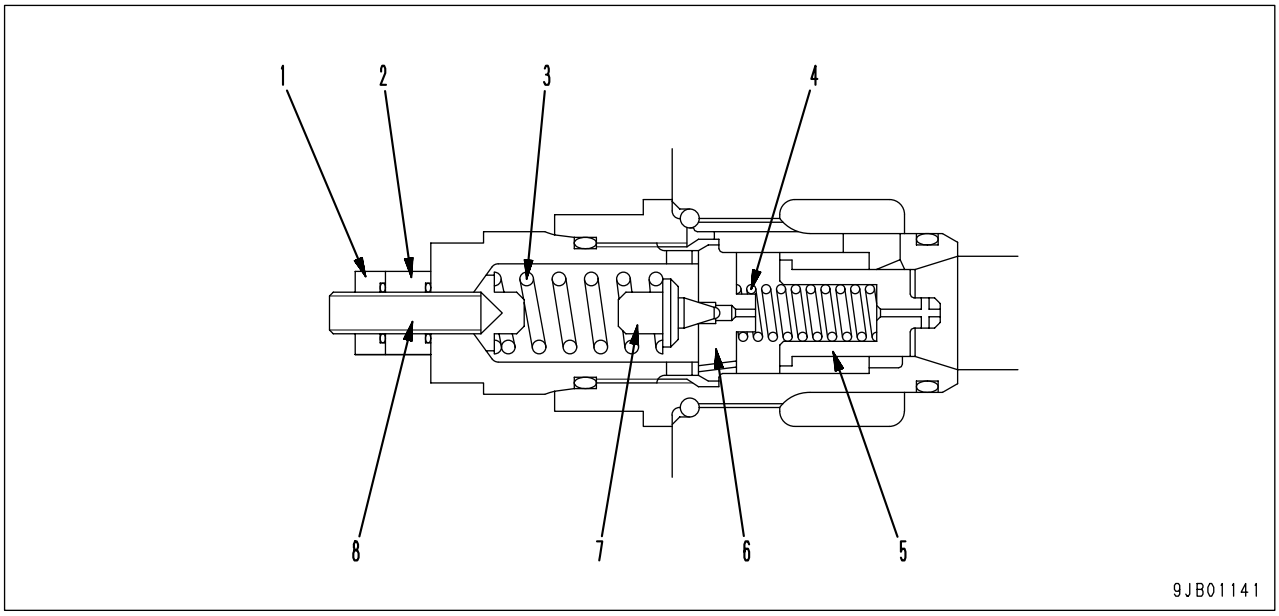


Flow of oil

- As swash plate (11) of the HST pump slants, pistons (10) in contact with its surface reciprocate and work as pumps to suck and discharge the oil in cylinder block (9).
- As a result, high-pressure oil flows in a constant direction into the HST motor.
- If swash plate (11) slants in the opposite direction, the sucking and discharging directions of the oil are reversed, that is, the oil flows in the opposite direction. While swash plate (11) is in neutral, pistons (10) do not reciprocate, thus they do not discharge any oil.
- The strokes of pistons (10) are changed to control the travel speed by increasing or decreasing inclination (angle) of swash plate (11).
- If the quantity of the oil in the low-pressure circuit (the return circuit from the motor to the pump) becomes insufficient because of leakage from the HST pump, HST motor, and control valve, the charge pump adds oil through speed-related valve (3) and check valve of high-pressure relief valve (7).



HIGH-PRESSURE RELIEF VALVE



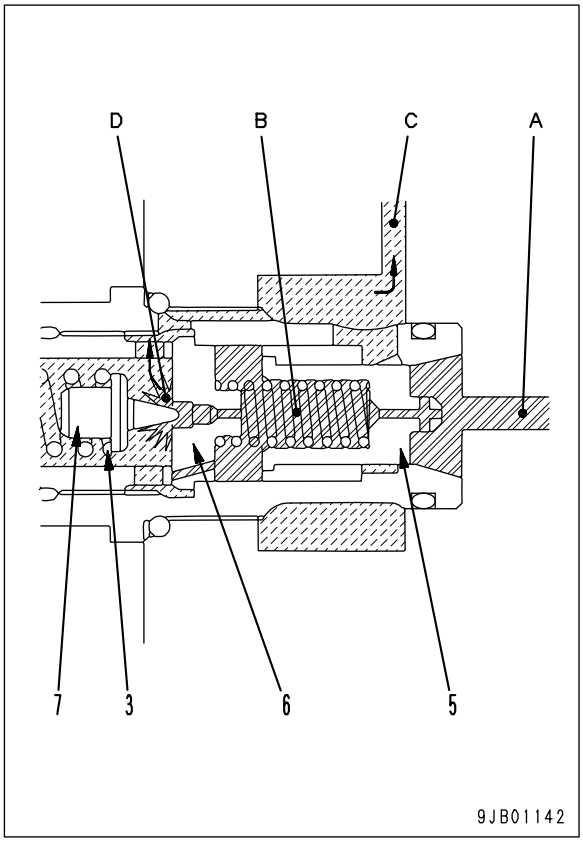
1. Nut
2. Locknut
3. Poppet spring
4. Check spring
5. Main piston
6. Valve seat
7. Pilot poppet
8. Adjustment screw

Function

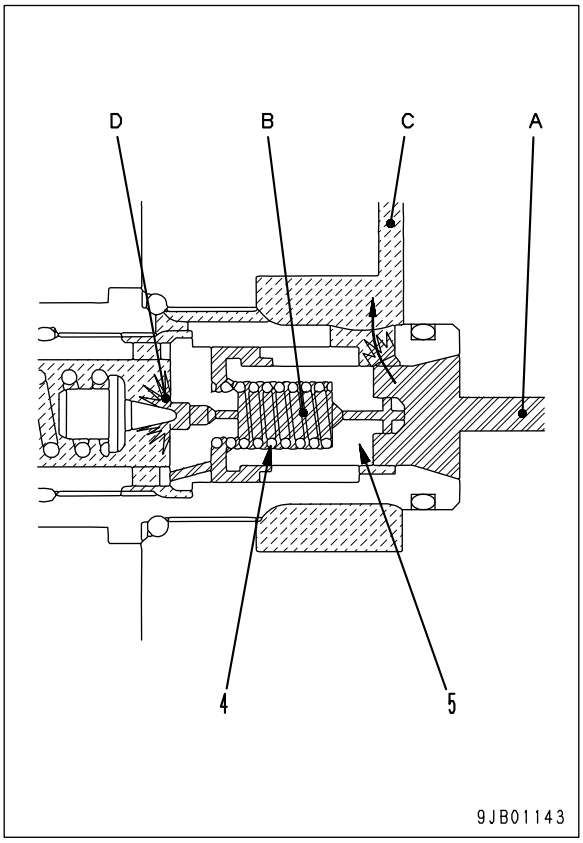
- The high-pressure relief valve is installed to the HST pump. If the oil pressure in the high-pressure circuit between the HST pump and HST motor rises higher than the set pressure, the high-pressure relief valve drains the oil into the low-pressure circuit.
  The high-pressure relief valve controls the maximum pressure in the circuit to protect the circuit with this function.
- If the quantity of the oil in the circuit becomes insufficient, the high-pressure valve leads oil in from the HST charge pump to prevent cavitation.

Operation

- Port **A** is connected to the high-pressure circuit of the HST pump and ports **C** and **D** are connected to the low-pressure circuit of the HST pump.
  The oil fills chamber **B** through the orifice of main piston (5).
  Pilot poppet (7) is seated on valve seat (6).

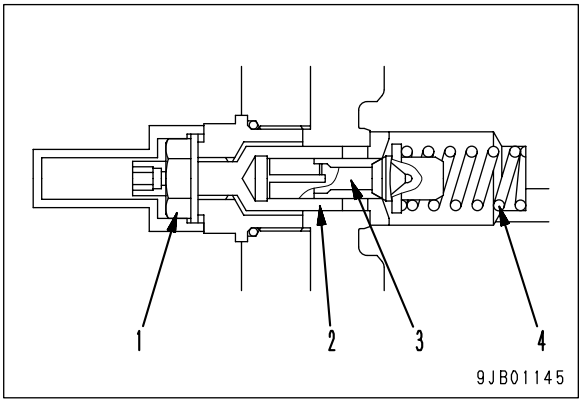


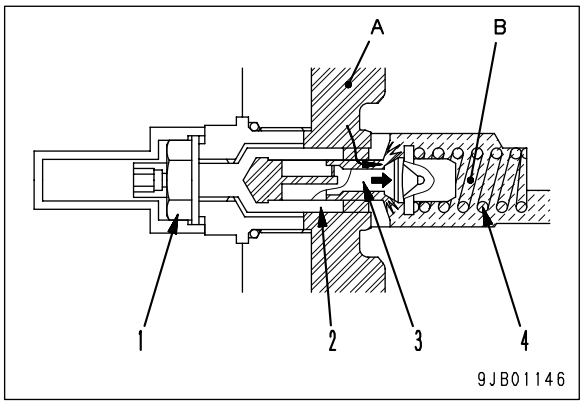
- If the oil pressure in port **A** and chamber **B** reaches the set pressure of poppet spring (3), pilot poppet (7) opens and the oil in chamber **B** flows through chamber **D** to port **C**, and the oil pressure in chamber **B** lowers consequently.
  If the oil pressure in chamber **B** lowers, a pressure difference is made between port **A** and chamber **B** by the orifice of main piston (5). As a result, main piston (5) is pushed open and the oil in port **A** flows into port **C** to relieve the abnormal pressure.



- The set pressure can be adjusted by increasing or decreasing the tension of poppet spring (3).
  To adjust the set pressure, remove the nut and loosen the locknut. If the adjustment screw is tightened, the set pressure is heightened. If the former is loosened, the latter is lowered.
- If the oil pressure in port **A** lowers below that in port **C**, check spring (4) pushes back main piston (5) and the oil in port **C** flows through chamber **D** into port **A** so that the quantity of the oil in port **A** will not become insufficient.

LOW-PRESSURE RELIEF VALVE





1. Locknut
2. Adjustment screw
3. Piston
4. Spring

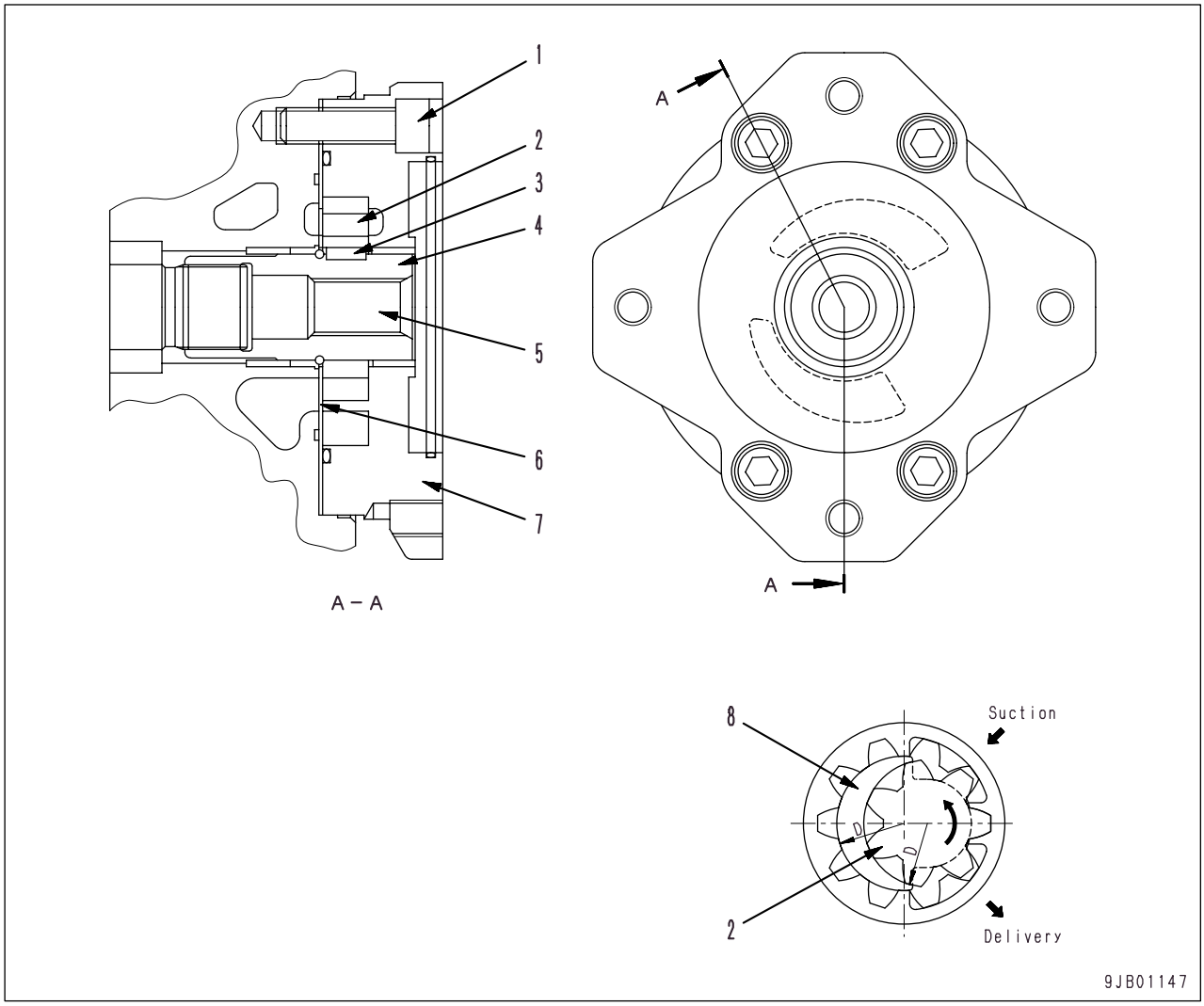
Function

- The low-pressure relief valve is installed to the HST pump. If the oil pressure in the low-pressure circuit between the HST pump and HST motor rises higher than the set pressure, the low-pressure relief valve drains the oil into the hydraulic tank.
  The low-pressure relief valve controls the pressure in the HST pump charge circuit to protect the circuit with this function.

Operation

- Port **A** is connected to the HST pump charge circuit and port **B** is connected to the drain circuit. If the oil pressure is below the set pressure, the oil does not flow into port **B**.
- If the pressure in port **A** reaches the set pressure for some reason, piston (3) opens and the oil in port **A** flows into port **B**, and the oil pressure in port **A** lowers consequently.
- The set pressure can be adjusted by increasing or decreasing the tension of spring (4).
  To adjust the set pressure, loosen locknut (1) and turn adjustment screw (2). If the adjustment screw is tightened, the set pressure is heightened. If the former is loosened, the latter is lowered.

HST CHARGE PUMP



1. Cover bolt
2. Pump gear
3. Key
4. Coupling
5. Drive shaft
6. Plate
7. Charge pump cover
8. Crescent divider board

Outline

- The HST charge pump is built in the HST pump and driven together with the HST pump to supply oil to the HST speed-related valve and low-pressure relief valve of the HST pump.
- The HST charge pump sucks in oil from the hydraulic tank.

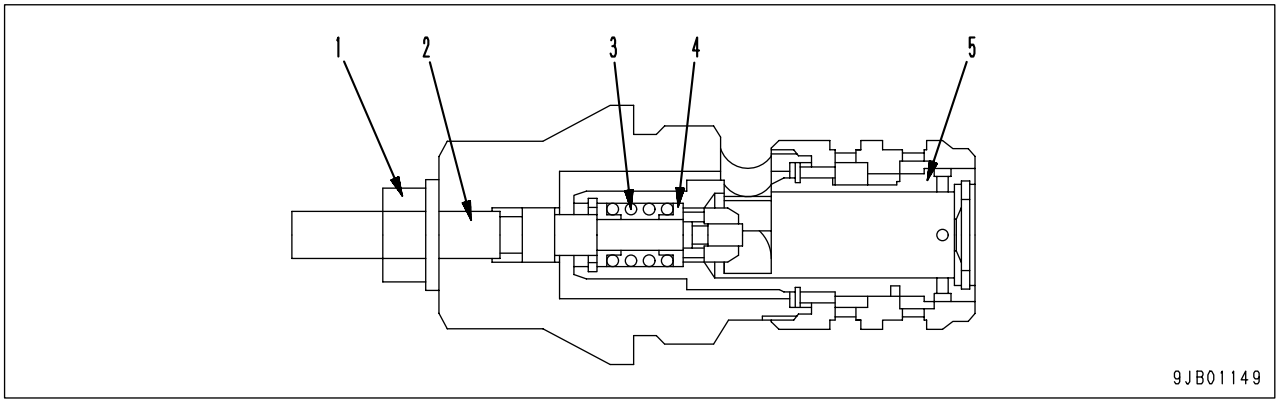
Specifications

Type	Gear pump (Inscribed type)
Theoretical capacity (cc/rev)	28.3

Function

- The HST charge pump is connected to drive shaft (5) of the HST pump and rotated by coupling (4).
- The HST charge pump has pump gear (2) and crescent divider board (8) in it and sucks and discharges the oil in the direction shown in the above figure.

SPEED-RELATED VALVE (DA VALVE)



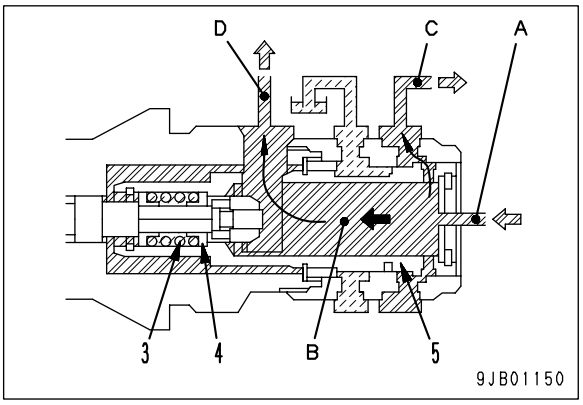
1. Locknut
2. Adjustment screw
3. Poppet spring
4. Spring seat
5. Pilot poppet

Function

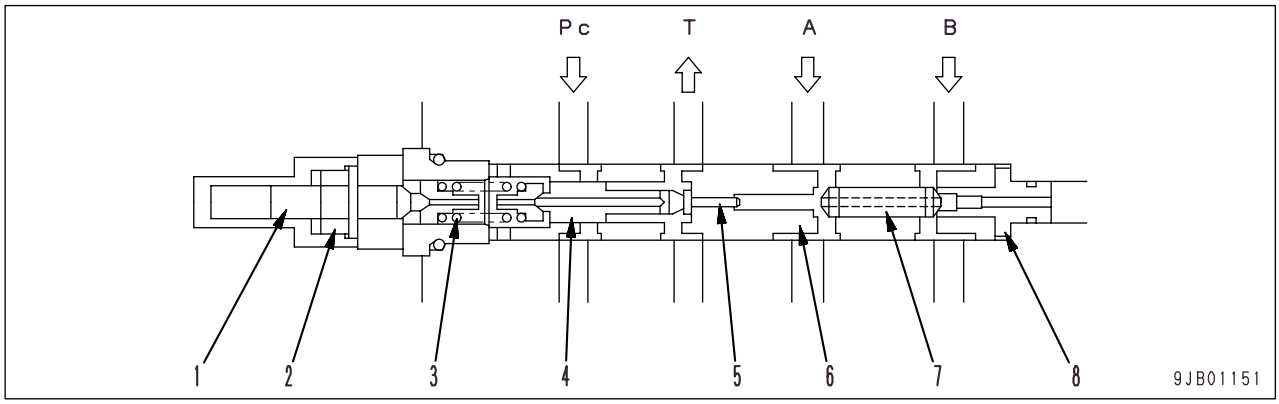
- The speed-related valve is installed to the HST pump and used to divide the oil from the HST charge pump into two parts. One part flows through a throttle valve to the forward-reverse shifting solenoid valve of the HST pump and the other part flows to the low-pressure relief valve of the HST pump.

Operation

- Port **A** is connected to the HST pump charge circuit. Port **D** is connected to the low-pressure relief valve circuit. Port **C** is connected to the forward-reverse shifting solenoid valve circuit.
- The oil from the HST charge pump always flow through the throttle valve of pilot poppet (5), chamber **B**, and port **D** to the low-pressure relief valve.
  As the hydraulic pressure from the HST charge pump is applied a differential pressure is generated between port **A** and chamber **B** because of the throttle valve of pilot poppet (5). Since this differential pressure moves pilot poppet (5), the oil flows from chamber **B** through port **C** to the forward-reverse shifting solenoid valve.
- Pilot poppet (5), poppet spring (3), and spring seat (4) are used as a set. To change the set pressure, loosen locknut (1) and turn the adjustment screw (2). If the adjustment screw is tightened, the set pressure is lowered. If the former is loosened, the latter is heightened.



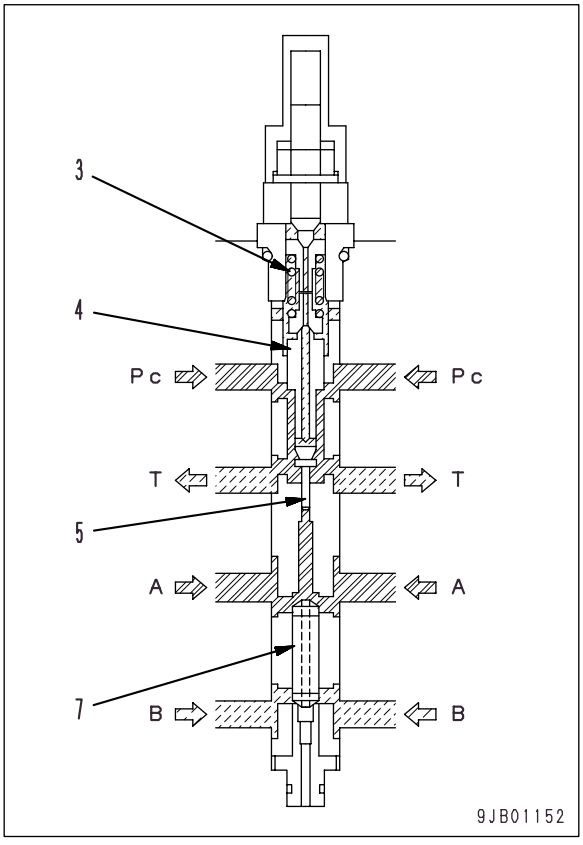
HIGH-PRESSURE CUT-OFF VALVE



1. Adjustment screw
2. Locknut
3. Spring
4. Spool
5. Piston
6. Barrel
7. Shuttle spool
8. Valve seat

Function

- The high-pressure cut-off valve is installed to the HST pump. If the oil pressure in the high-pressure circuit between the HST pump and HST motor rises higher than the set pressure, the high-pressure cut-off valve drains the oil from the servo cylinder circuit into the hydraulic tank to control the maximum pressure in the HST pump circuit.



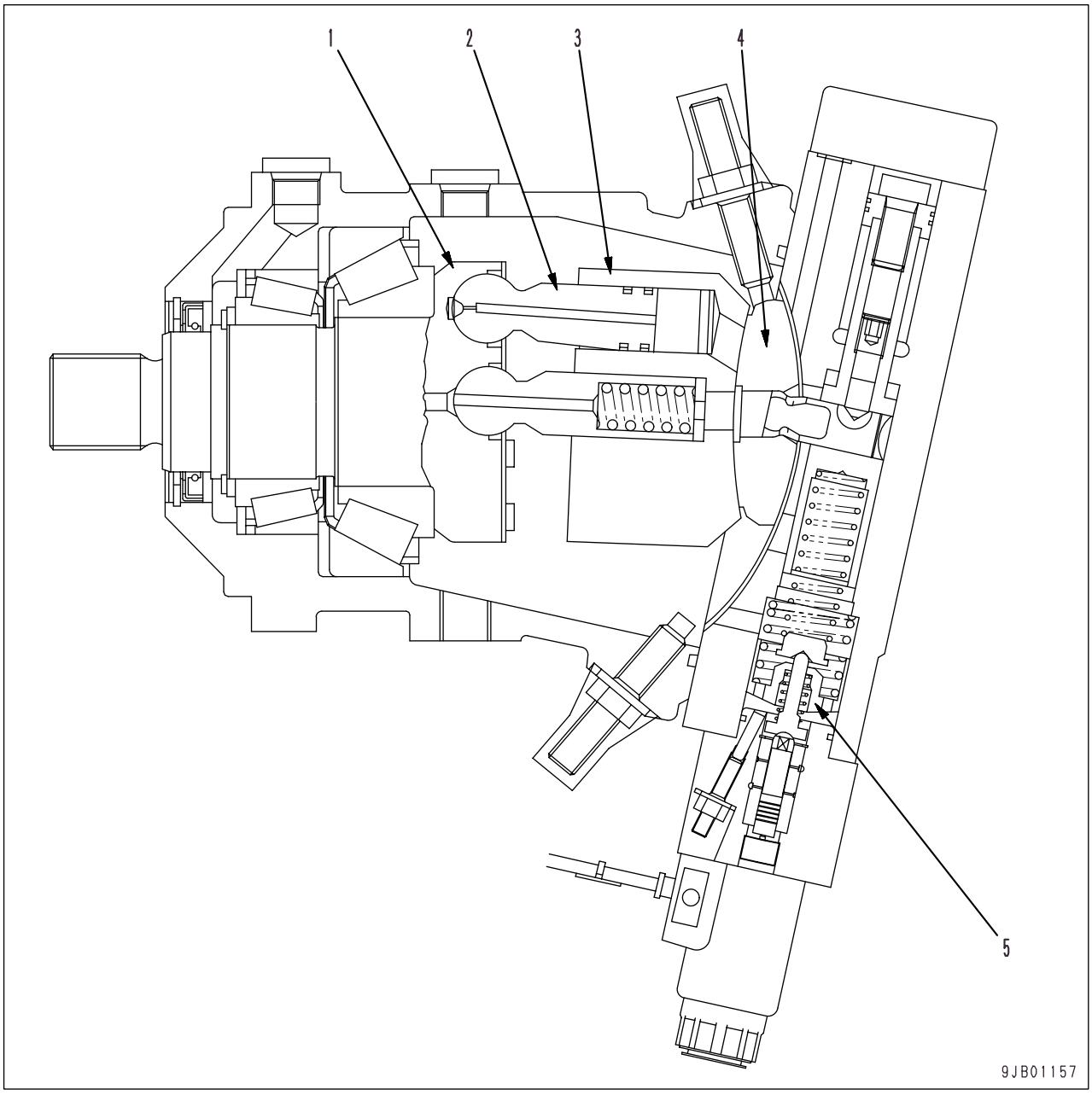
Operation

- Port **A** is connected to the high-pressure circuit during reverse travel. Port **B** is connected to the high-pressure circuit during forward travel. Port **Pc** is connected to the speed-related valve, and port **T** is connected to the drain circuit.
- If the pressure on the port **A** side rises high for some reason, shuttle spool (7) is pushed down and the circuit on port **B** side is closed. At the same time, piston (5) is pushed up by the hydraulic pressure on port **A** side and spring (3) is compressed and spool (4) is also pushed up. Then, ports **Pc** and **T** are opened and the hydraulic oil in the speed-related valve circuit flows into the drain port.
  As a result, the oil pressure in port **Pc** lowers and the swash plate angle of the HST pump reduces, and consequently the discharge reduces and the abnormal pressure in the HST pump circuit lowers.

HST MOTOR

★ HST: Abbreviation for Hydro Static Transmission

HST motor 1

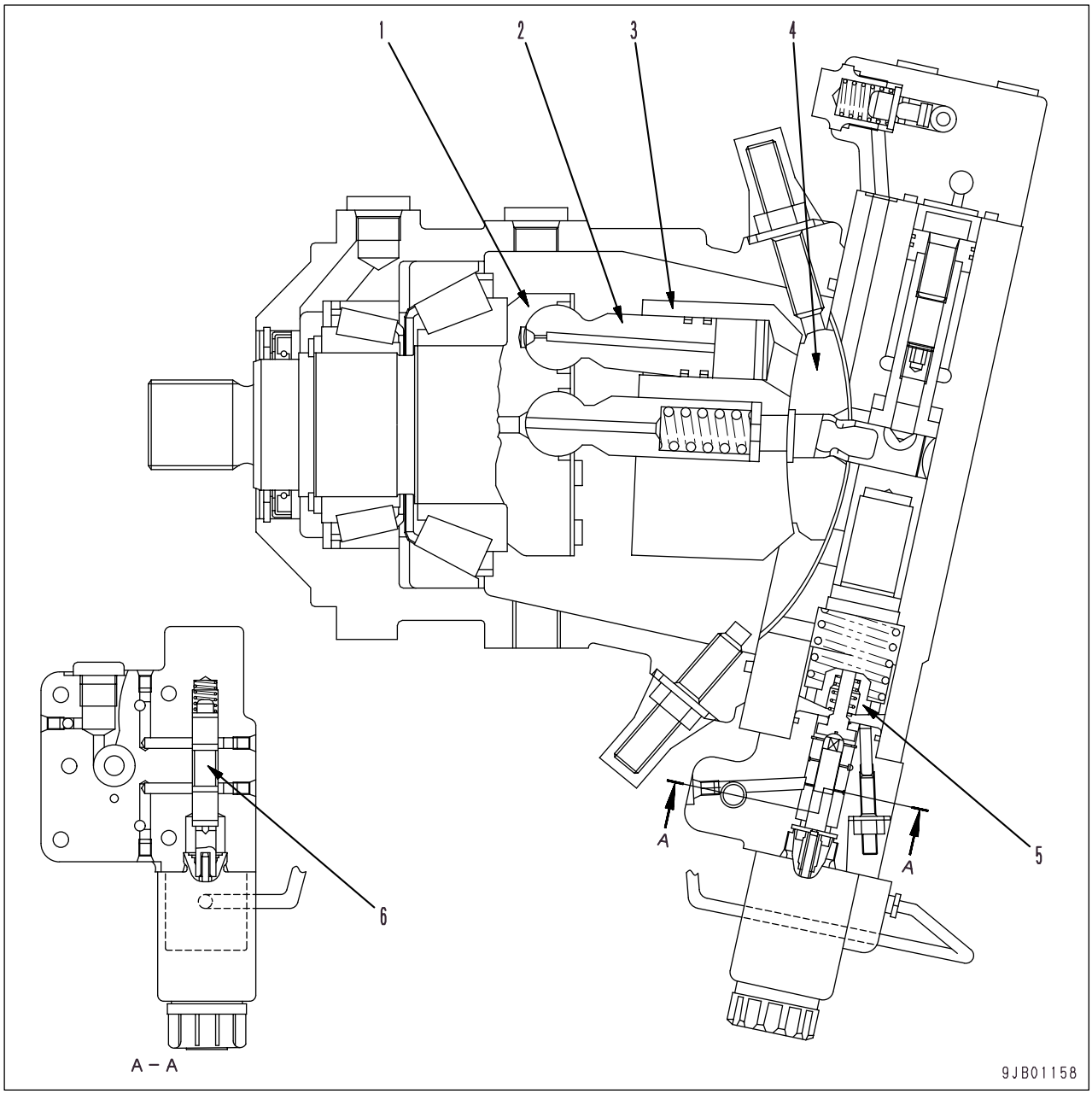


1. Drive shaft
2. Piston
3. Cylinder block
4. Port plate
5. EP servo valve

Specifications

Model	A6VM150EP
Type	Variable displacement swash plate-type piston motor
Theoretical capacity (cc/rev)	0 – 140
Set pressure of high-pressure relief valve (MPa {kg/cm^2})	44.1 {450}
Set pressure of high-pressure cut-off valve (MPa {kg/cm^2})	Effective differential pressure 41.2 {420}
Set pressure of low-pressure relief valve (MPa {kg/cm^2})	2.94 {30}

HST motor 2



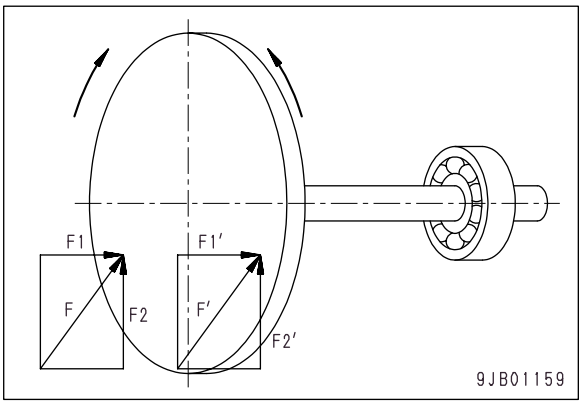
1. Drive shaft
2. Piston
3. Cylinder block
4. Port plate
5. HA servo valve
6. Forward-reverse shuttle valve

Specifications

Model	A6VM140HA
Type	Variable displacement swash plate-type piston motor
Theoretical capacity (cc/rev)	50 – 140
Set pressure of high-pressure relief valve (MPa {kg/cm^2})	44.1 {450}
Set pressure of high-pressure cut-off valve (MPa {kg/cm^2})	Effective differential pressure 41.2 {420}
Set pressure of low-pressure relief valve (MPa {kg/cm^2})	2.94 {30}

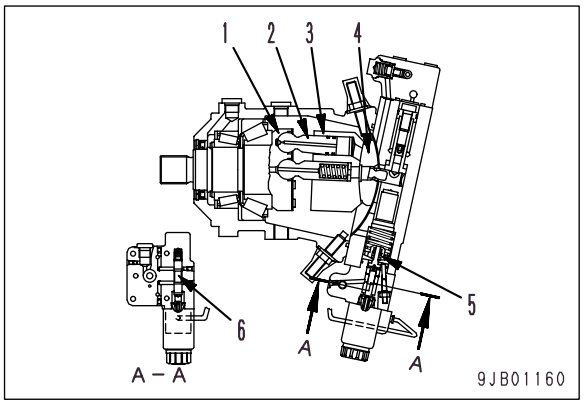
Principle

- Let's assume that a shaft of a disc is supported and the disc can rotate freely. If force F is applied bias to this disc, it is divided into component force F1 at right angles to the disc and component force F2 in the peripheral direction of the disc. Component force F2 rotates the disc to the right.
- If force F', not force F, is applied to the disc, it is divided into component forces F1' and F2' similarly to the above and force F2' rotates the disc to the left



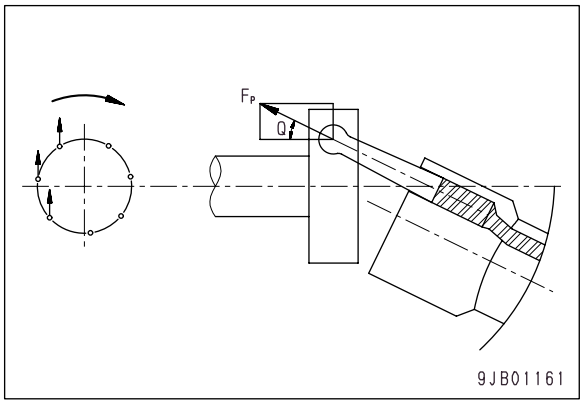
Structure

- There are 7 pistons (2) installed to the disc portion of the drive shaft (1) as if they are spherical joints. They are set in cylinder block (3) at a certain angle to drive shaft (1).
- As the external load on the HST motor is increased by servo valve (5) and forward-reverse shuttle valve (6), inclination of pistons (2) is increased. As a result, the revolving speed is lowered but the torque is increased.

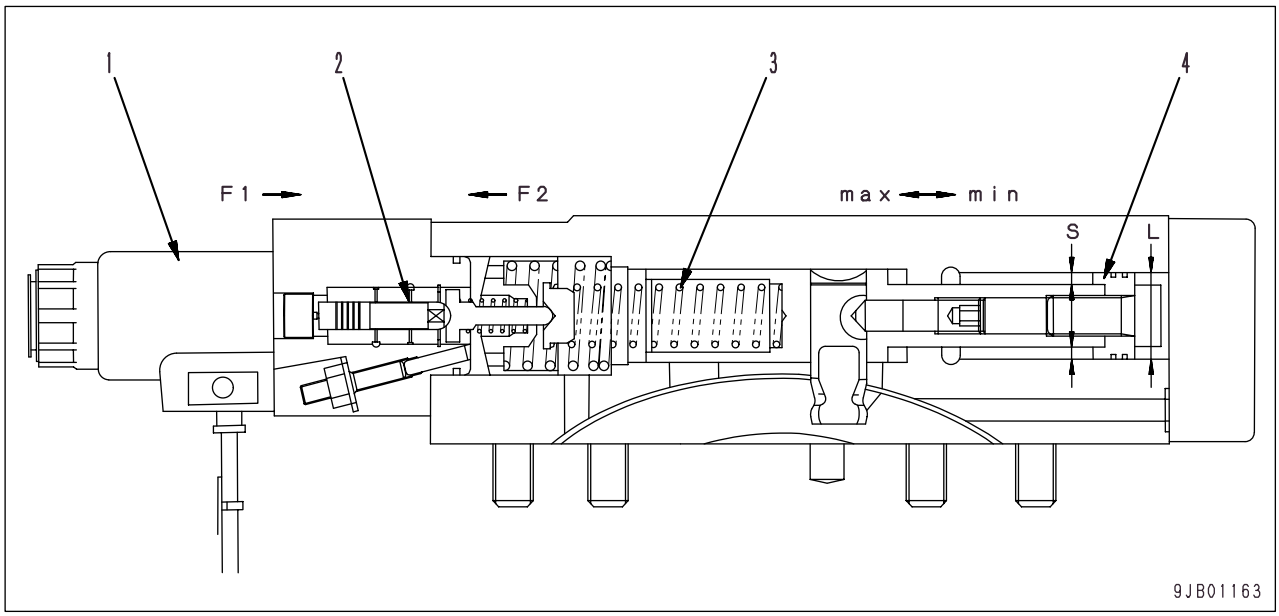


Operation

- The hydraulic oil sent from the HST pump flows in the inlet port of the HST motor and gives hydraulic pressure to the back side of pistons (2). Accordingly, drive shaft (1) rotates because of inclination of pistons (2) and cylinder block (3).
- The oil from the HST pump flows between the forward-reverse shifting solenoid valve and servo cylinder into forward-reverse shuttle valve (6) of the HST motor. The oil from the forward or reverse high-pressure discharge side of the HST motor flows into forward-reverse shuttle valve (6). If a load is applied to the motor connected to servo valve (5) in the HST motor, the oil flows into the servo cylinder of the HST motor because of the pressure difference from forward-reverse shuttle valve (6) side, thus cylinder block (3) is inclined more.



EP SERVO VALVE



1. Motor 1 solenoid valve
2. EP servo valve
3. Spring
4. Servo cylinder

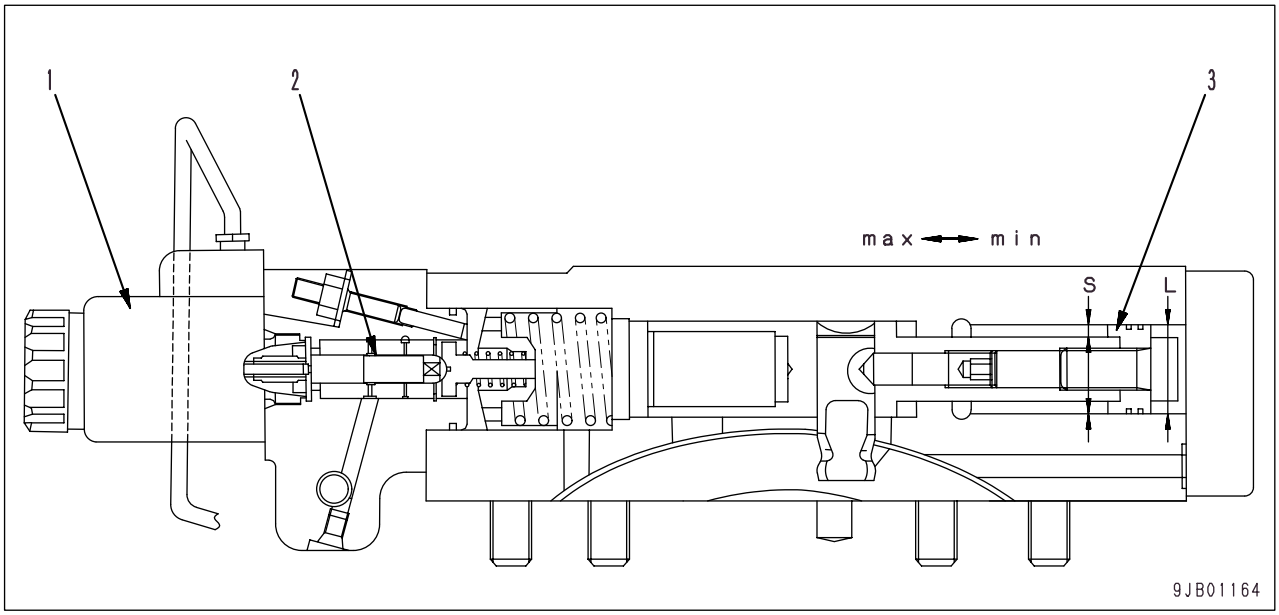
Function

- The EP servo valve is installed to the rear part of HST motor 1 and used to change the displacement of the motor according to the current given to motor 1 solenoid valve (1).

Operation

- Suction force F1 of motor 1 solenoid valve (1) and force F2 of spring (3) are applied to EP servo valve (2).
- If the current given to motor 1 solenoid valve (1) is little (F1 < F2), EP servo valve (2) leads the hydraulic pressure of the motor high-pressure circuit to the small diameter (S) side of servo cylinder (4) and releases the hydraulic pressure on the large diameter (L) side into the tank (motor housing). As a result, servo cylinder (4) moves toward the min side.
- If the current given to motor 1 solenoid valve (1) is large (F1 > F2), EP servo valve (2) leads the hydraulic pressure to the large diameter (L) side. As a result, servo cylinder (4) moves toward the max side because of the area difference between the small diameter (S) side and large diameter (L) side.
- The force of spring (3) changes according to the position of servo cylinder (4) (the displacement of the motor).
  Accordingly, the displacement of the motor is controlled by the current given to motor 1 solenoid valve (1) so that suction force F1 will be balanced with spring force F2.

HA SERVO VALVE



1. Motor 2 solenoid valve
2. HA servo valve
3. Servo cylinder

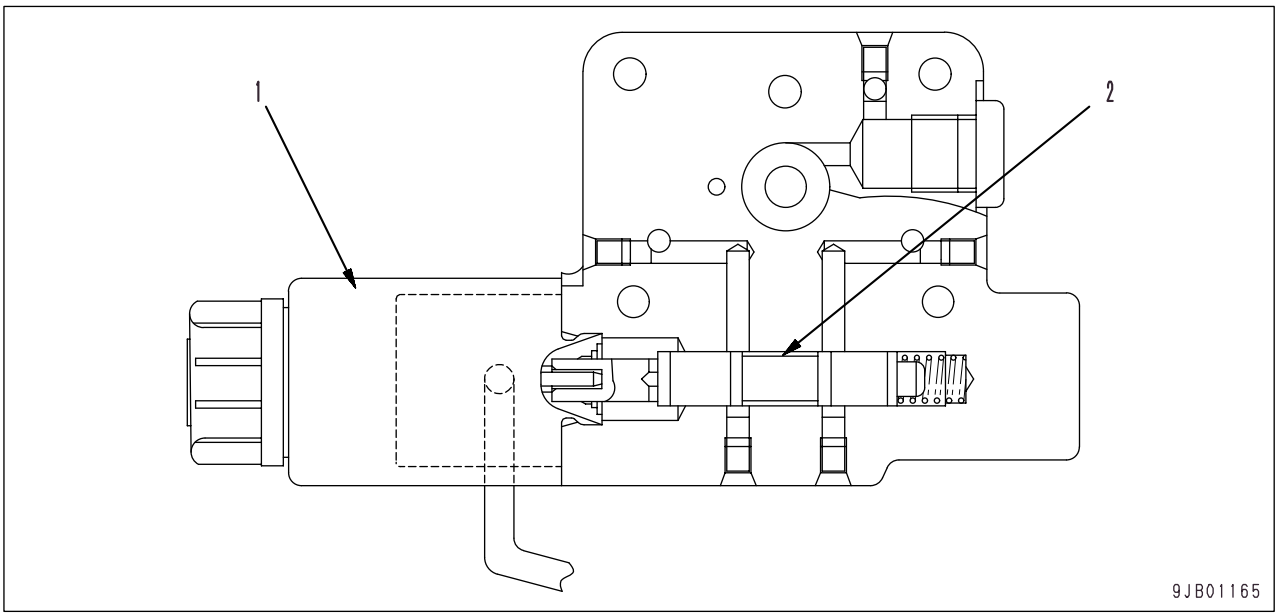
Function

- The HA servo valve is installed to the rear part of HST motor 2 and used to control the position of servo cylinder (3) (the displacement of the motor) to meet the motor output to the external load on the motor. The displacement is controlled with the hydraulic pressure in the circuit selected by the forward-reverse shuttle valve.

Operation

- When the load on the machine is small, HA servo valve (2) leads the hydraulic pressure on the side selected by the forward-reverse shuttle valve to the small diameter (S) side of servo cylinder (3) and releases the hydraulic pressure on the large diameter (L) side into the tank (motor housing) to minimize the displacement of the motor.
- When a large load is applied to the machine on a uphill, etc., HA servo valve (2) leads the hydraulic pressure to the large diameter (L) side. As a result, servo cylinder (3) moves toward the max side because of the area difference between the small diameter (S) side and large diameter (L) side. At this time, the displacement of the motor becomes largest and the motor generates large torque.
- If motor 2 solenoid valve (1) is energized, HA servo valve (2) leads the hydraulic pressure to the large diameter (L) side and the displacement of the motor becomes largest, regardless of the load on the machine.

FORWARD-REVERSE SHUTTLE VALVE



1. Forward-reverse shifting solenoid valve
2. Forward-reverse shuttle valve

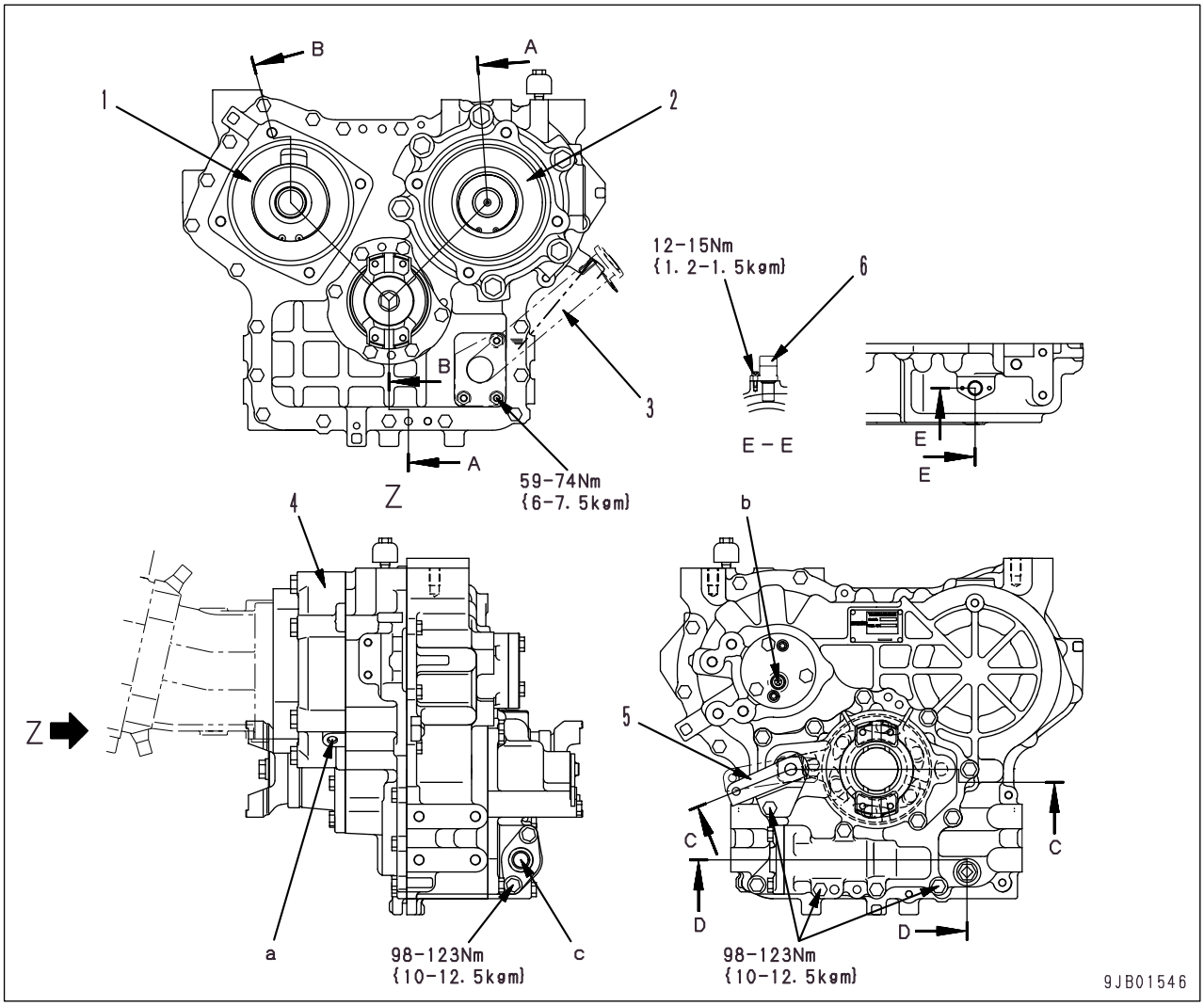
Function

- The forward-reverse shuttle valve is installed to the rear part of HST motor 2 and used to grasp and change the position of the forward-reverse shifting solenoid valve to control where to lead the hydraulic pressure for the HA servo valve.

Operation

- The electric signals given to the forward-reverse shifting solenoid valve of the HST pump are used for forward-reverse shifting solenoid valve (1) and linked to the forward-reverse shifting mechanism.
- Forward-reverse shuttle valve (2) changes the hydraulic pressure applied to the HA servo valve according to the forward-reverse shifting command.

TRANSFER



a. Clutch port
b. Lubricating oil inlet port
c. Lubricating oil suction port

1. HST motor 2 mount
2. HST motor 1 mount
3. Oil filler pipe
4. Transfer
5. Parking brake lever
6. Speed sensor

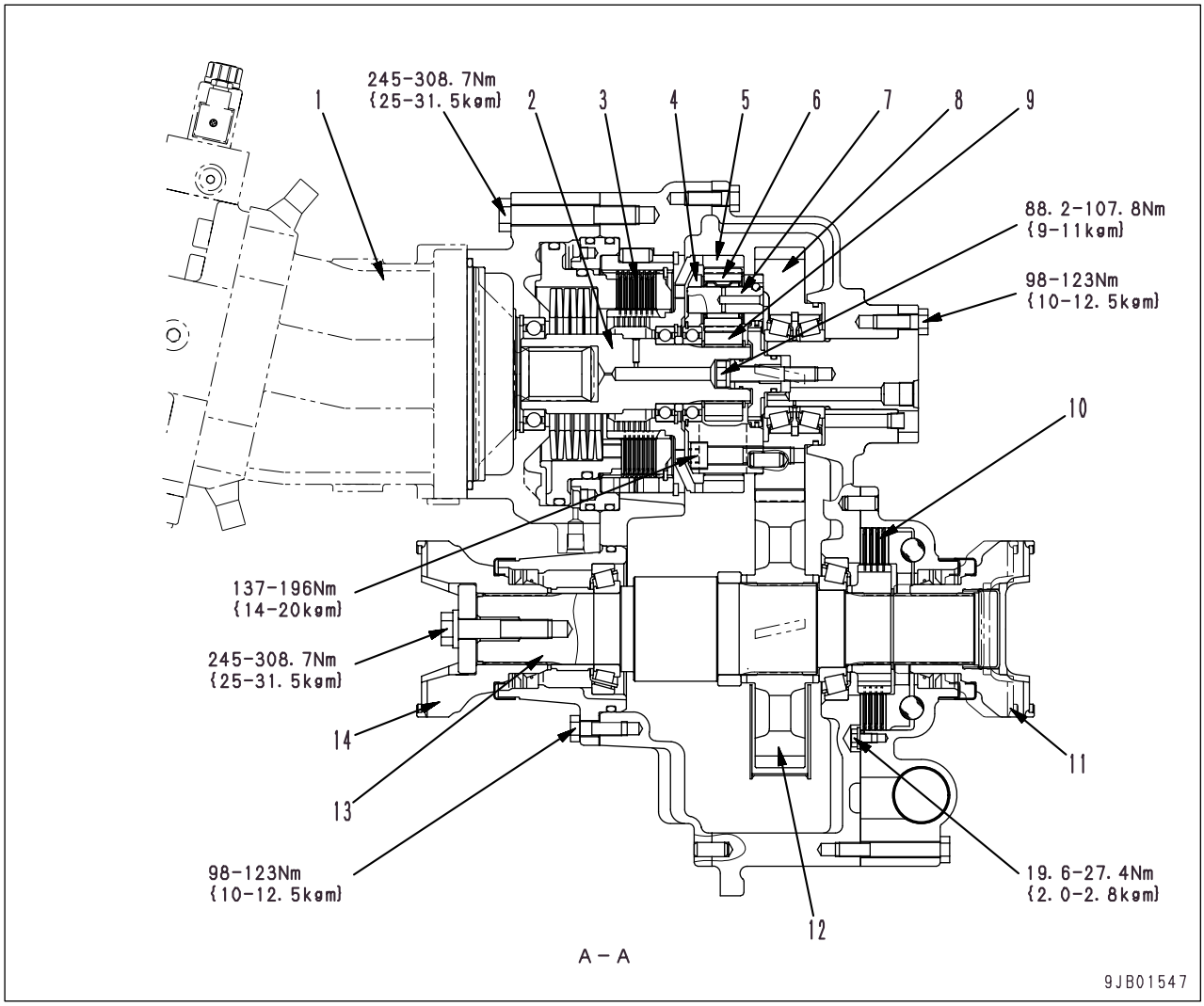
Outline

- The transfer is equipped with 2 HST motors. The engine speed is changed to the forward 1st – 4th and rear 1st – 4th gear speeds by combining the output and revolving direction of the HST motor and the transfer clutch.

Relationship between transfer clutch and transfer clutch pressure at each gear speed

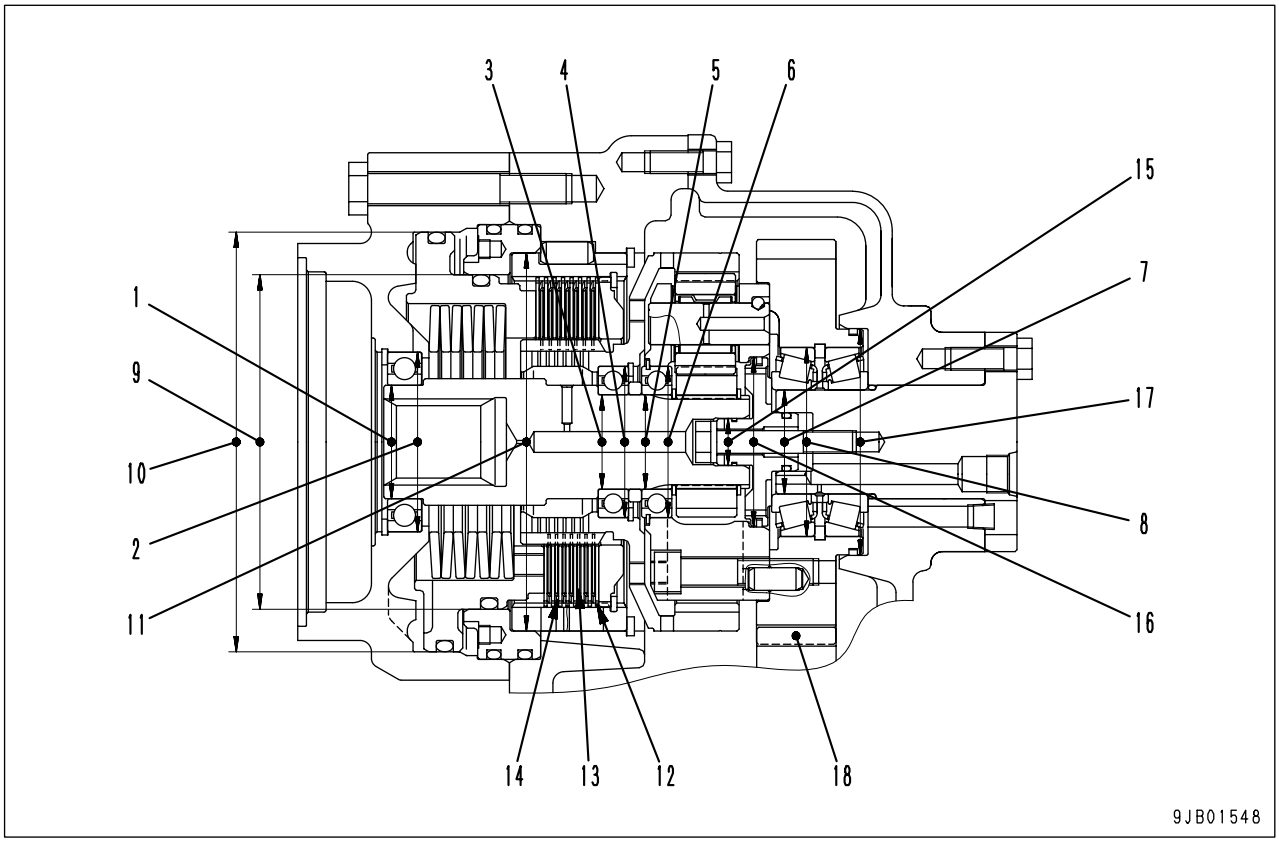
Gear speed	Transfer clutch		Transfer clutch pressure	
1st	Engaged		OFF	
2nd	Engaged		OFF	
3rd	Travel speed 0 – 10km/h	Travel speed 10 – 18km/h	Travel speed 0 – 10km/h	Travel speed 10 – 18km/h
	Engaged	Disengaged	OFF	ON
4th	Travel speed 0 – 10km/h	Travel speed 10 – 38km/h	Travel speed 0 – 10km/h	Travel speed 10 – 38km/h
	Engaged	Disengaged	OFF	ON

Note: The travel speed when tires of 20.5 – 25 size are used is shown in the table.



1. HST motor 1
2. Input shaft
3. Transfer clutch
4. Carrier
5. Ring gear (Number of teeth: 86)
6. Planetary gear (Number of teeth: 24)
7. Planetary shaft
8. Motor 1 gear (Number of teeth: 50)
9. Sun gear (Number of teeth: 37)
10. Parking brake
11. Rear coupling
12. Output gear (Number of teeth: 55)
13. Output shaft
14. Front coupling

Input shaft portion

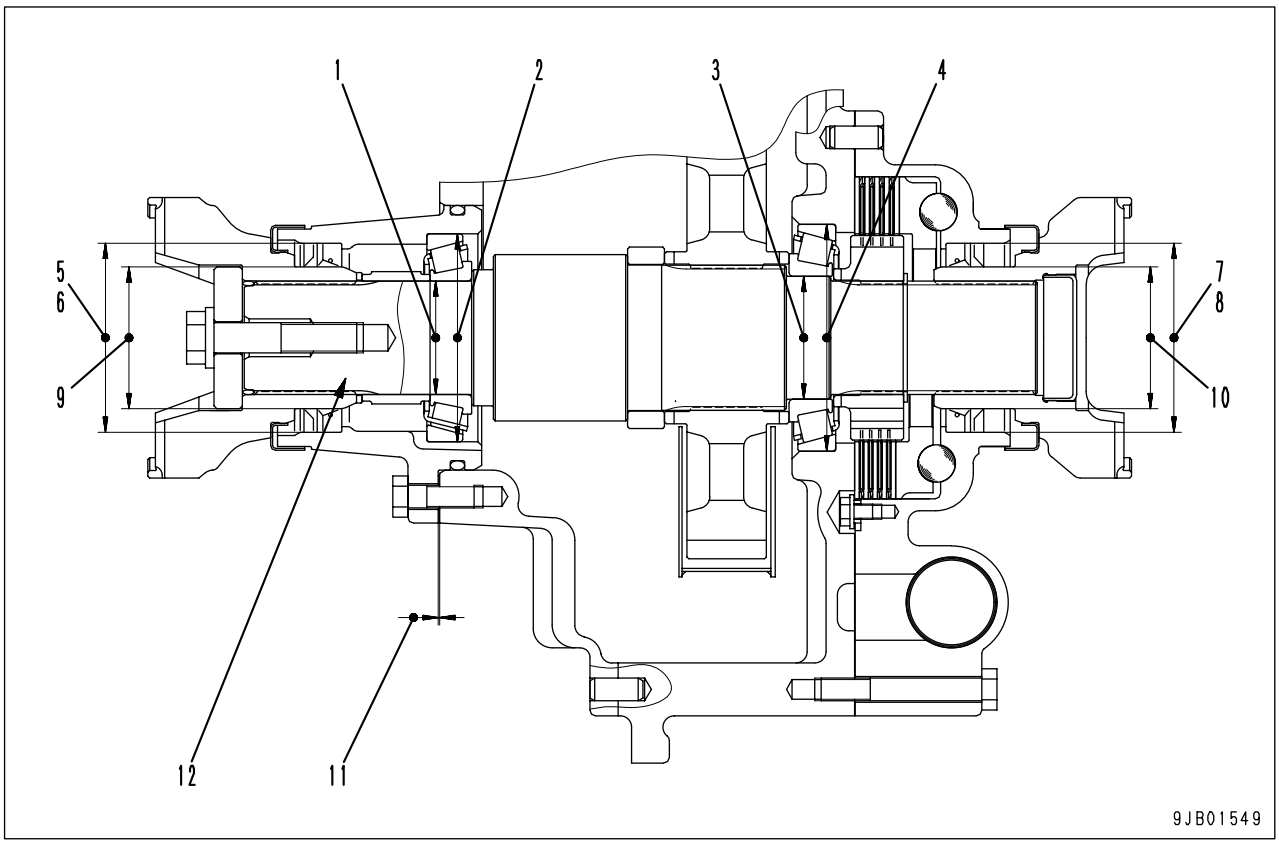


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between input shaft and bearing (F)	ø60	+0.012 -0.007	0 -0.012	-0.024 – 0.007	–	Replace
2	Clearance between input shaft bearing and cage (F)	ø95	0 -0.013	+0.016 -0.006	-0.006 – 0.029	–	
3	Clearance between input shaft and bearing (M)	ø50	+0.011 -0.005	0 -0.012	-0.023 – 0.005	–	
4	Clearance between input shaft bearing and ring gear (M)	ø80	0 -0.013	+0.013 -0.006	-0.006 – 0.026	–	
5	Clearance between input shaft and bearing (R)	ø50	+0.011 -0.005	0 -0.012	-0.023 – 0.005	–	
6	Clearance between input shaft bearing and carrier (R)	ø80	0 -0.013	+0.013 -0.006	-0.006 – 0.026	–	

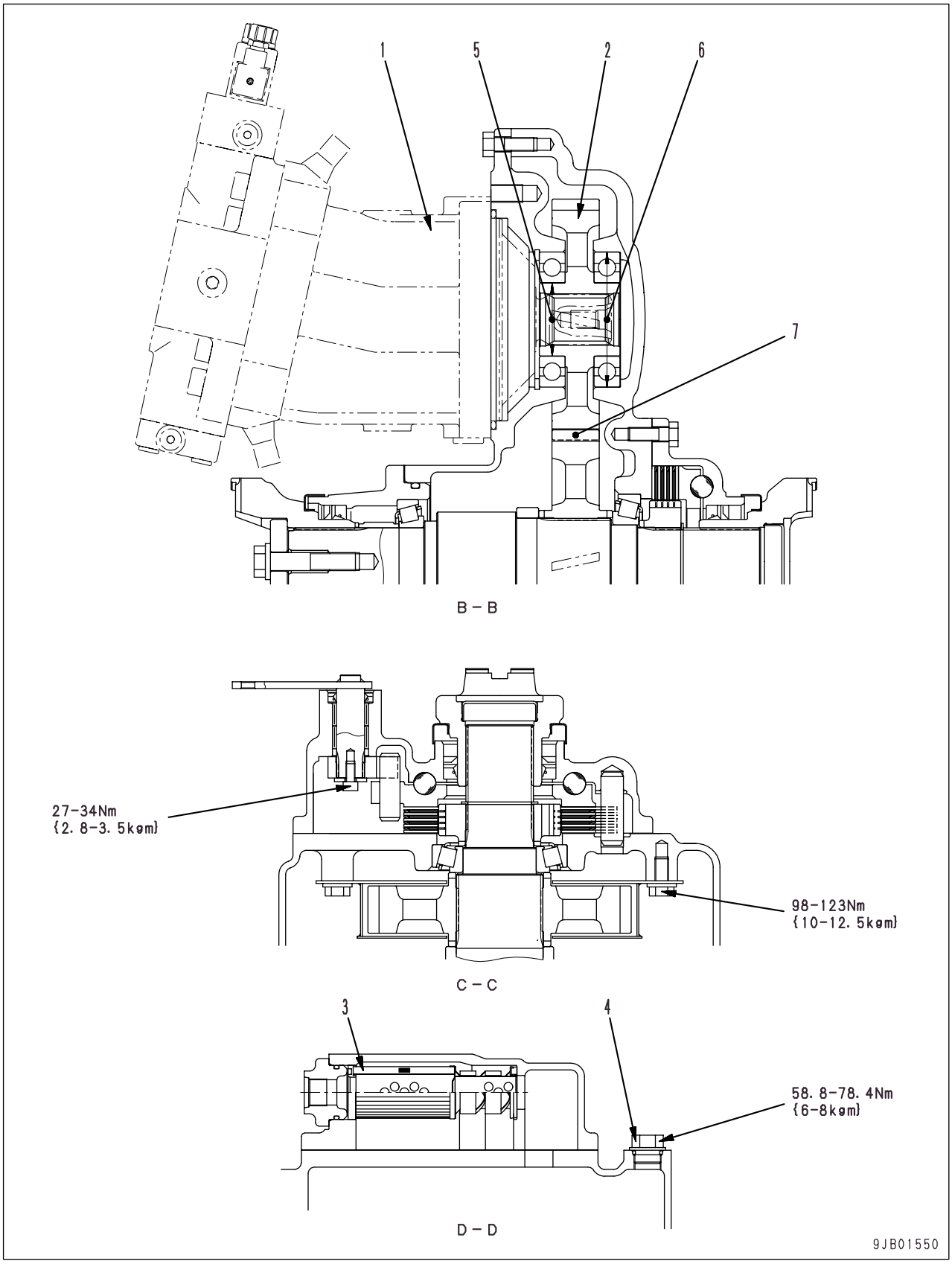
No.	Check item	Criteria					Remedy
7	Clearance between press-fit shaft and bearing	ø55	+0.039 +0.020	0 -0.015	-0.054 – -0.020	–	Replace
8	Clearance between press-fit shaft bearing and motor 1 gear	ø100	0 -0.018	-0.016 -0.038	-0.038 – 0.002	–	
9	Clearance between piston and spacer	ø177	-0.085 -0.125	+0.040 0	0.085 – 0.165	–	
10	Clearance between piston and cage	ø222	-0.550 -0.650	+0.046 0	0.550 – 0.696	–	
11	Clearance between clutch housing and front case	ø200	+0.061 +0.015	+0.046 0	-0.061 – 0.031	–	
12	Thickness of separator plate	Standard size		Tolerance		Repair limit	
		1.7		±0.05		1.6	
	Distortion of separator plate	–		0.05		0.15	
13	Thickness of friction plate	2.2		±0.08		1.8	
	Distortion of friction plate	–		0.02		0.25	
14	Load on wave spring (Height: 2.2 mm)	1,147 N {117 kg}		±115 N {±11.7 kg}		918 N {94 kg}	
15	Inside diameter of contact face of seal ring	ø25		+0.021 0		ø25.1	
	Width of groove of seal ring	2.5		+0.15 +0.10		2.7	
	Width of seal ring	2.5		-0.01 -0.03		2.3	
	Thickness of seal ring	1.2		±0.1		1.05	
16	Inside diameter of contact face of seal ring	ø90		+0.035 0		ø90.1	
	Width of groove of seal ring	3		+0.15 +0.10		3.3	
	Width of seal ring	3		-0.01 -0.03		2.7	
	Thickness of seal ring	3.7		±0.12		3.55	
17	Inside diameter of contact face of seal ring	ø120		+0.022 0		ø120.5	
	Width of groove of seal ring	4.5		+0.1 0		5.0	
	Width of seal ring	4.36		0 -0.1		3.9	
	Thickness of seal ring	3		±0.1		2.7	
18	Backlash between motor 1 gear and output gear	0.19 – 0.465					
—	Side clearance of planetary gear (on both sides)	0.35 – 0.80					

Output shaft portion



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between output shaft and bearing (F)	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		ø 60	+0.030 +0.011	0 -0.015	-0.045 – -0.011	–	
2	Clearance between output shaft bearing and cage (F)	ø 110	0 -0.018	-0.015 -0.040	-0.040 – 0.003	–	
3	Clearance between output shaft and bearing (R)	ø 65	+0.030 +0.011	0 -0.015	-0.045 – -0.011	–	
4	Clearance between output shaft bearing and rear case (R)	ø 120	0 -0.018	-0.015 -0.040	-0.040 – 0.003	–	
5	Clearance between oil seal and cage (F)	ø 100	+0.170 +0.080	+0.054 0	-0.170 – -0.026	–	
6	Clearance between dust seal and cage (F)	ø 100	+0.400 +0.200	+0.054 0	-0.400 – -0.146	–	
7	Clearance between oil seal and cage (R)	ø 100	+0.170 +0.080	+0.054 0	-0.170 – -0.026	–	
8	Clearance between dust seal and cage (R)	ø 100	+0.400 +0.200	+0.054 0	-0.400 – -0.146	–	
9	Inside diameter of sliding surface of coupling oil seal (F)	Standard size		Tolerance		Repair limit	
		ø 75		0 -0.074		74.8	
10	Inside diameter of sliding surface of coupling oil seal (R)	ø 75		0 -0.074		74.8	
11	Clearance between cage and front case	Standard size		Standard clearance		Clearance limit	Adjust shim
		0.7		0.1 – 1.3		–	
12	Free rotation torque of output shaft	4.9 – 6.7 Nm {0.5 – 0.7 kgm}					


1
5
2
6
7
B – B
27–34Nm
{2. 8–3. 5kgm}
98–123Nm
{10–12. 5kgm}
C – C
3
4
58. 8–78. 4Nm
{6–8kgm}
D – D
9JB01550

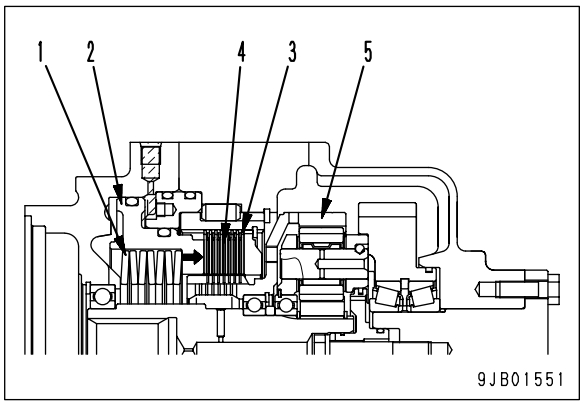
1. HST motor 2
2. Motor 2 gear (Number of teeth: 50)
3. Strainer
4. Drain plug

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
5	Clearance between input shaft and bearing (F)	ø 65	+0.035 +0.013	0 -0.015	-0.050 – -0.013	–	Replace
6	Clearance between input shaft bearing and cage (F)	ø 120	0 -0.015	+0.022 -0.013	-0.013 – 0.037	–	
7	Backlash between motor 2 gear and output gear	0.190 – 0.465					

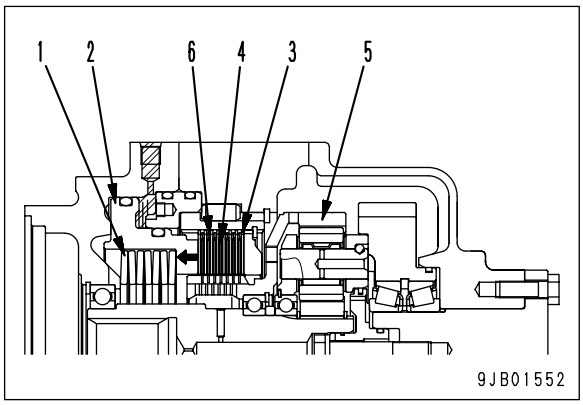
Operation of clutch

When clutch is ON (fixed)



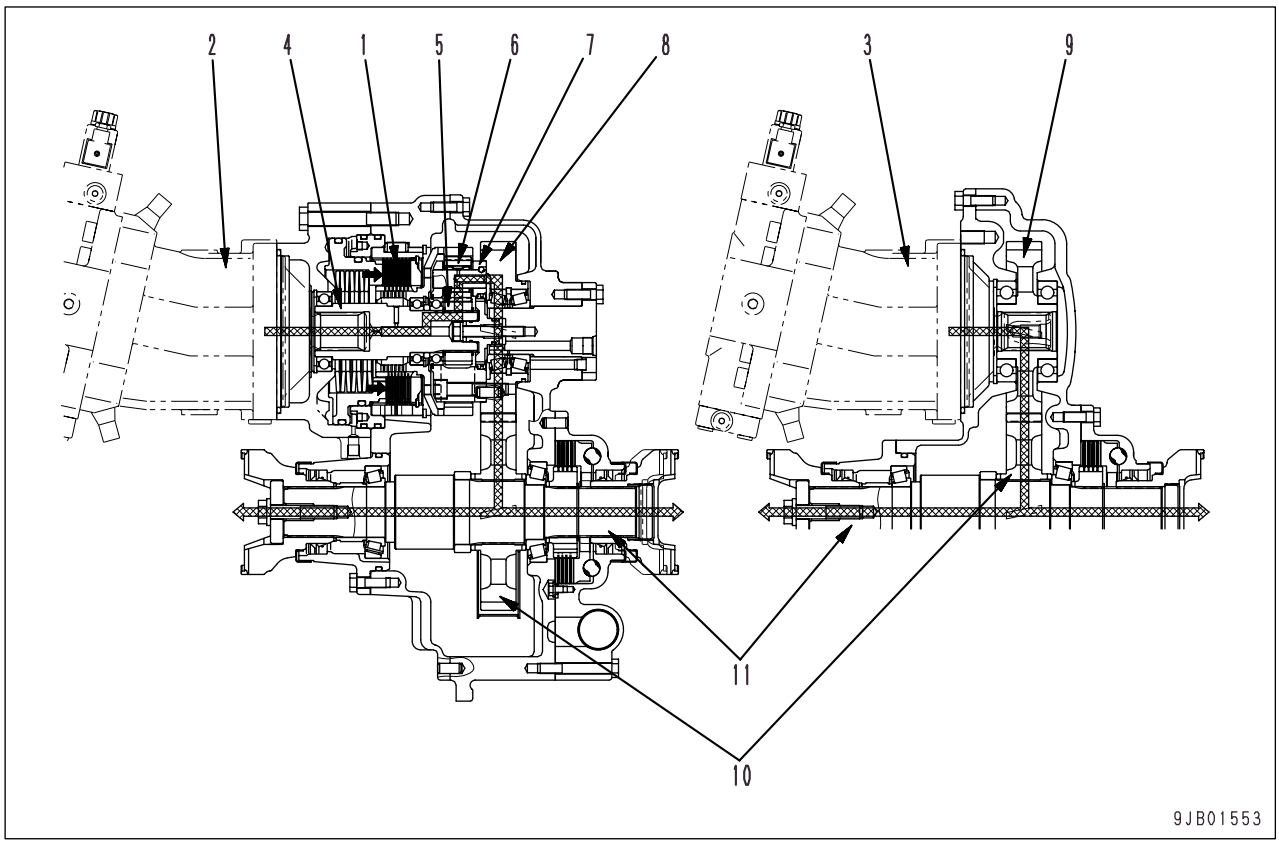
- If the oil from the clutch solenoid valve is shut off, piston (2) is moved to the right by the tension of spring (1).
  Plates (3) and discs (4) are fixed to each other and rotation of discs (4) is stopped by their friction force and ring gear (5) meshed with the internal teeth is fixed.

When clutch is OFF (released)



- The oil sent from the clutch solenoid valve is sent by pressure to the back side of piston (2) and it pushes back spring (1) and piston (2) moves to the left. The friction force of plates (3) and discs (4) is lost and ring gear (5) is set in neutral.
- Wave springs (6) installed between plates (3) return piston (2) quickly and separate plates (3) and discs (4) to prevent increase of slip loss when the clutch is disengaged.

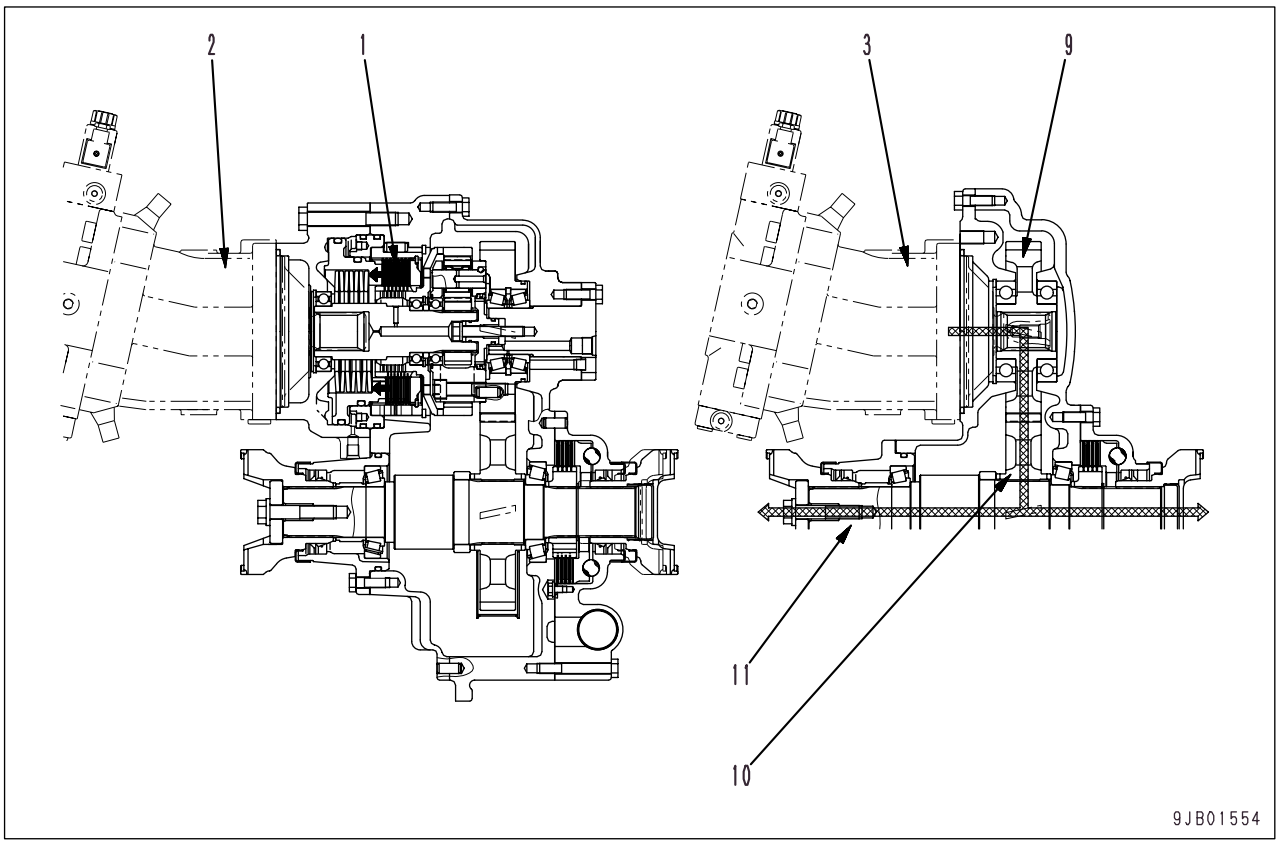
Low-speed mode



Operation

- In the low-speed mode, transfer clutch (1) is fixed and the power of both HST motor 1 (2) and HST motor 2 (3) is transmitted to output shaft (11).
- The power of HST motor 1 (2) is transmitted through input shaft (4), sun gear (5), planetary gear (6), carrier (7), motor 1 gear (8), and output gear (10) to output shaft (11).
- The power of HST motor 2 (3) is transmitted through motor 2 gear (9) and output gear (10) to output shaft (11).

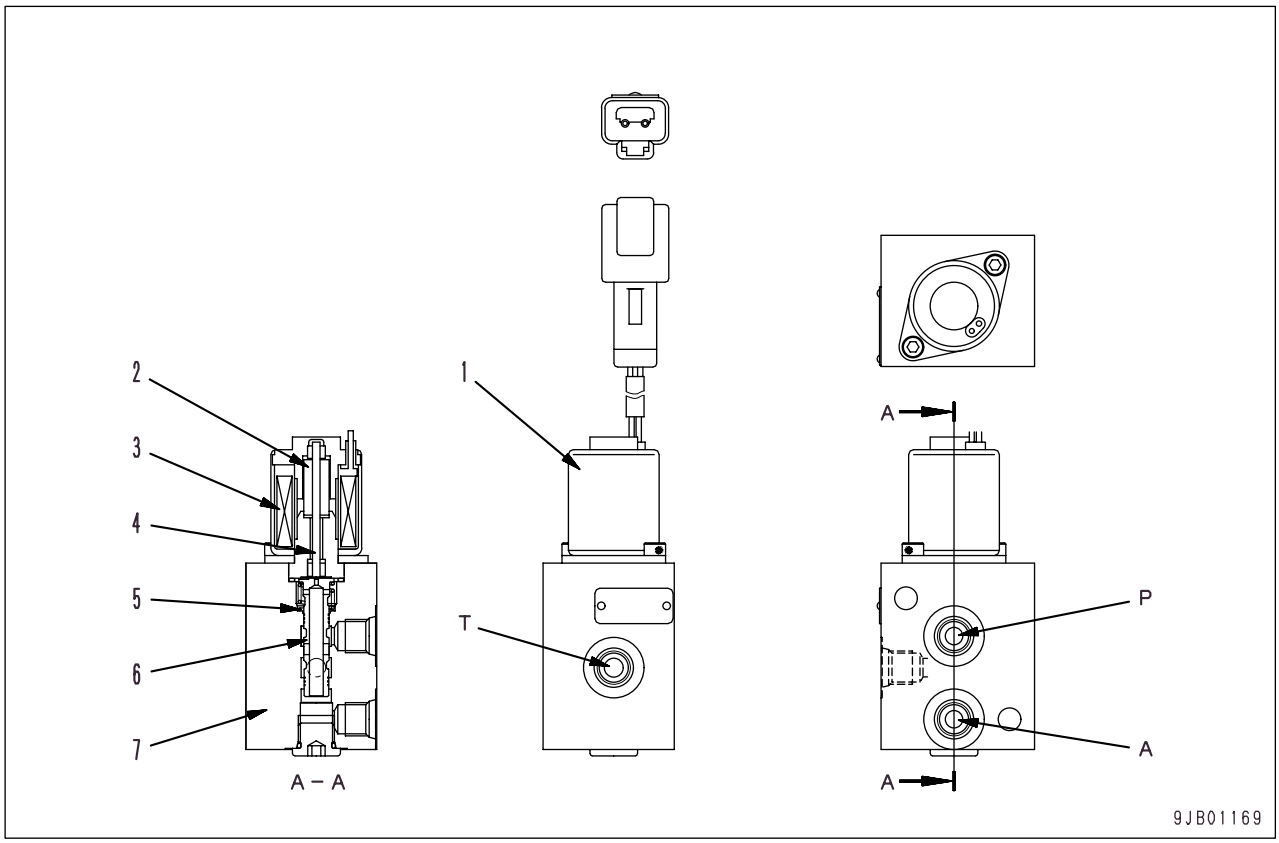
High-speed mode



Operation

- In the high-speed mode, transfer clutch (1) is released and HST motor 1 (2) stops. Accordingly, the power of only HST motor 2 (3) is transmitted to output shaft (11).
- The power of HST motor 2 (3) is transmitted through motor 2 gear (9) and output gear (10) to output shaft (11).

CLUTCH SOLENOID VALVE



P: From HST charge pump
A: To transfer clutch
T: To drain port

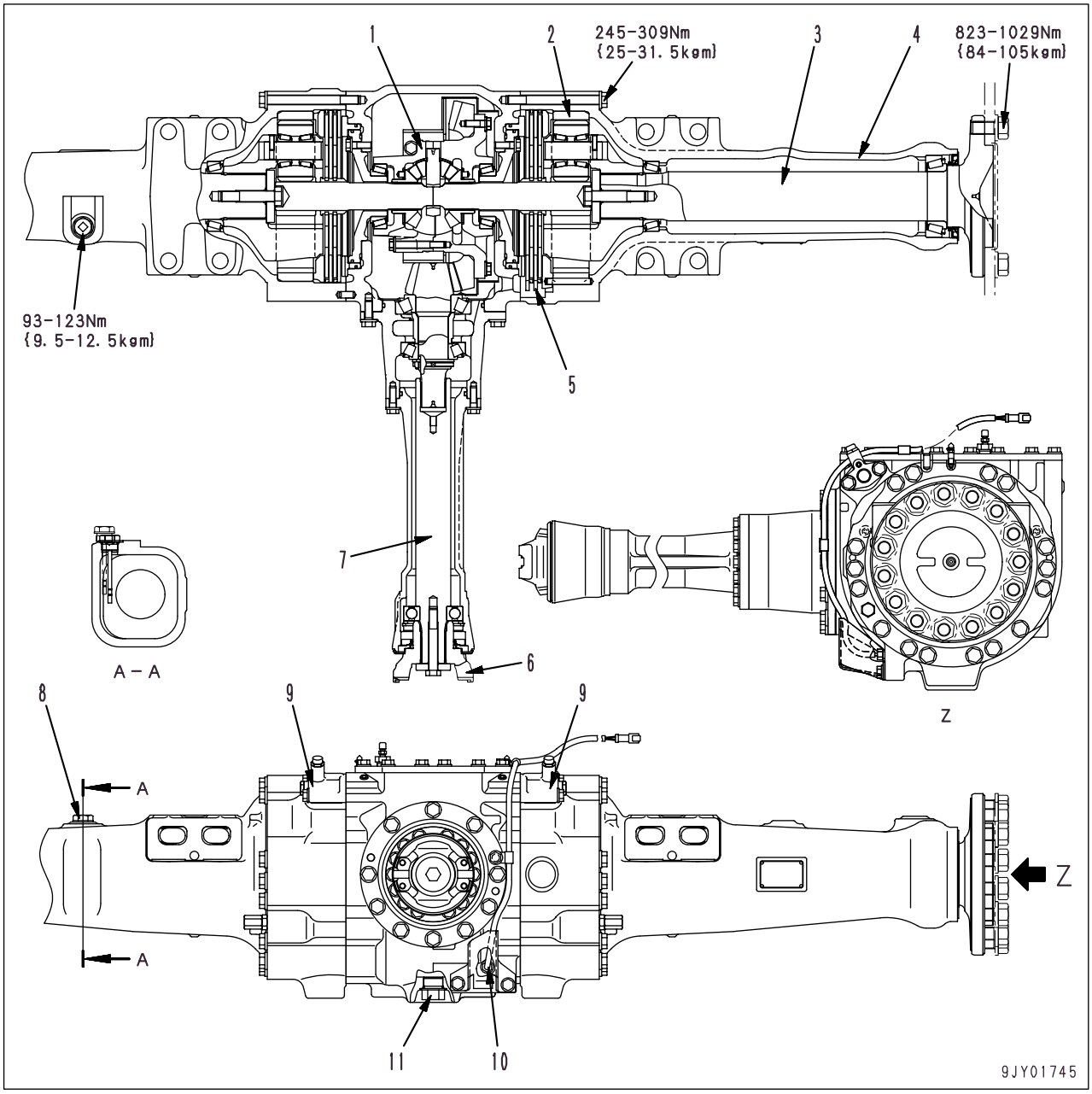
1. Clutch solenoid valve
2. Plunger
3. Coil
4. Push pin
5. Spring
6. Spool
7. Body

Operation

- When the current of the input signal is large, the hydraulic oil of the transfer clutch is drained.
- As the current of the input signal is reduced, the hydraulic pressure of the transfer clutch is heightened.
- After the current of the input signal is reduced until the hydraulic pressure of the transfer clutch reaches the hydraulic pressure sent from the HST charge pump, the hydraulic pressure of the transfer clutch is kept at the hydraulic pressure sent from the HST charge pump even if the current of the input signal is reduced further.

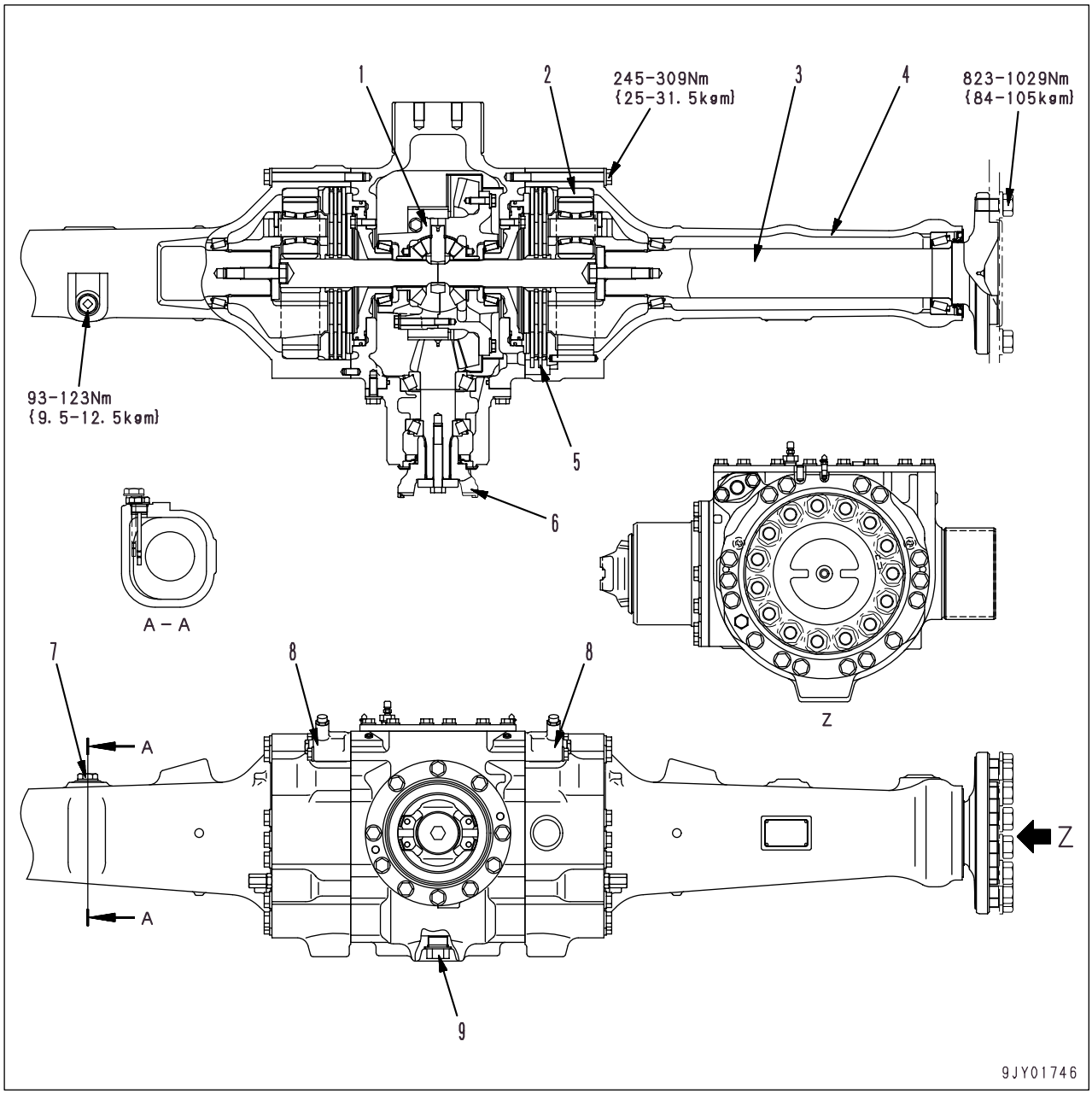
AXLE

FRONT AXLE



1. Differential
2. Final drive
3. Axle shaft
4. Axle housing
5. Wet-type multiple-disc brake
6. Coupling
7. Shaft
8. Oil filler port / level plug
9. Slack adjuster
10. Oil temperature sensor
11. Drain plug

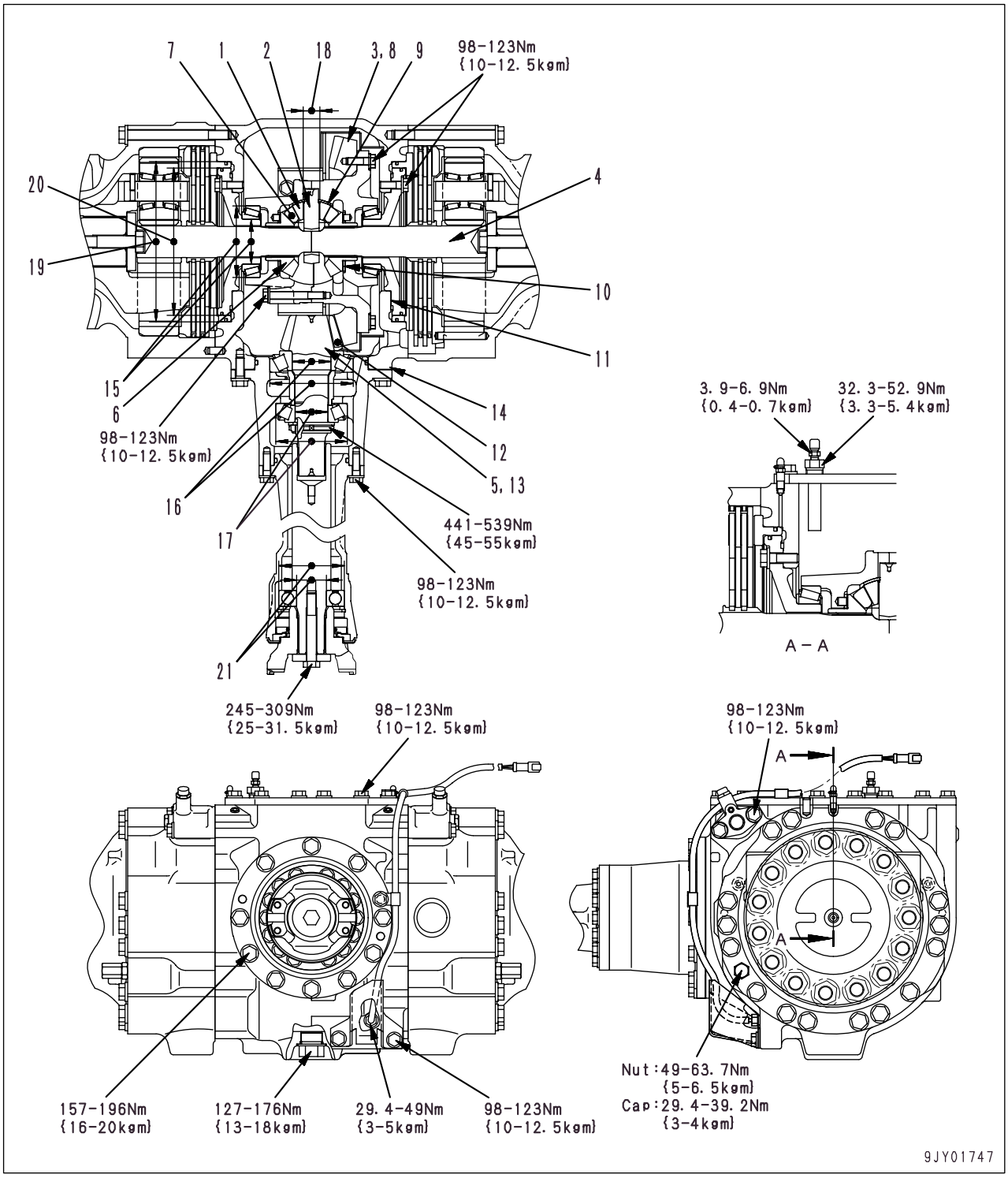
REAR AXLE



1. Differential
2. Final drive
3. Axle shaft
4. Axle housing
5. Wet-type multiple-disc brake
6. Coupling
7. Oil filler port / level plug
8. Slack adjuster
9. Drain plug

DIFFERENTIAL

FRONT DIFFERENTIAL

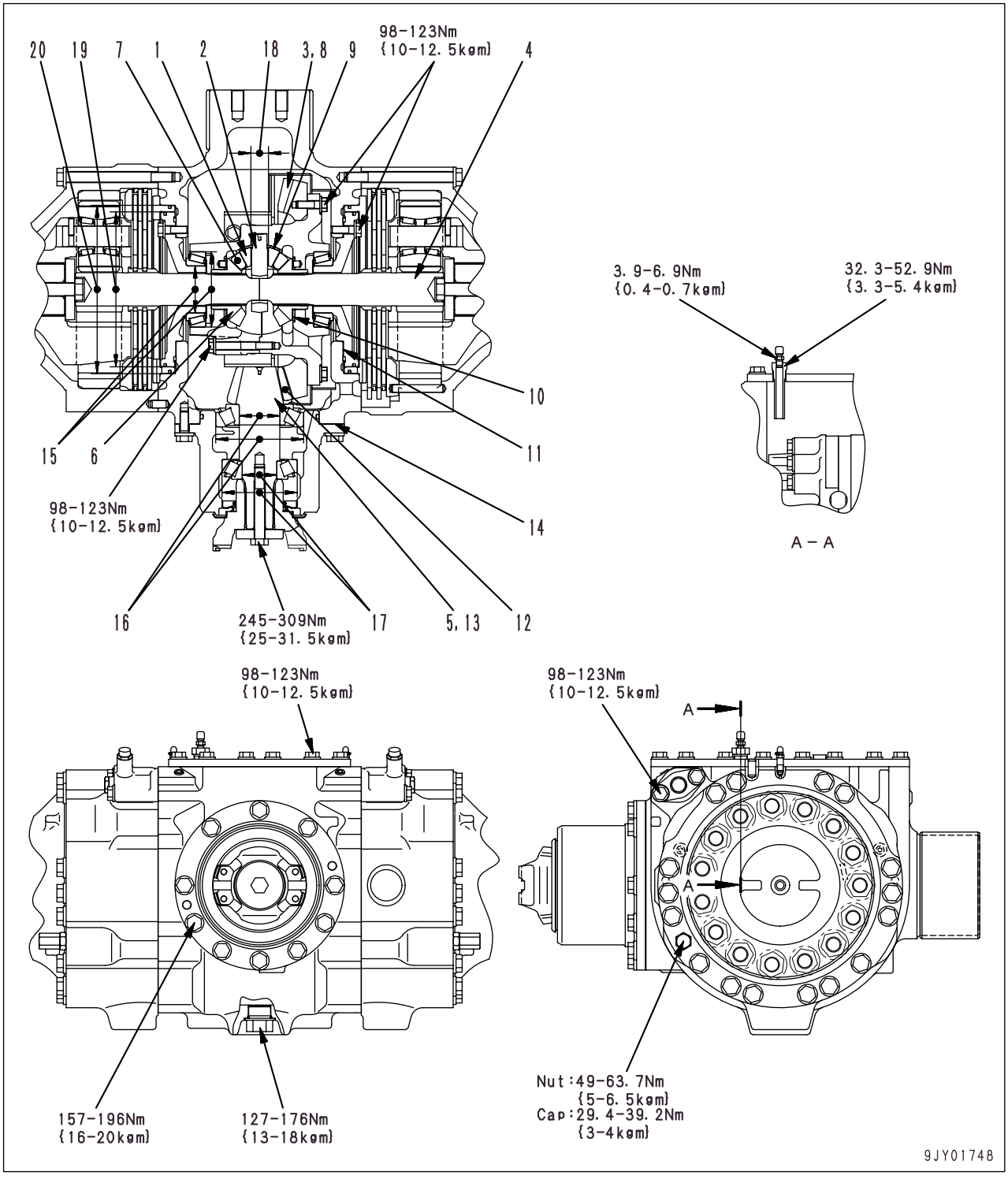


1. Pinion gear (Number of teeth: 9)
2. Shaft
3. Bevel gear (Number of teeth: 42)
4. Sun gear shaft
5. Bevel pinion (Number of teeth: 10)
6. Side gear (Number of teeth: 12)

Unit: mm

No.	Check item		Criteria					Remedy
7	Backlash of differential gear		0.1 – 0.25					Adjust
8	Starting torque of bevel gear		6.3 – 21.1 Nm {0.64 – 2.15 kgm} (At outside surface of bevel gear)					
9	Pinion gear washer thickness		Standard size	Tolerance	Repair limit			Replace
			3	± 0.08	2.8			
10	Side gear washer thickness		4	± 0.05	3.8			
11	Thickness of shim at differential side bearing carrier (Each side)		0.30 – 1.25					Adjust
12	Backlash of bevel gear		0.20 – 0.33					
13	End play of bevel pinion		0 – 0.165					Replace
14	Thickness of shim at differential housing and gauge assembly		1.07 ± 0.33					Adjust
15	Clearance of differential side bearing	Outer race	ø 120	0 -0.020	-0.041 -0.076	-0.076 – -0.021	—	Replace
		Inner race	ø 75	+0.051 +0.032	0 -0.015	-0.066 – -0.032	—	
16	Clearance of bearing on gear side of pinion shaft	Outer race	ø 140	0 -0.018	-0.048 -0.088	-0.088 – -0.030	—	
		Inner race	ø 65	+0.039 +0.020	0 -0.015	-0.054 – -0.020	—	
17	Clearance of bearing on coupling side of pinion shaft	Outer race	ø 120	0 -0.015	-0.041 -0.076	-0.076 – -0.026	—	
		Inner race	ø 55	+0.039 +0.020	0 -0.015	-0.054 – -0.020	—	
18	Clearance between pinion gear and spider		ø 28	-0.06 -0.11	+0.10 +0.05	0.11 – 0.21	—	
19	Clearance of piston fitting portion of differential housing (Housing and piston)		ø 268.5	-0.110 -0.191	+0.081 0	0.110 – 0.272	—	
20	Clearance of piston fitting portion of bearing carrier (Piston and carrier)		ø 247	-0.100 -0.172	+0.072 0	0.100 – 0.244	—	
21	Clearance between drive shaft and bearing of cage	Outer race	ø 110	0 -0.015	0 -0.035	-0.035 – 0.015	—	
		Inner race	ø 50	+0.018 +0.002	0 -0.012	-0.030 – -0.002	—	

REAR DIFFERENTIAL



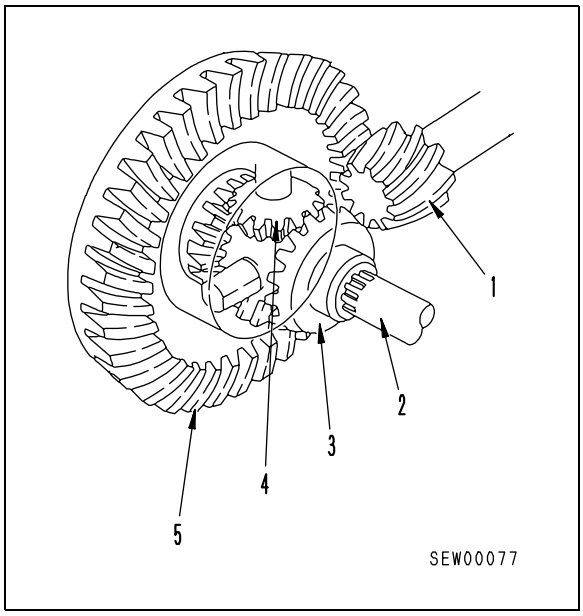
1. Pinion gear (Number of teeth: 9)
2. Shaft
3. Bevel gear (Number of teeth: 42)
4. Sun gear shaft
5. Bevel pinion (Number of teeth: 10)
6. Side gear (Number of teeth: 12)

Unit: mm

No.	Check item		Criteria					Remedy
7	Backlash of differential gear		0.1 – 0.25					Adjust
8	Starting torque of bevel gear		6.3 – 21.1 Nm {0.64 – 2.15 kgm} (At outside surface of bevel gear)					
9	Pinion gear washer thickness		Standard size	Tolerance	Repair limit			Replace
			3	± 0.08	2.8			
10	Side gear washer thickness		4	± 0.05	3.8			
11	Thickness of shim at differential side bearing carrier (Each side)		0.30 – 1.25					Adjust
12	Backlash of bevel gear		0.20 – 0.33					
13	End play of bevel pinion		0 – 0.165					Replace
14	Thickness of shim at differential housing and gauge assembly		1.07 ± 0.33					Adjust
15	Clearance of differential side bearing	Outer race	ø 120	0 -0.020	-0.041 -0.076	-0.076 – -0.021	—	Replace
		Inner race	ø 75	+0.051 +0.032	0 -0.015	-0.066 – -0.032	—	
16	Clearance of bearing on gear side of pinion shaft	Outer race	ø 140	0 -0.018	-0.048 -0.088	-0.088 – -0.030	—	
		Inner race	ø 65	+0.039 +0.020	0 -0.015	-0.054 – -0.020	—	
17	Clearance of bearing on coupling side of pinion shaft	Outer race	ø 120	0 -0.015	-0.041 -0.076	-0.076 – -0.026	—	
		Inner race	ø 55	+0.039 +0.020	0 -0.015	-0.054 – -0.020	—	
18	Clearance between pinion gear and spider		ø 28	-0.06 -0.11	+0.10 +0.05	0.110 – 0.210	—	
19	Clearance of piston fitting portion of differential housing (Housing and piston)		ø 268.5	-0.110 -0.191	+0.81 0	0.110 – 0.272	—	
20	Clearance of piston fitting portion of bearing carrier (Piston and carrier)		ø 247	-0.100 -0.172	+0.072 0	0.100 – 0.244	—	
21	Clearance between drive shaft and bearing of cage	Outer race	ø 110	0 -0.015	0 -0.035	-0.035 – 0.015	—	
		Inner race	ø 50	+0.018 +0.002	0 -0.012	-0.030 – -0.002	—	

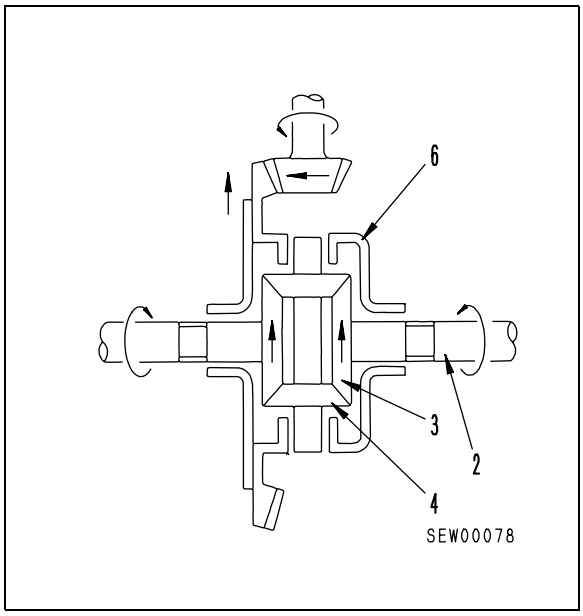
Outline

- The power transmitted to the front and rear axles is turned by 90 degrees and reduced in speed, and then transmitted through pinion gear (4) to sun gear shaft (2).
- The power of the sun gear is further reduced by the planetary gear type final drive and is transmitted to the axle shaft and wheels.



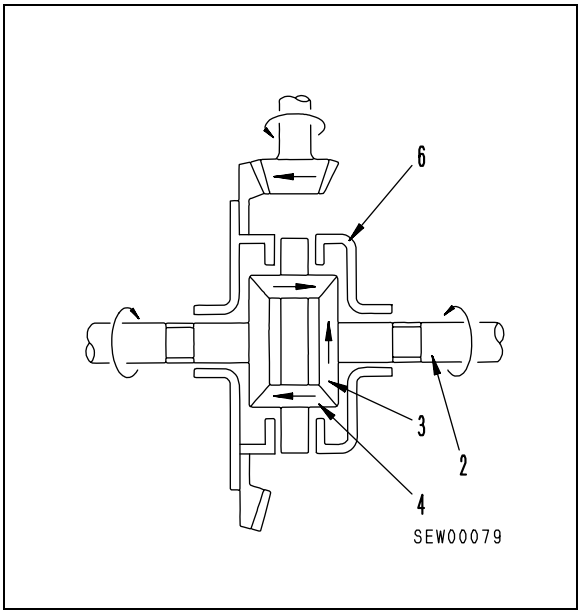
When traveling in a straight line

- When traveling in a straight line, the rotating speed of the left and right wheels is the same, so pinion gear (4) inside the differential assembly does not rotate. The power of carrier (6) passes through pinion gear (4) and side gear (3), and is transmitted equally to the left and right sun gear shafts (2).



When turning

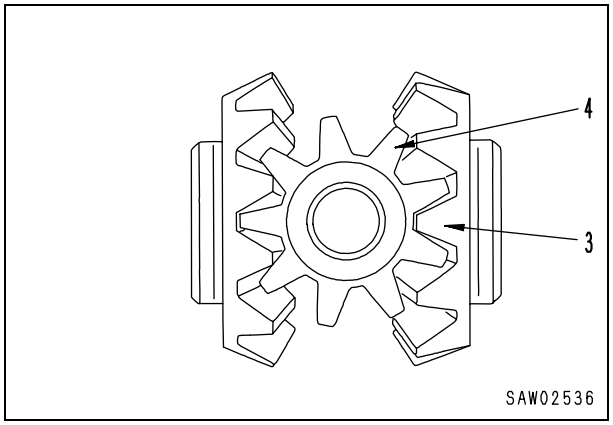
- When turning, the rotating speed of the left and right wheels is different, so pinion gear (4) and side gear (3) inside the differential transmit the power of carrier (6) to sun gear shaft (2) while rotating in accordance with the difference between the left and right rotating speeds.

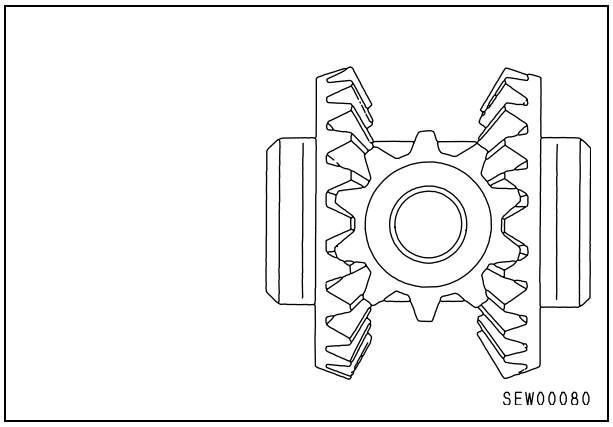


Torque proportioning differential

Outline

- A 4-wheel-drive wheel loader, as a construction machine, must naturally work on places where the ground condition is bad. If its tires slip in such places, its function lowers and the lives of the tires are shortened. To solve this problem, the torque proportioning differential is used.
- Differential pinion gear (4) of this differential has an odd number of teeth. The meshing points of pinion gear (4) and side gears (3) change according to the difference of the road resistance. Consequently, the traction forces of the tires on both sides change.

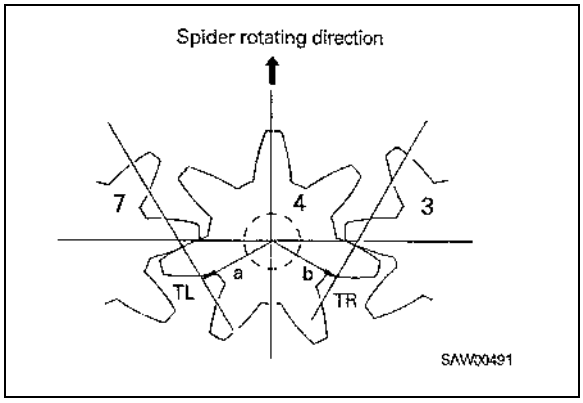




Operation

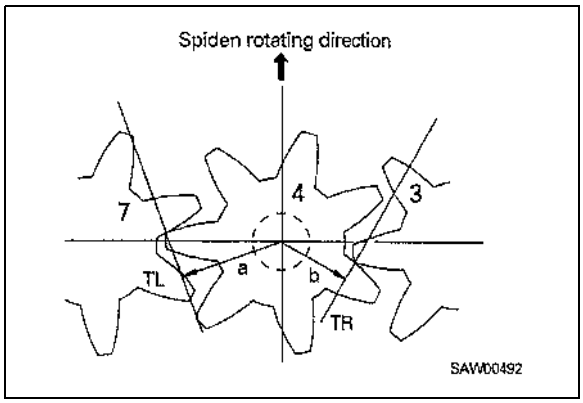
Straight travel (When the road resistances under both tires are the same)

- When the road resistances under the both tires are the same, distance "**a**" from differential pinion (4) to the meshing point of left side gear (7) and distance "**b**" to the meshing point of right side gear (3) are the same.
- Accordingly, left traction force **TL** and right traction force **TR** are balanced.



Travel on soft ground (When the road resistances under both tires are different)

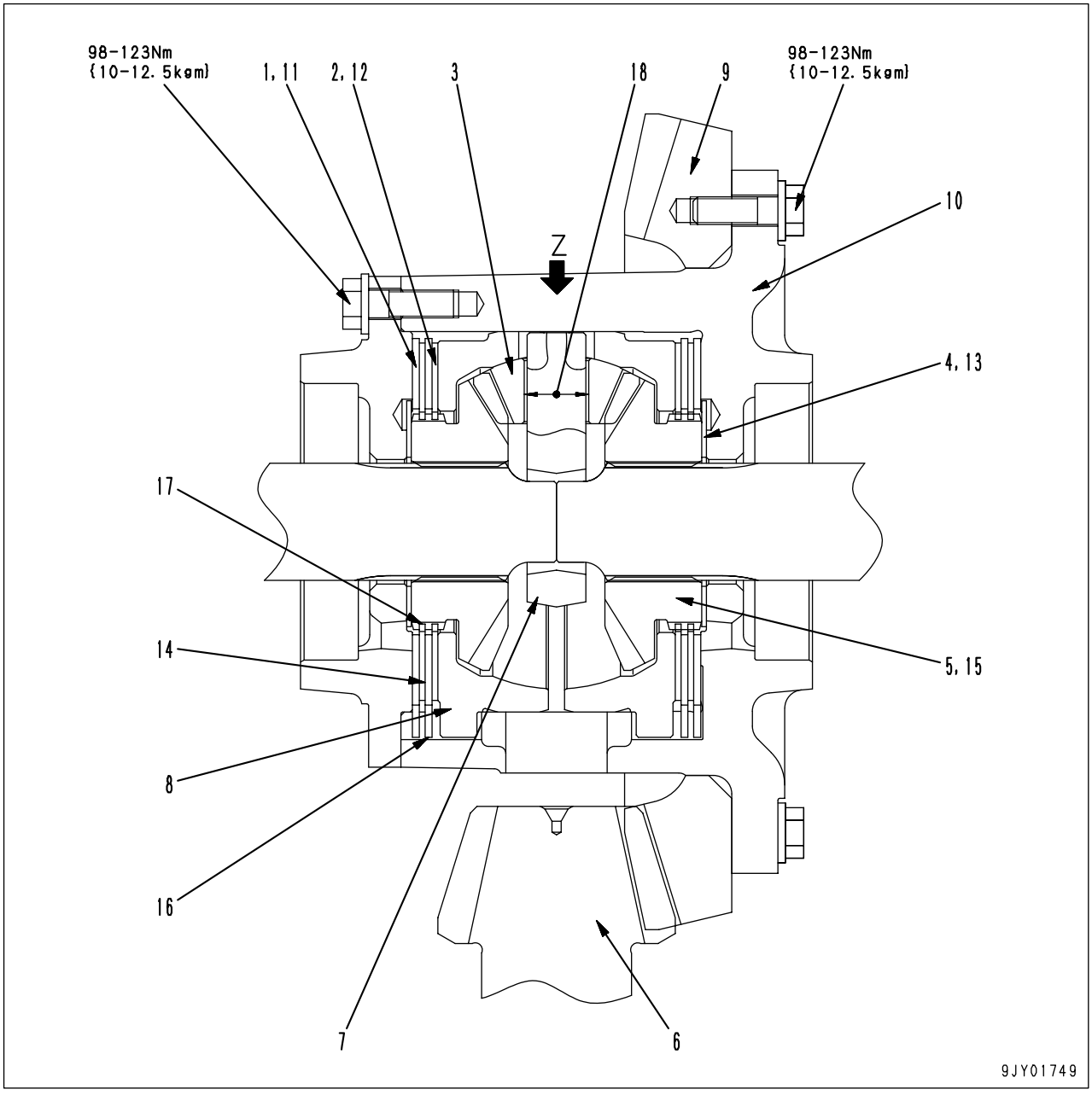
- When the tires slips on soft ground, the side gear of the tire on the less road resistance side turns forward. As a result, the meshing points of pinion gear (4) and the side gears change.
- If left side gear (7) turns forward a little, distance "a" from the pinion gear to the meshing point of the left side gear becomes longer than distance "b" to the meshing point of the right side gear, and then "**a**" and "**b**" are balanced at a point where **a x TL = b x TR**. The ratio of **a**:**b** changes up to 1:1.38, depending on the meshing condition.
- Accordingly, the pinion gear does not run idle and the drive force is transmitted to both side gears and the tires do not slip until the ratio of **a**:**b** becomes 1:1.38, or the difference between the road resistances under both tires becomes 38%.
- The lives of the tires are lengthened 20 - 30% and the working capacity is increased by the above effect.



white 10-45

LIMITED-SLIP DIFFERENTIAL

FRONT



1. Plate
2. Disc
3. Pinion (Number of teeth:12)
4. Washer
5. Side gear(Number of teeth:24)
6. Bevel pinion
7. Shaft
8. Pressure ring
9. Bevel gear
10. Case

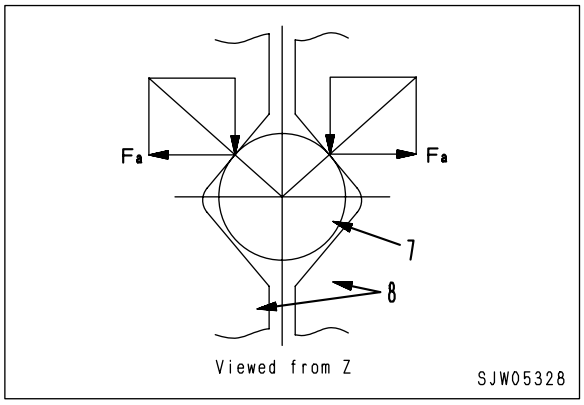
Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Plate thickness</td><td>Standard size</td><td colspan="2">Tolerance</td><td>Repair limit</td><td rowspan="10">Replace</td></tr>
<tr><td>3</td><td colspan="2" rowspan="2">± 0.02</td><td rowspan="2">2.9</td></tr>
<tr><td>3.1</td></tr>
<tr><td>12</td><td>Disc thickness</td><td>2.5</td><td colspan="2">+0.04
-0.03</td><td>2.45</td></tr>
<tr><td rowspan="2">13</td><td rowspan="2">Washer thickness</td><td>2</td><td colspan="2" rowspan="2">± 0.03</td><td rowspan="2">1.8</td></tr>
<tr><td>2.1</td></tr>
<tr><td>14</td><td>Clearance between disc and plate (Total of both sides)</td><td colspan="4">0.20 – 0.6</td></tr>
<tr><td>15</td><td>End play (one end) of side gear in axial direction</td><td colspan="4">0.15 – 0.35</td></tr>
<tr><td>16</td><td>Backlash between case and plate</td><td colspan="4">0.1 – 0.6</td></tr>
<tr><td>17</td><td>Backlash between side gear and disc</td><td colspan="4">0.13 – 0.36</td></tr>
<tr><td rowspan="2">18</td><td rowspan="2">Clearance between spider and differential pinion gear</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>ø 28</td><td>-0.110
-0.160</td><td>+0.05
0</td><td>0.110 –
0.210</td><td>—</td></tr>
</table>

Operation of limited-slip differential

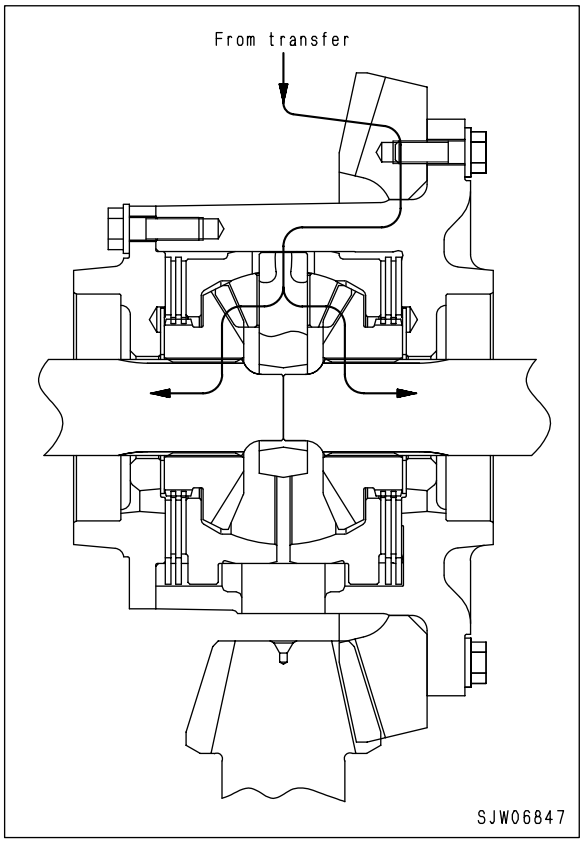
The power is transmitted from bevel gear (9) to case (10), pressure ring (8), shaft (7), pinion (3), and gear (5), and is divided to the left and right shafts.
The brake system, consisting of discs (2) and plates (1) is installed at the rear face of side gear (5). A brake torque is generated that is proportional to the torque transmitted from pressure ring (8) to shaft (7).
This brake torque acts to limit the rotation in relation to side gear (5) and case (10), so it is difficult for left and right side gears (5) to rotate mutually and the operation of the differential is limited.

Brake torque generation mechanism of left and right side gears (5).
Shaft (7) is supported at the cam surface cut into the facing surfaces of left and right pressure rings (8).
The power (torque) transmitted from pressure rings (8) to shaft (7) is transmitted at the cam surface, but force **Fa** separating left and right pressure rings (8) is generated in proportion to the torque transmitted according to the angle of this cam surface.
This separation load **Fa** acts on the brake at the rear face of left and right side gears (5) and generates the brake torque.

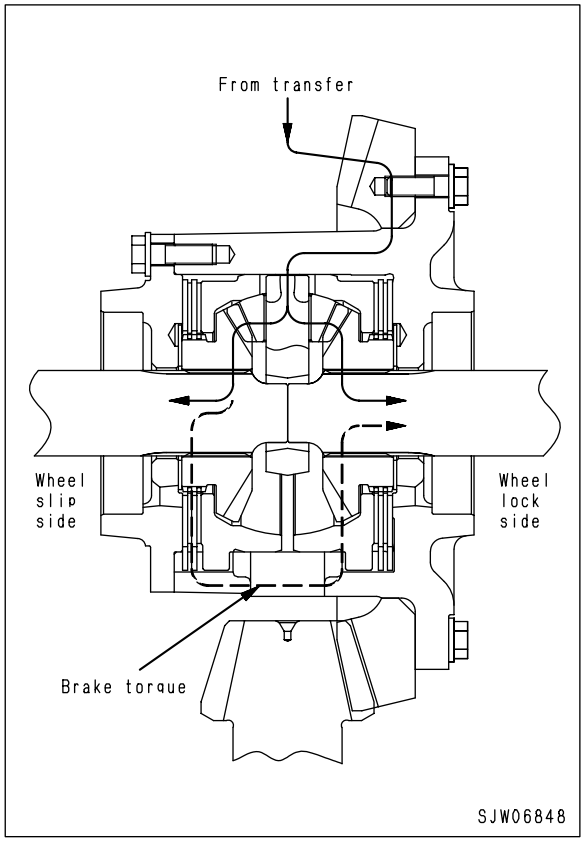


When traveling in a straight line

1. **When there is no imbalance between drive force of left and right wheels** [Road surface condition (friction coefficient) and load for left and right wheels are uniform and load on bucket is centered exactly]
   The power is divided equally to the left and right by the differential gear. In this case, the wheel slip limit of the left and right wheels is the same, so even if the power from the engine exceeds the wheel slip limit, both wheels will slip and the differential will not be actuated.
   There is no load on the brake at the rear face of the side gears.



2. **When there is imbalance between drive force of left and right wheels** [Road surface condition (friction coefficient) and load for left and right wheels are not uniform and it is easier for wheel on one side to slip]
   Example 1. When digging, and wheel on one side is on soft surface
   Example 2. When clearing snow, and wheel on one side is on snow and wheel on other side is on asphalt
   Example 3. When traveling on slope, and there is imbalance between load on left and right wheels
   The power is divided equally to the left and right by the differential gear. However, when the drive force exceeds the wheel slip limit on the side where the wheel is slipping, the amount of the force exceeding the wheel slip limit passes through the brake and case at the rear face of the side gear and is transmitted to the brake on the opposite side (locked side) and is sent to the wheel on the locked side.
   If this excess portion of the drive force becomes greater than the braking force, the differential starts to work.

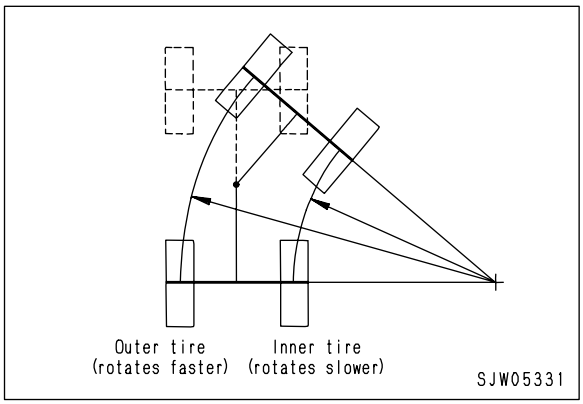


Difference in wheel drive force for each type of differential when wheel on one side slips

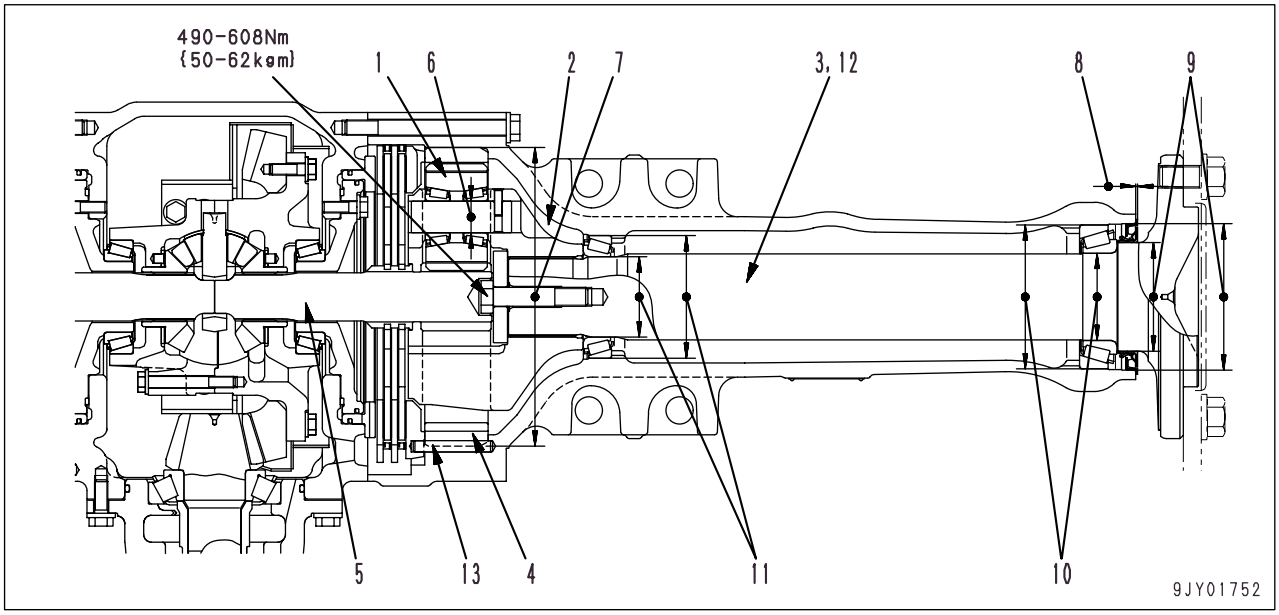
	Wheel drive force (when one wheel is slipping)		
	Slipping wheel	Locked wheel	Total (ratio)
Limited-slip differential (option)	1	2.64	3.64 (1.82)
Torque proportioning differential (standard)	1	1.38	2.38 (1)
Normal differential	1	1	2 (0.84)

On road surfaces where the wheel on one side is likely to slip, the limited-slip differential increases the drive force by 1.53 times more than the torque proportioning differential.

When turning
The differential gears built into a limited-slip differential are the same as the gears used in a normal differential, so the difference in rotation between the inside and outside wheels when turning the machine can be generated smoothly.



FINAL DRIVE



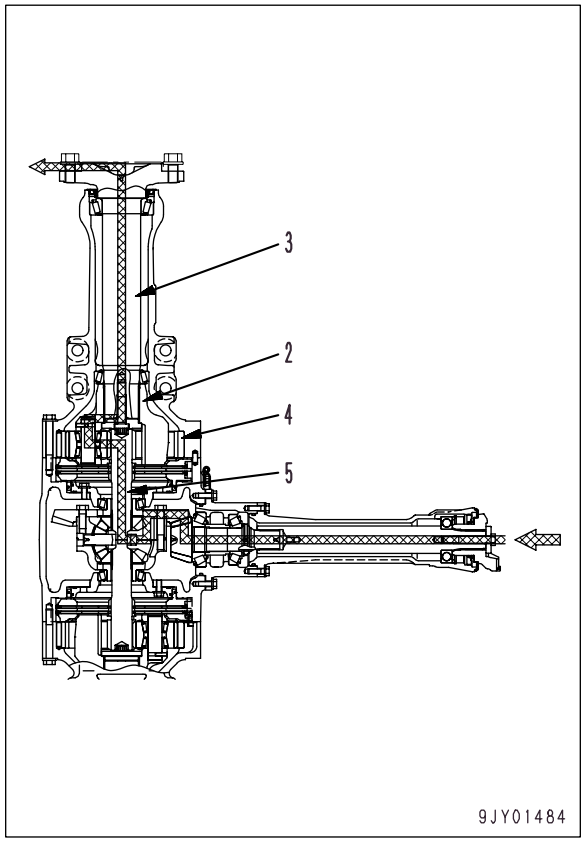
1. Planet gear (No. of teeth: 26)
2. Planetary carrier
3. Axle shaft
4. Ring gear (No. of teeth: 69)
5. Sun gear shaft (No. of teeth: 15)

Unit: mm

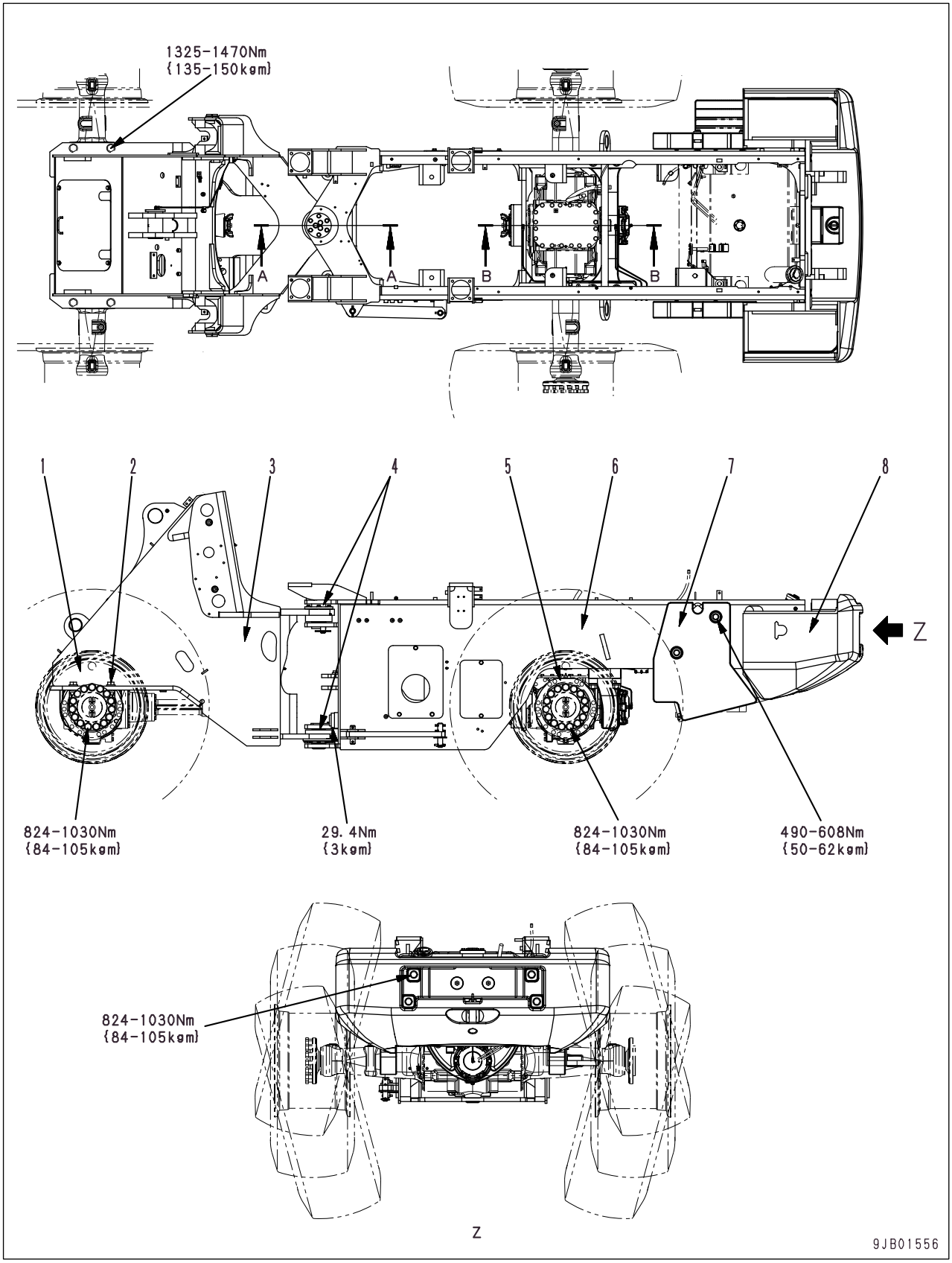
No.	Check item		Criteria					Remedy
6	Clearance between pinion gear bearing and shaft		Standard size	Tolerance		Standard Clearance	Clearance limit	Replace
				Shaft	Hole			
			ø 33.338	+0.025 +0.013	+0.013 0	-0.025 – 0	—	
7	Clearance between axle housing and ring gear		ø 316	+0.100 +0.030	+0.100 +0.040	-0.060 – +0.070	—	
8	Clearance between oil seal and housing		Max. 0.2					Adjust
9	Press-fitting portion of axle shaft seal	Housing	ø 155	+0.400 +0.200	+0.063 0	-0.4 – -0.137	—	Replace
		Shaft	ø 115	0 -0.054	-0.200 -0.400	-0.4 – -0.146	—	
10	Clearance at press-fitting portion of axle housing bearing	Outer race	ø 152.4	+0.025 0	-0.012 -0.052	-0.077– -0.012	—	
		Inner race	ø 92.075	+0.073 +0.051	+0.025 0	-0.073 – -0.026	—	
11	Clearance at press-fitting portion of axle housing bearing	Outer race	ø 130	0 -0.025	-0.038 -0.078	-0.078 – -0.013	—	
		Inner race	ø 85	+0.035 +0.013	0 -0.020	-0.055 – -0.013	—	
12	End play of axle shaft		0 – 0.1					Adjust
13	Clearance of guide pin		ø 12	+0.025 +0.007	+0.207 +0.145	0.120 – 0.200	—	Replace

Outline

- The final drive finally reduces the speed of the power transmitted from the HST motor through the transfer to the axle and increases the drive force.
- Ring gear (4) is press fitted to the axle housing and is fixed in position by a pin.
- The power transmitted from the differential and passing through sun gear shaft (5) has its speed reduced by the planetary gear mechanism and the drive force increased.
  The increased drive force passes through planetary carrier (2) and axle shaft (3) and is transmitted to the wheels.



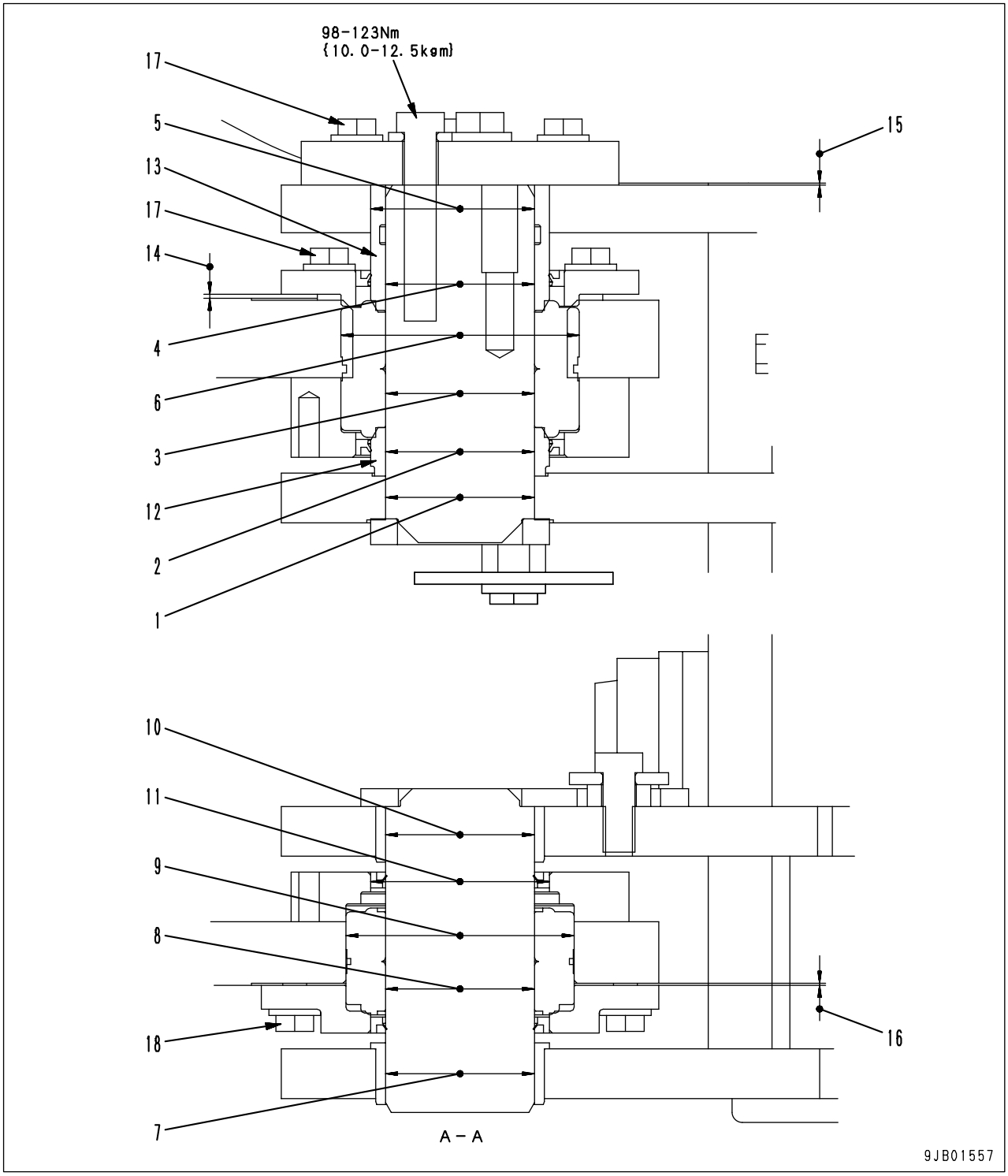
AXLE MOUNTING AND CENTER HINGE PIN



1. Front axle
2. Tension bolt
3. Front frame
4. Center hinge pin
5. Rear axle
6. Rear frame
7. Additional counterweight (If equipped)
8. Counterweight

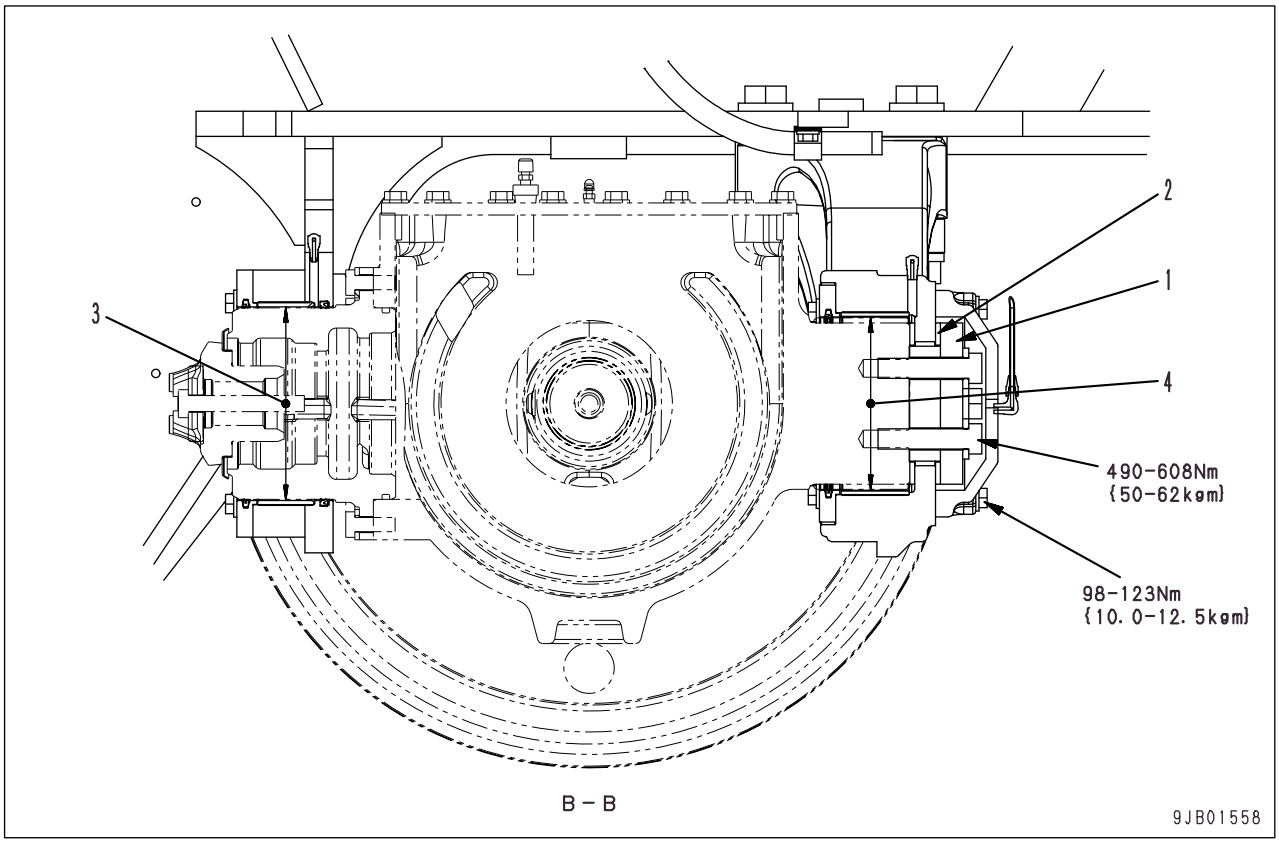
Outline

- Since front axle (1) receives forces directly during work, it is fixed to front frame (3) directly with tension bolts (2).
- Rear axle (5) rocks at the center of rear frame (6) so that each tire will keep in contact with ground even when the machine travels on soft ground.
- Front frame (3) and rear frame (6) are connected by center hinge pin (4) with the bearing between them. The steering cylinders on both sides connect front frame (3) and rear frame (6) and move to adjust the bending angle, or the turning radius.


98-123Nm
{10.0-12.5kgm}
17
5
13
17
14
4
6
3
12
2
1
15
10
11
9
8
18
7
16
A-A
9JB01557

Unit: mm

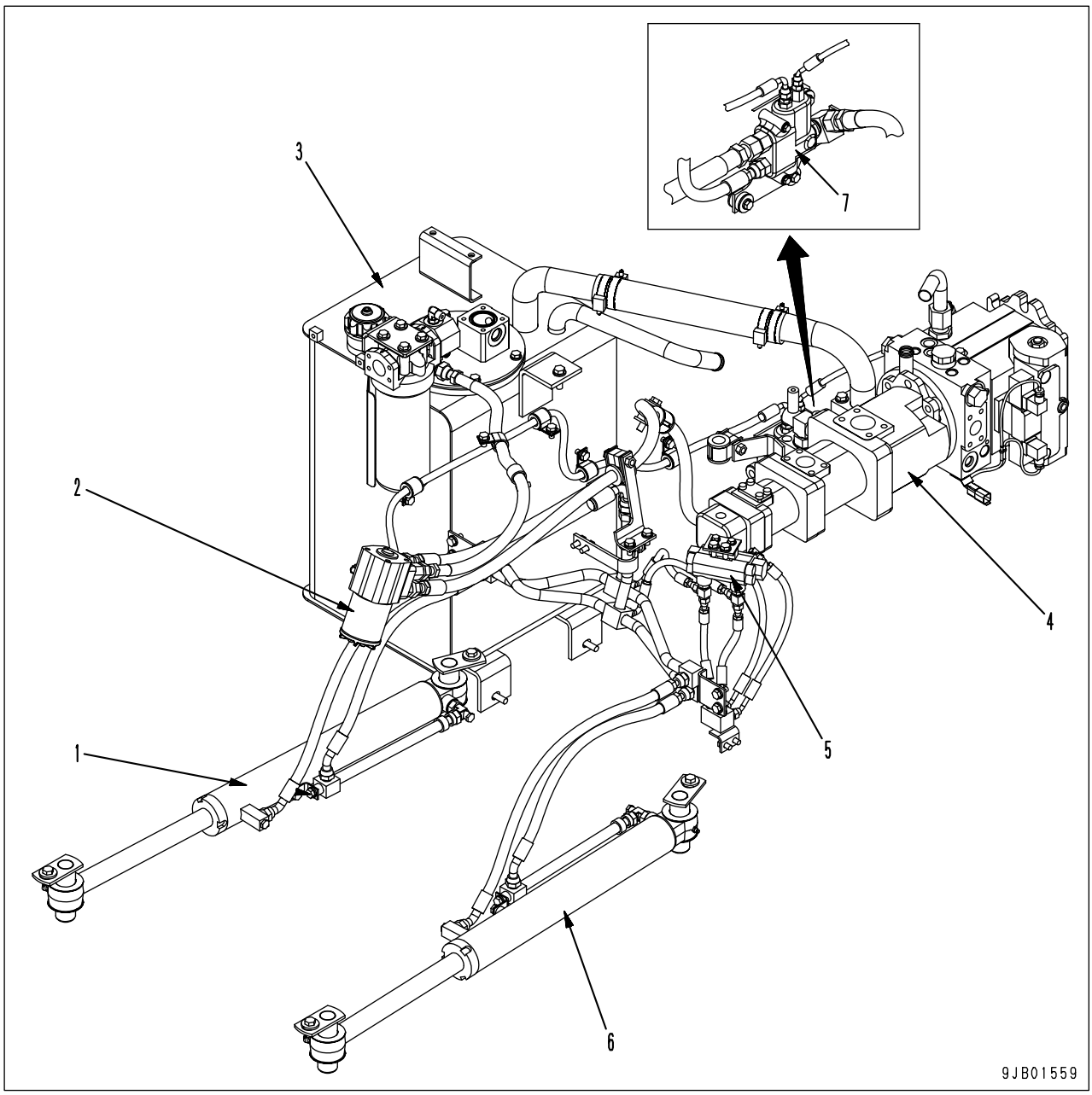
No.	Check item	Criteria					Remedy
1	Clearance between upper hinge pin and rear frame	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		ø 75	-0.030 -0.076	+0.046 0	0.030 – 0.122	–	
2	Clearance between upper hinge pin and spacer (small)	ø 75	-0.030 -0.076	+0.250 0	0.030 – 0.326	–	
3	Clearance between upper hinge pin and bearing	ø 75	-0.030 -0.076	0 -0.015	0.015 – 0.076	–	
4	Clearance between upper hinge pin and spacer (large)	ø 75	-0.030 -0.076	+0.026 -0.020	0.010 – 0.102	–	
5	Clearance between rear frame and spacer (large)	ø 90	-0.010 -0.040	+0.054 0	0.010 – 0.094	–	
6	Clearance between front frame and upper hinge bearing	ø 120	0 -0.020	-0.030 -0.076	-0.076 – -0.010	–	
7	Clearance between lower hinge pin and rear frame bushing	ø 75	-0.030 -0.076	+0.067 +0.027	0.057 – 0.143	–	
8	Clearance between lower hinge pin and bearing	ø 75	-0.030 -0.076	0 -0.015	0.015 – 0.076	–	
9	Clearance between front frame and lower hinge bearing	ø 115	0 -0.015	-0.041 -0.076	-0.076 – -0.026	–	
10	Clearance between rear frame and bushing	ø 85	+0.089 +0.059	+0.054 0	-0.089 – -0.005	–	
11	Clearance at seal press-fitting portion of lower hinge pin	ø 90	+0.280 +0.180	+0.054 0	-0.080 – -0.126	–	
12	Height of upper hinge spacer (small)	Standard size		Tolerance		Repair limit	
		24.5		±0.1		–	
13	Height of upper hinge spacer (large)	64.0		±0.1		–	
14	Standard shim thickness of upper hinge and retainer	Standard size					Adjust
		2.0					
15	Standard shim thickness of upper hinge and retainer	1.0					
16	Standard shim thickness of lower hinge and retainer	1.0					
17	Tightening torque for upper hinge retainer mounting bolt	19.6 ± 2.0 Nm {2.0 ± 0.2 kgm} (When adjusting shim)					
		98 – 123 Nm {10.0 – 12.5 kgm} (Final value)					
18	Tightening torque for lower hinge retainer mounting bolt	19.6 ± 2.0 Nm {2.0 ± 0.2 kgm} (When adjusting shim)					
		98 – 123 Nm {10.0 – 12.5 kgm} (Final value)					



Unit: mm

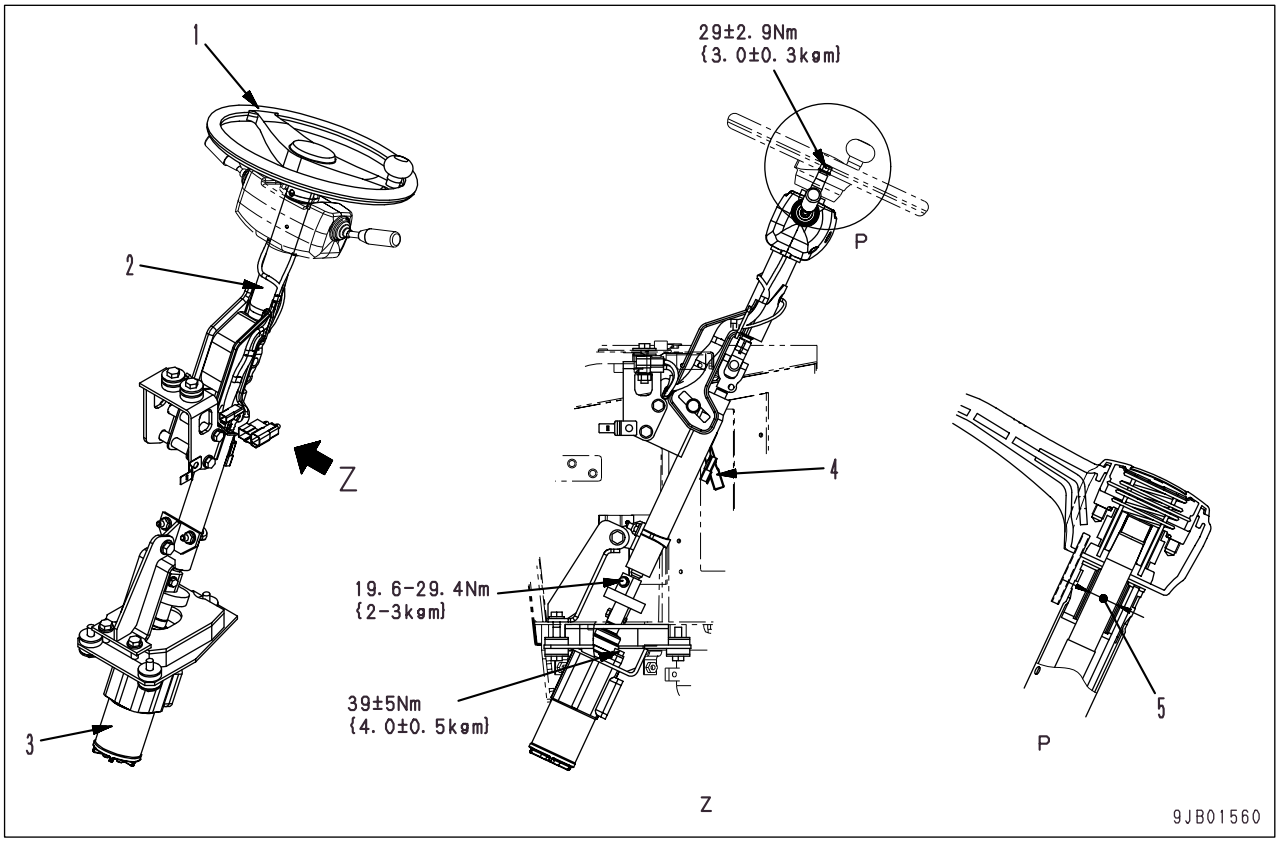
No.	Check item	Criteria					Remedy
1	Thickness of thrust plate	Standard size	Tolerance		Repair limit		Replace
		22	±0.5		–		
2	Thickness of thrust washer	5	+0.3 -0.1		–		
3	Clearance between hole and shaft at front support end	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		ø 190	-0.050 -0.122	+0.472 0	0.050 – 0.594	–	
4	Clearance between hole and shaft at rear support end	ø 170	-0.005 -0.124	+0.522 +0.050	0.055 – 0.646	–	

STEERING PIPING



1. Steering cylinder (right)
2. Orbit-roll valve
3. Hydraulic oil tank
4. Steering pump
5. Cushion valve
6. Steering cylinder (left)
7. Priority valve

STEERING COLUMN

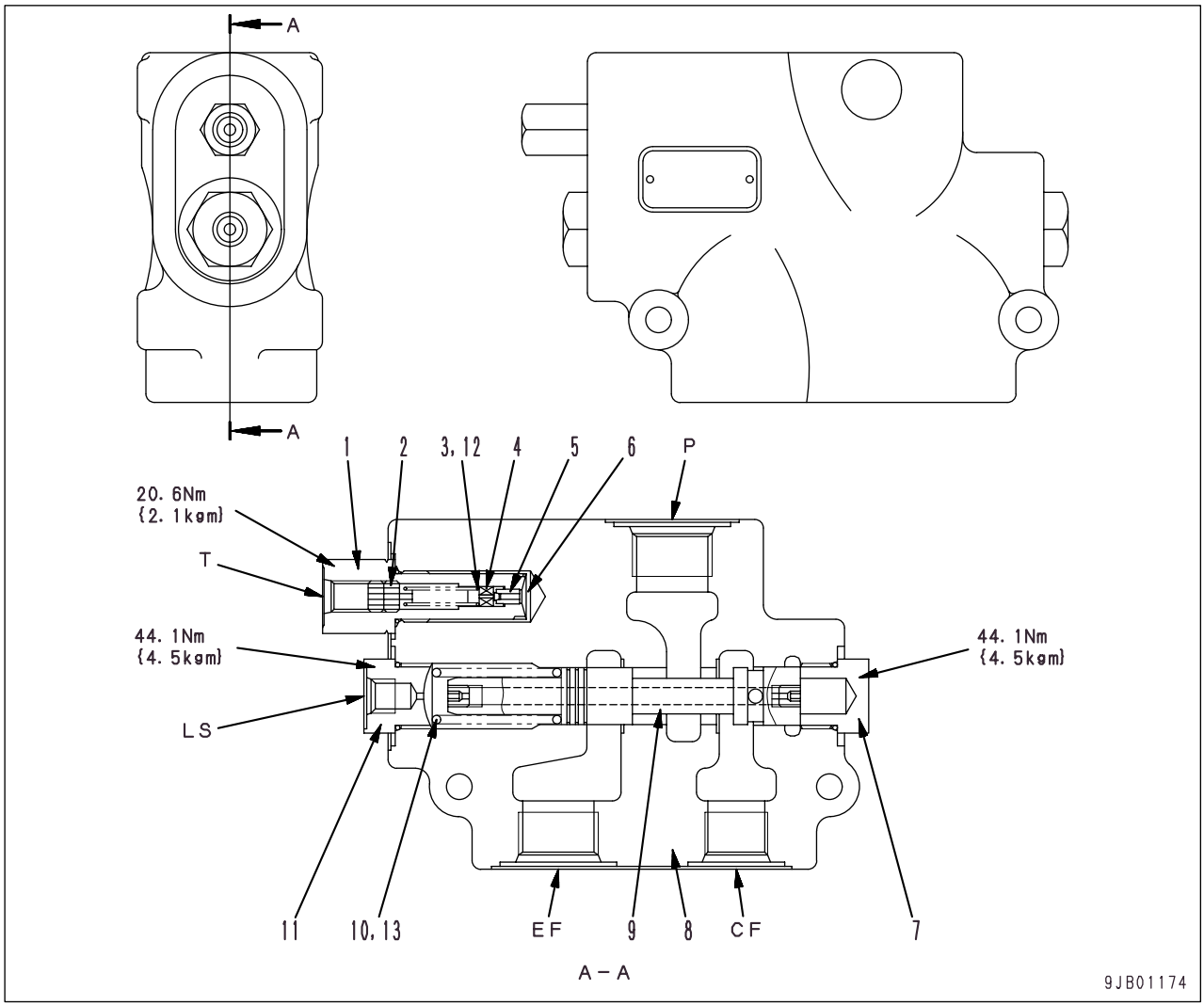


1. Steering wheel
2. Steering column
3. Orbit-roll valve
4. Tilt lever

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
5	Clearance between steering shaft and column bushing	ø 19	0 -0.08	+0.15 +0.05	0.05 – 0.23	0.4	Replace

PRIORITY VALVE



P: From steering pump
CF: To orbit-roll valve
EF: To work equipment control valve
LS: From orbit-roll valve
T: To hydraulic tank

1. Relief valve body
2. Spring seat
3. Spring
4. Poppet
5. Seat
6. Screen
7. Plug
8. Valve body
9. Spool
10. Spring
11. Plug

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
12	Control spring	Free length	Installed length	Installed load	Free length	Installed load	Replace
		63.4	47.6	187 N {19.1 kg}	63.4 ± 1	187 ± 14.7 N {19.1 ± 1.5 kg}	
13	Relief spring	31	26.9	146 N {14.9 kg}	–	146 ± 14.7 N {14.9 ± 1.5 kg}	

Outline

- The priority valve is in the circuit between the steering pump and the orbit-roll valve. It acts to divide the flow of oil from the steering pump and send it to the orbit-roll valve or oil cooler circuit. It also sets the oil pressure in the circuit from the priority valve to the orbit-roll valve to 20.6 MPa {210 kg/cm^2} to protect the circuit.

Operation

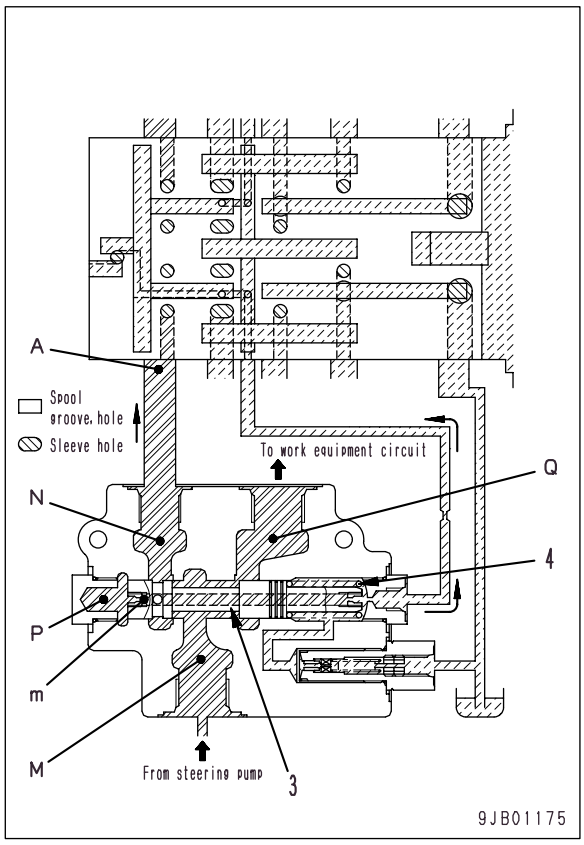
1. Steering wheel at neutral

When the engine is stopped, spool (3) is pushed fully to the left by the tension of spring (4). The circuit between ports **M** and **N** is fully open, while the circuit between ports **M** and **Q** is fully closed.

In this condition, is the engine is started and the steering pump is rotated, the oil from the pump goes from the port **M** to port **N**, and then enters port **A** to the orbit-roll valve.

When this happens, the oil passing through orifice **m** in spool (3) enters port **P**. It then compresses spring (4), and moves spool (3) to the right in the direction of the arrow.

This stabilizes the condition so that the circuit between ports **M** and **Q** is almost fully open and the circuit between ports **M** and **N** is almost fully closed. Therefore, the oil from the pump almost all flows to the work equipment circuit.



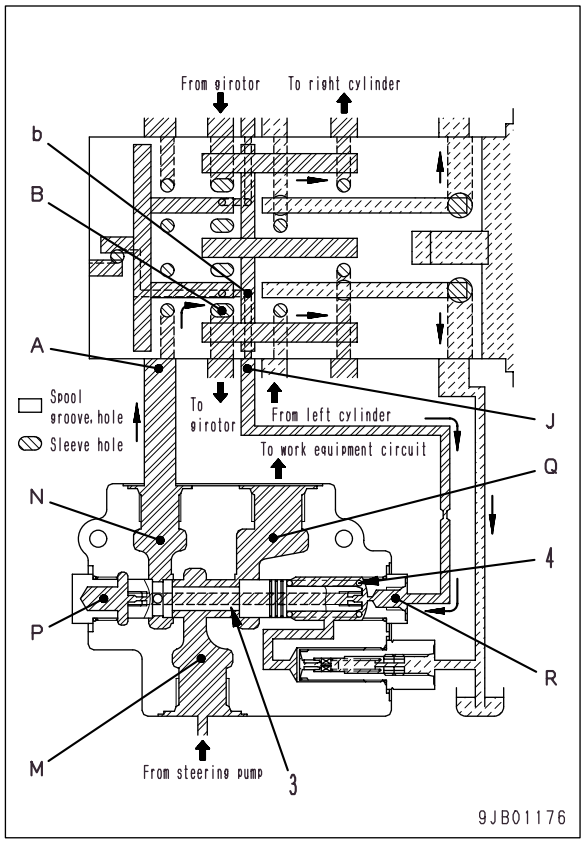
2. Steering wheel turned to left

When the steering wheel is turned to the left, an angle variation is generated between the spool and sleeve of the orbit-roll valve, and the oil flow is switched. (For details, see ORBIT-ROLL VALVE.)

The oil from the pump flows from port **M** to port **N**, and enters port **A**. The degree of opening of the sleeve (port **A**) and spool (port **B**) creates a difference between the pressure up to port **A** and the pressure beyond port **B**. Some of the oil from port **B** flows to the Girotor, and then goes to the front right cylinder. The remaining oil passes through orifice **b**, flows to port **J**, and then enters port **R**.

When this happens, spool (3) stabilizes at a position where the differential pressure between the circuit up to port **A** and circuit beyond port **B** (pressure of port **P** - pressure of port **R**) and the load of the spring (4) are balanced. It adjusts the degree of opening from port **M** to ports **N** and **Q**, and distributes the flow to both circuits.

The ratio of this distributed flow is determined by the degree of opening of port **A** and port **B**, in other words, the angle variation between the sleeve and spool of the orbit-roll valve. This degree the opening is adjusted steplessly by the amount the steering is turned.

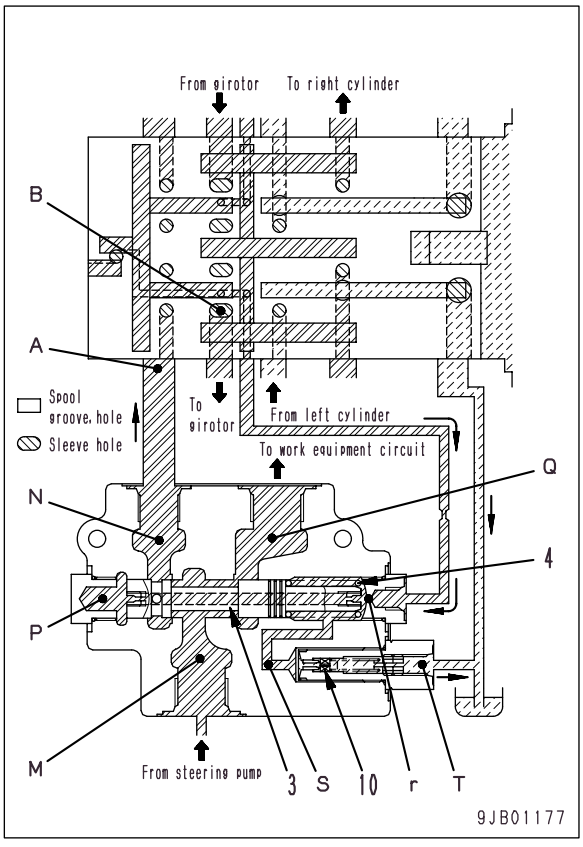


3. Steering cylinder at end of stroke

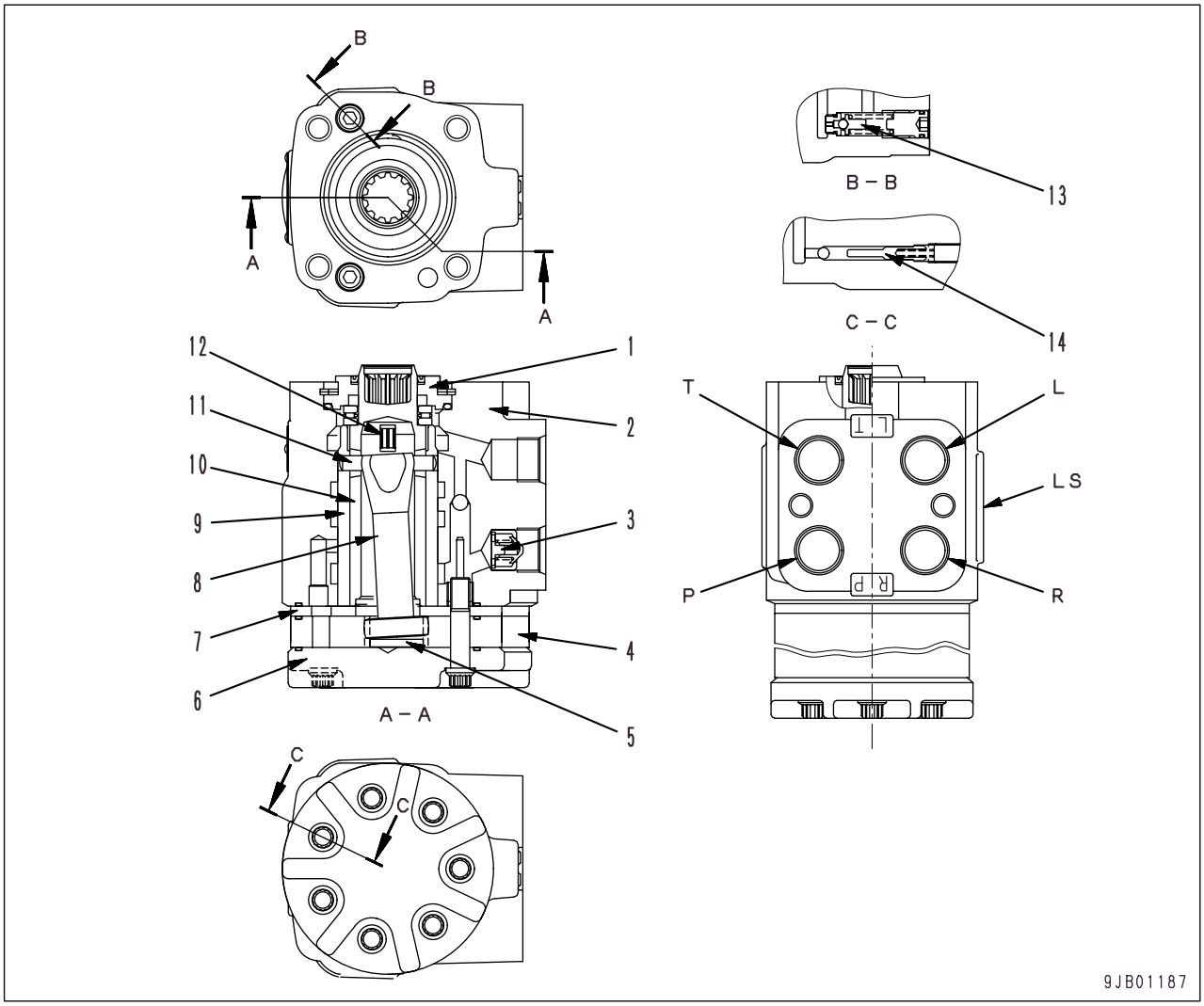
If the operator tries to turn the steering wheel further when the steering cylinder has reached the end of its stroke, the circuit from port **M** through port **N** to port **S** is kept open and the pressure rises.

When this pressure rises above requirement pressure relief valve (10) opens and the oil is relieved to the hydraulic tank. Because of this flow of oil, a differential pressure is created on both sides of orifice **r**. Therefore, the balance is lost between the load of spring (4) and the pressure up to port **A** and the pressure beyond port **B**. As a result, the pressure up tp the port **A** becomes relatively higher.

For this reason, the pressure at port **P** moves spool (3) even further to the right from the condition in Item 2. It stabilizes the condition at a position where the circuit between ports **M** and **N** is almost fully closed, and the circuit between ports **M** and **Q** is almost fully open.



ORBIT-ROLL VALVE



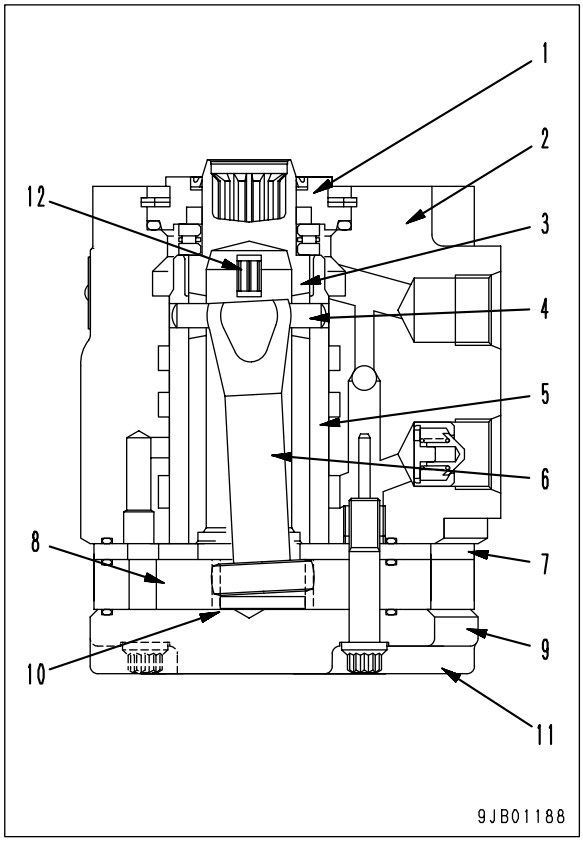
P: From steering pump
L: To steering cylinder
R: To steering cylinder

LS: To priority valve
T: To hydraulic tank

1. Ground
2. Valve body
3. Check valve
4. Gerotor
5. Spacer
6. Cover
7. Spacer
8. Drive shaft
9. Sleeve
10. Spool
11. Center pin
12. Centering spring
13. Anti-cavitation valve
14. Over-load relief valve

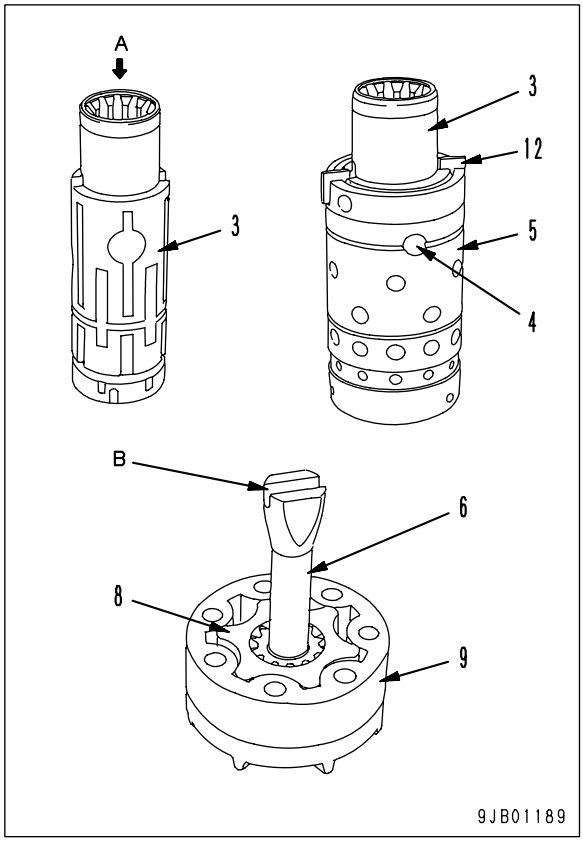
Outline

- The orbit-roll valve is connected directly to the shaft of the steering wheel. It switches the flow of oil from the steering pump to the left and right steering cylinders to determine the direction of travel of the machine.
- The orbit-roll valve, broadly speaking, consists of the following components: rotary type spool (3) and sleeve (5), which have the function of selecting the direction, and the Girotor set (a combination of rotor (8) and stator (9)), which acts as a hydraulic motor during normal steering operations, and as a hand pump (in fact, the operating force of the steering wheel is too high, so it cannot be operated) when the steering pump or engine have failed and the supply of oil has stopped.



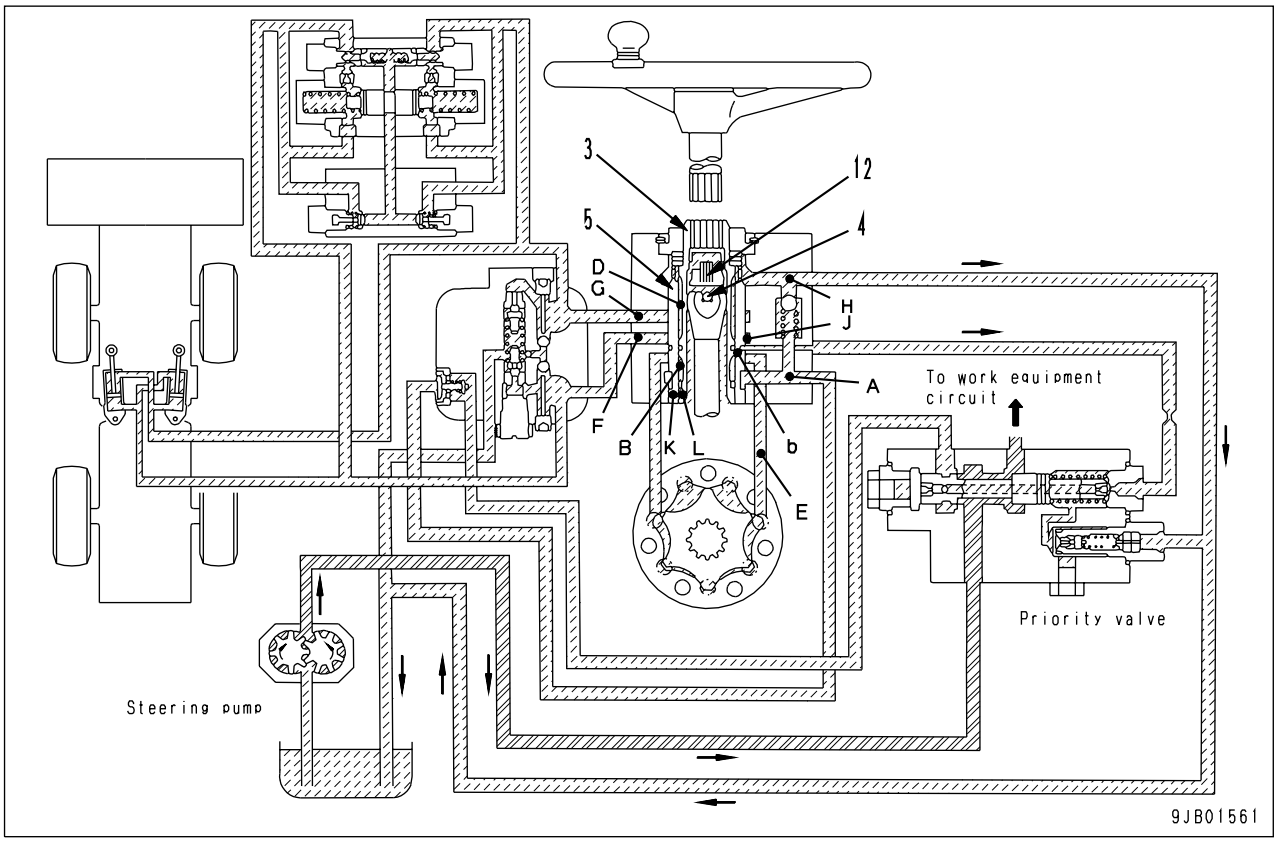
Structure

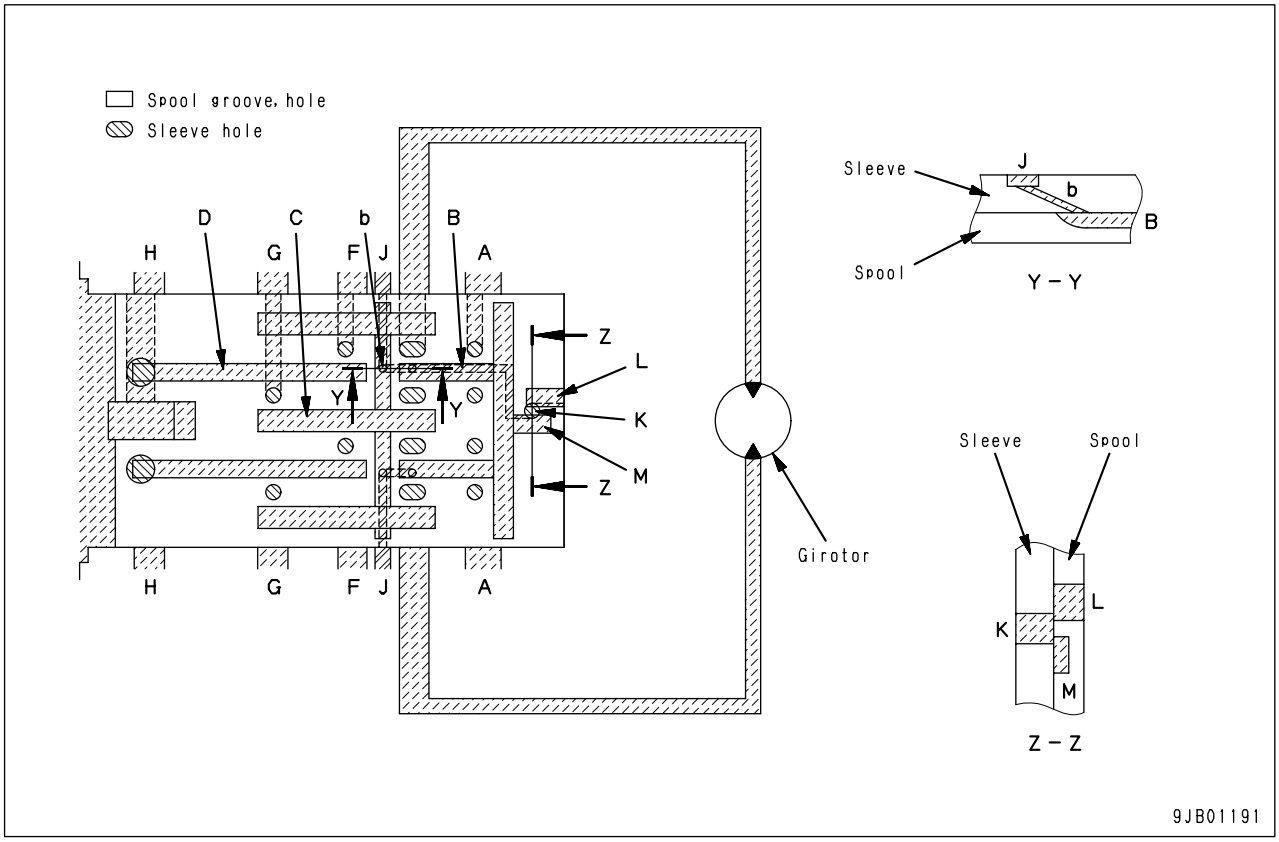
- Top (A) of spool (3) is connected to the drive shaft of the steering column and further connected to sleeve (5) through center pin (4) (which is not in contact with the spool while the steering wheel is in neutral) and centering spring (12).
- Top (B) of drive shaft (6) is engaged with center pin (4) and combined with sleeve (5) in one body, and the bottom is engaged with the spline of rotor (8) of the gerotor set.
- Valve body (2) has 5 ports, which are connected to the pump circuit, tank circuit, left steering circuit, right steering circuit, and LS circuit respectively. The ports on the pump side and tank side are connected by the check valve in the body. If the pump or engine fails, the oil can be sucked through this check valve directly from the tank side.



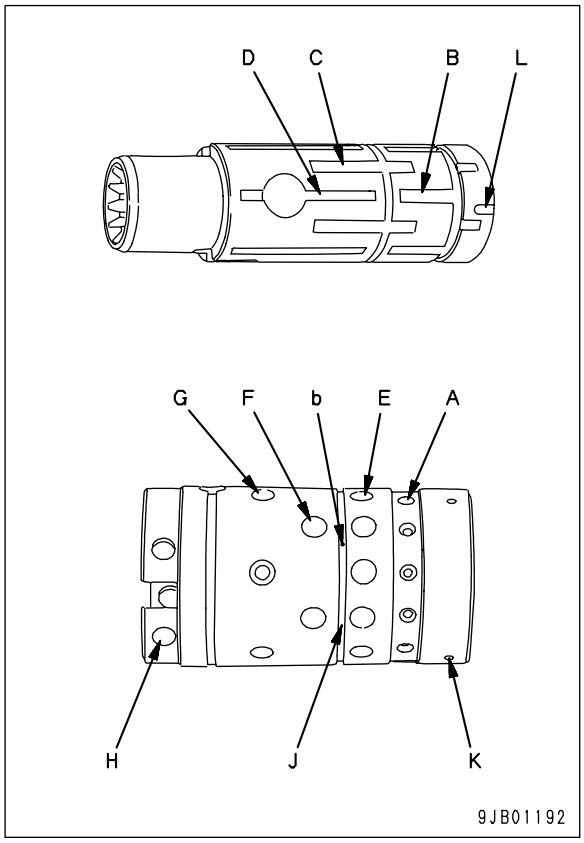
Operation

1. Steering wheel at neutral

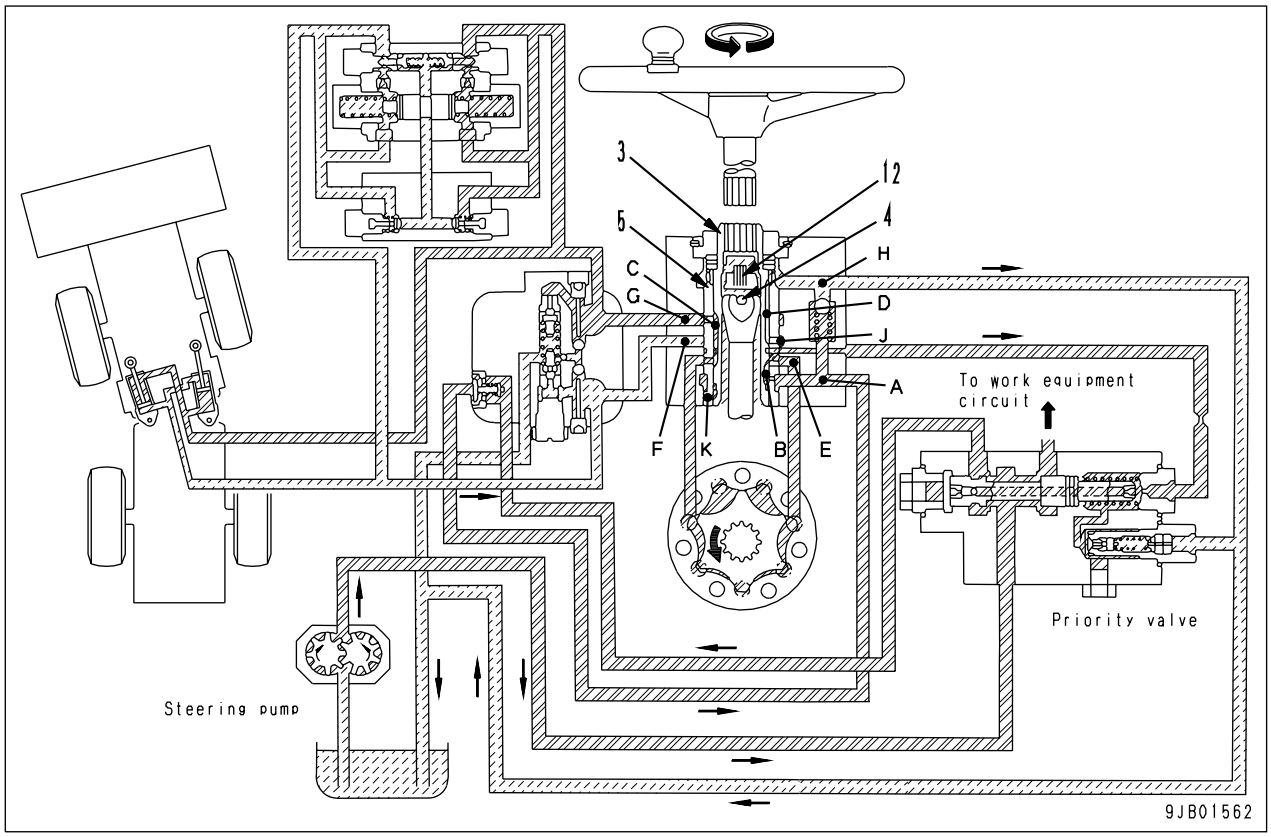


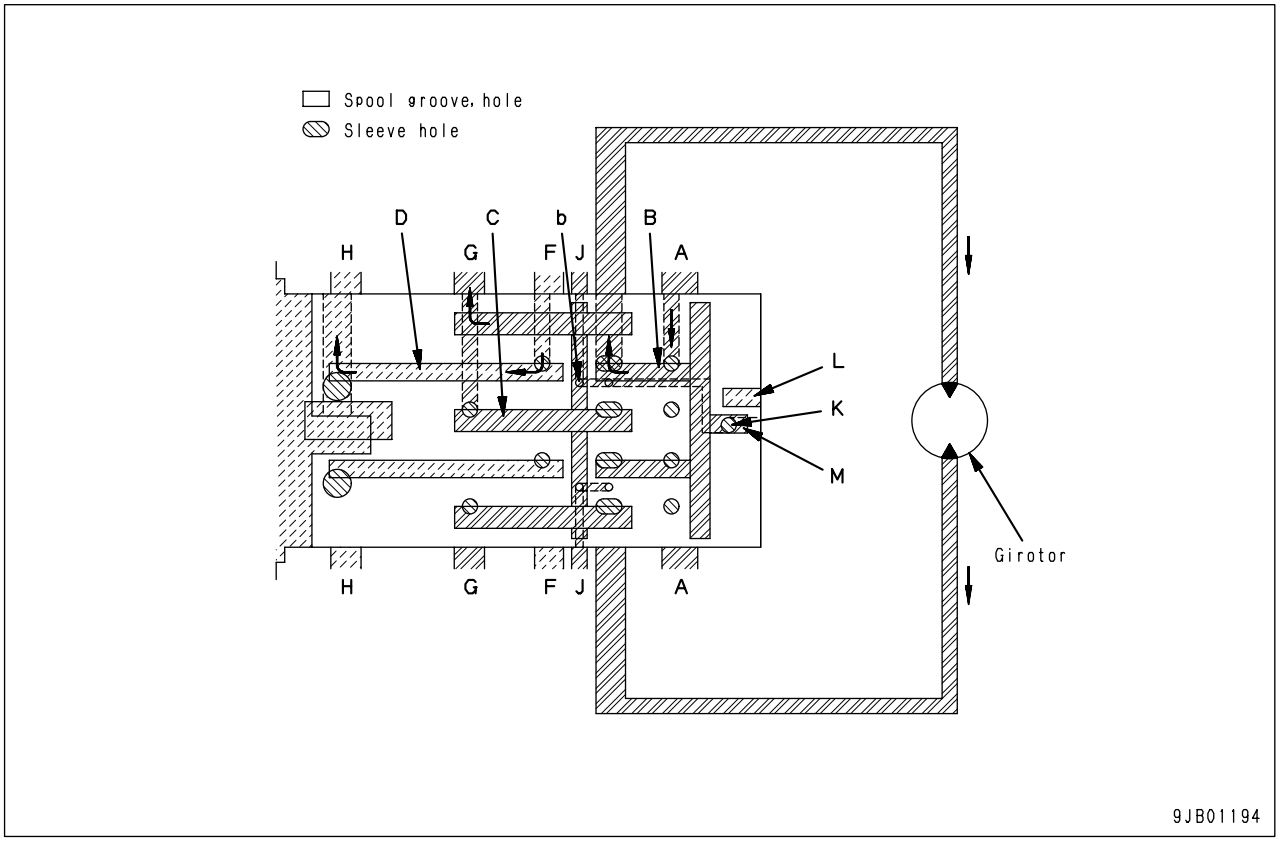


- While the steering wheel is in neutral, spool (3) and sleeve (5) are fixed at a place where center pin (4) is set to the center of the oblong hole of spool (3) by centering spring (12).
  At this time, port **A** of sleeve (5) from the pump, port **E** to gerotor, port **F** of the right steering circuit, port **G** of the left steering circuit, and vertical grooves **B**, **C**, and **D** of spool (3) are shut off.
  Orifice **b** of port **J** to the priority valve is connected to vertical groove **B** of spool (3).
  Port **K** of sleeve (5) connects port **L** of spool (3) to vertical groove **M**.
- As a result of above connection and disconnection of the ports and vertical grooves, the oil which has been set to the pilot pressure of the priority valve is drained through port **J**, orifice **b**, vertical grooves **M** and **K**, and port **L** into the hydraulic tank.



2. Steering wheel turned (turning left)



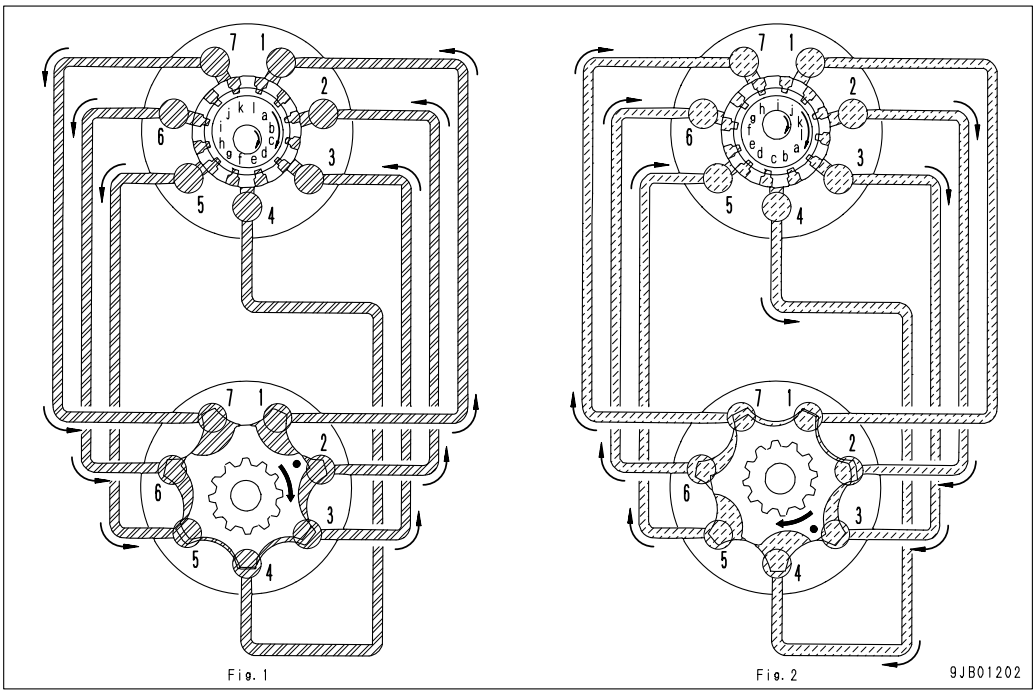


- If the steering wheel is turned to the left, spool (3) connected by the drive shaft of the steering column turns to the left.
  At this time, since spool (3) and sleeve (5) are connected by centering spring (12), spool (3) compresses centering spring.
  Accordingly, an angular displacement is made between spool (3) and sleeve (5) by the compression of centering spring (12).
  Then, port **A** is connected to vertical groove **B** first. Next, vertical groove **B** is connected to port **E**, and then port **E** is connected to vertical groove **C**, and vertical groove **C** is connected to port **G** of the left steering circuit at last.
  Orifice **b** of port **J** to vertical **B** and priority valve is kept connected, but port **K** of sleeve (5) disconnects vertical groove **M** and port **L** gradually.
  When port **A** is connected to vertical groove **B**, port **F** of the right steering circuit is connected to vertical groove **D**.
- As a result of above connection and disconnection of the ports and vertical grooves, the oil from the pump flows through port **A** to the vertical groove **B**, and then flows to port **E** to rotate the gerotor. The oil discharged from the gerotor flows through port **E**, vertical groove **C**, and port **G** to the head side of the left steering cylinder.
  The hydraulic pressure in vertical groove **M** is transmitted through orifice **b** to port **J** and used as the pilot pressure of the priority valve.
  The oil from the head side of the right steering cylinder is drained through port **F**, vertical groove **D**, and port **H** into the hydraulic tank.

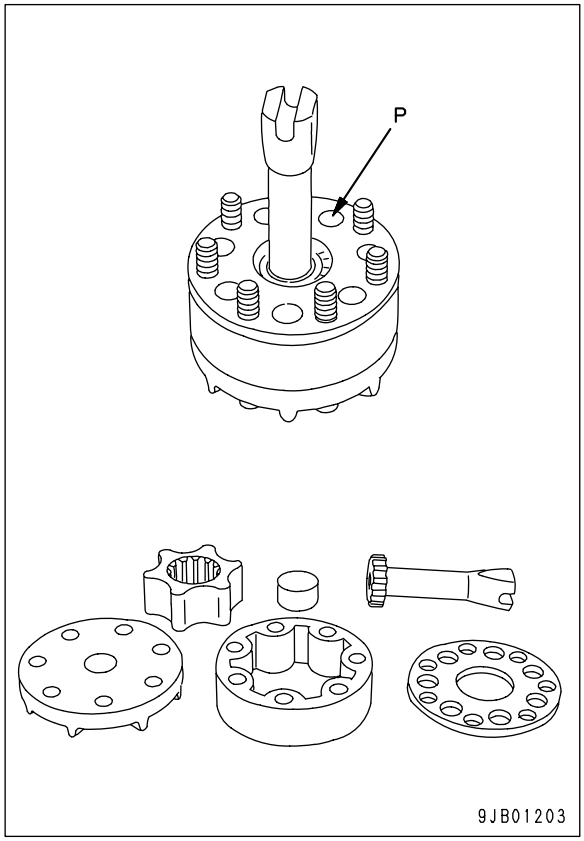
3. Steering wheel stopped

When the operation of steering wheel is stopped, the difference in rotation between the spool (3) and sleeve (5) is returned to the neutral condition by the reaction of centering spring (12).

CONNECTION BETWEEN HAND PUMP AND SLEEVE

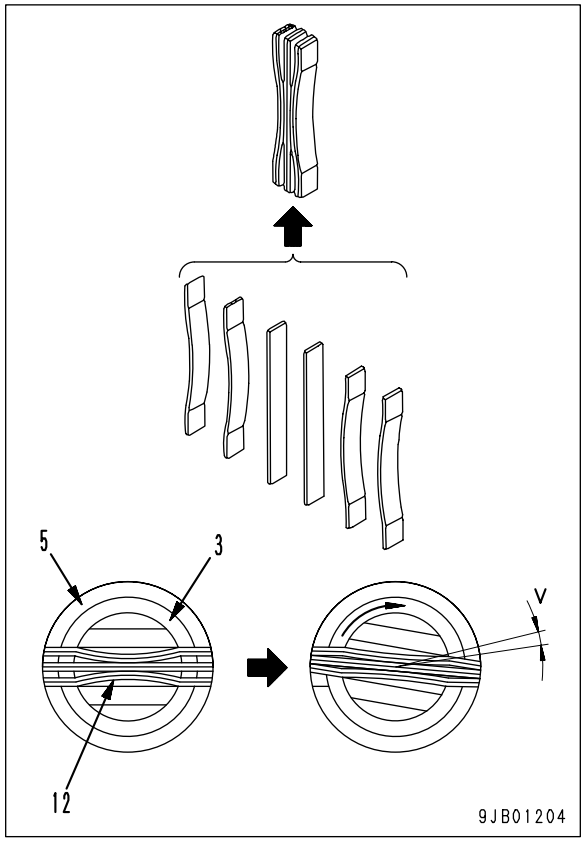


- The diagrams above show the connections with the sleeve ports used to connect the suction and discharge ports **P** of the Girotor.
- If the steering wheel has been turned to the right, ports **a**, **c**, **e**, **g**, **i**, and **k** are connected by the vertical grooves in the spool to the pump side. At the same time, ports **b**, **d**, **f**, **h**, **j**, and **l** are connected to the head end of the right steering cylinder in the same way.
  In the condition in Fig. 1, ports **1**, **2**, and **3** are the discharge ports of the Girotor set.
  They are connected to port **l**, **b**, and **d**, so the oil is sent to the steering cylinder.
  Ports **5**, **6**, and **7** are connected and the oil flows in from the pump.
  If the steering wheel is turned 90°, the condition changes to the condition shown in Fig. 2. In this case, ports **2**, **3**, and **4**, are the suction ports, and are connected to ports **k**, **a**, and **c**. Ports **5**, **6**, and **7** are the discharge ports, and are connected to ports **d**, **f**, and **h**.
- In this way, the ports acting as the discharge ports of the Girotor are connected to the ports going to the steering cylinder, while the ports acting as the suction ports are connected to the pump circuit.
- Adjustment of discharge according to amount steering wheel is turned.
  For each 1/7 turn of the steering wheel, the inside teeth of the Girotor advance one tooth, and the oil from the pump is discharged in an amount that matches this movement.
  Therefore, the amount of oil discharged is directly proportional to the amount the steering wheel is turned.

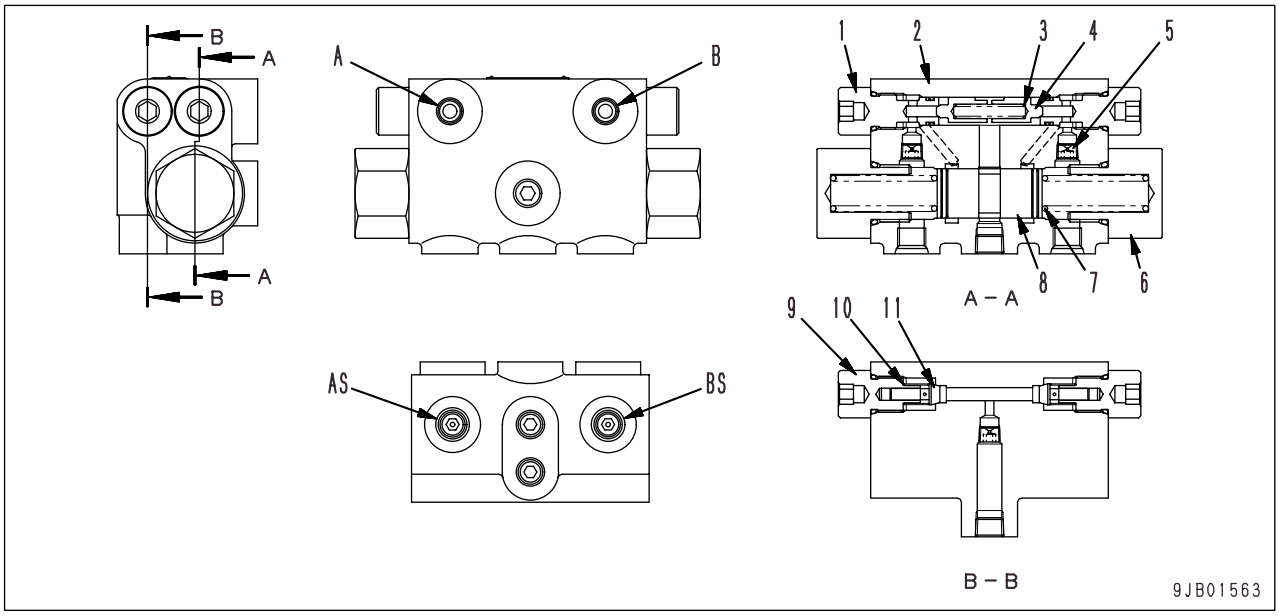


Role of centering spring

- Center spring (12) is composed of 4 X-shaped leaf springs and 2 flat leaf springs and installed between spool (3) and sleeve (5) as shown in the figure.
- If the steering wheel is turned, spool (3) compresses centering spring (12) and an angular displacement is made between spool (3) and sleeve (5).
  As a result, the ports of spool (3) and sleeve (5) are connected and the oil is sent to the steering cylinder. When the steering wheel stops turning, the gerotor also stops turning. Then, the oil is not sent to the steering cylinder and its pressure rises. To prevent this, when the steering wheel stops turning, it is returned by the reaction force of centering spring (12) toward the neutral position by the angular displacement of spool (3) and sleeve (5).



CUSHION VALVE



A: From left swing port of steering cylinder
AS: From left swing port of steering cylinder
B: From right swing port of steering cylinder
BS: From right swing port of steering cylinder

1. Valve seat
2. Valve body
3. Spring
4. Poppet
5. Orifice
6. Plug
7. Spring
8. Spool
9. Plug
10. Spring
11. Poppet

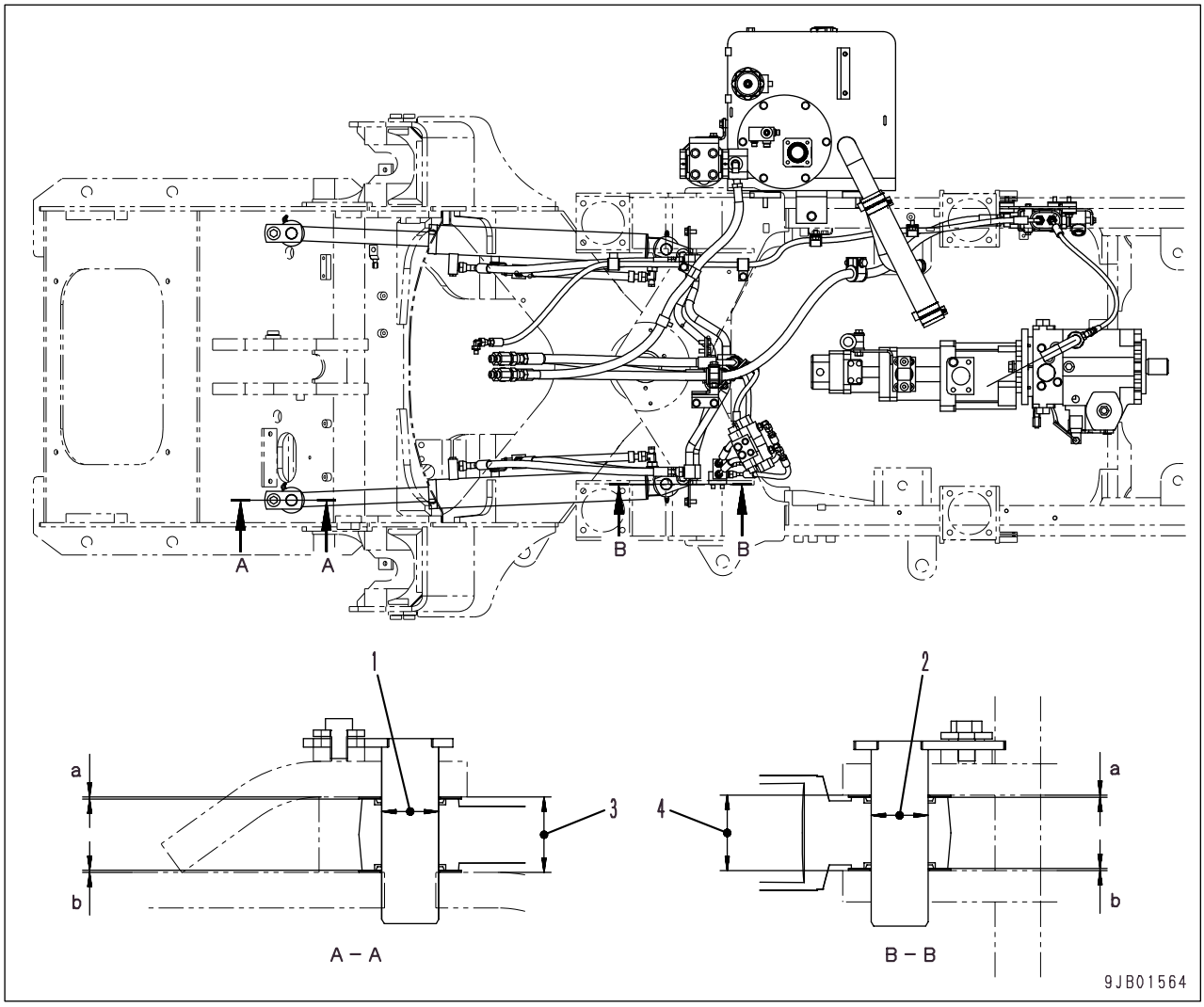
Outline

- When the oil pressure in the steering cylinder rises or rebounds, the cushion valve instantaneously lets the high-pressure oil escape to another line to prevent a shock.

Function

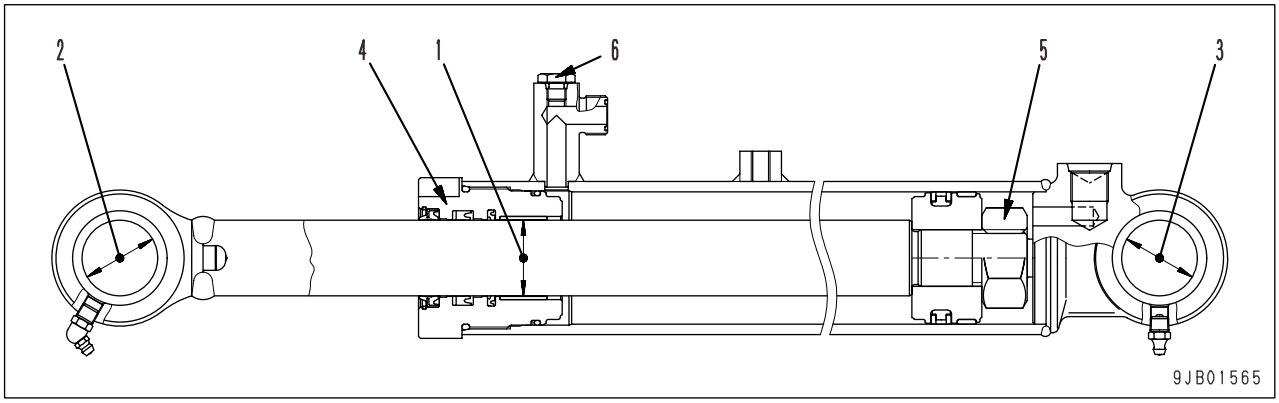
- If high-pressure oil flows in port A suddenly, it compresses spring (3) and pushes poppet (4) of port A open and flows through the center groove of spool (8), and then pushes poppet (11) of port B open and flows in port B.
- At the same time, this high-pressure oil flows through orifice (5) of port A to the pressure chamber of plug (6) and pushes back spool (8) to the right against the pressure on port B side and the tension of spring (7). As a result, the oil flow from port A to port B is stopped.
- This temporary oil flow has a cushioning effect. Since the cushion valve does not operate after this, it does not affect the ordinary steering operation.
- When the pressure changes so slowly that the cushioning effect is not necessary, spool (8) stops the oil before poppet (4) is opened, thus the cushion valve does not work as a cushion.

STEERING CYLINDER



Unit: mm

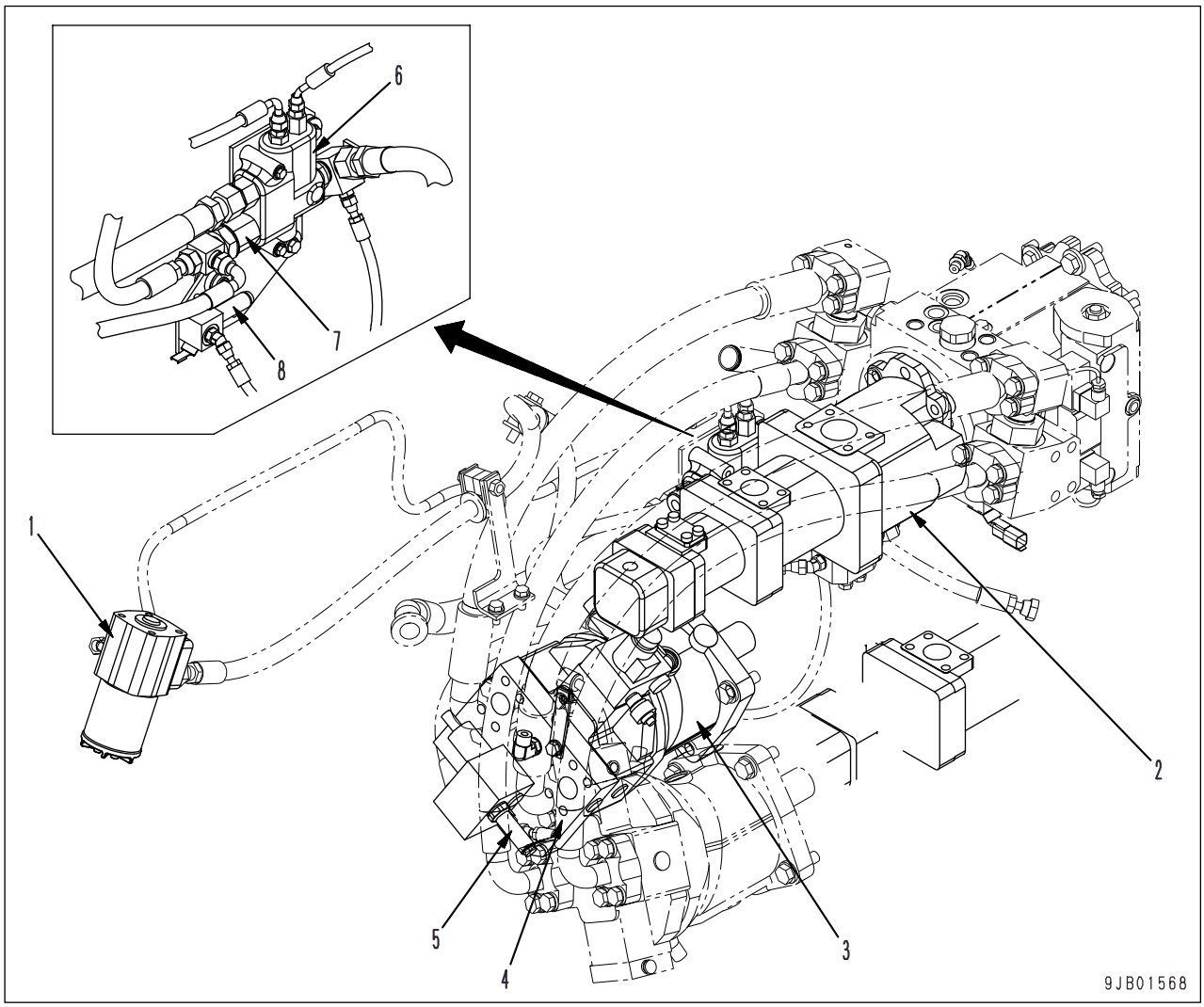
No.	Check item	Criteria					Remedy
1	Clearance between mounting pin and bushing at connection of frame and cylinder rod	Standard size	Tolerance		Standard Clearance	Clearance limit	Replace
			Shaft	Hole			
		ø 40	0 -0.025	+0.180 +0.042	0.042 – 0.205	—	
2	Clearance between mounting pin and bushing at connection of frame and cylinder bottom	ø 40	0 -0.025	+0.180 +0.042	0.042 – 0.205	—	
3	Connection of steering cylinder and front frame	Width of boss		Width of hinge	Standard clearance (a + b)		
		50		53	Max. 0.5 (after adjusting shim)		
4	Connection of steering cylinder and rear frame	50		53	Max. 0.5 (after adjusting shim)		



Unit: mm

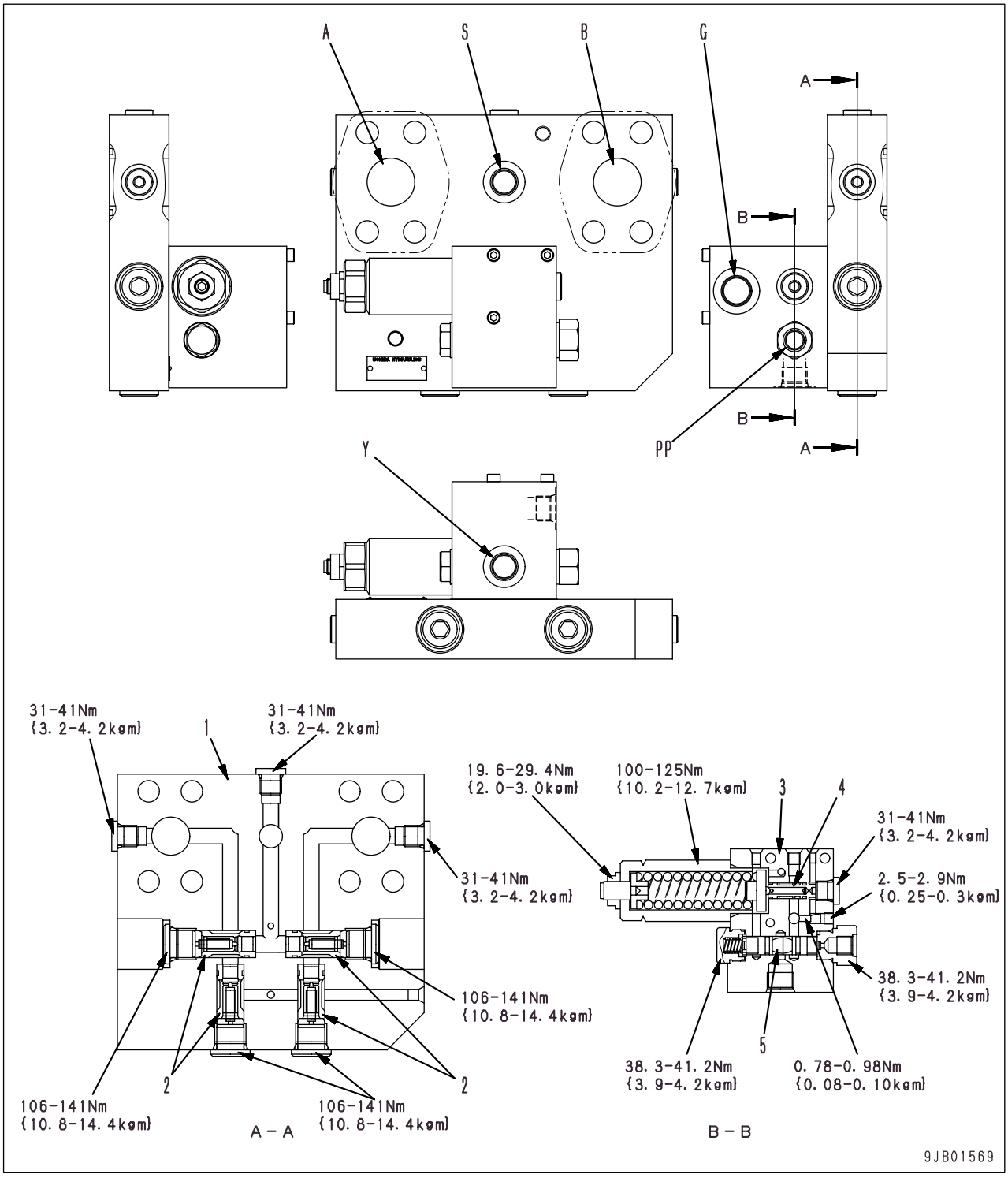
No.	Check item	Criteria					Remedy
1	Clearance between piston rod and bushing	Standard size	Tolerance		Standard Clearance	Clearance limit	Replace pin, bushing
			Shaft	Hole			
		ø 40	-0.025 -0.064	+0.132 +0.006	0.031 – 0.196	0.496	
2	Clearance between piston rod support shaft and bushing	ø 40	0 -0.025	+0.180 +0.042	0.042 – 0.205	1.0	
3	Clearance between cylinder bottom support shaft and bushing	ø 40	0 -0.025	+0.180 +0.042	0.042 – 0.205	1.0	
4	Tightening torque of cylinder head	539 ± 53.9 Nm {55 ± 5.5 kgm}					Tighten
5	Tightening torque of cylinder piston	785 ± 78.5 kNm {80 ± 8.0 kgm} (Width across flats: 46 mm)					
6	Tightening torque of nipple plug on cylinder head side	9.8 – 12.74 Nm {1.0 – 1.3 kgm}					

EMERGENCY STEERING PIPING



1. Orbit-roll valve
2. Steering pump
3. HST motor 2
4. Emergency steering valve
5. Pressure switch (For detecting operation of emergency steering)
6. Priority valve
7. Check valve
8. Pressure switch (for detecting drop of steering oil pressure)

EMERGENCY STEERING VALVE

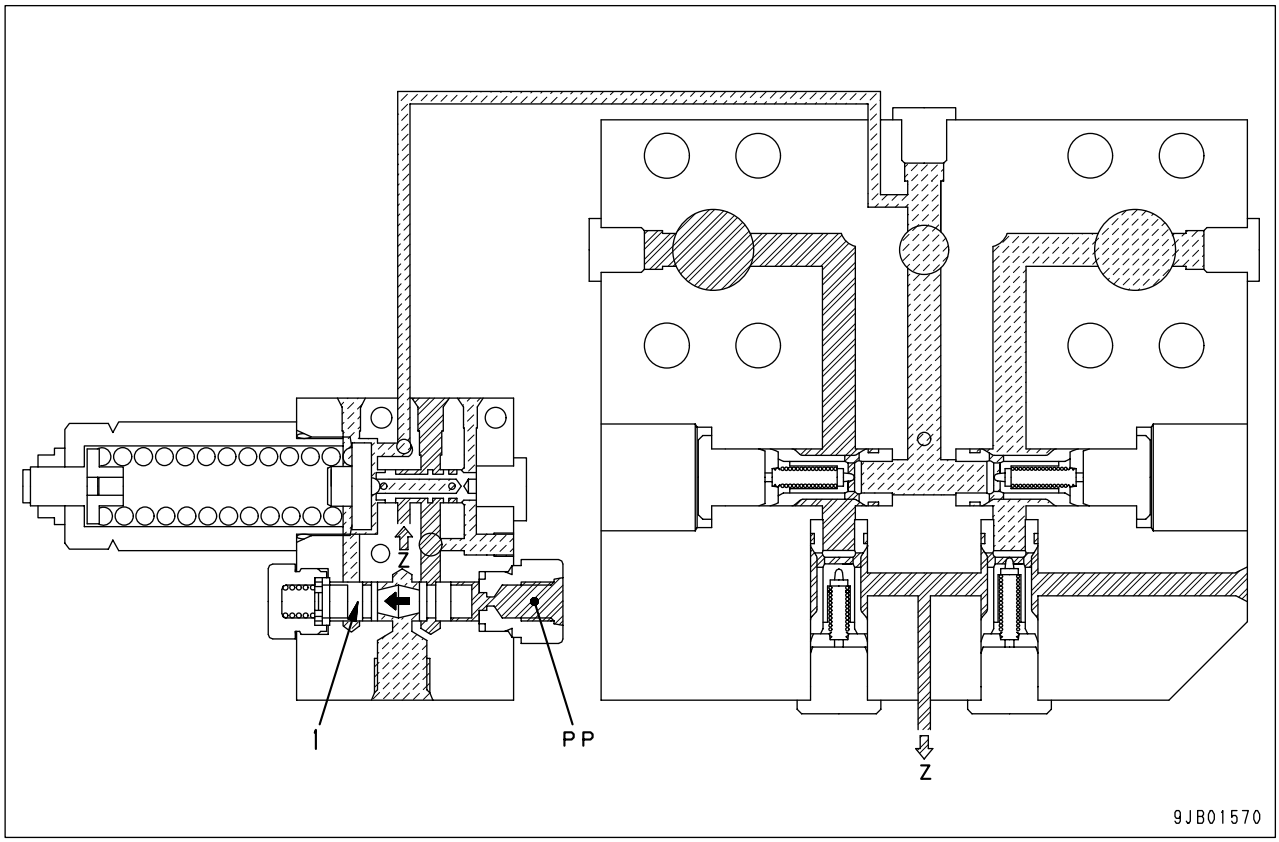


PP: From steering pump
A: To port A of HST motor 2
B: To port B of HST motor 2
Y: To orbit-roll valve
S: To hydraulic tank
G: To pressure switch

1. Check valve body
2. Check valve
3. Valve body
4. Pressure reducing valve
5. Selector valve

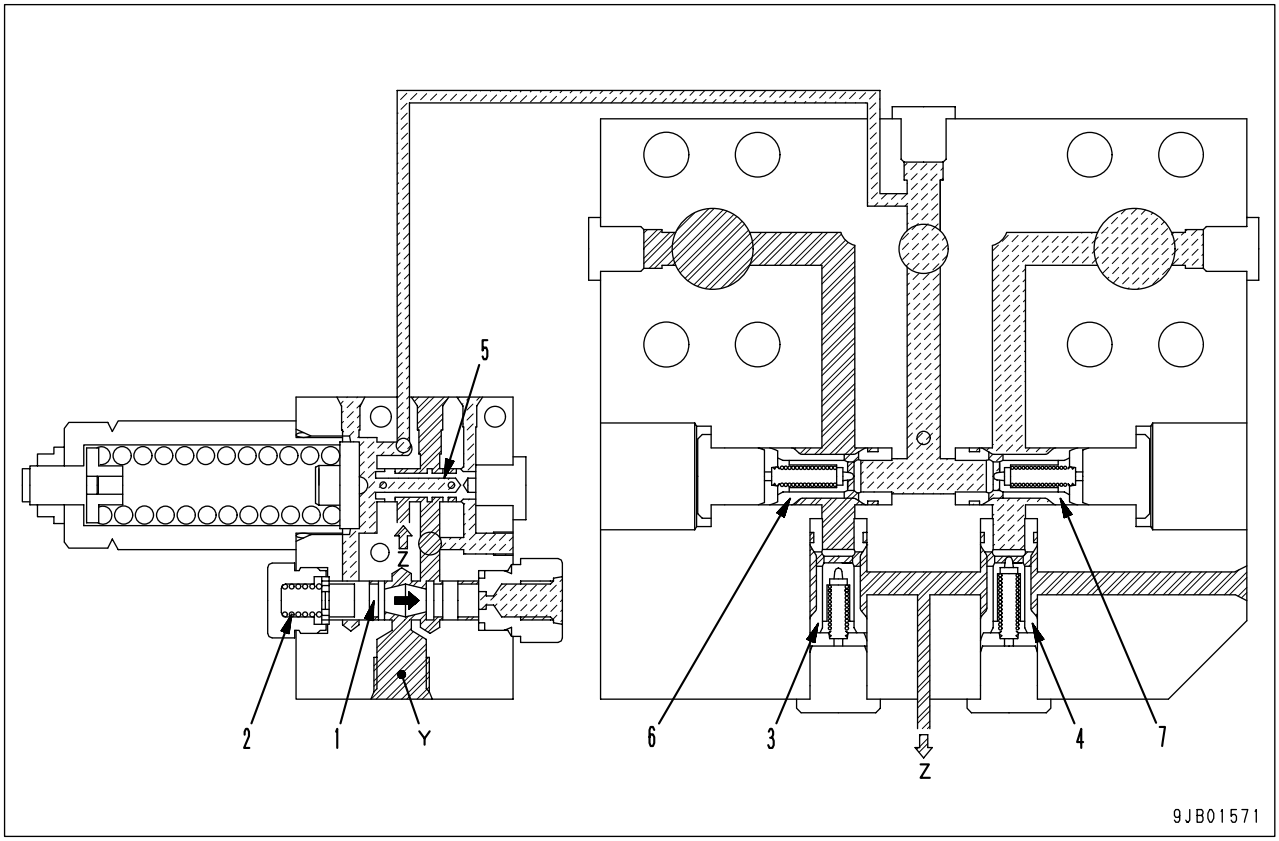
Operation

When engine and steering pump are normal



- While the engine and steering pump are operating normally, the oil sent from the steering pump flows into the orbit-roll valve to steer the machine.
- At this time, the oil from the steering pump flows in port **PP** and pushes spool (1) to the left to shut off the circuit from the HST motor to the orbit-roll valve.

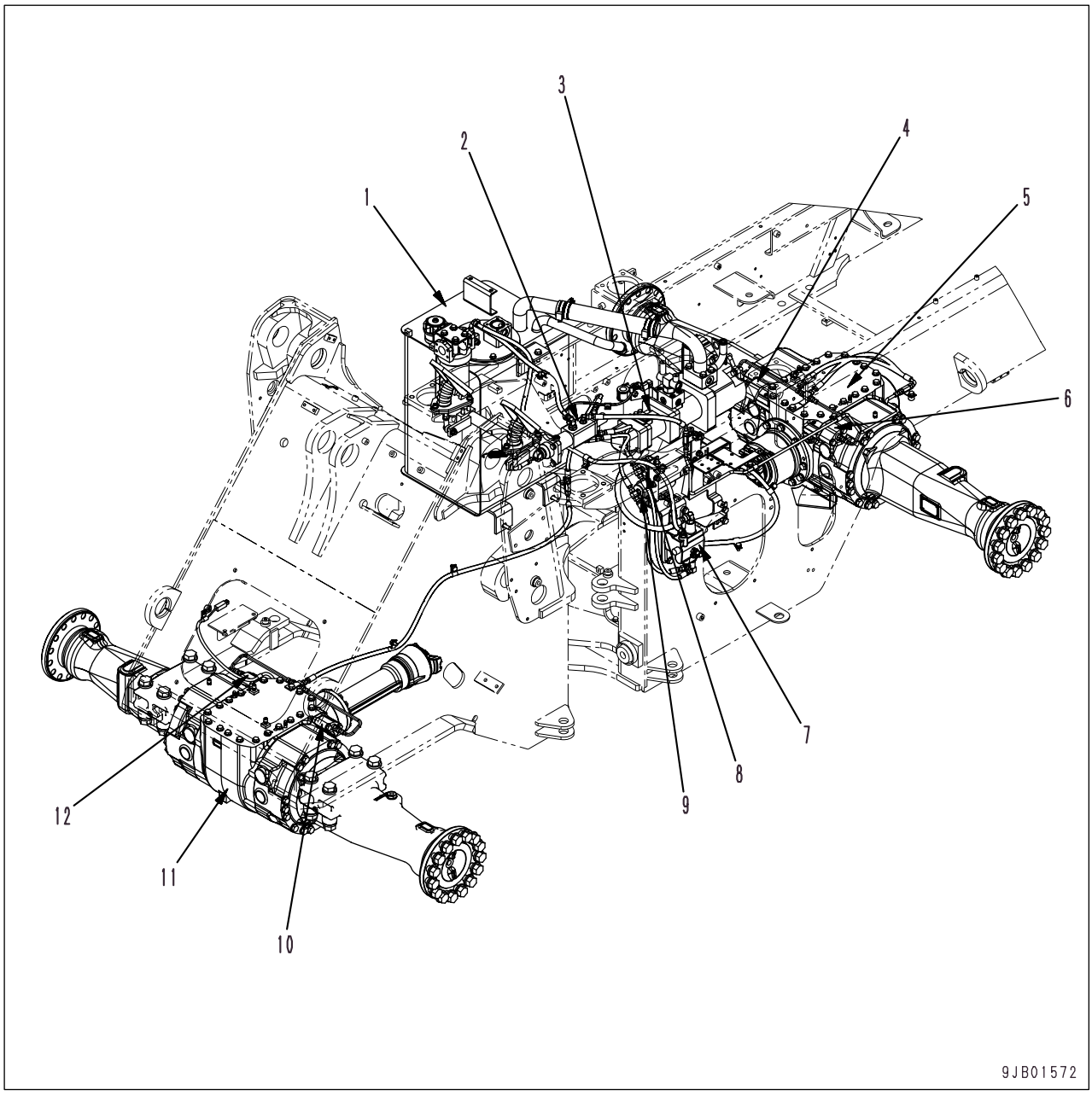
When engine or steering pump is abnormal



- If the engine or steering pump has a trouble and the steering pump does not supply oil sufficiently to the orbit-roll valve during travel, the discharge pressure of the steering pump lowers and spool (1) is pushed back to the right by the reaction force of spring (2).
- At this time, the oil from the HST motor is set high by check valves (3) and (4). Then, the oil is reduced in pressure by pressure reducing valve (5) to a proper level for the steering circuit and it flows through spool (1) and port **Y** to the orbit-roll valve. As a result, the machine can be steered.
- If the quantity of the oil in the HST circuit becomes insufficient because of oil leakage into the steering circuit, etc., check valves (6) and (7) add oil to the HST circuit.

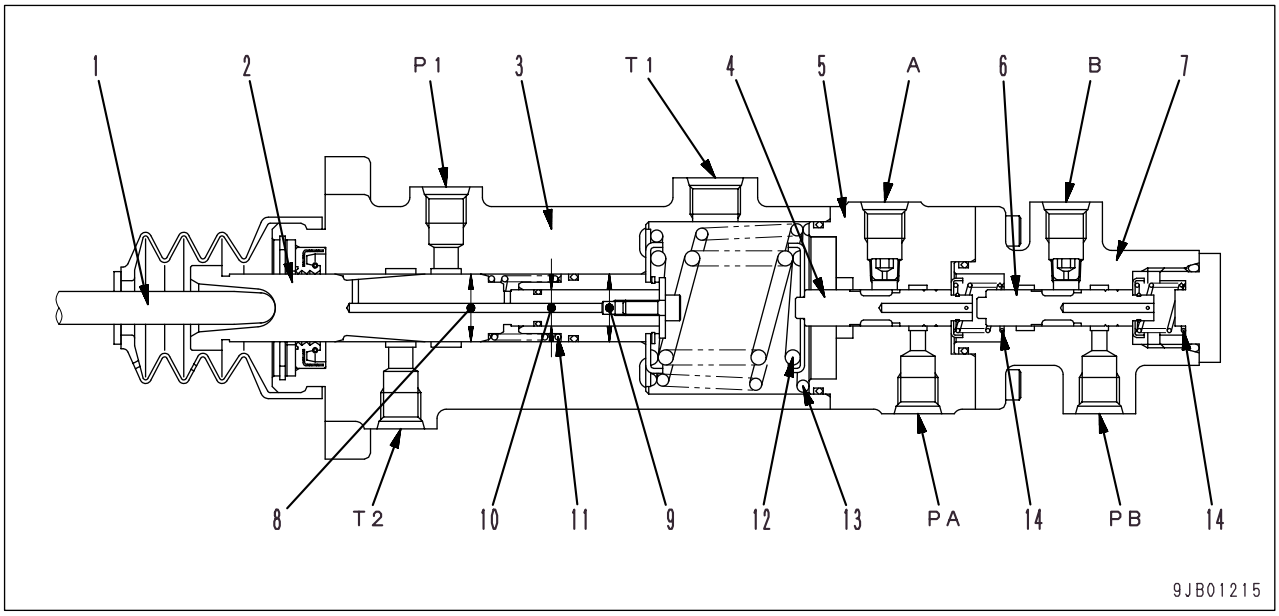
★ Check valves (3) and (4) work so that the emergency steering system will operate regardless of the travel direction.

BRAKE PIPING



1. Hydraulic tank
2. Brake valve
3. Brake and cooling fan pump
4. Slack adjuster (for right rear)
5. Rear brake
6. Slack adjuster (for left rear)
7. Charge valve
8. Accumulator (for front)
9. Accumulator (for rear)
10. Slack adjuster (for left front)
11. Front brake
12. Slack adjuster (for right front)

BRAKE VALVE



P1: From HST pump
T1: To hydraulic tank
T2: To steering pump (Suction side)
PA: From accumulator (Rear side)
A: To rear brake
PB: From accumulator (Front side)
B: To front brake

1. Rod
2. Inching valve spool
3. Inching valve body
4. Brake valve spool (for rear)
5. Brake valve body (for rear)
6. Brake valve spool (for front)
7. Brake valve body (for front)

Unit: mm

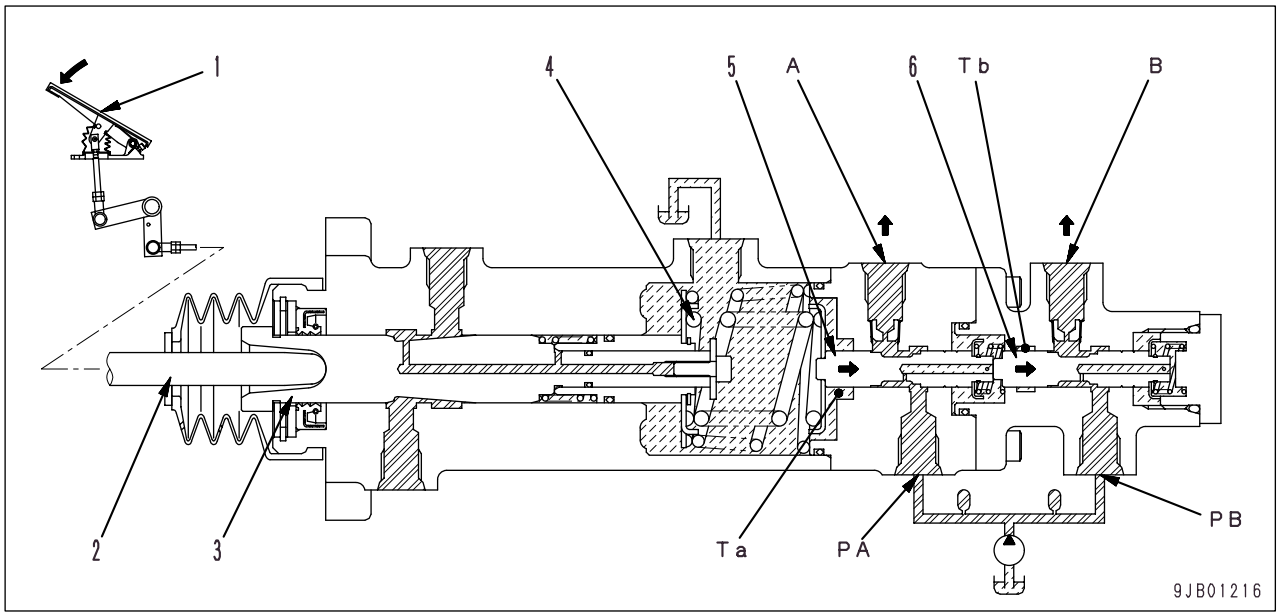
No.	Check item	Criteria					Remedy
8	Clearance between inching valve spool and body	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		ø 22.4	-0.022 -0.053	+0.033 0	0.020 – 0.086	0.096	
9	Clearance between inching valve guide and body	ø 22.4	-0.022 -0.053	+0.033 0	0.020 – 0.086	0.096	
10	Clearance between inching valve spool and guide	ø 12	-0.050 -0.093	+0.050 0	0.050 – 0.143	0.157	
11	Inching valve control spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		34.7	16.7	24.5 N {2.5 kg}	–	20.8 N {2.1 kg}	
12	Brake valve control spring	35.6	24.0	113 N {11.5 kg}	–	96 N {9.8 kg}	
13	Inching valve return spring	50.0	49.5	19.6 N {2.0 kg}	–	16.7 N {1.7 kg}	
14	Brake valve return spring	114.9	52.4	147 N {15.0 kg}	–	125 N {12.7 kg}	

Outline

- The brake valve is installed under the front of the operator's seat. If either brake pedal is pressed, oil flows to the brake piston to operate the brake.
- Both brake pedals are connected mechanically to each other. If either of them is pressed, the other moves, too.
- The brake valve has an inching valve in it to control the control pressure of the HST pump.

Operation

1. When brake pedal is pressed

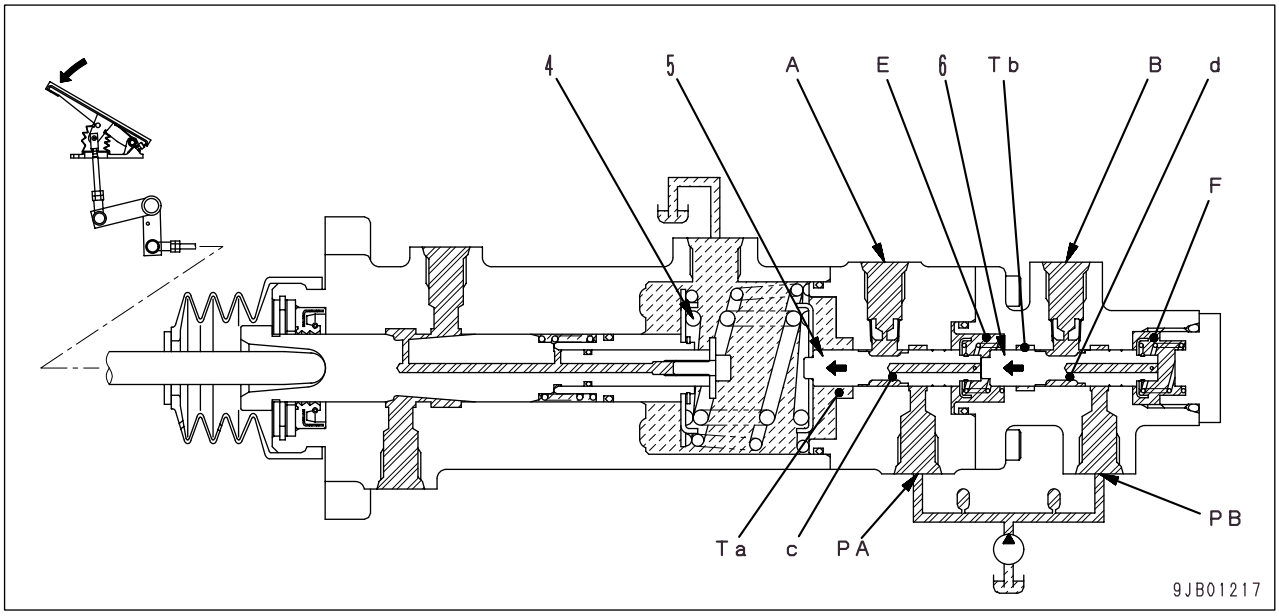


- If brake pedal (1) is pressed, the pressing force is transmitted through rod (2), spool (3), and spring (4) to spool (5).
- If spool (5) is pushed to the right, port **Ta** is closed and the oil from the pump flows through the accumulator, port **PA**, and port **A** to the rear brake piston to operate the rear brake.
- At the time when spool (5) is pushed to the right, spool (6) is also pushed to the right to close port **Pb**. As a result, the oil from the pump flows through the accumulator, port **PB**, and port **B** to the front brake piston to operate the front brake.

When only either brake operates (When either brake fails)

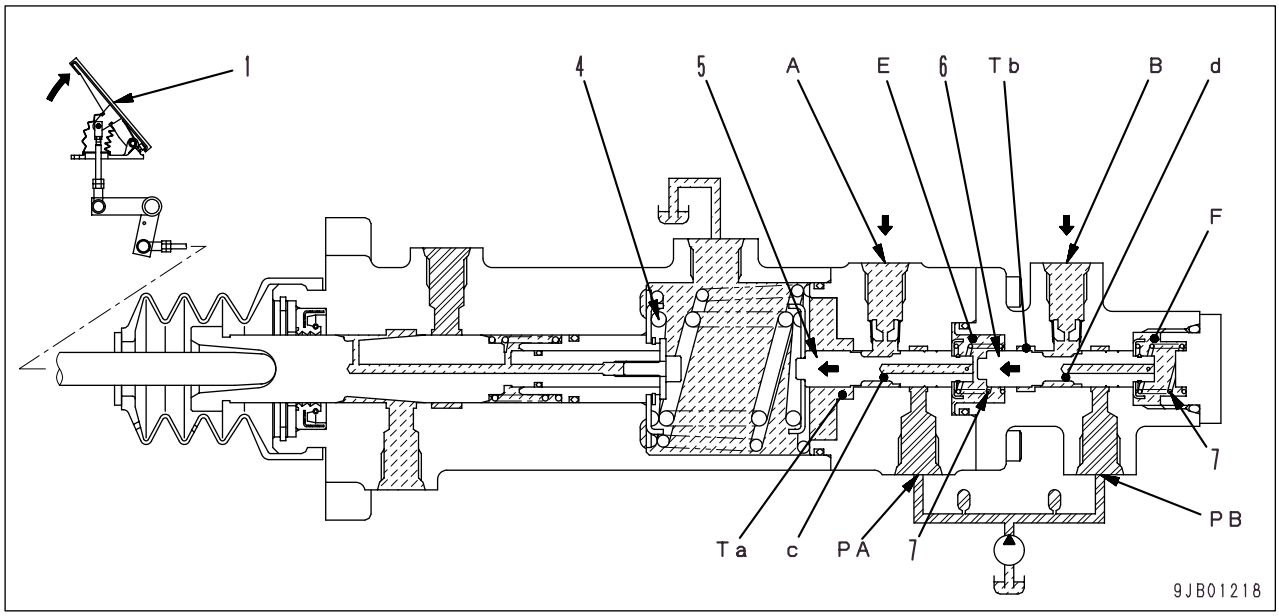
- Even if only either brake operates because of oil leakage, etc. in the front or rear brake system, the pressing force of brake pedal (1) moves spools (5) and (6) mechanically to the right. Accordingly, the oil from the pump flows normally to the brake piston of the normal system to operate the brake and stop the machine. With this mechanism, safety is heightened.

2. When balanced



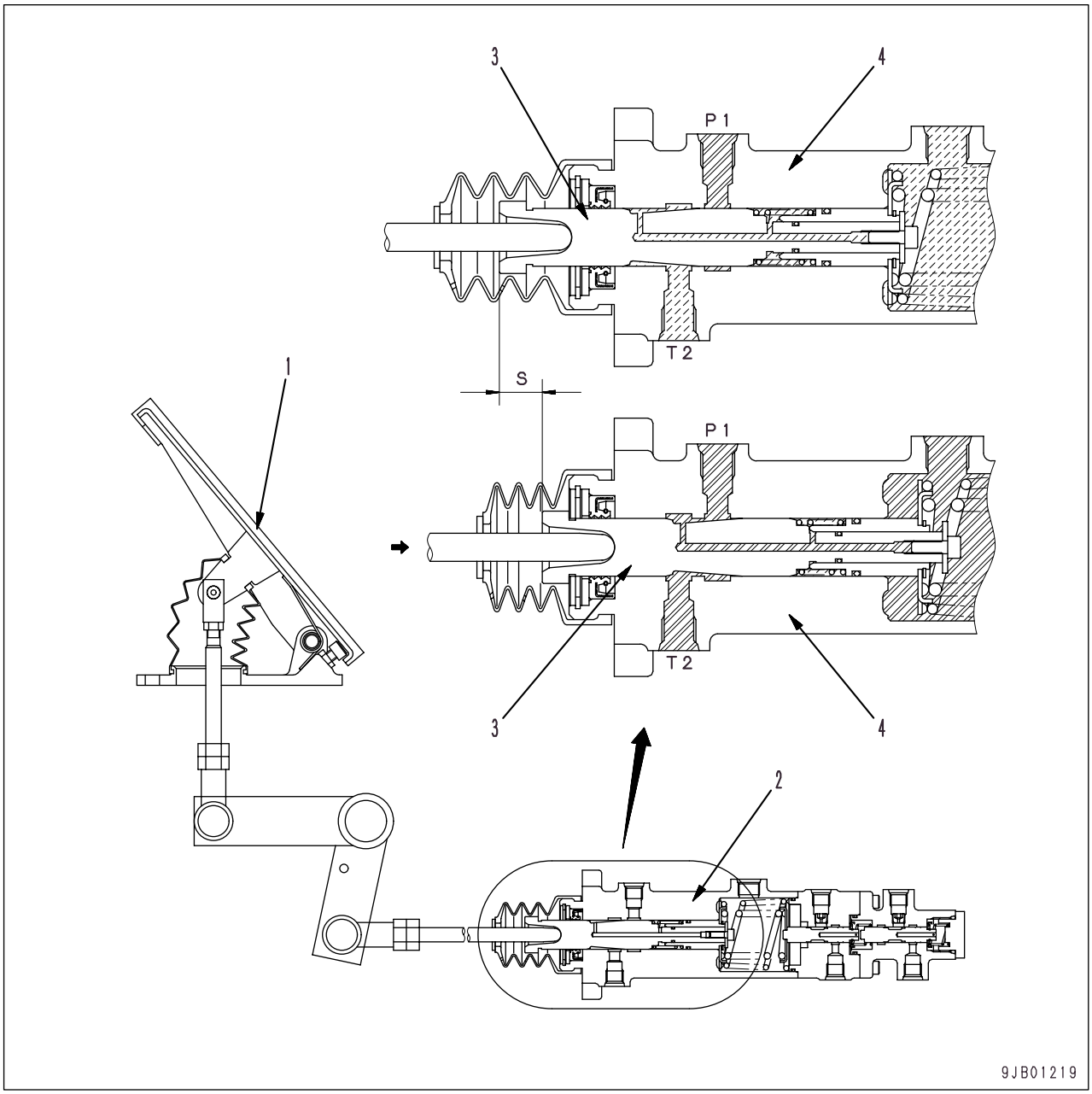
- If the rear brake piston is filled with oil and the oil pressure between ports **PA** and **A** rises, the oil flowing through orifice **c** of spool (5) into chamber **E** pushes back spool (5) to the left against spring (4) and close ports **PA** and **A** from. Since port **Ta** is kept closed at this time, the oil which flowed into the brake piston is held and the brake is kept operated.
- At the time when spool (5) is pushed to the left, the front brake piston is filled with oil and the pressure between ports **PB** and **B** rises. As a result, the oil which flowed through orifice **d** of spool (6) into chamber **F** pushes back spool (6) to the left by the moving distance of spool (5) to close ports **PB** and **B**. Since port **Tb** is kept closed, the oil which flowed into the brake piston is held and the brake is kept operated.
- The oil pressure in the rear brake circuit (on port **A** side) is balanced with the pressing force of the brake pedal. The oil pressure in the front brake circuit (on port **B** side) is balanced with the oil pressure in the rear brake circuit (on port **A** side).
  If spools (5) and (6) move to the right stroke end, the passes between ports **PA** and **A** and between ports **PB** and **B** are fully open and the oil pressure in the rear and front brake circuits is equal to the oil pressure from the pump. Accordingly, the operator can adjust the braking force with the brake pedal until spool (5) and (6) move to the right stroke end.

3. When brake pedal is released



- If brake pedal (1) is released, the pedal pressing force applied to spool (5) is lost.
- Spool (5) is pushed back to the left by the back pressure of the rear brake piston and reaction force of spring (7). Consequently, port **PA** is closed and the oil in the rear brake piston flows through ports **A** and port **Ta** into the hydraulic tank and the rear brake is released.
- At the time when spool (5) moves to the left, spool (6) is also pushed back to the left by the back pressure of the front brake piston and reaction force of spring (7). Consequently, port **PB** is closed and the oil in the front brake piston flows through ports **B** and **Tb** into the hydraulic tank and the front brake is released.

INCHING VALVE



P1: From port Y of HST pump
T2: To steering pump (Suction side)

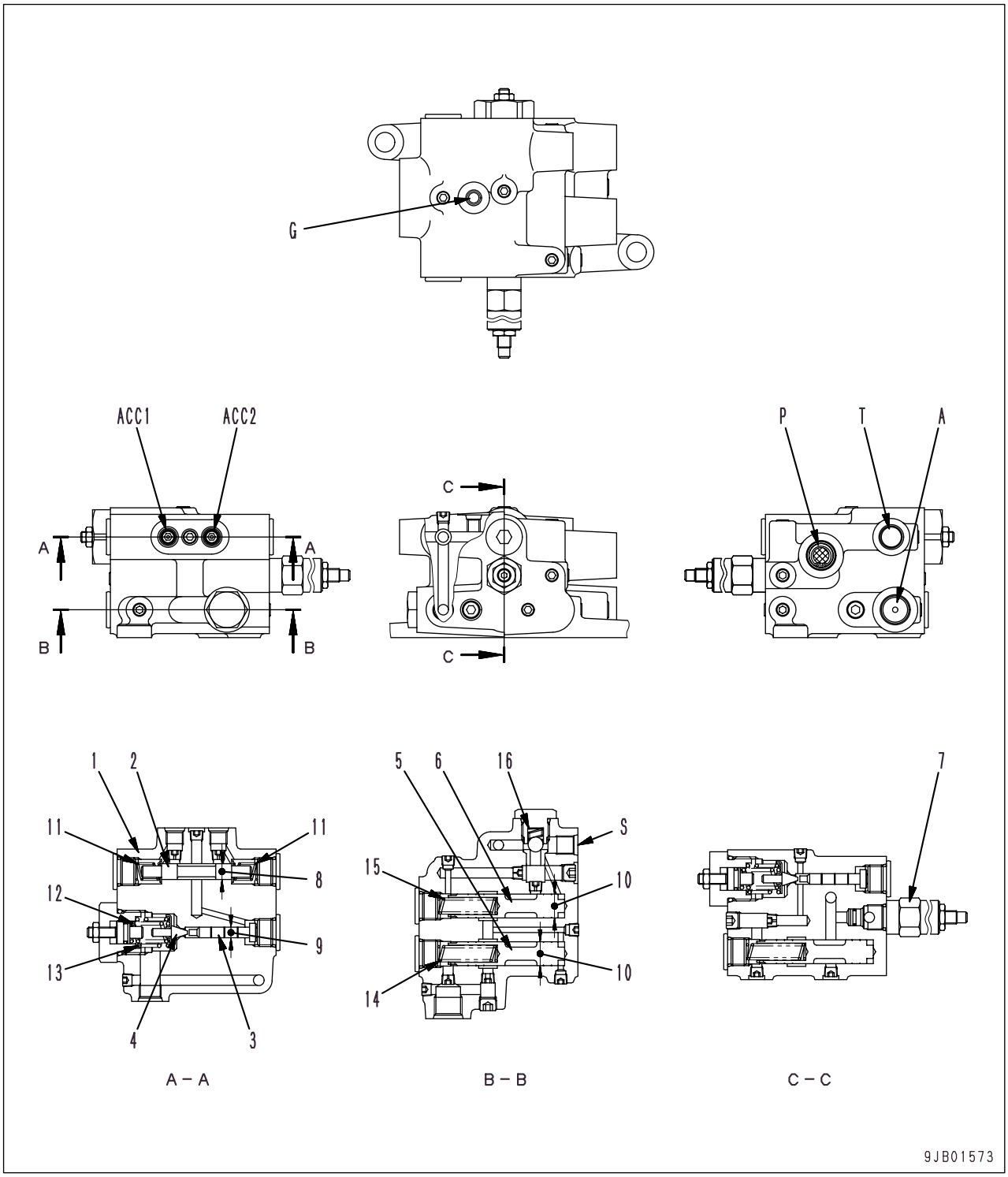
1. Brake pedal
2. Brake valve
3. Spool
4. Body

Outline

- The inching valve is built in brake valve (2). It reduces the control oil pressure of the HST circuit to reduce the capacity of the HST pump according to stroke (S) of spool (3).

white 10-83

CHARGE VALVE



P: From brake and cooling fan pump
T: To hydraulic tank
A: To cooling fan motor
ACC1: To accumulator (Rear side)
ACC2: To accumulator (Front side)
S: Brake operation sensor port
G: Gauge port

1. Valve body
2. Inverse shuttle valve
3. Plunger
4. Unload relief valve
5. Flow control valve
6. Unload valve
7. Relief valve

Unit: mm

No.	Check item	Criteria					Remedy
8	Clearance between inverse shuttle valve spool and body	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		ø 12	-0.006 -0.014	+0.011 0	0.006 – 0.025	0.029	
9	Clearance between plunger and body	ø 8	-0.005 -0.012	+0.009 0	0.005 – 0.021	0.024	
10	Clearance between flow control valve, unload valve spool and body	ø 18	-0.006 -0.017	+0.011 0	0.006 – 0.028	0.032	
11	Inverse shuttle valve return spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		21.6	18.3	9.8 N {1.0 kg}	–	8.3 N {0.85 kg}	
12	Unload relief valve return spring (inside)	35.9	30.0	188 N {19.2 kg}	–	160 N {16.3 kg}	
13	Unload relief valve return spring (outside)	39.8	27.5	137 N {14.0 kg}	–	116 N {11.8 kg}	
14	Flow Control valve return spring	53.7	45.0	89.2 N {9.1 kg}	–	76 N {7.8 kg}	
15	Unload valve spool return spring	51.6	45.0	49 N {5.0 kg}	–	42 N {4.3 kg}	
16	Check valve return spring	11.5	9.0	4.9 N {0.5 kg}	–	4.2 N {0.43 kg}	

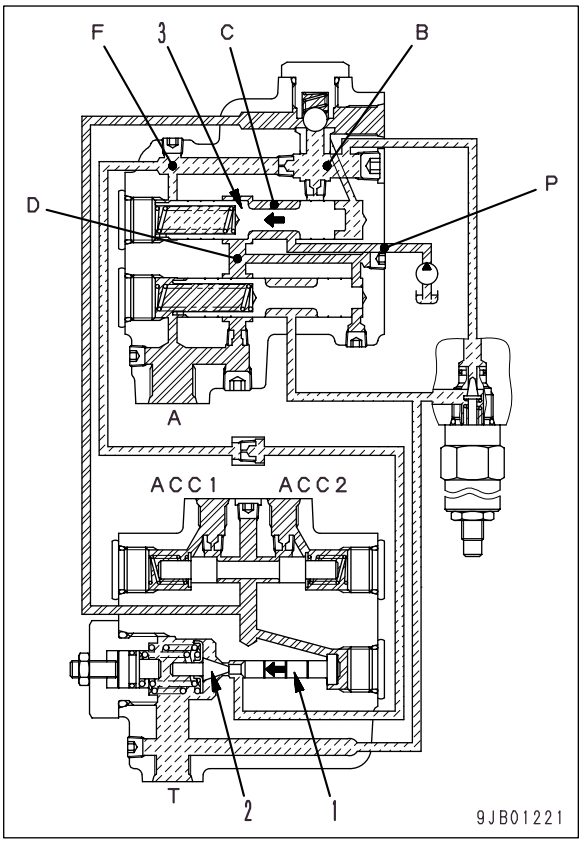
Function

- The charge valve keeps the oil pressure from the pump to the set pressure and stores it in the accumulator.
- If the oil pressure rises above the set pressure, the oil from the pump is led to the drain circuit to reduce the load on the pump.

Operation

1. When oil is not supplied to accumulator (Cut-out state)

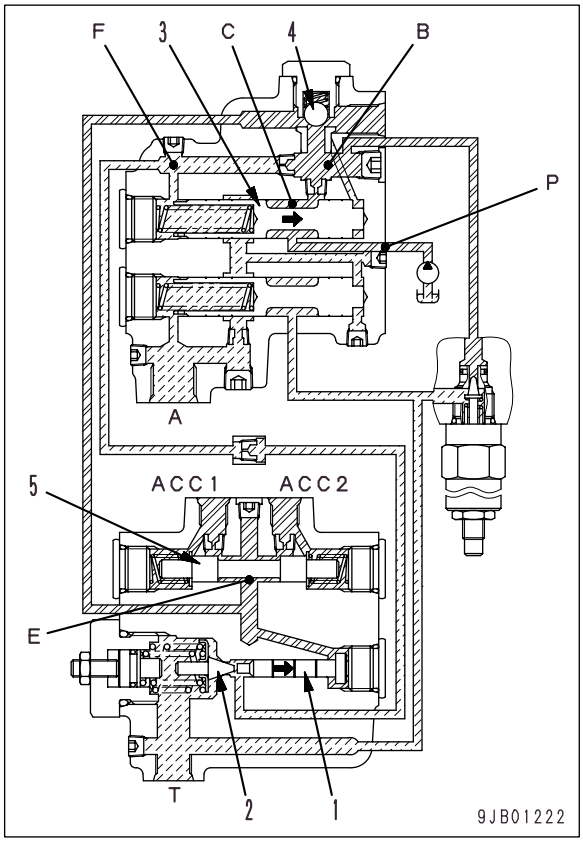
- Plunger (1) is moved by the pressure of the accumulator to the left to keep unload relief valve (2) pushed open.
- The oil in the spring chamber of unload valve (3) flows through port **F**, unload relief valve (2), and port **T** into the hydraulic tank.
- Since the oil pressure in port **F** lowers, unload valve (3) is moved by the oil pressure in chamber **B** to the left.
- Accordingly, ports **C** and **D** are connected to each other and almost all the oil from the pump flows through ports **P**, **C**, **D** and **A** to the cooling fan motor.



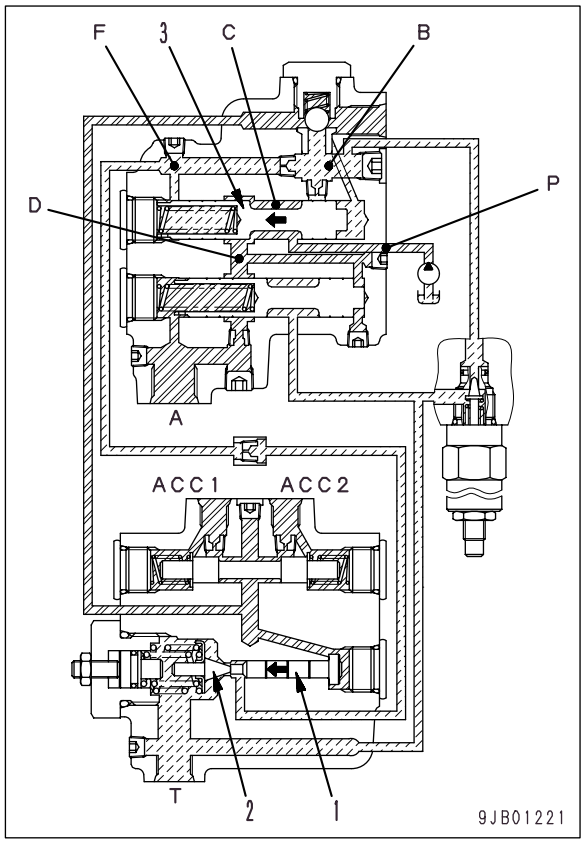
2. When oil is supplied to accumulator

1) Cut-in state

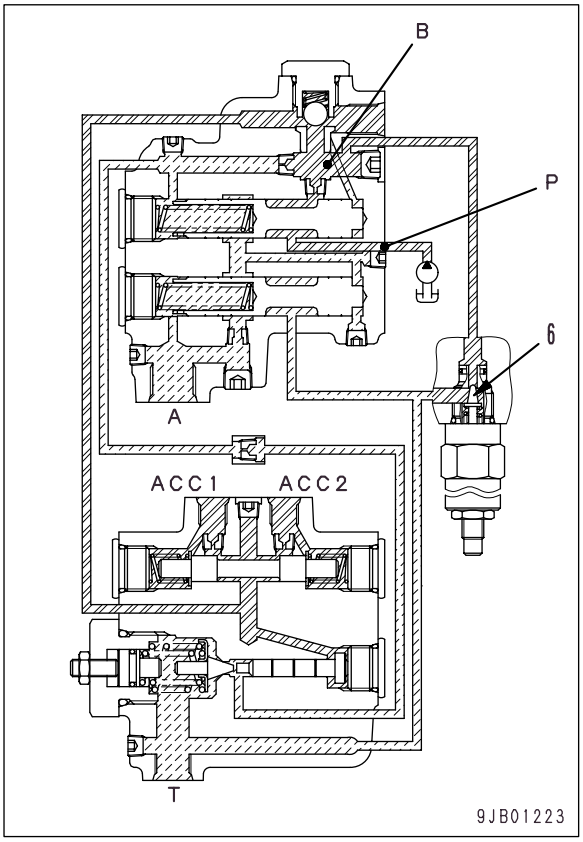
- If the accumulator pressure lowers, the pressure in port **E** lowers and plunger (1) moves to the right and unload relief valve (2) closes the drain circuit.
- Accordingly, the oil pressure in port **F** and the spring chamber of unload relief valve (3) rises and unload relief valve (3) moves to the right.
- As a result, ports **C** and **B** are connected to each other and the oil from the pump flows to port **B**.
- If the oil pressure in port **B** exceeds the set pressure of check valve (4), it pushes check valve (4) open and flows to port **E** to start heightening the pressure in the accumulator. The supply pressure for the accumulator is decided by the set pressure of check valve (4).
- A set quantity of oil is supplied to the accumulator, regardless of the engine speed, and the excessive oil flows through port **A** to the cooling fan motor.
- The oil flowing to port **E** is supplied first to the accumulator having the lowest pressure by inverse shuttle valve (5).



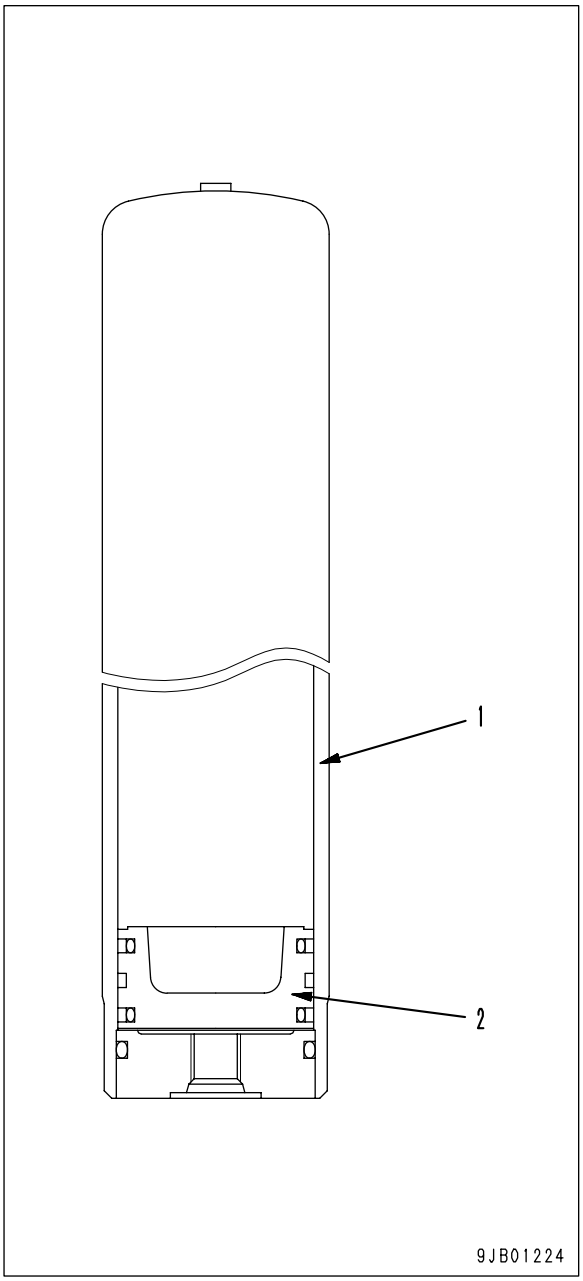
2) Cut-out state
   - If the pressure in port **F** reaches the set pressure (cut-out pressure) of unload relief valve (2), the oil in the spring chamber of unload valve (3) flows through port **F**, unload relief valve (2), and port **T** to the hydraulic tank.
   - Plunger (1) is moved to the left by the pressure of the accumulator to keep unload relief valve (2) pushed open.
   - Since the oil pressure in port **F** lowers, unload valve (3) is moved by the oil pressure in chamber **B** to the left.
   - Accordingly, ports **C** and **D** are connected to each other and almost all the oil from the pump flows through ports **P**, **C**, **D** and **A** to the cooling fan motor.



3. When input pressure to valve rises above set pressure
   - If the oil pressure in chamber **B** reaches the set pressure of relief valve (6), the oil flowing from the pump through port **P** to chamber **B** pushes relief valve (6) open and flows through port **T** into the hydraulic tank.
     As a result, the maximum pressure in the brake circuit is limited to protect the circuit.



ACCUMULATOR (FOR BRAKE)



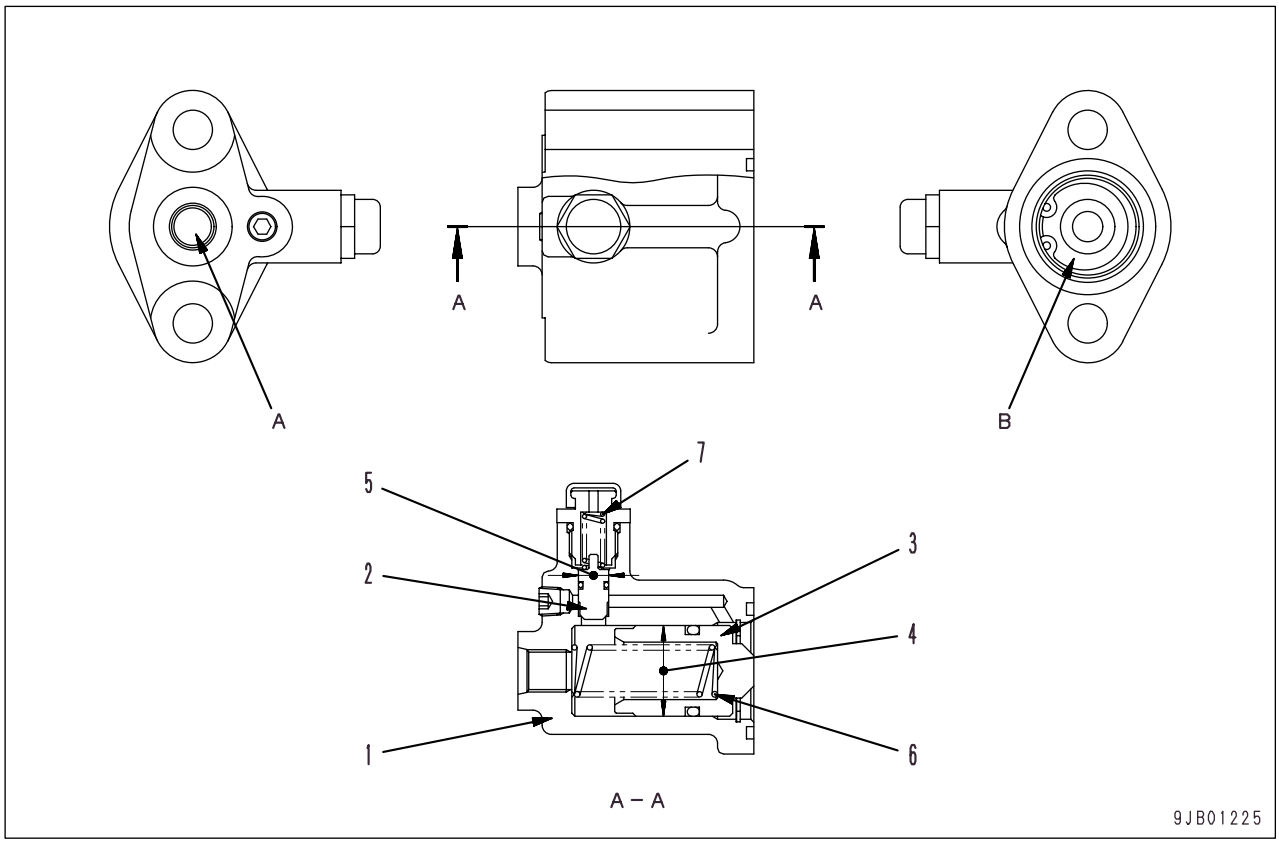
1. Cylinder
2. Piston

Function

- The accumulator is installed between the charge valve and brake valve. The space between its cylinder (1) and free piston (2) is filled with nitrogen gas. The brake oil pressure is stored in this space by utilizing the compressibility of the nitrogen gas and used as the pressure source to drive the brake.

Specifications
Gas used: Nitrogen gas
Amount of gas: 500cc
Charge pressure: 3.43 ± 0.1 MPa {35 ± 1.0 kg/cm^2}
(at 20°C)

SLACK ADJUSTER



A: From brake valve
B: To brake piston

1. Body
2. Check valve
3. Piston

Unit: mm

No.	Check item	Criteria					Remedy
4	Clearance between piston and body	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		ø 30	-0.065 -0.098	+0.052 0	0.065 – 0.150	0.163	
5	Clearance between check valve and body	ø 10	-0.013 -0.028	+0.015 0	0.013 – 0.043	0.048	
6	Piston return spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		87.5	48.2	11.8 N {1.2 kg}	–	9.8 N {1.0 kg}	
7	Check valve return spring	21.7	19.25	53.9 N {5.5 kg}	–	46.1 N {4.7 kg}	

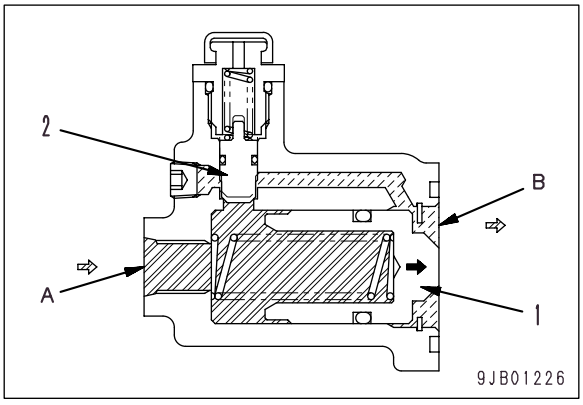
Function

- The slack adjuster is installed to the brake oil line from the brake valve to the brake piston and used to fix the time lag of operation of the brake.

Operation

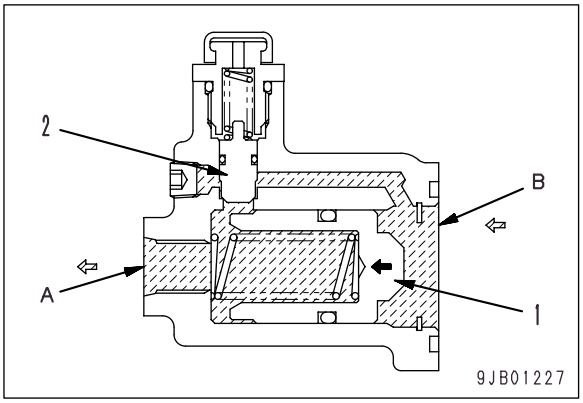
When brake is applied

- The oil from the brake valve flows to port **A** and moves piston (1) to the right. The oil kept between piston (1) and brake piston drives the brake.
- Since the oil kept between piston (1) and brake piston drives the brake, the brake piston stroke is fixed and the time lag of operation of the brake is reduced.
- If the quantity of the oil between piston (1) and brake piston becomes insufficient because of wear of the brake disc, etc., check valve (2) is pushed open and oil is added.

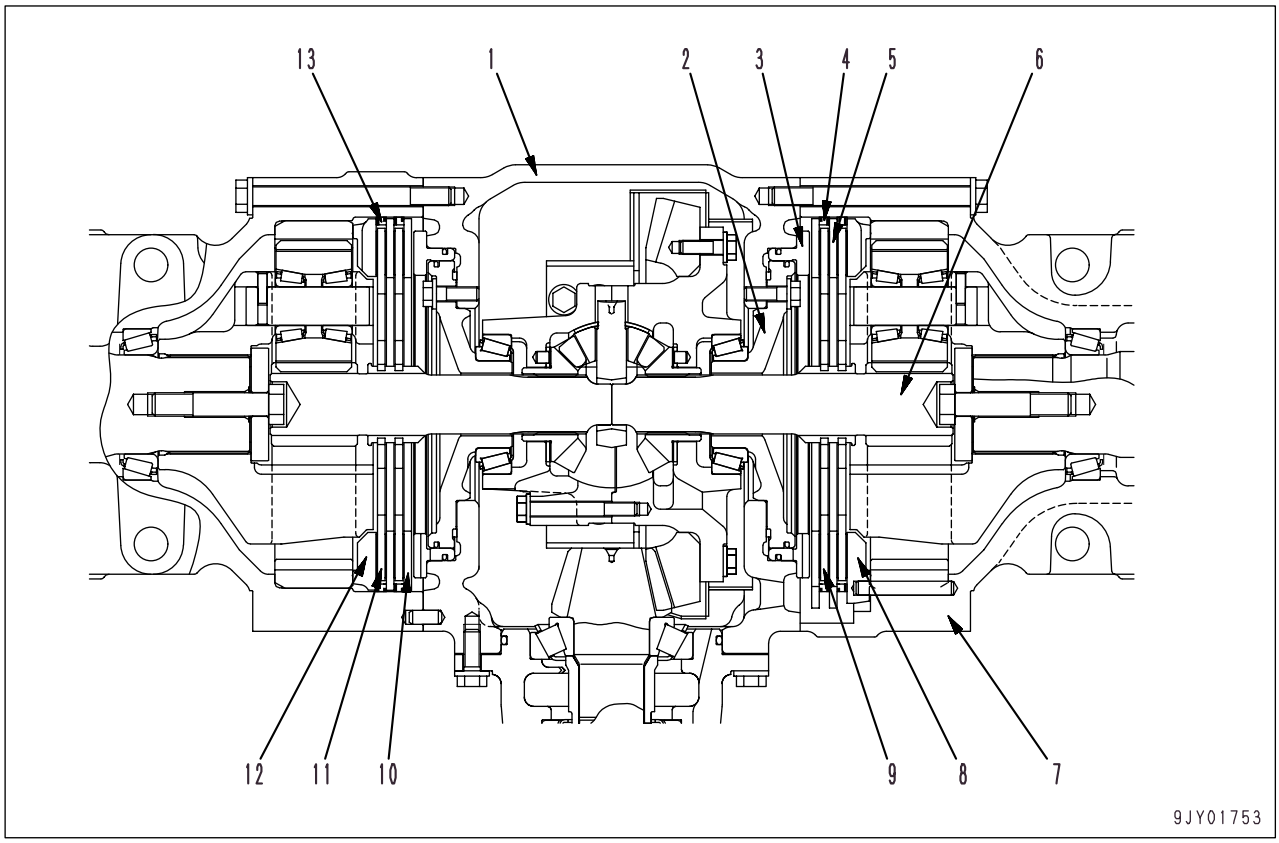


When brake is released

- The oil kept between piston (1) and brake piston pushes back piston (1) to the left. Oil of quantity equivalent to the moving distance of piston (1) is returned through port **A** to the brake valve and drained into the hydraulic tank.



BRAKE



1. Differential housing
2. Bearing carrier
3. Piston
4. Spring
5. Inner ring (x2)
6. Sun gear shaft
7. Axle housing
8. Outer ring
9. Discs (x2)

Unit: mm

No.	Check item	Criteria			Remedy
10	Thickness of inner ring	Standard size	Tolerance	Repair limit	Replace
		6.5	± 0.1	6.0	
11	Thickness of brake disc	8.7	± 0.15	7.9	
	Depth of lining groove	0.8	± 0.2	0.4	
	Thickness of lining	1.0	0.8 (Min.)	—	
12	Wear of brake outer ring disc contact surface	Standard size	Tolerance	Wear limit	
		20.1	± 0.1	0.3	
13	Spring load	Standard size		Repair limit	
		Installed height	Installed load	Installed load	
		7.6	912 N {93 kg}	730 N {74 kg}	

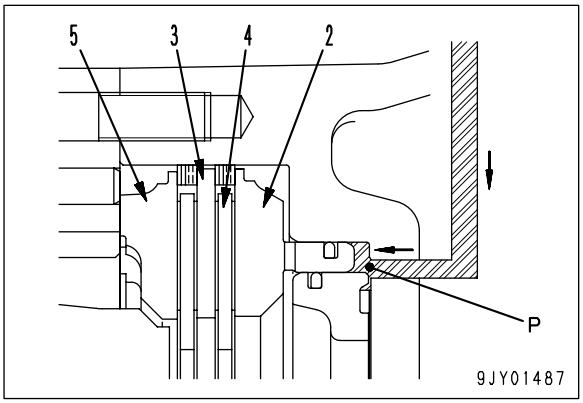
Outline

- The brake has a wet-type multiple-disc structure, and consists of piston (3), inner ring (5), disc (9), outer ring (8), and spring (4).
- The brake cylinder consists of differential housing (1) and bearing carrier (2), and piston (3) is assembled in it.
  Inner ring (5) and outer ring (8) are joined to the spline portion of axle housing (7).
- Disc (9) has a lining stuck to both sides. It is assembled between inner ring (5) and outer ring (8), and is joined by the spline of sun gear shaft (6).

Outline

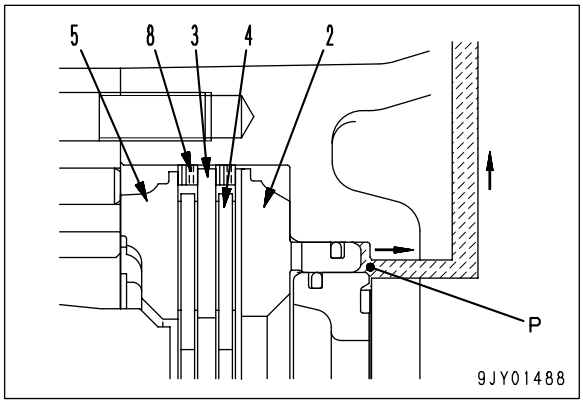
When brake is applied

- When the brake pedal is depressed, pressure oil **P** goes from the hydraulic tank through the pump and brake charge valve. It acts on the piston inside the brake cylinder and the piston (2) slides.
  Therefore, piston (2) stops the rotation of discs (4) fitted between inner ring (3) and outer ring (5), and applies the brake to the machine.

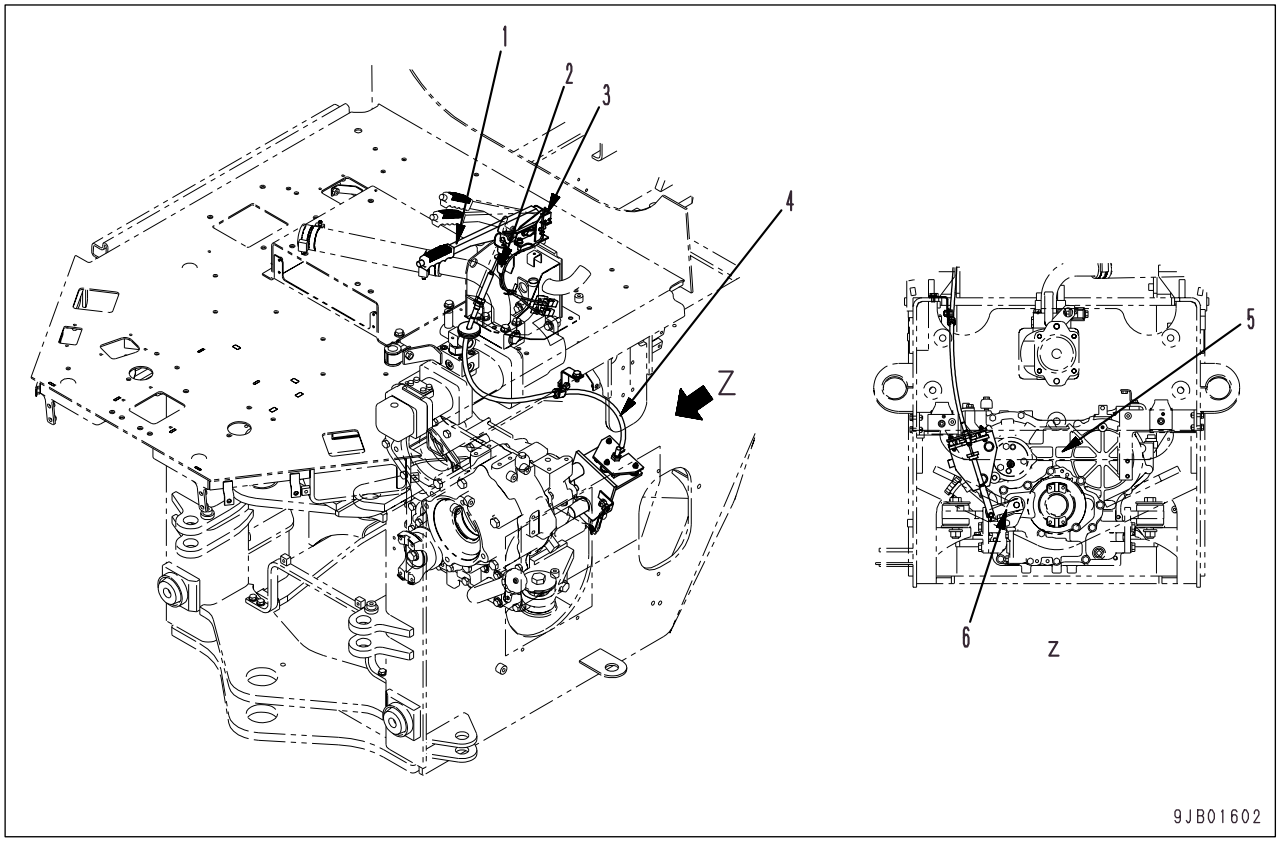


When brake is released

- When the oil pressure is released, piston (2) is returned to its original position by the force of spring (8), a gap is formed between inner ring (3) and outer ring (5), and discs (4) become free. Lattice shape grooves are cut into the lining stuck to disc (4), and when disc (4) is rotating, oil flows in the grooves and carries out cooling of the lining.



PARKING BRAKE CONTROL

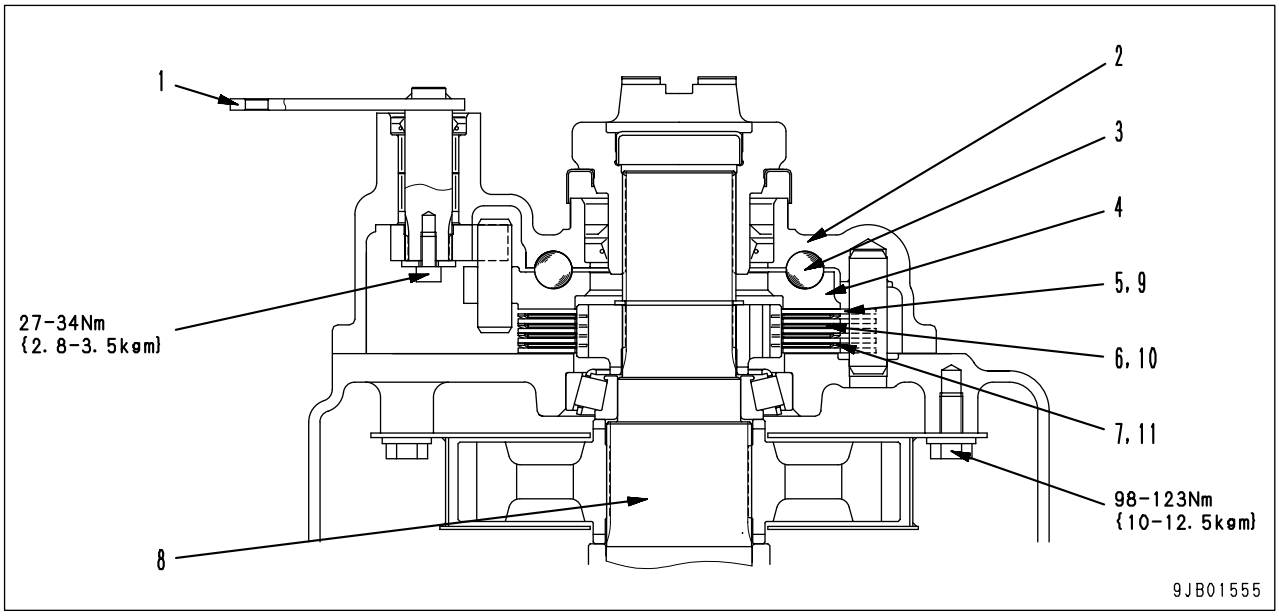


1. Parking brake lever
2. Lowest switch of parking brake lever
3. Intermediate switch of parking brake lever
4. Control cable
5. Transfer
6. Multiple-disc brake lever

Outline

- The mechanical parking brake is built in transfer (5). If parking brake lever (1) is operated, multiple-disc brake lever (6) is operated to "apply" or "release" the parking brake.
- If parking brake lever (1) installed on the operator's seat is pulled, multiple-disc brake lever (6) connected by control cable (4) is pulled up and the parking brake is "applied".
- If parking brake lever (1) is returned, multiple-disc brake lever (6) connected by control cable (4) is pushed down and the parking brake is "released"
- While the parking brake is "applied", the current to the forward-reverse solenoid valve of the HST pump is shut off and the swash plate of the HST pump is kept in neutral.

PARKING BRAKE



1. Lever
2. Housing
3. Ball
4. Piston
5. Plate
6. Disc
7. Wave spring
8. Output shaft

Unit: mm

No.	Check item	Criteria			Remedy
9	Thickness of plate	Standard size	Tolerance	Repair limit	Replace
		2.6	± 0.06	2.5	
	Distortion of plate	—	0.05	0.1	
10	Thickness of brake disc	2.2	± 0.08	2.05	
	Distortion of brake disc	—	0.02	0.25	
11	Load on wave spring (Height: 2.2 mm)	1,010 N {103 kg}	± 101N {± 10.3 kg}	858 N {87.6 kg}	

Outline

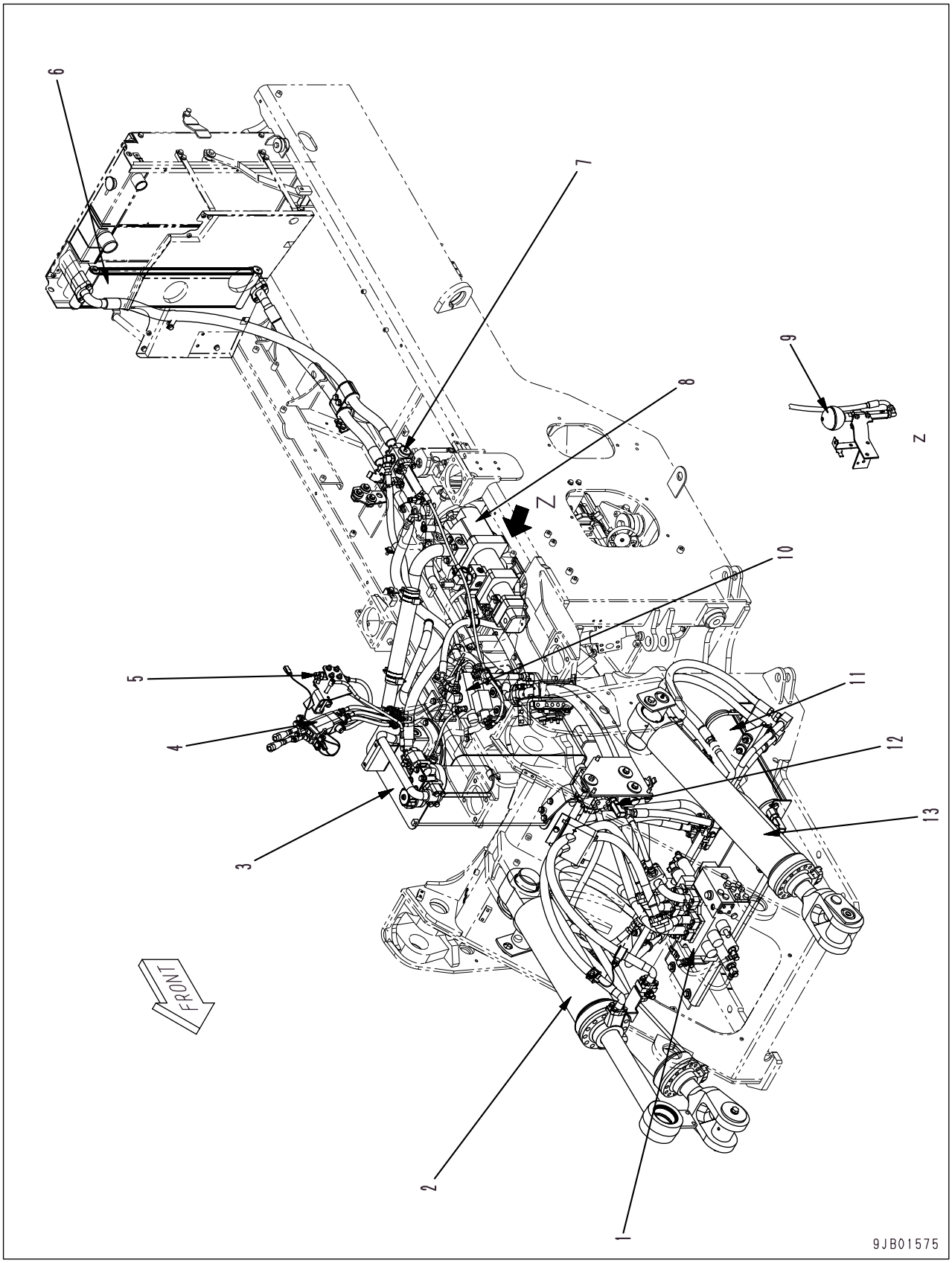
- The parking brake is a wet multiple-disc brake which mechanically brakes transmission output shaft (8).
- Lever (1) is connected to the control cable. If the parking brake lever is pulled, ball (3) between piston (4) connected to lever (1) and housing (2) moves on the inclined surface of the piston groove. As a result, piston (4) presses plates (5) and discs (6) to brake output shaft (8).

white 10-95

white 10-96

white 10-97

HYDRAULIC PIPING



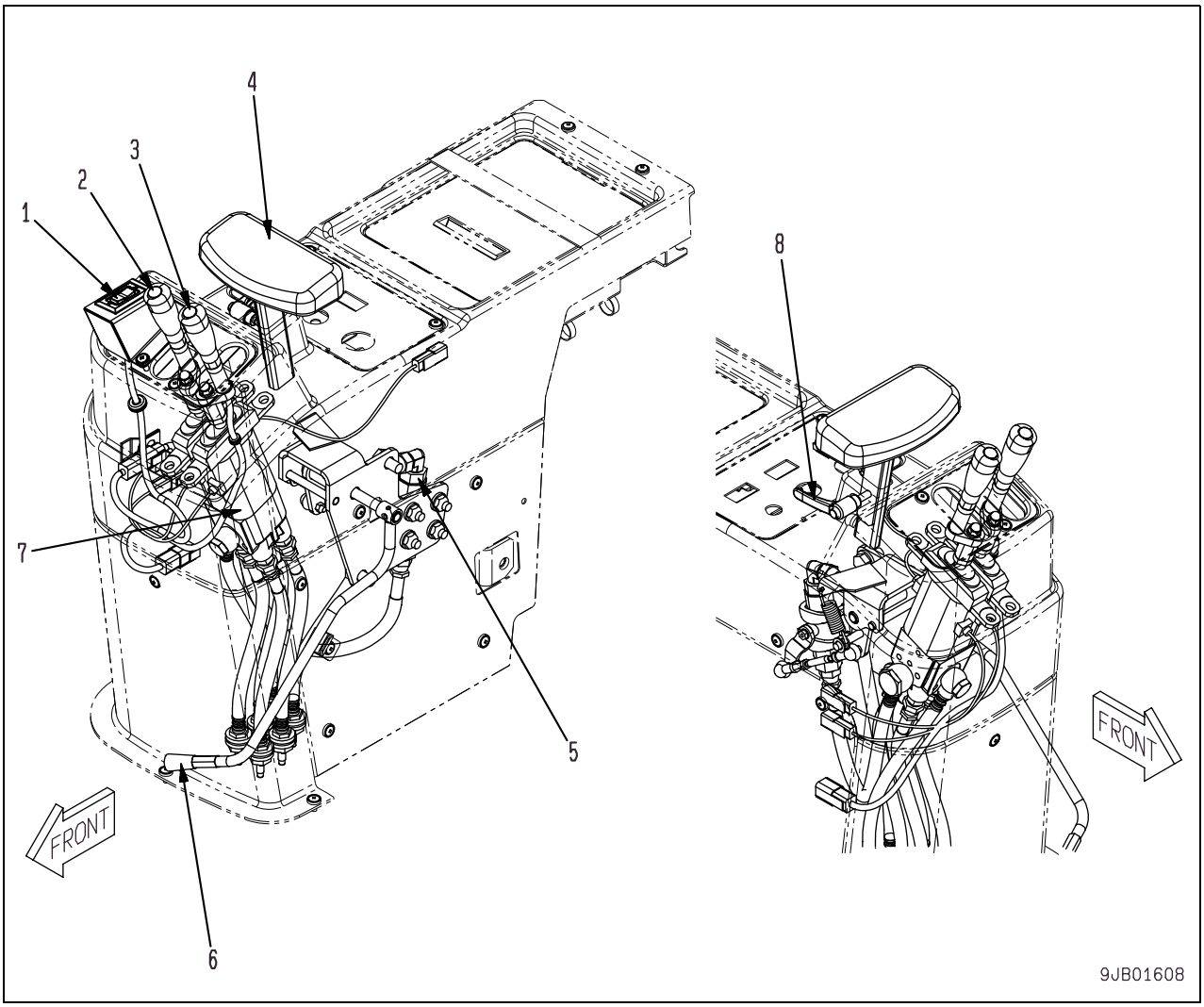
1. Work equipment control valve
2. Bucket cylinder
3. Hydraulic tank
4. Work equipment PPC valve
5. Lock valve
6. Oil cooler
7. Check valve
8. 4-gear pump unit
   - Steering pump
   - Work equipment pump
   - Brake and cooling fan pump
   - Transfer lubricating oil pump
9. Accumulator (for PPC circuit)
10. Cut-off valve
11. Accumulator (for travel damper)
12. Lift cylinder
13. Travel damper valve

Outline

- The hydraulic system consists of the HST, steering, work equipment, brake, cooling fan, and transfer lubricating circuit. Work equipment circuit controls the operation of the lift arm and bucket.
- The oil in hydraulic tank (3) is sent by the work equipment pump of 4-gear pump unit (8) to work equipment control valve (1). If both spools of the lift arm and bucket of work equipment control valve (1) are held, the oil flows through the drain circuit of work equipment control valve (1) and is filtrated by the return filter installed to hydraulic tank (3) and returns to hydraulic tank (3).
- If the work equipment control lever is operated, the spool of the lift arm or bucket of work equipment PPC valve (4) operates.
- The oil from the PPC valve hydraulically operates each spool of work equipment control valve (1) and flows to lift cylinder (12) or bucket cylinder (2) to move the lift arm or bucket.
- The maximum pressure in the hydraulic circuit is controlled by the relief valve in work equipment control valve (1). The bucket cylinder circuit has a safety valve (safety-suction valve) to protect itself.
- Accumulator (for PPC circuit) (9) is installed to the PPC pilot circuit so that the work equipment can be lowered to the ground even if the engine stops.
- Hydraulic tank (3) is pressurized, enclosed, and equipped with a breather which has a relief valve and which is also used as an oil filler cap. The breather pressurizes the tank and prevents generation of negative pressure and cavitation.

WORK EQUIPMENT LEVER LINKAGE

2-lever type

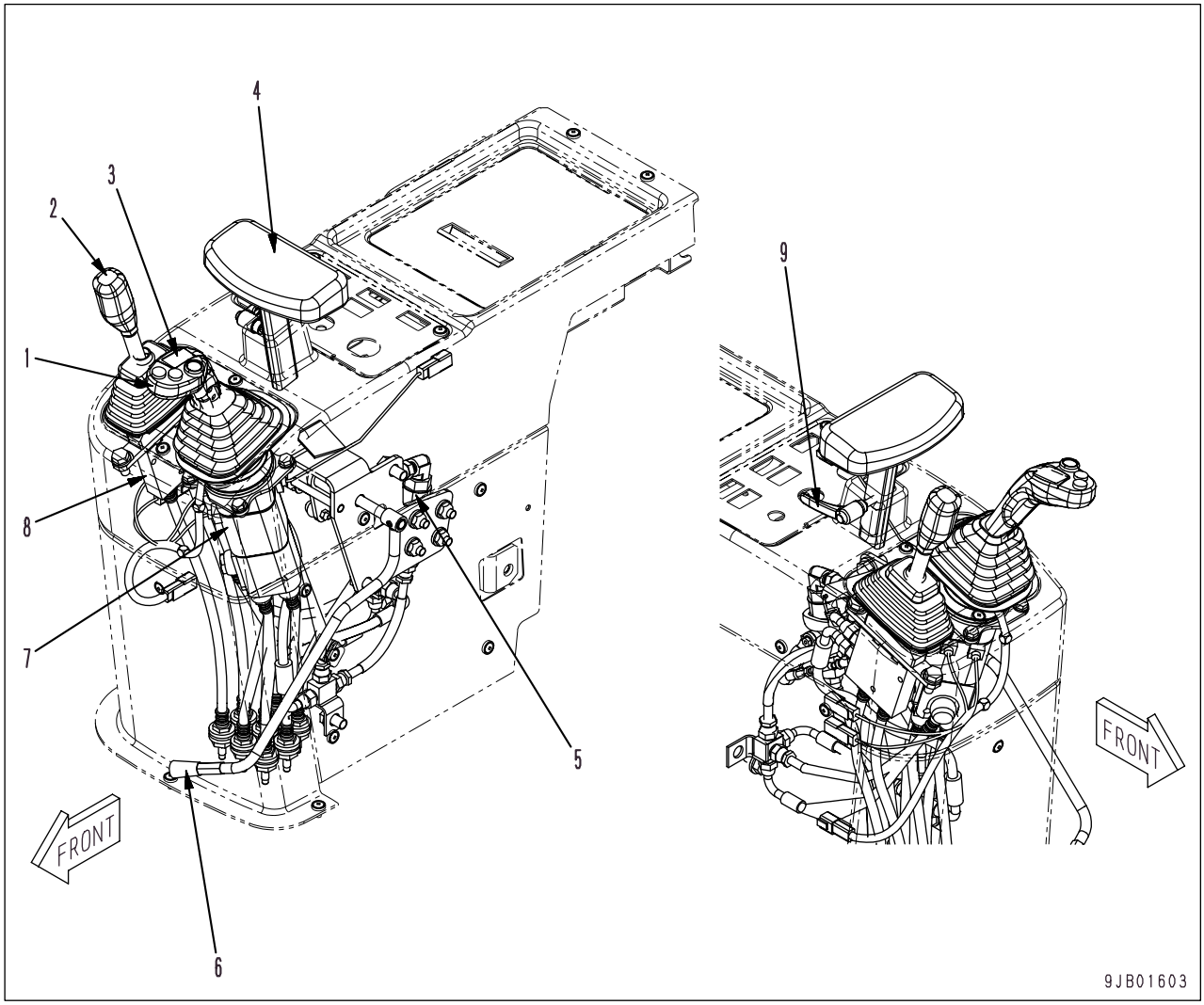


1. Forward-reverse shifting switch
2. Lift arm control lever
3. Bucket control lever
4. Wrist rest
5. Lock valve
6. Safety lock lever
7. Work equipment PPC valve
8. Wrist rest height adjustment lever

Multi function mono-lever type

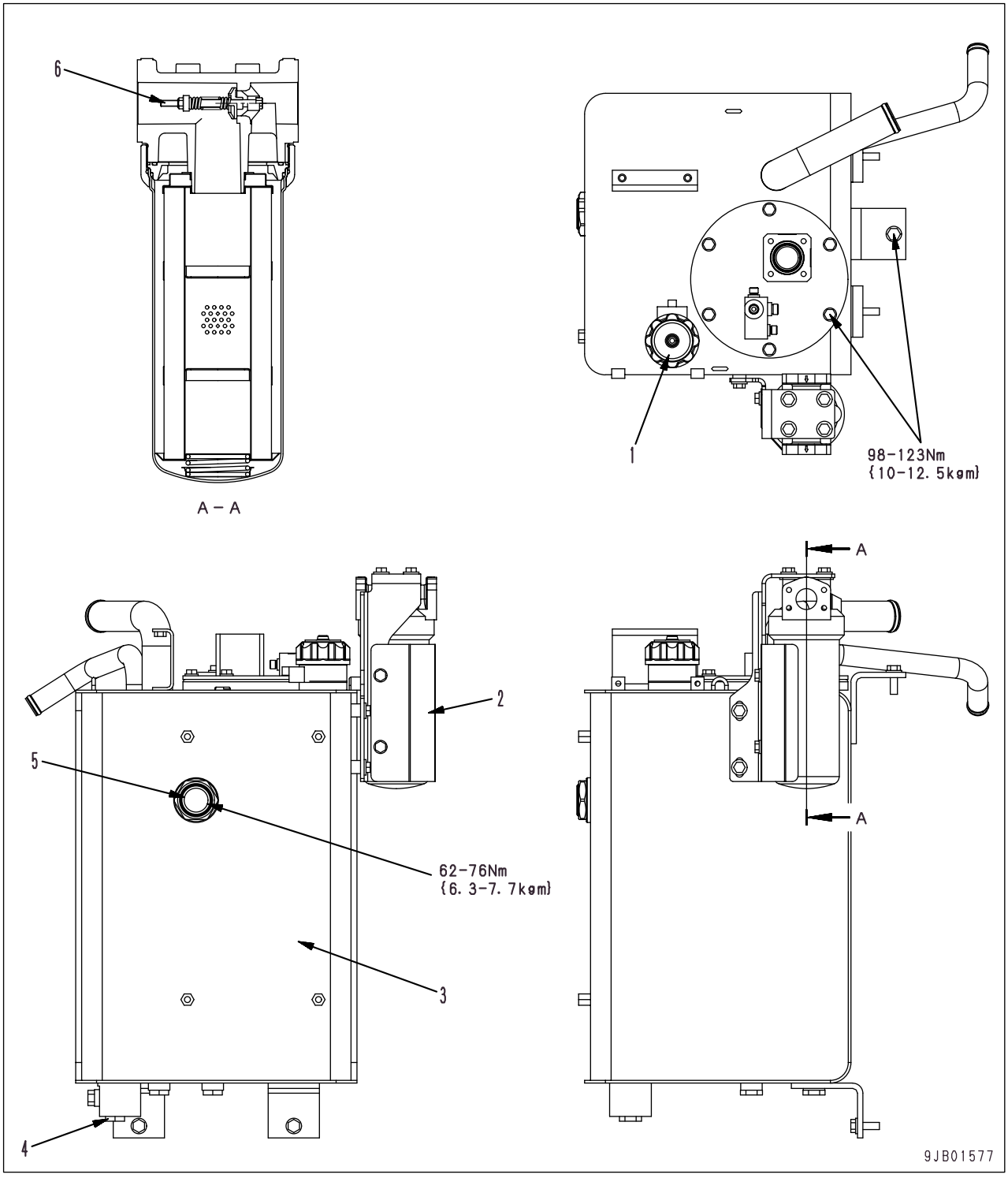
(If equipped)

★ The following figure shows the vehicle equipped with the attachment control lever.



1. Work equipment control lever
2. Attachment control lever
3. Forward-reverse shifting switch
4. Wrist rest
5. Lock valve
6. Safety lock lever
7. Work equipment PPC valve
8. Attachment PPC valve
9. Wrist rest height adjustment lever

HYDRAULIC TANK

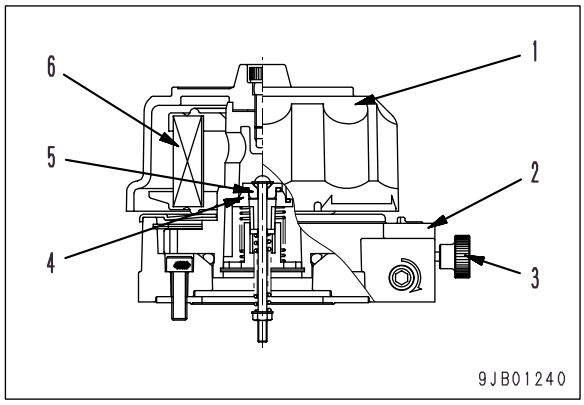


1. Oil filler cap / Breather
2. Return filter
3. Hydraulic tank
4. Drain plug
5. Sight gauge
6. Return filter bypass valve

Specifications

Tank capacity (ℓ)	124
Oil quantity inside the tank (ℓ)	89
Bypass valve setting pressure (MPa{kg/cm^2})	0.2 {2.04}

Breather



1. Oil filler cap
2. Case
3. Unlocking knob
4. Sleeve
5. Poppet
6. Filter element

Prevention of negative pressure in tank

- Since the hydraulic tank is pressurized and enclosed, negative pressure can be generated when the oil level in the tank lowers. At this time, sleeve (4) is opened by the pressure difference from the atmospheric pressure and the atmosphere flows in the tank to prevent generation of negative pressure.
  (Set pressure of air intake valve:
  3.0 ± 0.3 kPa {0.03 ± 0.003 kg/cm^2})

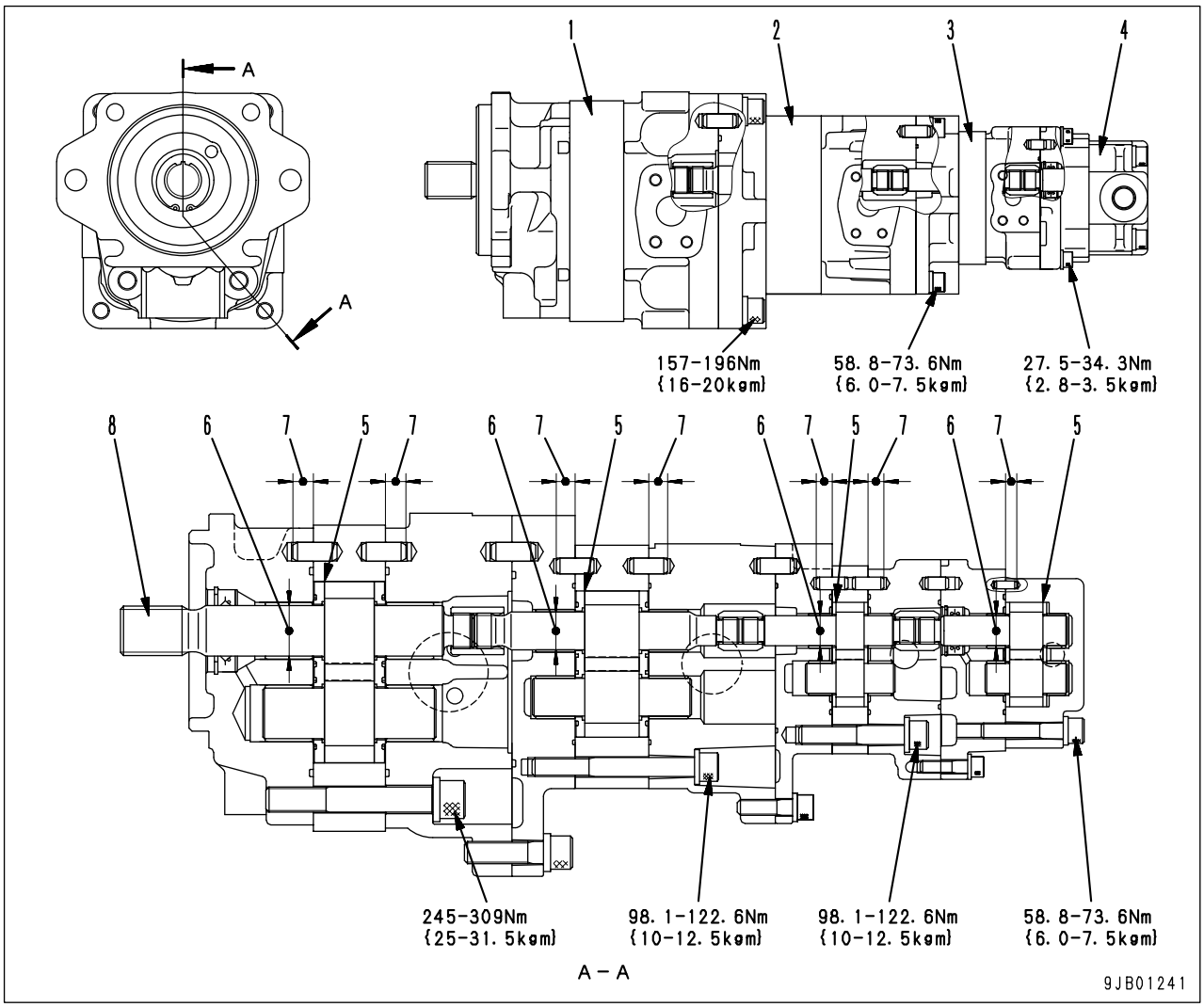
Prevention of rise of pressure in tank

- While the hydraulic circuit is in operation, the pressure in the hydraulic tank rises when the oil level in the hydraulic tank rises according to the operation of the hydraulic cylinders and when the temperature rises. If the pressure in the tank rises above the set pressure, poppet (5) operates to release the pressure from the tank.
  (Set pressure of exhaust valve:
  0.1 ± 0.015 MPa {1.0 ± 0.15 kg/cm^2})

4-GEAR PUMP UNIT

(Steering / Work equipment / Brake and cooling fan / Transfer lubricating oil)

SAR(3)90 + (2)32 + SBR(1)18 + 12



1. Steering pump
2. Work equipment pump
3. Brake and cooling fan pump
4. Transfer lubricating oil pump

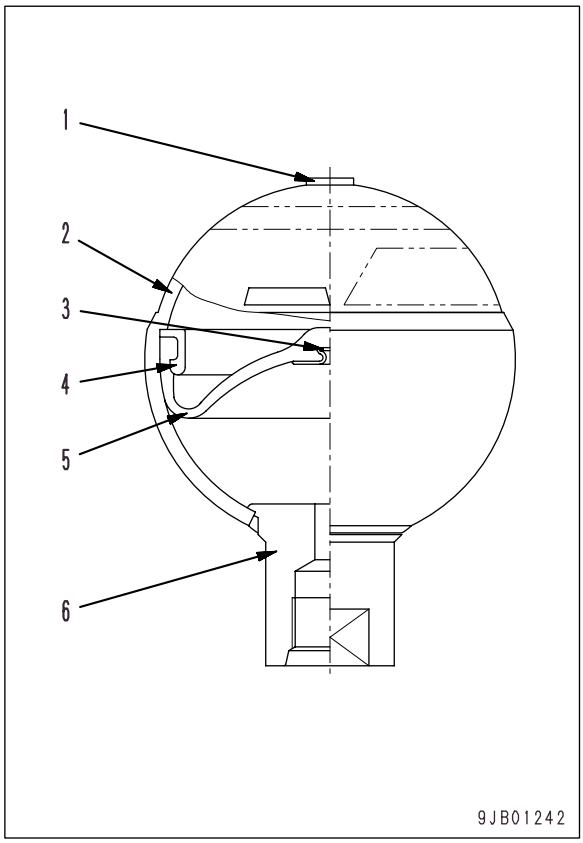
Outline

- The 4-gear pump unit is installed to the HST pump and driven through its shaft to supply hydraulic oil to the steering, work equipment, brake, cooling fan, and transfer.

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Side clearance</td><td>Model</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="12">Replace</td></tr>
<tr><td>SAR(3)90</td><td colspan="2" rowspan="4">0.10 – 0.15</td><td colspan="2" rowspan="4">0.19</td></tr>
<tr><td>SAR(2)32</td></tr>
<tr><td>SBR(1)18</td></tr>
<tr><td>SBR(1)12</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Clearance between inside diameter of plain bearing and outside diameter of gear shaft</td><td>SAR(3)90</td><td colspan="2">0.083 – 0.144</td><td colspan="2" rowspan="4">0.20</td></tr>
<tr><td>SAR(2)32</td><td colspan="2">0.071 – 0.121</td></tr>
<tr><td>SBR(1)18</td><td colspan="2" rowspan="2">0.068 – 0.115</td></tr>
<tr><td>SBR(1)12</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Diving depth of pin</td><td>Model</td><td>Standard size</td><td colspan="2">Tolerance</td><td>Repair limit</td></tr>
<tr><td>SAR(3)90</td><td>13</td><td colspan="2" rowspan="3">0
-0.5</td><td rowspan="4">–</td></tr>
<tr><td>SAR(2)32</td><td>12</td></tr>
<tr><td>SBR(1)18</td><td>10</td></tr>
<tr><td>SBR(1)12</td><td>7</td><td colspan="2">+0.5
0</td></tr>
<tr><td>8</td><td>Spline rotating torque</td><td colspan="6">13.8 – 28.5 Nm {1.4 – 2.9 kgm}</td><td rowspan="6">–</td></tr>
<tr><td rowspan="5">–</td><td rowspan="5">Discharge amount
Oil: SAE10W
Oil temperature: 45 - 55°C</td><td>Model</td><td>Speed (rpm)</td><td>Discharge pressure (MPa {kg/cm^2})</td><td>Standard discharge amount (ℓ/min)</td><td>Discharge amount limit (ℓ/min.)</td></tr>
<tr><td>SAR(3)90</td><td rowspan="4">2,500</td><td rowspan="3">20.6 {210}</td><td>129</td><td>119</td></tr>
<tr><td>SAR(2)32</td><td>91</td><td>82</td></tr>
<tr><td>SBR(1)18</td><td>23</td><td>21</td></tr>
<tr><td>SBR(1)12</td><td>2.9 {30}</td><td>27</td><td>24</td></tr>
</table>

ACCUMULATOR (FOR PPC CIRCUIT)



1. Gas plug
2. Shell
3. Poppet
4. Holder
5. Bladder
6. Oil port

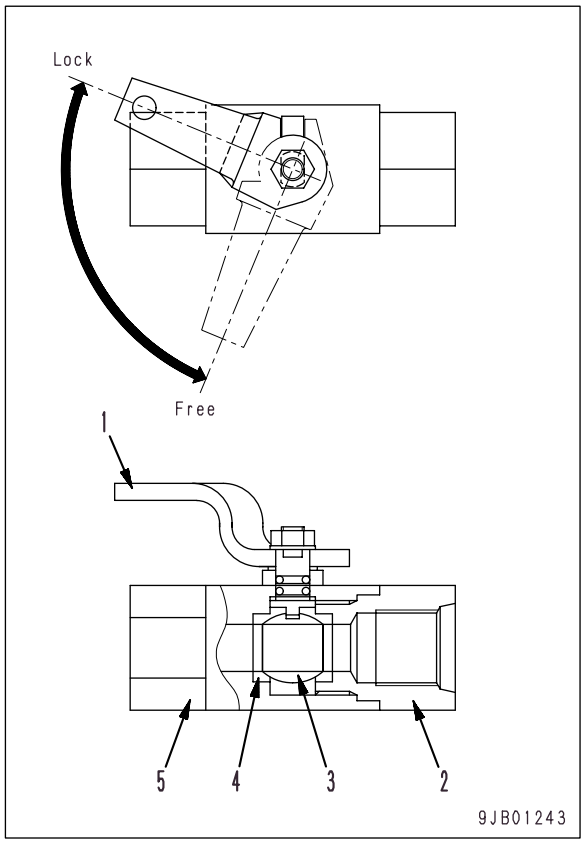
Outline

- The accumulator is installed between the HST charge pump and work equipment PPC valve. Even if the engine stops with the work equipment raised, the pressure of the compressed nitrogen gas in the accumulator sends the pilot oil pressure to the work equipment control valve to operate the valve so that the work equipment will lower by its weight.

Specifications

Gas used: Nitrogen gas
Amount of gas: 300 cc
Charge pressure: 1.18 MPa {12 kg/cm^2}) (at 80°C)
Max. using pressure: 6.86 MPa {70 kg/cm^2}

LOCK VALVE



1. Lever
2. End cap
3. Ball
4. Seat
5. Body

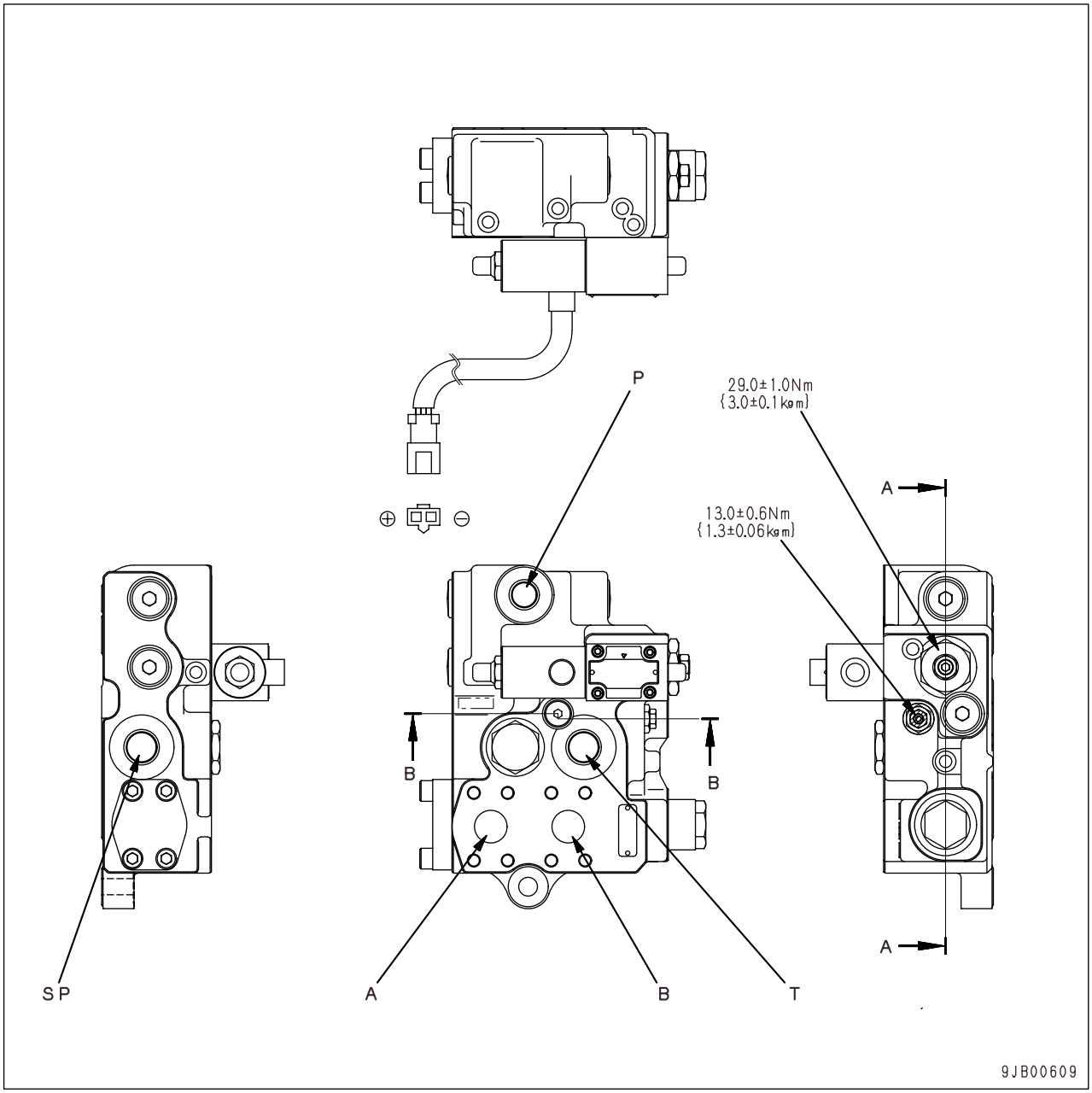
Outline

- The lock valve is installed between the HST charge pump and work equipment PPC valve. If the safety lock lever is set in the LOCK position, the lock valve operates to shut off the oil in the PPC circuit so that the work equipment cannot be operated.

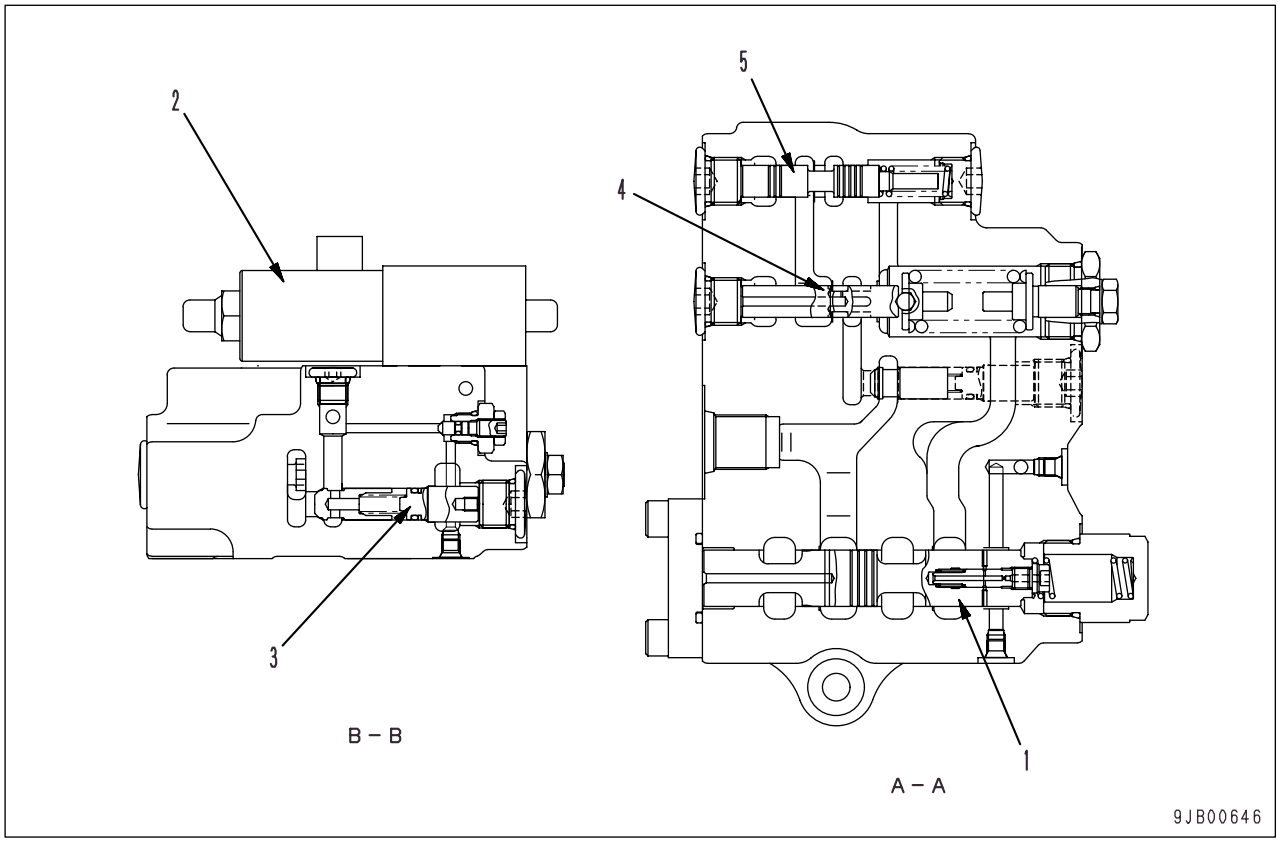
E. C. S. S. VALVE

(E. C. S. S. : Electronically Controlled Suspension System)

(If equipped)



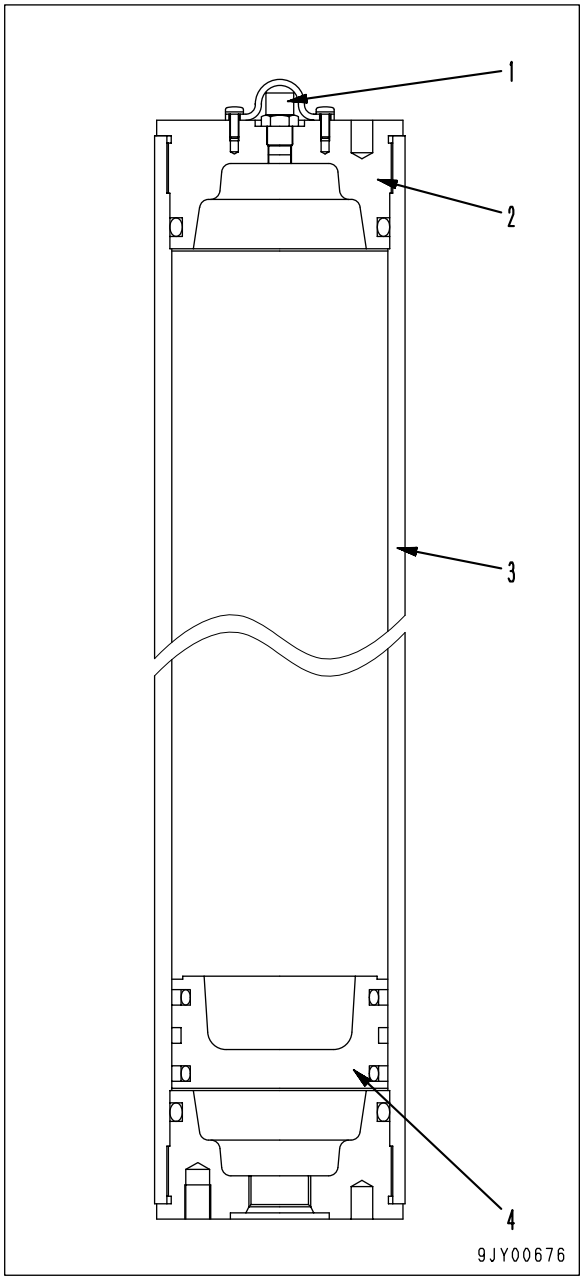
P: From work equipment pump
T: To hydraulic tank
A: From lift arm cylinder bottom
B: From lift arm cylinder head
SP: To accumulator (for E. C. S. S.)



1. Main spool
2. Solenoid valve
3. Flow control valve
4. Shuttle valve
5. Charge valve

ACCUMULATOR (FOR E. C. S. S.)

(If equipped)



1. Valve
2. Top cover
3. Cylinder
4. Free piston

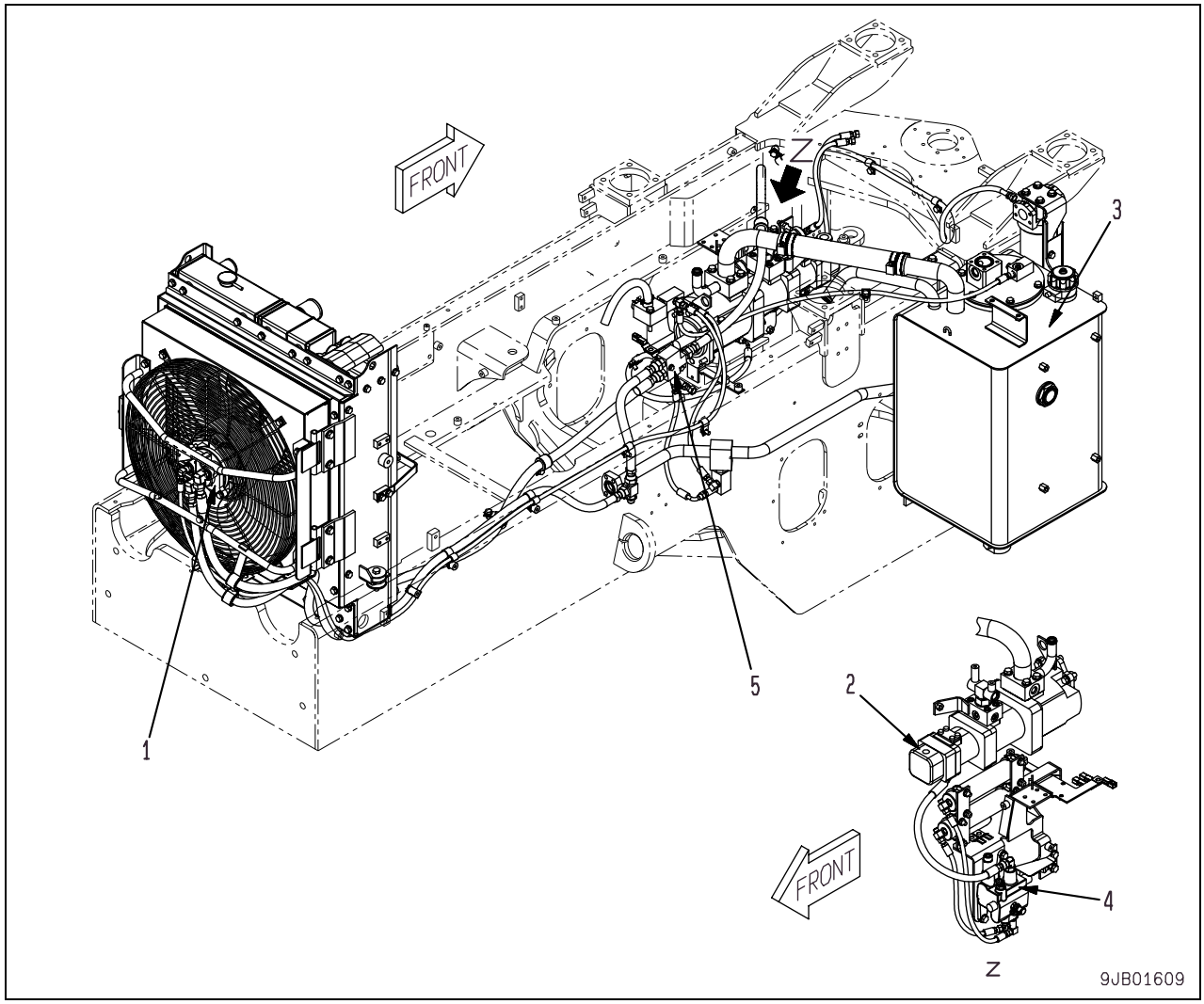
Function

- The accumulator is installed in the lift cylinder bottom circuit and the space between cylinder (3) and free piston (4) is filled with compressed nitrogen gas. The hydraulic pulses generated on the lift cylinder bottom side during travel are absorbed by the compressed nitrogen gas to improve the travel performance and operating performance.

Specifications

Gas used:	Nitrogen gas
Amount of gas:	3,000 cc
Charge pressure:	2.0 ± 0.1 MPa {20 ± 1.0 kg/cm^2} (at 20°C)

HYDRAULIC PIPING OF COOLING SYSTEM

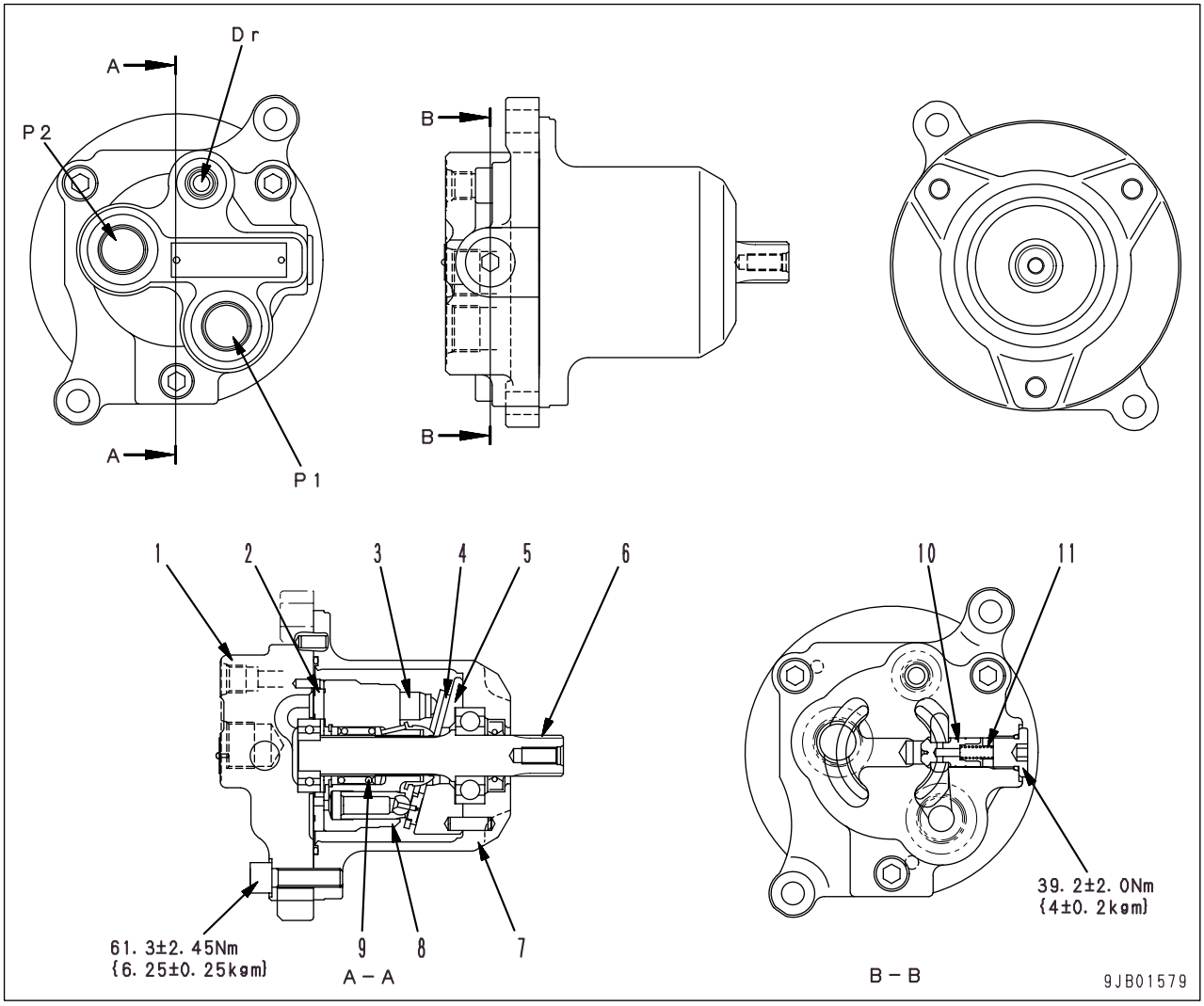


1. Cooling fan motor
2. Brake and cooling fan pump
3. Hydraulic tank
4. Charge valve
5. Priority valve

Outline

- Cooing fan motor (1) installed to the radiator is driven hydraulically by brake and cooling fan pump (2).

COOLING FAN MOTOR



P1: From charge valve
P2: To hydraulic tank
Dr: To hydraulic tank

1. Port block
2. Valve plate
3. Piston
4. Shoe
5. Thrust plate
6. Output shaft
7. Case
8. Cylinder block
9. Center spring
10. Check valve
11. Check valve spring

Specifications

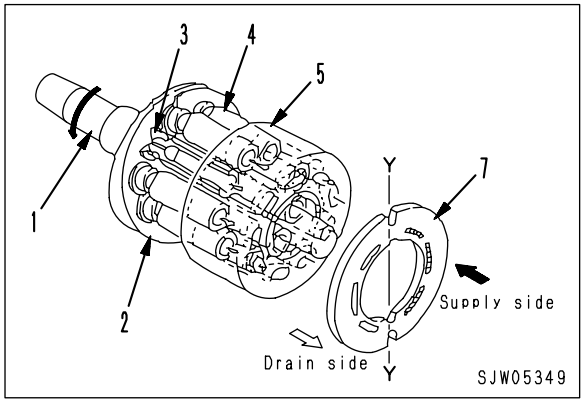
Model	MSF-18-16
Type	Fixed displacement swash plate-type piston motor
Theoretical capacity (cc/rev)	16.0
Rated speed (rpm)	1,700
Rated capacity (ℓ/min)	29.3

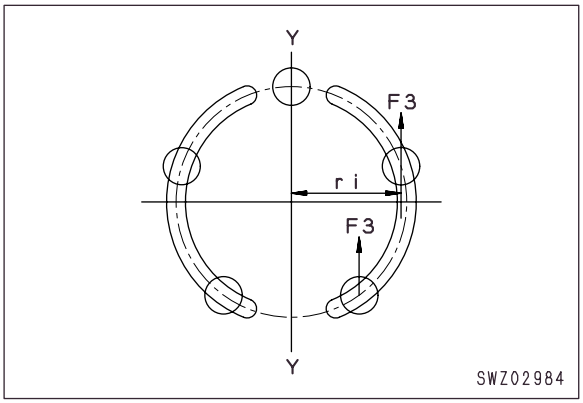
Function

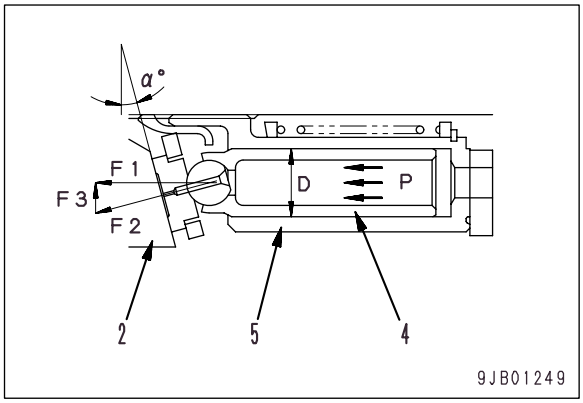
- This hydraulic motor is a swash plate-type axial piston motor, which converts the pressure of the hydraulic oil sent from the hydraulic pump into revolution.

Principle of operation

- The oil sent from the hydraulic port flows through valve plate (7) into cylinder block (5).
  This oil can flow on only one side of the Y-Y line connecting the top dead center and bottom dead center of the stroke of piston (4).
- The oil sent to one side of cylinder block (5) pressed pistons (4) (2 or 3 pieces) and generates force F1 (F1 kg=P kg/cm^2 x ✕/4 D2 cm^2).
- This force is applied to thrust plate (2). Since thrust plate (2) is fixed to the angle of Eo degrees to the output shaft (1), the force is divided into components F2 and F3.
- The radial components F3 generates torque against the Y-Y line connecting the top dead center and bottom dead center (T = F3 x ri).
- The resultant of this torque [T = Σ (F3 x ri)] rotates the cylinder block (5) throught the piston.
- Since the cylinder block (5) is coupled with the output shaft by means of spline, the output shaft (1) revolves to transmit the torque.







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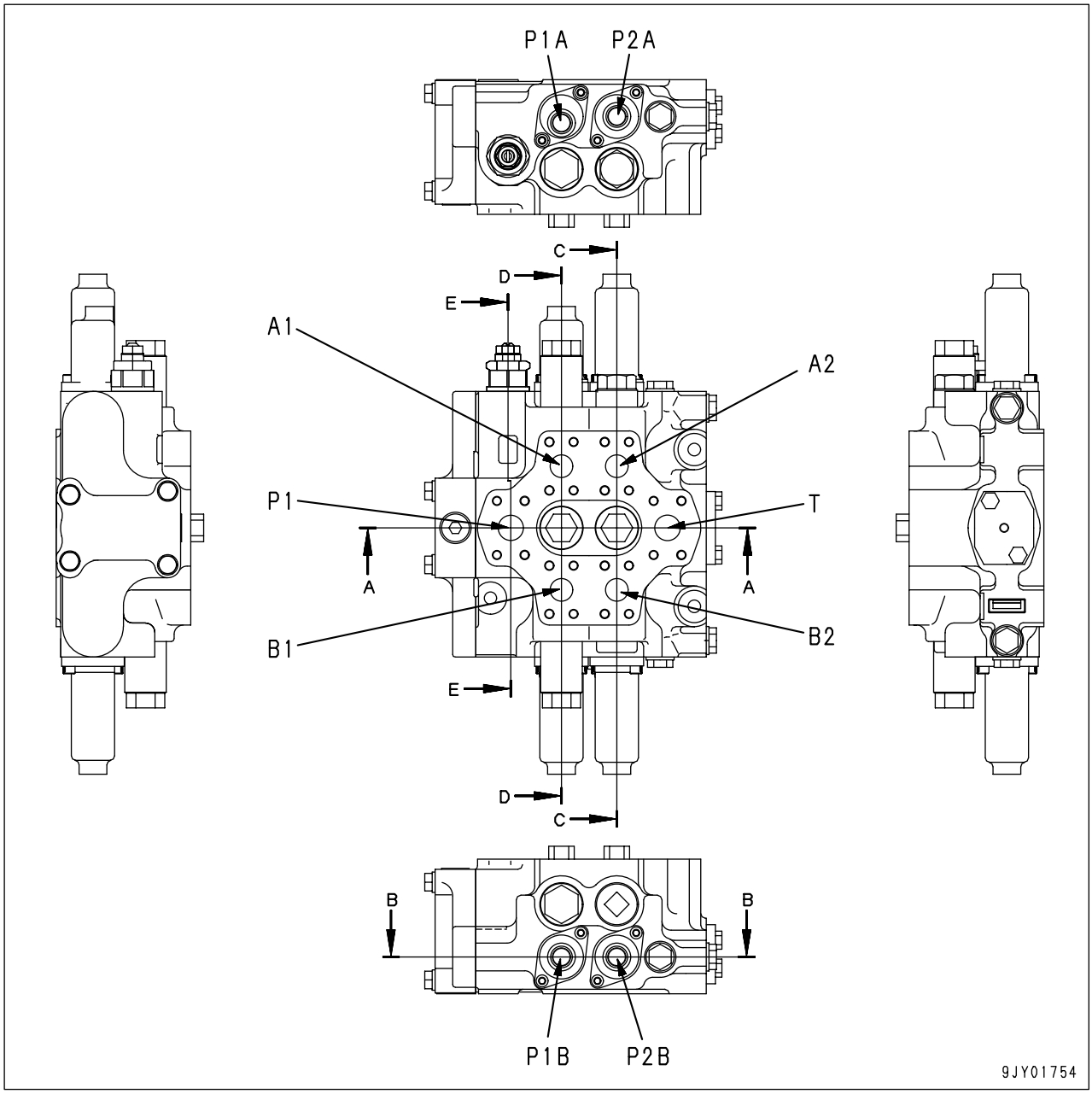
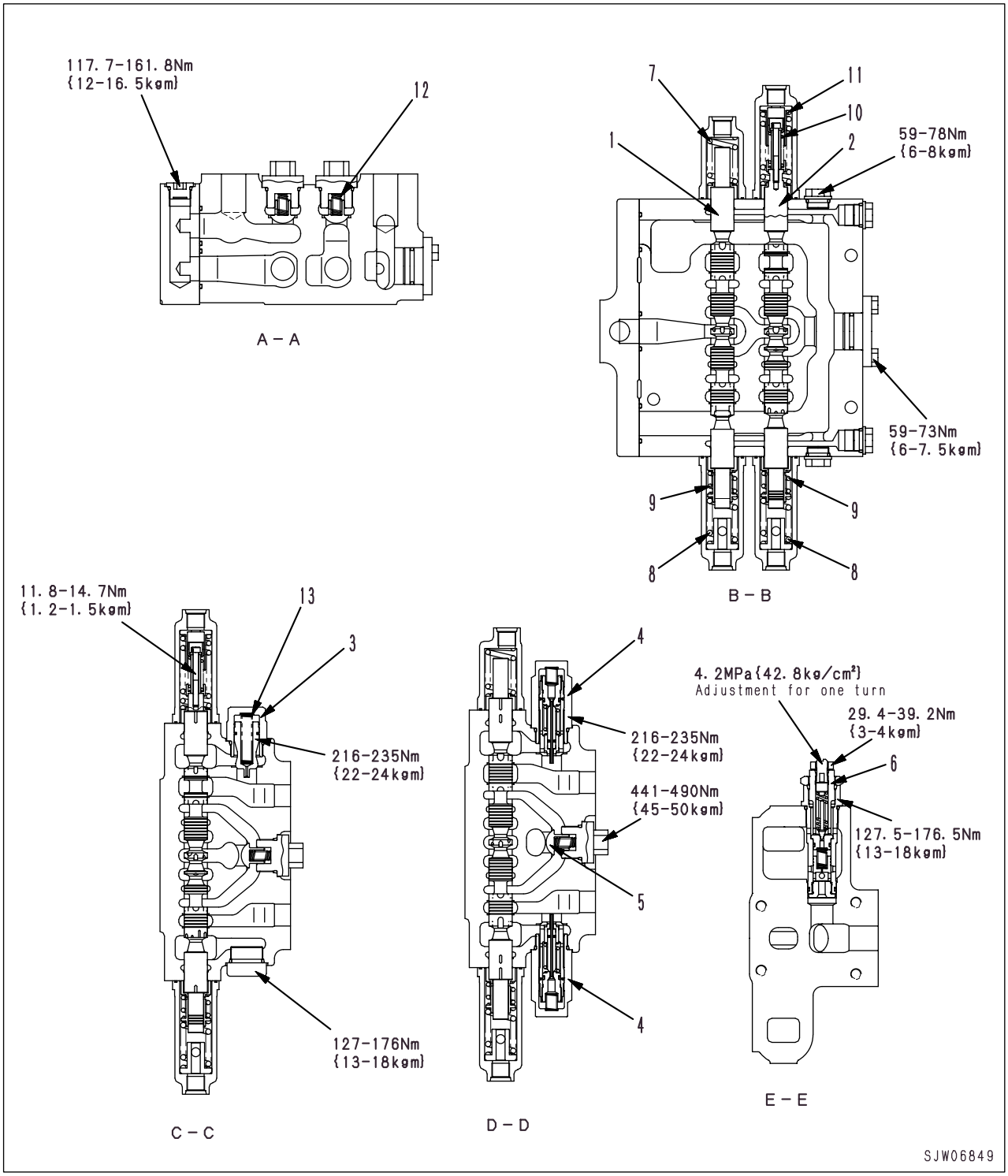
WORK EQUIPMENT CONTROL VALVE

1. 2-Spool valve



P1: From steering pump
T: Drain port (To tank)
A1: To bucket cylinder head
A2: To lift arm cylinder head
B1: To bucket cylinder bottom
B2: To lift arm cylinder bottom

P1A:From PPC valve P1 port
P1B:From PPC valve P2 port
P2A:From PPC valve P3 port
P2B:From PPC valve P4 port



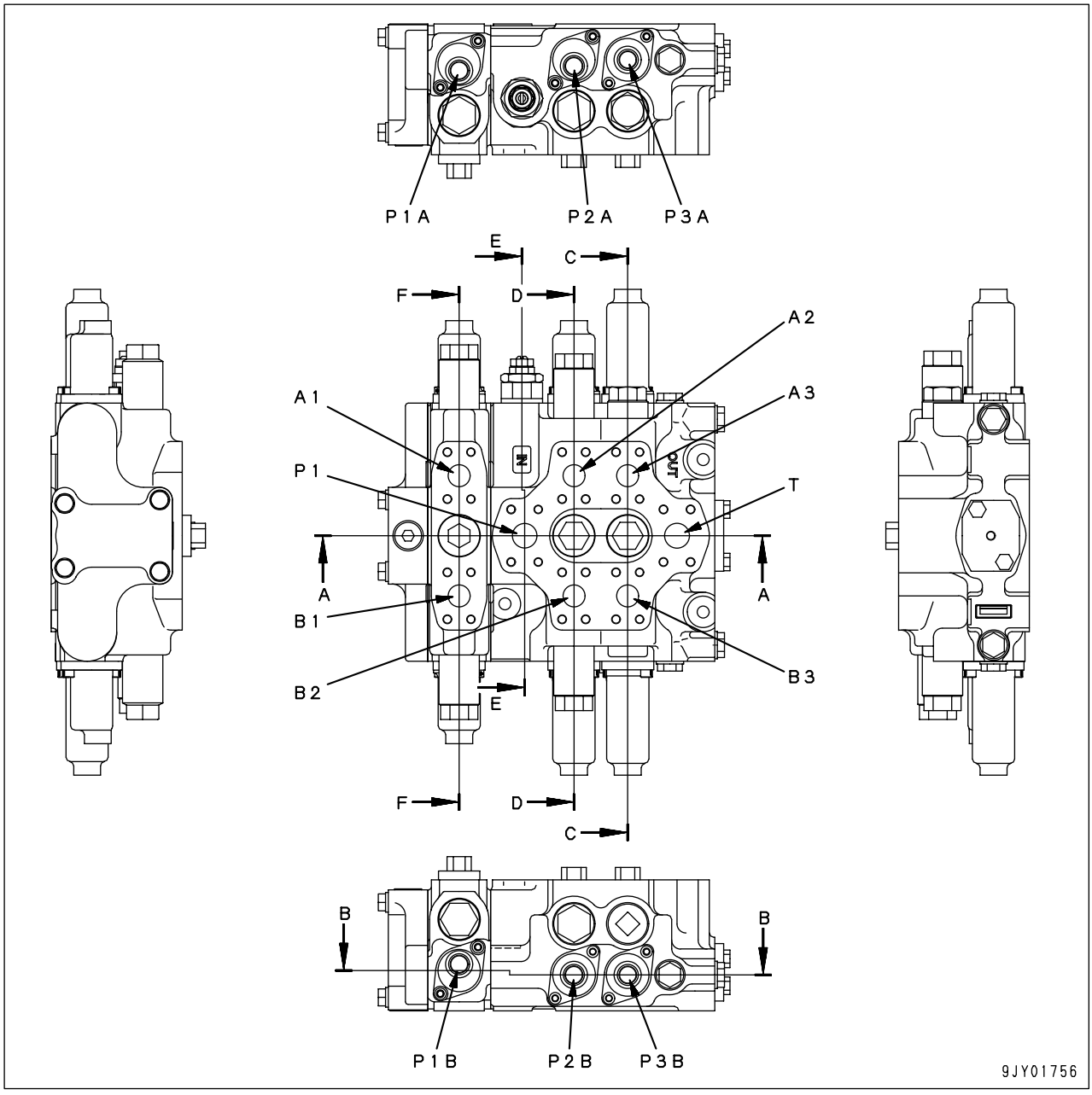
1. Bucket spool
2. Lift arm spool
3. Suction valve
4. Safety-suction valve
5. Check valve
6. Main relief valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
7	Spool return spring (for bucket)	Free length X Outside diameter	Installed length	Installed load	Free length	Installed load	
		54.8 x 34	53.5	125 N {12.7 kg}	—	100 N {10.2 kg}	
8	Spool return spring (for bucket and lift arm)	54.8 x 33.7	52.2	207.9 N {21.2 kg}	—	167 N {17 kg}	
9	Spool return spring (for bucket and lift arm)	30.7 x 32.5	26.5	255 N {26 kg}	—	204 N {20.8 kg}	Replace spring If damaged or replaced
10	Spool return spring (for lift arm)	51.9 x 16.9	40	182.4 N {18.6 kg}	—	146 N {14.9 kg}	
11	Spool return spring (for lift arm)	87.6 x 34.7	83.5	229.5 N {23.4 kg}	—	183 N {18.7 kg}	
12	Check valve spring	32.6 x 10.9	24.5	44.1 N {4.5 kg}	—	35.3 N {3.6 kg}	
13	Suction valve spring	64.9 x 12.5	56	6.4 N {0.65 kg}	—	5.1 N {0.52 kg}	

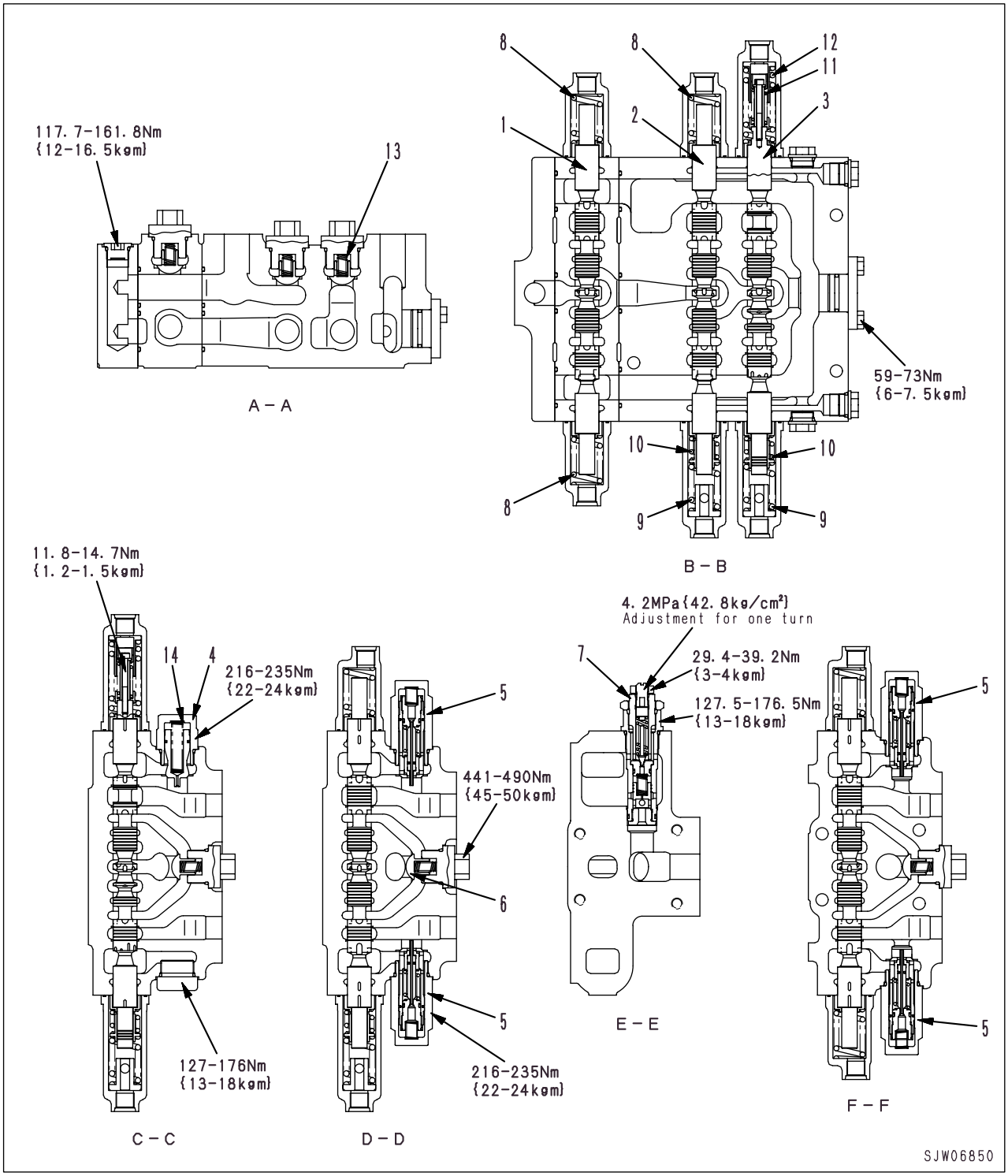
white 10-118

2. 3-spool valve



P1: From steering pump
T: Drain port (To tank)
A1: To attachment cylinder head
A2: To bucket cylinder head
A3: To lift arm cylinder head
B1: To attachment cylinder bottom
B2: To bucket cylinder bottom
B3: To lift arm cylinder bottom

P1A:From attachment PPC valve
P1B:From attachment PPC valve
P2A:From PPC valve P1 port
P2B:From PPC valve P3 port
P3A:From PPC valve P2 port
P3B:From PPC valve P4 port

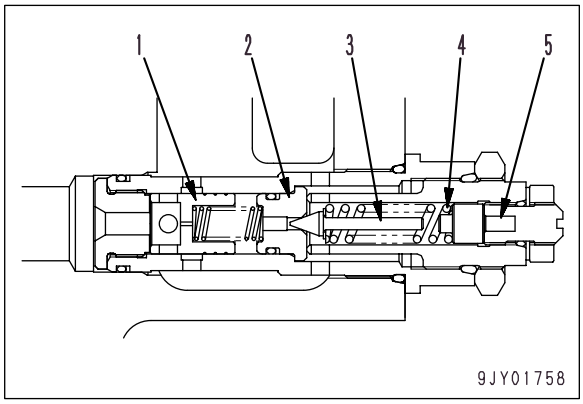


1. Attachment spool
2. Bucket spool
3. Lift arm spool
4. Suction valve
5. Safety-suction valve
6. Check valve
7. Main relief valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
8	Spool return spring (for bucket and attachment)	Free length X Outside diameter	Installed length	Installed load	Free length	Installed load	Replace spring If damaged or replaced
		54.8 x 34	53.5	125 N {12.7 kg}	—	100 N {10.2 kg}	
9	Spool return spring (for bucket and lift arm)	54.8 x 33.7	52.2	207.9 N {21.2 kg}	—	167 N {17 kg}	
10	Spool return spring (for bucket and lift arm)	30.7 x 32.5	26.5	255 N {26 kg}	—	204 N {20.8 kg}	
11	Spool return spring (for lift arm)	51.9 x 16.9	40	182.4 N {18.6 kg}	—	146 N {14.9 kg}	
12	Spool return spring (for lift arm)	87.6 x 34.7	83.5	229.5 N {23.4 kg}	—	183 N {18.7 kg}	
13	Check valve spring	32.6 x 10.9	24.5	44.1 N {4.5 kg}	—	35.3 N {3.6 kg}	
14	Suction valve spring	64.9 x 12.5	56	6.4 N {0.65 kg}	—	5.1 N {0.52 kg}	

3. Relief valve



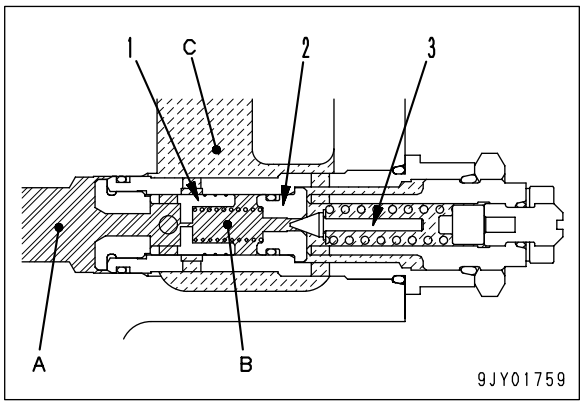
1. Main valve
2. Poppet seat
3. Pilot poppet
4. Spring
5. Adjustment screw

Function

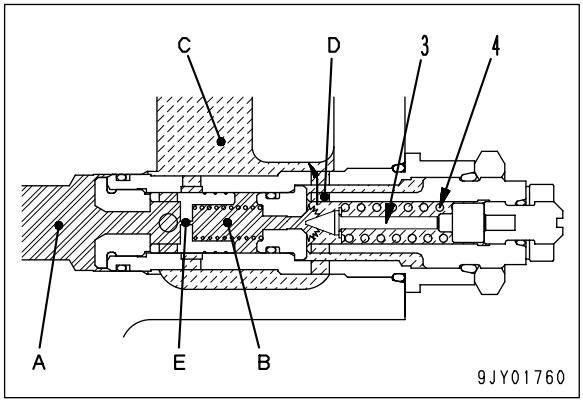
- The relief valve is installed at the inlet of the work equipment control valve and drains the oil into the hydraulic tank when the oil pressure rises above the set level. In other words, the relief valve limits the pressure in the work equipment circuit to protect the circuit.

Operation

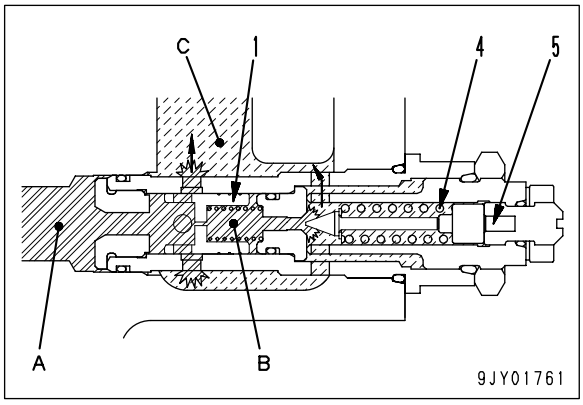
- Port A is connected to the pump circuit and port C is connected to the drain circuit. Oil flows through the orifice of main valve (1) and fills port B. Pilot poppet (3) is in contact with (seated on) poppet seat (2).



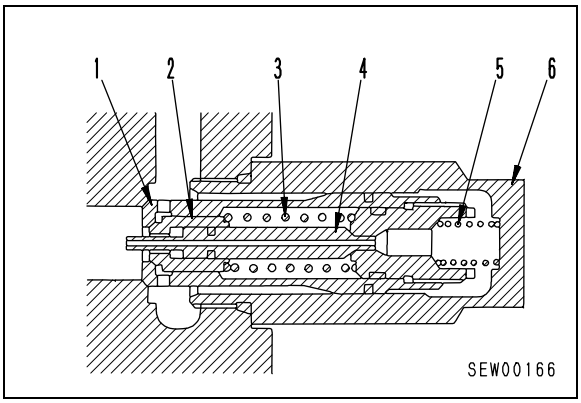
- If the oil pressure in ports A and B reaches the set pressure of pilot poppet spring (4), pilot poppet (3) opens.
- The oil in port A flows through orifice E to ports B, D, and C.
- As a result, differential pressure is made between ports A and B.



- The differential pressure between ports A and B pushes the main valve open, then the oil in port A flows through port C to the drain circuit to let the abnormal pressure escape.
- The set pressure can be changed by increasing or decreasing the tension of pilot poppet spring (4).
- To change the set pressure, loosen the locknut. Then, tighten or loosen adjustment screw (5) to heighten or lower the set pressure.



4. Safety-suction valve



1. Suction valve
2. Main valve
3. Main valve spring
4. Pilot piston
5. Suction valve spring
6. Valve body

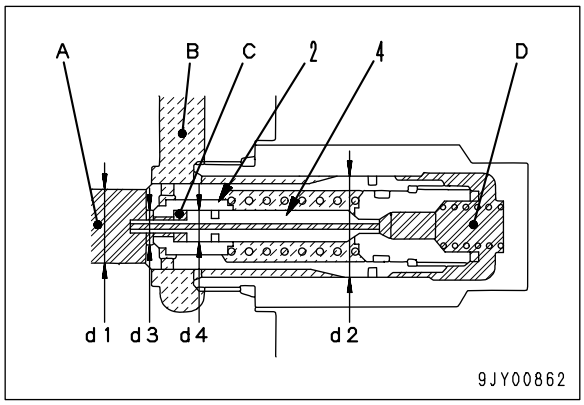
Function

- The safety-suction valve is installed to the bucket cylinder circuit in the work equipment control valve. When an impact is applied to the bucket cylinder and abnormal pressure is generated while the bucket control lever is in neutral, the safety-suction valve releases the abnormal pressure to protect the cylinder.
- When negative pressure is generated in the cylinder circuit, the safety-suction valve works as a suction valve.

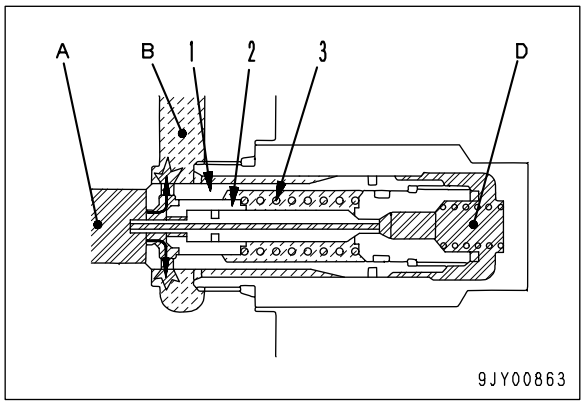
Operation

(1) Operation as safety valve

- Ports A and B are connected to the cylinder circuit and drain circuit respectively.
- The hydraulic oil in port A flows through the hole of pilot piston (4) to port D. It also flows through the orifice consisting of main valve (2) and pilot piston (4) to port C.
- Pilot piston (4) is fixed to the safety valve and the order of the diameters (areas) of the sections is d2 > d1 > d3 > d4.

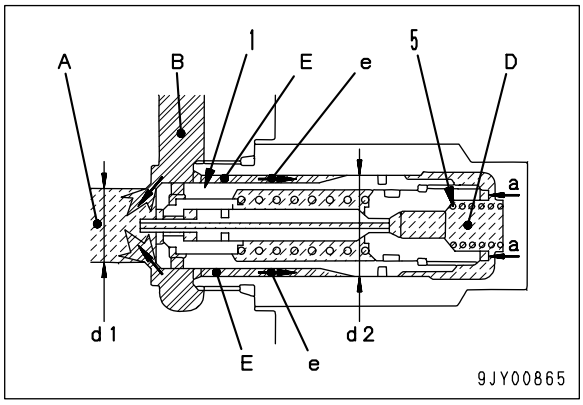


- If abnormal pressure is generated in port A, suction valve (1) does not operate since d2 > d1. At this time, however, main valve (2) receives oil pressure for the differential area between d3 and d4 since d3 of port A > d4 of port C.
- If the abnormal pressure reaches the set pressure of main valve spring (3), main valve (2) operates and the oil in port A flows to port B.

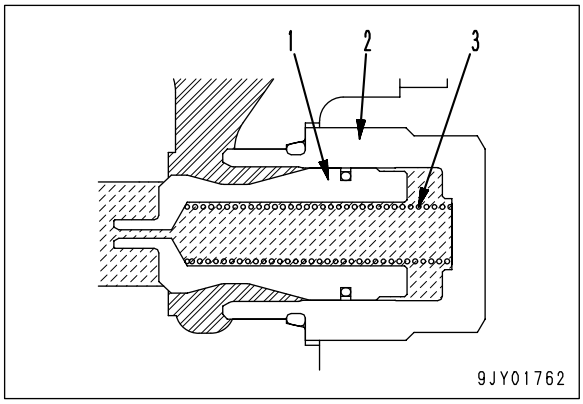


(2) Operation as suction valve

- When negative pressure is generated in port A, the pressure in port D which is connected to port A becomes negative.
- Since the tank pressure of port B is applied to port E, the safety valve receives oil pressure "e" for the differential area between d2 and d2.
- Accordingly, oil pressure "e" is applied in the opening direction of the valve and oil pressure "a" is applied in the closing direction of suction valve (1).
- When the pressure in port A lowers and becomes almost negative, it is lower than oil pressure "e".
- When oil pressure "e" > oil pressure "a" + force of valve spring (5), suction valve (1) opens and the oil flows through port B to port A, thus the pressure in port A does not become negative.



5. Suction valve



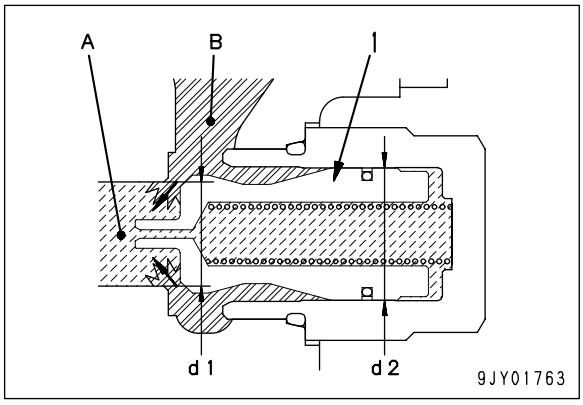
1. Main poppet
2. Sleeve
3. Spring

Function

- This valve prevents negative pressure in the circuit.

Operation

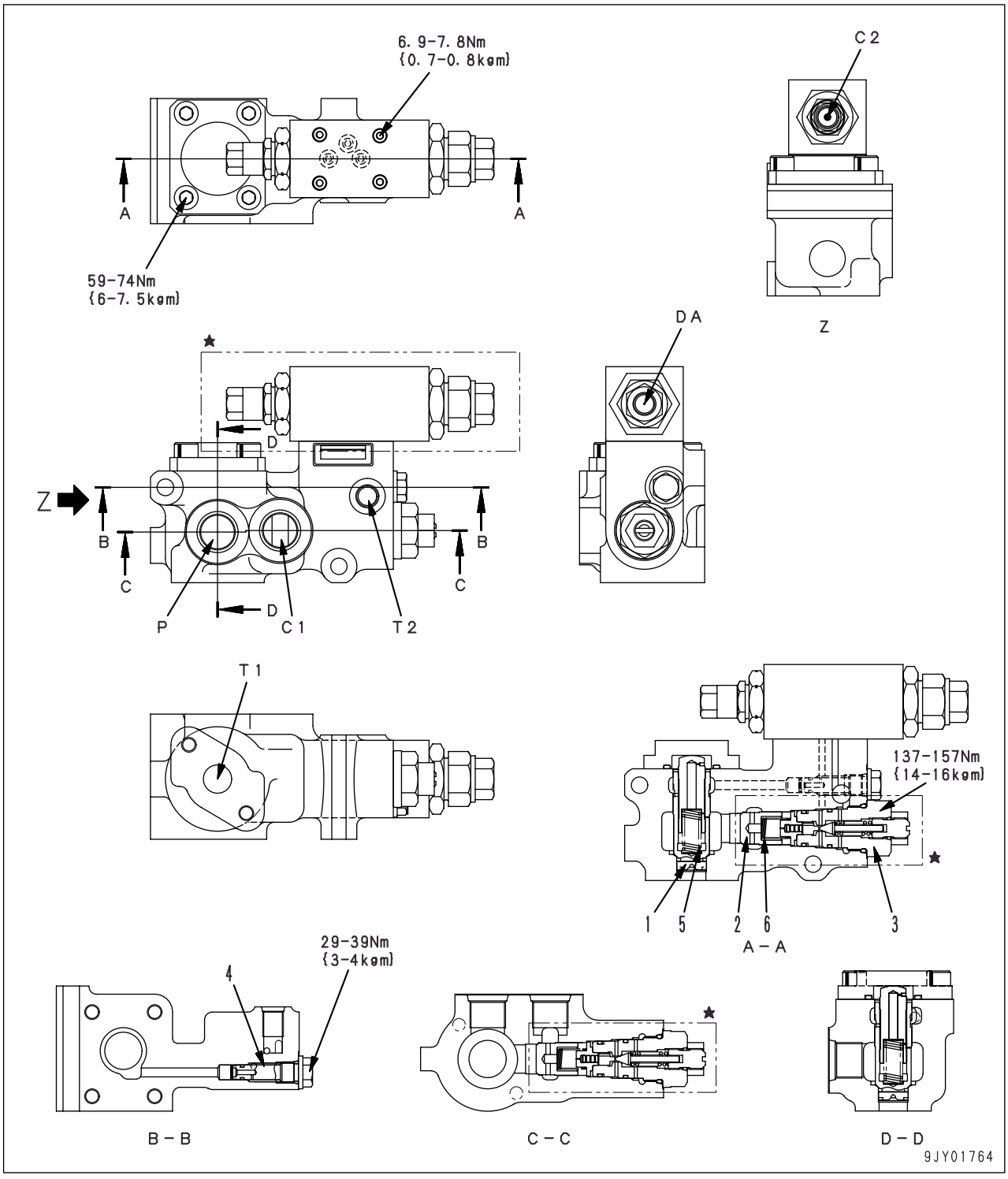
- When negative pressure is generated in port A (lift arm cylinder head) (When the pressure in port A is lower than the pressure in tank circuit port B), main poppet (1) opens because of the differential area between d1 and d2 and the oil flows through tank port B to cylinder port A.



White 10-125

6. Cut-off valve

★ Do not disassemble the cut-off valve. If it is disassembled, its set pressure must be adjusted.



P: From work equipment pump
C1: To work equipment control valve
C2: From work equipment control valve
DA: DA port pressure
T1: To tank
T2: To tank

1. Unload valve
2. Check valve
3. Cut-off relief valve
4. Screen

Unit: mm

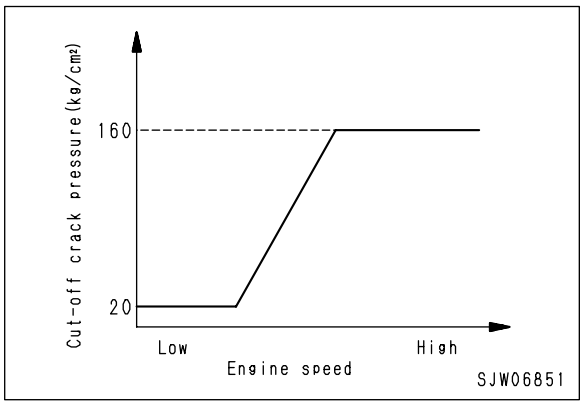
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
5	Unload valve spring	Free length X Outside diameter	Installed length	Installed load	Free length	Installed load	Replace spring If damaged or replaced
		36.95 x 12.6	30	35.3 N {3.6 kg}	—	28.4 N {2.9 kg}	
6	Check valve spring	33 x 13.8	20	1.7 N {0.17 kg}	—	1.4 N {0.14 kg}	

Function

- The cut-off valve is installed between the switching pump and work equipment control valve. It sends the oil from the switching pump to the work equipment control valve or drains it to control the work equipment speed according to the working condition.

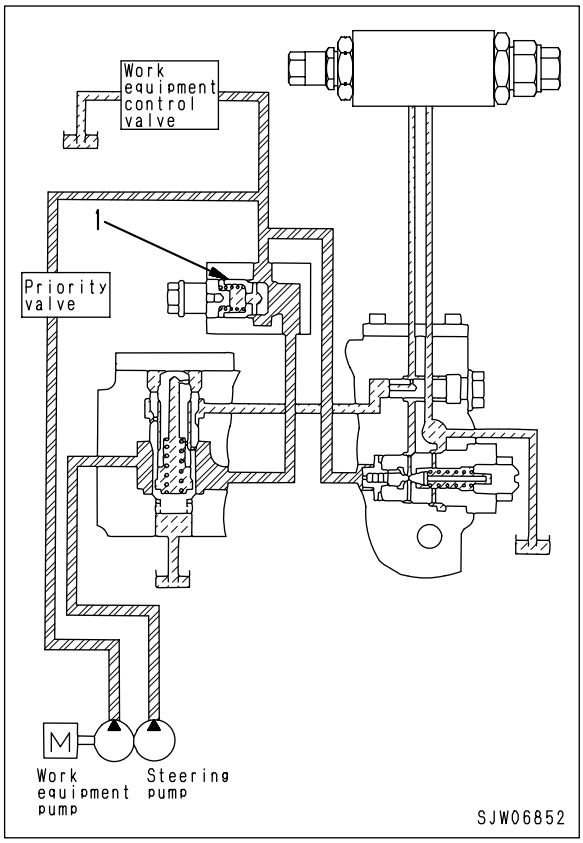
Operating condition of cut-off valve

- While the engine speed is in the low range, the cut-off valve operates at low pressure.



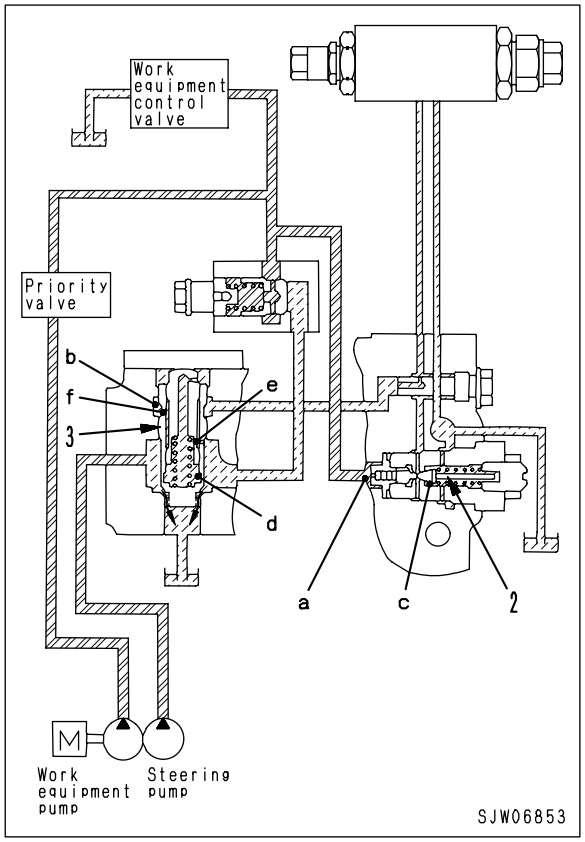
(1) When work equipment pump pressure is lower than cut-off pressure

- Similarly to the state where the work equipment valve is held, the oil of the work equipment pump pushes up check valve (1) and merges with the oil from the steering pump and then flows into the work equipment control valve.



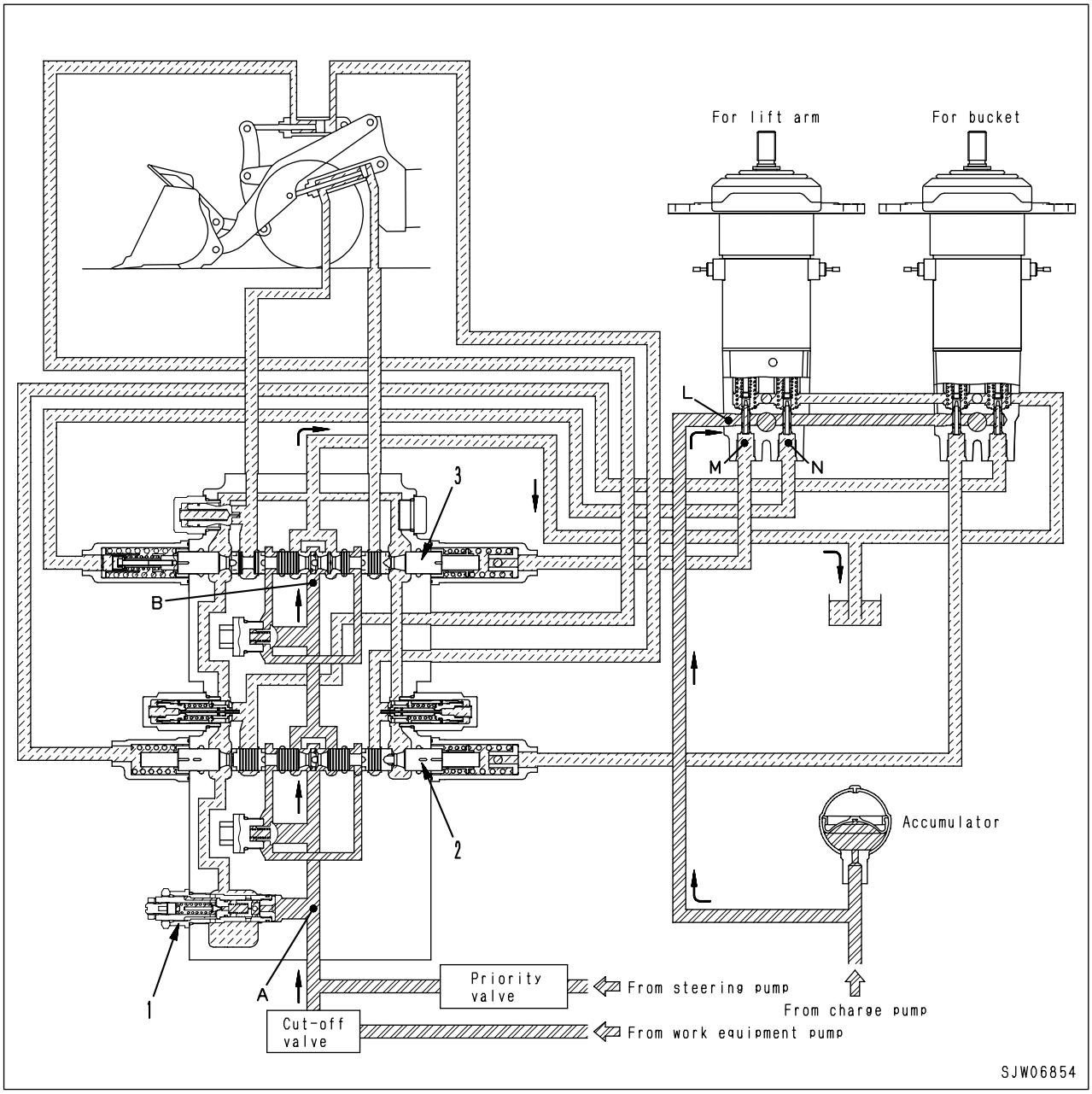
(2) When work equipment pump pressure is higher than cut-off pressure

- If the work equipment pump pressure reaches the cut-off pressure, cut-off valve (2) is opened by the oil pressure in chamber "a" and then the oil in chamber "b" of unload valve (3) is drained through chamber "c" of cut-off valve (2).
- Since the oil in chamber "d" of unload valve (3) flows through orifices "e" and "f" to chamber "b", the oil pressure in chamber "d" lowers and unload valve (3) opens.
- Accordingly, the oil from the work equipment pump is drained.



7. Operation of work equipment control valve

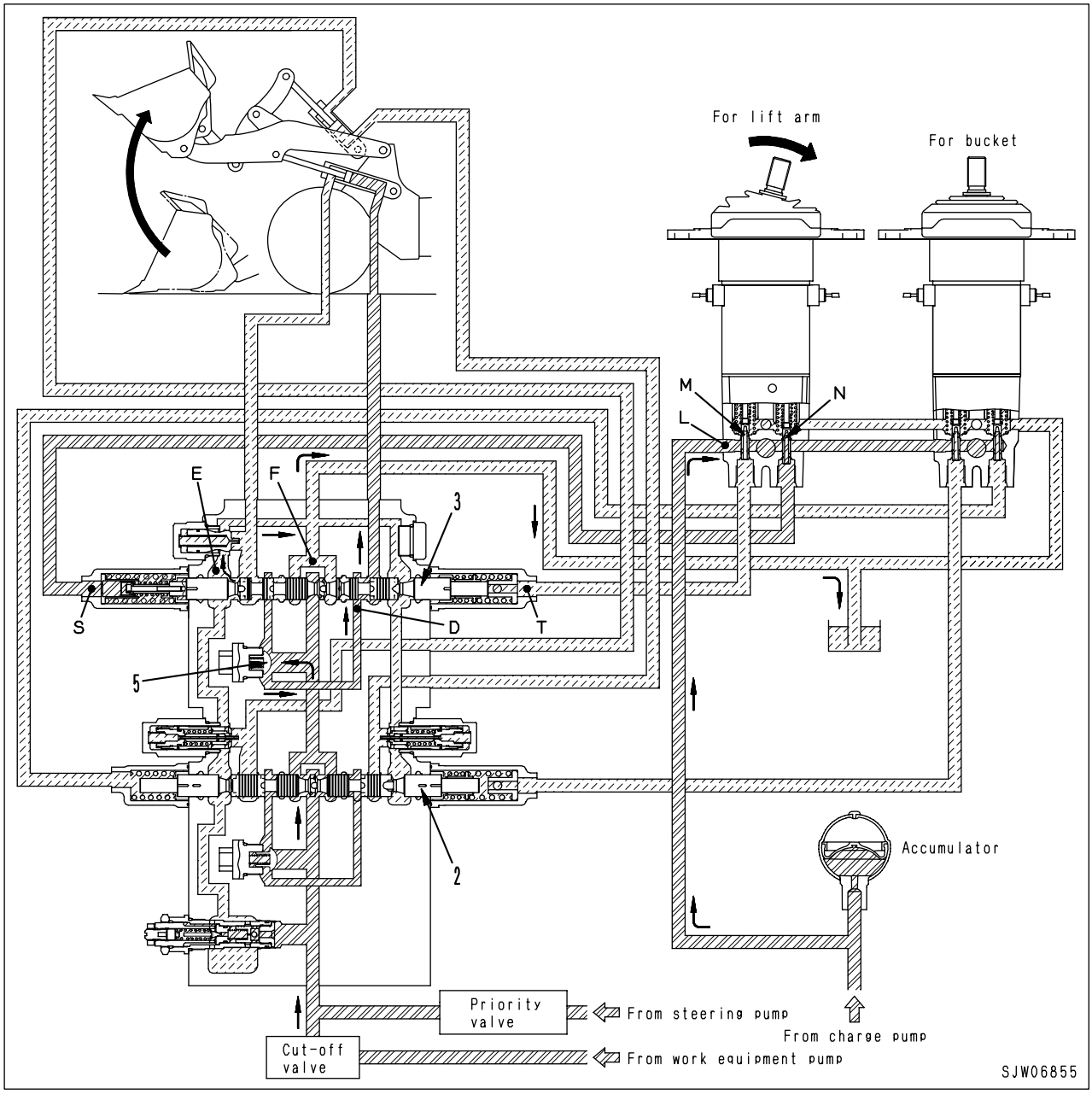
(1) Lift arm and bucket spool neutral position



Operation

- The oil flows from the pump to port A and its maximum pressure is limited by relief valve (1).
- The bypass circuit of bucket spool (2) is opened to hold the lift arm. As a result, the oil in port A flows around the spool into port B.
- Since lift arm spool (3) is in neutral, its bypass circuit is open. Accordingly, the oil in port B flows around the spool into the drain circuit and then returns to the tank.
- The oil from the PPC pump flows in port L of the PPC valve. Since the lift arm and bucket control levers are in the hold positions, however, the oil returns through the PPC relief valve to the hydraulic tank.

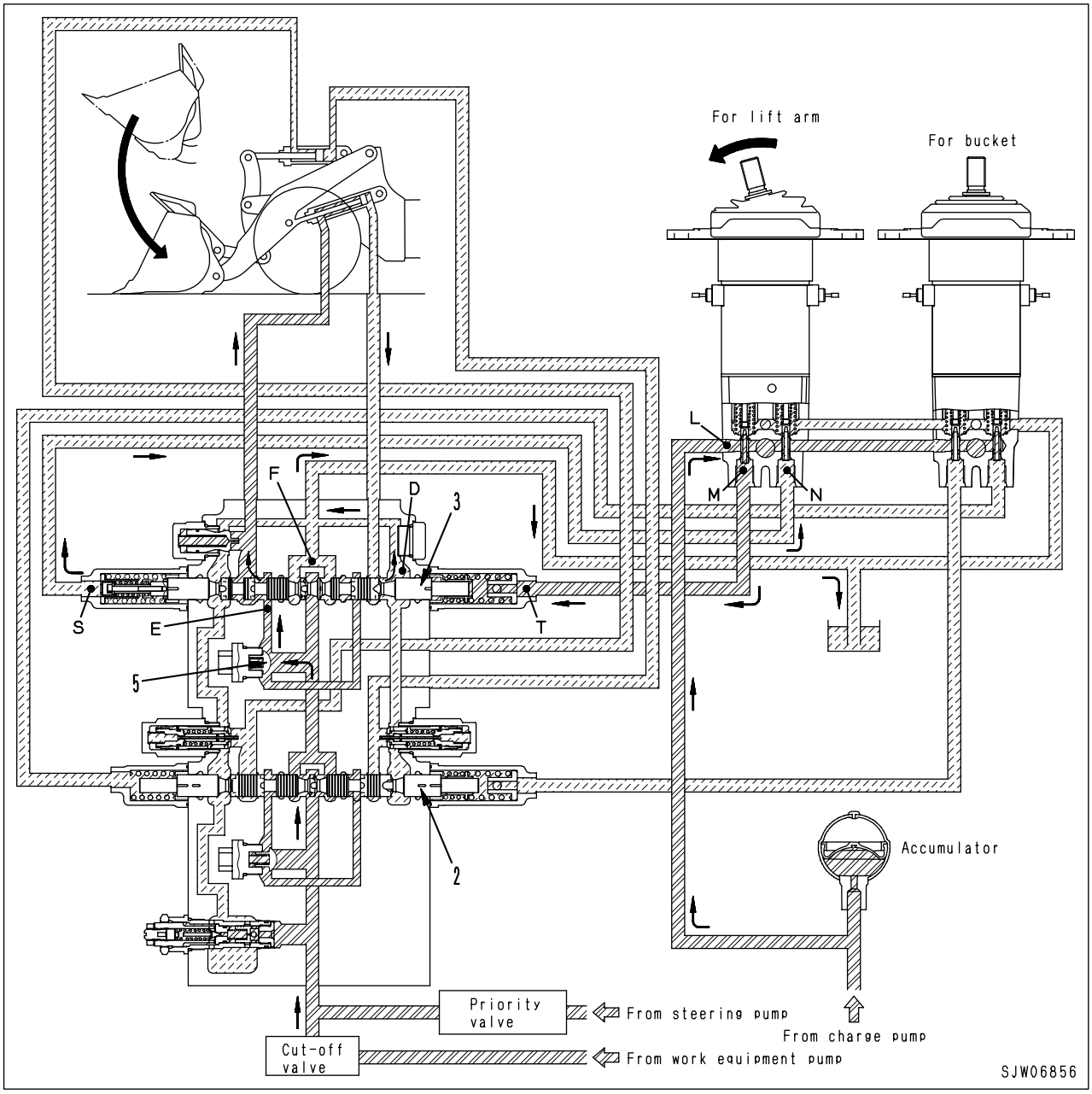
(2) Lift arm spool raise position



Operation

- If the lift arm control lever is pulled, the oil flows from port L of the PPC valve through port N to port S of the work equipment control valve.
- The oil in port T flows through port M to the drain circuit. The oil in port S pushes lift arm spool (3) to set it in the raise position.
- The oil from the pump flows through the bypass circuit of bucket spool (2) to the bypass circuit of spool (3).
- Since the bypass circuit is closed by spool (3), the oil pushes check valve (5) open.
- Then, then oil flows through port D to the cylinder bottom.
- The oil in the cylinder head flows through port E into drain port F and then returns to the tank. Accordingly, the lift arm is raised.

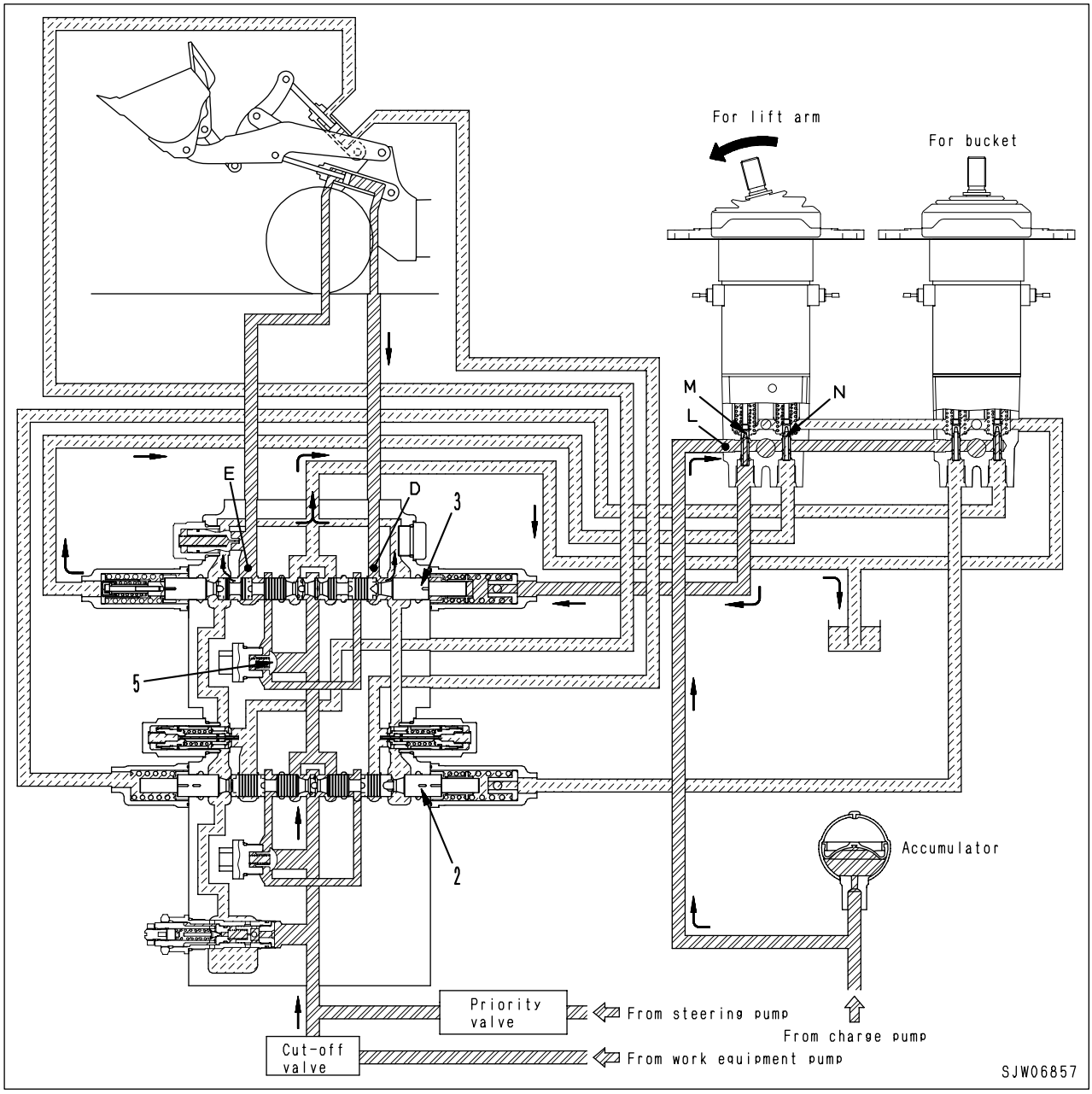
(3) Lift arm spool lower position



Operation

- If the lift arm control lever is pushed, the oil flows from port L of the PPC valve through port N to port T of work equipment control valve.
- The oil in port S flows to the drain circuit. The oil in port T pushes lift arm spool (3) to set it in the lower position.
- The oil from the pump flows through the bypass circuit of bucket spool (2) to the bypass circuit of spool (3).
- Since the bypass circuit is closed by spool (3), the oil pushes check valve (5) open.
- The oil flows through port E to the cylinder head.
- The oil in the cylinder bottom flows through port D into drain port F and then returns to the tank. Accordingly, the lift arm is lowered.

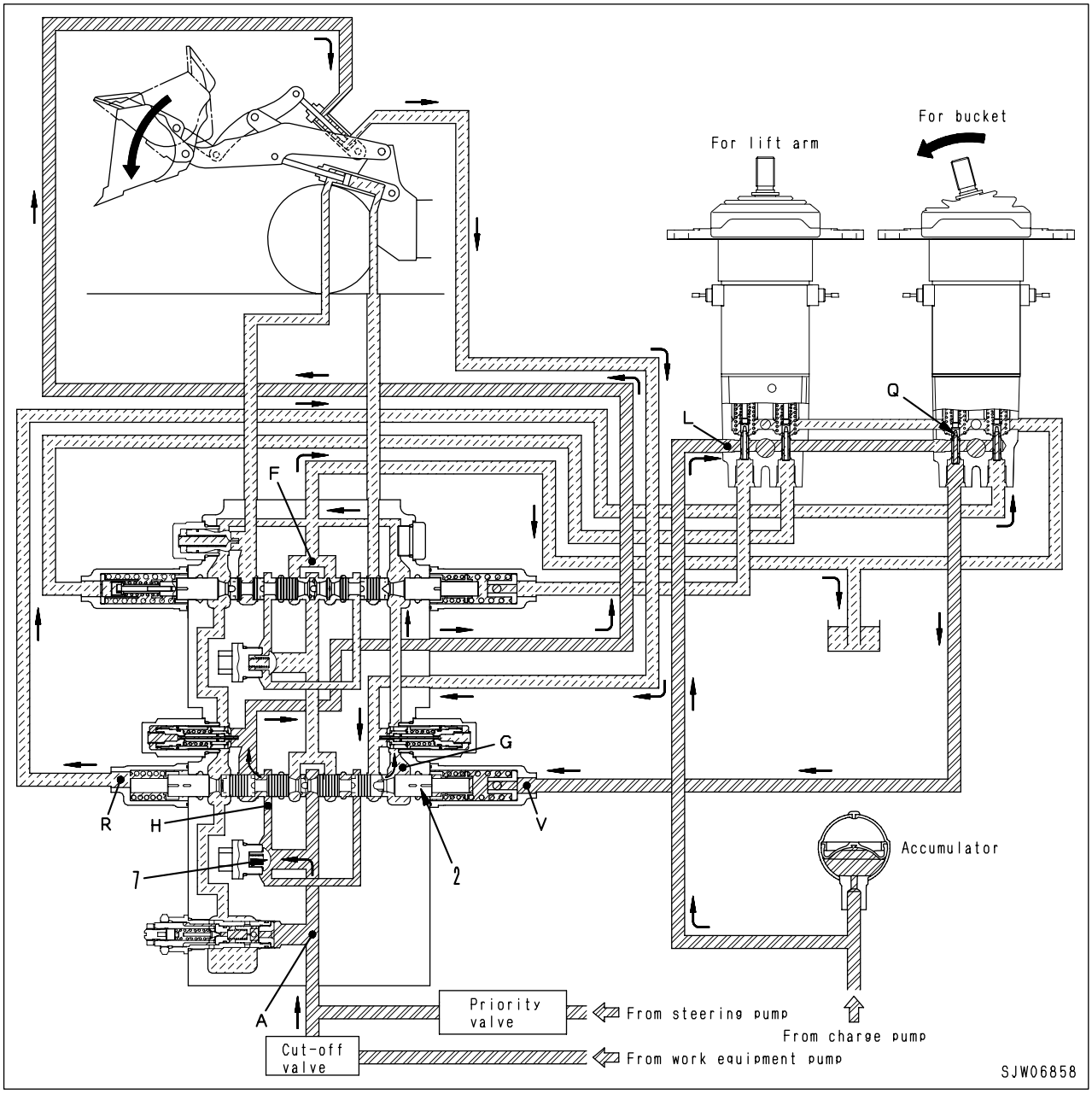
(4) Lift arm spool float position



Operation

- If the lift arm control lever is pushed to the float position, lift arm spool (3) moves over the lower position to the float position.
- The oil from the pump flows through the bypass circuit of bucket spool (2) to the bypass circuit of lift arm spool (3).
- The oil in the bypass circuit flows through spool (3) to the drain circuit and cannot push check valve (5) open.
- Since raise circuit D and lower circuit E of the lift arm cylinder are connected to the drain circuit, the lift arm is lowered by its gravity.
- While the bucket is in contact with the ground, it can move up and down according to the unevenness of the ground.

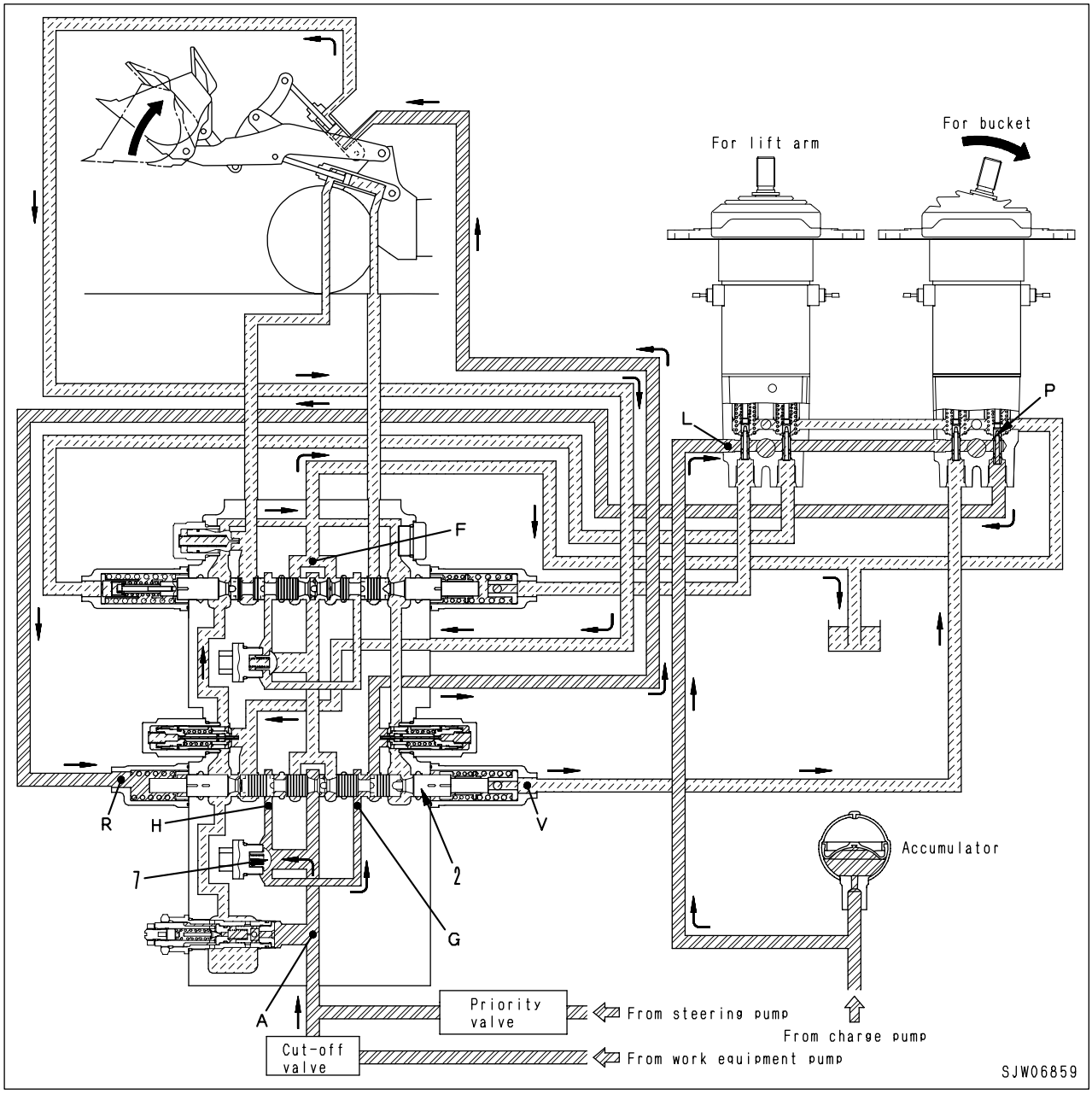
(5) Bucket spool dump position



Operation

- If the bucket control lever is pushed, the oil in port L of the PPC valve flows through port Q to port V of the work equipment control valve.
- The oil in port R flows to the drain circuit. The oil in port V sets bucket spool (2) in the dump position.
- Since the oil from the pump is stopped by spool (2), the oil from port A pushes check valve (7) open.
- The oil from check valve (7) flows through port H to the bucket cylinder head.
- The oil in the bucket cylinder bottom flows through port G into drain port F and then returns to the tank. Accordingly, the bucket is dumped.

(6) Bucket spool tilt position

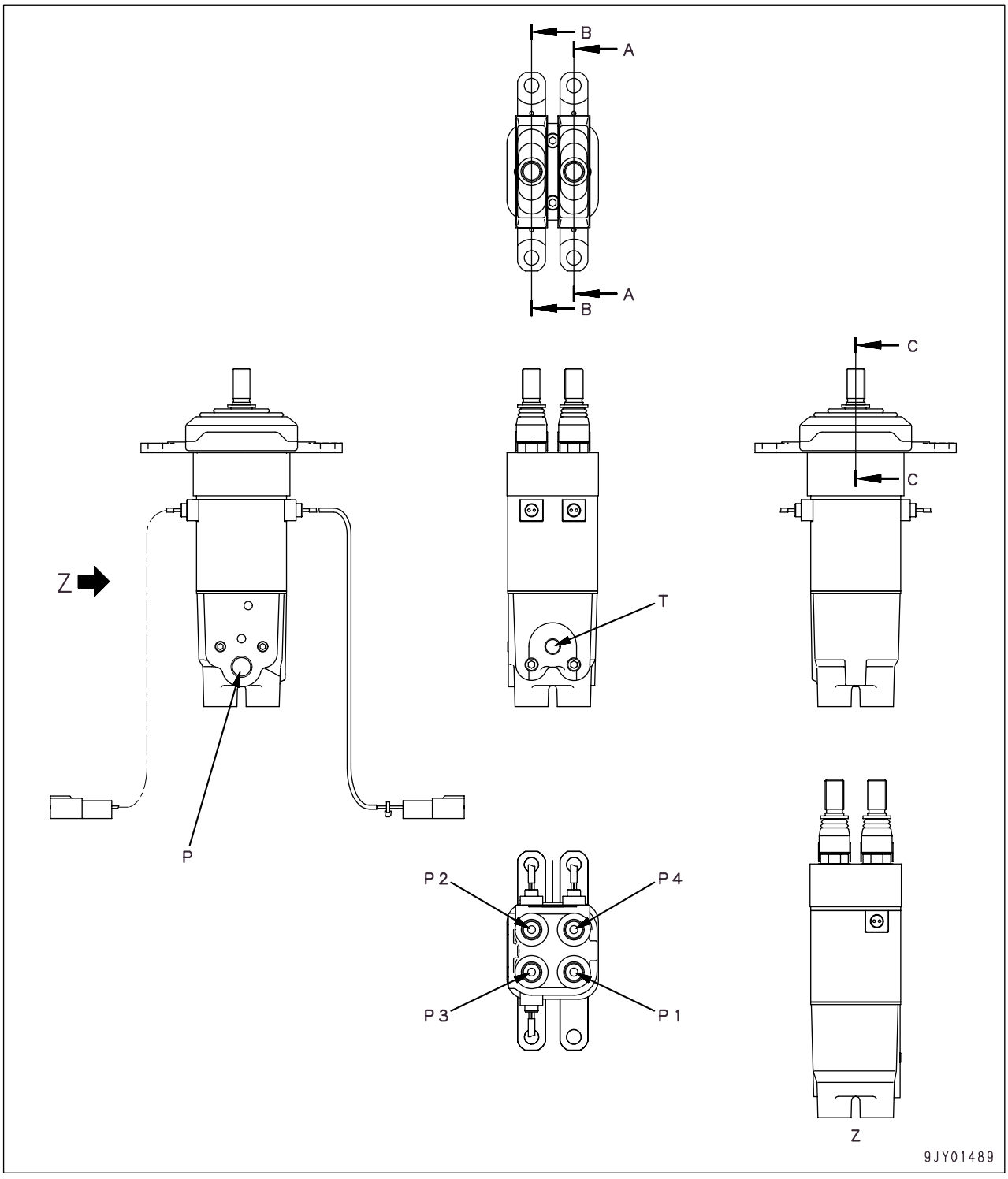


Operation

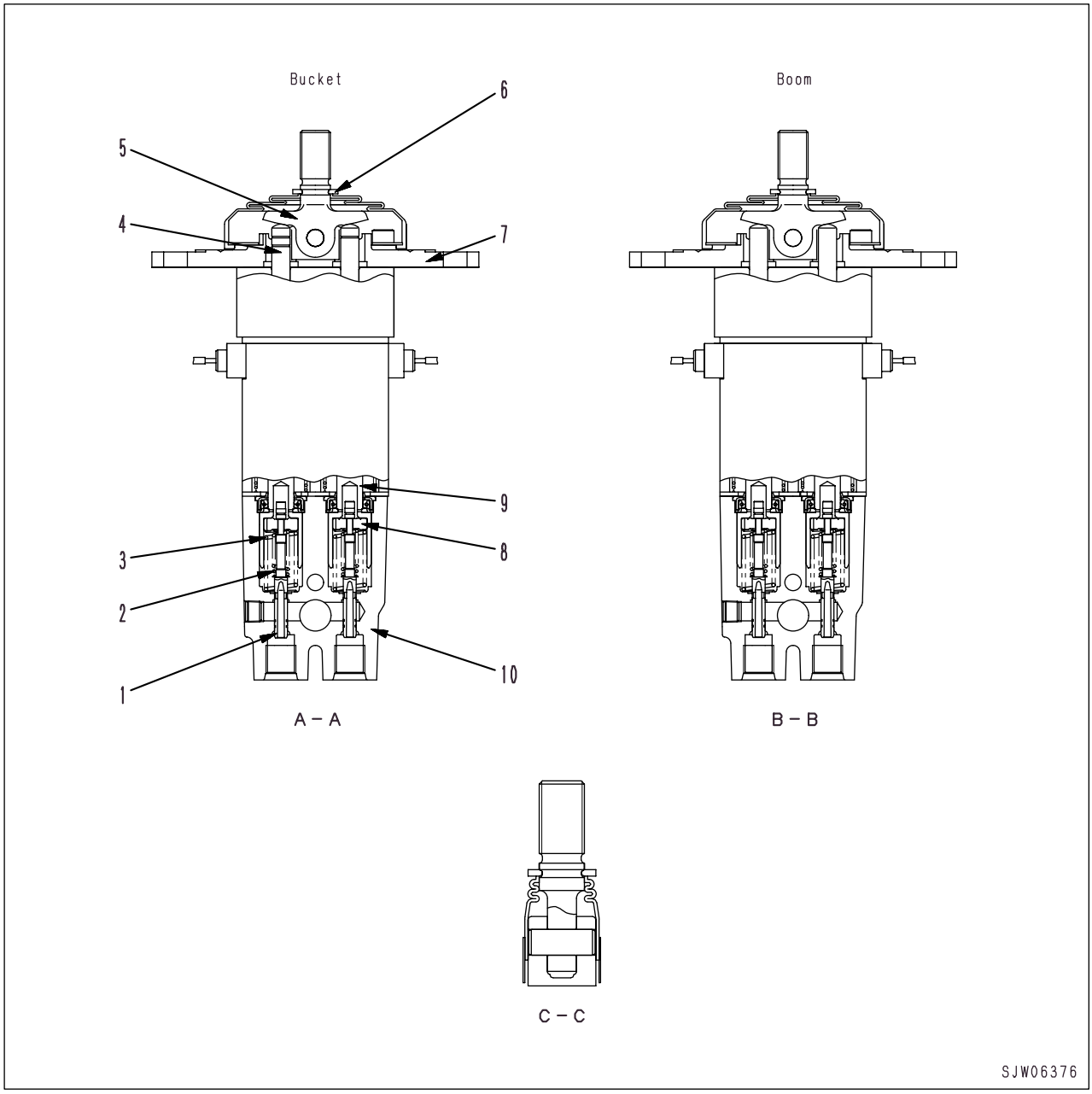
- If the bucket control lever is pulled, the oil in port L of the PPC valve flows through port P to port R of the work equipment control valve.
- The oil in port V flows to the drain circuit. The oil in port R sets bucket spool (2) in the tilt position.
- Since the oil from the pump is stopped by spool (2), the oil from port A pushes check valve (7) open.
- The oil from check valve (7) flows through port G to the bucket cylinder bottom.
- The oil in the bucket cylinder head flows through port H into drain port F and then returns to the tank. Accordingly, the bucket is tilted.

WORK EQUIPMENT PPC VALVE

2-lever type



P: From HST charge pump
T: To hydraulic tank
P1: To bucket tilt valve
P2: To lift arm LOWER (FLOAT) valve
P3: To lift arm RAISE valve
P4: To bucket DUMP valve



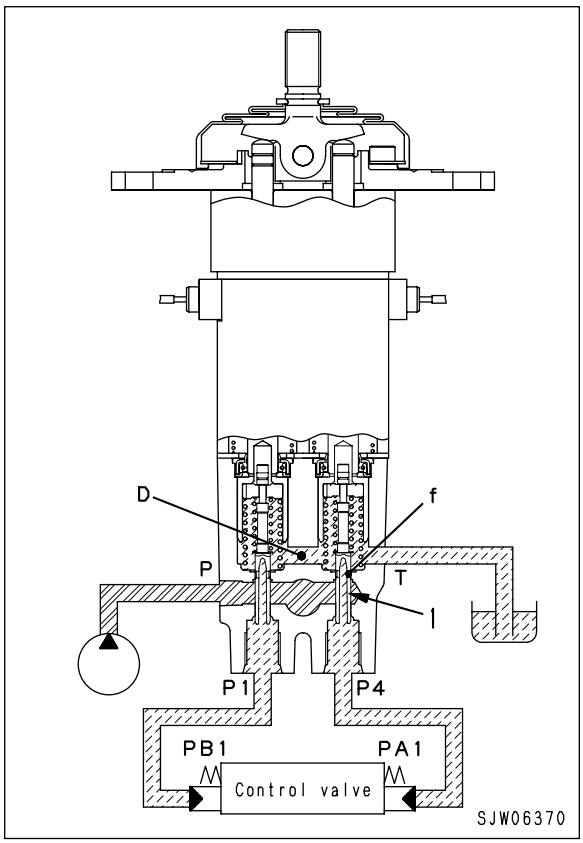
1. Spool
2. Metering spring
3. Centering spring
4. Rod
5. Lever
6. Ring
7. Plate
8. Retainer
9. Piston
10. Body

Operation

1. When in neutral

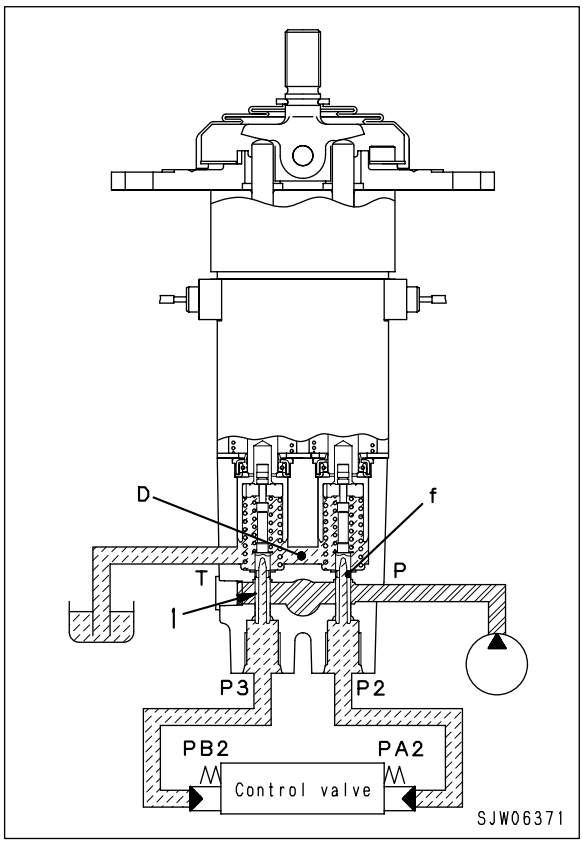
(1) Bucket PPC valve

- Ports **PA1** and **PB1** of the bucket control valve and ports **P1** and **P4** of the PPC valve are connected through fine control hole **f** of spool (1) to drain chamber **D**.



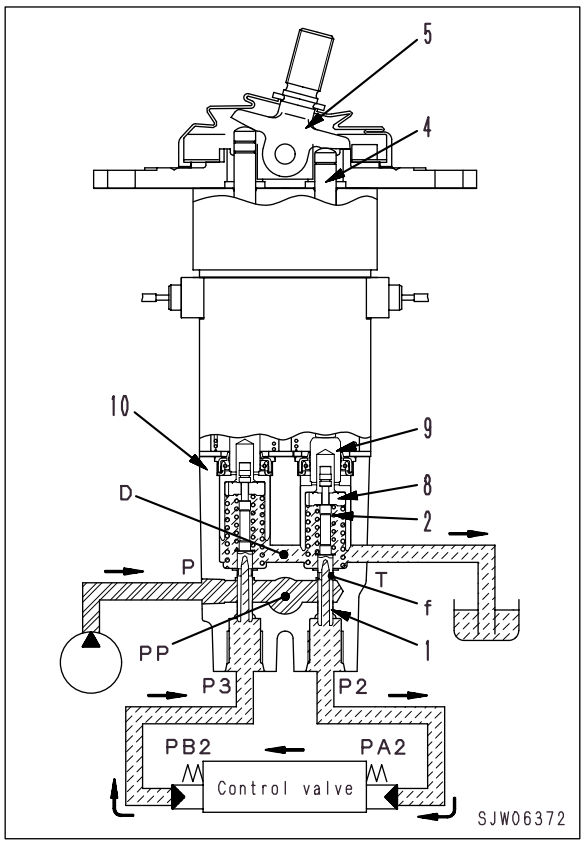
(2) Lift arm PPC valve

- Ports **PA2** and **PB2** of the lift arm control valve and ports **P2** and **P3** of the PPC valve are connected through fine control hole **f** of spool (1) to drain chamber **D**.



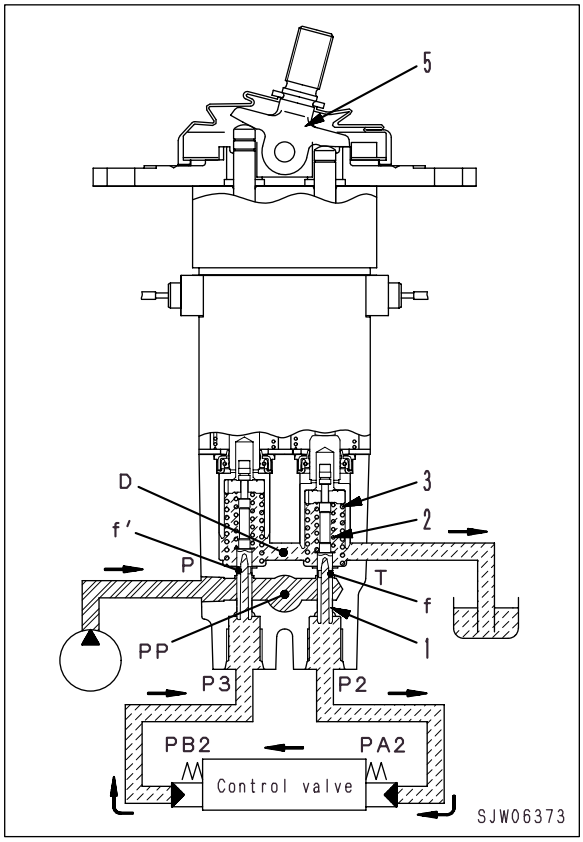
2. When in fine control mode (Neutral ✕ Fine control)

- If rod (4) and piston (9) are pushed by lever (5), retainer (8) is pushed and spool (1) is also pushed down through metering spring (2).
- Accordingly, the fine control hole **f** is disconnected from drain chamber **D** and connected to pump pressure chamber **PP** almost simultaneously. Then, the pilot hydraulic oil of the main pump flows through fine control hole **f** and port **P2** to port **PA2**.
- If the pressure in port **P2** rises, spool (1) is pushed back and fine control hole **f** is disconnected from pump pressure chamber **PP** and connected to drain chamber **D** almost simultaneously to release the pressure in port **P2**.
- Accordingly, spool (1) moves up and down so that the force of metering spring (2) will be balanced with the pressure in port **P2**.
- The positional relationship between spool (1) and body (10) (that fine control hole **f** is between drain chamber **D** and pump pressure chamber **PP**) does not change until retainer (8) reaches spool (1).
- Since metering spring (2) is compressed in proportion to the control lever stroke, the pressure in port **P2** rises in proportion to the control lever stroke, too.
- Accordingly, the control valve spool moves to a point at which the pressure in chamber **PA2** (that is the same as the pressure in port **P2**) is balanced with the force of the control valve spool return spring.



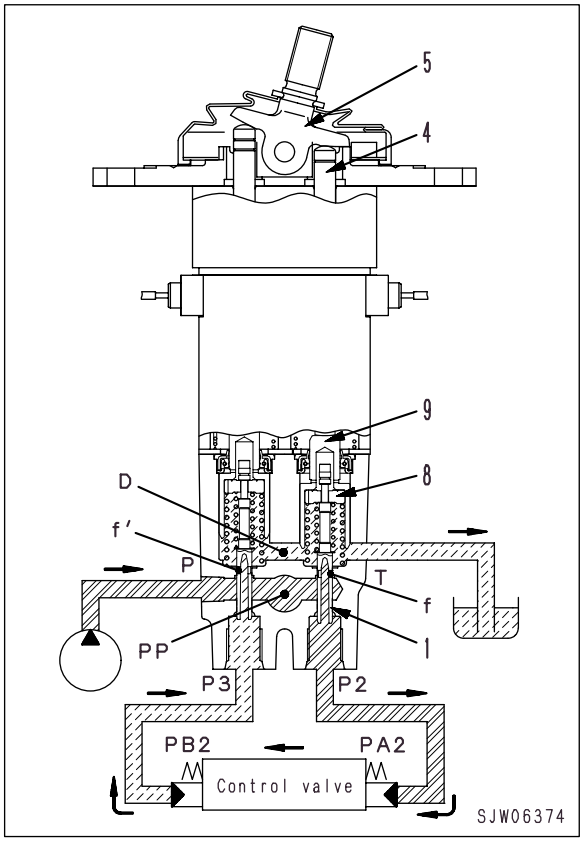
3. When in fine control mode (When control lever is returned)

- If lever (5) is returned a little, spool (1) is pushed up by the force of centering spring (3) and the pressure in port **P2**.
- Accordingly, fine control hole **f** is connected to drain chamber **D** to release the hydraulic oil through port **P2**.
- If the pressure in port **P2** lowers too much, spool (1) is pushed down by metering spring (2) and fine control hole **f** is disconnected from drain chamber **D** and connected to pump pressure chamber **PP** almost simultaneously to supply the pump pressure until the pressure in port **P2** rises again to the level equivalent to the lever position.
- When the control valve spool returns, the oil in drain chamber **D** flows in chamber **PB2** through fine control hole **f'** of the valve which is not moving and port **P3**.



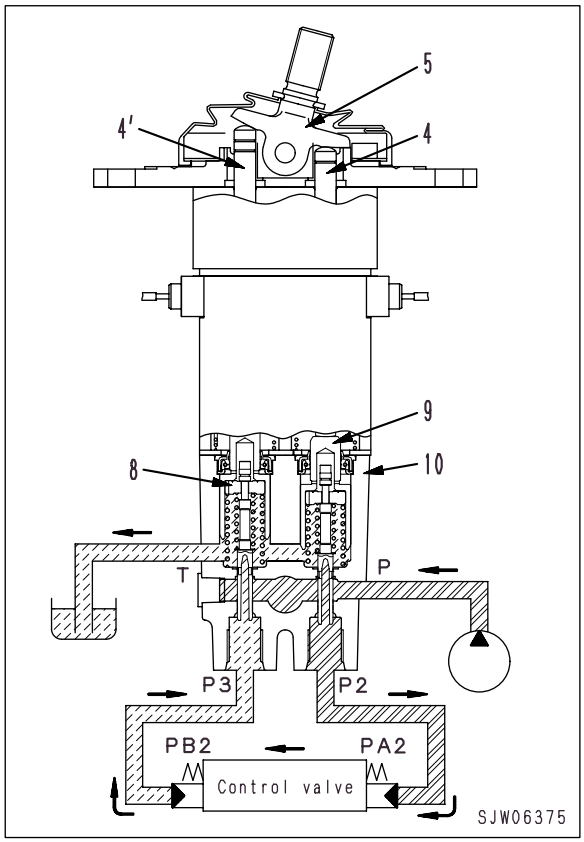
4. When lever is moved to stroke end

- Lever (5) and rod (4) push down piston (9) and retainer (8) pushes down spool (1) to disconnect fine control hole **f** from drain chamber **D** and connect it to pump pressure chamber **PP**.
- Accordingly, the pilot hydraulic pressure from the main pump flows through fine control hole **f** and port **P2** into chamber **PA2** to push the control valve spool.
- The oil returning from chamber **PB2** flows through port **P3** and fine control hole **f'** into drain chamber **D**.



5. When lift arm is "floated"

- If rod (4) and piston (9) of port **P2** are pushed down further from the LOWER position with lever (5), they are moved to the FLOAT position.
- Rod (4') on the opposite side is pushed up and a current flows in the solenoid in body (10), and then rod (4') is kept pushed up and the lever (5) is kept at the FLOAT position even if it is released.
- At this time, the control valve is also moved to the "float" position and kept in that position.

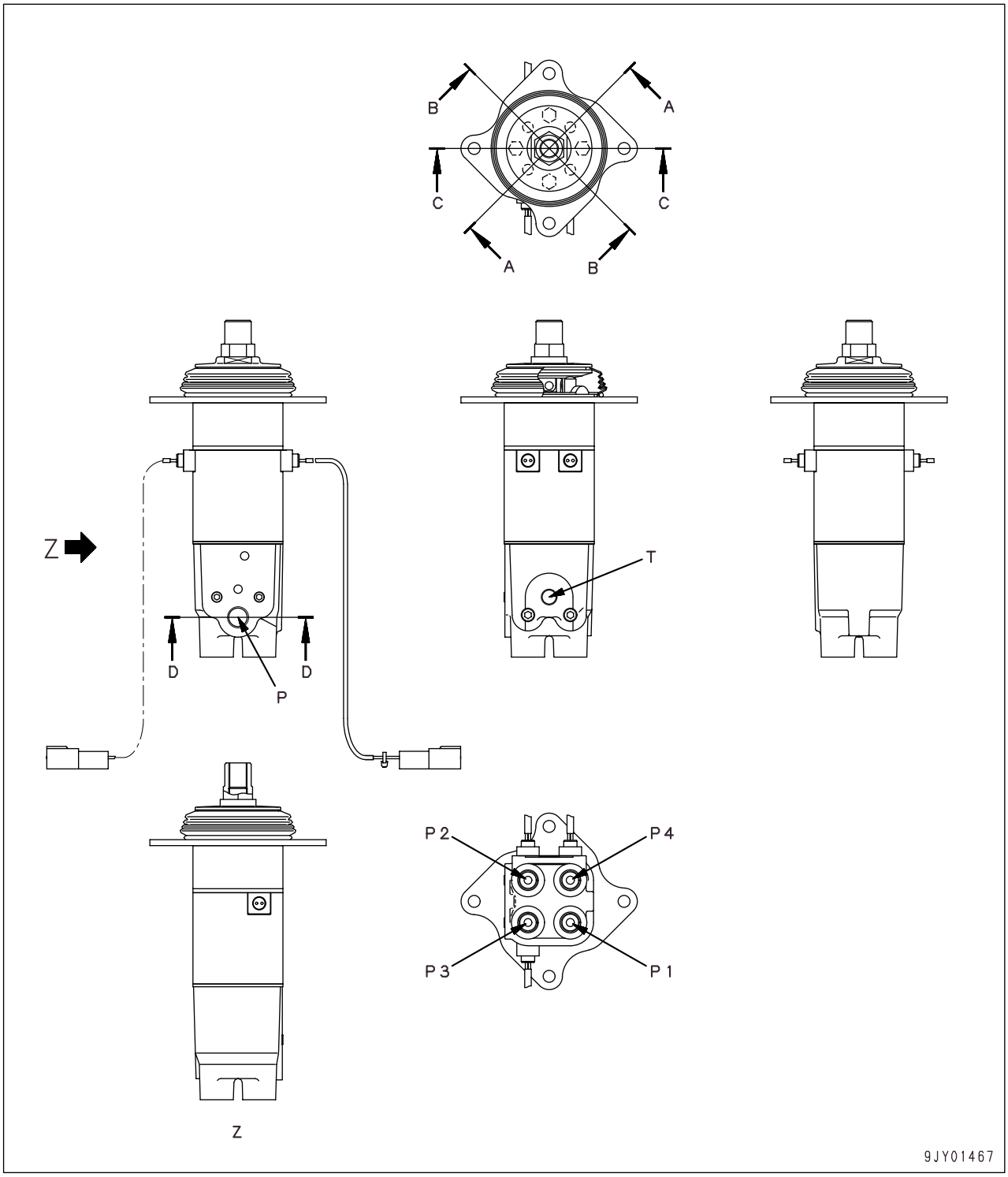


6. When "floating" of lift arm is reset

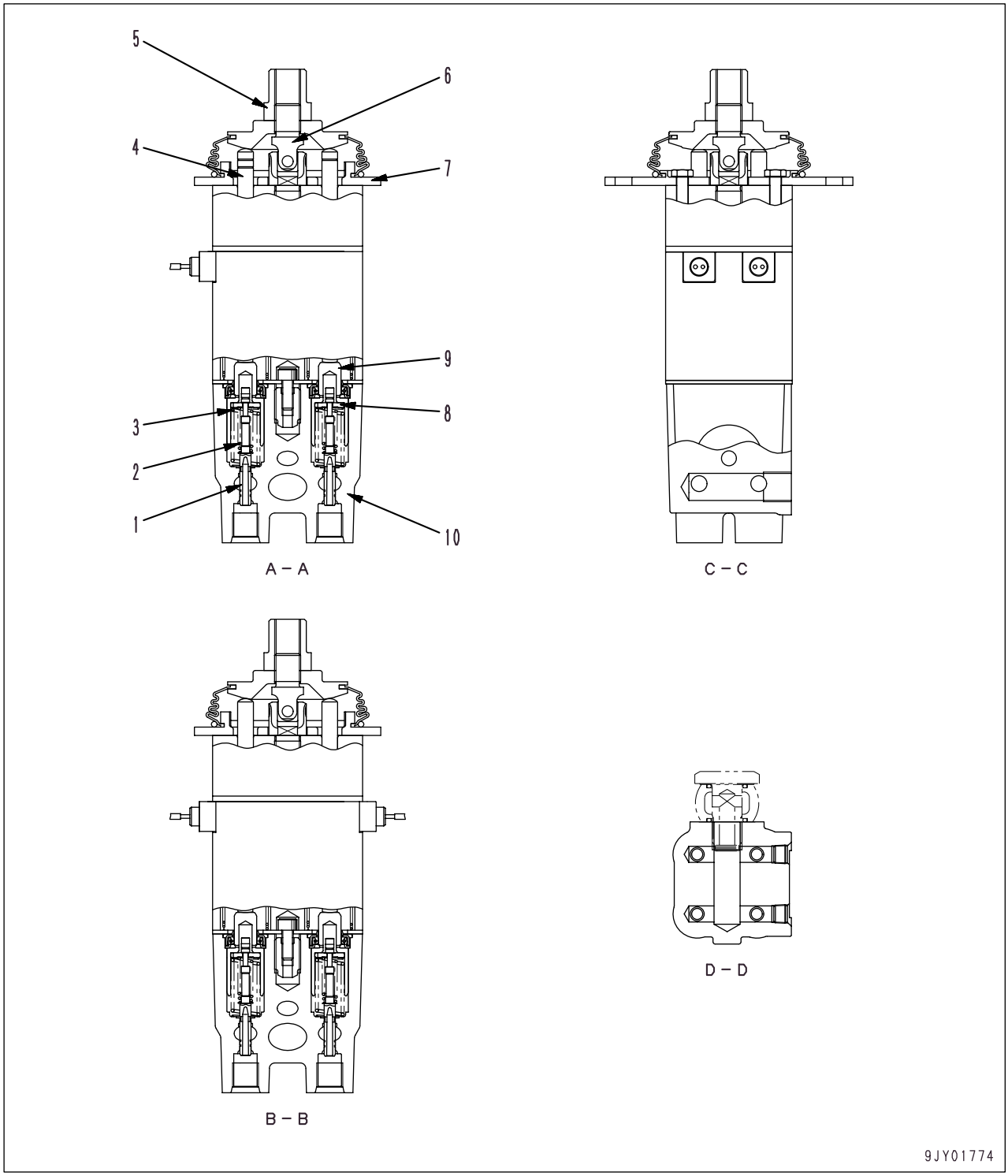
- If lever (5) is released at the FLOAT position, lever (4') is pushed down to turn the solenoid current OFF. Accordingly, the force to keep lever (5) in the FLOAT position is canceled and lever (5) returns to the neutral position.
- When the lift arm is raised or the bucket is tilted, the PPC valve operates similarly to the above.

Mono-lever type

★ Do not disassemble the cut-off valve. If it is disassembled, its set pressure must be adjusted.



P: From HST charging pump
T: To hydraulic tank
P1: To bucket TILT valve
P2: To bucket DUMP valve
P3: To lift arm RAISE valve
P4: To lift arm LOWER (FLOAT) valve



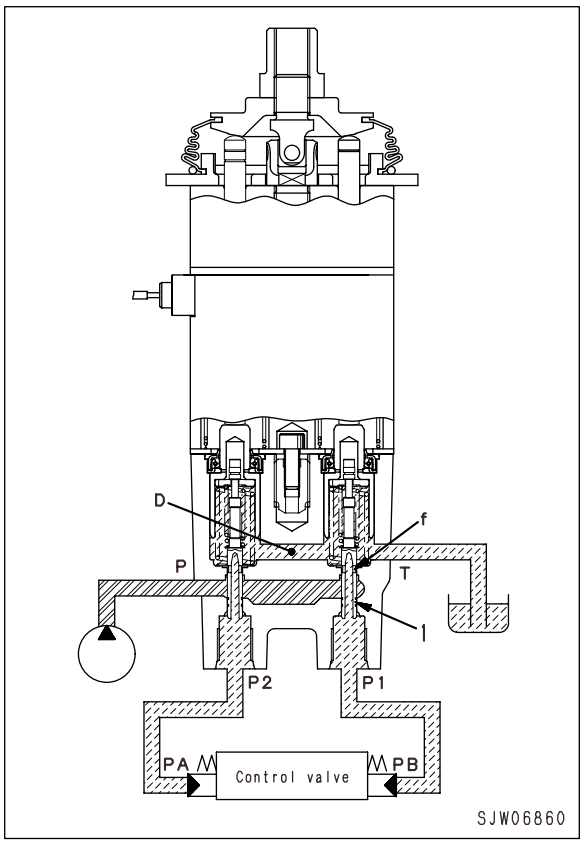
1. Spool
2. Metering spring
3. Centering spring
4. Rod
5. Nut (for connecting lever)
6. Joint
7. Plate
8. Retainer
9. Piston
10. Body

Operation

1. When in NEUTRAL

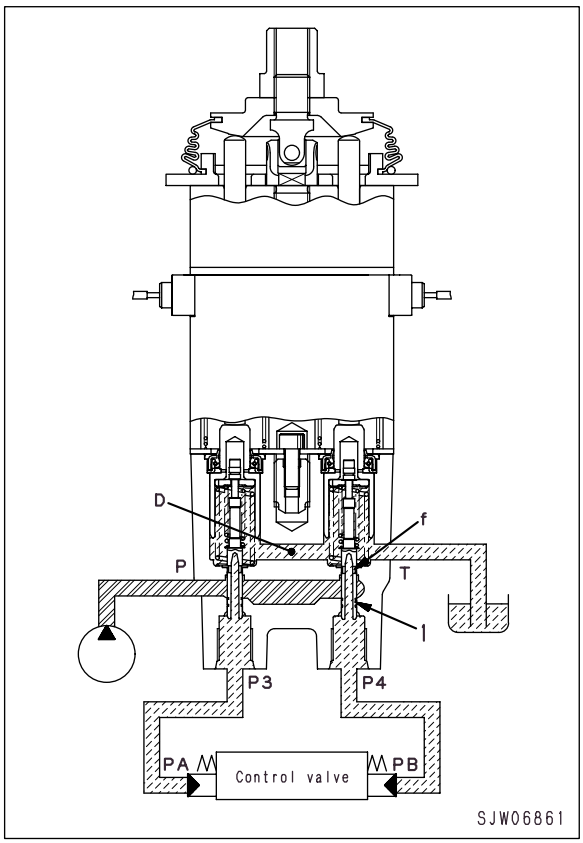
(1) PPC valve for bucket

- Ports **PA** and **PB** of the bucket control valve and ports **P1** and **P2** of the PPC valve are connected through fine control hole **f** of spool (1) to the drain chamber **D**.



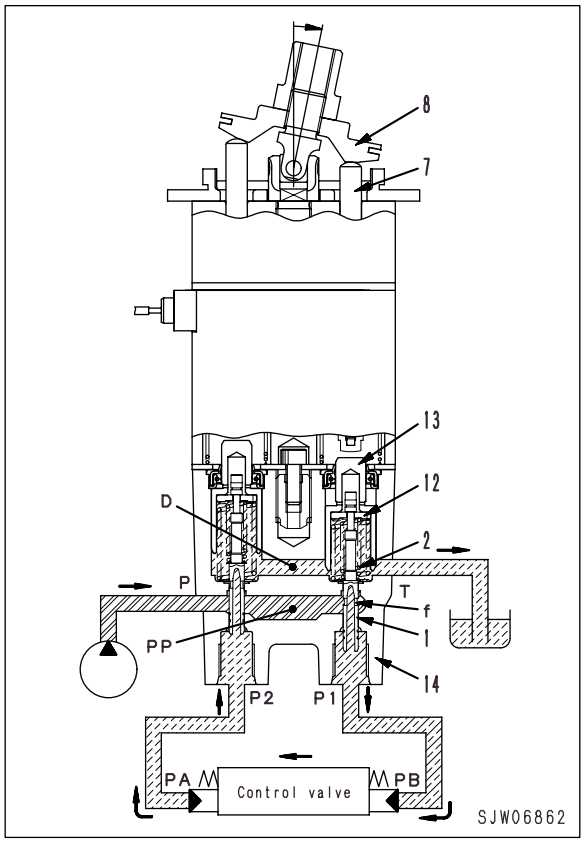
(2) PPC valve for lift arm

- Ports **PA** and **PB** of the lift arm control valve and ports **P3** and **P4** of the PPC valve are connected through fine control hole **f** of spool (1) to the drain chamber **D**.



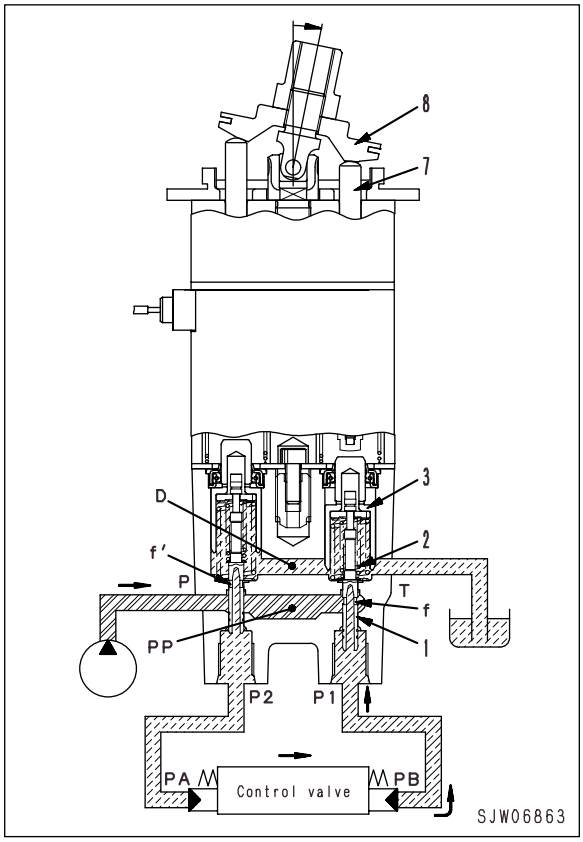
2. When in fine control
NEUTRAL ✕ Fine control)

- If rod (7) and piston (13) are pushed by disc (8), retainer (12) is pushed and spool (1) is also pushed down through metering spring (2).
- Accordingly, fine control hole **f** is disconnected from drain chamber **D** and connected to pump pressure chamber **PP** almost simultaneously, and then the pilot oil of the main pump flows from port **P1** to port **PB**.
- If the pressure in port **P1** rises, spool (1) is pushed back and fine control hole **f** is disconnected from pump pressure chamber **PP** and connected to drain chamber **D** almost simultaneously to release the pressure in port **P1**.
- As a result, spool (1) moves up and down to balance the force of metering spring (2) with the pressure in port **P1**.
  The positional relationship between spool (1) and body (14) (where fine control hole **f** is between drain chamber **D** and pump pressure chamber **PP**) does not change until retainer (12) comes in contact with spool (1).
- Since metering spring (2) is compressed in proportion to the stroke of the control lever, the pressure in port **P1** rises in proportion to the stroke of the control lever.
- Accordingly, the control valve spool moves to a position at which the pressure in the chamber **PB** (equal to the pressure in port **P1**) is balanced with the force of the control valve spool return spring.



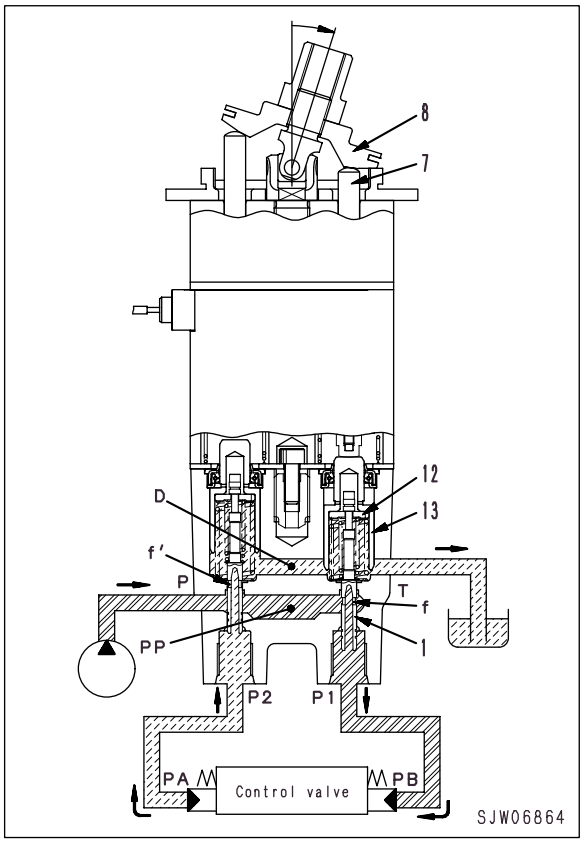
3. When in fine control (When control lever is returned)

- If disc (8) begins to return, the force of centering spring (3) and the pressure in port **P1** push up spool (1).
- As a result, fine control hole **f** is connected to drain chamber **D** and the oil in port **P1** is released.
- If the pressure in port **P1** lowers too much, spool (1) is pushed down by metering spring (2) and fine control hole **f** is disconnected from drain chamber **D** and connected to pump pressure chamber **PP** almost simultaneously. Then, the pump pressure is applied until the pressure in port **P1** is restored to the level corresponding to the position of the lever.
- When the control valve spool returns, the oil in drain chamber **D** flows in through fine control hole **f'** of the valve which is not in operation and then flows through port **P2** into chamber **PA**.



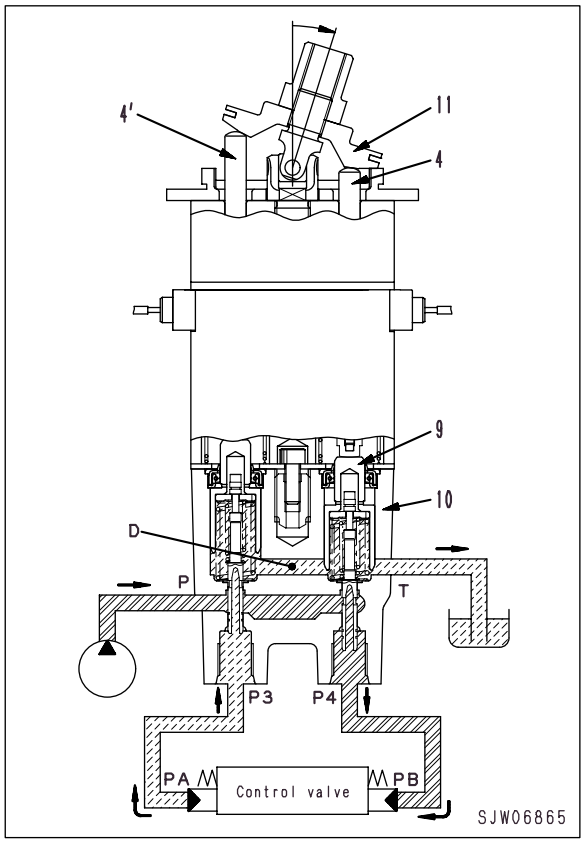
4. When lever is operated to stroke end

- If disc (8) and rod (7) push down piston (13) and retainer (12) pushes down spool (1), fine control hole **f** is disconnected from drain chamber **D** and connected to pump pressure chamber **PP**.
- Accordingly, the pilot oil from the main pump flows through fine control hole **f** and port **P1** into chamber **PB** and pushes the control valve spool.
- The oil returning from chamber **PA** flows through port **P2** and fine control **f'** into drain chamber **D**.



5. When lift arm is FLOATED

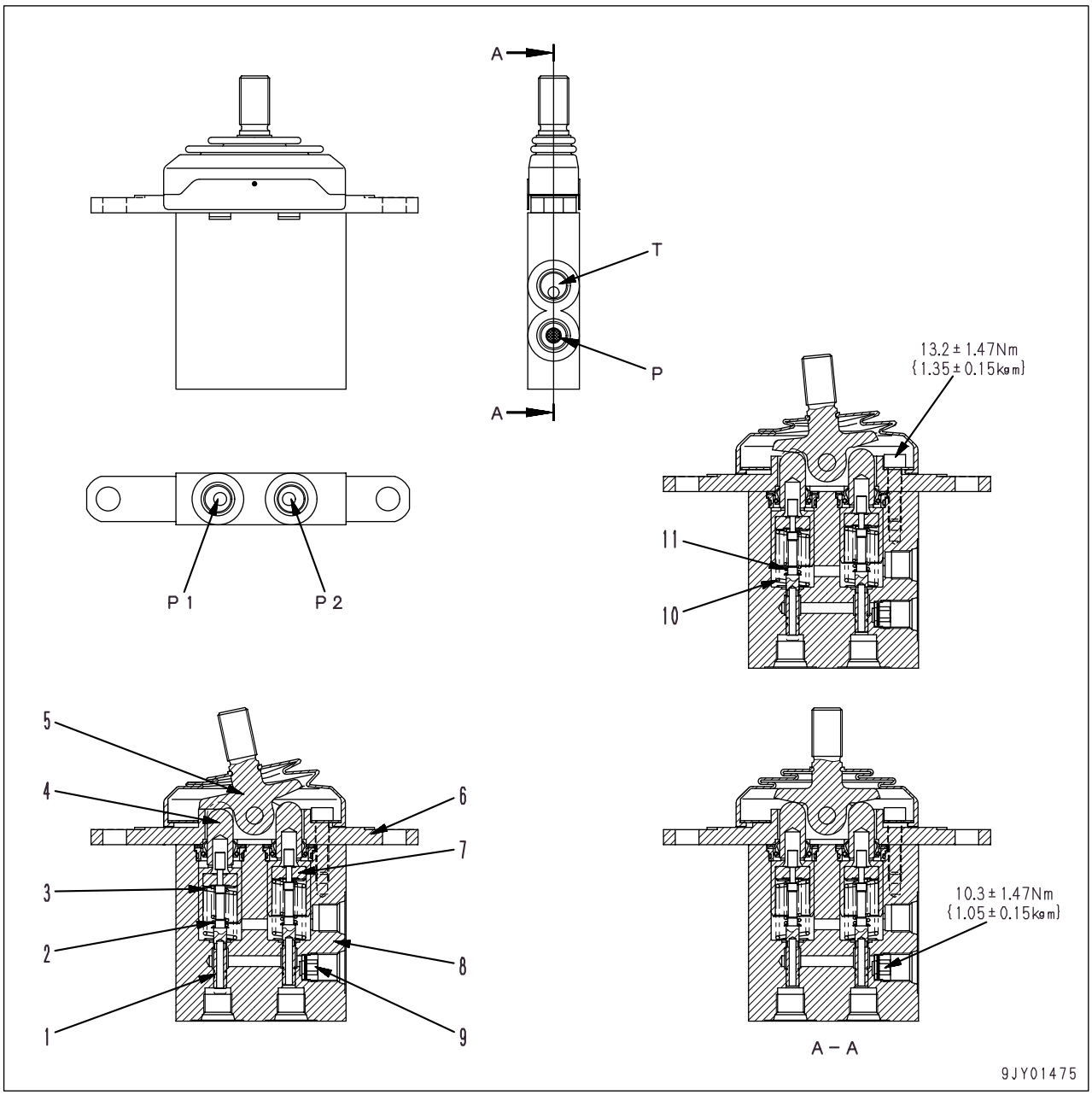
- If rod (7) and piston (13) on the LOWER side of port P3 are pushed down by disc (8), ball (15) touches projection **a** of rod (7) in the middle of the stroke (The detent starts to operate).
- If rod (7) is pushed in further, ball (15) pushes up collar (16) supported on detent spring (17) and escapes out to go over projection **a** of the piston.
- At this time, rod (7') on the opposite side is pushed up by spring (4) through retainer (5).
- If rod (7') is pushed up and the current is flowing in solenoid (6), retainer (5) is attracted by solenoid (6).
- Accordingly, rod (7') is kept pushed up and the FLOAT state is kept even if the lever is released.
- At the same time, the control valve is also moved to the FLOAT position and kept at that position.



6. When FLOAT state of lift arm is reset

- Disc (8) is returned from the FLOAT position by pushing it down with a force greater than the attractive force of solenoid (6) and retainer (5).
- The FLOAT state also can be reset and the lever can be returned to the neutral position by turning off the current in solenoid (6) (demagnetizing the solenoid).
- The lift arm RAISE and bucket TILT operations are carried out similarly to the above.

ATTACHMENT PPC VALVE



T: To the tank
P: From the main pump

P1: To the service valve
P2: To the service valve

1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Lever
6. Plate
7. Retainer
8. Body
9. Filter

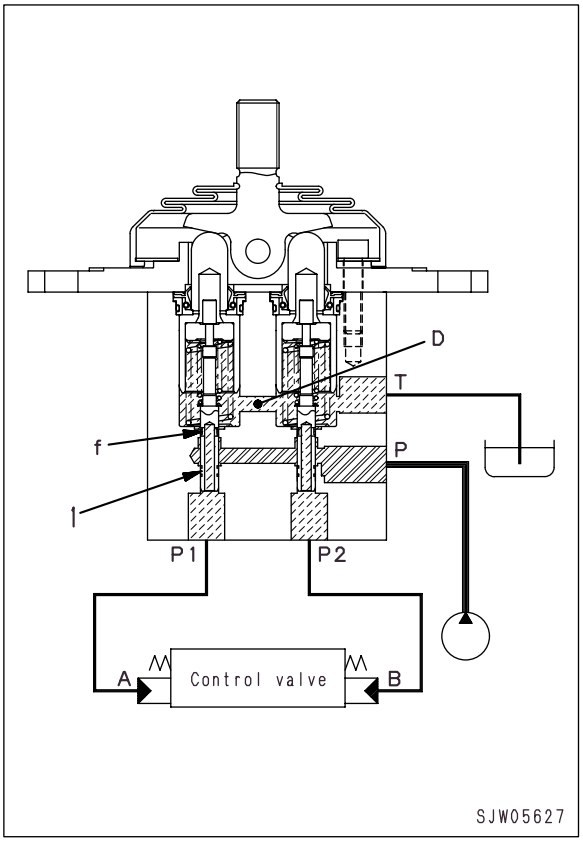
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
10	Center ring spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If spring is damaged or deformed, replace it
		41.1 X 15.5	29.0	36.3 N {3.70 kg}	—	30.4 N {3.1 kg}	
11	Metering spring	22.7 X 8.10	22.0	16.7 N {1.70 kg}	—	13.3 N {1.36 kg}	

Operation

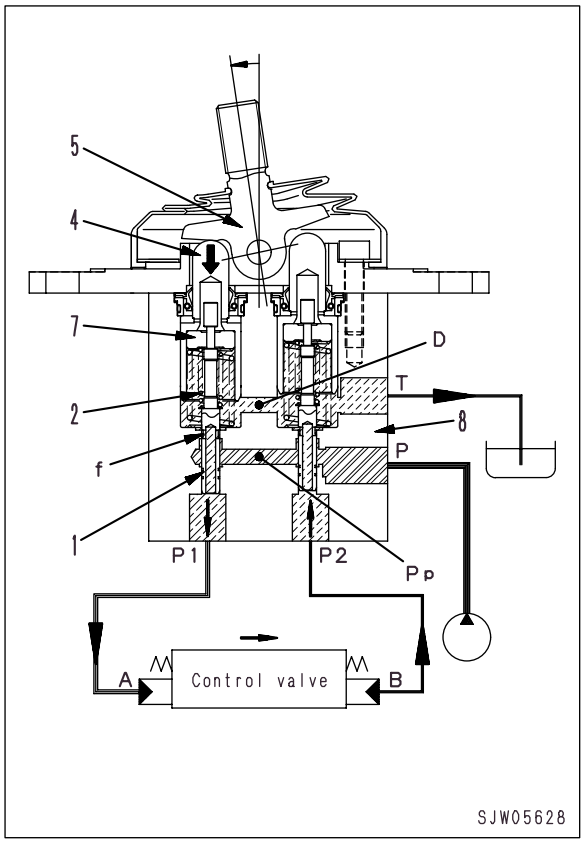
1. At the neutral position

- The ports **A** and **B** of the control valve and the ports **P1** and **P2** of the PPC valve are being connected to the drain chamber **D** through the fine control hole of the spool (1).



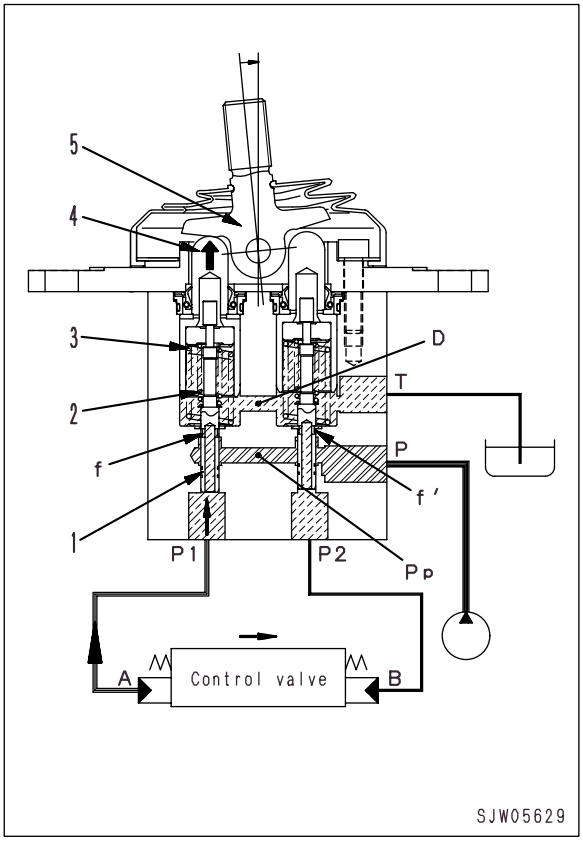
2. At the fine control position (Neutral ✕ fine control)

- When the piston (4) is pushed by the lever (5), the retainer (7) is pushed and the spool (1) also is pushed trough the metering spring (2) to move to the lower side.
- When the fine control hole **f** is shut off from the drain chamber **D** by the above, it connects to the pressure chamber **PP** of the pump almost simultaneously and the pilot pressure oil of the main pump is led from the **P1** port to the **A** port through the fine control hole **f**.
- When the pressure at the **P1** port goes up, the spool (1) is pushed back and, when the fine control hole **f** is shut off from the pressure chamber **PP** of the pump, it connects to the drain chamber **D** almost simultaneously to release the pressure at the **P1** port.
- By the above structure, the spool (1) moves up and down so that the power of the metering spring (2) and the **P1** port pressure may balance.
- Until the retainer (7) hits the spool (1), the positional relation between the spool (1) and the body (8) (the fine control hole comes to the intermediate potion between the drain chamber **D** and the pressure chamber of the pump) does not change.
- Therefore, since the metering spring (2) is compressed in proportion to the control lever stroke, the pressure at the **P1** port also rises in proportion to the control lever stroke.
- By the above, control valve spool moves to the position where pressure of the chamber **A** (same pressure to **P1** port) balances to the force of control valve spool return spring.



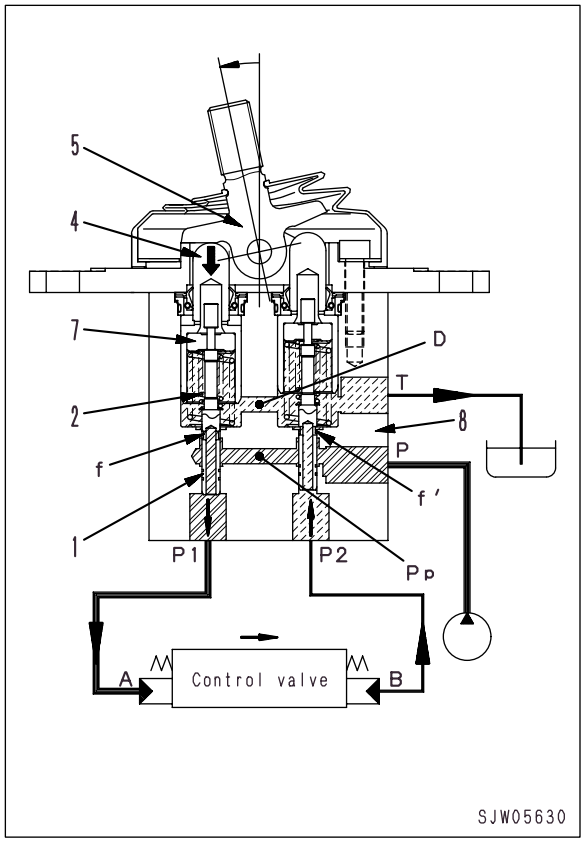
3. At the fine control position (When the control lever is returned)

- When the lever (5) is started to be returned, by the power of the centering spring (3) and by the pressure of the **P1** port, the spool (1) is pushed up. By the above, the fine control hole **f** connects to the drain chamber **D** to release the pressurized oil from the **P1** port.
- In case the pressure of the **P1** port drops excessively, the spool (1) is pushed down by the metering spring (2) and the fine control hole **f** is shut off from the drain chamber **D**, connecting to the drain chamber **D** almost simultaneously to supply the pump pressure **PP** until the pressure of the **P1** port returns to the pressure corresponding to the lever position.
- When the control valve spool returns, the oil in the drain chamber **D** flows through the fine control hole **f'** of the valve which is not moving to be led to the **B** chamber through the **P2** port to refill the oil.

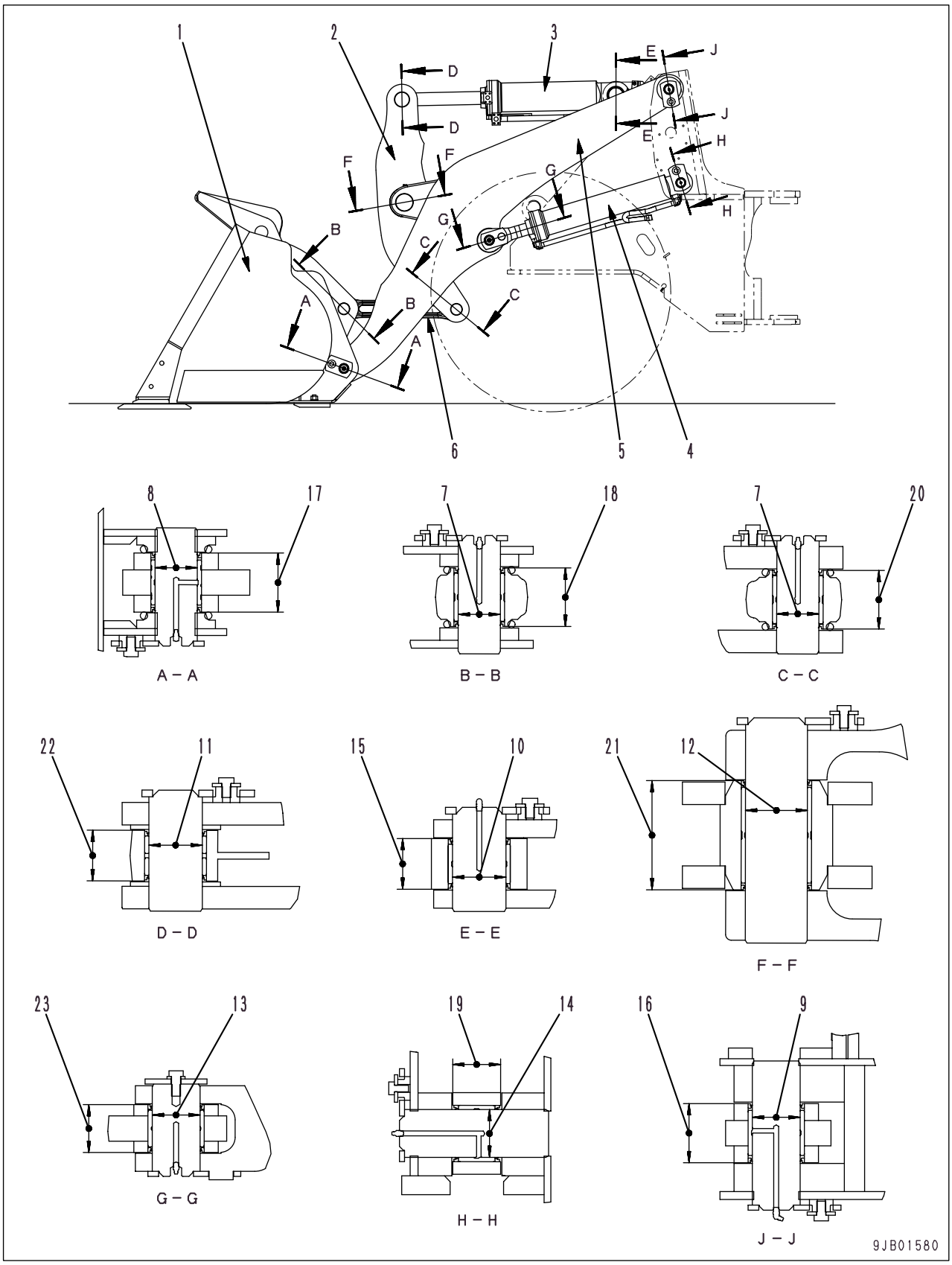


4. At full stroke

- When the lever (5) pushes down the piston (4) and when the retainer pushes down the spool (1), the fine control hole **f** is shut off from the drain chamber **D** and, then, it connects to the pressure chamber **PP** of the pump.
- Therefore, the pilot pressure oil coming from the main pump passes through the fine control hole **f** to be led to the **A** chamber through the **P1** port to push the control valve spool.
- The return oil from the **B** chamber passes through the **P2** port and the fine control hole **f'** to flow into the drain chamber **D**.



WORK EQUIPMENT LINKAGE

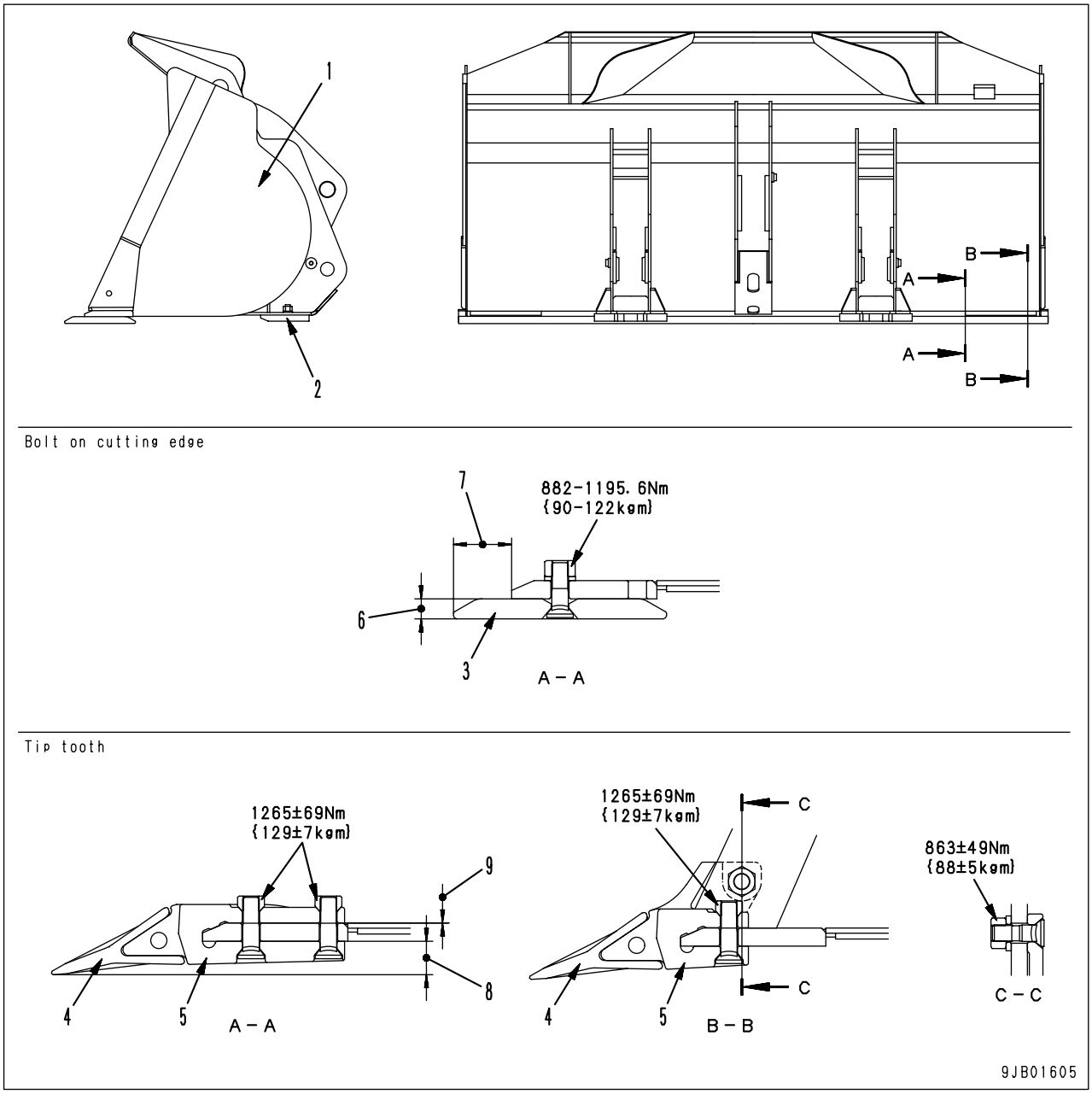


1. Bucket
2. Tilt lever
3. Bucket cylinder
4. Lift cylinder
5. Lift arm
6. Bucket link

Unit: mm

No.	Check item	Criteria					Remedy
7	Clearance between bushing and pin at each end of bucket link	Standard size	Tolerance		Standard clearance	Clearance limit	Replace (Replace if pin has scuff mark)
			Shaft	Hole			
		ø 75	-0.030 -0.076	+0.174 +0.100	0.130 – 0.250	1.0	
8	Clearance between bushing and pin of joint of lift arm and bucket	ø 75	-0.030 -0.076	+0.174 +0.100	0.130 – 0.250	1.0	
9	Clearance between bushing and pin of joint of lift arm and frame	ø 85	-0.036 -0.090	+0.207 +0.120	0.156 – 0.297	1.0	
10	Clearance between bushing and pin of joint of bucket cylinder bottom and frame	ø 95	-0.036 -0.090	+0.207 +0.120	0.156 – 0.297	1.0	
11	Clearance between bushing and pin of joint of bucket cylinder rod and tilt lever	ø 95	-0.036 -0.090	+0.207 +0.120	0.156 – 0.297	1.0	
12	Clearance between bushing and pin of joint of tilt lever and lift arm	ø 110	-0.036 -0.090	+0.207 +0.120	0.156 – 0.297	1.0	
13	Clearance between bushing and pin of joint of lift cylinder rod and lift arm	ø 85	-0.036 -0.090	+0.207 +0.120	0.156 – 0.297	1.0	
14	Clearance between bushing and pin of joint of lift cylinder bottom and frame	ø 85	-0.036 -0.090	+0.207 +0.120	0.156 – 0.297	1.0	
15	Joint of bucket cylinder and frame	Width of boss		Width of hinge		Standard clearance	Replace (Insert shims on both sides so that clearance will be 1.5 mm or less on each side)
		Standard size	Tolerance	Standard size	Tolerance		
		90	+0.8 0	93	± 1.5	0.7 – 4.5	
16	Joint of lift arm and frame	105	—	109	± 1.5	2.5 – 5.5	
17	Joint of lift arm and bucket	105	—	108	+1.5 0	3.0 – 4.5	
18	Joint of bucket link and bucket	104	+2.8 -0.5	109	+1.5 0	2.2 – 7.0	
19	Joint of lift cylinder and frame	85	0 -0.5	89	± 1.5	2.5 – 6.0	
20	Joint of tilt lever and bucket link	104	+2.8 -0.5	109	± 1.5	0.7 – 7.0	Replace
21	Joint of tilt lever and lift arm	194	± 0.5	197	± 0.5	2.0 – 4.0	
22	Joint of bucket cylinder and tilt lever	90	0 -0.5	93	± 1.5	1.5 – 5.0	Replace (Adjust clearance on each side to 1.5 mm or less)
23	Joint of lift arm and lift cylinder	85	—	88	± 1.5	1.5 – 4.5	

BUCKET



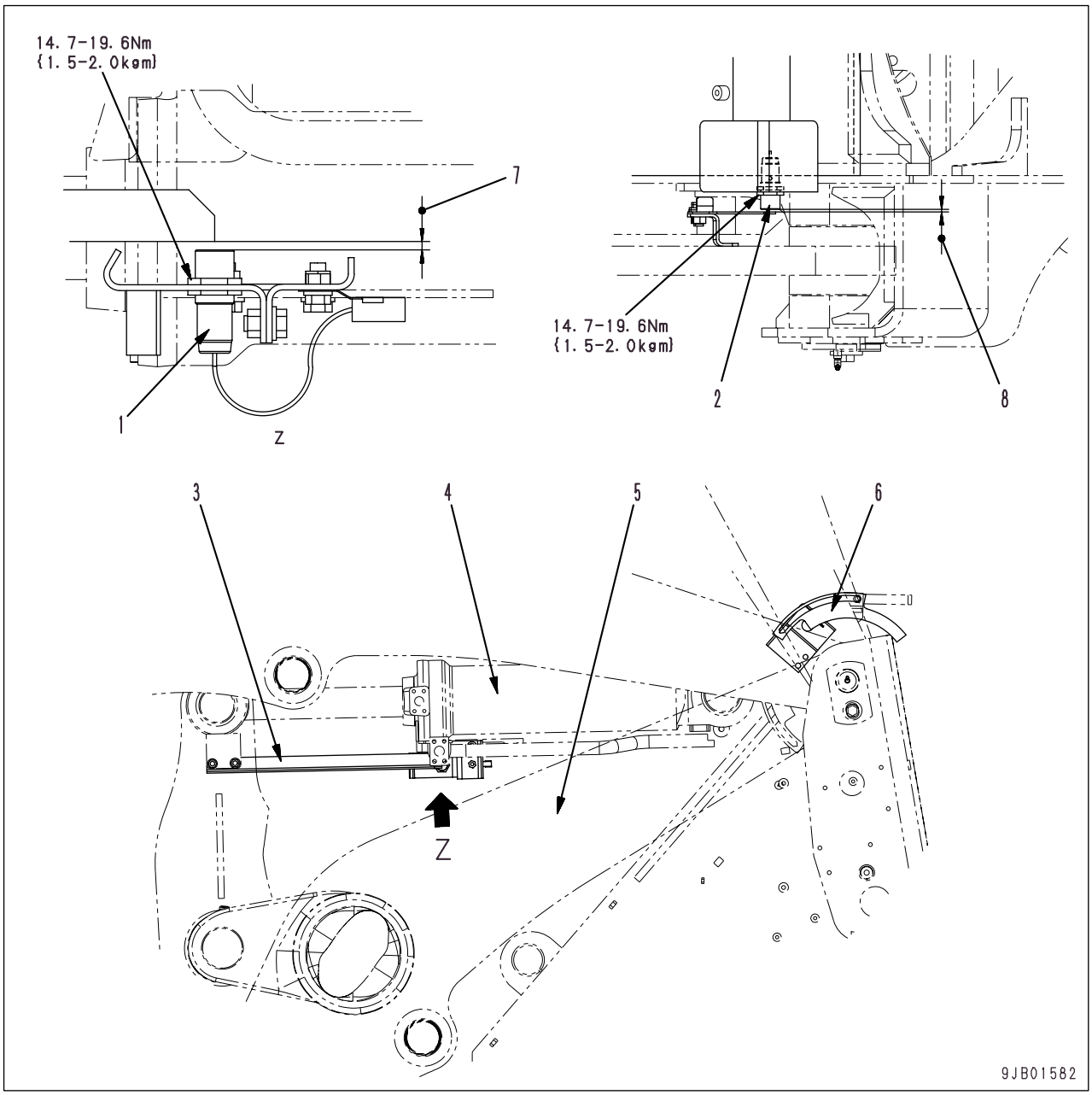
1. Bucket
2. Wear plate
3. Bolt-on cutting edge
4. Bucket tooth (If equipped)
5. Adapter (If equipped)

Unit: mm

No.	Check item	Criteria		Remedy
6	Wear of cutting edge (Thickness)	Standard size	Repair limit	Turn over or replace
		31.8	19	
7	Wear of cutting edge (Length)	90	5	
8	Wear of bucket tooth	51	21	Replace
9	Clearance of adapter mount	Max. 0.5	—	Adjust or replace

white 10-155

BUCKET POSITIONER AND BOOM KICK-OUT



1. Bucket positioner proximity switch
2. Boom kick-out proximity switch
3. Plate
4. Bucket cylinder
5. Lift arm
6. Plate

Unit: mm

No.	Check item	Criteria	Remedy
7	Clearance of bucket positioner proximity switch	3 – 5	Adjust
8	Clearance of boom kick-out proximity switch	3 – 5	

OUTLINE

Bucket positioner

- The bucket positioner is driven electrically. When the bucket is returned to an angle from the DUMP position toward the TILT position, the bucket positioner returns the work equipment (bucket) control lever from the TILT position to the HOLD position to automatically stop the bucket at a proper digging angle.
- Plate (3) is bolted to the rod of bucket cylinder (4). Proximity switch (1) is bolted to the cylinder.
- If the work equipment (bucket) control lever is moved from the DUMP position to the TILT position, the rod of bucket cylinder (4) moves toward the front of the machine. When plate (3) parts from proximity switch (1) at a point, proximity switch (1) operates to return the work equipment (bucket) control lever to the HOLD position.

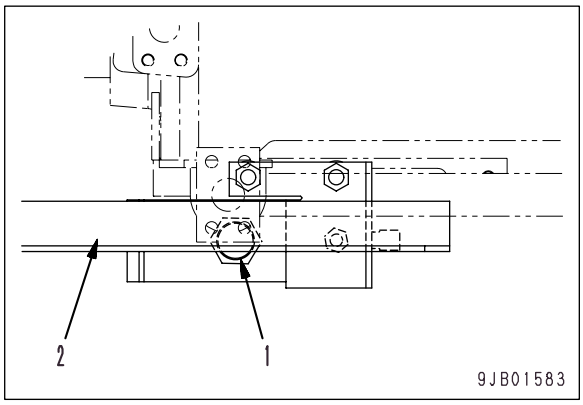
Boom kick-out

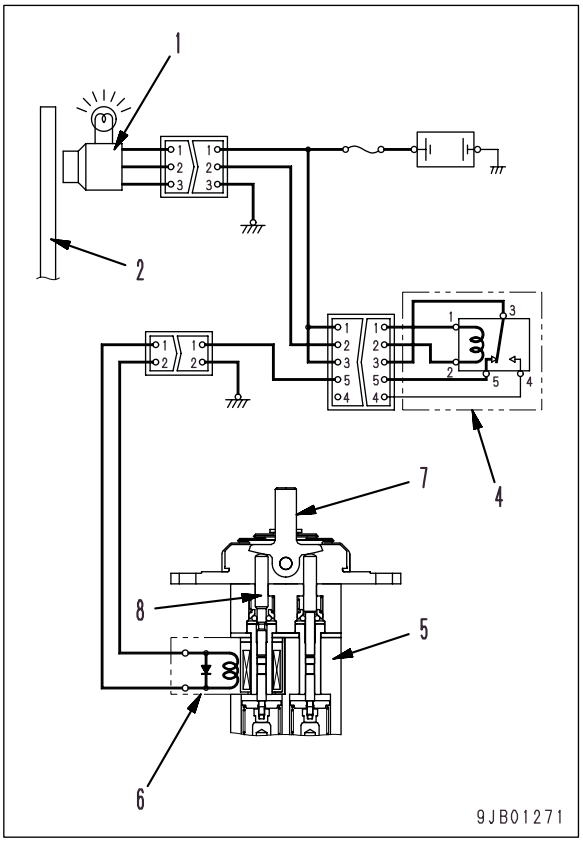
- The boom kick-out is driven electrically. When the lift arm is raised to an angle before the maximum position, the boom kick-out returns the work equipment (lift arm) control lever from the RAISE position to the HOLD position to automatically stop the lift arm at the current position.
- Plate (6) is fixed to lift arm (5). Proximity switch (2) is fixed to the front frame.
- If the work equipment (lift arm) control lever is moved from the LOWER position to the RAISE position, lift arm (5) rises. When plate (6) parts from proximity switch (2), proximity switch (2) operates to return the work equipment (lift arm) control lever to the HOLD position.

OPERATION OF PROXIMITY SWITCH

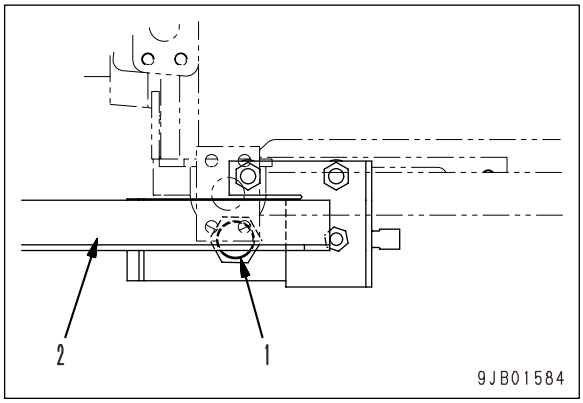
When bucket is tilted

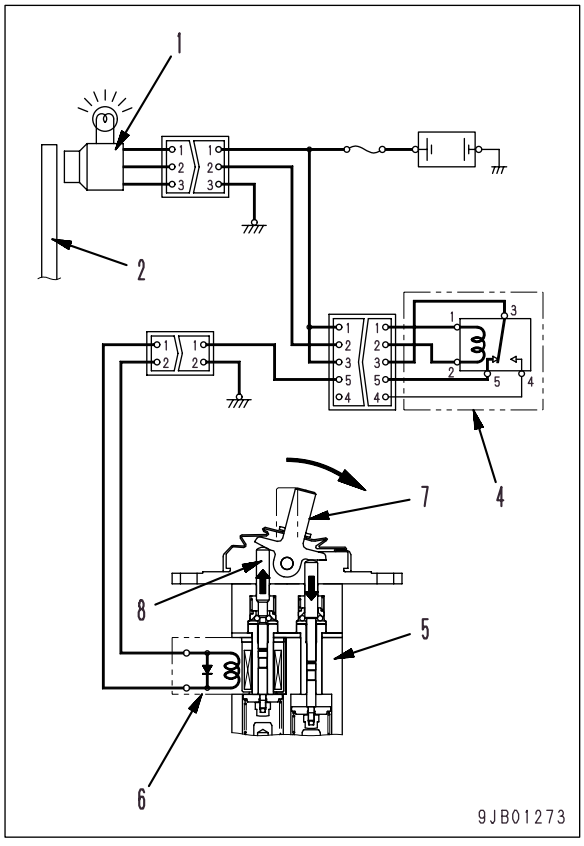
- While the bucket is dumping more than the set position of the bucket positioner, plate (2) is over the sensing face of proximity switch (1), the lamp of which is lighting up.
  At this time, bucket positioner relay (4) is turned on and a current flows in detent solenoid (6) of work equipment PPC valve (5) to magnetize the coil.



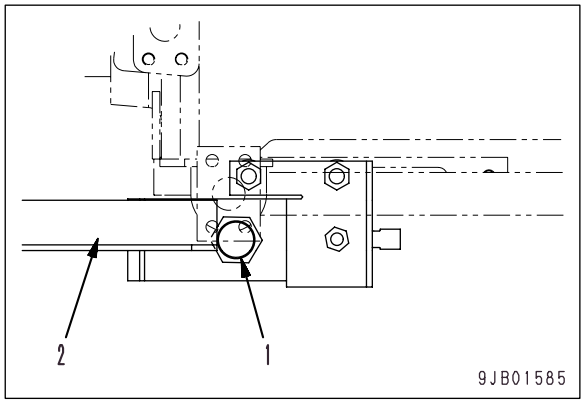


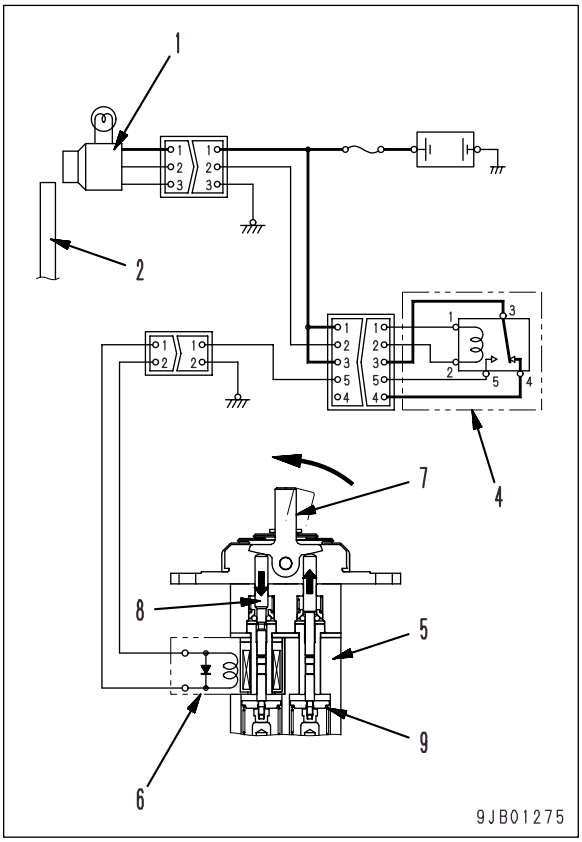
- If the work equipment (bucket) control lever (7) is moved to the TILT position, bucket dump spool (8) moves up and is held at that position by the coil magnetized by detent solenoid (6). As a result, work equipment (bucket) control lever (7) is held at TILT position and the bucket tilts.





- If the bucket tilts and parts from the set position of the bucket positioner, or if plate (2) parts from over the sensing face of proximity switch (1), the lamp of proximity switch (1) goes off and bucket positioner relay (4) is turned off. Accordingly, the circuit of detent solenoid (6) of work equipment PPC valve (5) is turned off to demagnetize the coil.
  Bucket dump spool (8) held at the TILT position receives the reaction force of spring (9) and returns work equipment (bucket) control lever (7) to the HOLD position.





FUNCTION OF PROXIMITY SWITCH

When object of sensing is over sensing face of proximity switch

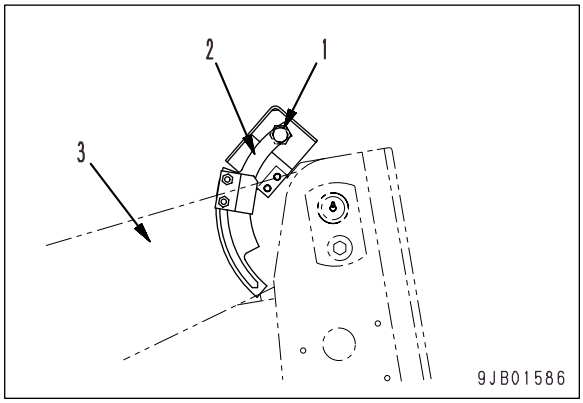
Lamp of proximity switch	ON
Bucket positioner relay switch circuit	Made
Work equipment PPC valve detent solenoid circuit	Made
Work equipment PPC valve detent solenoid	Magnetized

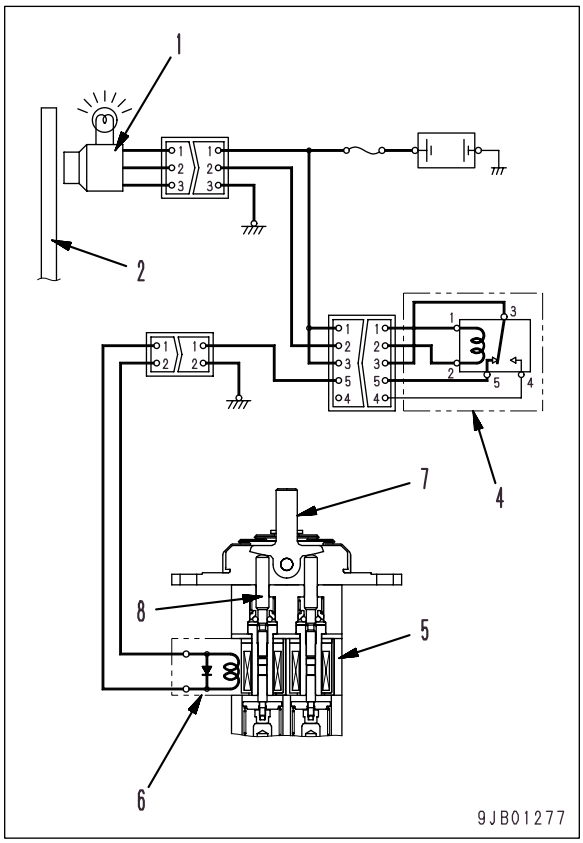
When object of sensing is apart from over sensing face of proximity switch

Lamp of proximity switch	OFF
Bucket positioner relay switch circuit	Broken
Work equipment PPC valve detent solenoid circuit	Broken
Work equipment PPC valve detent solenoid	Demagnetized

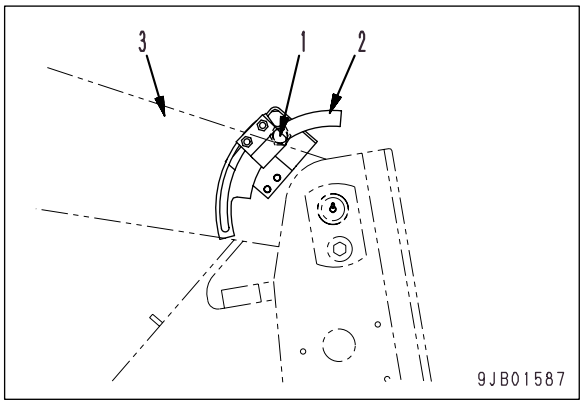
When lift arm is raised

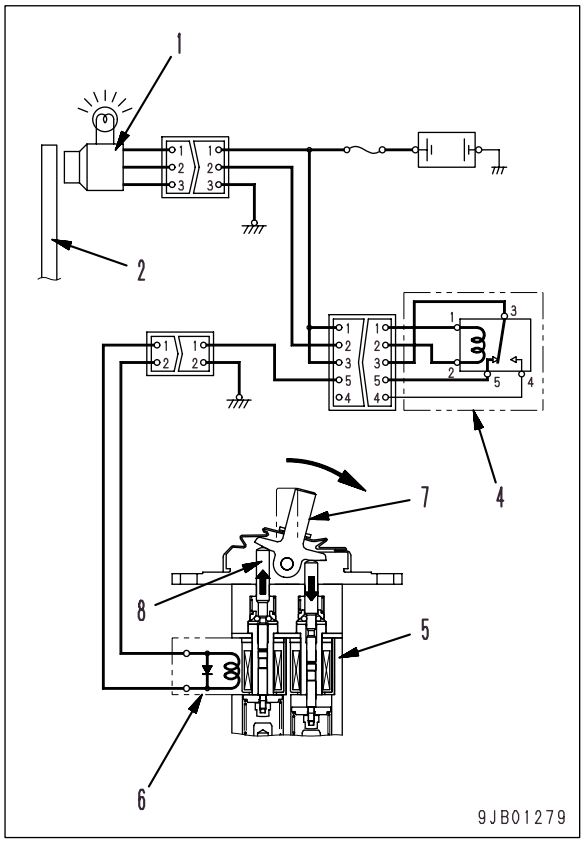
- While the lift arm (3) is lower than the set position of the boom kick-out, plate (2) is over the sensing face of proximity switch (1), the lamp of which is lighting up.
  At this time, boom kick-out relay (4) is turned on and a current flows in detent solenoid (6) of work equipment PPC valve (5) to magnetize the coil.



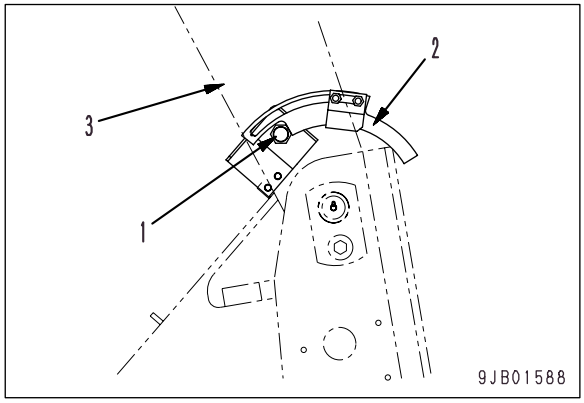


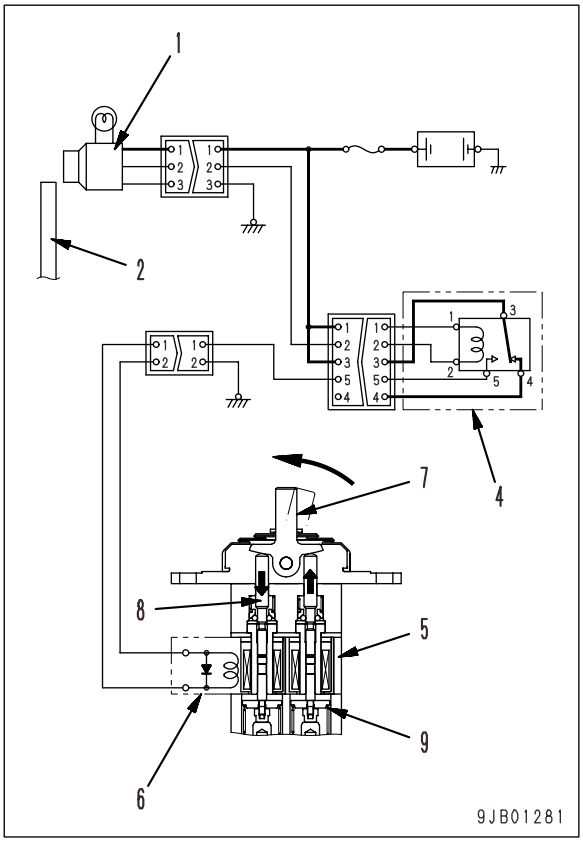
- If the work equipment (lift arm) control lever (7) is moved to the RAISE position, lift arm lower spool (8) moves up and is held at that position by the coil magnetized by detent solenoid (6). As a result, work equipment (lift arm) control lever (7) is held at RAISE position and the lift arm rises.





- If the lift arm (3) rises and parts from the set position of the kick-out, or if plate (2) parts from over the sensing face of proximity switch (1), the lamp of proximity switch (1) goes off and boom kick-out relay (4) is turned off. Accordingly, the circuit of detent solenoid (6) of work equipment PPC valve (5) is turned off to demagnetize the coil.
  Lift arm raise spool (8) held at the RAISE position receives the reaction force of spring (9) and returns work equipment (lift arm) control lever (7) to the HOLD position.





FUNCTION OF PROXIMITY SWITCH

When object of sensing is over sensing face of proximity switch

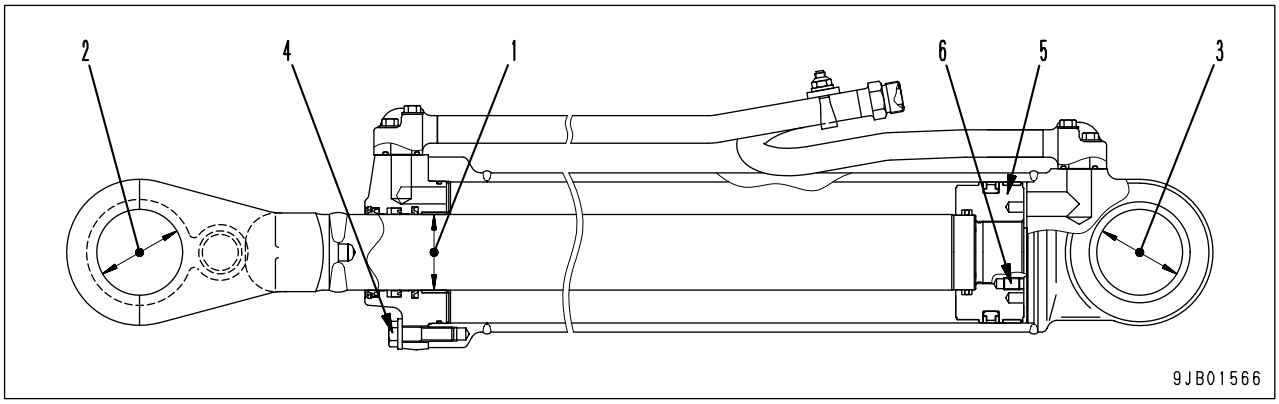
Lamp of proximity switch	ON
Boom kick-out relay switch circuit	Made
Work equipment PPC valve detent solenoid circuit	Made
Work equipment PPC valve detent solenoid	Magnetized

When object of sensing is apart from over sensing face of proximity switch

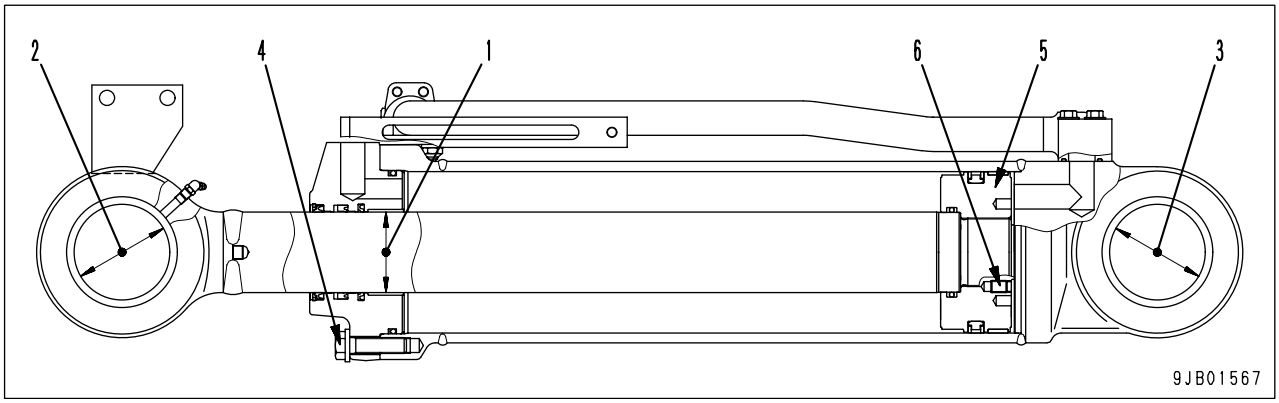
Lamp of proximity switch	OFF
Boom kick-out relay switch circuit	Broken
Work equipment PPC valve detent solenoid circuit	Broken
Work equipment PPC valve detent solenoid	Demagnetized

WORK EQUIPMENT CYLINDER

LIFT CYLINDER



BUCKET CYLINDER

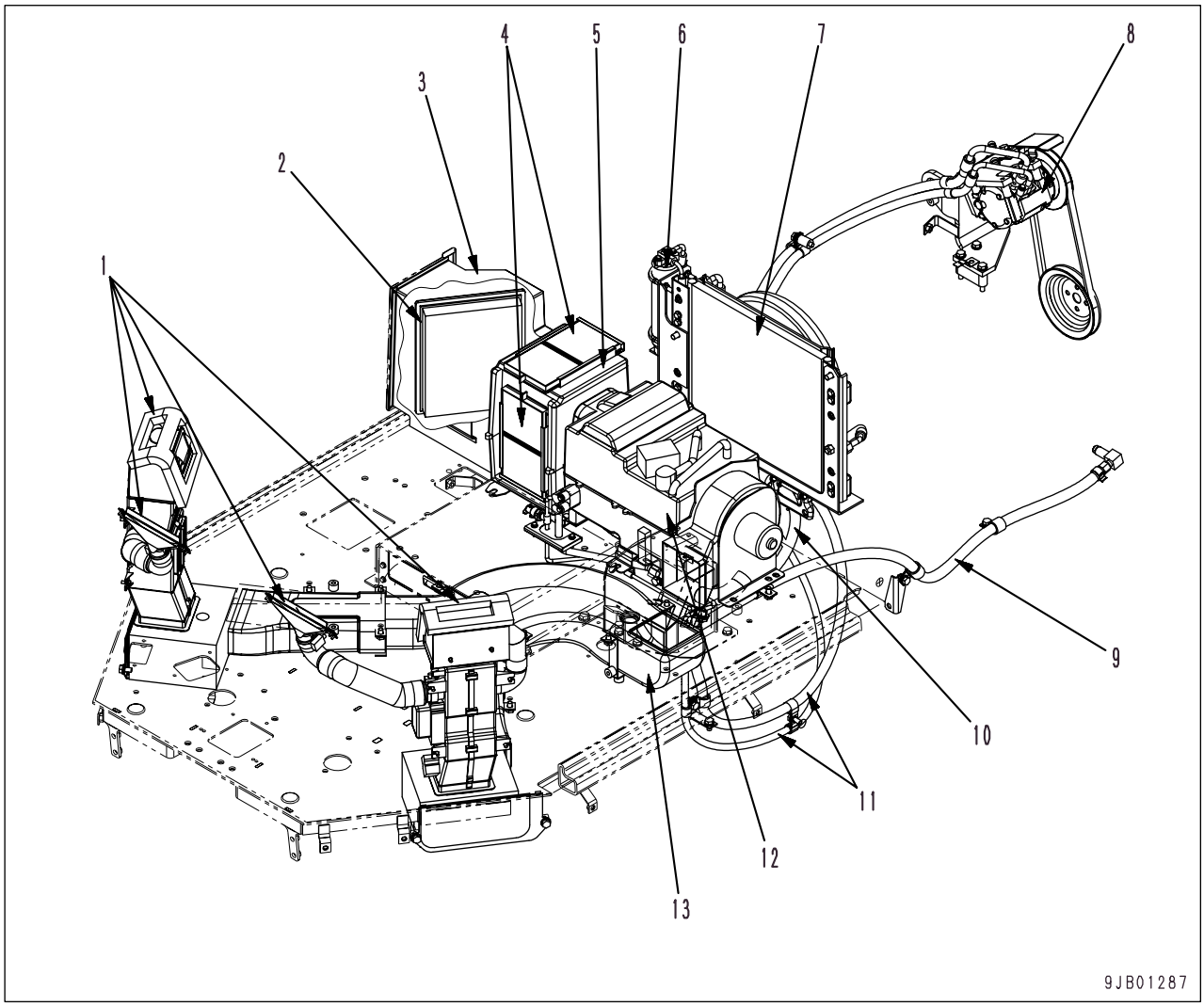


Unit: mm

No.	Check Item		Criteria					Remedy
		Name of cylinder	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	Lift	ø 75	-0.030 -0.076	+0.279 +0.065	0.095 – 0.355	0.655	Replace bushing
		Bucket	ø 80	-0.030 -0.076	+0.258 +0.048	0.078 – 0.334	0.634	
2	Clearance between piston rod supporting pin and bushing	Lift	ø 85	-0.036 -0.090	+0.350 +0.200	0.236 – 0.440	1.0	Replace pin and bushing
		Bucket	ø 95	-0.036 -0.090	+0.207 +0.120	0.156 – 0.297	1.0	
3	Clearance between cylinder bottom supporting pin and bushing	Lift	ø 85	-0.036 -0.090	+0.207 +0.120	0.156 – 0.297	1.0	
		Bucket	ø 95	-0.036 -0.090	+0.207 +0.120	0.156 – 0.297	1.0	
4	Tightening torque of cylinder head	Lift	162 ± 14.5 Nm {16.5 ± 1.5 kgm}					Retighten
		Bucket	250 ± 24.5 Nm {25.5 ± 2.5 kgm}					
5	Tightening torque of cylinder piston	Lift	294 ± 29.4 Nm {30 ± 3.0 kgm}					
		Bucket	294 ± 29.4 Nm {30 ± 3.0 kgm}					
6	Tightening torque of cylinder piston lock screw	Lift	58.9 ± 73.6 Nm {6.0 ± 7.5 kgm}					
		Bucket	58.9 ± 73.6 Nm {6.0 ± 7.5 kgm}					

AIR CONDITIONER

AIR CONDITIONER PIPING



1. Air outlet duct
2. Fresh air inlet filter
3. Fresh air inlet duct
4. Recirculating air filter
5. Recirculating / Fresh air selector damper
6. Receiver tank
7. Condenser
8. Compressor
9. Hot water return piping
10. Hot water take-out piping
11. Refrigerant piping
12. Air conditioner unit
13. Floor duct

MACHINE MONITORING SYSTEM

Outline

- The machine monitor system uses the sensors and other devices installed to various parts of the machine to observe the condition of the machine. It processes this information swiftly and displays it on the monitor panel to inform the operator of the condition of the machine.
- The machine monitor has the speedometer specification or load meter specification. The load meter specification machine monitor has the functions necessary for calculation and indication of the load meter which are not installed to the speedometer specification machine monitor. The optional printer to print the load meter calculation data is prepared.
- The indications of the machine monitor will be made under the normal mode and under the service mode.
- The machine monitor has ON/OFF output function of automatic preheating which assists with the starting of the engine.
- The machine monitor has the relay ON/OFF output function to cut the output to the HST solenoid when the HST controller has a trouble.

- Normal mode indications are those which are usually being made for ordinary use by the machine operators. The description below applies to the contents of the main indications.

1. Items which are always indicated
   - Meters (Travel speedometer or engine tachometer)
   - Gauges (Engine cooling water temperature gauge, HST oil temperature gauge and fuel level gauge)
   - Pilot indications
   - Service meter

   1) Items always displayed on load meter specification machine monitor
      (Items added to speedometer specification machine monitor)
      - Weight calculated by load meter
      - Time

2. Items which will be indicated only when some abnormality occurs
   - Cautions
   - Action code indications (When the machine monitor panel mode selector switch (>) is depressed and released while the action code is being indicated, the failure code (6 digits) will be indicated.)

3. When the time comes to change the filter or oil, necessary items for the filter change or oil change will be indicated on the character display. (Maintenance monitoring functions)

4. In addition to the above, this system is equipped with the functions to indicate the travel distance integrating meter (odometer), to reset the filter/oil changing time, and to select the language by use of the character display and the machine monitor panel mode selector switch which is the operation switch of the character display.

   1) Other functions of load meter specification machine monitor
      The following functions are installed to only the load meter specification machine monitor and selected with the monitor panel mode selector switch; Load meter display selection, printer output mode selection, load meter calibration, clock adjustment, phone No. input, and machine monitor illumination intensity adjustment.

- This machine monitoring system is equipped with the service mode function to facilitate the troubleshooting work for respective controllers (including the machine monitor itself) on the network. The description below applies to the contents of the main functions.

1. Electric fault history
   This function will indicate the electric fault history data of respective controllers being memorized by the machine monitor. Also, it can be used to delete the aforementioned data.

2. Machine fault history
   This function will indicate the machine fault history and machine fault history data of respective controllers being memorized by the machine monitor.

3. Real time monitor
   This function will make real time indications of the inputting data and outputting data being recognized by respective controllers on the network.

4. Tuning (Only load meter specification)
   This function will correct and adjust the installation errors and manufacturing dispersion of the sensors.

5. Maintenance monitor
   This function is to be used for revisions of the preset filter and oil changing time. (Revision of the time for the maintenance monitor operation)

6. Selection of optional items
   This function is used to set the machine model, tier size, and optional equipment.

7. Setting of machine serial No. (Only load meter specification)
   This function will set a machine serial No.

8. Controller initializing function
   This function is being used to effect the settings of this machine monitor before shipment from our factory.

- Also, the service mode is equipped with the following functions necessary when replacing the machine monitor.

1. Service meter setting
   This function is to be used to make setting of the service meter value being memorized by the machine monitor. However, this setting is valid only toward the direction to increase the current value.

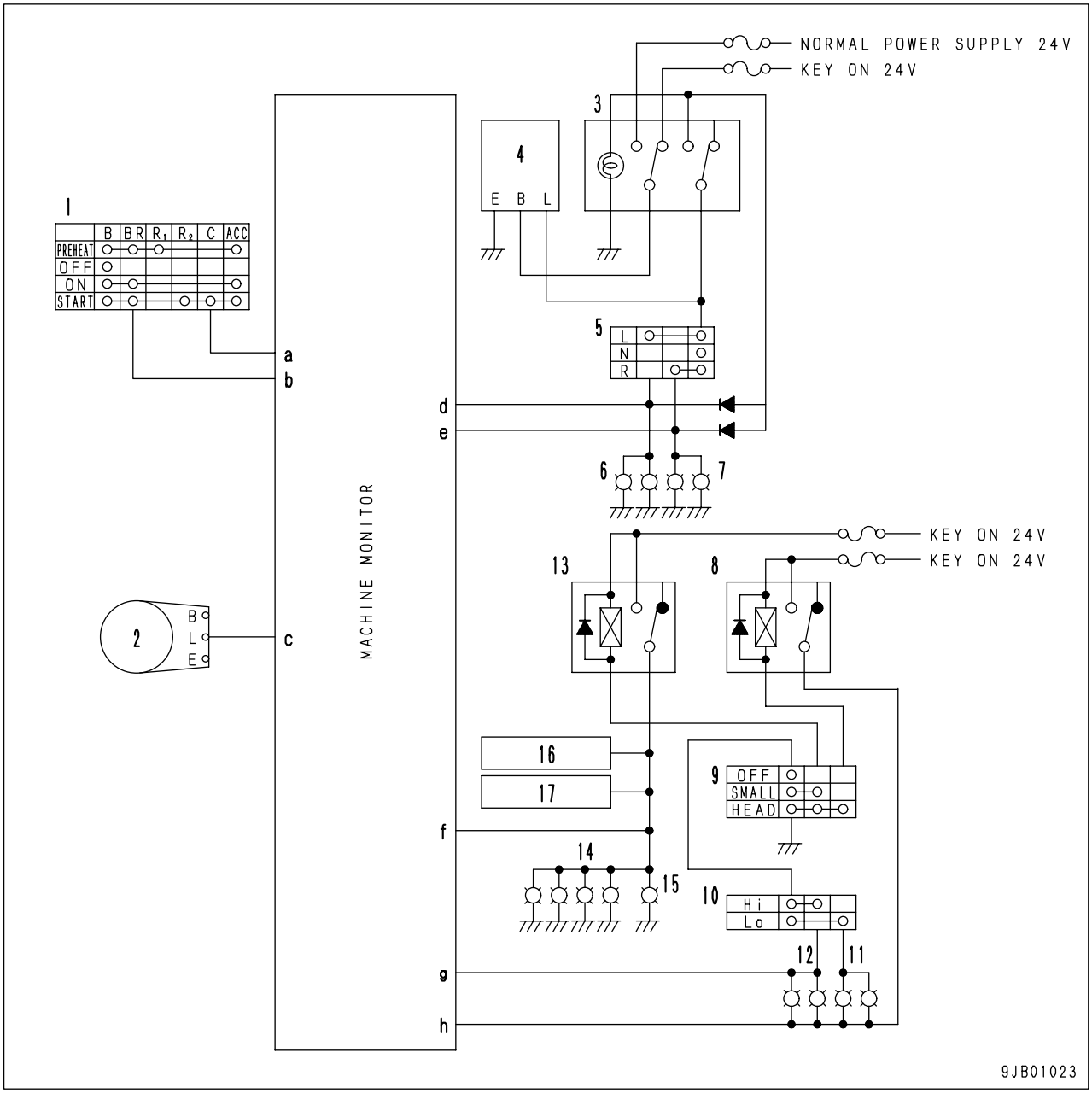
2. Travel distance integrating meter value setting
   This function is to be used to set the travel distance integrating meter value being memorized by the machine monitor. However, this setting is valid only toward the direction to increase the current value.

★ For "Setting service meter" and "Setting integrated travel distance", ask the manufacturer since they are carried out with the initializing function.

- The machine monitoring system consists of the machine monitor proper, buzzer, and switches that are used for inputting data to the machine monitor proper, sensors, respective controller on the network, and relevant switches and sensors.

Individual circuit diagrams of the machine monitor

Starting and lighting



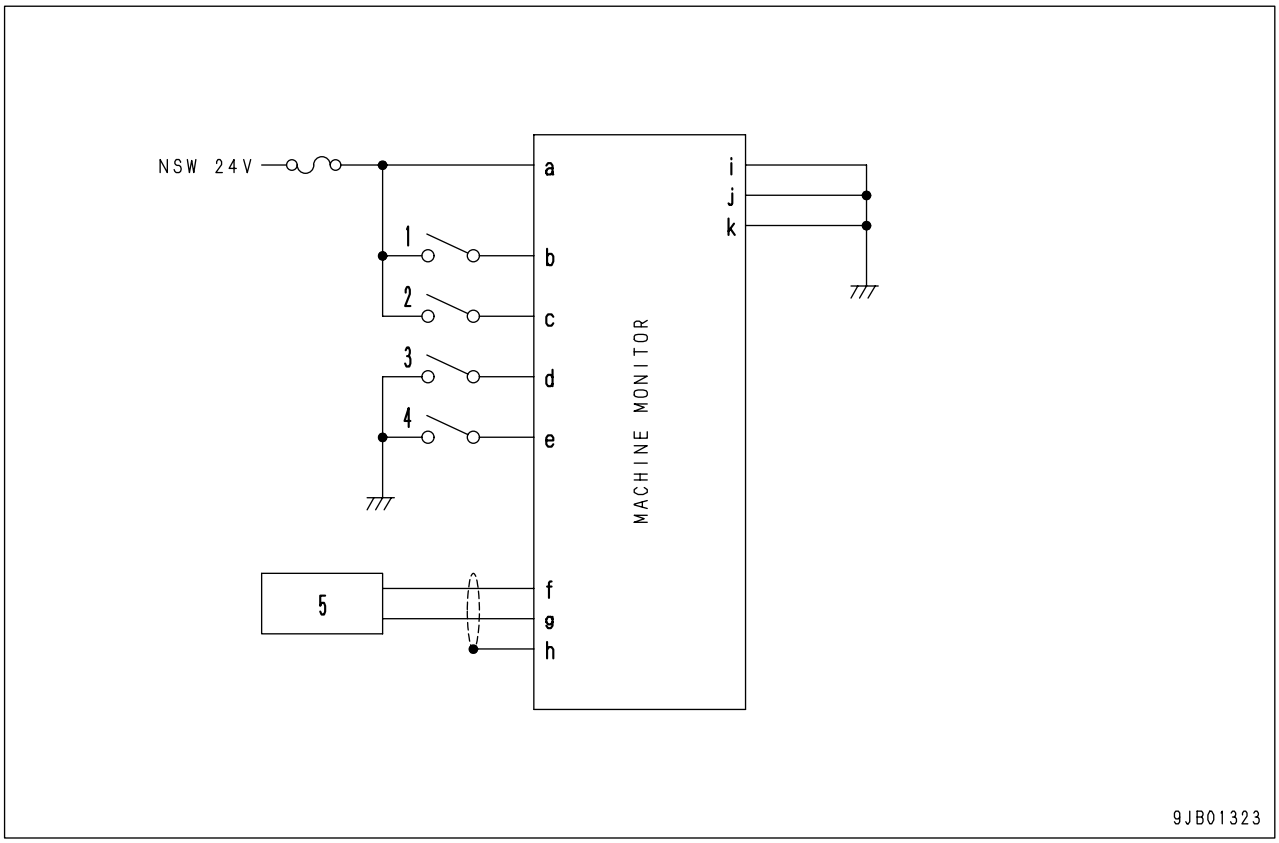
1. Starting switch
2. Alternator
3. Emergency flasher switch
4. Flasher unit
5. Turn signal lever
6. Turn signal lamp (Left)
7. Turn signal lamp (Right)
8. Head lamp relay
9. Lamp switch
10. Dimmer switch
11. Head lamp (Lo)
12. Head lamp (Hi)
13. Clearance lamp, tail lamp relay
14. Clearance lamp, tail lamp
15. License plate lamp
16. Working lamp relay
17. Tachograph lamp (If equipped)

Connection table of connector pins of machine monitor

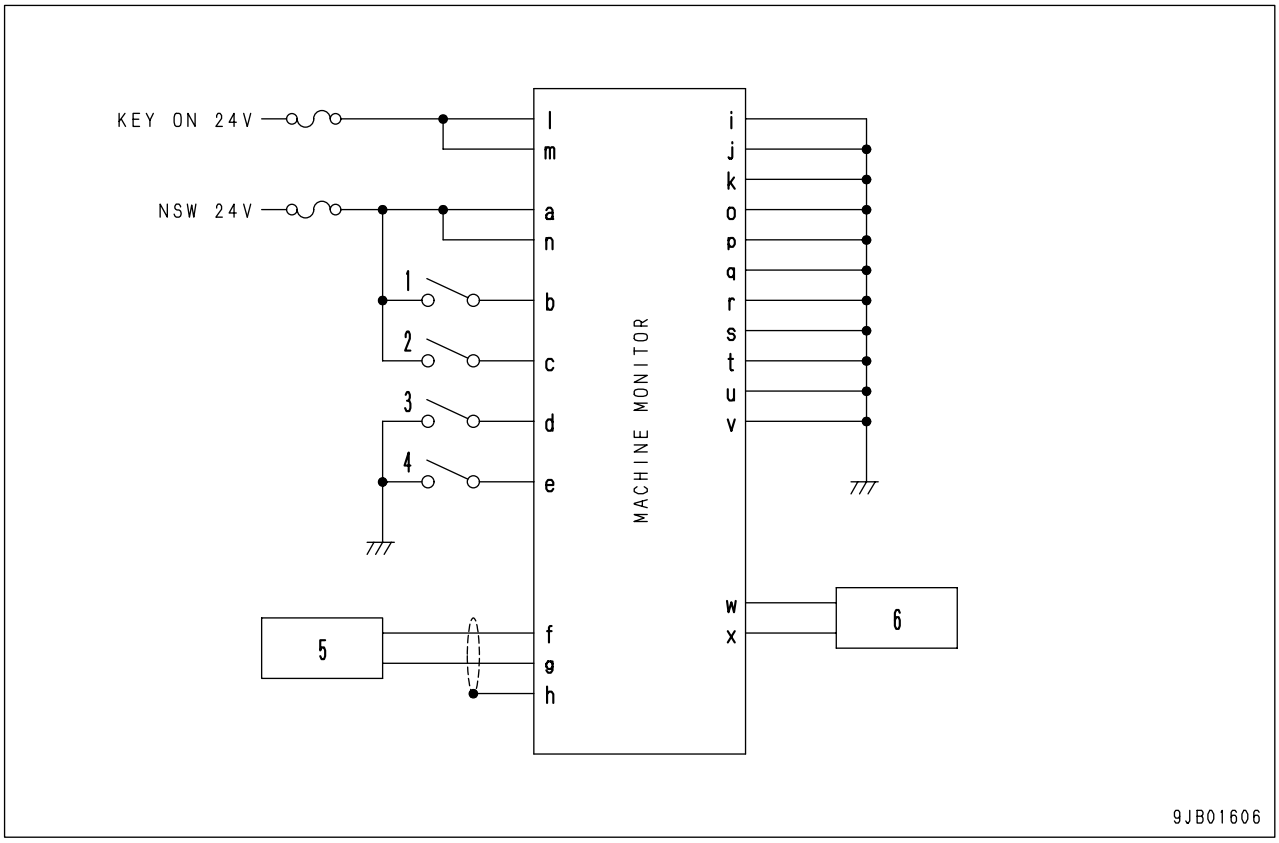
Symbol	Connector pin No.	
	Speed meter specification	Load meter specification
a	CNL23-3	CNL25-2
b	CNL23-1	CNL25-10
c	CNL23-12	CNL25-18
d	CNL22-11	CNL25-16
e	CNL23-17	CNL25-7
f	CNL21-12	CNL26-12
g	CNL22-12	CNL27-5
h	CNL23-9	CNL25-1

Power supply and network

Speed meter specification



Load meter specification

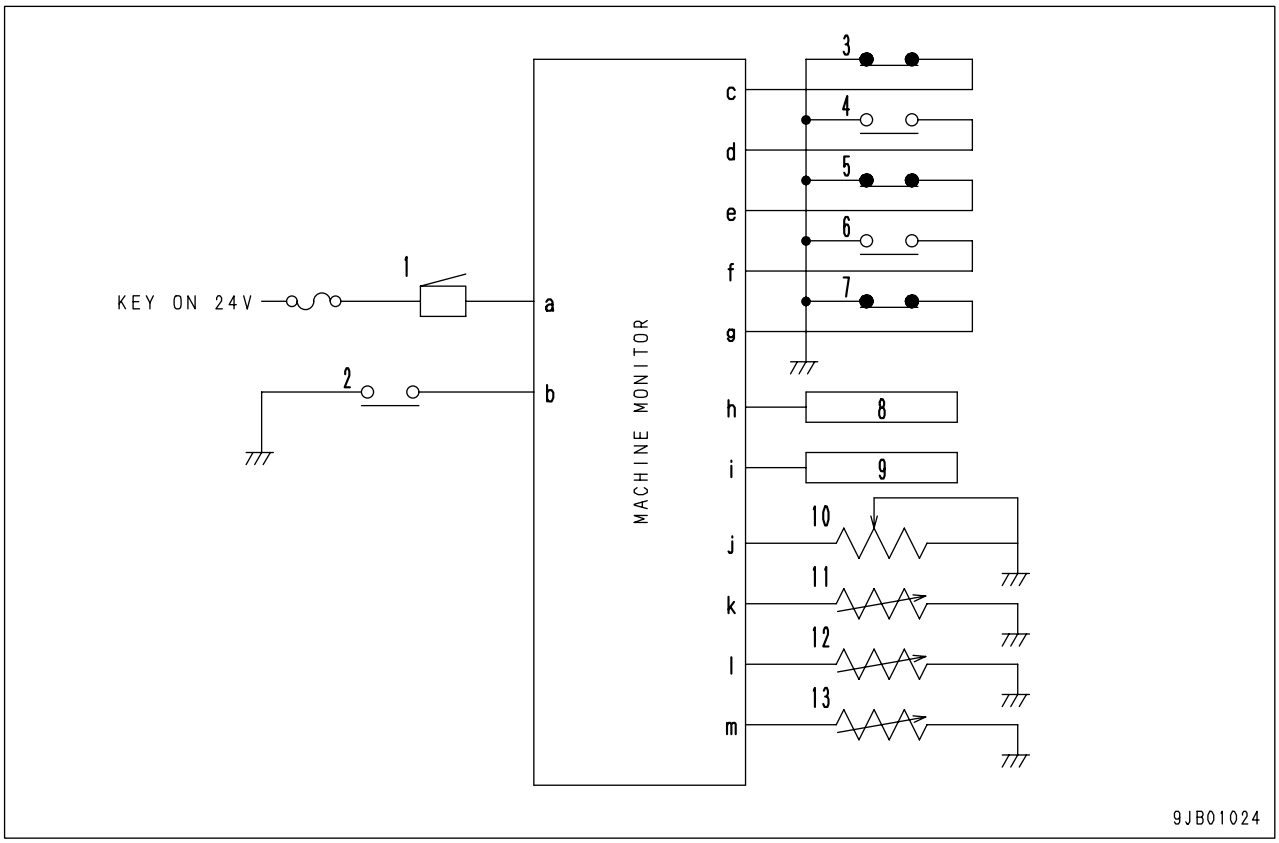


1. Monitor panel mode selector switch 1 "◇"
2. Monitor panel mode selector switch 1 "◆"
3. Monitor panel mode selector switch 2 "<"
4. Monitor panel mode selector switch 2 ">"
5. HST controller
6. Printer for load meter (If equipped) (Load meter specification)

Connection table of connector pins of machine monitor

Symbol	Connector pin No.	
	Speed meter specification	Load meter specification
a	CNL23-11	CNL24-4
b	CNL21-2	CNL25-8
c	CNL21-1	CNL25-6
d	CNL21-4	CNL27-15
e	CNL21-5	CNL27-7
f	CNL22-6	CNL29-3
g	CNL22-2	CNL29-8
h	CNL21-3	CNL29-7
i	CNL21-7	CNL24-9
j	CNL21-15	CNL24-10
k	CNL23-14	CNL24-17
l	—	CNL24-6
m	—	CNL24-7
n	—	CNL24-5
o	—	CNL24-18
p	—	CNL24-19
q	—	CNL24-20
r	—	CNL25-9
s	—	CNL26-6
t	—	CNL27-9
u	—	CNL28-6
v	—	CNL29-6
w	—	CNL30-6
x	—	CNL30-9

Sensing

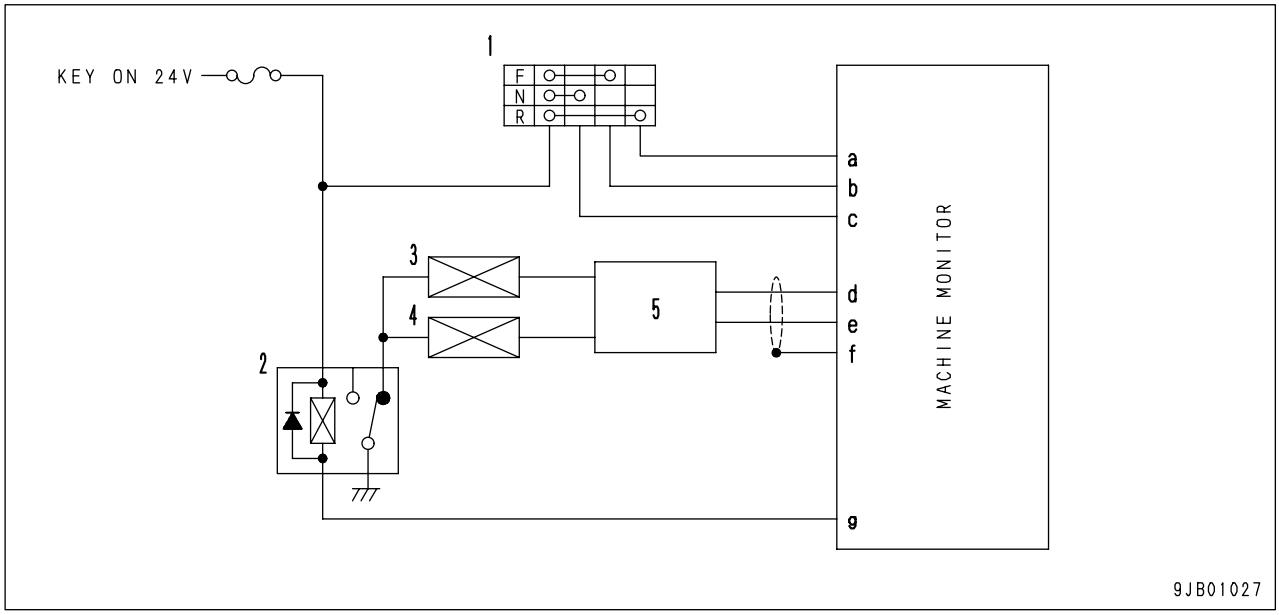


1. Alarm buzzer
2. HST filter clogging sensor
3. Steering oil pressure sensor
   (Machines equipped with emergency steering)
4. Emergency steering oil pressure sensor
   (Machines equipped with emergency steering)
5. Coolant level sensor
6. Brake oil pressure sensor
7. Engine oil pressure sensor
8. Parking brake not applied signal
9. Parking brake indicator signal
10. Fuel level sensor
11. HST oil temperature sensor
12. Coolant temperature sensor (for monitor)
13. Axle oil temperature sensor

Connection table of connector pins of machine monitor

Symbol	Connector pin No.	
	Speed meter specification	Load meter specification
a	CNL21-11	CNL24-14
b	CNL23-6	CNL26-5
c	CNL22-3	CNL27-16
d	CNL22-5	CNL27-3
e	CNL23-8	CNL27-10
f	CNL23-19	CNL26-1
g	CNL23-10	CNL27-2
h	CNL21-13	CNL25-17
i	CNL23-18	CNL27-1
j	CNL23-13	CNL28-1
k	CNL21-14	CNL28-2
l	CNL21-16	CNL28-8
m	CNL21-8	CNL28-7

HST safety control

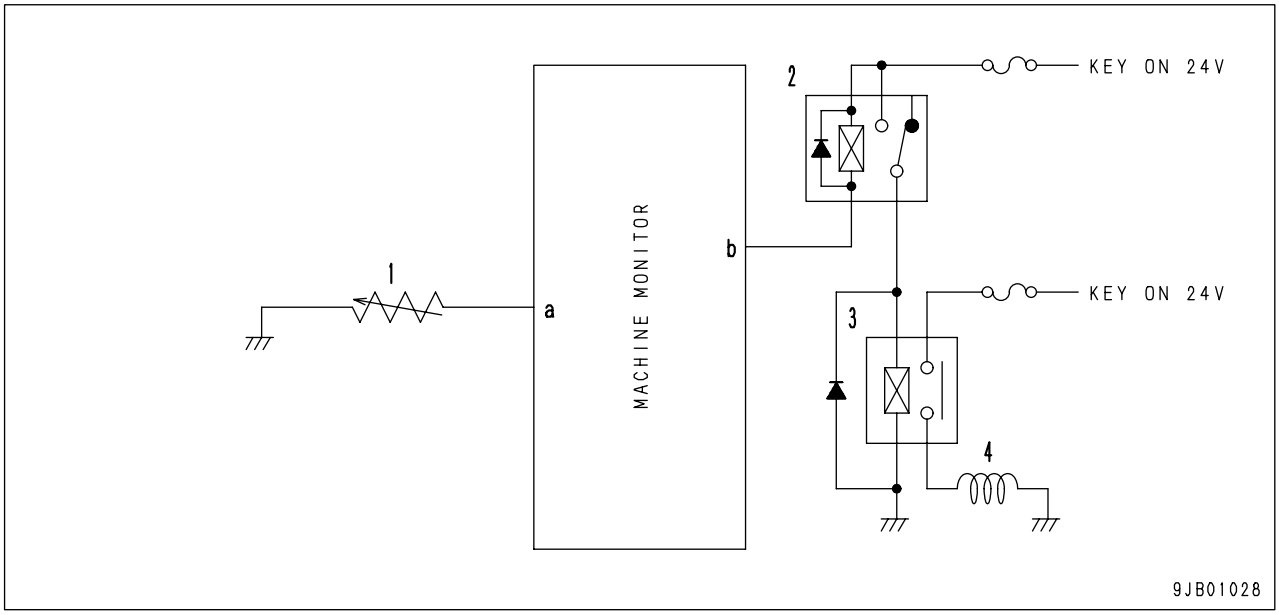


1. Forward-reverse lever
2. HST safety relay
3. Motor 1 solenoid valve
4. Clutch solenoid valve
5. HST controller

Connection table of connector pins of machine monitor

Symbol	Connector pin No.	
	Speed meter specification	Load meter specification
a	CNL22-8	CNL25-5
b	CNL22-10	CNL25-4
c	CNL22-9	CNL25-13
d	CNL22-6	CNL29-3
e	CNL22-2	CNL29-8
f	CNL21-3	CNL29-7
g	CNL23-15	CNL24-13

Autmatic preheating



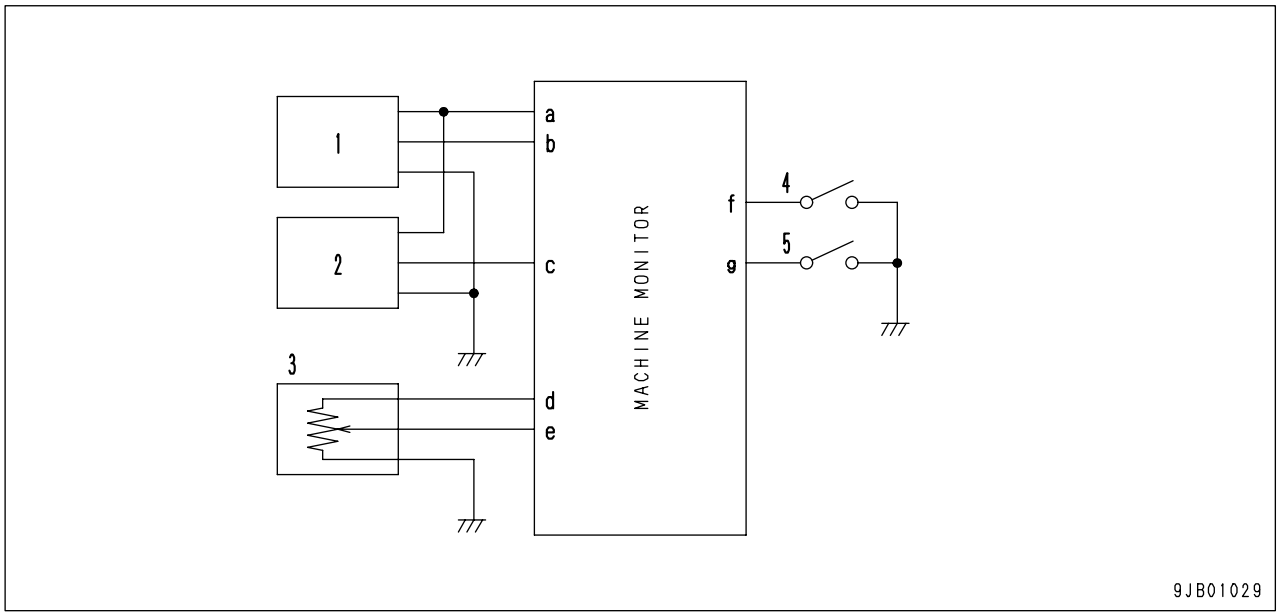
1. Coolant temperature sensor (for preheating)
2. Automatic preheater relay
3. Engine heater relay
4. Ribbon heater

Connection table of connector pins of machine monitor

Symbol	Connector pin No.	
	Speed meter specification	Load meter specification
a	CNL21-6	CNL28-3
b	CNL22-4	CNL24-12

Load meter

Load meter specification



1. Lift arm pressure sensor (head)
2. Lift arm pressure sensor (bottom)
3. Lift arm angle sensor
4. Sub total switch
5. Cancel switch

Connection table of connector pins of machine monitor

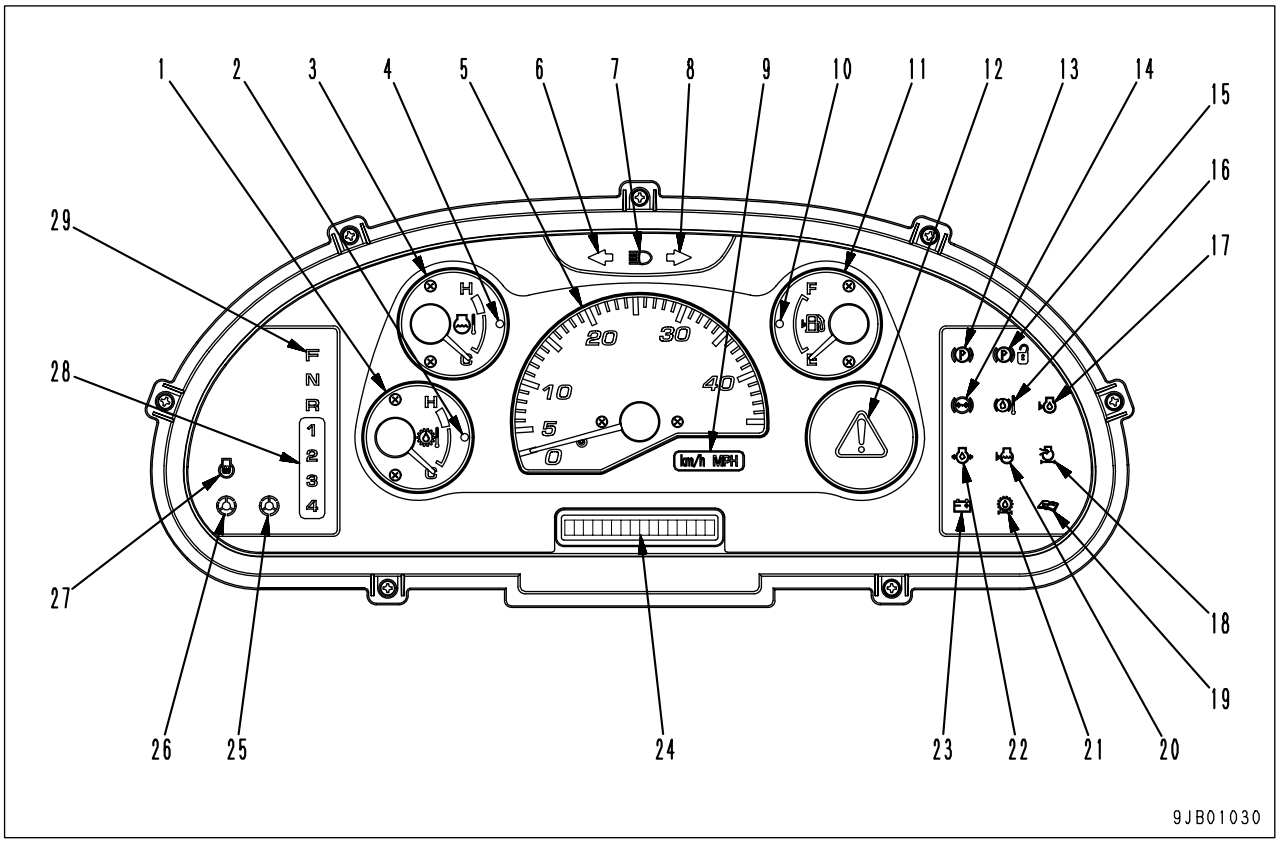
Symbol	Connector pin No.
	Load meter specification
a	CNL24-15
b	CNL28-4
c	CNL28-9
d	CNL24-16
e	CNL28-10
f	CNL27-4
g	CNL27-13

CAN output \ CAN input		Machine monitor	HST controller
Machine monitor	Forward-reverse lever signal		HST control
	Model selection		Model selection
	HST function selection		HST control
HST controller	Travel speed pulse	Travel speedometer	
	Gear speed signal	Indication of 1, 2, 3, or 4	
	Error	Indication of characters	
	Input/Output state signal	Real-time monitor	

white 10-175

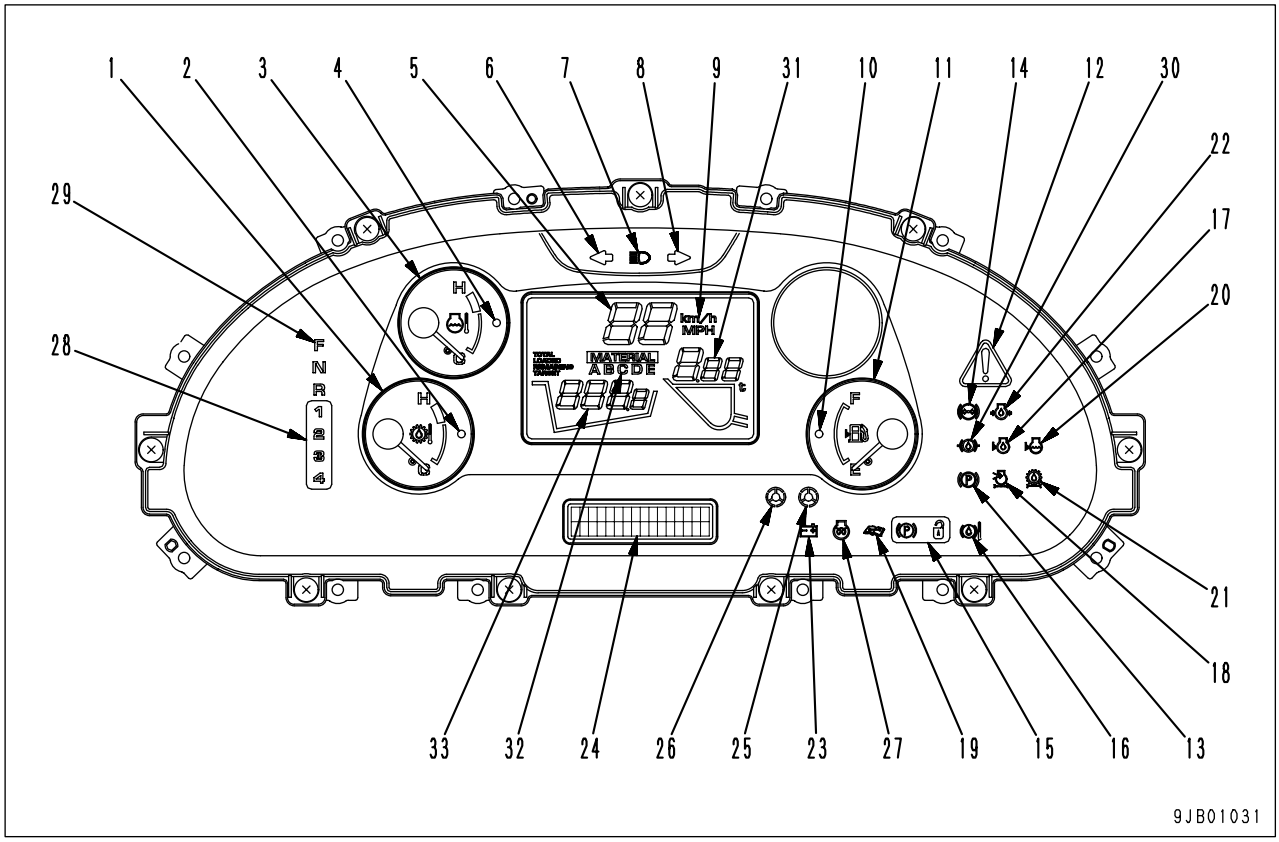
MACHINE MONITOR

Speed meter specification



1. HST oil temperature gauge
2. HST oil temperature caution lamp
3. Engine water temperature gauge
4. Engine water temperature caution lamp
5. Speedometer
6. Turn signal pilot lamp (Left)
7. Head lamp beam pilot lamp
8. Turn signal pilot lamp (Right)
9. Meter indication pilot lamp
10. Fuel level caution lamp
11. Fuel level gauge
12. Centralized warning lamp
13. Parking brake pilot lamp
14. Brake oil pressure caution lamp
15. Parking brake not applied caution lamp
16. Axle oil temperature caution lamp
17. Engine oil level caution lamp
18. Air cleaner clogging caution lamp
19. Maintenance caution lamp
20. Radiator water level caution lamp
21. HST oil filter clogging caution lamp
22. Engine oil pressure caution lamp
23. Battery charge circuit caution lamp
24. Character display
25. Steering oil pressure caution lamp
    (Machines equipped with emergency steering)
26. Emergency steering pilot lamp
    (Machines equipped with emergency steering)
27. Preheater pilot lamp
28. Gear speed selector switch position pilot lamp
29. Forward-reverse lever position pilot lamp

Load meter specification (If equipped)



1. HST oil temperature gauge
2. HST oil temperature caution lamp
3. Engine water temperature gauge
4. Engine water temperature caution lamp
5. Speedometer
6. Turn signal pilot lamp (Left)
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14. Brake oil pressure caution lamp
15. Parking brake not applied caution lamp
16. Brake oil temperature caution lamp
17. Engine oil level caution lamp
18. Air cleaner clogging caution lamp
19. Maintenance caution lamp
20. Radiator water level caution lamp
21. HST oil filter clogging caution lamp
22. Engine oil pressure caution lamp
23. Battery charge circuit caution lamp
24. Character display
25. Steering oil pressure caution lamp
    (Machines equipped with emergency steering)
26. Emergency steering pilot lamp
    (Machines equipped with emergency steering)
27. Preheater pilot lamp
28. Gear speed selector switch position pilot lamp
29. Forward-reverse lever position pilot lamp
30. Brake oil level caution lamp
31. Display of load on bucket
32. Display of handled material
33. Addition mode: Display of total load
    Subtraction mode: Display of remaining target load

LIST OF ITEMS DISPLAYED ON MONITOR

Condition for judging running of engine: When running judgment A or B is satisfied, it is judged that the engine is running.

1. Input is given to alternator terminal R (24 V).
2. Engine oil pressure is normal (Open).
3. Signal of terminal C has been input at least once after IGN_BR, and then it has been turned OFF at least once.

Judgment of operation

A: After 1 and 2 are established simultaneously, it is judged that the engine is running until IGN_BR is turned OFF.

B: If 1 and 3 are established simultaneously or 2 and 3 are established simultaneously, it is judged that the engine is running. If both signals of 1 and 2 are lost, however, it is judged that the engine is stopped even if IGN_BR is turned ON.

Lamp	Period of lamp
○: ON	–
◎: Flash	Period: 1,600 msec ON: 800 msec OFF: 800 msec (DUTY 50%)
☆: Intermittent	Period: 240 msec ON 1: 80 msec OFF: 160 msec
△: Condition is set separately	–

Buzzer	Condition for operation	Period of buzzer	Priority
◎: ON and OFF continuously	Warning for dangerous condition (When error indication or caution is turned on)	Period: 1,600 msec ON: 800 msec OFF: 800 msec (DUTY 50%)	1
☆: Intermittent	Caution for wrong operation, etc. (When abnormal operation is performed)	Period: 240 msec ON 1: 80 msec OFF: 160 msec	2
△: Cancellation sound	Cancellation of calibration, etc. (When operation is not accepted)	ON: 1,000 msec (Once)	3
▲: Completion sound	Completion of calibration, etc. (When completed normally)	ON: 1,000 msec. OFF: 160 msec. ON: 1,000 msec (Once)	4

Division	No.	Item	Device (LDM: Load meter specification) (SPM: Speed meter specification)	Condition for operation	Operation								Indication color	Remarks
					Engine is stopped				Engine is running					
					Warning buzzer	Individual indication	Centralized warning	Indication of error code message	Warning buzzer	Individual indication	Centralized warning	Indication of error code message		
Backup lamp	–	Backup lamp	LDM: LCD SPM: Bulb	When clearance lamp is ON	–	–	–	–	–	–	–	–	Orange	
Unit	9	Indication of meter	LDM: LCD SPM: LCD		–	○	–	–	–	○	–	–	Green	km/h or MPH (Selected by setting monitor)
Gauge/ Meter	5	Travel speed (Speed meter spec.)	Pointer: Movement	Conversion of travel speed pulse into travel speed	–	–	–	–	–	–	–	–	–	If there is error in communication, condition is held until key is turned OFF.
		Travel speed (Load meter spec.)	LCD	Conversion of travel speed pulse into travel speed	–	–	–	–	–	–	–	–	–	If there is error in communication, displayed “0“.
	1 2	HST oil temperature/HST oil temperature caution	Pointer: Movement Indicator: LED	Other than below	–	–	–	–	–	–	–	–	–	White range: 50 - 110°C Red range: 110 - 135°C
				Alarm: Above 110°C	◎	○	○	B@CRNS	◎	○	○	B@CRNS	Red	
				HST oil temperature: Above 150°C	–	–	–	DGH1KX	–	–	–	DGH1KX	–	
	3 4	Engine water temperature/ Engine water temperature caution	Pointer: Movement Indicator: LED	Other than below	–	–	–	–	–	–	–	–	–	White range: 50 - 102°C Red range: 102 - 135°C
				Alarm: Above 102°C	–	○	–	–	–	○	–	–	Red	
				Alarm: Above 105°C	◎	○	○	B@BCNS	◎	○	○	B@BCNS	Red	
				Engine water temperature: Above 150°C	–	–	–	DGE2KX	–	–	–	DGE2KX	–	
	10 11	Fuel level / Fuel level caution	Pointer: Movement Indicator: LED	Other than below	–	–	–	–	–	–	–	–	–	
				Above 110✗ (Below 5%)	–	○	–	–	–	○	–	–	Red	
	24	Odometer	LCD	Conversion of travel speed pulse into travel distance	–	–	–	–	–	–	–	–	–	
		Service meter		Operates when charge is normal. Corresponds to clock time in 1:1.	–	–	–	–	–	–	–	–	–	
Caution lamp	12	Centralized warning lamp	LDM: LED SPM: Bulb	Other than below	–	–	–	–	–	–	–	–	–	Lamp is turned ON by each controller and message is indicated on character display. Lamp is turned ON by caution.
				When error is made	△	△	△	△	△	△	△	△	Red	
	14	Brake oil pressure (Accumulator oil pressure)	LDM: LED SPM: Bulb	Oil pressure is normal (GND)	–	–	–	–	–	–	–	–	–	*1: For 30 sec just after key is turned ON and engine is started *2: 30 sec after engine is started (after *1)
				Oil pressure is abnormal (OPEN) (*1)	–	○	–	–	◎	○	○	–	Red	
				Oil pressure is abnormal (OPEN) (*2)	–	–	–	–	◎	○	○	2G42ZG	Red	
	15	Prevention of omitting to apply parking brake	LDM: LED SPM: Bulb	Other than below	–	–	–	–	–	–	–	–	–	Lamp lights up and warning buzzer sounds when engine is stopped and parking brake is released (or when key is turned OFF).
				When application of parking brake is omitted (24 V)	☆	○	○	–	–	–	–	–	Red	
	16	Axle oil temperature	LDM: LED SPM: Bulb	Oil temperature is normal	–	–	–	–	–	–	–	–	–	
				Oil temperature is abnormal	◎	○	○	B@C7NS	◎	○	○	B@C7NS	Red	
				Brake oil temperature: Above 150°C	–	–	–	DGR1KX	–	–	–	DGR1KX	–	
				Detection of error	–	–	–	DGR1KB	–	–	–	DGR1KB	–	

Division	No.	Item	Device (LDM: Load meter specification) (SPM: Speed meter specification)	Condition for operation	Operation								Indication color	Remarks
					Engine is stopped				Engine is running					
					Warning buzzer	Individual indication	Centralized warning	Indication of error code message	Warning buzzer	Individual indication	Centralized warning	Indication of error code message		
Caution lamp	17	Engine oil temperature	LDM: LED SPM: Bulb	Oil level is normal (GND)	–	–	–	–	–	–	–	–	–	If error is detected when IGN_C signal is turned ON. Error is not detected while engine is running. (If abnormality is detected when key is turned ON, alarm is kept turned ON until normal oil level is detected.)
				Oil level is low (OPEN)	–	○	–	B@BAZK	–	–	–	–	Red	
	18	Clogging of air cleaner	LDM: LED SPM: Bulb	Normal (OPEN)	–	–	–	–	–	–	–	–	–	Error is detected only while engine is running.
				Clogging (GND)	–	○	–	–	–	○	–	AA1ANX	Red	
	19	Maintenance	LDM: LED SPM: Bulb	Normal	–	–	–	–	–	–	–	–	–	
				30 h before maintenance	–	○	–	△	–	○	–	△	Red	
	20	Radiator water level	LDM: LED SPM: Bulb	Water level is normal (GND)	–	–	–	–	–	–	–	–	–	Error is judged when it is detected for 30 sec.
				Water level is low (OPEN)	–	○	–	B@BCZK	–	○	–	B@BCZK	Red	
	21	Clogging of HST oil filter	LDM: LED SPM: Bulb	Normal (OPEN)	–	–	–	–	–	–	–	–	–	Error is judged when HST oil temperature is above 50°C.
				Clogging (GND)	–	○	–	15BONX	–	○	–	15BONX	Red	
	22	Engine oil pressure	LDM: LED SPM: Bulb	Oil pressure is normal (OPEN)	–	–	–	–	–	–	–	–	–	Error is detected 15 sec after engine is started.
				Oil pressure is low (GND)	–	○	–	–	◎	○	○	B@BAZG	Red	
				When abnormality is detected (OPEN)	–	–	–	DHE4L6	–	–	–	–	Red	
	23	Battery charge circuit	LDM: LED SPM: Bulb	Normal voltage (24 V)	◎	–	○	AB00L6	–	–	–	–	Red	
				Defective charge (0 V)	–	○	–	–	◎	○	○	AB00MA	Red	
Pilot lamp	6 8	Turn signal lamp	LDM: LED SPM: Bulb	When turn signal lever is turned ON (while key is turned OFF, too)	–	○	–	–	–	○	–	–	Green	Interlocked with turn signal lever. Operates when hazard lamp switch is turned ON.
	7	Beam of head lamp	LDM: LED SPM: Bulb	When beam of head lamp is turned ON (When both head lamp and beam are turned ON)	–	○	–	–	–	○	–	–	Blue	Interlocked with lamp switch and dimmer switch.
	13	Parking brake	LDM: LED SPM: Bulb	Parking brake is released (OPEN)	–	–	–	–	–	–	–	–	–	Lamp lights up when parking brake is applied. Operation of forward-reverse (F-R) lever is prohibited and warning buzzer is turned ON while parking brake is applied.
				Parking brake is applied (GND)	–	○	–	–	–	○	–	–	Red	
				Prevention of dragging of parking brake	☆	○	○	–	☆	○	○	–	Red	
	25	Steering oil pressure (Machines equipped with emergency steering)	LDM: LED SPM: Bulb	Oil pressure is normal (OPEN)	–	–	–	–	–	–	–	–	–	
				Oil pressure is low (GND)	–	○	–	–	◎	○	○	DDS5L6	Red	
	26	Emergency steering (Machines equipped with emergency steering)	LDM: LED SPM: Bulb	Oil pressure is lost (GND)	–	–	–	–	–	–	–	–	–	
				Oil pressure is normal (OPEN)	–	○	–	–	–	○	–	–	Green	

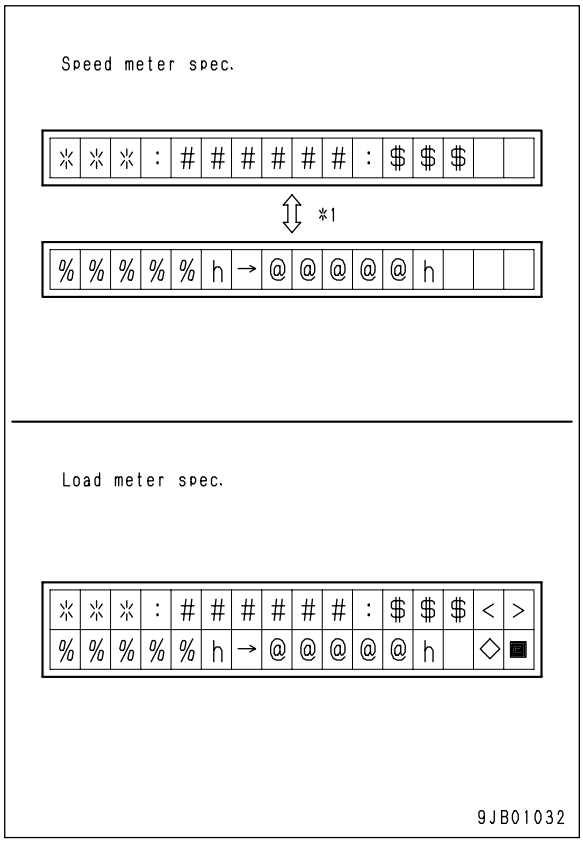
Division	No.	Item		Device (LDM: Load meter specification) (SPM: Speed meter specification)	Condition for operation	Operation								Indication color	Remarks
						Engine is stopped				Engine is running					
						Warning buzzer	Individual indication	Centralized warning	Indication of error code message	Warning buzzer	Individual indication	Centralized warning	Indication of error code message		
Pilot lamp	27	Automatic preheating		LDM: LED SPM: Bulb	Other than below	–	–	–	–	–	–	–	–	–	Lamp lights up when automatic preheater is turned ON. Output is turned OFF when IGN_C signal is turned ON. Postheater is turned ON after IGN_C signal is turned OFF.
					When engine is preheated (postheated)	–	○	–	–	–	○	–	–	Orange	
	29	Forward-reverse lever position	F	LED	When F is selected	–	○	–	–	–	○	–	–	Green	
			N		When N is selected	–	○	–	–	–	○	–	–	Orange	
			R		When R is selected	–	○	–	–	–	○	–	–	Green	
	28	Gear speed selector switch position	1	LED	When 1st gear speed is received	–	○	–	–	–	○	–	–	Green	Indicator lamp lights up when CAN signal is received from HST controller. Indicator lamp does not light up when CAN communication is defective (All lamps go off).
			2		When 2nd gear speed is received	–	○	–	–	–	○	–	–	Green	
			3		When 3rd gear speed is received	–	○	–	–	–	○	–	–	Green	
			4		When 4th gear speed is received	–	○	–	–	–	○	–	–	Green	
Others	5 31 32 33	Load meter (Load meter spec.)		LCD	When load meter is not displayed	–	–	–	–	–	–	–	–	–	Display of calculated value
					When load meter is displayed	△	△	△	△	△	△	△	△	△	

★ Monitor lamp 30 does not operate on this machine.

Service mode functions

1. Outline

1) Electrical equipment system failure history
This function is used to check the electrical equipment system failure history of each controller saved in the machine monitor. For the failure codes displayed in the electrical equipment system failure history, see TROUBLESHOOTING. After each failure is repaired and the normal operation is confirmed, delete the failure history.
The contents of the electrical equipment system failure history displayed on the character display are as follows.

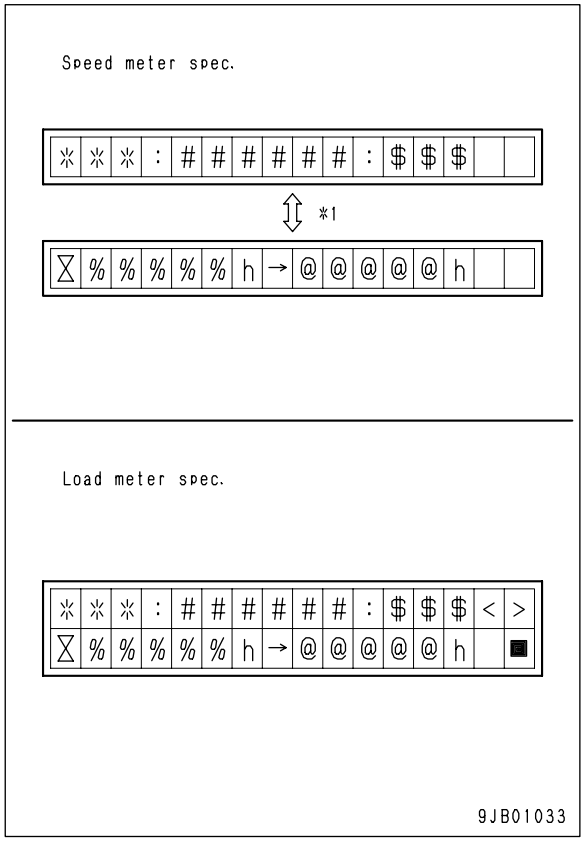


*1: Displayed alternately every 3 seconds

***: The order in which the subject failure occurred
######: Failure code
$$$: Frequency of occurrence of the subject failure
%%%%%: The time elapsed since the subject failure occurrence for the first time (it is determined by subtracting the service meter value of the first occurrence from the current service meter value)
@@@@@: The time elapsed since occurrence of the latest failure (it is determined by subtracting the service meter value at the latest occurrence from the current service meter value)

The failure code failure of a currently detected failure flashes. Up to 20 failure codes are saved.

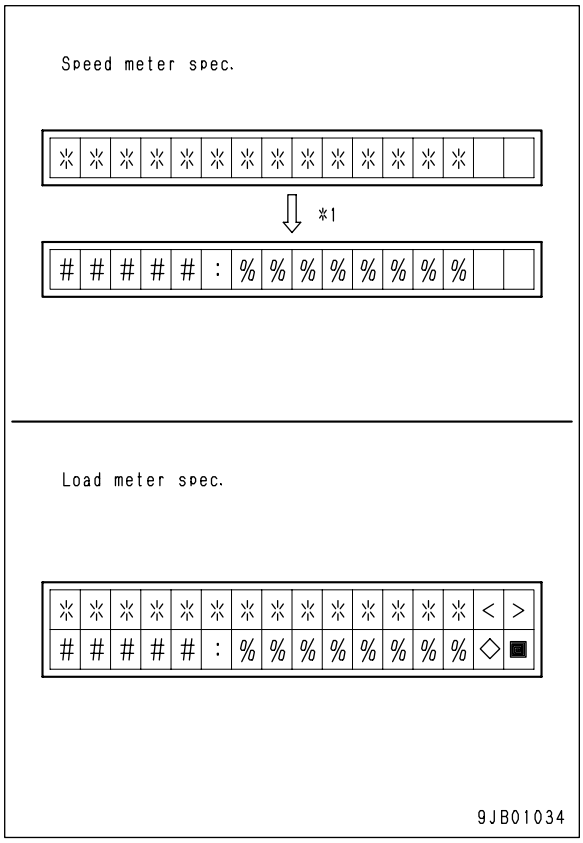
2) Machine system failure history
This function is used to check the machine system failure history of each controller saved in the machine monitor. For the failure codes displayed in the machine system failure history, see TROUBLESHOOTING.
The contents of the machine system failure history displayed on the character display are as follows.



*1: Displayed alternately every 3 seconds

***: The order in which the subject failure occurred
######: Failure code
$$$: Frequency of occurrence of the subject failure
%%%%%: The service meter value of the first occurrence of the subject failure
@@@@@: The service meter value at the occurrence of the latest failure
The failure code failure of a currently detected failure flashes. Up to several machine system failure codes are saved.

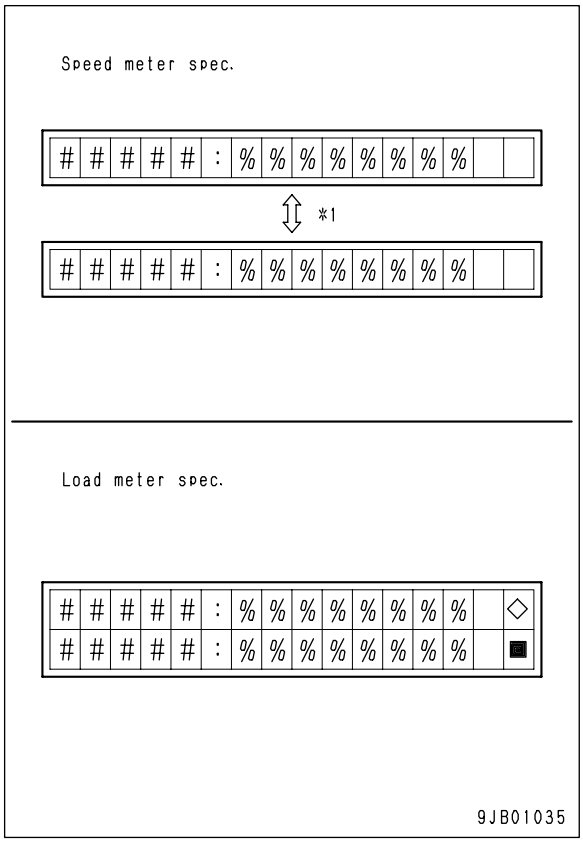
3) Real-time monitor
This function is used to check the input and output signals, etc. recognized by each controller on the network.
The contents of the real-time monitor displayed on the character display are as follows.



*1: Changed after 3 seconds

***: Item name
######: ID No. given to each item
%%%: Data. If a unit is used, it is displayed on the right of the data.

Any 2 items can be displayed simultaneously by specifying their ID Nos. In this case, they are displayed on the character display as shown below.



*1: Displayed alternately every 3 seconds

#####: Specified ID Nos.
%%%: Data. If a unit is used, it is displayed on the right of the data.

4) Tuning (Only load meter specification)
With this function, you can initially adjust the sensors, etc. installed to the machine.
Use this function when a sensor or a controller is replaced or added.

5) Maintenance monitor
This function is explained in "Operation manual, Operation, Character display, Display of replacement periods of filters and oils". It is used to change the replacement periods of the filters and oils.

6) Selection of options
With this function, you can display installation of an optional device and change the setting of that device. Use this function after any optional device is installed or removed.

7) Setting of machine serial No. (Only load meter specification)
With this function, you can display and set a machine serial No.
Use this function for control of the machines, etc.

8) Initialize
This function is used only in the factory. Do not use it.

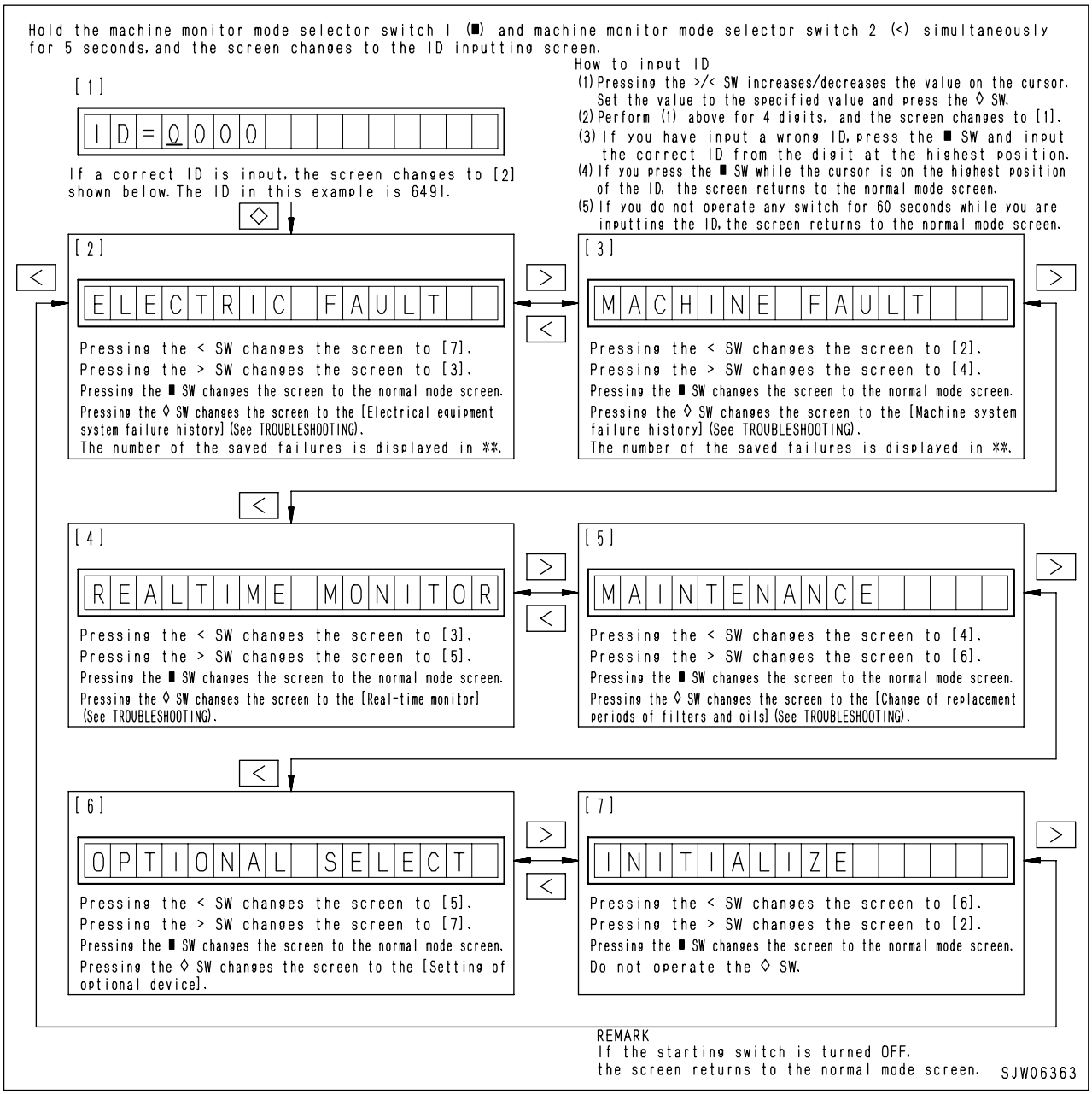
9) Setting of service meter
This function is used to set the service meter value of a machine when the machine monitor on that machine is replaced.

10) Setting of odometer
This function is used to set the odometer value of a machine when the machine monitor on that machine is replaced.

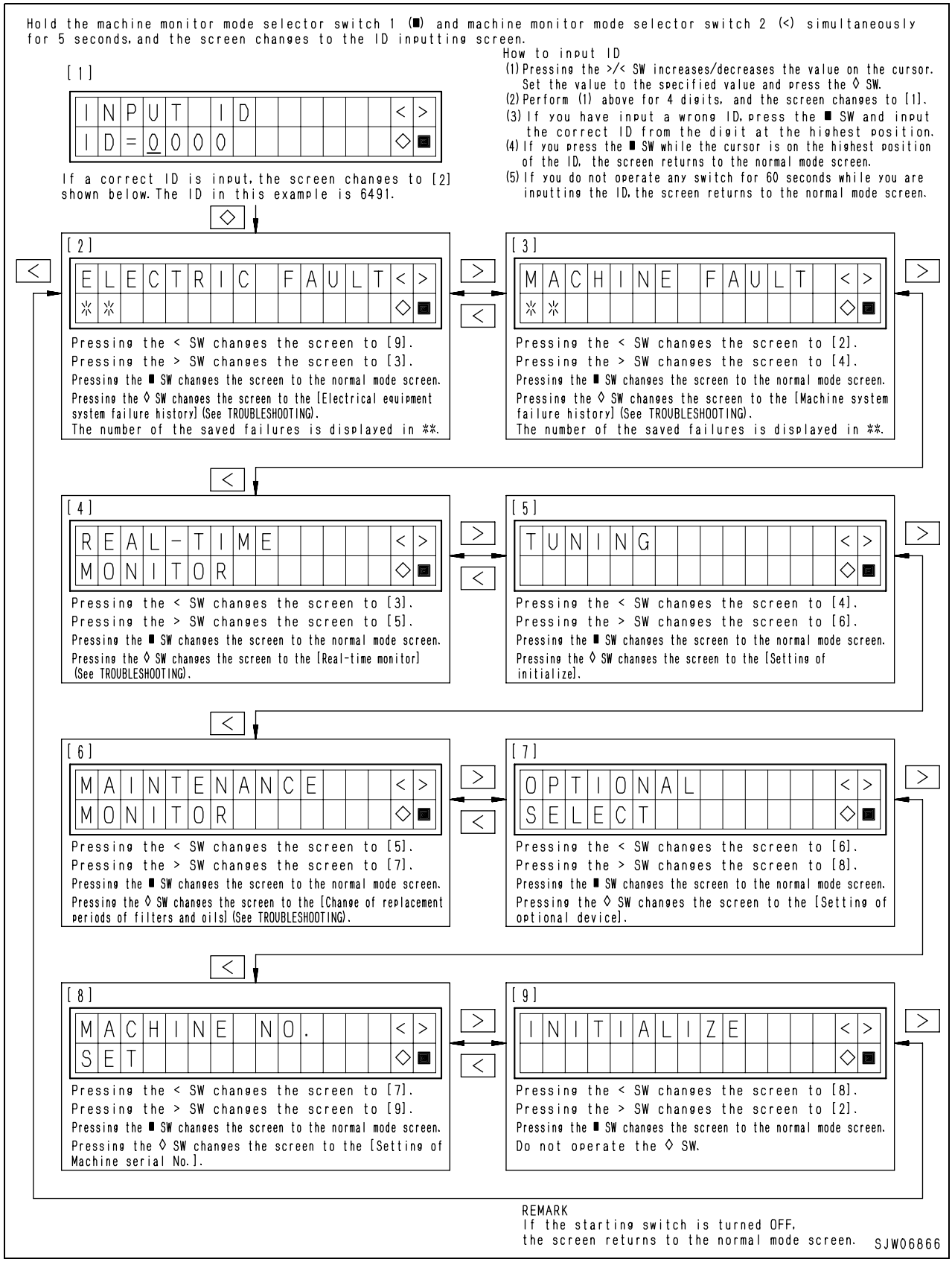
★ Since "Setting of service meter" and "Setting of odometer" are executed with the Initialize function, ask the manufacturer about them.

2. Operating method

Speed meter specification

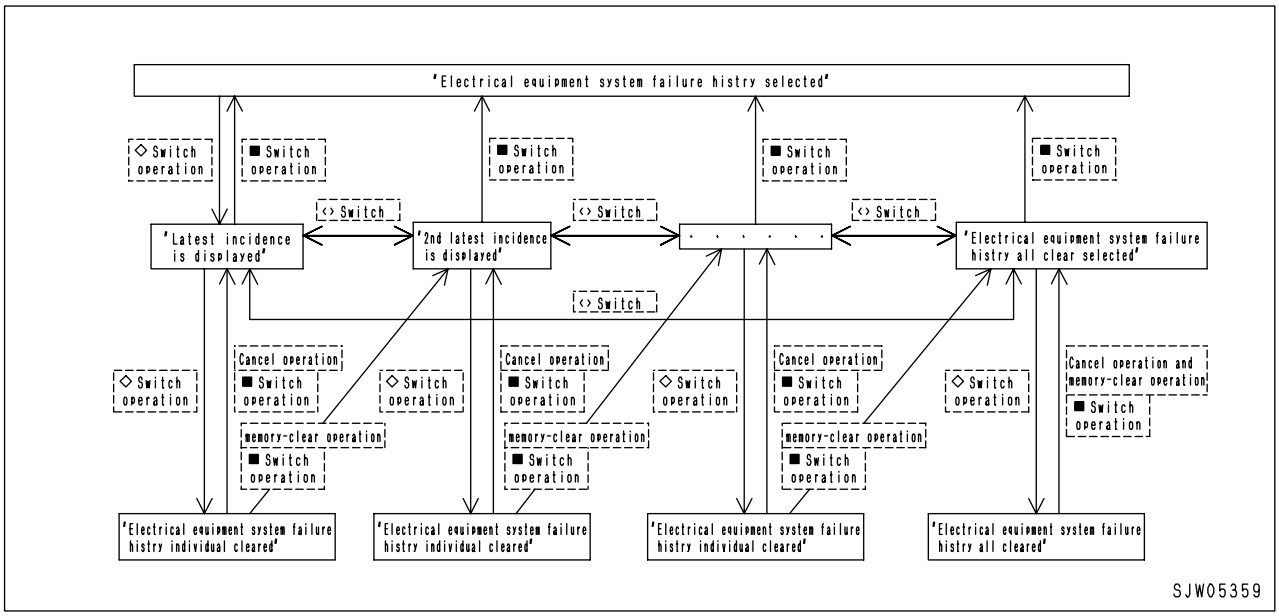


Load meter specification

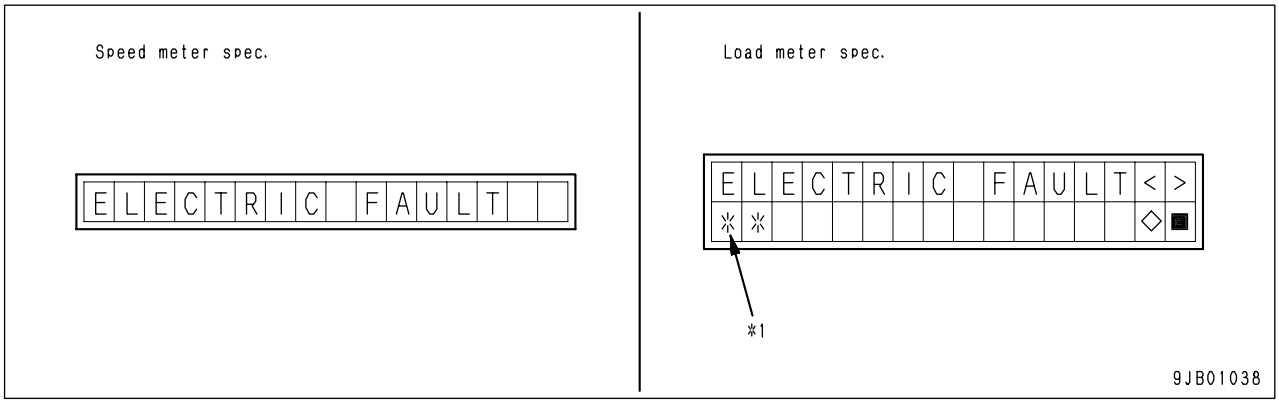


Items Related to the Fault History of Electric System

1) Selection of displaying and clearing the fault history of electric system
The fault history is displayed in the order of occurrence with the new fault first.
A current fault is displayed prior to the restored ones.
Pressing the > SW displays the next older fault.
Pressing the < SW displays the next newer fault.
After the oldest fault in memory was displayed, a screen is displayed allowing to select clearing the entire fault history of electric system of the relevant controller.
Pressing the ■SW changes the screen to the [Select displaying abnormalities in electric system] screen on the first layer.
Pressing the ◇SW changes the screen to the [Clear individually the fault history of electric system] or [Clear the fault history of electric system] screen.

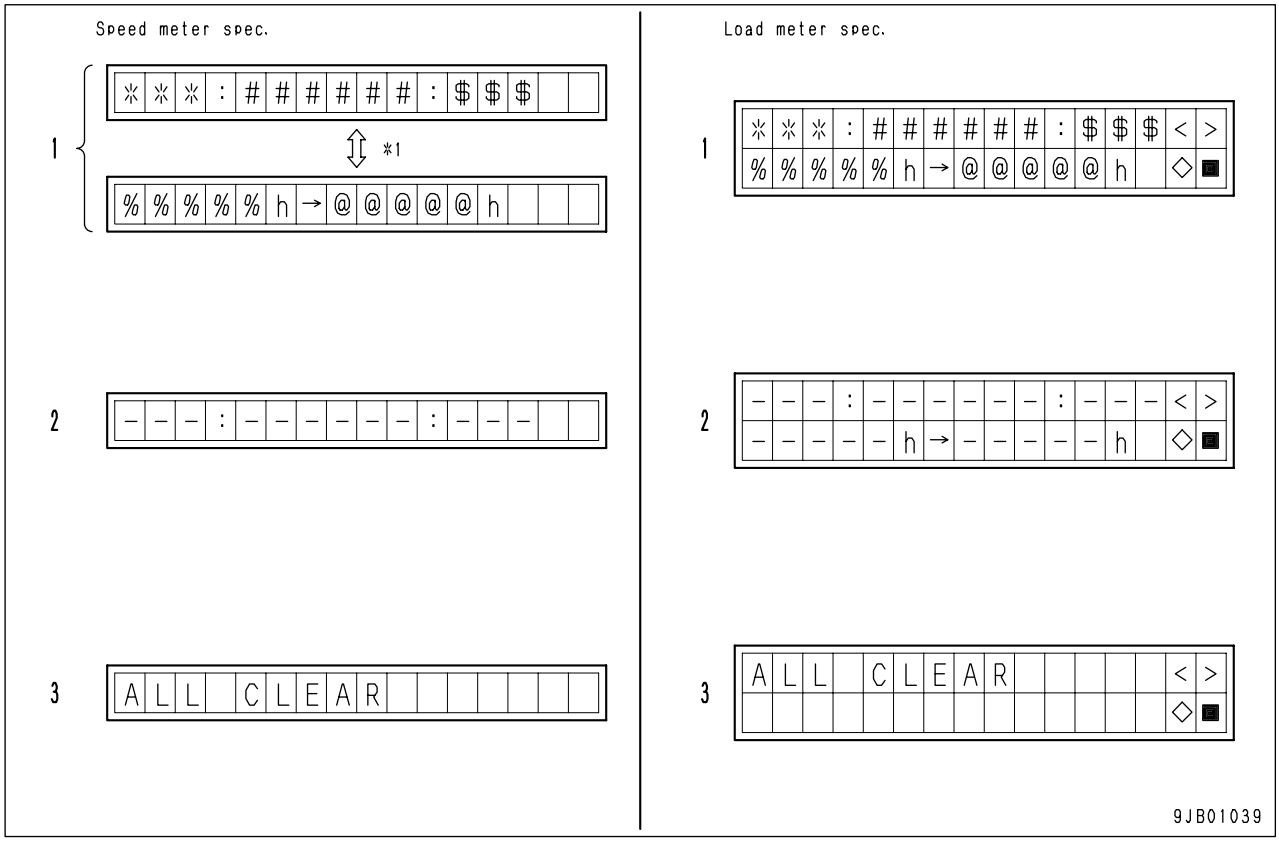


2) Selection of displaying the fault history of electric system (first layer)
Pressing the > SW changes the screen to the [Select the initializing function] screen.
Pressing the < SW changes the screen to the [Select displaying the fault history of vehicle system] screen.
Pressing the ■SW changes the screen to the ordinary or alert screen.
Pressing the ◇SW changes the screen to the [Display abnormalities in electric system] screen.



*1: The number of saved abnormalities is displayed in the part of ** (Number of saved items: Max. 20).

3) Selection of displaying the fault history of electric system and clearing the entire fault history of electric system (second layer)
A current fault is displayed piror to the restored ones.
Pressing the > SW displays the next older fault.
Pressing the < SW displays the next newer fault.
After the oldest fault in memory was displayed, a screen is displayed allowing to select clearing the entire fault history of electric system of the relevant controller.
Pressing the ■SW changes the screen to the [Select displaying abnormalities in electric system] screen on the first layer.
Pressing the ◇SW changes the screen to the [Clear individually the fault history of electric system] or [Clear the fault history of electric system]screen.
* If the history consisted of one fault, pressing the switch does not change the screen to that for all-out clearing (but change the screen to that for individual clearing).



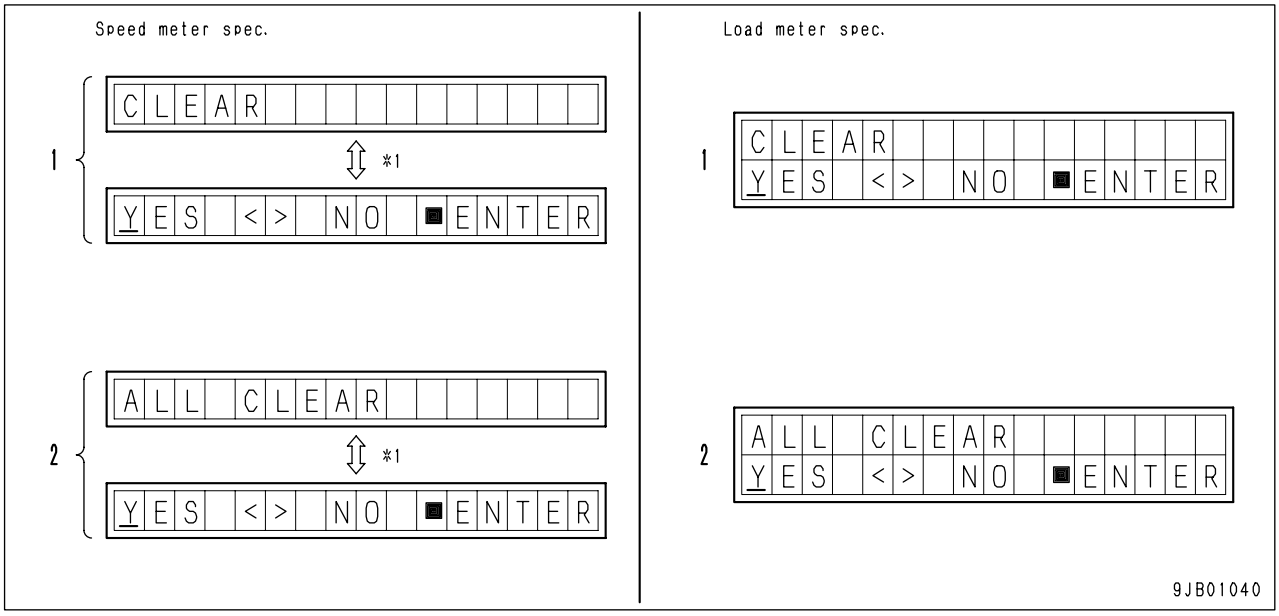
*1: Displayed alternately every 3 seconds

1.[Display the electrical equipment system failure history] screen
2.[Display the electrical equipment system failure history] screen (When there is not history)
3.[Select clearing entirely the electrical equipment system failure history] screen

***: The order in which the subject failure occurred
######: Unified failure code (6 digits)
$$$: Frequency of occurrence of the subject failure
%%%%%: The time elapsed since the subject failure occurrence for the first time (it is determined by subtracting the service meter value of the first occurrence from the current service meter value)
@@@@@: The time elapsed since occurrence of the latest failure (it is determined by subtracting the service meter value at the latest occurrence from the current service meter value)

4) Clearing individually the fault history of electric system, and clearing the entire fault history of electric system (the third layer)
Select YES or NO with the < or > SW.
Cursor (_) blinks on the selected item. Pressing the ■SW changes the display as follows, with the history reset if YES was selected, or not if NO was selected:
   a. If No (cancel) was selected, the display returns to the [Display the fault history of electric system] screen of the relevant fault (i.e., the screen before entering the [Clearing individually (entirely) the fault history of electric system] screen).
   b. If YES (clear) was selected, the display returns to the [Display the fault history of electric system] screen of a fault next to the relevant fault. If the fault history to be shown exhausts, the screen returns to the [Select displaying the fault history of electric system] screen.

   By default, the cursor is on NO (no reset) to prevent resetting by error.
   A current fault cannot be cleared. If it was selected, a peep sounds for one second to notify that the operation is cancelled.
   If a fault was cleared, peeps sound (on for 0.1 sec. - off for 0.1 sec. - on for0.1 sec.) to notify that the operation has been accepted.
   If the entire history was cleared, it is considered to have been cleared even if it consisted of only one fault .

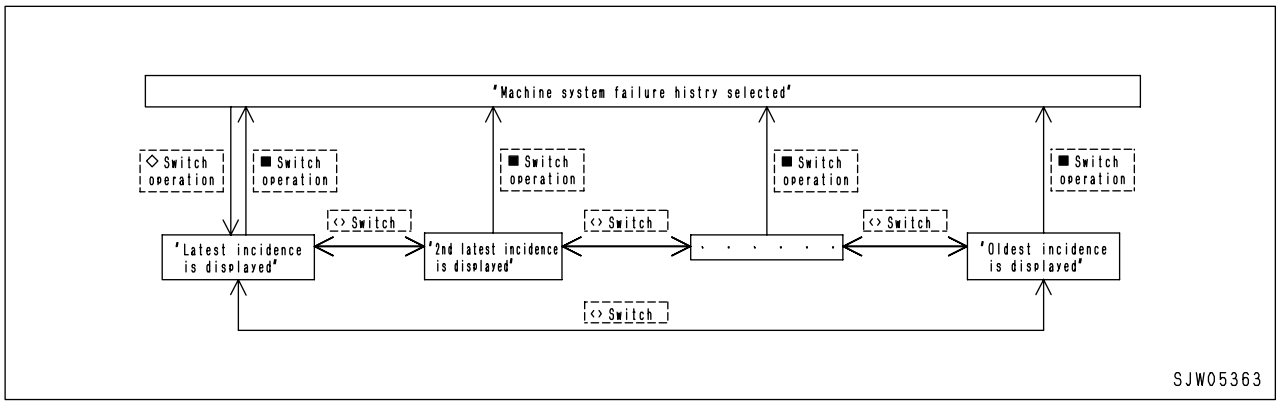


*1: Displayed alternately every 3 seconds

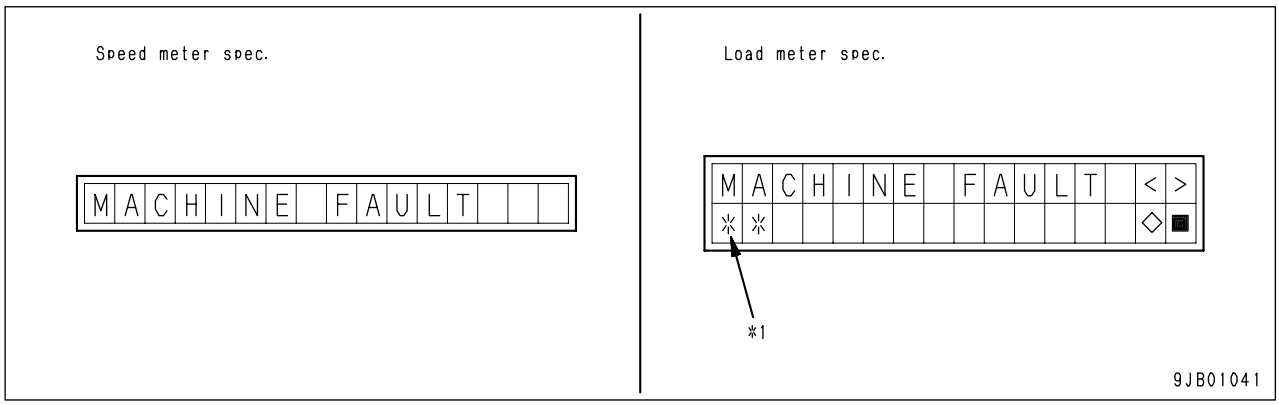
1.[Clear individually the electrical equipment system failure history] screen
2.[Clear entirely the electrical equipment system failure history] screen

Items Related to the Fault History of Machine System

1) Display of the fault history of vehicle system
   A current fault is displayed prior to the restored ones.
   Pressing the > SW displays the next older fault.
   Pressing the < SW displays the next newer fault.
   After the oldest fault in memory was displayed, a screen is displayed allowing to select clearing the entire fault history of electric system of the relevant controller.
   Pressing the ■SW changes the screen to the [Select displaying abnormalities in machine system] screen on the first layer.

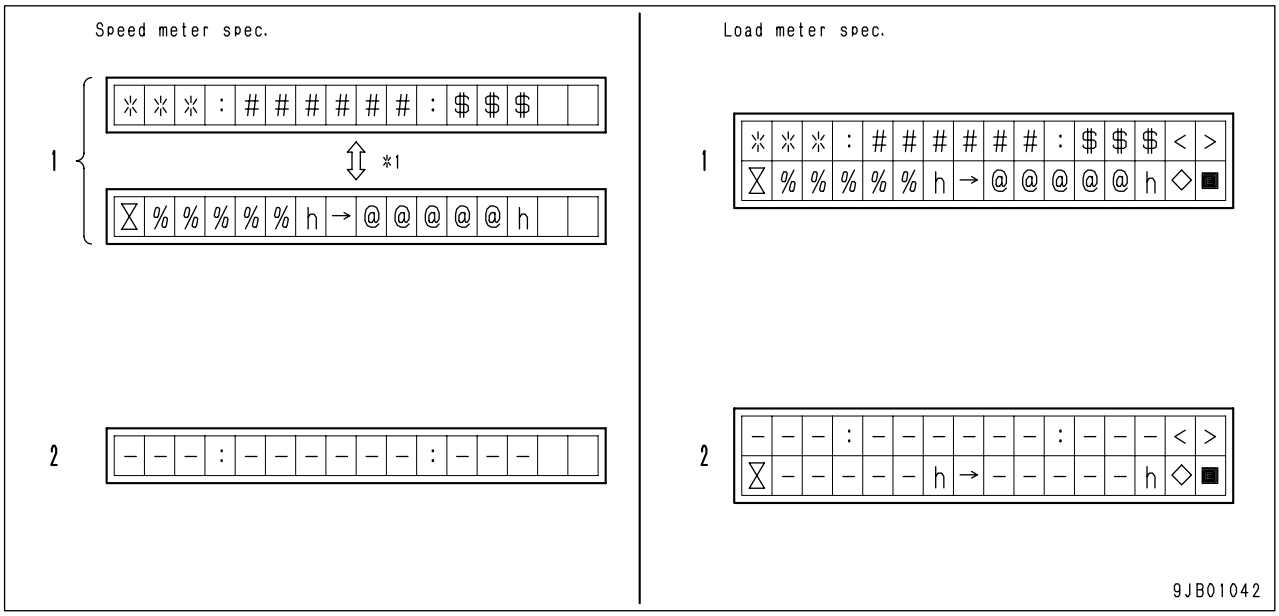


2) Selection of displaying the fault history of machine system (first layer)
   Pressing the > SW changes the screen to the [Select the real-time monitor functions] screen.
   Pressing the < SW changes the screen to the [Select displaying the fault history of machine system] screen.
   Pressing the ■SW changes the screen to the ordinary or alert screen.
   Pressing the ◇SW changes the screen to the [Display abnormalities in electric system] screen.



*1: The number of saved abnormalities is displayed in the part of **.

3) Display of the fault history of vehicle system (second layer)
The fault history is displayed in the order of occurrence with the newest fault first.
A current fault is displayed prior to the restored ones.
The fault history is displayed in the order of occurrence with the newest fault first.
Pressing the > SW displays the next newer fault.
Pressing the < SW displays the next older fault.
Pressing the ■SW changes the screen to the [Select displaying abnormalities in vehicle system] screen.



*1: Displayed alternately every 3 seconds

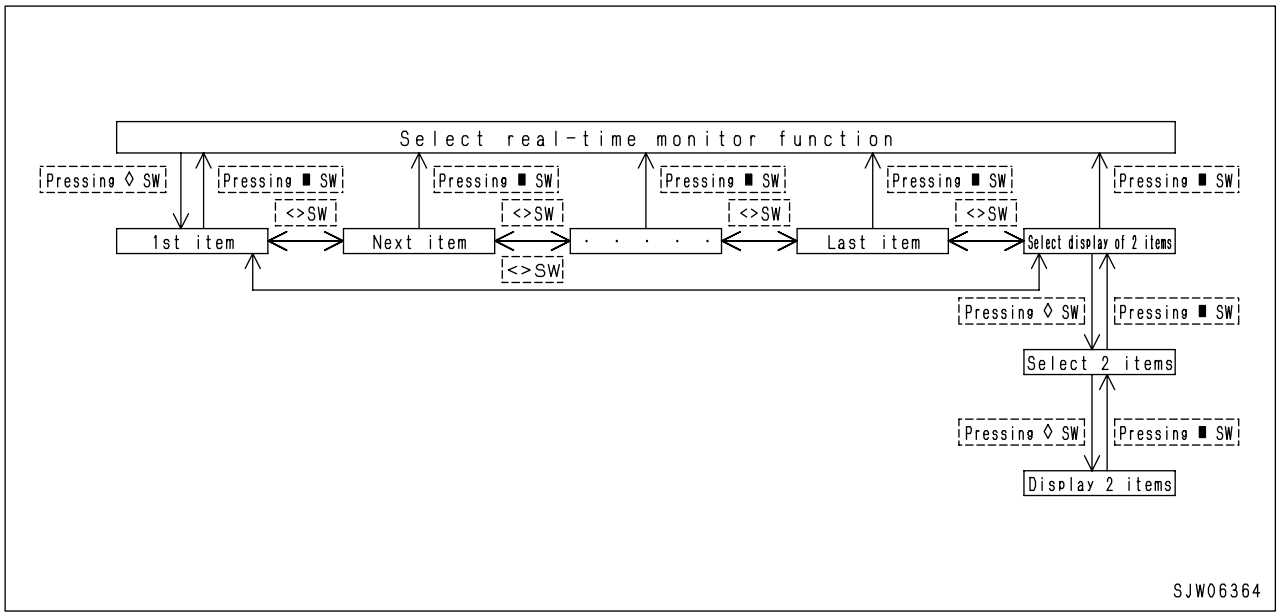
1.[Display the machine system failure history] screen
2.[Display the machine system failure history] screen (When there is not history)

***: The order in which the subject failure occurred
######: Unified failure code (6 digits)
$$$: Frequency of occurrence of the subject failure
%%%%%: The service meter value of the first occurrence of the subject failure
@@@@@: The service meter value at the occurrence of the latest failure

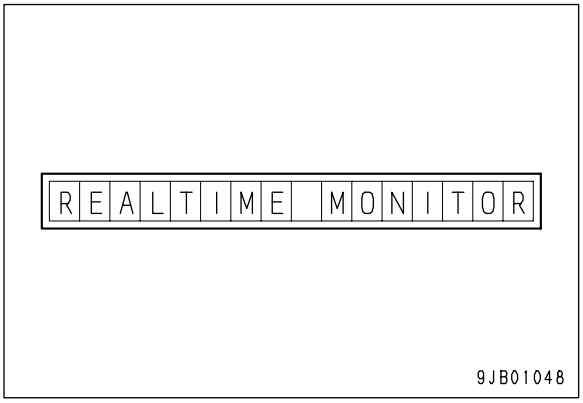
Real-time monitor function
Speed meter specification

The real-time monitor function displays the information saved in the HST controller and machine monitor mounted on the machine in real time.
This function is used for testing, adjusting, and troubleshooting in the normal display mode or 2-item display mode for displaying 2 data simultaneously.

1) Selection/Display of real-time monitor item
   Pressing the > SW changes the screen in the order of No. 1, No. 2, No. 3 --- Select display of 2 items.
   Pressing the < SW changes the screen in the order of Select of display of 2 items, No. 13, No. 12, No. 11 ---.
   Pressing the ■SW changes the screen to the [Select real-time monitor function] screen.
   In [Display of real-time monitor]: Pressing the ◇SW holds the displayed data. Pressing it again returns the displayed data into the active state.
   In [Select display of 2 items]: Pressing the ◇SW changes the screen to the [Select 2 items] screen.

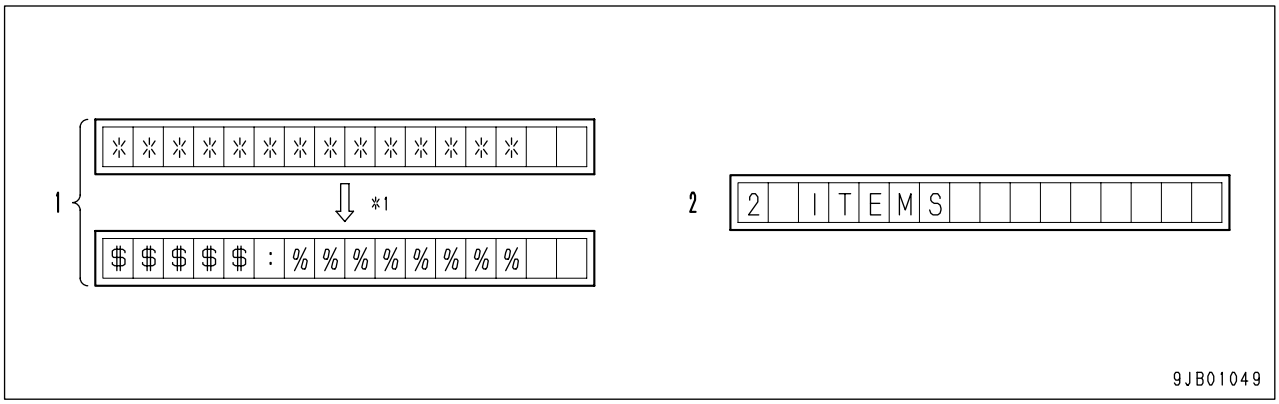


2) Selection of real-time monitor function (first layer)
   Pressing the > SW changes the screen to the [Select maintenance monitor function] screen.
   Pressing the < SW changes the screen to the [Select display of machine system failure history] screen.
   Pressing the ■SW change the screen to the normal screen or alarm screen.
   Pressing the ◇SW change the screen to the [Display of real-time monitor] screen.



3) Display of real-time monitor and selection of display of 2 items (second layer)
Pressing the > SW displays the next data.
Pressing the < SW displays the previous data.
Pressing the ■SW changes the screen to the [Select real-time monitor function] screen.

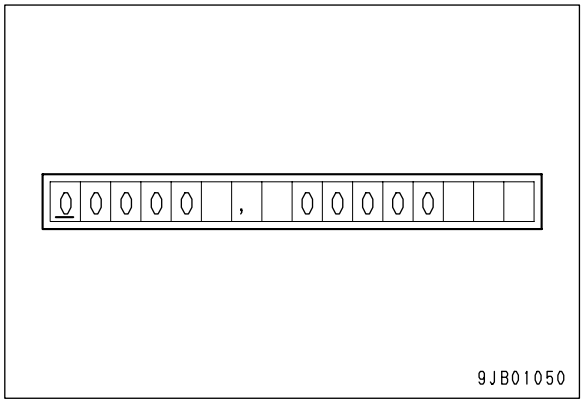
In [Display of real-time monitor]: Pressing the ◇SW holds the displayed data. Pressing it again returns the displayed data into the active state.
In [Select display of 2 items]: Pressing the ◇SW changes the screen to the [Select 2 items] screen.



*1: Changed after 3 seconds

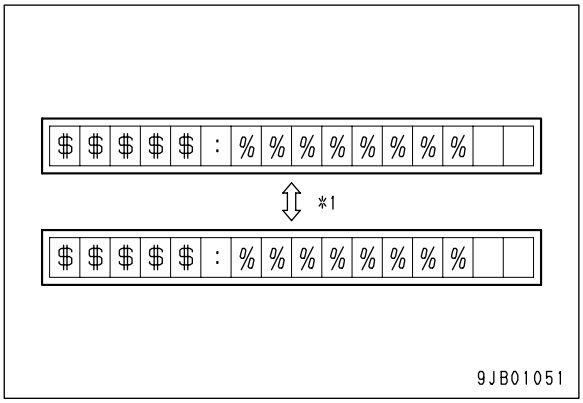
1.[Display of real-time monitor] screen
2.[Select display of 2 items] screen

***: Real-time monitor item name
$$$$$: ID of item
%%%: Data and unit (SI unit)



4) Selection of 2 items (third layer)
How to input ID
a. When the screen appears, the cursor (_) is blinking at the highest position of "00000".
b. Each time the > SW or the < SW is pressed, the digit changes by 1 between 0 and 9.
c. Select a necessary digit and press the ◇SW.
d. The cursor moves to the 2nd position. Select the digits for the all positions by performing steps b. and c. above.
e. After selecting the digit for the lowest position, press the ◇SW.
f. If the ID is entered, the screen changes to the [Display 2 items] screen.
g-1. If you press the ■SW before finishing entering the ID, the cursor moves to the highest position.
g-2. If you press the ■SW while the cursor is at the highest position, the screen returns to the [Select display of 2 items] screen.

5) Display of 2 items (fourth layer)
Pressing the ■SW changes the screen to the [Select 2 items] screen.
Pressing the ◇SW holds the displayed data. Pressing it again returns the displayed data into the active state.



*1: Displayed alternately every 3 seconds

$$$$$: ID of item
%%%%: Data and unit (SI unit)

★ The first item and second item are displayed alternately every 3 seconds
★ If an item ID that cannot be displayed is selected on the [Select 2 items] screen, the data & unit display box (%%%) is left blank.

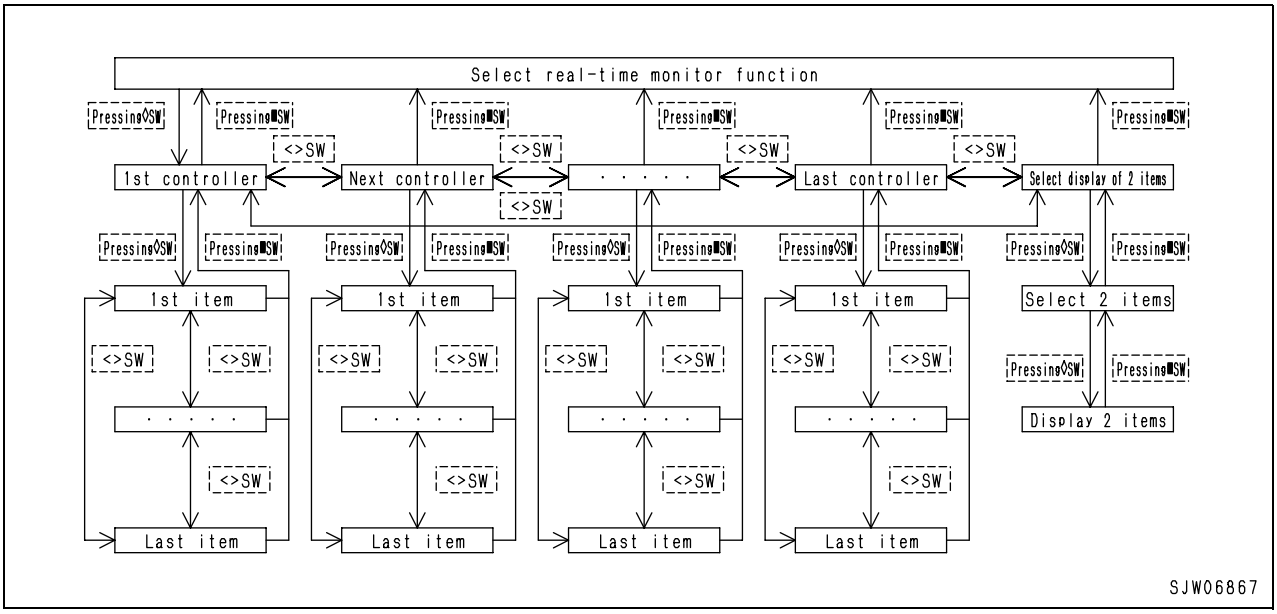
Real-time Monitoring Items

Item ID	Real-time monitoring item	Item displayed	Display unit	Displayed range	Component detected	Terminal No.	Remarks
	All the items are shown even if some of them are not equipped depending on models and options.	Abridged due to limitation of number of letters.	SI unit system so long as the values have units	A value out of the range displayed is shown as the lowest (highest) value in the range.			
20200	Monitor ROM No.	MONITOR ROM	---	---	Monitor	---	
40000	Travel speed	SPEED	1 km/h	0 – 50	HST	L41-13	
04202	Fuel level	FUEL SENSOR	1%	0 – 100	Monitor	L23-13	
04101	Engine water temperature	COOLANT TEMP	1 °C	24 – 131	Monitor	L21-16	
04103	Engine water temperature low	COOLANT Lo	1 °C	-31 – 91	Monitor	L21-6	
30100	HST oil temperature	HST TEMP	1 °C	24 – 131	Monitor	L21-14	
30202	Axle oil temperature	BRAKE TEMP	1 °C	24 – 131	Monitor	L21-8	
01005	Engine speed	ENG SPEED	1 rpm	0 – 3000	HST	L42-4	HST controller CAN
32600	HST oil pressure	HST PRESS	0.1 MPa	0.0 – 100.0	HST	L41-3	HST controller CAN
80000	Motor 1 solenoid feedback current	MOTOR SOL	1 mA	0 – 1000	HST	L41-6	HST controller CAN
80100	Clutch solenoid feedback current	CLUTCH SOL	1 mA	0 – 1000	HST	L41-14	HST controller CAN
50302	Potentiometer voltage	SPEED POT	1 %	0 – 100	HST	L41-1	HST controller CAN
80200	HST traction force	TRACTION	---	STD/LIMIT	HST	L42-3	HST controller CAN

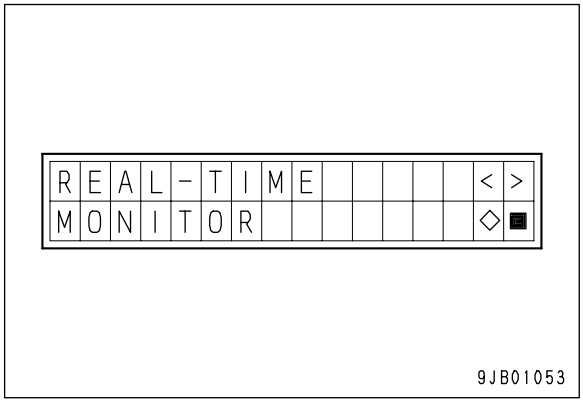
Real-time monitor function
Load meter specification

The real-time monitor function displays the information saved in the controller mounted on the machine in real time.
This function is used for testing, adjusting, and troubleshooting in the normal display mode or 2-item display mode for displaying 2 data simultaneously.
The real-time monitor displays the item names and data classified under the controllers having information.

1) Selection/Display of real-time monitor item
   Pressing the > SW changes the screen in the order of controller 1, controller 2, controller 3 --- Select display of 2 items.
   Pressing the < SW changes the screen in the order of Select of display of 2 items, controller 5, controller 4, controller 3 ---.
   Pressing the ■SW changes the screen to the [Select real-time monitor function] screen.
   In [Select information display of each controller]: Pressing the ž SW changes the screen to the [Display of real-time monitor] screen.
   In [Select display of 2 items]: Pressing the ◇SW changes the screen to the [Select 2 items] screen.

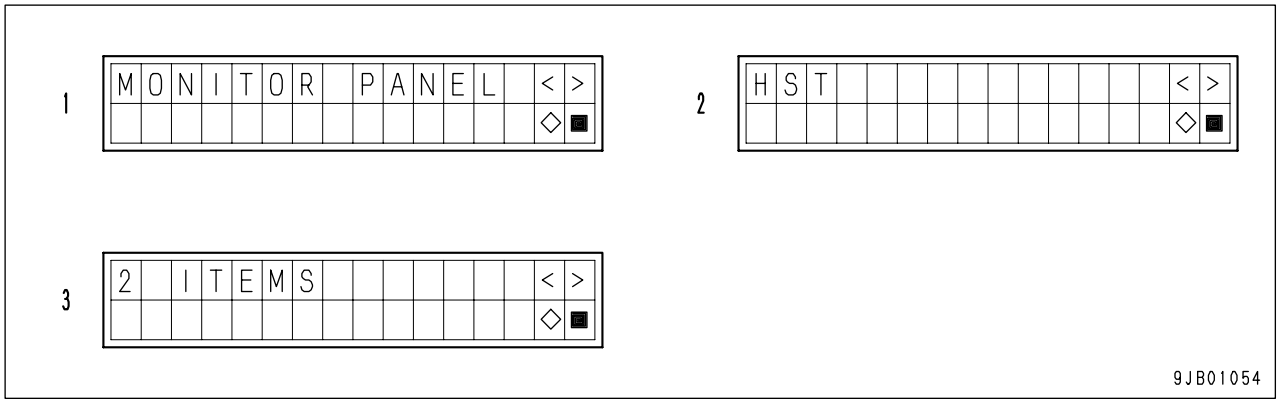


2) Selection of real-time monitor function (first layer)
   Pressing the > SW changes the screen to the [Select tuning function] screen.
   Pressing the < SW changes the screen to the [Select display of machine system failure history] screen.
   Pressing the ■SW change the screen to the normal screen or alarm screen.
   Pressing the ◇SW change the screen to the [Select of information display] screen.



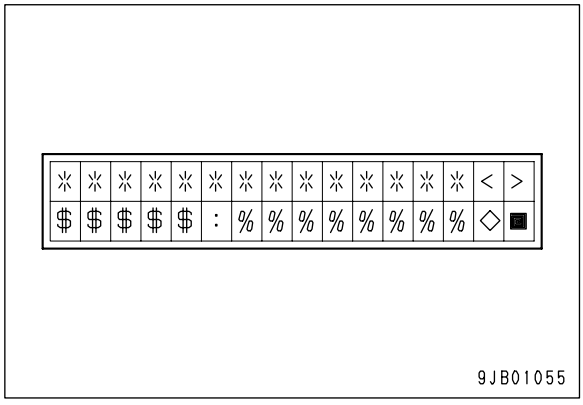
3) Selection of information display of each controller and selection of display of 2 items (second layer)
Pressing the > SW changes the screen to the next [Select information display] screen.
Pressing the < SW returns the screen to the previous [Select information display] screen.
Pressing the ■SW changes the screen to the [Select real-time monitor function] screen.

In [Select information display of each controller]: Pressing the ◇SW changes the screen to the [Display of real-time monitor] screen.
In [Select display of 2 items]:Pressing the ◇SW changes the screen to the [Select 2 items] screen.



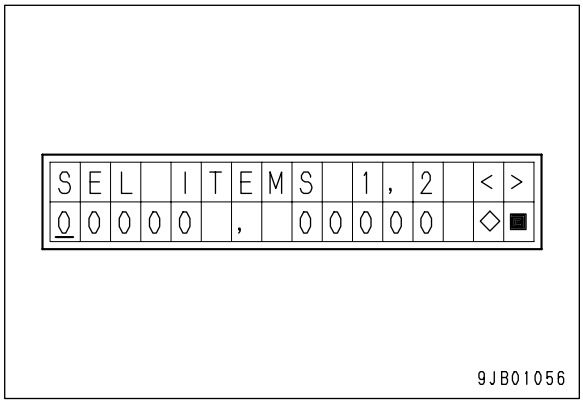
1. [Select information display of monitor panel] screen
2. [Select information display of HST controller] screen
3. [Select display of 2 items] screen

4) Display of real-time monitor (third layer)
Pressing the > SW changes the screen in the order of No. 1, No. 2, No. 3 ---.
Pressing the < SW changes the screen in the order of No. 13, No. 12, No. 11 ---.
Pressing the ■SW changes the screen to the [Select information display of each controller] screen.
Pressing the ◇SW holds the displayed data. Pressing it again returns the displayed data to the active state.
(While the displayed data are held, the mark of ◇flashes.)

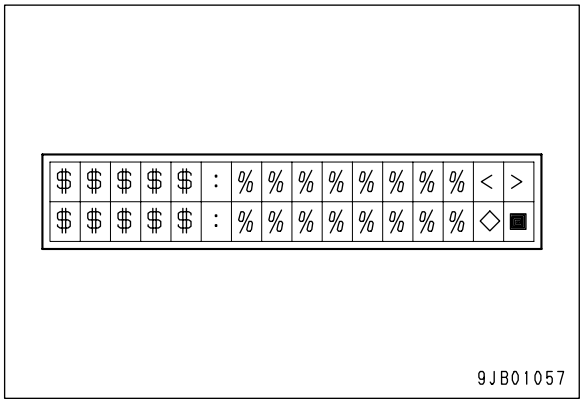


***: The real-time monitor item name is displayed.
$$$$$: The item ID is displayed.
%%%: The data and unit are displayed (Unit is SI unit).

5) Selection of 2 items (third layer)
How to input ID
a. When the screen appears, the cursor (_) is blinking at the highest position of "00000".
b. Each time the > SW or the < SW is pressed, the digit changes by 1 between 0 and 9.
c. Select a necessary digit and press the ◇SW.
d. The cursor moves to the 2nd position. Select the digits for the all positions by performing steps b. and c. above.
e. After selecting the digit for the lowest position, press the ◇SW.
f. If the ID is entered, the screen changes to the [Display 2 items] screen.
g-1. If you press the ■SW before finishing entering the ID, the cursor moves to the highest position.
g-2. If you press the ■SW while the cursor is at the highest position, the screen returns to the [Select display of 2 items] screen.



6) Display of 2 items (fourth layer)
Pressing the ■SW changes the screen to the [Select 2 items] screen.
Pressing the ◇SW holds the displayed data. Pressing it again returns the displayed data into the active state.
(While the displayed data are held, the mark of ž flashes.)



$$$$$: ID of item
%%%%: Data and unit (SI unit)

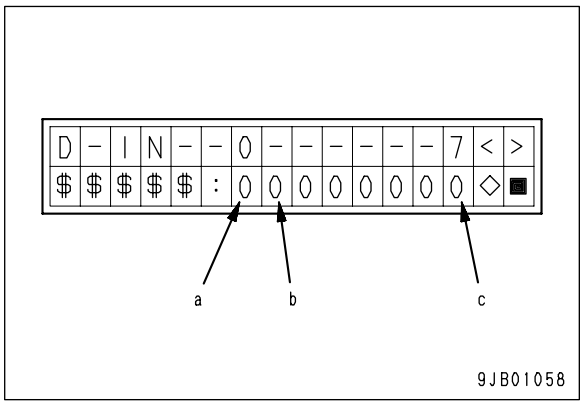
★ The first item is displayed on the upper line and the second item is displayed on the lower line.
★ If an item ID that cannot be displayed is selected on the [Select 2 items] screen, the data & unit display box (%%%) is left blank.

Real-time Monitoring Items

Item ID	Real-time monitoring item	Item displayed	Display unit	Displayed range	Component detected	Terminal No.	Remarks
	All the items are shown even if some of them are not equipped depending on models and options.	Abridged due to limitation of number of letters.	SI unit system so long as the values have units	A value out of the range displayed is shown as the lowest (highest) value in the range.			
Monitor panel controller							
20200	Monitor ROM No.	MONITOR ROM	---	---	Monitor	---	
40000	Travel speed	SPEED	1 km/h	0 – 50	HST	L41-13	
04202	Fuel level	FUEL SENSOR	1%	0 – 100	Monitor	L28-1	
04101	Engine water temperature	COOLANT TEMP	1 °C	24 – 131	Monitor	L28-8	
04103	Engine water temperature low	COOLANT Lo	1 °C	-31 – 91	Monitor	L28-3	
30100	HST oil temperature	HST TEMP	1 °C	24 – 131	Monitor	L28-2	
30202	Axle oil temperature	BRAKE TEMP	1 °C	24 – 131	Monitor	L28-7	
06001	Lift arm angle	LIFT ARM ANG	1 °C	-41 – 46	Monitor	L28-10	For load meter specification
40400	Lift cylinder bottom pressure	BTM PRESS	0.01 MPa	0.00 – 50.00	Monitor	L28-9	For load meter specification
40500	Lift cylinder head pressure	ROD PRESS	0.01 MPa	0.00 – 50.00	Monitor	L28-4	For load meter specification
40600	Calibration pressure	CAL PRESS	0.01 MPa	0.00 – 50.00	Monitor	Calculation value	For load meter specification
40700	Calculation pressure	MES PRESS	0.01 MPa	0.00 – 50.00	Monitor	Calculation value	For load meter specification
40800	Calculation weight	MES LOAD	0.01 t	0.00 – 50.00	Monitor	Calculation value	For load meter specification
40900	Input signal	D-IN--0------7	---	01010101	Monitor	See viewpoint of Input signal	For load meter specification
40901	Input signal	D-IN--8------15	---	01010101	Monitor	See viewpoint of Input signal	For load meter specification
40902	Input signal	D-IN--16------23	---	01010101	Monitor	See viewpoint of Input signal	For load meter specification
40903	Input signal	D-IN--24------31	---	01010101	Monitor	See viewpoint of Input signal	For load meter specification
40904	Input signal	D-IN--32------39	---	01010101	Monitor	See viewpoint of Input signal	For load meter specification
HST controller							
01005	Engine speed	ENG SPEED	1 rpm	0 – 3000	HST	L42-4	HST controller CAN
32600	HST oil pressure	HST PRESS	0.1 MPa	0.0 – 100.0	HST	L41-3	HST controller CAN
80000	Motor 1 solenoid feedback current	MOTOR SOL	1 mA	0 – 1000	HST	L41-6	HST controller CAN
80100	Clutch solenoid feedback current	CLUTCH SOL	1 mA	0 – 1000	HST	L41-14	HST controller CAN
50302	Potentiometer voltage	SPEED POT	1 %	0 – 100	HST	L41-1	HST controller CAN
80200	HST traction force	TRACTION	---	STD/LIMIT	HST	L42-3	HST controller CAN

How to read input signal (D-IN--0------7)
★ Only load meter specification

Each signal input through the ON/OFF switch to the controller is displayed in the form of D-IN-* (* is the input No.)
The actual display is as follows.



a: The state of the input signal of D-IN-0 is displayed.
b: The state of the input signal of D-IN-1 is displayed.
c: The state of the input signal of D-IN-7 is displayed.

$$$$$: The item ID is displayed.
If the input state is displayed as [0], the signal is not input (OFF).
If the input state is displayed as [1], the signal is input (ON).

Item ID	Input signal	Displayed item	Connector pin No.	ON/OFF logic
Machine monitor				
40900	D-IN-0	Lamp switch of headlamp	L25-1	Headlamp is turned ON = (24V) / OFF (OPEN)
	D-IN-1	IGN_BR	L25-10	Starting switch is not in OFF position = (24V) / OFF (OPEN)
	D-IN-2	IGN_C	L25-2	Starting switch is in START position = (24V) / OFF (OPEN)
	D-IN-3	No items	L25-11	ON (24V) / OFF (OPEN)
	D-IN-4	No items	L25-3	ON (24V) / OFF (OPEN)
	D-IN-5	No items	L25-12	ON (24V) / OFF (OPEN)
	D-IN-6	Forward-reverse lever F	L25-4	Forward = ON (24V) / OFF (OPEN)
	D-IN-7	Forward-reverse lever N	L25-13	Neutral = ON (24V) / OFF (OPEN)
40901	D-IN-8	Forward-reverse lever R	L25-5	Reverse = ON (24V) / OFF (OPEN)
	D-IN-9	No items	L25-14	ON (24V) / OFF (OPEN)
	D-IN-10	Monitor panel mode selector SW1 ■	L25-6	Switch is pressed = ON (24V) / OFF (OPEN)
	D-IN-11	No items	L25-15	ON (24V) / OFF (OPEN)
	D-IN-12	Turn signal lever right	L25-7	Right turn signal lamp is turned ON = ON (24V) / OFF (OPEN)
	D-IN-13	Turn signal lever left	L25-16	Left turn signal lamp is turned ON = ON (24V) / OFF (OPEN)
	D-IN-14	Monitor panel mode selector SW1 ◇	L25-8	Switch is pressed = ON (24V) / OFF (OPEN)
	D-IN-15	Omission of applying parking brake	L25-17	Parking brake is released = ON (24V) / OFF (OPEN)
40902	D-IN-16	Brake oil pressure	L26-1	Oil pressure is normal = ON (GND) / OFF (OPEN)
	D-IN-17	No items	L26-7	ON (24V) / OFF (OPEN)
	D-IN-18	No items	L26-2	ON (GND) / OFF (OPEN)
	D-IN-19	No items	L26-8	ON (GND) / OFF (OPEN)
	D-IN-20	Clogging of air cleaner	L26-3	Cleaner is not clogged = ON (GND) / OFF (OPEN)
	D-IN-21	No items	L26-8	ON (GND) / OFF (OPEN)
	D-IN-22	No items	L26-4	ON (GND) / OFF (OPEN)
	D-IN-23	No items	L26-10	ON (GND) / OFF (OPEN)
40903	D-IN-24	Clogging of HST filter	L26-5	Filter is clogged = ON (GND) / OFF (OPEN)
	D-IN-25	No items	L26-11	ON (GND) / OFF (OPEN)
	D-IN-26	Parking brake	L27-1	Parking brake operates = ON (GND) / OFF (OPEN)
	D-IN-27	Engine water level	L27-10	Water level is normal (There is water) = ON (GND) / OFF (OPEN)
	D-IN-28	Engine oil pressure	L27-2	Oil pressure is low = ON (GND) / OFF (OPEN)
	D-IN-29	Engine oil level	L27-11	Oil level is normal (There is oil) = ON (GND) / OFF (OPEN)
	D-IN-30	Normal emergency steering	L27-3	Emergency steering is normal = ON (GND) / OFF (OPEN)
	D-IN-31	No items	---	---
40904	D-IN-32	Load meter subtotal SW	L27-4	Switch is pressed = ON (GND) / OFF (OPEN)
	D-IN-33	Load meter cancel SW	L27-13	Switch is pressed = ON (GND) / OFF (OPEN)
	D-IN-34	Dimmer switch	L27-5	Headlamp beam is turned ON = ON (GND) / OFF (OPEN)
	D-IN-35	No items	L27-14	ON (GND) / OFF (OPEN)
	D-IN-36	No items	L27-6	ON (GND) / OFF (OPEN)
	D-IN-37	Monitor panel mode selector SW2 >	L27-15	Switch is pressed = ON (GND) / OFF (OPEN)
	D-IN-38	Monitor panel mode selector SW2 <	L27-7	Switch is pressed = ON (GND) / OFF (OPEN)
	D-IN-39	Low steering pressure	L27-16	Steering pressure is low ON (GND) / OFF (OPEN)

(Reference) Inspection with real-time monitor

Example) Measurement of engine speed
Measure the engine speed under the following condition.
Cooling water temperature: Within operating range
HST oil temperature: 45 - 55°C
First, check this condition with the real-time monitor.

Condition	Real-time monitor item	Component	ID
Cooling water temperature	COOLANT TEMP	Machine monitor	04101
HST oil temperature	HST TEMP	Machine monitor	30100

After checking the above items with the real-time monitor, check the engine speed.

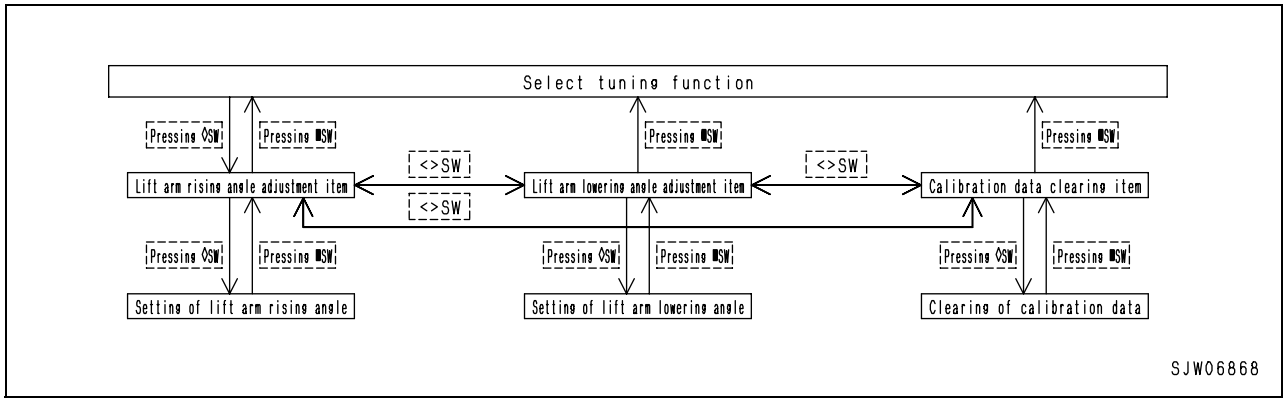
Condition	Real-time monitor item	Component	ID
Engine speed	ENG SPEED	HST controller	01005

Tuning function

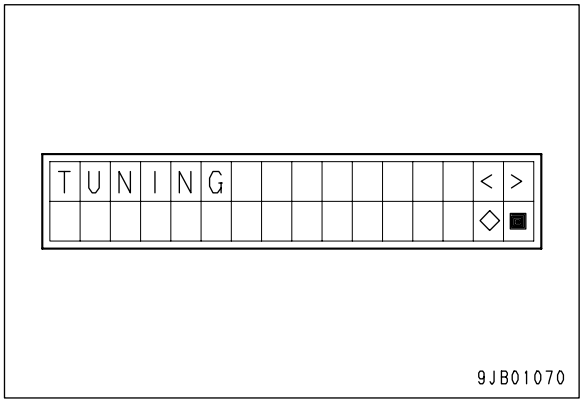
★ Only load meter specification

The tuning function initially sets a replaced or added sensor or controller and corrects and adjusts the installation errors and manufacturing dispersion of the sensor or controller.

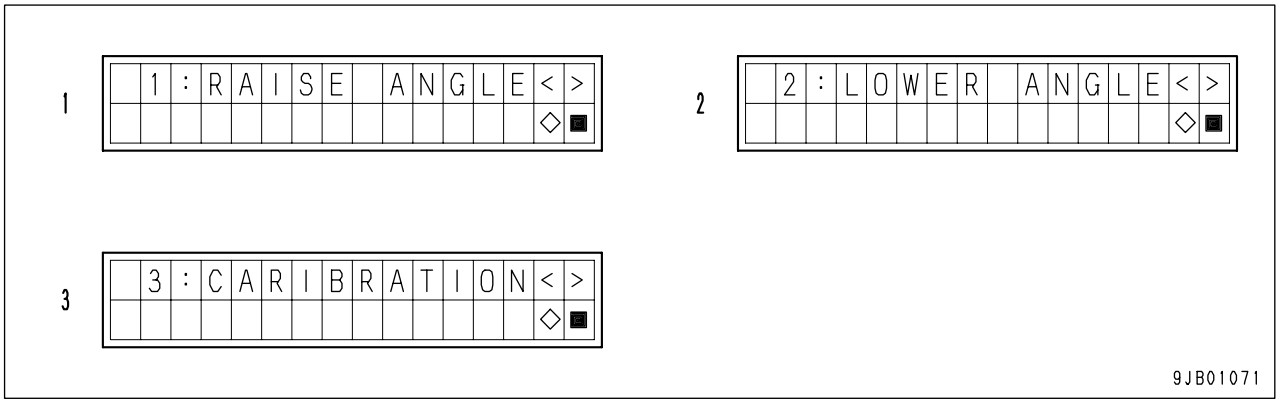
1) Selection/Display of tuning item
   Pressing the > SW or < SW changes the tuning item in order.
   Pressing the ■SW changes the screen to the [Select tuning function] screen.
   Pressing the ◇SW changes the screen to the [Select tuning item] screen.



2) Selection of tuning function (first layer)
   Pressing the > SW changes the screen to the [Select maintenance monitor function] screen.
   Pressing the > SW changes the screen to the [Select real-time monitor function] screen.
   Pressing the ■SW changes the screen to the normal screen or alarm screen.
   Pressing the ◇SW changes the screen to the [Select tuning item] screen.

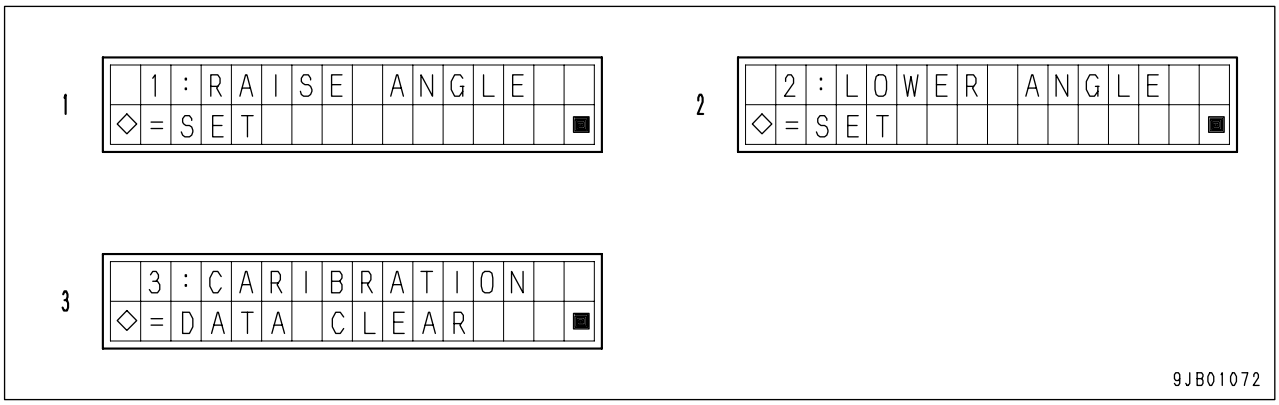


3) Selection of tuning item (second layer)
Pressing the > SW or < SW changes the tuning item in order.
Pressing the ■SW changes the screen to the [Select tuning function] screen.
Pressing the ◇SW changes the screen to the [Select tuning item] screen.



1. [Adjust lift arm raise angle] screen (for load meter)
2. [Adjust lift arm lower angle] screen (for load meter)
3. [Clear calibration data] screen (for load meter)

4) Selection of tuning item (third layer)
When adjusting the lift arm raise angle, set the empty lift arm to the maximum height and press the ◇SW.
When adjusting the lift arm lower angle, set the empty lift arm to the minimum height (lift arm cylinder stroke end) and press the ◇SW.
If the ◇SW is pressed and selection is finished, the operation acceptance peeps (on for 0.1 second -> off for 0.1 second -> on for 0.1 second) are heard and the screen returns to the [Select tuning item] screen.
If the ■SW is pressed before the above operation is finished, setting is interrupted and the screen returns to the [Select tuning item] screen.

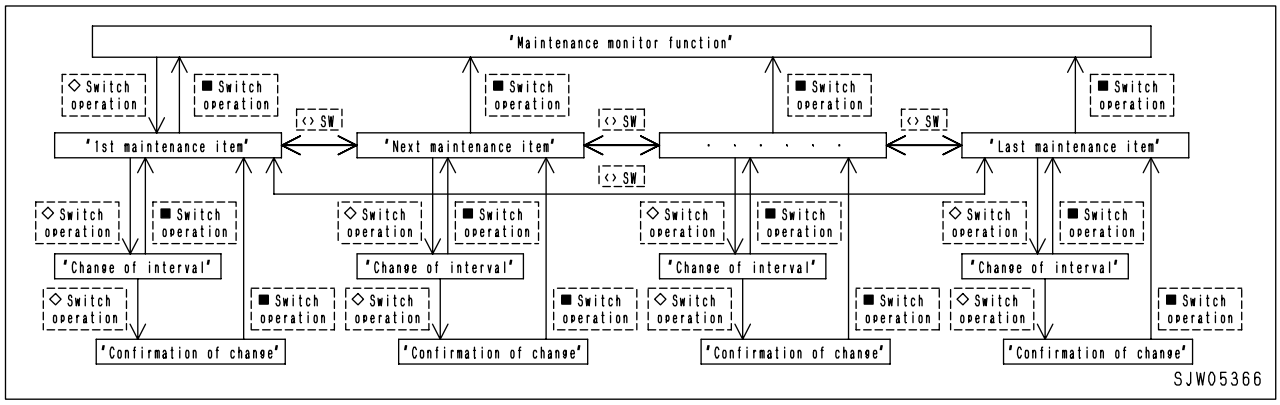


1. [Set lift arm raise angle] screen (for load meter)
2. [Set lift arm lower angle] screen (for load meter)
3. [Clear calibration data] screen (for load meter)

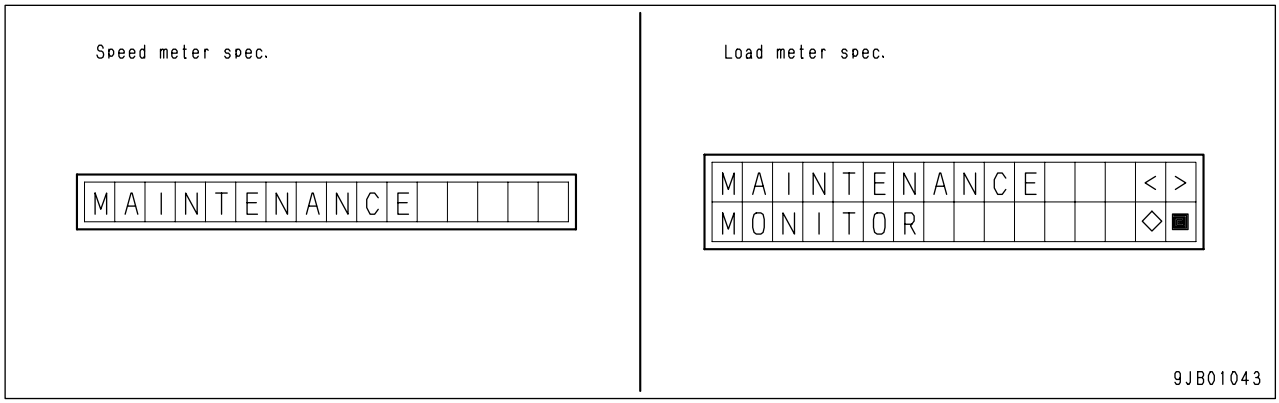
★ After adjusting the lift arm angle, be sure to calibrate the empty bucket.
★ For the method of calibration, see TESTING AND ADJUSTING, "Testing and adjusting load meter".

Maintenance functions

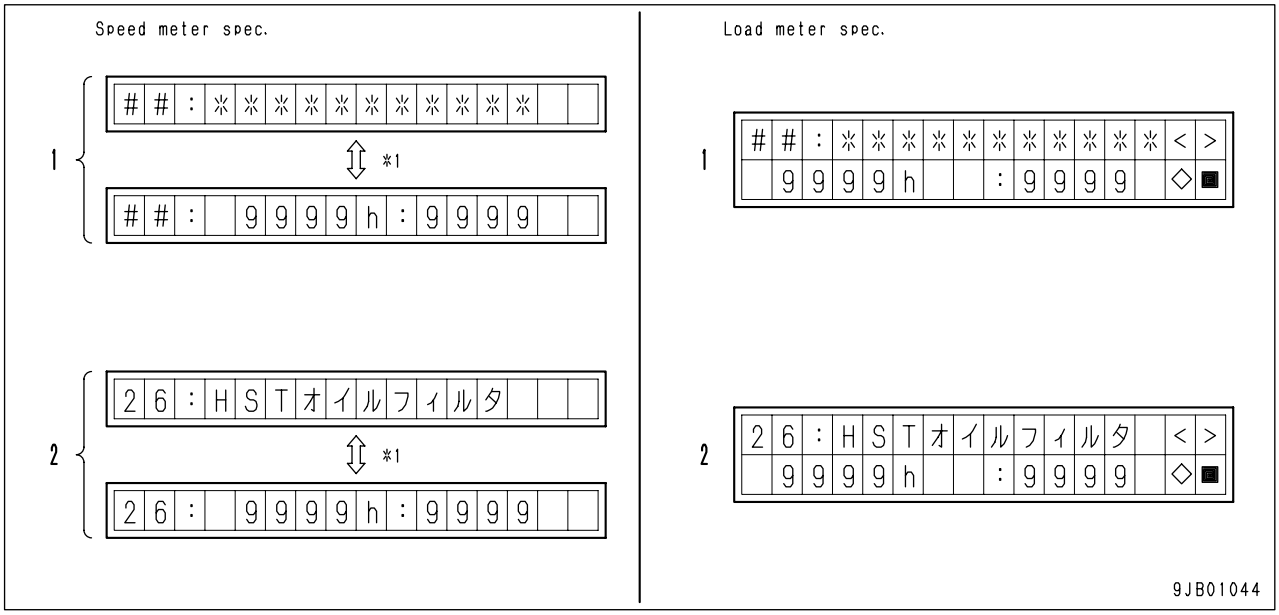
1) Selection/Display of maintenance monitor item
   Pressing the > SW changes the screen in the order of No. 1, No. 2, No. 3 ---.
   Pressing the < SW changes the screen in the order of No. 13, No. 12, No. 11 ---.
   Pressing the ■SW changes the screen to the [Select maintenance monitor function] screen.
   Pressing the ◇SW changes the screen to the [Change maintenance interval time].



2) Selection of display of maintenance monitor function (first layer)
   Pressing the > SW changes the screen to the [Select OPT function] screen.
   Pressing the < SW changes the screen to the [Select real-time monitor function] screen.
   Pressing the ■SW change the screen to the normal screen or alarm screen.
   Pressing the ◇SW change the screen to the [Select maintenance monitor item] screen.



3) Selection of maintenance monitor (second layer)
The contents of this display are the same as those of the maintenance monitor of the function opened to the operator. Maintenance caution lamp does not light up, however.
Pressing the ■SW change the screen to the [Select maintenance monitor function] screen.
Pressing the ◇SW change the screen to the [Change maintenance monitor interval time] screen.



*1: Displayed alternately every 3 seconds

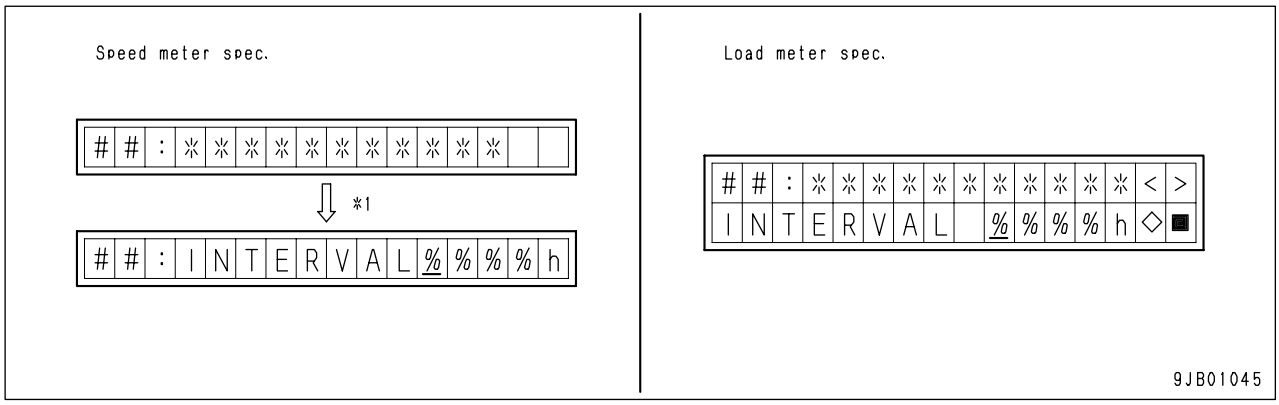
1.[Select maintenance item] screen
2.Example) When the data is HST oil filter

##: ID No. of each maintenance item
***: Each maintenance item

4) Change of maintenance interval time (third layer)
The maintenance interval time can be set freely to 0 - 9999 h.
If you press the ■SW, the time is not changed but the screen changes to the [Select maintenance item] screen.
At this time, the operation cancel sound (1-second peep) is heard.

How to input interval

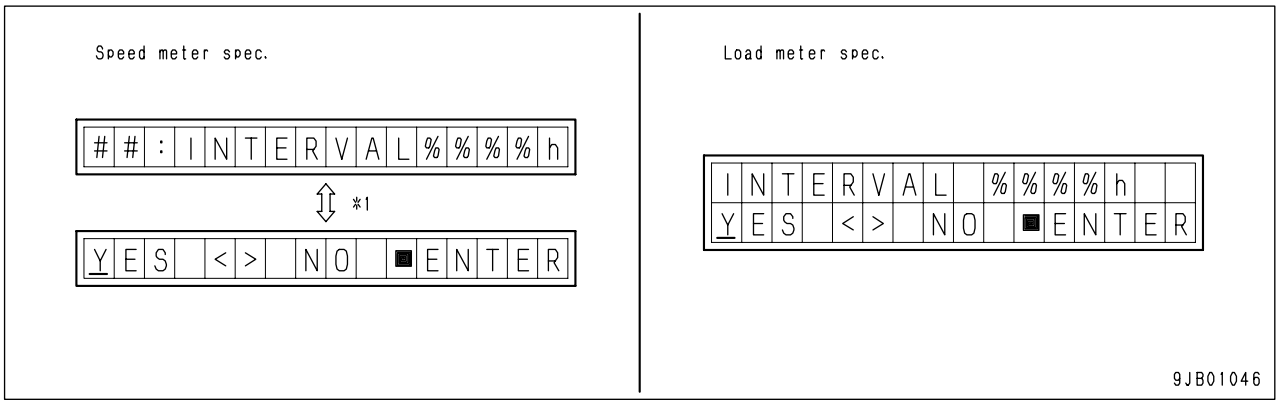
a. When the screen appears, the cursor (_) is blinking at the highest position.
b. Each time the > SW or the < SW is pressed, the digit changes by 1 between 0 and 9.
c. Select a necessary digit and press the ◇SW.
d. The cursor moves to the 2nd position. Select the digits for the all positions by performing steps (b.) and (c.) above.
e. After selecting the digit for the lowest position, press the ◇SW.
f-1. If the input interval time is acceptable, the screen changes to the check screen.
f-2. If the input interval time is not acceptable, the time does not change but the screen changes to the [Select maintenance item] screen. At this time, the operation cancel sound (1-second peep) is heard.
g. If you have input a wrong value, press the ■SW to return to the [Select maintenance item] screen and repeat the above steps from the first.



*1: Changed after 6 seconds

##: ID No. of each maintenance item
***: Each maintenance item
%%%%: Current interval time (4 digits)
If there is not a digit in a position of the interval time, input "0". Example: "0012"

5) Check of change of maintenance interval time (fourth layer)
Select YES or NO with the < or > SW. The cursor (_) blinks on the selected item. Pressing the ■SW returns the screen to the [Select maintenance item] screen with the change done if YES was selected, or not if NO was selected.
By default, the cursor is on NO (the change not done) to prevent resetting by error.
When the change of the set time is finished, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard.



*1: Displayed alternately every 3 seconds

##: ID No. of each maintenance item
%%%%: Interval time (4 digits) to be changed

The maintenance interval time is set as shown in the following table, when shipped.

Item	Replacement interval time (h)	Displayed item name	ID No.
Engine oil	500	ENG OIL	01
Engine oil filter	500	ENG FILT	02
Fuel filter	500	FUEL FILT	03
Transfer oil	1,000	TRANSF OIL	25
HST oil filter	1,000	HST FILT	26
Hydraulic oil filter	2,000	HYD FILT	04
Hydraulic oil	2,000	HYD OIL	10
Axle oil	2,000	AXLE OIL	15

Setting required when optional device is installed

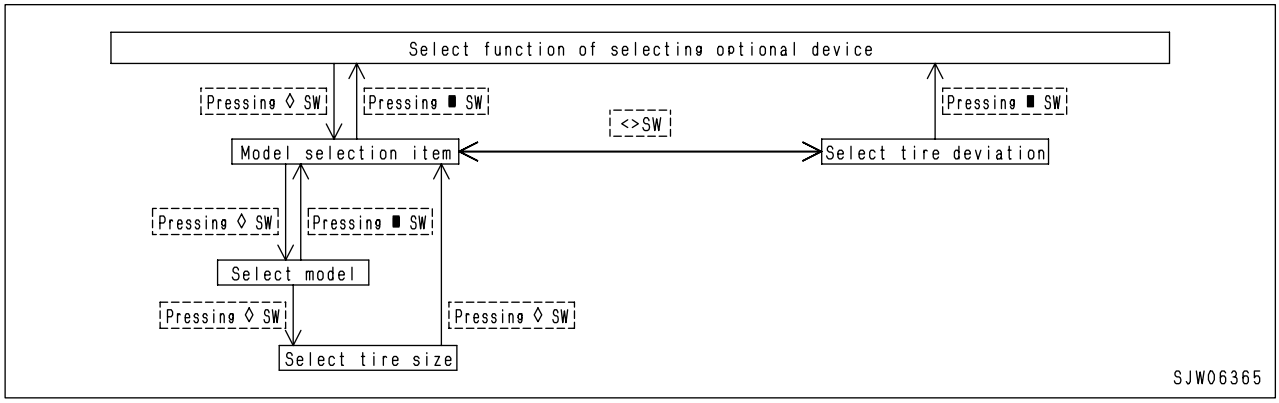
When any of the following optional devices is added or replaced, adjust the sensors, etc. to the initial values with the machine monitor.

Added or replaced optional device	Adjustment Item
Tire size, machine monitor	Model selection, tire size selection, tire deviation selection
Lift arm angle sensor, machine monitor (For load meter specification)	Lift arm angle adjustment for load meter
Lift arm (For load meter specification)	Lift arm type selection
Printer (For load meter specification)	Printer selection

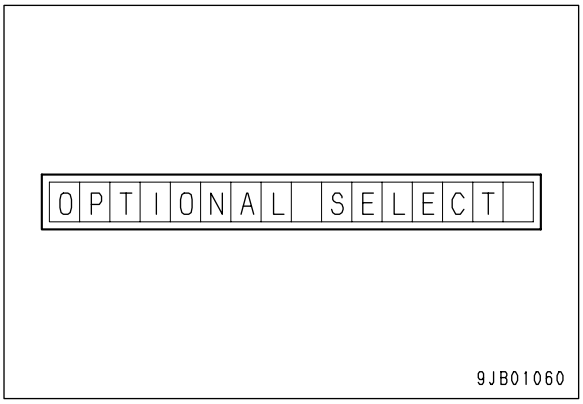
Function of selecting optional device

Speed meter specification

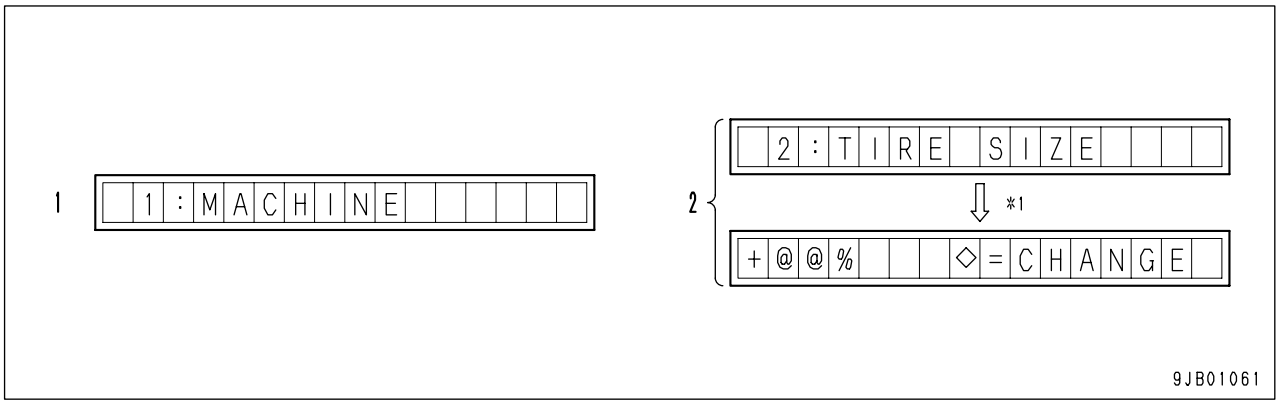
1) Selection and display of optional item
   Pressing the > SW or < SW changes the selected optional items in order.
   Pressing the ■SW changes the screen to the [Select function of selecting optional device]
   In [Model selection item]: Pressing the ◇SW changes the screen to the [Select model] screen.
   In [Select each optional device]: Pressing the ◇SW updates the items of each optional device.



2) Selection of function of selecting optional device (fourth layer)
   Pressing the > SW changes the screen to the [Select initializing function] screen.
   Pressing the < SW changes the screen to the [Select maintenance monitor function] screen
   Pressing the ■SW changes the screen to the normal screen or alarm screen.
   Pressing the ◇SW changes the screen to the [Model selection item] screen.



3) Model selection item and selection of optional device (second layer)
Pressing the > SW or < SW changes the selected optional items in order.
Pressing the ■SW changes the screen to the [Select function of selecting optional device]
In [Model selection item]: Pressing the ◇SW changes the screen to the [Select model] screen.
In [Select each optional device]: Pressing the ◇SW updates the items of each optional device.



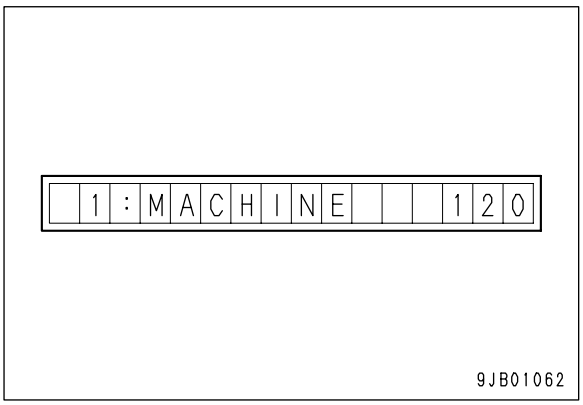
*1: Changed after 3 seconds

1.[Model selection item] screen
2.[Select tire deviation] screen

Selection of tire deviation
Pressing the ◇SW selects deviation from the standard tire between -12% and +12% (at intervals of 2%). (@@ is the deviation selected when shipped.)
(+00/+02/+04/+06/+08/+10/+12/-02/-04/-06/-08/-10/-12)
When selection is finished, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard.
Pressing the ■SW changes the screen to the [Select function of selecting optional device]

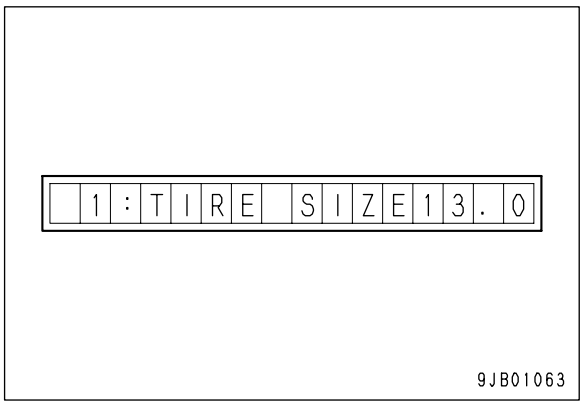
4) Selection of model (third layer)
Pressing the >SW or <SW selects a model.
(120/150/200/250/320)
Pressing the ■SW changes the screen to the [Model selection item] screen.
If you press the ◇SW to finish selection, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard and the screen changes to the [Select tire size] screen.

★ Select "320" for this machine.



5) Selection of tire size (fourth layer)
Pressing the > SW or < SW selects a tire size.
(13.0/15.5/16.9/17.5/18.4/20.5)
If you press the ◇SW to finish selection, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard and the screen changes to the [Model selection item] screen.

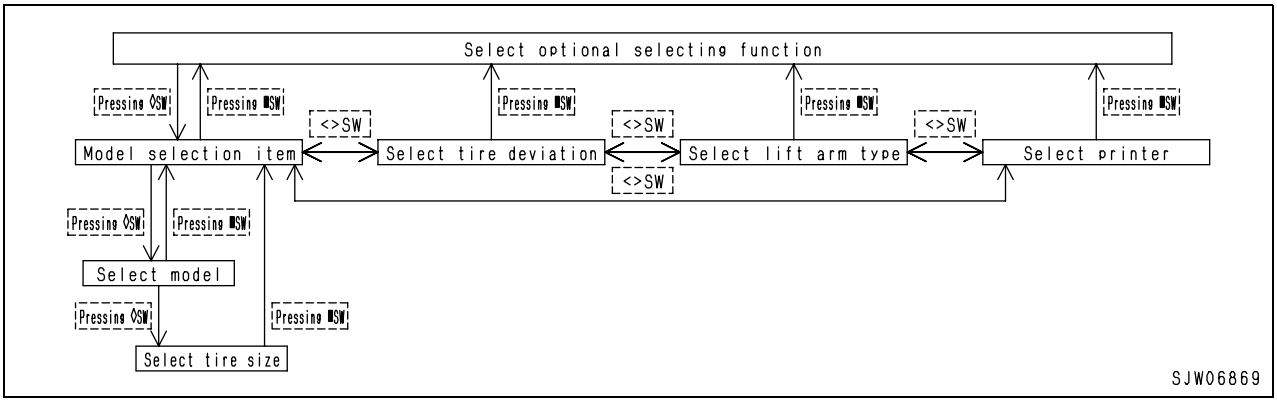
★ Since "320" was selected on the "Select model" screen, "17.5" or "20.5" can be selected. (Other tire sizes are not displayed.)



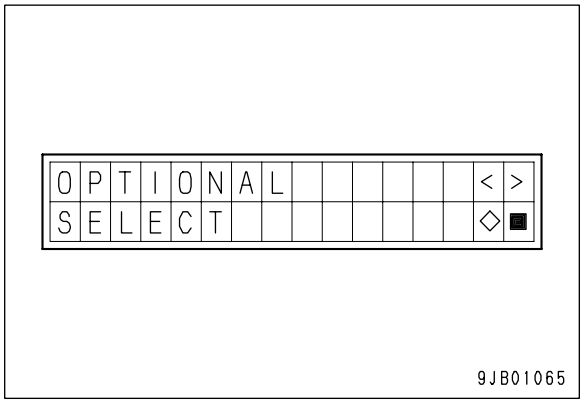
Function of selecting optional device

Load meter specification

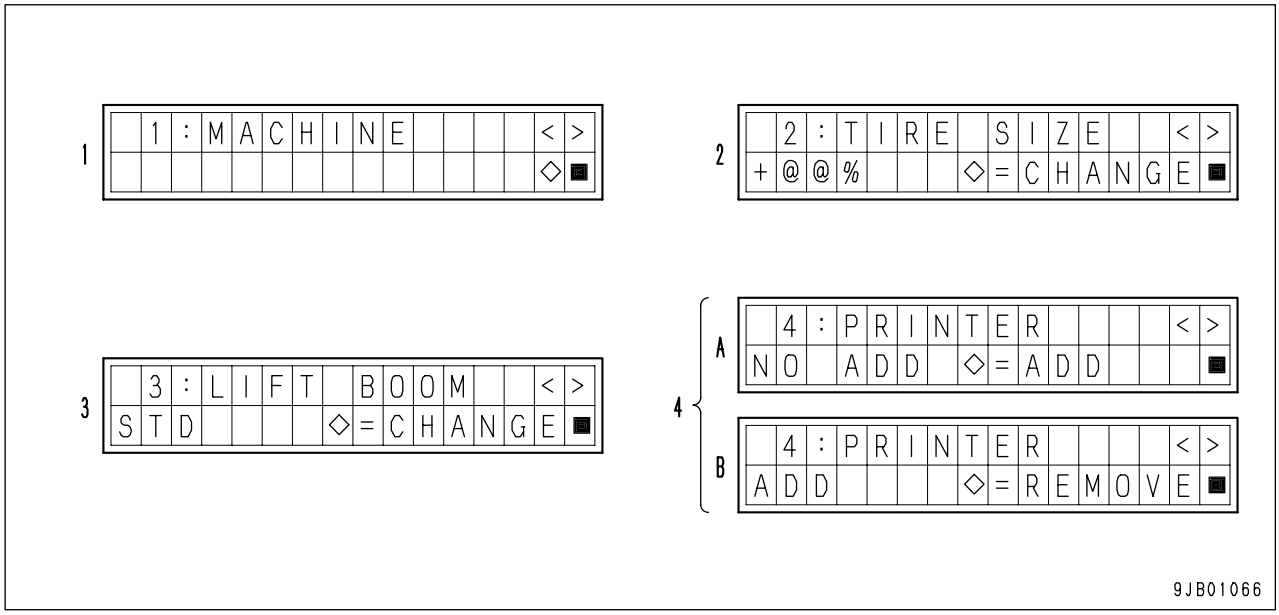
1) Selection and display of optional item
   Pressing the > SW or < SW changes the selected optional items in order.
   Pressing the ■SW changes the screen to the [Select function of selecting optional device]
   In [Model selection item]: Pressing the ◇SW changes the screen to the [Select model] screen.
   In [Select each optional device]: Pressing the ◇SW updates the items of each optional device.



2) Selection of function of selecting optional device (fourth layer)
   Pressing the > SW changes the screen to the [Select machine serial No. setting function] screen.
   Pressing the < SW changes the screen to the [Select maintenance monitor function] screen
   Pressing the ■SW changes the screen to the normal screen or alarm screen.
   Pressing the ◇SW changes the screen to the [Model selection item] screen.



3) Model selection item and selection of optional device (second layer)
Pressing the > SW or < SW changes the selected optional items in order.
Pressing the ■SW changes the screen to the [Select function of selecting optional device]
In [Model selection item]: Pressing the ◇SW changes the screen to the [Select model] screen.
In [Select each optional device]: Pressing the ◇SW updates the items of each optional device.



1. [Model selection item] screen
2. [Select tire deviation] screen
3. [Select lift arm type] screen
4. [Select printer setting state] screen (A: Removal is set, B: Addition is set)

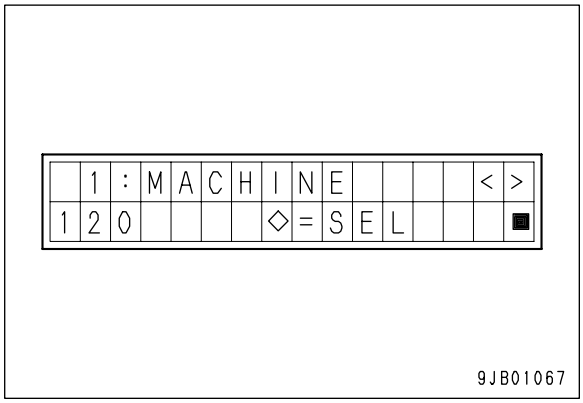
Selection of tire deviation
Pressing the ◇SW selects deviation from the standard tire between -12% and +12% (at intervals of 2%). (@@ is the deviation selected when shipped.)
(+00/+02/+04/+06/+08/+10/+12/-02/-04/-06/-08/-10/-12)
When selection is finished, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard.
Pressing the ■SW changes the screen to the [Select function of selecting optional device]

Selection of lift arm deviation
Pressing the ◇SW selects lift arm type.
(STD/MULTI/Hi LIFT/SEMI Hi)
When selection is finished, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard.
Pressing the ■SW changes the screen to the [Select function of selecting optional device]

Selection of printer setting state
Pressing the ◇SW selects printer setting state.
(ADD/REMOVE)
When selection is finished, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard.
Pressing the ■SW changes the screen to the [Select function of selecting optional device]

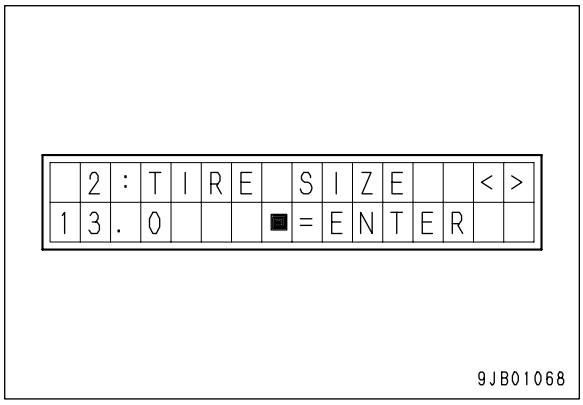
4) Selection of model (third layer)
Pressing the >SW or <SW selects a model.
(120/150/200/250/320)
Pressing the ■SW changes the screen to the [Model selection item] screen.
If you press the ◇SW to finish selection, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard and the screen changes to the [Select tire size] screen.

★ Select "320" for this machine.



5) Selection of tire size (fourth layer)
Pressing the >SW or <SW selects a tire size.
(13.0/15.5/16.9/17.5/18.4/20.5)
Pressing the ■SW changes the screen to the [Model selection item] screen.
If you press the ◇SW to finish selection, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard and the screen changes to the [Model selection item] screen.

★ Select "320" for this machine.

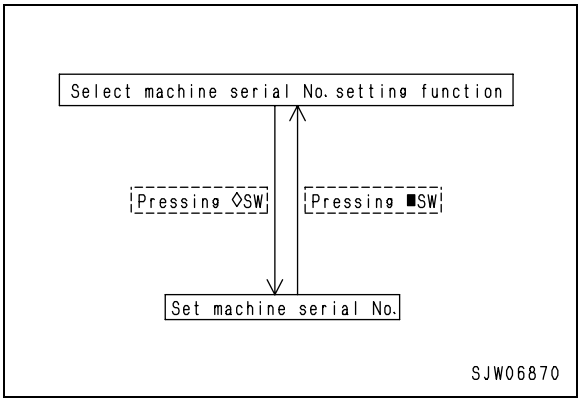


Machine serial No. setting function

★ Only load meter specification

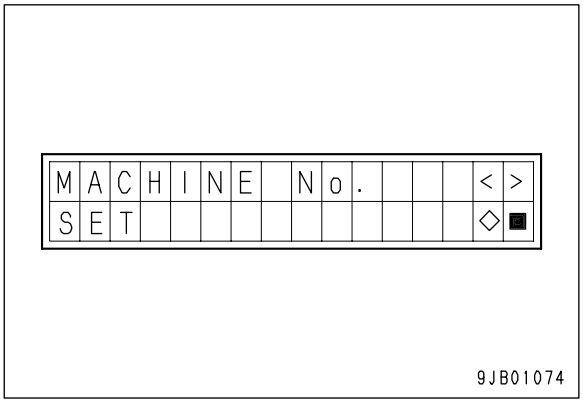
1) Selection/Display of machine serial No. setting item

Pressing the ■SW changes the screen to the [Select machine serial No. setting function] screen.
Pressing the ◇SW sets the machine serial No.



2) Selection of machine serial No. setting function (first layer)

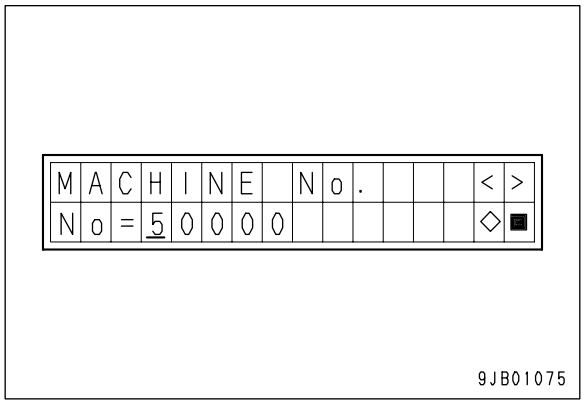
Pressing the > SW changes the screen to the [Select initialize function] screen.
Pressing the < SW changes the screen to the [Select option selection function] screen.
Pressing the ■SW changes the screen to the normal screen or alarm screen.
Pressing the ◇SW changes the screen to the [Set machine serial No.] screen.



3) Setting of machine serial No. (second layer)

How to input machine serial No.

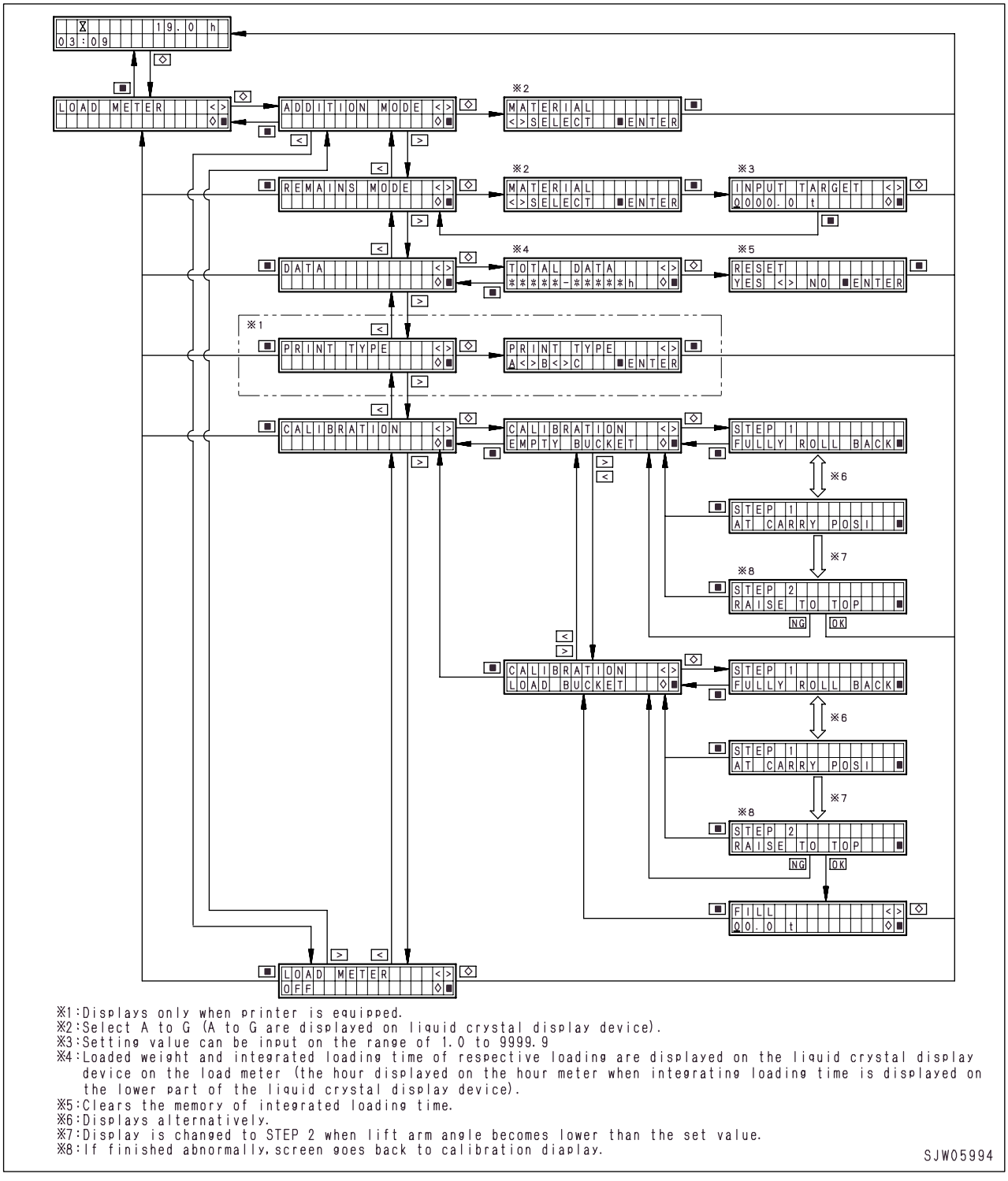
(1) When the screen is changed to the [Set machine serial No.] screen, the cursor (_) is at the 1st place of "50000" or "a set value" from the left.
(2) Each time the > SW or < SW is pressed, the displayed digit changes by 1 between 0 and 9.
(3) Select a desired digit and press the ◇SW.
(4) The cursor moves to the 2nd place. Select desired digits down to the first place from the right according to steps (2) and (3).
(5) Select the 1st place from the right and press the ◇SW.
(6) If the serial No. is entered, the operation acceptance peeps (on for 1 second -> off for 1 second -> on for 1 second) are heard.
(7) If you input a wrong number, press the ■SW to return the screen to the [Select machine serial No. setting] screen, and then repeat the operation from the first.



Load Meter Function

1. Outline
   For the load meter, there are addition mode, subtraction mode, data display mode, calibration mode and calculation stop mode, and each mode can be selected with the monitor panel mode selector switch. If a printer (if equipped) is connected to the load meter, it is possible to print out measurement data.

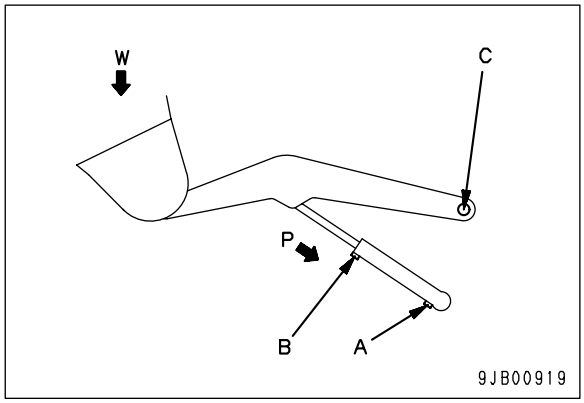
2. Operating Method



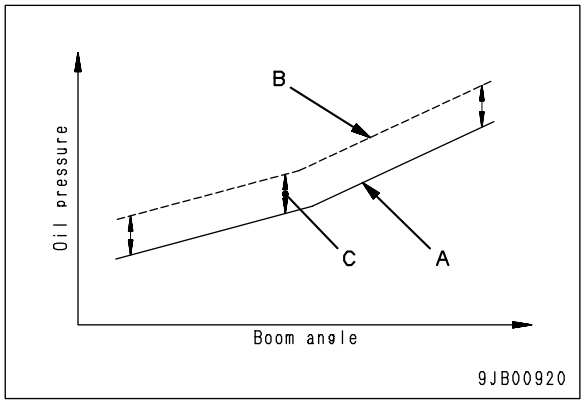
※1:Displays only when printer is equipped.
※2:Select A to G (A to G are displayed on liquid crystal display device).
※3:Setting value can be input on the range of 1.0 to 9999.9
※4:Loaded weight and integrated loading time of respective loading are displayed on the liquid crystal display device on the load meter (the hour displayed on the hour meter when integrating loading time is displayed on the lower part of the liquid crystal display device).
※5:Clears the memory of integrated loading time.
※6:Displays alternatively.
※7:Display is changed to STEP 2 when lift arm angle becomes lower than the set value.
※8:If finished abnormally, screen goes back to calibration diaplay.

SJW05994

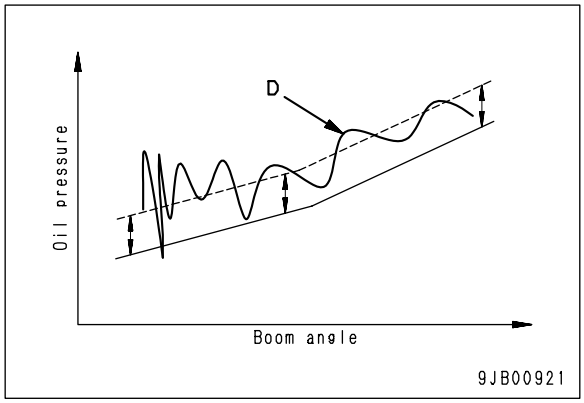
3. Weight Calculation
Since the pressure sensor (A) mounted on the bottom side of the lift arm cylinder and the pressure sensor (B) mounted on the head side detect operating pressures (P) of the lift arm, and also the lift arm angle sensor (C) calculates positions of the center of gravity, the load meter calculates weight (W) of load.



Weight is calculated from the differential pressure (C) between the standard value (A) of lift arm pressure in unloaded state memorized (and corrected by calibration) and the calculated value (B) of lift arm pressure in the loaded state. Also, it is designed for improving accuracy that weights are detected and calculated while the lift arm is being lifted.

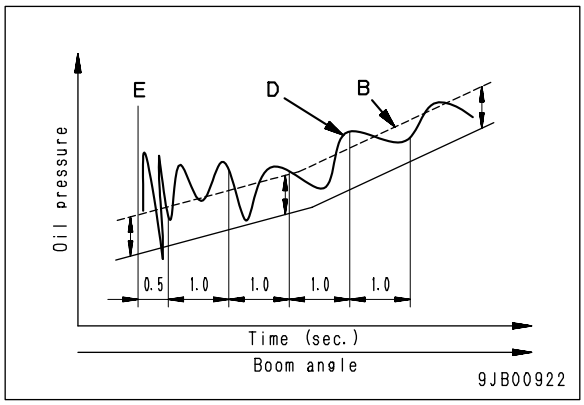


However, the real measured value (D) of lift arm pressure has characteristics shown in the figure below because operations of the tires and the work equipment cause spring effect to the machine.



From the really measured value (D) in lift arm lifting operation, value (B) is calculated according to the calculation method below.

- The pressure fluctuates greatly and no fixed value can be measured for 0.5 seconds after the lift arm lifting start (E) due to the shift from the static state to an dynamic state. So, the pressure cannot be used for calculation.
- Since the machine spring effect has periodic cycle of approximately one second, the calculated value (B) is calculated as a mean value of every second from the lift arm lifting start to the stop.



Judgment of start of lift arm raising operation
When all of the following conditions are satisfied, the load meter judges that the lift arm has started moving, and then starts calculation of the load.

Condition 1	Lift arm angle is between -10‹ and -30‹. (Lift arm is below the level line but not in contact with ground.)
Condition 2	Lift arm angle changes at least 0.1‹ in 0.1 second. (Lift arm started rising at speed higher than certain level.)

Judgment of stop of lift arm raising operation
When one of the following conditions is satisfied, the load meter judges that the lift arm has stopped moving, and then starts calculation of the load.

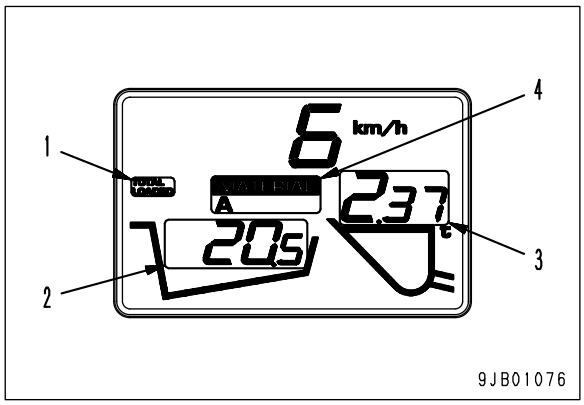
Condition 1	Change rate of lift arm angle is less than 0.5‹ in 0.5 seconds. (Rising speed of arm lift is below certain level.)
Condition 2	Lift arm angle changes in lowering direction. (If lift arm lowering operation is performed, calculation of load is finished.)
Condition 3	Lift arm angle is larger than +20‹. (Calculation of load is stopped at high place.)
Condition 4	Lift arm rising speed changes suddenly. (Angular velocity is below 70% of previous value.)
Condition 5	Load has been calculated 7 times.

Display of calculated load
The calculated loads are further averaged and the result is displayed as the calculated load.

Number of times of calculation	Calculation time (sec)	Method of calculation and display of load
Only 1	1.5 – 2.5	Calculation result of 1 time is displayed as load. In this case, displayed load is flashed to notify operator that calculation time is short and accuracy is not stable.
2	2.5 – 3.5	Average of calculation results of 2 times is displayed as load.
3 or more	3.5 –	Average of calculation results of latest 3 times is displayed as load.

4. Weight Calculation

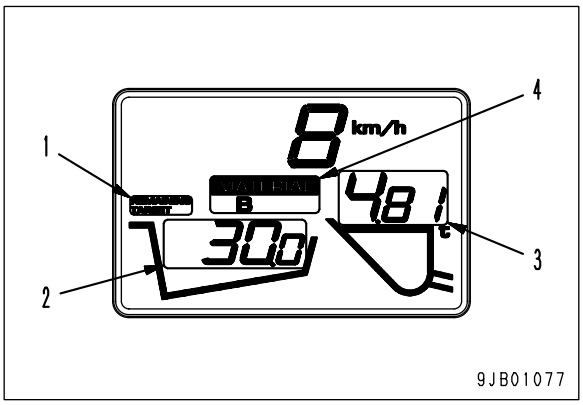
Subtraction and addition mode
Display of addition mode on monitor
In this mode, the load on the bucket of each time is added and the total load is displayed. This mode is used to grasp the production, etc.



- When the addition mode is selected, addition mode (1) "TOTAL LOADED" is displayed. The value of calculated bucket load (3) is added to total load (2) and the result is displayed.
- Loads of materials of up to 5 kinds can be integrated and displayed independently.
  When the mode is selected, 1 kind can be selected and set from A to E in objective materials (4).
- Total load (2) is displayed up to 9,999 t until the data are cleared with the load meter subtotal switch.
  The total load is displayed down to the first decimal place (100 kg) when it is less than 1,000 t. When it exceeds 1,000 t, the decimal point disappears and it is displayed by 1 t.

★ For details of display of total load, see Display of total load and display of remaining target load.

Display of subtraction mode on monitor
In this mode, the load on the bucket of each time is subtracted from a target load which is set in advance and the remaining target load is displayed. This mode is used to load a dump truck, etc. up to a set level.



- When the subtraction mode is selected, subtraction mode (1) "REMAINING TARGET" is displayed. The value of calculated bucket load (3) is subtracted from remaining load (2) and the result is displayed.
- Loads of materials of up to 5 kinds can be integrated and displayed independently.
  When the mode is selected, 1 kind can be selected and set from A to E in objective materials (4).

★ For the display and calculation method when calculated bucket load (3) is larger than remaining load (2), see HANDLING OF LOAD METER in the operation manual.
★ For details of display of remaining target load, see Display of total load and display of remaining target load.

Display of total load and display of remaining target load

Actual total load (t)	Total load	Remarks
– -99.5	-99.9	Decimal point is displayed.
-99.4 – -0.1	-**.*	Decimal point is displayed. (Figure is rounded off to 1 decimal place)
0 – 9994	***.*	Decimal point is displayed. (Figure is rounded off to 1 decimal place)
999.5 – 9999.4	****	Display by integer (Figure is rounded off to integer)
999.5 –	9999	Display by integer

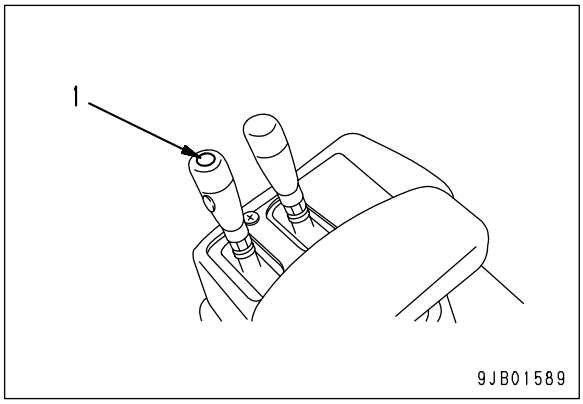
Unit of calculated load

- All loads are calculated on the SI unit (metric ton).
  If the display of speed is set to "MPH", however, short ton can be selected by initialization. In this case, the unit of the printed load is also short ton.

★ The units of speed and load are changed by using the initialization function. For change of them, ask the manufacturer.

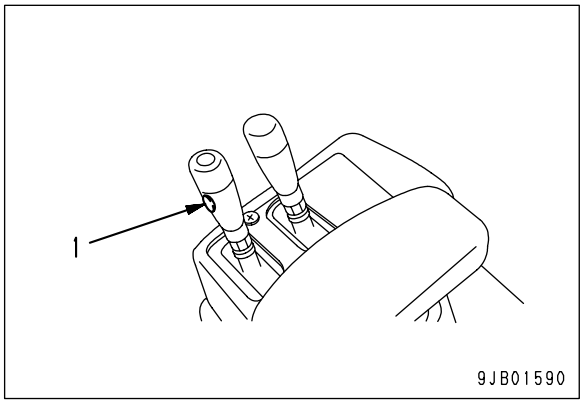
In a country where the SI units are used, do not change the units of speed and load from the SI units.

Load meter cancel switch



- If switch (1) is pressed during the holding time of the calculated load (in 15 seconds after calculation is finished), it is judged that the displayed bucket load is not added, and then the calculated load is discarded.
  The total load (or remaining target load) after addition (or subtraction) of this time is also cancelled and the previous value is displayed.

Load meter subtotal switch



- To clear the total load (in addition mode) or remaining target load (in the subtraction mode) or to print the data, hold switch (1) for 2 seconds.

Specification	Operation after switch is held
Without printer	Total load (Remaining target load) is cleared.
With printer	Saved subtotal data is printed. After it is printed, it is cleared.

Subtotal data

- The following data are saved as a set when the calculated load is entered.
  - Kind of objective material
  - Weight of load on bucket
  - Total number of loading times
  - Total load

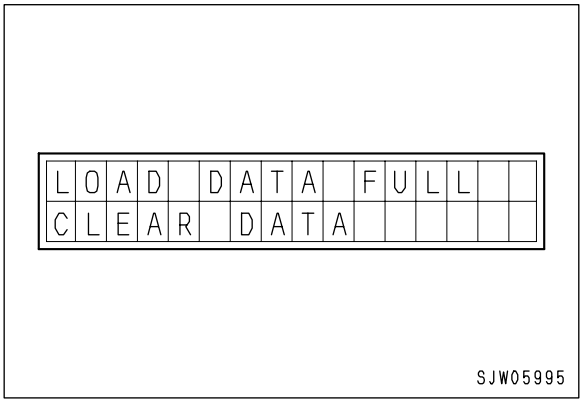
  Saving capacity: Min. 500 loading times

Auto-subtotal function

1) When printer (optional) is connected
   The weight of the 501st time is calculated. After 15 seconds, the data are saved in the RAM and the data of up to the 500th time are printed.
   After the data are printed, the subtotal data are cleared.
   After the data of the 500th time are saved, "LOAD DATA FULL" and "CLEAR DATA" are displayed on the character display. The load meter continues measurement, however.

2) When printer (optional) is not connected
   The weight of the 501st time is calculated. After 15 seconds, the data are saved in the RAM and the bucket load data of up to the 500th time are cleared to secure a data saving area.
   After the data of the 500th time are saved, "LOAD DATA FULL" and "CLEAR DATA" are displayed on the character display. The load meter continues measurement, however.

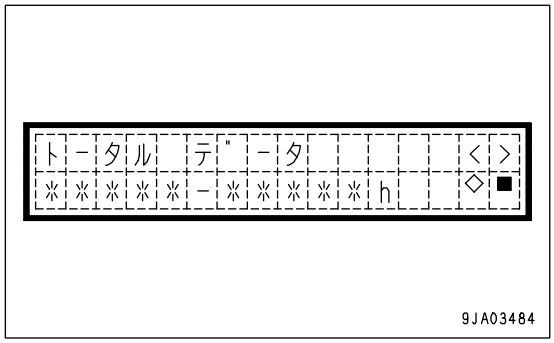
Display on character display after data of 500th time are saved



5. Integrated data display function

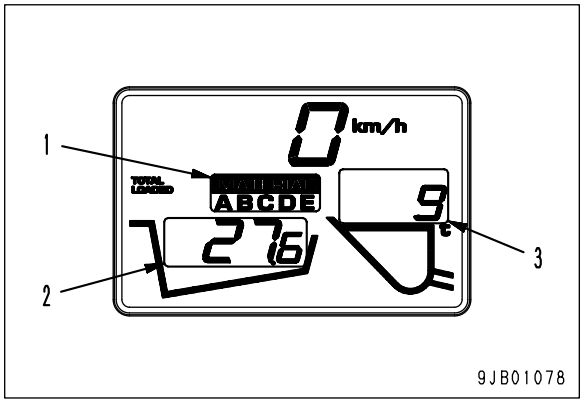
Display of data
- Display the total load and the total number of loading times in the addition mode or subtraction mode.

- Select "DISPLAY DATA" on the load meter function and display "TATAL DATA" on the character display.



★ On the lower line (*****-*****h), the integration time based on the hour meter is displayed.
Example) If 12300-12450h is displayed, the data integrated during the time from 12300 h to 12450 h are displayed on the character display.

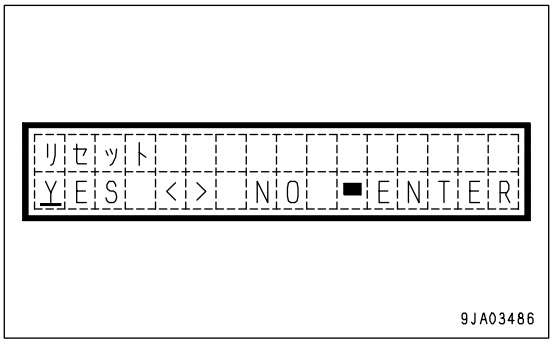
- Press (>) or (<) of monitor panel mode selector switch 2 and select A - E or all lighting up from objective material (1).
If A - E is selected, total load (2) and number of loading times (3) of each kind are displayed.
If all lighting up is selected, total load and total number of loading times of all of objective materials A - E are displayed.



Resetting of data
- Reset the integrated data of objective materials A - E one by one or all of them.

- Display "TOTAL DATA" on the character display and press (>) or (<) of monitor panel mode selector switch 2 and select A - E or all lighting up from objective material, and then press (ž) of mode selector switch 1.

- "RESET" and "YES < > NO" are displayed on the character display for confirmation of the operation.
The cursor is at the "NO" position just after the screen changes. Press (<) of monitor panel mode selector switch (2) to move the cursor to the "YES" position and press (¡) of mode selector switch 1.



- If the monitor accept the operation, the buzzer makes peeps and the service meter is displayed.

★ If the load meter is left with the battery disconnected for more than 6 hours, the integrated data in the load meter are lost. Take care when the battery disconnecting switch is used.

6. Printing of data
(If equipped)
★ This function works only when the optional printer is installed.

The load meter has 3 kinds (A, B, and C) of output mode. The output format of each mode is shown below.
★ For how to select the output mode and how to print the data, see OPERATION MANUAL, "Handling of load meter".

A-mode (Total printer output)	B-mode (Subtotal printer output)	C-mode (Operation record printer output)
• Model, serial No. • Date and time of printing • Subtotal data of loading (Kind/Number of loading times/Load) • Total data of loading (Total number of loading times/Total load)	• Model, serial No. • Date and time of printing • Data of loading (Load) • Subtotal data of loading (Kind/Number of loading times/Load) • Total data of loading (Total number of loading times/Total load)	• Model, serial No. • Date and time of printing and service meter • Date and time of finishing recording (printing) and service meter • Subtotal data of loading (Kind/Number of loading times/Load) • Total data of loading (Total number of loading times/Total load) • Maintenance period (Maintenance item/Remaining time)

Examples of printing in each mode (WA470-5)

Example of printing in A-mode

WA470-5 #70001

2001/10/25, 17:30

Kind	Number of loading	Total load
A-kind	1 time	2.62 t
B-kind	2 times	6.04 t
C-kind	3 times	7.11 t
D-kind	4 times	9.04 t
E-kind	5 times	14.82 t
Total	16 times	42.25 t

Example of printing in B-mode

WA470-5 #70001

2001/10/25, 17:30

A-kind
1st time: 2.62 t

Total: 1 time	2.62 t

B-kind

1st time: 2.62 t	2nd time: 3.42 t
Total: 2 times	6.04 t

C-kind

1st time: 3.43 t	2nd time: 2.25 t
3rd time: 1.43 t	
Total: 3 times	7.11 t

D-kind

1st time: 1.43 t	2nd time: 2.27 t
3rd time: 2.05 t	4th time: 3.38 t
Total: 4 times	9.04 t

E-kind

1st time: 3.48 t	2nd time: 2.94 t
3rd time: 3.64 t	4th time: 1.97 t
5th time: 2.79 t	
Total: 5 times	14.82 t

Example of printing in C-mode

WA470-5 #70001

Time of starting recording
2001/10/25, 9:15
Service meter: 00043.0 h
Time of finishing recording
2001/10/25, 17:30
Service meter: 00051.2 h

Kind	Number of loading	Total load
A-kind	1 time	2.62 t
B-kind	2 times	6.04 t
C-kind	3 times	7.11 t
D-kind	4 times	9.04 t
E-kind	5 times	14.82 t
Total	16 times	42.25 t

Remaining maintenance period

Engine oil	250 h
Transmission oil	1000 h
Hydraulic oil	2000 h
Axle oil	2000 h
Engine oil filter	250 h
Transmission oil filter	500 h
Hydraulic oil filter	1000 h
Axle pivot pin	50 h
Work equipment pin	100 h
Steering cylinder pin	250 h
Center hinge pin	1000 h

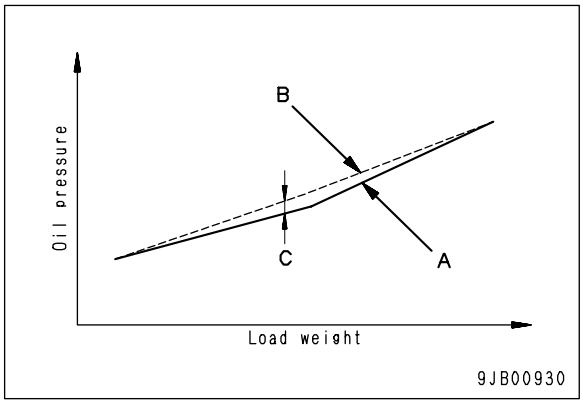
7. Calibration

- Calibration is classified into empty calibration where the pressure under the empty bucket is measured and loaded calibration where the pressure under the bucket loaded with known weight is measured.
  For calibration, tilt the bucket fully and raise the lift arm. At this time, save the lift arm operation pressure under no load (0 kg) or a load of known weight.
- Normally, sufficient accuracy can be secured by performing only the empty calibration. If the center of gravity of the load is shifted largely from the position we have set after modification of the lift arm of bucket, however, the loaded calibration must be performed.

★ The calibration data are not deleted even if the battery is disconnected for a long period.

Empty calibration
- Deviation of the weight of the work equipment, etc. which is unique to each machine is cancelled. As shown in the following figure, the difference from the standard value (A) is offset (B).

Loaded calibration
- The standard pressure under the load is corrected. As shown in the following figure, the difference from the standard value (A) near the loaded calibration point (C) is corrected (B).



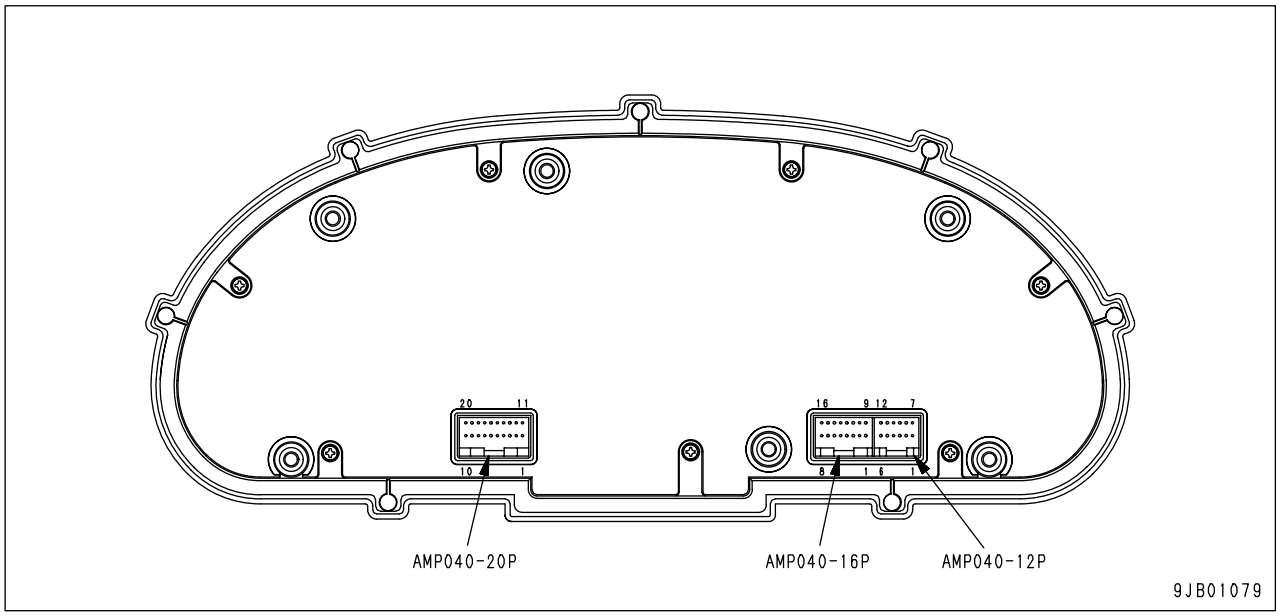
★ For the calibration method, see TESTING AND ADJUSTING, Testing and adjusting load meter.

8. Stopping of calculation
   The calculation function of the load meter is stopped.
   While calculation is stopped, the load meter is not displayed and the travel speed or engine speed is displayed. The load handled in this period is not added to the total data.
   To start calculation again, select the addition mode or subtraction mode.

   ★ For how to stop calculation, see OPERATION MANUAL, "Handling of load meter".

Input / Ouput signal

Speed meter specification



AMP040-16P [CN-L21]

Pin No.	Specification	I/O	Type of use	Signal name	WA320-5	Remarks
1	D_IN (NSW +24V)	I	D/I+24V	Service SW	■ SW input	SW for operating machine monitor
2	D_IN (+24V)	I	D/I+24V	Service SW	◇ SW input	SW for operating machine monitor
3	GND	I	GND	CAN shield	GND	
4	D_IN (GND)	I	D/IGND	Increment SW	< SW input	SW for operating machine monitor
5	D_IN (GND)	I	D/IGND	Decrement SW	> SW input	SW for operating machine monitor
6	A_IN	I	A/I	Engine water temperature sensor (For automatic preheating)	Engine water temperature sensor (For automatic preheating)	
7	GND	I	GND	Sensor GND	GND	
8	A_IN	I	A/I	Brake oil temperature sensor	Brake oil temperature sensor	
9	N.C.	–	–	---	---	
10	N.C.	–	–	---	---	
11	D_OUT (+24 V, sink: 200 mA)	O	D/O sink	Buzzer (Machine monitor)	Buzzer (Machine monitor)	
12	D_IN (+24V)	I	D/I+24V	Lamp switch (Clearance lamp)	Lamp switch (Clearance lamp)	
13	D_IN (NSW +24V)	I	D/I+24V	Parking brake omission prevention	Parking brake omission prevention	
14	A_IN	I	A/I	HST oil temperature sensor	HST oil temperature sensor	
15	GND	I	GND	GND	GND	
16	A_IN	I	A/I	Engine water temperature sensor	Engine water temperature sensor	

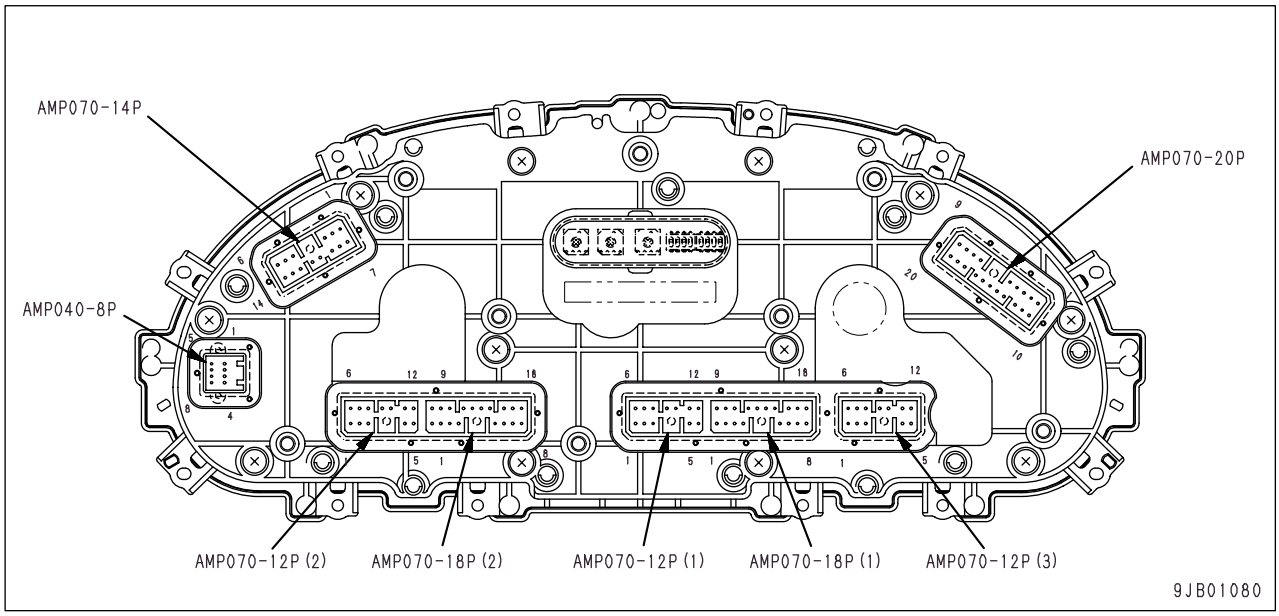
AMP040-12P [CN-L22]

Pin No.	Specification	I/O	Type of use	Signal name	WA320-5	Remarks
1	N.C.	–	–	---	---	
2	CAN-	I/O	CAN	Machine monitor – HST controller	CAN-	
3	D_IN (GND)	I	D/IGND	Emergency steering operation	Emergency steering operation	(If equipped)
4	D_OUT (+24 V, sink: 200 mA)	O	D/O sink	Automatic preheater relay	Automatic preheater relay	
5	D_IN (GND)	I	D/IGND	Emergency steering normal	Emergency steering normal	(If equipped)
6	CAN+	I/O	CAN	Machine monitor – HST controller	CAN+	
7	N.C.	–	–	---	---	
8	D_IN (+24V)	I	D/I+24V	Direction R	Direction R	
9	D_IN (+24V)	I	D/I+24V	Direction N	Direction N	
10	D_IN (+24V)	I	D/I+24V	Direction F	Direction F	
11	D_IN (+24V)	I	D/I+24V	Turn signal lamp left	Turn signal lamp left	
12	D_IN (GND)	I	D/IGND	Dimmer switch	Dimmer switch	

AMP040-20P [CN-L23]

Pin No.	Specification	I/O	Type of use	Signal name	WA320-5	Remarks
1	D_IN (NSW+24V)	I	D/I+24V	IGN BR	IGN BR	
2	N.C.	–	–	---	---	
3	D_IN (+24V)	I	D/I+24V	IGN C	IGN C	
4	N.C.	–	–	---	---	
5	N.C.	–	–	---	---	
6	D_IN (GND)	I	D/IGND	HST filter clogging	HST filter clogging	
7	D_IN (GND)	I	D/IGND	Air cleaner clogging	Air cleaner clogging	
8	D_IN (GND)	I	D/IGND	Engine water level	Engine water level	
9	D_IN (+24V)	I	D/I+24V	Lamp switch (Head lamp)	Lamp switch (Head lamp)	
10	D_IN (GND)	I	D/IGND	Engine oil pressure	Engine oil pressure	
11	NSW power supply (+24 V)	I	Power supply +24 V	NSW power supply (+24 V)	NSW power supply (+24 V)	
12	D_IN (GND)	I	D/IGND	Alternator R	Alternator R	
13	A_IN	I	A_I	Fuel level sensor	Fuel level sensor	
14	GND	I	GND	GND	GND	
15	D_OUT (+24 V, sink: 200 mA)	O	D/O sink	HST solenoid cut-out relay	HST solenoid cut-out relay	
16	N.C.	–	–	---	---	
17	D_IN (+24V)	I	D/I+24V	Turn signal lamp right	Turn signal lamp right	
18	D_IN (+24V)	I	D/I+24V	Parking brake	Parking brake	
19	D_IN (GND)	I	D/IGND	Brake oil pressure	Brake oil pressure	
20	D_IN (GND)	I	D/IGND	(Engine oil level)	---	

Load meter specification



AMP070-20P [CN-L24]

Pin No.	Specifications	I/O	Group	Type of use	Signal name	WA320-5	Remarks
1	---	—	—		---	---	
2	Small lamp power	I	—	Power +24V	---	---	
3	Small lamp power	I	—	Power +24V	---	---	
4	NSW power (+24V)	I	—	Power +24V	NSW power (+24V)	NSW power (+24V)	
5	NSW power (+24V)	I	—	Power +24V	NSW power (+24V)	NSW power (+24V)	
6	SW power (+24V)	I	—	Power +24V	SW power (+24V)	SW power (+24V)	
7	SW power (+24V)	I	—	Power +24V	SW power (+24V)	SW power (+24V)	
8	---	—	—		---	---	
9	GND	I	—	GND	GND	GND	
10	GND	I	—	GND	GND	GND	
11	D_OUT_3 (+24V, sink 200mA)	O	A	D/0 sink	HST overrun prevention relay	HST overrun prevention relay	
12	D_OUT_2 (+24V, sink 200mA)	O	A	D/0 sink	Automatic preheating relay	Automatic preheating relay	
13	D_OUT_1 (+24V, sink 200mA)	O	A	D/0 sink	HST solenoid cut relay	HST solenoid cut relay	
14	D_OUT_0 (+24V, sink 200mA)	O	A	D/0 sink	Buzzer 1 (Machine monitor)	Buzzer 1 (Machine monitor)	
15	Sensor power output (+24V)	O	—	Sensor power	Lift arm pressure sensor power	Lift arm pressure sensor power	For load meter
16	Sensor power output (+5V)	O	—	Sensor power	Lift arm angle sensor power	Lift arm angle sensor power	For load meter
17	GND	I	—	GND	GND	GND	
18	GND	I	—	GND	GND	GND	
19	GND	I	—	GND	GND	GND	
20	GND	I	—	GND	GND	GND	

AMP070-18P(1) [CN-L25]

Pin No.	Specifications	I/O	Group	Type of use	Signal name	WA320-5	Remarks
1	D_IN_0 (24V,5mA)	I	B	D/I+24V	Lamp switch (head lamp)	Lamp switch (head lamp)	
2	D_IN_ 2(24V,5mA)	I	B	D/I+24V	IGN C	IGN C	
3	D_IN_4 (24V,5mA)	I	B	D/I+24V	(Auto grease A)	---	
4	D_IN_6 (24V,5mA)	I	B	D/I+24V	Direction F	Direction F	
5	D_IN_8 (24V,5mA)	I	B	D/I+24V	Direction R	Direction R	
6	D_IN_10 (24V,5mA)	I	B	D/I+24V	Service SW Input	◇SW Input	SW for operating machine monitor
7	D_IN_12 (NSW24V,5mA)	I	C	D/I+24V	Turn signal lamp right	Turn signal lamp right	
8	D_IN_14 (NSW24V,5mA)	I	C	D/I+24V	Service SW input	◇SW input	SW for operating machine monitor
9	GND	O	—		SIGNAL GND	SIGNAL GND	
10	D_IN_1 (24V,5mA)	I	B	D/I+24V	IGN BR	IGN BR	
11	D_IN_3 (24V,5mA)	I	B	D/I+24V	(IGN R1)	---	
12	D_IN_5 (24V,5mA)	I	B	D/I+24V	(Auto grease B)	---	
13	D_IN_7 (24V,5mA)	I	B	D/I+24V	Direction N	Direction N	
14	D_IN_9 (24V,5mA)	I	B	D/I+24V	(HST: Hi/Lo switch)	---	
15	D_IN_11 (24V,5mA)	I	B	D/I+24V	(Diagnosis IN B)	---	
16	D_IN_13 (NSW24V,5mA)	I	C	D/I+24V	Turn signal lamp left	Turn signal lamp left	
17	D_IN_15 (NSW24V,5mA)	I	C	D/I+24V	Parking brake omission prevention	Parking brake omission prevention	
18	A_IN_0 (0-30V)	I	H	A/I	Alternator R	Alternator R	

AMP070-12P (1) [CN-L26]

Pin No.	Specifications	I/O	Group	Type of use	Signal name	WA320-5	Remarks
1	D_IN_16 (24V/GND,5mA)	I	D	D/IGND	Break oil pressure (Front)	Break oil pressure	
2	D_IN_18 (24V/GND,5mA)	I	D	D/IGND	(Break oil level) (Front)	---	
3	D_IN_20 (24V/GND,5mA)	I	D	D/IGND	Air cleaner clogging 1	Air cleaner clogging	
4	D_IN_22 (24V/GND,5mA)	I	D	D/IGND	(Spare)	---	
5	D_IN_24 (24V/GND,5mA)	I	E	D/IGND	HST filter clogging	HST filter clogging	
6	GND	O	—	GND	Sensor GND	Sensor GND	
7	D_IN_17 (24V/GND,5mA)	I	D	D/IGND	(Break oil pressure) (Rear)	---	
8	D_IN_19 (24V/GND,5mA)	I	D	D/IGND	(Break oil level) (Rear)	---	
9	D_IN_21 (24V/GND,5mA)	I	D	D/IGND	(Air cleaner clogging 2)	---	
10	D_IN_23 (24V/GND,5mA)	I	D	D/IGND	(Spare)	---	
11	D_IN_25 (24V/GND,5mA)	I	E	D/IGND	(Seat belt mounting alarm)	---	
12	A_IN_0 (0-30V)	I	H	A/I	Lamp switch (Clearance lamp)	Lamp switch (Clearance lamp)	

AMP070-18P(2) [CN-L27]

Pin No.	Specifications	I/O	Group	Type of use	Signal name	WA320-5	Remarks
1	D_IN_26 (24V/GND,5mA)	I	E	D/IGND	Parking brake	Parking brake	
2	D_IN_28 (24V/GND,5mA)	I	E	D/IGND	Engine oil pressure	Engine oil pressure	
3	D_IN_30 (24V/GND,5mA)	I	E	D/IGND	Emergency steering normal	Emergency steering normal	With emergency steering (If equipped)
4	D_IN_32 (24V/GND,5mA)	I	F	D/IGND	Subtotal SW	Subtotal SW	For load meter
5	D_IN_34 (24V/GND,5mA)	I	F	D/IGND	Dimmer switch	Dimmer switch	
6	D_IN_36 (24V/GND,5mA)	I	G	D/IGND	Machine monitor indicator SW	---	
7	D_IN_38 (24V/GND,5mA)	I	G	D/IGND	Increment SW	< SW input	SW for operating machine monitor
8	P_IN_0 (0.5Vp-p)	I	M	P/I	(Machine speed sensor)	---	Pulse Input
9	GND	O	—	GND	GND	GND	
10	D_IN_27 (24V/GND,5mA)	I	E	D/IGND	Engine coolant level	Engine coolant level	
11	D_IN_29 (24V/GND,5mA)	I	E	D/IGND	Engine oil level	Engine oil level	
12	N.C.	I	E	D/IGND	N.C.	---	
13	D_IN_33 (24V/GND,5mA)	I	F	D/IGND	Cancel SW	Cancel SW	For load meter
14	D_IN_35 (24V/GND,5mA)	I	F	D/IGND	(Lift arm proximity SW)	---	
15	D_IN_37 (24V/GND,5mA)	I	G	D/IGND	Decrement SW	> SW input	SW for operating machine monitor
16	D_IN_39 (24V/GND,5mA)	I	G	D/IGND	Emergency steering operation	Emergency steering operation	With emergency steering (If equipped)
17	P_IN_1 (0.5Vp-p)	I	M	P/I	(Spare)	---	Pulse input
18	(NC)	—	—		(NC)	---	

AMP070-12P(2) [CN-L28]

Pin No.	Specifications	I/O	Group	Type of use	Signal name	WA320-5	Remarks
1	A_IN_2 (High resistance input)	I	J	A/I	Fuel level sensor	Fuel level sensor	
2	A_IN_4 (High resistance input)	I	J	A/I	HST oil temperature sensor	HST oil temperature sensor	
3	A_IN_6 (High resistance input)	I	K	A/I	Engine coolant temperature sensor (for auto pre-heating)	Engine coolant temperature sensor (for auto pre-heating)	
4	A_IN_8 (0-5V)	I	L	A/I	Lift arm pressure sensor (head)	Lift arm pressure sensor (head)	For load meter
5	A_IN_10 (0-14V)	—	—	---	(Battery electrolyte level A)	---	
6	GND	O	—	GND	SIGNAL GND	GND	
7	A_IN_3 (High resistance input)	I	J	A/I	Brake oil temperature sensor	Brake oil temperature sensor	
8	A_IN_5 (High resistance input)	I	J	A/I	Engine coolant temperature sensor	Engine coolant temperature sensor	
9	A_IN_7 (0-5V)	I	L	A/I	Lift arm pressure sensor (bottom)	Lift arm pressure sensor (bottom)	For load meter
10	A_IN_9 (0-5V)	I	L	A/I	Lift arm angle sensor	Lift arm angle sensor	For load meter
11	GND	O	—	GND	SIGNAL GND	GND	
12	A_IN_11 (0-14V)	—	—	---	(Battery electrolyte level B)	---	

AMP070-12P(3) [CN-L29]

Pin No.	Specifications	I/O	Group	Type of use	Signal name	WA320-5	Remarks
1	S_NET(+)	I/O	N	S-NET	---	---	
2	S_NET(+)	I/O	N	S-NET	---	---	
3	CAN+	I/O	P	CAN	Machine monitor HST controller	CAN+	
4	S_NET(-)	O	N	S-NET	---	---	
5	S_NET(-)	O	N	S-NET	---	---	
6	GND	O	—	GND	GND	GND	
7	GND	O	—	GND	CAN shield	GND	
8	CAN-	I/O	P	CAN	Machine monitor HST controller	CAN-	
9	(NC)	—	—	—	---	---	
10	(NC)	—	—	—	---	---	
11	(NC)	—	—	—	---	---	
12	(NC)	—	—	—	---	---	

AMP070-14P(2) [CN-L30]

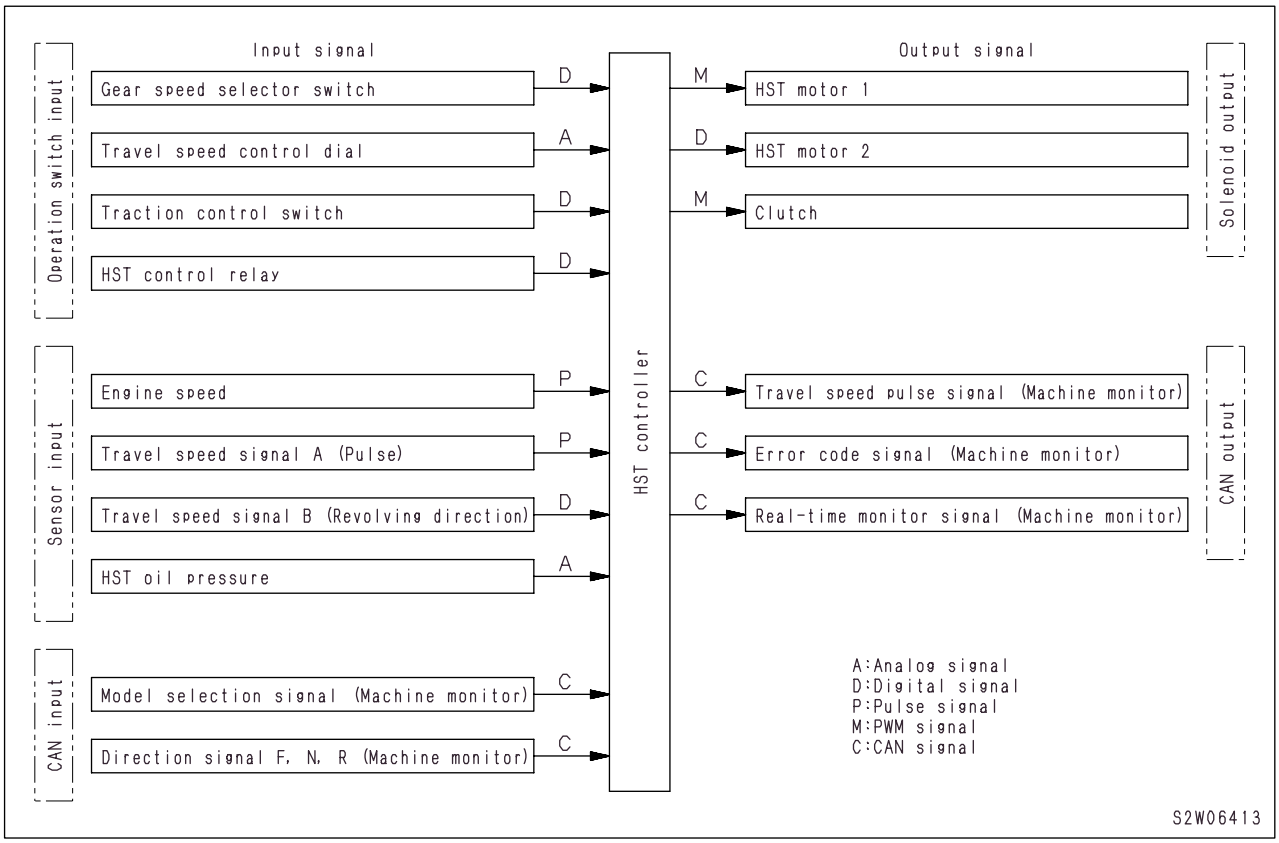
Pin No.	Specifications	I/O	Group	Type of use	Signal name	WA320-5	Remarks
1	(NC)	—	—	---	---	---	
2	RS232C_1_RTS	I/O	Q	---	RS232_C serial communication	---	
3	RS232C_1_RD	I	Q	RD	RS232_C serial communication	PC RX	For monitoring PC
4	RS232C_2_RD	I	R	RD	NC	---	
5	RS232C_2_RTS	I/O	R	---	NC	---	
6	---	—	—	---	Load meter printer BUSY input	Printer BUSY	For load meter (If equipped)
7	(NC)	—	—	---	---	---	
8	RS232C_1_CTS	I/O	Q	---	RS232_C serial communication	---	
9	RS232C_1_TX	O	Q	TX	RS232_C serial communication	Printer & PC TX	For load meter (If equipped) For monitoring (PC)
10	RS232C_1_SG	O	Q	---	RS232_C serial communication	---	
11	RS232C_2_SG	O	R	---	NC	---	
12	RS232C_2_TX	O	R	TX	NC	---	
13	RS232C_2_CTS	I/O	R	---	NC	---	
14	(NC)	—	—	---	---	---	

AMP040-8P [CN-L31]

Pin No.	Specifications	I/O	Group	Type of use	Signal name	WA320-5	Remarks
1	RS232C_0_TXD	O	S	---	Flash writing data (sending)	---	Harness not connected in machine
2	FLASH_SW	I	S	---	Flash writing switch	---	Harness not connected in machine
3	RS232C_0_TXD	O	S	---	Flash writing data (sending)	---	Harness not connected in machine
4	(NC)	—	—	---	(NC)	---	Harness not connected in machine
5	RS232C_0_RXD	I	S	---	Flash writing data (receiving)	---	Harness not connected in machine
6	(NC)	—	—	---	(NC)	---	Harness not connected in machine
7	RS232C_0_RXD	I	S	---	Flash writing data (receiving)	---	Harness not connected in machine
8	GND	O	—	---	GND	---	Harness not connected in machine

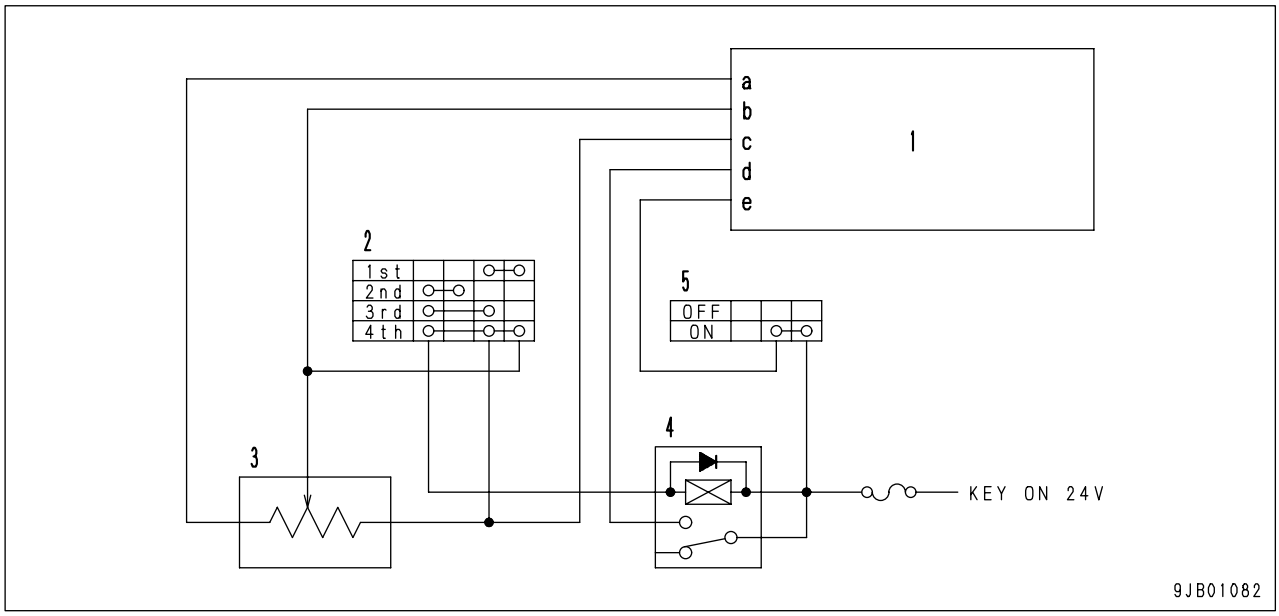
ELECTRICAL SYSTEM (HST CONTROLLER SYSTEM)

System diagram



Control function

1. Speed changing function
   The HST controller calculates the maximum speed matched to the selected gear speed and controls the HST according to the gear speed signal and travel speed adjustment signal.



1. HST controller
2. Gear speed selector switch
3. Travel speed control dial
4. HST control relay
5. Traction control switch

a. CNL41-10: Travel speed control dial power supply (+5 V)
b. CNL41-1: Travel speed control potentiometer signal
c. CNL41-2: Travel speed control dial GND
d. CNL42-12: Gear speed signal
e. CNL42-3: Traction control signal

Selected gear speed	Travel speed range (km/h)	Traction control switch signal	Traction control	Clutch solenoid output	Motor 1 solenoid output	Motor 2 solenoid output	Travel speed control signal input voltage (V)
1st	0 – 13 (Set with travel speed control signal)	– (Normally OFF)	Unlimited	OFF	MAX – MID	MAX. fixed	1.0 – 4.0
2nd	0 – 13	Standard (OFF)	Unlimited	OFF	MAX – MID	MAX. fixed	Below 1.0
		Limited (ON)	Limited				
3rd	0 – 18	Standard (OFF)	Unlimited	OFF,ON	MAX – 0	MAX. fixed	0
		Limited (ON)	Limited				
4th	0 – 38	Standard (OFF)	Unlimited	OFF,ON	MAX – 0	MAX. fixed - Variable	0
		Limited (ON)	Limited				

Note: The travel speed range shown above is for the tire size of 20.5-25.

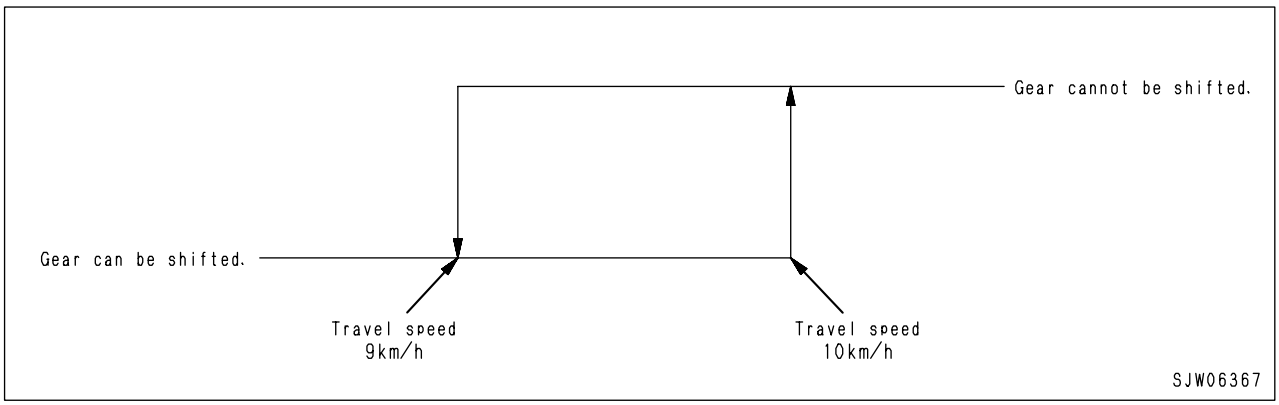
2. Traction control function
   The HST controller can limit the output torque according to the traction control signals when the selected gear speed is 2nd - 4th.

3. Travel speed control function (Variable shift control system)
   If the gear speed selector switch is set to the 1st position, the maximum speed can be limited to 4 - 13 km/h with the travel speed control signal.

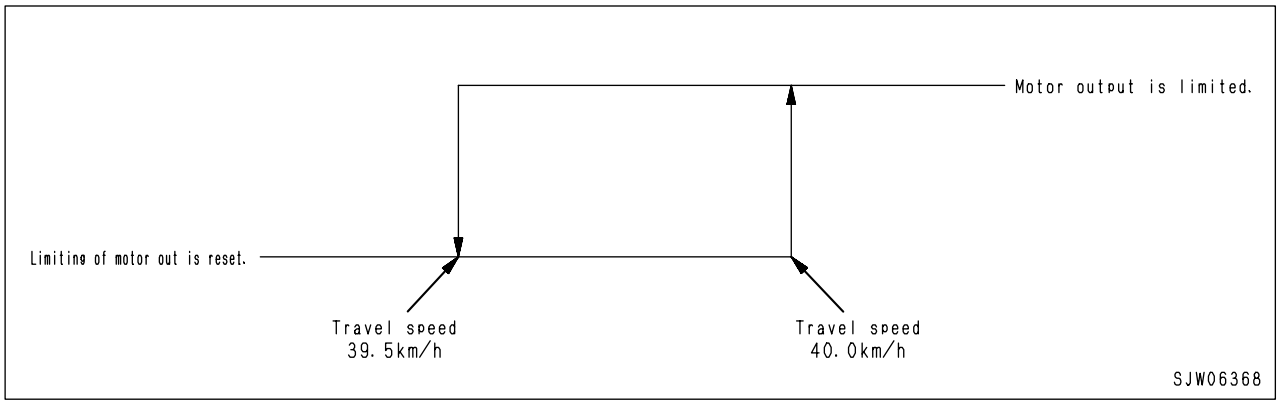
4. Motor 1 overrun prevention function
   While the machine is traveling at high speed (15 km/h or higher) with the gear in the 3rd or 4th position, if the gear is shifted to the 1st or 2nd position, the clutch is engaged at high speed and motor 1 speed exceeds the allowable limit.
   To prevent motor 1 from overrunning in this case, the HST controller prohibits shifting the gear from 3rd or 4th position to the 1st or 2nd position while the travel speed is above 10 km/h.
   If the gear cannot be shifted, the error code (989F00) is displayed on the machine monitor and the alarm buzzer is turned ON.
   The error condition is reset when the travel speed lowers below 9 km/h or the gear speed selector switch is set in a gear speed position at which the gear can be shifted.

Gear shifting operation			Action after gear shifting		
Switch position before gear shifting	Travel speed at gear shifting (km/h)	Switch position after gear shifting	Actual gear speed after gear shifting	Display of error code	Remarks
1st	0 –	2nd	2nd	Not displayed	Gear can be shifted regardless of travel speed.
		3rd	3rd		
		4th	4th		
2nd	0 –	1st	1st	Not displayed	Gear can be shifted regardless of travel speed.
		3rd	3rd		
		4th	4th		
3rd	0 – 10	1st	1st	Not displayed	Gear can be shifted to 1st or 2nd only when travel speed is below 9 km/h.
		2nd	2nd		
		4th	4th		
	10 –	1st	3rd	Displayed (989F00)	
		2nd	3rd		
		4th	4th	Not displayed	
4th	0 –10	1st	1st	Not displayed	Gear can be shifted to 1st or 2nd only when travel speed is below 9 km/h.
		2nd	2nd		
		3rd	3rd		
	10 –	1st	3rd	Displayed (989F00)	
		2nd	3rd		
		3rd	3rd	Not displayed	

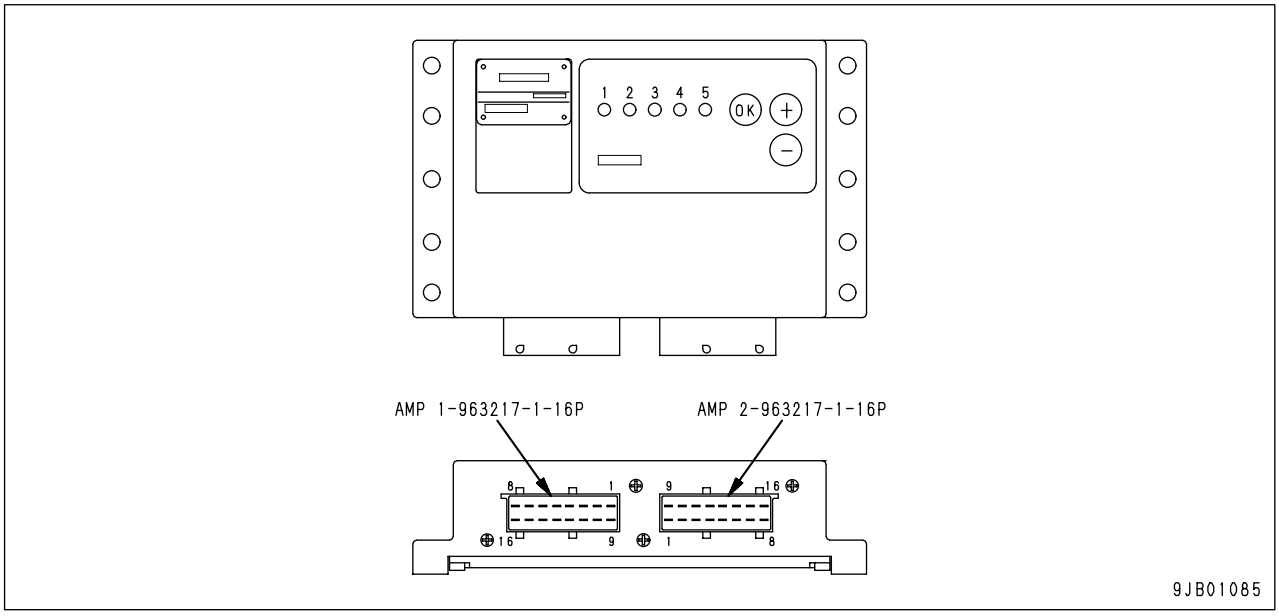
Note: The travel speed range shown above is for the tire size of 20.5-25.



5. Travel speed limiting function
   When the machine travels down a slope at high speed, the axle speed and engine speed exceed the allowable limit, and the travel speed exceeds the allowable limit consequently.
   To limit the travel speed in this case, the HST controller limits the output of motor 2 while the travel speed is above 40 km/h.
   If the travel speed is limited, the error code (989F00) is displayed on the machine monitor and the alarm buzzer is turned ON.
   The error condition is reset when the travel speed lowers below 39.5 km/h.



HST CONTROLLER



Input and output signals

AMP 1-963217-1-16P [CN-L41]

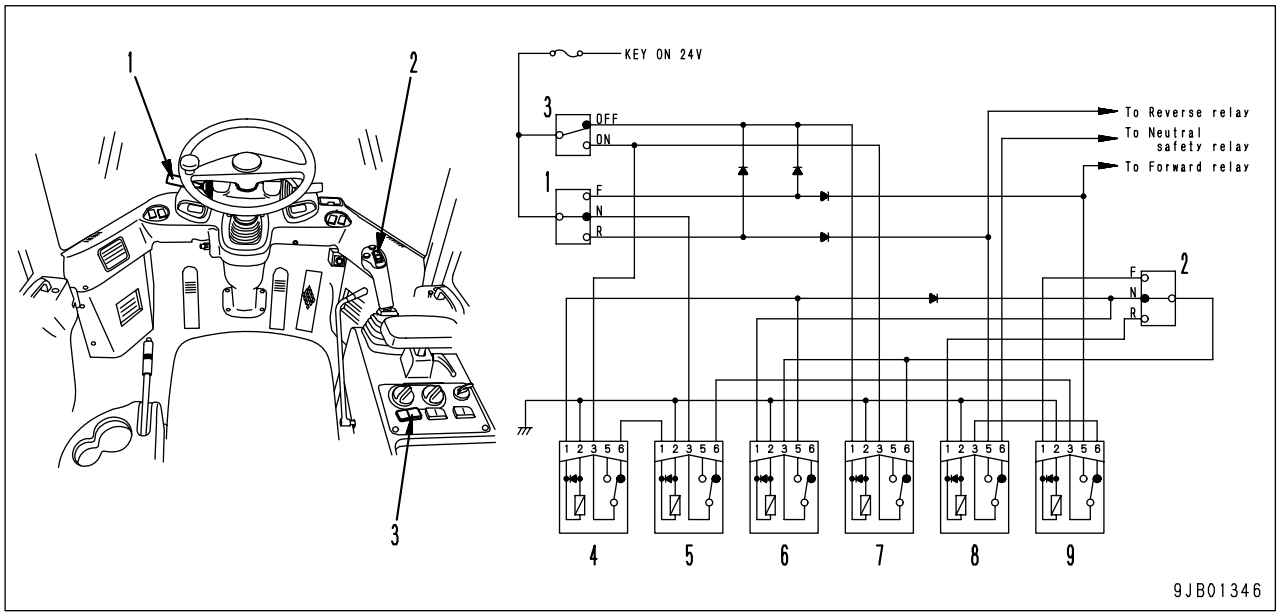
Pin No.	Signal name	Input/Output signal
1	Travel speed control potentiometer signal	Input
2	Travel speed potentiometer GND	–
3	HST pressure sensor signal	Input
4	HST pressure sensor GND	–
5	Motor 2 solenoid	Output
6	Motor 1 solenoid	Output
7	Power supply (+24 V)	Input
8	Power supply (+24 V)	Input
9	NC	–
10	Travel speed adjustment potentiometer GND	Output
11	NC	–
12	HST pressure sensor (+5 V)	Output
13	Travel speed signal A (Pulse)	Input
14	Clutch solenoid	Output
15	NC	–
16	GND	–

AMP 2-963217-1-16P [CN-L42]

Pin No.	Signal name	Input/Output signal
1	NC	–
2	Checker H	Input and output
3	Traction control signal	Input
4	Engine speed signal	Input
5	Travel speed signal B (Revolving direction)	Input
6	NC	–
7	Checker C	Input and output
8	CAN-L	Input and output
9	NC	–
10	NC	–
11	Engine speed sensor GND	–
12	Gear speed signal	Input
13	NC	–
14	Checker D	Input and output
15	Checker B	Input and output
16	CAN-H	Input and output

FUNCTION OF SELECTING DIRECTIONAL SELECTOR SWITCH

(If equipped)



1. Directional lever
2. Directional selector switch
3. Directional selector actuation switch
4. Multi-relay 1
5. Multi-relay 2
6. Multi-relay 3
7. Multi-relay 4
8. Multi-relay 5
9. Multi-relay 6

Outline

- If directional selector actuation switch (3) on the switch panel on the right side of the console box is operated, the travel direction can be changed with directional lever (1) or directional selector switch (2).

Function

1. Change of travel direction with directional lever
   While directional selector actuation switch (3) is turned OFF, the travel direction can be changed with directional lever (1).

2. Safety function for use of directional selector switch
   To prevent unexpected start of the machine just after directional selector actuation switch (3) is turned ON, the travel direction cannot be changed with directional selector switch (2) unless both of directional lever (1) and directional selector switch (2) are in the N (Neutral) position.

3. Change of travel direction with directional selector switch
   While directional lever (1) is in the N (Neutral) position and directional selector actuation switch (3) is turned ON, the travel direction can be changed with directional selector switch (2).

4. Directional lever priority function
   Directional lever (1) is kept effective, regardless of the position of directional selector actuation switch (3), so that the travel direction can be changed in an emergency.
   After the travel direction is changed with directional lever (1) while directional selector actuation switch (3) is turned ON, it cannot be changed with directional selector switch (2) unless directional lever (1) and directional selector switch (2) are returned to the N (Neutral) position.

Operation

When travel direction is changed with directional lever

- Since directional selector actuation switch (3) is OFF, the contacts of multi-relay 4 (7) are closed and the current to directional selector switch (2) and multi-relay 3 (6) is cut out.
- At this time, the F (Forward) signal and R (Reverse) signal of directional lever (1) flow through the diode to the forward relay or reverse relay.
- The N (Neutral) signal of directional lever (1) flows through multi-relay 2 (5), multi-relay 6 (9), and multi-relay 5 (8) to the neutral safety relay.

When directional selector switch is selected to be used

- While directional lever (1) and directional selector switch (2) are in the N (Neutral) position, if directional selector actuation switch (3) is turned ON, the contacts of multi-relay (4) (7) are open and the current flows through the ON terminal of directional selector actuation switch (3), multi-relay 4 (7), and N terminal of directional selector switch (2) to the coil of multi-relay 3 (6), and then the contacts are closed.
- Since the current in multi-relay 4 (7) flows through multi-relay 3 (6) to the coil of multi-relay 1 (4) and the contacts are closed, the current to the coil of multi-relay 2 (5) is cut out and the contacts are opened.
- Since the current at N terminal of directional lever (1) flows through multi-relay 2 (5) to multi-relay 6 (9), the travel direction can be changed with directional selector switch (2).
- Once the current flows in the coil of multi-relay 3 (6) to close the contacts, it keeps flowing until directional selector actuation switch (3) is turned OFF or directional lever (1) is set in the FORWARD or REVERSE position.
- While directional lever (1) is in the N (Neutral) position and directional selector switch (2) is not in the N (Neutral) position, if directional selector actuation switch (3) is turned ON, the current does not flow in multi-relay 3 (6) and the travel direction cannot be changed with directional selector switch (2).

When travel direction is changed with directional selector switch

1. When directional selector switch is in N (Neutral)
   Since the current does not flow in the coils of multi-relay 6 (9) and multi-relay 5 (8), the current at N terminal of directional lever (1) flows through multi-relay 2 (5), multi-relay 6 (9), and multi-relay 5 (8) to the neutral safety relay.

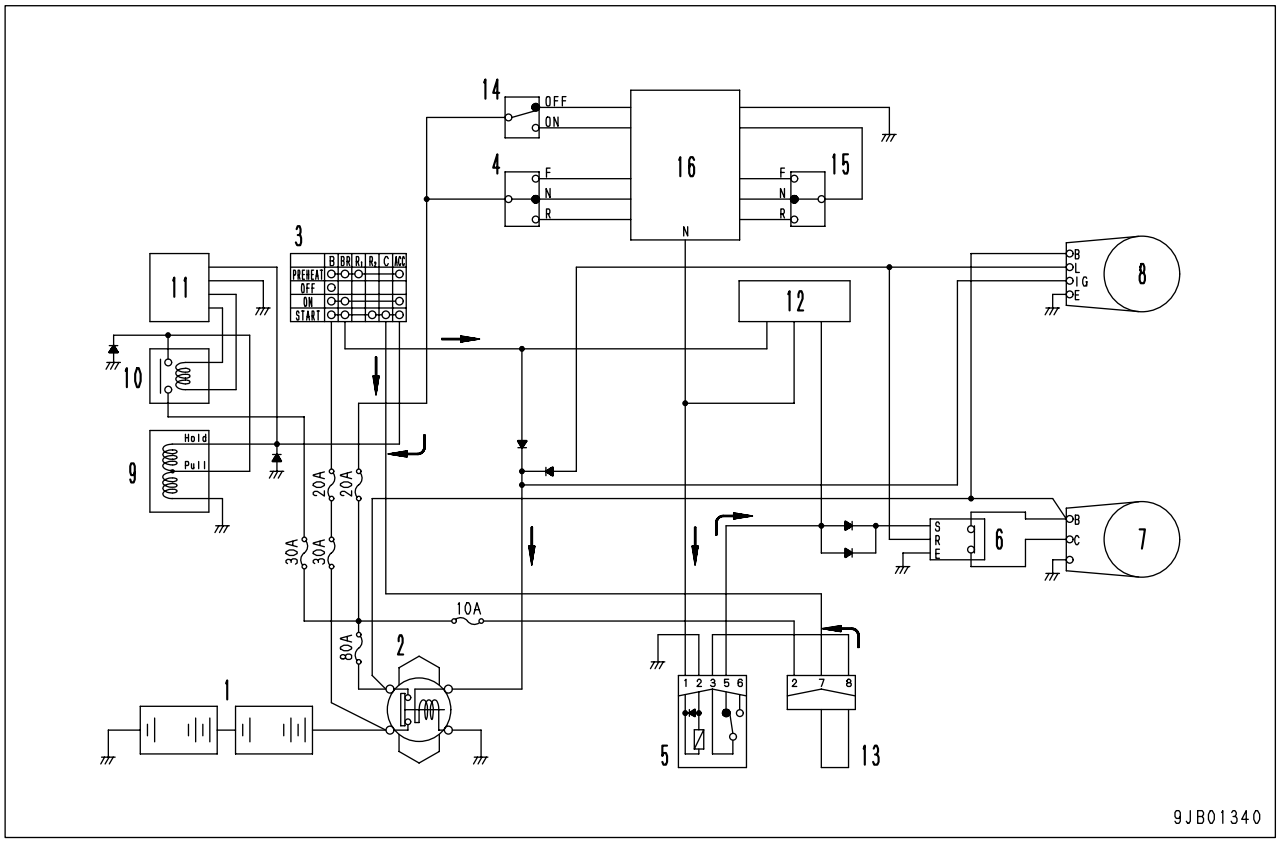
2. When directional selector switch is in F (Forward)
   Since the current flows in the coil of multi-relay 6 (9) and the contacts are closed, the current at N terminal of directional lever (1) flows through multi-relay 2 (5) and multi-relay 6 (9) to the forward relay.

3. When directional selector switch is in R (Reverse)
   Since the current flows in the coil of multi-relay 5 (8) and the contacts are closed, the current at N terminal of directional lever (1) flows through multi-relay 2 (5), multi-relay 6 (9), and multi-relay 5 (8) to the reverse relay.

When directional lever has priority

- While directional selector switch (2) is operated, if directional lever (1) is set in the F (Forward) or R (Reverse) position, the F (Forward) or R (Reverse) signal of directional lever (1) flows through the diode into the coil of multi-relay 4 (7) and the contacts are closed. Accordingly, the current does not flow into directional selector switch (2). In this case, the travel direction does not change even if directional selector switch (2) is operated.
- The F (Forward) or R (Reverse) signal of directional lever (1) flows through the diode into the forward relay or reverse relay and the travel direction can be changed.
- When directional lever (1) is returned to the N (Neutral) position, even if directional selector switch (2) is in the F (Forward) or R (Reverse) position, the travel direction does not change since the coil of multi-relay 3 (6) is not energized. Accordingly, the machine does not start unexpectedly.
- If both directional lever (1) and directional selector switch (2) are returned to the N (Neutral) position, the travel direction can be changed again with directional selector switch (2).

ENGINE START CIRCUIT



★ For details of the multi-function selector relay circuit, see Function of selecting directional selector switch.

1. Battery
2. Battery relay
3. Starting switch
4. Directional lever
5. Neutral safety relay
6. Starting motor safety relay
7. Starting motor
8. Alternator
9. Fuel cut-out solenoid
10. Fuel solenoid pull relay
11. Fuel cut-out solenoid timer
12. Machine monitor
13. Short connector
14. Directional selector actuation switch (If equipped)
15. Directional selector switch (If equipped)
16. Multi-function selector relay circuit (If equipped)

Function

1. The neutral safety circuit is employed to secure the safety when the engine is started.
   - While the directional selector actuation switch is OFF, the engine does not start if the directional lever is not in the N (Neutral) position.
   - While the directional selector actuation switch is ON, the engine does not start if the directional selector switch is not in the N (Neutral) position.

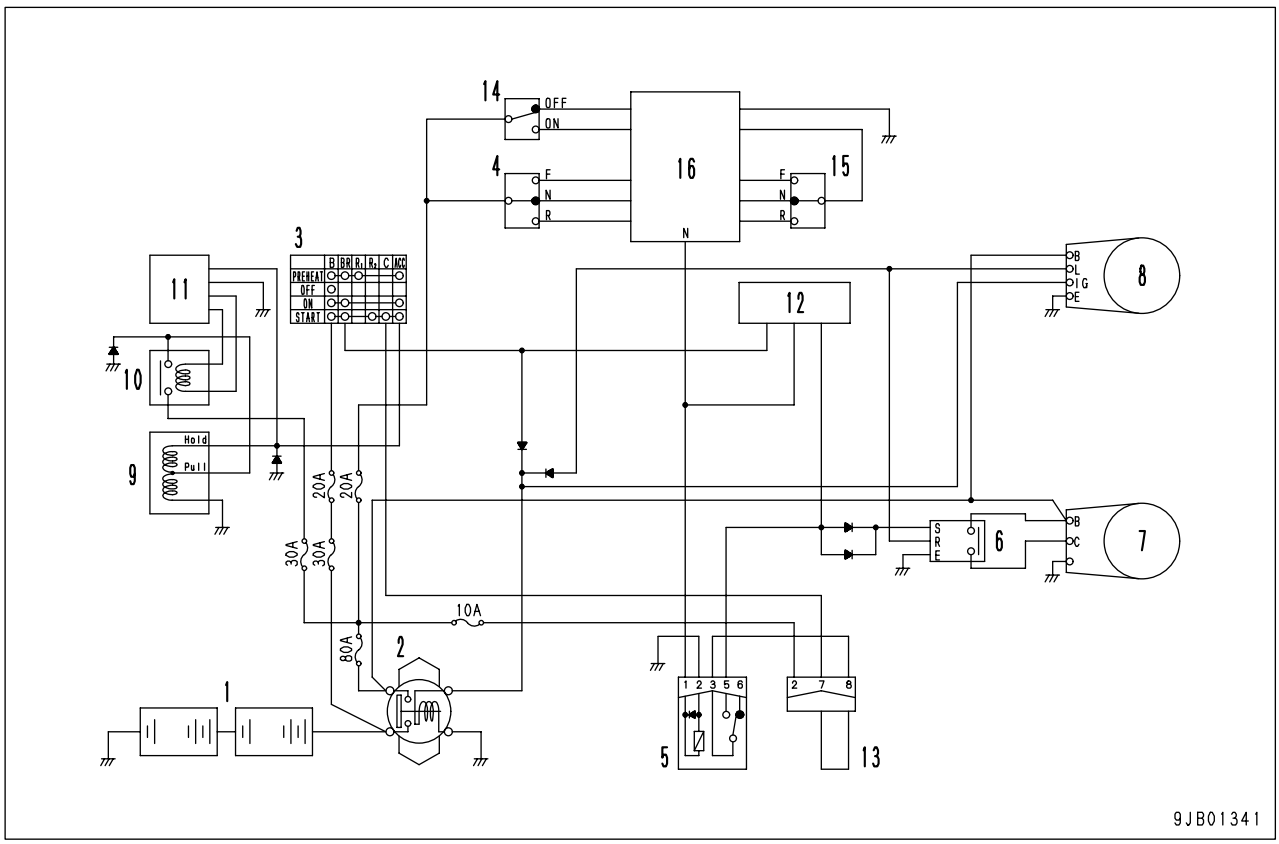
Operation

1. When starting switch is ON
   - If the starting switch is turned ON, terminals B and BR of the starting switch are closed and the current flows from the battery through the starting switch and battery relay coil to the ground and the contacts are closed. As a result, the power is supplied to each circuit of the machine.
     At this time, if the signal from terminal ACC of the starting switch flows in the timer relay, the relay contacts are closed for 3 seconds and the current flows into the coil on the pull side of the fuel cut-out solenoid.
     The current from terminal ACC of the starting switch flows into the coil on the hold side of the fuel cut-out solenoid to hold the solenoid so that the fuel will be supplied even after the coil on the pull side is energized. The engine is now ready to start.

2. Neutral safety circuit
   - While the directional selector actuation switch is OFF, if the directional lever is set in the N (Neutral) position, the current flows from contact N of the directional lever to the multi-function selector relay circuit. At this time, multi-function selector relay circuit supplies a current as the N signal to the neutral safety relay coil to connect neutral safety relay terminals 3 and 5.
   - While the directional selector actuation switch is ON, the current flows from its ON contact to the multi-function selector relay circuit.
     Then, the multi-function selector relay circuit supplies a current as the N signal to the neutral safety relay coil to connect neutral safety relay terminals 3 and 5 only when both directional lever and directional selector switch are in the N (Neutral) position.

3. When starting switch is turned to START position
   - If the starting switch is turned to the START position, terminals B and C of the starting switch are closed and the current flows from short connector terminal 7 through terminal 8 and neutral safety relay terminals 3 and 5 to starting motor safety relay terminal S, and then the contacts are closed to start the starting motor and engine.
   - While directional selector actuation switch is OFF, if the directional lever is not in the N (Neutral) position, the neutral safety relay does not operate and the engine does not start.
   - While directional selector actuation switch is ON, if the directional lever and directional selector switch are not in the N (Neutral) position, the neutral safety relay does not operate and the engine does not start.

ENGINE STOP CIRCUIT



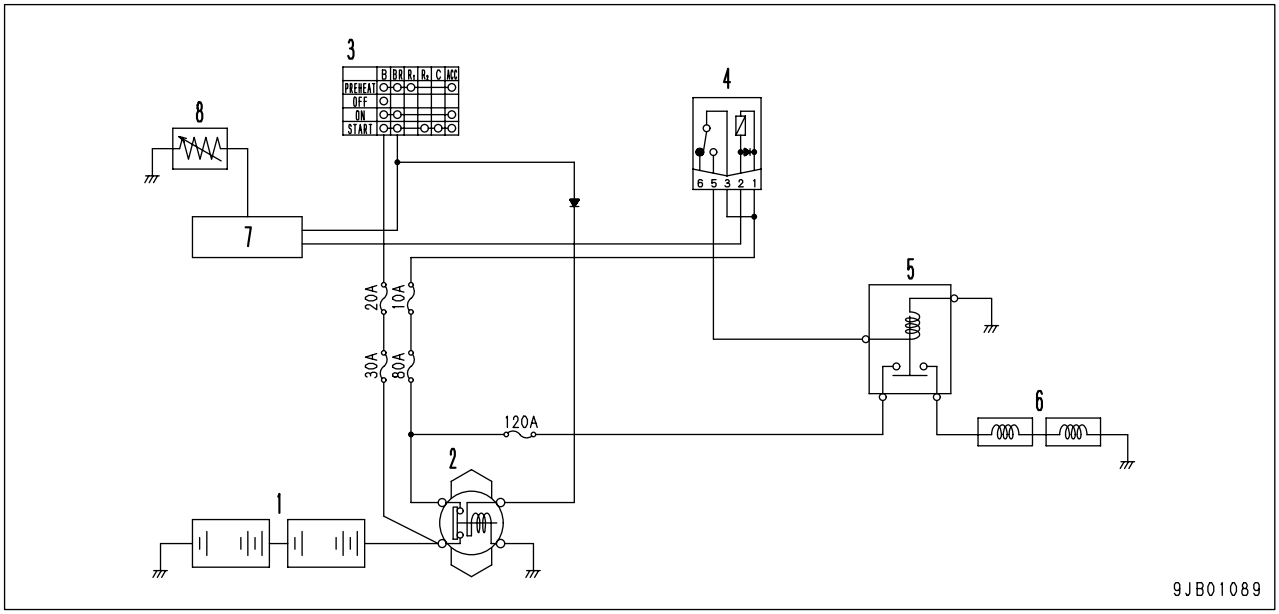
★ For details of the multi-function selector relay circuit, see Function of selecting directional selector switch.

1. Battery
2. Battery relay
3. Starting switch
4. Directional lever
5. Neutral safety relay
6. Starting motor safety relay
7. Starting motor
8. Alternator
9. Fuel cut-out solenoid
10. Fuel solenoid pull relay
11. Fuel cut-out solenoid timer
12. Machine monitor
13. Short connector
14. Directional selector actuation switch (If equipped)
15. Directional selector switch (If equipped)
16. Multi-function selector relay circuit (If equipped)

Operation

- The current from ACC terminal of starting switch to hold side coil of fuel cut solenoid is cutoff when starting is turned off. Fuel supply to engine is shut off.
  When the fuel supply is stopped, the engine reduces its speed and stops. Then, the power generation of the alternator stops to shut off voltage supply from the terminal L of the alternator. In addition, the current from the terminal BR of starting switch is shut off. Consequently, the battery relay contact opens to shut down the power supplied to every circuit of the machine.

PREHEATING CIRCUIT (AUTOMATIC PREHEATING SYSTEM)



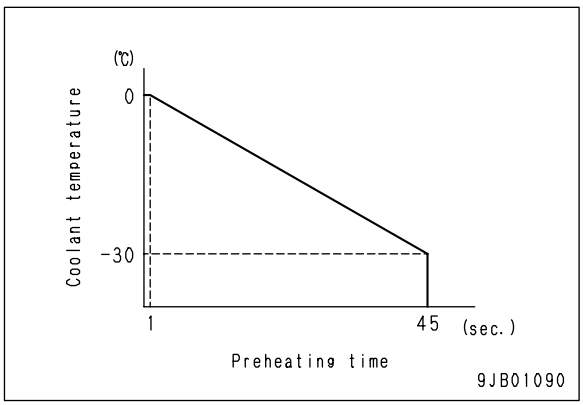
1. Battery
2. Battery relay
3. Starting switch
4. Automatic preheating relay
5. Engine heater relay
6. Ribbon heater
7. Machine monitor
8. Coolant temperature sensor (For preheating)

Outline

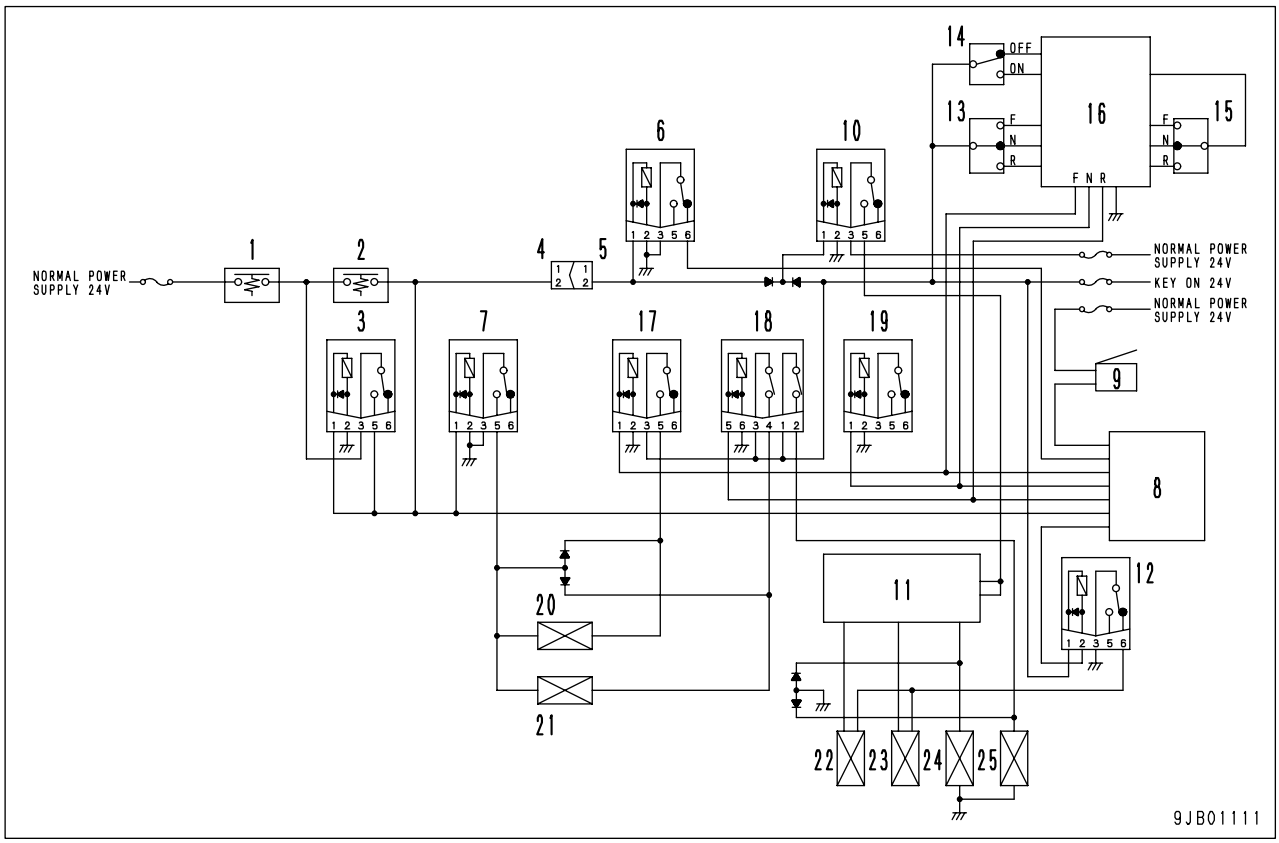
- The automatic preheating system is being installed to improve the engine starting capability in cold weather areas. This system is capable of shortening the preheating time and, at the same time, it is capable of making automatic setting of the preheating time matching the current coolant temperature, by merely turning the starting switch.
- When the starting switch is turned ON, the preheating pilot lamp on the machine monitor lights and the electric intake air heater starts preheating the intake air.
  As for the preheating time, the coolant temperature is detected by the coolant temperature sensor and the controller being built into the machine monitor carries out the preheating time setting.
- While the pilot lamp is lighting, preheating is in progress and keep the starting switch at the ON state. If the starting switch is turned to the START position, the preheating process is cancelled.

Operation

- When the starting switch is turned ON, the machine monitor is started up. At this time, if the coolant temperature is 0°C or less, the machine monitor makes to contact the coil of the preheating relay to the earth and the preheating relay operates to let the engine heater relay operate to start preheating by the electric intake air heater.
- The operating time of the preheating process is as shown below



PARKING BRAKE CIRCUIT



★ For details of the multi-function selector relay circuit, see Function of selecting directional selector switch.

1. Parking brake lever intermediate switch
2. Parking brake lever bottom switch
3. Parking brake relay
4. Parking brake selector connector (CNL20)
5. Parking brake selector connector (CNL18)
6. Parking brake indicator relay
7. Parking brake drag prevention relay
8. Machine monitor
9. Alarm buzzer
10. HST controller power hold relay
11. HST controller
12. HST safety relay
13. Forward-reverse lever
14. Forward-reverse selector switch drive switch (If equipped)
15. Forward-reverse selector switch (If equipped)
16. Multi-function selector relay circuit (If equipped)
17. Forward relay
18. Reverse relay
19. Neutral safety relay
20. HST pump forward solenoid valve
21. HST pump reverse solenoid valve
22. Motor 1 solenoid valve
23. Clutch solenoid valve
24. Motor 2 solenoid valve
25. HST motor forward-reverse selector solenoid valve

Operation

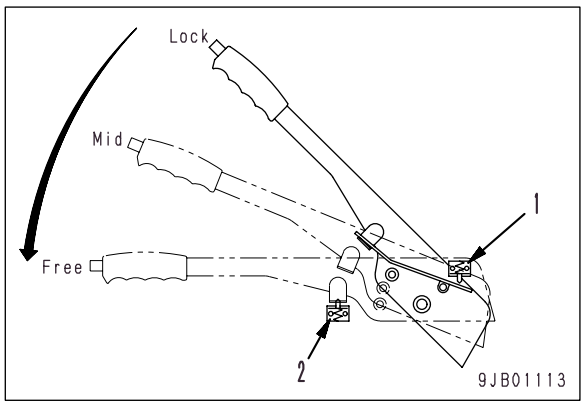
1. When parking brake lever is returned (ON ✕ OFF)

Position of starting switch	OFF			ON					
State of engine	Stopped						Running		
Position of parking brake lever	Lock	Mid-Free	Free	Lock	Mid-Free	Free	Lock	Mid-Free	Free
Intermediate switch (1)	Open	Close		Open	Close		Open	Close	
Bottom switch (2)	Open		Close	Open		Close	Open		Close
Parking brake omission prevention indicator (Alarm buzzer)	OFF (Reset)		ON (Operated)	OFF (Reset)		ON (Operated)	OFF (Reset)		
Parking brake indicator	OFF			ON		OFF	ON		OFF

1) When parking brake lever is in Lock position
   - When the parking brake is applied, both intermediate switch (1) and bottom switch (2) are open.
   - The parking brake indicator lights up only while the starting switch is in the ON position and goes off regardless of the state of the parking brake omission prevention indicator.
   - The parking brake is applied.

2) When parking brake lever is moved from Lock position to Mid position
   - If the parking brake lever is returned a little, intermediate switch (1) is closed but the contacts of the parking brake relay are kept open.
   - The parking brake indicator and parking brake omission prevention indicator operate as in step 1).
   - The parking brake is kept applied.

3) When parking brake is set in Free position
   - If the parking brake lever is returned to the end, bottom switch (2) is closed.
   - At this time, the coil flows in the coil of the parking brake relay to close the contacts, and then the parking brake indicator relay operates.
   - Since the current flows in the coil of the parking brake drag prevention relay, the forward-reverse solenoid circuit is closed and the machine can travel forward or in reverse and the parking brake omission prevention signal is input to the machine monitor.
   - The parking brake indicator goes off regardless of the state of the parking brake. Parking brake omission prevention indicator lights up and the alarm buzzer sounds only when the engine is stopped.
   - Then, the HST controller power hold relay operates and the current flows in the HST controller to hold the operation of the motor solenoid and clutch solenoid and prevent the machine from moving down on a slope, etc.
   - The parking brake is released.



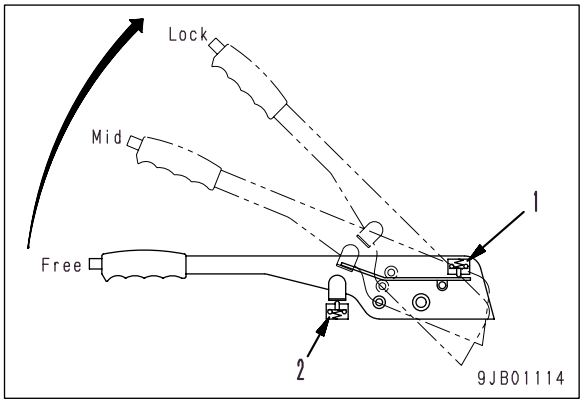
2. When parking brake lever is pulled (OFF ✕ ON))

Position of starting switch	OFF			ON					
State of engine	Stopped						Running		
Position of parking brake lever	Free	Free-Mid	Lock	Free	Free-Mid	Lock	Free	Free-Mid	Lock
Intermediate switch (1)	Close		Open	Close		Open	Close		Open
Bottom switch (2)	Close	Open		Close	Open		Close	Open	
Parking brake omission prevention indicator (Alarm buzzer)	ON (Operated)		OFF (Reset)	ON (Operated)		OFF (Reset)	OFF (Reset)		
Parking brake indicator	OFF			OFF		ON	OFF		ON

1) When parking brake is set in Free position
   - When the parking brake is released, both intermediate switch (1) and bottom switch (2) are closed.
   - The parking brake indicator goes off regardless of the state of the parking brake. Parking brake omission prevention indicator lights up and the alarm buzzer sounds only when the engine is stopped.
   - Then, the HST controller power hold relay operates and the current flows in the HST controller to hold the operation of the motor solenoid and clutch solenoid and prevent the machine from moving down on a slope, etc.
   - The parking brake is released.

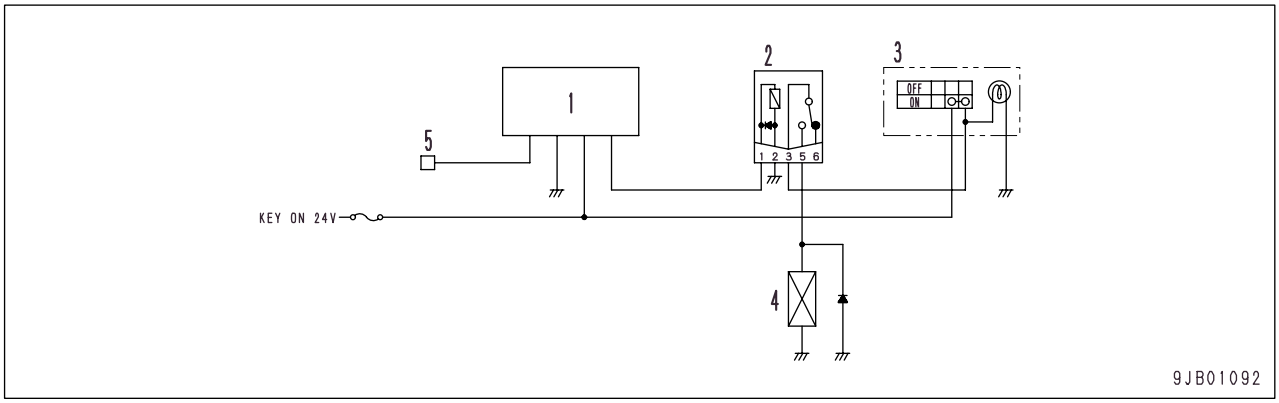
2) When parking brake lever is moved from Free position to Mid position
   - If the parking brake lever is pulled a little, bottom switch (2) is opened but the contacts of the parking brake relay are kept closed.
   - The parking brake indicator and parking brake omission prevention indicator operate as in step 1).
   - The parking brake is kept released.

3) When parking brake lever is in Lock position
   - If the parking brake lever is pulled to the end, intermediate switch (1) is opened.
   - At this time, the current to the coil of the parking brake relay is cut out and the contacts are opened and the parking brake indicator relay is turned OFF.
   - Since the current to the coil of the parking brake drag prevention relay is cut out, the forward-reverse solenoid circuit is opened. Accordingly, the machine does not move forward or in reverse even if the forward-reverse lever or the forward-reverse selector switch is operated.
   - The parking brake indicator lights up only while the starting switch is in the ON position and goes off regardless of the state of the parking brake omission prevention indicator.
   - The parking brake is applied.



ELECTRONICALLY CONTROLLED SUSPENSION SYSTEM

Electronically Controlled Suspension System (Abbreviation: ECSS)
(If equipped)



1. ECSS controller
2. ECSS relay
3. ECSS switch
4. ECSS solenoid
5. Speed sensor

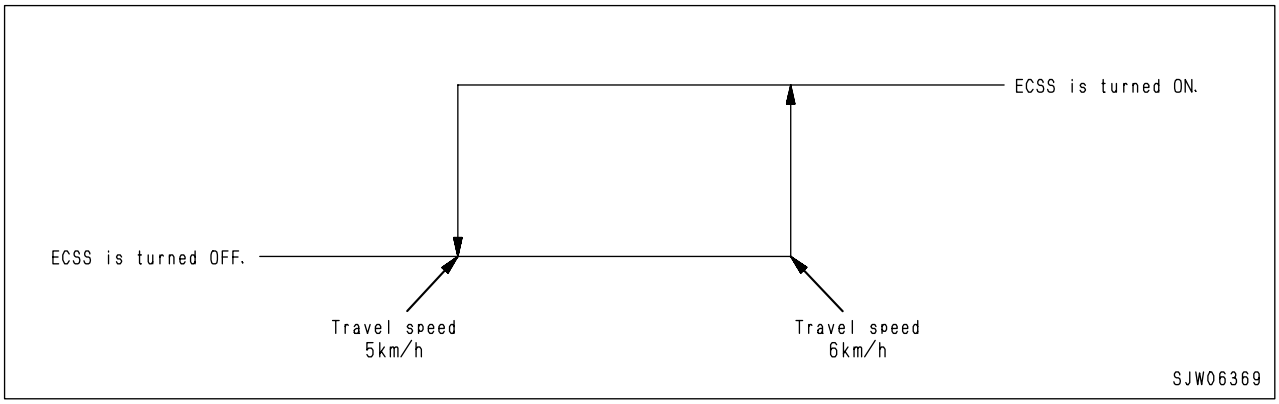
Function

- The controller controls the ECSS solenoid valve automatically to turn the accumulator charged with high-pressure gas ON and OFF to damp the vertical movement of the work equipment and reduce the jolts of the machine during high-speed travel. Consequently, the operator comfort is improved, the material spills less, and the working efficiency is increased.

System operation table

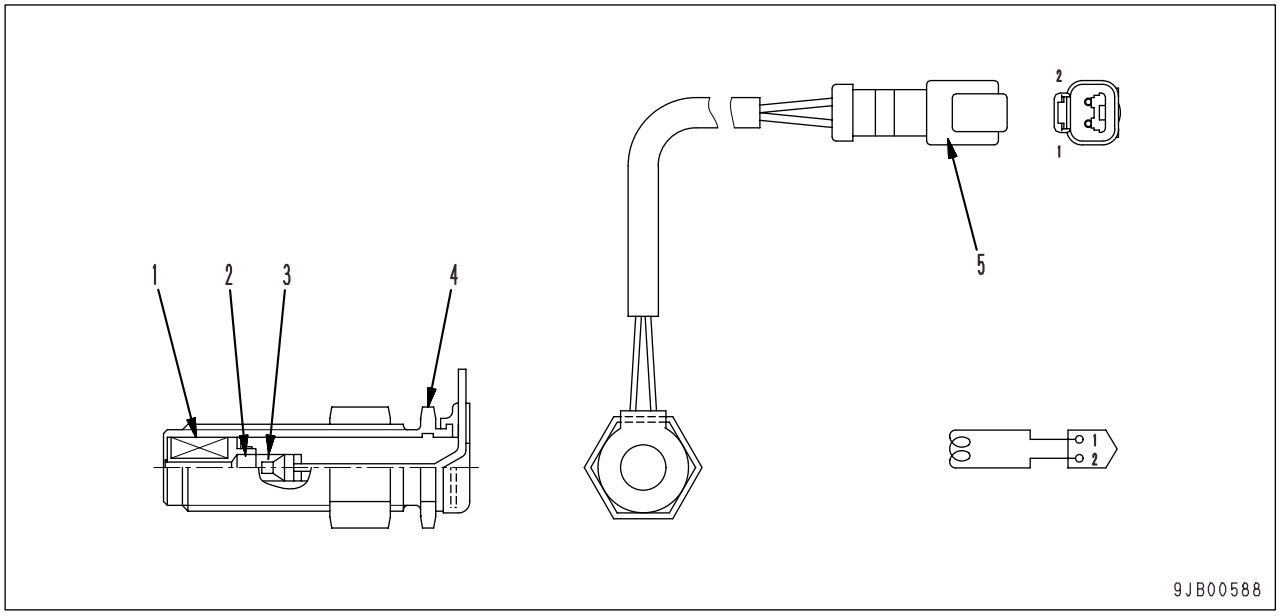
ECSS switch		Travel speed (km/H)	ECSS solenoid output	State of ECSS
OFF		0 – MAX	OFF	OFF
ON	Turn system ON	0 – 6	OFF	OFF
		6 – MAX	ON	ON
	Turn system OFF	MAX – 5	ON	ON
		5 – 0	OFF	OFF

Note: The travel speed range shown above is for the tire size of 20.5-25.



SENSORS

Engine speed sensor

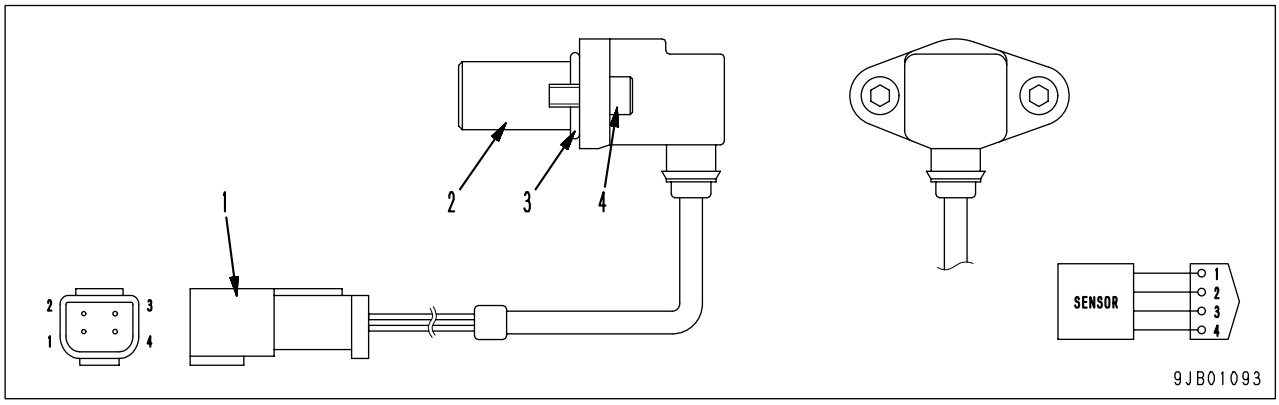


1. Wire
2. Magnet
3. Terminal
4. Housing
5. Connector

Function

- The engine speed sensor is installed to the ring gear of the flywheel housing. As the gear revolves, the engine speed sensor generates a pulse voltage.

Speed sensor

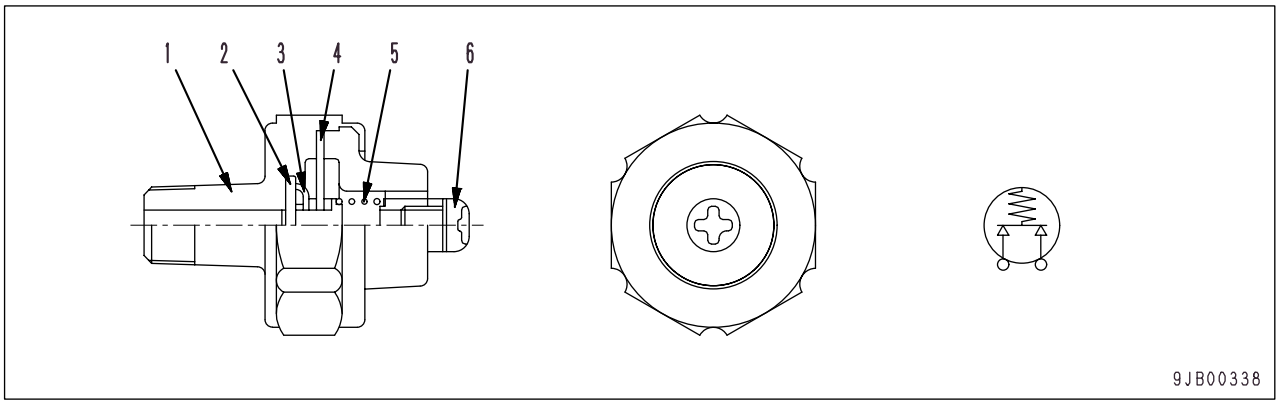


1. Connector
2. Sensor
3. O-ring
4. Bolt

Function

- The speed sensor is installed to the transfer case. As the gear revolves, the speed sensor generates a pulse voltage and a revolving direction signal (Counterclockwise: ON).

Engine oil pressure sensor

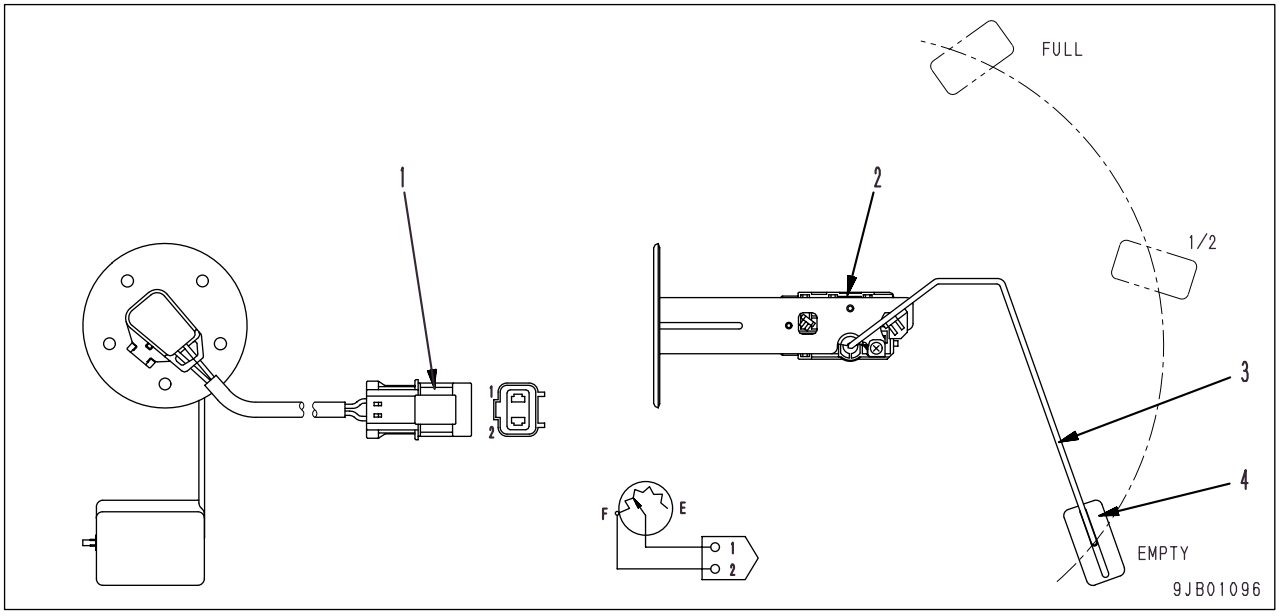


1. Plug
2. Contact ring
3. Contact
4. Diaphragm
5. Spring
6. Terminal

Function

- This sensor is mounted to the engine block. The diaphragm detects oil pressure, and when it reaches below the specified value, the switch is turned ON.

Fuel level sensor



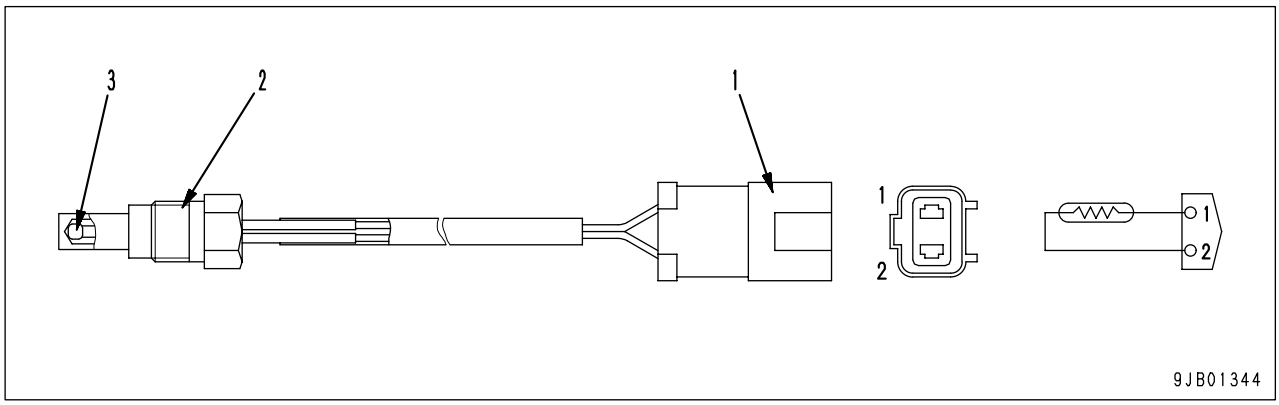
1. Connector
2. Variable resistor
3. Arm
4. Froat

Function

- This sensor is mounted to the side surface of the fuel tank. The float moves vertically depending on the remaining quantity of the fuel.
  The movement of the float operates the variable resistor through the arm and sends a signal to the machine monitor to indicate the remaining quantity of the fuel.

Coolant temperature sensor (Formonitor)

HST oil temperature sensor

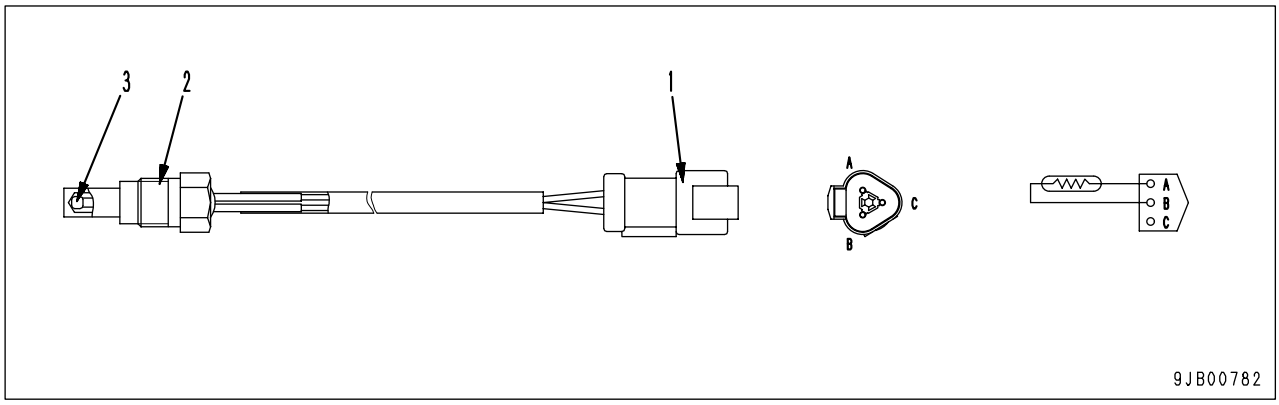


1. Connector
2. Plug
3. Thermistor

Function

- The coolant temperature sensor (for monitor) is installed to the engine cylinder block and the HST oil temperature sensor is installed to the hydraulic piping of motor 2. They generate thermistor resistance change signals as temperature change signals.

Coolant temperature sensor (For preheating)

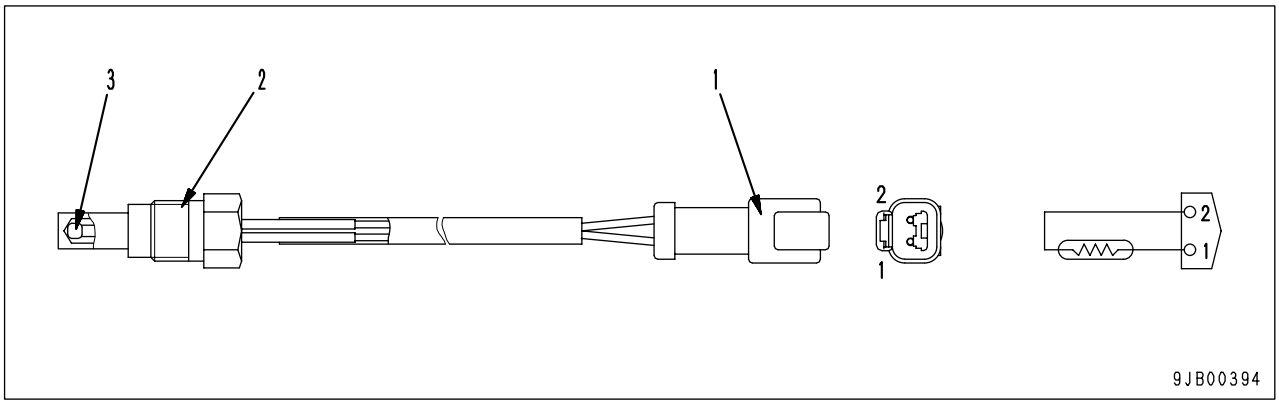


1. Connector
2. Plug
3. Thermistor

Function

- The coolant temperature sensor (for preheating) is installed to the engine coolant piping. It generates thermistor resistance change signals as temperature change signals.

Axle oil temperature sensor

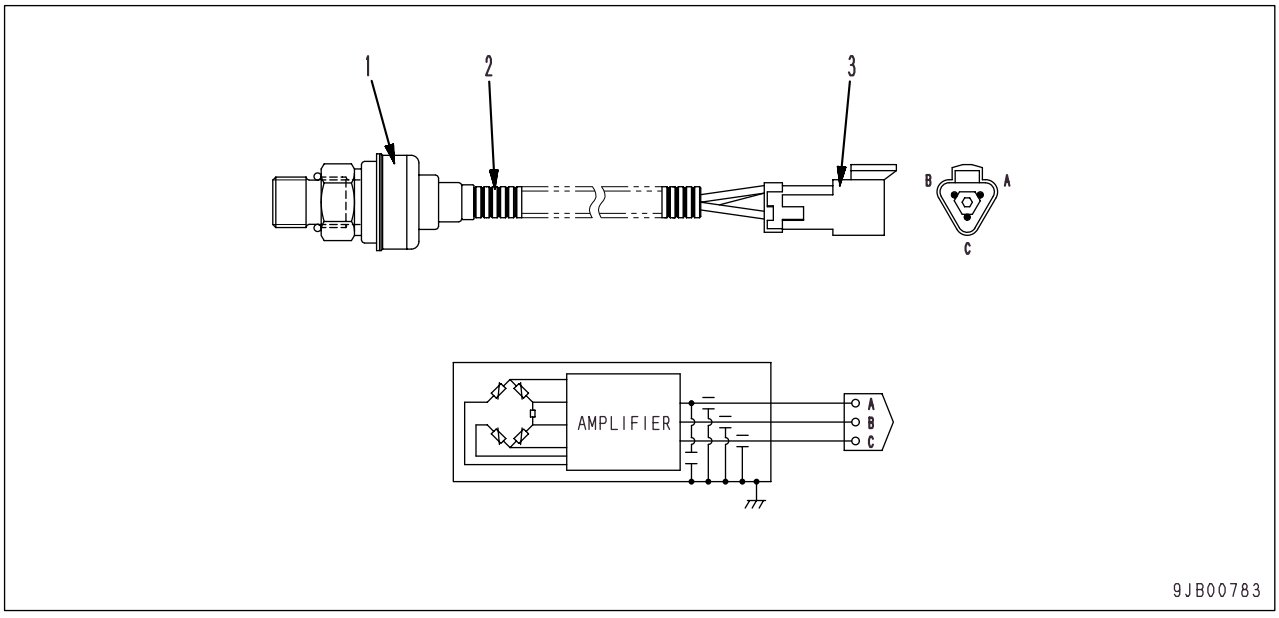


1. Connector
2. Plug
3. Thermistor

Function

- The axle oil temperature sensor is installed to the front axle. It generates thermistor resistance change signals as temperature change signals.

HST oil pressure sensor
Oil puressure sensor for load meter (Load meter specification)



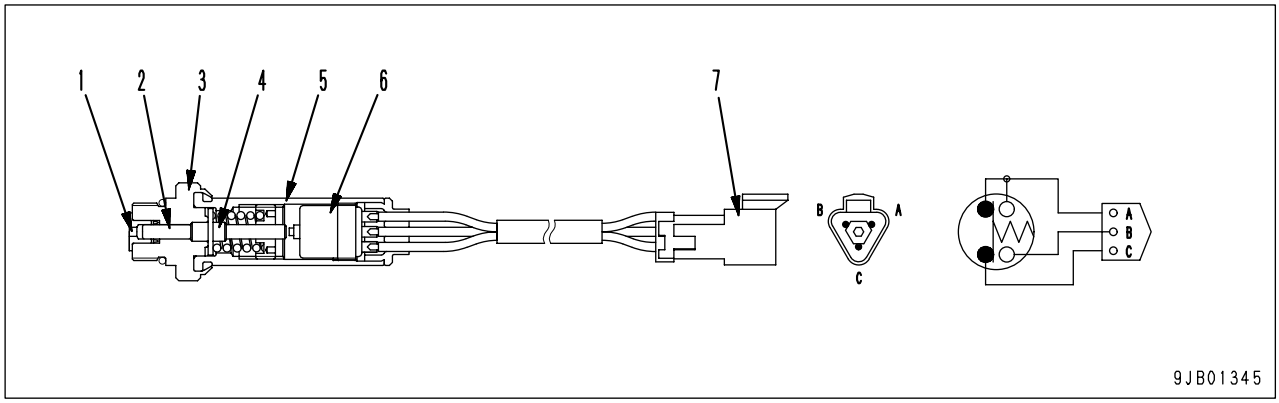
1. Sensor
2. Lead wires
3. Connector

Function

- The HST oil pressure sensor is installed to the solenoid block of motor 2. It measures the oil pressure in the HST circuit and generates signals of that pressure.
- The oil pressure sensors for the load meter are installed on the bottom and rod sides of the lift cylinder. They measure the oil pressure in the cylinder and generates signals.

Steering oil pressure sensor
(Machines equipped emergency steering)

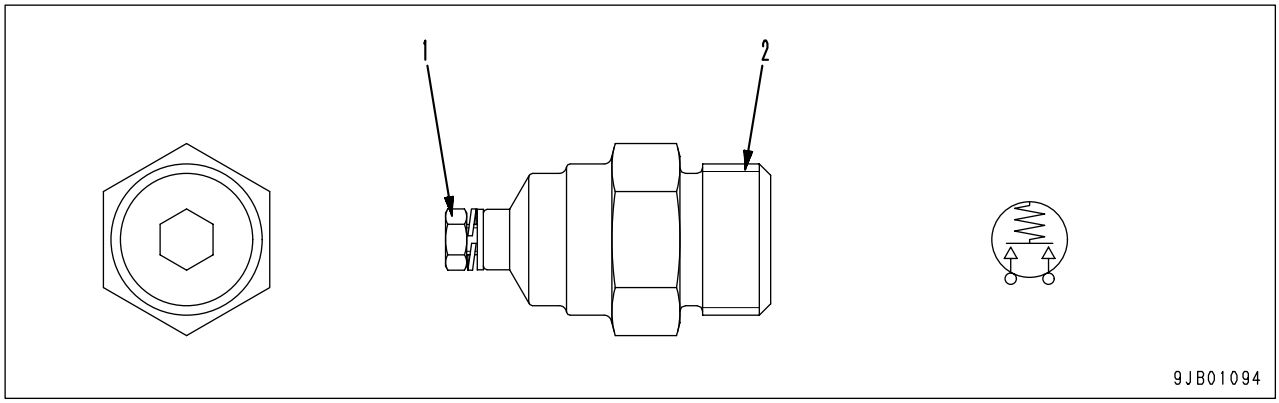
Emergency steering oil pressure sensor
(Machines equipped emergency steering)



1. Retainer
2. Piston
3. Body
4. Push rod
5. Case
6. Switch
7. Connector

Function
- The steering oil pressure sensor is installed to the block of priority valve port P. It measures the oil pressure in the steering circuit and generates signals of that pressure.
- The emergency steering oil pressure sensor is installed to the emergency steering valve. It measures the oil pressure in the emergency steering circuit and generates signals of that pressure.

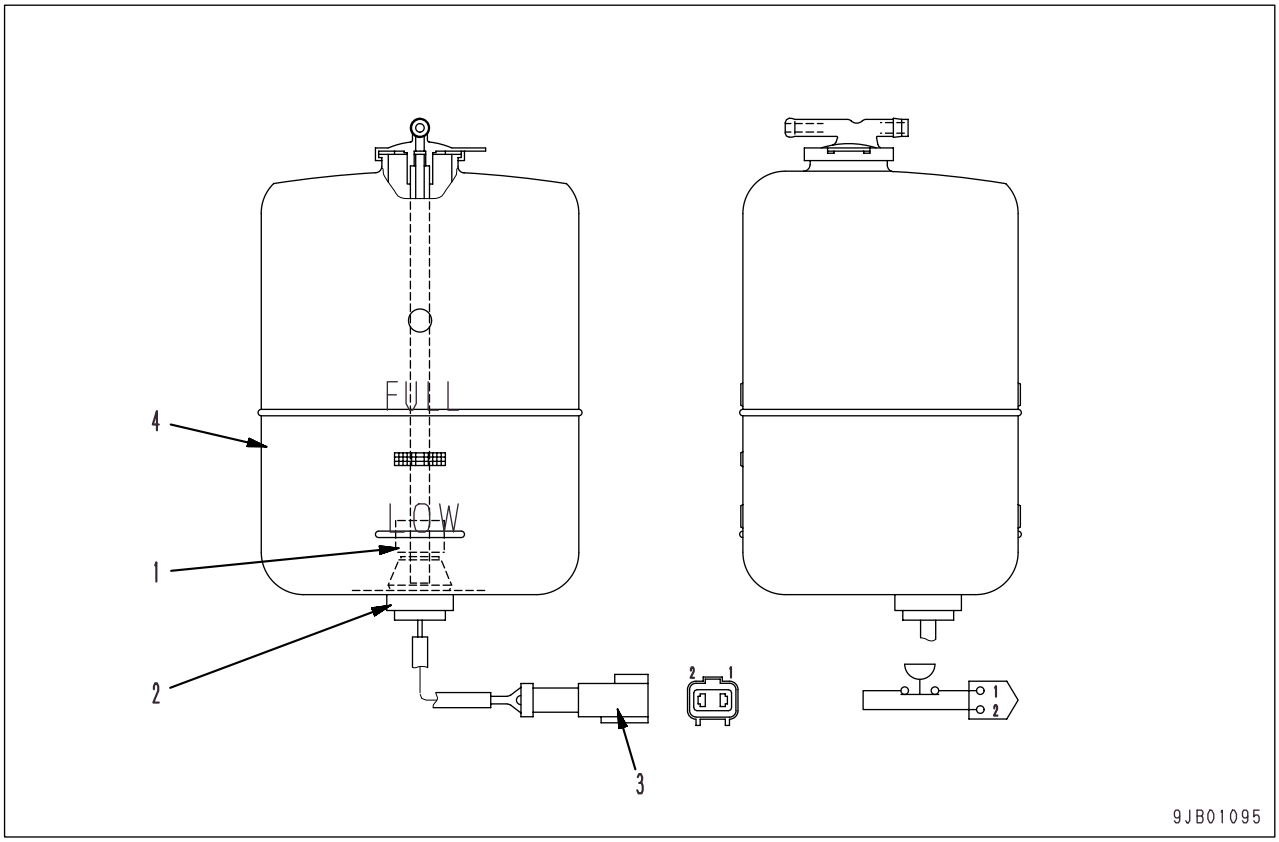
HST filter clogging sensor



1. Terminal
2. Plug

Function
- The HST filter clogging sensor is installed to the HST filter. It senses the oil pressures before and after the filter. If the difference between the measured pressures exceeds the set level, the switch is turned ON.

Coolant level sensor

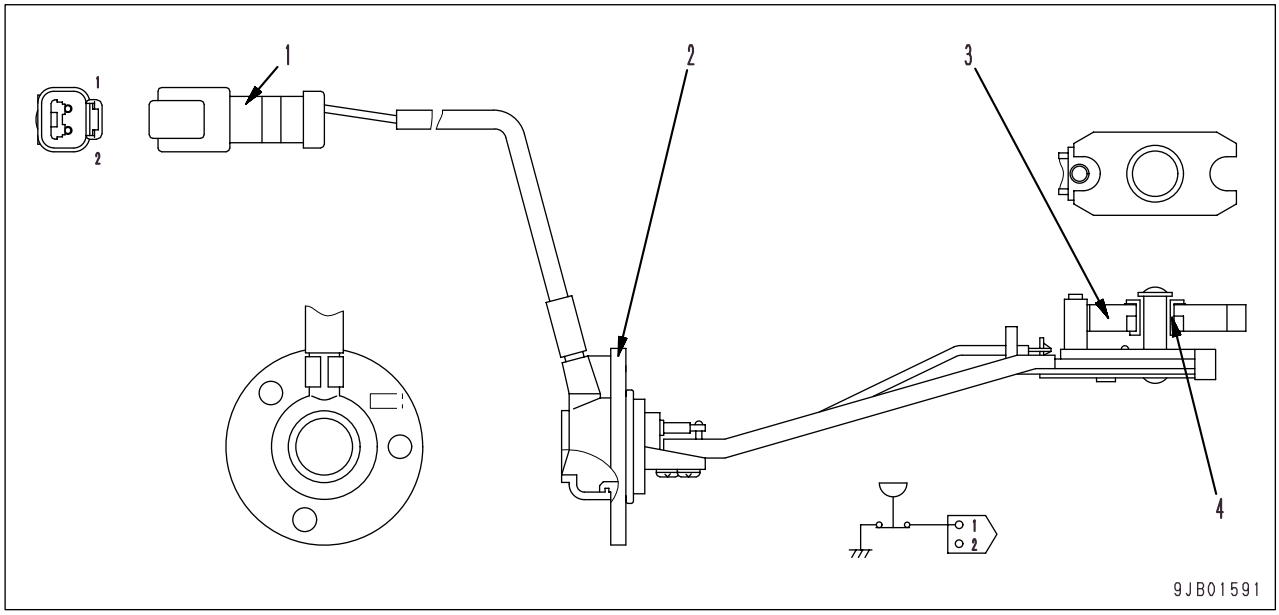


1. Float
2. Sensor
3. Connector
4. Sub-tank

Function

- This sensor is mounted to the sub-tank in the bulkhead. The float lowers to turn off the switch when the coolant level reaches below the specified level.

Engine oil level sensor

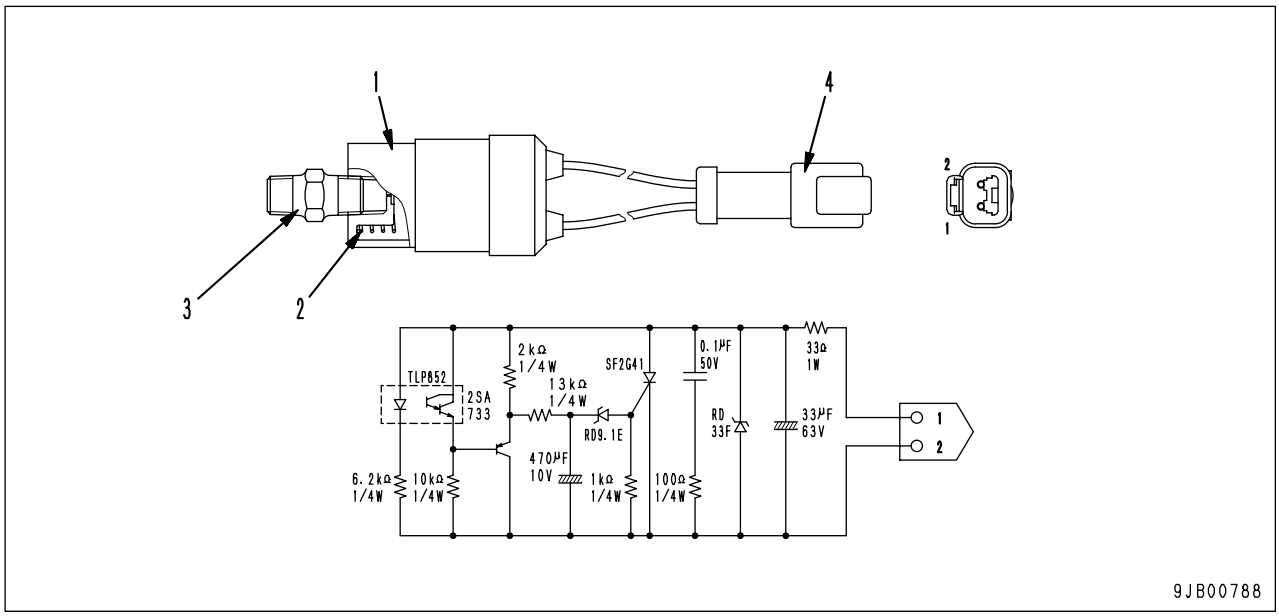


1. Connector
2. Bracket
3. Float
4. Switch

Function

- The engine oil level sensor is installed on the side of the oil pan. If the oil level lowers below the set level, the float lowers and the switch is turned OFF.

Air cleaner clogging sensor

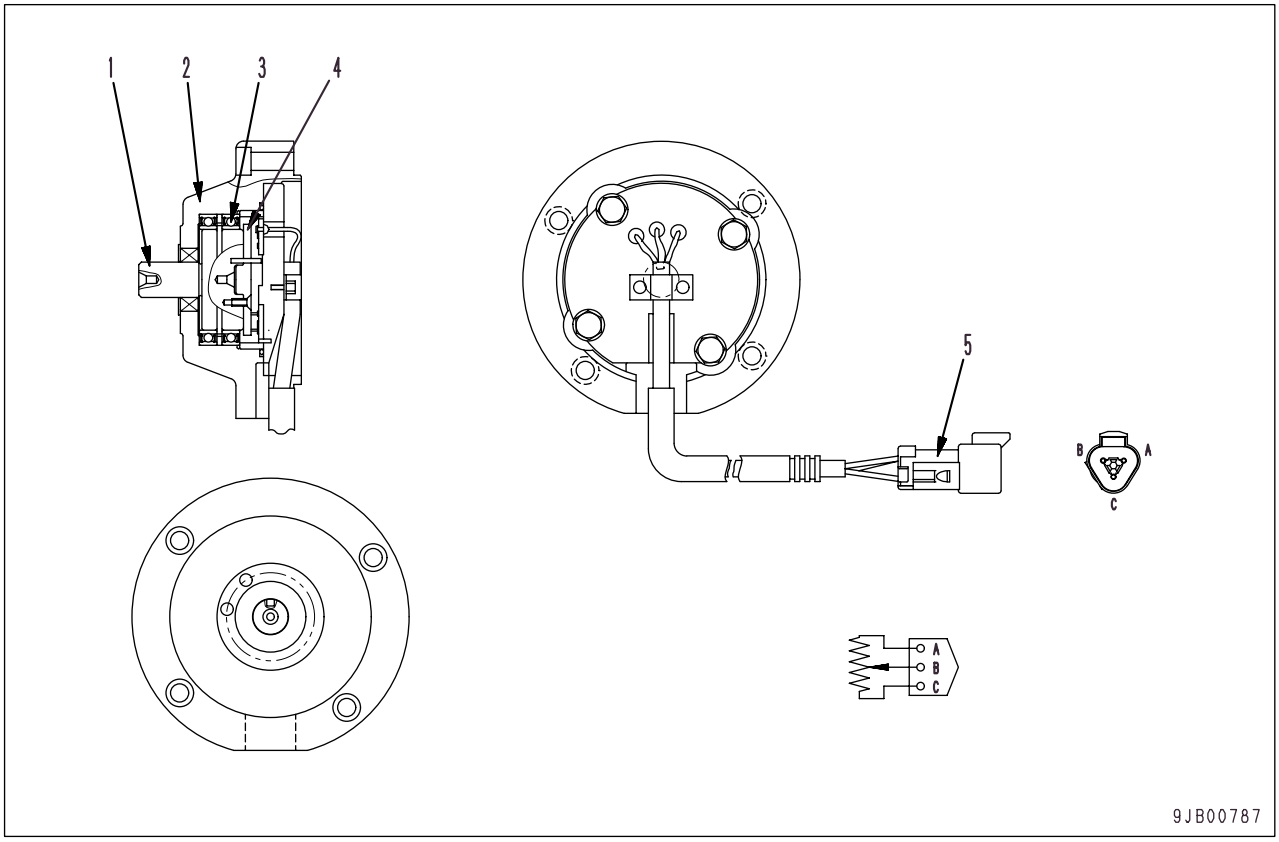


1. Indicator
2. Spring
3. Adapter
4. Connector

Function

- The air cleaner clogging sensor is installed to the outlet of the air cleaner. If the air cleaner is clogged and the pressure lowers to the set pressure (negative pressure), the air cleaner clogging sensor sends a signal to the machine monitor.

Lift arm angle sensor
(load meter specification) (if equipped)



1. Shaft
2. Housing
3. Bearing
4. Rotor
5. Connector

Function

- The lift arm angle sensor is installed to the front frame. If the lift arm angle changes, the shaft of the lift arm angle sensor receives sliding resistance and senses the change of the lift arm angle through the link installed on the lift arm side.

20 TESTING AND ADJUSTING

★ Note the following when making judgements using the standard value tables for testing, adjusting, or trouble-shooting.

1. The standard value for a new machine given in the table is the value used when shipping the machine from the factory and is given for reference. It is used as a guideline for judging the progress of wear after the machine has been operated, and as a reference value when carrying out repairs.
2. The service limit value given in the tables is the estimated value for the shipped machine based on the results of various tests. It is used for reference together with the state of repair and the history of operation to judge if there is a failure.
3. These standard values are not the standards used in dealing with claims

When carrying out testing, adjusting, or troubleshooting, park the machine on level ground, insert the safety pins, and use blocks to prevent the machine from moving.

When carrying out work together with other workers, always use signals and do not let unauthorized people near the machine.

When checking the water level, always wait for the water to cool down. If the radiator cap is removed when the water is still hot, the water will spurt out and cause burns.

Be careful not to get caught in the fan, fan belt or other rotating parts.

STANDARD VALUE TABLE FOR ENGINE

Machine Model			WA320-5	
Engine			SAA6D102E-2	
Item	Measurement Conditions	Unit	Standard Value For New Machine	Service Limit Value
Revolving Speed	High idling	rpm	2,225 ± 50	-
	Low idling		875 ± 50	-
	Rated revolving speed		2,000	-
Exhaust gas color	At sudden acceleration	Bosch index	Max. 4.1	Min. 6.1
	At high idling		Max. 1.0	Max. 2.0
Valve clearance	Air intake valve	mm	0.25	-
	Exhaust valve		0.51	-
	(Normal temperature)			
Compression pressure	Oil temperature: 40 - 60°C	MPa {kg/cm^2}	Min. 2.4	1.69
	(SAE15W-40 oil)		{Min. 24.6}	{17.2}
	(Engine speed)	(rpm)	(250 - 280)	(250 - 280)
Blow-by pressure	At high idling	KPa {mmH2O}	Max. 0.49 {Max. 50}	Max. 0.98 {Max. 100}
	(Water temperature: Min. 70°C) (SAE15W-40 oil)			
Oil pressure	(Oil temperature: Min. 80°C)	kPa {kg/cm^2}		
	At high idling (SAE15W-40)		340 - 640 {3.5 - 6.5}	245 {2.5}
	At low idling (SAE15W-40)		Min. 150 {Min. 1.5}	80 {0.8}
Oil temperature	All revolution range (Inside oil pan)	°C	90 -110	Min. 120
Fuel injection timing	Before compression top dead center	°(deg.)	11 ± 1	11 ± 1
Fan belt tension	-	-	Auto-tensioner	-
Air conditioner compressor belt tension	Deflection made by finger pressure of about 98.1N {about 10kg}	mm	10 - 15	-

STANDARD VALUE TABLE FOR CHASSIS

Machine model					WA320-5	
Category	Item		Measurement Conditions	Unit	Standard Value For New Machine	Service Limit Value
Accelerator pedal	Pressing effort		• Engine running • Measure at 150 mm from fulcrum of pedal	N {kg}	$61.7\ ^{+19.6}_{0}$ $\{6.3\ ^{+2}_{0}\}$	132.4{13.5}
	Pressing angle	α1	• Engine stopped ★ Detail drawing, See TESTING AND ADJUSTING	deg.	50	-
		α2			$31.5\ ^{+3}_{-2}$	-
	Height of stopper L1			mm	52	-
Directional lever	Operating effort	N - FORWARD	• Engine stopped • Measure at 10 mm from top of lever	N {kg}	$7.8\ ^{+1.96}_{0}$ $\{0.8\ ^{+0.2}_{0}\}$	13.7 {1.4}
		N - REVERSE			$7.8\ ^{+1.96}_{0}$ $\{0.8\ ^{+0.2}_{0}\}$	13.7 {1.4}
	Travel	N - FORWARD		mm	45 ± 10	45 ± 20
		N - REVERSE			45 ± 10	45 ± 20
Speed switch (Dial switch)	Operating effort	F1 - F2	• Engine stopped • Measure at 10 mm from end of switch knob	N {kg}	7.8 ± 4.9 {0.8 ± 0.5}	15.7 {1.6}
		F2 - F3			7.8 ± 4.9 {0.8 ± 0.5}	15.7 {1.6}
		F3 - F4			7.8 ± 4.9 {0.8 ± 0.5}	15.7 {1.6}
	Travel	F1 - F2	• Engine stopped	deg.	30 ± 5	30 ± 10
		F2 - F3			30 ± 5	30 ± 10
		F3 - F4			30 ± 5	30 ± 10
Steering wheel	Operating effort		• Flat, horizontal, straight, dry paved road surface • Engine speed: Low idling (Bucket empty) • Hydraulic oil temperature: 45 - 55°C • Engine water temperature: Operating range • Tire inflation pressure: Specified pressure	N {kg}	9.8 ± 2.9 {1.0 ± 0.3}	Max. 14.7 {Max. 1.5}
	Operating time	Low idling	• Flat, horizontal, straight, dry paved road surface • Hydraulic oil temperature: 45 - 55°C • Engine water temperature: Operating range • Tire inflation pressure: Specified pressure • Machine stopped • Steering wheel turning speed: 90rpm	Sec.	4.7 ± 0.4	Max. 6.9
		High idling			3.0 ± 0.3	Max. 5.0
	Play		• Engine stopped • Machine facing straight to front	mm	20 ± 20	Max. 60
Brake pedal	Pressing angle	• α1: Pressing effort at 0N {0kg}	• Engine water temperature: Operating range • Engine speed: Low idling • Detail drawing, See TESTING AND ADJUSTING	deg.	50	-
		• α2: Pressing effort at 196N {20kg}			35 ± 2	35 ± 4

Machine model						WA320-5	
Category	Item		Measurement Conditions		Unit	Standard Value For New Machine	Service Limit Value
Work equipment control lever	Operating effort	Lift arm	• Engine water temperature: Operating range • Engine speed: Low idling • Hydraulic oil temperature: 60 - 80°C	HOLD→RAISE	N {kg}	$10.8\,^{+4.9}_{0}$ $\{1.1\,^{+0.5}_{0}\}$	16.7 {1.7}
				RAISE→HOLD		$7.8\,^{+4.9}_{0}$ $\{0.8\,^{+0.5}_{0}\}$	11.8 {1.2}
				HOLD→LOWER		$10.8\,^{+4.9}_{0}$ $\{1.1\,^{+0.5}_{0}\}$	16.7 {1.7}
				LOWER→HOLD		-	-
				LOWER→FLOAT		$20.6\,^{+4.9}_{0}$ $\{2.1\,^{+0.5}_{0}\}$	31.4 {3.2}
				FLOAT→HOLD		$20.6\,^{+4.9}_{0}$ $\{2.1\,^{+0.5}_{0}\}$	31.4 {3.2}
		Bucket		HOLD→DUMP		$12.3\,^{+4.9}_{0}$ $\{1.25\,^{+0.5}_{0}\}$	18.6 {1.9}
				HOLD→TILT		$10.8\,^{+4.9}_{0}$ $\{1.1\,^{+0.5}_{0}\}$	16.7 {1.7}
				TILT→HOLD		$7.8\,^{+4.9}_{0}$ $\{0.8\,^{+0.5}_{0}\}$	11.8 {1.2}
	Travel	Lift arm		HOLD→RAISE	mm	37 ± 9	37 ± 12
				HOLD→LOWER		37 ± 9	37 ± 12
				LOWER→FLOAT		13.5 ± 9	13.5 ± 12
		Bucket		HOLD→DUMP		50.5 ± 9	50.5 ± 12
				HOLD→TILT		37 ± 9	37 ± 12
Engine	Engine speed	HST stall	• Engine water temperature: Operating range • HST oil temperature: 60 - 80°C • Hydraulic oil temperature: 45 - 55°C		rpm	2,150 ± 100	2,150 ± 200
		Hydraulic stall				2,120 ± 100	2,120 ± 200
		Full stall (HST stall + Hydraulic stall)				2,030 ± 200	2,030 ± 300

Machine model						WA320-5	
Category	Item		Measurement Conditions		Unit	Standard Value For New Machine	Service Limit Value
Power train (HST)	HST oil pressure	High pressure cut-off pressure	• Engine speed: Full speed • Hydraulic oil temperature: 45 -55°C • Directional lever: FORWARD • Speed switch: 3RD speed		MPa {kg/cm^2}	40.7 ± 1.0 {415 ± 10}	40.7 ± 2.0 {415 ± 20}
		Low pressure relief pressure (Work equipment PPC circuit pressure)	• Engine speed: Full speed • Hydraulic oil temperature: 45 -55°C • Directional lever: N			$3.0^{+0.2}_{0}$ {31^{+2}_{0}}	$3.0^{+0.2}_{-0.1}$ {31^{+2}_{-1}}
		Servo piston control oil pressure	• Engine speed: Full speed • Hydraulic oil temperature: 45 - 55°C • Directional lever: N	When brake pedal releasing		$3.0^{+0.2}_{0}$ {31^{+2}_{0}}	$3.0^{+0.2}_{-0.1}$ {31^{+2}_{-1}}
				When brake pedal depressing		Max. 0.6 {Max. 6}	Max. 0.6 {Max. 6}
	Transfer	Clutch control pressure	• Hydraulic oil temperature: 45 - 55°C • Directional lever: FORWARD • Speed switch: 3RD or 4TH speed • Travel at a speed of at least 10km/h			$3.0^{+0.2}_{0}$ {31^{+2}_{0}}	$3.0^{+0.2}_{-0.1}$ {31^{+2}_{-1}}
Steering	Steering relief pressure		• Engine speed: High idling • Hydraulic oil temperature: 45 - 55°C			$20.6^{+1}_{-0.3}$ {210^{+10}_{-3}}	20.6 ± 2.0 {210 ± 20}
Wheel brake	Performance		• Flat, horizontal, straight, dry paved road surface • Speed when applying brake: 32km/h, braking delay: Within 0.1sec • Brake pedal operating effort: 313.8N{32kg} • Tire inflation pressure: Specified pressure • Measure braking distance		m	Max.12	Max.12
	Disc wear		• Oil pressure: 4.4 MPa {45 kg/cm^2} • Pedal: Stroke end		mm	Projection of shaft: 0	Distance between projected shaft end and repair limit: (1.6 mm)
Parking brake	Performance		• Tire inflation pressure: Specified pressure • Flat paved road with 1/5 (11°20') grade • Machine at operating condition		-	Holds position	Holds position
Work equipment control valve	Relief pressure		• Engine speed: High idling • Hydraulic oil temperature: 45 - 55°C		MPa {kg/cm^2}	$20.6^{+1.0}_{-0.3}$ {210^{+10}_{-3}}	20.6 ± 2.0 {210 ± 20}

Machine model						WA320-5	
Category	Item		Measurement Conditions		Unit	Standard Value For New Machine	Service Limit Value
Work equipment	Speed	Lift arm	• Engine speed: High idling • Hydraulic oil temperature: 45 - 55°C • Steering valve: Neutral • Apply no load • Time taken for work equipment to rise from position with bucket in contact with ground (bottom of bucket horizontal) to max. height of lift arm	RAISE	Sec.	5.7 ± 0.5	Max. 8.6
				LOWER		3.5 ± 0.5	Max. 5.3
		Bucket	• Engine speed: High idling • Hydraulic oil temperature: 45 - 55°C • Steering valve: Neutral • Apply no load • Time taken for bucket to move from max. tilt to max. dump	TILT		1.9 ± 0.3	Max. 2.9
				DUMP		1.2 ± 0.3	Max. 1.8
			• Engine speed: High idling • Hydraulic oil temperature: 45 - 55°C • Steering valve: Neutral • Apply no load • Time taken for bucket to move from horizontal position to max. tilt	TILT		1.3 ± 0.3	Max. 2
	Hydraulic drift	Lift arm cylinder	• Bucket no load • Position of work equipment: Lift arm and bucket in level position • Engine stopped • Hydraulic oil temperature: 45 -55°C • Stop engine and leave for 5 minutes, then measure for 15 minutes.		mm	Max. 20	Max. 30
		Bucket cylinder				Max. 17	Max. 26
Proximity switch	Clearance between bucket positioner switch		• Hydraulic oil temperature: 45 -55°C			3 - 5	-
	Clearance between lift arm positioner switch					3 - 5	-
Oil pressure drive fan	Max. fan speed		• Engine speed: High idling • Hydraulic oil temperature: 45 -55°C		rpm	1,730 ± 30	-
	Fan driving pressure		• Hydraulic oil temperature: 45 -55°C		MPa {kg/cm^2}	14.7 ± 1.5 {150 ± 15}	14.7 ± 2.5 {150 ± 25}

TESTING AND ADJUSTING

When carrying out testing, adjusting, or troubleshooting, park the machine on level ground, inset the safety pins, and use blocks to prevent the machine from moving.

When carrying out work together with other workers, always use signals and do not let unauthorized people near the machine.

When checking the water level, always wait for the water to cool down. If the radiator cap is removed when the water is still hot, the water will spurt out and cause burns.

Be careful not to get caught in the fan, fan belt or other rotating parts.

TOOLS FOR TESTING, ADJUSTING, AND TROUBLESHOOTING

Check or measurement item	Symbol		Part No.	Part Name	Q'ty	Remarks
Engine speed	A	1	799-203-8001	Multi-tachometer	1	Digital indication L: 60 – 2,000rpm H: 60 – 19,999rpm
		2	795-790-2500	Adapter assembly	1	For 102 engine series
Exhaust gas color	B	1	799-201-9000	Handy smoke checker	1	Discoloration 0- 70% (With standard color) (Discoloration x 1/10 ✕ Bosch index)
		2	Commercially available	Smoke meter	1	
Valve clearance	Q	1	795-799-1131	Gear (Cranking tool)	1	For 102 engine series
		2	795-799-1900	Pin assembly	1	
		4	Commercially available	Filler gauge	1	(Intake: 0.25mm, Exhaust: 0.51mm)
Compression pressure	A	1	799-203-8001	Multi-tachometer	1	Digital indication L: 60 – 2,000rpm H: 60 – 19,999rpm
	D	1	795-502-1590	Gauge assembly	1	0 – 6.9MPa {0 – 70kg/cm^2}
		2	795-502-1700	Adapter	1	For 102 engine series
Blow-by pressure	E		799-201-1504	Blow-by checker	1	0 – 4.9MPa {0 – 500mmH_2O}
Fuel injection timing	Q	1	795-799-1131	Gear (Cranking tool)	1	For 102 engine series
		2	795-799-1900	Pin assembly	1	
		3	795-799-1950	Lock pin	1	
Engine oil pressure	C	1	799-101-5002	Analog type hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm^2}
			790-261-1203	Digital type hydraulic tester	1	Pressure gauge: 58.8MPa {600kg/cm^2}
		2	799-401-2320	Hydraulic tester	1	Pressure gauge: 0.98MPa {10kg/cm^2}
HST oil pressure	C	1	799-101-5002	Analog type hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm^2}
			790-261-1203	Digital type hydraulic tester	1	Pressure gauge: 58.8MPa {600kg/cm^2}
		7	790-301-1760	Joint	1	For G 3/8
			07000-12014	O-ring	1	
Clutch control pressure	C	1	799-101-5002	Analog type hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm^2}
			790-261-1203	Digital type hydraulic tester	1	Pressure gauge: 58.8MPa {600kg/cm^2}
		4	799-401-3100	Adapter	1	Size: 02
Steering oil pressure	C	1	799-101-5002	Analog type hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm^2}
			790-261-1203	Digital type hydraulic tester	1	Pressure gauge: 58.8MPa {600kg/cm^2}
Hydraulic fan speed, oil pressure	A	1	799-203-8001	Multi-tachometer	1	Digital indication L: 60 – 2,000rpm H: 60 – 19,999rpm
	C	1	799-101-5002	Analog type hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm^2}
			790-261-1203	Digital type hydraulic tester	1	Pressure gauge: 58.8MPa {600kg/cm^2}
		6	799-401-3400	Adapter	3	Size: 05
Accumulator charge pressure	C	1	799-101-5002	Analog type hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm^2}
			790-261-1203	Digital type hydraulic tester	1	Pressure gauge: 58.8MPa {600kg/cm^2}
Brake oil pressure	K	1	793-605-1001	Brake test KIT	1	
		2	790-101-1430	Coupler	1	
		3	790-101-1102	Pump	1	
		4	793-463-1100	Stopper	1	
Bleeding air from brake circuit	K	4	793-463-1100	Stopper	1	

Check or measurement item	Symbol		Part No.	Part Name	Q'ty	Remarks
Work equipment hydraulic pressure	C	1	799-101-5002	Analog type hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm^2}
			790-261-1203	Digital type hydraulic tester	1	Pressure gauge: 58.8MPa {600kg/cm^2}
	K	4	793-463-1100	Stopper	1	
Work equipment PPC oil pressure	C	1	799-101-5002	Analog type hydraulic tester	1	Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm^2}
			790-261-1203	Digital type hydraulic tester	1	Pressure gauge: 58.8MPa {600kg/cm^2}
	K	4	793-463-1100	Stopper	1	
Bleeding air	C	6	799-401-3300	Adapter	1	Size: 04
Water temperature, oil temperature	P		799-101-1502	Digital thermometer	1	-99.9 – 1,299°C
Operating effort	H		79A-264-0021	Push-pull scale	1	0 – 294N {0 – 30kg}
			79A-264-0091	Push-pull scale	1	0 – 490N {0 – 50kg}
Stroke, hydraulic drift	R		Commercially available	Scale	1	
Work equipment speed	S		Commercially available	Stopwatch	1	
Voltage, resistance	T		Commercially available	Tester	1	
Troubleshooting of sensor and wiring harness	U	1	799-601-7400	T-adapter assembly	1	
			799-60-7330	Adapter	1	For S-16 (White)
		2	799-601-9000	T-adapter assembly	1	For DT type connector

MEASURING ENGINE SPEED

Special tools required

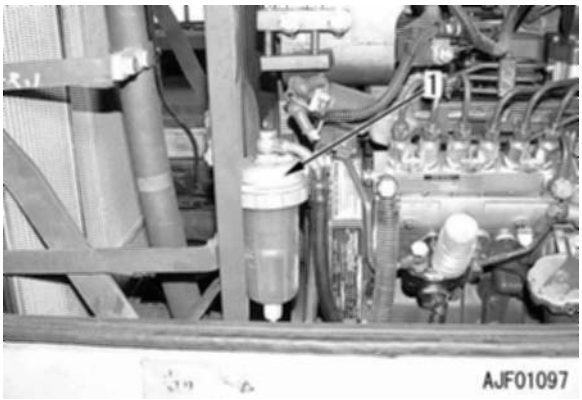
Symbol		Part No.	Part Name
A	1	799-203-8001	Multi-tachometer
	2	795-790-2500	Adapter assembly

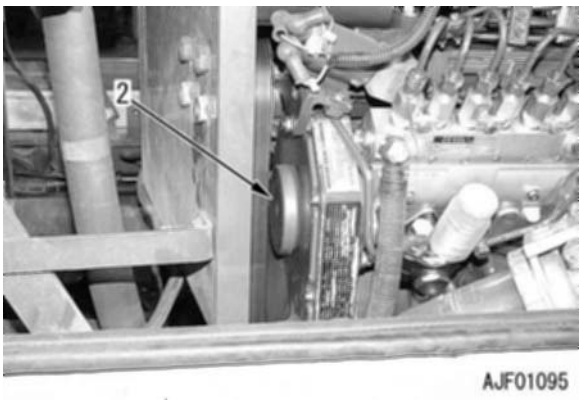
When installing or removing the measuring equipment, be careful not to touch any hot parts.

MEASURING HIGH-IDLING AND LOW-IDLING SPEEDS

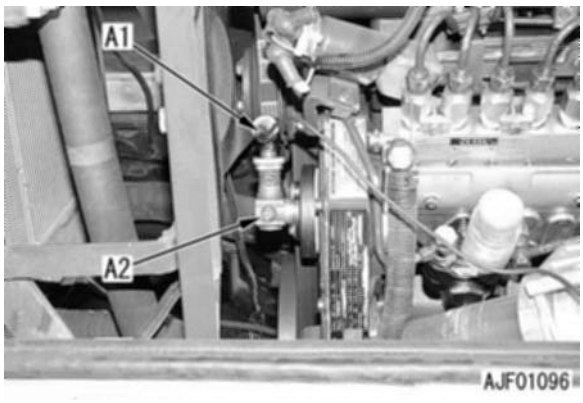
★ Measure the engine speed under the following conditions.
- Coolant temperature: Within operating range.
- Hydraulic temperature: 45 - 55°C
- HST oil temperature: 60 - 80°C

1. Remove cap (2) of speed pick-up port.
   ★ You can work easier by removing water separator (1). If you remove water separator (1), however, install again after installing the adapter.





2. Install adapter **A2** and connect multi-tachometer **A1**.

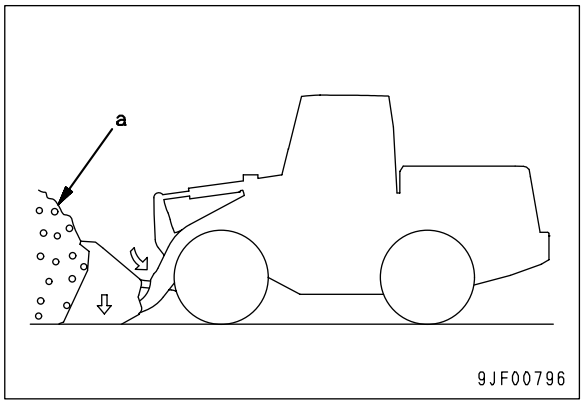


3. Start engine, and then measure the engine speeds at high-idling and low-idling.

When measuring the engine speed, be careful not to touch any rotating parts or hot parts.

MEASURING HST STALL SPEED

Dig the bucket into the stockpile (part "a") to prevent the machine from moving forward.



★ Check that the low idling and high idling speeds are the standard value.
★ Check that the engine speed is within the standard value. If it is not within the standard value, loosen the linkage and check that there is no play.
1. Measure the engine speed when the HST is stalled.

MEASURING HYDRAULIC SPEED

★ Check that the low idling and high idling speeds are the standard value.

★ Check that the engine speed is within the standard value. If it is not within the standard value, loosen the linkage and check that there is no play.

1. Start the engine and run at low idling.
2. Operate the work equipment control lever and operate the cylinder to the end of its stroke.
3. Relieve the cylinder at the end of its stroke and measure the engine speed at this point.

MEASURING FULL STALL SPEED

• Measure the engine speed when the HST stall and hydraulic stall (bucket dump end relief) are carried out at the same time.

★ Measure the full stall if the HST stall speed and hydraulic stall speed are normal.
If either of them shows any abnormality, remove the problem and carry out the measurement again.

MEASURING EXHAUST GAS COLOR

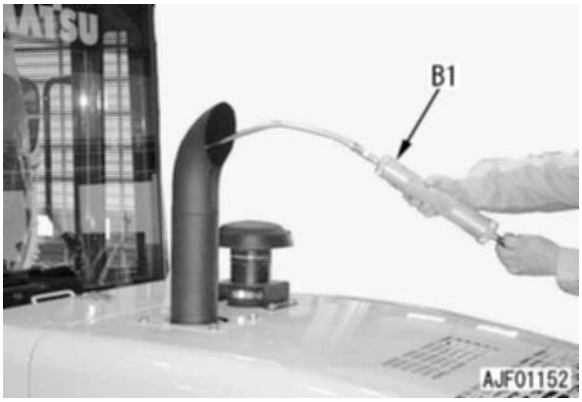
Special tools required

Symbol		Part No.	Part Name
B	1	799-201-9000	Handy Smoke Checker
	2	Commercially available	Smoke meter

When installing or removing the measuring equipment, be careful not to touch any hot parts.

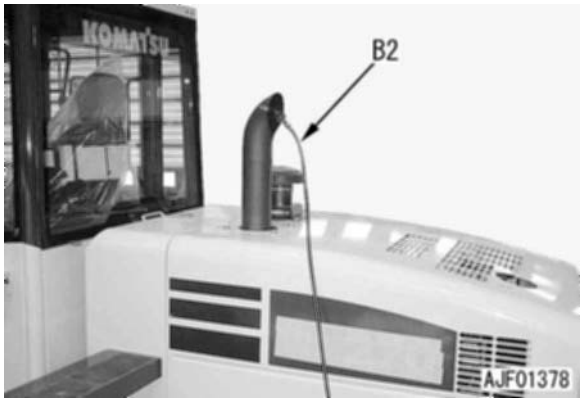
★ When measuring in the field where there is no air or power supply, use Handy Smoke Checker **B1**; when recording official data, use Smoke meter **B2**.

1. Measuring with Handy Smoke Checker **B1**
   1) Fit filter paper in tool **B1**.
   2) Insert the exhaust gas intake port into the exhaust pipe.
   3) Start the engine and raise the engine water temperature to the operating range.
   4) Accelerate the engine suddenly run it at high idling, and at the same time operate the handle of Handy Smoke Checker **B1** to catch the exhaust gas on the filter paper.

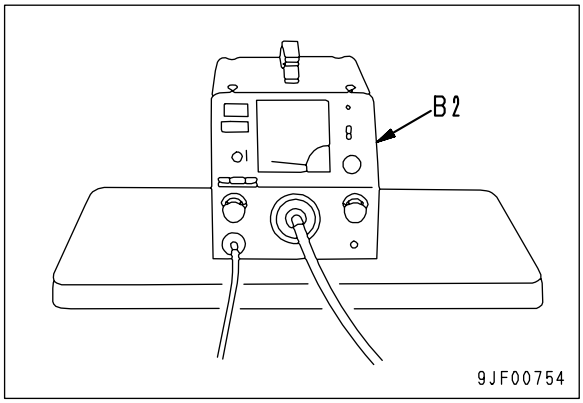


   5) Remove the filter paper and compare it with the scale provided to judge the condition.
   6) After completing the measurement, remove the measuring equipment and return to the original condition.

2. Measuring with Smoke Meter **B2**
   1) Insert probe of smoke meter **B2** into the outlet port of the exhaust pipe, then secure it to the exhaust pipe with the clip.



   2) Connect the probe hose, accelerator switch plug, and air hose to smoke meter **B2**.
      ★ The pressure of the air supply should be less than 1.5 MPa {15 kg/cm^2}.
   3) Connect the power cord to the AC 100 V outlet.
      ★ Before connecting the cord, check that the power switch of the smoke meter is OFF.
   4) Loosen the cap nut of the suction pump, then fit the filter paper.
      ★ Fit the filter paper securely so that the exhaust gas does not leak.
   5) Turn the power switch of smoke meter **B2** ON.



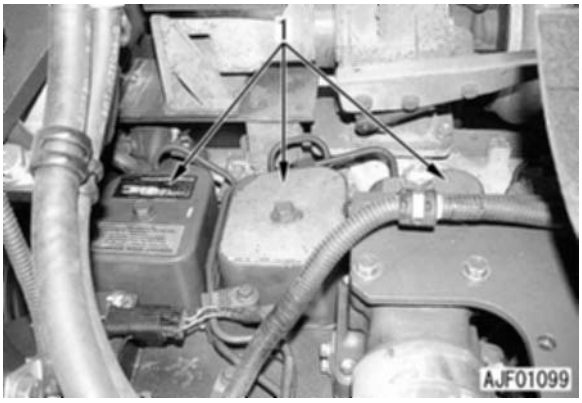
   6) Start the engine and raise the engine water temperature to the operating range.
   7) Accelerate the engine suddenly, and at the same time, depress the accelerator pedal to catch the exhaust gas color on the filter paper.
   8) Lay the filter paper used to catch the exhaust gas color on top of unused filter papers (10 sheets or more) inside the filter paper holder, and read the indicated value.
   9) After completing the measurement, remove the measuring equipment and return to the original condition.

ADJUSTING VALVE CLEARANCE

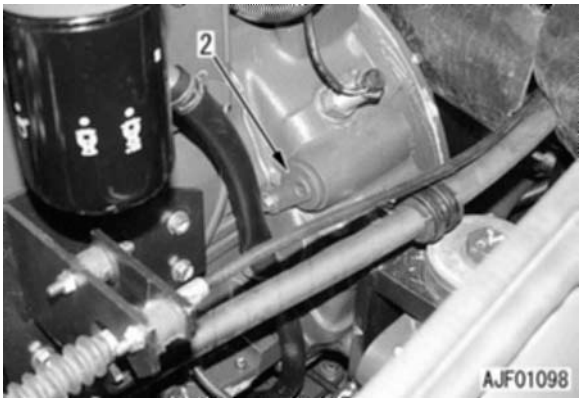
Special tools required

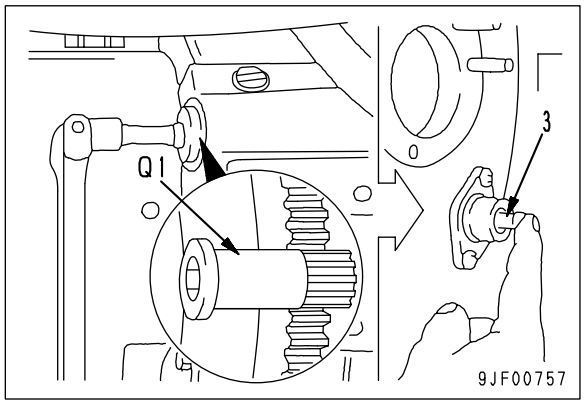
Symbol		Part No.	Part Name
Q	1	795-799-1131	Gear (Cranking tool)
	2	795-799-1900	Pin assembly
	4	Commercially available	Filler gauge

1. Remove the air cleaner, and air cleaner bracket, then remove all cylinder head covers (1).



2. Remove cap (2), then use gear **Q1** to rotate the crankshaft in the normal direction until timing pin (3) enters the hole in the gear.
   - ★ Push pin (3) lightly while cranking.
   - ★ The position where the pin enters is the top dead center for No. 1 cylinder.
   - ★ Check with pin (3) installed to the flywheel housing.
   - ★ At compression top dead center, the rocker arm of the No. 1 cylinder moves by hand an amount equal to the valve clearance.





3. In this position, adjust the valve clearance of the valves marked ● in the valve arrangement chart. At the same time, make counter marks on the crankshaft pulley and timing gear case, then remove timing pin (3).

Valve arrangement

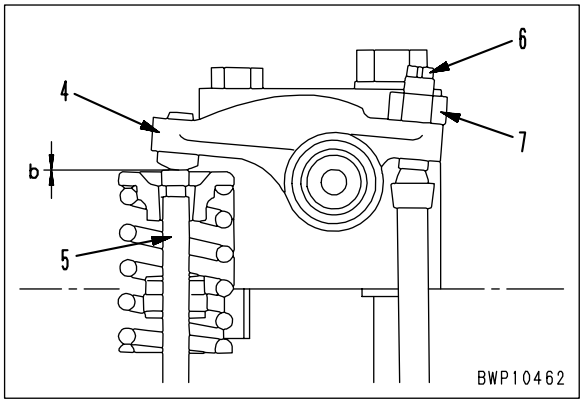
Cylinder No.	1	2	3	4	5	6
Exhaust valve	●	○	●	○	●	○
Intake valve	●	●	○	●	○	○

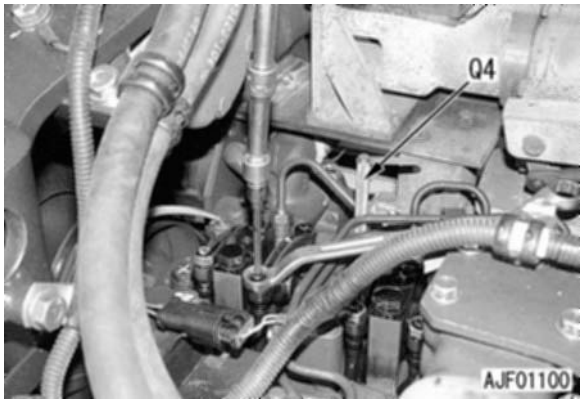
TDD00723

4. Rotate the crankshaft one more turn in the normal direction, align the counter marks made in Step 3, then adjust the valve clearance of the remaining valves marked ○.
   ★ When adjusting the valve clearance, loosen locknut (7) of adjustment screw (6), insert filler gauge **Q4** between the valve stem (5) and rocker arm (4), and adjust the clearance so that it is a sliding fit. Then tighten the locknut to hold the adjustment screw in position.

Locknut: 24± 4 Nm {2.45± 0.41 kgm}

   ★ After tightening the locknut, check the valve clearance again.
   ★ Firing order: 1 - 5 - 3 - 6 - 2 - 4 Valve clearance
   Intake: 0.25 mm
   Exhaust: 0.51 mm





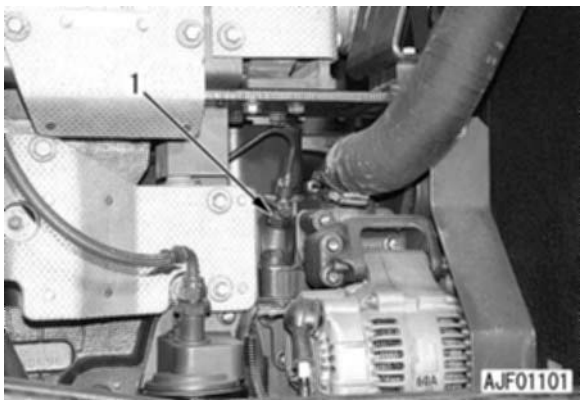
MEASURING COMPRESSION PRESSURE

Special tools required

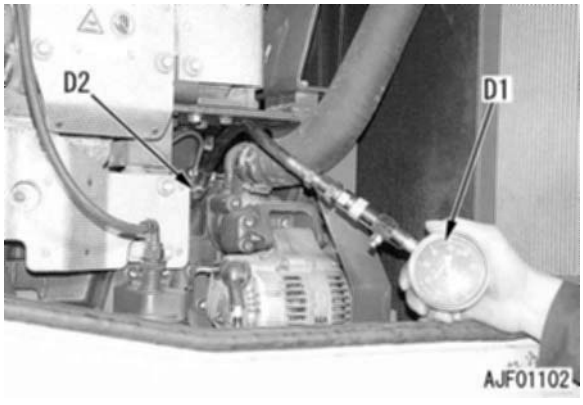
Symbol		Part No.	Part Name
A	1	799-203-8001	Multi-tachometer
D	1	795-502-1590	Gauge assembly
	2	795-502-1700	Adapter

When measuring the compression pressure, be careful not to burn yourself on the exhaust manifold or muffler, or to get your clothes caught in the fan, fan belt or other rotating parts.

1. Adjust the valve clearance.
   For details, see ADJUSTING VALVE CLEARANCE.
2. Warm up the engine to make the oil temperature 40 - 60°C.
3. Remove nozzle holder assembly (1) from the cylinder to be measured.



4. Install adapter **D2** in the mount of the nozzle holder, then connect compression gauge D1.



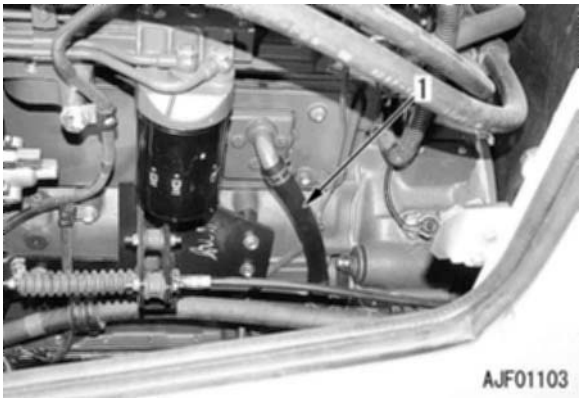
5. Set multi-tachometer **A1** in position.
   ★ For details, see MEASUREMENT OF ENGINE SPEED.
6. Disconnect fuel cut solenoid connectors (CN-E23, E03, E24).
7. Disconnect the fuel control linkage, secure the governor lever of the fuel pump at the NO INJECTION position, then crank the engine with the starting motor and measure the compression pressure.
   ★ Measure the compression pressure at the point where the pressure gauge indicator remains steady.
   ★ When measuring the compression pressure, measure the engine speed to confirm that it is within the specified range.
   ★ After measuring the compression pressure, install the nozzle holder assembly.

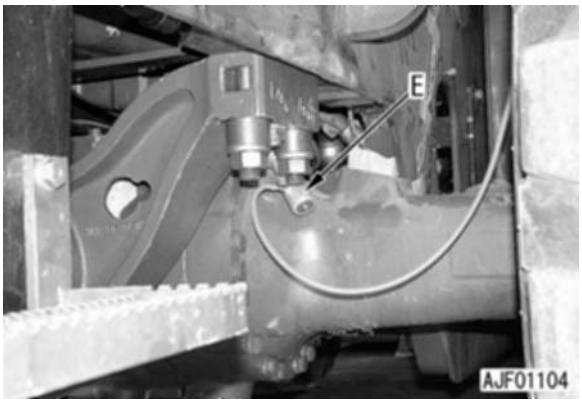
MEASURING BLOW-BY PRESSURE

Special tools required

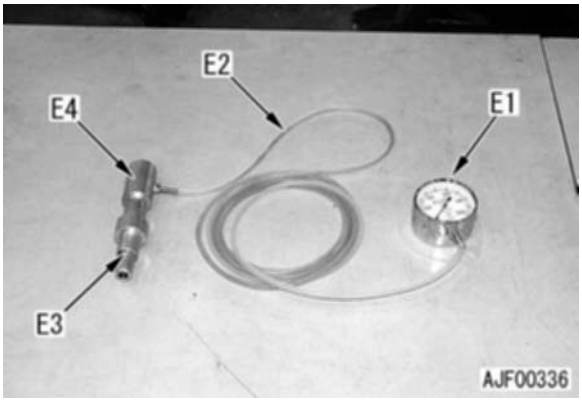
Symbol		Part No.	Part Name
E		799-201-1504	Blow-by checker
E	1	• 799-201-1541	Gauge
	2	• 795-201-1571	Tube
	3	• 799-201-1450	Adapter
	4	• 795-790-1950	Nozzle

1. When measuring the blow-by, warm up the engine thoroughly so that the water temperature is at least 70°C.
2. Stop the engine, then install blow-by checker E to breather hose (1).





Blow-by checker E



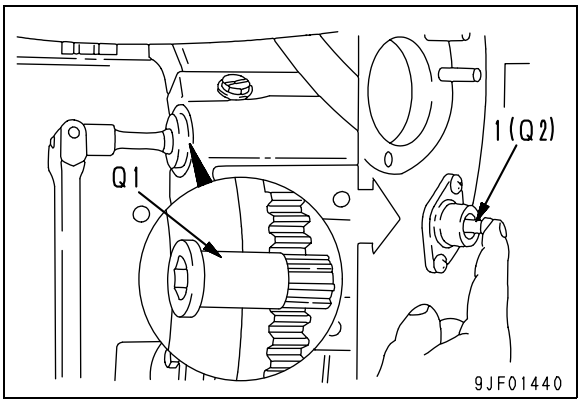
3. Run the engine at the rated output, and measure the blow-by pressure.
   - ★ The blow-by should be measured with the engine running at rated output.
   - • When measuring in the field, a similar value can be obtained at stall speed. In this case, the blow-by value will be about 80% of the value at rated output.
   - ★ Blow-by varies greatly according to the condition of the engine. Therefore, if the blow-by value is considered abnormal, check for problems connected with defective blow-by, such as excessive oil consumption, defective exhaust gas color, and prematurely dirty or deteriorated oil.

TESTING AND ADJUSTING FUEL INJECTION TIMING

Special tools required

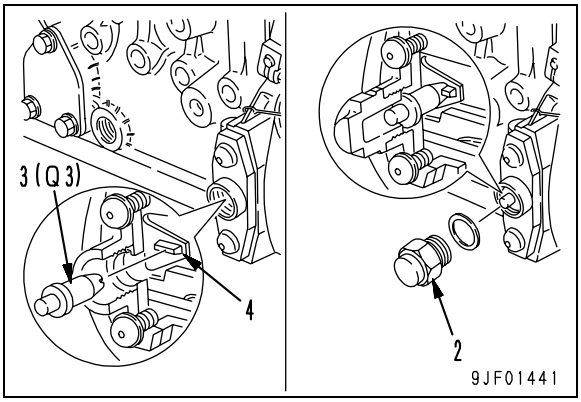
Symbol		Part No.	Part Name
Q	1	795-799-1131	Gear (Cranking tool)
	2	795-799-1900	Pin assembly
	3	795-799-1950	Lock pin

1. Testing
   1) Using cranking tool **Q1**, rotate the crankshaft in the normal direction until timing pin (1) enters the hole in the gear.
      - ★ Highly precise adjustment of the fuel injection timing is needed, so always lock the drive gear with the pin when adjusting the injection timing.
      - ★ If it is difficult to check with the pin installed to the flywheel housing, it is possible to use metal pin assembly **Q2**.
      - ★ While pressing pin (1) or **Q2** lightly, rotate the crankshaft.



   2) Remove plug (2), then reverse timing pin (3) and check that pin (3) meshes with timing pointer (4) on the fuel injection pump.
      - ★ If it is possible to insert the timing pin smoothly, the injection timing is correct.
      - ★ If it is impossible to insert the timing pin, the injection timing is not correct, so adjust it.
      - ★ If it is difficult to check with the pin (3) installed to the fuel injection pump, it is possible to use metal pin assembly **Q3**.
      - ★ After completing the inspection, remove the inspection equipment and return to the original condition.

Be careful not to forget to return timing pin (3) of the drive gear and the timing pin of the fuel injection pump to the original condition.



2. Adjusting
   - If the timing pin does not mesh, adjust as follows.
   1) Remove the fuel injection pump assembly. For details, see REMOVAL OF FUEL INJECTION PUMP ASSEMBLY.
   2) Rotate the camshaft of the fuel injection pump, push timing pin (3) and mesh with timing pin pointer (4).
   3) Install the fuel injection pump assembly.
      ★ For details, see INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY.
      ★ After completing the inspection, remove the inspection equipment and return to the original condition.
      ★ After completing the adjustment, remove the adjustment equipment and return to the original condition.

Before starting the engine, check again that you have not forgotten to return timing pin (3) of the drive gear and the timing pin of the fuel injection pump to the original condition.

MEASURING ENGINE OIL PRESSURE

Special tools required

Symbol		Part No.	Part Name
C	1	799-101-5002	Analog type hydraulic tester
		790-261-1203	Digital type hydraulic tester
	2	799-401-2320	Hydraulic tester

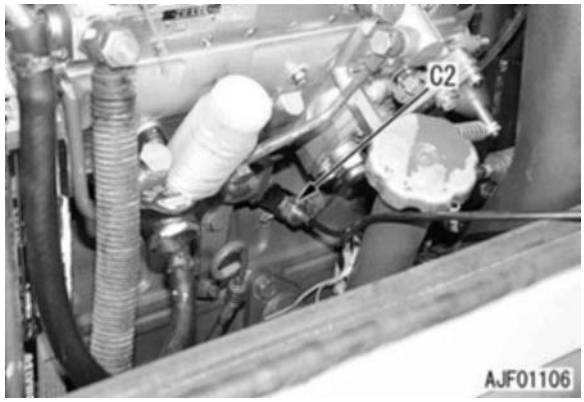
When measuring, be careful not to let your clothes get caught in any rotating part.

Always stop the engine before removing or installing any oil pressure sensor or oil pressure gauge.

★ When measuring the oil pressure, always measure at the specified oil temperature.

1. Remove engine oil pressure sensor (1).

2. Install tool **C2** (Gauge: 1MPa {10kg/cm^2}).



3. Start the engine, and measure the engine oil pressure.

MEASURING, TESTING OPERATING FORCE OF ACCELERATOR PEDAL

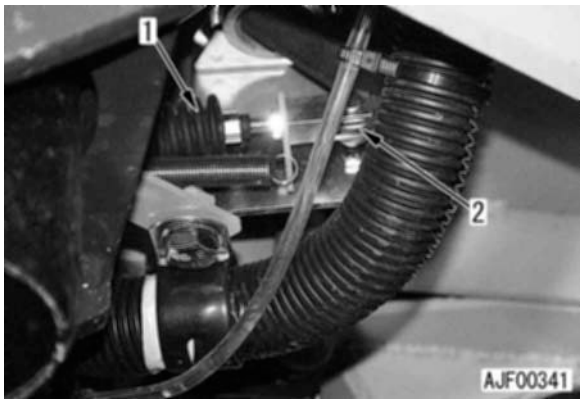
Special tools required

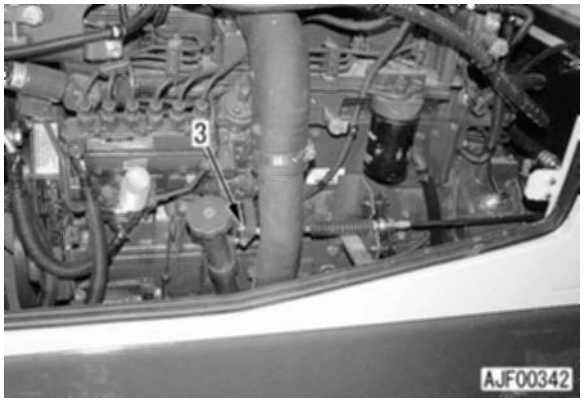
Symbol	Part No.	Part Name
H	79A-264-0021	Push-pull scale

MEASURING, TESTING OPERATING FORCE OF ACCELERATOR PEDAL

1. Set tool **H** at a position 150 mm from pedal fulcrum a.
   ★ Put the center of tool **H** in contact with a point 150 mm from the pedal fulcrum.

2. Start the engine, then measure the maximum value when the pedal is pushed in from the low idling position to the end of its travel (high idling).
3. Stop the engine.
4. Disconnect cable (1) at the bottom of the accelerator pedal, and check that there is no stiffness in plate (2) or ball joint (3) at the engine end.



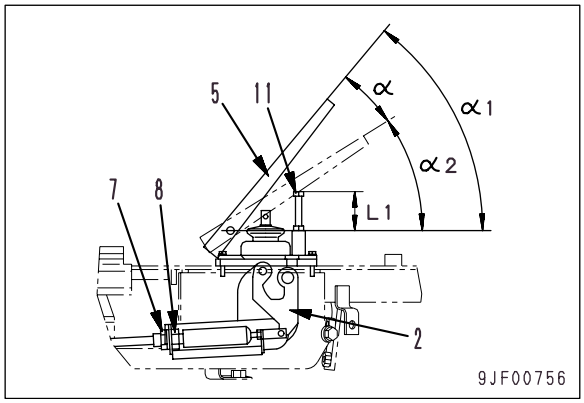


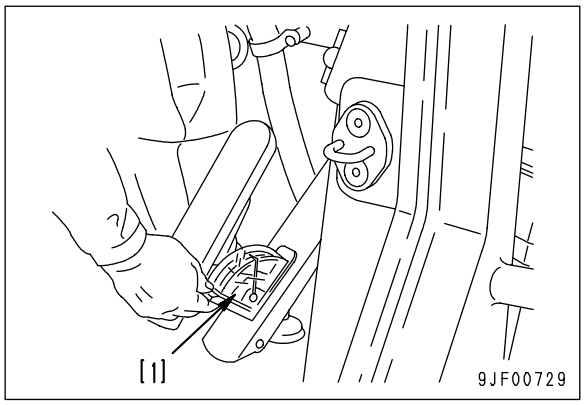
★ Carry out the above inspection, and adjust or replace parts if necessary. Then carry out the measurement of the operating effort again to check that it is within the standard value.

OPERATING ANGLE OF ACCELERATOR PEDAL

Measuring

1. Stop the engine.
2. Measure operating angle a when the pedal is operated from the low idling position to the high idling position.
   Put angle gauge [1] in contact with the accelerator pedal, and measure operating angle α (α = α1 - α2) when the pedal is operated from low idling position α1 to high idling position α2.





Adjusting

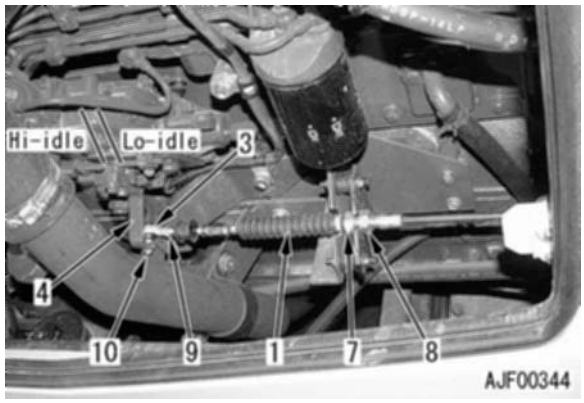
1. Open the inspection cover of the engine hood.
2. Set accelerator pedal (5) at the FREE position (lever (2) is in contact with U-bolt), adjust cable (1) so that governor lever (4) is in the idling position, then tighten nuts (7) and (8).

Locknut (7), (8):
44 - 59 Nm {4.5 - 6.0 kgm}

Locknut (9): 2.9 - 4.9 Nm {0.3 - 0.5 kgm}

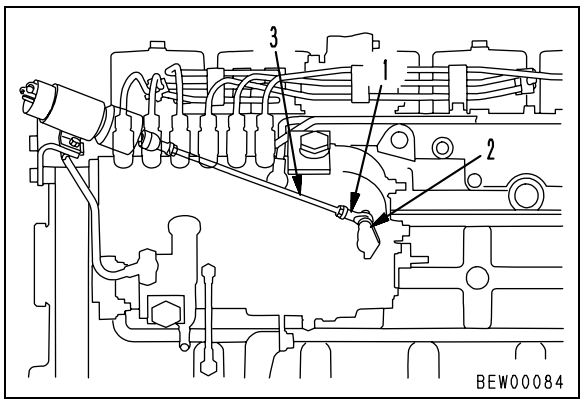
Mounting nut (10):
11.8 - 14.7 Nm {1.2 - 1.5 kgm}

3. Adjust stopper bolt (11) so that governor lever (4) is at the high idling position when accelerator pedal (5) is depressed.
   ★ Screw in ball joint (3) at least 8 mm.



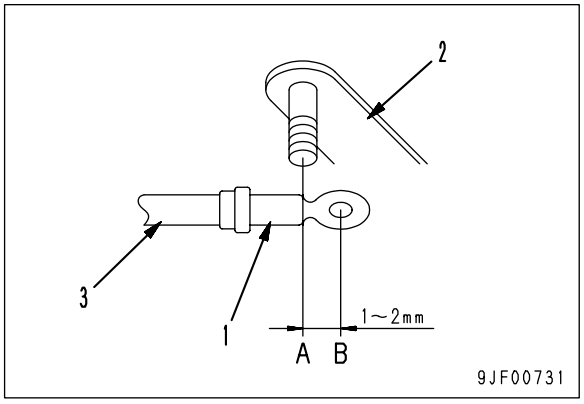
ADJUSTING ENGINE STOP SOLENOID

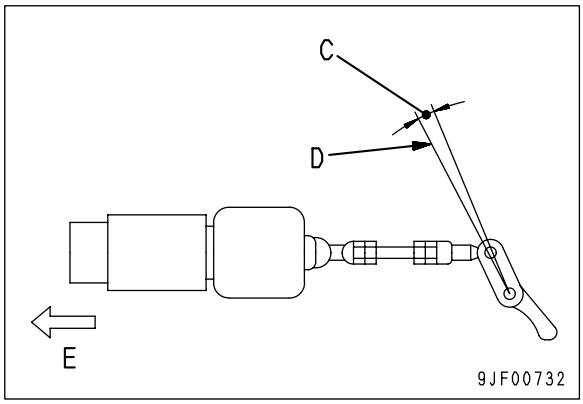
1. Disconnect joint (1) of stop rod (3) from fuel injection pump stop lever (2).
   ★ Always turn the starting switch OFF before doing this.



2. Turn the starting switch ON and actuate the solenoid.
3. Check that the relationship between the position of the pin and pin hole is as follows when fuel injection pump stop lever (2) is operated fully by hand to the OPERATING position.
   • Check that the center (portion A) of the pin hole of stop rod joint (1) is 1 - 2 mm to the right of the center (portion B) of the pin of stop lever (2).
   ★ If it is not within the above measurement, adjust with rod (3).
   C: Play from operating end
   D: Stop lever operating end
   E: Solenoid at hold position

   If the above dimension is the opposite, there is a possibility that the engine stop solenoid has seized.

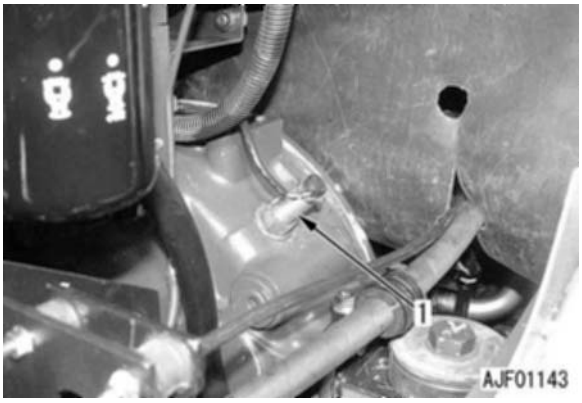




4. If the position of the pin hole is within the standard value, connect rod (3) and lever (2).
5. Start the engine, then turn the starting switch OFF and check that the engine stops.

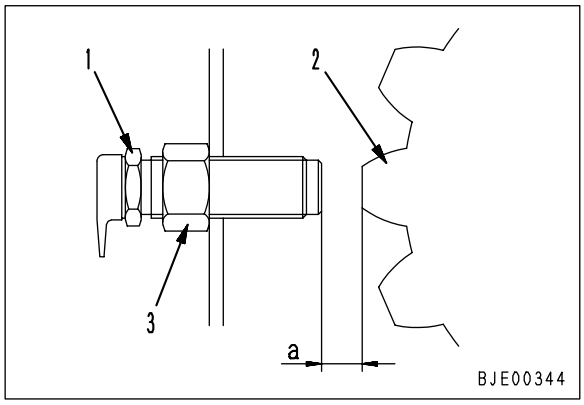
ADJUSTING ENGINE SPEED SENSOR

★ If engine speed sensor (1) (CN-E12) or the flywheel have been removed and installed, adjust as follows.



1. Open the engine right side cover.
2. Screw in until the tip of engine speed sensor (1) contacts the tip of the teeth of flywheel ring gear (2) lightly.
   ★ Check that there are no metal particles or scratches on the tip of the sensor before installing.

   Thread: Gasket sealant (LG-5)
3. Turn engine speed sensor (1) back 1/2 - 1 turns from that point.
   ★ Adjust clearance a between the tip of the sensor and the tip of the gear teeth to 0.75 - 1.5 mm.
4. Hold engine speed sensor (1) in position and tighten locknut (2).

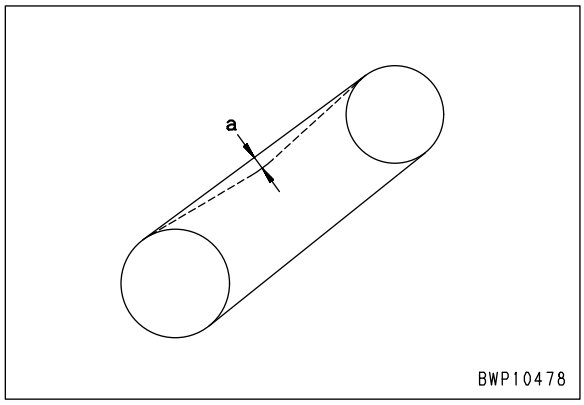


TESTING AND ADJUSTING AIR CONDITIONER COMPRESSOR BELT TENSION

Testing

Press a point midway between the fan pulley and the compressor pulley with a thumb and, and check belt deflection (a).

- Belt pressing force: 98.0 N {10 kg} or equivalent
- Deflection of belt: 10 - 15 mm



Adjusting

★ If the deflection is not correct, adjust as follows.

1. Loosen the mounting bolts (top and bottom: 2 each) of compressor bracket (1).
2. Loosen locknut (2), and use adjustment bolt (3) to move compressor bracket (1) and adjust the belt tension.
3. Tighten locknut (2).
4. Tighten the mounting bolts (top and bottom: 2 each) of compressor bracket (1).

5. After adjusting the belt tension, check the belt tension again.

MEASURING DIRECTIONAL LEVER

Special tools required

Symbol	Part No.	Part Name
H	79A-264-0021	Push-pull scale

Apply the parking brake and put blocks under the tires.

Operating effort of directional lever

1. Stop the engine.
2. Install push-pull scale H or a spring balance to a point 10mm from the tip of the control lever, then measure the operating effort when the lever is pulled in the direction of actuation.
   ★ Carry out the measurement in each speed range.

Travel of directional lever

1. Stop the engine.
2. Make mark **a** on the center of the knob of the control lever, then measure the travel when the lever is operated in the direction of actuation.

TESTING AND ADJUSTING HST OIL PRESSURE

Special tools required

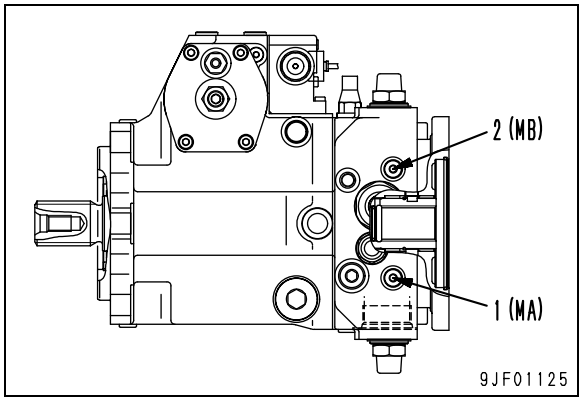
Symbol		Part No.	Part Name
C	1	799-101-5002	Analog type hydraulic tester
		790-261-1203	Digital type hydraulic tester
	7	790-301-1760	Joint (for G 3/8)
		07000-12014	O-ring

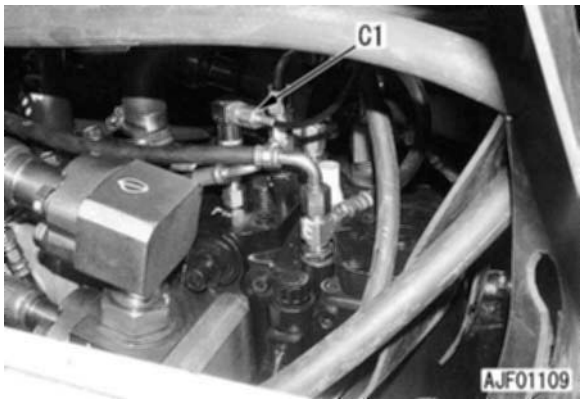
Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

★ HST oil temperature when measuring: Within operating range

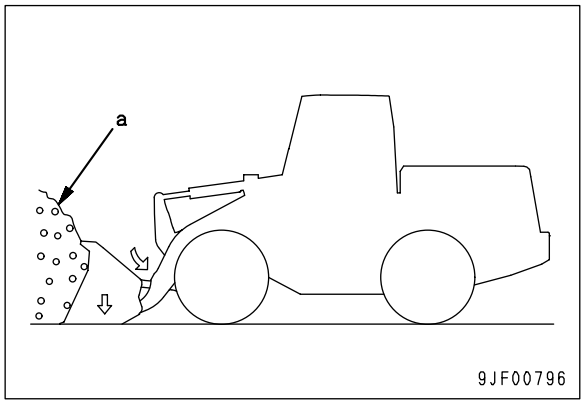
★ The high-pressure relief pressure is the same as the safety pressure of the main circuit, so it cannot be measured. (Normally, the cut-off valve is actuated first, so it does not rise to the safety valve set pressure)

1. Measuring high-pressure cut-off oil pressure
   1) Open the engine hood side cover.
   2) Install oil pressure gauge C1 (58.8 MPa {600 kg/cm^2}) to pressure measurement nipple (1) or (2).
      - Nipple (1): For FORWARD circuit (port: MA)
      - Nipple (2): For REVERSE circuit (port: MB)





3) Measure the high-pressure cut-off oil pressure under the following conditions.
   i) Lower the bucket to near the ground, then drive the machine forward and thrust the bucket into the stockpile of soil or rock (portion a).
      ★ Set the directional lever to FORWARD and the speed selector switch to 3rd.

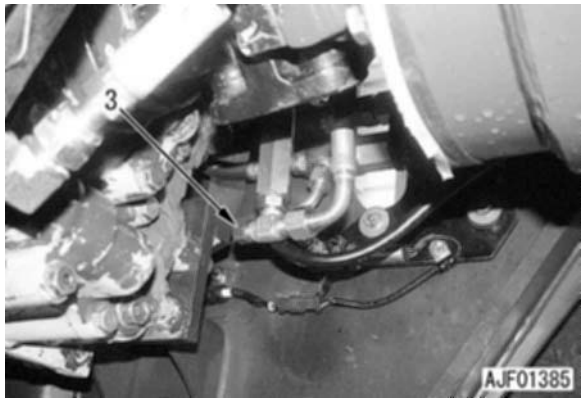


   ii) Run the engine at full throttle and push in until the machine stops moving forward.

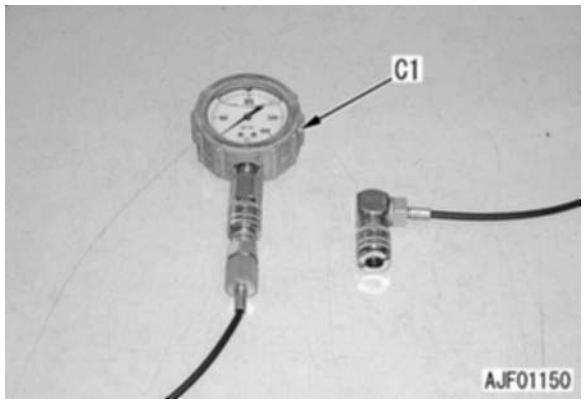
      Carry out the measurement on hard ground where it is difficult for the tires to slip.

   iii) Keep the engine running at full throttle, check that the tires are not turning, then measure the oil pressure.

2. Measuring low-pressure relief pressure (basic pressure of work equipment EPC circuit)
   1) Remove low-pressure relief pressure measurement plug (3) (10mm, P=1.25mm) from under the accumulator for PPC.
      ★ The accumulator for PPC is installed near right under the transfer on the right of the rear frame.

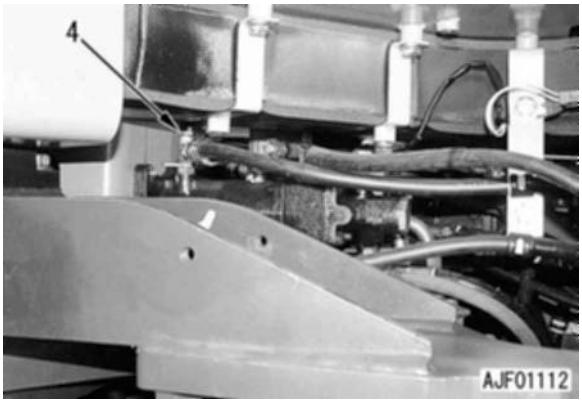


   2) Install a nipple, then connect oil pressure gauge C1 (5.9 MPa {60 kg/cm^2}).

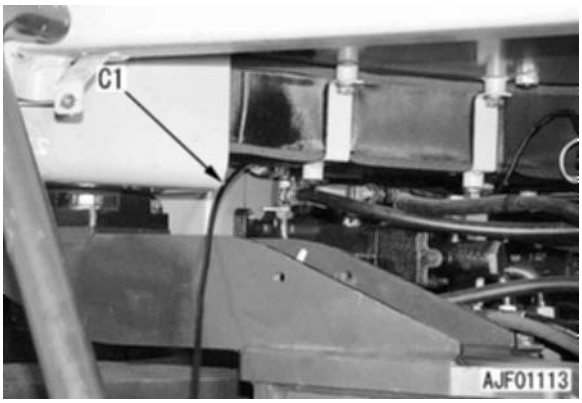


   3) Place the directional lever at N, run the engine at high idling, and measure the low-pressure relief pressure.

3. Measuring servo piston control pressure (DA pressure)
   1) Remove the floor frame cover (bottom left of operator's cab).
   2) Remove servo piston control pressure measurement plug (4) (DA pressure) (10mm, P=1.25mm).

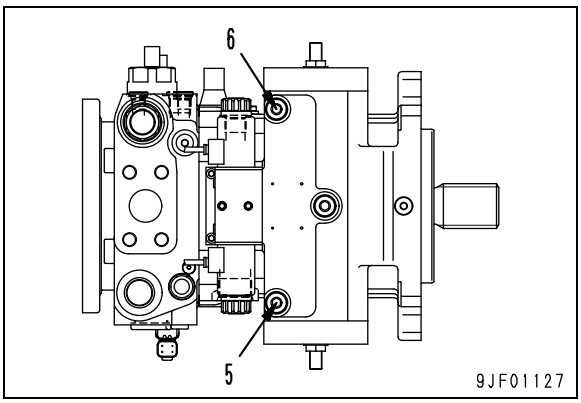


   3) Install a nipple, then connect oil pressure gauge C1 (5.9 MPa {60 kg/cm^2}).

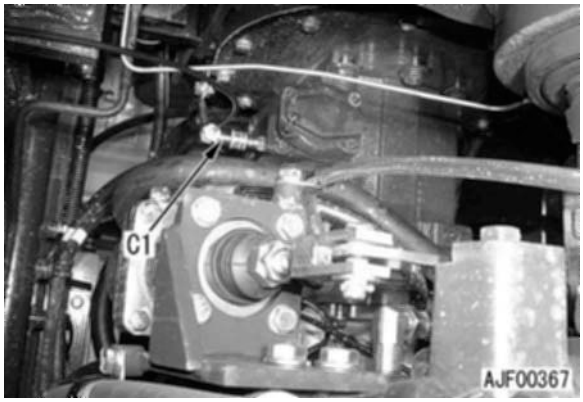


   4) Place the directional lever at N, run the engine at high idling, and measure the control pressure when the wheel brake pedal is depressed and when it is released.
      ★ The brake pedal is connected to the inching valve and controls the control pressure.

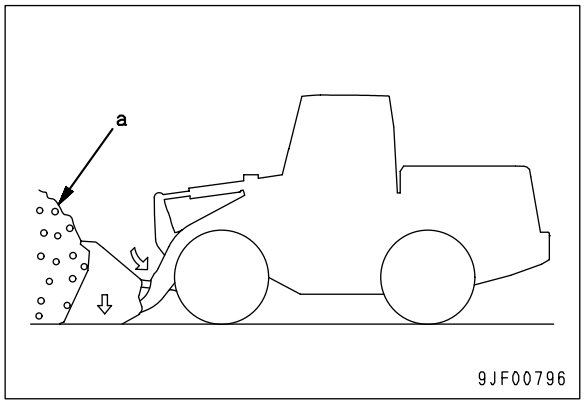
4. Measuring servo piston actuating pressure
   1) Remove servo piston actuation pressure measurement plug (5) or (6) (G 3/8) (width across flats for hexagonal head wrench: 8 mm).
      - Plug (5): For FORWARD circuit (port: X1)
      - Plug (6): For REVERSE circuit (port: X2)



   2) Install joint C7 and nipple (10 mm, P = 1.25), then connect oil pressure gauge C1 (5.9 MPa {60 kg/cm^2}).



3) Measure the servo piston actuating pressure under the following conditions.
   i) Lower the bucket to near the ground, then drive the machine forward and thrust the bucket into the stockpile of soil or rock (portion a).
      ★ Set the directional lever to FORWARD and the speed selector switch to 3rd.



   ii) Run the engine at full throttle and push in until the machine stops moving forward.

      Carry out the measurement on hard ground where it is difficult for the tires to slip.

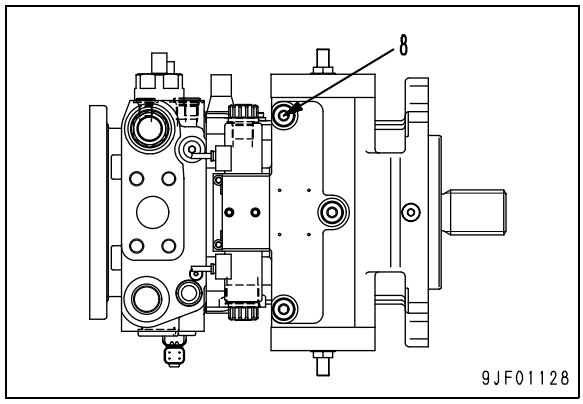
   iii) Keep the engine running at full throttle, check that the tires are not turning, then measure the oil pressure.

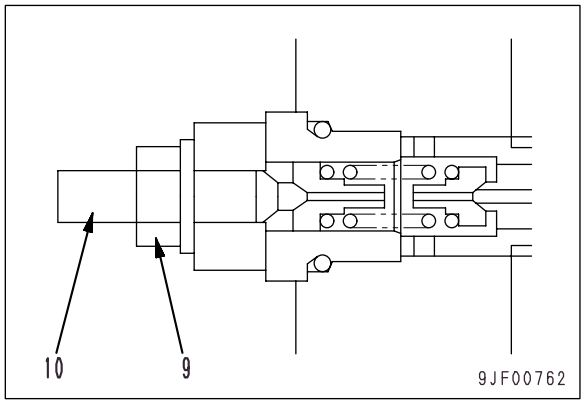
Adjusting

★ The high-pressure relief pressure is also the safety pressure of the main circuit, so it cannot be measured. (Normally, the cut-off valve is actuated first, so it does not rise to the safety valve set pressure)

1. Adjusting high-pressure cut-off valve
   ★ If the high-pressure cut-off pressure is not correct, adjust high-pressure cut-off valve (8) as follows.
   1) Remove the engine hood.
   2) Loosen locknut (9) of high-pressure cut-off valve (8), then turn adjustment screw (10) to adjust.
      ★ Turn the adjustment screw to adjust as follows.
         • To INCREASE pressure, turn CLOCKWISE.
         • To DECREASE pressure, turn COUNTERCLOCKWISE.
      ★ Amount of adjustment for one turn of adjustment screw: 9.1 MPa {93 kg/cm^2}
   3) After adjusting, tighten locknut (9).

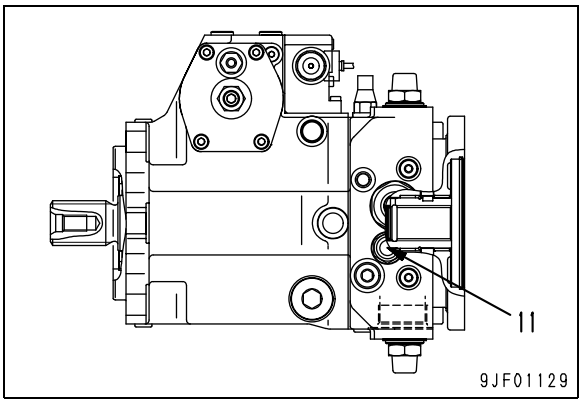
      Locknut: 37.2 Nm {3.8 kgm}

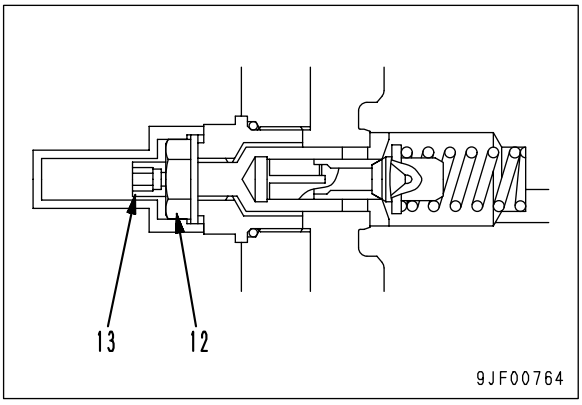




2. Adjusting low-pressure relief valve
   ★ If the low-pressure relief pressure is not correct, adjust the low-pressure relief valve as follows.
   1) Remove the engine hood and side cover.
   2) Loosen locknut (12) of low-pressure relief valve (11), then turn adjustment screw (13) to adjust.
      ★ Turn the adjustment screw to adjust as follows.
         • To INCREASE pressure, turn CLOCKWISE.
         • To DECREASE pressure, turn COUNTERCLOCKWISE
      ★ Amount of adjustment for one turn of adjustment screw: 0.38 MPa {3.9 kg/cm^2}
   3) After adjusting, tighten locknut (12).

      Locknut: 69.6 Nm {7.1 kgm}

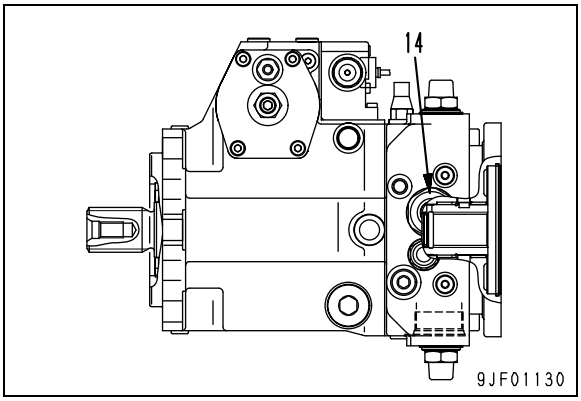


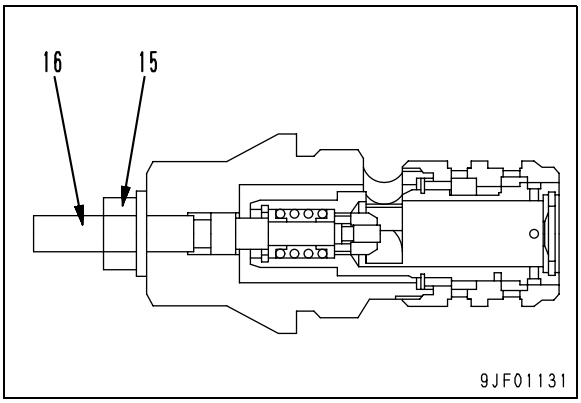


   ★ After completion of adjustment, repeat the measurement procedure to check the low-pressure relief pressure again.

3. Adjusting DA valve
   ★ If the servo piston control pressure is not correct, adjust the DA valve as follows.
   1) Remove the engine hood.
   2) Loosen locknut (15) of DA valve (14), then turn adjustment screw (16) to adjust.
      ★ Turn the adjustment screw to adjust as follows.
         • To DECREASE pressure, turn CLOCKWISE.
         • To INCREASE pressure, turn COUNTERCLOCKWISE
      ★ Amount of adjustment for one turn of adjustment screw: 0.34 MPa {3.5 kg/cm^2}
   3) After adjusting, tighten locknut (15).

      Locknut: 22 Nm {2.2 kgm}





   ★ After completion of adjustment, repeat the measurement procedure to check the control pressure again.

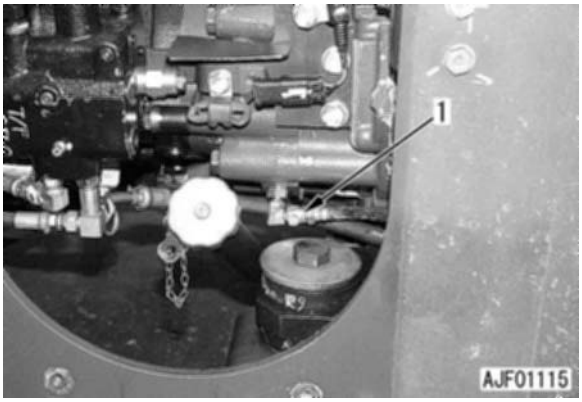
MEASURING CLUTCH CONTROL PRESSURE

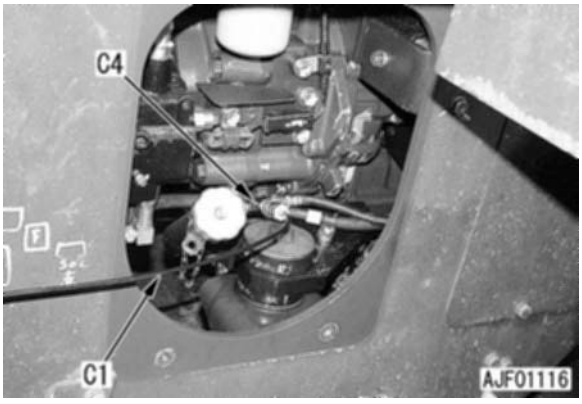
Special tools required

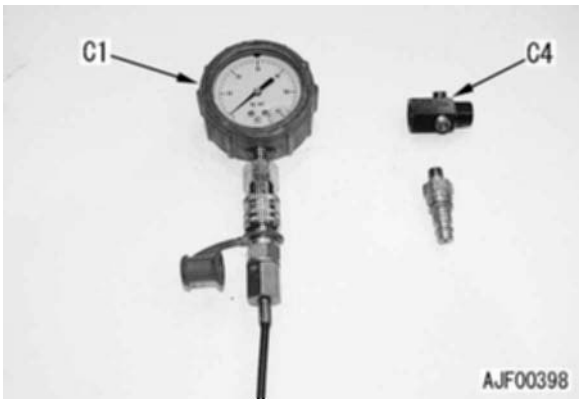
Symbol		Part No.	Part Name
C	1	799-101-5002	Analog type hydraulic tester
		790-261-1203	Digital type hydraulic tester
	4	799-401-3100	Adapter

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

1. Remove the rear frame left side cover.
2. Disconnect clutch solenoid valve output pressure (clutch inlet pressure) hose (1), then connect tool **C1** (5.9 MPa {60 kg/cm^2}) and **C4** (hose size: for # 02).
3. Disconnect hose (1), then connect tool **C1** (5.9 MPa {60 kg/cm^2}) and **C4** (hose size: for # 02).







4. Set the speed selector switch to 3rd or 4th, travel at a speed of at least 10 km/h, and measure the clutch inlet pressure (clutch solenoid valve output pressure).

TESTING AND ADJUSTING STEERING WHEEL

Special tools required

Symbol	Part No.	Part Name
H	79A-264-0021	Push-pull scale

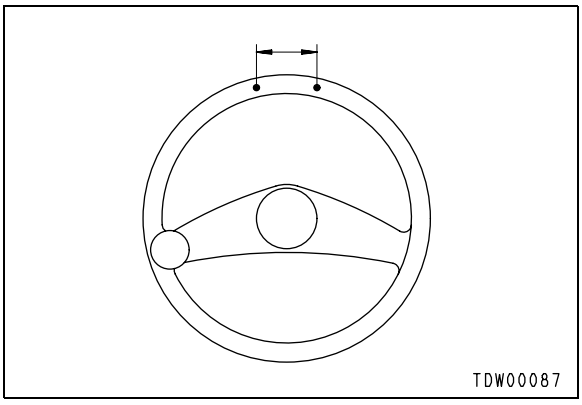
MEASURING PLAY OF STEERING WHEEL

★ Measurement conditions
- Engine speed: Stopped
- Machine posture: Facing straight forward

Method of measurement

1. Move the steering wheel 2 or 3 times lightly to the left and right, check that the steering mechanism is at the neutral position, then make mark (A) on the outside frame of the machine monitor.
2. Turn the steering wheel to the right, and make mark (B) at the position where the operating effort starts to become heavy.

3. Turn the steering wheel to the left in the opposite direction from Step 2, and make a mark at the point where the operating effort becomes heavy. Then measure the distance in a straight line between marks (B) and (C).

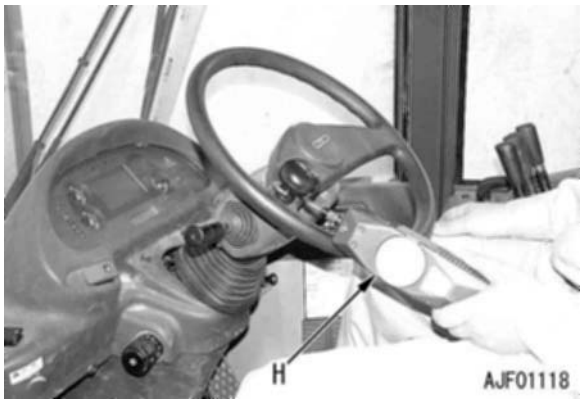


MEASURING OPERATING FORCE OF STEERING WHEEL

★ Measurement conditions
- Road surface : Flat, horizontal, dry paved surface
- Engine water temperature : Within green range on engine water temperature gauge
- Hydraulic oil temperature : 45 - 55°C
- Tire inflation pressure : Specified pressure
- Engine speed : Low idling (bucket empty)

Measurement method

1. Install push-pull scale **H** to the steering wheel knob.
   ★ Install push-port scale **H** to the center.
2. Start the engine.
   ★ After starting the engine, raise the bucket approx. 400 mm and remove the safety bar.
3. Pull push-pull scale **H** in the tangential direction and measure the value when the steering wheel moves smoothly.
   ★ Stop measuring when the steering wheel starts to move.



MEASURING OPERATING TIME FOR STEERING WHEEL

★ Measurement conditions
- Road surface : Flat, horizontal, dry paved surface
- Engine water temperature : Within green range on engine water temperature gauge
- Hydraulic oil temperature : 45 - 55°C
- Tire inflation pressure : Specified pressure
- Engine speed : Low idling and high idling

Measurement method

1. Start the engine.
   ★ After starting the engine, raise the bucket approx. 400 mm and remove the safety bar.
2. Operate the steering wheel to the end of its stroke to turn the machine to the left or right.
3. Measure the time taken to operate the steering wheel to the end of the stroke to the right or left.
   ★ Operate the steering wheel at about 60 turns per minute without using force.
   ★ Carry out the measurements both at low idling and high idling, and to both the left and right.

TESTING AND ADJUSTING STEERING OIL PRESSURE

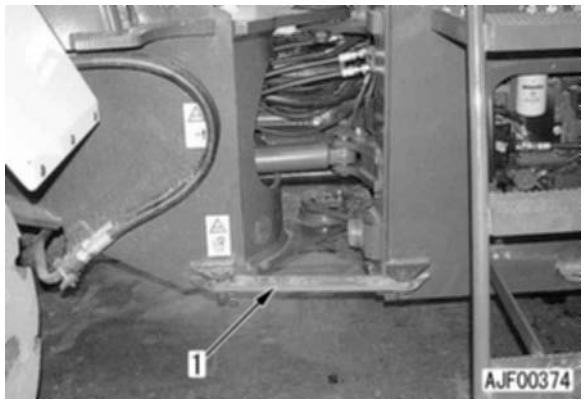
Special tools required

Symbol		Part No.	Part Name
C	1	799-101-5002	Analog type hydraulic tester
		790-261-1203	Digital type hydraulic tester

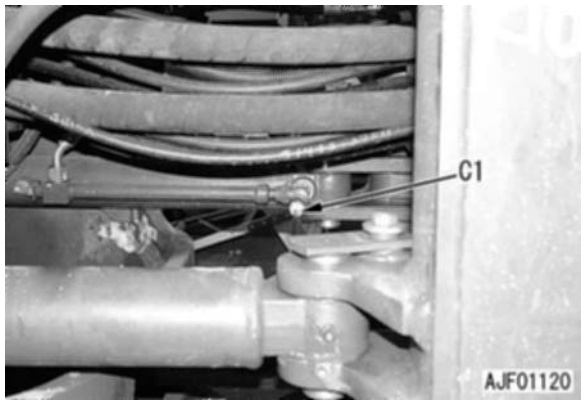
★ Measuring condition
- Hydraulic oil temperature:45 - 55°C
- Engine speed: High idling

Method of measuring main relief pressure

1. Fit safety bar (1) to the frame.



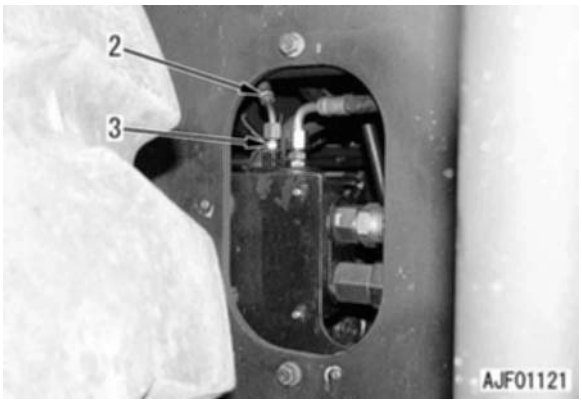
2. Fit a nipple to the steering circuit pressure measurement plug, then install oil pressure gauge **C1** (39.2 MPa {400 kg/cm^2}).



3. Start the engine, run the engine at high idling, then turn the steering wheel to the left or right and measure the pressure when the relief valve is actuated.

Method of adjusting main relief pressure

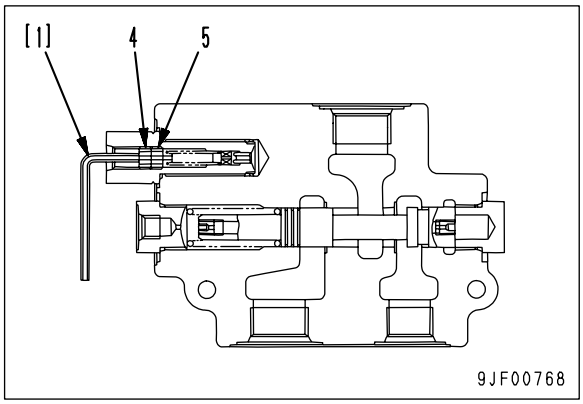
1. Stop the engine.
2. Disconnect hose (2) and fitting (3) connected to port T of the priority valve.



3. Loosen lock screw (4), and then turn adjustment screw (5) to adjust.
   - ★ Turn the adjustment screw to adjust as follows.
     - To INCREASE pressure, turn CLOCKWISE.
     - To DECREASE pressure, turn COUNTERCLOCKWISE.
   - ★ Pressure adjustment for one turn of adjustment screw: Approx. 6.9 MPa (70 kg/cm^2)
   - ★ Tool [1] for adjusting adjustment screw: Size 7/32 inch, hexagonal
   - ★ Do not carry out any adjustment if the relief pressure cannot be measured accurately.

   Lock screw (4):
   14.7 ± 2 Nm (1.5 ± 0.2 kgm)

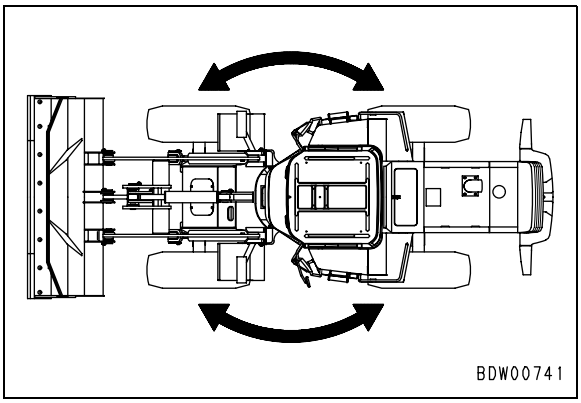
   Adjustment screw (5):
   2.3 - 6.8 Nm (0.23 - 0.69 kgm)



BLEEDING AIR FROM STEERING CIRCUIT

★ Bleed the air from the circuit as follows if the steering valve or steering cylinder have been removed and installed again.

1. Start the engine and run at idling for approx. 5 minutes.
2. Run the engine at low idling and turn 4 - 5 times to the left and right.
   - ★ Operate the piston rod to approx. 100 mm before the end of its stroke. Be careful not to relieve the circuit.
3. Repeat Step 2 with the engine at full throttle.
4. Run the engine at low idling and operate the piston to the end of its stroke to relieve the circuit.



TESTING HYDRAULIC FAN

Special tools required

Symbol		Part No.	Part Name
A	1	799-203-8001	Multi-tachometer
C	1	799-101-5002	Analog type hydraulic tester
		790-261-1203	Digital type hydraulic tester
	6	799-401-3300	Adapter

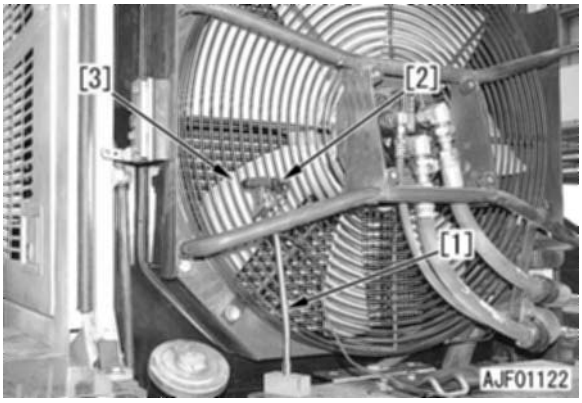
Set the bottom face of the bucket horizontal, lower the bucket completely to the ground, and put blocks under the tires.

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

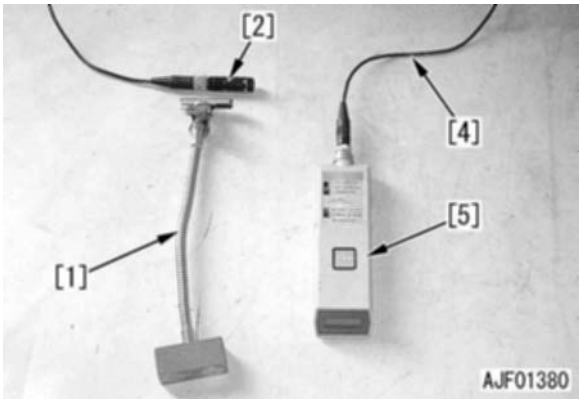
★ Measurement conditions
- Hydraulic oil temperature: 45 - 55°C

Measuring fan speed

1. Open the radiator grill.
2. Install stand [1], probe [2], and reflecting tape [3] in the multi-tachometer **A1** kit, then connect the meter itself [4], [5].



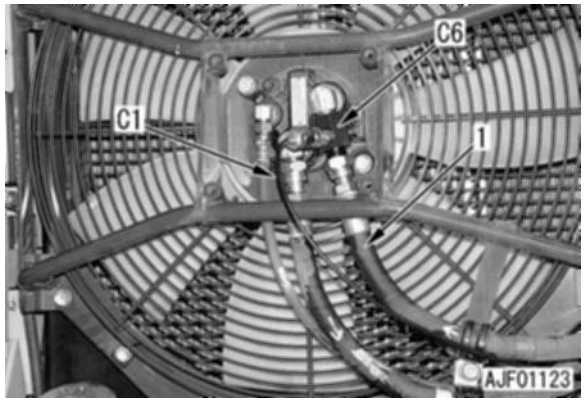
Multi-tachometer **A1**

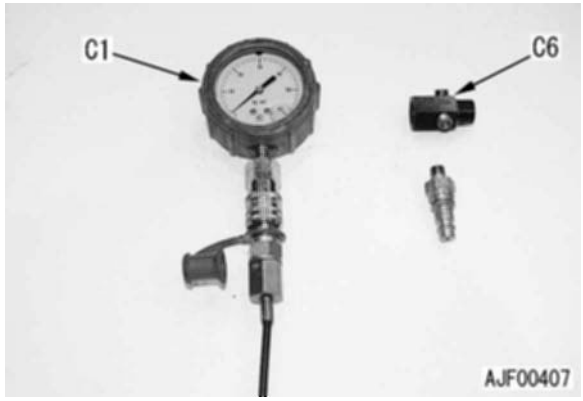


3. Start the engine, run at high idling, and measure the fan speed.

Measuring oil pressure

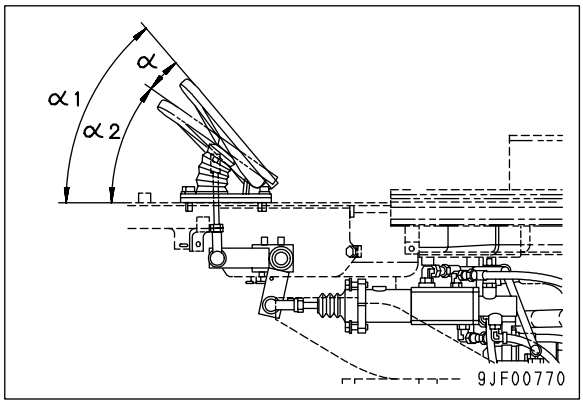
1. Open the radiator grill.
2. Disconnect hose (1), then connect tool **C1** (39.2 MPa {400 kg/cm^2}) and **C6** (hose size: for # 05).





3. Start the engine and measure the fan drive oil pressure.

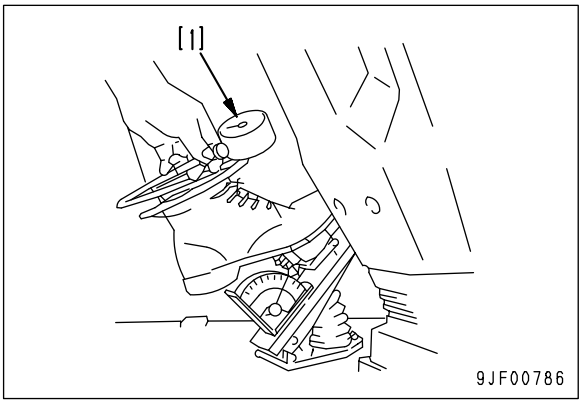
MEASURING BRAKE PEDAL

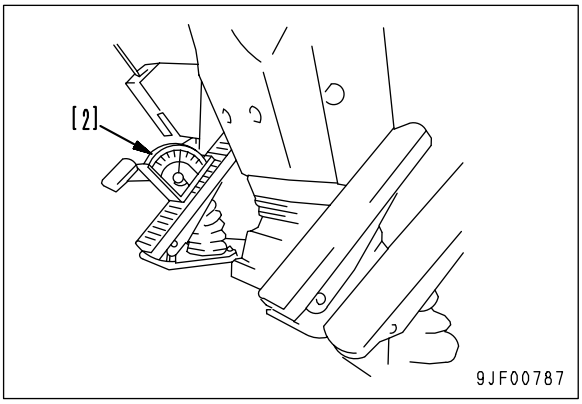


★ Measurement conditions
- Engine water temperature: Within green range on engine water temperature gauge
- Engine speed: Low idling

Operating effort of pedal

1. Install push gauge [1] to the operator's foot.
   ★ Set the push gauge at a point 150 mm from the fulcrum of the pedal.
2. Start the engine, and measure pedal angle α1 when running at low idling.
3. Next, put angle meter [2] in contact with the brake pedal and measure operating angle a from position α1 to position α2 (α = α1 - α2) when the pedal is depressed.
   - Operating force at α2: 196 N (20 kg).





TESTING AND ADJUSTING BRAKE PEDAL LINKAGE

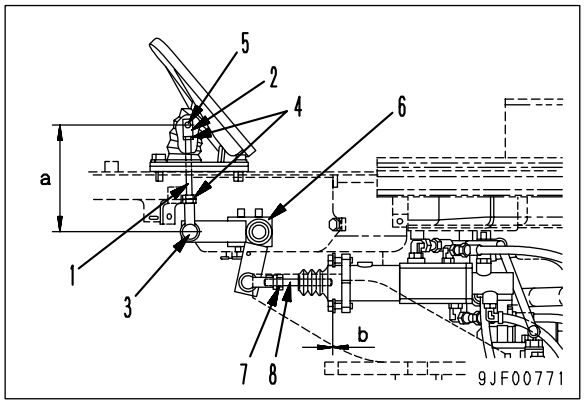
Testing

1. Check for play in linkage mounting pin (7), pin-hole of lever (6), and lever bushing.
2. Measure length of link (a = 200 mm), and check that it is within the standard value.
   ★ Measure the length from the center of pin (6) to the center of ball joint (3).
3. Measure the distance of movement of rod (8) and check that clearance b is within the standard value.
   ★ When doing this, check that the brake pedal is in contact with the stopper.

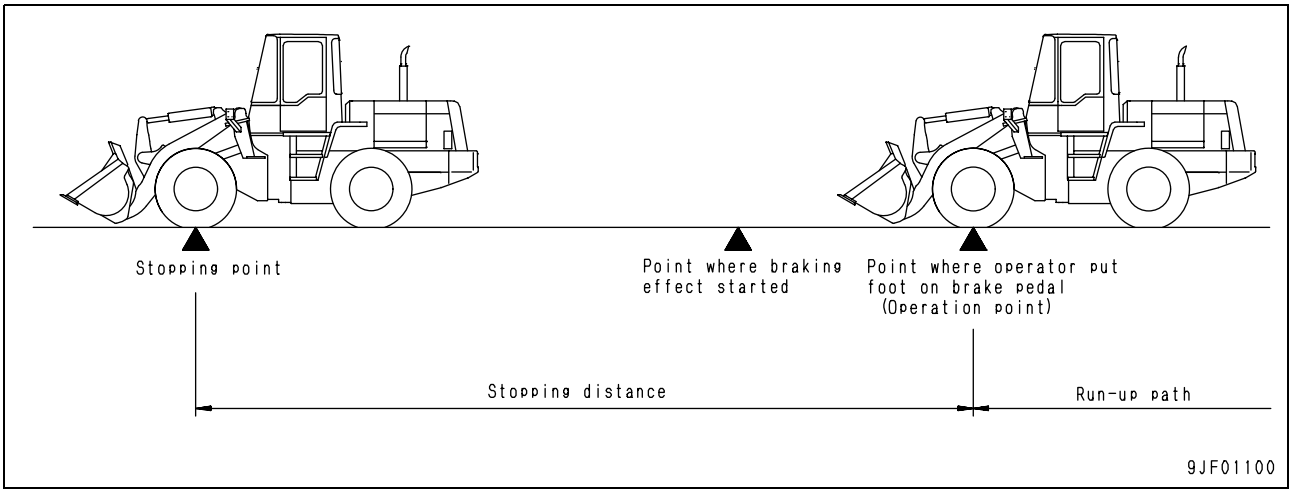
Adjusting

1. Adjusting link length (a)
   1) Remove pin (5) and ball joint (3), then remove rod (1).
   2) Loosen locknuts (4), then turn yoke (2) and ball joint (3) to adjust the length.
   3) After adjusting the length of link (a), connect it to the brake pedal.
      ★ Standard values
      a = 184 mm

2. Adjusting rod length (b)
   1) Loosen locknut (7), turn rod (8) so that the tip of the rod contacts the booster cylinder piston, then turn rod (8) back 1/4 turn.
      ★ Movement for 1/2 turn of rod: 0.75 mm
   2) Tighten locknut (7) to hold in position.
      ★ Standard values
      b = 0 - 0.3 mm



MEASURING BRAKE PERFORMANCE



★ Measurement conditions
- Road surface : Flat, horizontal, dry paved surface
- Travel speed : 35 km/h when brakes are applied
- Tire inflation pressure : Specified pressure
- Tire size : 20.5 - 25
- Delay in applying brakes : 0.1 sec

Measurement method

1. Start the engine and drive the machine.
2. Set the speed selector switch to 4th and drive the machine.
3. When the travel speed reaches 35 km/h, depress the left brake pedal with the specified operating force.
   ★ Before carrying out this operation, determine the run-up path and the point for applying the brakes, then apply the brakes when the machine reaches that point.
4. Measure the distance from the point where the brakes were applied to the point where the machine stopped.
   ★ Repeat this measurement three times and take the average.

TESTING AND ADJUSTING ACCUMULATOR CHARGE PRESSURE

Special tools required

Symbol		Part No.	Part Name
C	1	799-101-5002	Analog type hydraulic tester
		790-261-1203	Digital type hydraulic tester

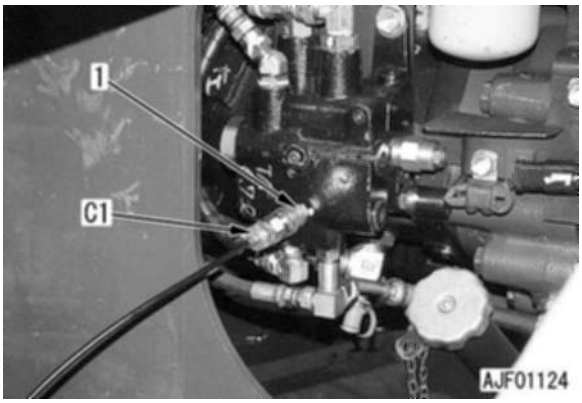
Measuring

- Hydraulic oil temperature:45 - 55°C

Put blocks under the tires.

Stop the engine, then depress the brake pedal at least 100 times to release the pressure inside the accumulator circuit.

1. Remove the rear frame left side cover.
2. Install oil pressure gauge **C1** (39.2 MPa {400 kg/cm^2}) to nipple (1).



3. Measure the accumulator charge cut-in pressure. Start the engine, run the engine at low idling, and measure the oil pressure when the brake pressure caution lamp on the monitor panel goes out.
   - cut-in pressure:5.9 $^{+0.2}_{0}$ MPa {60 $^{+2}_{0}$ kg/cm^2}
4. Measure the accumulator charge cut-out pressure. After the accumulator charge cut-in is actuated, measure the oil pressure when the indicator of the oil pressure gauge has risen and suddenly starts to drop.
   - cut-out pressure:9.8 $^{+0.98}_{0}$ MPa {100 $^{+10}_{0}$ kg/cm^2}

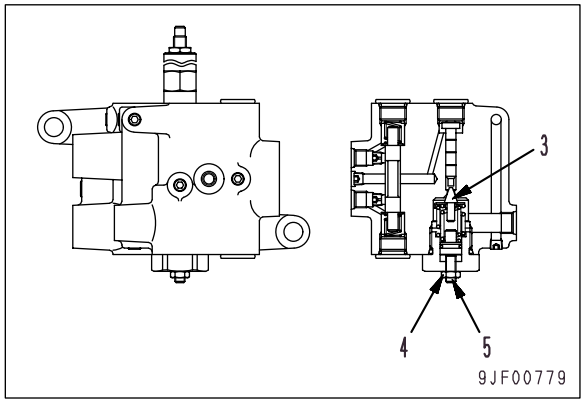
Adjusting

★ When the accumulator charge cut-out pressure is adjusted, the cut-in pressure also changes in proportion to the ratio of the valve area.

1. Loosen locknut (4) of unload relief valve (accumulator charge cut-out valve) (3), then turn adjustment screw (5) to adjust.
   ★ Turn the adjustment screw to adjust as follows.
   - To RAISE pressure, turn CLOCKWISE
   - To LOWER pressure, turn COUNTER-CLOCKWISE

   ★ Pressure adjustment for one turn of adjustment screw: 1.45 MPa {14.8 kg/cm^2}

   Locknut :
   11.8 - 16.7 Nm {1.2 - 1.7 kgm}
2. After adjusting, tighten locknut (4).



★ After completion of adjustment, repeat the measurement procedure given above to check the accumulator cut-in pressure and cutout pressure again.

MEASURING BRAKE OIL PRESSURE

Special tools required

Symbol		Part No.	Part Name
K	1	793-605-1001	Brake test KIT
	2	790-101-1430	Coupler
	3	790-101-1102	Pump
	4	793-463-1100	Stopper

★ Measurement conditions
- Engine water temperature: Within white range on engine water temperature gauge
- Brake pressure: 4.4 MPa (45 kg/cm^2)

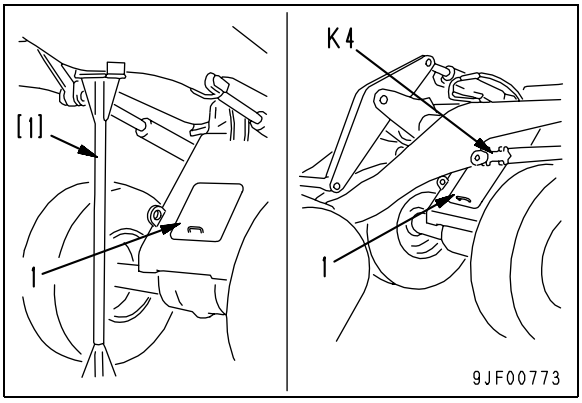
Apply the parking brake and put blocks under the tires.

★ If the brake piston has been disassembled or replaced, measure drop of low brake pressure (0.1 MPa {1 kg/cm^2}), referring to DISASSEMBLY AND ASSEMBLY, Disassembly and assembly of axle assembly.

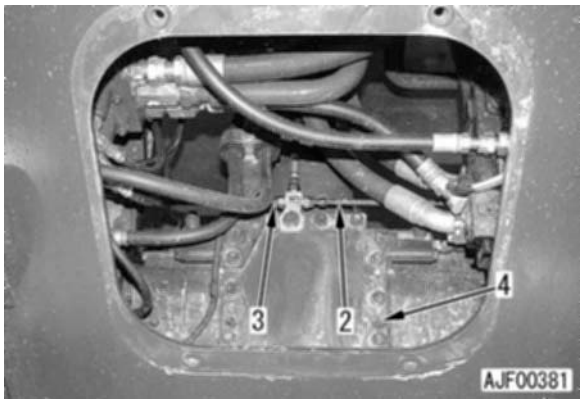
Measuring

1. Raise the boom, set support [1] or boom drop prevention stopper **K4** in position, then remove front cover (1).

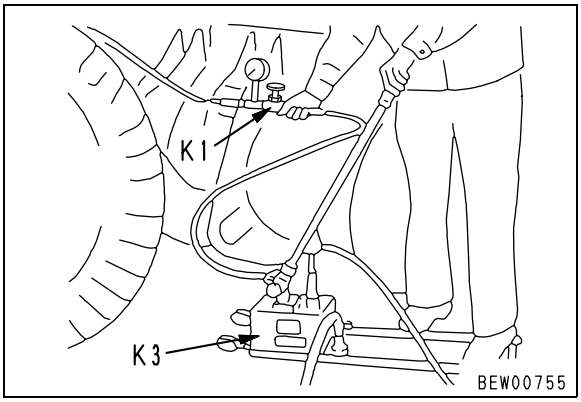
When leaving the operator's seat, apply the safety lock lever to the work equipment control levers securely.



2. Stop the engine.
3. Remove brake tube (2) on the side to be measured, then remove nipple (3).
4. Set brake test kit **K1** in position, then connect pump **K3** with coupler **K2**.
5. Loosen bleeder screw (4) and bleed the air.
   ★ Operate pump **K3** to bleed the air.

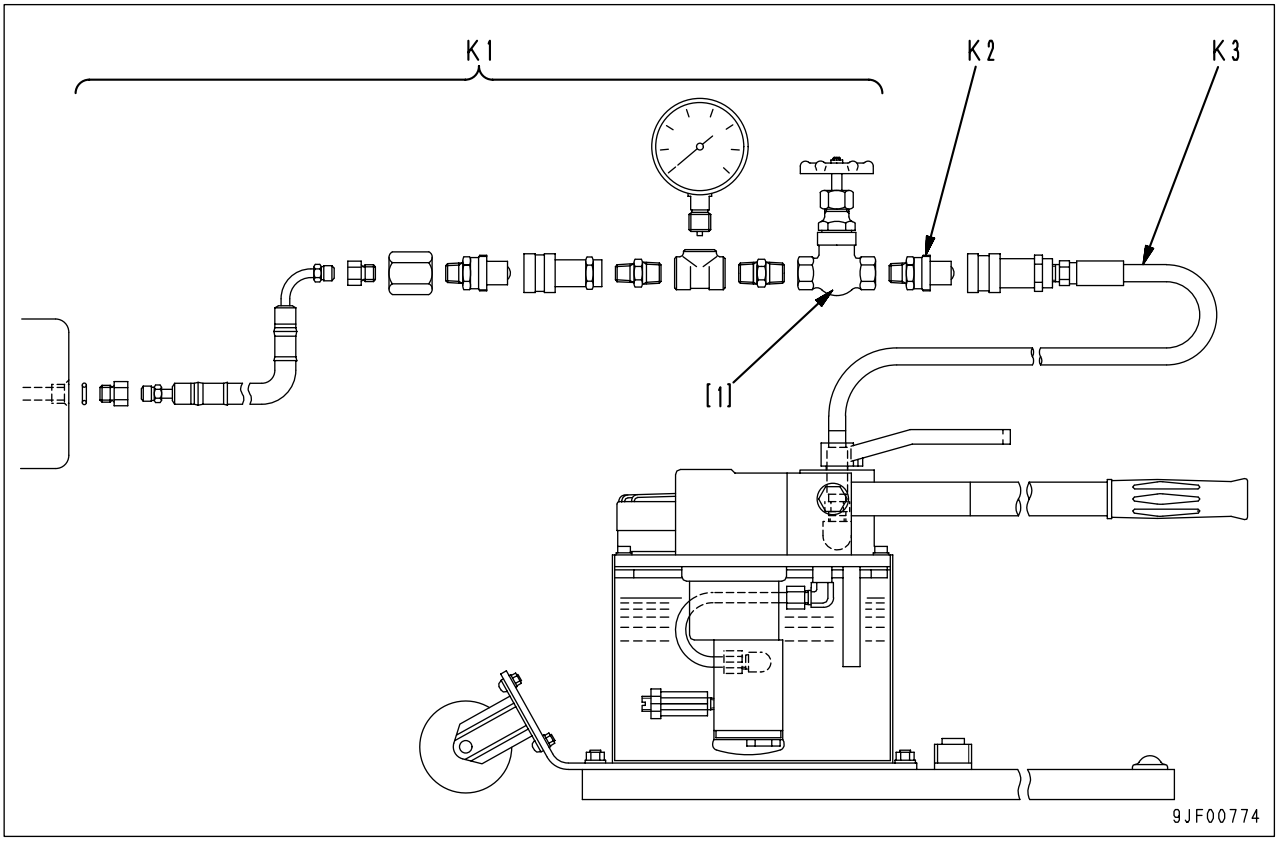


6. Tighten the bleeder screw, operate pump **K3**, raise the pressure to 4.1 MPa (42 kg/cm^2), then close stop valve (1).



7. After applying the pressure, leave for 5 minutes and measure the drop in the pressure.
   ★ If the hose is moved while measuring the pressure, the pressure will change, so do not move the hose.
   ★ After testing, operate pump **K3** to lower the pressure of the brake circuit, then remove brake test kit **K1**.
   ★ After completing the inspection, install the brake tube, then bleed the air from the brake circuit.

Brake test tool



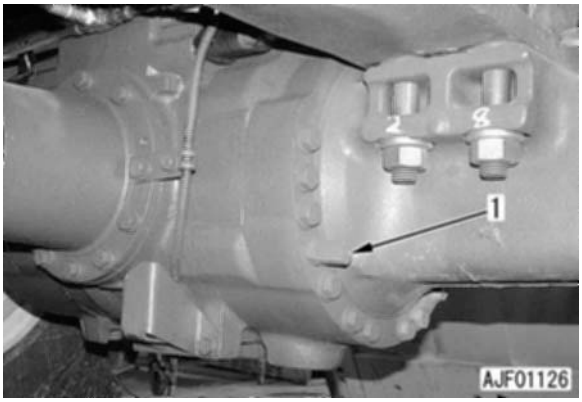
MEASURING WEAR OF BRAKE DISC

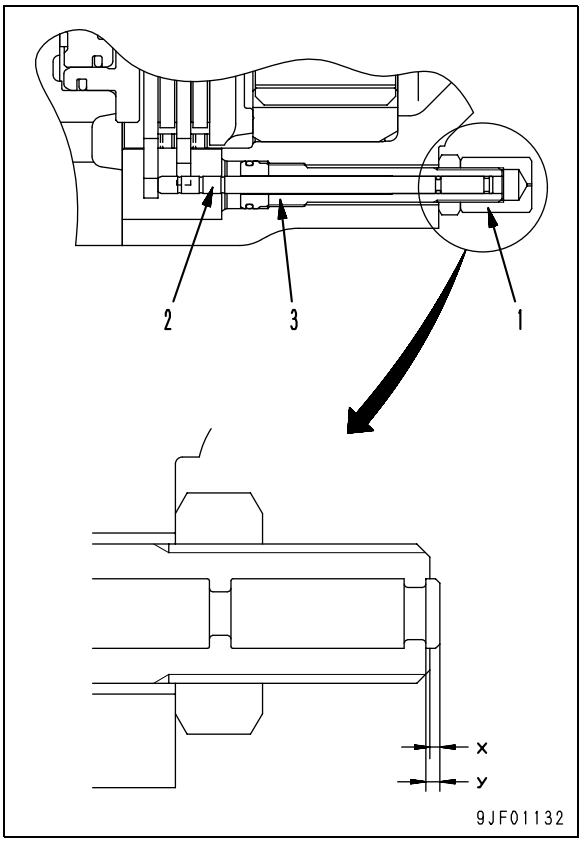
Special tools required

Symbol		Part No.	Part Name
Q	4	Commercially available	Filler gauge

Stop the machine on level ground, then lock the tires with chocks.

1. Remove cap (1).





2. Lightly press the brake pedal to the stroke end.
3. With shaft (2) pushed in, measure projection (x) from guide (3) (wear).
   - ★ Keep pressing the brake pedal while measuring the wear.
   - ★ If shaft (2) is projected from the end of guide (3) to the groove, replace the disc.
   - Wear: **x**
   - Repair limit: **y (1.6 mm)**
4. After testing, return cap (1).

Cap (1):
29.4 - 39.2 Nm {3.0 - 4.0 kgm}

BLEEDING AIR FROM BRAKE CIRCUIT

Special tools required

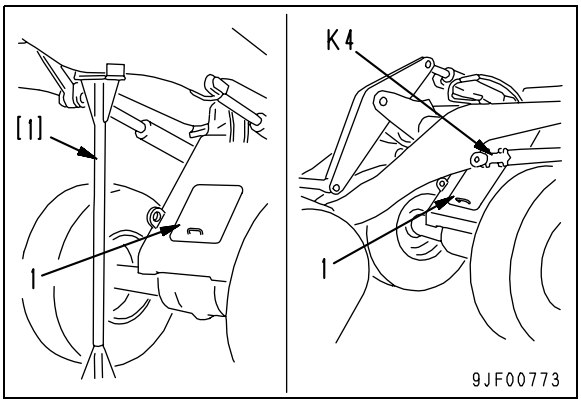
Symbol		Part No.	Part Name
K	4	793-463-1100	Stopper

Stop the machine on horizontal ground and put blocks under the tires.

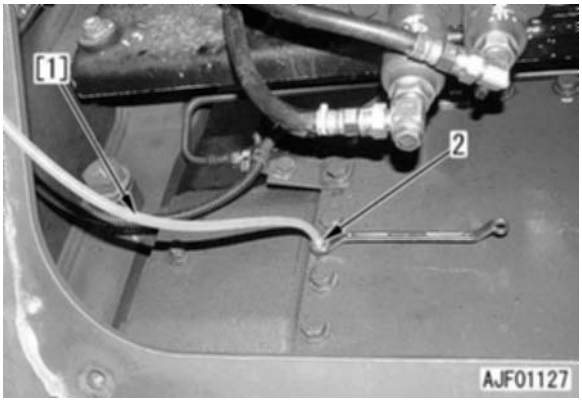
★ If equipment in the brake circuit has been removed and installed, bleed the air from the brake circuit as follows.
★ Use the same procedure for both the front brake circuit and rear brake circuit (2 places each).

1. Raise the boom, set support [1] or boom drop prevention stopper **K4** in position, then remove front cover (1).
2. Increase the pressure in the accumulator and stop the engine.

   Always be sure to apply the safety lock to the work equipment control lever.



3. Remove the cap, insert vinyl hose [1] into bleeder screw (2), and insert the other end in a container.



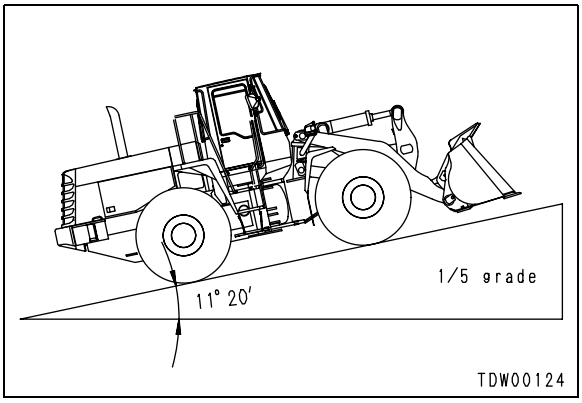
4. Depress the brake pedal, then loosen the bleeder screw (2) and bleed the air.
   ★ Tighten the bleeder screw, then release the brake pedal slowly.
   ★ Add brake oil when necessary during the operation to keep the brake oil tank full.
5. Repeat this operation, and when no more bubbles come out with the fluid from the hose, depress the pedal fully and tighten the bleeder screw while the oil is still flowing.
   ★ Repeat the operation to bleed the air from the other cylinders, and after completing the operation, check the level in the oil tank and add more oil if necessary.
   ★ To bleed the air completely, bleed the air first from the cylinder, which is farthest from the brake pedal.
   ★ After bleeding the air, carry out a brake performance test, then bleed the air again and check that there is no air in the circuit.

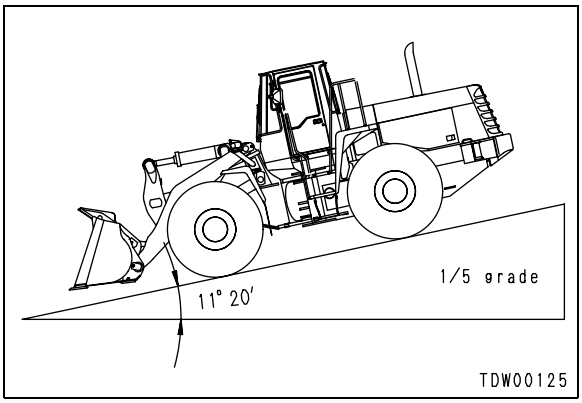
MEASURING PARKING BRAKE PERFORMANCE

★ Measurement conditions
- Tire inflation pressure : Specified pressure
- Road surface : Flat, dry paved road surface with slope of 1/5 grade (11°20').
- Machine : Operating condition
- Operating effort : Operating effort: Max. 392 N {Max. 40 kg}

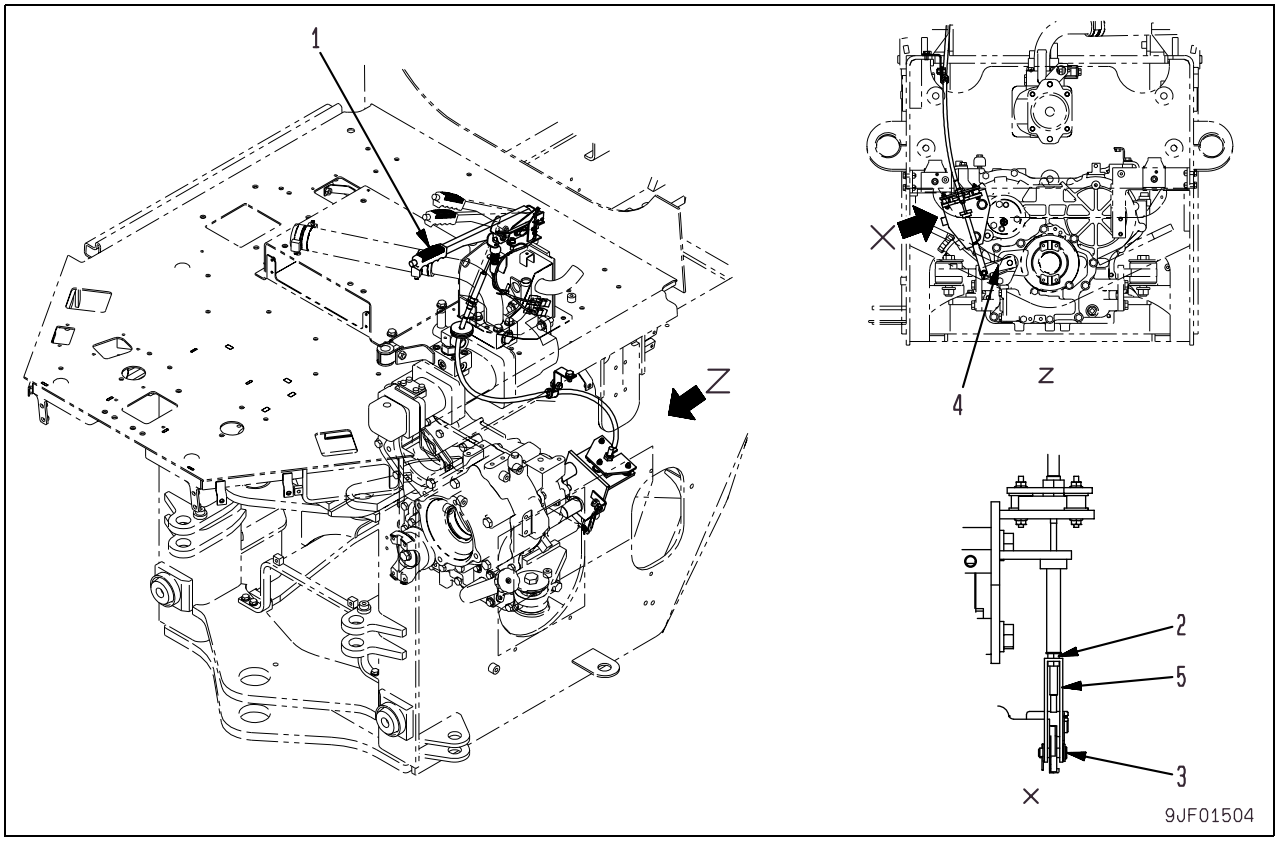
Measurement method

1. Start the engine, set the machine facing in a straight line, then drive the machine up a 1/5 grade slope with the bucket empty.
2. Depress the brake, stop the machine, set the directional lever to the neutral position, then stop the engine.
3. Set the parking brake lever to PARKING, then gradually release the brake pedal and check that the machine is held in position.
   ★ Carry out the measurement in two ways: Once with the machine facing uphill, and once more with the machine facing downhill.





TESTING AND ADJUSTING PARKING BRAKE LINKAGE



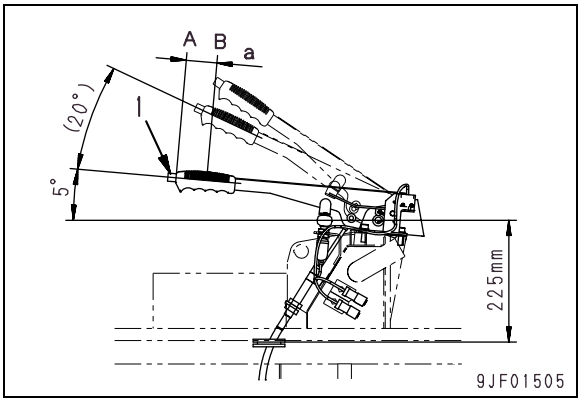
Special tools required

Symbol	Part No.	Part Name
H	79A-264-0091	Push-pull scale

Apply the parking brake and lock the tires with chocks.

Testing

1. Release the parking brake.
   ★ Check that the pawl of parking brake lever (1) is in the lowest position.
2. Set tool **H** to position (B) at a distance of "a" from end (A) of the parking brake lever (excluding the button).
   ★ Distance "a": **55 mm**
3. Pull the parking brake lever with force of about 294 N {30 kg} - 392 N {40 kg}. If it is pulled by 8 teeth or more at this time, check the mounting parts of the parking brake linkage (on both lever side and brake side) for looseness. If the mounting parts are loosened, tighten them and perform the following adjustment.



Adjusting

1. Release the parking brake.
   ★ Check that the pawl of parking brake lever (1) is in the lowest position.
2. Loosen locknut (2) and remove clevis pin (3).
3. Pull parking brake lever (4) in the releasing direction (Move it up by its play, however).

4. Under the above condition, screw in clevis (5) to align its hole with the hole of parking brake lever (4).
5. Install clevis pin (3) and tighten locknut (2).

Locknut:
5.9 - 9.8 Nm {0.6 - 1.0 kgm}

★ Pull the parking brake lever again with force of about 294 N {30 kg} - 392 N {40 kg} and check that it is pulled by 6 - 8 teeth.

MEASURING AND ADJUSTING WORK EQUIPMENT CONTROL LEVER

Special tools required

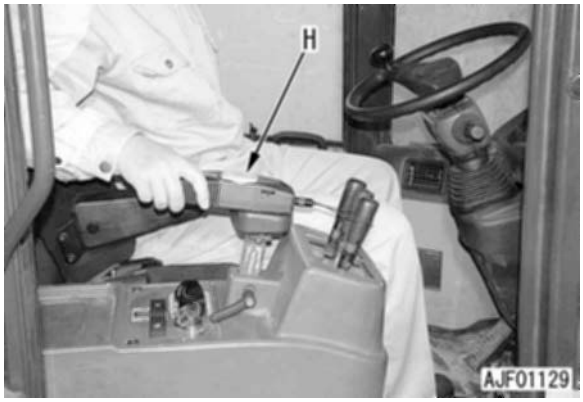
Symbol	Part No.	Part Name
H	79A-264-0021	Push-pull scale

★ Measuring condition
- Engine coolant temperature: Operating range of engine coolant thermometer
- Hydraulic oil temperature:45 - 55°C
- Engine speed: Low idling

Install the safety bar to the frame.

Measurement

1. Operating effort of work equipment control lever
   1) Install tool **H** to the work equipment control lever and secure it in position.
      ★ Install tool **H** to the center of the knob.
      ★ Operate the control lever at the same speed as for normal operations, and measure the minimum value for the effort needed to operate the knob.
      ★ The following photo shows an example of the 2-lever type, which is measured similarly.



2. Travel of work equipment control lever
   1) Measure the travel at each position when operating the work equipment control lever.
      ★ Mark the lever knob and use a scale to measure.
      ★ If the stroke is not within the standard value, check for play in the linkage and wear of the bushing.
      ★ The following photo shows an example of the 2-lever type, which is measured similarly.

TESTING AND ADJUSTING WORK EQUIPMENT HYDRAULIC PRESSURE

Special tools required

Symbol		Part No.	Part Name
C	1	799-101-5002	Analog type hydraulic tester
		790-261-1203	Digital type hydraulic tester
K	4	793-463-1100	Stopper

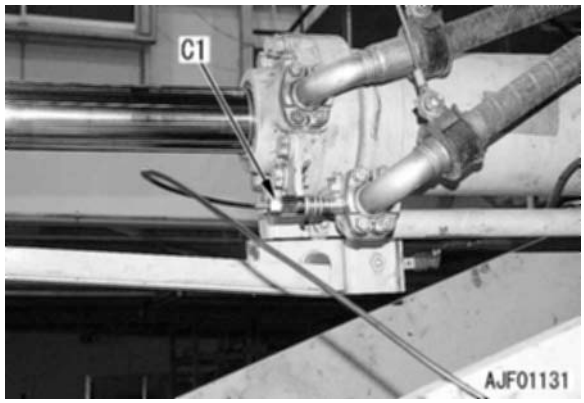
Measuring condition

- Hydraulic oil temperature:45 - 55°C

Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank, then operate the control levers several times to release the remaining pressure in the hydraulic piping.

Measuring

1. Install tool **C1** (39.2 MPa {400 kg/cm^2}) to the oil pressure measurement nipple.

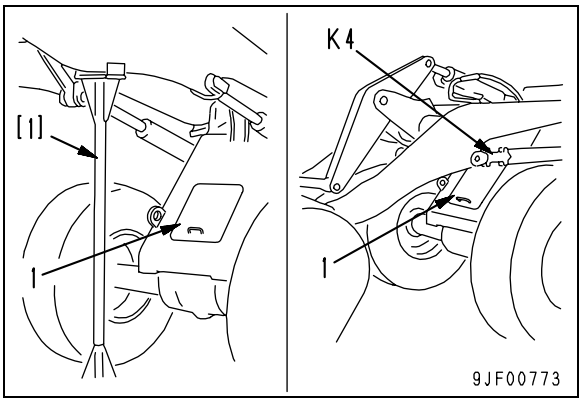


2. Start the engine, raise the lift arm approx. 400 mm, run the engine at high idling, then operate the control lever to tilt back the bucket, and measure the pressure when the relief valve is actuated.

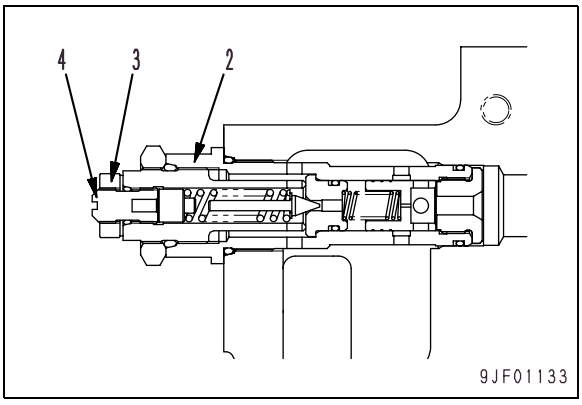
Adjusting

★ Always stop the engine before adjusting the oil pressure.

When carrying out the operation with the boom raised, set support [1] or boom drop prevention stopper **K4** in position before starting the operation.



1. Loosen locknut (3) of relief valve (2), then turn adjustment screw (4) to adjust.
   - ★ Turn the adjustment screw to adjust the set pressure as follows.
     - TIGHTEN to INCREASE pressure
     - LOOSEN to DECREASE pressure
   - ★ Pressure adjustment for one turn of adjustment screw: Approx. 4.2 MPa (Approx. 42.8 kg/cm^2)
   - ★ Do not carry out any adjustment if the relief pressure cannot be measured accurately.



TESTING AND ADJUSTING WORK EQUIPMENT PPC OIL PRESSURE

Special tools required

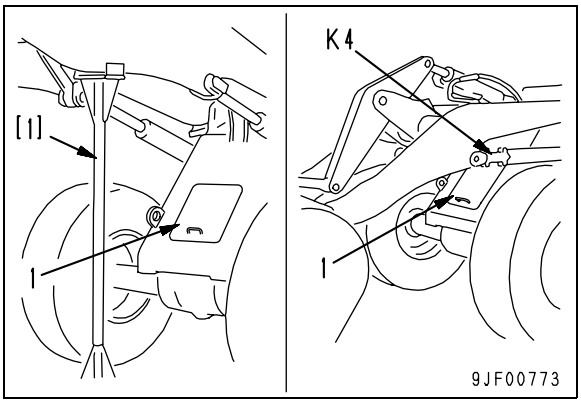
Symbol		Part No.	Part Name
C	1	799-101-5002	Analog type hydraulic tester
		790-261-1203	Digital type hydraulic tester
	6	799-401-3300	Adapter (Size=04)
K	4	793-463-1100	Stopper

Measuring condition

- Hydraulic oil temperature:45 - 55°C

Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then operate the control levers several times to release the pressure in the piping.

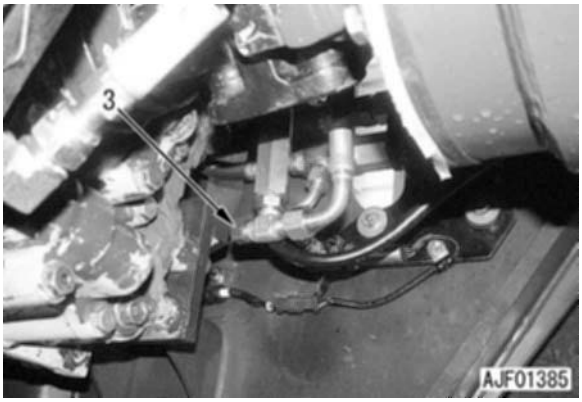
Except for measuring the oil pressure, when carrying out preparatory operations with the boom raised, set support [1] or boom drop prevention stopper **K4** in position before starting the operation.



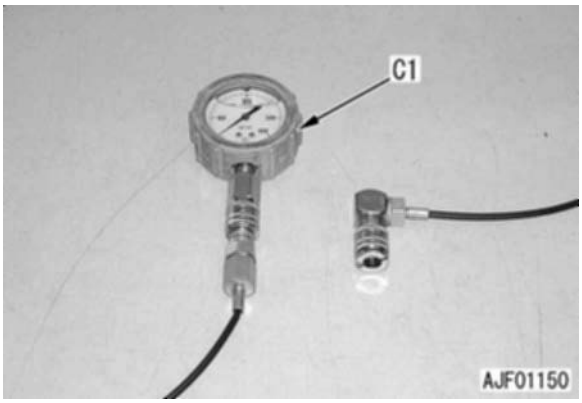
When leaving the operator's seat, apply the safety lock lever to the work equipment control levers securely.

Measuring

1. Measuring PPC valve basic pressure
   1) Remove plug (3) (10 mm, P = 1.25 mm) for measuring the work equipment EPC valve basic pressure (same as low-pressure relief pressure) from under the machine.

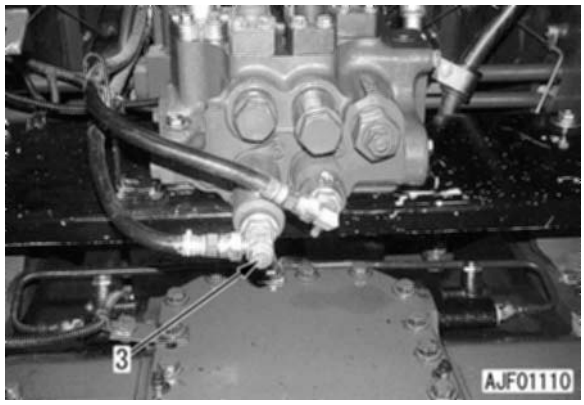


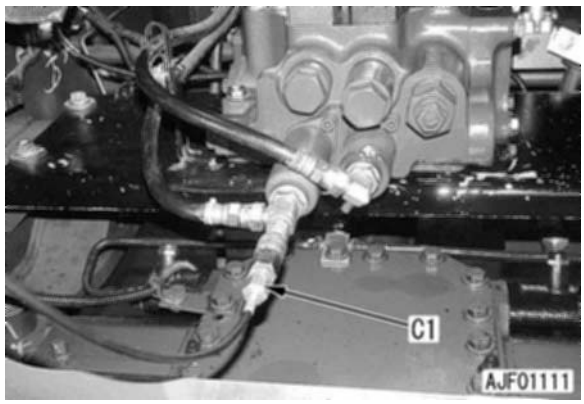
   2) Fit a nipple, then install oil pressure gauge **C1** (5.9 MPa {60 kg/cm^2}).



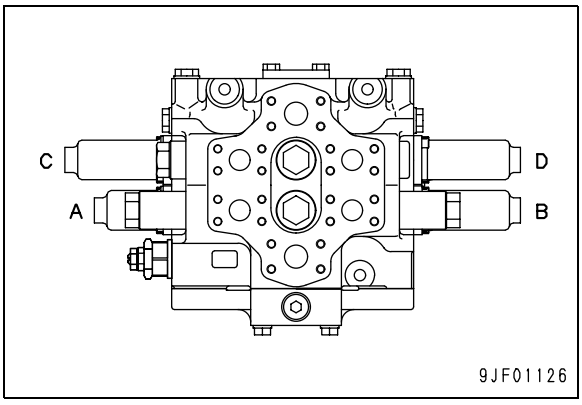
   3) Set the forward-reverse lever in the "N" position, run the engine at full throttle, and measure the low relief pressure.

2. Measuring PPC valve output pressure
   1) Remove the inspection cover of the front frame.
   2) Remove PPC output pressure measurement plug (3) of the circuit to be measured, then install oil pressure gauge **C1** (5.9 MPa {60 kg/cm^2}).





★ A: Bucket TILT
B: Bucket DUMP
C: Boom RAISE
D: Boom LOWER

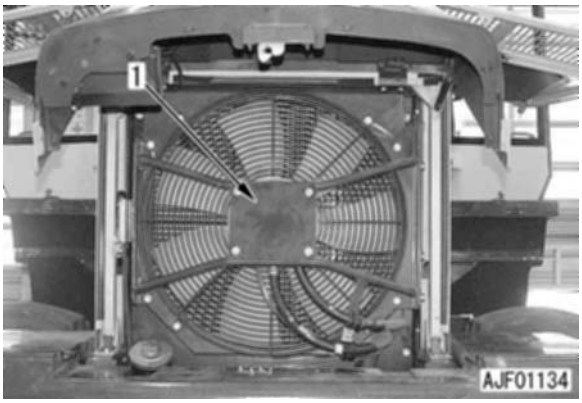


BLEEDING AIR

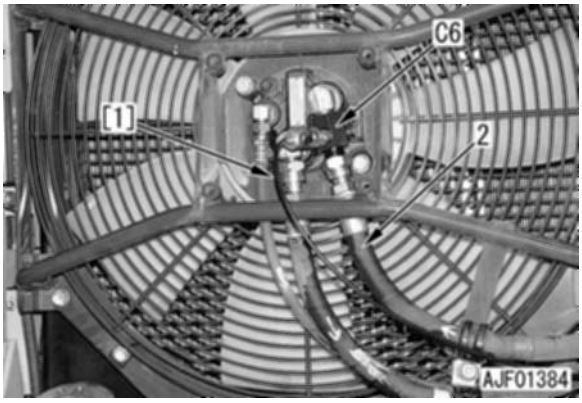
Special tools required

Symbol		Part No.	Part Name
C	6	799-401-3400	Adapter (Size=05)

1. Bleeding air from fan motor circuit
   1) Open the radiator grill, then remove cover (1).



   2) Disconnect hose (2) at the inlet port of the motor, then fit tool **C6** and connect air bleed hose [1].



   3) Start the engine, and when oil comes out from air bleed hose, stop the engine and remove the air bleed hose.

2. Bleeding air from work equipment PPC circuit
   1) Operate each work equipment lever fully and hold it in position to relieve the circuit for approx. 1 minute. Carry out this operation once for each work equipment lever stroke end.

3. Bleeding air from cylinders
   1) Start the engine and run at idling for approx. 5 minutes.
   2) Run the engine at low idling, then raise and lower the lift arm 4 - 5 times in succession.
      ★ Operate the piston rod to a point approx. 100 mm before the end of its stroke. Do not relieve the circuit under any circumstances.
   3) Run the engine at full throttle and repeat Step 2). After that, run the engine at low idling, and operate the piston rod to the end of its stroke to relieve the circuit.
   4) Repeat Steps 2) and 3) to bleed the air from the bucket and steering cylinders.
      ★ When the cylinder has been replaced, bleed the air before connecting the piston rod.

RELEASING REMAINING PRESSURE IN HYDRAULIC CIRCUIT

1. Releasing remaining pressure between each hydraulic cylinder and control valve.
   ★ If the piping between the hydraulic cylinder and the control valve is to be disconnected, release the remaining pressure from the circuit as follows.
   1) Stop the engine.
   2) Loosen the oil filler cap slowly to release the pressure inside the tank.
   3) Operate the control levers.
      ★ When the levers are operated 2 - 3 times, the pressure stored in the PPC accumulator is removed. Start the engine, run at low idling for approx. 5 seconds to charge the accumulator, then stop the engine and operate the control levers.
      ★ Repeat the above operation 2 - 3 times to release all the remaining pressure.

2. Releasing remaining pressure in brake accumulator circuit
   ★ If the piping between the ACC charge valve and brake accumulator, between the ACC charge valve and parking brake valve, and between the accumulator and brake valve is to be disconnected, release the remaining pressure from the circuit as follows.
   1) Stop the engine.
   2) Depress the brake pedal at least 100 times to release the pressure inside the brake accumulator circuit.

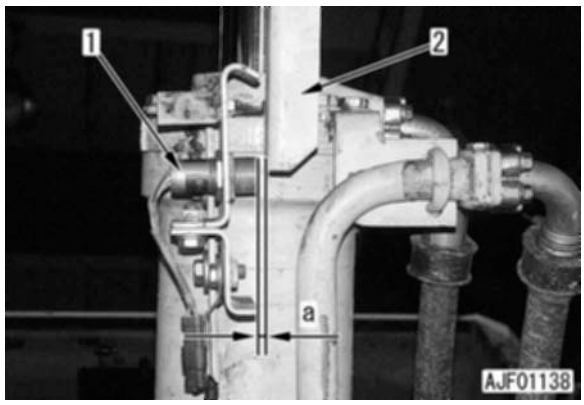
3. Releasing remaining pressure in PPC accumulator circuit
   ★ If the piping between the PPC accumulator and PPC valve is to be disconnected, release the remaining pressure from the circuit as follows.
   1) Operate the control lever 2 - 3 times to release all the remaining pressure from the circuit.

TESTING AND ADJUSTING BUCKET POSITIONER

★ Engine coolant temperature: Operating range of engine coolant thermometer
★ Hydraulic oil temperature: 45 - 55 °C

Testing

1. Stop the engine and check that clearance **a** between proximity switch (1) and sensing bar (2) is in the standard range.
   ★ Clearance **a**: 3 - 5 mm

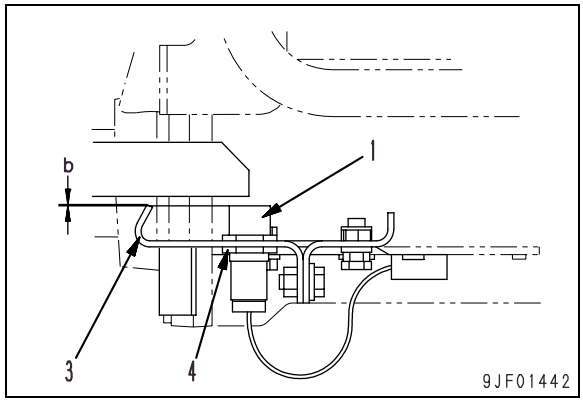


2. Run the engine at low idling and check the operating point. (Measure 3 times and obtain the average.)

Adjusting

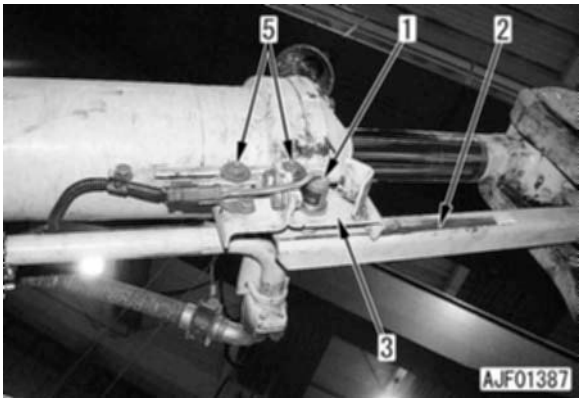
1. Adjusting clearance.
   1) Adjust and secure clearance **b** between the tip of switch protector (3) and the sensitive surface of the switch to the standard range with switch nuts (4).
   ★ Standard clearance **b**: 0.5 - 1.0 mm

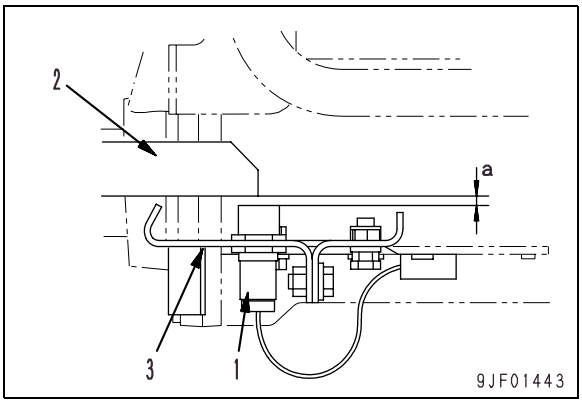
Mounting nut:
14.7 - 19.6 Nm {1.5 - 2.0 kgm}



2) Adjust and secure clearance **a** between the sensitive surface of proximity switch (1) and sensing bar (2) to the standard range with the shim and mounting bolt of the proximity switch bracket.
   ★ Clearance **a**: 3 - 5 mm
   ★ Adjust sensing bar (2) with the shim so that clearance **a** will be in the standard range through the stroke of the sensing bar.

2. Adjusting installing position (stopping position).
   1) Lower the bucket to the ground and set it to a desired digging angle, then return the lever to the holding position and stop the engine.
   2) Loosen 2 mounting bolts (5) and adjust the position of switch protector (3) so that the rear end of sensing bar (2) will be at the center of the sensitive surface of proximity switch (1), and then tighten 2 mounting bolts (5).
   3) Check again that clearance (a) between proximity switch (1) and sensing bar (2) is 3 - 5 mm.
      • The installing position may be checked by checking the operation of the pilot lamp of the proximity switch with the starting switch at the ON position. (When the pilot lamp goes off, the bucket stops.)



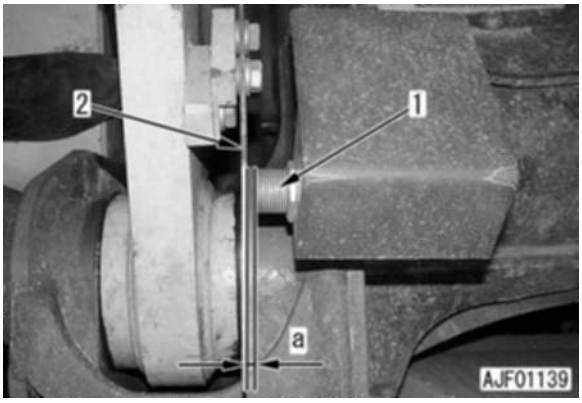


★ After adjusting, start the engine and operate the bucket control lever to check that the bucket positioner operates at the desired position.

TESTING AND ADJUSTING OF BOOM KICK-OUT

Testing

1. With the engine stopped, check that clearance **a** between switch (1) and plate (2) is the standard value.
   ★ Clearance **a**: 3 - 5 mm



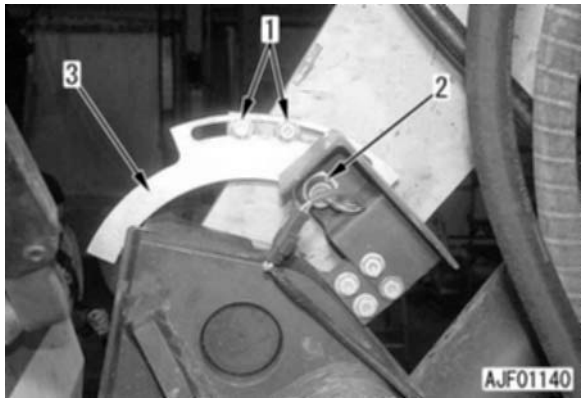
2. Start the engine, run at high idling, and check the actuation point.
   (Check three times and take the average.)

Adjusting

1. Raise the boom to the desired height.

   Always be sure to apply the safety lock to the work equipment control lever.

2. Loosen 2 bolts (1) and adjust the position of the plate so that the center of switch (2) will be at the lower end of plate (3), and then tighten bolts (1).



3. Adjust the switch so that clearance **a** between the sensing surface of the switch and plate (2) is the standard value, then secure in position.

   Switch mounting nut:
   14.7 - 19.6 Nm {1.5 - 2.0 kgm}

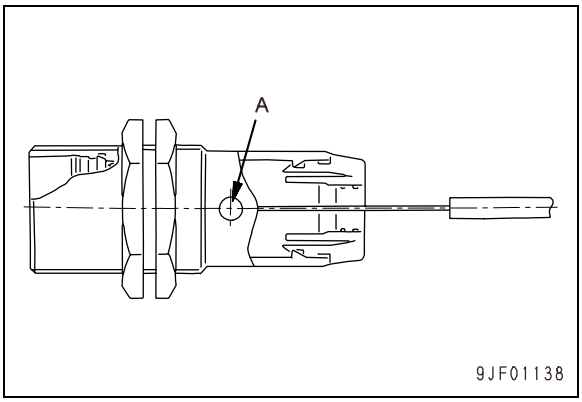
   ★ After adjusting, operate the work equipment and check that the boom kickout is actuated at the desired position.
   ★ Standard clearance **a**: 3 - 5 mm

CHECKING PROXIMITY SWITCH ACTUATION DISPLAY LAMP

Proximity switch actuation display lamp (red)

A display lamp is installed to the proximity switch to show the actuation status, and so use this when adjusting.

- A: Actuation display lamp (red)

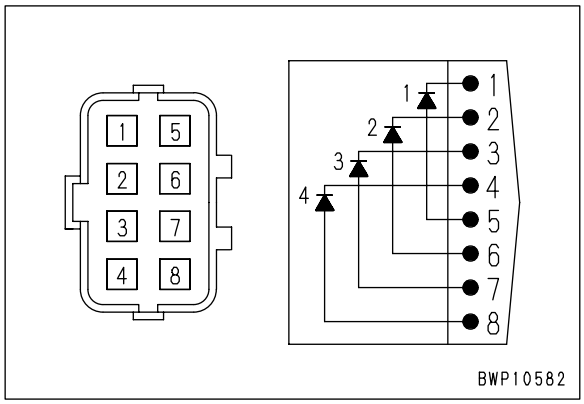


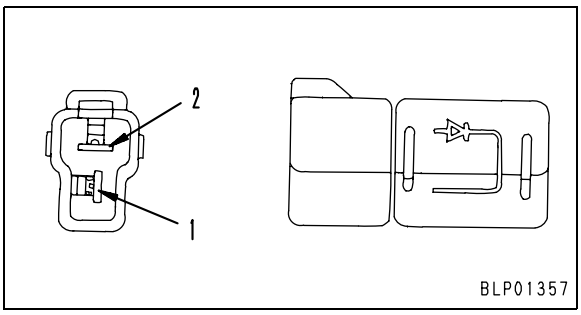
Proximity switch	Relative position of detector and detection surface of proximity switch	Actuation display lamp	Remarks
Bucket positioner	In contact	ON	Actuated when center of switch approaches
	Separated	OFF	
Boom kick-out	In contact	ON	Actuated when center of switch separates
	Separated	OFF	

PROCEDURE FOR CHECKING DIODE

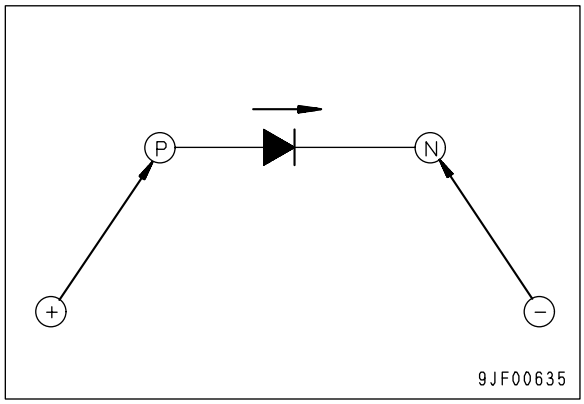
★ Use the following procedure to check the centralized diode (8-pin) and theindividual diode (2-pin).

★ The direction of continuity of the individual diode is marked on the surface of the diode as shown in the diagram below.





1. When using digital tester
   1) Switch to the diode range and check the display value.
      ★ With a normal tester, the internal battery voltage is displayed.
   2) Put the red (+) end of the test pin in contact with the anode (P) of the diode, and the black (-) end in contact with the cathode (N), and check the display.
   3) Judge the condition of the diode from the display value.
      - Display value does not change: No continuity (defective)
      - Display value of changes: There is continuity (normal) (see ★)
      ★ In the case of silicon diodes, a value between 460 and 600 is displayed.



2. When using analog tester
   1) Set to the resistance range.
   2) When doing the following, check the deflection of the indicator.
      i) Put the red (+) end of the test pin in contact with the anode (P) of the diode, and the black (-) end in contact with the cathode (N).
      ii) Put the red (+) end in contact with the cathode (N) and the black (-) end of the test pin in contact with the anode (P) of the diode.
   3) Judge the condition of the diode from the deflection of the indicator.
      - If the indicator does not deflect in Step i), but it deflects in Step ii): Normal (note that the amount of the deflection (resistance value) differs according to the type of tester and the selection of the measurement range.)
      - If the indicator deflects in both Step i) and Step ii): Defective (internal short circuit)
      - If the indicator does not deflect in either Step i) or Step ii): Defective (internal disconnection)

SPECIAL FUNCTIONS OF MACHINE MONITOR

Normal functions and special functions of machine monitor

The machine monitor is equipped with normal functions and special functions.

Various items of data are displayed on the character display in the middle of the machine monitor. Depending on the internal setting of the machine monitor, the display items are divided into automatic display items and items displayed when the machine monitor switches are operated.

1. Normal functions: Operator mode
   Functions for which the content is normally displayed or which can be used displayed and operated by the operator operating the switches.
2. Special functions 1: Service Mode 1
   Functions which the serviceman can display and operate with the special switches to carry out inspection, maintenance, and troubleshooting.
3. Special functions 2: Service Mode 2
   Special operations performed by the serviceman or at the factory.

Operator mode	
1	Service meter, time display (Load meter specification)
2	(Load meter function)
3	Odometer display function
4	HST selection function
5	Filter, oil replacement interval display function
6	(Phone No. input display function)
7	Language selection function
8	(Monitor brightness adjusting function)
9	(Clock adjusting function)
10	Action code display function
11	Failure code display function

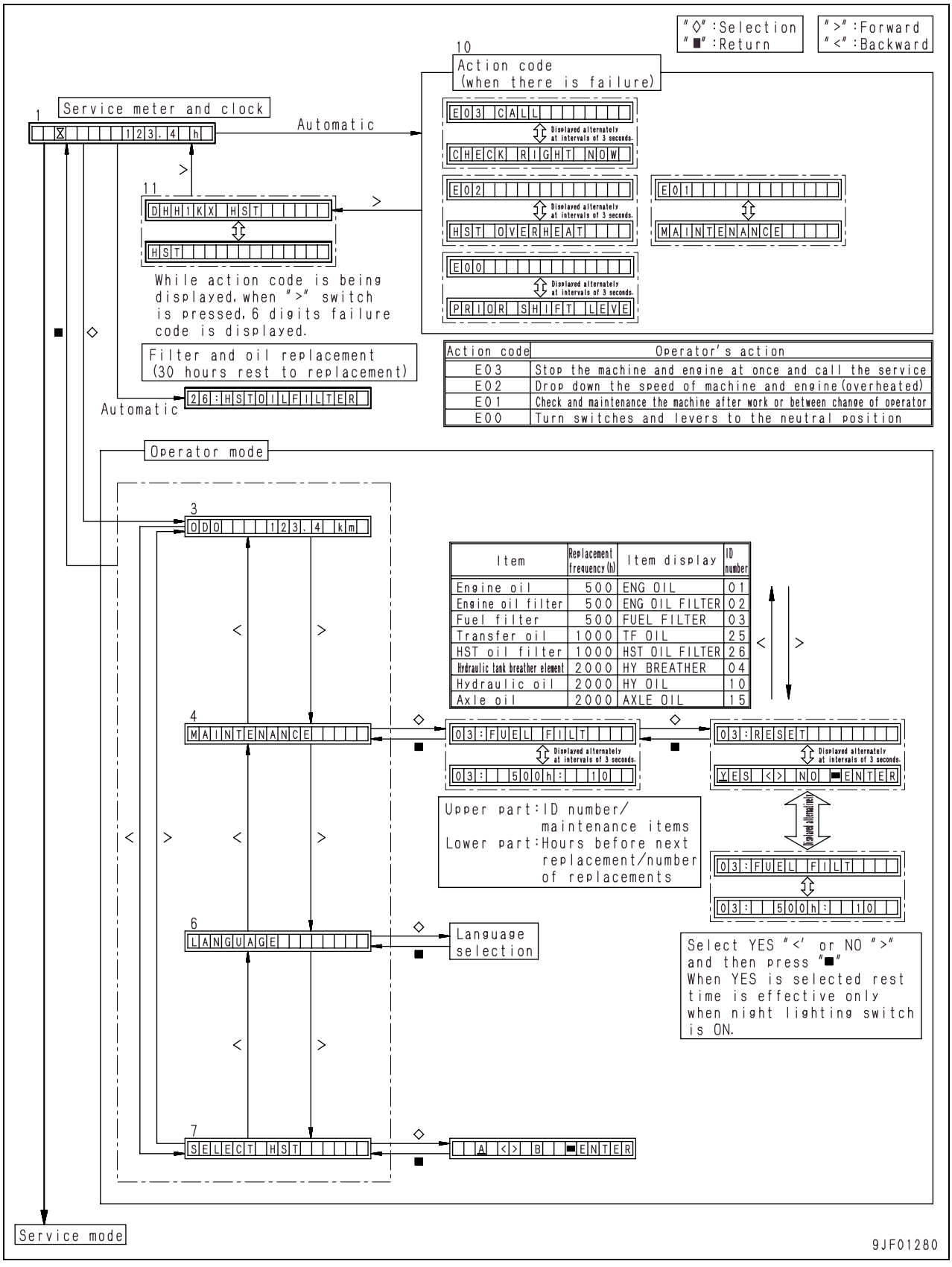
Service mode 1	
12	Electrical system trouble data display function
13	Mechanical system trouble data display function
14	Machine data monitoring function
15	(Adjusting function)
16	Filter, oil replacement time setting function
17	Option selection function
18	(Machine serial No. setting function)
19	Initialize function

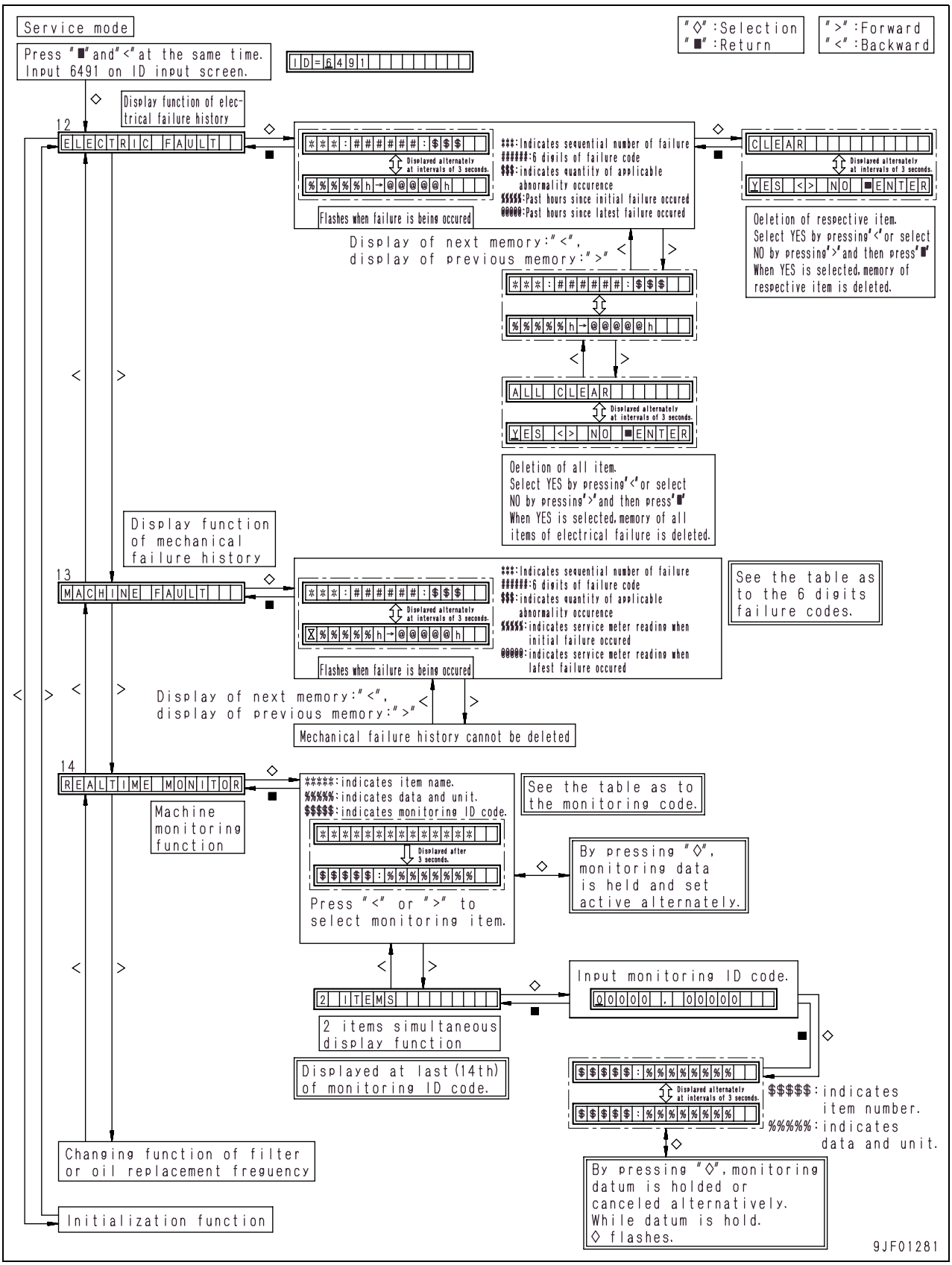
Service mode 2	
20	Service meter setting function
21	Odometer setting function

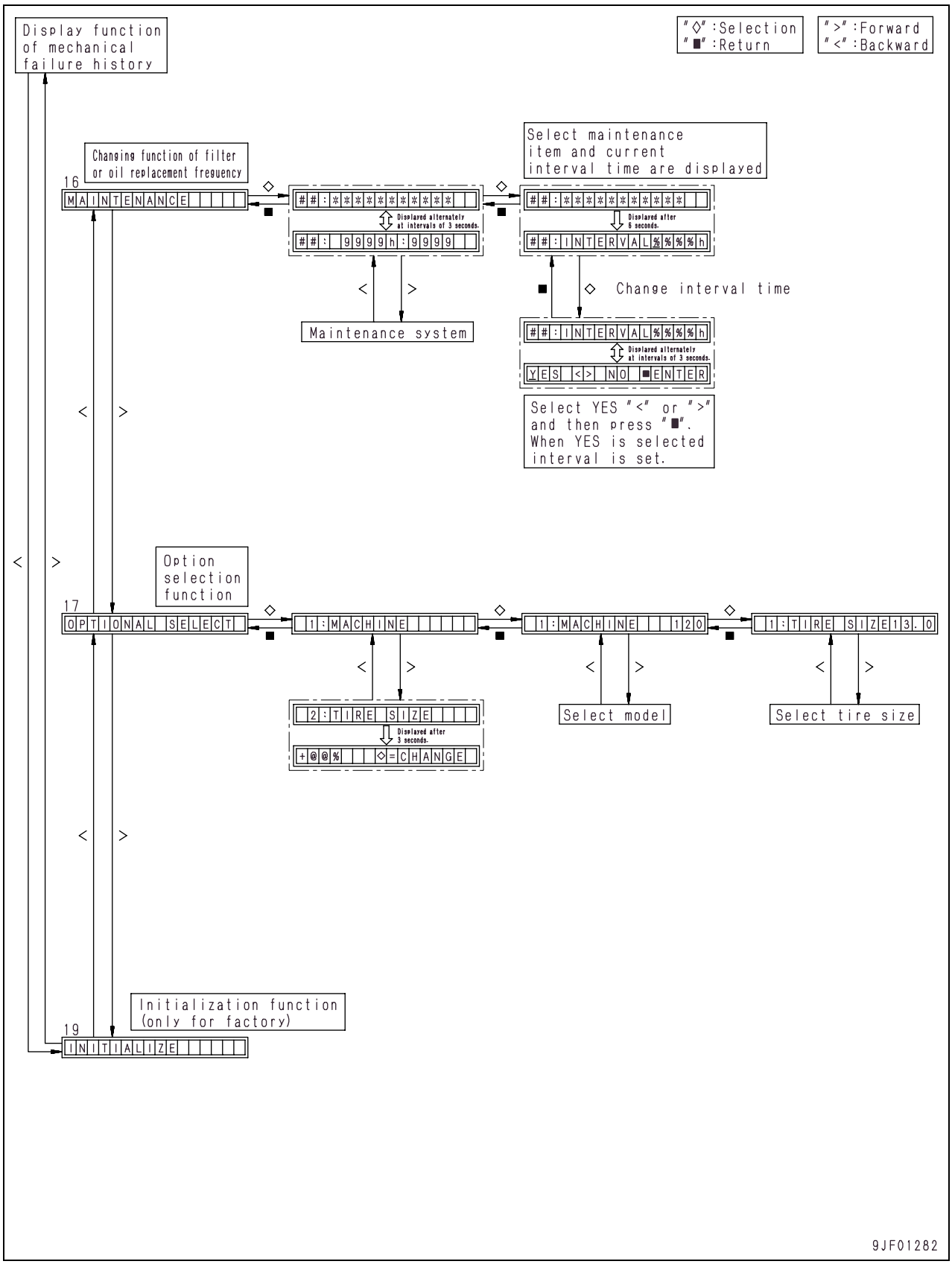
( ): Only load meter specification.

FLOW OF EACH MODE AND FUNCTION

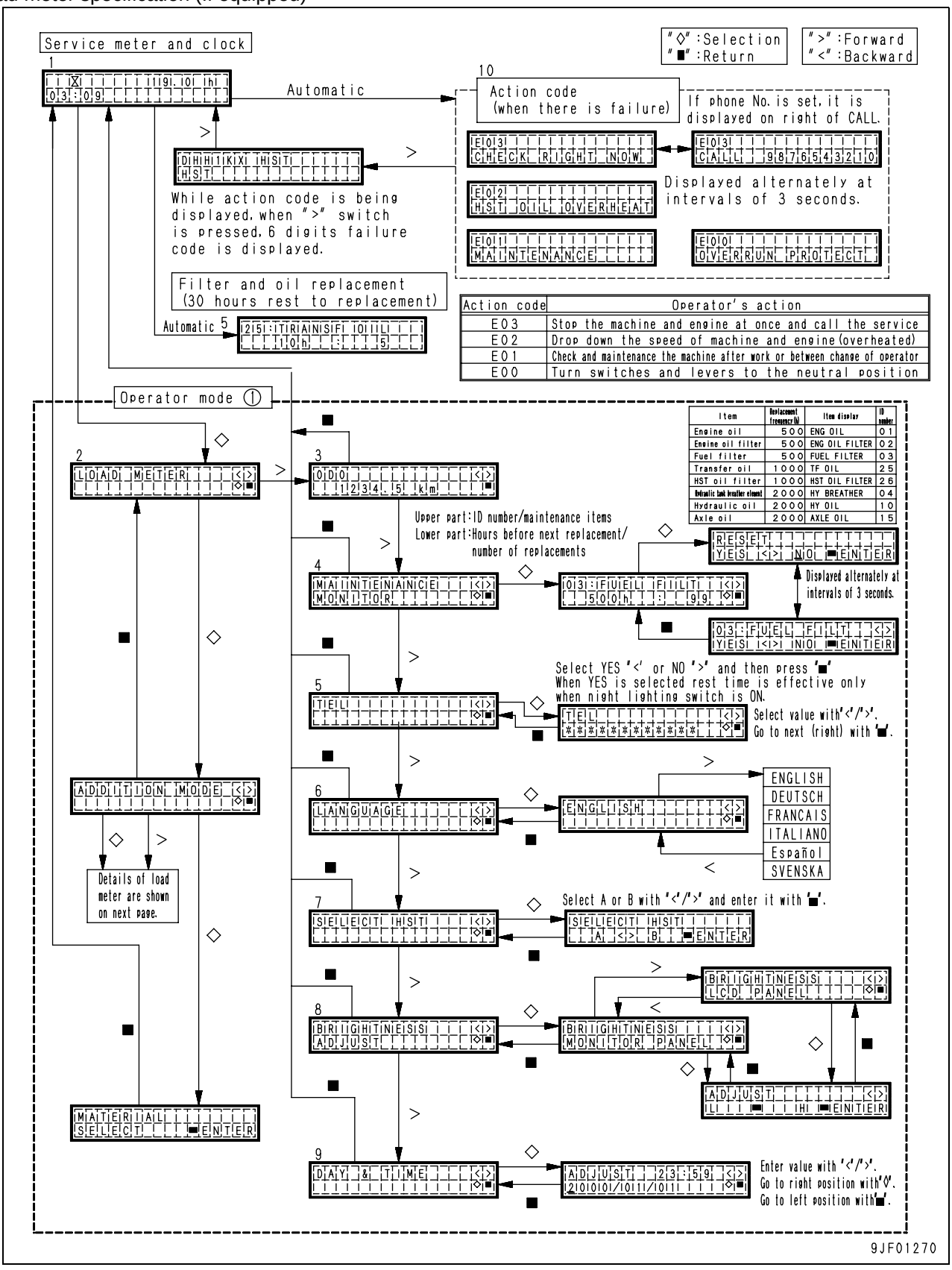
Speed meter specification (STD)




Service mode
Press "■" and "<" at the same time.
Input 6491 on ID input screen.
ID=6491
"◇" :Selection
"■" :Return
">" :Forward
"<" :Backward
Display function of electrical failure history
12
ELECTRIC FAULT
***:######:$$$
%%%%%h→@@@@@h
Displayed alternately at intervals of 3 seconds.
***:Indicates sequential number of failure
######:6 digits of failure code
$$$:indicates quantity of applicable abnormality occurence
%%%%%:Past hours since initial failure occured
@@@@@:Past hours since latest failure occured
Flashes when failure is being occured
Display of next memory:"<",
display of previous memory:">"
CLEAR
YES <> NO ■ENTER
Oeletion of respective item.
Select YES by pressing'<'or select NO by pressing'>'and then press'■'
When YES is selected, memory of respective item is deleted.
ALL CLEAR
Oeletion of all item.
Select YES by pressing'<'or select NO by pressing'>'and then press'■'
When YES is selected, memory of all items of electrical failure is deleted.
Display function of mechanical failure history
13
MACHINE FAULT
%%%%%h→@@@@@h
%%%%%:indicates service meter reading when initial failure occured
@@@@@:indicates service meter reading when latest failure occured
See the table as to the 6 digits failure codes.
Mechanical failure history cannot be deleted
14
REALTIME MONITOR
Machine monitoring function
*****:indicates item name.
%%%%%:indicates data and unit.
$$$$$:indicates monitoring ID code.
Displayed after 3 seconds.
Press "<" or ">" to select monitoring item.
See the table as to the monitoring code.
By pressing "◇", monitoring data is held and set active alternately.
2 ITEMS
Input monitoring ID code.
0.0000
2 items simultaneous display function
Displayed at last (14th) of monitoring ID code.
$$$$$:indicates item number.
%%%%%:indicates data and unit.
By pressing "◇", monitoring datum is holded or canceled alternatively.
While datum is hold.
◇ flashes.
Changing function of filter or oil replacement freguency
Initialization function
9JF01281


Display function of mechanical failure history
"◇" :Selection
"■" :Return
">" :Forward
"<" :Backward
Changing function of filter or oil replacement frequency
Select maintenance item and current interval time are displayed
16
MAINTENANCE
##:**********
Displayed alternately at intervals of 3 seconds.
##: 9999h:9999
Displayed after 6 seconds.
##:INTERVAL%%%%h
Maintenance system
Change interval time
##:INTERVAL%%%%h
Displayed alternately at intervals of 3 seconds.
YES <> NO ■ENTER
Select YES "<" or ">" and then press "■". When YES is selected interval is set.
Option selection function
17
OPTIONAL SELECT
1:MACHINE
1:MACHINE 120
1:TIRE SIZE 13.0
2:TIRE SIZE
Displayed after 3 seconds.
+@@% ◇=CHANGE
Select model
Select tire size
Initialization function (only for factory)
19
INITIALIZE
9JF01282

Load meter specification (If equipped)



Operator mode

★ Data are displayed endlessly by operating [>], [<], [◇], or [■] switches.

★ If any failure occurs, the screen changes automatically to the [Action code display function], regardless of the current screen.

★ If any switch is not operated for 30 seconds, regardless of the current screen, the screen changes automatically to the following screen.
- [Service meter/(Time display) function]: While any failure is not occurring
- [Suction code display function]: While any failure is occurring

Service mode 1

★ Functions are changed endlessly by operating [>], [<], [◇], or [■] switches.

★ Once the ID is input and entered, it is effective until the starting switch is turned to the OFF position.

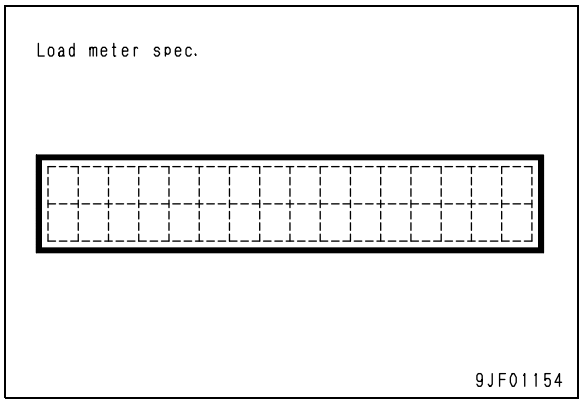
Service mode 2

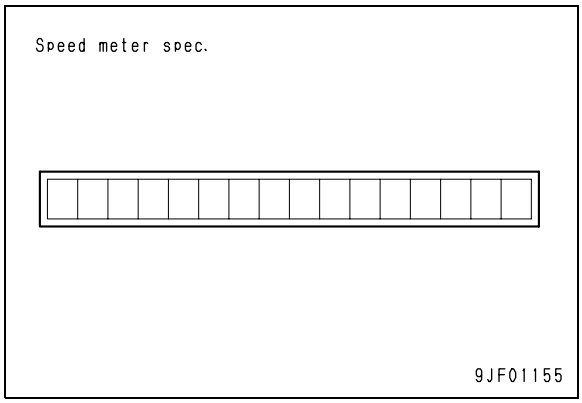
★ Functions are changed by operating [>], [<], [◇], or [■] switches.

Character display section

Up to 16 of the following characters are displayed on the character display section to show information.

1. Arabic numerals: 1, 2, 3, ---
2. Small letters: a, b, c, ---
3. Capital letters: A, B, C, ---
4. Symbols: @, ¥, $, ---
5. Special letters

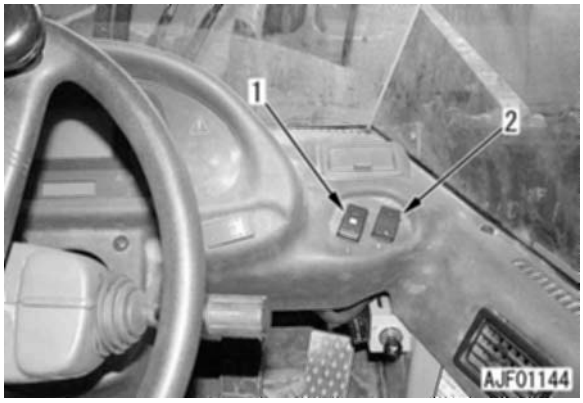




Control switches

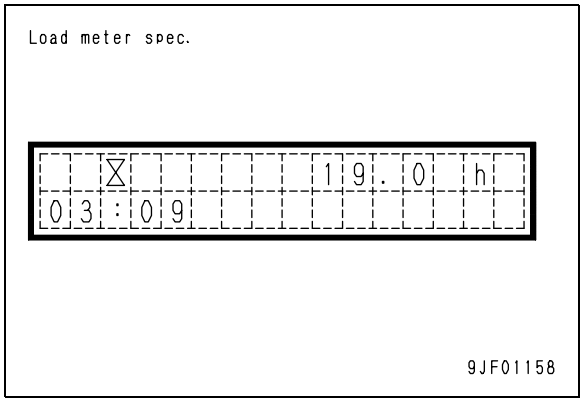
All display of the machine monitor is controlled with machine monitor mode selector switches (1) and (2). The buttons of each switch have the following functions.

1. [◇]: Decision and execution
2. [■]: Cancellation, resetting, decision (on only YES/NO screen)
3. [>]: Right, next, going
4. [<]: Left, previous, returning

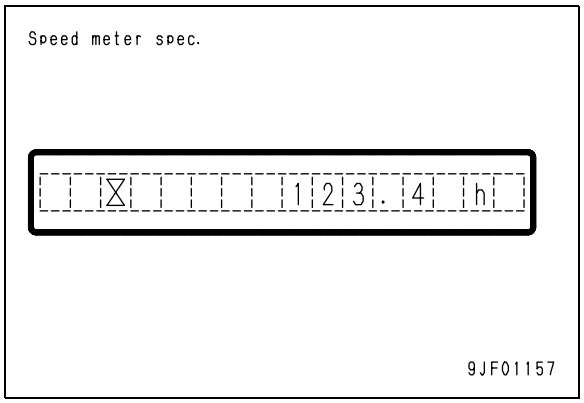


OPERATION AND DISPLAY IN OPERATOR MODE

1. Display of service meter and clock
   [Load meter specification]
   If the starting switch is turned to the ON position, the service meter is displayed on the upper line and the time is displayed on the lower line.

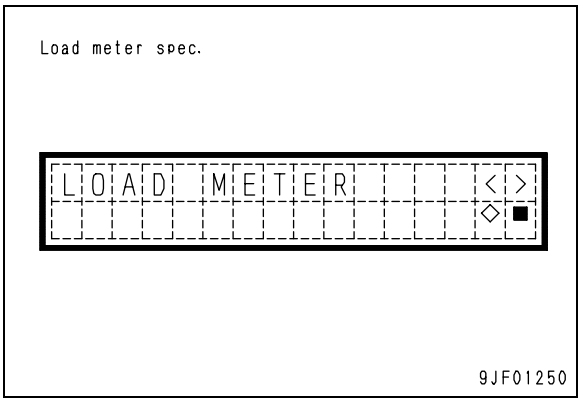


   [Speedometer specification]
   If the starting switch is turned to the ON position, the service meter is displayed.

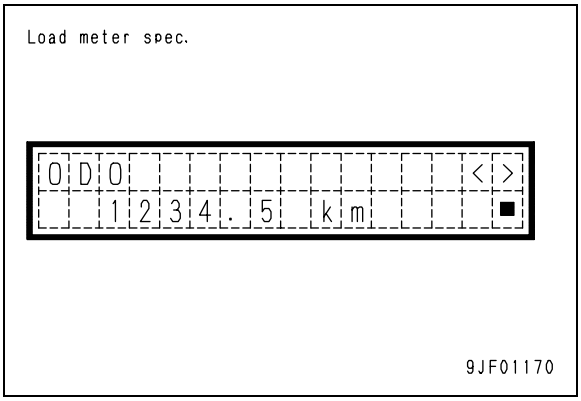


2. Load meter function
   [Only load meter specification]

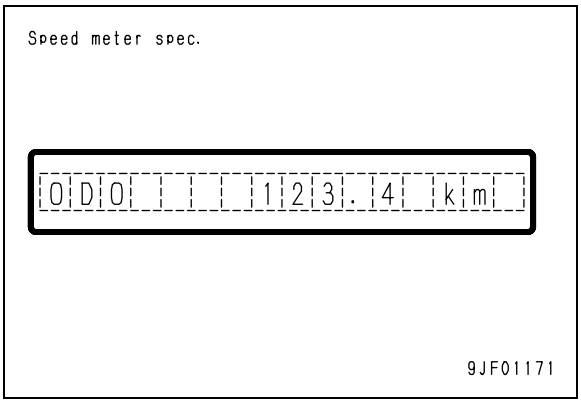
★ For the flow of the load meter function, see "Flow of each mode and function" above. For details of operation of the load meter, see OPERATION MANUAL, "Handling of load meter".



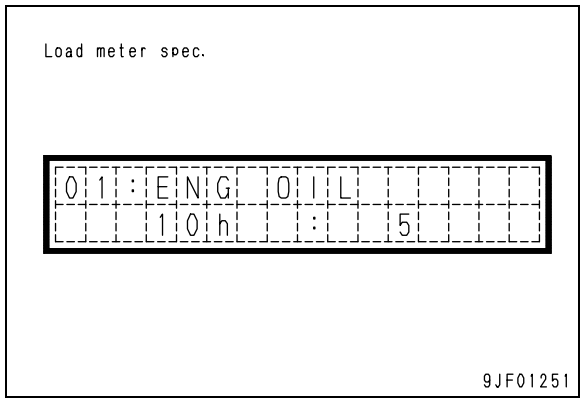
3. Odometer display function
   [Load meter specification]
   Press the [◇] switch to display "Load meter", and then display the odometer with the [>] or [<] switch.

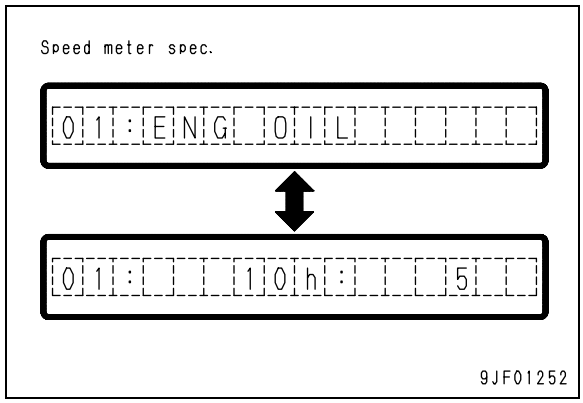


   [Speedometer specification]
   Press the [◇] switch, and the odometer is displayed.

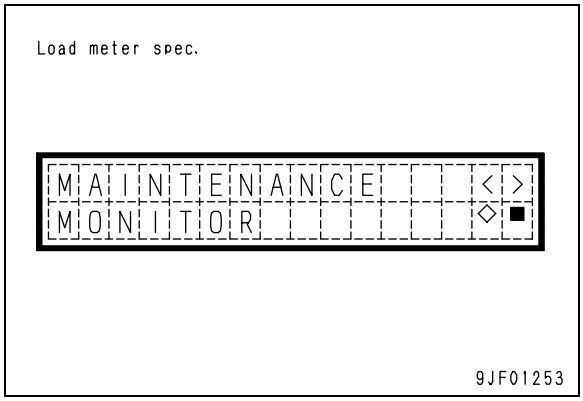


4. Filter and oil replacement period display function
   1) Filter and oil replacement period display (Automatic display)
      When the starting switch is turned to the ON position (after the system check is finished), the filters and oils which need to be replaced soon are displayed for about 30 seconds. At this time, the maintenance caution lamp flashes or lights up to press the operator for maintenance.

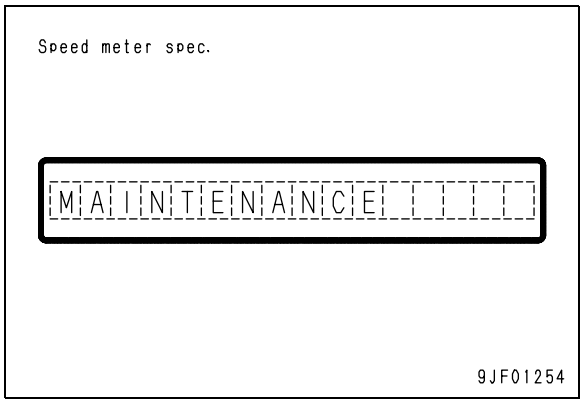




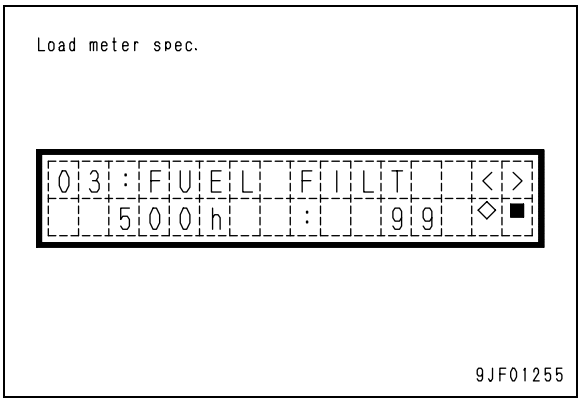
2) Resetting replacement period
After various filters and oils are replaced, their replacement periods can be reset with the switches.
[Load meter specification]
i) Press the [◇] switch to display "Load meter", and then display "Maintenance monitor" with the [>] or [<] switch.



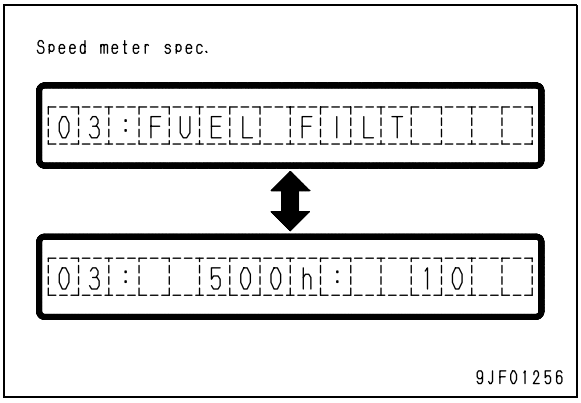
[Speedometer specification]
i) Press the [◇] switch to display the odometer, and then display "Maintenance monitor" with the [>] or [<] switch.



[Load meter specification]
i) Press the [◇] switch, and an item is displayed on the upper line. The replacement period is displayed at the center of the lower line and the integrated number of replacement times of the displayed item is displayed at the right of the lower line.
ii) Select the item to be reset with the [>] or [<] switches.



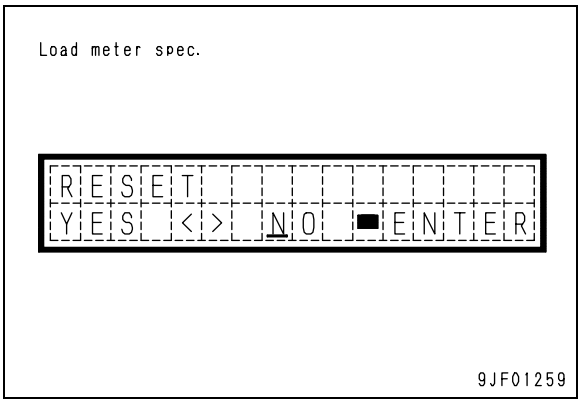
[Speedometer specification]
i) Press the [◇] switch, and an item is displayed. Then, the replacement period is displayed at the center and the integrated number of replacement times of the displayed item is displayed at the right.
ii) Select the item to be reset with the [>] or [<] switches.

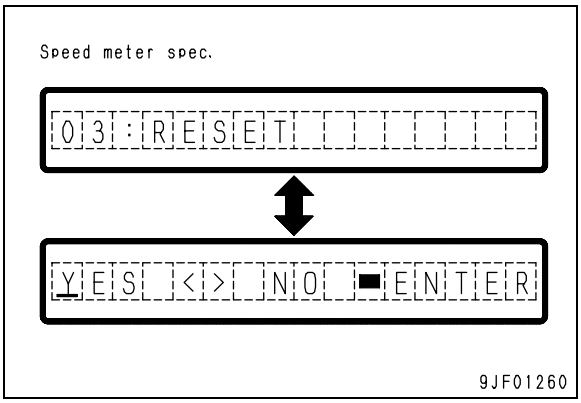


[Common to load meter specification and speedometer specification]

i) Press the [◇] switch, and the letters of "RESET" and an "item to be reset" are displayed.

★ When resetting the replacement period, select "YES" with the [>] or [<] switch and press the [■] switch. Then, the replacement period is reset and the screen returns to the previous screen. (When not resetting, select "NO" and press the [■] switch. Then, the screen returns to the previous screen.)





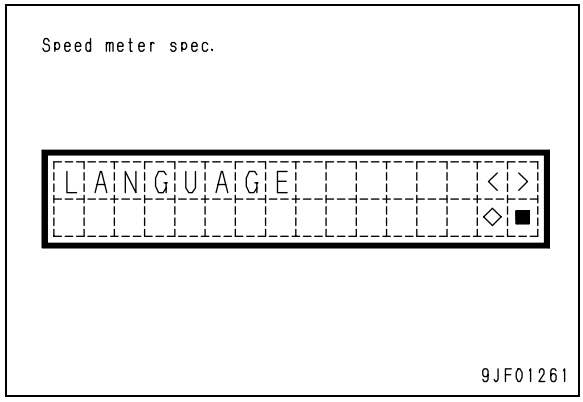
ii) When resetting the replacement period of another item, repeat the procedure from step 3].

★ When finishing the operation, press the [■] switch twice or turn the starting switch to the OFF position.

5. Language selecting function

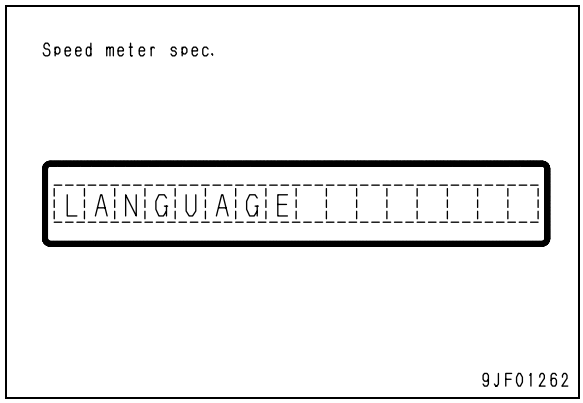
[Load meter specification]

1) Press the [◇] switch to display "Load meter", and then display "Select language" with the [>] or [<] switch.



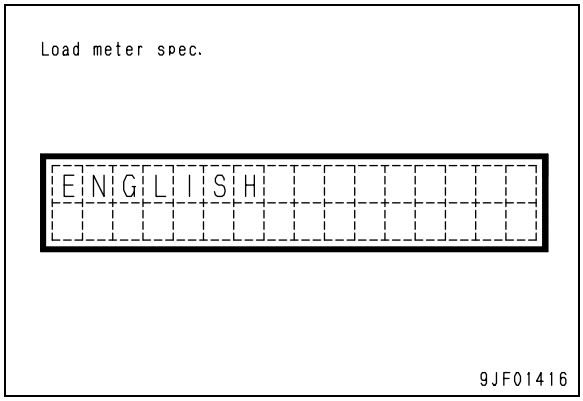
[Speedometer specification]

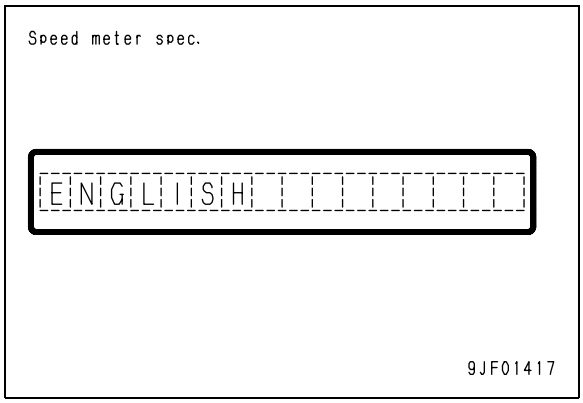
1) Press the [◇] switch to display the odometer, and then display "Select language" with the [>] or [<] switch.



[Common to load meter specification and speedometer specification]

1) Press the [◇] switch, and the current language is displayed.
2) Select a language with the [>] or [<] switch.



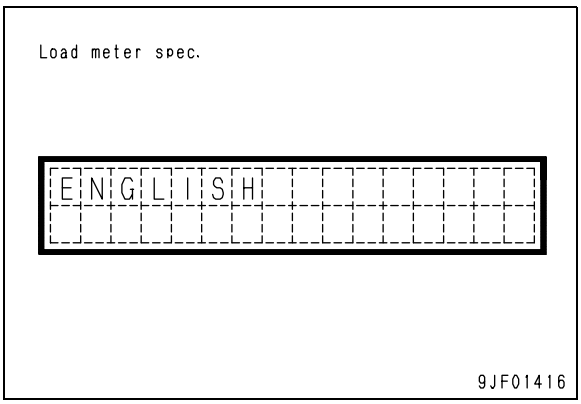


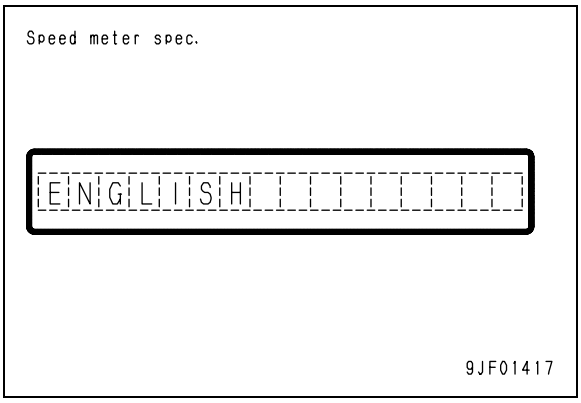
- You can select English, Japanese, German, French, Italian, Spanish, or Swedish.

Language	Display
English	ENGLISH
Japanese	JAPANESE
German	DEUTSCH
French	FRANCAIS
Italian	ITALIANO
Spanish	Español
Swedish	SVENSKA

3) After selecting a language, press the [◇] switch.

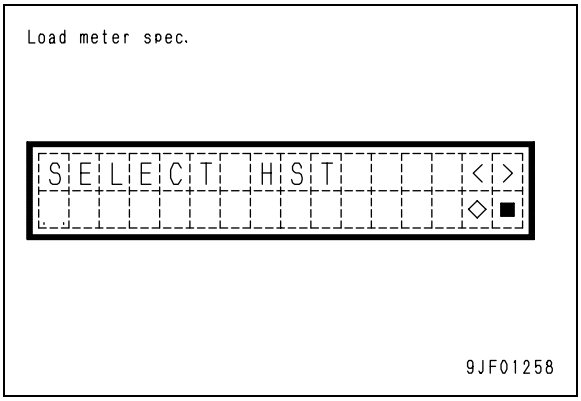
★ When entering the selected language, select "YES" with the [>] or [<] switch and press the [■] switch. Then, the language is entered and the screen returns to the previous screen. (When not entering the selected language, select "NO" and press the [■] switch. Then, the screen returns to the previous screen.)



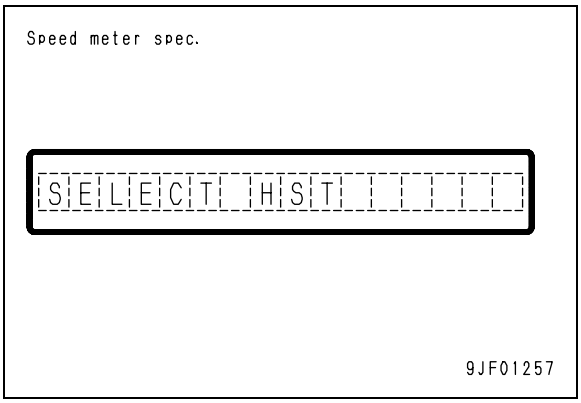


★ When finishing the operation, press the [■] switch twice or turn the starting switch to the OFF position.

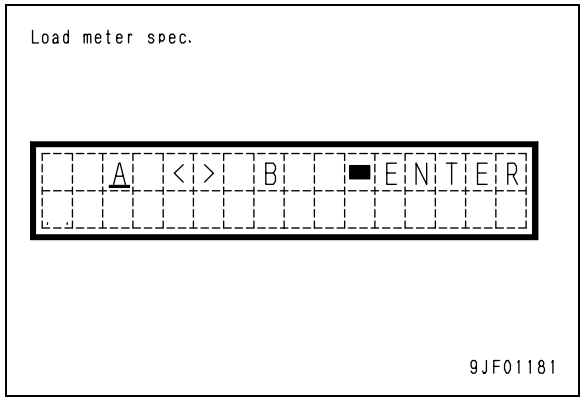
6. HST selecting function
   [Load meter specification]
   1) Press the [◇] switch to display "Load meter", and then display "Select HST" with the [>] or [<] switch.

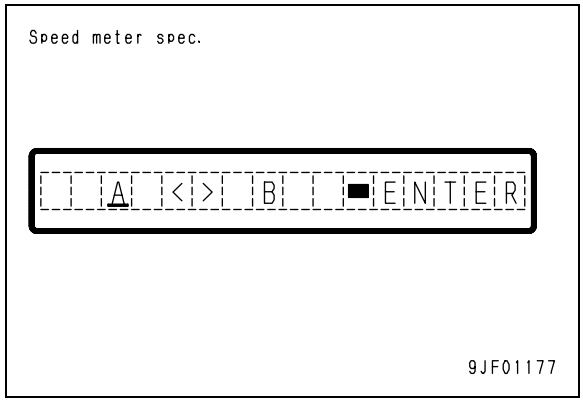


   [Speedometer specification]
   1) Display the odometer, and then display "Select HST" with the [>] or [<] switch.

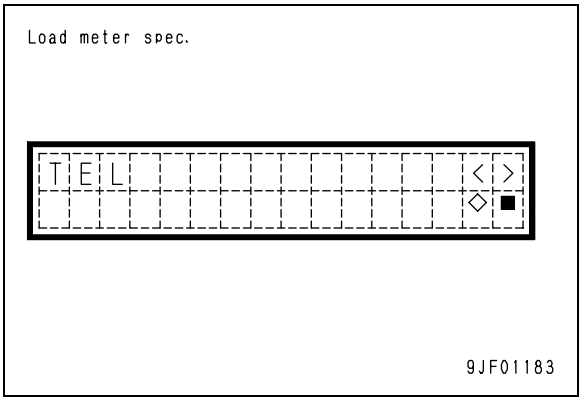


   [Common to load meter specification and speedometer specification]
   1) Press the [◇] switch, and the current HST is displayed.
   2) Select "A" or "B" with the [>] or [<] switch.
   3) Press the [■] switch, and the selected HST is entered and the screen returns to the previous screen.

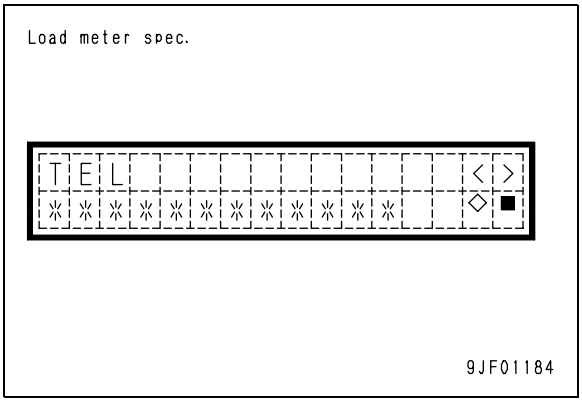




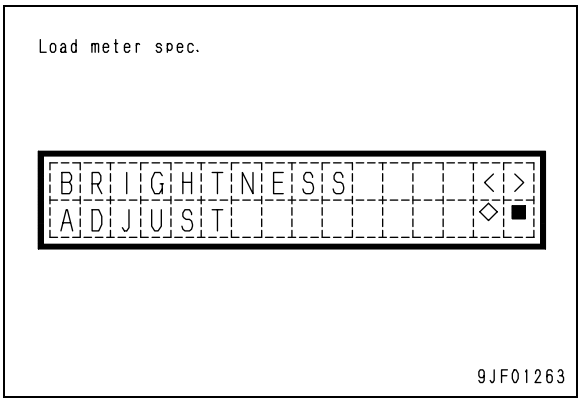
7. Phone No. display function
   [Only load meter specification]
   1) If the error of action code "E03" occurs, the letters of "CALL" and a phone No. are displayed.
      i) Press the [◇] switch to display "Load meter", and then display "TEL" with the [>] or [<] switch.



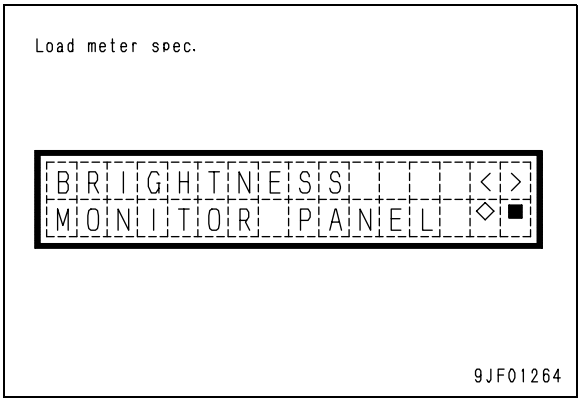
      ii) Press the [◇] switch and input a phone No. with the [>] and [<] switches.
      iii) Enter the input No. with the [◇] switch.

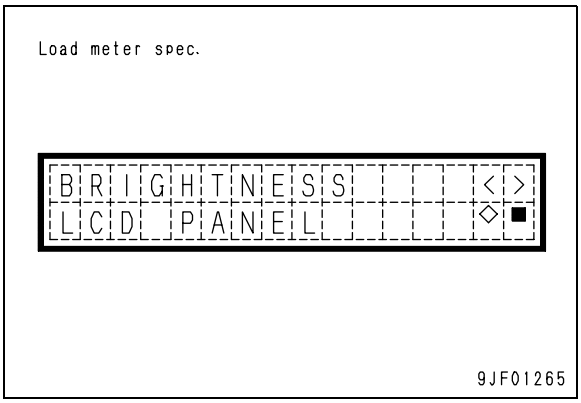


8. Monitor brightness adjusting function
   [Only load meter specification]
   The brightness of the machine monitor can be adjusted to 7 grades with the switches.
   1) Press the [◇] switch to display "Load meter", and then display "Adjust brightness" with the [>] or [<] switch.

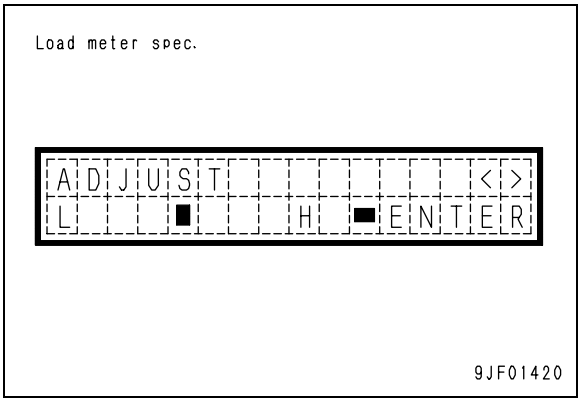


   2) Press the [◇] switch, and the brightness adjustment screen appears on the monitor panel. When adjusting the monitor panel, press the [◇] switch on this screen.
   3) When adjusting the brightness of the LCD panel, press [>] and [<], and then press [◇] on the monitor panel brightness adjustment screen.

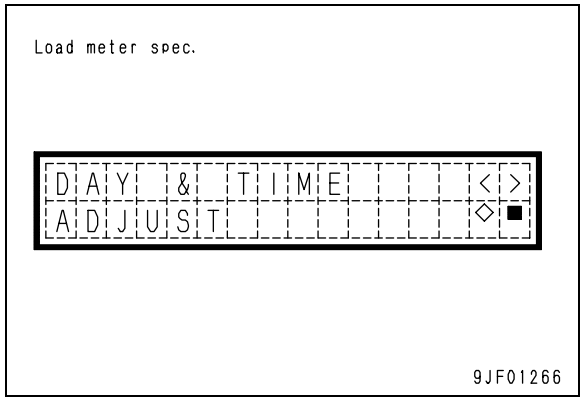




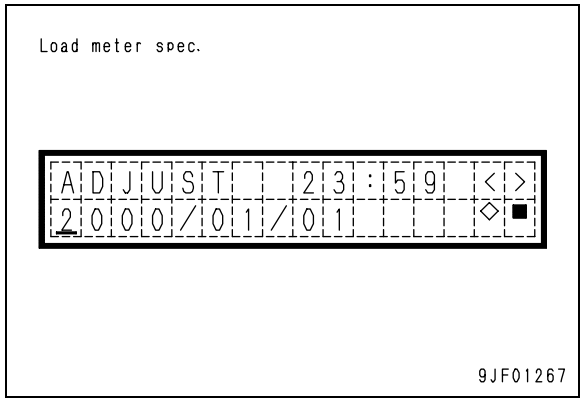
4) The current brightness grade is indicated by [■]. Each time the [>] or [<] switch is pressed, the [■] mark moves and the brightness changes.
   ★ The brightness becomes lowest when the [■] switch is next to "L" and becomes highest when the [■] switch is next to "H".
   ★ If the [■] switch is pressed, adjustment is finished and the screen returns to the previous screen.



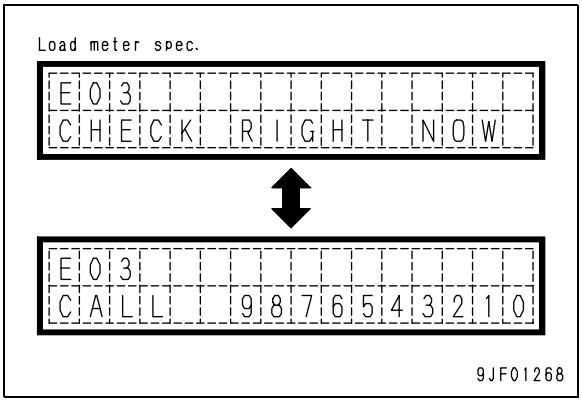
9. Clock adjusting function
   [Only load meter specification]
   1) Press the [◇] switch to display "Load meter", and then display "Adjust time" with the [>] or [<] switch.



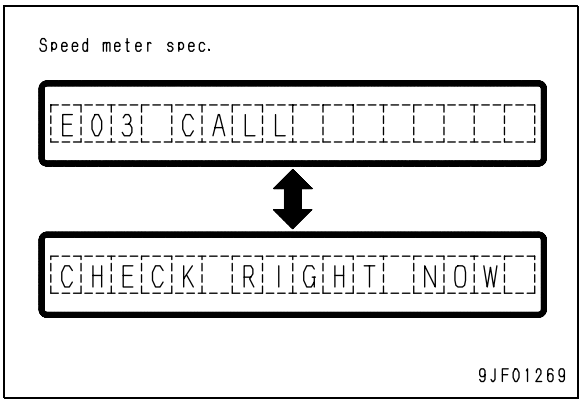
   2) Press the [◇] switch, and "Adjust 23:59" is displayed on the upper line and "2000/01/01" is displayed on the lower line.
   3) Input a value with the [>] and [<] switches.
   4) Enter the input value with the [◇] switch.



10. Action display function
    If any failure occurs in the machine, an action code is displayed automatically according to the level of that failure to press the operator for proper remedy.
    ★ The following figure is an example where action codes "E03 CHECK / RIGHT / NOW" and "E03 CALL 9876543210" (When the phone No. has not been set, the phone No. section is blank) are displayed alternately. (Load meter specification)



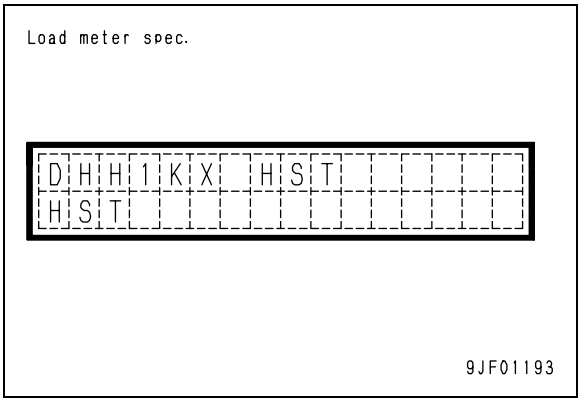
    ★ The following figure is an example where action codes "E03 CALL" and " CHECK / RIGHT / NOW" are displayed alternately. (Speedometer specification)

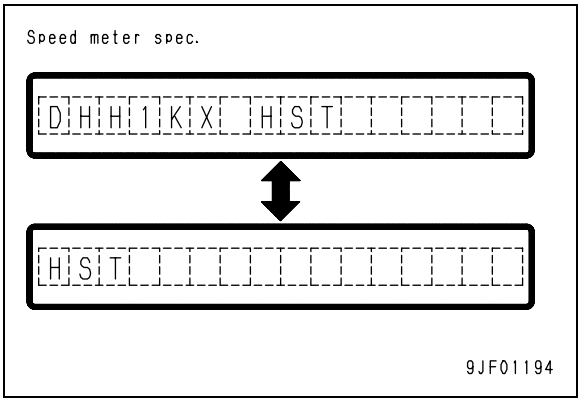


    ★ Action codes and instructions given to operator

Action code	CALL	Instructions given to operator
E00	Not displayed	• Return the switches, levers, etc. related to the control switches to the normal state.
E01	Not displayed	• After the work is finished or the operator is changed, inspect and maintain the machine.
E02	Not displayed	• If overrun is displayed, keep the engine speed and machine speed low. • If overheat is displayed, stop the machine and run the engine at medium speed with no load applied.
E03	Displayed	• Stop the engine and machine immediately and call the serviceman.

11. Failure code display function
While an action code is displayed, if the [>] switch is pressed once, each failure code detected currently is displayed.
★ The failure codes detected in the past are classified into the electric system codes and mechanical system codes and recorded as failure histories. (For details, see SERVICE MODE 1.)
★ The service code display function displays the following information.
"The failure code and the controller which detected the failure code (on the left side)" and "the component having the failure (on the right side)" are displayed. (They are displayed alternately in the speedometer specification.)
Code on right side:
MON -> Machine monitor
HST -> HST controller





★ Each failure code currently detected is flashing.
★ If 2 or more failure codes are detected, press the [>] switch more, and the other failure codes are displayed.
★ After all the failure codes currently detected are displayed by pressing the [>] switch, if the [>] switch is pressed once more, the screen returns to the service meter display screen.
★ For details of the displayed failure codes, see "Failure codes list".

Failure codes list

Failure code	Failed section (Phenomenon/Contents of failure)	Failure phenomenon	Controller code	Action code	Remarks
(Failures related to HST controller)					
989F00	HST motor protection caution	Operation (OO)	HST	E00	
DDD7KK	Failure in speed potentiometer system	Out of input signal range (KX)	HST	E01	
DHH1KX	HST oil pressure sensor	Out of input signal range (KX)	HST	E03	
DLE2LC	Disagreement of speed signals from engine speed sensor (LC)	* See separate list. (LC)	HST	E03	
DLT3KA	Abnormality in speed sensor system	Disconnection (KA)	HST	E03	
DW26KZ	Motor 2 solenoid system	Disconnection or short circuit (KZ)	HST	E03	
DX19KZ	Motor 1 solenoid system	Disconnection or short circuit (KZ)	HST	E03	
DX20KZ	Clutch solenoid system	Disconnection or short circuit (KZ)	HST	E03	
(Failures related to monitor)					
15B0NX	HST oil filter	Clogging (NX)	MON	E01	
2G42ZG	Brake oil pressure	Lowering of oil pressure (ZG)	MON	E03	
989F00	Transmission protection caution	Operation (OO)	MON	E00	
989FN1	HST overrun	Overrun (N1)	MON	E02	
AA1ANX	Air cleaner	Clogging (NX)	MON	E01	
AB00L6	Failure in battery charging circuit (Alternator terminal R signal is turned ON when engine stops)	* See separate list. (L6)	MON	E03	
AB00MA	Failure in battery charging circuit (Alternator terminal R signal is turned OFF. Detection is abnormal.)	Malfunction (MA)	MON	E03	
B@BAZG	Engine	Lowering of oil pressure (ZG)	MON	E01	
B@BAZK	Engine	Lowering of level (ZK)	MON	E01	
B@BCNS	Engine coolant temperature	Overheating (NS)	MON	E02	
B@BCZK	Low coolant level alarm	Lowering of level (ZK)	MON	E01	
B@C7NS	Axle oil temperature	Overheating (NS)	MON	E02	
B@CRNS	HST oil temperature	Overheating (NS)	MON	E02	
D5ZHL6	Abnormality in starting switch "C" (IGN "C") input	* See separate list. (L6)	MON	E01	
DAF3KK	Power supply for operation and memory	There is power supply for operation but not for memory (KK)	MON	E03	*1
DAF5KP	Abnormality in 5-V power supply output	Lowering of output voltage (KP)	MON	E01	*1
DAF6KP	Abnormality in 24-V power supply output	Lowering of output voltage (KP)	MON	E01	*1
DAJ0KR	Stop of HST controller communication	Communication trouble (Abnormality in objective component system)	MON	E03	
D182KZ	Automatic preheating relay system	Disconnection or short circuit (KZ)			
D1B0KB	HST safety relay system	Short circuit (KB)			
DD1CLD	Subtotal switch system	* See separate list. (LD)	MON	E01	*1
DD15LD	Abnormality in monitor panel mode selector switch 1 "■" (panel switch 1) input	* See separate list. (LD)	MON	E01	
DD16LD	Abnormality in monitor panel mode selector switch 1 "■" (panel switch 2) input	* See separate list. (LD)	MON	E01	
DD17LD	Abnormality in monitor panel mode selector switch 2 "<" (panel switch 3) input	* See separate list. (LD)	MON	E01	
DD18LD	Abnormality in monitor panel mode selector switch 2 ">" (panel switch 4) input	* See separate list. (LD)	MON	E01	
DDK3KB	Simultaneous input of F and R signals of forward-reverse lever	Short circuit (KB)	MON	E03	
DDS5L6	Lowering of steering oil pressure	* See separate list. (L6)	MON	E03	
DDYOLD	Cancel switch system	* See separate list. (LD)	MON	E01	*1
DGE2KX	Abnormality in engine coolant (high temperature) sensor system	Out of input signal range (KX)	MON	E01	
DGE3L6	Abnormality in engine coolant (low temperature) sensor system	* See separate list. (L6)	MON	E01	

Failure code	Failed section (Phenomenon/Contents of failure)	Failure phenomenon	Controller code	Action code	Remarks
DGH1KX	Abnormality in HST oil temperature sensor system	Out of input signal range (KX)	MON	E01	
DGR4KA	Axle oil temperature sensor system	Disconnection (KA)	MON	E01	
DGR4KX	Axle oil temperature sensor system	Out of input signal range (KX)	MON	E01	
DHE4L6	Disconnection in engine oil pressure sensor	* See separate list. (L6)	MON	E01	
DHPCKX	Bottom pressure sensor system	Out of input signal range (KX)	MON	E01	*1
DHPDKX	Rod pressure sensor system	Out of input signal range (KX)	MON	E01	*1
DKA0KX	Boom angle sensor	Out of input signal range (KX)	MON	E01	*1
DV00KB	Caution buzzer		MON	E01	*1

*1: Only load meter specification

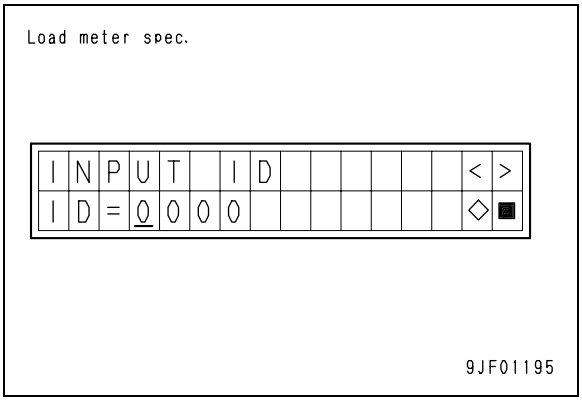
* Separate list: Details of contents of phenomenon code (L*)

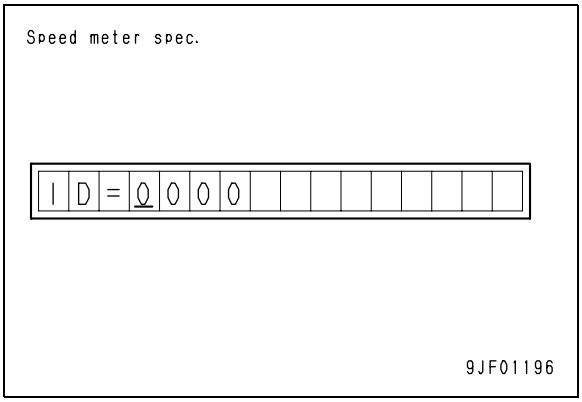
Device code	Contents
L0	Clutch fill signals which are not in combination table are turned on in 2 or more channels.
L1	When command current for ECMV is turned OFF, fill signal is turned ON.
L2	Fuel pressure is higher than maximum specified value.
L3	Corresponding part cannot be controlled.
L4	ON and OFF signals of 2 systems are not matched.
L5	Potentiometer signal and switch signal are not matched.
L6	Engine speed signal, terminal-C signal, oil pressure switch signal, water temperature sensor signal, etc. are not matched to operating or stopping condition.
L8	Analog signals of 2 systems are not matched.
LC	Speed signals of 2 systems are not matched.
LD	Switch is pressed and held for abnormally long time.
LH	When command current to ECMV is turned ON, fill signal is turned OFF.

Selection of service mode 1 and operation of screen

★ When using service mode 1, perform the following special operation to change the screen.

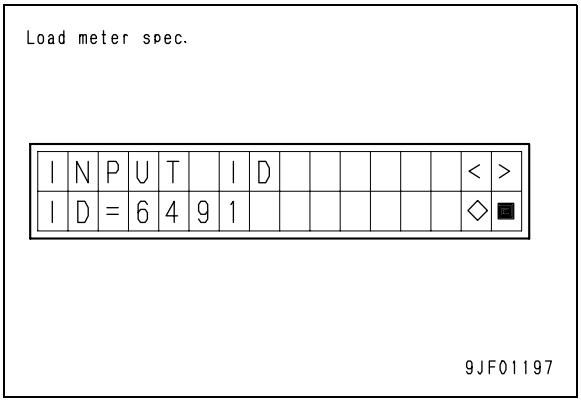
1) Check of screen
   Check that the machine monitor is in the operator mode and displaying the "Service mode", "Action code", or "Failure code".
2) Display of ID input initial screen
   Hold the following 2 switches similarly for 5 seconds to display the ID input initial screen.
   - [■] switch and [<] switch
   - ★ If the above switches are hold for 5 seconds, all the displayed items go off. Check this state, and then release the switches.

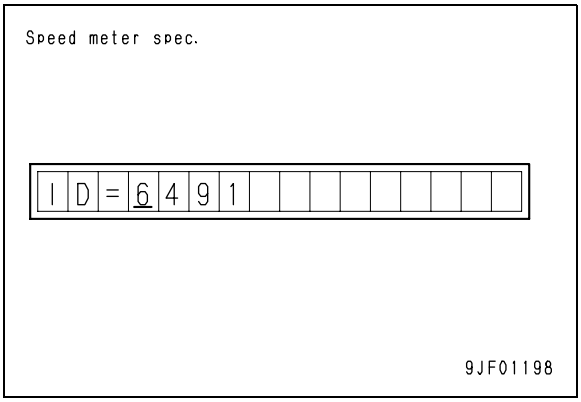




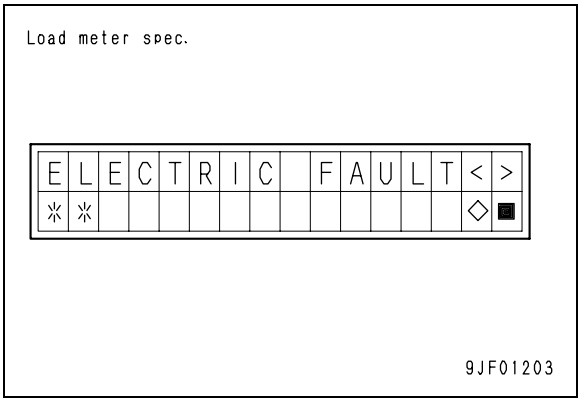
3) Inputting and entry of ID
   Input the ID with the following switches.
   - ★ ID: 6491
   - [>] switch: The number at the cursor moves forward.
   - [<] switch: The number at the cursor moves backward.
   - [◇] switch: Enter the number at the cursor.
   - [■] switch: Return to the initial screen.

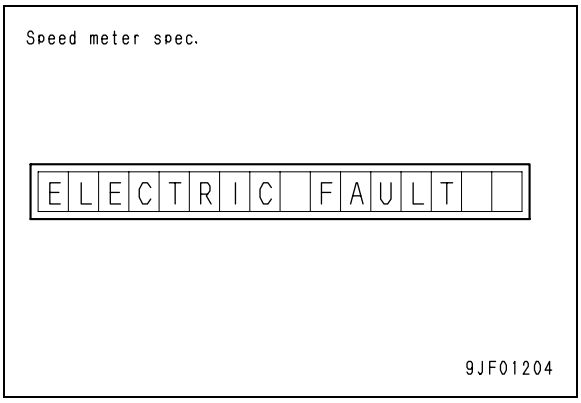
   Note: If the cursor is at the left end, the screen returns to the normal screen (operator mode).
   If the cursor is not at the left end, it returns to the left end.
   - ★ If any switch is not operated for 60 seconds on the ID input screen, the screen returns to the normal screen automatically.





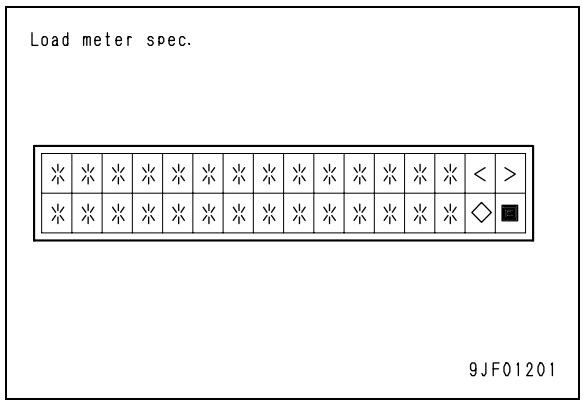
4) Display of menu initial screen
Enter all of the four figures of the ID to display the menu initial screen of service mode 1.
★ Once the ID is input/entered, it is effective until the starting switch is turned OFF.
★ The number of the saved fault histories is displayed in ** (Only load meter specification).





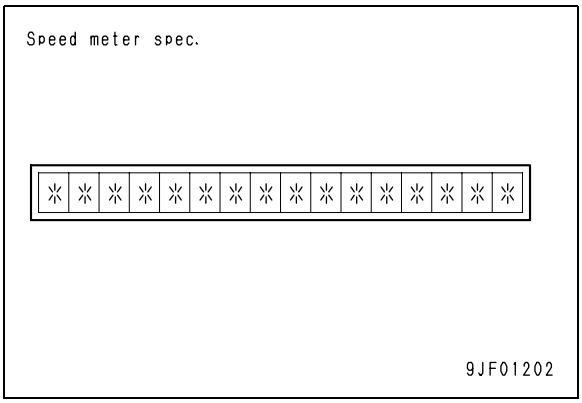
5) Selection of menu of service mode 1
[Load meter specification]
Press the [>] switch or [<] switch on the menu screen, and the menus of service mode 1 are displayed endlessly in the following order.
★ The menu is displayed at "*". The number of the saved fault histories is displayed in the first and second "*" from the left under "ELECTRIC FAULT" and "MACHINE FAULT".
• [>] switch: Go to the next menu.
• [<] switch: Go to the next menu.

(1) ELECTRIC FAULT:
Electric system fault history display function
(2) MACHINE FAULT:
Machine system fault history display function
(3) REAL-TIME MONITOR:
Machine information monitoring function
(4) TUNING: Adjusting function
(5) MAINTENANCE MONITOR:
Filter/Oil replacement period setting function
(6) OPTIONAL SELECT:
Optional device selecting function
(7) MACHINE NO. SET:
Machine No. setting function
(8) INITIALIZE: Initializing function
(Special function for factory)



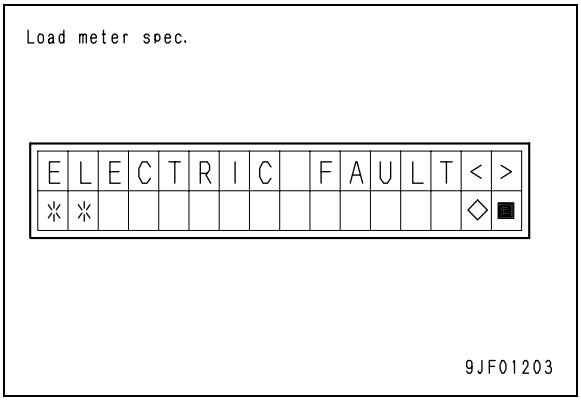
[Speedometer specification]
Press the [>] switch or [<] switch on the menu screen, and the menus of service mode 1 is displayed endlessly in the following order.
★ The menu is displayed at "*".
• [>] switch: Go to the next menu.
• [<] switch: Go to the next menu.

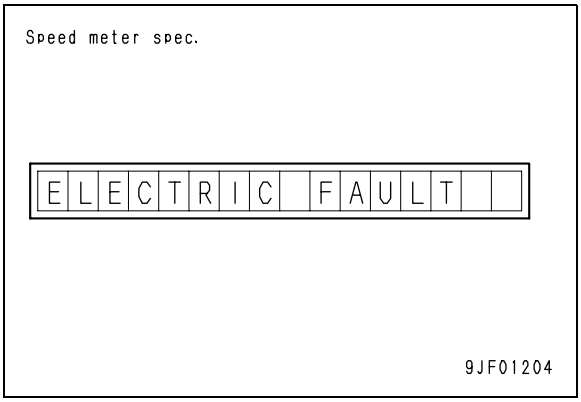
(1) ELECTRIC FAULT:
Electric system fault history display function
(2) MACHINE FAULT:
Machine system fault history display function
(3) REAL-TIME MONITOR:
Machine information monitoring function
(4) MAINTENANCE MONITOR:
Filter/Oil replacement period setting function
(5) OPTIONAL SELECT:
Optional device selecting function
(6) INITIALIZE: Initializing function
(Special function for factory)



6) Finishing of mode/function
The current mode or function can be finished by either of the following methods, regardless of the current function and layer.
(1) To continue the operation in another mode or function:
Press the [■] switch to return to the mode screen or menu screen to be used next.
★ Note that the [■] switch has an executing function on the [YES/NO] screen.
★ If you have returned to the normal screen (operator mode) by mistake, repeat the above operations from Step 1). (You do not need to input the ID, however.)
(2) To finish the operation:
Turn the starting switch OFF.

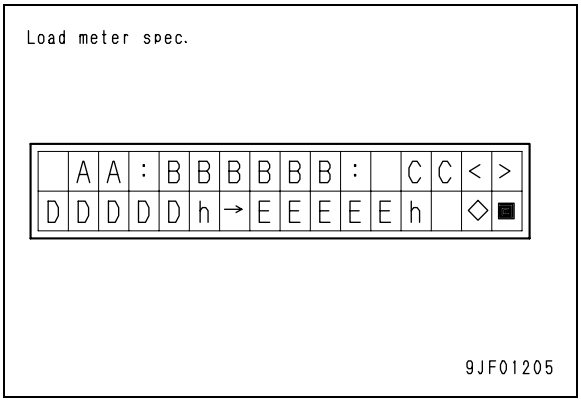
1. Electric system fault history display function
The machine monitor records the past faults of the electric system in the form of failure codes. You can display those faults by the following operation.
1) Selection of menu
Select "Electric system fault history information" on the menu screen of service mode 1.

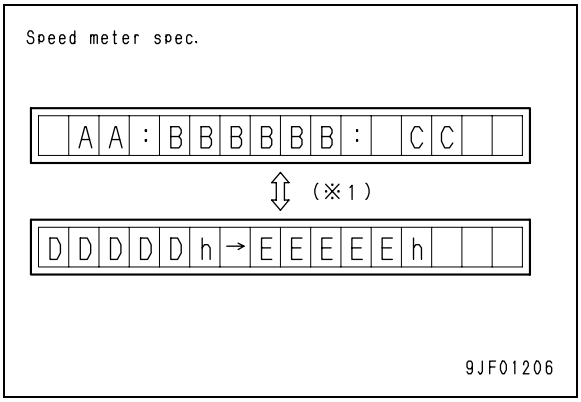




2) Display of fault history information
After selecting the menu, press the [◇] switch to display the recorded fault history information.
3) Displayed fault history information
A: Record No.
B: Failure code (4-digit section code + 2-digit phenomenon code)
C: Number of occurrences (Number of times when the same code has been detected)
D: Elapsed time 1 (Increase of the service meter after the fault was detected first time)
E: Elapsed time 2 (Increase of the service meter after the fault was detected last time)

★ The failure codes detected currently are flashed.
★ For details of the failure codes, see the "Failure codes list" in the failure code display function.
★ Note that the information displayed in the electric system fault history display function is partly different from that displayed in the failure code display function.
★ If any fault history is not recorded, "-" is displayed instead of the history.





(*1): Displayed every 3 seconds.

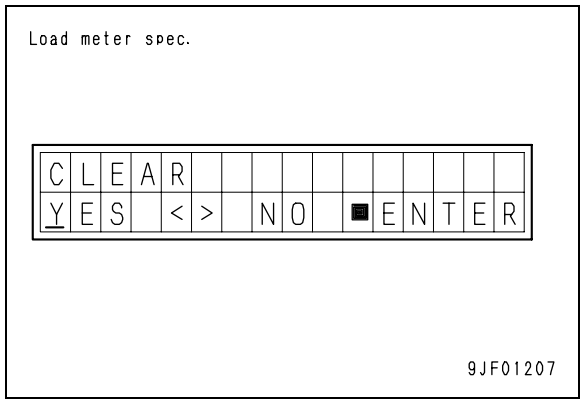
4) Change of displayed fault history
While a piece of the fault history information is displayed, if the [>] switch or [<] switch is pressed, another piece of the recorded fault history information is displayed.
[>] switch: Go to the information of the next record No.
[<] switch: Return to the information of the previous record No.

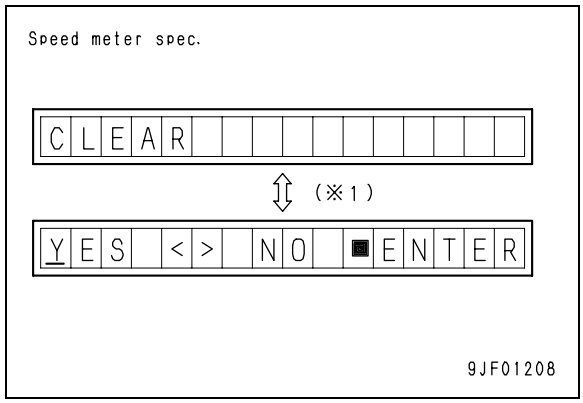
5) Deletion of each piece of fault history information

(1) While the piece of the fault history information to be deleted is displayed, press the [◇] switch once to display the screen for deleting each piece of information.
• [◇] switch: Display the deletion screen.

(2) Press the switches according to the instructions displayed on the screen.
[<] switch: Select YES.
[>] switch: Select NO.
[■] switch: Execute.

★ The information of a fault currently detected (indicated by flashing) cannot be deleted.





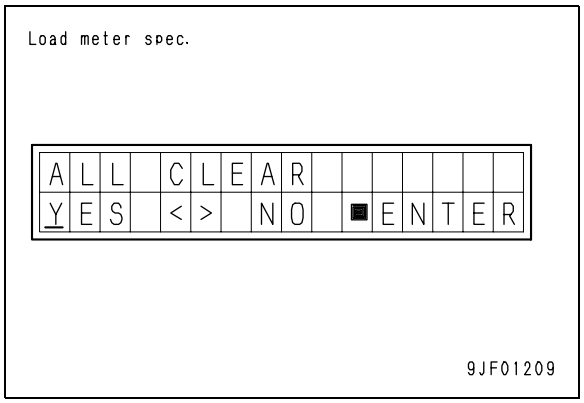
(*1): Displayed every 3 seconds.

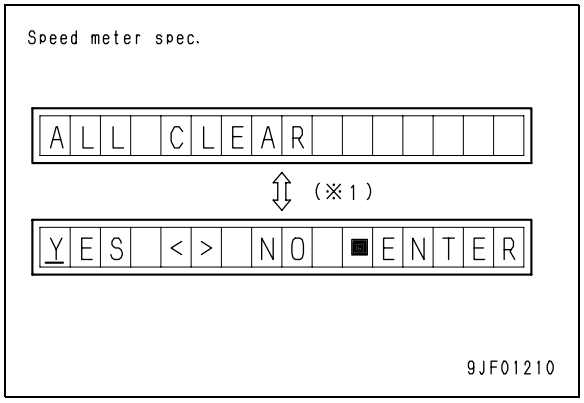
6) Deletion of all fault history information

(1) While the fault history information is displayed, press the [>] switch or [<] switch to display the screen for deleting all fault history information.
(2) Press the [◇] switch once to display the screen for deleting all fault history information.
- [◇] switch: Delete all the fault history information.

(3) Press the switches according to the instructions displayed on the screen.
[<] switch: Select YES.
[>] switch: Select NO.
[■] switch: Execute.

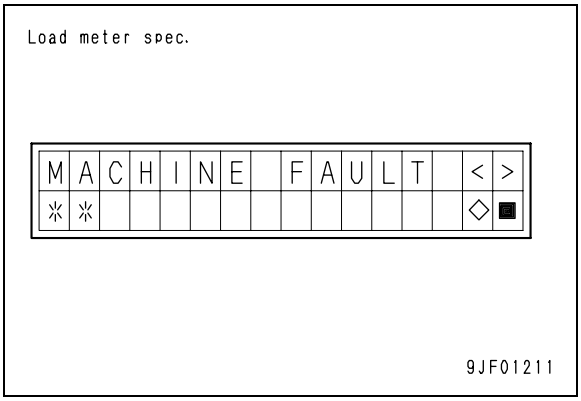
★ The information of a fault currently detected (indicated by flashing) cannot be deleted.

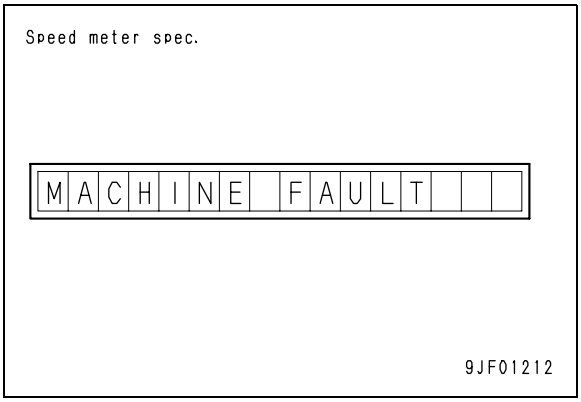




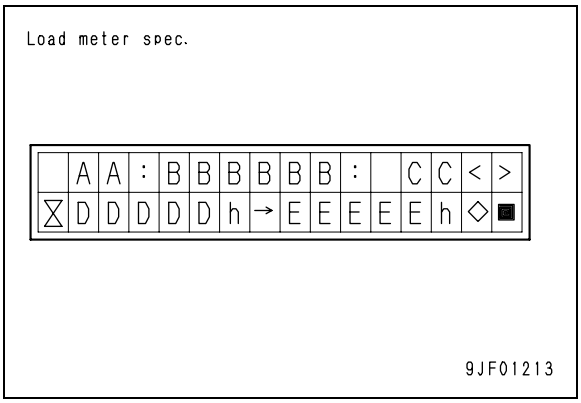
(*1): Displayed every 3 seconds.

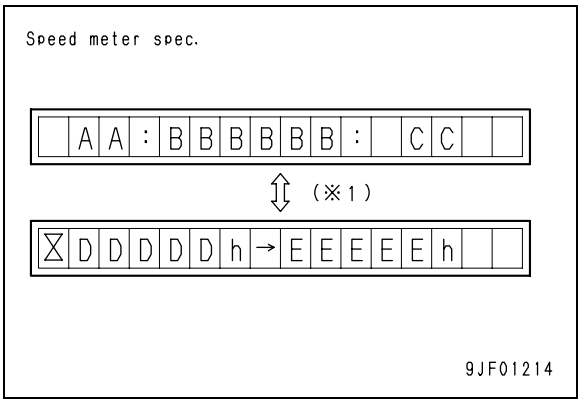
2. Machine system fault history display function
The machine monitor records the past faults of the machine system in the form of failure codes. You can display those faults by the following operation.
1) Selection of menu
Select "Machine system fault history information" on the menu screen of service mode 1.





2) Display of fault history information
   After selecting the menu, press the [◇] switch to display the recorded fault history information.
3) Displayed fault history information
   A: Record No.
   B: Failure code (4-digit section code + 2-digit phenomenon code)
   C: Number of occurrences (Number of times when the same code has been detected)
   D: Elapsed time 1 (Increase of the service meter after the fault was detected first time)
   E: Elapsed time 2 (Increase of the service meter after the fault was detected last time)
   ★ The failure codes detected currently are flashed.
   ★ For details of the failure codes, see the "Failure codes list" in the failure code display function.
   ★ Note that the information displayed in the machine system fault history display function is partly different from that displayed in the failure code display function.
   ★ If any fault history is not recorded, "-" is displayed instead of the history.



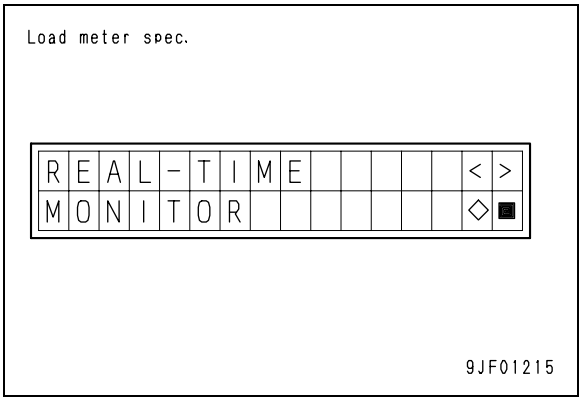


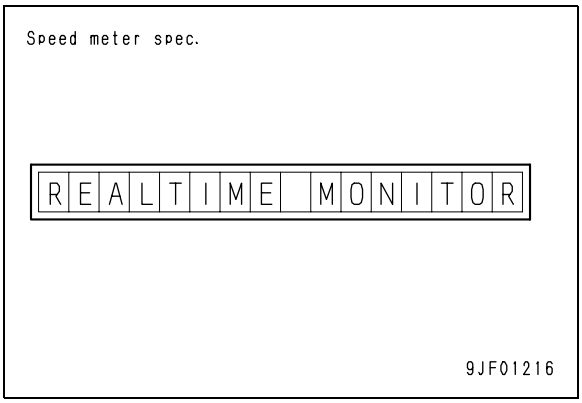
(*1): Displayed every 3 seconds.

4) Change of displayed fault history
   While a piece of the fault history information is displayed, if the [>] switch or [<] switch is pressed, another piece of the recorded fault history information is displayed.
   [>] switch: Go to the information of the next record No.
   [<] switch: Return to the information of the previous record No.
5) Deletion of each piece of fault history information
   ★ The fault history information of the machine system cannot be deleted.

3. Machine information monitoring function (REAL-TIME MONITOR)
   The machine monitor can monitor the machine condition in real time by receiving signals from various sensors installed to the machine.
   The machine information monitoring function can display the data in the following 2 ways.
   - Display of only 1 item
   - Simultaneous display of 2 items (Inputting of codes)

   1) Selection of menu
      Select "REAL-TIME MONITOR" on the menu screen of service mode 1.



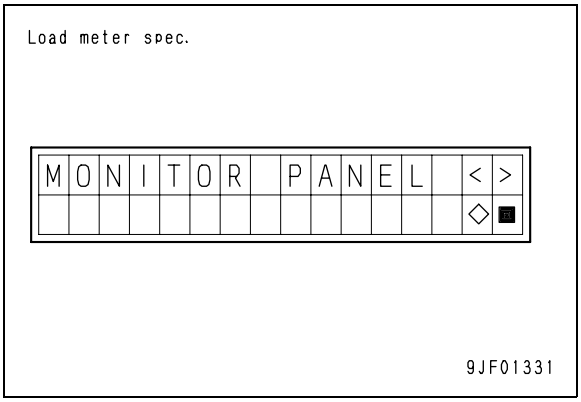


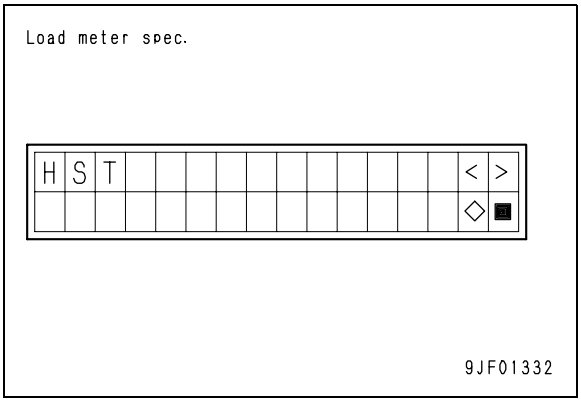
   2) Setting of 1-item monitoring

      (1) Press the [◇] switch to display the "Information display/selection screen", and then select "MONITOR PANEL" or "HST" with the [>] or [<] switch, and then press the [◇] switch to display "REAL-TIME MONITOR DISPLAY screen".
      [Load meter specification]
      [>] switch: The number at the cursor moves forward.
      [<] switch: The number at the cursor moves backward.
      Press the [◇] switch to display "REAL-TIME MONITOR DISPLAY screen".
      [Speedometer specification]

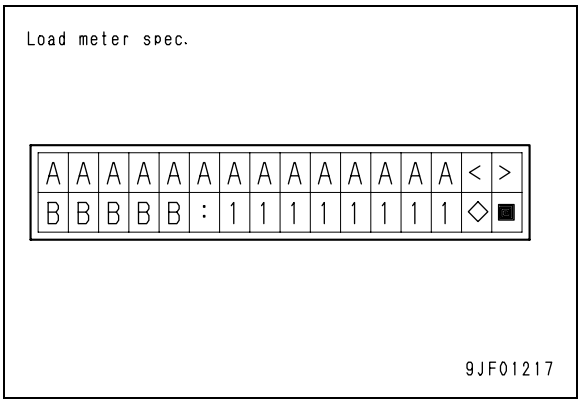
      (2) Press the [>] switch or [<] switch to select the item to be monitored.
      [>] switch: Go to the next item.
      [<] switch: Return to the previous item.

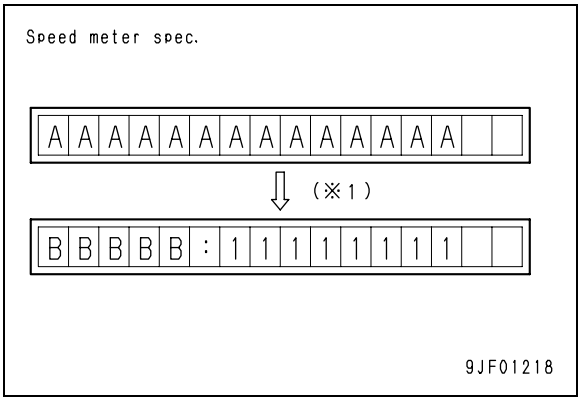
      ★ The monitoring items are scrolled according to the order set internally.
      ★ If either switch is held, the monitoring items are scrolled fast.
      ★ After the [◇] switch is pressed to hold the displayed data, if it is pressed again, the screen returns to the active state.





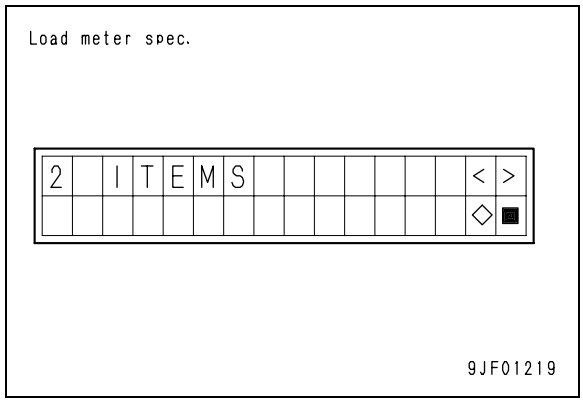
3) Information displayed in 1-item monitoring mode
   ★ The following information is displayed on the 1-item monitoring screen.
   A: Monitoring item
   B: Monitoring code (5 digits)
   1: Monitoring data (including unit)
   ★ For details, see the monitoring codes table.

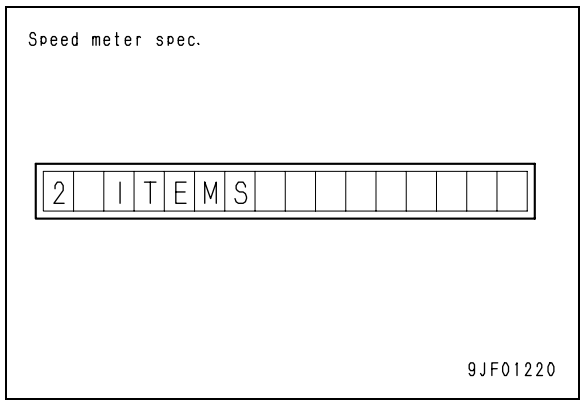




(*1): Displayed every 3 seconds.

4) Setting of simultaneous 2-item monitoring
   (1) Press the [◇] switch to display the "Information display/selection screen". [Load meter specification]
   Press the [◇] switch to display "REAL-TIME MONITOR DISPLAY screen". [Speedometer specification]
   (2) Press the [>] switch or [<] switch to select "2-ITEM SELECTION screen".
   [>] switch: The number at the cursor moves forward.
   [<] switch: The number at the cursor moves backward.
   (3) Press the [◇] switch to display monitoring inputting screen.
   (4) Press each button to directly input the monitoring codes of the 2 items to be monitored.
   [>] switch: The number at the cursor moves forward.
   [<] switch: The number at the cursor moves backward.
   [◇] switch: Enter the number at the cursor.
   [■] switch: Return to the code inputting screen.





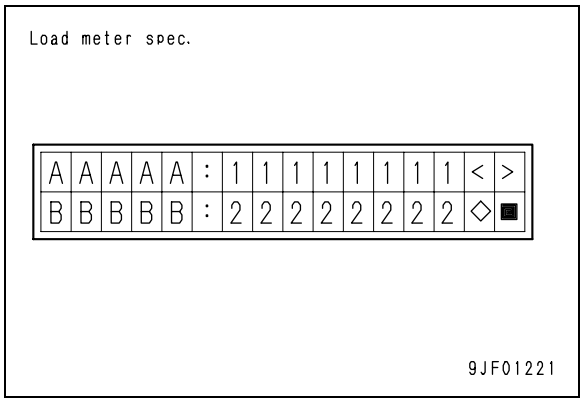
(5) If both monitoring codes are entered, the screen changes to the 2-item display screen.

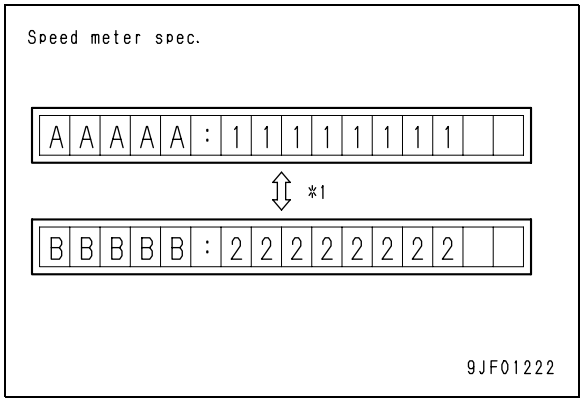
★ Holding and activation of monitoring data:
If the [◇] switch is pressed while the data are being monitored, the monitoring data are held and the [◇] mark flashes. If the [◇] switch is pressed again, the monitoring data become active.

★ The following information is displayed on the simultaneous 2-item monitoring screen.

A: Monitoring code 1
1: Monitoring data 1 (including unit)
B: Monitoring code 2
2: Monitoring data 2 (including unit)

★ For details, see the monitoring codes table.





(*1): Displayed every 3 seconds.

Real-time monitoring items
[Load meter specification]

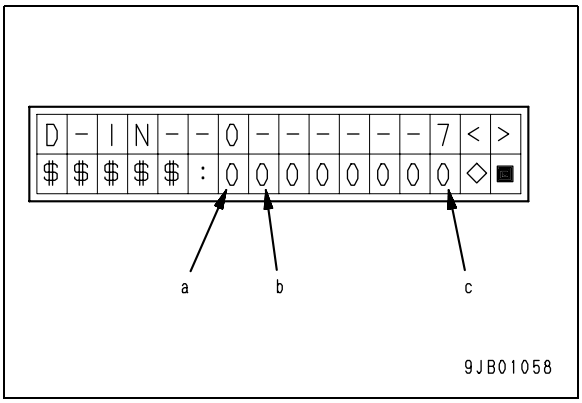
Item ID	Real-time monitoring item	Display of item	Unit of display	Range of display	Detecting component	Terminal No.	Remarks
	All items, including ones for which sensors are not installed on some models and optional components, are displayed.	Abbreviated as number of characters is limited.	SI units are used for all items which need units.	Values below (or above) display range are fixed to display range.			
Monitor panel controller							
20200	Part No. of monitor ROM	MONITOR ROM	---	---	---	---	
40000	Travel speed	SPEED	1 km/h	0 - 50	HST	L41-13	
04202	Fuel level	FUEL SENSOR	1 %	0 - 100	Monitor	L28-1	
04101	Engine coolant temperature	COOLANT TEMP	1 °C	24 - 131	Monitor	L28-8	
04103	Low engine coolant temperature	COOLANT Lo	1 °C	-31 - 91	Monitor	L28-3	
30100	HST oil temperature	HST TEMP	1 °C	24 - 131	Monitor	L28-2	
30202	Axle oil temperature	BRAKE TEMP	1 °C	24 - 131	Monitor	L28-7	
06001	Lift arm angle	BOOM ANG	1°	-41 - 46	Monitor	L28-10	Only load meter specification
40400	Lift cylinder bottom pressure	BTM PRESS	0.01 MPa	0.00 - 50.00	Monitor	L28-9	Only load meter specification
40500	Lift cylinder rod pressure	ROD PRESS	0.01 MPa	0.00 - 50.00	Monitor	L28-4	Only load meter specification
40600	Calibration pressure	CAL PRESS	0.01 MPa	0.00 - 50.00	Monitor	Calculated value	Only load meter specification
40700	Calculated pressure	MES PRESS	0.01 MPa	0.00 - 50.00	Monitor	Calculated value	Only load meter specification
40800	Calculated weight	MES LOAD	0.01 t	0.00 - 50.00	Monitor	Calculated value	Only load meter specification
40900	Input signal D_IN_0-7	D-IN--0------7	---	01010101	Monitor	Separate sheet	Only load meter specification
40901	Input signal D_IN_8-15	D-IN--8-----15	---	01010101	Monitor	Separate sheet	Only load meter specification
40902	Input signal D_IN_16-23	D-IN-16-----23	---	01010101	Monitor	Separate sheet	Only load meter specification
40903	Input signal D_IN_24-31	D-IN-24-----31	---	01010101	Monitor	Separate sheet	Only load meter specification
40904	Input signal D_IN_32-39	D-IN-32-----39	---	01010101	Monitor	Separate sheet	Only load meter specification
HST controller							
01005	Engine speed	ENG SPEED	1 rpm	0 - 3000	HST	L42-4	HST controller CAN
32600	HST oil pressure	HST PRESS	0.1 MPa	0.0 - 100.0	HST	L41-3	HST controller CAN
80000	Motor 1 solenoid feedback current	MOTOR SOL	1 mA	0 - 1000	HST	L41-6	HST controller CAN
80100	Clutch solenoid feedback current	CLUTCH SOL	1 mA	0 - 1000	HST	L41-14	HST controller CAN
50302	Potentiometer voltage	SPEED POT	1 %	0 - 100	HST	L41-1	HST controller CAN
80200	HST traction force	TRACTION	---	STD/LIMIT	HST	L42-3	HST controller CAN

[Speedometer specification]

Item ID	Real-time monitoring item	Display of item	Unit of display	Range of display	Detecting component	Terminal No.	Remarks
	All items, including ones for which sensors are not installed on some models and optional components, are displayed.	Abbreviated as number of characters is limited.	SI units are used for all items which need units.	Values below (or above) display range are fixed to display range.			
20200	Part No. of monitor ROM	MONITOR ROOM	---	---	Monitor	---	
40000	Travel speed	SPEED	1 km/h	0 - 50	HST	L41-13	
04202	Fuel level	FUEL SENSOR	1 %	0 - 100	Monitor	L23-13	
04101	Engine coolant temperature	COOLANT TEMP	1 °C	24 - 131	Monitor	L21-16	
04103	Low engine coolant temperature	COOLANT Lo	1 °C	-31 - 91	Monitor	L21-6	
30100	HST oil temperature	HST TEMP	1 °C	24 - 131	Monitor	L21-14	
30202	Axle oil temperature	BRAKE TEMP	1 °C	24 - 131	Monitor	L21-8	
01005	Engine speed	ENG SPEED	1 rpm	0 - 3000	HST	L42-4	HST controller CAN
32600	HST oil pressure	HST PRESS	0.1 MPa	0.0 - 100.0	HST	L41-3	HST controller CAN
80000	Motor 1 solenoid feedback current	MOTOR SOL	1 mA	0 - 1000	HST	L41-6	HST controller CAN
80100	Clutch solenoid feedback current	CLUTCH SOL	1 mA	0 - 1000	HST	L41-14	HST controller CAN
50302	Potentiometer voltage	SPEED POT	1 %	0 - 100	HST	L41-1	HST controller CAN
80200	HST traction force	TRACTION	---	STD/LIMIT	HST	L42-3	HST controller CAN

How to read input signal (D-IN--0------7)
[Only load meter specification]

A signal input through an ON/OFF switch to the controller is displayed in the form of D-IN-* (* is the input No.) It is displayed actually as shown below.



a: The state of the input signal of D-IN-0 is displayed.
b: The state of the input signal of D-IN-1 is displayed.
c: The state of the input signal of D-IN-7 is displayed.

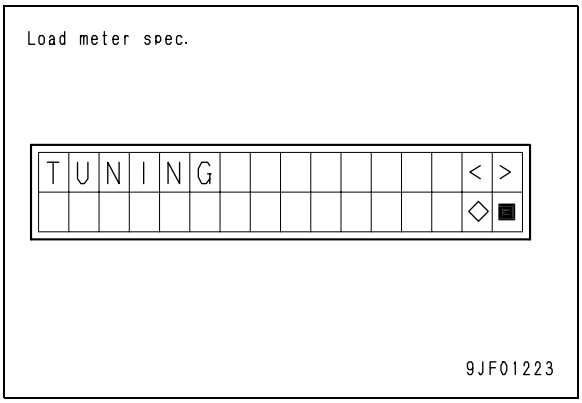
$$$$$: The item ID is displayed.

If the input state is displayed as "0", any signal is not input (OFF).
If the input state is displayed as "1", a signal is input.

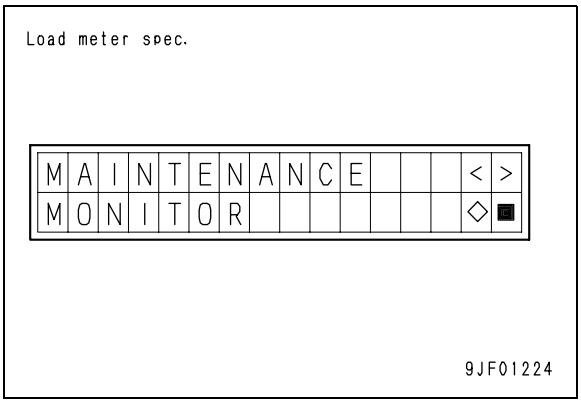
[Only load meter specification]

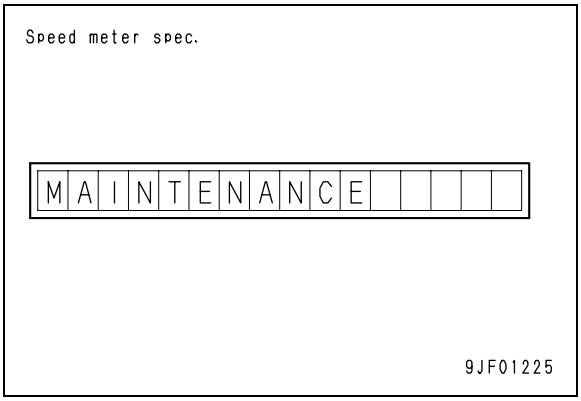
Item ID	Input signal	Indication item	Connector pin No.	ON/OFF logic
Machine monitor				
40900	D-IN-0	Headlamp switch	L25-1	Headlamp ON = ON (24V) / OFF (OPEN)
	D-IN-1	IGN_BR	L25-10	Starting switch is not in OFF position = ON (24V) / OFF (OPEN)
	D-IN-2	IGN_C	L25-2	Starting switch START = ON (24V) / OFF (OPEN)
	D-IN-3	No items	L25-11	ON (24V) / OFF (OPEN)
	D-IN-4	No items	L25-3	ON (24V) / OFF (OPEN)
	D-IN-5	No items	L25-12	ON (24V) / OFF (OPEN)
	D-IN-6	Forward-reverse lever F	L25-4	Forward = ON (24V) / OFF (OPEN)
	D-IN-7	Forward-reverse lever N	L25-13	Neutral = ON (24V) / OFF (OPEN)
40901	D-IN-8	Forward-reverse lever R	L25-5	Reverse = ON (24V) / OFF (OPEN)
	D-IN-9	No items	L25-14	ON (24V) / OFF (OPEN)
	D-IN-10	Monitor panel mode selector SW1 ■	L25-6	Switch pressed = ON (24V) / OFF (OPEN)
	D-IN-11	No items	L25-15	ON (24V) / OFF (OPEN)
	D-IN-12	Turn signal lever right	L25-7	Turn signal right lamp ON = ON (24V) / OFF (OPEN)
	D-IN-13	Turn signal lever left	L25-16	Turn signal left lamp ON = ON (24V) / OFF (OPEN)
	D-IN-14	Monitor panel mode selector SW1 ◇	L25-8	Switch pressed = ON (24V) / OFF (OPEN)
	D-IN-15	Omission of application of parking brake	L25-17	Parking brake released = ON (24V) / OFF (OPEN)
40902	D-IN-16	Brake oil pressure	L26-1	Oil pressure normal = ON (GND) / OFF (OPEN)
	D-IN-17	No items	L26-7	ON (24V) / OFF (OPEN)
	D-IN-18	No items	L26-2	ON (GND) / OFF (OPEN)
	D-IN-19	No items	L26-8	ON (GND) / OFF (OPEN)
	D-IN-20	Clogging of air cleaner	L26-3	Not clogged = ON (GND) / OFF (OPEN)
	D-IN-21	No items	L26-9	ON (GND) / OFF (OPEN)
	D-IN-22	No items	L26-4	ON (GND) / OFF (OPEN)
	D-IN-23	No items	L26-10	ON (GND) / OFF (OPEN)
40903	D-IN-24	Clogging of HST filter	L26-5	Clogged = ON (GND) / OFF (OPEN)
	D-IN-25	No items	L26-11	ON (GND) / OFF (OPEN)
	D-IN-26	Parking brake	L27-1	Parking brake operated = ON (GND) / OFF (OPEN)
	D-IN-27	Engine coolant level	L27-10	Coolant level normal (Coolant supplied) = ON (GND) / OFF (OPEN)
	D-IN-28	Engine oil pressure	L27-2	Oil pressure low = ON (GND) / OFF (OPEN)
	D-IN-29	Engine oil level	L27-11	Oil level normal (Oil supplied) = ON (GND) / OFF (OPEN)
	D-IN-30	Emergency steering normal	L27-3	Emergency steering normal = ON (GND) / OFF (OPEN)
	D-IN-31	No items	---	---
40904	D-IN-32	Load meter subtotal SW	L27-4	Switch pressed = ON (GND) / OFF (OPEN)
	D-IN-33	Load meter cancel SW	L27-13	Switch pressed = ON (GND) / OFF (OPEN)
	D-IN-34	Dimmer switch	L27-5	Headlamp directed up = ON (GND) / OFF (OPEN)
	D-IN-35	No items	L27-14	ON (GND) / OFF (OPEN)
	D-IN-36	No items	L27-6	ON (GND) / OFF (OPEN)
	D-IN-37	Monitor panel selector SW2 >	L27-15	Switch pressed = ON (GND) / OFF (OPEN)
	D-IN-38	Monitor panel selector SW2 <	L27-7	Switch pressed = ON (GND) / OFF (OPEN)
	D-IN-39	Low steering pressure	L27-16	Oil pressure low = ON (GND) / OFF (OPEN)

4. Adjusting (Tuning) function
   ★ [Only load meter specification]
   The adjusting function is used for initial setting of a replaced sensor or controller and correcting or adjusting the installation error and manufacturing dispersion.
   ★ For details, see STRUCTURE, FUNCTION AND MAINTENANCE STANDARD, Tuning function.



5. Maintenance monitor function
   The machine monitor can set the maintenance intervals of various filters and oils which are used as the basis of display of the filter/oil replacement periods.
   ★ For details, see STRUCTURE, FUNCTION AND MAINTENANCE STANDARD, Maintenance function.

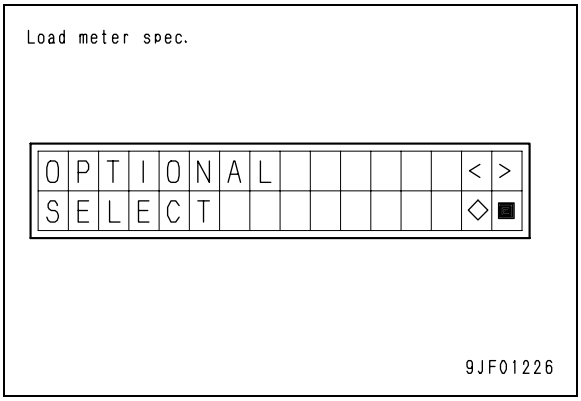


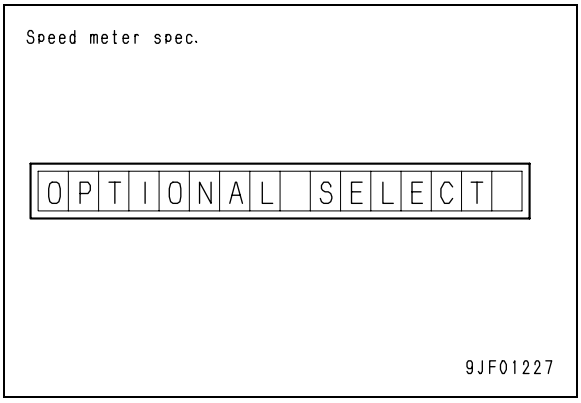


Filter and oil replacement period setting items table (when shipped)

Item	Replacement period (h)	Display of item name	ID No.
Engine oil	500	ENG oil	01
Engine oil filter	500	ENG oil filter	02
Fuel filter	500	Fuel filter	03
Transfer oil	1,000	Transfer oil	25
HST oil filter	1,000	HST oil filter	26
Hydraulic oil filter	2,000	Hydraulic oil filter	04
Hydraulic oil	2,000	Hydraulic oil	10
Axle oil	2,000	Axle oil	15

6. Optional device selecting function
   Select "OPTIONAL SELECT function" on the menu screen of service mode 1.





When any of the following optional devices is added or replaced, adjust the sensor, etc. to the initial value with the machine monitor.

★ For details, see STRUCTURE AND OPERATION, Optional device selecting function.

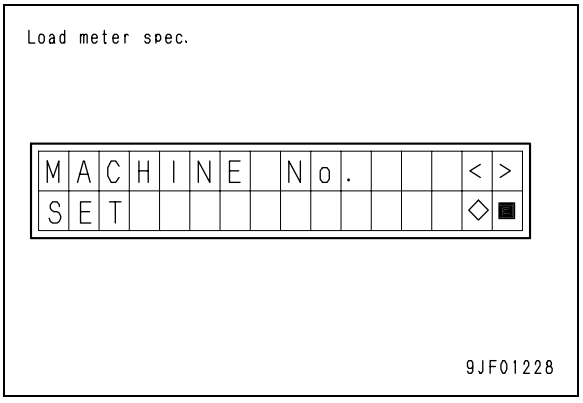
Optional device setting items

Added/Replaced optional device	Adjustment items
Tire size, machine monitor	Selection of model, selection of tire size, selection of tire deviation
Boom angle sensor, machine monitor (Load meter specification)	Adjustment of boom angle for load meter
Boom (Load meter specification)	Selection of boom type
Printer (Load meter specification)	Selection of printer

7. Machine serial No. setting function

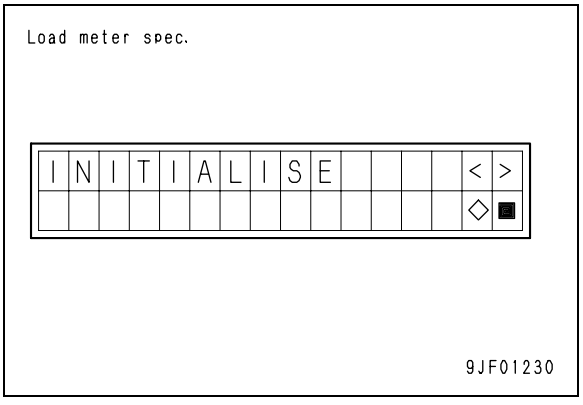
★ [Only load meter specification]
Set the machine serial No.

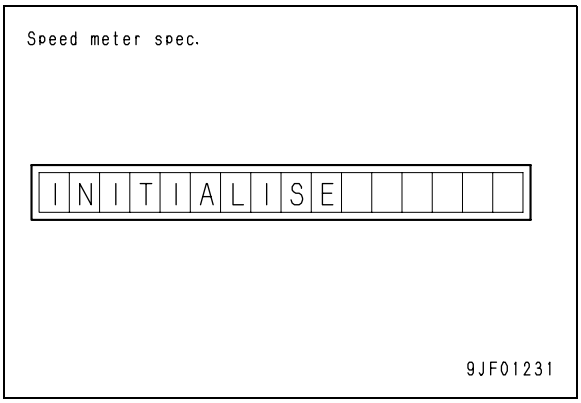
★ For details, see STRUCTURE, FUNCTION AND MAINTENANCE STANDARD, Machine serial No. setting function.



8. Initializing function

★ This is a special function used in the factory, which is not used for servicing.





Service mode 2

The following functions are prepared to be used when the machine monitor is replaced.

1. Setting of service monitor
The service meter value saved in the machine monitor is set.
   ★ The service meter value can be set in only the direction of increasing from the current value.

2. Setting of odometer value
The odometer value saved in the machine monitor is set.
   ★ For details, see STRUCTURE, FUNCTION AND MAINTENANCE STANDARD, Setting necessary to machine.
   ★ The odometer value can be set in only the direction of increasing from the current value.

Pm CLINIC INSPECTION CHART

WA320-5 #60001--

Machine serial No.	
Engine serial No.	SAA6D102E-2#

	Hours inspection

Work order No.	Rotate	Service Meter	Serviceman
		h	

Questions asked to operator, walk around nspection

Was there any abnormality before inspection tarted?	Ambient temperature Max. °C
	Min. °C
	Altitude m

Max. coolant temp. (During operation)		Max. HST oil temp. (During operation)	
Segment color	W 1 W 2 W 3 W 4 W 5 R 6 R 7	Segment color	W 1 W 2 W 3 W 4 W 5 R 6 R 7

★ If the machine is cold, warm it up fully.

	Item	Conditions		Unit	Standard value for new machine	Service limit value	Measure-ment results	Pass	Fail
Engine	Engine speed	Low idling		rpm	850 - 900	-			
		High idling			2,175 - 2,275	-			
		HST stall			2,050 - 2,250	1,950 - 2,350			
		Hydraulic stall			1,830 - 2,230	1,890 - 2,290			
		Full stall (HST stall + hydraulic stall)			1,840 - 2,240	1,730 - 2,330			
	Blow-by pressure	High idling		kPa {mmH_2O}	Max. 0.49 {Max. 50}	0.98 {100}			
	Oil pressure	SAE15W-40	High idling	kPa {kg/cm^2}	340 - 640 {3.5 - 6.5}	245 {2.5}			
			Low idling		Min. 150 {Min. 1.5}	80 {0.8}			

★ Before starting the inspection, check that the machine does not move when the directional lever is placed in position.

★ When measuring the transfer clutch control pressure, carry out the measurement at a place where the machine can travel safety at a speed of more than 10 km/h.

HST	High-pressure cut-off pressure	• Engine: Full throttle • Hydraulic oil temp.: 45 - 55°C	Directional lever: F Speed selector switch: 3rd	MPa {kg/cm^2}	39.7 - 41.7 {405 - 425}	38.7 - 42.7 {395 - 435}			
	Low-pressure relief pressure (work equip-ment PPC cir-cuit basic pressure)		Directional lever: N		3.0 - 3.2 {31 - 33}	2.9 - 3.2 {30 - 33}			
	Servo piston control pressure		Directional lever: N Brake: released		3.0 - 3.2 {31 - 33}	2.9 - 3.2 {30 - 33}			
			Directional lever: N Brake: depressed		Max. 0.6 {Max. 6}	Max. 0.6 {Max. 6}			
	Servo piston actuation pres-sure		Directional lever: F Speed selector switch: 3rd		3.0 - 3.2 {31 - 33}	2.9 - 3.2 {30 - 33}			
	Transfer clutch control pressure	Hydraulic oil temp.: 45 - 55°C	Directional lever: F Speed selector switch: 3rd		3.0 - 3.2 {31 - 33}	2.9 - 3.2 {30 - 33}			

WA320-5 #60001-

Item		Conditions		Unit	Standard value for new machine	Service limit value	Measure-ment results	Pass	Fail
Steering	Steering wheel operating time	Engine low idling		sec	4.3 - 5.1	Max. 6.9			
		Engine high idling			2.7 - 3.3	Max. 5.0			
	Lock frame with safety bar								
	Steering relief pressure	Engine high idling		MPa {kg/cm^2}	20.3 - 21.6 {207 - 220}	18.6 - 22.6 {190 - 230}			
Brake	Service brake	Oil pressure: 4.4 MPa {45 kg/cm^2} Pedal: Stroke end		mm	Projection of shaft: 0	Distance between projected shaft end and limit: (1.6 mm)			
Work equipment	Relief pressure	Engine high idling	Bucket relief	MPa {kg/cm^2}	20.3 - 21.6 {207 - 220}	18.6 - 22.6 {190 - 230}			
	Lift arm speed		Raising time	sec	5.2 - 6.2	Max. 8.6			
			Lowering time		3.0 - 4.0	Max. 5.3			
	Bucket speed		Dumping time		0.9 - 1.5	Max. 1.8			
			Tilting-back time		1.6 - 2.2	Max. 2.9			
	Hydraulic drift	Engine stopped	Bucket cylinder	mm/15 min	Max. 17	Max. 26			
			Lift cylinder		Max. 20	Max. 30			
Axle	Check differential drain plug visually		Front axle	-	Must be no excessive metal particles				
			Rear axle						

MEMO

TROUBLESHOOTING

POINTS TO REMEMBER WHEN TROUBLESHOOTING

Stop the machine in a level place, and check that the safety pin, blocks, and parking brake are securely fitted.

When carrying out the operation with two or more workers, keep strictly to the agreed signals, and do not allow any unauthorized person to come near.

If the radiator cap is removed when the engine is hot, hot coolant may spurt out and cause burns, so wait for the engine to cool down before starting troubleshooting.

Be extremely careful not to touch any hot parts or to get caught in any rotating parts.

When disconnecting wiring, always disconnect the negative (-) terminal of the battery first.

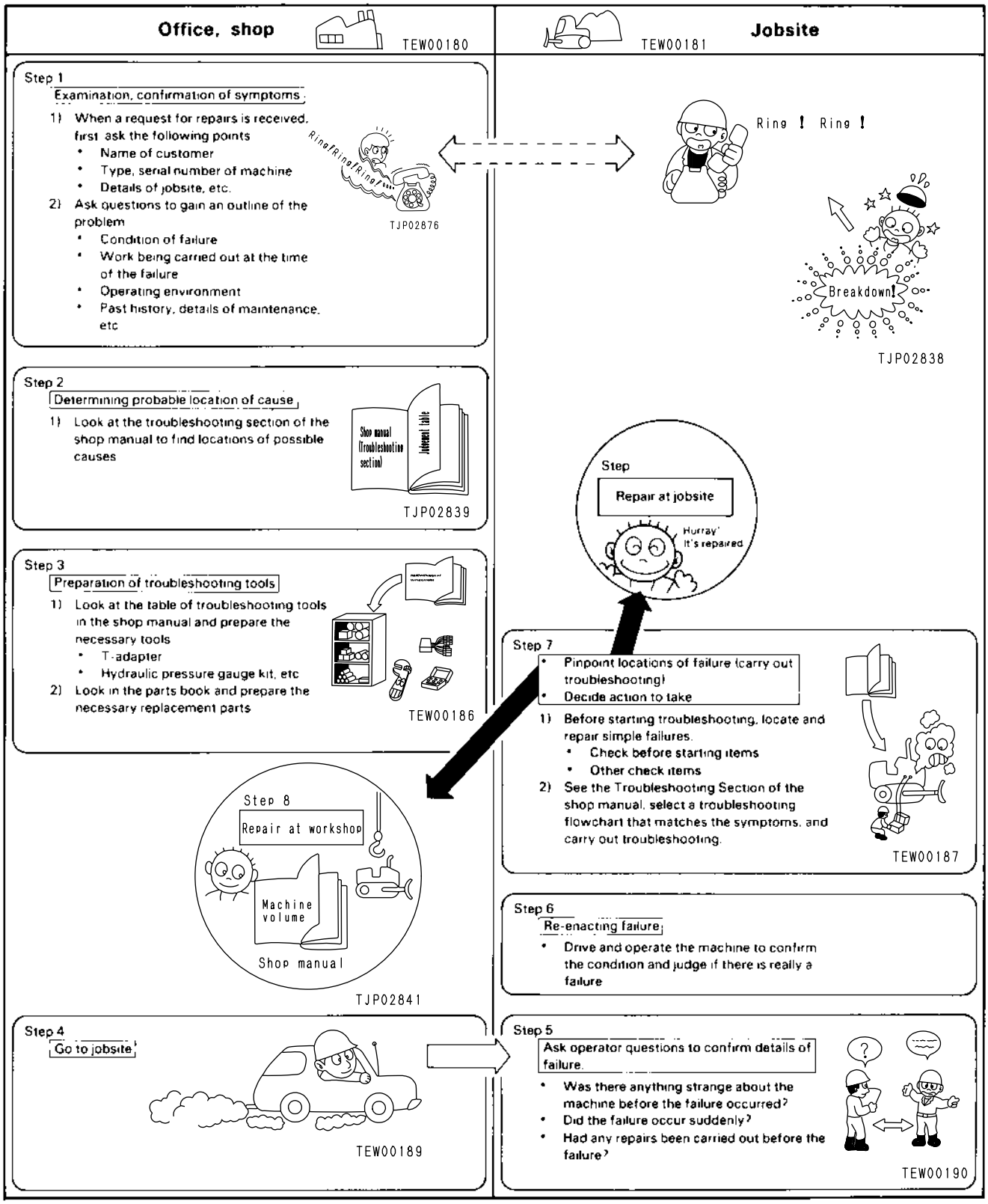
When removing the plug or cap from a location which is under pressure from oil, water or air, always release the internal pressure first. When installing measuring equipment, be sure to connect it properly.

The aim of troubleshooting is to pinpoint the basic cause of the failure, to carry out repairs swiftly, and to prevent reoccurrence of the failure.
When carrying out troubleshooting, an important point is to understand the structure and function of the machine. However, a short cut to effective troubleshooting is to ask the operator various questions to form some idea of possible causes of the failure that would produce the reported symptoms.

1. When carrying out troubleshooting, do not hurry to disassemble the components. If components are disassembled immediately after a failure occurs:
   - Parts that have no connection with the failure or other unnecessary parts will be disassembled.
   - It will become impossible to find the cause of the failure.

   It will also cause a waste of man hours, parts, or oil and grease. At the same time, it will also lose the confidence of the user or operator. For this reason, when carrying out troubleshooting, it is necessary to carry out thorough prior investigation and to carry out troubleshooting in accordance with the fixed procedure.
2. Points to ask the user or operator.
   1) Have any other problems occurred apart from the problem that has been reported?
   2) Was there anything strange about the machine before the failure occurred?
   3) Did the failure occur suddenly, or were there problems with the machine condition before this?
   4) Under what conditions did the failure occur?
   5) Had any repairs been carried out before the failure? When were these repairs carried out?
   6) Has the same kind of failure occurred before?
3. Check before troubleshooting.
   1) Check the oil level.
   2) Check for any external leakage of oil from the piping or hydraulic equipment.
   3) Check the travel of the control levers.
   4) Check the stroke of the control valve spool.
   5) Other maintenance items can be checked externally, so check any item that is considered to be necessary.
4. Confirming the failure.
   Confirm the extent of the failure yourself, and judge whether to handle it as a real failure or as a problem with the method of operation, etc.
   ★ When operating the machine to re-enact the troubleshooting symptoms, do not carry out any investigation or measurement that may make the problem worse.
5. Troubleshooting
   Use the results of the investigation and inspection in Steps 2 - 4 to narrow down the causes of the failure, then use the troubleshooting flowchart to locate the position of the failure exactly.
   ★ The basic procedure for troubleshooting is as follows.
      1) Start from the simple points.
      2) Start from the most likely points.
      3) Investigate other related parts or information.
6. Measures to remove root cause of failure.
   Even if the failure is repaired, if the root cause of the failure is not repaired, the same failure will occur again.
   To prevent this, always investigate why the problem occurred. Then, remove the root cause.

SEQUENCE OF EVENTS IN TROUBLESHOOTING

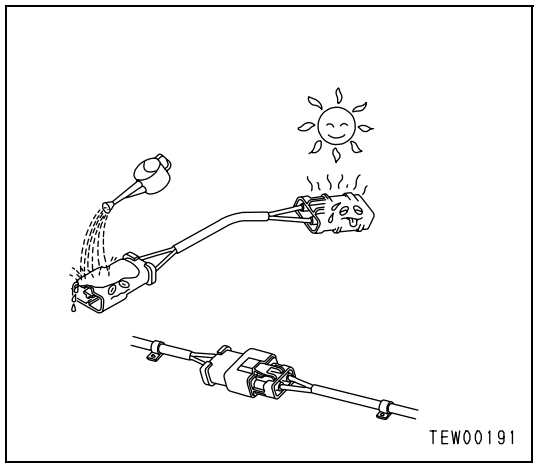


PRECAUTIONS WHEN CARRYING OUT MAINTENANCE

To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct operation, maintenance and inspection, troubleshooting, and repairs must be carried out. This section deals particularly with correct repair procedures for mechatronics and is aimed at improving the quality of repairs. For this purpose, it gives sections on 'Handling electric equipment' and 'Handling hydraulic equipment' (particularly hydraulic oil).

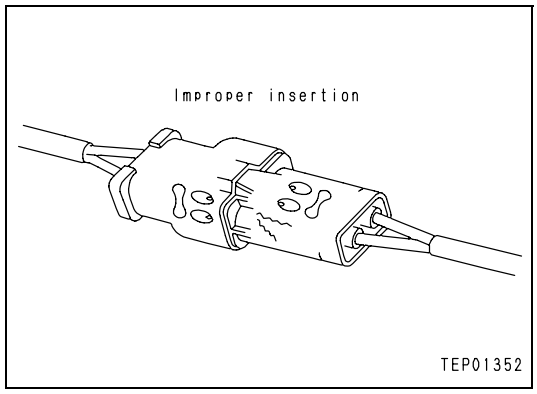
1. PRECAUTIONS WHEN HANDLING ELECTRIC EQUIPMENT

1) Handling wiring harnesses and connectors
Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protector or tubes used for protecting the wiring.
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.


TEW00191

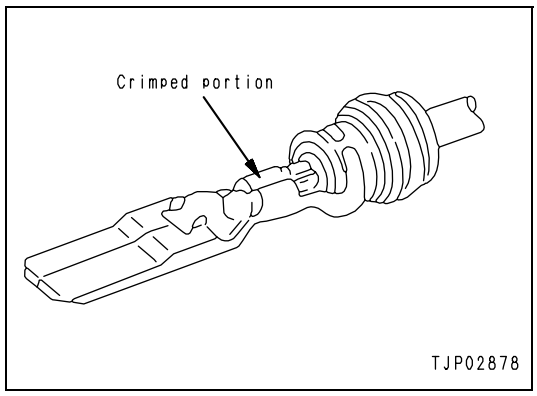
Main failures occurring in wiring harness

(1) Faulty contact of connectors
(faulty contact between male and female).
Problems with faulty contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidation of the contact surfaces.



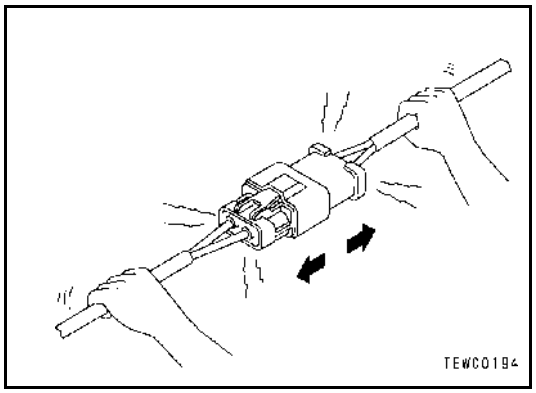
TEP01352

(2) Defective compression or soldering of connectors
The pins of the male and female connectors are in contact at the compressed terminal or soldered portion, but there is excessive force on the wiring, and the plating peels to cause improper connection or breakage.

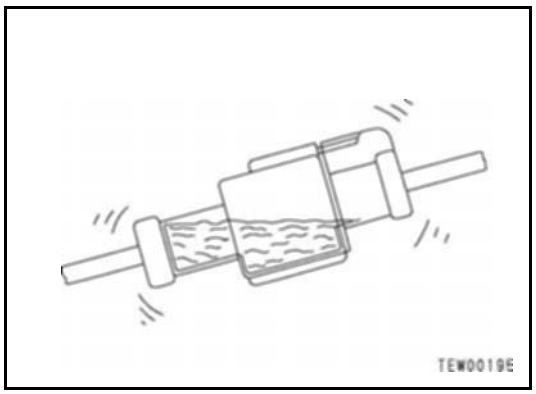


TJP02878

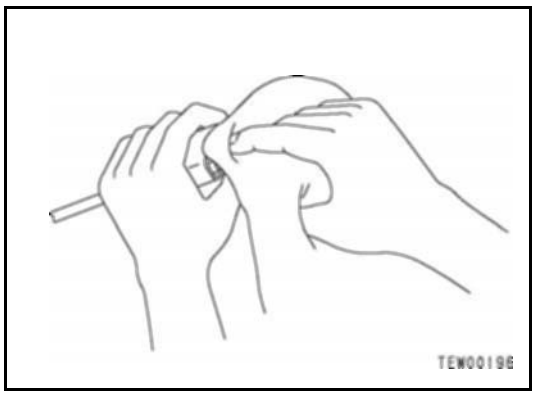
(3) Disconnections in wiring
If the wiring is held and tugged and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping compression of the connectors to the wire may be loosened, or the soldering may be damaged, or the wiring may be broken.



(4) High pressure water entering a connector
The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector depending on the direction of the water jet. The connector is designed to prevent water from entering, but if water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be short-circuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.



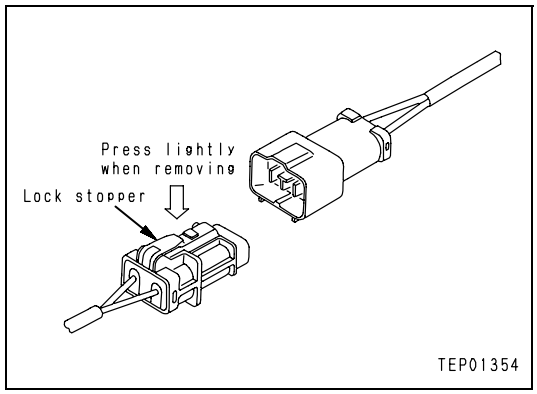
(5) Oil, grease or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, and this will cause a defective contact. If there is oil or grease or dirt stuck to the connector, wipe it off with a dry cloth or blow dry with air, and spray it with a contact restorer.
★ When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.
★ If there is water or oil present, it will increase the contamination of the points, so clean with air until all water and oil has been removed.



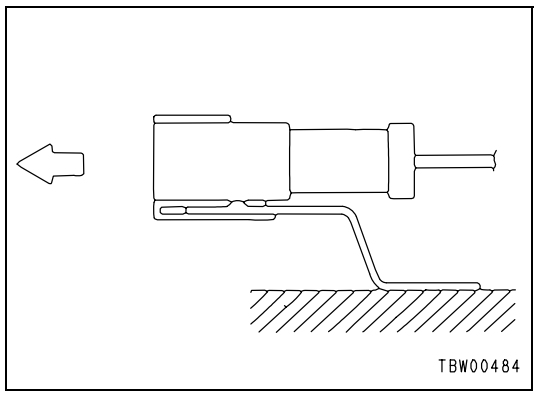
2) Removing, installing, and drying connectors and wiring harnesses

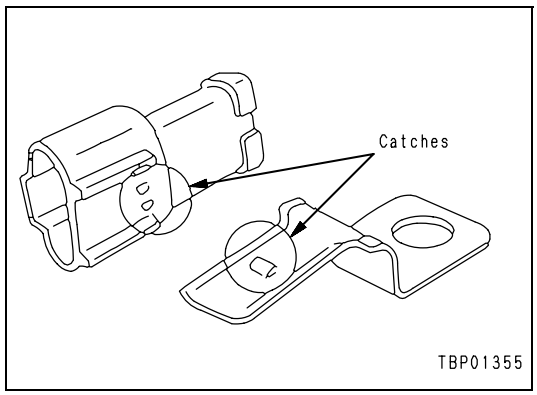
- Disconnecting connectors

(1) Hold the connectors when disconnecting. When disconnecting the connectors, hold the connectors and not the wires. For connectors held by a screw, loosen the screw fully, then hold the male and female connectors in each hand and pull apart. For connectors which have a lock stopper, press down the stopper with your thumb and pull the connectors apart.
★ Never try to pull apart with one hand.

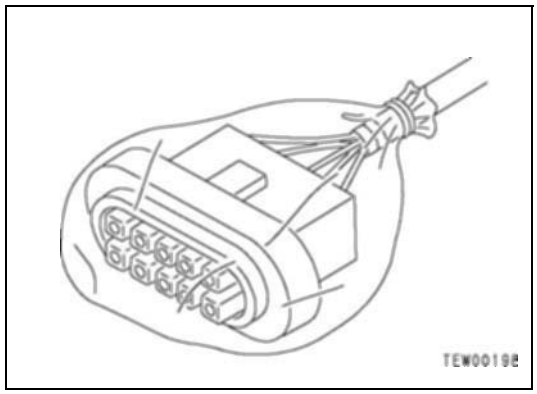


(2) When removing the connectors from the clips, pull the connector in a parallel direction to the clip.
★ If the connector is twisted to the left and right or up and down, the housing may break.

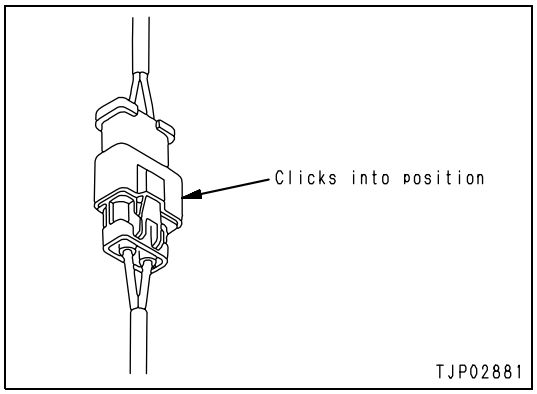




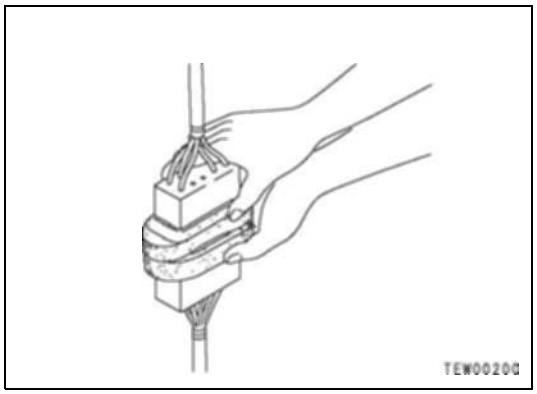
(3) Action to take after removing connectors. After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.
★ If the machine is left for a long time, it is particularly easy for improper contact to occur, so always cover the connector.



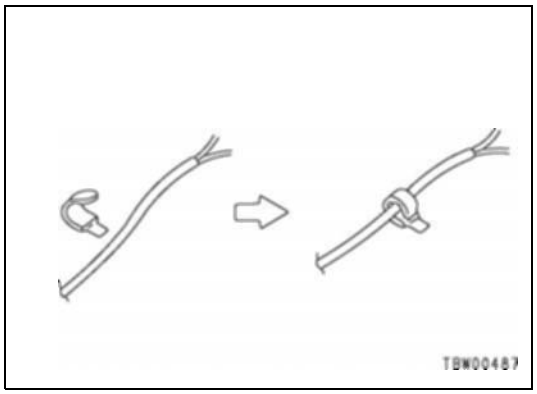
- Connecting connectors
  (1) Check the connector visually.
    1) Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
    2) Check that there is no deformation, faulty contact, corrosion, or damage to the connector pins.
    3) Check that there is no damage or breakage to the outside of the connector.
    ★ If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has gotten inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.
    ★ If there is any damage or breakage, replace the connector.



  (2) Assemble the connector securely.
  Align the position of the connector correctly, then insert it securely.
  For connectors with a lock stopper:
  Push in the connector until the stopper clicks into position.

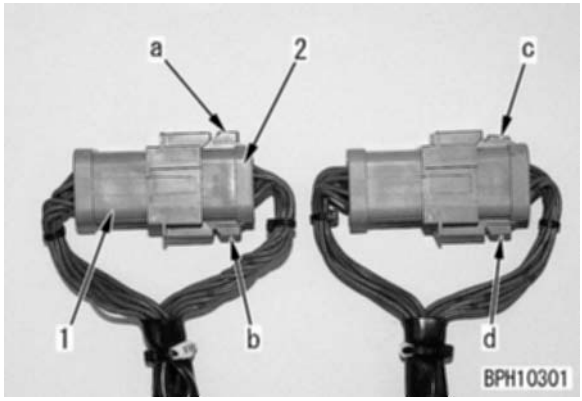


  (3) Correct any protrusion of the boot and any misalignment of the wiring harness.
  For connectors fitted with boots, correct any protrusion or the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.
    ★ When blowing with dry air, there is danger that the oil in the air may cause improper contact, so clean with properly filtered air.



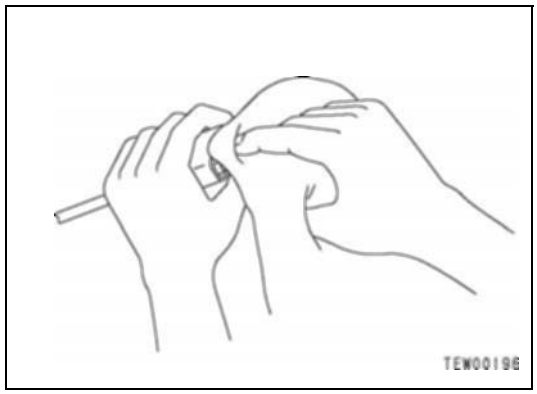
  (4) When the wiring harness clamp of the connector has been removed, always return it to its original condition and check that there is no looseness of the clamp.

- Connecting connectors (DT type connector)
  Since the DT 8-pole and 12-pole DT type connectors have 2 latches respectively, push them in until they click 2 times.
  1. Male connector, 2. Female connector
  - Normal locking state (Horizontal) : **a**, **b**, **d**
  - Incomplete locking state (Diagonal) : **c**

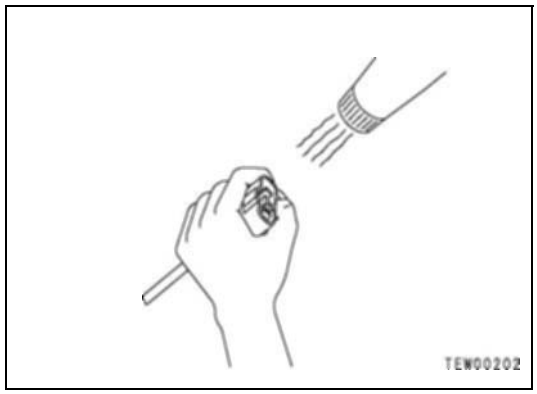


- Drying wiring harness
  If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high pressure water or steam directly on the wiring harness.

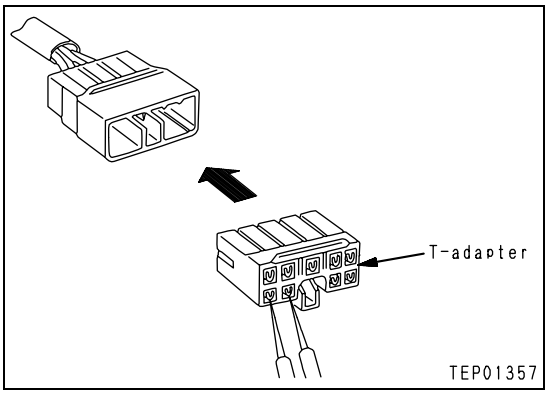
  If water gets directly on the connector, do as follows:
  (1) Disconnect the connector and wipe off the water with a dry cloth.
      ★ If the connector is blown dry with air, there is the risk that oil in the air may cause a faulty contact, so avoid blowing with air.



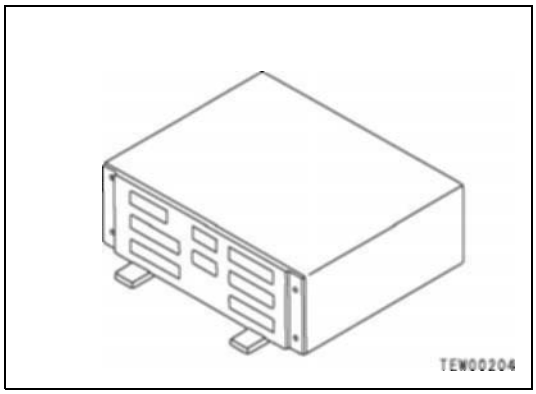
  (2) Dry the inside of the connector with a dryer.
  If water gets inside the connector, use a dryer to dry the connector.
      ★ Hot air from the dryer can be used, but be careful not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.



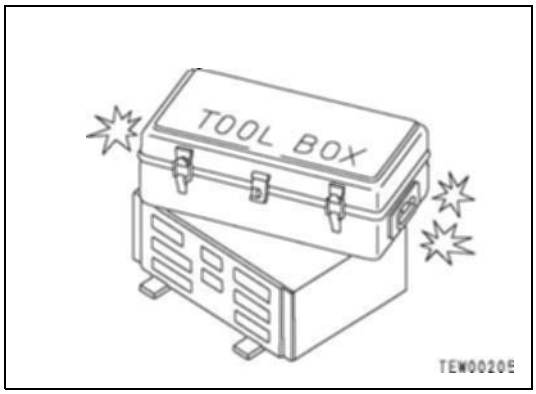
  (3) Carry out a continuity test on the connector.
  After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.
      ★ After completely drying the connector, spray it with contact restorer and reassemble.



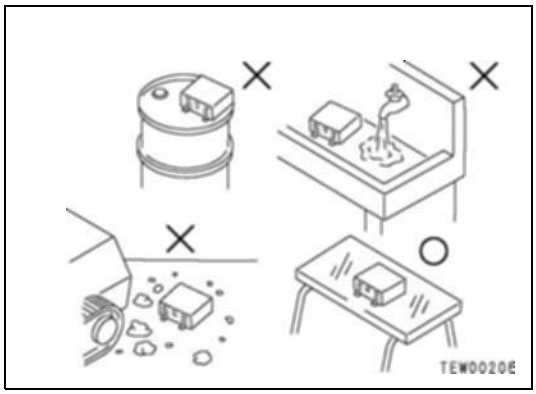
3) Handling control box
   (1) The control box contains a microcomputer and electronic control circuits.
   This controls all of the electronic circuits on the machine, so be extremely careful when handling the control box.
   (2) Do not open the cover of the control box unless necessary.



   (3) Do not place objects on top of the control box.
   (4) Cover the control connectors with tape or a vinyl bag.
   Never touch the connector contacts with your hand.
   (5) Do not leave the control box in a place where it is exposed to rain.



   (6) Do not place the control box on oil, water, or soil, or in any hot place, even for a short time. (Place it on a suitable dry stand)
   (7) Precautions when carrying out arc welding
   When carrying out arc welding on the body, disconnect all wiring harness connectors connected to the control box. Fit an arc welding ground close to the welding point.



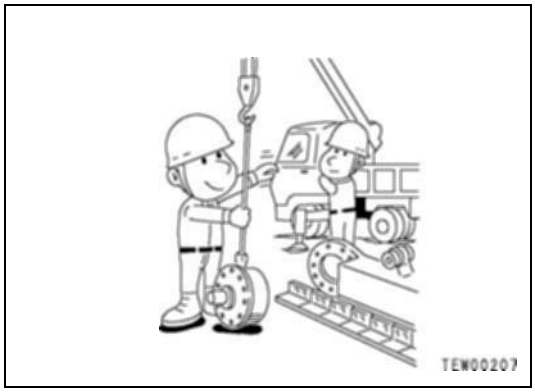
2. Points to remember when troubleshooting electric circuits
   1) Always turn the power OFF before disconnecting or connecting connectors.
   2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
      ★ Disconnect and connect the related connectors several times to check.
   3) Always connect any disconnected connectors before going on to the next step.
      ★ If the power is turned ON with the connectors still disconnected, unnecessary abnormality displays will be generated.
   4) When carrying out troubleshooting of circuits (measuring the voltage, resistance, continuity, or current), move the related wiring and connectors several times and check that there is no change in the reading of the tester.
      ★ If there is any change, there is probably defective contact in the circuit.

3. Points to remember when handling hydraulic equipment

With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

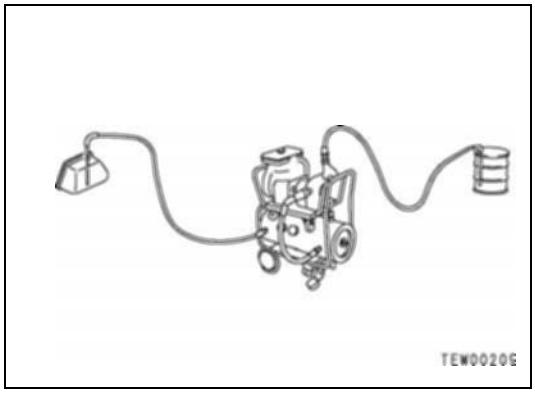
1) Be careful of the operating environment
Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

2) Disassembly and maintenance work in the field
If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to confirm the performance after repairs, so it is desirable to use unit exchange. Disassembly and maintenance of hydraulic equipment should be carried out in a specially prepared dust proof workshop, and the performance should be confirmed with special test equipment.



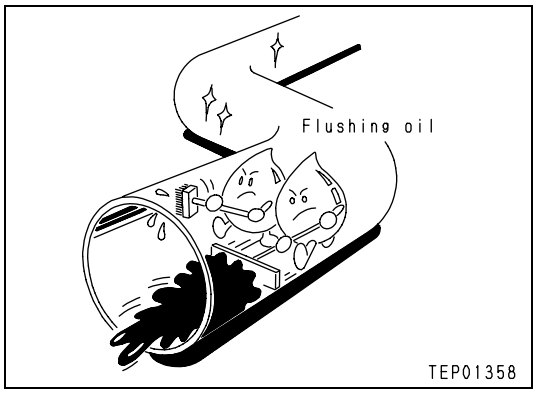
3) Sealing openings
After any piping or equipment is removed, the openings should be sealed with caps, tape, or vinyl bags to prevent any dirt or dust from entering. Never leave any openings opened or blocked with a rag, this could cause particles or dirt to get into the system.
Drain all oil into a container and not unto the ground and be sure to follow the proper environmental regulation for any disposal of oil.

4) Do not let any dirt, or dust get in during refilling operations.
Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil containers. If an oil cleaning device is used, it is possible to filter out the dirt that has collected during storage, so this is an even more effective method.

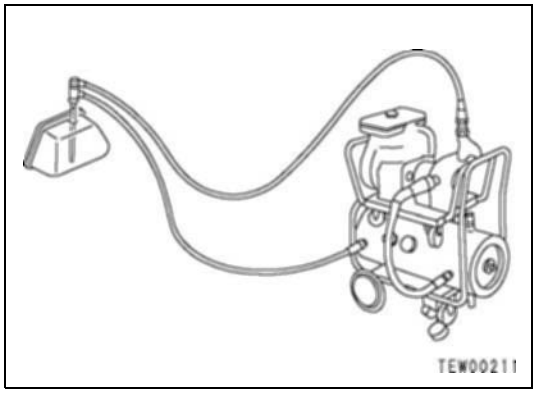


5) Change hydraulic oil when the temperature is high.
When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit together with the oil, so it is best to change the oil when it is still warm.
When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Do not drain the oil from the hydraulic tank; but drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

6) Flushing operations
After disassembling and assembling the equipment, or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit.
Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.



7) Cleaning operations
After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit.
The oil cleaning equipment is used to remove the ultra fine (about 3µ) particles that the filter built into the hydraulic equipment cannot remove, so it is an extremely effective device.



CHECK BEFORE TROUBLESHOOTING

		Item	Judgement Value	Action
Before Starting Checking Item	Lubricating oil, coolant	1. Check fuel level	-	Add fuel
		2. Check for impurities in fuel	-	Drain
		3. Check oil level in hydraulic oil tank	-	Add oil
		4. Check oil filter (Hydraulic, HST)	-	Replace
		5. Check brake oil level	-	Add oil
		6. Check engine oil level inside oil pan	-	Add oil
		7. Check coolant level	-	Add coolant
		8. Check dust indicator for clogging	-	Clean or replace
	Air, Hydraulic, Mechanical equipment	9. Check play of steering wheel	**mm or below	Adjust
		10. Check emergency steering	-	Repair
		11. Check tire inflation pressure and damage	-	Air charge or replace
		12. Check loosen of hub nut	Tightening torque (See DISASSEMBLY AND ASSEMBLY)	Tighten
		13. Check effect of foot brake	-	Adjust
		14. Check effect of parking brake	-	Adjust or repair
		15. Check effect of emergency brake	-	Adjust or repair
		16. Check operation of steering	-	Adjust or repair
		17. Check direction of rear view mirror and under mirror	-	Adjust
		18. Check effect of exhaust gas color and sound	-	Adjust or repair
		19. Check effect retarder brake	-	Adjust or repair
		20. Check effect body mounting rubber	-	Replace
	Electrical equipment	21. Check sound of horn	-	Repair
		22. Check flashing of lamps	-	Repair or replace
		23. Check operation of gauge when during operation	-	Adjust or repair
		24. Check operation of monitor panel	-	Adjust or repair
		25. Check operation of machine monitor system	-	Adjust or repair
		26. Check for missing central warning lamps	-	Repair or replace
		27. Check for looseness, corrosion of battery terminal, wiring	-	Tighten or clean
		28. Check for looseness, corrosion of alternator terminal, wiring	-	Tighten or clean
		29. Check for looseness, corrosion of starting motor terminal, wiring	-	Tighten or clean
Others Checking Item		30. Check for abnormal noise, smell	-	Repair
		31. Check for oil leakage	-	Repair
		32. Carry out air bleeding	-	Bleed air
		33. Check battery voltage (Engine stopped)	24 V	Charge or replace
		34. Check battery electrolyte level	-	Add
		35. Check for discolored, burnt, exposed wiring	-	Replace
		36. Check for missing wiring clamps, hanging wire	-	Repair
		37. Check for water leakage on wiring (Pay particular attention to water leaking on connectors or terminals)	-	Dry
		38. Check for blown, corroded fuses	-	Replace
		39. Check alternator voltage (Engine running at 1/2 throttle of above)	After running for several minutes: 28.5 - 29.5V	Replace
		40. Check sound of actuation of battery relay (When starting switch is turned ON, OFF)	-	Replace

CATEGORIES, PROCEDURE, AND METHOD OF USING TROUBLESHOOTING CHARTS

1. Categories of troubleshooting codes
   - ★ If the machine monitor displays a failure code, the name of the controller is also displayed at the same time, so the troubleshooting codes are categorized according to the name of each controller. (This may also includes some failure codes for the electrical system that are not displayed)
   - ★ Failures of the hydraulic and mechanical system that the machine monitor cannot display are categorized as H mode.

Failure code	System for troubleshooting
HST	Troubleshooting of HST controller system
MON	Troubleshooting of machine monitor system
E	Troubleshooting of electrical system
H	Troubleshooting of hydraulic, mechanical system
S	Troubleshooting of engine

2. Procedure for troubleshooting
   - ★ If a problem occurs on the machine, or if any problem is felt, carry out troubleshooting as follows.
   1) When failure code is displayed on machine monitor
      If a failure code is displayed on the machine monitor at the same time as the problem occurs, check the content of the display, then go to the applicable troubleshooting for the failure code.
   2) If no failure code is displayed on the machine monitor but the failure is recorded in memory
      If it is impossible to check the failure code display on the machine monitor when a problem occurs, use the troubleshooting history display function in the service mode of the machine monitor to check if there is a failure code.
      If a failure code is recorded, it is probable that it is the cause, so go to the applicable troubleshooting for the failure code.
   3) If no failure code is displayed and no failure history is recorded
      If it is impossible to check the failure display on the machine monitor when a problem occurs, and there is also no failure code recorded in the troubleshooting history display function in the service mode of the machine monitor, it is probable that are problem has occurred in the hydraulic or mechanical system or in the electrical system that the controller cannot detect.
      In such a case, check the condition of the failure carefully, then go to the applicable troubleshooting for the failure.

PHENOMENA CONSIDERED TO BE FAILURES AND TROUBLESHOOTING NO.

★With mark ● go to troubleshooting No. on failure code display.

No.	Phenomena considered to be failures		Troubleshooting					
			Failure code	HST mode	MON mode	E mode	H mode	S mode (Engine)
Failures related to failure code								
1	Failure code is displayed on failure code display unit (LED display unit)		●					
Failures related to engine (S mode)								
2	Starting performance is poor (starting always takes time)							S-1
3	Engine does not start	Engine does not rotate						S-2a)
4		Engine rotates but no exhaust smoke comes out						S-2b)
5		Exhaust smoke comes out but engine does not start						S-2c)
6	Engine does not pick up smoothly (follow-up is poor)							S-3
7	Engine stops during operations							S-4
8	Engine does not rotate smoothly (hunting)							S-5
9	Engine lacks output (or lacks power)							S-6
10	Exhaust smoke is black (incomplete combustion)							S-7
11	Oil consumption is excessive (or exhaust smoke is blue)							S-8
12	Oil becomes contaminated quickly							S-9
13	Fuel consumption is excessive							S-10
14	Oil in cooling water (or water spurts back, or water level goes down)							S-11
15	Oil pressure caution lamp light ON (drop in oil pressure)							S-12
16	Oil level rises (water, fuel in oil)							S-13
17	Water temperature becomes too high (overheating)							S-14
18	Abnormal noise is made							S-15
19	Vibration is excessive							S-16
Failures related to HST (HST mode)								
20	Defective HST controller power source (HST controller does not function)			HST-1				
21	Travel speed does not shifted			HST-2				
22	HST output cannot be controlled (traction control)			HST-3				
Failures related to monitor (MON mode)								
23	The parking brake indicator lamp does not light ON				MON-1			
24	The brake oil pressure caution lamp does not light ON				MON-2			
25	The engine water temperature caution lamp does not light ON or the engine water temperature gauge does not rises when engine is started				MON-3			
26	The HST oil temperature caution lamp does not light ON or the HST oil temperature gauge does not rises when engine is started				MON-4			
27	The fuel level gauge does not rises or goes down				MON-5			
28	The radiator coolant level caution lamp does not light				MON-6			

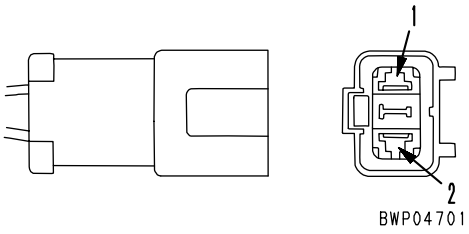
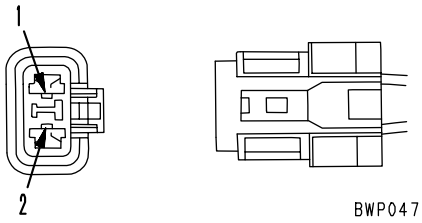
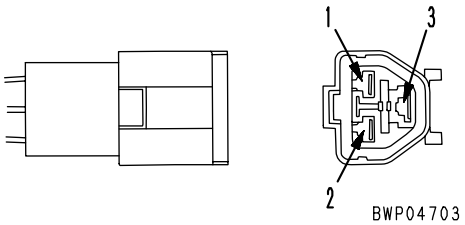
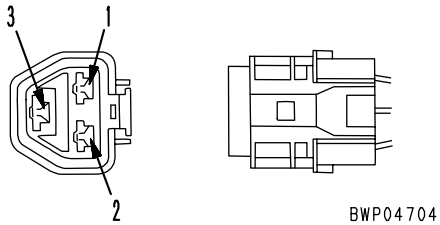
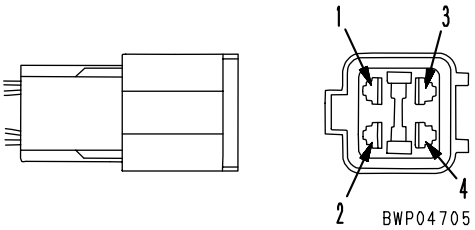
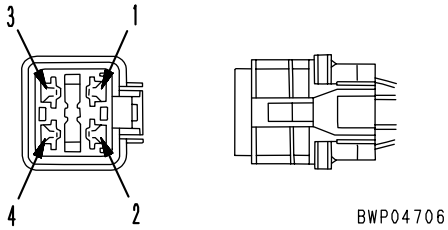
No.	Phenomena considered to be failures	Troubleshooting					
		Failure code	HST mode	MON mode	E mode	H mode	S mode (Engine)
Failures related to monitor (MON mode)							
29	The steering oil pressure caution lamp does not light ON			MON-7			
30	The emergency steering oil pressure indicator lamp does not light ON			MON-8			
31	Input fault in monitor panel mode switch 1 [■] (panel switch 1)			MON-9			
32	Input fault in monitor panel mode switch 1 [◇] (panel switch 2)			MON-10			
33	Input fault in monitor panel mode switch 2 [<] (panel switch 3)			MON-11			
34	Input fault in monitor panel mode switch 2 [>] (panel switch 4)			MON-12			
35	The alarm buzzer does not sound or stop			MON-13			
36	The engine oil level caution lamp does not light ON			MON-14			
37	The air cleaner clogging indicator lamp does not light ON			MON-15			
38	Defective cancel switch			MON-16			
39	Defective subtotal switch			MON-17			
40	Defective bottom pressure sensor (Short circuit with power source)			MON-18			
41	Defective rode pressure sensor			MON-19			
42	The wiper does not function			MON-20			
43	The each lamps do not light ON			MON-21			
Failures related to electrical system (E mode)							
44	The engine does not start				E-1		
45	The engine does not stop				E-2		
46	Preheating is impossible or constant				E-3		
47	Defective parking brake system				E-4		
48	Defective lift arm kick-out function and cancellation				E-5		
49	Defective bucket leveler function and cancellation				E-6		
50	Defective lift arm FLOATING holding and cancellation				E-7		
51	The wiper does not function				E-8		
52	The window washer does not function				E-9		
53	The each lamps do not light ON				E-10		
54	The horn does not sound				E-11		
55	The air conditioner does not work				E-12		
Failures related to hydraulic and mechanical system (H mode)							
56	The machine does not start					H-1	
57	The travel speed is slow					H-2	
58	The thrusting force is weak					H-3	
59	Engine stalls when traveling or engine speed drops excessively					H-4	
60	Travel speed (gear) does not shifted					H-5	
61	The steering wheel dose not turn					H-6	
62	Steering is heavy					H-7	
63	The steering wheel shakes or jerks					H-8	

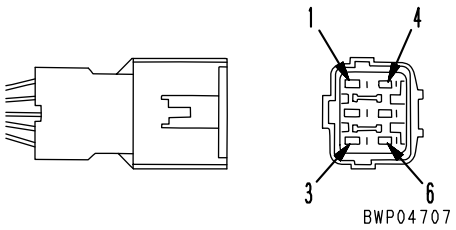
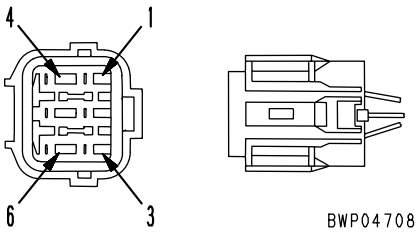
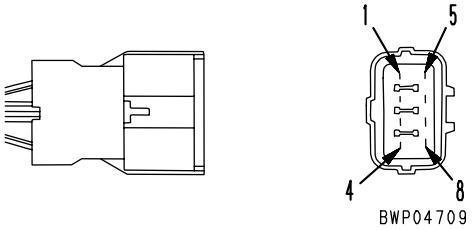
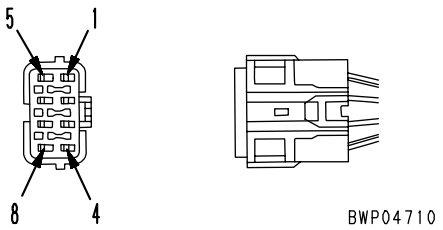
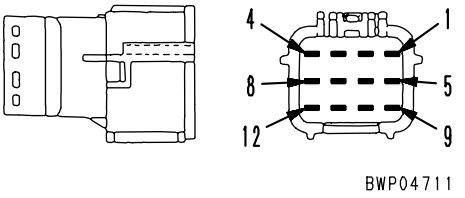
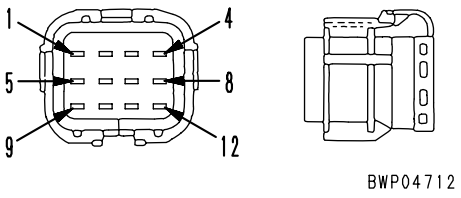
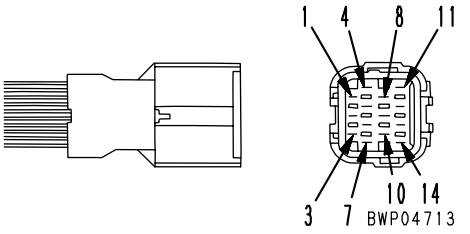
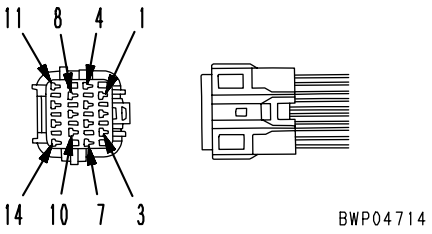
No.	Phenomena considered to be failures	Troubleshooting					
		Failure code	HST mode	MON mode	E mode	H mode	S mode (Engine)
Failures related to hydraulic and mechanical system (H mode)							
64	Machine deviates naturally to one side when traveling					H-9	
65	The brake does not work or does not work well					H-10	
66	The brake is not released or is dragged					H-11	
67	The lift arm does not rise					H-12	
68	The lift arm moves slowly or the lift arm rising force is insufficient					H-13	
69	When rising, the lift arm comes to move slowly at specific height					H-14	
70	The lift arm cylinder cannot hold down the bucket (The bucket rises in the air)					H-15	
71	Hydraulic drifts of the lift arm occur often					H-16	
72	The lift arm wobbles during operation					H-17	
73	When the control lever is switched from "HOLD" to "RAISE", the lift arm falls temporarily					H-18	
74	The bucket does not tilt back					H-19	
75	The bucket moves slowly or the tilting-back force is insufficient					H-20	
76	The bucket comes to operate slowly in the midst of tilting-back					H-21	
77	The bucket cylinder cannot hold down the bucket					H-22	
78	Hydraulic drifts of the bucket occur often					H-23	
79	The bucket wobbles during travel with cargo (The work equipment valve is set to "HOLD")					H-24	
80	When the control lever is switched from "HOLD" to "TILT", the bucket falls temporarily					H-25	
81	The control levers of lift arm and bucket do not move smoothly and heavy					H-26	

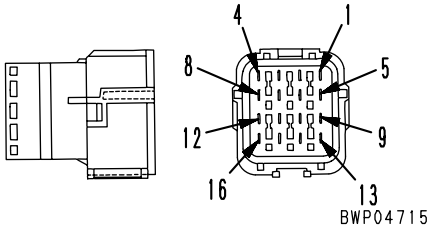
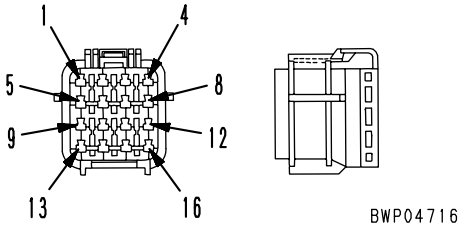
CONNECTION TABLE FOR CONNECTOR PIN NUMBERS

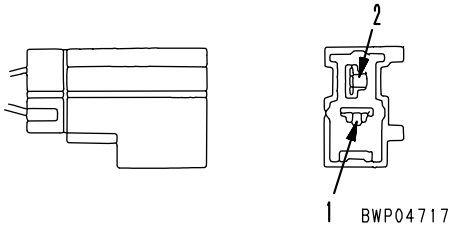
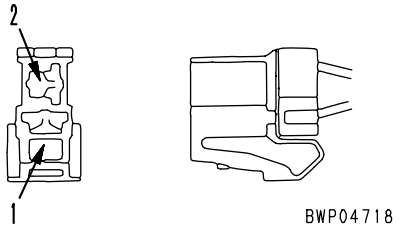
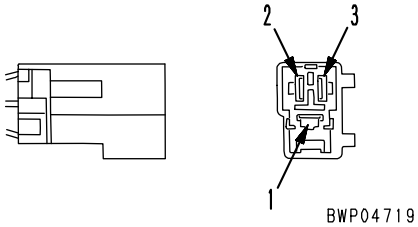
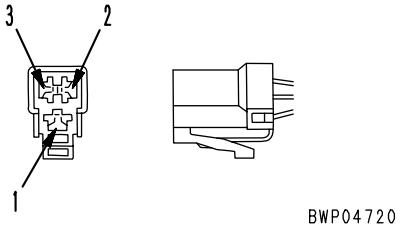
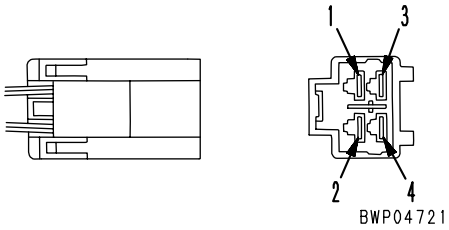
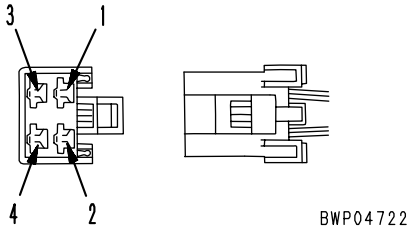
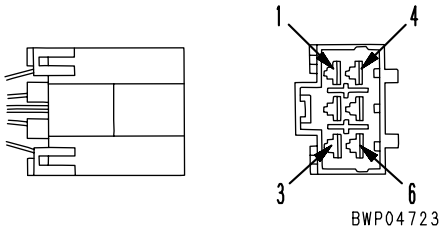
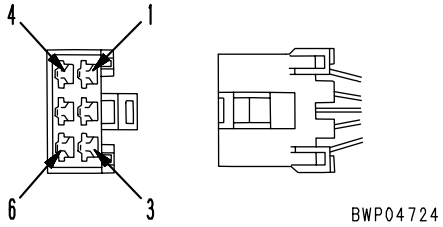
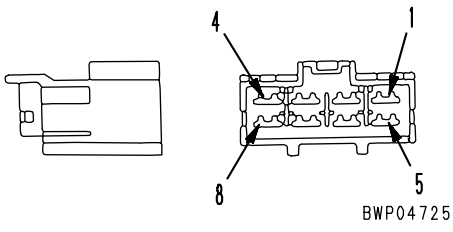
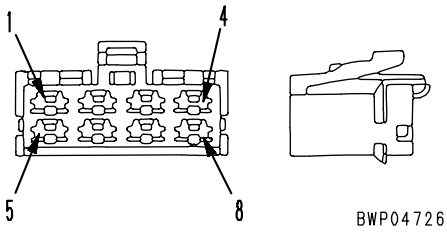
★ The terms male and female refer to the pins, while the terms male housing and female housing refer to the mating portion of the housing.

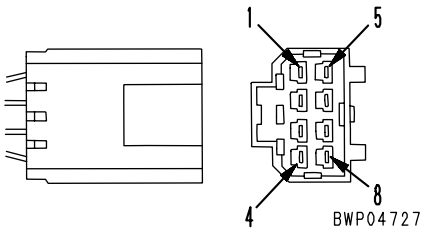
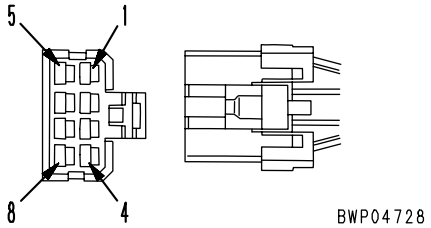
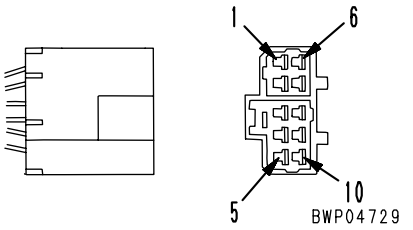
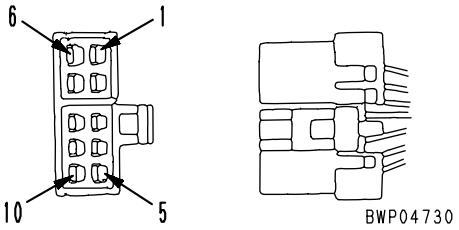
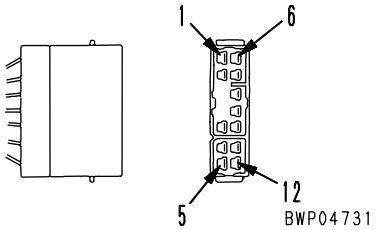
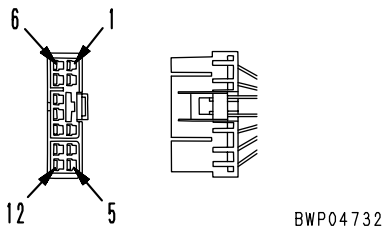
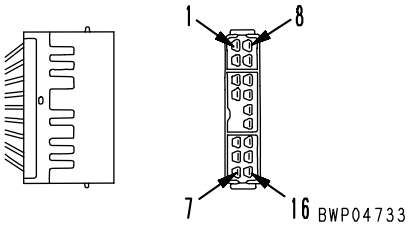
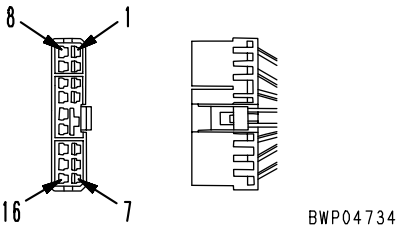
★ Deuscht connector has marks of pin numbers on the wiring harness side.

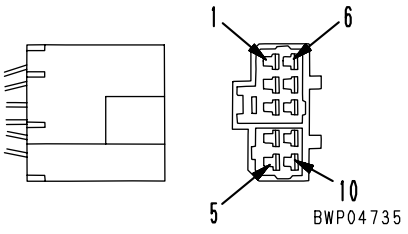
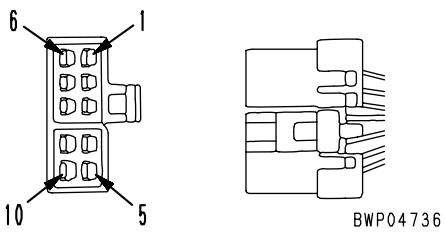
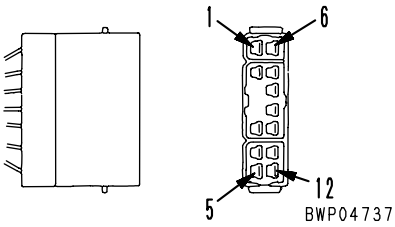
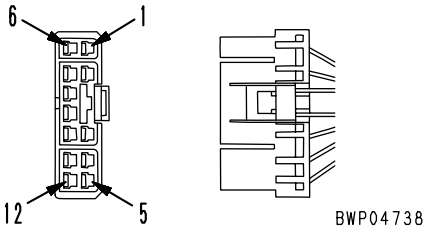
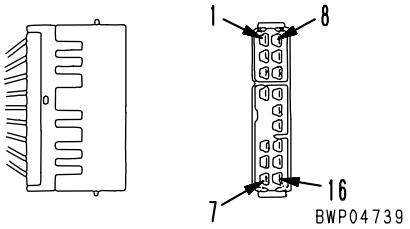
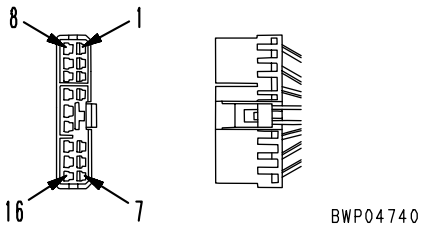
Number of Pins	X Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
1	Part number: 08055-00181	Part number: 08055-00191	799-601-7010
2			799-601-7020
	Part number: 08055-00282	Part number: 08055-00292	
3			799-601-7030
	Part number: 08055-00381	Part number: 08055-00391	
4			799-601-7040
	Part number: 08055-00481	Part number: 08055-00491	
—	Terminal part number: 79A-222-3370 • Wire size: 0.85 • Quantity: 20 pieces • Grommet: black	Terminal part number: 79A-222-3390 • Wire size: 0.85 • Quantity: 20 pieces • Grommet: black	—
—	Terminal part number: 79A-222-3380 • Wire size: 2.0 • Quantity: 20 pieces • Grommet: red	Terminal part number: 79A-222-3410 • Wire size: 2.0 • Quantity: 20 pieces • Grommet: red	—

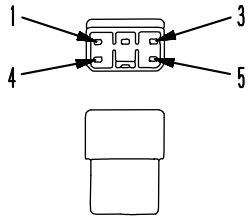
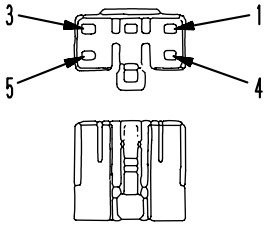
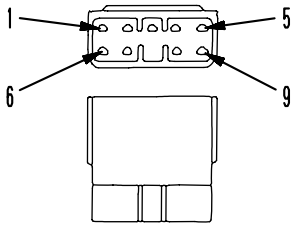
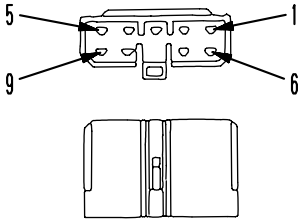
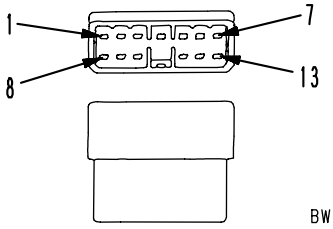
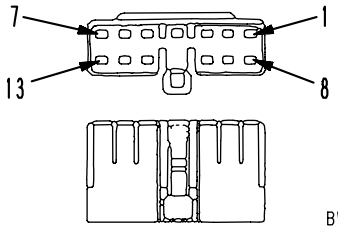
Number of Pins	SWP Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
6			799-601-7050
	Part number: 08055-10681	Part number: 08055-10691	
8			799-601-7060
	Part number: 08055-10881	Part number: 08055-10891	
12			799-601-7310
	Part number: 08055-11281	Part number: 08055-11291	
14			799-601-7070
	Part number: 08055-11481	Part number: 08055-11491	

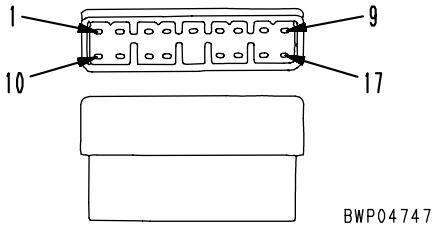
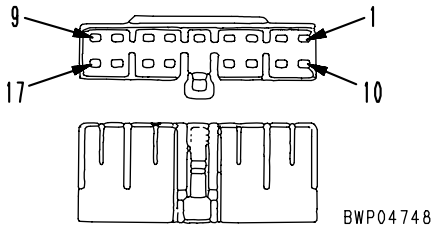
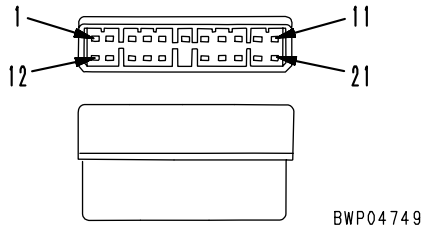
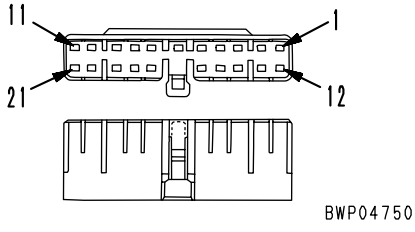
Number of Pins	SWP Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
16			799-601-7320
	Part number: 08055-11681	Part number: 08055-11691	
—	Terminal part number: • Wire size: 0.85 • Quantity: 20 pieces • Grommet: black	Terminal part number: • Wire size: 0.85 • Quantity: 20 pieces • Grommet: black	—
—	Terminal part number: • Wire size: 1.25 • Quantity: 20 pieces • Grommet: red	Terminal part number: • Wire size: 1.25 • Quantity: 20 pieces • Grommet: red	—

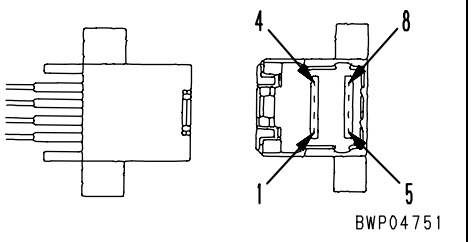
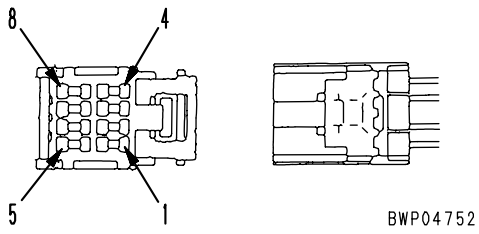
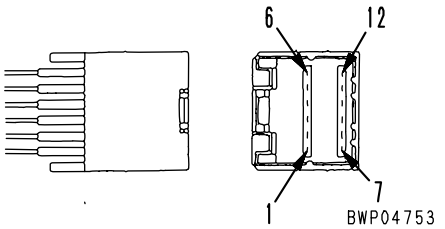
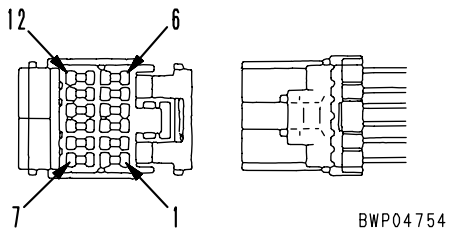
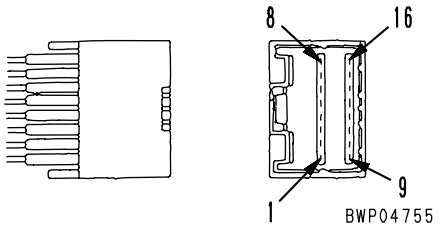
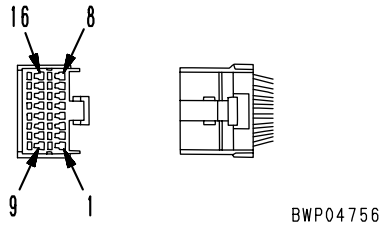
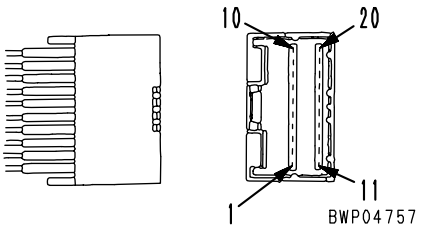
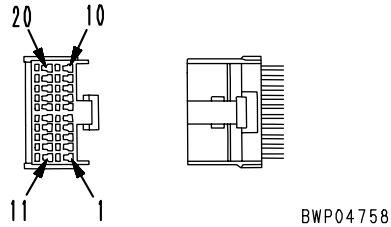
Number of Pins	M Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
1	Part number: 08056-00171	Part number: 08056-00181	799-601-7080
2			799-601-7090
	Part number: 08056-00271	Part number: 08056-00281	
3			799-601-7110
	Part number: 08056-00371	Part number: 08056-00381	
4			799-601-7120
	Part number: 08056-00471	Part number: 08056-00481	
6			799-601-7130
	Part number: 08056-00671	Part number: 08056-00681	
8			799-601-7340
	Part number: 08056-00871	Part number: 08056-00881	

Number of Pins	S Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
8			799-601-7140
	Part number: 08056-10871	Part number: 08056-10881	
10 (white)			799-601-7150
	Part number: 08056-11071	Part number: 08056-11081	
12 (white)			799-601-7350
	Part number: 08056-11271	Part number: 08056-11281	
16 (white)			799-601-7330
	Part number: 08056-11671	Part number: 08056-11681	

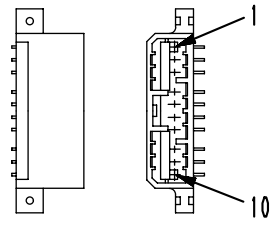
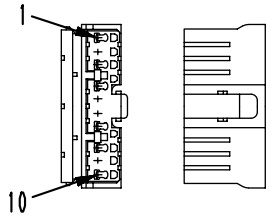
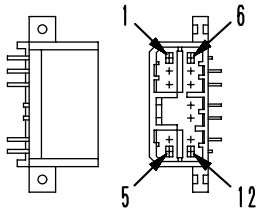
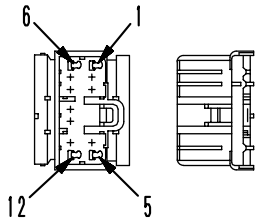
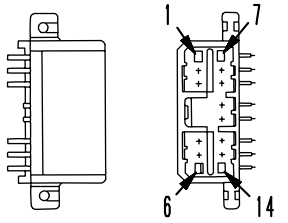
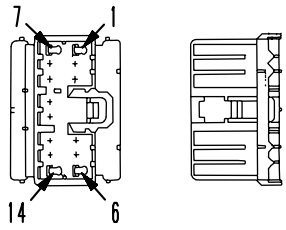
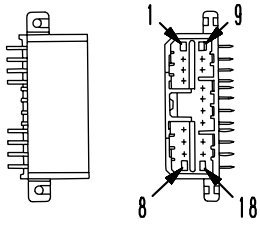
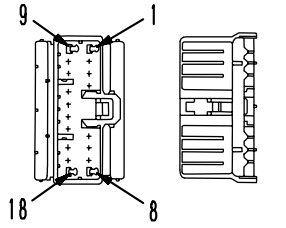
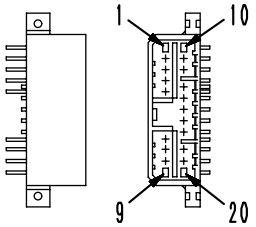
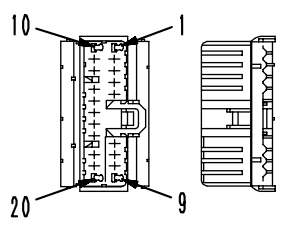
Number of Pins	S Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
10 (blue)			—
	—	—	
12 (blue)			799-601-7160
	Part number: 08056-11272	Part number: 08056-11282	
16 (blue)			799-601-7170
	Part number: 08056-11672	Part number: 08056-11682	

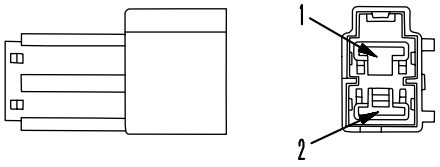
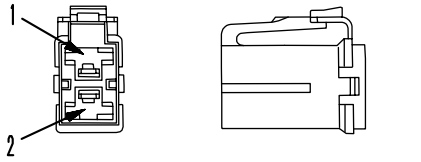
Number of Pins	MIC Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
7	Body part number: 79A-222-2640 (Quantity: 5 pieces)	Body part number: 79A-222-2630 (Quantity: 5 pieces)	—
11	Body part number: 79A-222-2680 (Quantity: 5 pieces)	Body part number: 79A-222-2670 (Quantity: 5 pieces)	—
5	 BWP04741	 BWP04742	799-601-2710
	Body part number: 79A-222-2620 (Quantity: 5 pieces)	Body part number: 79A-222-2610 (Quantity: 5 pieces)	
9	 BWP04743	 BWP04744	799-601-2950
	Body part number: 79A-222-2660 (Quantity: 5 pieces)	Body part number: 79A-222-2650 (Quantity: 5 pieces)	
13	 BWP04745	 BWP04746	799-601-2720
	Body part number: 79A-222-2710 (Quantity: 2 pieces)	Body part number: 79A-222-2690 (Quantity: 2 pieces)	

Number of Pins	MIC Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
17			799-601-2730
	Body part number: 79A-222-2730 (Quantity: 2 pieces)	Body part number: 79A-222-2720 (Quantity: 2 pieces)	
21			799-601-2740
	Body part number: 79A-222-2750 (Quantity: 2 pieces)	Body part number: 79A-222-2740 (Quantity: 2 pieces)	
—	Body part number: 79A-222-2770 (Quantity: 50 pieces)	Body part number: 79A-222-2760 (Quantity: 50 pieces)	—

Number of Pins	AMP040 Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
8			799-601-7180
	—	Housing part number: 79A-222-3430 (Quantity: 5 pieces)	
12			799-601-7190
	—	Housing part number: 79A-222-3440 (Quantity: 5 pieces)	
16			799-601-7210
	—	Housing part number: 79A-222-3450 (Quantity: 5 pieces)	
20			799-601-7220
	—	Housing part number: 79A-222-3460 (Quantity: 5 pieces)	

★ Terminal part number: 79A-222-3470 (for all numbers of pins).

Number of Pins	AMP070 Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
10	 BWP04759	 BWP04760	799-601-7510
	—	Part number: 08195-10210	
12	 BWP04761	 BWP04762	799-601-7520
	—	Part number: 08195-12210	
14	 BWP04763	 BWP04764	799-601-7530
	—	Part number: 08195-14210	
18	 BWP04765	 BWP04766	799-601-7540
	—	Part number: 08195-18210	
20	 BWP04767	 BWP04768	799-601-7550
	—	Part number: 08195-20210	

Number of Pins	L Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
2	 BWP04769	 BWP04770	—
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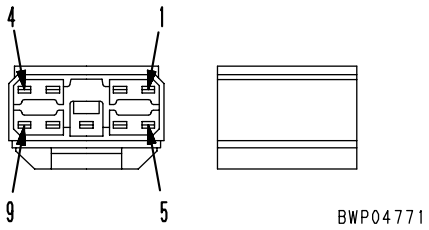
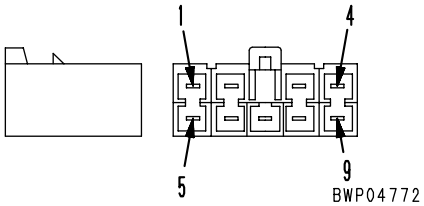
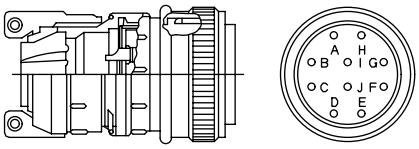
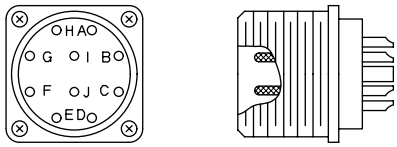
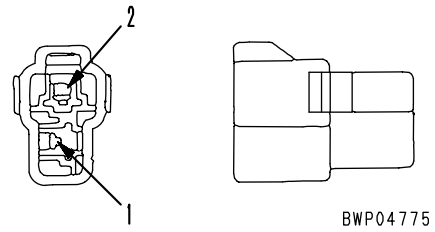
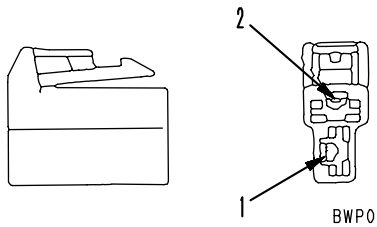
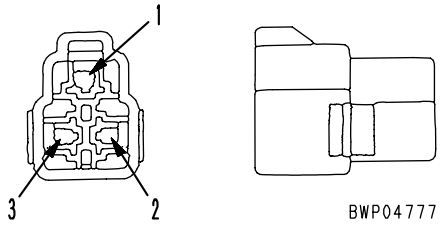
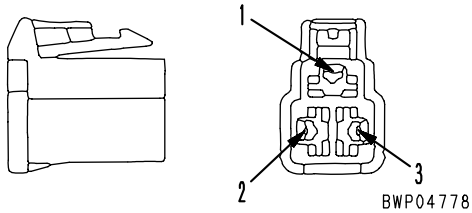
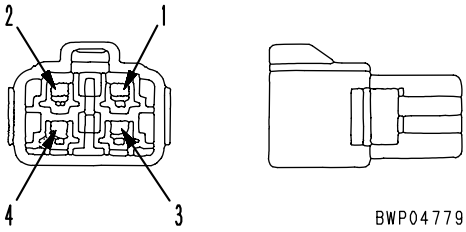
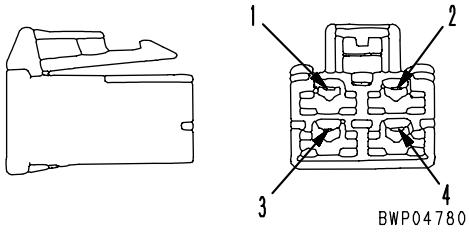
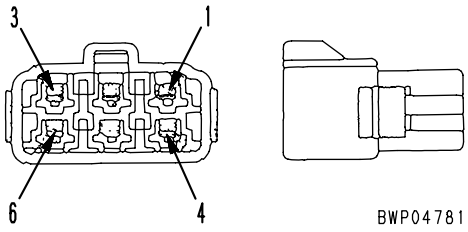
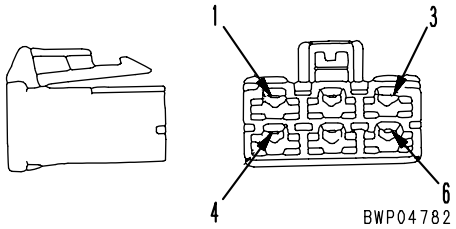
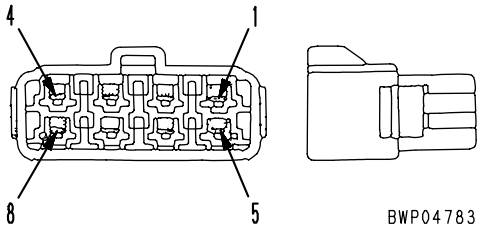
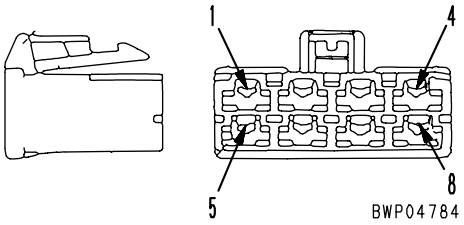
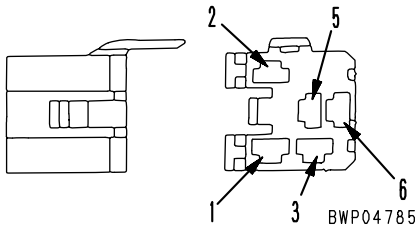
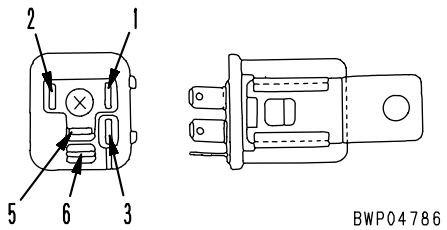
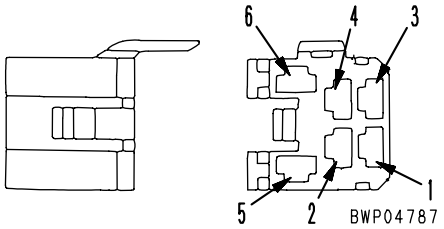
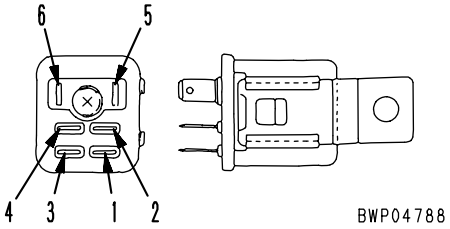
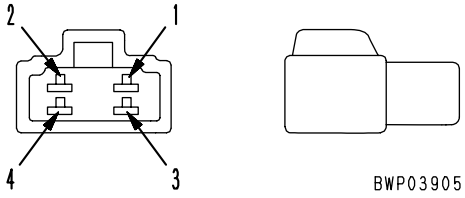
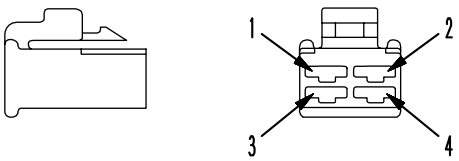
Number of Pins	PA Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
9	 BWP04771	 BWP04772	—
	—	—	

Number of Pins	BENDIX (MS) Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
10	 BWP04773	 BWP04774	799-601-3460
	—	—	

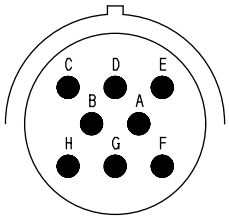
Number of Pins	KES1 Automobile Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
2			—
	Part number: 08027-10210 (Natural color) 08027-10220 (Black)	Part number: 08027-10260 (Natural color) 08027-10270 (Black)	
3			—
	Part number: 08027-10310	Part number: 08027-10360	
4			—
	Part number: 08027-10410 (Natural color) 08027-10420 (Black)	Part number: 08027-10460 (Natural color) 08027-10470 (Black)	
6			—
	Part number: 08027-10610 (Natural color) 08027-10620 (Black)	Part number: 08027-10660 (Natural color) 08027-10670 (Black)	

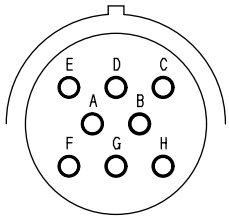
Number of Pins	KES1 Automobile Type Connector		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
8			—
	Part number: 08027-10810 (Natural color) 08027-10820 (Black)	Part number: 08027-10860 (Natural color) 08027-10870 (Black)	

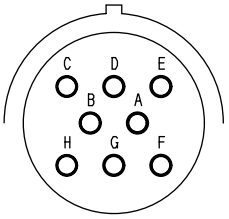
Number of Pins	Connector for relay (Socket)		
	Male (Female housing)	Female (Male housing)	T-adapter Part Number
5			799-601-7360
	—	—	
6			799-601-7370
	—	—	

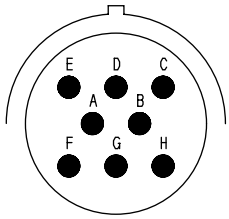
Type (shell size code)	F Type Connector		
	Pin (Male terminal)	Body (Female terminal)	T-adapter Part Number
4			—
	—	—	

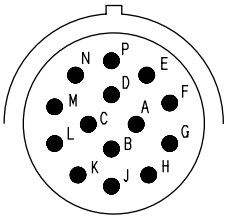
[The pin No. is also marked on the connector (electric wire insertion end)]

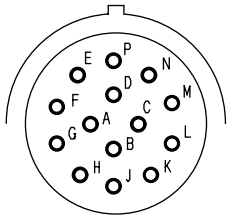
<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part Number</td></tr>
<tr><td rowspan="6">18-8 (1)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="3">799-601-9210</td></tr>
<tr><td> 

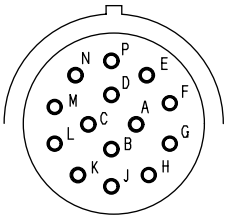
BWP05001</td><td> 

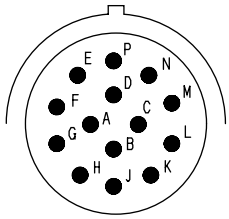
BWP05002</td></tr>
<tr><td>Part number: 08191-11201, 08191-11202
08191-11205, 08191-11206</td><td>Part number: 08191-14101, 08191-14102
08191-14105, 08191-14106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male terminal)</td><td rowspan="3">799-601-9210</td></tr>
<tr><td> 

BWP05003</td><td> 

BWP05004</td></tr>
<tr><td>Part number: 08191-11201, 08191-12202
08191-11205, 08191-12206</td><td>Part number: 08191-13101, 08191-13102
08191-13105, 08191-13106</td></tr>
<tr><td rowspan="6">18-14 (2)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="3">799-601-9220</td></tr>
<tr><td> 

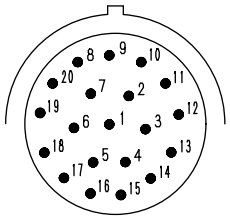
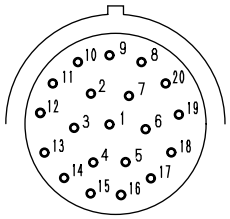
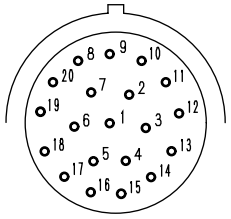
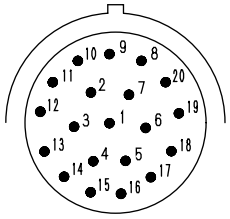
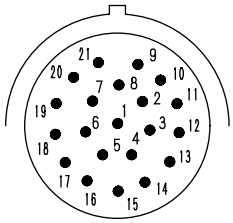
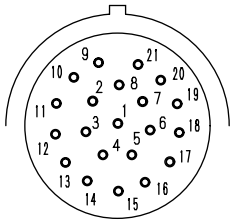
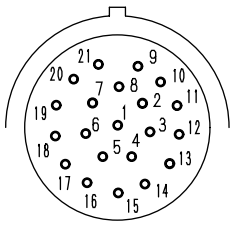
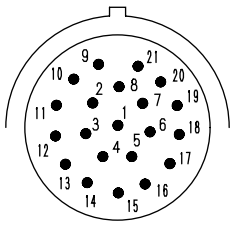
BWP05005</td><td> 

BWP05006</td></tr>
<tr><td>Part number: 08191-21201, 08191-12202
08191-21205, 08191-12206</td><td>Part number: 08191-24101, 08191-24102
08191-24105, 08191-24106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male terminal)</td><td rowspan="3">799-601-9220</td></tr>
<tr><td> 

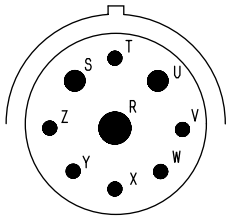
BWP05007</td><td> 

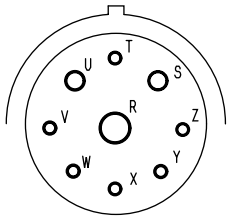
BWP05008</td></tr>
<tr><td>Part number: 08191-22201, 08191-22202
08191-22205, 08191-22206</td><td>Part number: 08191-23101, 08191-23102
08191-23105, 08191-23106</td></tr>
</table>

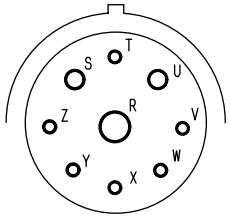
[The pin No. is also marked on the connector (electric wire insertion end)]

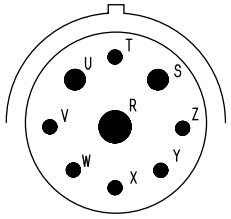
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part Number
18-20 (3)	Pin (male terminal)	Pin (female terminal)	799-601-9230
	 BWP05009	 BWP05010	
	Part number: 08191-31201, 08191-31202	Part number: 08191-34101, 08191-34102	
	Pin (female terminal)	Pin (male terminal)	799-601-9230
	 BWP05011	 BWP05012	
	Part number: 08191-32201, 08191-32202	Part number: 08191-33101, 08191-33102	
18-21 (4)	Pin (male terminal)	Pin (female terminal)	799-601-9240
	 BWP05013	 BWP05014	
	Part number: 08191-41201, 08191-42202	Part number: 08191-44101, 08191-44102	
	Pin (female terminal)	Pin (male terminal)	799-601-9240
	 BWP05015	 BWP05016	
	Part number: 08191-42201, 08191-42202	Part number: 08191-43101, 08191-43102	

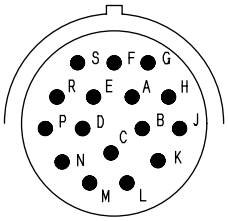
[The pin No. is also marked on the connector (electric wire insertion end)]

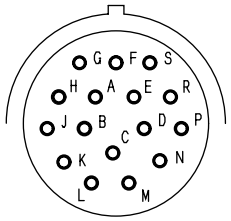
<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part Number</td></tr>
<tr><td rowspan="6">24-9 (5)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9250</td></tr>
<tr><td> 

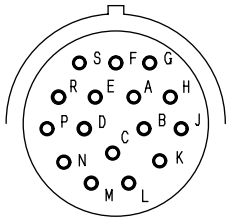
BWP05017</td><td> 

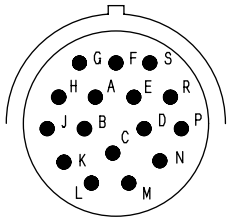
BWP05018</td></tr>
<tr><td>Part number: 08191-51201, 08191-51202</td><td>Part number: 08191-54101, 08191-54102</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male terminal)</td><td rowspan="2">799-601-9250</td></tr>
<tr><td> 

BWP05019</td><td> 

BWP05020</td></tr>
<tr><td>Part number: 08191-52201, 08191-52202</td><td>Part number: 08191-53101, 08191-53102</td></tr>
<tr><td rowspan="6">24-16 (6)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9260</td></tr>
<tr><td> 

BWP05021</td><td> 

BWP05022</td></tr>
<tr><td>Part number: 08191-61201, 08191-62202
08191-61205, 08191-62206</td><td>Part number: 08191-64101, 08191-64102
08191-64105, 08191-64106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male terminal)</td><td rowspan="2">799-601-9260</td></tr>
<tr><td> 

BWP05023</td><td> 

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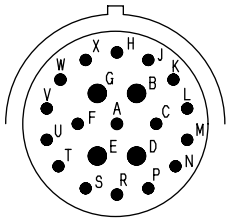
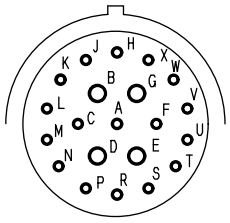
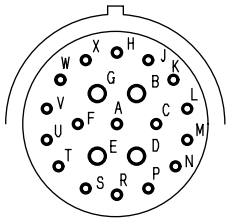
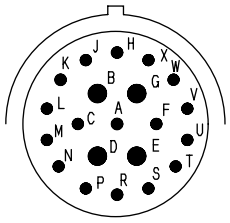
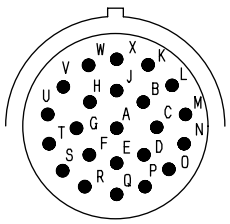
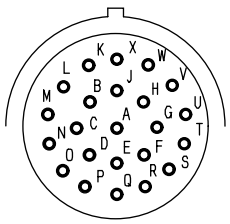
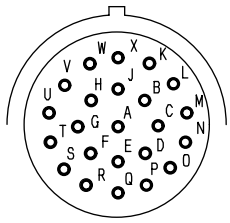
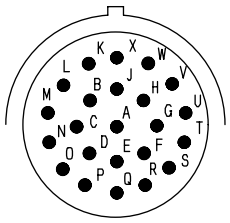
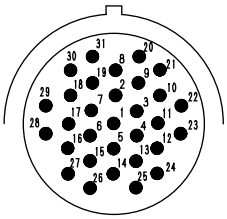
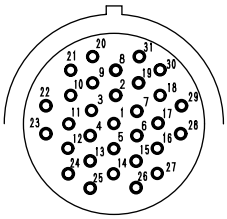
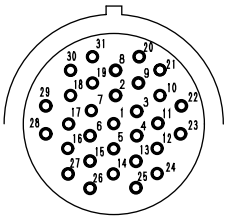
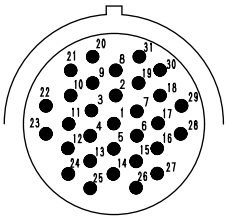
<tr><td>Part number: 08191-62201, 08191-62202
08191-62205, 08191-62206</td><td>Part number: 08191-63101, 08191-63102
08191-63105, 08191-63106</td></tr>
</table>

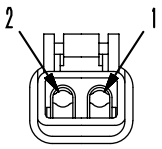
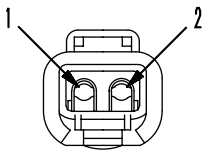
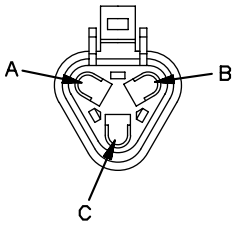
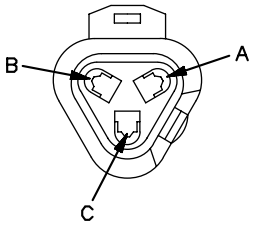
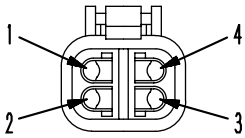
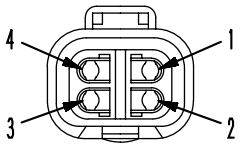
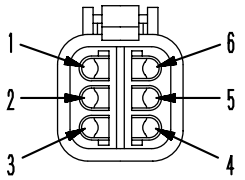
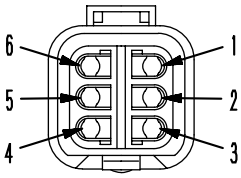
[The pin No. is also marked on the connector (electric wire insertion end)]

<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part Number</td></tr>
<tr><td rowspan="4">24-21 (7)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9270</td></tr>
<tr><td> 
BWP05025</td><td> 
BWP05026</td></tr>
<tr><td>Part number: 08191-71201, 08191-71202
08191-71205, 08191-71206</td><td>Part number: 08191-74101, 08191-74102
08191-74105, 08191-74106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male terminal)</td><td rowspan="2">799-601-9270</td></tr>
<tr><td> 
BWP05027</td><td> 
BWP05028</td></tr>
<tr><td></td><td>Part number: 08191-72201, 08191-72202
08191-72205, 08191-72206</td><td>Part number: 08191-73102, 08191-73102
08191-73105, 08191-73106</td></tr>
<tr><td rowspan="4">24-22 (8)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9280</td></tr>
<tr><td> 
BWP05029</td><td> 
BWP05030</td></tr>
<tr><td>Part number: 08191-81201, 08191-81202,
08191-81203, 08191-81204,
08191-81205, 08191-80206</td><td>Part number: 08191-84101, 08191-84102,
08191-84103, 18191-84104,
08191-84105, 08191-84106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male terminal)</td><td rowspan="2">799-601-9280</td></tr>
<tr><td> 
BWP05031</td><td> 
BWP05032</td></tr>
<tr><td></td><td>Part number: 08191-82201, 08191-82202,
08191-82203, 08191-82204,
08191-82205, 08191-82206</td><td>Part number: 08191-83101, 08191-83102,
08191-83103, 18191-83104,
08191-83105, 08191-83106</td></tr>
</table>

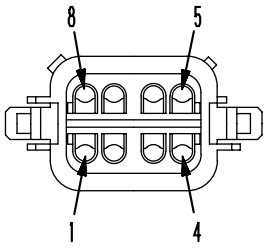
[The pin No. is also marked on the connector (electric wire insertion end)]

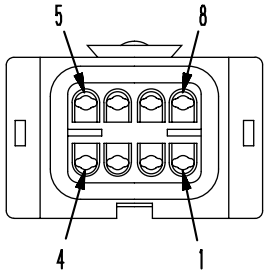
<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part Number</td></tr>
<tr><td rowspan="4">24-31 (9)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9290</td></tr>
<tr><td> 
BWP05033</td><td> 
BWP05034</td></tr>
<tr><td>Part number: 08191-91203, 08191-91204
08191-91205, 08191-91206</td><td>Part number: 08191-94103, 08191-94104
08191-94105, 08191-94106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male terminal)</td><td rowspan="2">799-601-9290</td></tr>
<tr><td> 
BWP05035</td><td> 
BWP05036</td></tr>
<tr><td></td><td>Part number: 08191-92203, 08191-92204
08191-92205, 08191-92206</td><td>Part number: 08191-93103, 08191-93104
08191-93105, 08191-93106</td><td></td></tr>
<tr><td rowspan="5"></td><td></td><td></td><td rowspan="2"></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td><td rowspan="3"></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>

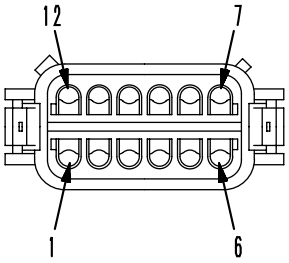
[The pin No. is also marked on the connector (electric wire insertion end)]

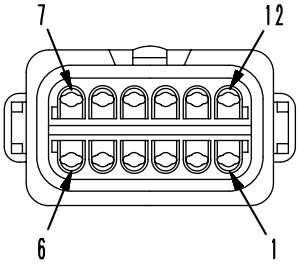
Number of Pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part Number
2	 BWP05037	 BWP05038	799-601-9020
	Part number: 08192-12200 (normal type) 08192-22200 (fine wire type)	Part number: 08192-12100 (normal type) 08192-22100 (fine wire type)	
3	 BWP05039	 BWP05040	799-601-9030
	Part number: 08192-13200 (normal type) 08192-23200 (fine wire type)	Part number: 08192-13100 (normal type) 08192-23100 (fine wire type)	
4	 BWP05041	 BWP05042	799-601-9040
	Part number: 08192-14200 (normal type) 08192-24200 (fine wire type)	Part number: 08192-14100 (normal type) 08192-24100 (fine wire type)	
6	 BWP05043	 BWP05044	799-601-9050
	Part number: 08192-16200 (normal type) 08192-26200 (fine wire type)	Part number: 08192-16100 (normal type) 08192-26100 (fine wire type)	

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

<table>
<tr><th rowspan="2">Number of Pins</th><th colspan="2">DT Series connector</th><th rowspan="2">T-adapter Part Number</th></tr>
<tr><th>Body (plug)</th><th>Body (receptacle)</th></tr>
<tr><td rowspan="2">8</td><td> 

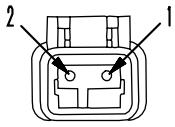
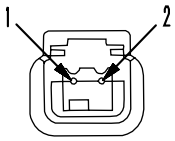
BWP05045</td><td> 

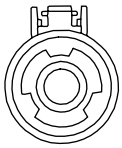
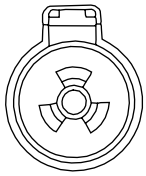
BWP05046</td><td rowspan="2">8GR: 799-601-9060
8B: 799-601-9070
8G: 799-601-9080
8BR: 799-601-9080</td></tr>
<tr><td>Part number: 08192-1820 □ (normal type)
08192-2820 □ (fine wire type)</td><td>Part number: 08192-1810 □ (normal type)
08192-2810 □ (fine wire type)</td></tr>
<tr><td rowspan="2">12</td><td> 

BWP05047</td><td> 

BWP05048</td><td rowspan="2">12GR: 799-601-9110
12B: 799-601-9120
12G: 799-601-9130
12BR: 799-601-9140</td></tr>
<tr><td>Part number: 08192-1920 □ (normal type)
08192-2920 □ (fine wire type)</td><td>Part number: 08192-1910 □ (normal type)
08192-2910 □ (fine wire type)</td></tr>
<tr><td rowspan="2"></td><td></td><td></td><td rowspan="2"></td></tr>
<tr><td></td><td></td></tr>
</table>

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

Number of Pins	DTM Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part Number
2	 BWP05049	 BWP05050	799-601-9010
	Part number: 08192-02200	Part number: 08192-02100	

Number of Pins	DTHD Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part Number
1	 BWP05051	 BWP05052	—
	Part number: 08192-31200 (Contact size #12) 08192-41200 (Contact size #8) 08192-51200 (Contact size #4)	Part number: 08192-31100 (Contact size #12) 08192-41100 (Contact size #8) 08192-51100 (Contact size #4)	

T-ADAPTER TABLE

★ The part Nos. of the T-adapter boxes and T-adapters are shown in the columns and those of the wiring harness checker assemblies are shown in the lines.

			KIT No.																	
Port No.	Connector type	Pin No.	799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	—
799-601-2600	For measuring box	Econo-21P	○		○	○						○	○		○					
799-601-3100	For measuring box	MS-37P					○													
799-601-3200	For measuring box	MS-37P					○													
799-601-3300	For measuring box	Econo-24P							○											
799-601-3360	Plate	For MS box																		
799-601-3370	Plate	For MS box																		
799-601-3380	Plate	For MS box																		
799-601-3410	BENDIX(MS)	24P							○	○										
799-601-3420	BENDIX(MS)	24P							○	○										
799-601-3430	BENDIX(MS)	17P							○	○										
799-601-3440	BENDIX(MS)	17P							○	○										
799-601-3450	BENDIX(MS)	5P						○	○											
799-601-3460	BENDIX(MS)	10P							○	○										
799-601-3510	BENDIX(MS)	5P						○	○											
799-601-3520	BENDIX(MS)	14P						○	○											
799-601-3530	BENDIX(MS)	19P							○	○										
799-601-2910	BENDIX(MS)	14P						○	○											
799-601-3470	CASE								○											
799-601-2710	MIC	5P	○	○		○							○							
799-601-2720	MIC	13P	○	○		○							○							
799-601-2730	MIC	17P	○	○	○	○						○	○		○					
799-601-2740	MIC	21P	○	○	○	○						○	○		○					
799-601-2950	MIC	9P									○	○	○		○					
799-601-2750	ECONO	2P	○	○																
799-601-2760	ECONO	3P	○	○																
799-601-2770	ECONO	4P	○	○																
799-601-2780	ECONO	8P	○	○																
799-601-2790	ECONO	12P	○	○																
799-601-2810	DLI	8P	○	○																
799-601-2820	DLI	12P	○	○																
799-601-2830	DLI	16P	○	○																
799-601-2840	Extension cable		○	○									○							
799-601-2850	CASE		○																	
799-601-7010	X	1P											○		○					
799-601-7020	X	2P									○	○	○		○					
799-601-7030	X	3P									○	○	○		○					
799-601-7040	X	4P									○	○	○		○					
799-601-7050	SWP	6P									○	○	○							
799-601-7060	SWP	8P									○	○	○							
799-601-7310	SWP	12P																		○
799-601-7070	SWP	14P											○		○					

Port No.	Connector type	Pin No.	KIT No. 799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	—
799-601-7320	SWP	16P																		○
799-601-7080	M	1P											○		○					
799-601-7090	M	2P									○	○	○		○					
799-601-7110	M	3P									○	○	○		○					
799-601-7120	M	4P									○	○	○		○					
799-601-7130	M	6P									○	○	○		○					
799-601-7340	M	8P																		○
799-601-7140	S	8P									○	○	○		○					
799-601-7150	S	10P-White									○	○	○		○					
799-601-7160	S	12P-Blue									○	○	○							
799-601-7170	S	16P-Blue									○	○	○		○					
799-601-7330	S	16P-White													○					
799-601-7350	S	12P-White																		○
799-601-7180	AMP040	8P											○							
799-601-7190	AMP040	12P											○		○					
799-601-7210	AMP040	16P									○	○	○		○					
799-601-7220	AMP040	20P									○	○	○		○					
799-601-7230	Short connector	X-2									○	○	○		○					
799-601-7240	Case										○	○								
799-601-7270	Cace												○							
799-601-7510	070	10P												○						
799-601-7520	070	12P												○						
799-601-7530	070	14P												○						
799-601-7540	070	18P												○						
799-601-7550	070	20P												○						
799-601-7360	Relay connector	5P																		○
799-601-7370	Relay connector	6P																		○
799-601-7380	JFC connector	2P																		○
799-601-9010	DTM	2P														○		○		
799-601-9020	DT	2P														○		○		
799-601-9030	DT	3P														○		○		
799-601-9040	DT	4P														○		○		
799-601-9050	DT	6P														○		○		
799-601-9060	DT	8P-Gray														○		○		
799-601-9070	DT	8P-Black														○		○		
799-601-9080	DT	8P-Green														○		○		
799-601-9090	DT	8P-Blown														○		○		
799-601-9110	DT	12P-Gray														○		○		
799-601-9120	DT	12P-Black														○		○		
799-601-9130	DT	12P-Green														○		○		
799-601-9140	DT	12P-Blown														○		○		
799-601-9210	HD30	18-8														○	○			
799-601-9220	HD30	18-14														○	○			

Port No.	Connector type	Pin No.	KIT No. 799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	—
799-601-9230	HD30	18-20														○	○			
799-601-9240	HD30	18-21														○	○			
799-601-9250	HD30	24-9														○	○			
799-601-9260	HD30	2-16														○	○			
799-601-9270	HD30	24-21														○	○			
799-601-9280	HD30	24-23														○	○			
799-601-9290	HD30	24-31														○	○			
799-601-9310	Plate	For HD30														○	○		○	
799-601-9320	For measuring box	For DT, HD														○	○		○	
799-601-9330	Case															○				
799-601-9340	Case																○			
799-601-9350	DEUTSCH	40P																	○	
799-601-9360	DEUTSCH	24P																	○	
799-601-9410	For NE, G sensor	2P																		○
799-601-9420	For boost pressure, fuel	3P																		○
799-601-9430	PVC socket	2P																		○

CONNECTOR TYPES AND IONS MOUNTING LOCAT

(*1): Only speedometer specification (Standard) (*2): Only load meter specification (If equipped)

No.	Type	Number of pins	Device name	Address
A01	M	6	Blower motor, resistor	V-7
A02	SWP	6	Air mix servomotor	V-6
A03	M	2	Thermistor	V-7
A05	Sumitomo	4	Air conditioner compressor switch	V-8
A07	SWP	8	Left air outlet servomotor	R-1
A08	SWP	8	Right air outlet servomotor	N-4
A09	Sumitomo	5	Blower relay (Main)	U-8
A10	Sumitomo	5	Blower relay (HI)	U-8
A11	Sumitomo	5	Blower relay (M2)	T-9
A12	Sumitomo	5	COND relay	T-9
A13	Sumitomo	5	Blower relay (M1)	S-9
A15	Sumitomo	5	Magnet clutch relay	T-9
AL1	S	16	Intermediate connector (Air conditioner relay wiring harness)	T-9
B01	M	2	Rear working lamp (Right)	I-9
B02	M	2	Rear working lamp (Left)	J-8
B03-1	Terminal	1	Backup alarm (+)	L-7
B03-2	Terminal	1	Backup alarm (–)	L-7
B04	DT-T	3	Capacitor	H-9
B05	X	2	Coolant level sensor	G-9
B06	KES1	2	Rear windshield washer	G-9
B07	KES1	2	Front windshield washer	G-9
BL1	DT-T	6	Intermediate connector (Bulkhead wiring harness)	J-3, W-1
BR1	DT-T	4	Intermediate connector (Grille wiring harness)	J-8
C03	AMP040	16	Air conditioner controller	E-9
C04	AMP040	12	Air conditioner controller	E-9
C05	M	2	Front working lamp (Right)	D-8
C06	M	2	Front working lamp (Left)	E-9
C07	KES1	2	Room lamp	F-9
C08	M	1	Door switch (Left) (Room lamp)	F-9
C09	M	1	Door switch (Right) (Room lamp)	D-8
C10	Terminal	1	Ground	D-9
C11	PA	9	AM/FM radio	D-9
C12	M	2	Speaker (Left)	G-9
C13	M	2	Speaker (Right)	F-9
C14	VHC	8	Warning lamp (Beacon) switch	E-9
C15	M	1	Working lamp connector	E-9
C16	One-pin connector	1	Working lamp (Beacon)	C-8
C17	Terminal	1	Ground (Beacon)	C-8
C18	Terminal	1	Ground	D-9

(*1): Only speedometer specification (Standard) (*2): Only load meter specification (If equipped)

No.	Type	Number of pins	Device name	Address
C19	VCH	8	Defroster switch	E-9
C20	Sumitomo	5	Defroster relay	F-9
C21	Yazaki	1	Rear glass (Defroster)	F-9
C22	Yazaki	1	Rear glass (Defroster)	H-9
C23	Terminal	1	Ground	C-8
CAN1	DT-T	3	CAN connector	O-7
CAN2	DT-T	3	CAN connector	N-3
CL1	S	16	Intermediate connector (Cab wiring harness)	A-7, N-3
CL2	S	12	Intermediate connector (Cab wiring harness)	A-6, N-3
CLEA	Terminal	1	Clearance lamp	A-9
D01	Yazaki	3	Diode (Forward-reverse solenoid)	X-9
D03	Yazaki	2	Diode (Fuel cut-off solenoid)	X-9
D04	Yazaki	2	Diode (Fuel cut-off solenoid)	X-9
D05	Yazaki	3	Diode (ECSS solenoid, heater relay)	X-7
D06	Yazaki	2	Diode (Magnet clutch)	W-9
D07	Yazaki	3	Diode (Engine starting)	W-9
D08	Yazaki	2	Diode (Engine starting)	W-7
D09	Yazaki	4	Diode (Parking brake, HST motor 2 solenoid)	X-8
D10	Yazaki	2	Diode (Washer motor [F])	W-8
D11	Yazaki	2	Diode (Hazard)	P-1
D12	Yazaki	3	Diode (HST controller power supply)	W-9
D13	Yazaki	2	Diode (Washer motor [R])	W-8
D14	Yazaki	2	Diode (Hazard)	P-1
D15	Yazaki	2	Diode (Engine starting)	W-8
D16	Yazaki	3	Diode (Forward)	X-3
D17	Yazaki	3	Diode (Reverse)	X-3
D18	Yazaki	3	Diode (Neutral)	X-3
E01	DT-T	2	Safety relay	AD-2
E02	Sumitomo	3	Alternator	K-8
E03	Terminal	1	Fuel cut-off solenoid	Z-5
E06	Terminal	1	Heater relay	AB-7
E07	Terminal	1	Heater relay	AB-7
E08	Terminal	1	Heater relay	AB-7
E09	Terminal	1	Ribbon heater	AB-6
E10	Terminal	1	Starting motor terminal B	AC-1
E11	Terminal	1	Alternator terminal B	L-8
E12	DT-T	2	Engine speed sensor	AA-3
E13	DT-T	3	Engine coolant temperature sensor (Preheating)	L-7
E14	X	2	Engine coolant temperature sensor (Monitor)	AA-5
E15	Terminal	1	Engine oil pressure switch	AA-5
E16	DT-T	2	Freon compressor magnet clutch	Y-7
E19	Terminal	1	Safety relay	Z-3

(*1): Only speedometer specification (Standard) (*2): Only load meter specification (If equipped)

No.	Type	Number of pins	Device name	Address
E20	Terminal	1	Safety relay	Z-3
E21	Terminal	1	Starting motor terminal C	Y-3
E22	Terminal	1	Ground	Y-7
E23	Terminal	1	Fuel cut-off solenoid (HOLD)	Z-5
E24	Terminal	1	Fuel cut-off solenoid (GND)	Z-4
E25	Terminal	1	Ground	AA-3
E26	DT-T	2	Dust indicator	AB-8
E27	DT-T	2	Engine oil level sensor	AA-5
ER1	DT	6	Intermediate connector (Engine wiring harness)	L-4, AD-2
ER2	DT-T	12	Intermediate connector (Engine wiring harness)	L-3, AC-2
ER3	L	2	Intermediate connector (Engine wiring harness)	K-3, AC-2
F03	DT-T	3	Proximity switch (Bucket positioner)	A-4
F04	DT-T	3	Proximity switch (Boom kick-out)	A-5
F07	DT-T	2	ECSS solenoid	E-1
F10	Terminal	1	Ground	E-1
F11	DT-T	3	Steering pump pressure switch (Low pressure)	C-8
F12	DT-T	3	Emergency steering pressure switch	G-1
F14	DT-T	2	Axle oil temperature sensor	A-2
F15	DT-T	3	Boom angle potentiometer (*2)	A-5
F16	DT-T	3	Boom bottom pressure sensor (*2)	A-3
F17	DT-T	3	Boom head pressure sensor (*2)	D-1
FL1	S	10	Intermediate connector (Front wiring harness)	B-8, P-1
FL2	DT-T	6	Intermediate connector (Front wiring harness)	C-8, P-1
FL3	DT-T	4	Intermediate connector (Emergency steering wiring harness)	C-8, Q-1
FL4	DT-T	6	Intermediate connector (Front wiring harness) (*2)	B-7
FS1	-	30	Fuse box	S-9
FS2	-	30	Fuse box	S-9
GND	Terminal	1	GND (Clearance lamp)	A-9
GND	Terminal	1	GND (Turn signal lamp)	B-8
GND	Terminal	1	GND (Hose)	B-8
HEAD	M	1	Headlamp	B-9
HEAD L	SWP	3	Intermediate connector (Front lamp) (Left)	E-1
HEAD R	SWP	3	Intermediate connector (Front lamp) (Right)	A-5
H1	Terminal	1	Head lamp (Hi)	A-9
HORN	Terminal	1	Horn	B-8
J01	J	20	Junction connector (Orange)	Q-1
J02	J	20	Junction connector (Blue)	N-4
J03	J	20	Junction connector (Blue)	N-4
J04	J	20	Junction connector (Gray)	S-9
J05	J	20	Junction connector (Brown)	X-7
J06	J	20	Junction connector (Brown)	W-6
J07	J	20	Junction connector (Green)	P-8

(*1): Only speedometer specification (Standard) (*2): Only load meter specification (If equipped)

No.	Type	Number of pins	Device name	Address
J08	J	20	Junction connector (Orange)	X-7
J09	J	20	Junction connector (Pink)	X-6
J10	J	20	Junction connector (Blue)	W-7
J11	J	20	Junction connector (Brown)	P-8
J12	J	20	Junction connector (Orange)	W-7
J13	J	20	Junction connector (Brown) (*2)	N-2
L02	DT	4	Starting switch	P-8
L03	DT-T	4	Gear speed selector switch	O-7
L04	X	8	Light combination switch	N-2
L05	S	10	Wiper switch (Front, rear)	O-2
L06	VCH	8	Hazard switch	O-1
L07	VCH	8	Front working lamp switch	Q-1
L08	VCH	8	Rear working lamp switch	Q-1
L09	VCH	8	ECSS switch	Q-8
L10	VCH	8	Monitor mode switch 1	N-5
L11	VCH	8	Monitor mode switch 2	N-5
L12	Yazaki	2	Cigarette lighter	N-4
L13	DT-T	2	Steering horn switch	O-1
L14	DT-T	4	Intermediate connector (ECSS controller)	N-2
L15	DT-T	4	FNR switch	O-1
L16	DT-T	2	Optional connector (Horn)	N-6
L17	DT-T	2	Parking brake selector connector (Electric type)	V-5
L18	DT-T	2	Parking brake selector connector (Mechanical type)	V-6
L19	VCH	8	Parking brake switch (Electric type)	N-5
L20	DT-T	2	Parking brake selector connector	V-5
L21	AMP040	16	Machine monitor controller (*1)	M-3
L22	AMP040	12	Machine monitor controller (*1)	M-2
L23	AMP040	20	Machine monitor controller (*1)	M-5
L24	AMP070	20	Machine monitor controller (*2)	N-1
L25	AMP070	18	Machine monitor controller (*2)	N-1
L26	AMP070	12	Machine monitor controller (*2)	N-1
L27	AMP070	18	Machine monitor controller (*2)	M-1
L28	AMP070	12	Machine monitor controller (*2)	M-1
L29	AMP070	12	Machine monitor controller (*2)	N-1
L30	AMP070	14	Machine monitor controller (*2)	M-2
L31	AMP040	4	Machine monitor controller (*2)	M-1
L34	DT-T	2	Stop lamp switch	V-3
L35	DT-T	2	PPC valve, electrical detent (Boom FLOAT)	Q-9
L36	DT-T	2	PPC valve, electrical detent (Boom RAISE)	N-7
L37	DT-T	2	PPC valve, electrical detent (Bucket TILT)	N-6
L38	M	2	Electric power supply (Battery power supply)	V-5
L39	M	2	Electric power supply (KEY ON power supply)	L-6, V-5

(*1): Only speedometer specification (Standard) (*2): Only load meter specification (If equipped)

No.	Type	Number of pins	Device name	Address
L40	Terminal	1	Ground (HST controller)	O-7
L41	AMP 1-963217-1	16	HST controller	N-7
L42	AMP 2-963217-1	16	HST controller	O-7
L43	DT-T	4	Checker (HST controller)	N-6
L44	M	4	For steering controller	R-1
L45	SWP	6	Auto grease	N-5
L46	M	2	Caution buzzer	N-7
L47	DT-T	2	Parking brake switch (Intermediate)	V-4
L48	M	6	Interval wiper timer	P-8
L49	KES1	4	Flasher unit	R-1
L50	M	4	Power supply (For tachograph)	V-4
L51	X	2	Air servomotor	S-9
L52	M	4	Rear wiper motor	G-9, U-8
L53	DT-T	2	Parking brake switch (Lowest part)	V-4
L54	M	3	Travel speed control dial	P-8
L55	DT-T	2	Air suspension seat	V-8
L56	VCH	8	Traction control switch	Q-8
L57	M	6	Front wiper motor	B-7, N-2
L58	M	2	DC converter	V-4
L59	DT-T	4	Load meter cancel & subtotal switch	M-6
L60	M	6	Intermediate connector (Printer) (*2)	V-1
L72	HOSHIDEN	3	Printer (*2)	U-1
L73	D-Sub	25	Printer (*2)	V-1
L74	R	5	Printer power supply cut-out relay (*2)	V-1
L75	Yazaki	2	Diode (*2)	V-5
L76	Yazaki	2	Diode (*2)	V-6
L77	Yazaki	2	Diode (*2)	V-5
L78	Yazaki	2	Diode (*2)	V-6
L100	Terminal	1	Ground	V-7
L101	R	5	Mechanical parking brake relay	N-9
L102	R	5	HST controller power supply holding relay	M-8
L103	R	5	Shift control relay	N-8
L104	R	5	Parking brake indicator relay	N-9
L105	R	5	Parking brake safety relay (Electric type)	N-8
L106	R	5	Neutral safety relay	M-8
L107	R	6	Reverse relay	M-8
L108	R	5	Forward relay	N-7
L109	R	5	Backup buzzer relay	M-9
L110	R	5	Travel damper relay	N-9
L111	R	5	HST solenoid safety relay	M-9
L112	R	5	Parking brake dragging prevention relay	M-9
L113	R	5	Boom kick-out relay	N-9

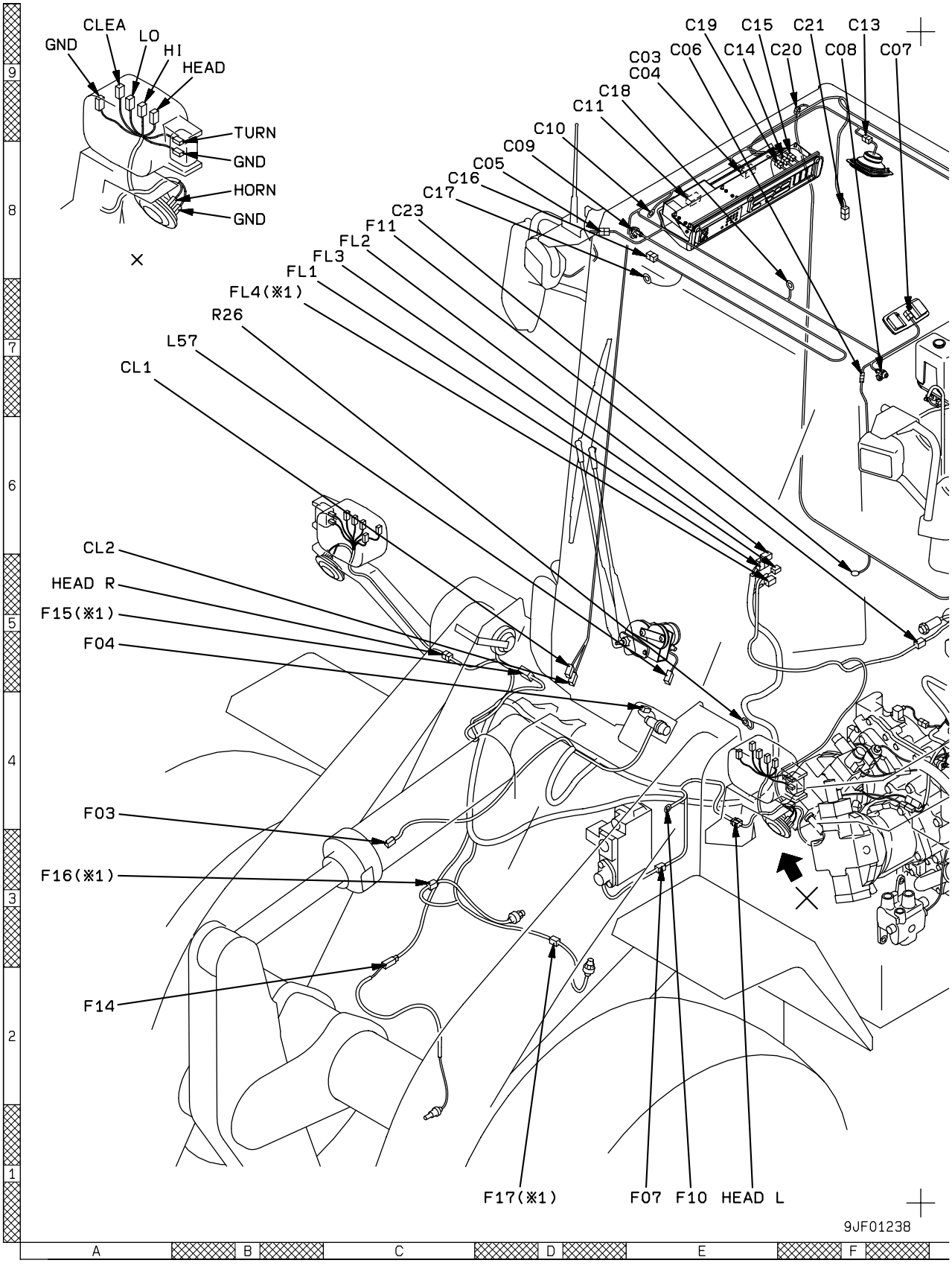
(*1): Only speedometer specification (Standard) (*2): Only load meter specification (If equipped)

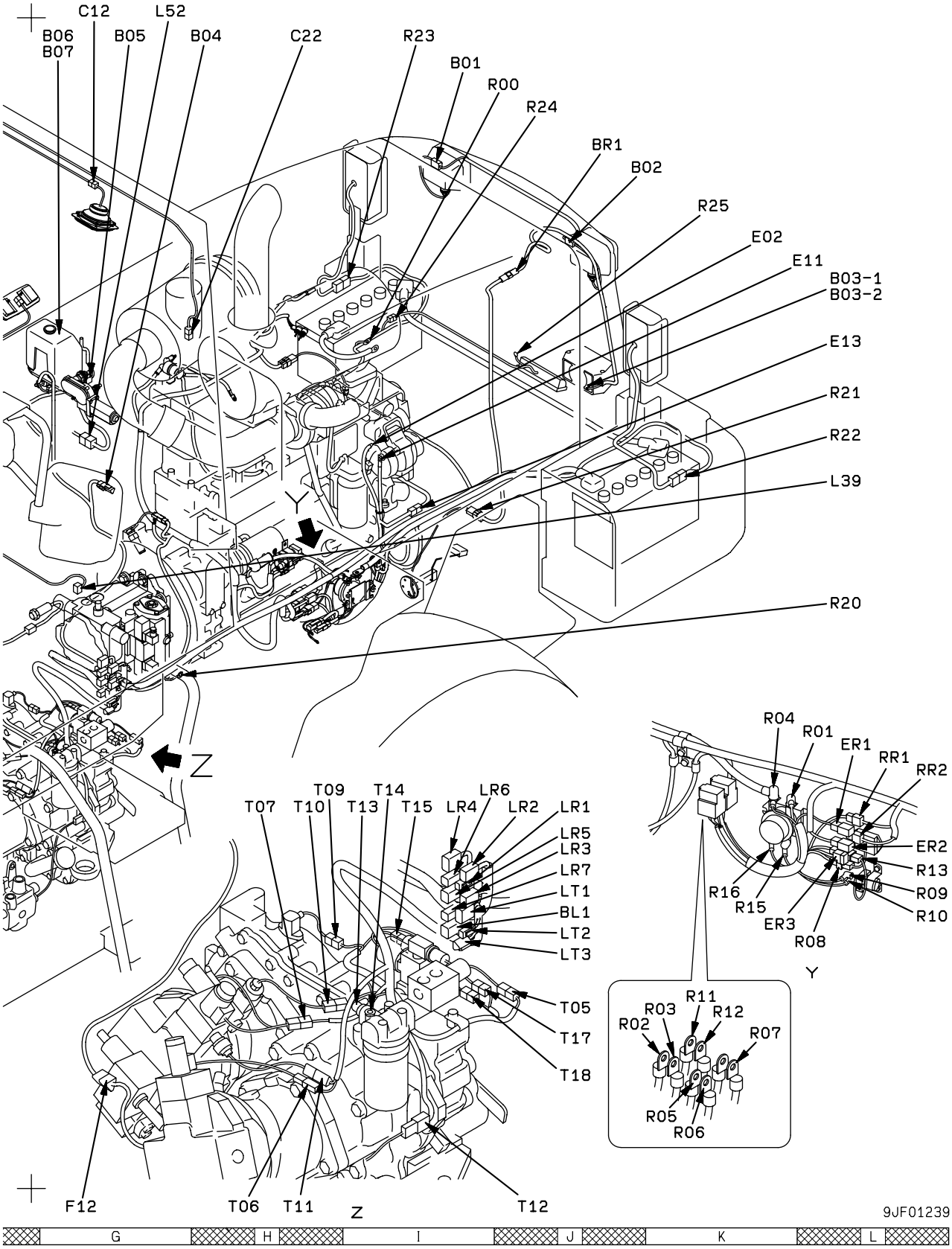
No.	Type	Number of pins	Device name	Address
L114	R	5	Bucket positioner relay	N-8
L115	R	5	Automatic preheating relay	M-9
L116	R	5	Horn relay	N-9
L117	R	5	Small lamp (Left) relay	U-9
L118	R	5	Small lamp (Right) relay	X-5
L119	R	5	Headlamp (Right) relay	W-4
L120	R	5	Headlamp (Left) relay	T-9
L121	R	5	Stop lamp relay	U-8
L122	R	6	Working lamp relay	U-8
L123	R	5	Air cleaner clogging relay	W-5
L132	R	5	Manual lever relay	W-5
L133	R	5	Forward-reverse lever selector relay	W-4
L134	R	5	Forward-reverse lever selector relay	W-4
L135	R	5	Forward-reverse lever selector relay	W-5
L136	R	5	Reverse relay	X-5
L137	R	5	Forward relay	X-5
Lo	Terminal	1	Head lamp (Lo)	A-9
LR1	DT	2	Intermediate connector (Rear wiring harness)	J-4, X-2
LR2	L	2	Intermediate connector (Rear wiring harness)	J-4, X-3
LR3	L	2	Intermediate connector (Rear wiring harness)	J-3, X-2
LR4	DT-T	12	Intermediate connector (Rear wiring harness)	I-4, W-3
LR5	DT-T	6	Intermediate connector (Rear wiring harness)	J-3, W-2
LR6	DT-T	6	Intermediate connector (Rear wiring harness)	I-4, W-2
LR7	DT-T	2	Intermediate connector (Rear wiring harness)	J-3, W-2
LT1	DT-T	12	Intermediate connector (HST wiring harness)	J-3, X-2
LT2	DT-T	4	Intermediate connector (HST wiring harness)	J-3, X-1
LT3	DT-T	4	Intermediate connector (HST wiring harness)	J-3, X-1
MF1	DTM	12	Multi-function switch	N-6
MF2	VCH	8	Multi-function selector switch	Q-8
MF3	DT-T	12	Multi-function relay	X-3
MF4	DT-T	2	Multi-function relay	X-4
R00	Terminal	1	Ground (Battery)	J-9
R01	Terminal	1	Battery relay	L-4, AD-2
R02	Terminal	1	Slow-blow fuse (30A)	J-2
R03	Terminal	1	Slow-blow fuse (30A)	K-2
R04	Terminal	1	Battery relay	K-4
R05	Terminal	1	Slow-blow fuse (120A)	K-1
R06	Terminal	1	Slow-blow fuse (80A)	K-1
R07	Terminal	1	Slow-blow fuse (120A)	K-2
R08	DT-T	4	Fuel solenoid cut-out timer	L-3
R09	Terminal	1	Fuel solenoid pull relay	L-3
R10	Terminal	1	Fuel solenoid pull relay	L-3

(*1): Only speedometer specification (Standard) (*2): Only load meter specification (If equipped)

No.	Type	Number of pins	Device name	Address
R11	Terminal	1	Slow-blow fuse (30A)	K-2
R12	Terminal	1	Slow-blow fuse (30A)	K-2
R13	DT-T	2	Fuel solenoid pull relay	L-3
R15	Terminal	1	Battery relay (+)	K-3
R16	Terminal	1	Battery relay (–)	K-3
R20	Terminal	1	Ground	L-5
R21	X	2	Fuel level sensor	L-7
R22	M	6	Rear combination lamp (Left)	L-6
R23	M	6	Rear combination lamp (Right)	I-9
R24	DT-T	2	License lamp	J-9
R25	Terminal	1	Ground (License lamp)	K-8
R26	Terminal	1	Ground	B-7
RR1	L	2	Intermediate connector (Power supply wiring harness)	L-4
RR2	DT-T	6	Intermediate connector (Power supply wiring harness)	L-4
T01	DT-T	4	Forward-reverse solenoid	AA-1
T05	DT-T	2	Clutch control EPC solenoid	J-2
T06	DT-T	2	HST motor 1 EPC solenoid	H-1
T07	DT-T	4	HST motor 2 solenoid & motor 2 overrun solenoid	H-4
T09	DT-T	4	Speed sensor	H-4
T10	X	2	HST oil temperature sensor	H-4
T11	DT-T	3	HST pressure sensor	H-1
T12	X	2	Brake oil pressure sensor	J-1
T13	Terminal	1	HST filter clogging sensor	I-4
T14	Terminal	1	Ground	I-4
T15	DT-T	2	Parking brake solenoid	I-4
T17	DT-T	2	Emergency brake pressure switch	J-2
T18	DT-T	2	Parking brake indicator pressure switch	J-2
TEL	DT-T	12	Intermediate connector	-
TURN	Terminal	1	Turn signal lamp	B-9

CONNECTOR LAYOUT DRAWING

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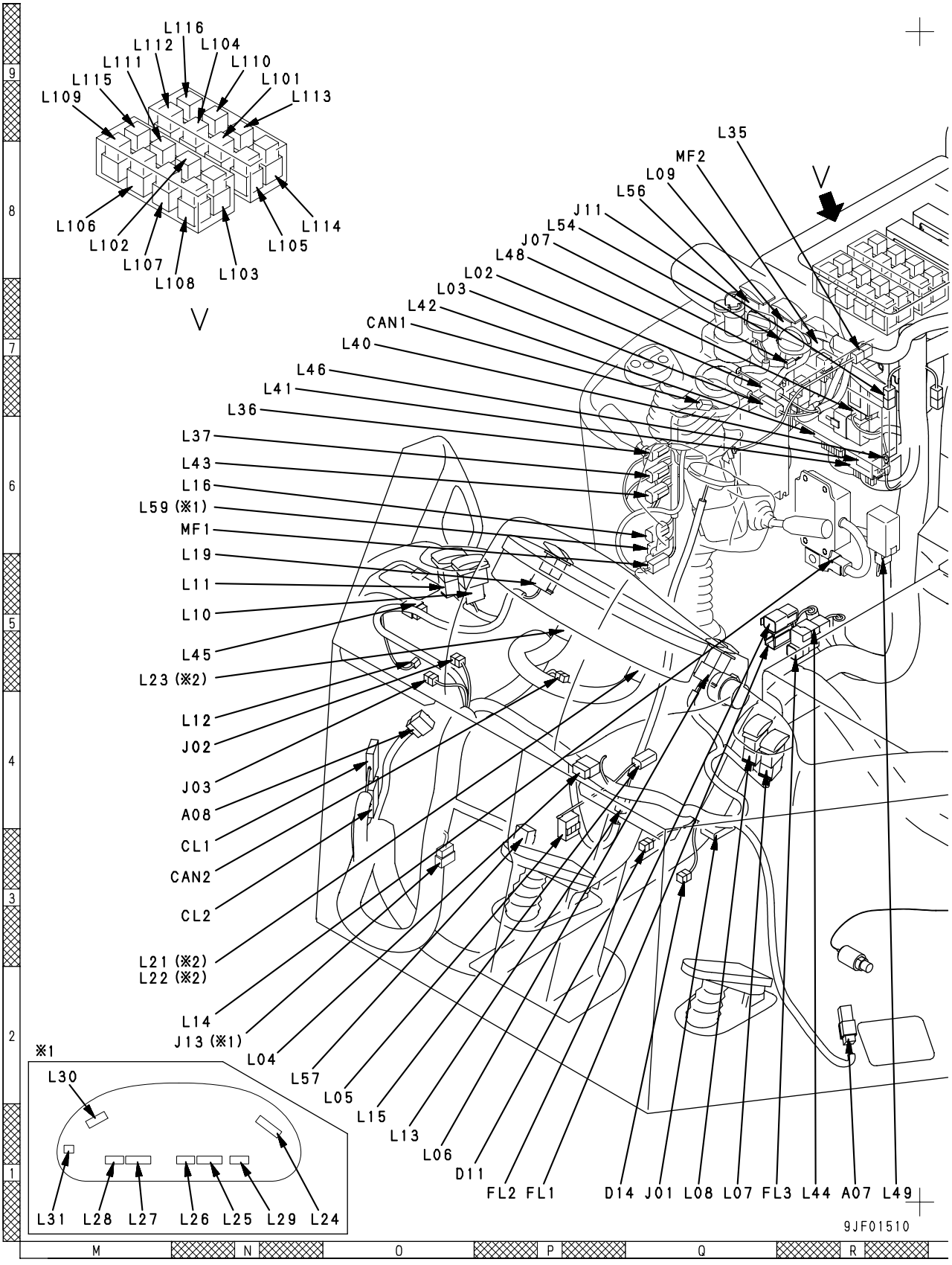
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MF2
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J11
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J07
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CAN1
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L16
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MF1
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L23 (※2)
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J02
J03
A08
CL1
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L21 (※2)
L22 (※2)
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J13 (※1)
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D14 J01 L08 L07 FL3 L44 A07 L49
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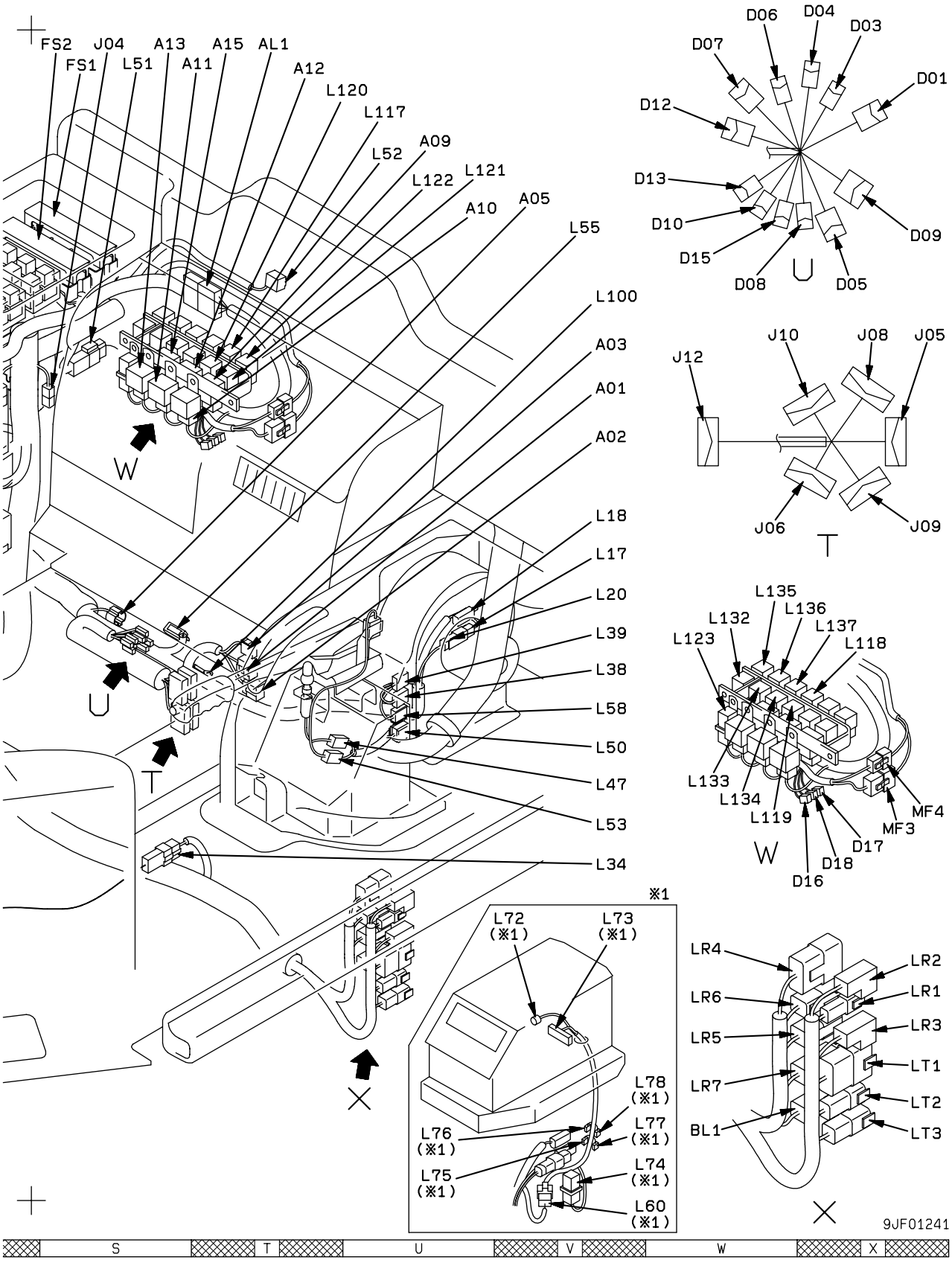
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LR5
LR3
LR7
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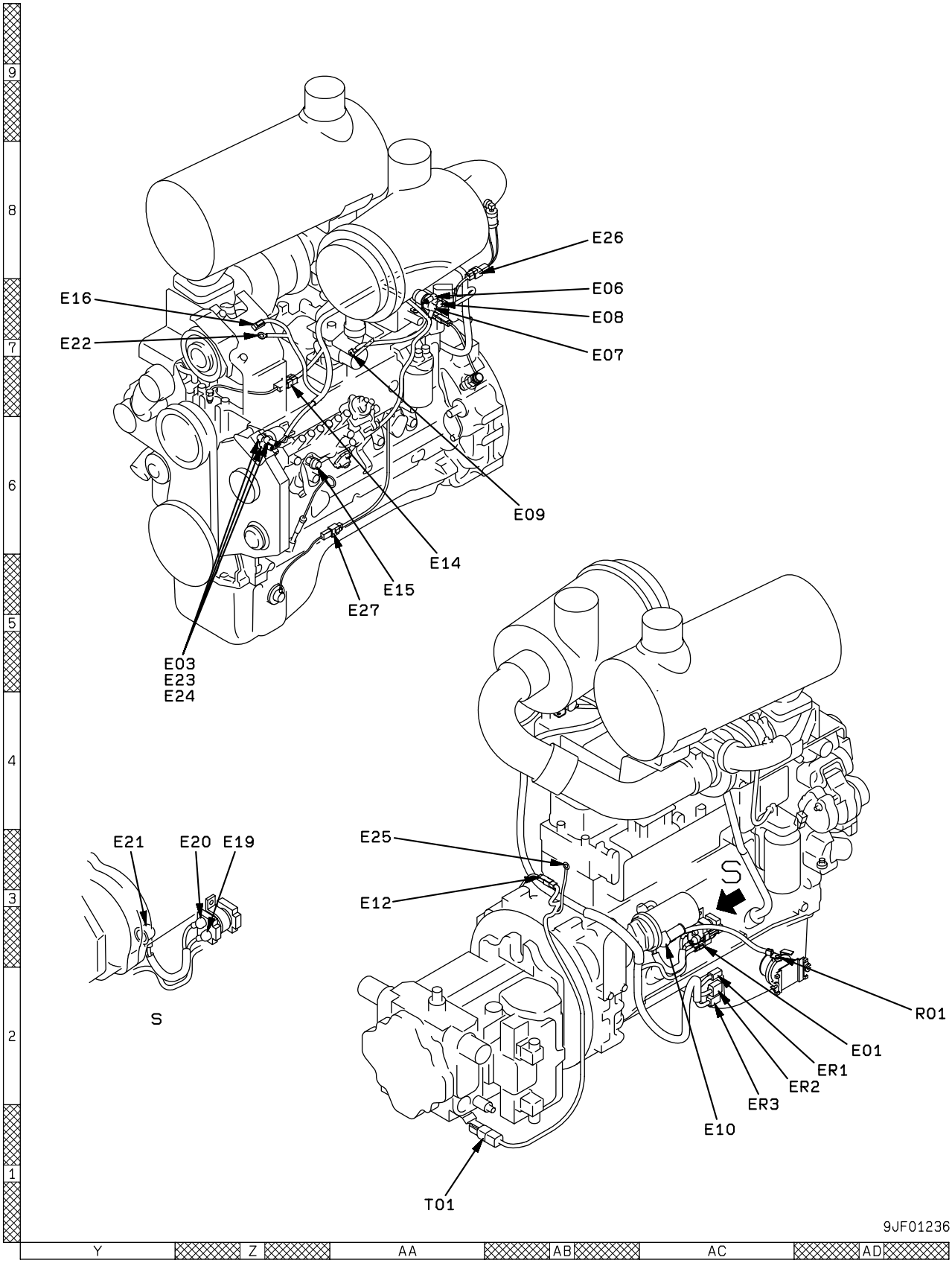
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ER1
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ER3
E10
T01
9JF01236

TROUBLESHOOTING OF HST CONTROLLER SYSTEM (HST MODE)

BEFORE TROUBLESHOOTING CODE DISPLAY

FAILURE CODE AND POSSIBLE CAUSES TABLE

Failure code (*): Only load meter specification (If equipped)	Action code	Possible causes																					
		Defective machine monitor	Defective HST controller	Defective starting switch	Defective monitor panel mode selector switch 1 ■	Defective monitor panel mode selector switch 1 ◇	Defective monitor panel mode selector switch 2 <	Defective monitor panel mode selector switch 2 >	Defective forward-reverse lever	Deterioration of battery	Defective battery relay	Defective fuse/fusible link	Defective alternator	Clogging of air cleaner	Defective air cleaner clogging sensor	Defective engine speed sensor	Defective HST motor 2 solenoid	Defective HST motor 1 solenoid	Defective clutch solenoid	Lowering of engine oil pressure	Defective engine oil pressure sensor	Lowering of engine oil level	Defective engine oil level sensor
(Codes related to HST controller)																							
989F00	E00		●																				
DHH1KX	E03		●																				
DLE2LC	E03		●													●							
DW26KZ	E03		●						●								●						
DX19KZ	E03		●															●					
DX20KZ	E03	●	●																●				
(Codes related to monitor)																							
15B0NX	E01	●																					
2G42ZG	E03	●																					
989F00	E00		●																				
989FN1	E02	●																●	●				
AA1ANX (*)	E01	●												●	●								
AB00L6	E03	●											●										
AB00MA	E03	●								●	●												
B@BAZG	E01	●																		●	●		
B@BAZK (*)	E01	●																				●	●
B@BCNS	E02	●																					
B@BCZK	E01	●																					
B@C7NS	E02	●																					
B@CRNS	E02	●																					
D5ZHL6	E01	●		●																			
DAF0KT	E03	●																					
DAF3KK (*)	E03	●																					
DAF5KP (*)	E01	●																					
FAF6KP (*)	E01	●																					
DAJ0KR	E03	●	●																				
D182KZ (*)	E01	●																					
D1B0KB (*)	E01	●																					
DD1CLD (*)	E01	●																					
DD15LD	E01	●			●																		
DD16LD	E01	●				●																	
DD17LD	E01	●					●																
DD18LD	E01	●						●															
DDK3KB	E03	●							●														
DDS5L6	E03	●							●														
DDY0LD (*)	E01	●																					
DGE2KX	E01	●																					
DGE3L6	E01	●																					
DGH1KX	E01	●																					
DGR1KX	E01	●																					
DGR4KA	E01	●																					
DHE4L6	E01	●																			●		
DHPCKX (*)	E01	●																					
DHPDKX (*)	E01	●																					
DKA0KX (*)	E01	●																					
DV00KB (*)	E01	●																					

Possible causes																												
Overheating of engine coolant	Defective engine coolant temperature (high temperature) sensor	Defective engine coolant temperature (low temperature) sensor	Lowering of coolant level	Defective coolant level sensor	Defective HST oil pressure sensor	Clogging of HST oil filter	Defective HST oil filter clogging sensor	Overheating of HST oil	Defective HST oil temperature sensor	Lowering of brake oil pressure	Defective brake oil pressure sensor	Overheating of axle oil	Defective axle oil temperature sensor	Lowering steering oil pressure	Defective steering oil pressure sensor	Defective boom angle sensor	Defective boom pressure sensor (bottom side)	Defective boom pressure sensor (head side)	Defective subtotal switch	Defective cancel switch	Defective alarm buzzer	Defective relay	Disconnection in wiring harness	Grounding fault in wiring harness	Short circuit with power source in wiring harness
					●																		●	●	●
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BEFORE TROUBLESHOOTING ELECTRICAL SYSTEM

FUSE BOX CONNECTION TABLE

★ This connection chart shows the equipment that each fuse box power source supplies power directly to ("switch power source" means the power supplied when the starting switch is ON; "permanent power source" means the power supplied when the starting switch is OFF).

Category	Fuse No.	Fuse capacity	Power supply destination
Permanent power source (Fuse box 1)	1	20A	Starting switch
	2	10A	Hazard lamp
	3	10A	HST control A
	4	10A	Parking brake 1
	5	10A	Meter, panel
	6	10A	Car radio A, Room lamp
	7	10A	Spare power supply (battery +24 V)
Switch power source (Fuse box 1)	8	10A	Head lamp (left side)
	9	10A	Head lamp (right side)
	10	10A	Turn signal lamp
	11	10A	Back lamp, stop lamp
	12	20A	HST control B
	13	10A	Work equipment positioner
	14	10A	Wiper
	15	10A	Car radio B
Switch power source (Fuse box 2)	1	20A	Air conditioner A
	2	20A	Air conditioner B
	3	10A	Beacon lamp
	4	10A	-
	5	10A	Load-meter
	6	20A	DC converter
	7	10A	Spare power supply (+24 V when key is ON)
	8	10A	Parking brake 2
	9	10A	Horn
	10	10A	Side marker lamp (left side)
	11	10A	Side marker lamp (right side)
	12	20A	Front working lamp
	13	20A	Rear working lamp
	14	10A	(Spare 1)
	15	10A	(Spare 2)

INFORMATION CONTAINED IN TROUBULESHOOTING TABLE

★ The troubleshooting table and the related circuit diagrams contain the following information. Grasp their contents fully before proceeding to actual troubleshooting work.

Action Code	Failure Code	Controller Code	Trouble	Trouble displayed in trouble data
Panel display	Panel display	Panel display		
Description of Trouble	• Condition when machine monitor or controller detected trouble.			
Machine monitor or controller Reaction	• Action to take to protect system or equipment when machine monitor or controller detected trouble.			
Effect on Machine	• Condition that appeared as problem on machine when action (given above) was taken by machine monitor or controller.			
Related Information	• Information related to troubleshooting or error that occurred.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting
Possible Causes and Standard Values	1	Probable cause when trouble occurred (the numbers are index numbers and do not indicate the order of priority)	<Data to fill in> • Normal standard values used to judge probable cause • Remarks regarding decision-making <Condition when wiring harness is defective> • Disconnection There is defective connection of connector or disconnection in wiring harness • Short circuit with ground Wiring harness not wired to ground (GND) circuit is in contact with ground (GND) circuit • Short circuit with power source Wiring harness not wired to power supply (24 V) circuit is in contact with power supply (24 V) circuit <Points to remember when troubleshooting> 1) Method of displaying connector No. and handling T-adapter Unless there is special instruction, insert or connect the T-adapter as follows • If there is no indication for the male or female terminal of the connector No., disconnect the connector and insert the T-adapter in both the male and female terminals • If there is indication for the male or female terminal of the connector No., disconnect the connector and connect the T-adapter to only the terminal indicated (either the male terminal or female terminal) <Points to remember when troubleshooting> 2) Given order for pin numbers and handling tester lead Unless there is a special instruction, connect tester (+) lead and (-) lead as follows to carry out troubleshooting • Connect the (+) lead to the wiring harness for the pin No. given first • Connect the (-) lead to the wiring harness for the pin No. given last
	2		
	3		
	4		
	5		

Related circuit diagram

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

- Connector No.: Indicates (Type - numbers of a pin) (color)
- Arrow: Roughly indicates the location in the machine where it is installed.

Phenomena code table

★ For problem codes marked "See list", see the list below.

Phenomena code	Details	Disconnection	Details
KA	Disconnection	L0	Fill signal ON 2 or more channels
KB	Short circuit	L1	Fill signal is ON when command current is OFF
KK	Drop in power source voltage, input	L2	Fuel pressure is higher than maximum set value
KQ	Non match in model selection signal	L3	Corresponding component cannot be controlled
KR	Defective communication	L4	ON/OFF signals for 2 systems do not match
KT	Abnormality inside controller	L6	Engine signals do not match operating condition or stopped condition of machine
KX	Input signal outside range	L8	Analog signals for 2 systems do not match
KY	Short circuit in power supply line	LC	Speed signals for 2 systems do not match
KZ	Disconnection or short circuit	LD	Switch has been kept pressed for abnormally long time
MA	Function impossible	LH	Fill signal is OFF when command current is ON
NS	Overheat		
ZG	Drop in oil pressure		
ZK	Drop in level		

Failure Code [989F00] (HST motor protection caution (00))

Action Code	Failure Code	Controller Code	Trouble	HST motor protection caution (00)
E00	989F00	HST		
Description of Trouble	• Not considered to be a failure. • The travel speed exceeds the allowable speed the HST motor on down shifting.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• If travel speed exceeds 40 km/h, speed is automatically reduced.			
Related Information				

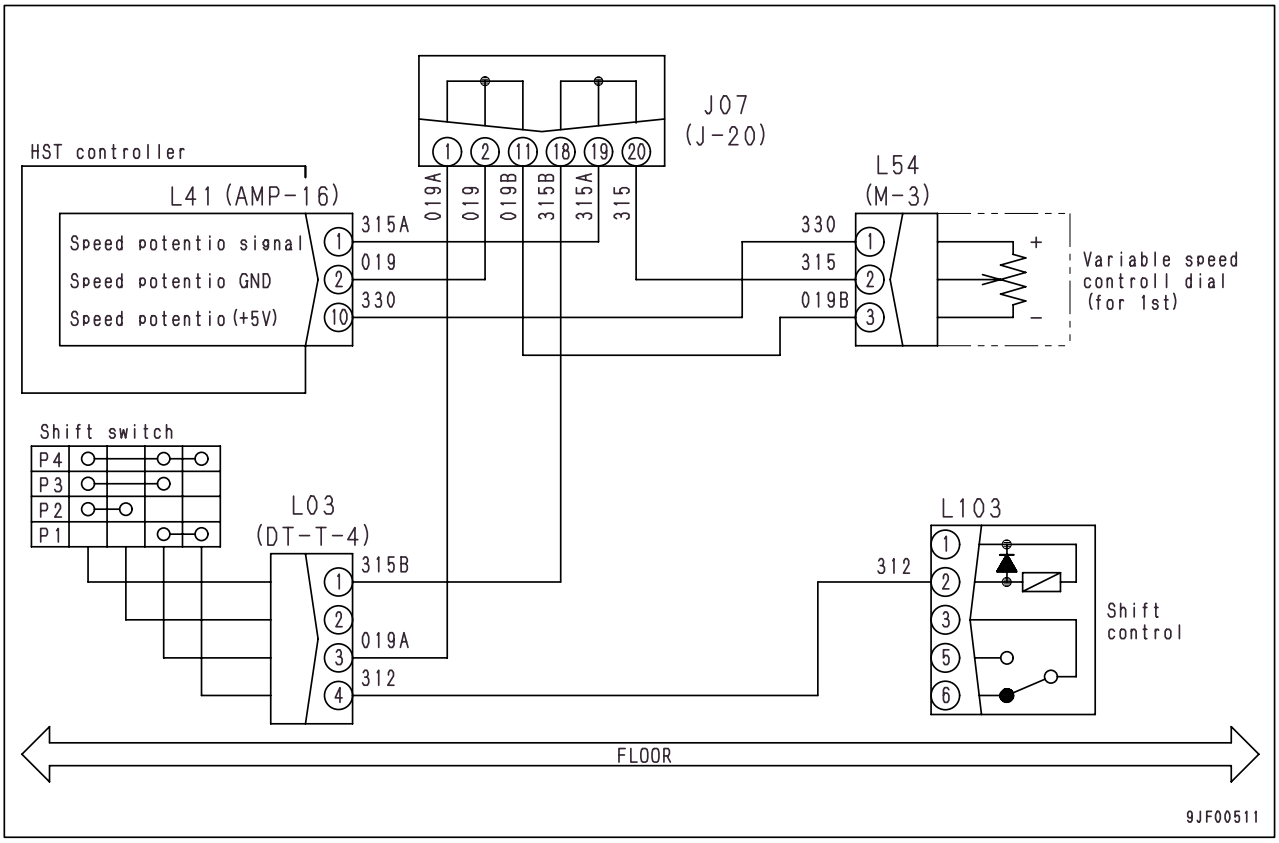
Failure Code [DDD7KX] (Speedmeter system input signal is out of range (KX)

Action Code	Failure Code	Controller Code	Trouble	Speedmeter system input signal is out of range (KX)
E01	DDD7KX	HST		
Description of Trouble	• There is disconnection, short circuit with ground, short circuit with power source in speed potentiometer system, so speed potentiometer signal is not input.			
Machine monitor or controller Reaction	• No action			
Effect on Machine	• Travel speed cannot be controlled when the travel speed selector switch is at 1st. (Speed is fixed at 4 km/h or 13 km/h)			
Related Information	• The speed potentiometer is displayed by real-time monitoring code 50302 {speed limit is taken as follows: max. (13 km/h = 100%)/min. (4 km/h = 0%)			

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective travel speed potentiometer	1) Turn starting switch OFF. 2) Disconnect connector L54. 3) Connect T-adapter			
			Between L54 (Female) (1) and (3)		Resistance	4 - 6k✕
			Between L54 (Female) (1) and (2)		Resistance	0.25 - 5k✕
			Between L54 (Female) (2) and (3)		Resistance	0.25 - 5k✕
	2	Defective travel speed selector switch	1) Turn starting switch OFF. 2) Disconnect connector L03. 3) Connect T-adapter			
			Between L03 (Female) (1) and (2)	2nd	Resistance	1✕ andbelow
				Other than the above	Resistance	1M✕ and above
			Between L03 (Female) (1) and (3)	1st	Resistance	1M✕ and above
				2nd	Resistance	1M✕ and above
				3rd	Resistance	1✕ andbelow
				4th	Resistance	1✕ andbelow
			Between L03 (Female) (1) and (4)	4th	Resistance	1✕ andbelow
				Other than the above	Resistance	1M✕ and above
			Between L03 (Female) (3) and (4)	1st	Resistance	1✕ andbelow
				2nd	Resistance	1M✕ and above
				3rd	Resistance	1M✕ and above
				4th	Resistance	1✕ andbelow
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L41, L54, L03. 3) Connect T-adapter			
			Wiring harness between L41 (Female) (10) and L54 (Female) (1)		Resistance	1✕ andbelow
			Wiring harness between L41 (Female) (1) and L54 (Female) (2)		Resistance	1✕ andbelow
			Wiring harness between L41 (Female) (2) and L54 (Female) (3)		Resistance	1✕ andbelow
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L41, L54, L03. 3) Connect T-adapter			
			Wiring harness between L41 (Female) (10) and L54 (Female) (1)	Resistance between L41 (Female) (10) and chassis ground		1M✕ and above
			Wiring harness between L41 (Female) (1), L54 (Female) (2) and L03 (Female) (1) 30	Resistance between L41 (Female) (1) and chassis ground		1M✕ and above
			Wiring harness between L41 (Female) (2), L54 (Female) (3) and L03 (Female) (3)	Resistance between L41 (Female) (2) and chassis ground		1M✕ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	5	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect connector L41, L54 and L03. 3) Connect T-adapter. 4) Turn starting switch ON		
			Wiring harness between L41 (Female) (10) and L54 (Female) (1)	Voltage between L41 (Female) (10) and chassis ground	1V and below
			Wiring harness between L41 (Female) (1), L54 (Female) (2) and L03 (Female) (1)	Voltage between L41 (Female) (1) and chassis ground	1V and below
			Wiring harness between L41 (Female) (2), L54 (Female) (3) and L03 (Female) (3)	Voltage between L41 (Female) (2) and chassis ground	1V and below
	6	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect Connectors L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON 6) Travel speed selector switch 1ST		
			Between L41 (10) and (2)	Voltage	4 - 6V
			Between L41 (1) and (2)	Voltage	0.5V - 5V

Related circuit diagram

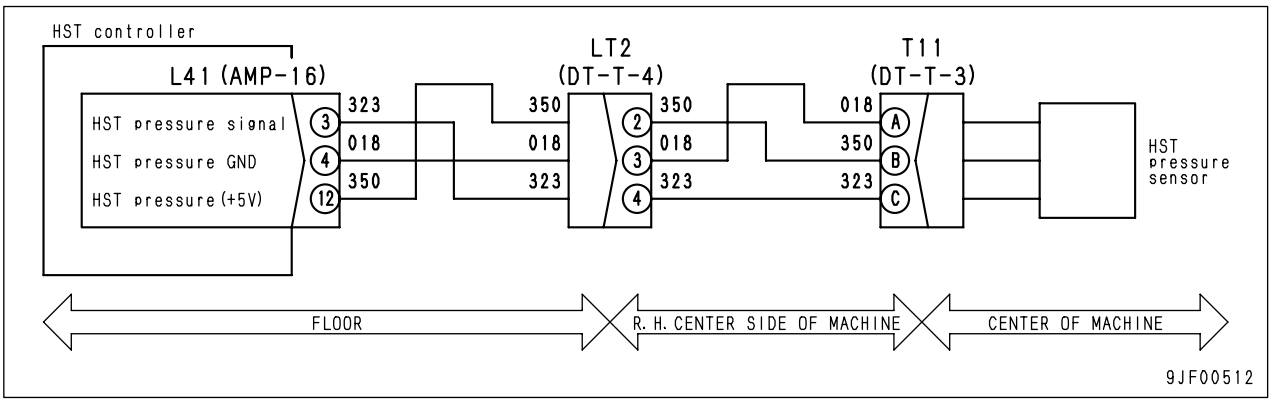


Failure Code [DHH1KX] (HST oil pressure sensor input signal outside range (KX))

Action Code	Failure Code	Controller Code	Trouble	HST oil pressure sensor input signal outside range (KX)
E03	DHH1KX	HST		
Description of Trouble	• There is disconnection, short circuit with ground, short circuit with power source in HST oil pressure sensor system, so HST oil pressure sensor signal is not input.			
Machine monitor or controller Reaction	• Error is sent to machine monitor through CAN communications, and machine monitor turns HST safety relay ON (cuts motor 1, clutch solenoid circuit).			
Effect on Machine	• Travels but drive power is low			
Related Information	• The HST oil pressure can be checked in the monitoring function (Code: 32600).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective HST oil pressure sensor	1) Turn starting switch OFF. 2) Disconnect connector T11. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON			
			Between T11 (A) and (C)		Voltage	0.5 - 4.5 V
			Between T11 (A) and (B)		Voltage	4 - 6 V
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connectors L41 and T11. 3) Connect T-adapter			
			Wiring harness between L41 (Female) (3) and T11 (Female) (C)		Resistance	1✕ and below
			Wiring harness between L41 (Female) (4) and T11 (Female) (A)		Resistance	1✕ and below
			Wiring harness between L41 (Female) (12) and T11 (Female) (B)		Resistance	1✕ and below
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connectors L41 and T11. 3) Connect T-adapter			
			Wiring harness between L41 (Female) (3) and T11 (Female) (C)	Resistance between L41 (Female) (3), T11 (Female) (C) and chassis ground		1M✕ and above
			Wiring harness between L41 (Female) (12) and T11 (Female) (B)	Resistance between L41 (Female) (12), T11 (Female) (B) and chassis ground		1M✕ and above
	4	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect connectors L41 and T11. 3) Connect T-adapter. 4) Turn starting switch ON			
			Wiring harness between L41 (Female) (3) and T11 (Female) (C)	Voltage between L41 (Female) (3), T11 (Female) (C) and chassis ground		1V and below
			Wiring harness between L41 (Female) (4) and T11 (Female) (A)	Voltage between L41 (Female) (4), T11 (Female) (A) and chassis ground		1V and below
			Wiring harness between L41 (Female) (12) and T11 (Female) (B)	Voltage between L41 (Female) (12), T11 (Female) (B) and chassis ground		1V and below
	5	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON			
			Between L41 (3) and (4)		Voltage	0.5 - 4.5 V
			Between L41 (12) and (4)		Voltage	4 - 6 V

Related circuit diagram

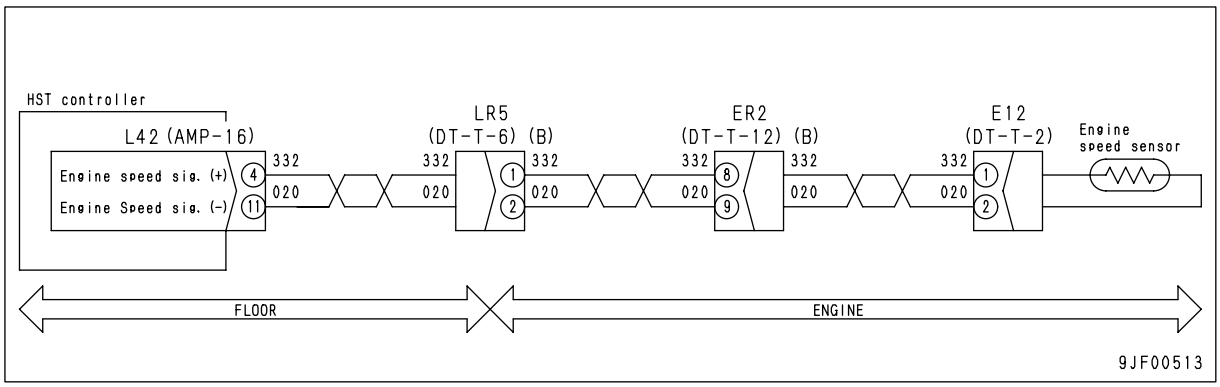


Failure Code [DLE2LC] (Engine revolution sensor revolution speed signal mismatch (LC))

Action Code	Failure Code	Controller Code	Trouble	Engine revolution sensor revolution speed signal mismatch (LC)
E03	DLE2LC	HST		
Description of Trouble	• There is an abnormality in the speed calculated from the speed sensor signal and signal speed from the engine revolution signal.			
Machine monitor or controller Reaction	• Error is sent to machine monitor through CAN communications, and machine monitor turns HST safety relay ON (cuts motor 1, clutch solenoid circuit).			
Effect on Machine	• Travels but drive power is low			
Related Information	• The engine speed can be checked in the monitoring function (Code: 01005).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	1	Defective engine revolution sensor	1) Turn starting switch OFF. 2) Disconnect connector E12. 3) Connect T-adapter		
			Between E12 (Male) (1) and (2)	Resistance	500 - 1,000Ω
			Between E12 (Male) (1), (2) and chassis ground	Resistance	1MΩ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L42, E12. 3) Connect T-adapter		
			Wiring harness between L42 (Female) (4) and E12 (Female) (1)	Resistance between L42 (Female) (4), E12 (Female) (1) and chassis ground	1MΩ and above
	3	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L42, E12. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON		
			Wiring harness between L42 (Female) (4) and E12 (Female) (1)	Voltage between L42 (Female) (4), E12 (Female) (1) and chassis ground	1V and below
	4	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect connector L42. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON		
			Between L42 (Female) (4) and (11)	Voltage (AC range)	0.5V and above

Related circuit diagram



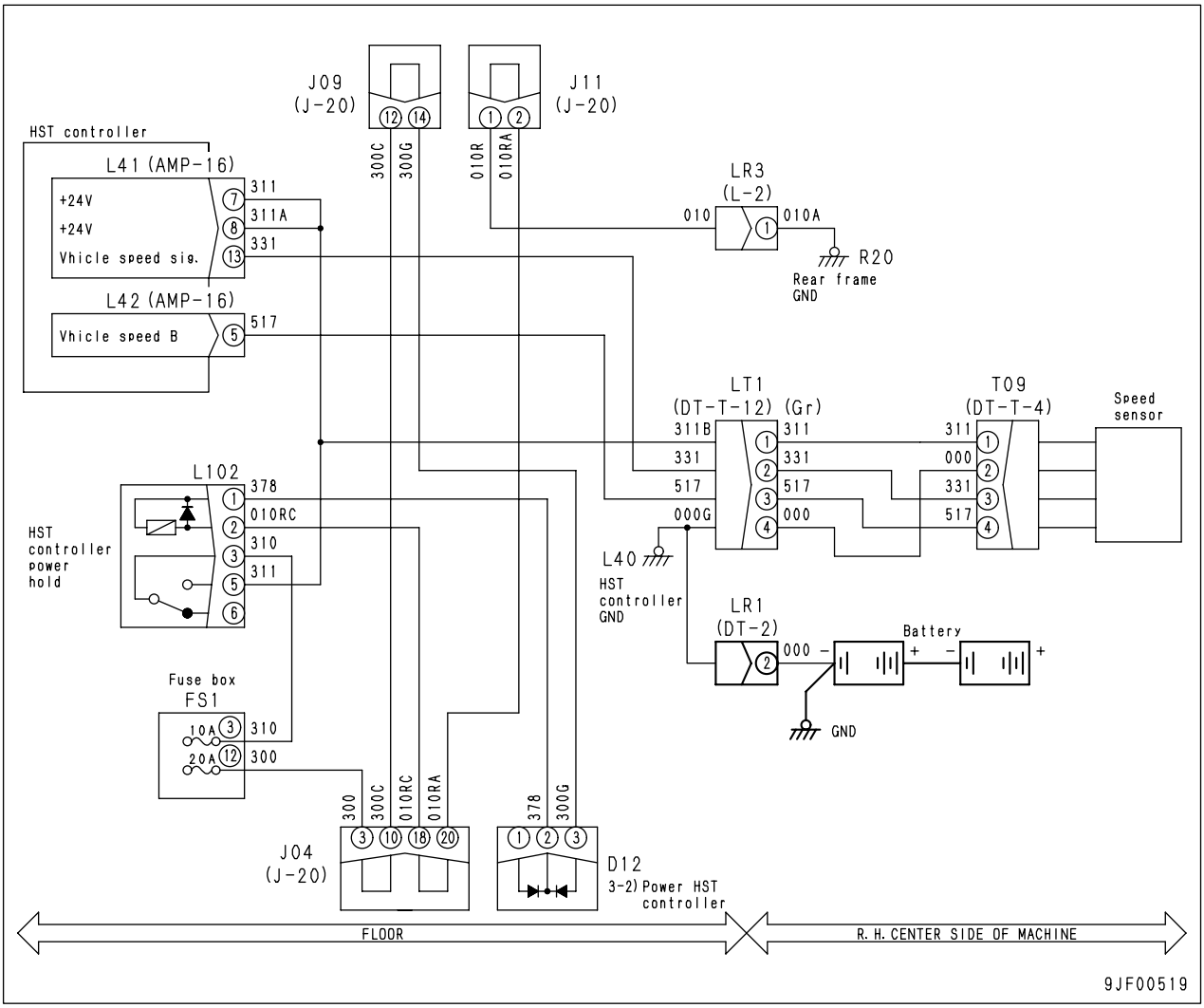
Failure Code [DLT3KA] (Speedmeter system discontinuity (KA))

Action Code	Failure Code	Controller Code	Trouble	Speedmeter system discontinuity (KA)
E03	DLT3KA	HST		
Description of Trouble	• The travel speed signal does not input due to disconnection or short-circuit with ground in travel speed sensor signal.			
Machine monitor or controller Reaction	• No action.			
Effect on Machine	• Travel speed does not increase. • Travel speed indicator on machine monitor stays at 0 km/h and does not move			
Related Information				

Possible Causes and Standard Values		Causes	Standard Value in Normal State and Remarks on Troubleshooting			
	1	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L41, L42, L102 and T09. 3) Connect T-adapter			
			Wiring harness between T09 (Female) (4) and L42 (Female) (5)		Resistance	1✕ and below
			Wiring harness between T09 (Female) (3) and L41 (Female) (13)		Resistance	1✕ and below
			Wiring harness between T09 (Female) (2) and chassis ground		Resistance	1✕ and below
			Wiring harness between T09 (Female) (1) and L41 (Female) (7), between L41 (Female) (8) and L102 (Female) (5)		Resistance	1✕ and below
			Wiring harness between L102 (Female) (3) and fuse FS1 (3)		Resistance	1✕ and below
			Wiring harness between L102 (Female) (2) and chassis ground		Resistance	1✕ and below
			Wiring harness between L102 (Female) (1) and D12 (Female) (2)		Resistance	1✕ and below
			Wiring harness between D12 (Female) (3) and fuse FS1 (12)		Resistance	1✕ and below
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L41, L42, L102 and T09. 3) Connect T-adapter			
			Wiring harness between T09 (Female) (4) and L42 (Female) (5)	Resistance between T09 (Female) (4), L42 (Female) (5) and chassis ground		1M✕ and above
			Wiring harness between T09 (Female) (3) and L41 (Female) (13)	Resistance between T09 (Female) (3), L41 (Female) (13) and chassis ground		1M✕ and above
			Wiring harness between T09 (Female) (1) and L41 (Female) (7), between L41 (Female) (8) and L102 (Female) (5) *	Resistance between T09 (Female) (1), L41 (Female) (7) and chassis ground, between L41 (Female) (8), L102 (Female) (5) and chassis ground		1M✕ and above
			Wiring harness between L102 (Female) (3) and fuse FS1 (3) *	Resistance between L102 (Female) (3) and fuse FS1 (3) and chassis ground		1M✕ and above
			Wiring harness between L102 (Female) (1) and D12 (Female) (2) *	Resistance between L102 (Female) (1) and D12 (Female) (2) and chassis ground		1M✕ and above
			Wiring harness between D12 (Female) (3) and fuse FS1 (12) *	Resistance between D12 (Female) (3) and fuse FS1 (12) and chassis ground		1M✕ and above
			★ In the above case of marked mark (*), the fuse is blown.			
	3	Defective travel speed sensor	1) Turn starting switch OFF. 2) Disconnect connector T09. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. 6) Move machine slightly and repeat following action: stop machine ✕ measure voltage			
			Between T09 (1) and (2)		Voltage	20 - 30V
			Between T09 (3) and (2)		Voltage	5 V and above (Pulse)
			★ Measure the voltages according to the position where the machine is stopped.			
			Between T09 (4) and (2)	Move machine forward in measurement condition	Voltage	20 - 30V
				Move machine in reverse in measurement condition	Voltage	5 V and above
			WARNING When moving the machine forward and in reverse when measuring the voltage, be particularly careful to ensure safety.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	4	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect connector L42. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. 6) Move machine slightly and repeat following action: stop machine ✕ measure voltage			
			Between L41 (7), (8) and chassis ground		Voltage	20 - 30V
			Between L41 (13) and chassis ground		Voltage	5 V and above (Pulse)
			★ Measure the voltages according to the position where the machine is stopped.			
			Between L42 (5) and chassis ground	Move machine forward in measurement condition	Voltage	20 - 30V
				Move machine in reverse in measurement condition	Voltage	5 V and above
			WARNING When moving the machine forward and in reverse when measuring the voltage, be particularly careful to ensure safety.			

Related circuit diagram



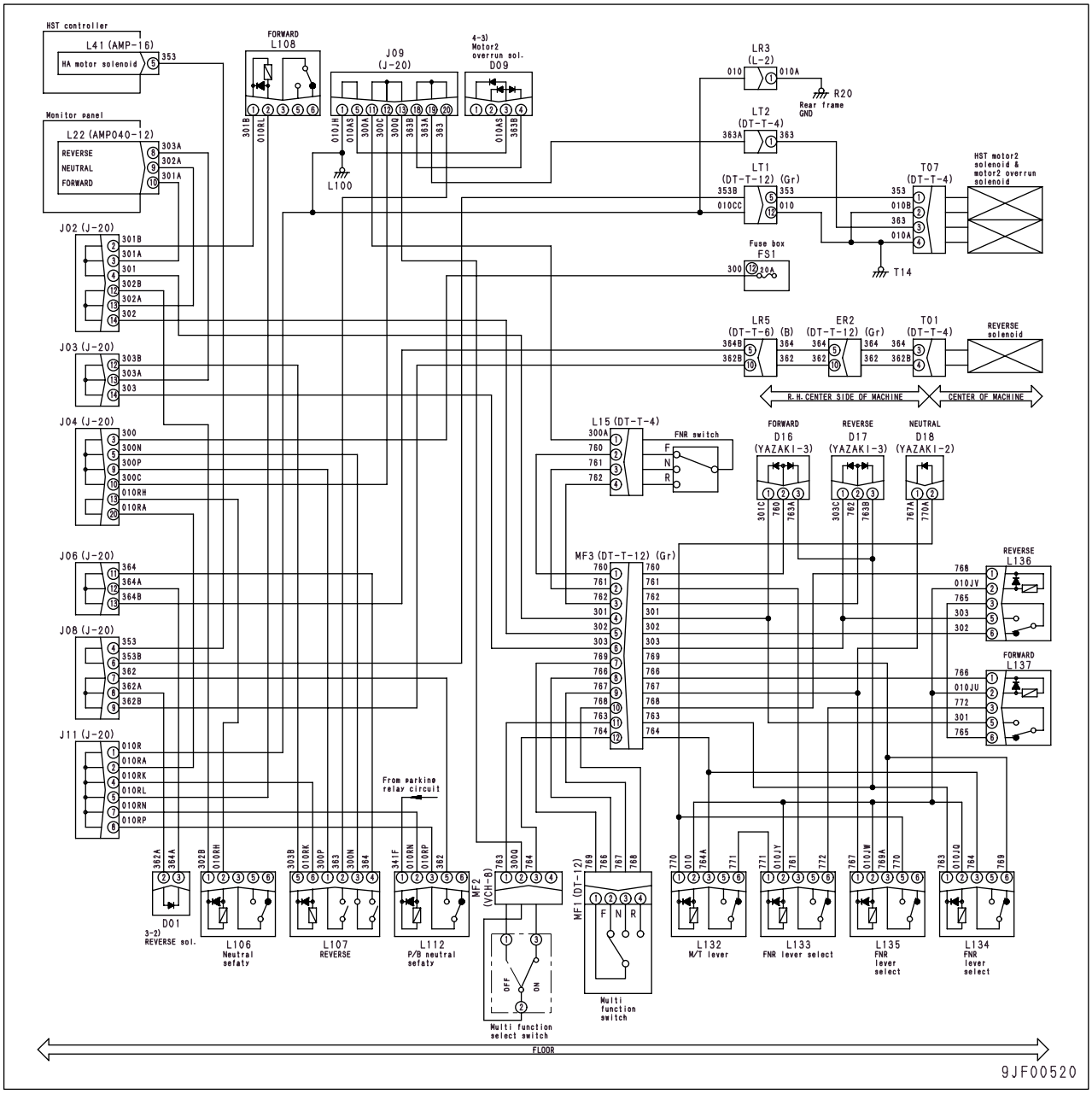
Failure Code [DW26KZ] (Motor 2 solenoid system discontinuity or short-circuiting (KZ))

Action Code	Failure Code	Controller Code	Trouble	Motor 2 solenoid system discontinuity or short-circuiting (KZ)
E03	DW26KZ	HST		
Description of Trouble	• Excessive electricity flows when output to motor 2 solenoid circuit is ON; no electricity flows when output is ON or electricity flows when output is ON.			
Machine monitor or controller Reaction	• Error is sent to machine monitor through CAN communications, and machine monitor turns HST safety relay ON (cuts motor 1, clutch solenoid circuit).			
Effect on Machine	• Travel speed does not increase. • Travel speed indicator on machine monitor stays at 0 km/h and does not move			
Related Information				

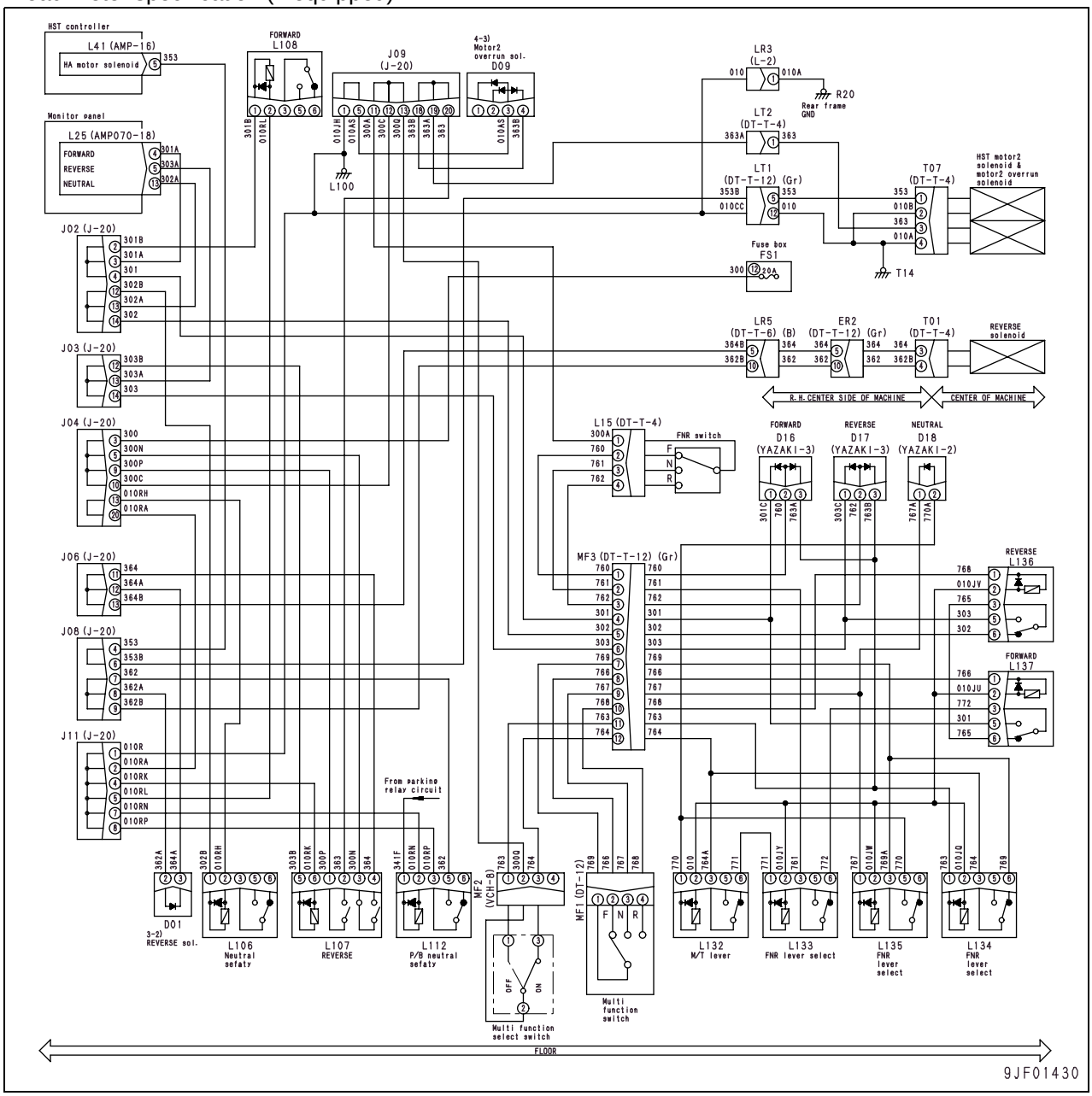
	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective motor 2 solenoid	1) Turn starting switch OFF. 2) Disconnect connector T07. 3) Connect T-adapter			
			Between T07 (Female) (1) and (2)		Resistance	10 - 30Ω
			Between T07 (Female) (3) and (4)		Resistance	10 - 30Ω
			Between T07 (Female) (1), (3) and chassis ground		Resistance	1MΩ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L41, T07 and fuse FS1 terminal. 3) Connect T-adapter			
			Wiring harness between T07 (Female) (1) and L41 (Female) (5)		Resistance	1Ω and below
			Wiring harness between T07 (Female) (2) and chassis ground		Resistance	1Ω and below
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L41 and fuse FS1 (12). 3) Connect T-adapter			
			Wiring harness between T07 (Female) (1) and L41 (Female) (5)	Resistance between T07 (Female) (1), L41 (Female) (5) and chassis ground		1MΩ and above
	4	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON			
			Between L41 (5) and chassis ground	Turn travel speed selector switch 1st	Voltage	20 - 30 V
				Turn travel speed selector switch 2nd	Voltage	20 - 30 V
				Turn travel speed selector switch 3rd	Voltage	20 - 30 V
				Turn travel speed selector switch 4th (10km/h and below)	Voltage	20 - 30 V
				Turn travel speed selector switch 4th (10 - 38km/h)	Voltage	2V and below

Related circuit diagram

Speed meter specification (STD)



Load meter specification (If equipped)



Failure Code [DX19KZ] (Motor 1 solenoid system discontinuity or short-circuiting (KZ))

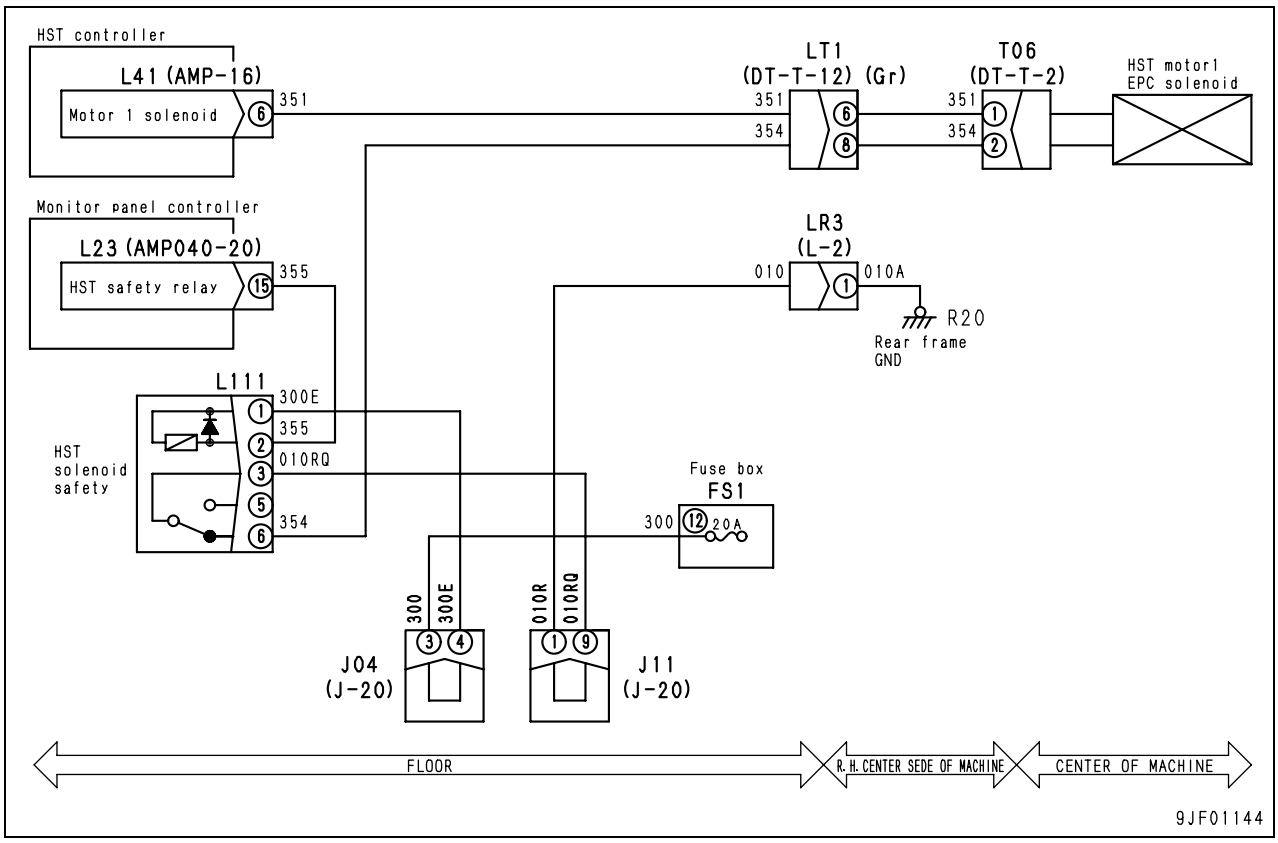
Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Motor 1 solenoid system discontinuity or short-circuiting (KZ)
E03	DX19KZ	HST		
Description of Trouble	• Excessive electricity flows when output to motor 1 solenoid circuit is ON; no electricity flows when output is ON or electricity flows when output is ON.			
Machine monitor or controller Reaction	• Error is sent to machine monitor through CAN communications, and machine monitor turns HST safety relay ON (cuts motor 1, clutch solenoid circuit).			
Effect on Machine	• Travels but drive power is low			
Related Information	• Motor 1 solenoid current can be checked in the monitoring function (Code:80000).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective motor 1 solenoid	1) Turn starting switch OFF. 2) Disconnect connector T06. 3) Connect T-adapter			
			Between T06 (Female) (1) and (2)		Resistance	15 - 35Ω
			Between T06 (Female) (1), (2) and chassis ground		Resistance	1MΩ and above
	2	Defective HST safety relay (L111)	1) Turn starting switch OFF. 2) Interchange relay (L111) with normal relay. 3) Turn starting switch ON. 4) Operate FNR switch			
			Does condition become normal when HST safety relay (L111) is interchanged with normal relay?		The condition is abnormal	Relay (L111) is normal
					The condition is normal	Defective relay (L111)
			1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check			
			Between L111 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check. 4) Applies impressed voltage between L111 (Male) (1) - (2)			
			Between L111 (Male) (3) and (6)	Applies 24V impressed voltage between L111 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L111 (Male) (1) - (2)	Resistance	1MΩ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L23, L41, L111, T06 and fuse FS1 (12). 3) Connect T-adapter			
			Wiring harness between T06 (Female) (1) and L41 (Female) (6)		Resistance	1Ω and below
			Wiring harness between T06 (Female) (2) and L111 (Female) (6)		Resistance	1Ω and below
			Wiring harness between L111 (Female) (3) and chassis ground		Resistance	1Ω and below
			Wiring harness between L111 (Female) (2) and L23 (Female) (15)		Resistance	1Ω and below
			Wiring harness between fuse FS1 (12) and L111 (Female) (1)		Resistance	1Ω and below
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L23, L41, L111, T06 and fuse FS1 (12). 3) Connect T-adapter			
			Wiring harness between T06 (Female) (1) and L41 (Female) (6)	Resistance between T06 (Female) (1), L41 (Female) (6) and chassis ground		1MΩ and above
			Wiring harness between T06 (Female) (2) and L111 (Female) (6)	Resistance between T06 (Female) (2), L111 (Female) (6) and chassis ground		1MΩ and above
			Wiring harness between fuse FS1 (12) and L111 (Female) (1) *	Resistance between fuse FS1 (12), L111 (Female) (1) and chassis ground		1MΩ and above
			In the above case of marked mark (*), the fuse is blown.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	5	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON			
			Between L41 (6) and chassis ground	Turn travel speed selector switch 1st	Voltage	2 - 20V
				Turn travel speed selector switch 2nd	Voltage	2 - 20V
				Turn travel speed selector switch 3rd and 4th	Voltage	2 - 20V
				Turn travel speed selector switch 3rd and 4th (10km/h and below)	Voltage	3V and below

Related circuit diagram



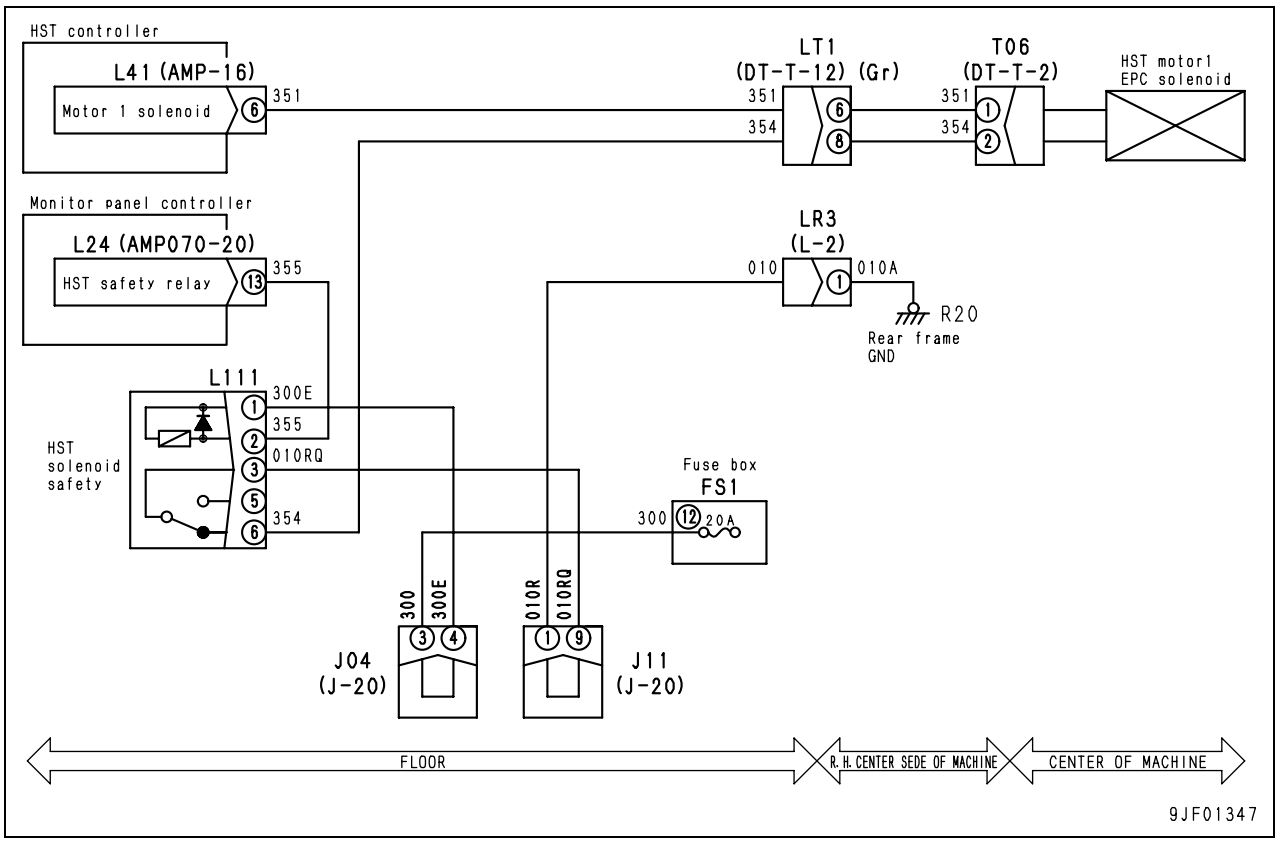
Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Motor 1 solenoid system discontinuity or short-circuiting (KZ)
E03	DX19KZ	HST		
Description of Trouble	• Excessive electricity flows when output to motor 1 solenoid circuit is ON; no electricity flows when output is ON or electricity flows when output is ON.			
Machine monitor or controller Reaction	• Error is sent to machine monitor through CAN communications, and machine monitor turns HST safety relay ON (cuts motor 1, clutch solenoid circuit).			
Effect on Machine	• Travels but drive power is low			
Related Information	• Motor 1 solenoid current can be checked in the monitoring function (Code:80000).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective motor 1 solenoid	1) Turn starting switch OFF. 2) Disconnect connector T06. 3) Connect T-adapter			
			Between T06 (Female) (1) and (2)		Resistance	15 - 35Ω
			Between T06 (Female) (1), (2) and chassis ground		Resistance	1MΩ and above
	2	Defective HST safety relay (L111)	1) Turn starting switch OFF. 2) Interchange relay (L111) with normal relay. 3) Turn starting switch ON. 4) Operate FNR switch			
			Does condition become normal when HST safety relay (L111) is interchanged with normal relay?		The condition is abnormal	Relay (L111) is normal
					The condition is normal	Defective relay (L111)
			1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check			
			Between L111 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check. 4) Applies impressed voltage between L111 (Male) (1) - (2)			
			Between L111 (Male) (3) and (6)	Applies 24V impressed voltage between L111 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L111 (Male) (1) - (2)	Resistance	1MΩ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L24, L41, L111, T06 and fuse FS1 (12). 3) Connect T-adapter			
			Wiring harness between T06 (Female) (1) and L41 (Female) (6)		Resistance	1Ω and below
			Wiring harness between T06 (Female) (2) and L111 (Female) (6)		Resistance	1Ω and below
			Wiring harness between L111 (Female) (3) and chassis ground		Resistance	1Ω and below
			Wiring harness between L111 (Female) (2) and L24 (Female) (13)		Resistance	1Ω and below
			Wiring harness between fuse FS1 (12) and L111 (Female) (1)		Resistance	1Ω and below
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L24, L41, L111, T06 and fuse FS1 (12). 3) Connect T-adapter			
			Wiring harness between T06 (Female) (1) and L41 (Female) (6)	Resistance between T06 (Female) (1), L41 (Female) (6) and chassis ground		1MΩ and above
			Wiring harness between T06 (Female) (2) and L111 (Female) (6)	Resistance between T06 (Female) (2), L111 (Female) (6) and chassis ground		1MΩ and above
			Wiring harness between fuse FS1 (12) and L111 (Female) (1) *	Resistance between fuse FS1 (12), L111 (Female) (1) and chassis ground		1MΩ and above
			In the above case of marked mark (*), the fuse is blown.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	5	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON			
			Between L41 (6) and chassis ground	Turn travel speed selector switch 1st	Voltage	2 - 20V
				Turn travel speed selector switch 2nd	Voltage	2 - 20V
				Turn travel speed selector switch 3rd and 4th	Voltage	2 - 20V
				Turn travel speed selector switch 3rd and 4th (10km/h and below)	Voltage	3V and below

Related circuit diagram



Failure Code [DX20KZ] (Clutch solenoid system discontinuity or short-circuiting (KZ))

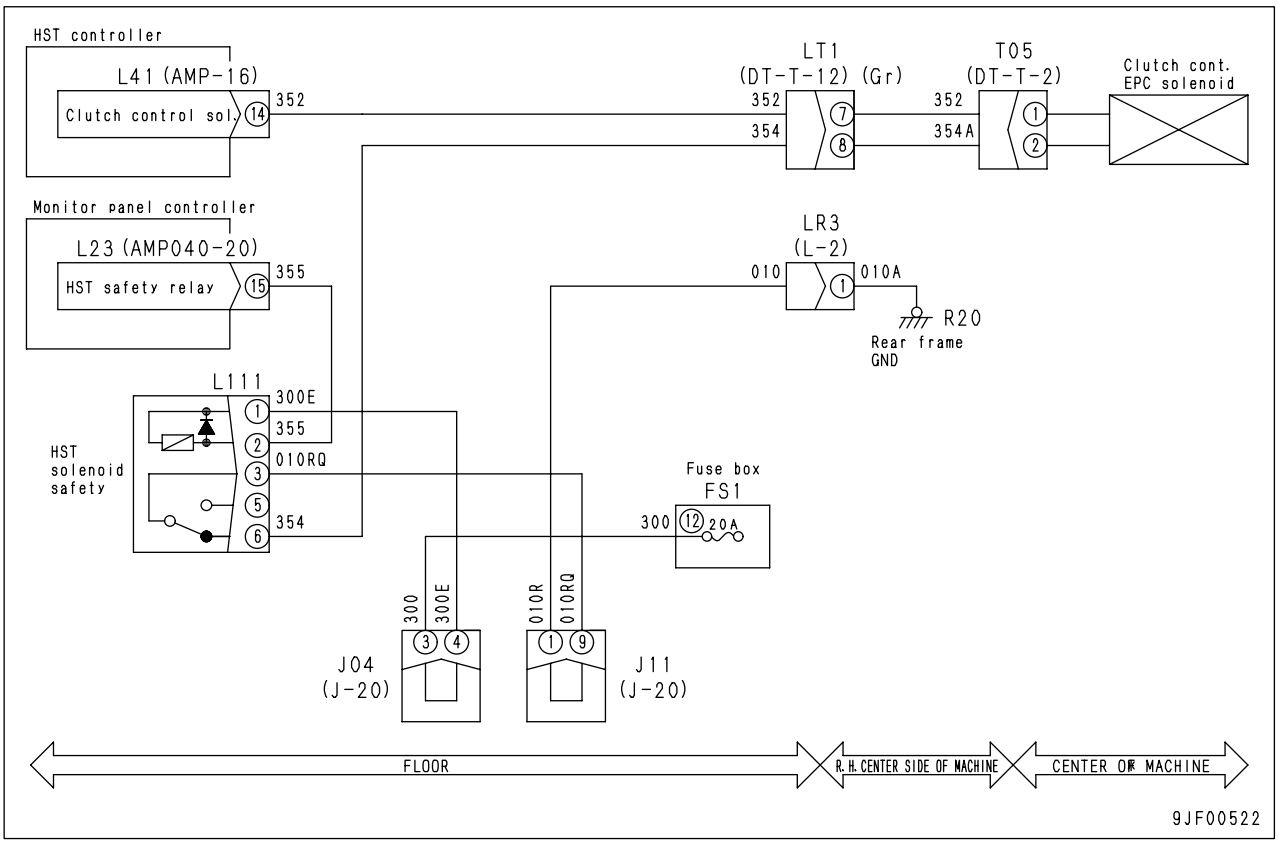
Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Clutch solenoid system discontinuity or short-circuiting (KZ)
E03	DX20KZ	HST		
Description of Trouble	• Excessive electricity flows when output to clutch solenoid circuit is ON; no electricity flows when output is ON or electricity flows when output is ON.			
Machine monitor or controller Reaction	• Error is sent to machine monitor through CAN communications, and machine monitor turns HST safety relay ON (cuts motor 1, clutch solenoid circuit).			
Effect on Machine	• Travel speed does not switch. • Does not control 3rd or 4th, or does not control 1st or 2nd.			
Related Information	• The clutch solenoid current can be checked in the monitoring function (Code:80100).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective clutch solenoid	1) Turn starting switch OFF. 2) Disconnect connector T05. 3) Connect T-adapter			
			Between T05 (Female) (1) and (2)		Resistance	15 - 35Ω
			Between T05 (Female) (1), (2) and chassis ground		Resistance	1MΩ and above
	2	Defective HST safety relay (L111)	1) Turn starting switch OFF. 2) Interchange relay (L111) with normal relay. 3) Turn starting switch ON. 4) Operate FNR switch			
			Does condition become normal when HST safety relay (L111) is interchanged with normal relay?		The condition is abnormal	Relay (L111) is normal
					The condition is normal	Defective relay (L111)
			1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check			
			Between L111 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check, 4) Applies impressed voltage between L111 (Male) (1) - (2)			
			Between L111 (Male) (3) and (6)	Applies 24V impressed voltage between L111 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L111 (Male) (1) - (2)	Resistance	1MΩ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L23, L41, L111, T05 and fuse FS1 (12). 3) Connect T-adapter			
			Wiring harness between T05 (Female) (1) and L41 (Female) (14)		Resistance	1Ω and below
			Wiring harness between T05 (Female) (2) and L111 (Female) (6)		Resistance	1Ω and below
			Wiring harness between L111 (Female) (3) and chassis ground		Resistance	1Ω and below
			Wiring harness between L111 (Female) (2) and L23 (Female) (15)		Resistance	1Ω and below
			Wiring harness between fuse FS1 (12) and L111 (Female) (1)		Resistance	1Ω and below
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L23, L41, L111, T05 and fuse FS1 (12). 3) Connect T-adapter		Resistance	1Ω and below
			Wiring harness between T05 (Female) (1) and L41 (Female) (14)	Resistance between T05 (Female) (1), L41 (Female) (14) and chassis ground		1MΩ and above
			Wiring harness between T05 (Female) (2) and L111 (Female) (6)	Resistance between T05 (Female) (2), L111 (Female) (6) and chassis ground		1MΩ and above
			Wiring harness between fuse FS1 (12) and L111 (Female) (1) *	Resistance between fuse FS1 (12), L111 (Female) (1) and chassis ground		1MΩ and above
			In the above case of marked mark (*), the fuse is blown.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	5	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON			
			Between L41 (14) and chassis ground	Turn travel speed selector switch 1st	Voltage	3 - 15V
				Turn travel speed selector switch 2nd	Voltage	3 - 15V
				Turn travel speed selector switch 3rd and 4th	Voltage	3 - 15V
				Turn travel speed selector switch 3rd and 4th (10km/h and below)	Voltage	4V and below

Related circuit diagram



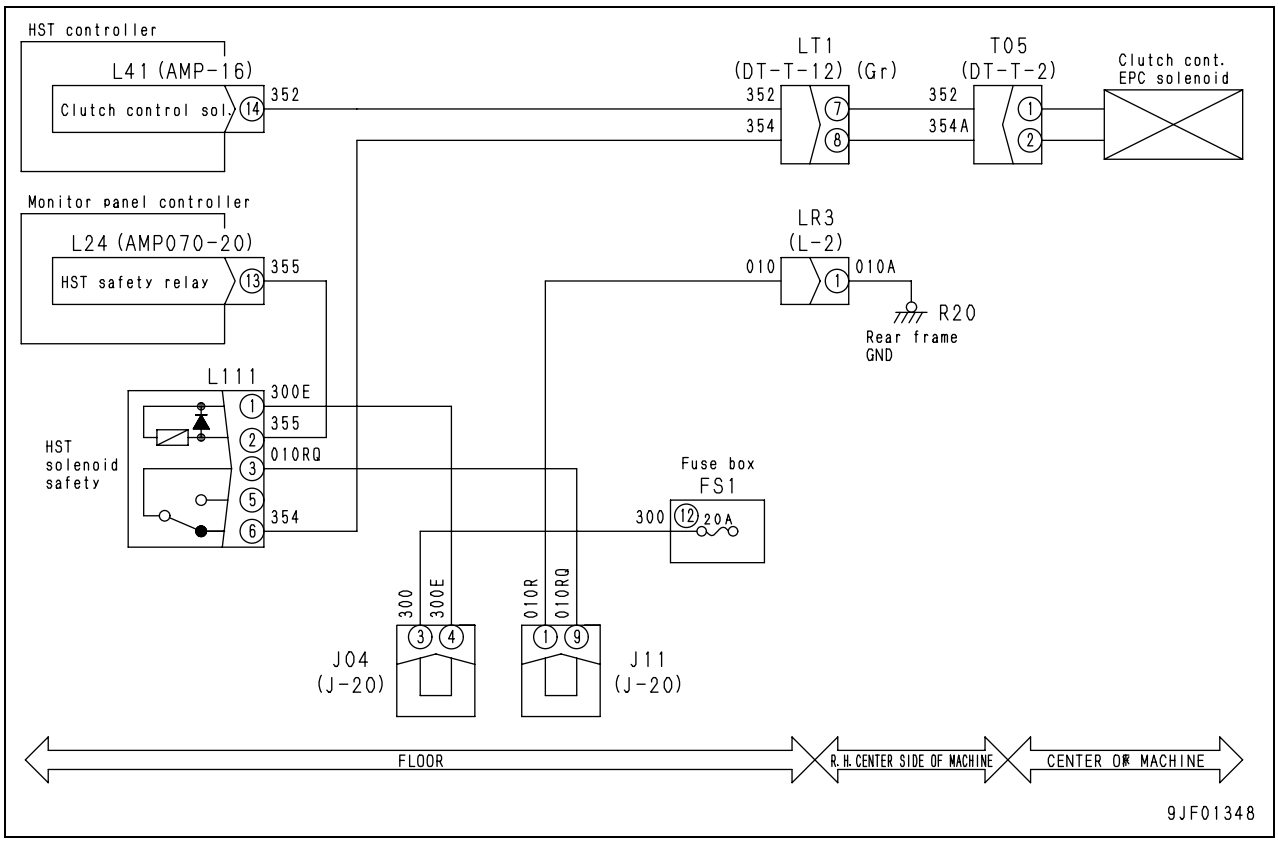
Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Clutch solenoid system discontinuity or short-circuiting (KZ)
E03	DX20KZ	HST		
Description of Trouble	• Excessive electricity flows when output to clutch solenoid circuit is ON; no electricity flows when output is ON or electricity flows when output is ON.			
Machine monitor or controller Reaction	• Error is sent to machine monitor through CAN communications, and machine monitor turns HST safety relay ON (cuts motor 1, clutch solenoid circuit).			
Effect on Machine	• Travel speed does not switch. • Does not control 3rd or 4th, or does not control 1st or 2nd.			
Related Information	• The clutch solenoid current can be checked in the monitoring function (Code:80100).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective clutch solenoid	1) Turn starting switch OFF. 2) Disconnect connector T05. 3) Connect T-adapter			
			Between T05 (Female) (1) and (2)		Resistance	15 - 35Ω
			Between T05 (Female) (1), (2) and chassis ground		Resistance	1MΩ and above
	2	Defective HST safety relay (L111)	1) Turn starting switch OFF. 2) Interchange relay (L111) with normal relay. 3) Turn starting switch ON. 4) Operate FNR switch			
			Does condition become normal when HST safety relay (L111) is interchanged with normal relay?		The condition is abnormal	Relay (L111) is normal
					The condition is normal	Defective relay (L111)
			1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check			
			Between L111 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check, 4) Applies impressed voltage between L111 (Male) (1) - (2)			
			Between L111 (Male) (3) and (6)	Applies 24V impressed voltage between L111 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L111 (Male) (1) - (2)	Resistance	1MΩ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L24, L41, L111, T05 and fuse FS1 (12). 3) Connect T-adapter			
			Wiring harness between T05 (Female) (1) and L41 (Female) (14)		Resistance	1Ω and below
			Wiring harness between T05 (Female) (2) and L111 (Female) (6)		Resistance	1Ω and below
			Wiring harness between L111 (Female) (3) and chassis ground		Resistance	1Ω and below
			Wiring harness between L111 (Female) (2) and L24 (Female) (13)		Resistance	1Ω and below
			Wiring harness between fuse FS1 (12) and L111 (Female) (1)		Resistance	1Ω and below
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L24, L41, L111, T05 and fuse FS1 (12). 3) Connect T-adapter		Resistance	1Ω and below
			Wiring harness between T05 (Female) (1) and L41 (Female) (14)	Resistance between T05 (Female) (1), L41 (Female) (14) and chassis ground		1MΩ and above
			Wiring harness between T05 (Female) (2) and L111 (Female) (6)	Resistance between T05 (Female) (2), L111 (Female) (6) and chassis ground		1MΩ and above
			Wiring harness between fuse FS1 (12) and L111 (Female) (1) *	Resistance between fuse FS1 (12), L111 (Female) (1) and chassis ground		1MΩ and above
			In the above case of marked mark (*), the fuse is blown.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	5	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON			
			Between L41 (14) and chassis ground	Turn travel speed selector switch 1st	Voltage	3 - 15V
				Turn travel speed selector switch 2nd	Voltage	3 - 15V
				Turn travel speed selector switch 3rd and 4th	Voltage	3 - 15V
				Turn travel speed selector switch 3rd and 4th (10km/h and below)	Voltage	4V and below

Related circuit diagram



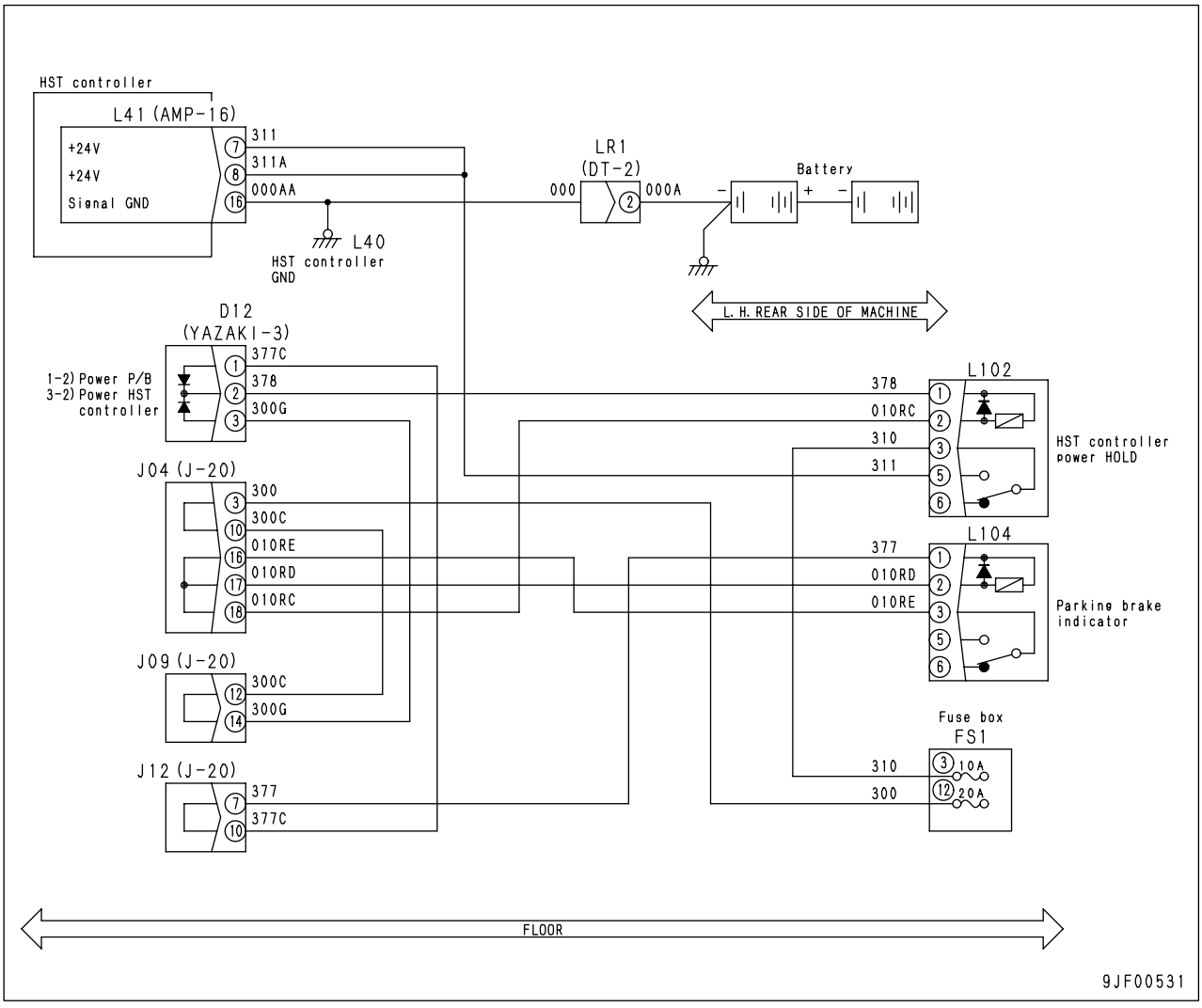
Troubleshooting Code [HST-1] (Defective HST controller power source (HST controller does not function))

Action Code	Failure Code	Controller Code	Trouble	Defective HST controller power source (HST controller does not function)
-	-	-		
Description of Trouble	• HST controller power source system is defective, so HST controller does not work.			
Machine monitor or controller Reaction	• No action.			
Effect on Machine	• Travels but drive power is low • Machine monitor announces failure code DAJOKR for defective HST controller communications			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L41, L102 and fuse FS1 terminal. 3) Connect T-adapter			
			Wiring harness between L41 (Female) (8) and L102 (Female) (5)		Resistance	1✕ and below
			Wiring harness between fuse FS1 (3) and L102 (Female) (3)		Resistance	1✕ and below
			Wiring harness between fuse FS1 (12) and L102 (Female) (1)		Resistance	1✕ and below
			Wiring harness between L102 (Female) (2) and chassis ground		Resistance	1✕ and below
			Wiring harness between L41 (Female) (16) and chassis ground		Resistance	1✕ and below
	2	Defective HST power source safety relay (L102)	1) Turn starting switch OFF. 2) Interchange relay (L102) with normal relay. 3) Turn starting switch ON. 4) Operate FNR switch			
			Does condition become normal when HST safety relay (L102) is interchanged with normal relay?	The condition is abnormal	Relay (L102) is normal	
				The condition is normal	Defective relay (L102)	
			1) Turn starting switch OFF. 2) Disconnect connector L102. 3) Solid part check			
			Between L102 (Male) (1) and (2)		Resistance	200 - 400✕
			1) Turn starting switch OFF. 2) Disconnect connector L102. 3) Solid part check. 4) Applies impressed voltage between L102 (Male) (1) - (2)			
			Between L102 (Male) (3) and (5)	Applies 24V impressed voltage between L102 (Male) (1) - (2)	Resistance	1✕ and below
				Does not apply voltage between L102 (Male) (1) - (2)	Resistance	1M✕ and above
	3	Defective diode (D12)	1) Turn starting switch OFF. 2) Replace diode (D12) to correct diode. 3) Turn starting switch START			
			The condition is abnormal		Diode (D12) is normal	
			The condition is normal		Defective diode (D12)	
			Measure at diode range			
			D12 (Male) (1) ✕ (2)	Continuity		
			D12 (Male) (3) ✕ (2)	Continuity		
			D12 (Male) (1) ✕ (3)	Discontinuity		
			D12 (Male) (2) ✕ (1)	Discontinuity		
			D12 (Male) (2) ✕ (3)	Discontinuity		
			D12 (Male) (3) ✕ (1)	Discontinuity		
			★ Connect the (+) pole of the tester to the left side of D12 ( ) ✕ ( ).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L41, L102 and fuse FS1 terminal. 3) Connect T-adapter		
			Wiring harness between L41 (Female) (8) and L102 (Female) (5)	Resistance between L41 (Female) (8), L102 (Female) (5) and chassis ground	1MΩ and above
			Wiring harness between fuse FS1 (3) and L102 (Female) (3)	Resistance between fuse FS1 (3), L102 (Female) (3) and chassis ground	1MΩ and above
			Wiring harness between fuse FS1 (12) and L102 (Female) (1)	Resistance between fuse FS1 (12), L102 (Female) (1) and chassis ground	1MΩ and above
			★ In the above case, the all fuses are blown.		
	5	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON		
			Between L41 (8) and (16)	Voltage	20 - 30V

Related circuit diagram



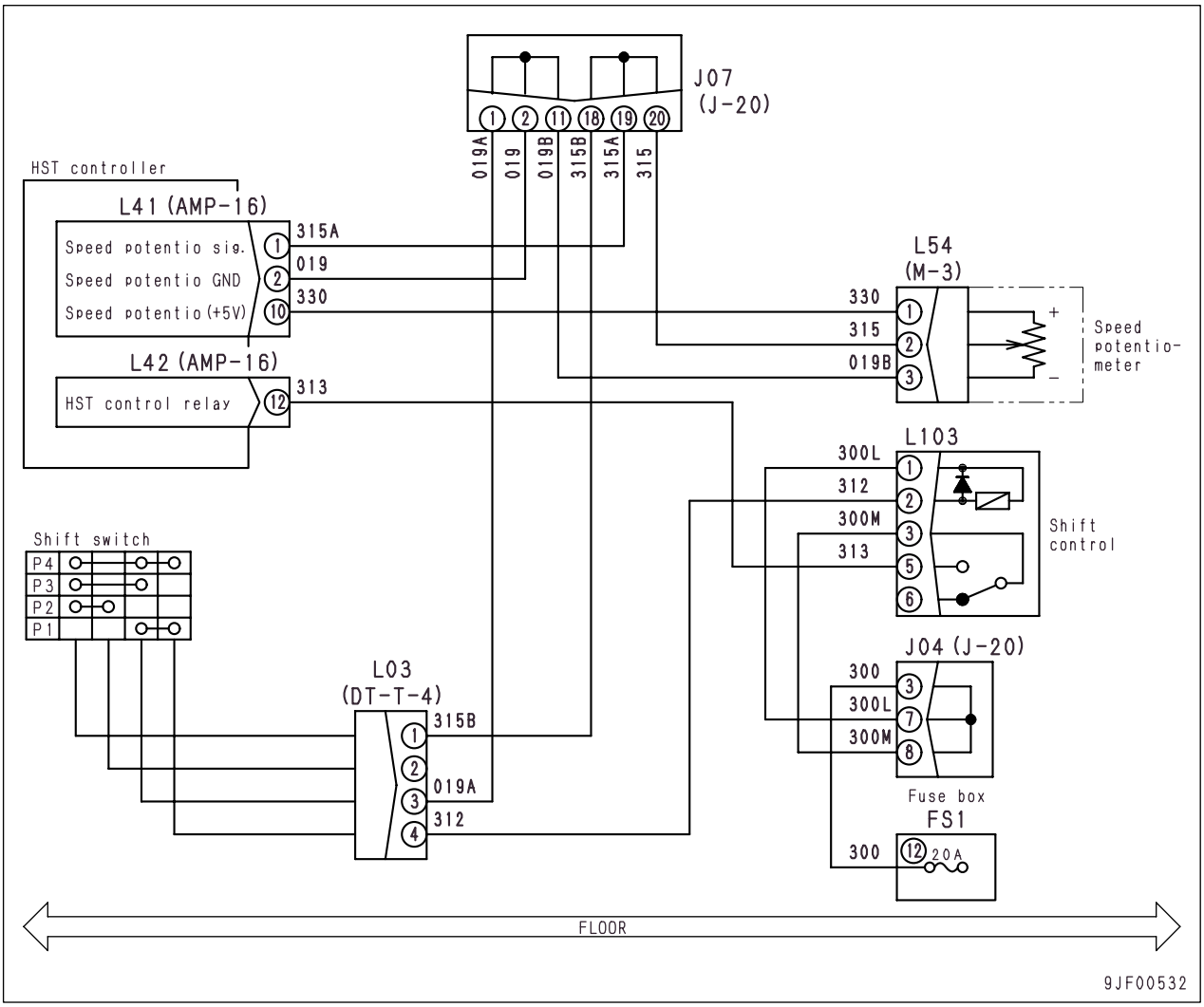
Troubleshooting Code [HST-2] (Travel speed does not shifted)

Action Code	Failure Code	Controller Code	Trouble	Travel speed does not shifted
-	-	-		
Description of Trouble	• The speed selector switch system is defective, so the travel speed cannot be changed.			
Machine monitor or controller Reaction	• No action.			
Effect on Machine	• Travel speed does not shifted			
Related Information				

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective travel speed selector switch	1) Turn starting switch OFF. 2) Disconnect connector L03. 3) Connect T-adapter			
			Between L03 (Female) (1) and (2)	2nd	Resistance	1✕ and below
				Other than the above	Resistance	1M✕ and above
			Between L03 (Female) (1) and (3)	1st	Resistance	1M✕ and above
				2nd	Resistance	1M✕ and above
				3rd	Resistance	1✕ and below
				4th	Resistance	1✕ and below
			Between L03 (Female) (1) and (4)	4th	Resistance	1✕ and below
				Other than the above	Resistance	1M✕ and above
			Between L03 (Female) (3) and (4)	1st	Resistance	1✕ and below
				2nd	Resistance	1M✕ and above
				3rd	Resistance	1M✕ and above
				4th	Resistance	1✕ and below
	2	Defective shift control relay (L103)	1) Turn starting switch OFF. 2) Interchange relay (L103) with normal relay. 3) Turn starting switch ON. 4) Operate FNR switch			
			Does condition become normal when shift control relay (L103) is interchanged with normal relay?		The condition is abnormal	Relay (L103) is normal
					The condition is normal	Defective relay (L103)
			1) Turn starting switch OFF. 2) Disconnect connector L103. 3) Solid part check			
			Between L103 (Male) (1) and (2)		Resistance	200 - 400✕
			1) Turn starting switch OFF. 2) Disconnect connector L103. 3) Solid part check, 4) Applies impressed voltage between L103 (Male) (1) - (2)			
			Between L103 (Male) (3) and (5)	Applies 24V impressed voltage between L103 (Male) (1) - (2)	Resistance	1✕ and below
				Does not apply voltage between L103 (Male) (1) - (2)	Resistance	1M✕ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting				
Possible Causes and Standard Values	3	Defective travel speed potentiometer	1) Turn starting switch OFF. 2) Disconnect connector L54. 3) Connect T-adapter				
			Between L54 (Female) (1) and (3)			Resistance	4 - 6 kΩ
			Between L54 (Female) (1) and (2)			Resistance	0.25 - 5 kΩ
			Between L54 (Female) (2) and (3)			Resistance	0.25 - 5 kΩ
	4	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L42, L103, J07 and fuse FS1 terminal. 3) Connect T-adapter				
			Wiring harness between L42 (Female) (12) and L103 (Female) (5)			Resistance	1Ω and below
			Wiring harness between fuse FS1 (12) and L103 (Female) (3)			Resistance	1Ω and below
			Wiring harness between fuse FS1 (12) and L103 (Female) (1)			Resistance	1Ω and below
			Wiring harness between L103 (Female) (2) and L03 (Female) (4)			Resistance	1Ω and below
			Wiring harness between L03 (Female) (3) and J07 (Female) (1)			Resistance	1Ω and below
			Wiring harness between L03 (Female) (1) and J07 (Female) (18)			Resistance	1Ω and below
	5	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L42, L103 and fuse FS1 terminal. 3) Connect T-adapter				
			Wiring harness between L42 (Female) (12) and L103 (Female) (5)		Resistance between L42 (Female) (12), L103 (Female) (5) and chassis ground		1MΩ and above
			Wiring harness between fuse FS1 (12) and L103 (Female) (3)		Resistance between fuse FS1 (12), L103 (Female) (3) and chassis ground		1MΩ and above
			Wiring harness between fuse FS1 (12) and L103 (Female) (1)		Resistance between fuse FS1 (12), L103 (Female) (1) and chassis ground		1MΩ and above
			★ In the above case, the all fuses are blown.				
	6	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L42, L103. 3) Insert T-adapter. 4) Turn starting switch ON				
			Wiring harness between L42 (Female) (12) and L103 (Female) (5)		Voltage between L42 (Female) (12), L103 (Female) (5) and chassis ground		1V and below
	7	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect connector L42. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON				
			Between L42 (12) and chassis ground	Travel speed selector switch	"1st", "4th"	Voltage	20 - 30V
					"2nd", "3rd"	Voltage	1V and below

Related circuit diagram

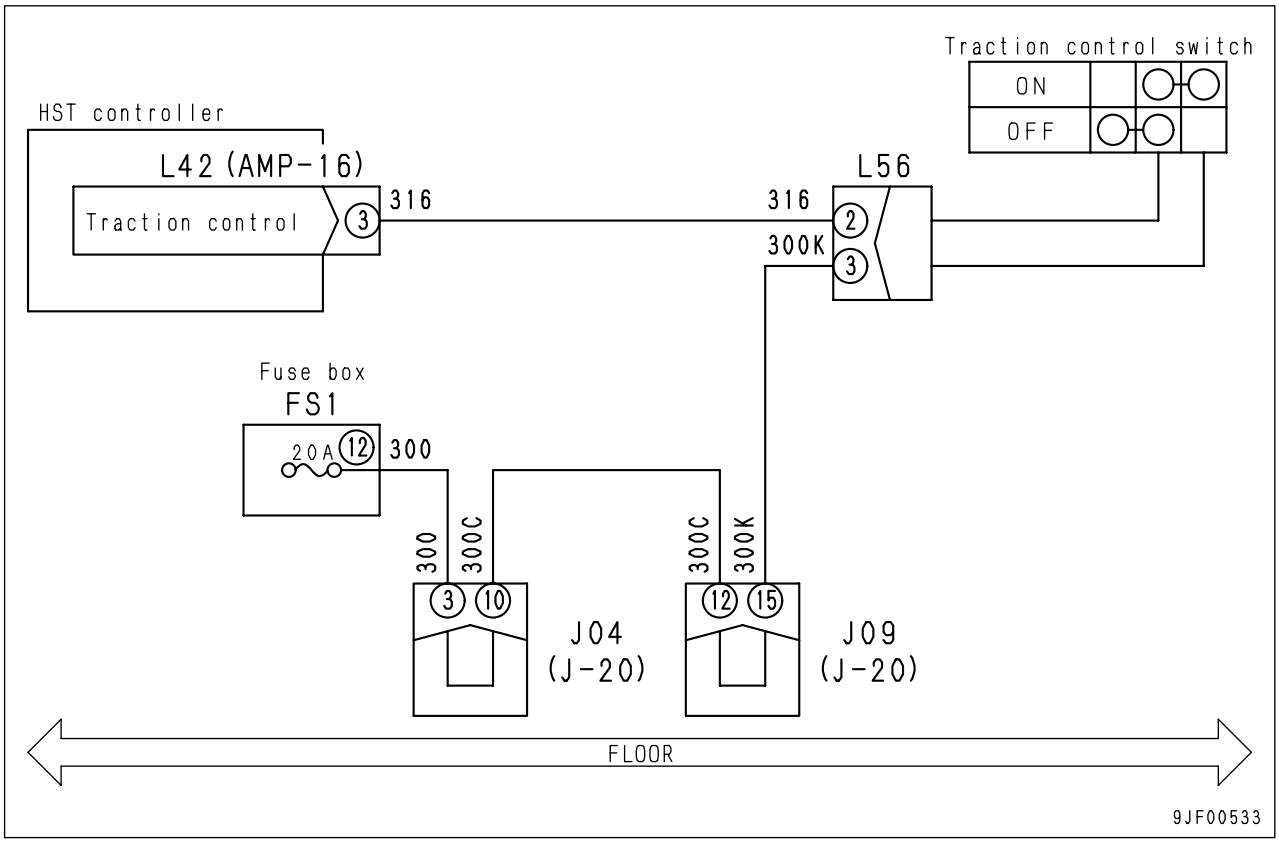


Troubleshooting Code [HST-3] HST Output Control (Traction control) cannot be controlled

Action Code	Failure Code	Controller Code	Trouble	HST output control (Traction control) cannot be controlled
-	-	-		
Description of Trouble	• The traction control switch system is defective, so the HST output control cannot be controlled.			
Machine monitor or controller Reaction	• No action.			
Effect on Machine	• The HST output control (Traction control) cannot be controlled.			
Related Information	• Traction control ON-OFF output signal can be checked in the monitoring function (Code: 80200).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective traction control switch	1) Turn starting switch OFF. 2) Disconnect connector L56. 3) Connect T-adapter.			
			Between L56 (Female) (3) and (2)	Traction control switch ON	Resistance	1Ω and below
				Traction control switch OFF	Resistance	1MΩ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L42, L56 and fuse FS1 terminal. 3) Connect T-adapter.			
			Wiring harness between L42 (Female) (3) and L56 (Female) (2)		Resistance	1Ω and below
			Wiring harness between fuse FS1 (12) and L56 (Female) (3)		Resistance	1Ω and below
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L42, L56 and fuse FS1 terminal. 3) Connect T-adapter.			
			Wiring harness between L42 (Female) (3) and L56 (Female) (3)	Resistance between L42 (Female) (3), L56 (Female) (2) and chassis ground		1MΩ and above
			Wiring harness between fuse FS1 (12) and L56 (Female) (3)	Resistance between fuse FS1 (12), L56 (Female) (3) and chassis ground		1MΩ and above
			★ In the above case, the all fuses are blown.			
	4	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect connectors L41 and L56. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L42 (Female) (3) and L56 (Female) (2)	Voltage between L42 (Female) (3), L56 (Female) (2) and chassis ground		1V and below
	5	Defective HST controller	1) Turn starting switch OFF. 2) Disconnect Connector L42. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L42 (3) and chassis ground	Traction control switch ON	Voltage	20 - 30V
				Traction control switch OFF	Voltage	1V and below

Related circuit diagram



TROUBLESHOOTING OF MONITOR SYSTEM (MON MODE)

white 20-403

BEFORE TROUBLESHOOTING CODE DISPLAY

FAILURE CODE AND POSSIBLE CAUSES TABLE

Failure code (*): Only load meter specification (If equipped)	Action code	Possible causes																					
		Defective machine monitor	Defective HST controller	Defective starting switch	Defective monitor panel mode selector switch 1 ■	Defective monitor panel mode selector switch 1 ◇	Defective monitor panel mode selector switch 2 <	Defective monitor panel mode selector switch 2 >	Defective forward-reverse lever	Deterioration of battery	Defective battery relay	Defective fuse/fusible link	Defective alternator	Clogging of air cleaner	Defective air cleaner clogging sensor	Defective engine speed sensor	Defective HST motor 2 solenoid	Defective HST motor 1 solenoid	Defective clutch solenoid	Lowering of engine oil pressure	Defective engine oil pressure sensor	Lowering of engine oil level	Defective engine oil level sensor
(Codes related to HST controller)																							
989F00	E00		●																				
DHH1KX	E03		●																				
DLE2LC	E03		●													●							
DW26KZ	E03		●						●								●						
DX19KZ	E03		●															●					
DX20KZ	E03	●	●																●				
(Codes related to monitor)																							
15B0NX	E01	●																					
2G42ZG	E03	●																					
989F00	E00		●																				
989FN1	E02	●																●	●				
AA1ANX (*)	E01	●												●	●								
AB00L6	E03	●											●										
AB00MA	E03	●								●	●												
B@BAZG	E01	●																		●	●		
B@BAZK (*)	E01	●																				●	●
B@BCNS	E02	●																					
B@BCZK	E01	●																					
B@C7NS	E02	●																					
B@CRNS	E02	●																					
D5ZHL6	E01	●		●																			
DAF0KT	E03	●																					
DAF3KK (*)	E03	●																					
DAF5KP (*)	E01	●																					
FAF6KP (*)	E01	●																					
DAJ0KR	E03	●	●																				
D182KZ (*)	E01	●																					
D1B0KB (*)	E01	●																					
DD1CLD (*)	E01	●																					
DD15LD	E01	●			●																		
DD16LD	E01	●				●																	
DD17LD	E01	●					●																
DD18LD	E01	●						●															
DDK3KB	E03	●							●														
DDS5L6	E03	●							●														
DDY0LD (*)	E01	●																					
DGE2KX	E01	●																					
DGE3L6	E01	●																					
DGH1KX	E01	●																					
DGR1KX	E01	●																					
DGR4KA	E01	●																					
DHE4L6	E01	●																			●		
DHPCKX (*)	E01	●																					
DHPDKX (*)	E01	●																					
DKA0KX (*)	E01	●																					
DV00KB (*)	E01	●																					

Possible causes																									
Overheating of engine coolant	Defective engine coolant temperature (high temperature) sensor	Defective engine coolant temperature (low temperature) sensor	Lowering of coolant level	Defective coolant level sensor	Defective HST oil pressure sensor	Clogging of HST oil filter	Defective HST oil filter clogging sensor	Overheating of HST oil	Defective HST oil temperature sensor	Lowering of brake oil pressure	Defective brake oil pressure sensor	Overheating of axle oil	Defective axle oil temperature sensor	Lowering steering oil pressure	Defective steering oil pressure sensor	Defective boom angle sensor	Defective boom pressure sensor (bottom side)	Defective boom pressure sensor (head side)	Defective subtotal switch	Defective cancel switch	Defective alarm buzzer	Defective relay	Disconnection in wiring harness	Grounding fault in wiring harness	Short circuit with power source in wiring harness
					●																		●	●	●
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BEFORE TROUBLESHOOTING ELECTRICAL SYSTEM

FUSE BOX CONNECTION TABLE

★ This connection chart shows the equipment that each fuse box power source supplies power directly to ("switch power source" means the power supplied when the starting switch is ON; "permanent power source" means the power supplied when the starting switch is OFF).

Category	Fuse No.	Fuse capacity	Power supply destination
Permanent power source (Fuse box 1)	1	20A	Starting switch
	2	10A	Hazard lamp
	3	10A	HST control A
	4	10A	Parking brake 1
	5	10A	Meter, panel
	6	10A	Car radio A, Room lamp
	7	10A	Spare power supply (battery +24 V)
Switch power source (Fuse box 1)	8	10A	Head lamp (left side)
	9	10A	Head lamp (right side)
	10	10A	Turn signal lamp
	11	10A	Back lamp, stop lamp
	12	20A	HST control B
	13	10A	Work equipment positioner
	14	10A	Wiper
	15	10A	Car radio B
Switch power source (Fuse box 2)	1	20A	Air conditioner A
	2	20A	Air conditioner B
	3	10A	Beacon lamp
	4	10A	-
	5	10A	Load-meter
	6	20A	DC converter
	7	10A	Spare power supply (+24 V when key is ON)
	8	10A	Parking brake 2
	9	10A	Horn
	10	10A	Side marker lamp (left side)
	11	10A	Side marker lamp (right side)
	12	20A	Front working lamp
	13	20A	Rear working lamp
	14	10A	(Spare 1)
	15	10A	(Spare 2)

INFORMATION CONTAINED IN TROUBULESHOOTING TABLE

★ The troubleshooting table and the related circuit diagrams contain the following information. Grasp their contents fully before proceeding to actual troubleshooting work.

Action Code	Failure Code	Controller Code	Trouble	Trouble displayed in trouble data
Panel display	Panel display	Panel display		
Description of Trouble	• Condition when machine monitor or controller detected trouble.			
Machine monitor or controller Reaction	• Action to take to protect system or equipment when machine monitor or controller detected trouble.			
Effect on Machine	• Condition that appeared as problem on machine when action (given above) was taken by machine monitor or controller.			
Related Information	• Information related to troubleshooting or error that occurred.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting
Possible Causes and Standard Values	1 2 3 4 5	Probable cause when trouble occurred (the numbers are index numbers and do not indicate the order of priority)	<Data to fill in> • Normal standard values used to judge probable cause • Remarks regarding decision-making <Condition when wiring harness is defective> • Disconnection There is defective connection of connector or disconnection in wiring harness • Short circuit with ground Wiring harness not wired to ground (GND) circuit is in contact with ground (GND) circuit • Short circuit with power source Wiring harness not wired to power supply (24 V) circuit is in contact with power supply (24 V) circuit <Points to remember when troubleshooting> 1) Method of displaying connector No. and handling T-adapter Unless there is special instruction, insert or connect the T-adapter as follows • If there is no indication for the male or female terminal of the connector No., disconnect the connector and insert the T-adapter in both the male and female terminals • If there is indication for the male or female terminal of the connector No., disconnect the connector and connect the T-adapter to only the terminal indicated (either the male terminal or female terminal) <Points to remember when troubleshooting> 2) Given order for pin numbers and handling tester lead Unless there is a special instruction, connect tester (+) lead and (-) lead as follows to carry out troubleshooting • Connect the (+) lead to the wiring harness for the pin No. given first • Connect the (-) lead to the wiring harness for the pin No. given last

Related circuit diagram

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

- Connector No.: Indicates (Type - numbers of a pin) (color)
- Arrow: Roughly indicates the location in the machine where it is installed.

Phenomena code table

★ For problem codes marked "See list", see the list below.

Phenomena code	Details	Disconnection	Details
KA	Disconnection	L0	Fill signal ON 2 or more channels
KB	Short circuit	L1	Fill signal is ON when command current is OFF
KK	Drop in power source voltage, input	L2	Fuel pressure is higher than maximum set value
KQ	Non match in model selection signal	L3	Corresponding component cannot be controlled
KR	Defective communication	L4	ON/OFF signals for 2 systems do not match
KT	Abnormality inside controller	L6	Engine signals do not match operating condition or stopped condition of machine
KX	Input signal outside range	L8	Analog signals for 2 systems do not match
KY	Short circuit in power supply line	LC	Speed signals for 2 systems do not match
KZ	Disconnection or short circuit	LD	Switch has been kept pressed for abnormally long time
MA	Function impossible	LH	Fill signal is OFF when command current is ON
NS	Overheat		
ZG	Drop in oil pressure		
ZK	Drop in level		

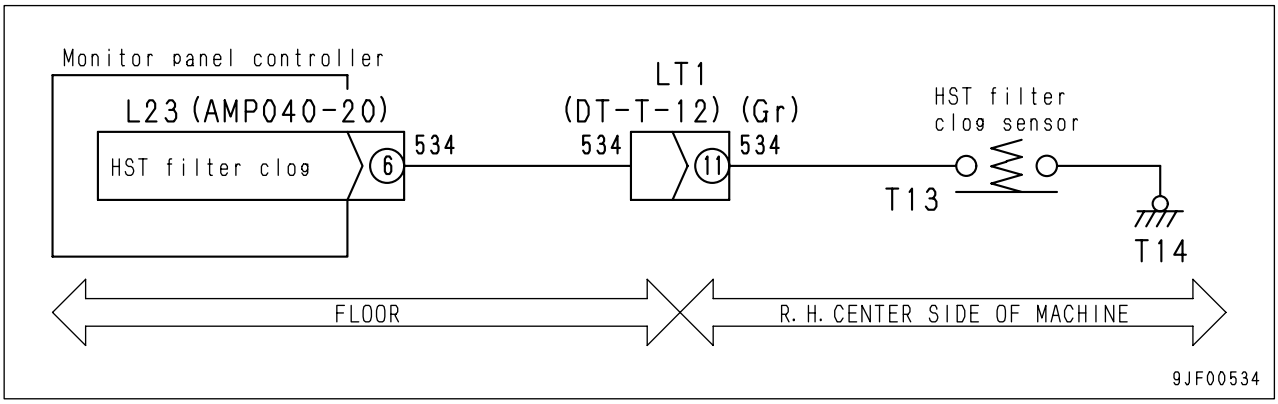
Failure Code [15B0NX] (HST oil filter clogged (NX))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	HST oil filter clogged (NX)
E01	15B0NX	MON		
Description of Trouble	• When HST oil temperature went above 50oC: signal circuit of HST oil filter clogging sensor changed to CLOSE (connected to GND)			
Machine monitor or controller Reaction	• Trigger an alarm.			
Effect on Machine	• If it is used as it is, there is danger that dirt will circulated in the HST circuit			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	HST oil filter clogged	• Clean or replace			
	2	Defective HST oil filter clogging sensor	1) Turn starting switch OFF. 2) Disconnect connector T13.			
			Between T13 and chassis ground	Filter is normal	Resistance	1MΩ and above
				Filter clogged	Resistance	1Ωandbelow
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector T13.			
			Wiring harness between L23 (Female) (6) and T13	Resistance between L23 (Female) (6), T13 and chassis ground		1MΩ and above
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L23 (Female) (6) and chassis ground	Filter is normal	Voltage	20 - 30V
				Filter clogged	Voltage	1V and below

Related circuit diagram

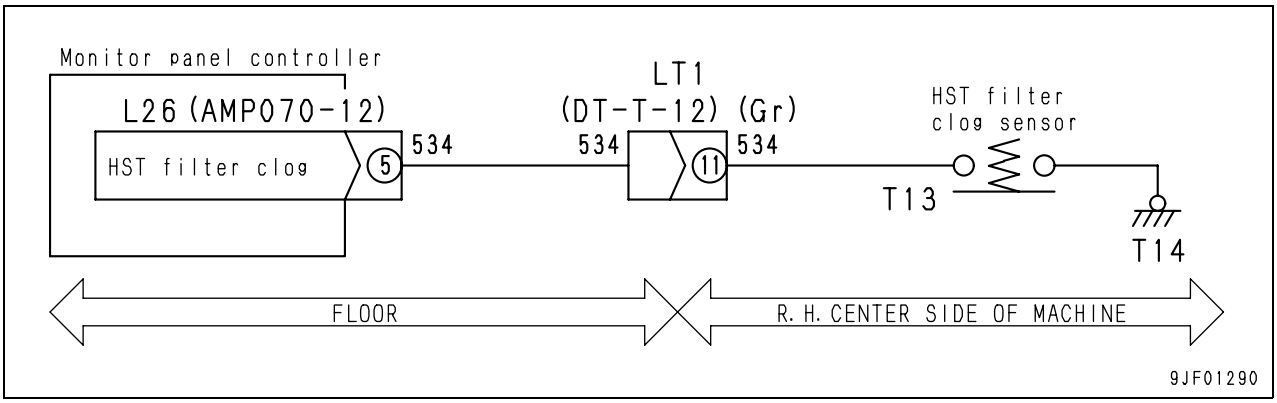


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	HST oil filter clogged (NX)
E01	15B0NX	MON		
Description of Trouble	• When HST oil temperature went above 50oC: signal circuit of HST oil filter clogging sensor changed to CLOSE (connected to GND)			
Machine monitor or controller Reaction	• Trigger an alarm.			
Effect on Machine	• If it is used as it is, there is danger that dirt will circulated in the HST circuit			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	HST oil filter clogged	• Clean or replace			
	2	Defective HST oil filter clogging sensor	1) Turn starting switch OFF. 2) Disconnect connector T13.			
			Between T13 and chassis ground	Filter is normal	Resistance	1MΩ and above
				Filter clogged	Resistance	1Ωandbelow
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector T13.			
			Wiring harness between L26 (Female) (5) and T13	Resistance between L26 (Female) (5), T13 and chassis ground		1MΩ and above
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L26. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L26 (Female) (5) and chassis ground	Filter is normal	Voltage	20 - 30V
				Filter clogged	Voltage	1V and below

Related circuit diagram



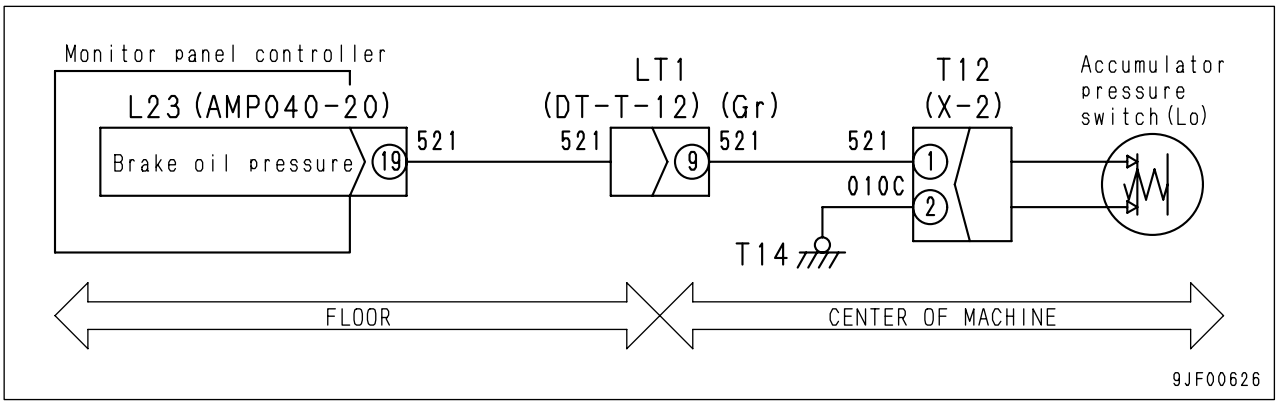
Failure Code [2G42ZG] (Decreased brake oil pressure (ZG))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Decreased brake oil pressure (ZG)
E03	2G42ZG	MON		
Description of Trouble	• When engine was running (continuously for more than 30 seconds), signal from accumulator oil pressure sensor went below 4.6 MPa {45 kg/cm^2}.			
Machine monitor or controller Reaction	• Trigger an alarm.			
Effect on Machine	• If it is used as it is, there is danger that the brake will have no effect.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Decrease brake oil pressure	Accumulator (Brake) oil pressure is normal ★ If the oil pressure is not normal, carry out troubleshooting for the hydraulic, mechanical system.			
	2	Defective brake oil pressure sensor	1) Turn starting switch OFF. 2) Disconnect connector T12. 3) Connect T-adapter.			
			Between T12 (Male) (1) and (2)	Oil pressure is normal (6MPa {61.2kg/cm^2})	Resistance	1✕ and below
				Oil pressure is low (4MPa {40.8kg/cm^2})	Resistance	1M✕ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	Turn starting switch OFF. 2) Disconnect Connectors T12, L23. 3) Connect T-adapter.			
			Wiring harness between T12 (Female) (1) and L23 (Female) (19)		Resistance	1✕ and below
			Wiring harness between T12 (Female) (2) and chassis ground		Resistance	1✕ and below
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors T12, L23. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (19) and T12 (Female) (1)	Resistance between L23 (Female) (19), T12 (Female) (1) and chassis ground		1M✕ and above
	5	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L23 (Female) (19) and chassis ground	Oil pressure is normal (5.88MPa {60kg/cm^2})	Voltage	1V and below
				Oil pressure is low (3.92MPa {40kg/cm^2})	Voltage	20 - 30V

Related circuit diagram

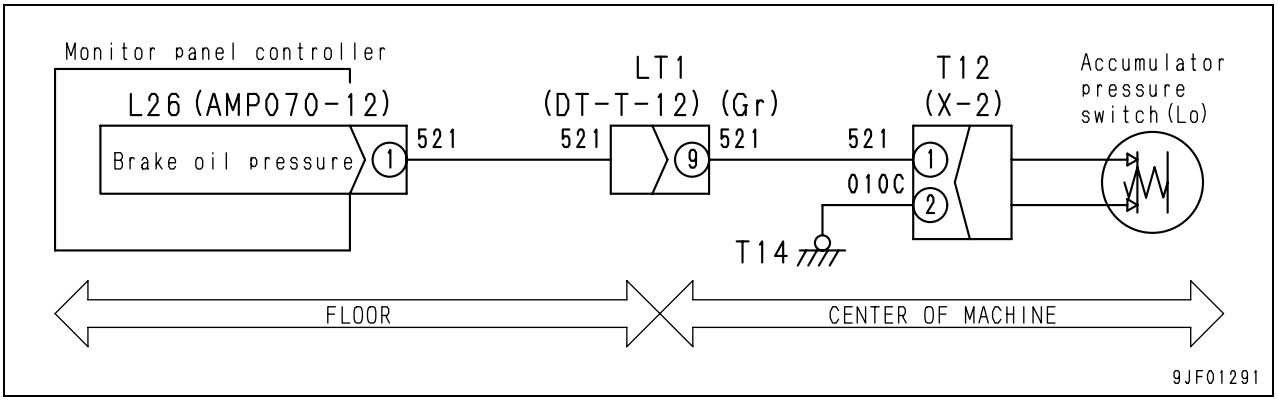


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Decreased brake oil pressure (ZG)
E03	2G42ZG	MON		
Description of Trouble	• When engine was running (continuously for more than 30 seconds), signal from accumulator oil pressure sensor went below 4.6 MPa {45 kg/cm^2}.			
Machine monitor or controller Reaction	• Trigger an alarm.			
Effect on Machine	• If it is used as it is, there is danger that the brake will have no effect.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Decrease brake oil pressure	Accumulator (Brake) oil pressure is normal ★ If the oil pressure is not normal, carry out troubleshooting for the hydraulic, mechanical system.			
	2	Defective brake oil pressure sensor	1) Turn starting switch OFF. 2) Disconnect connector T12. 3) Connect T-adapter.			
			Between T12 (Male) (1) and (2)	Oil pressure is normal (6MPa {61.2kg/cm^2})	Resistance	1✕ andbelow
				Oil pressure is low (4MPa {40.8kg/cm^2})	Resistance	1M✕ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	Turn starting switch OFF. 2) Disconnect Connectors T12, T26. 3) Connect T-adapter.			
			Wiring harness between T12 (Female) (1) and L26 (Female) (1)		Resistance	1✕ andbelow
			Wiring harness between T12 (Female) (2) and chassis ground		Resistance	1✕ andbelow
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors T12, L26 3) Connect T-adapter.			
			Wiring harness between L26 (Female) (1) and T12 (Female) (1)	Resistance between L26 (Female) (1), T12 (Female) (1) and chassis ground		1M✕ and above
	5	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L26. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L26 (Female) (1) and chassis ground	Oil pressure is normal (5.88MPa {60kg/cm^2})	Voltage	1V and below
				Oil pressure is low (3.92MPa {40kg/cm^2})	Voltage	20 - 30V

Related circuit diagram



Failure Code [989F00] (HST motor protection caution (00))

Action Code	Failure Code	Controller Code	Trouble	Transmission protection caution (00)
E00	989F00	MON		
Description of Trouble	• Not considered to be a failure. • The travel speed exceeds the allowable speed the HST motor on down shifting. • The travel speed exceeds 40km/h.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• If travel speed exceeds 40 km/h, speed is automatically reduced.			
Related Information				

Failure Code [989FN1] (HST overrunning (N1))

Action Code	Failure Code	Controller Code	Trouble	HST overrunning (N1)
E02	989FN1	MON		
Description of Trouble	• Travel speed exceeds 45 km/h. • Automatic speed reduction when travel speed exceeds 40 km/h does not work.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• If the machine is driven as it is, HST motor may be broken (seized).			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting	
Possible Causes and Standard Values	1	- - -	1) Turn starting switch ON. 2) Operate machine monitor	
			Other code is displayed at same time	Carry out troubleshooting for applicable code displayed
	2	Overrunning HST	When machine was used in way that would cause HST to overrun	Inspect and repair cause of problem and damage to HST.
	3	Defective machine monitor	1) Start engine. 2) Operate machine monitor 3) Travel on flat ground.	
			Travel speed goes above 40 km/h.	Carry out troubleshooting for HST controller system failure codes DW26KZ and DX19KZ.
			Travel speed does not go above 40 km/h. (Less than 40 km/h)	Inspect and repair cause of problem and damage to HST.

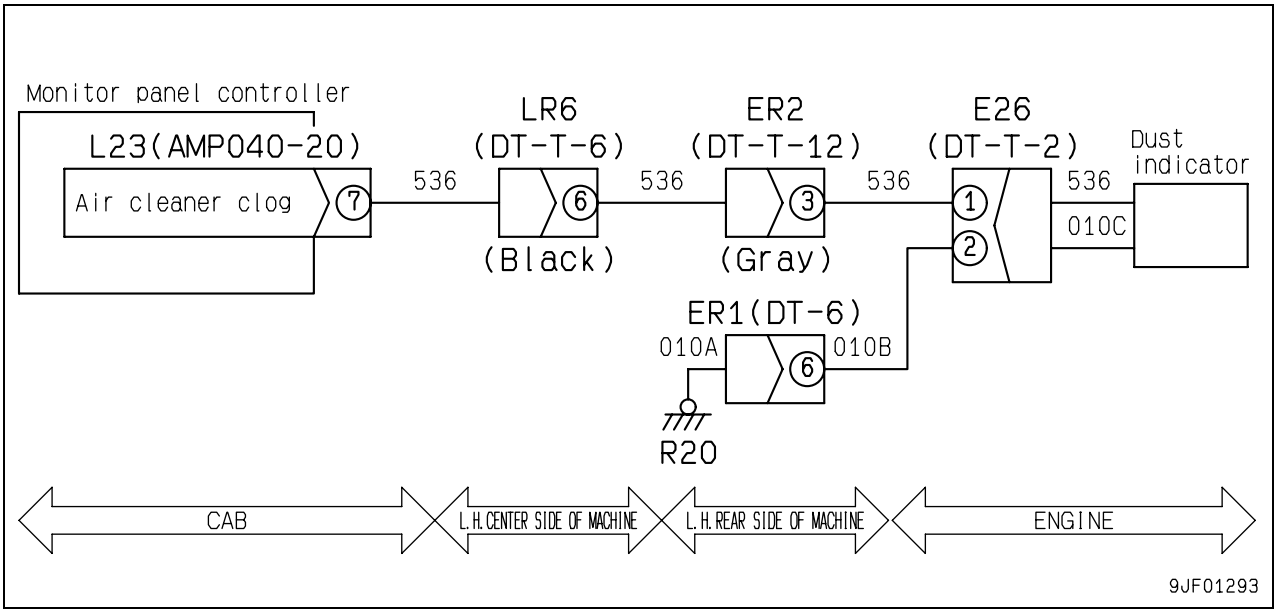
Failure Code [AA1ANX] (Clogging of air cleaner (NX))

Speedometer specification (Standard)

Action Code	Failure Code	Controller Code	Trouble	Clogging of air cleaner (NX)
E01	AA1ANX	MON		
Description of Trouble	• The signal circuit of the dust indicator (air cleaner clogging sensor) is closed (in contact with the ground).			
Machine monitor or controller Reaction	• The alarm is turned ON.			
Effect on Machine	• The air cleaner is clogged (The engine may be damaged).			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Clogging of air cleaner	Clean or replace.			
	2	Defective dust indicator (air cleaner clogging sensor)	1) Turn starting switch OFF. 2) Disconnect connector E26. 3) Connect T-adapter. 4) Start engine.			
			Between E26 (female) (1) and (2)	Air cleaner is normal.	Resistance	Min. 1 MΩ
				Air cleaner is clogged.	Resistance	Max. 1 Ω
	3	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connector E26. 3) Connect T-adapter.			
			Wiring harness between L23 (female) (7) and E26 (female) (1)	Resistance between L23 (female) (7), E26 (female) (1), and chassis ground		Min. 1 MΩ
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON. 6) Start engine.			
			Between L23 (female) (7) and chassis ground	Air cleaner is normal.	Voltage	20 - 30 V
				Air cleaner is clogged.	Voltage	Max. 1 V

Related circuit diagram

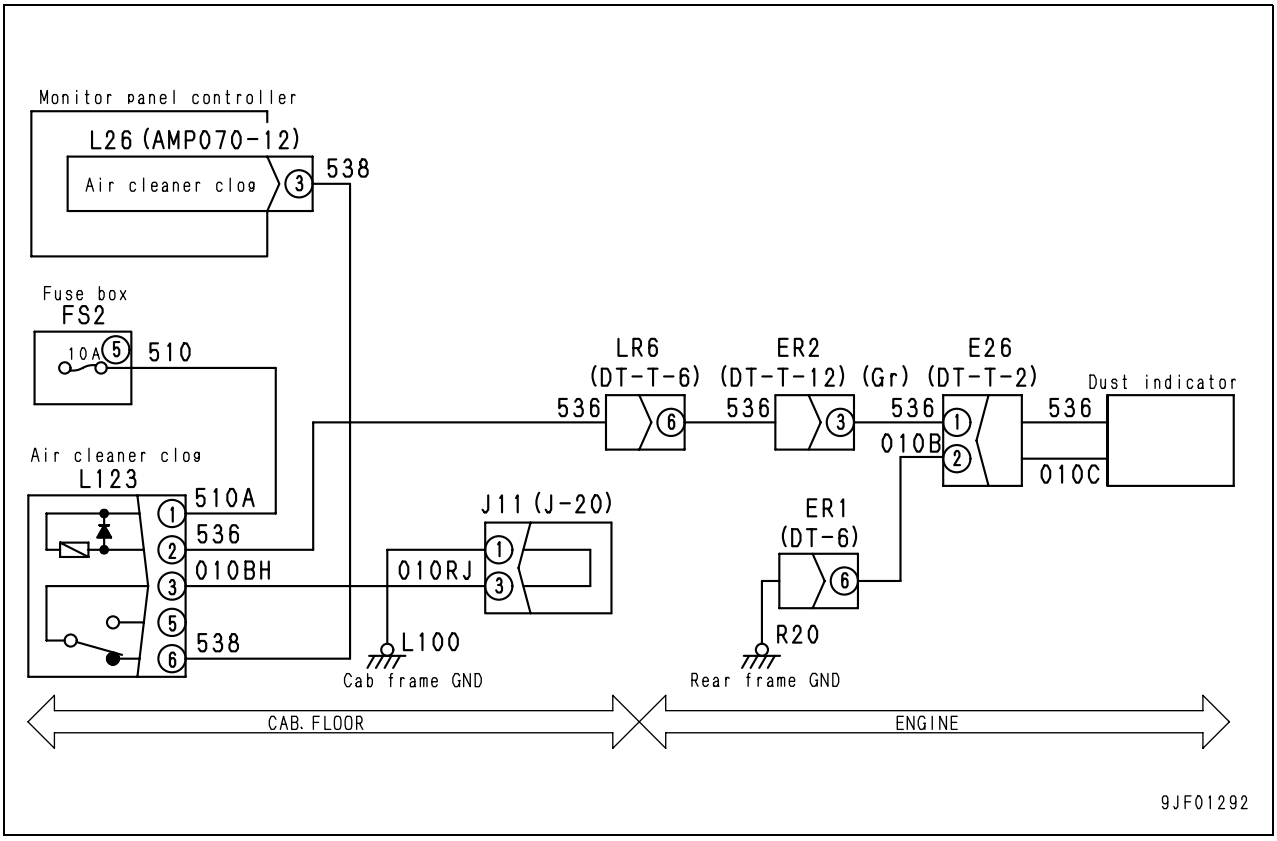


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Clogging of air cleaner (NX)
E01	AA1ANX	MON		
Description of Trouble	• The signal circuit of the dust indicator (air cleaner clogging sensor) is closed (in contact with the ground).			
Machine monitor or controller Reaction	• The alarm is turned ON.			
Effect on Machine	• The air cleaner is clogged (The engine may be damaged).			
Related Information	• The input signal of the air cleaner clogging sensor can be checked with the monitoring function (Code: 40902, D_IN_20).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Clogging of air cleaner	Clean or replace.			
	2	Defective dust indicator (air cleaner clogging sensor)	1) Turn starting switch OFF. 2) Disconnect connector E26. 3) Connect T-adapter. 4) Start engine.			
			Between E26 (female) (1) and (2)	Air cleaner is normal.	Resistance	Min. 1 MΩ
				Air cleaner is clogged.	Resistance	Max. 1 Ω
	3	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connector E26. 3) Connect T-adapter.			
			Wiring harness between L123 (female) (2) and E26 (female) (1)	Resistance between L123 (female) (2), E26 (female) (1), and chassis ground		Min. 1 MΩ
	4	Disconnection in wiring harness	1) Turn starting switch OFF. 2) Disconnect connector L26. 3) Connect T-adapter.			
			Between L26 (female) (3) and L123 (female) (3)		Resistance	Max. 1 Ω
	5	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L26. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON. 6) Start engine.			
			Between L26 (female) (3) and chassis ground	Air cleaner is normal.	Voltage	Max. 1 V
				Air cleaner is clogged.	Voltage	20 - 30 V
	6	Defective air cleaner clogging relay (L123)	1) Turn starting switch OFF. 2) Replace L123 with normal relay. 3) Turn starting switch ON. 4) When failure code is displayed			
			Replace air cleaner clogging relay (L123).	Condition does not become normal.	Relay (L123) is normal.	
				Condition becomes normal.	Relay (L123) is defective.	
			1) Turn starting switch OFF. 2) Disconnect connector L123. 3) Check relay L123.			
			Between L123 (male) (1) and (2)		Resistance	200 - 400 Ω
			1) Turn starting switch OFF. 2) Disconnect connector L123. 3) Check relay L123. 4) Apply test voltage between L123 (male) (1) and (2).			
			Between L123 (male) (3) and (6)	When 24 V is applied between (1) and (2).	Resistance	Max. 1 Ω
				When 24 V is not applied between (1) and (2).	Resistance	Min. 1 MΩ

Related circuit diagram



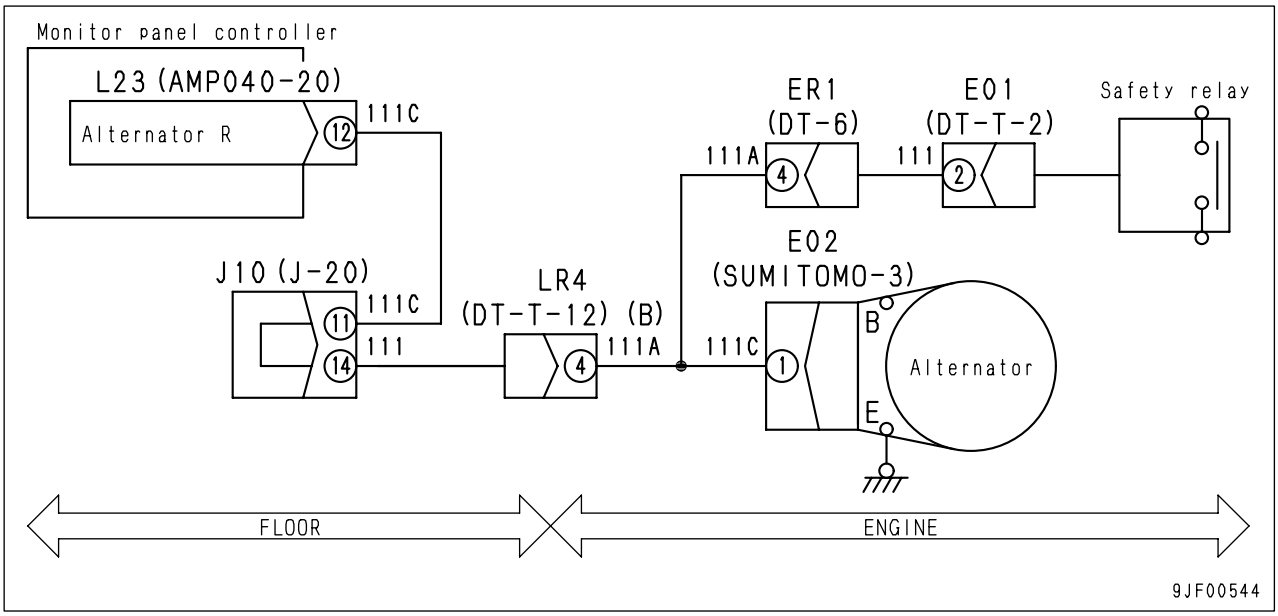
Failure Code [AB00L6] (Defective battery charging circuit (L6))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Defective battery charging circuit (L6) (Alternator terminal R signal detected when engine stopped)
E03	AB00L6	MON		
Description of Trouble	• The alternator terminal R signal input voltage is 12V or higher before the engine started.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The engine cannot be started. • The service meter increases simply by starting switch ON.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective alternator	Between alternator terminal R [E02 (1)] and chassis ground	Engine started (Throttle 1/2 or more).	Voltage	28 - 29V
				Engine stopped.	Voltage	1.5V and below
	2	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L23, E02. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L23 (Female) (12) and E02 (Female) (1)	Voltage between L23 (Female) (12), E02 (Female) (1) and chassis ground		1V and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L23 (Female) (12) and chassis ground	Engine started (Throttle 1/2 or more).	Voltage	28 - 29V
				Engine stopped.	Voltage	1.5V and below

Related circuit diagram

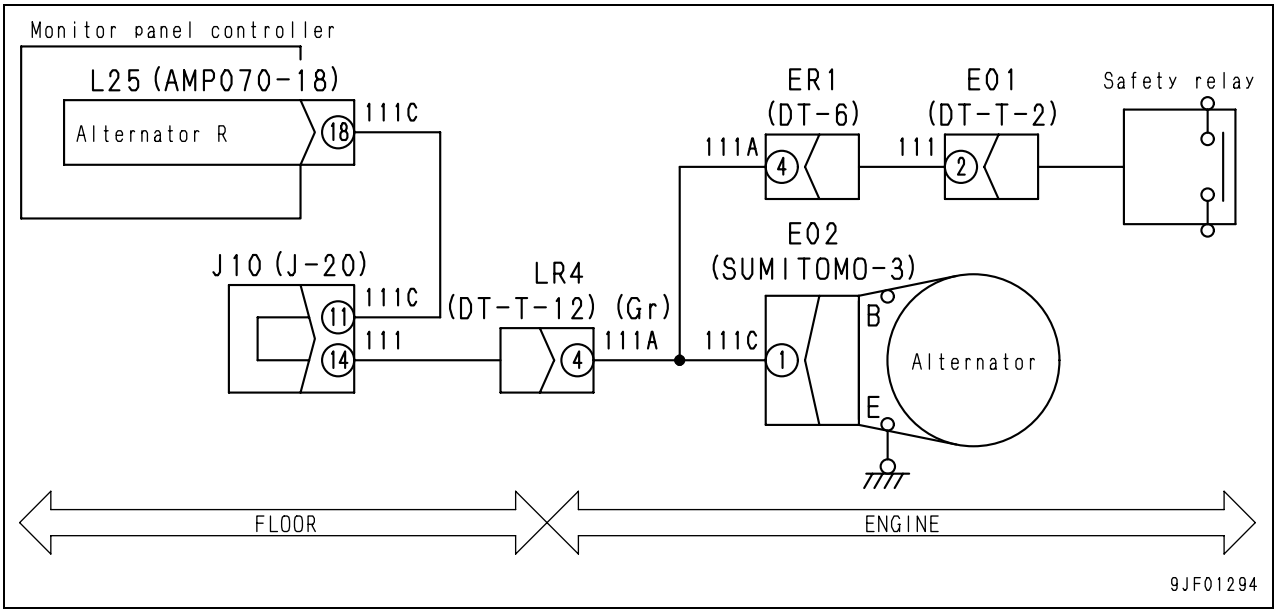


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Defective battery charging circuit (L6) (Alternator terminal R signal detected when engine stopped)
E03	AB00L6	MON		
Description of Trouble	• The alternator terminal R signal input voltage is 12V or higher before the engine started.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The engine cannot be started. • The service meter increases simply by starting switch ON.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective alternator	Between alternator terminal R [E02 (1)] and chassis ground	Engine started (Throttle 1/2 or more).	Voltage	28 - 29V
				Engine stopped.	Voltage	1.5V and below
	2	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L25, E02. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L25 (Female) (18) and E02 (Female) (1)	Voltage between L25 (Female) (18), E02 (Female) (1) and chassis ground		1V and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L25 (Female) (18) and chassis ground	Engine started (Throttle 1/2 or more).	Voltage	28 - 29V
				Engine stopped.	Voltage	1.5V and below

Related circuit diagram



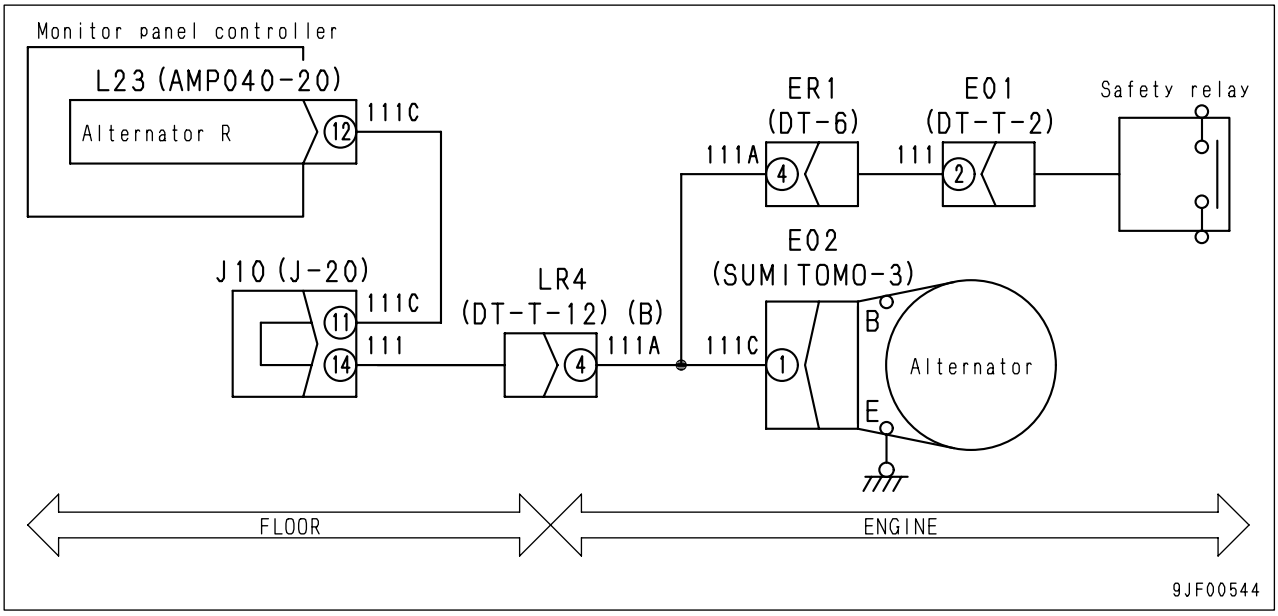
Failure Code [AB00MA] (Defective battery charging circuit (MA))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Defective battery charging circuit (MA) (No signal from alternator terminal R when engine stopped, Abnormal detection)
E03	AB00MA	MON		
Description of Trouble	• During engine operation, the input voltage to the alternator terminal R signal is below 5V.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The battery is deteriorated. • The engine cannot be started. • The service meter does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Battery is deteriorated.	- - -			
	2	Defective alternator	Between alternator terminal R [E02 (1)] and chassis ground	Engine started (Throttle 1/2 or more).	Voltage	28 - 29V
				Engine stopped.	Voltage	1.5V and below
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L23, E02. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (12) and E02 (Female) (1)		Resistance	1✕ andbelow
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L23, E02. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (12) and E02 (Female) (1)	Resistance between L23 (Female) (12), E02 (Female) (1) and chassis ground		1M✕ and above
	5	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L23 (Female) (12) and chassis ground	Engine started (Throttle 1/2 or more).	Voltage	28 - 29V
				Engine stopped.	Voltage	1.5V and below

Related circuit diagram

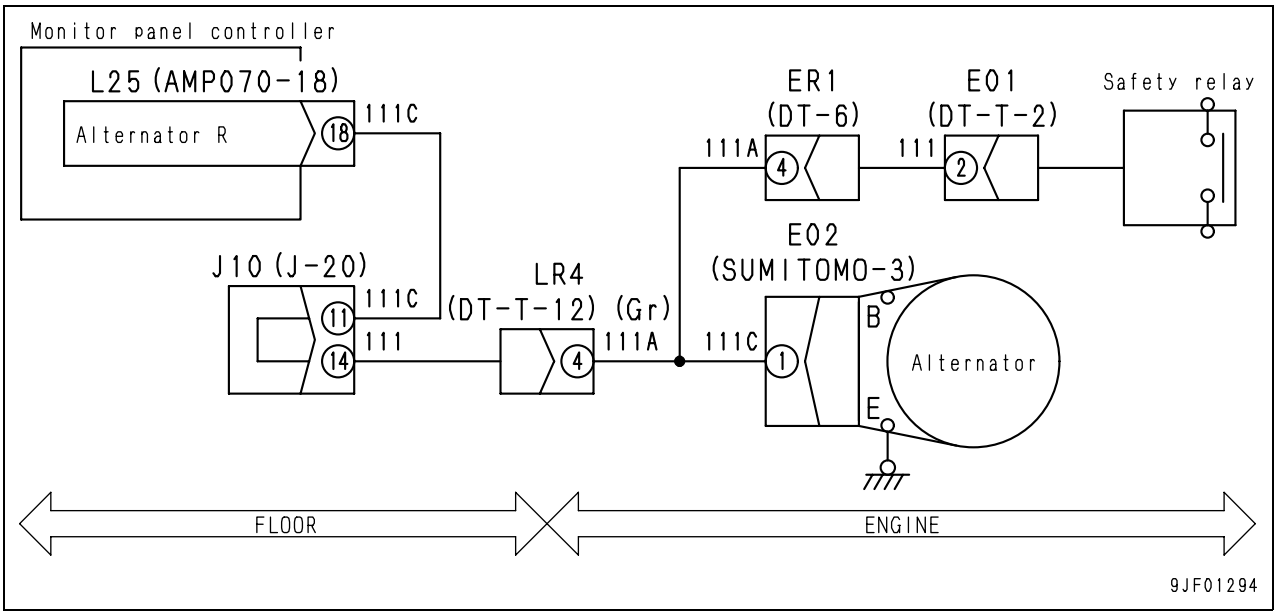


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Defective battery charging circuit (MA) (No signal from alternator terminal R when engine stopped, Abnormal detection)
E03	AB00MA	MON		
Description of Trouble	• During engine operation, the input voltage to the alternator terminal R signal is below 5V.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The battery is deteriorated. • The engine cannot be started. • The service meter does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Battery is deteriorated.	- - -			
	2	Defective alternator	Between alternator terminal R [E02 (1)] and chassis ground	Engine started (Throttle 1/2 or more).	Voltage	28 - 29V
				Engine stopped.	Voltage	1.5V and below
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L25, E02. 3) Connect T-adapter.			
			Wiring harness between L25 (Female) (18) and E02 (Female) (1)		Resistance	1✕and below
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L25, E02. 3) Connect T-adapter.			
			Wiring harness between L25 (Female) (18) and E02 (Female) (1)	Resistance between L25 (Female) (18), E02 (Female) (1) and chassis ground		1M✕ and above
	5	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L25. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L25 (Female) (18) and chassis ground	Engine started (Throttle 1/2 or more).	Voltage	28 - 29V
				Engine stopped.	Voltage	1.5V and below

Related circuit diagram



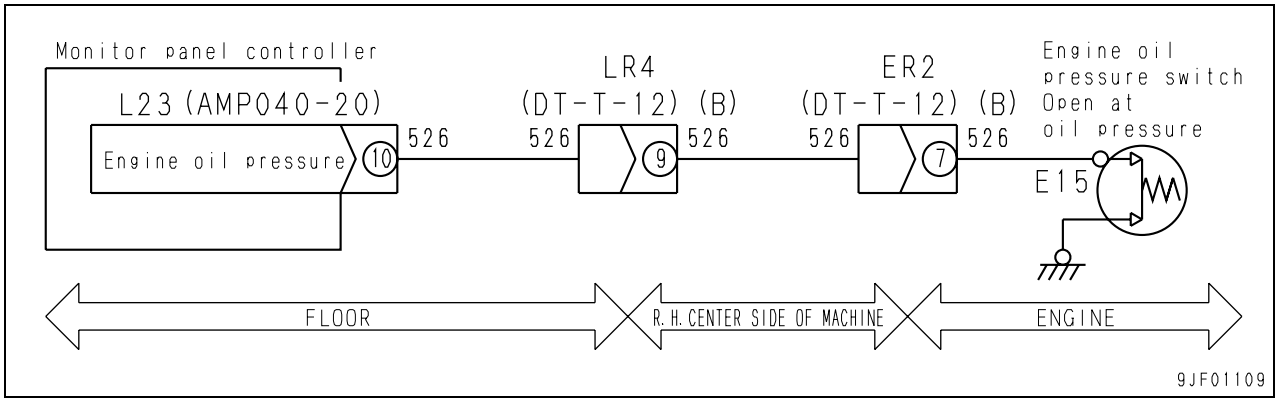
Failure Code [B@BAZG] (Degreased engine oil pressure (ZG))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Degreased engine oil pressure (ZG)
E01	B@BAZG	MON		
Description of Trouble	• The engine oil pressure sensor circuit is always in the CLOSE state 15 minutes after the engine started.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The engine oil pressure is low (The engine may be damaged).			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Degrease engine oil pressure	- - -			
	2	Defective engine oil pressure sensor (switch)	1) Turn starting switch OFF. 2) Disconnect connector E15. 3) Connect T-adapter.			
			Between engine oil pressure sensor terminal (E15) and chassis ground	Engine stopped.	Resistance	1✕ andbelow
				Engine rotating.	Resistance	1M✕ and above
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L23, E15. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (10) and E15	Resistance between L23 (Female) (10), E15 and chassis ground		1M✕ and above
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L23 (Female) (10) and chassis ground	Engine stopped.	Voltage	1V and below
				Engine rotating.	Voltage	20 - 30V

Related circuit diagram

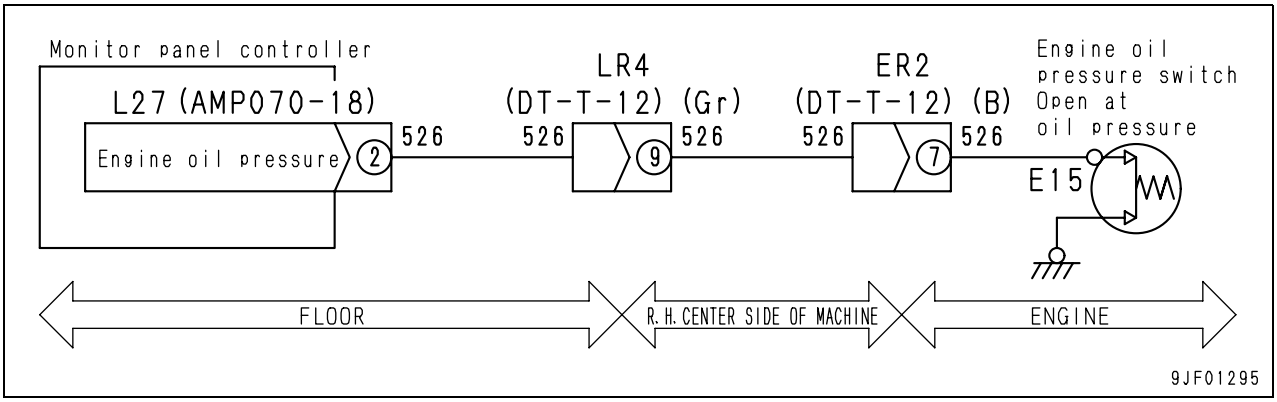


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Degreased engine oil pressure (ZG)
E01	B@BAZG	MON		
Description of Trouble	• The engine oil pressure sensor circuit is always in the CLOSE state 15 minutes after the engine started.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The engine oil pressure is low (The engine may be damaged).			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Degrease engine oil pressure	- - -			
	2	Defective engine oil pressure sensor (switch)	1) Turn starting switch OFF. 2) Disconnect connector E15. 3) Connect T-adapter.			
			Between engine oil pressure sensor terminal (E15) and chassis ground	Engine stopped.	Resistance	1✕ andbelow
				Engine rotating.	Resistance	1M✕ and above
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L27, E15. 3) Connect T-adapter.			
			Wiring harness between L27 (Female) (2) and E15	Resistance between L27 (Female) (2), E15 and chassis ground		1M✕ and above
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L27 (Female) (2) and chassis ground	Engine stopped.	Voltage	1V and below
				Engine rotating.	Voltage	20 - 30V

Related circuit diagram



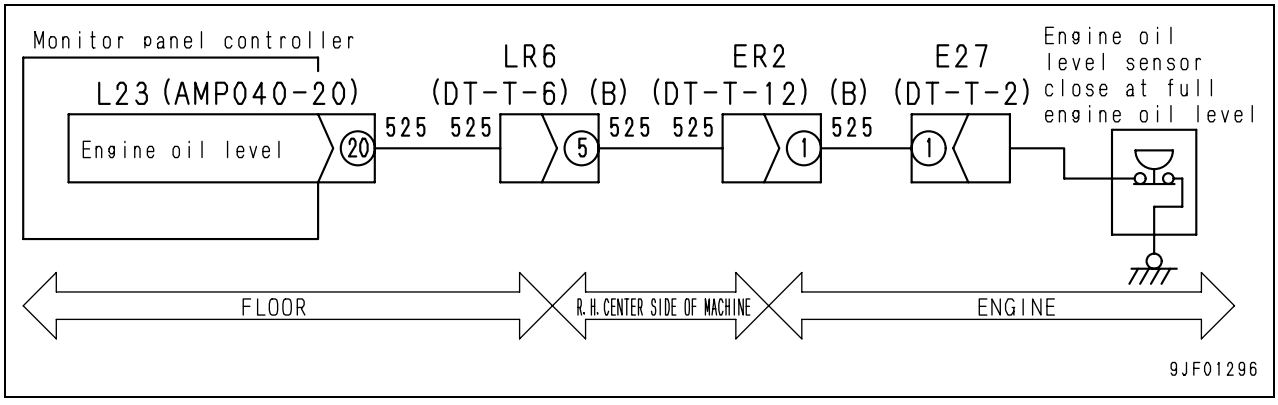
Failure Code [B@BAZK] Lowering of engine oil level (ZK)

Speedometer specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Lowering of engine oil level (ZK)
E01	B@BAZK	MON		
Description of Trouble	• The engine oil level sensor circuit is OPEN.			
Machine monitor or controller Reaction	• None in particular.			
Effect on Machine	• The engine oil level is low (The engine may be damaged).			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Lowering of engine oil level	- - -			
	2	Defective engine oil level sensor	1) Turn starting switch OFF. 2) Disconnect connector E27. 3) Connect T-adapter.			
			Between E27 (male) (1) and chassis	When oil level is normal	Resistance	Max. 1 Ω
				When oil level is insufficient (low)	Resistance	Min. 1 MΩ
	3	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L23 and E27. 3) Connect T-adapter.			
			Wiring harness between L23 (female) (20) and E27	Resistance between L23 (female) (20), E27 and chassis ground		Min. 1 MΩ
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L23 (female) (20) and chassis ground	When oil level is normal	Voltage	Max. 1 V
				When oil level is insufficient (low)	Voltage	20 - 30 V

Related circuit diagram

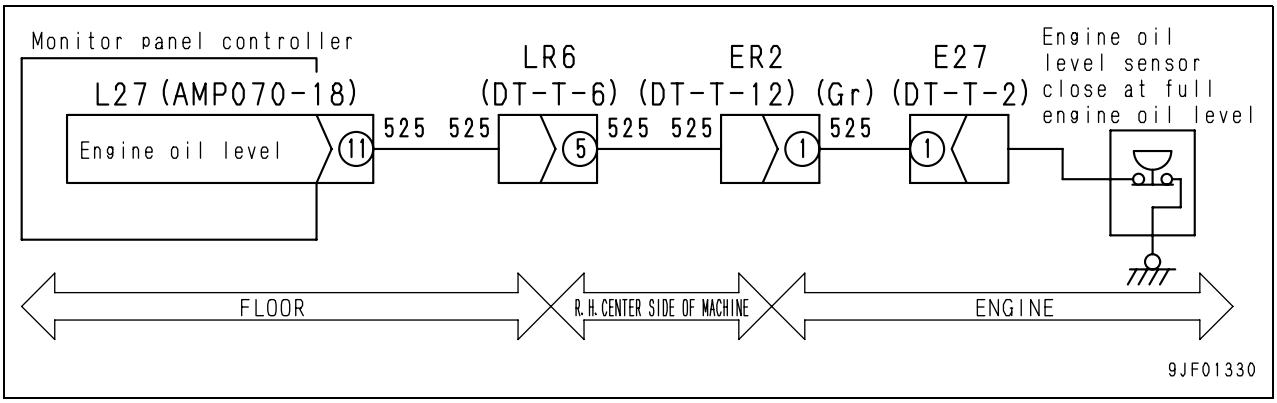


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Lowering of engine oil level (ZK)
E01	B@BAZK	MON		
Description of Trouble	• The engine oil level sensor circuit is OPEN.			
Machine monitor or controller Reaction	• None in particular.			
Effect on Machine	• The engine oil level is low (The engine may be damaged).			
Related Information	• The input signal of the engine oil level sensor can be checked with the monitoring function (Code: 40903, D_IN_29).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Lowering of engine oil level	- - -			
	2	Defective engine oil level sensor	1) Turn starting switch OFF. 2) Disconnect connector E27. 3) Connect T-adapter.			
			Between E27 (male) (1) and chassis	When oil level is normal	Resistance	Max. 1 Ω
				When oil level is insufficient (low)	Resistance	Min. 1 MΩ
	3	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L27 and E27. 3) Connect T-adapter.			
			Wiring harness between L27 (female) (11) and E27 (female) (1)	Resistance between L23 (female) (10), E27 and chassis ground		Min. 1 MΩ
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L27 (female) (11) and chassis ground	When oil level is normal	Voltage	Max. 1 V
				When oil level is insufficient (low)	Voltage	20 - 30 V

Related circuit diagram



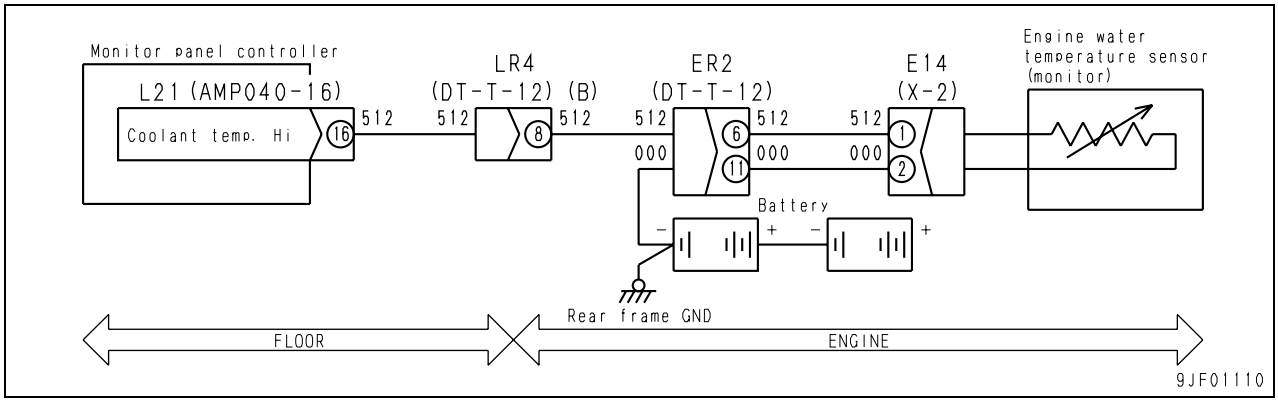
Failure Code [B@BCNS] (Engine water temperature overheating (NS))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Engine water temperature overheating (NS)
E02	B@BCNS	MON		
Description of Trouble	• The engine water temperature is above 105°C			
Machine monitor or controller Reaction	• Activates an alarm (Turns the engine water temperature caution lamp ON at 102°C or above and issues this failure code at 105°C or above).			
Effect on Machine	• The engine water temperature overheat alarm is issued (The engine may be damaged if operation continues).			
Related Information	• The engine coolant temperature can be checked with the monitoring function (Code: 04101).			

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Overheating engine water temperature	- - -			
	2	Defective engine water temperature sensor (high temperature)	1) Turn starting switch OFF. 2) Disconnect connector E14. 3) Connect T-adapter.			
			Between E14 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L21, E14. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (16) and E14 (Female) (1)	Resistance between L21 (Female) (16), E14 (Female) (1) and chassis ground		1MΩ and above
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (16) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram

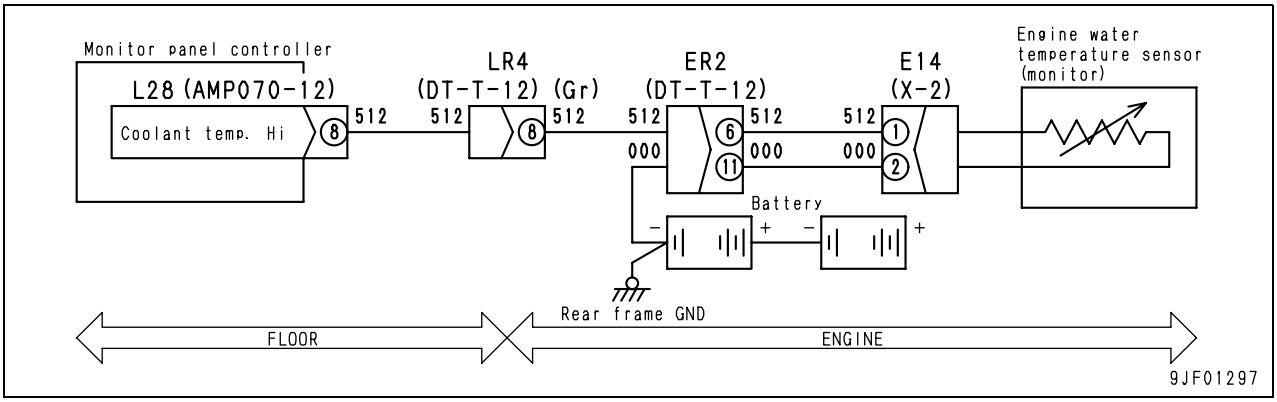


Load meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Engine water temperature overheating (NS)
E02	B@BCNS	MON		
Description of Trouble	• The engine water temperature is above 105°C			
Machine monitor or controller Reaction	• Activates an alarm (Turns the engine water temperature caution lamp ON at 102°C or above and issues this failure code at 105°C or above).			
Effect on Machine	• The engine water temperature overheat alarm is issued (The engine may be damaged if operation continues).			
Related Information				

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Overheating engine water temperature	- - -			
	2	Defective engine water temperature sensor (high temperature)	1) Turn starting switch OFF. 2) Disconnect connector E14. 3) Connect T-adapter.			
			Between E14 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L21, E14. 3) Connect T-adapter.			
			Wiring harness between L28 (Female) (8) and E14 (Female) (1)	Resistance between L28 (Female) (8), E14 (Female) (1) and chassis ground		1MΩ and above
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L28 (Female) (8) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram



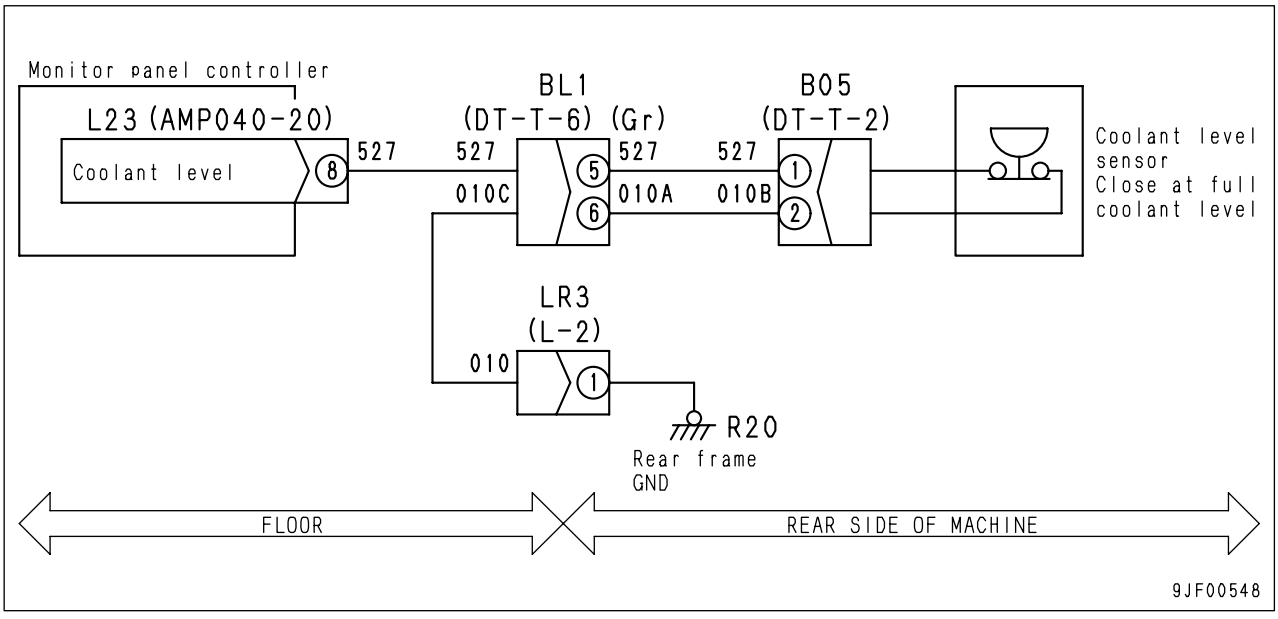
Failure Code [B@BCZK] (Alarm indicating low coolant level (ZK))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Alarm indicating low coolant level (ZK)
E01	B@BCZK	MON		
Description of Trouble	• The coolant level sensor circuit is opened.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The coolant level is low (The engine may be damaged).			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Decrease coolant level.	- - -			
	2	Defective coolant level sensor	1) Turn starting switch OFF. 2) Disconnect connector B05. 3) Connect T-adapter.			
			Between B (Male) (1) and (2)	Reserve tank low level and above (normal).	Resistance	1Ω and below
				Reserve tank low level and below (abnormal).	Resistance	1MΩ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L23, B05. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (8) and B05 (Female) (1)		Resistance	1Ω and below
			Wiring harness between B05 (Female) (2) and Chassis ground		Resistance	1Ω and below
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L23 (Female) (8) and chassis ground	Reserve tank low level and above (normal).	Voltage	1V and below
				Reserve tank low level and below (abnormal).	Voltage	20 - 30V

Related circuit diagram

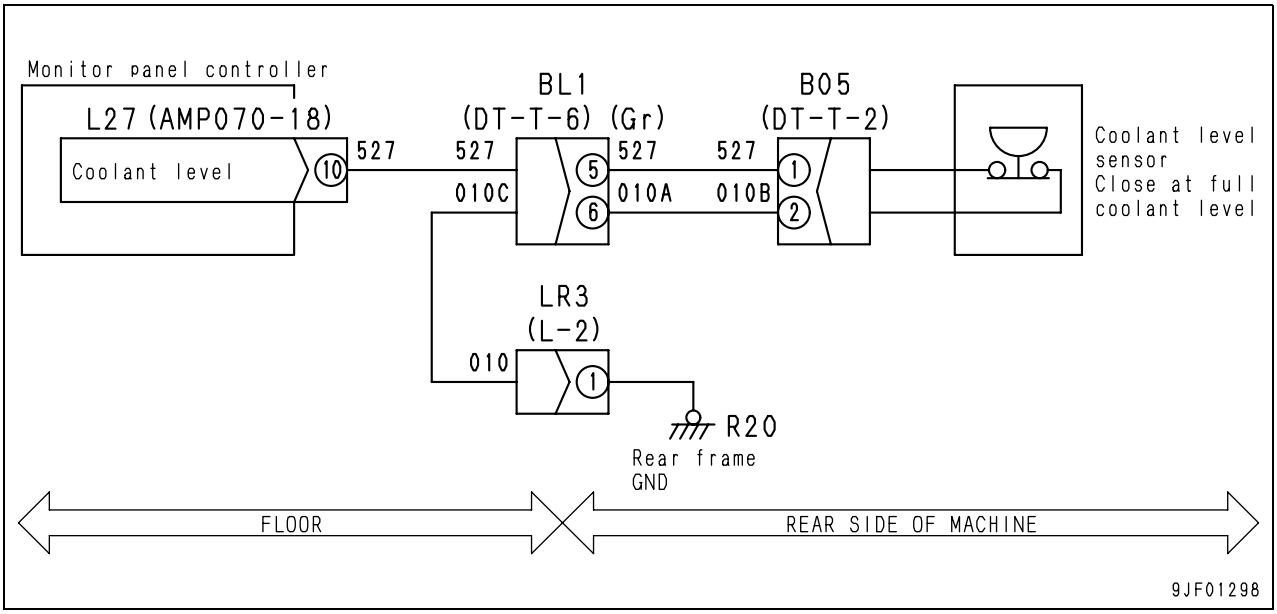


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Alarm indicating low coolant level (ZK)
E01	B@BCZK	MON		
Description of Trouble	• The coolant level sensor circuit is opened.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The coolant level is low (The engine may be damaged).			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Decrease coolant level.	- - -			
	2	Defective coolant level sensor	1) Turn starting switch OFF. 2) Disconnect connector B05. 3) Connect T-adapter.			
			Between B (Male) (1) and (2)	Reserve tank low level and above (normal).	Resistance	1Ω and below
				Reserve tank low level and below (abnormal).	Resistance	1MΩ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L27, B05. 3) Connect T-adapter.			
			Wiring harness between L27 (Female) (10) and B05 (Female) (1)		Resistance	1Ω and below
			Wiring harness between B05 (Female) (2) and Chassis ground		Resistance	1Ω and below
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L27 (Female) (10) and chassis ground	Reserve tank low level and above (normal).	Voltage	1V and below
				Reserve tank low level and below (abnormal).	Voltage	20 - 30V

Related circuit diagram



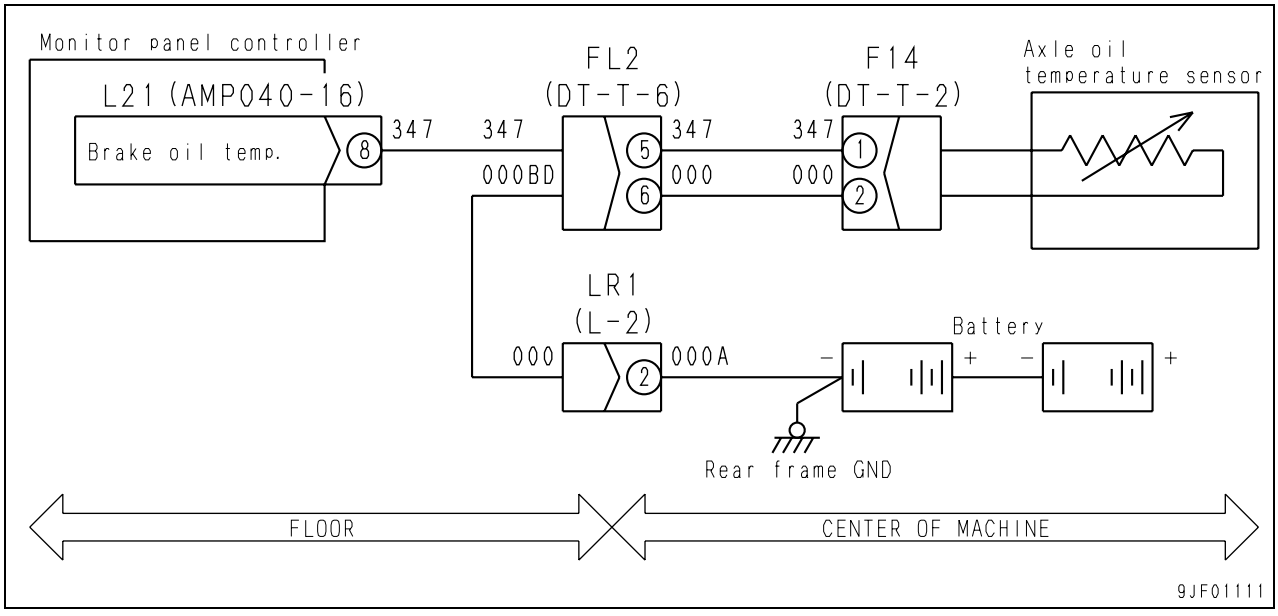
Failure Code [B@C7NS] (Axle oil temperature overheating (NS))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Axle oil temperature overheating (NS)
E02	B@C7NS	MON		
Description of Trouble	• The axle oil temperature is overheating.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The brake may be damaged if operation continues.			
Related Information	• This failure code is displayed if the probability of a failure in the electrical system is low. • The axle oil temperature is displayed by monitoring code 30202.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Overheating axle oil temperature.	- - -			
	2	Defective axle oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adapter.			
			Between F14 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (8) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram

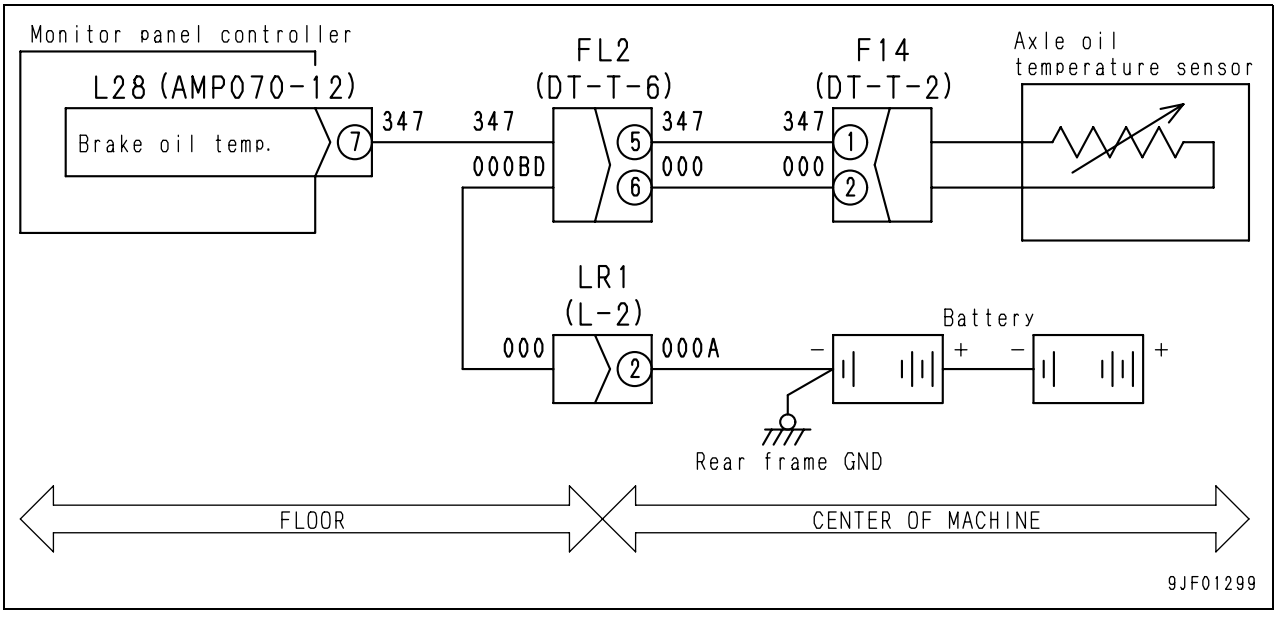


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Axle oil temperature overheating (NS)
E02	B@C7NS	MON		
Description of Trouble	• The axle oil temperature is overheating.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The brake may be damaged if operation continues.			
Related Information	• This failure code is displayed if the probability of a failure in the electrical system is low. • The axle oil temperature is displayed by monitoring code 30202.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Overheating axle oil temperature.	- - -			
	2	Defective axle oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adapter.			
			Between F14 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L28 (Female) (7) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram



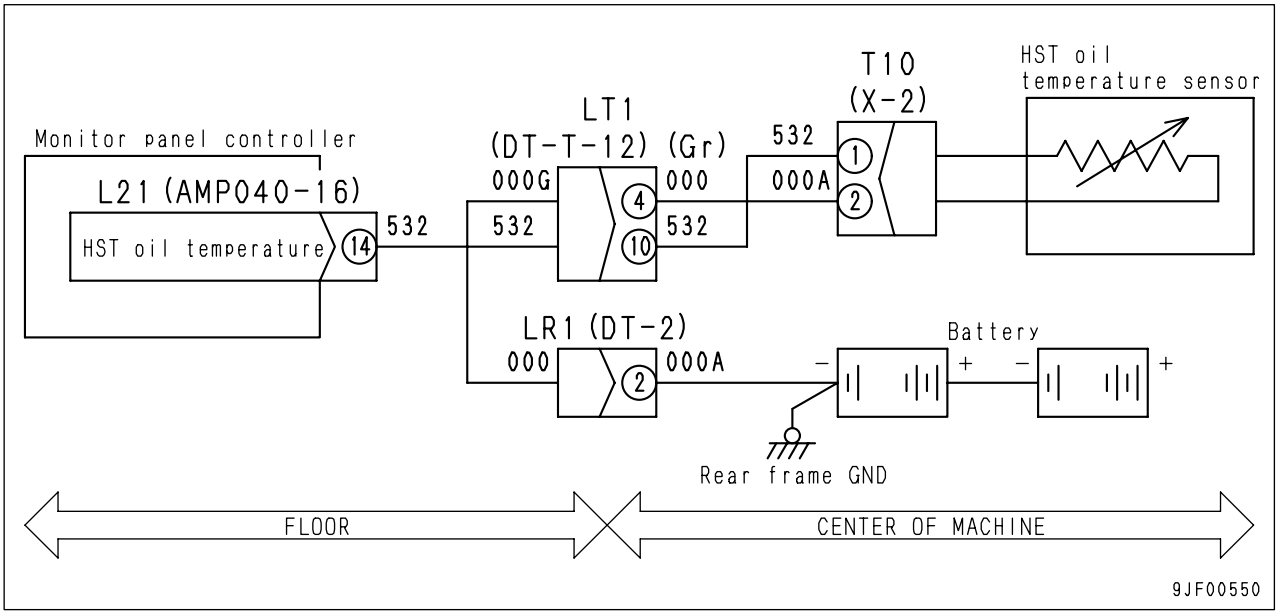
Failure Code [B@CRNS] (HST oil temperature overheating (NS))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	HST oil temperature overheating (NS)
E02	B@CRNS	MON		
Description of Trouble	• The HST oil temperature is above 110°C.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The HST may be damaged if operation continues.			
Related Information	• This failure code is displayed if the probability of a failure in the electrical system is low. • The HST oil temperature is display by monitoring code 30100.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Overheating HST oil temperature.	- - -			
	2	Defective HST oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector T10. 3) Connect T-adapter.			
			Between T10 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (14) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram

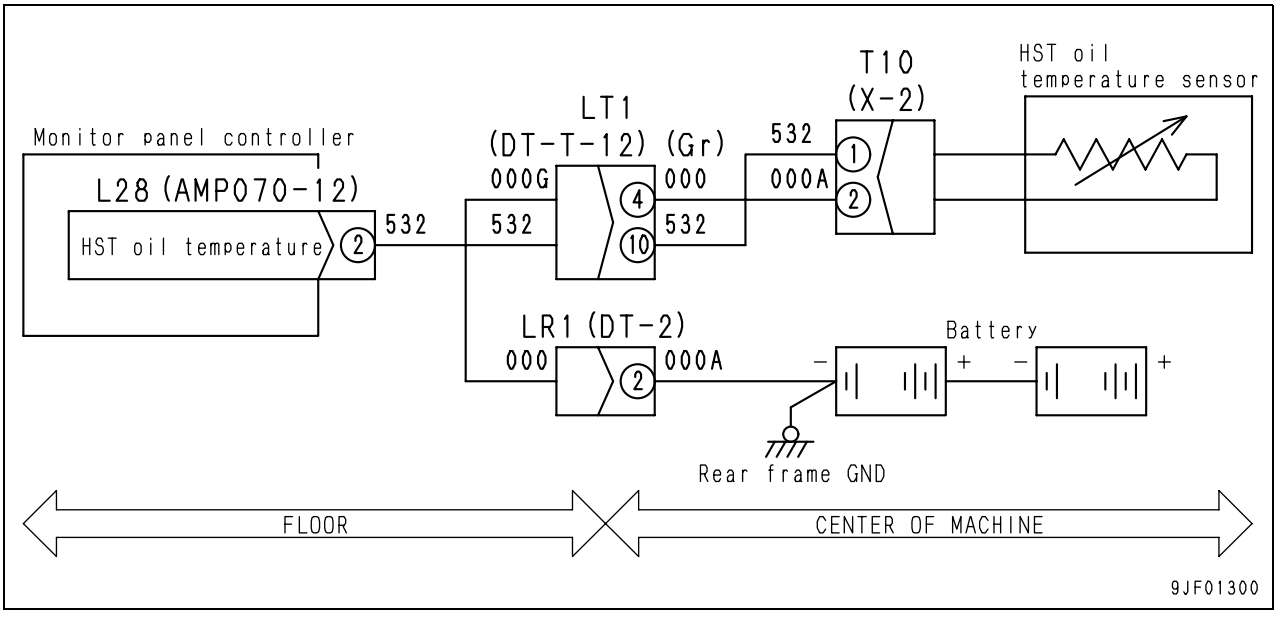


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	HST oil temperature overheating (NS)
E02	B@CRNS	MON		
Description of Trouble	• The HST oil temperature is above 110°C.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The HST may be damaged if operation continues.			
Related Information	• This failure code is displayed if the probability of a failure in the electrical system is low. • The HST oil temperature is display by monitoring code 30100.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Overheating HST oil temperature.	- - -			
	2	Defective HST oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector T10. 3) Connect T-adapter.			
			Between T10 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L28 (Female) (2) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram



white 20-435

Failure Code [D5ZHL6] (Starting switch "C" (IGN "C") input failure (L6))

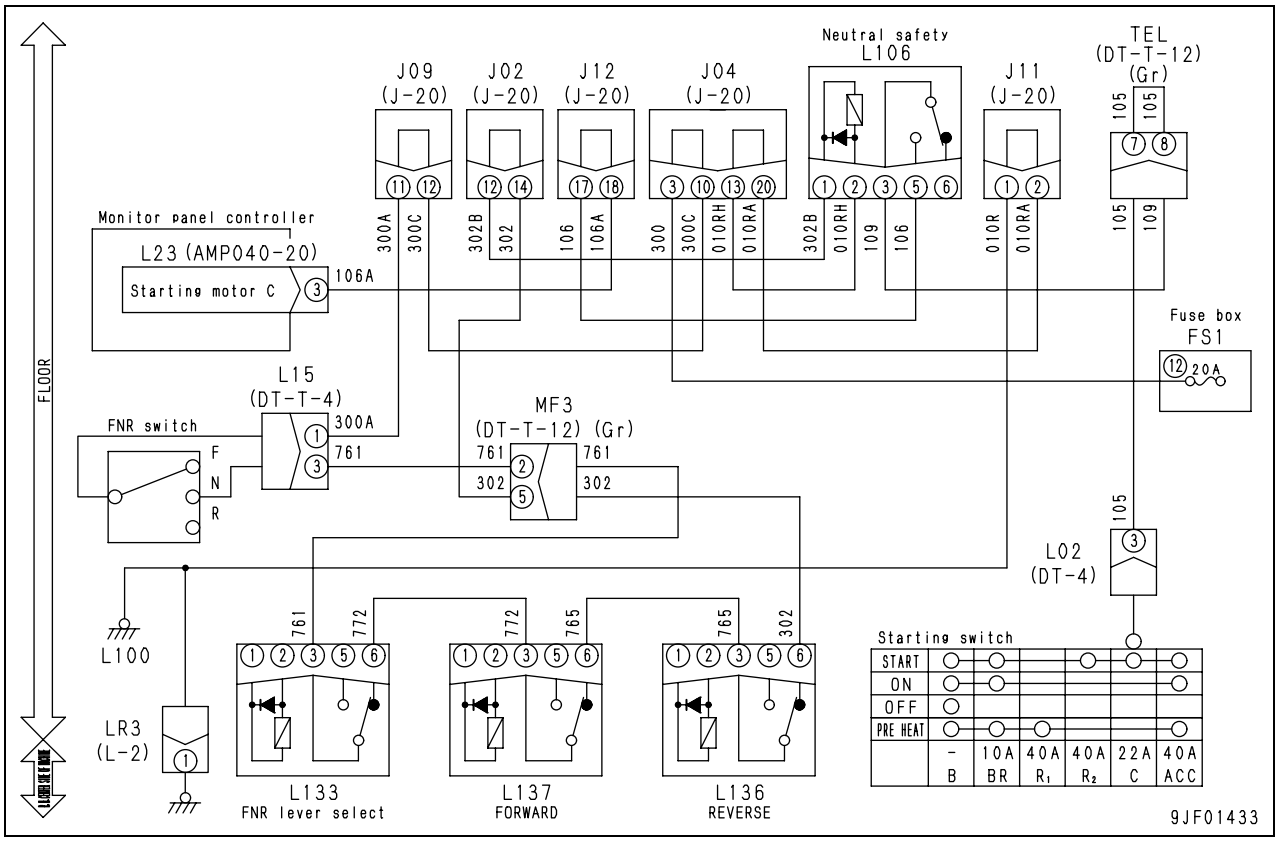
Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Starting switch "C" (IGN "C") input failure (L6)
E01	D5ZHL6	MON		
Description of Trouble	• When engine was running, starting switch C (IGN C) terminal signal turned ON, or did not turn ON when starting switch was at START			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• No reaction.			
Related Information				

Possible Causes and Standard Values		Causes	Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective starting switch	1) Turn starting switch OFF. 2) Disconnect starting switch terminals. 3) Connect T-adapter.			
			Between starting switch terminal B and C	Starting switch START.	Resistance	1✕ and below
				Other than the above.	Resistance	1M✕ and above
	2	Defective neutral safety relay (L106)	1) Turn starting switch OFF. 2) Interchange relay (L106) with normal relay			
			Does condition become normal when neutral safety relay (L106) is interchanged with normal relay?		The condition is abnormal.	Relay (L106) is normal.
					The condition is normal.	Defective relay (L106)
			1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check.			
			Between L106 (Male) (1) and (2)		Resistance	200 - 400✕
			1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check. 4) Applies impressed voltage between L106 (Male) (1) - (2)			
			Between L106 (Male) (3) and (5)	Applies 24V impressed voltage between L106 (Male) (1) - (2)	Resistance	1✕ and below
				Does not apply voltage between L106 (Male) (1) - (2)	Resistance	1M✕ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L02, L15, L23 and fuse L106. 3) Connect T-adapter.			
			Wiring harness between L02 (Female) (3) and L106 (Female) (3)		Resistance	1✕ and below
			Wiring harness between L23 (Female) (3) and L106 (Female) (5)		Resistance	1✕ and below
			Wiring harness between L106 (Female) (2) and chassis ground		Resistance	1✕ and below
			Wiring harness between L106 (Female) (1) and L15 (Female) (3)		Resistance	1✕ and below
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L02, L15, L23 and L106. 3) Connect T-adapter.			
			Wiring harness between L02 (Female) (3) and L106 (Female) (3)	Resistance between L02 (Female) (3), L106 (Female) (3) and chassis ground		1M✕ and above
			Wiring harness between L23 (Female) (3) and L106 (Female) (5)	Resistance between L23 (Female) (3), L106 (Female) (5) and chassis ground		1M✕ and above
			Wiring harness between L106 (Female) (1) and L15 (Female) (3)	Resistance between L106 (Female) (1), L15 (Female) (3) and chassis ground		1M✕ and above
			★ In the above case, the fuse is blown.			

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	5	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L23, L106. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (3) and L106 (Female) (5)	Voltage between L23 (Female) (3), L106 (Female) (5) and chassis ground		1V and below
	6	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L23 (Female) (3) and Chassis ground	Starting switch START.	Voltage	20 - 30V
				Other than the above.	Voltage	1V and below

Related circuit diagram



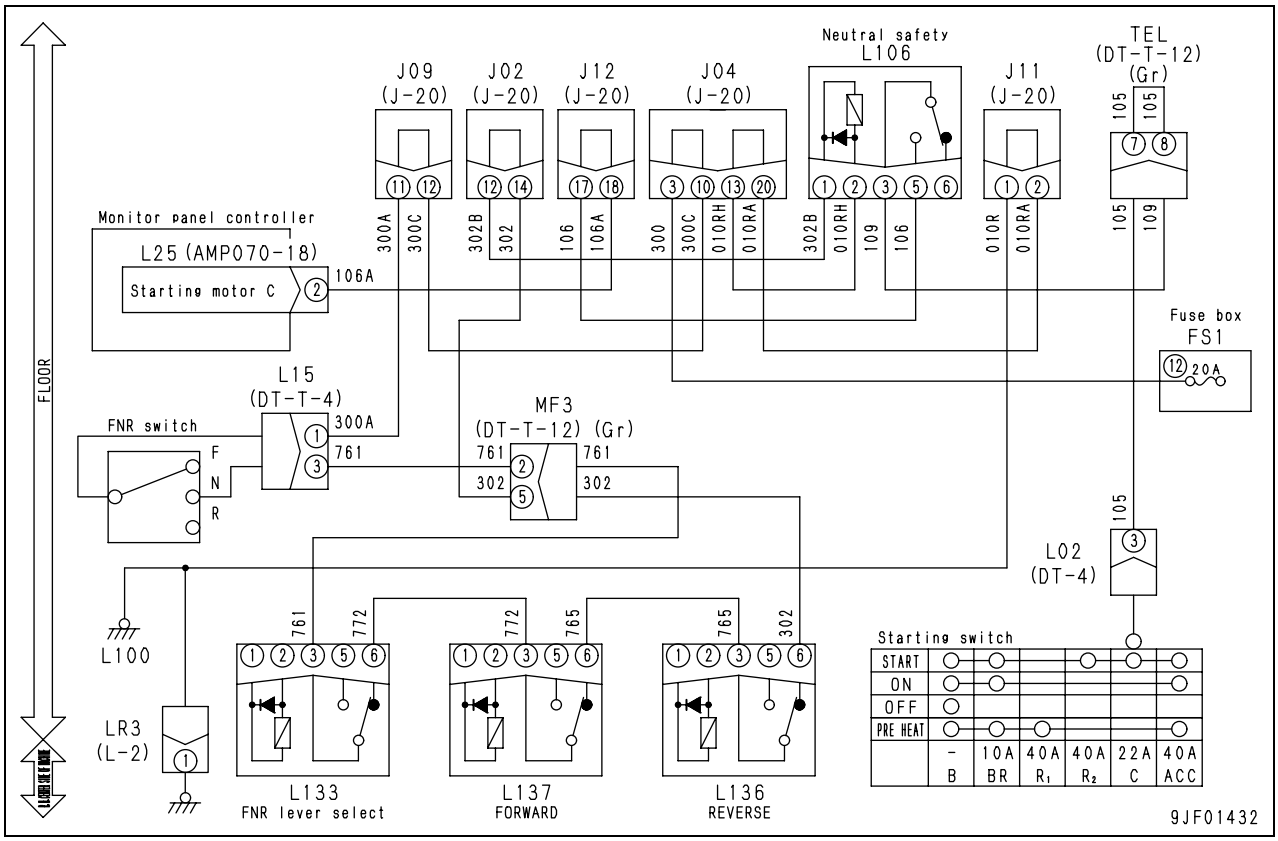
Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Starting switch "C" (IGN "C") input failure (L6)
E01	D5ZHL6	MON		
Description of Trouble	• When engine was running, starting switch C (IGN C) terminal signal turned ON, or did not turn ON when starting switch was at START			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• No reaction.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective starting switch	1) Turn starting switch OFF. 2) Disconnect starting switch terminals. 3) Connect T-adapter.			
			Between starting switch terminal B and C	Starting switch START.	Resistance	1✕ and below
				Other than the above.	Resistance	1M✕ and above
	2	Defective neutral safety relay (L106)	1) Turn starting switch OFF. 2) Interchange relay (L106) with normal relay			
			Does condition become normal when neutral safety relay (L106) is interchanged with normal relay?		The condition is abnormal.	Relay (L106) is normal.
					The condition is normal.	Defective relay (L106)
			1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check.			
			Between L106 (Male) (1) and (2)		Resistance	200 - 400✕
			1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check. 4) Applies impressed voltage between L106 (Male) (1) - (2)			
			Between L106 (Male) (3) and (5)	Applies 24V impressed voltage between L106 (Male) (1) - (2)	Resistance	1✕ and below
				Does not apply voltage between L106 (Male) (1) - (2)	Resistance	1M✕ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L02, L15, L25 and fuse L106. 3) Connect T-adapter.			
			Wiring harness between L02 (Female) (3) and L106 (Female) (3)		Resistance	1✕ and below
			Wiring harness between L25 (Female) (2) and L106 (Female) (5)		Resistance	1✕ and below
			Wiring harness between L106 (Female) (2) and chassis ground		Resistance	1✕ and below
			Wiring harness between L106 (Female) (1) and L15 (Female) (3)		Resistance	1✕ and below
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L02, L15, L25 and L106. 3) Connect T-adapter.			
			Wiring harness between L02 (Female) (3) and L106 (Female) (3)	Resistance between L02 (Female) (3), L106 (Female) (3) and chassis ground		1M✕ and above
			Wiring harness between L25 (Female) (2) and L106 (Female) (5)	Resistance between L25 (Female) (2), L106 (Female) (5) and chassis ground		1M✕ and above
			Wiring harness between L106 (Female) (1) and L15 (Female) (3)	Resistance between L106 (Female) (1), L15 (Female) (3) and chassis ground		1M✕ and above
			★ In the above case, the fuse is blown.			

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	5	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L25, L106. 3) Connect T-adapter.			
			Wiring harness between L25 (Female) (2) and L106 (Female) (5)	Voltage between L25 (Female) (2), L106 (Female) (5) and chassis ground		1V and below
	6	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L25. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L25 (Female) (2) and Chassis ground	Starting switch START.	Voltage	20 - 30V
				Other than the above.	Voltage	1V and below

Related circuit diagram



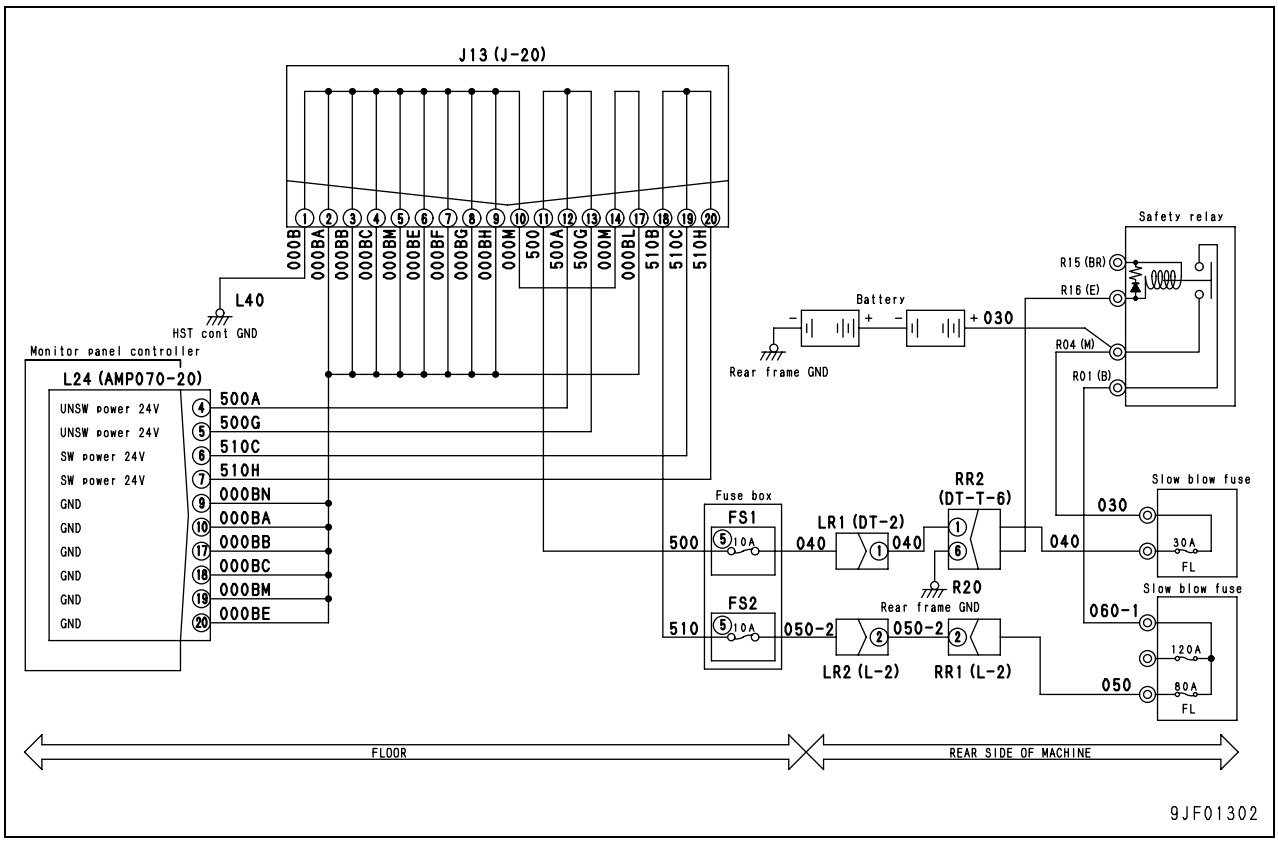
Failure Code [DAF3KK] While SW power supply (for operation) is turned ON, UNSW power supply (for memory) is turned OFF (KK)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	While SW power supply (for operation) is turned ON, UNSW power supply (for memory) is turned OFF (KK)
E03	DAF3KK	MON		
Description of Trouble	• When the SW power supply voltage (for operation) is above 17 V, the UNSW power supply voltage (for memory) is below 17 V.			
Machine monitor or controller Reaction	• The alarm is turned ON.			
Effect on Machine	• The service meter time varies, the odometer value does not increased, and the fault history data are not saved.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective fuse FS1 (5)	The fuse must not be broken.			
	2	Disconnection in wiring harness (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect battery relay terminal M and connectors LR2 and L24. 3) Connect T-adapter.			
			Wiring harness between battery relay terminal M and LR2 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between LR2 (male) (2) and L24 (male) (4), (5)		Resistance	Max. 1 Ω
			Wiring harness between L24 (female) (9), (10), (17), (18), (19), (20) and chassis		Resistance	Max. 1 Ω
	3	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect battery relay terminal M and connectors LR2 and L24. 3) Connect T-adapter.			
			Between battery relay terminal M and LR2 (female) (2)	Resistance between battery relay terminal M, LR2 (female) (2) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between LR2 (male) (2) and L24 (female) (4), (5)	Resistance between LR2 (female) (2), L24 (female) (4), (5) and chassis ground	Resistance	Min. 1 MΩ
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L24. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (6), (7) and chassis ground		Voltage	20 - 30 V
			Between L24 (6), (7) and (9), (10), (17), (18), (19), (20)		Voltage	20 - 30 V

Related circuit diagram



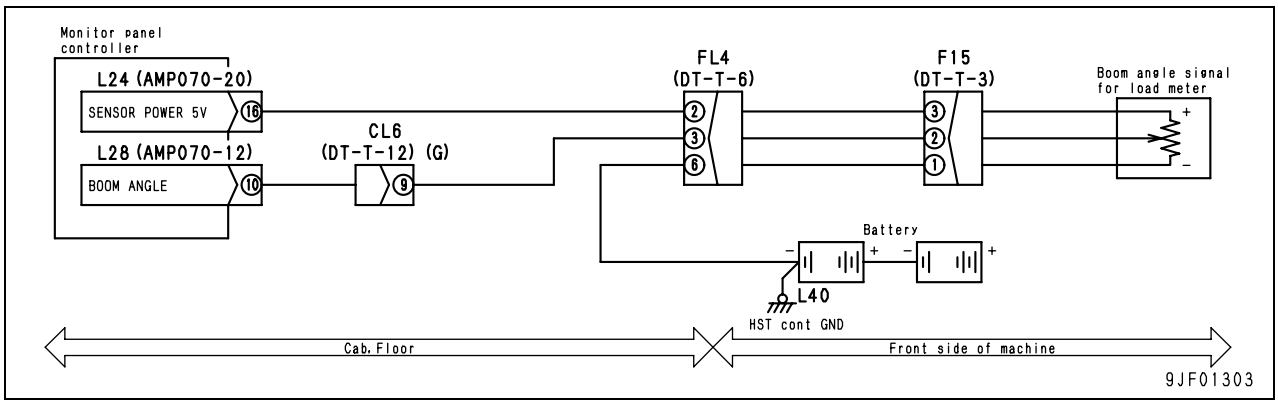
Failure Code [DAF5KP] Defective 5-V power supply output (KP)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Short circuit in 5-V power supply output (KK)
E01	DAF5KP	MON		
Description of Trouble	• The 5-V sensor power supply output line is shorted with the ground.			
Machine monitor or controller Reaction	• The 5-V power supply output is stopped until the starting switch is turned OFF. • The load is not displayed.			
Effect on Machine	• The load cannot be detected (The load is not displayed).			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective boom angle sensor	1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Connect T-adapter.			
			Between F15 (male) (3) and (1)		Resistance	4 - 6 kΩ
			1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between F15 (3) and (1)		Voltage	4.75 - 5.25 V
			Between F15 (2) and (1)	When boom is raised fully	Voltage	3.5 - 4.0 V
				When boom is lowered fully	Voltage	1.0 - 2.0 V
	2	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L24 and F15. 3) Connect T-adapter.			
			Wiring harness between L24 (female) (16) and F15 (female) (3)	Resistance between L24 (female) (16), F15 (female) (3) and chassis ground	Resistance	Min. 1 MΩ
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connectors L24 and L28. 3) Insert T-adapter.			
			Between L24 (male) (16) and chassis ground		Resistance	4 - 6 kΩ
			1) Turn starting switch OFF. 2) Disconnect connectors L24 and L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (16) and chassis ground		Voltage	4.75 - 5.25 V
			Between L28 (10) and chassis ground	When boom is raised fully	Voltage	3.5 - 4.0 V
				When boom is lowered fully	Voltage	1.0 - 2.0 V

Related circuit diagram



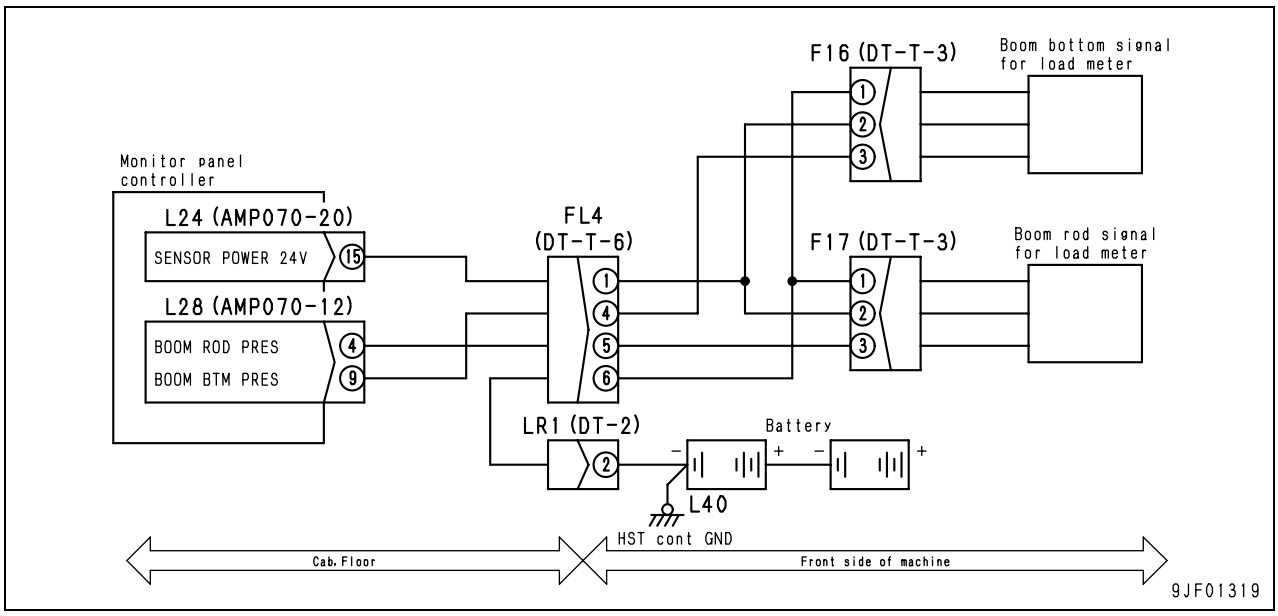
Failure Code [DAF6KP] Defective 24-V power supply output (KP)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Defective 24-V power supply output (KP)
E01	DAF6KP	MON		
Description of Trouble	• The 24-V sensor power supply output line is shorted with the ground.			
Machine monitor or controller Reaction	• The 24-V power supply output is stopped until the starting switch is turned OFF. • The load is not displayed.			
Effect on Machine	• The load cannot be detected (The load is not displayed).			
Related Information				

Causes			Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective boom pressure sensor (on the bottom side)	1) Turn starting switch OFF. 2) Disconnect connector F16. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between F16 (2) and (1)		Voltage	20 - 30 V
			Between F16 (3) and (1)	When operated	Voltage	0.7 - 5.3 V
				When opened to atmosphere	Voltage	0.5 - 1.5 V
	2	Defective boom pressure sensor (on the head side)	1) Turn starting switch OFF. 2) Disconnect connector F17. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between F17 (2) and (1)		Voltage	20 - 30 V
			Between F17 (3) and (1)	When operated	Voltage	0.7 - 5.3 V
				When opened to atmosphere	Voltage	0.5 - 1.5 V
	3	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L24, F16, and F17. 3) Connect T-adapter.			
			Wiring harness between L24 (female) (15) and F16 (female) (2), F17 (female) (2)	Resistance between L24 (female) (15), F16 (female) (2), F17 (female) (2) and chassis ground	Resistance	Min. 1 MΩ
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connectors L24 and L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (15) and chassis ground		Voltage	20 - 30 V
			Between L28 (4) and chassis ground	When operated	Voltage	0.7 - 5.3 V
			Between L28 (9) and chassis ground	When operated	Voltage	0.7 - 5.3 V
			Between L28 (4), (9) and chassis ground	When operated	Voltage	0.5 - 1.5 V

Related circuit diagram



Failure Code [DAF0KT] (Controller inside failure (KT))

Action Code	Failure Code	Controller Code	Trouble	Controller inside failure (KT)
E03	DAF0KT	MON		
Description of Trouble	• Abnormality has occurred inside controller.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• Abnormality in data recorded inside monitor, monitor operation possible			
Related Information				

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting
	1	Defective machine monitor	Abnormality inside machine monitor, so troubleshooting cannot be carried out. (Abnormality may be repaired by initializing machine monitor.)

white 20-447

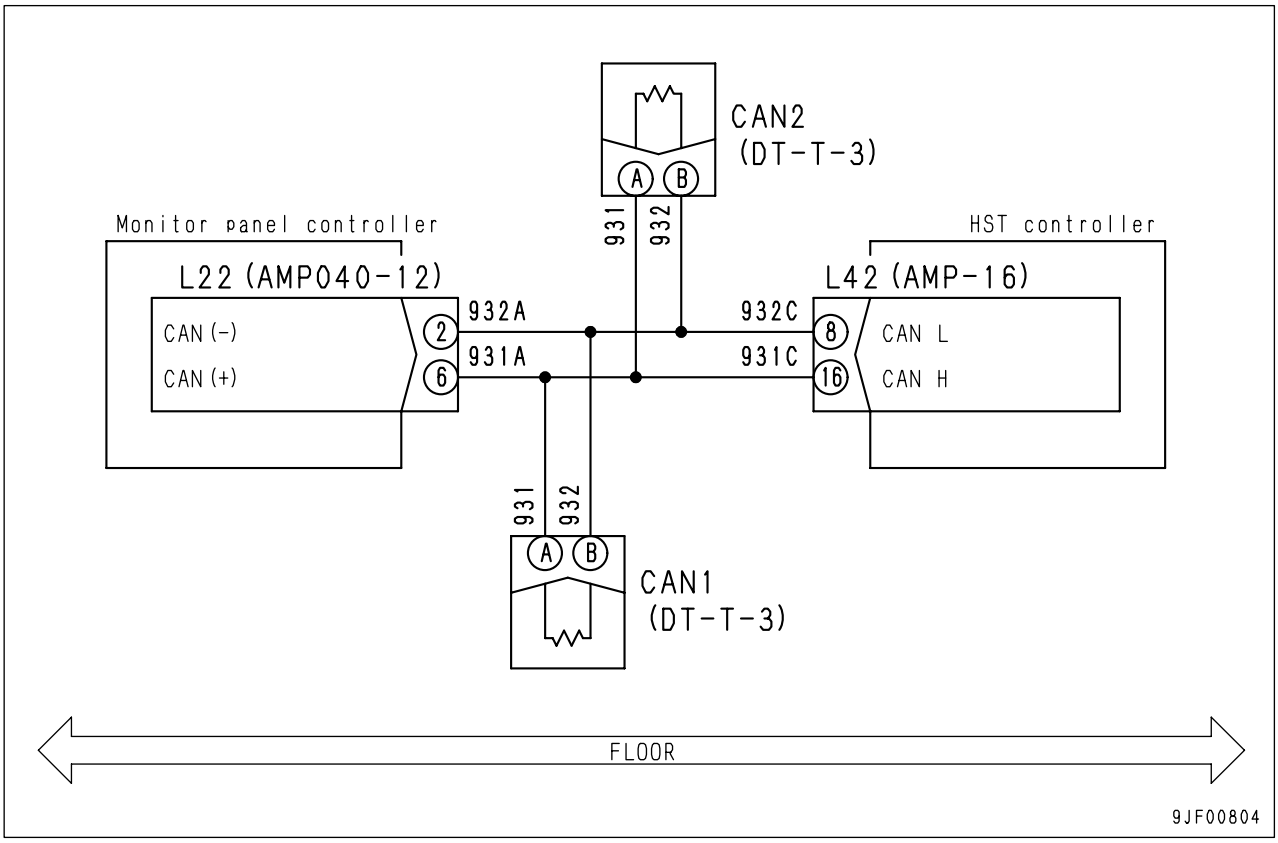
Failure Code [DAJ0KR] (HST controller communication failure (KR))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	HST controller communication failure (KR)
E03	DAJ0KR	MON		
Description of Trouble	• Communications (CAN) data cannot be received from HST controller.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• HST controller holds at condition before abnormality occurred. • HST controller actuates with mode that ignores CAN communications.			
Related Information	• Movement of machine becomes abnormal. • Speed range display does not switch. • Speedometer always displays 0 km/h.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	1	Defective wiring harness	1) Turn starting switch OFF. 2) Disconnect Connectors L22, L42. 3) Connect T-adapter.		
			Wiring harness between L22 (Female) (6), L42 (Female) (16)	Resistance between L22 (Female) (2) and (6)	40 - 80Ω
			Wiring harness between L22 (Female) (2), L42 (Female) (8)	Resistance between L22 (Female) (2) and (6)	40 - 80Ω
			Wiring harness between L22 (Female) (6), L42 (Female) (16)	Resistance between L22 (Female) (2) and chassis ground	1MΩ and above
			Wiring harness between L22 (Female) (2), L42 (Female) (8)	Resistance between L22 (Female) (2) and chassis ground	1MΩ and above
			★ Check that terminal resistances CAN1, CAN 2 are connected. ★ Resistance value of terminal resistances CAN1, CAN 2: 120Ω		
	2	Defective HST controller	1) Turn starting switch OFF. 2) Replace HST controller. 3) Turn starting switch ON.		
			When HST controller is replaced, do communications become normal?	Communication is abnormal.	HST controller is normal.
				Communication is normal.	Defective HST controller
	3	Defective terminal resistance	1) Turn starting switch OFF. 2) Disconnect Connectors CAN1, CAN2. 3) Connect T-adapter.		
			Wiring harness between CAN1 (A) and (B) (3)	Resistance	100 - 130Ω
			Wiring harness between CAN2 (A) and (B) (3)	Resistance	100 - 130Ω
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Replace machine monitor. 3) Turn starting switch ON.		
			When machine monitor is replaced, do communications become normal?	Communication is abnormal.	Machine monitor is normal.
				Communication is normal.	Defective Machine monitor
			★ When replacing the machine monitor, carry out adjustments. For details, see TESTING AND ADJUSTING, Adjusting machine monitor.		

Related circuit diagram

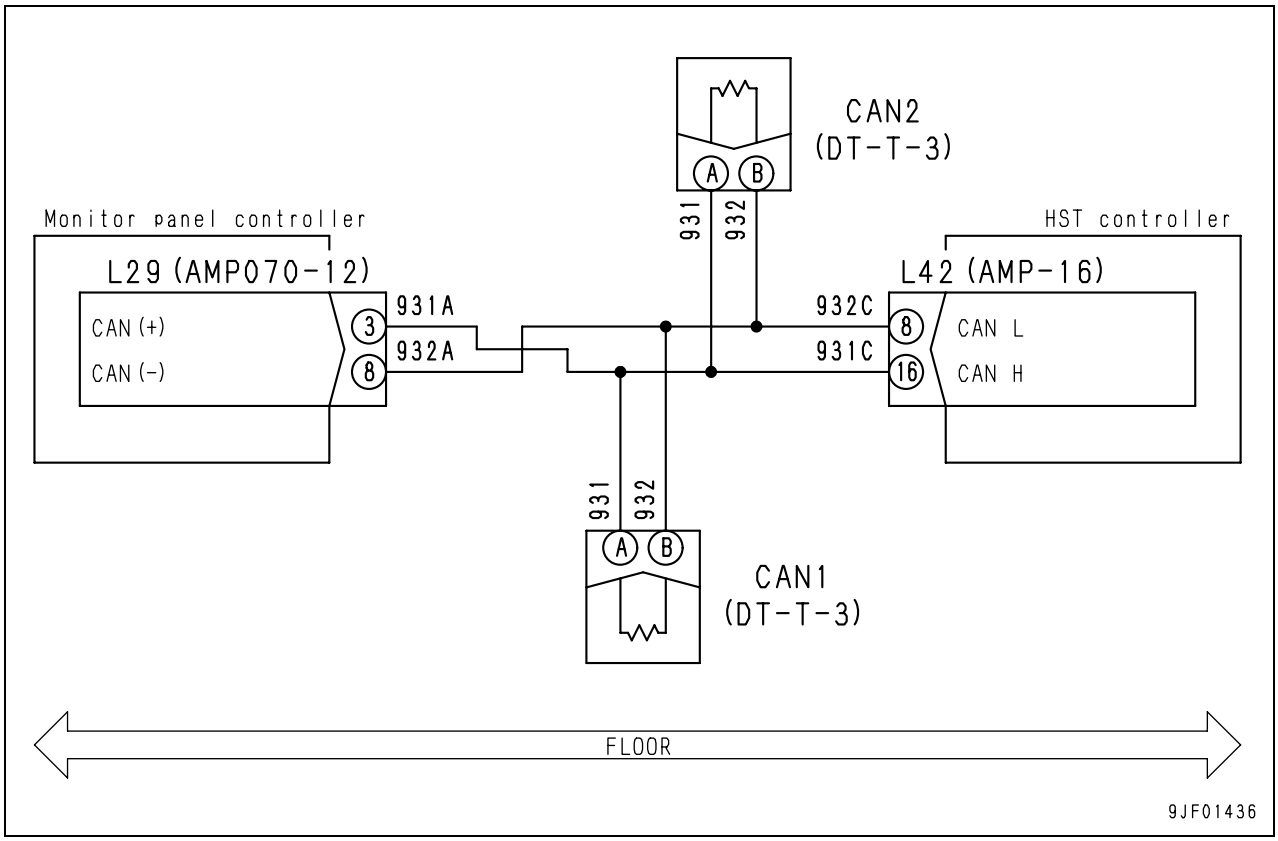


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	HST controller communication failure (KR)
E03	DAJ0KR	MON		
Description of Trouble	• Communications (CAN) data cannot be received from HST controller.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• HST controller holds at condition before abnormality occurred. • HST controller actuates with mode that ignores CAN communications.			
Related Information	• Movement of machine becomes abnormal. • Speed range display does not switch. • Speedometer always displays 0 km/h.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	1	Defective wiring harness	1) Turn starting switch OFF. 2) Disconnect Connectors L29, L42. 3) Connect T-adapter.		
			Wiring harness between L29 (Female) (3), L42 (Female) (16)	Resistance between L29 (Female) (3) and (8)	40 - 80Ω
			Wiring harness between L29 (Female) (8), L42 (Female) (8)	Resistance between L29 (Female) (3) and (8)	40 - 80Ω
			Wiring harness between L29 (Female) (3), L42 (Female) (16)	Resistance between L29 (Female) (3) and chassis ground	1MΩ and above
			Wiring harness between L29 (Female) (8), L42 (Female) (8)	Resistance between L29 (Female) (8) and chassis ground	1MΩ and above
			★ Check that terminal resistances CAN1, CAN 2 are connected. ★ Resistance value of terminal resistances CAN1, CAN 2: 120Ω		
	2	Defective HST controller	1) Turn starting switch OFF. 2) Replace HST controller. 3) Turn starting switch ON.		
			When HST controller is replaced, do communications become normal?	Communication is abnormal.	HST controller is normal.
				Communication is normal.	Defective HST controller
	3	Defective terminal resistance	1) Turn starting switch OFF. 2) Disconnect Connectors CAN1, CAN2. 3) Connect T-adapter.		
			Wiring harness between CAN1 (A) and (B) (3)	Resistance	100 - 130Ω
			Wiring harness between CAN2 (A) and (B) (3)	Resistance	100 - 130Ω
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Replace machine monitor. 3) Turn starting switch ON.		
			When machine monitor is replaced, do communications become normal?	Communication is abnormal.	Machine monitor is normal.
				Communication is normal.	Defective Machine monitor
			★ When replacing the machine monitor, carry out adjustments. For details, see TESTING AND ADJUSTING, Adjusting machine monitor.		

Related circuit diagram



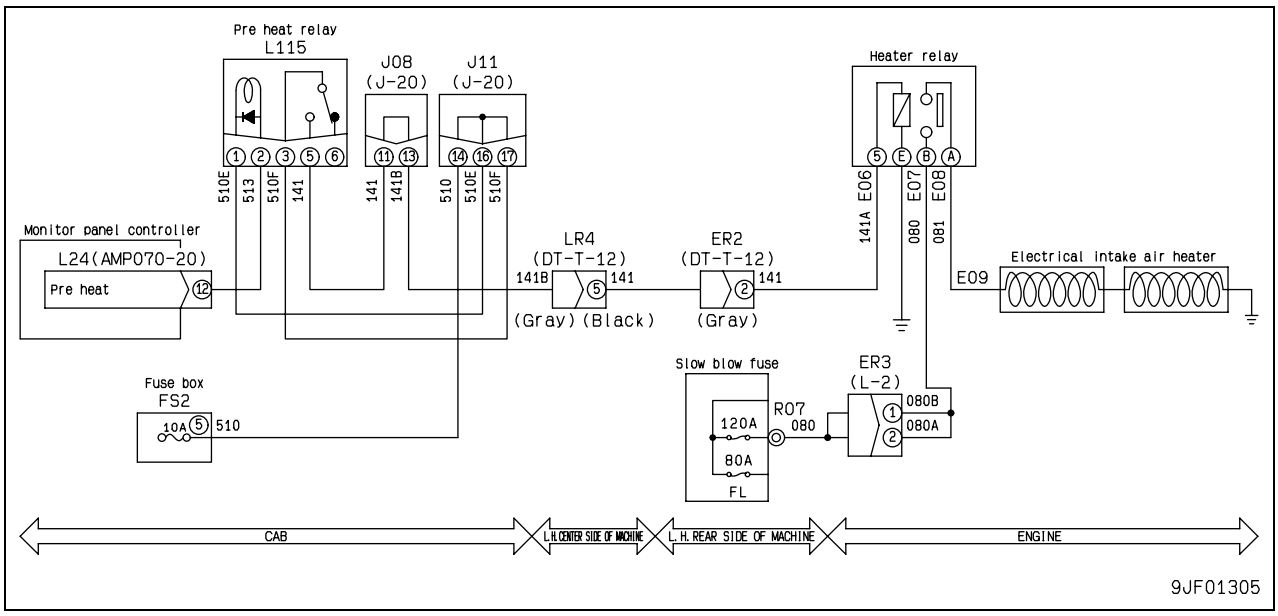
Failure Code [D182KZ] Short circuit of automatic preheater output (with 24 V) (KZ)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Short circuit of automatic preheater output (KZ)
E01	D182KZ	MON		
Description of Trouble	• While the power for the automatic preheater relay output circuit is turned OFF, a current flows.			
Machine monitor or controller Reaction	• The alarm is turned ON. • The output to the automatic preheater relay circuit is turned OFF.			
Effect on Machine	• The automatic preheater does not operate.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective wiring harness	1) Turn starting switch OFF. 2) Replace L115 with normal relay. 3) Turn starting switch ON. 4) Operate automatic preheater.			
			When the automatic preheater relay is replaced, does condition become normal?	Condition does not become normal.		Relay (L115) is normal.
				Condition becomes normal.		Relay (L115) is defective.
	2	Short circuit with power source in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L24 and L115. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L24 (female) (12) and L115 (female) (2)	Voltage between L24 (female) (12), L115 (female) (2) and chassis ground		Max. 1 V
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L24. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (12) and chassis ground	When automatic preheater is turned ON	Voltage	Max. 1 V
				When automatic preheater is not turned ON	Voltage	20 - 30 V

Related circuit diagram



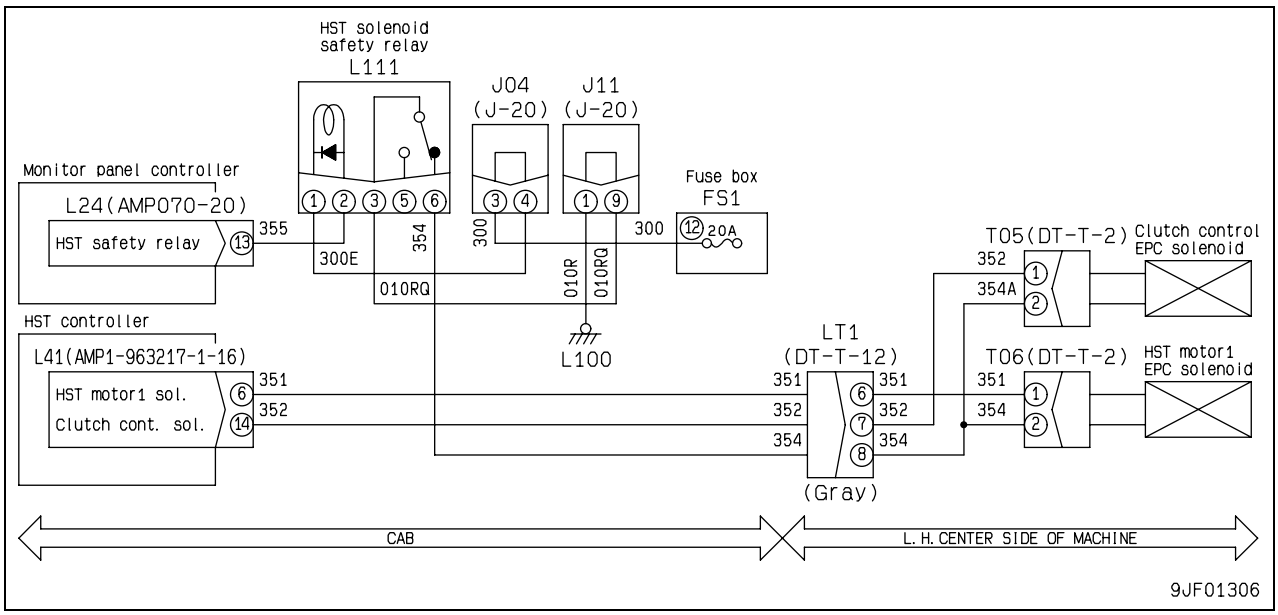
Failure Code [D1B0KB] Short circuit of HST safety (transmission cut-off) relay output (KB)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Short circuit of HST safety relay output (KB)
E01	D1B0KB	MON		
Description of Trouble	• When the power for the HST safety relay output circuit is turned ON, a large current flows. When the output is turned ON, any current does not flow.			
Machine monitor or controller Reaction	• The alarm is turned ON. • The output to the HST relay circuit is turned OFF.			
Effect on Machine	• HST does not function.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective wiring harness	1) Turn starting switch OFF. 2) Replace L111 with normal relay. 3) Turn starting switch ON. 4) When failure code is displayed			
			When the HST safety relay is replaced, does condition become normal?	Condition does not become normal.		Relay (L111) is normal.
				Condition becomes normal.		Relay (L111) is defective.
			1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Check relay L111.			
			Between L111 (male) (1) and (2)		Resistance	200 - 400 Ω
			1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Check relay L111. 4) Apply test voltage between L111 (male) (1) and (2).			
			Between L111 (male) (3) and (5)	When 24 V is applied between (1) and (2)	Resistance	Max. 1 Ω
				When 24 V is not applied between (1) and (2)	Resistance	Min. 1 MΩ
	2	Short circuit with power source in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L111 and fuse FS1 (12). 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between fuse FS1 (12) and L111 (female) (1)	Resistance between fuse FS1 (12), L111 (female) (1) and chassis ground		Min. 1 MΩ
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L24. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (13) and chassis ground	When failure code is displayed	Voltage	Max. 1 V
				When failure code is not displayed	Voltage	20 - 30 V

Related circuit diagram



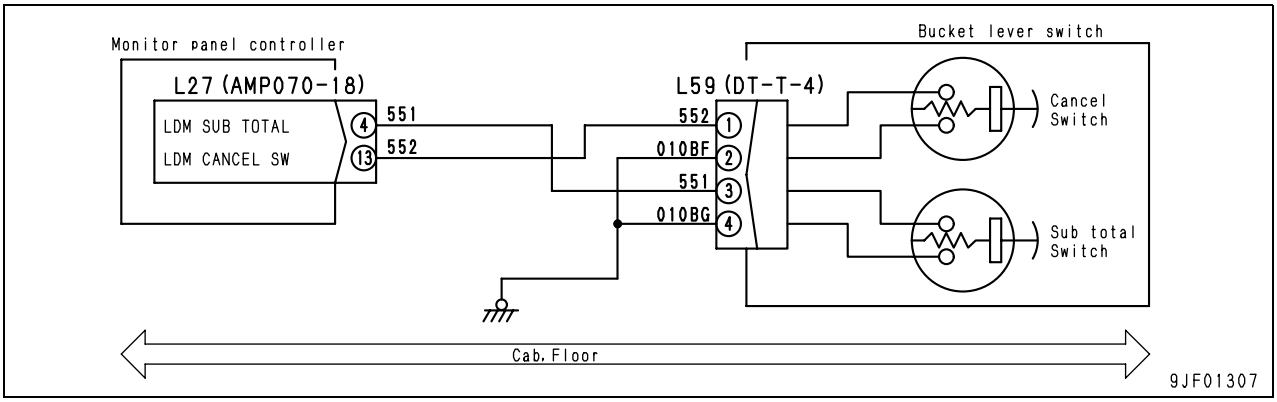
Failure Code [DD1CLD] Defective subtotal switch (LD)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Defective subtotal switch (LD)
E01	DD1CLD	MON		
Description of Trouble	• The subtotal switch input circuit is kept closed for more than 1 minute.			
Machine monitor or controller Reaction	• The alarm is turned ON.			
Effect on Machine	• The subtotal of the load meter cannot be obtained.			
Related Information	The subtotal input signal (0/1) can be checked with the monitoring function (Code: 40904, D_IN_32).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective subtotal switch (BUCKET LEVER FOR OPT LDM)	1) Turn starting switch OFF. 2) Disconnect connector L59. 3) Connect T-adapter.			
			Between L59 (female) (3) and (4)	When subtotal switch is turned ON	Resistance	Max. 1 Ω
				When subtotal switch is turned OFF	Resistance	Min. 1 MΩ
	2	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L27 and L59. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L27 (female) (4) and L59 (female) (3)	Resistance between L27 (female) (4), L59 (female) (3) and chassis ground		Min. 1 MΩ
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Turn starting switch ON.			
			Between L27 (4) and chassis ground	When subtotal switch is turned ON	Voltage	Max. 1 V
				When subtotal switch is turned OFF	Voltage	20 - 30 V

Related circuit diagram



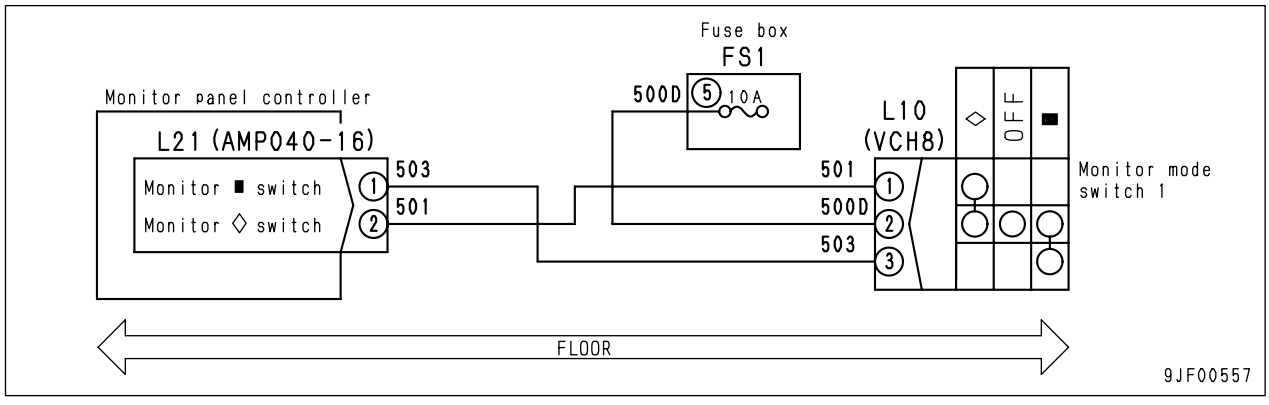
Failure Code [DD15LD] (Monitor panel mode selector switch 1 [■] (Panel switch 1) input error (LD))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Monitor panel mode selector switch 1 [■] (Panel switch 1) input error (LD)
E01	DD15LD	MON		
Description of Trouble	• The monitor panel mode selector switch 1 [■] (Panel switch 1) input circuit is always in the CLOSE state for more thirty seconds.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 1 [■]	1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter.			
			Between L10 (Female) (2) and (3)	When monitor panel mode selector switch 1 [■] is turned ON.	Resistance	1✕ andbelow
				Other than above.	Resistance	1M✕ and above
	2	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L21 (Female) (1) and L10 (Female) (3)	Voltage between L21 (Female) (1), L10 (Female) (3) and chassis ground		1V and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (1) and chassis ground	When monitor panel mode selector switch 1 [■] is turned ON.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below

Related circuit diagram

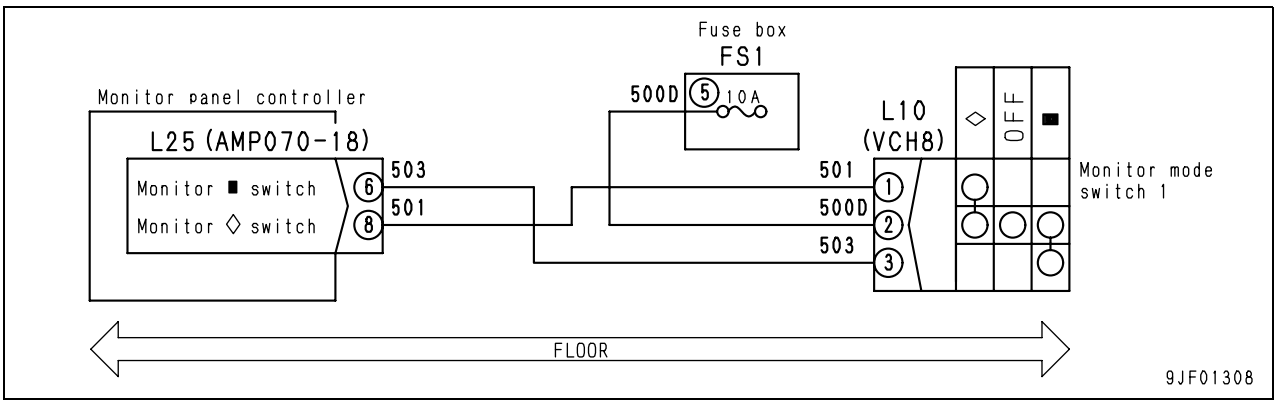


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Monitor panel mode selector switch 1 [■] (Panel switch 1) input error (LD)
E01	DD15LD	MON		
Description of Trouble	• The monitor panel mode selector switch 1 [■] (Panel switch 1) input circuit is always in the CLOSE state for more thirty seconds.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 1 [■]	1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter.			
			Between L10 (Female) (2) and (3)	When monitor panel mode selector switch 1 [■] is turned ON.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above
	2	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L25, L10. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L25 (Female) (6) and L10 (Female) (3)	Voltage between L25 (Female) (6), L10 (Female) (3) and chassis ground		1V and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L25. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L25 (Female) (6) and chassis ground	When monitor panel mode selector switch 1 [■] is turned ON.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below

Related circuit diagram



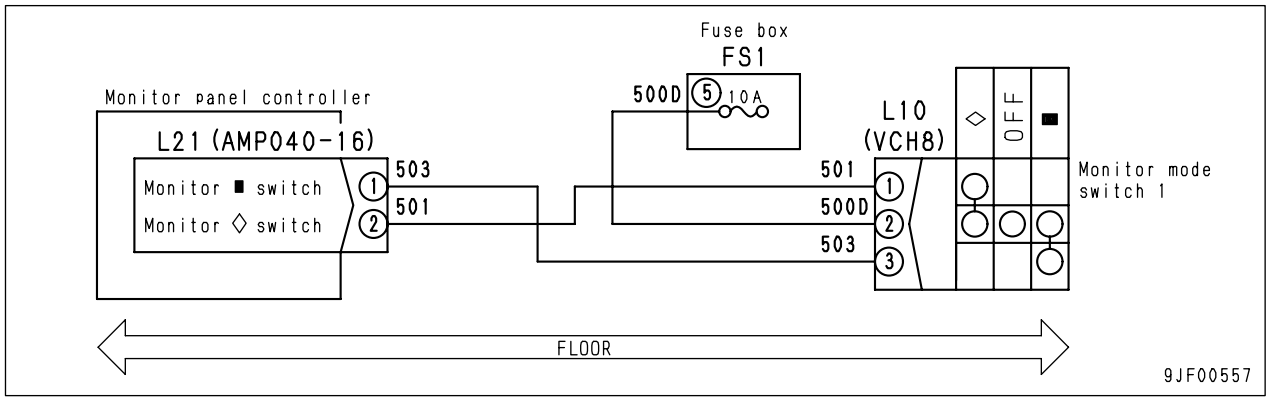
Failure Code [DD16LD] (Monitor panel mode selector switch 1 [◇] (Panel switch 2) input error (LD))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Monitor panel mode selector switch 1 [◇] (Panel switch 2) input error (LD)
E01	DD16LD	MON		
Description of Trouble	• The monitor panel mode selector switch 1 [◇] (Panel switch 2) input circuit is always in the CLOSE state for more thirty seconds.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 1 [◇]	1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter.			
			Between L10 (Female) (2) and (1)	When monitor panel mode selector switch 1 [◇] is turned ON.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above
	2	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L21 (Female) (2) and L10 (Female) (1)	Voltage between L21 (Female) (2), L10 (Female) (1) and chassis ground		1V and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (2) and chassis ground	When monitor panel mode selector switch 1 [◇] is turned ON.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below

Related circuit diagram

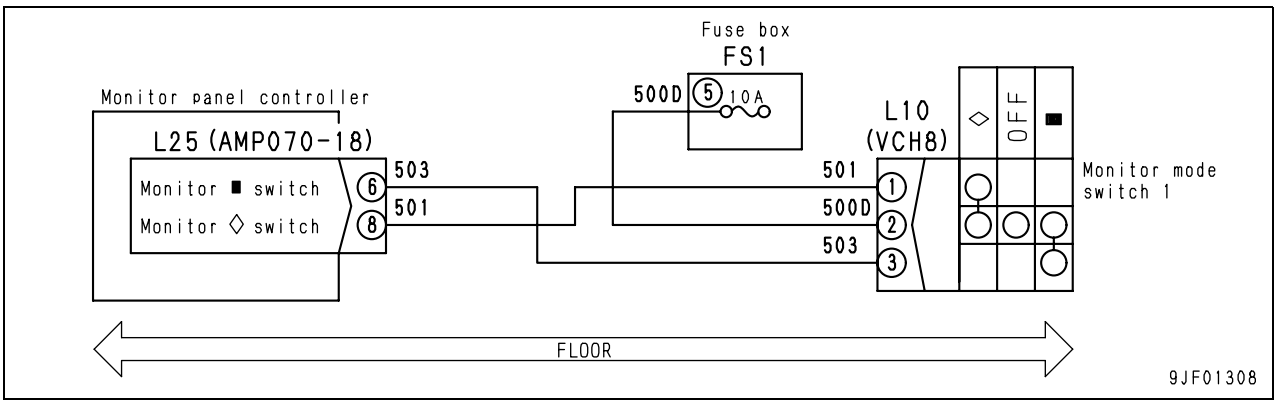


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Monitor panel mode selector switch 1 [◇] (Panel switch 2) input error (LD)
E01	DD16LD	MON		
Description of Trouble	• The monitor panel mode selector switch 1 [◇] (Panel switch 2) input circuit is always in the CLOSE state for more thirty seconds.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 1 [◇]	1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter.			
			Between L10 (Female) (2) and (1)	When monitor panel mode selector switch 1 [◇] is turned ON.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
	2	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L25, L10. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L25 (Female) (8) and L10 (Female) (1)	Voltage between L25 (Female) (8), L10 (Female) (1) and chassis ground		1V and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L25. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L25 (Female) (8) and chassis ground	When monitor panel mode selector switch 1 [◇] is turned ON.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below

Related circuit diagram



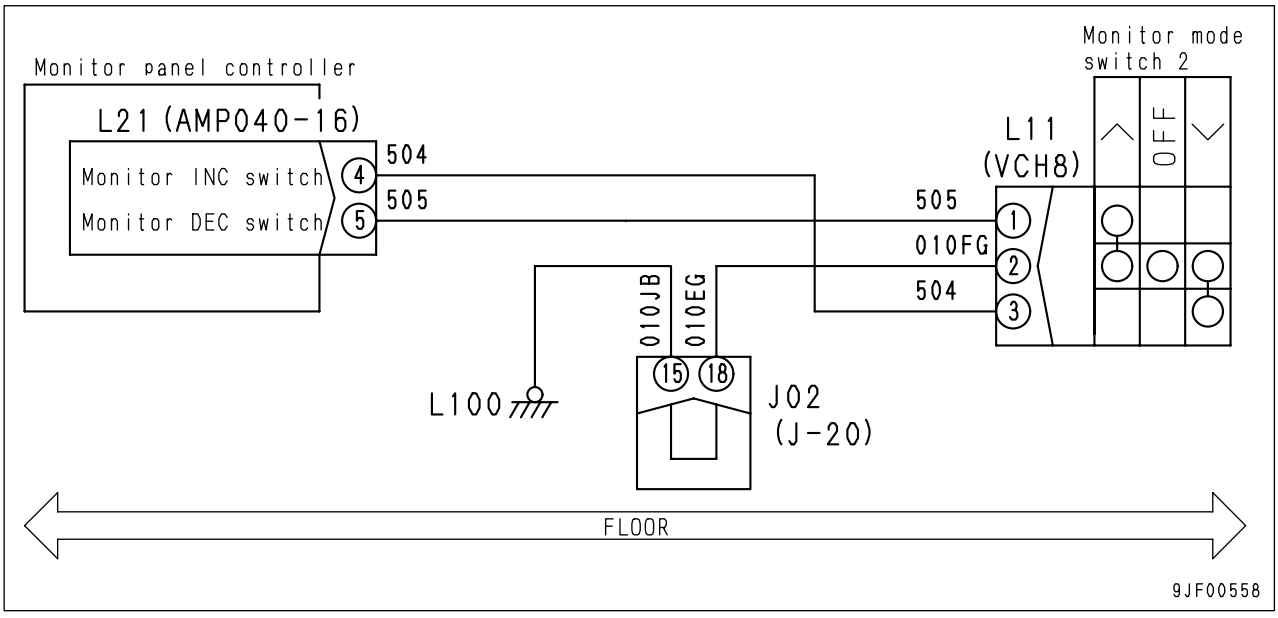
Failure Code [DD17LD] (Monitor panel mode selector switch 2 [<] (Panel switch 3) input error (LD))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Monitor panel mode selector switch 2 [<] (Panel switch 3) input error (LD)
E01	DD17LD	MON		
Description of Trouble	• The monitor panel mode selector switch 2 [<] (Panel switch 3) input circuit is always in the CLOSE state for more thirty seconds.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 2 [<]	1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter.			
			Between L11 (Female) (2) and (3)	When monitor panel mode selector switch 2 [<] is turned ON.	Resistance	1✕ andbelow
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L21 (Female) (4) and L11 (Female) (3)	Resistance between L21 (Female) (4), L11 (Female) (3) and chassis ground		1M✕ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (4) and chassis ground	When monitor panel mode selector switch 2 [<] is turned ON.	Voltage	1V and below
				Other than above.	Voltage	20 - 30V

Related circuit diagram

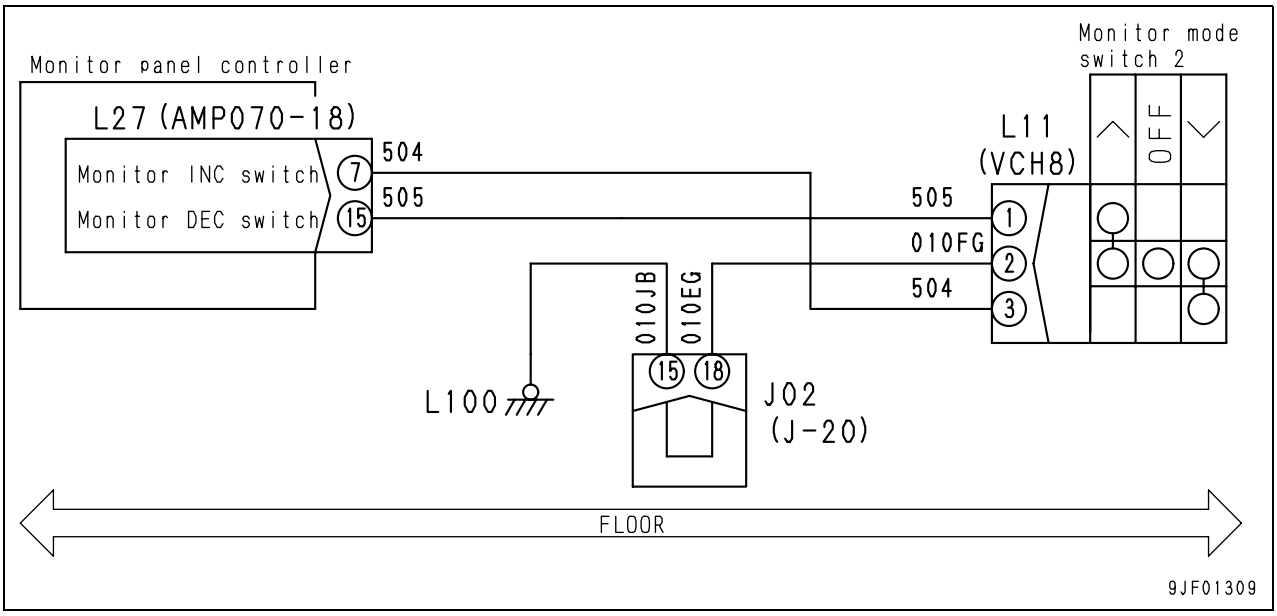


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Monitor panel mode selector switch 2 [<] (Panel switch 3) input error (LD)
E01	DD17LD	MON		
Description of Trouble	• The monitor panel mode selector switch 2 [<] (Panel switch 3) input circuit is always in the CLOSE state for more thirty seconds.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 2 [<]	1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter.			
			Between L11 (Female) (2) and (3)	When monitor panel mode selector switch 2 [<] is turned ON.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L27, L11. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L27 (Female) (7) and L11 (Female) (3)	Resistance between L27 (Female) (7), L11 (Female) (3) and chassis ground		1M✕ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L27 (Female) (7) and chassis ground	When monitor panel mode selector switch 2 [<] is turned ON.	Voltage	1V and below
				Other than above.	Voltage	20 - 30V

Related circuit diagram



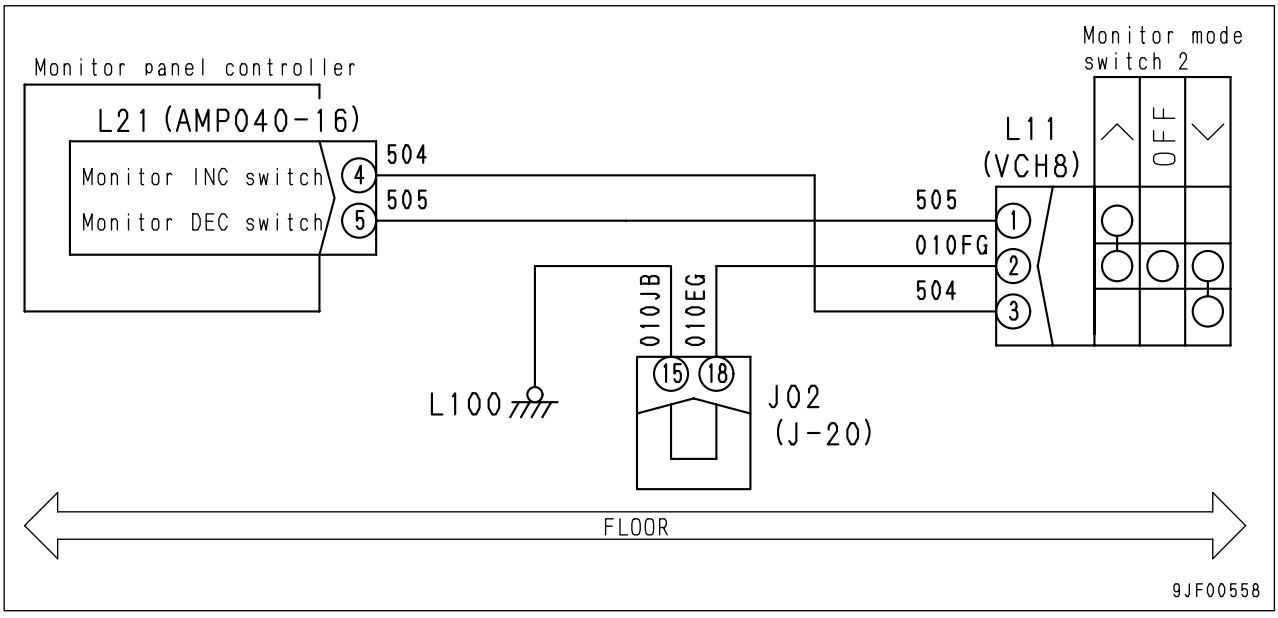
Failure Code [DD18LD] (Monitor panel mode selector switch 2 [>] (Panel switch 4) input error (LD))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Monitor panel mode selector switch 2 [>] (Panel switch 4) input error (LD)
E01	DD18LD	MON		
Description of Trouble	• The monitor panel mode selector switch 2 [>] (Panel switch 4) input circuit is always in the CLOSE state for more thirty seconds.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 2 [>].	1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter.			
			Between L11 (Female) (2) and (1)	When monitor panel mode selector switch 2 [>] is turned ON.	Resistance	1✕ andbelow
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L21 (Female) (5) and L11 (Female) (1)	Resistance between L21 (Female) (5), L11 (Female) (1) and chassis ground		1M✕ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (5) and chassis ground	When monitor panel mode selector switch 2 [>] is turned ON.	Voltage	1V and below
				Other than above.	Voltage	20 - 30V

Related circuit diagram

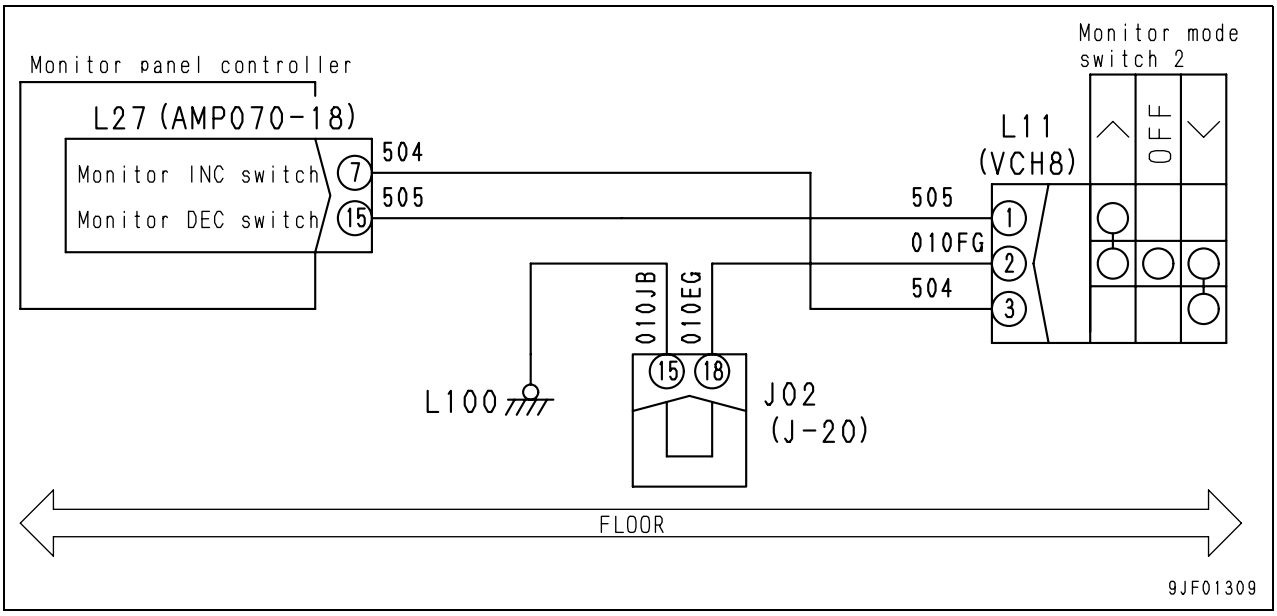


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Monitor panel mode selector switch 2 [>] (Panel switch 4) input error (LD)
E01	DD18LD	MON		
Description of Trouble	• The monitor panel mode selector switch 2 [>] (Panel switch 4) input circuit is always in the CLOSE state for more thirty seconds.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 2 [>].	1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter.			
			Between L11 (Female) (2) and (1)	When monitor panel mode selector switch 2 [>] is turned ON.	Resistance	1✕ andbelow
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L27, L11. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L27 (Female) (15) and L11 (Female) (1)	Resistance between L27 (Female) (15), L11 (Female) (1) and chassis ground		1M✕ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L27 (Female) (15) and chassis ground	When monitor panel mode selector switch 2 [>] is turned ON.	Voltage	1V and below
				Other than above.	Voltage	20 - 30V

Related circuit diagram



white 20-465

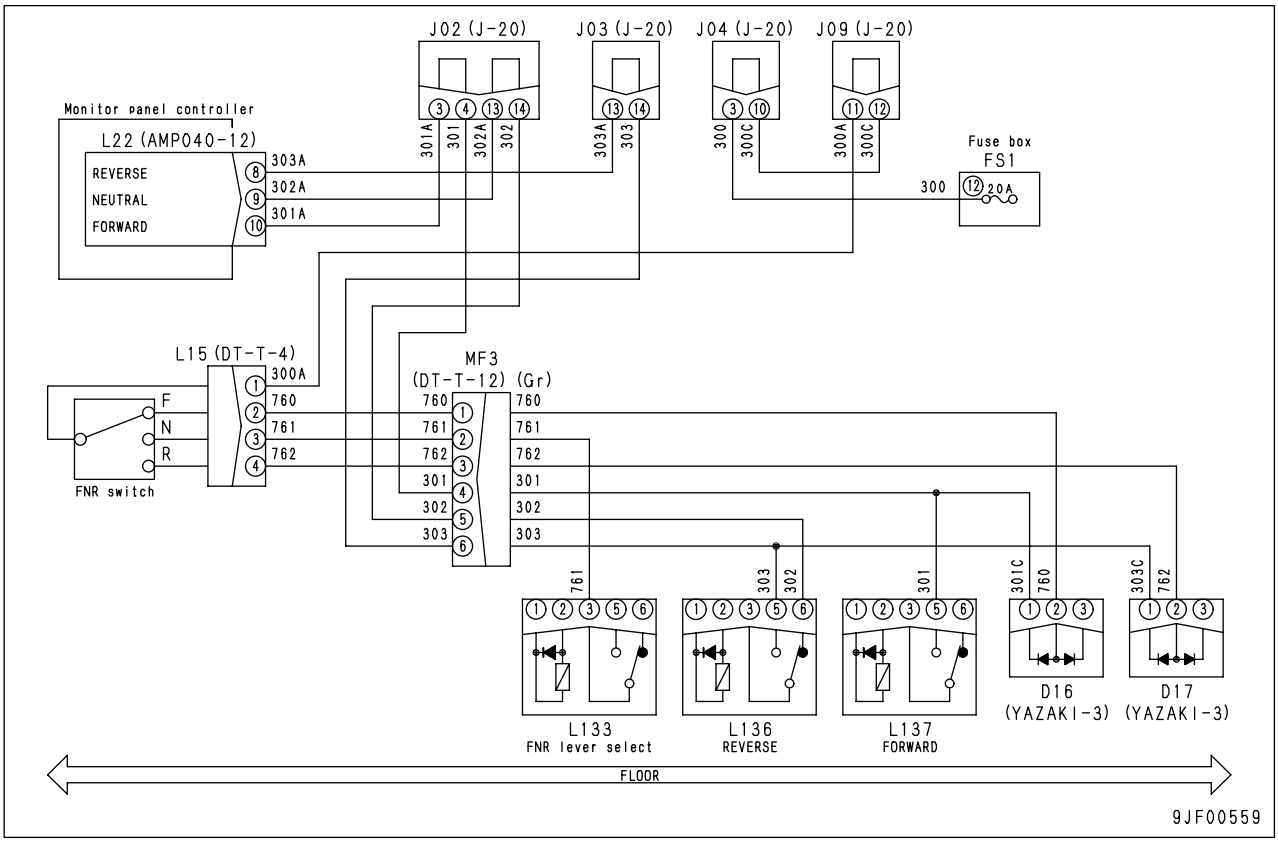
Failure Code [DDK3KB] (Multiple directional lever FR signal input (KB))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Multiple directional lever FR signal input (KB)
E03	DDK3KB	MON		
Description of Trouble	• Multiple signals (F and R signal) are input due to short-circuited directional lever.			
Machine monitor or controller Reaction	• Input signal is displayed as it is (F and R light up at same time). • When engine is started, machine moves even when directional lever is at N position. • Activates an alarm.			
Effect on Machine	• Does not travel. • The power train may be damaged.			
Related Information				

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L22, L15. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L22 (Female) (10) and L15 (Female) (2)	Voltage between L22 (Female) (10), L15 (Female) (2) and chassis ground		1V and below
			Wiring harness between L22 (Female) (8) and L15 (Female) (4)	Voltage between L22 (Female) (8), L15 (Female) (4) and chassis ground		1V and below
	2	Defective directional lever	1) Turn starting switch OFF. 2) Disconnect connector L15. 3) Connect T-adapter.			
			Between L15 (Female) (1) and (2)	When directional lever is turned F.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above
			Between L15 (Female) (1) and (4)	When directional lever is turned R.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L22. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L15 (Female) (1) and (2)	When directional lever is turned F.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below
			Between L15 (Female) (1) and (4)	When directional lever is turned R.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below

Related circuit diagram

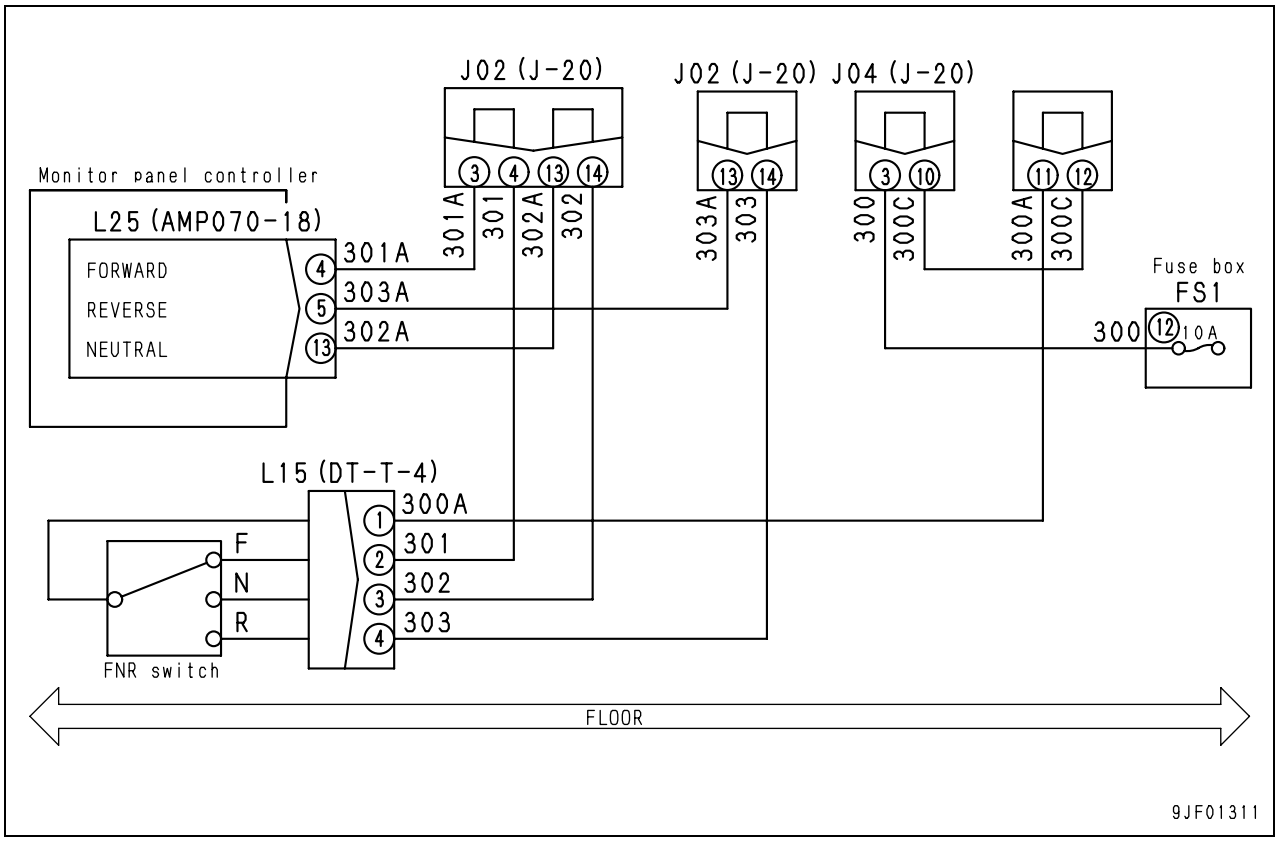


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Multiple directional lever FR signal input (KB)
E03	DDK3KB	MON		
Description of Trouble	• Multiple signals (F and R signal) are input due to short-circuited directional lever.			
Machine monitor or controller Reaction	• Input signal is displayed as it is (F and R light up at same time). • When engine is started, machine moves even when directional lever is at N position. • Activates an alarm.			
Effect on Machine	• Does not travel. • The power train may be damaged.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L25, L15. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L25 (Female) (4) and L15 (Female) (2)	Voltage between L25 (Female) (4), L15 (Female) (2) and chassis ground		1V and below
			Wiring harness between L25 (Female) (5) and L15 (Female) (4)	Voltage between L25 (Female) (5), L15 (Female) (4) and chassis ground		1V and below
	2	Defective directional lever	1) Turn starting switch OFF. 2) Disconnect connector L15. 3) Connect T-adapter.			
			Between L15 (Female) (1) and (2)	When directional lever is turned F.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above
			Between L15 (Female) (1) and (4)	When directional lever is turned R.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L25. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L15 (Female) (1) and (2)	When directional lever is turned F.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below
			Between L15 (Female) (1) and (4)	When directional lever is turned R.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below

Related circuit diagram



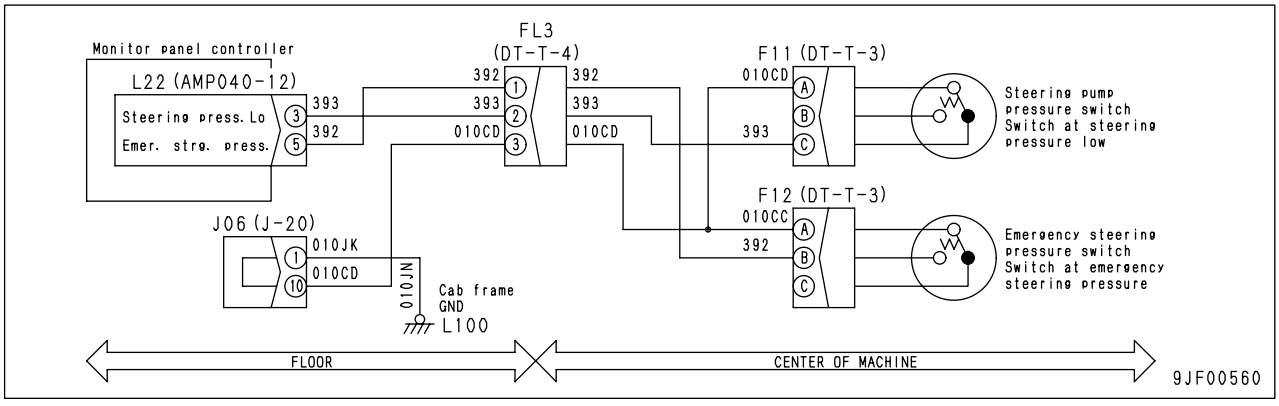
Failure Code [DDS5L6] (Decreased steering oil pressure (L6))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Decreased steering oil pressure (L6)
E03	DDS5L6	MON		
Description of Trouble	• The steering oil pressure sensor signal circuit is always in the CLOSE state during the engine is revolved.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The steering may be not worked if operation continues.			
Related Information	• This warning is given only when the emergency steering is installed.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Decrease steering oil pressure	• Steering oil pressure is normal. ★ If the oil pressure is not normal, carry out troubleshooting for the hydraulic, mechanical system.			
	2	Defective steering oil pressure sensor (switch)	1) Turn starting switch OFF. 2) Disconnect connector F11. 3) Connect T-adapter.			
			Between F11 (Male) (A) and (C)	Steering oil pressure is low (Engine stopped).	Resistance	1✕ and below
				Steering oil pressure is normal (Engine started).	Resistance	1M✕ and above
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L22, F11. 3) Connect T-adapter.			
			Wiring harness between L22 (Female) (3) and F11 (Female) (C)	Resistance between L22 (Female) (3), F11 (Female) (C) and chassis ground		1M✕ and above
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L22. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L22 (Female) (3) and Chassis ground	Steering oil pressure is normal. [0.9 MPa {9.2 kg/cm^2}] and above	Voltage	20 - 30V
				Steering oil pressure is abnormal (low). [0.5 MPa {5.1 kg/cm^2}] and below	Voltage	1V and below

Related circuit diagram

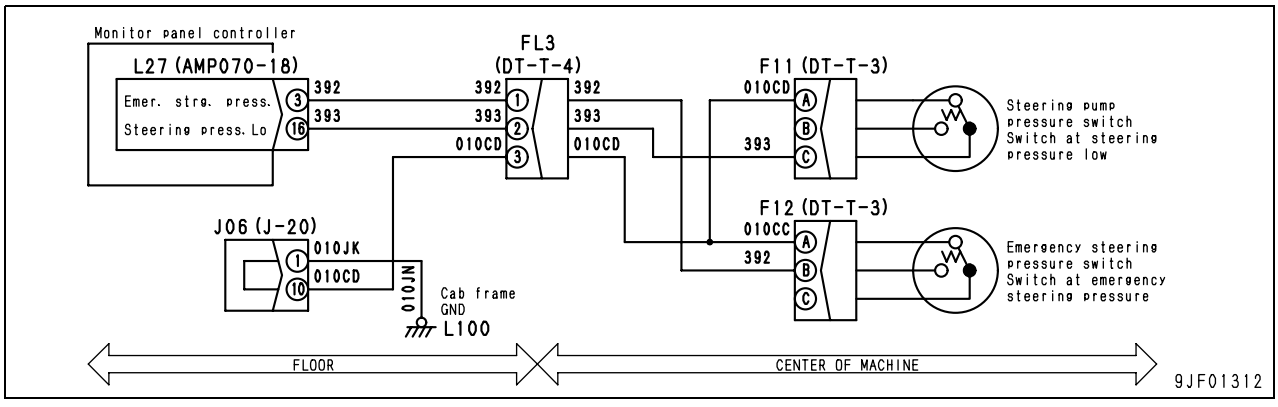


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Decreased steering oil pressure (L6)
E03	DDS5L6	MON		
Description of Trouble	• The steering oil pressure sensor signal circuit is always in the CLOSE state during the engine is revolved.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The steering may be not worked if operation continues.			
Related Information	• This warning is given only when the emergency steering is installed.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Decrease steering oil pressure	• Steering oil pressure is normal. ★ If the oil pressure is not normal, carry out troubleshooting for the hydraulic, mechanical system.			
	2	Defective steering oil pressure sensor (switch)	1) Turn starting switch OFF. 2) Disconnect connector F11. 3) Connect T-adapter.			
			Between F11 (Male) (A) and (C)	Steering oil pressure is low (Engine stopped).	Resistance	1✕ and below
				Steering oil pressure is normal (Engine started).	Resistance	1M✕ and above
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L27, F11. 3) Connect T-adapter.			
			Wiring harness between L27 (Female) (16) and F11 (Female) (C)	Resistance between L27 (Female) (16), F11 (Female) (C) and chassis ground		1M✕ and above
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L27 (Female) (16) and Chassis ground	Steering oil pressure is normal. [0.9 MPa {9.2 kg/cm^2}] and above	Voltage	20 - 30V
				Steering oil pressure is abnormal (low). [0.5 MPa {5.1 kg/cm^2}] and below	Voltage	1V and below

Related circuit diagram



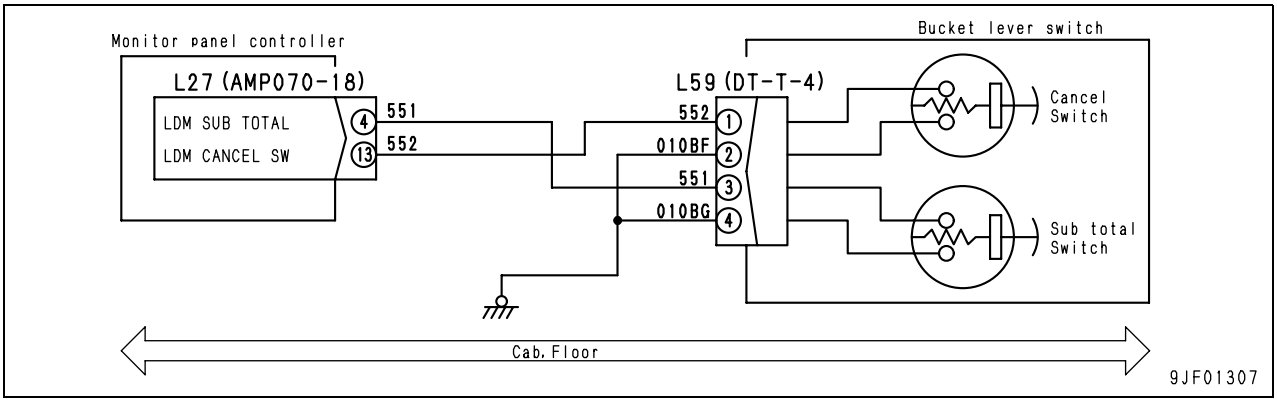
Failure Code [DDY0LD] Defective cancel switch (LD)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Defective cancel switch (LD)
E01	DDY0LD	MON		
Description of Trouble	• The cancel switch input circuit is kept closed for more than 1 minute.			
Machine monitor or controller Reaction	• The alarm is turned ON.			
Effect on Machine	• The weight indicated by the load meter cannot be canceled.			
Related Information	The cancel switch input signal (0/1) can be checked with the monitoring function (Code: 40904, D_IN_33).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective cancel switch (BUCKET LEVER FOR OPT LDM)	1) Turn starting switch OFF. 2) Disconnect connector L59. 3) Connect T-adapter.			
			Between L59 (female) (1) and (2)	When cancel switch is turned ON	Resistance	Max. 1 Ω
				When cancel switch is turned OFF	Resistance	Min. 1 MΩ
	2	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L27 and L59. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L27 (female) (13) and L59 (female) (1)	Resistance between L27 (female) (13), L59 (female) (1) and chassis ground		Min. 1 MΩ
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Turn starting switch ON.			
			Between L27 (13) and chassis ground	When cancel switch is turned ON	Voltage	Max. 1 V
				When cancel switch is turned OFF	Voltage	20 - 30 V

Related circuit diagram



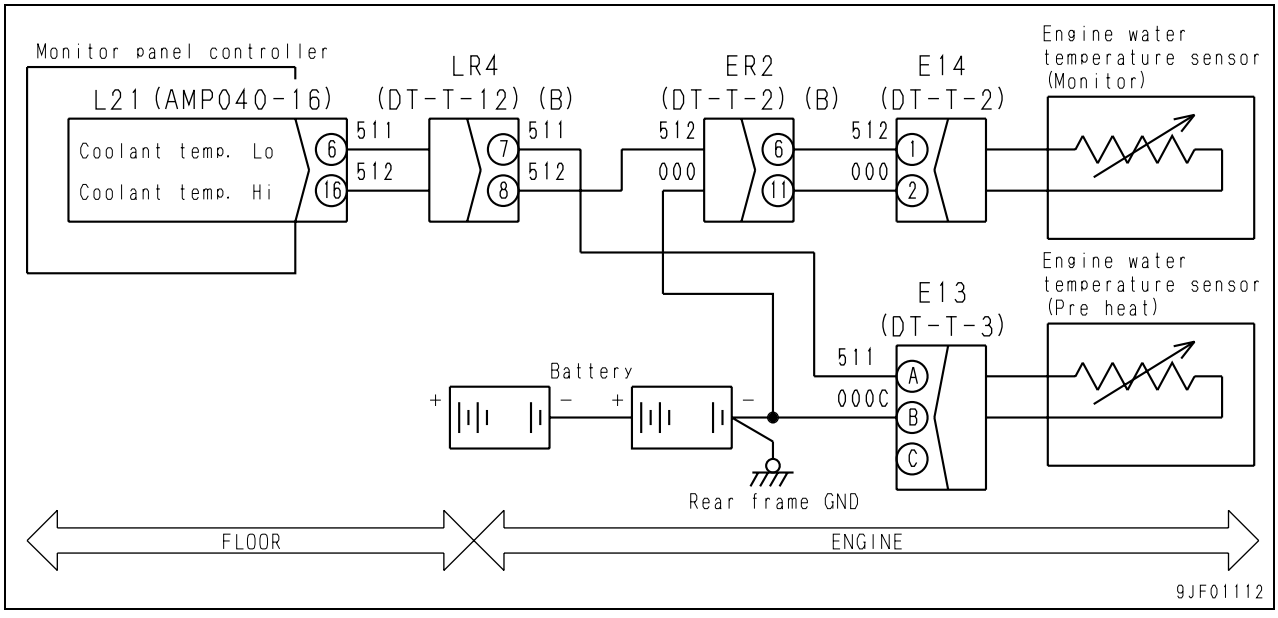
Failure Code [DGE2KX] (Engine water temperature (High temperature) sensor system failure (KX))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Engine water temperature (High temperature) sensor system failure (KX)
E01	DGE2KX	MON		
Description of Trouble	• The engine water temperature sensor input voltage is less 0.98V.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The engine water temperature gauge is in the MAX position.			
Related Information	• The engine water temperature is displayed by real-time monitoring code 04101.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective engine water temperature (High temperature) sensor	1) Turn starting switch OFF. 2) Disconnect connector E14. 3) Connect T-adapter.			
			Between E14 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L21, E14. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (16) and E14 (Female) (1)	Resistance between L21 (Female) (16), E14 (Female) (1) and chassis ground		1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (16) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram

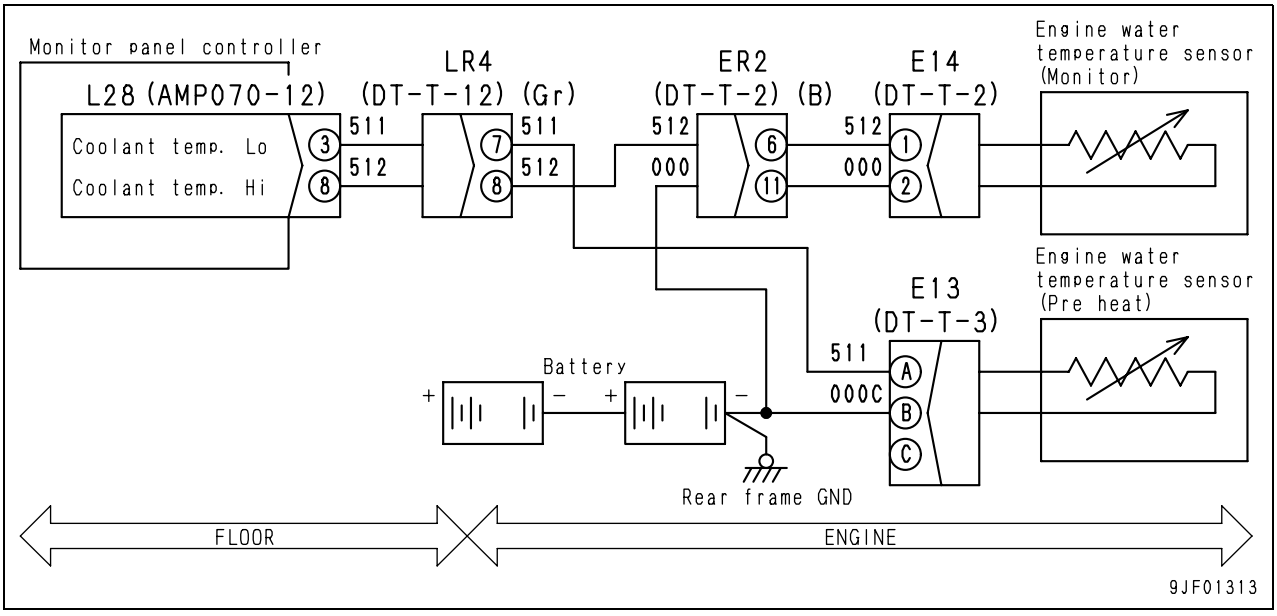


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Engine water temperature (High temperature) sensor system failure (KX)
E01	DGE2KX	MON		
Description of Trouble	• The engine water temperature sensor input voltage is less 0.98V.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The engine water temperature gauge is in the MAX position.			
Related Information	• The engine water temperature is displayed by real-time monitoring code 04101.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective engine water temperature (High temperature) sensor	1) Turn starting switch OFF. 2) Disconnect connector E14. 3) Connect T-adapter.			
			Between E14 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L28, E14. 3) Connect T-adapter.			
			Wiring harness between L28 (Female) (8) and E14 (Female) (1)	Resistance between L28 (Female) (8), E14 (Female) (1) and chassis ground		1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L28 (Female) (8) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram



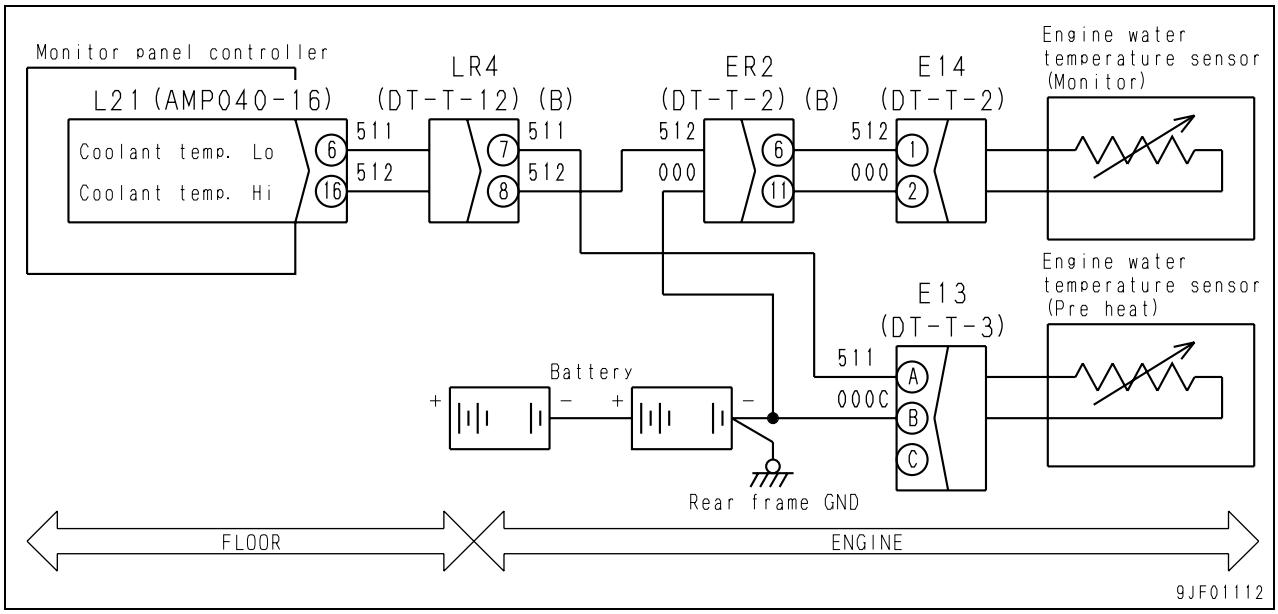
Failure Code [DGE3L6] (Engine water temperature (Low temperature) sensor system failure (L6))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Engine water temperature (Low temperature) sensor system failure (L6)
E01	DGE3L6	MON		
Description of Trouble	• After starting the engine, and running it for more than 30 minutes, engine water temperature (low temperature) sensor signal becomes abnormal 4.5V			
Machine monitor or controller Reaction	• The Activates an alarm.			
Effect on Machine	• After starting switch is turned ON, system always carries out automatic preheating.			
Related Information	• The engine water temperature (low temperature) is displayed by real-time monitoring code 04101.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective engine water temperature (Low temperature) sensor	1) Turn starting switch OFF. 2) Disconnect connector E13. 3) Connect T-adapter.			
			Between E13 (Male) (A) and (B)	Normal temperature (25°C).	Resistance	3.1 - 5.7kΩ
				When 100°C	Resistance	0.2 - 0.7kΩ
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L21, E13. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (6) and E13 (Female) (A)		Resistance	1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (6) and chassis ground	Normal temperature (25°C).	Resistance	3.1 - 5.7kΩ
				When 100°C	Resistance	0.2 - 0.7kΩ

Related circuit diagram

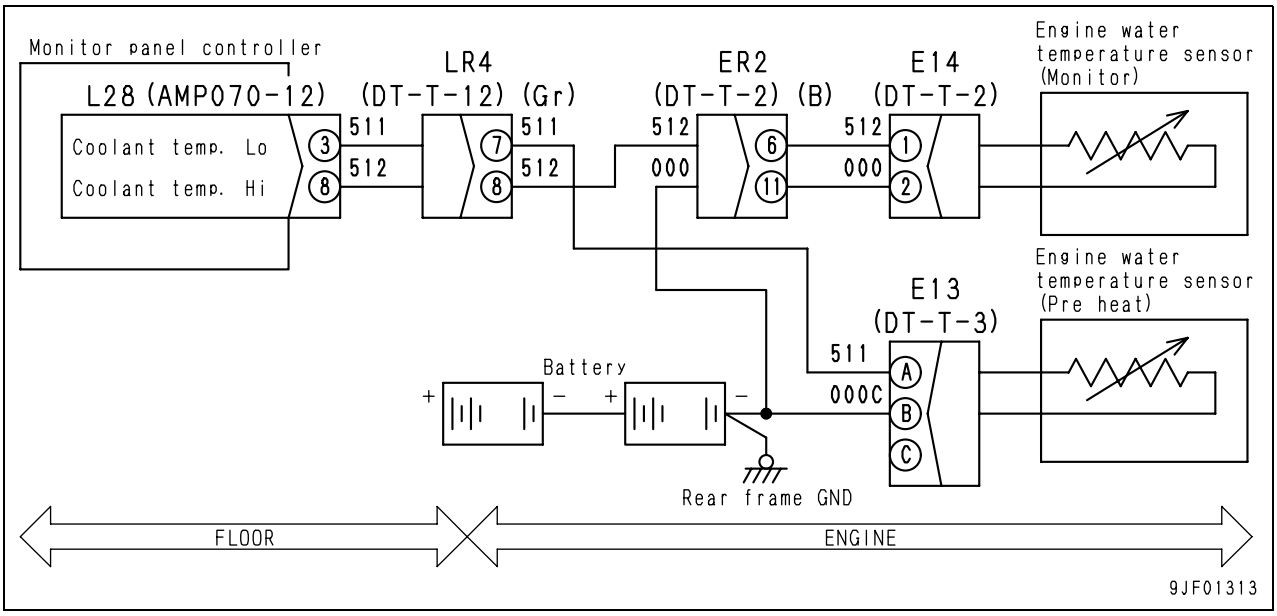


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Engine water temperature (Low temperature) sensor system failure (L6)
E01	DGE3L6	MON		
Description of Trouble	• After starting the engine, and running it for more than 30 minutes, engine water temperature (low temperature) sensor signal becomes abnormal 4.5V			
Machine monitor or controller Reaction	• The Activates an alarm.			
Effect on Machine	• After starting switch is turned ON, system always carries out automatic preheating.			
Related Information	• The engine water temperature (low temperature) is displayed by real-time monitoring code 04101.			

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective engine water temperature (Low temperature) sensor	1) Turn starting switch OFF. 2) Disconnect connector E13. 3) Connect T-adapter.			
			Between E13 (Male) (A) and (B)	Normal temperature (25°C).	Resistance	3.1 - 5.7kΩ
				When 100°C	Resistance	0.2 - 0.7kΩ
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L28, E13. 3) Connect T-adapter.			
			Wiring harness between L28 (Female) (3) and E13 (Female) (A)		Resistance	1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L28 (Female) (3) and chassis ground	Normal temperature (25°C).	Resistance	3.1 - 5.7kΩ
				When 100°C	Resistance	0.2 - 0.7kΩ

Related circuit diagram



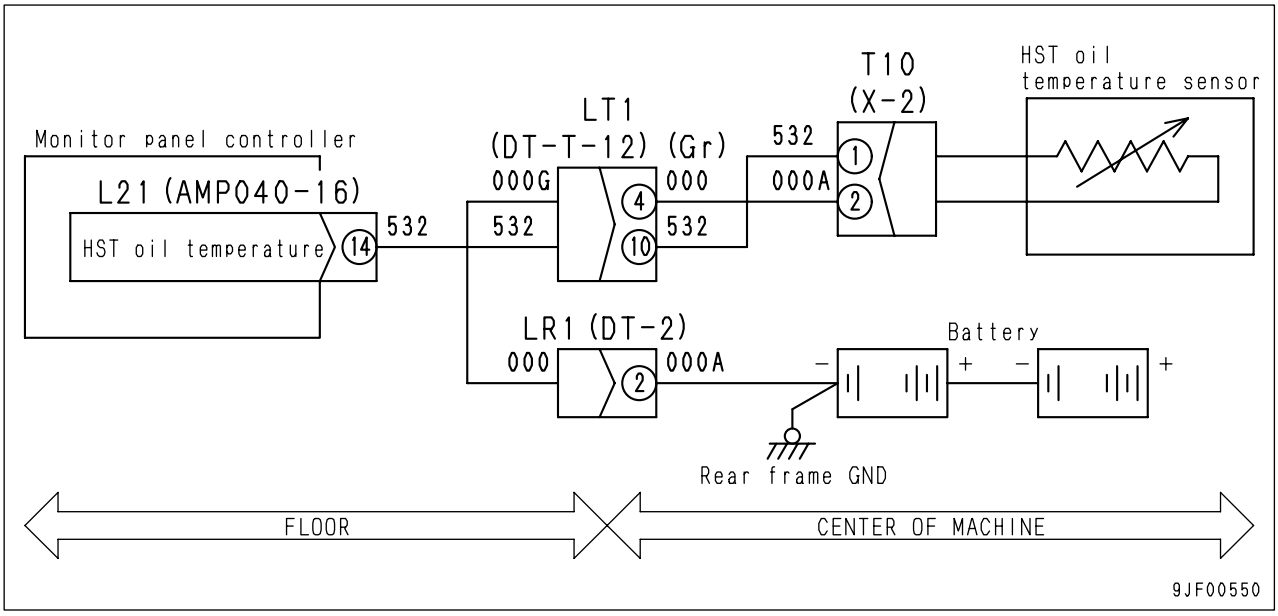
Failure Code [DGH1KX] (HST oil temperature sensor system failure (KX))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	HST oil temperature sensor system failure (KX)
E01	DGH1KX	MON		
Description of Trouble	• The HST oil temperature sensor input voltage is less 0.98V.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The HST oil temperature gauge is in the MAX position.			
Related Information	• The HST oil temperature is displayed by real-time monitoring code 30100.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective HST oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector T10. 3) Connect T-adapter.			
			Between T10 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L21, T10. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (14) and T10 (Female) (1)	Resistance between L21 (Female) (14), T10 (Female) (1) and chassis ground		1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (14) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram

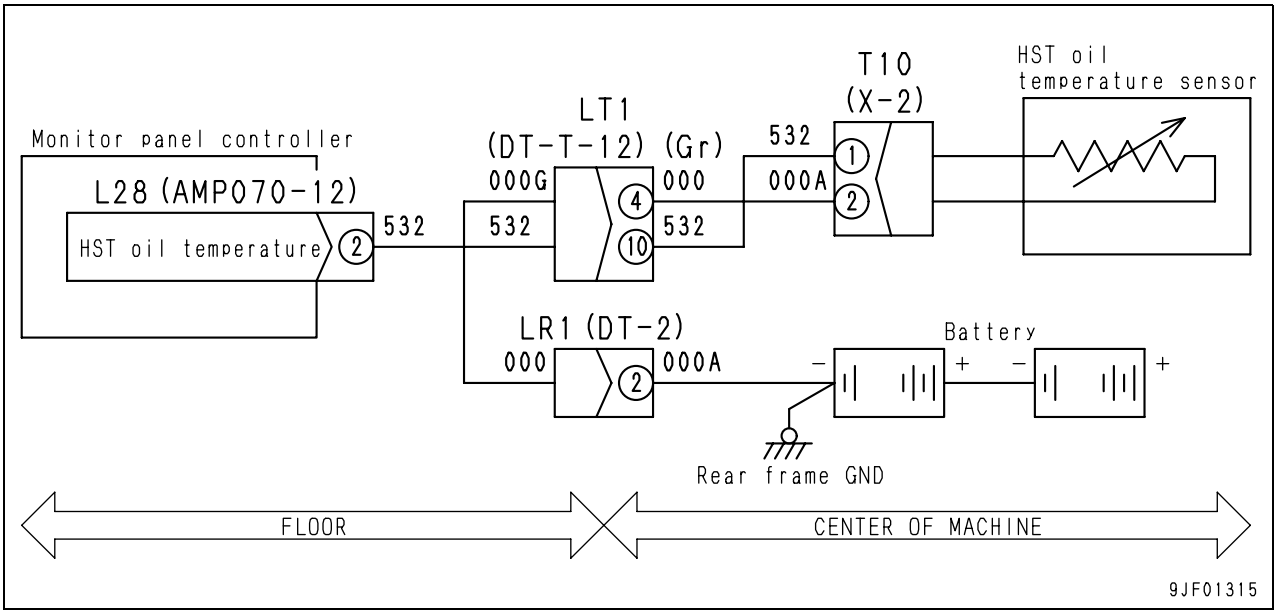


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	HST oil temperature sensor system failure (KX)
E01	DGH1KX	MON		
Description of Trouble	• The HST oil temperature sensor input voltage is less 0.98V.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The HST oil temperature gauge is in the MAX position.			
Related Information	• The HST oil temperature is displayed by real-time monitoring code 30100.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective HST oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector T10. 3) Connect T-adapter.			
			Between T10 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L28, T10. 3) Connect T-adapter.			
			Wiring harness between L28 (Female) (2) and T10 (Female) (1)	Resistance between L28 (Female) (2), T10 (Female) (1) and chassis ground		1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L28 (Female) (2) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram



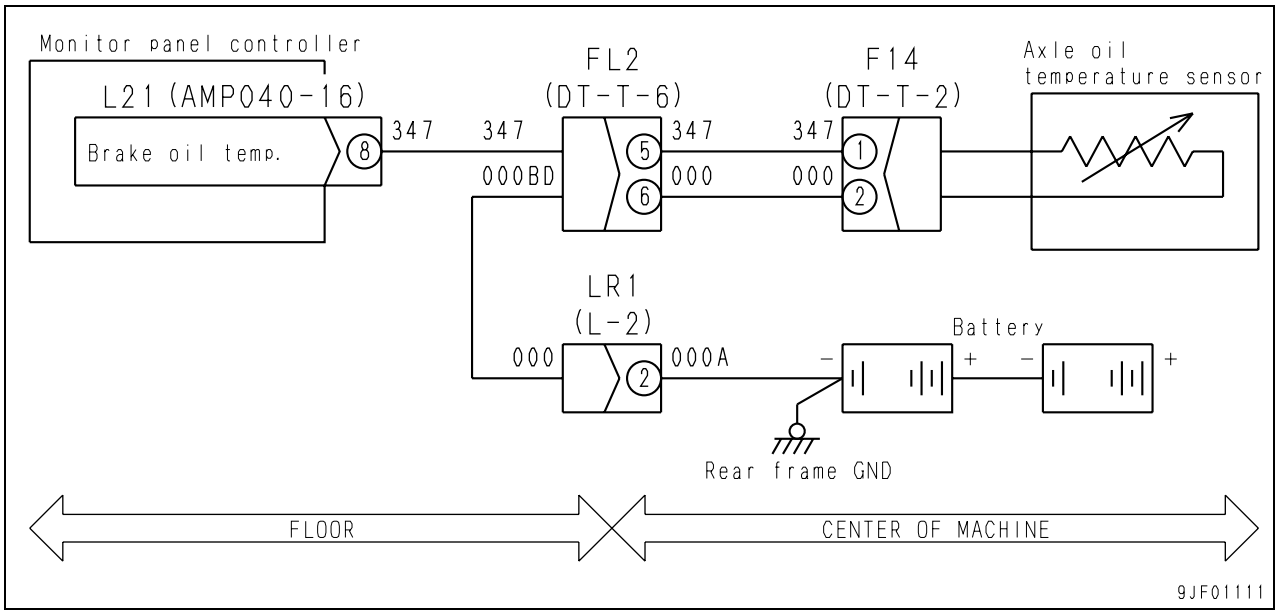
Failure Code [DGR4KA] (Axle oil temperature sensor system discontinuity (KA))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Axle oil temperature sensor system discontinuity (KA)
E01	DGR4KA	MON		
Description of Trouble	• The axle oil temperature sensor signal is 4.5 V or above.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The axle oil temperature is displayed by real-time monitoring code 30202.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective axle oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adapter.			
			Between F14 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L21, F14. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (8) and F14 (Female) (1)		Resistance	1Ω and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (8) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram

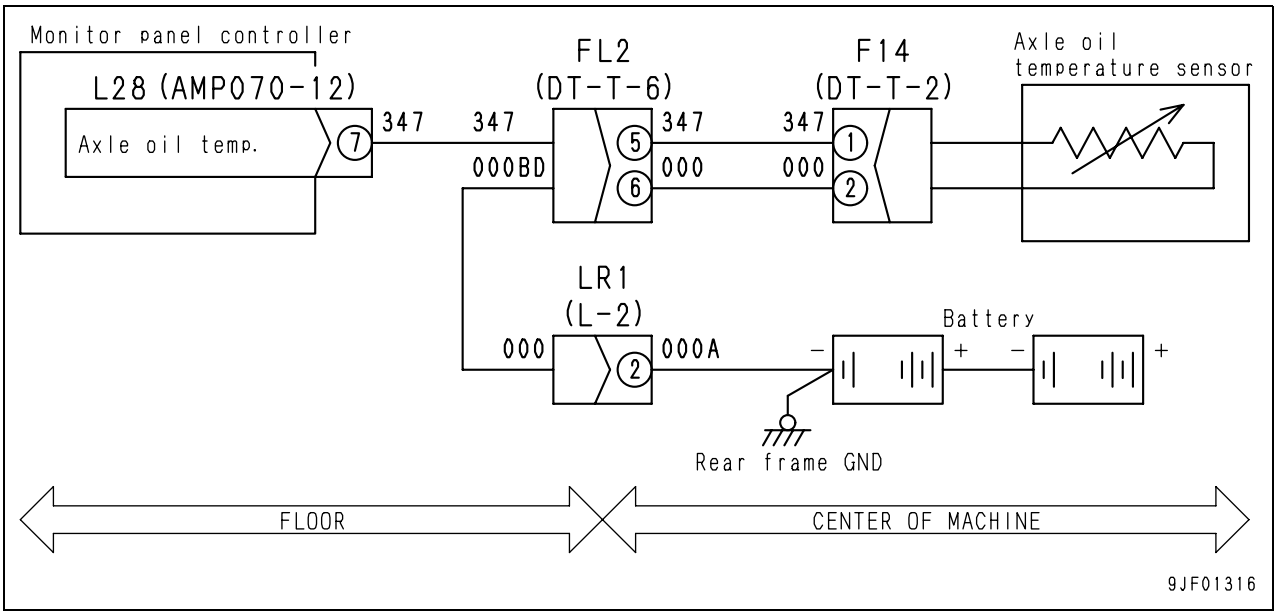


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Axle oil temperature sensor system discontinuity (KA)
E01	DGR4KA	MON		
Description of Trouble	• The axle oil temperature sensor signal is 4.5 V or above.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The axle oil temperature is displayed by real-time monitoring code 30202.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective axle oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adapter.			
			Between F14 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L28, F14. 3) Connect T-adapter.			
			Wiring harness between L28 (Female) (7) and F14 (Female) (1)		Resistance	1Ω and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L28 (Female) (7) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram



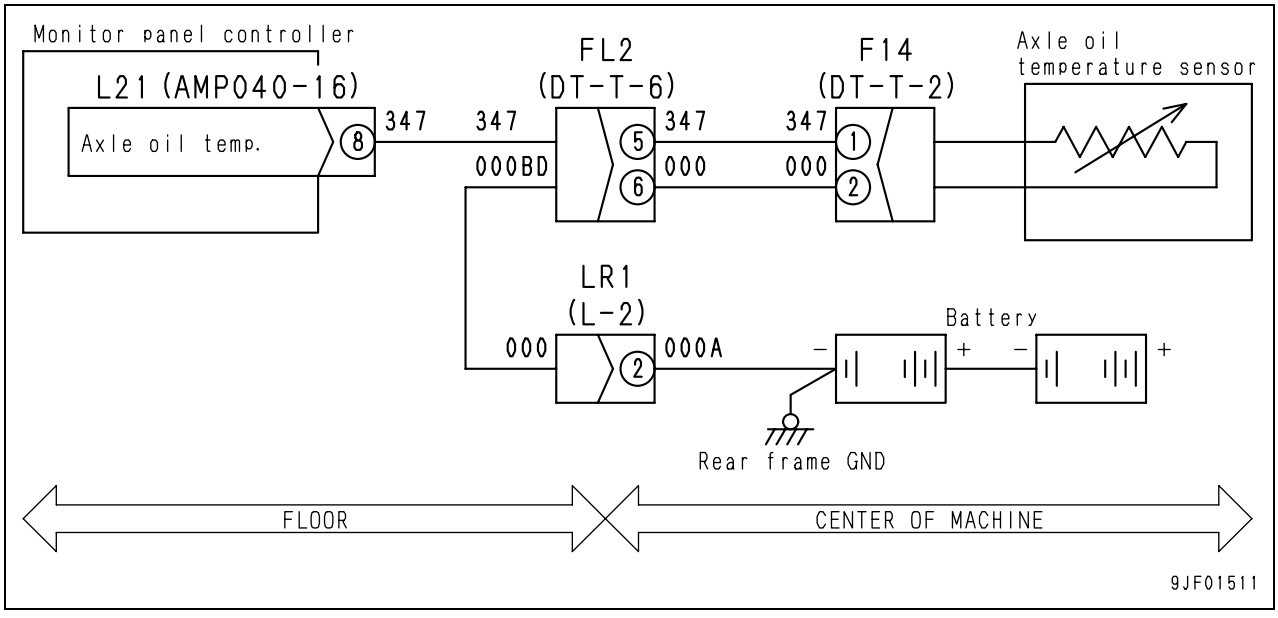
Failure Code [DGR4KX] (Axle oil temperature sensor system failure (KX))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Axle oil temperature sensor system failure (KX)
E01	DGR4KX	MON		
Description of Trouble	• The brake oil temperature sensor input voltage is less 0.98V.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The axle oil temperature is displayed by real-time monitoring code 30202.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective axle oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adapter.			
			Between F14 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L21, F14. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (8) and F14 (Female) (1)	Resistance between L21 (Female) (8), F14 (Female) (1) and chassis ground		1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (8) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram

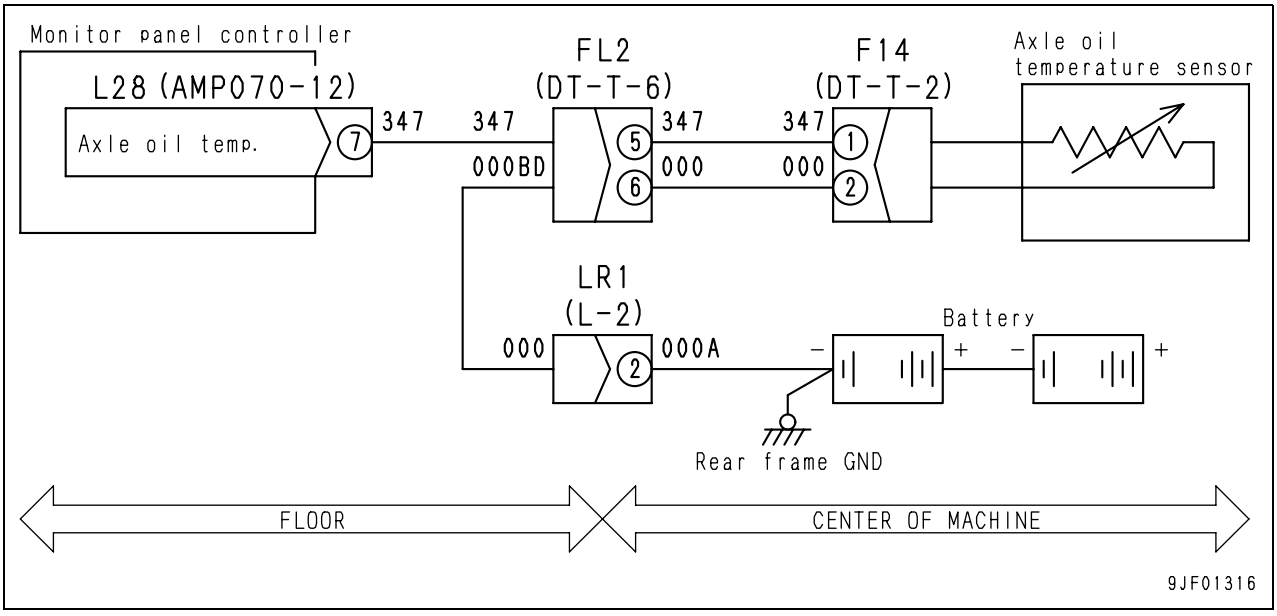


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Axle oil temperature sensor system failure (KX)
E01	DGR4KX	MON		
Description of Trouble	• The brake oil temperature sensor input voltage is less 0.98V.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The axle oil temperature is displayed by real-time monitoring code 30202.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective axle oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adapter.			
			Between F14 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L28, F14. 3) Connect T-adapter.			
			Wiring harness between L28 (Female) (7) and F14 (Female) (1)	Resistance between L28 (Female) (7), F14 (Female) (1) and chassis ground		1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L28 (Female) (7) and chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram



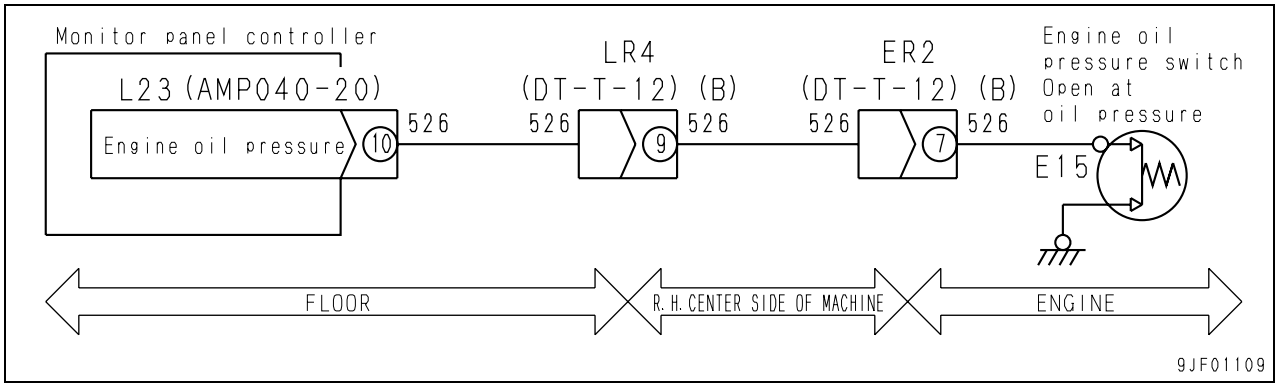
Failure Code [DHE4L6] (Engine oil pressure sensor system discontinuity (L6))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Engine oil pressure sensor system discontinuity (L6)
E01	DHE4L6	MON		
Description of Trouble	• The engine oil pressure sensor circuit is always in the CLOSE state when the engine is stopped.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	•			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective engine oil pressure sensor (switch)	1) Turn starting switch OFF. 2) Disconnect connector E15. 3) Connect T-adapter.			
			Between engine oil pressure sensor terminal E15 and chassis ground	Engine stopped.	Resistance	1✕ and below
				Engine rotating.	Resistance	1M✕ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L22, E15. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (10) and E15 (Female) (C)		Resistance	1✕ and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L23 (Female) (10) and Chassis ground	Engine stopped.	Voltage	1V and below
				Engine rotating.	Voltage	20 - 30V

Related circuit diagram

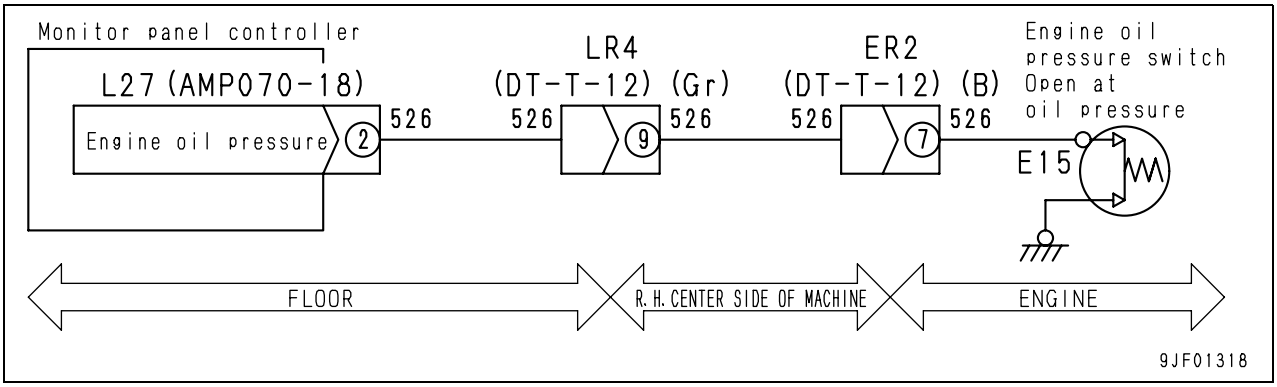


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Engine oil pressure sensor system discontinuity (L6)
E01	DHE4L6	MON		
Description of Trouble	• The engine oil pressure sensor circuit is always in the CLOSE state when the engine is stopped.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	•			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective engine oil pressure sensor (switch)	1) Turn starting switch OFF. 2) Disconnect connector E15. 3) Connect T-adapter.			
			Between engine oil pressure sensor terminal E15 and chassis ground	Engine stopped.	Resistance	1Ω and below
				Engine rotating.	Resistance	1MΩ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L27, E15. 3) Connect T-adapter.			
			Wiring harness between L27 (Female) (2) and E15 (Female) (C)		Resistance	1Ω and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L27 (Female) (2) and Chassis ground	Engine stopped.	Voltage	1V and below
				Engine rotating.	Voltage	20 - 30V

Related circuit diagram



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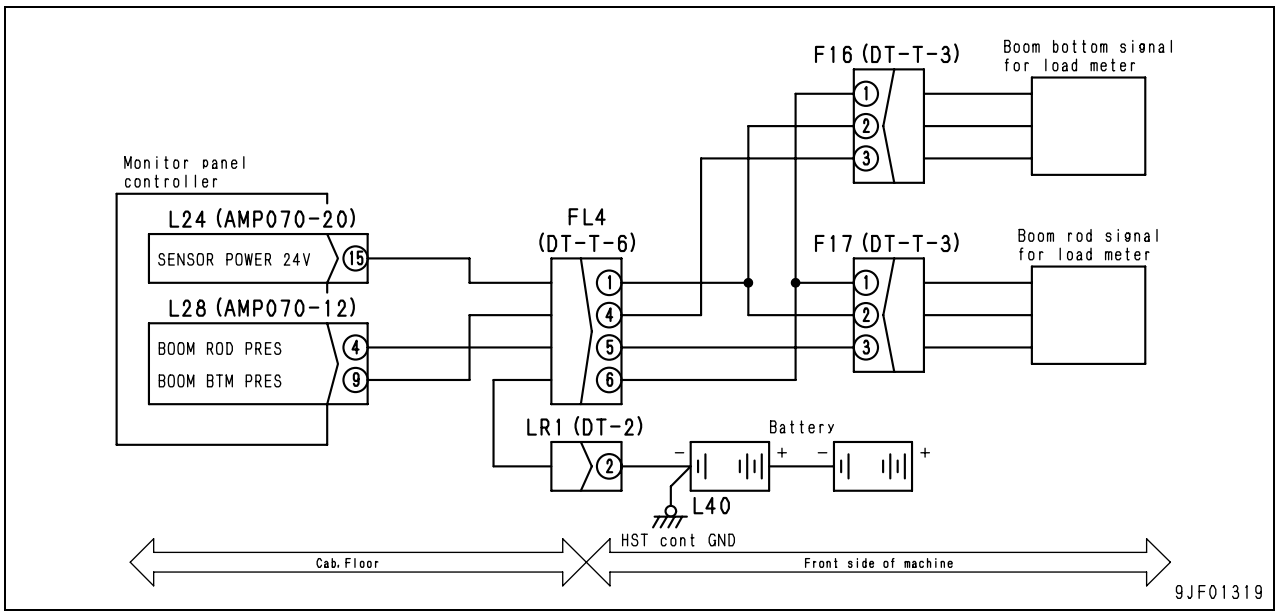
Failure Code [DHPCKX] Defective bottom pressure sensor (KX)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Disconnection in bottom pressure sensor system (KX)
E01	DHPCKX	MON		
Description of Trouble	• The input voltage from the bottom pressure sensor is below 0.5 V.			
Machine monitor or controller Reaction	• The alarm is turned ON. • The load is not displayed.			
Effect on Machine	• The alarm is turned ON. • The load is not displayed.			
Related Information	• The bottom pressure signal (0.01 MPa) can be checked with the monitoring function (Code: 40400).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective boom pressure sensor (on bottom side)	1) Turn starting switch OFF. 2) Disconnect connector F16. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between F16 (B) and (A)		Voltage	20 - 30 V
			Between F16 (C) and (A)	When operated	Voltage	0.7 - 5.3 V
				When opened to atmosphere	Voltage	0.5 - 1.5 V
	2	Disconnection in wiring harness (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connectors L24, L28, and F16. 3) Connect T-adapter.			
			Wiring harness between L28 (female) (9) and F16 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between L24 (female) (15) and F16 (female) (B)		Resistance	Max. 1 Ω
	3	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L28, F16, and F17. 3) Connect T-adapter.			
			Wiring harness between L28 (female) (9) and F16 (female) (C)	Resistance between L28 (female) (9), F16 (female) (C) and chassis ground		Min. 1 MΩ
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connectors L24 and L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (15) and chassis ground		Voltage	20 - 30 V
			Between L28 (9) and chassis ground	When operated	Voltage	0.7 - 5.3 V
				When opened to atmosphere	Voltage	0.5 - 1.5 V

Related circuit diagram



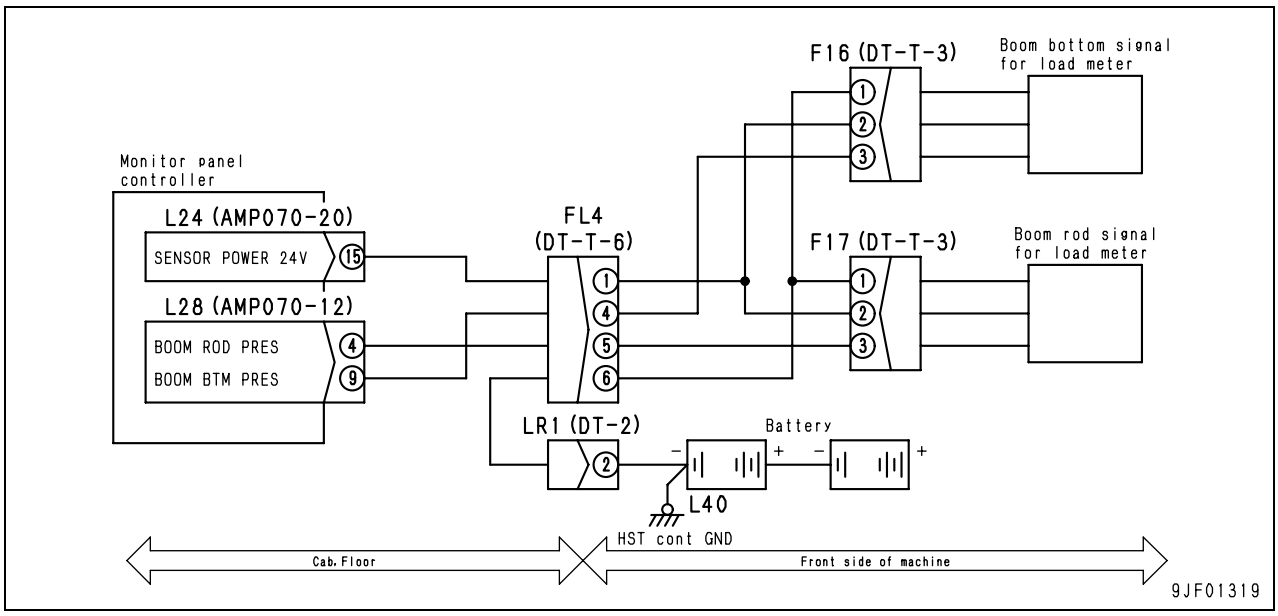
Failure Code [DHPDKX] Defective rod pressure sensor (KX)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Disconnection in rod pressure sensor system (KX)
E01	DHPDKX	MON		
Description of Trouble	• The input voltage from the head pressure (rod pressure) sensor is below 0.5 V.			
Machine monitor or controller Reaction	• The alarm is turned ON. • The load is not displayed.			
Effect on Machine	• The alarm is turned ON. • The load is not displayed.			
Related Information	• The head pressure signal (0.01 MPa) can be checked with the monitoring function (Code: 40500).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective boom pressure sensor (on head side)	1) Turn starting switch OFF. 2) Disconnect connector F16. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between F17 (B) and (A)		Voltage	20 - 30 V
			Between F17 (C) and (A)	When operated	Voltage	0.7 - 5.3 V
				When opened to atmosphere	Voltage	0.5 - 1.5 V
	2	Disconnection in wiring harness (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connectors L24, L28, F16, and F17. 3) Connect T-adapter.			
			Wiring harness between L28 (female) (4) and F17 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between L24 (female) (15) and F17 (female) (B)		Resistance	Max. 1 Ω
	3	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L28, F16, and F17. 3) Connect T-adapter.			
			Wiring harness between L28 (female) (4) and F17 (female) (C)	Resistance between L28 (female) (4), F17 (female) (C) and chassis ground		Min. 1 MΩ
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connectors L24 and L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (15) and chassis ground		Voltage	20 - 30 V
			Between L28 (4) and chassis ground	When operated	Voltage	0.7 - 5.3 V
				When opened to atmosphere	Voltage	0.5 - 1.5 V

Related circuit diagram



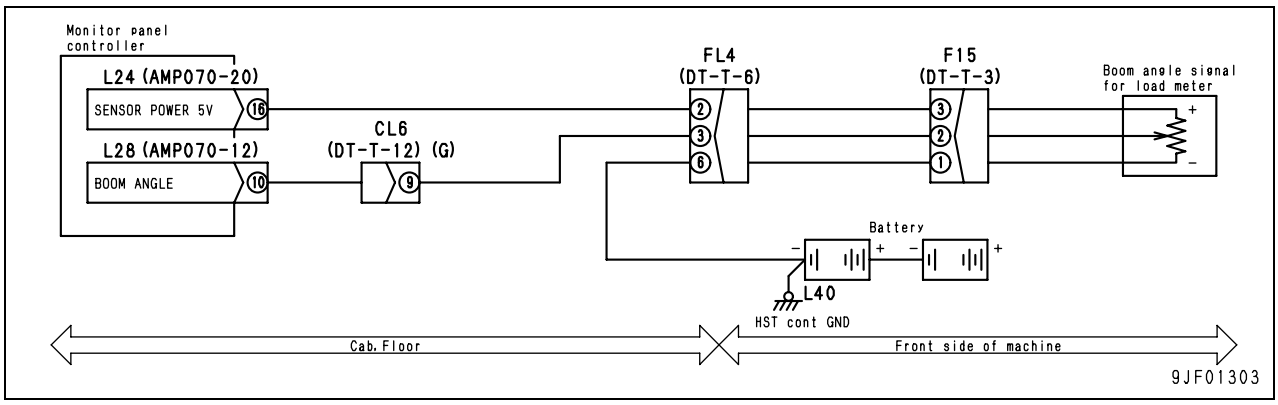
Failure Code [DKA0KX] Defective boom angle sensor (KX)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Defective boom angle sensor (KX)
E01	DKA0KX	MON		
Description of Trouble	• The input voltage from the boom angle sensor is below 1 V or above 4 V.			
Machine monitor or controller Reaction	• The alarm is turned ON. • The load is not displayed.			
Effect on Machine	• The alarm is turned ON. • The load is not displayed.			
Related Information	• The boom angle signal (°) can be checked with the monitoring function (Code: 06001).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective boom angle sensor	1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Connect T-adapter.			
			Between F15 (male) (C) and (A)		Resistance	4 - 6 kΩ
			1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Between F15 (C) and (A)		Voltage	4.75 - 5.25 V
			Between F15 (B) and (A)	When boom is raised fully	Voltage	3.5 - 4.0 V
				When boom is lowered fully	Voltage	1.0 - 2.0 V
	2	Disconnection in wiring harness (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connectors L24, L28, and F15. 3) Connect T-adapter.			
			Wiring harness between L24 (female) (16) and F15 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between L28 (female) (10) and F15 (female) (B)		Resistance	Max. 1 Ω
	3	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L28 and F15. 3) Connect T-adapter.			
			Wiring harness between L28 (female) (10) and F15 (female) (B)	Resistance between L24 (female) (10), F15 (female) (B) and chassis ground		Min. 1 MΩ
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connectors L24 and L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (16) and chassis ground		Voltage	4.75 - 5.25 V
			Between L28 (10) and chassis ground	When boom is raised fully	Voltage	3.5 - 4.0 V
				When boom is lowered fully	Voltage	1.0 - 2.0 V

Related circuit diagram



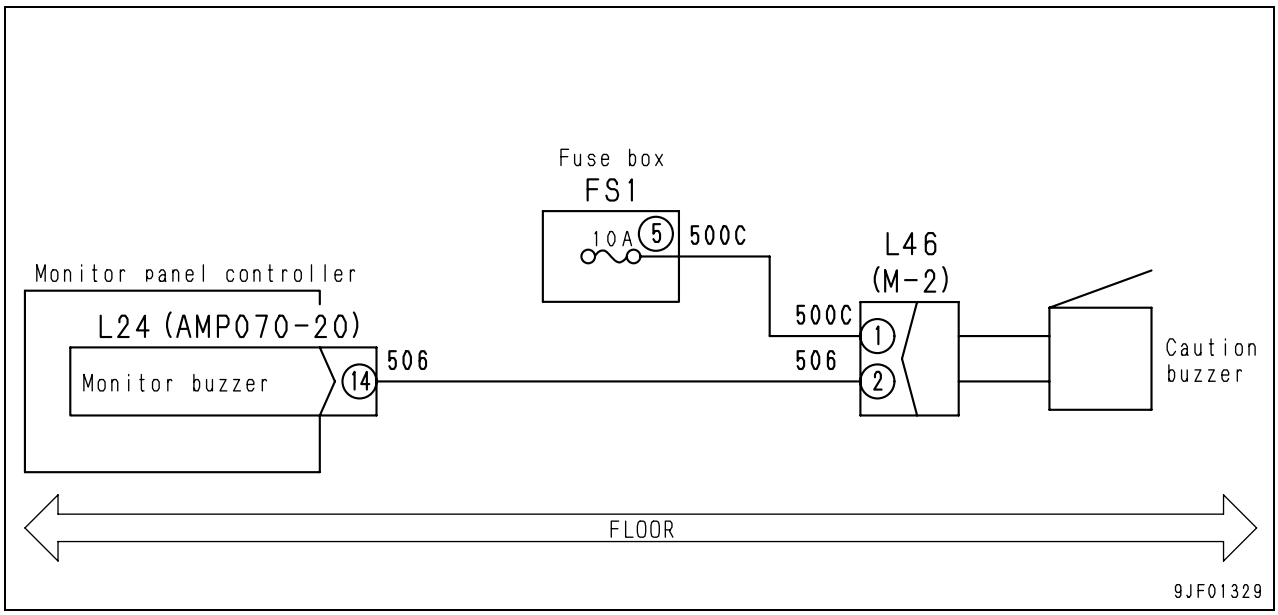
Failure Code [DV00KB] Short circuit of alarm buzzer output (KB)

Only load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Short circuit of alarm buzzer output (KB) (When engine is stopped, signal of alternator terminal R is turned ON)
E01	DV00KB	MON		
Description of Trouble	• There is a short circuit in the alarm buzzer output system.			
Machine monitor or controller Reaction	• The alarm is turned ON. • The output is stopped until the starting switch is turned OFF.			
Effect on Machine	• The alarm buzzer does not sound until the starting switch is turned OFF.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective alarm buzzer	1) Turn starting switch OFF. 2) Disconnect connector L46. 3) Connect T-adapter. 4) Connect connector. 5) 5 seconds after starting switch is turned ON or later			
			Short-circuit L46 (female) (2) to chassis ground.	Alarm buzzer sounds.	Buzzer is normal.	
				Alarm buzzer does not sound.	Buzzer is defective.	
	2	Short circuit with power source in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L24 and L46. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Wiring harness between L24 (female) (14) and L46 (female) (2)	Voltage between L24 (female) (14), L46 (female) (2) and chassis ground	Max. 1 V	
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L24. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (14) and chassis ground	Turn starting switch ON.	Voltage	20 - 30 V
				For 1 second after 2 seconds after starting switch is turned ON (Alarm buzzer does not sound).	Voltage	20 - 30 V
				For 2 seconds after starting switch is turned ON (Alarm buzzer sounds).	Voltage	Max. 1 V

Related circuit diagram



Troubleshooting Code [MON-1] (The parking brake indicator lamp does not light ON)

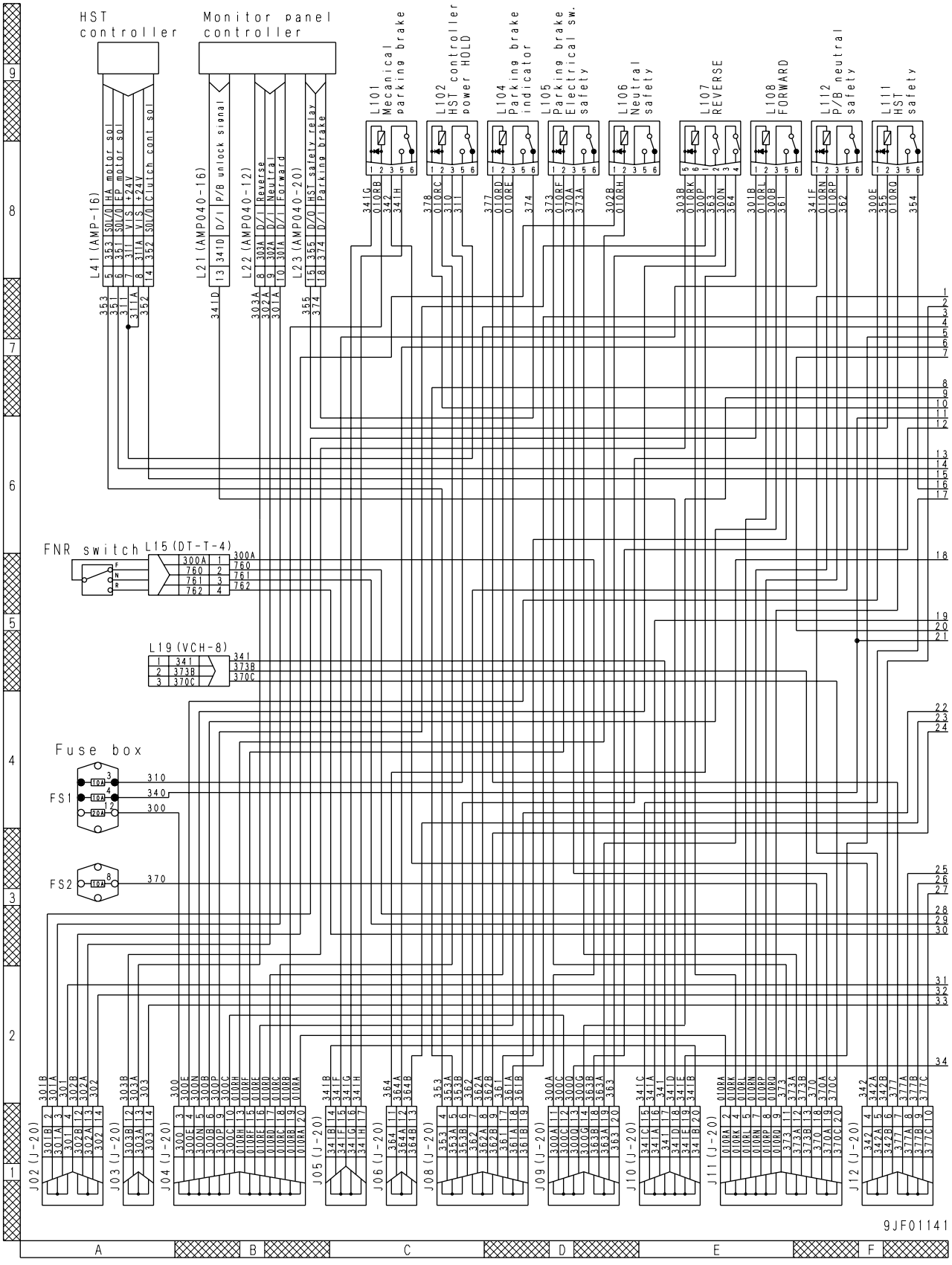
Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	The parking brake indicator lamp does not light ON
-	-	-		
Description of Trouble	• The parking brake indicator lamp does not light ON when the parking brake switch is turned ON.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The parking brake indicator lamp does not light ON when the parking brake switch is turned ON.			
Related Information	• If the parking brake does not work normally, carry out troubleshooting after carrying out the applicable troubleshooting.			

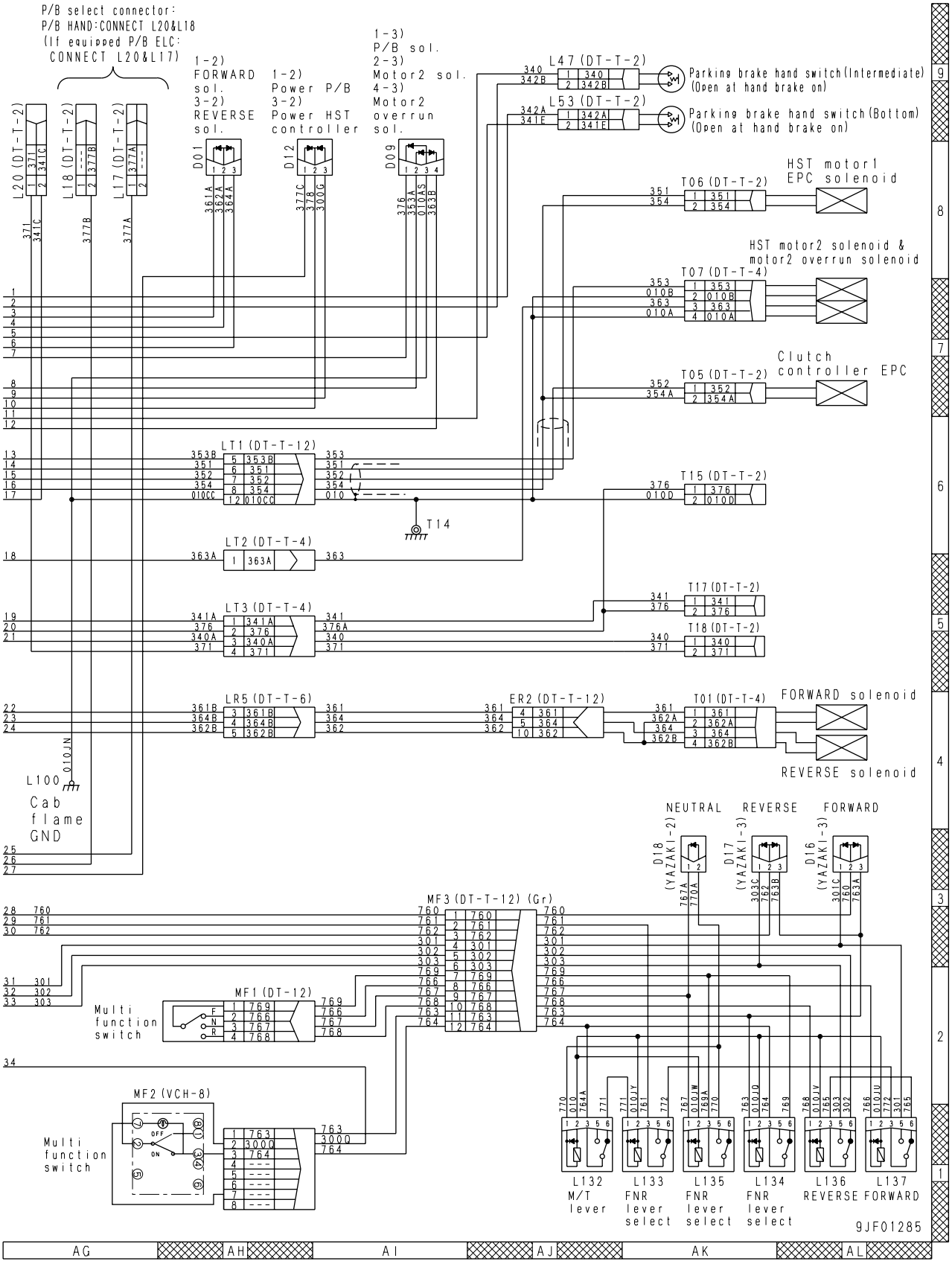
	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective parking brake indicator lamp relay (L104)	1) Turn starting switch OFF. 2) Interchange relay (L104) with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch.			
			Does condition become normal when parking brake indicator lamp relay (L104) is interchanged with normal relay?	The condition is abnormal.		Relay (L104) is normal.
				The condition is normal.		Defective relay (L104)
			1) Turn starting switch OFF. 2) Disconnect connector L104. 3) Solid part check.			
			Between L104 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L104. 3) Solid part check. 4) Applies impressed voltage between L104 (Male) (1) - (2)			
			Between L104 (Male) (3) and (5)	Applies 24V impressed voltage between L104 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L104 (Male) (1) - (2)	Resistance	1MΩ and above
	2	Defective mechanical parking brake relay (L101)	1) Turn starting switch OFF. 2) Replace L101 with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch.			
			When mechanical parking brake relay (L101) is replaced, does condition becomes normal?	No		Relay (L101) is normal.
				Yes		Relay (L101) is defective.
			1) Turn starting switch OFF. 2) Disconnect connector L101. 3) Check relay unit.			
			Between L101 (male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L101. 3) Check relay unit. 4) Apply normal voltage between L101 (male) (1) and (2).			
			Between L101 (male) (3) and (4)	Apply 24 V between (1) and (2).	Resistance	1Ω and below
				Do not apply 24 V between (1) and (2).	Resistance	1MΩ and above
	3	Defective parking brake lever middle position detection switch (Mechanical type)	1) Turn starting switch OFF. 2) Disconnect connector L47. 3) Connect T-adapter.			
			Between L47 (Male) (1) and (2)	Parking brake lever is placed LOCK to MIDDLE.	Resistance	1Ω and below
				Parking brake lever is placed MIDDLE to FREE.	Resistance	1MΩ and above
	4	Defective parking brake lever lowest position detection switch (Mechanical type)	1) Turn starting switch OFF. 2) Disconnect connector L53. 3) Connect T-adapter.			
			Between L53 (Male) (1) and (2)	Set parking brake lever to bottom position.	Resistance	1Ω and below
				Set parking brake lever to any position other than bottom position.	Resistance	1MΩ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	5	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L23, L47, L53, L104 and fuse T18. 3) Connect T-adapter. 4) Check that connector L20 is connected to L18.			
			Wiring harness between L23 (Female) (18) and L104 (Female) (6)		Resistance	1Ω and below
			Wiring harness between L104 (Female) (3) and chassis ground		Resistance	1Ω and below
			Wiring harness between L104 (Female) (2) and chassis ground		Resistance	1Ω and below
			Wiring harness between L104 (Female) (1) and J12 (Female) (7)		Resistance	1Ω and below
			Wiring harness between L53 (Female) (1) and J12 (Female) (5)		Resistance	1Ω and below
			Wiring harness between J12 (Female) (6) and L47 (Female) (2)		Resistance	1Ω and below
			Wiring harness between L47 (Female) (1) and fuse FS1 (4)		Resistance	1Ω and below
	6	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector L23, L53, L47, L104. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (18) and L104 (Female) (5) *	Resistance between L23 (Female) (18), L104 (Female) (5) and chassis ground		1MΩ and above
			Wiring harness between L104 (Female) (1) and J12 (Female) (7)	Resistance between L104 (Female) (1) and chassis ground		1MΩ and above
			Wiring harness between J10 (Female) (19) and L53 (Female) (2)	Resistance between L53 (Female) (2) and chassis ground		1MΩ and above
			Wiring harness between L53 (Female) (1) and J12 (Female) (5), (6) and L47 (Female) (2)	Resistance between L53 (Female) (1) and chassis ground		1MΩ and above
			Wiring harness between L47 (Female) (1) and fuse FS1 (4)	Resistance between L47 (Female) (1) and chassis ground		1MΩ and above
			★ In the above case (Other than marked mark (*)), the fuse is blown.			
	7	Defective junction connector (J10) and (J12)	Carry out inspection, and if any abnormality is found, repair or replace.			
	8	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L23 (Female) (18) and chassis ground	Parking brake lever is placed PARKING.	Voltage	1V and below
				Parking brake lever is placed other than FREE.	Voltage	20 - 30V

Related circuit diagram



Related circuit diagram



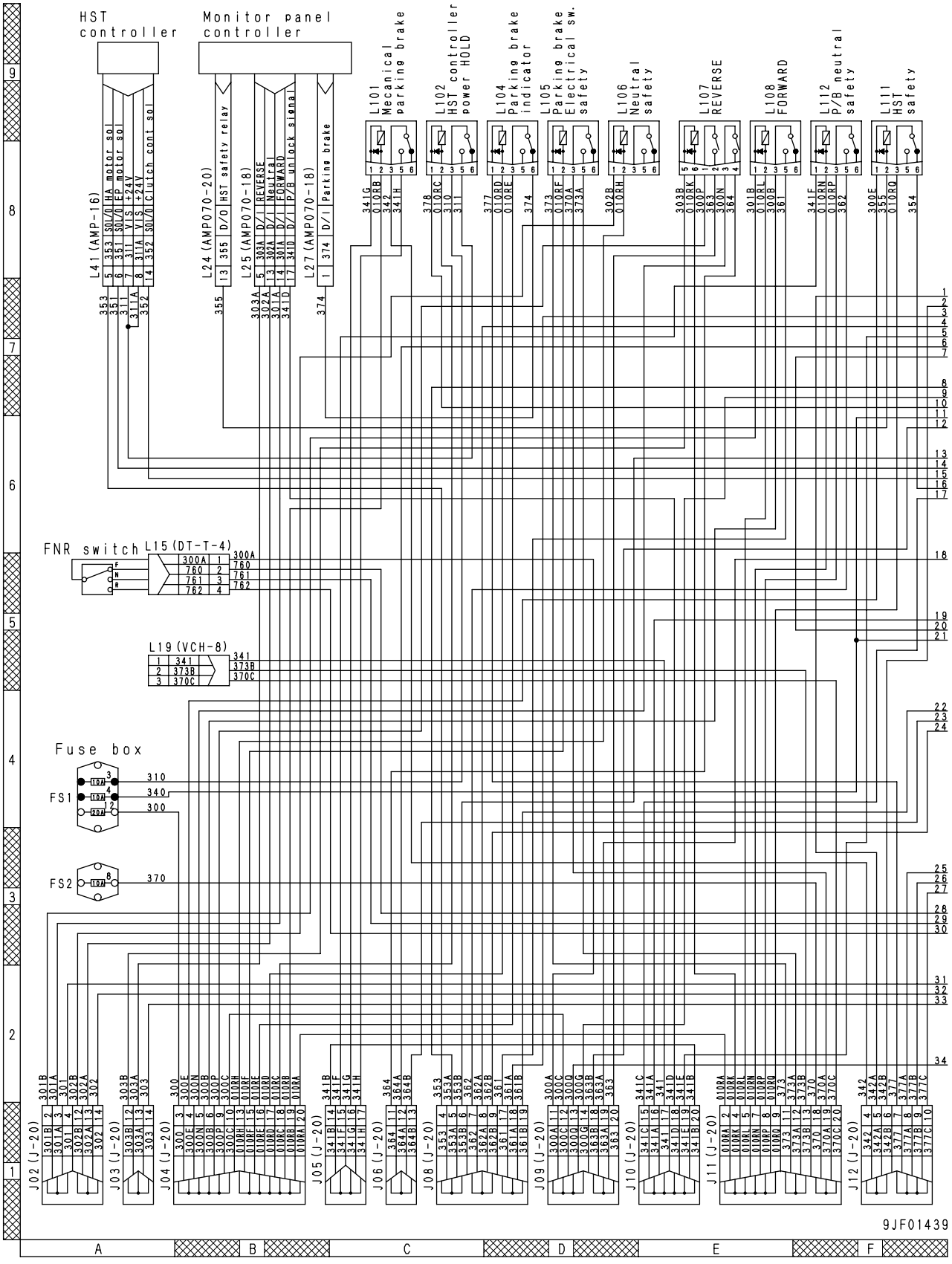
Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	The parking brake indicator lamp does not light ON
-	-	-		
Description of Trouble	• The parking brake indicator lamp does not light ON when the parking brake switch is turned ON.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The parking brake indicator lamp does not light ON when the parking brake switch is turned ON.			
Related Information	• If the parking brake does not work normally, carry out troubleshooting after carrying out the applicable troubleshooting.			

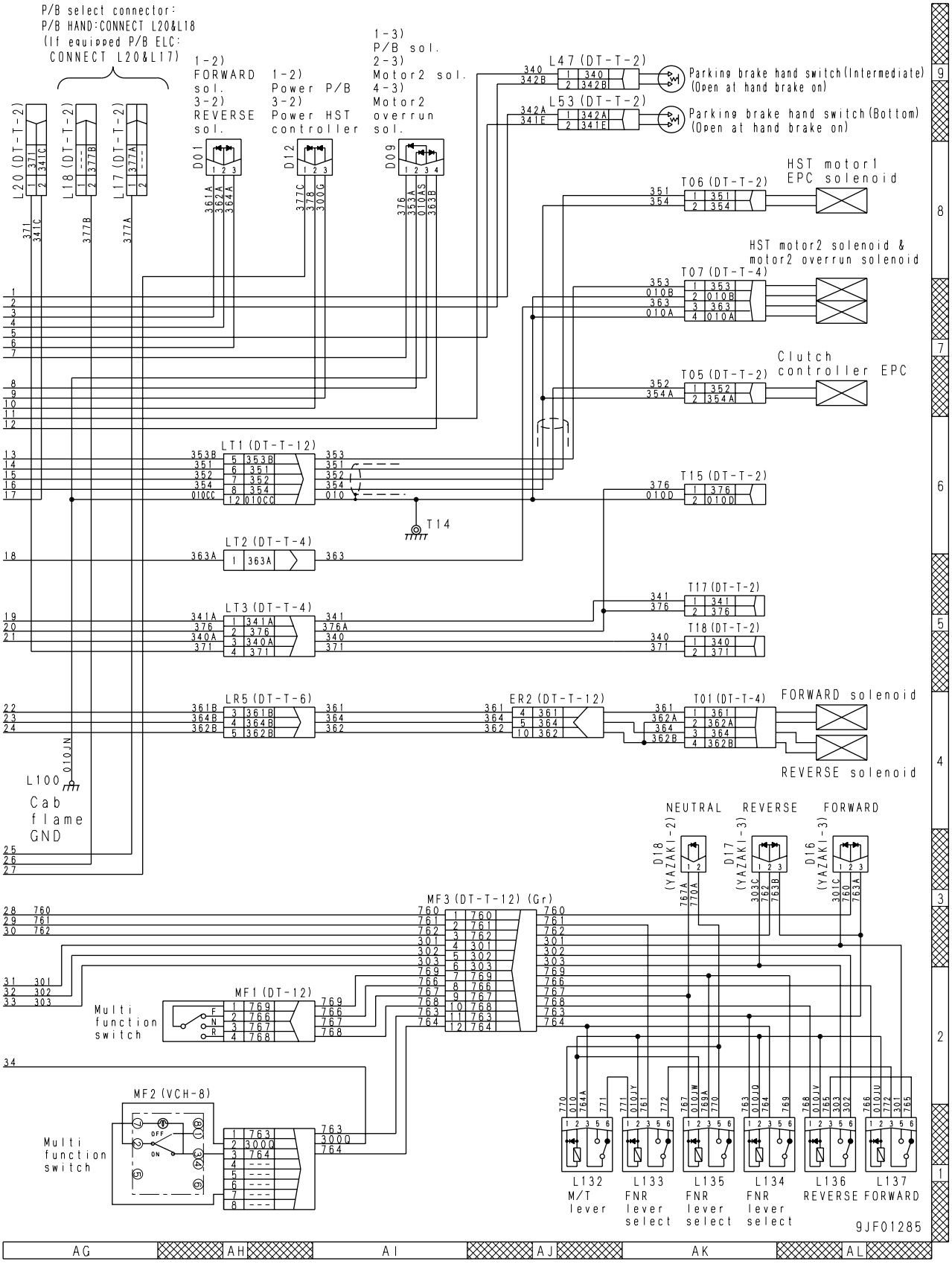
	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective parking brake indicator lamp relay (L104)	1) Turn starting switch OFF. 2) Interchange relay (L104) with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch.			
			Does condition become normal when parking brake indicator lamp relay (L104) is interchanged with normal relay?	The condition is abnormal.		Relay (L104) is normal.
				The condition is normal.		Defective relay (L104)
			1) Turn starting switch OFF. 2) Disconnect connector L104. 3) Solid part check.			
			Between L104 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L104. 3) Solid part check. 4) Applies impressed voltage between L104 (Male) (1) - (2)			
			Between L104 (Male) (3) and (5)	Applies 24V impressed voltage between L104 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L104 (Male) (1) - (2)	Resistance	1MΩ and above
	2	Defective mechanical parking brake relay (L101)	1) Turn starting switch OFF. 2) Replace L101 with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch.			
			When mechanical parking brake relay (L101) is replaced, does condition becomes normal?	No		Relay (L101) is normal.
				Yes		Relay (L101) is defective.
			1) Turn starting switch OFF. 2) Disconnect connector L101. 3) Check relay unit.			
			Between L101 (male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L101. 3) Check relay unit. 4) Apply normal voltage between L101 (male) (1) and (2).			
			Between L101 (male) (3) and (4)	Apply 24 V between (1) and (2).	Resistance	1Ω and below
				Do not apply 24 V between (1) and (2).	Resistance	1MΩ and above
	3	Defective parking brake lever middle position detection switch (Mechanical type)	1) Turn starting switch OFF. 2) Disconnect connector L47. 3) Connect T-adapter.			
			Between L47 (Male) (1) and (2)	Parking brake lever is placed LOCK to MIDDLE.	Resistance	1Ω and below
				Parking brake lever is placed MIDDLE to FREE.	Resistance	1MΩ and above
	4	Defective parking brake lever lowest position detection switch (Mechanical type)	1) Turn starting switch OFF. 2) Disconnect connector L53. 3) Connect T-adapter.			
			Between L53 (Male) (1) and (2)	Set parking brake lever to bottom position.	Resistance	1Ω and below
				Set parking brake lever to any position other than bottom position.	Resistance	1MΩ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	5	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L27, L47, L53, L104 and fuse T18. 3) Connect T-adapter. 4) Check that connector L20 is connected to L18.			
			Wiring harness between L27 (Female) (1) and L104 (Female) (6)		Resistance	1Ω and below
			Wiring harness between L104 (Female) (3) and chassis ground		Resistance	1Ω and below
			Wiring harness between L104 (Female) (2) and chassis ground		Resistance	1Ω and below
			Wiring harness between L104 (Female) (1) and J12 (Female) (7)		Resistance	1Ω and below
			Wiring harness between L53 (Female) (1) and J12 (Female) (5)		Resistance	1Ω and below
			Wiring harness between J12 (Female) (6) and L47 (Female) (2)		Resistance	1Ω and below
			Wiring harness between L47 (Female) (1) and fuse FS1 (4)		Resistance	1Ω and below
	6	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector L27, L53, L47, L104. 3) Connect T-adapter.			
			Wiring harness between L27 (Female) (1) and L104 (Female) (5) *	Resistance between L27 (Female) (1), L104 (Female) (5) and chassis ground		1MΩ and above
			Wiring harness between L104 (Female) (1) and J12 (Female) (7)	Resistance between L104 (Female) (1) and chassis ground		1MΩ and above
			Wiring harness between J10 (Female) (19) and L53 (Female) (2)	Resistance between L53 (Female) (2) and chassis ground		1MΩ and above
			Wiring harness between L53 (Female) (1) and J12 (Female) (5), (6) and L47 (Female) (2)	Resistance between L53 (Female) (1) and chassis ground		1MΩ and above
			Wiring harness between L47 (Female) (1) and fuse FS1 (4)	Resistance between L47 (Female) (1) and chassis ground		1MΩ and above
			★ In the above case (Other than marked mark (*)), the fuse is blown.			
	7	Defective junction connector (J10) and (J12)	Carry out inspection, and if any abnormality is found, repair or replace.			
	8	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L27 (Female) (1) and chassis ground	Parking brake lever is placed PARKING.	Voltage	1V and below
				Parking brake lever is placed other than FREE.	Voltage	20 - 30V

Related circuit diagram



Related circuit diagram



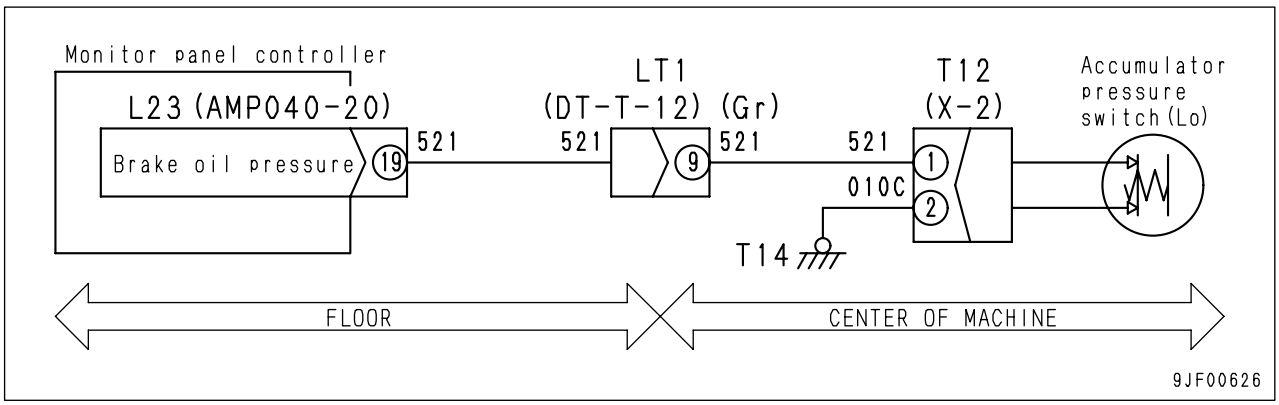
Troubleshooting Code [MON-2] (The brake oil pressure caution lamp does not light ON)

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	The brake oil pressure caution lamp does not light ON
-	-	-		
Description of Trouble	• The brake oil pressure sensor signal circuit is always in the CLOSE state.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The brake oil pressure caution lamp does not light ON when accumulator oil pressure is decreased.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective brake oil pressure sensor	1) Turn starting switch OFF. 2) Disconnect connector T12. 3) Connect T-adapter.			
			Between T12 (Male) (1) and (2)	Brake oil pressure is normal (When 5.88MPa {60kg/cm^2} and above).	Resistance	1✕ and below
				Steering oil pressure is abnormal (When 3.92MPa {40kg/cm^2} and below).	Resistance	1M✕ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L23, T12. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (19) and T12 (Female) (1)	Resistance between L23 (Female) (19), T12 (Female) (1) and chassis ground		1M✕ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Start engine.			
			Between L23 (Female) (19) and Chassis ground	Brake oil pressure is normal (When 5.88MPa {60kg/cm^2} and above).	Voltage	1V and below
				Steering oil pressure is abnormal (When 3.92MPa {40kg/cm^2} and below).	Voltage	20 - 30V

Related circuit diagram

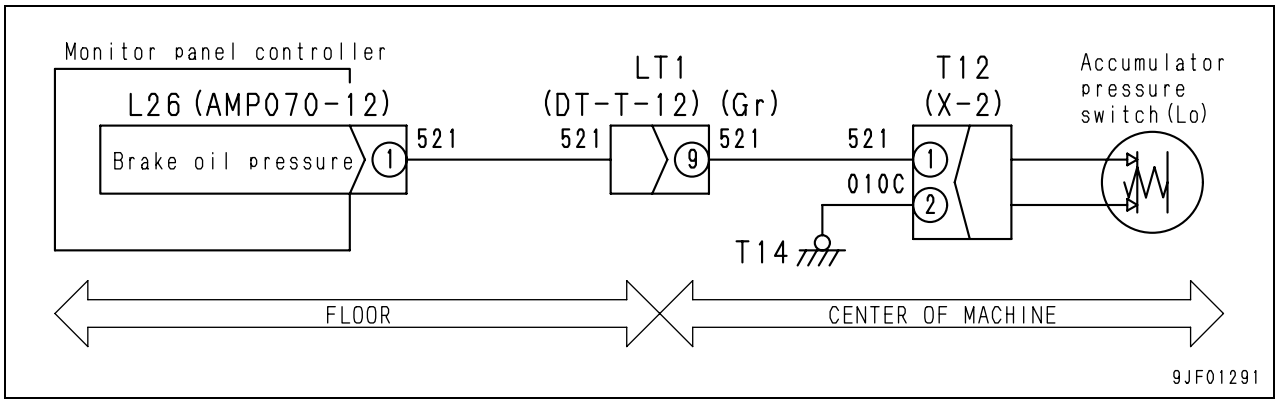


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	The brake oil pressure caution lamp does not light ON
-	-	-		
Description of Trouble	• The brake oil pressure sensor signal circuit is always in the CLOSE state.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The brake oil pressure caution lamp does not light ON when accumulator oil pressure is decreased.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective brake oil pressure sensor	1) Turn starting switch OFF. 2) Disconnect connector T12. 3) Connect T-adapter.			
			Between T12 (Male) (1) and (2)	Brake oil pressure is normal (When 5.88MPa {60kg/cm^2} and above).	Resistance	1Ω and below
				Steering oil pressure is abnormal (When 3.92MPa {40kg/cm^2} and below).	Resistance	1MΩ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L26, T12. 3) Connect T-adapter.			
			Wiring harness between L26 (Female) (1) and T12 (Female) (1)	Resistance between L26 (Female) (1), T12 (Female) (1) and chassis ground		1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L26. 3) Insert T-adapter. 4) Connect connector. 5) Start engine.			
			Between L26 (Female) (1) and Chassis ground	Brake oil pressure is normal (When 5.88MPa {60kg/cm^2} and above).	Voltage	1V and below
				Steering oil pressure is abnormal (When 3.92MPa {40kg/cm^2} and below).	Voltage	20 - 30V

Related circuit diagram



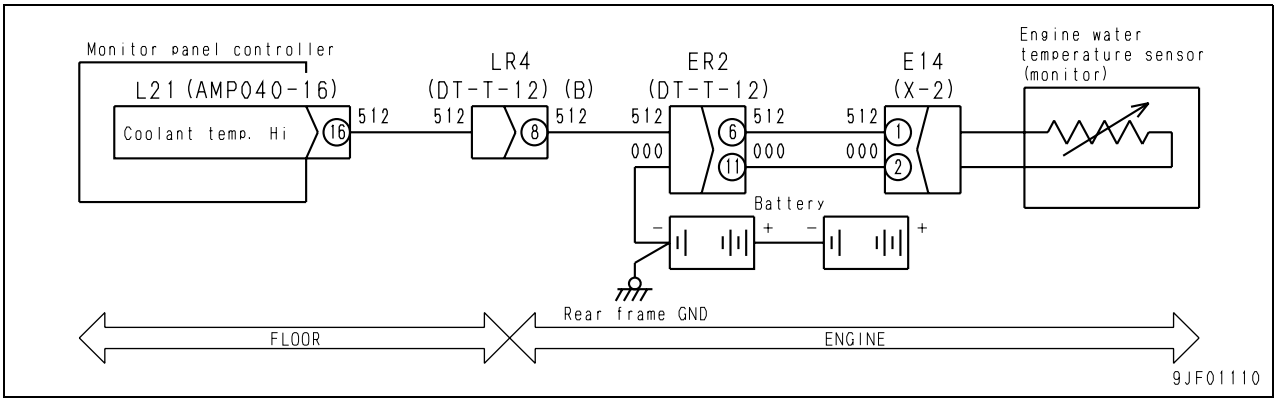
Troubleshooting Code [MON-3] (The engine water temperature caution lamp does not light ON, or after the engine starts, the engine water temperature gauge does not rise.)

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	The engine water temperature caution lamp does not light ON, or after the engine starts, the engine water temperature gauge does not rise.
-	-	-		
Description of Trouble	• The engine water temperature sensor circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The engine water temperature caution lamp does not light ON. • After the engine starts, the engine water temperature gauge does not rise.			
Related Information	• The engine water temperature is displayed by real-time monitoring code 04101.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective engine water temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector E14. 3) Connect T-adapter.			
			Between E14 (Male) (1) and (2)	Normal temperature (25°C)	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L21, E14. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (16) and E14 (Female) (1)		Resistance	1MΩ and above
			Wiring harness between E14 (Female) (2) and chassis ground		Resistance	1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Connect T-adapter.			
			Between L21 (Female) (16) and Chassis ground	Normal temperature (25°C)	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram

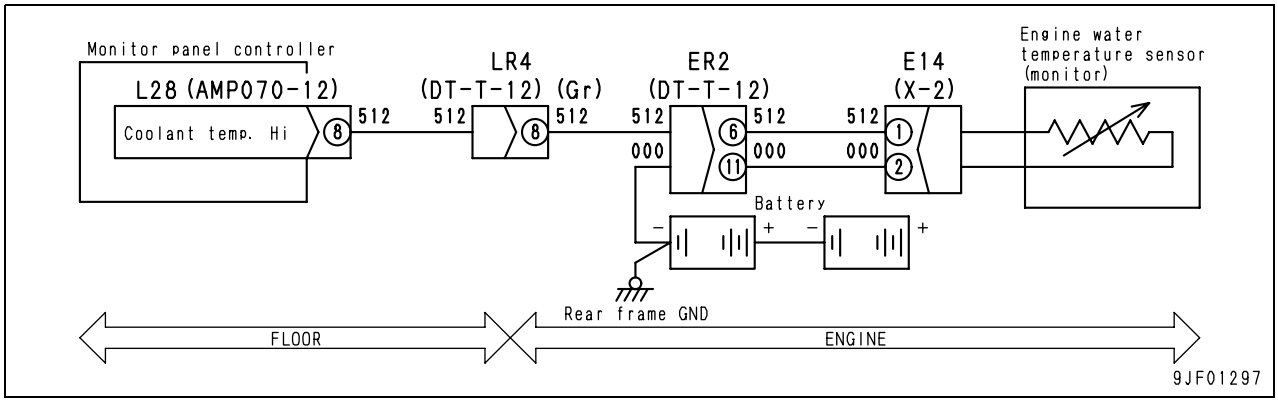


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	The engine water temperature caution lamp does not light ON, or after the engine starts, the engine water temperature gauge does not rise.
-	-	-		
Description of Trouble	• The engine water temperature sensor circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The engine water temperature caution lamp does not light ON. • After the engine starts, the engine water temperature gauge does not rise.			
Related Information	• The engine water temperature is displayed by real-time monitoring code 04101.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective engine water temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector E14. 3) Connect T-adapter.			
			Between E14 (Male) (1) and (2)	Normal temperature (25°C)	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L28, E14. 3) Connect T-adapter.			
			Wiring harness between L28 (Female) (8) and E14 (Female) (1)		Resistance	1MΩ and above
			Wiring harness between E14 (Female) (2) and chassis ground		Resistance	1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Connect T-adapter.			
			Between L28 (Female) (8) and Chassis ground	Normal temperature (25°C)	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram



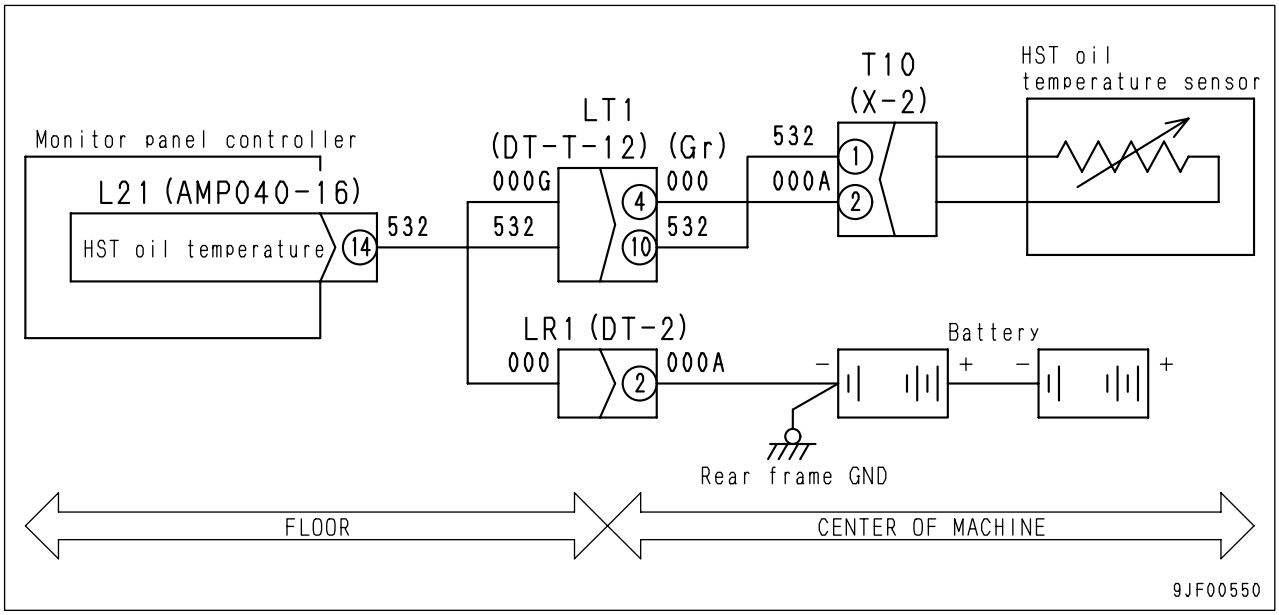
Troubleshooting Code [MON-4] (The HST oil temperature caution lamp does not light ON, or after the engine starts, the HST oil temperature gauge does not rise.)

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	The HST oil temperature caution lamp does not light ON, or after the engine starts, the HST oil temperature gauge does not rise.
-	-	-		
Description of Trouble	• The HST oil temperature sensor circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The HST oil temperature caution lamp does not light ON. • After the engine starts, the HST oil temperature gauge does not rise.			
Related Information	• The HST oil temperature is displayed by real-time monitoring code 30100.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective HST oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector T10. 3) Connect T-adapter.			
			Between T10 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L21, T10. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (14) and T10 (Female) (1)		Resistance	1MΩ and above
			Wiring harness between T10 (Female) (2) and chassis ground		Resistance	1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Connect T-adapter.			
			Between L21 (Female) (14) and Chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram

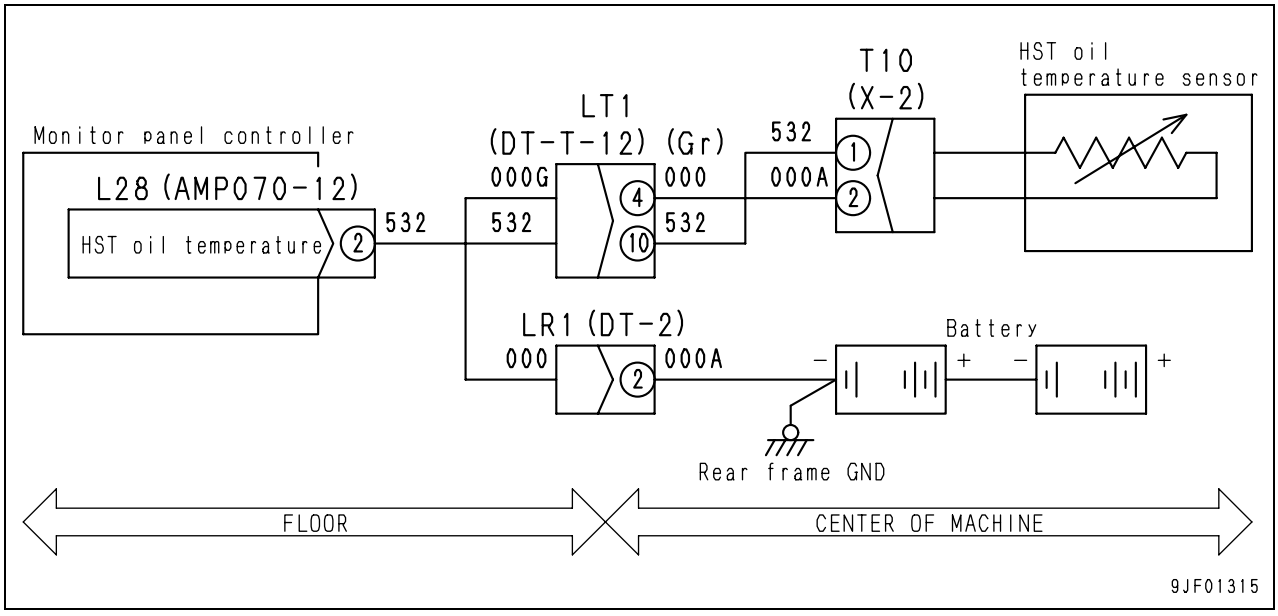


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	The HST oil temperature caution lamp does not light ON, or after the engine starts, the HST oil temperature gauge does not rise.
-	-	-		
Description of Trouble	• The HST oil temperature sensor circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The HST oil temperature caution lamp does not light ON. • After the engine starts, the HST oil temperature gauge does not rise.			
Related Information	• The HST oil temperature is displayed by real-time monitoring code 30100.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective HST oil temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector T10. 3) Connect T-adapter.			
			Between T10 (Male) (1) and (2)	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L28, T10. 3) Connect T-adapter.			
			Wiring harness between L28 (Female) (2) and T10 (Female) (1)		Resistance	1MΩ and above
			Wiring harness between T10 (Female) (2) and chassis ground		Resistance	1MΩ and above
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Connect T-adapter.			
			Between L28 (Female) (2) and Chassis ground	Normal temperature (25°C).	Resistance	35 - 50kΩ
				When 100°C	Resistance	3.1 - 4.5kΩ

Related circuit diagram



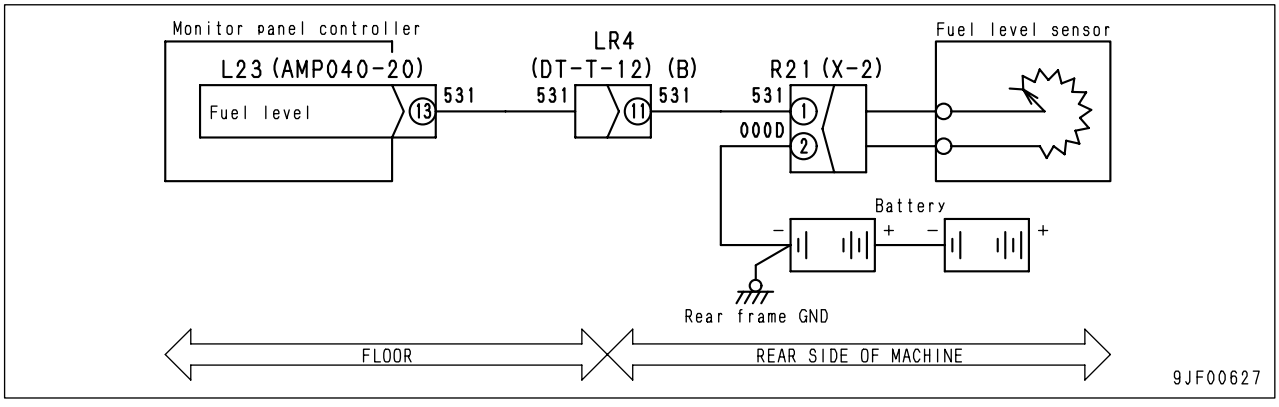
Troubleshooting Code [MON-5] (The fuel level gauge does not rise or decrease.)

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	The fuel level gauge does not rise or decrease.
-	-	-		
Description of Trouble	• An abnormality has occurred in the fuel level sensor circuit.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The fuel level gauge does not rise or decrease.			
Related Information	• The fuel level is displayed by real-time monitoring code 04202.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective fuel level sensor	1) Turn starting switch OFF. 2) Disconnect connector R21. 3) Connect T-adapter.			
			Between R21 (Male) (1) and (2)	FULL	Resistance	1 - 5Ω
				1/2 LEVEL	Resistance	29 - 36Ω
				EMPTY	Resistance	103 - 117Ω
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L23, R21. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (13) and R21 (Female) (1)		Resistance	1MΩ and above
			Wiring harness between R21 (Female) (2) and chassis ground		Resistance	1MΩ and above
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L23, R21. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (13) and R21 (Female) (1)	Resistance between L23 (Female) (13), R21 (Female) (1) and chassis ground		1Ω and below
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Connect T-adapter.			
			Between L23 (Female) (13) and Chassis ground	FULL	Resistance	1 - 5Ω
				1/2 LEVEL	Resistance	29 - 36Ω
				EMPTY	Resistance	103 - 117Ω

Related circuit diagram

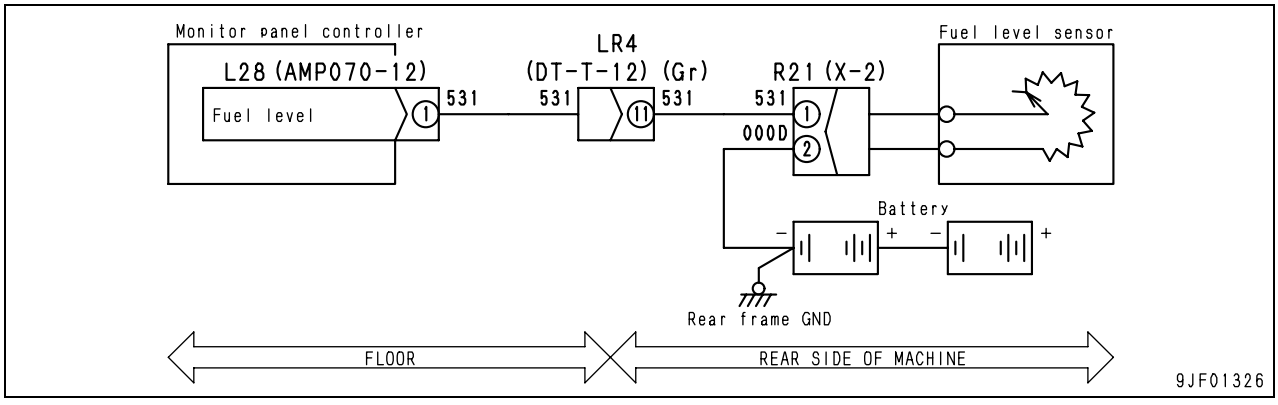


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	The fuel level gauge does not rise or decrease.
-	-	-		
Description of Trouble	• An abnormality has occurred in the fuel level sensor circuit.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The fuel level gauge does not rise or decrease.			
Related Information	• The fuel level is displayed by real-time monitoring code 04202.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective fuel level sensor	1) Turn starting switch OFF. 2) Disconnect connector R21. 3) Connect T-adapter.			
			Between R21 (Male) (1) and (2)	FULL	Resistance	1 - 5✕
				1/2 LEVEL	Resistance	29 - 36✕
				EMPTY	Resistance	103 - 117✕
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L28, R21. 3) Connect T-adapter.			
			Wiring harness between L28 (Female) (1) and R21 (Female) (1)		Resistance	1M✕ and above
			Wiring harness between R21 (Female) (2) and chassis ground		Resistance	1M✕ and above
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L28, R21. 3) Connect T-adapter.			
			Wiring harness between L28 (Female) (1) and R21 (Female) (1)	Resistance between L28 (Female) (1), R21 (Female) (1) and chassis ground		1✕ andbelow
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L28. 3) Connect T-adapter.			
			Between L28 (Female) (1) and Chassis ground	FULL	Resistance	1 - 5✕
				1/2 LEVEL	Resistance	29 - 36✕
				EMPTY	Resistance	103 - 117✕

Related circuit diagram



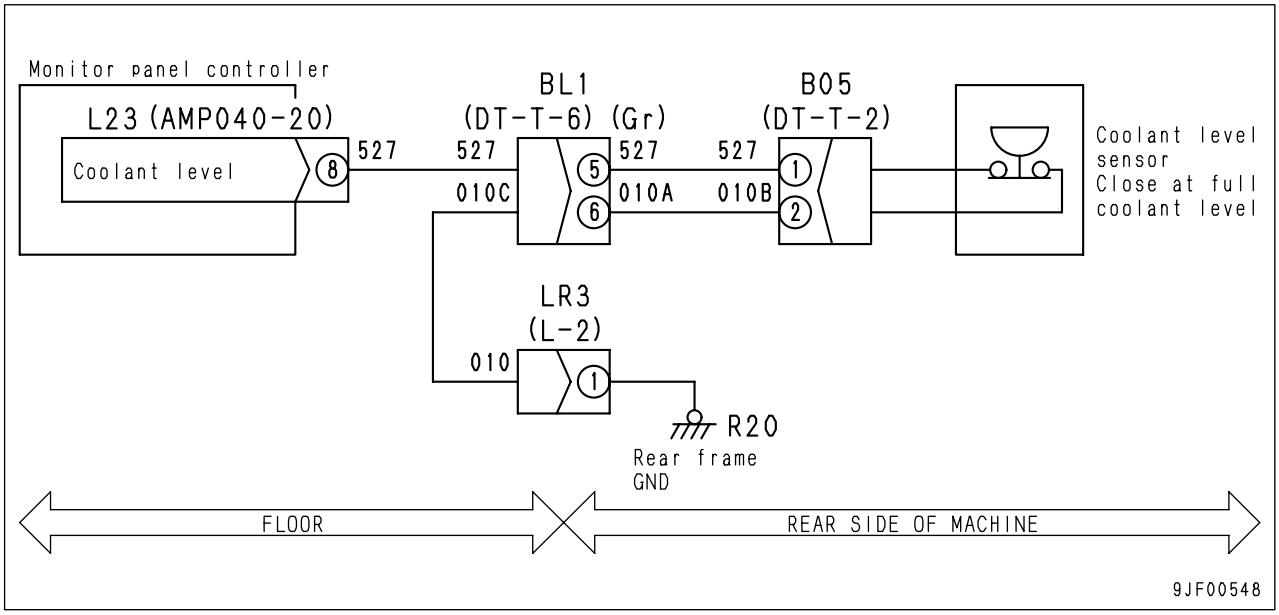
Troubleshooting Code [MON-6] (The radiator coolant level caution lamp does not light ON)

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	The radiator coolant level caution lamp does not light ON
-	-	-		
Description of Trouble	• The radiator coolant level sensor signal circuit is always in the CLOSE state.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The radiator coolant level caution lamp does not light ON, when the radiator coolant level (Coolant water volume) is insufficient.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective radiator coolant level sensor	1) Turn starting switch OFF. 2) Disconnect connector B05. 3) Connect T-adapter.			
			Between B05 (Male) (1) and chassis ground	Reserve tank low level or more (Normal).	Resistance	1✕ and below
				Reserve tank low level or less (Abnormal).	Resistance	1M✕ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L23, B05. 3) Connect T-adapter.			
			Wiring harness between L23 (Female) (8) and B05 (Female) (1)	Resistance between L23 (Female) (8), B05 (Female) (1) and chassis ground	Resistance	1✕ and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Connect T-adapter.			
			Between L23 (Female) (8) and Chassis ground	Reserve tank low level or more (Normal).	Resistance	1✕ and below
				Reserve tank low level or less (Abnormal).	Resistance	1M✕ and above

Related circuit diagram

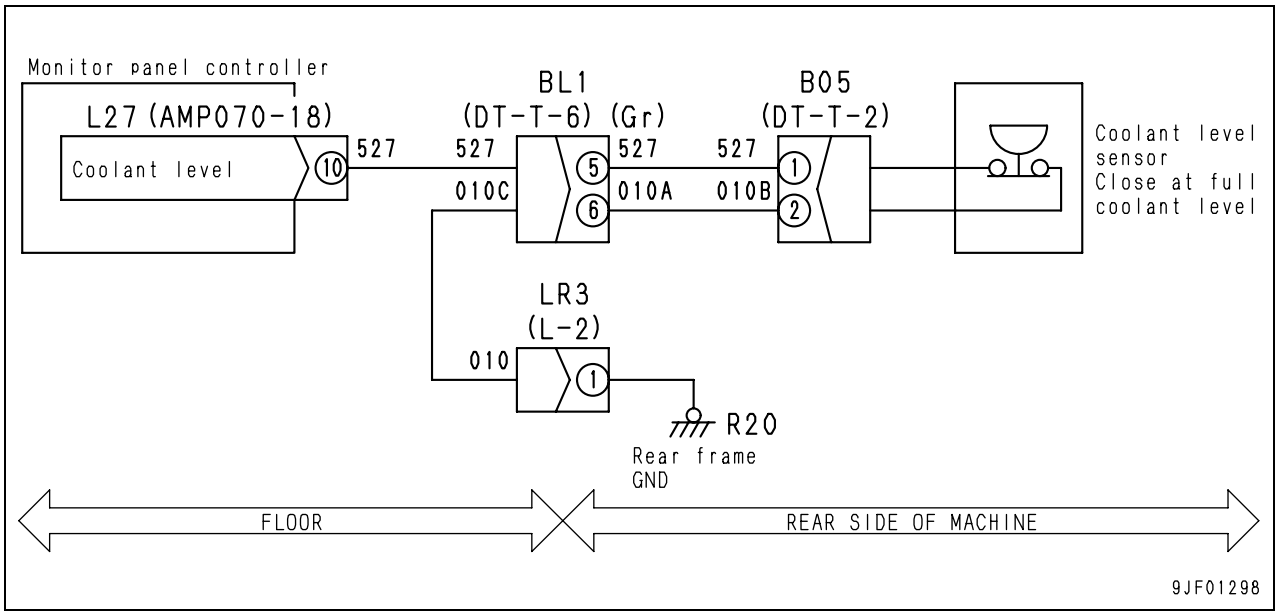


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	The radiator coolant level caution lamp does not light ON
-	-	-		
Description of Trouble	• The radiator coolant level sensor signal circuit is always in the CLOSE state.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The radiator coolant level caution lamp does not light ON, when the radiator coolant level (Coolant water volume) is insufficient.			
Related Information	• The input signal of the coolant level sensor can be checked with the monitoring function (Code: 40903, D_IN_27).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective radiator coolant level sensor	1) Turn starting switch OFF. 2) Disconnect connector B05. 3) Connect T-adapter.			
			Between B05 (Male) (1) and chassis ground	Reserve tank low level or more (Normal).	Resistance	1✕ and below
				Reserve tank low level or less (Abnormal).	Resistance	1M✕ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L27, B05. 3) Connect T-adapter.			
			Wiring harness between L27 (Female) (10) and B05 (Female) (1)	Resistance between L27 (Female) (10), B05 (Female) (1) and chassis ground	Resistance	1✕ and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Connect T-adapter.			
			Between L27 (Female) (10) and Chassis ground	Reserve tank low level or more (Normal).	Resistance	1✕ and below
				Reserve tank low level or less (Abnormal).	Resistance	1M✕ and above

Related circuit diagram



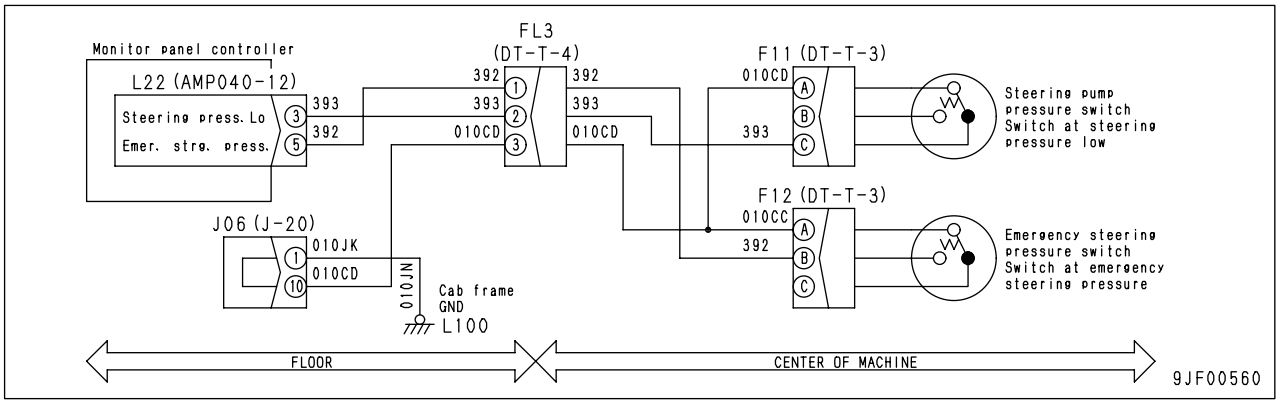
Troubleshooting Code [MON-7] (The steering oil pressure caution lamp does not light ON)

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	The steering oil pressure caution lamp does not light ON
-	-	-		
Description of Trouble	• The steering oil pressure sensor signal circuit is always in the CLOSE state during the engine is revolved.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The steering may be not worked if operation continues.			
Related Information	• This warning is given when the emergency steering (option) is installed.			

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective steering oil pressure sensor (switch)	1) Turn starting switch OFF. 2) Disconnect Connectors L22, F11. 3) Connect T-adapter.			
			Between F11 (Male) (A) and (C)	Steering oil pressure is low (Engine stopped).	Resistance	1Ω and below
				Steering oil pressure is normal (Engine started).	Resistance	1MΩ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L22, F11. 3) Connect T-adapter.			
			Wiring harness between L22 (Female) (3) and F11 (Female) (C)		Resistance	1Ω and below
			Wiring harness between F11 (Female) (A) and chassis ground		Resistance	1Ω and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L22. 3) Insert T-adapter. 4) Connect connector. 5) Start engine.			
			Between L22 (Female) (3) and Chassis ground	Steering oil pressure is low (Engine stopped).	Voltage	1V and below
				Steering oil pressure is normal (Engine started).	Voltage	20 - 30V

Related circuit diagram

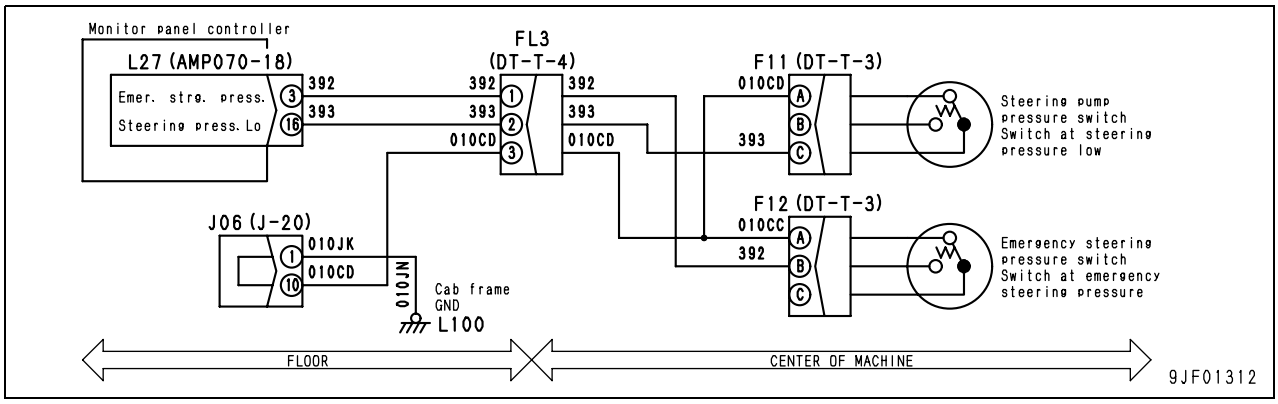


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	The steering oil pressure caution lamp does not light ON
-	-	-		
Description of Trouble	• The steering oil pressure sensor signal circuit is always in the CLOSE state during the engine is revolved.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The steering may be not worked if operation continues.			
Related Information	• This warning is given when the emergency steering (option) is installed.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective steering oil pressure sensor (switch)	1) Turn starting switch OFF. 2) Disconnect Connectors L27, F11. 3) Connect T-adapter.			
			Between F11 (Male) (A) and (C)	Steering oil pressure is low (Engine stopped).	Resistance	1Ω and below
				Steering oil pressure is normal (Engine started).	Resistance	1MΩ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L27, F11. 3) Connect T-adapter.			
			Wiring harness between L27 (Female) (16) and F11 (Female) (C)		Resistance	1Ω and below
			Wiring harness between F11 (Female) (A) and chassis ground		Resistance	1Ω and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Start engine.			
			Between L27 (Female) (16) and Chassis ground	Steering oil pressure is low (Engine stopped).	Voltage	1V and below
				Steering oil pressure is normal (Engine started).	Voltage	20 - 30V

Related circuit diagram



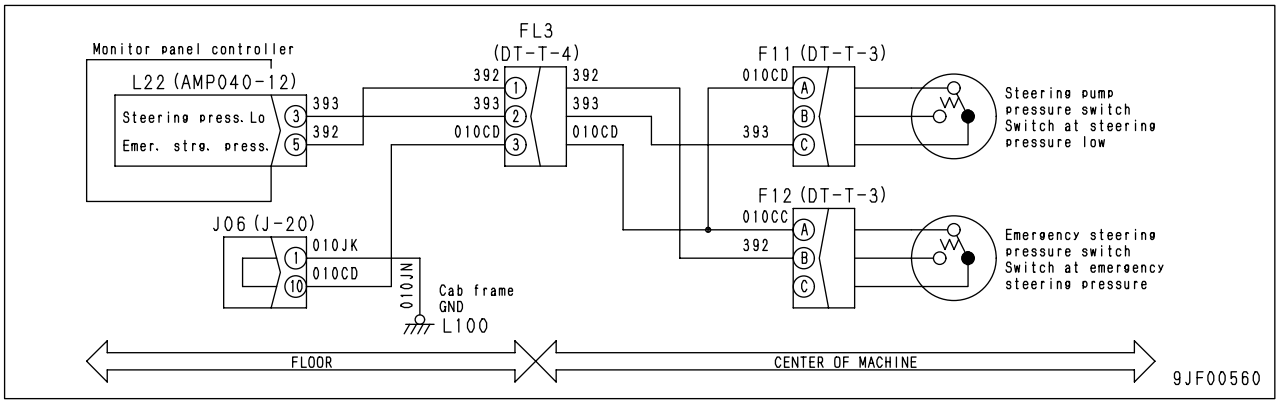
Troubleshooting Code [MON-8] (The emergency steering oil pressure indicator lamp does not light ON)

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	The emergency steering oil pressure indicator lamp does not light ON
-	-	-		
Description of Trouble	• The emergency steering oil pressure sensor circuit is always in the OPEN state during the engine is revolved.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The emergency steering does not work, so if the machine continues to be used, there is danger that the steering itself will stop working.			
Related Information	• This indicator lights up only when the emergency steering (option) is installed.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective steering oil pressure sensor (switch)	1) Turn starting switch OFF. 2) Disconnect Connectors L22, F12. 3) Connect T-adapter.			
			Between F12 (Male) (A) and (B)	Steering oil pressure is low. (While engine is stopped)	Resistance	1MΩ and above
				Steering oil pressure is normal. (While engine is running)	Resistance	1Ω and below
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L22, F12. 3) Connect T-adapter.			
			Wiring harness between L22 (Female) (5) and F12 (Female) (B)		Resistance	1Ω and below
			Wiring harness between F12 (Female) (A) and chassis ground		Resistance	1Ω and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L22. 3) Insert T-adapter. 4) Connect connector. 5) Start engine.			
			Between L22 (Female) (5) and Chassis ground	Steering oil pressure is low. (While engine is stopped)	Voltage	20 - 30V
				Steering oil pressure is normal. (While engine is running)	Voltage	1V and below

Related circuit diagram

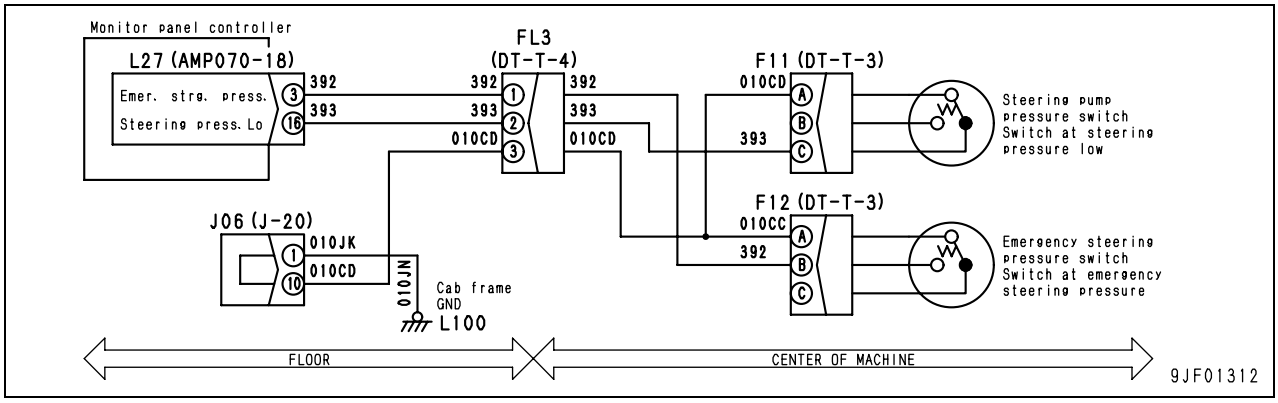


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	The emergency steering oil pressure indicator lamp does not light ON
-	-	-		
Description of Trouble	• The emergency steering oil pressure sensor circuit is always in the OPEN state during the engine is revolved.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The emergency steering does not work, so if the machine continues to be used, there is danger that the steering itself will stop working.			
Related Information	• This indicator lights up only when the emergency steering (option) is installed. • The input signal of the emergency steering oil pressure sensor can be checked with the monitoring function (Code: 40903, D_IN_30).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective steering oil pressure sensor (switch)	1) Turn starting switch OFF. 2) Disconnect Connectors L27, F12. 3) Connect T-adapter.			
			Between F12 (Male) (A) and (B)	Steering oil pressure is low. (While engine is stopped)	Resistance	1MΩ and above
				Steering oil pressure is normal. (While engine is running)	Resistance	1Ω and below
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L27, F12. 3) Connect T-adapter.			
			Wiring harness between L27 (Female) (3) and F12 (Female) (B)		Resistance	1Ω and below
			Wiring harness between F12 (Female) (A) and chassis ground		Resistance	1Ω and below
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Start engine.			
			Between L27 (Female) (3) and Chassis ground	Steering oil pressure is low. (While engine is stopped)	Voltage	20 - 30V
				Steering oil pressure is normal. (While engine is running)	Voltage	1V and below

Related circuit diagram



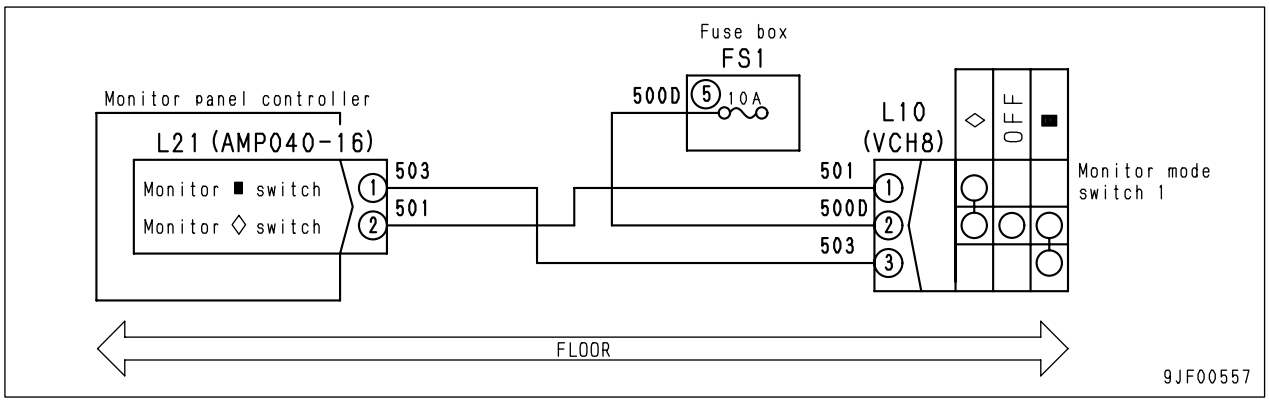
Troubleshooting Code [MON-9] (Input failure in monitor panel mode selector switch 1 [■] (Panel switch 1))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Input failure in monitor panel mode selector switch 1 [■] (Panel switch 1)
-	-	-		
Description of Trouble	• The monitor panel mode selector switch 1 [■] (Panel switch 1) input circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective monitor panel mode selector switch 1 [■]	1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter.			
			Between L10 (Female) (2) and (3)	When monitor panel mode selector switch 1 [■] is turned ON.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10, fuse FS1 (5). 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (1) and L10 (Female) (3)		Resistance	1✕ and below
			Wiring harness between L10 (Female) (2) and fuse FS1 (5)		Resistance	1✕ and below
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10, fuse FS1 (5). 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (1) and L10 (Female) (3)	Resistance between L21 (Female) (1), L10 (Female) (3) and chassis ground		1M✕ and above
			Wiring harness between L10 (Female) (2) and fuse FS1 (5)	Resistance between L10 (Female) (2), fuse FS1 (5) and chassis ground		1M✕ and above
			★ In the above case, the fuse is blown.			
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (1) and chassis ground	When monitor panel mode selector switch 1 [■] is turned ON.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below

Related circuit diagram

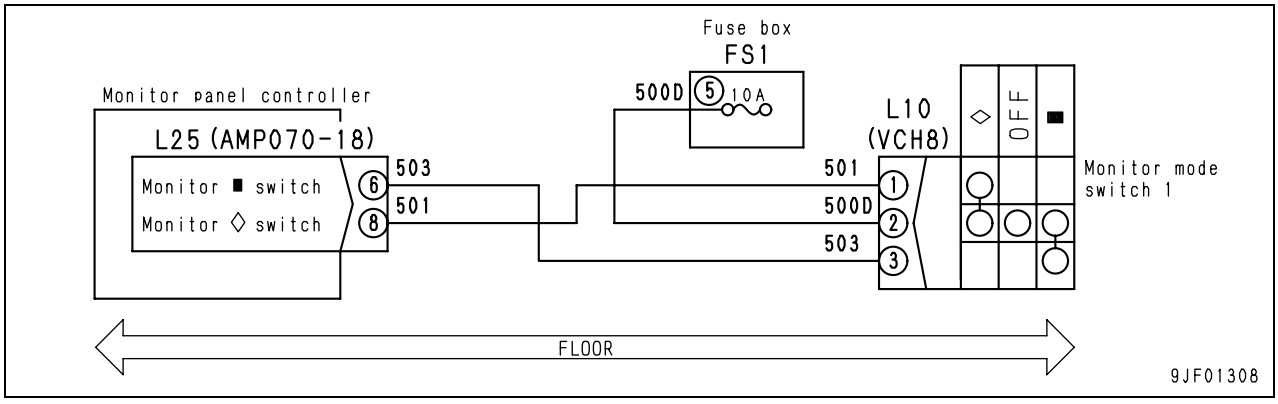


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Input failure in monitor panel mode selector switch 1 [■] (Panel switch 1)
-	-	-		
Description of Trouble	• The monitor panel mode selector switch 1 [■] (Panel switch 1) input circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 1 [■]	1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter.			
			Between L10 (Female) (2) and (3)	When monitor panel mode selector switch 1 [■] is turned ON.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L25, L10, fuse FS1 (5). 3) Connect T-adapter.			
			Wiring harness between L25 (Female) (6) and L10 (Female) (3)		Resistance	1✕ and below
			Wiring harness between L10 (Female) (2) and fuse FS1 (5)		Resistance	1✕ and below
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L25, L10, fuse FS1 (5). 3) Connect T-adapter.			
			Wiring harness between L25 (Female) (6) and L10 (Female) (3)	Resistance between L25 (Female) (6), L10 (Female) (3) and chassis ground		1M✕ and above
			Wiring harness between L10 (Female) (2) and fuse FS1 (5)	Resistance between L10 (Female) (2), fuse FS1 (5) and chassis ground		1M✕ and above
			★ In the above case, the fuse is blown.			
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L25. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L25 (Female) (6) and chassis ground	When monitor panel mode selector switch 1 [■] is turned ON.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below

Related circuit diagram



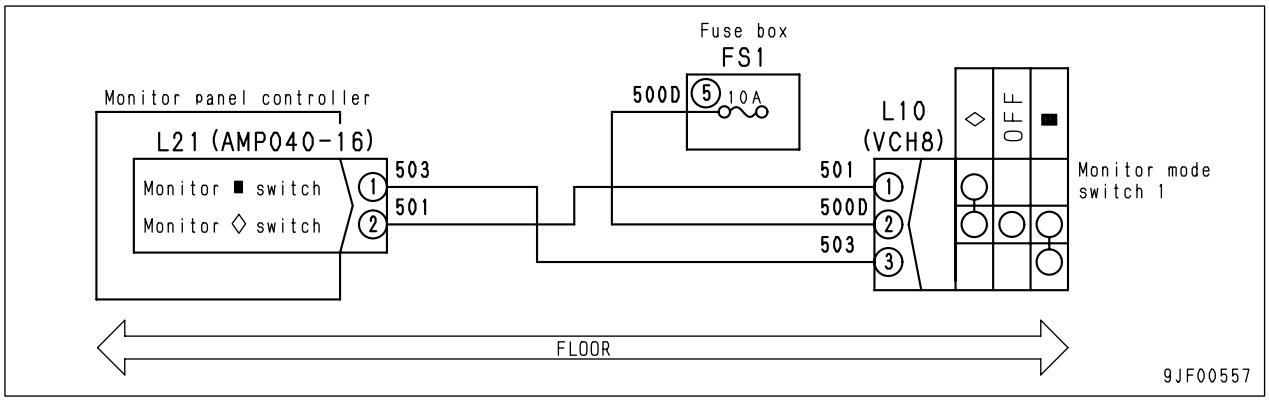
Troubleshooting Code [MON-10] (Input failure in monitor panel mode selector switch 1 [◇] (Panel switch 2))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Input failure in monitor panel mode selector switch 1 [◇] (Panel switch 2)
-	-	-		
Description of Trouble	• The monitor panel mode selector switch 1 [◇] (Panel switch 2) input circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective monitor panel mode selector switch 1 [◇]	1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter.			
			Between L10 (Female) (2) and (1)	When monitor panel mode selector switch 1 [◇] is turned ON.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10, fuse FS1 (5). 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (2) and L10 (Female) (1)		Resistance	1✕ and below
			Wiring harness between L10 (Female) (2) and fuse FS1 (5)		Resistance	1✕ and below
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10, fuse FS1 (5). 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (2) and L10 (Female) (1)	Resistance between L21 (Female) (2), L10 (Female) (1) and chassis ground		1M✕ and above
			Wiring harness between L10 (Female) (2) and fuse FS1 (5)	Resistance between L10 (Female) (2), fuse FS1 (5) and chassis ground		1M✕ and above
			★ In the above case, the fuse is blown.			
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (2) and chassis ground	When monitor panel mode selector switch 1 [◇] is turned ON.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below

Related circuit diagram

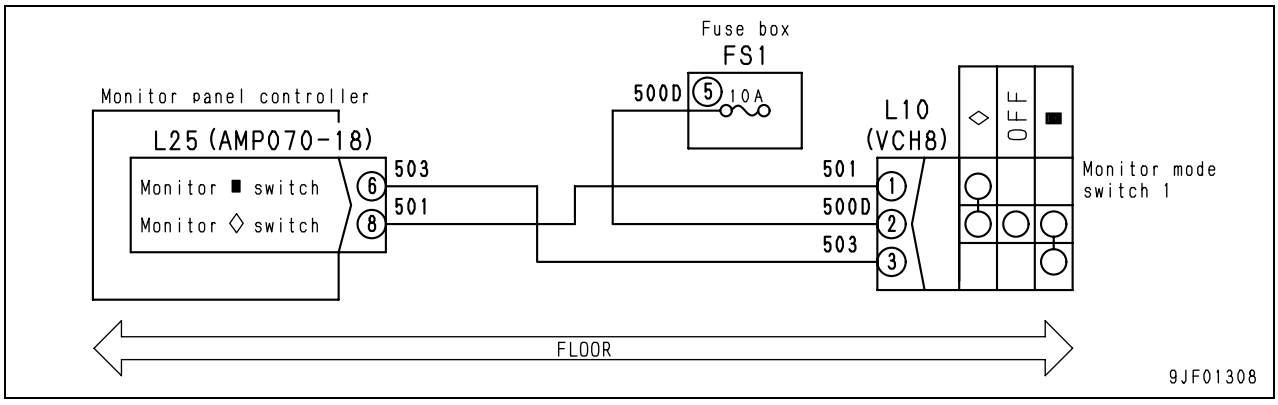


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Input failure in monitor panel mode selector switch 1 [◇] (Panel switch 2)
-	-	-		
Description of Trouble	• The monitor panel mode selector switch 1 [◇] (Panel switch 2) input circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

Possible Causes and Standard Values		Causes	Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective monitor panel mode selector switch 1 [◇]	1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter.			
			Between L10 (Female) (2) and (1)	When monitor panel mode selector switch 1 [◇] is turned ON.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L25, L10, fuse FS1 (5). 3) Connect T-adapter.			
			Wiring harness between L25 (Female) (8) and L10 (Female) (1)		Resistance	1✕ and below
			Wiring harness between L10 (Female) (2) and fuse FS1 (5)		Resistance	1✕ and below
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L25, L10, fuse FS1 (5). 3) Connect T-adapter.			
			Wiring harness between L25 (Female) (8) and L10 (Female) (1)	Resistance between L25 (Female) (8), L10 (Female) (1) and chassis ground		1M✕ and above
			Wiring harness between L10 (Female) (2) and fuse FS1 (5)	Resistance between L10 (Female) (2), fuse FS1 (5) and chassis ground		1M✕ and above
			★ In the above case, the fuse is blown.			
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L25. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L25 (Female) (8) and chassis ground	When monitor panel mode selector switch 1 [◇] is turned ON.	Voltage	20 - 30V
				Other than above.	Voltage	1V and below

Related circuit diagram



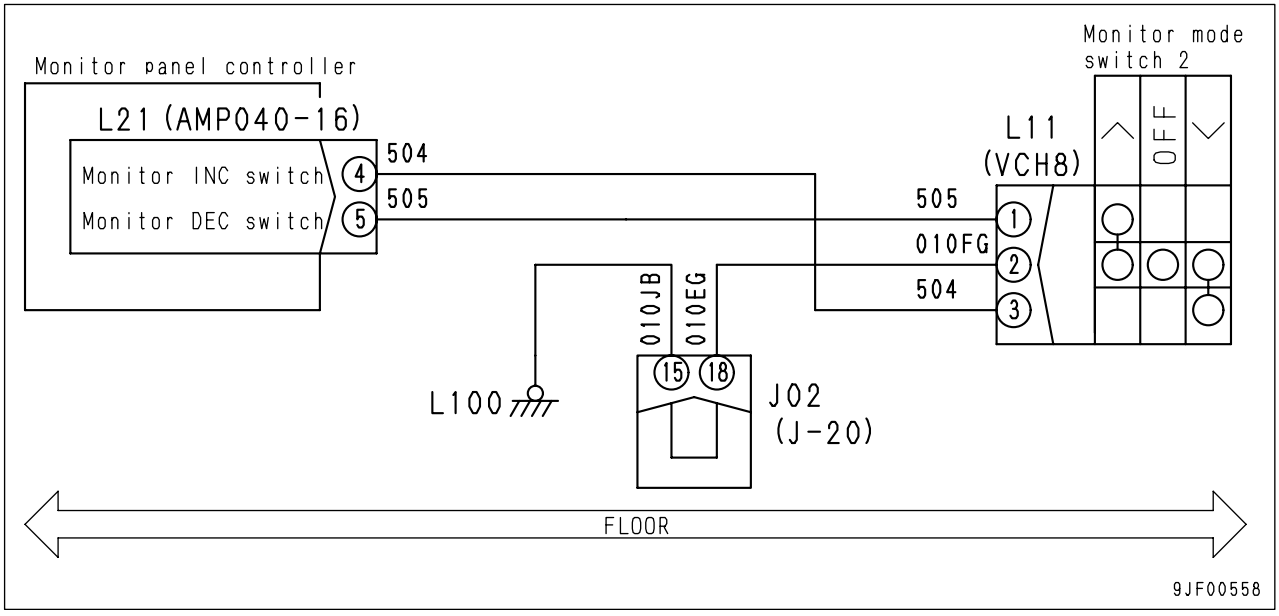
Troublesho oting Code [MON-11] (In put failure in monitor panel mode selector switch 2 [<] (Panel switch 3))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Input failure in monitor panel mode selector switch 2 [<] (Panel switch 3)
-	-	-		
Description of Trouble	• The monitor panel mode selector switch 2 [<] (Panel switch 3) input circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 2 [<]	1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter.			
			Between L11 (Female) (2) and (3)	When monitor panel mode selector switch 2 [<] is turned ON.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (4) and L11 (Female) (3)		Resistance	1✕ and below
			Wiring harness between L11 (Female) (2) and chassis ground		Resistance	1✕ and below
	3	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L21 (Female) (4) and L11 (Female) (3)	Voltage between L21 (Female) (4), L11 (Female) (3) and chassis ground		1V and below
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (4) and chassis ground	When monitor panel mode selector switch 2 [<] is turned ON.	Voltage	1V and below
				Other than above.	Voltage	20 - 30V

Related circuit diagram

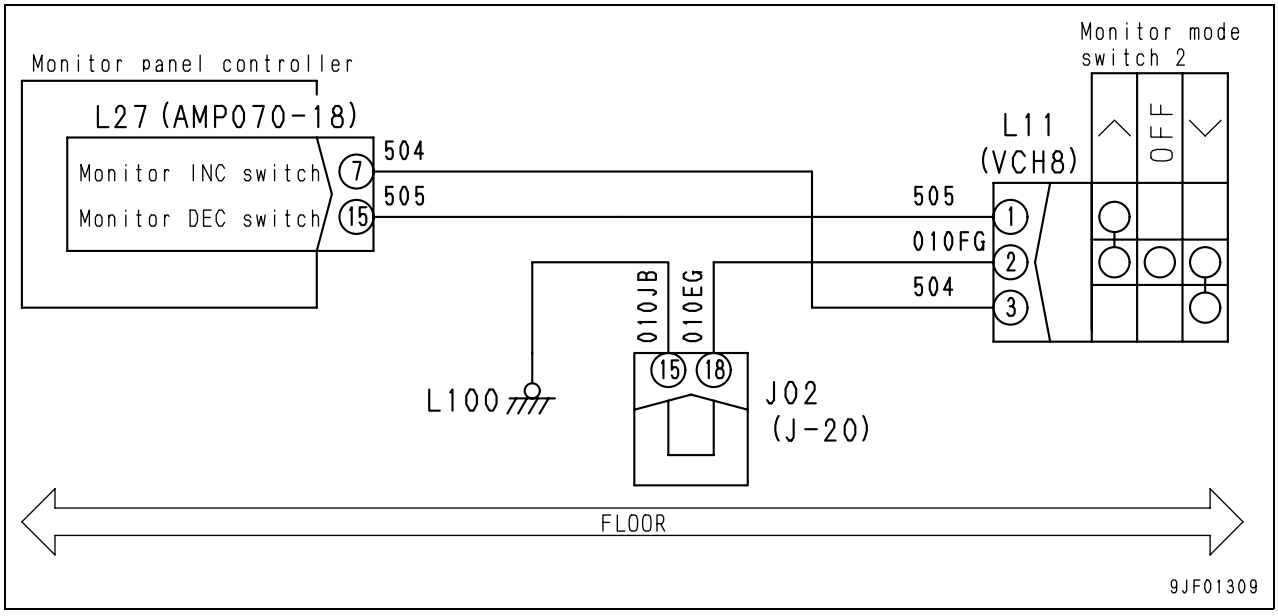


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Input failure in monitor panel mode selector switch 2 [<] (Panel switch 3)
-	-	-		
Description of Trouble	• The monitor panel mode selector switch 2 [<] (Panel switch 3) input circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

Possible Causes and Standard Values		Causes	Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective monitor panel mode selector switch 2 [<]	1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter.			
			Between L11 (Female) (2) and (3)	When monitor panel mode selector switch 2 [<] is turned ON.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L27, L11. 3) Connect T-adapter.			
			Wiring harness between L27 (Female) (7) and L11 (Female) (3)		Resistance	1Ω and below
			Wiring harness between L11 (Female) (2) and chassis ground		Resistance	1Ω and below
	3	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L27, L11. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L27 (Female) (7) and L11 (Female) (3)	Voltage between L27 (Female) (7), L11 (Female) (3) and chassis ground		1V and below
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L27 (Female) (7) and chassis ground	When monitor panel mode selector switch 2 [<] is turned ON.	Voltage	1V and below
				Other than above.	Voltage	20 - 30V

Related circuit diagram



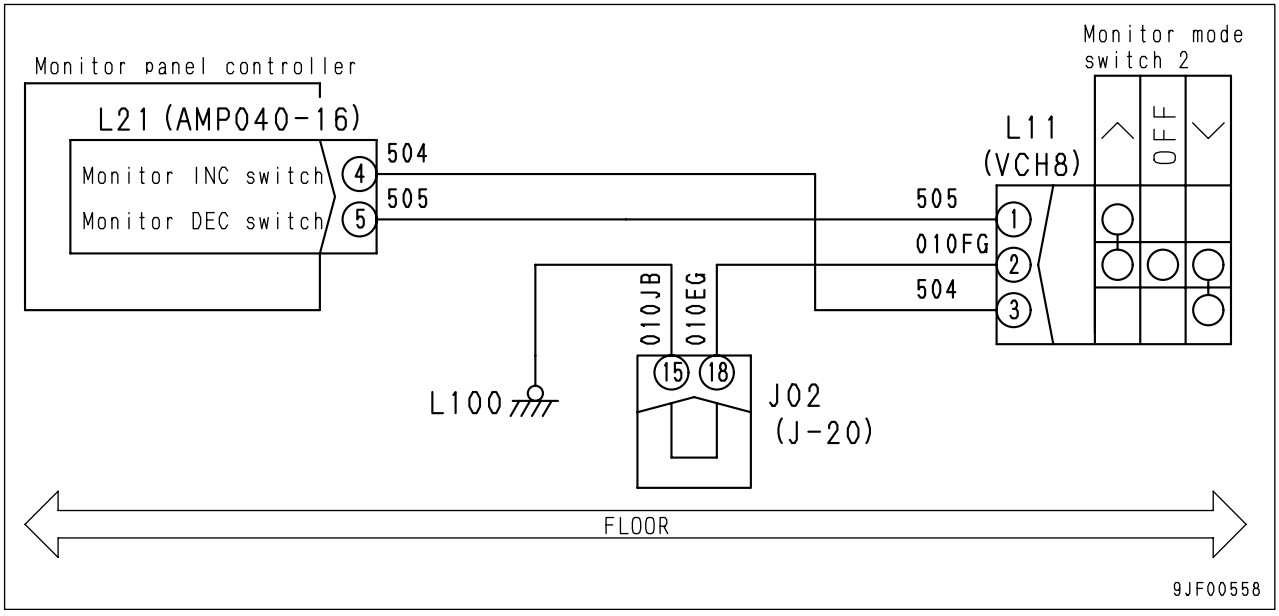
Troubleshooting Code [MON-12] (Input failure in monitor panel mode selector switch 2 [>] (Panel switch 4))

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Input failure in monitor panel mode selector switch 2 [>] (Panel switch 4)
-	-	-		
Description of Trouble	• The monitor panel mode selector switch 2 [>] (Panel switch 4) input circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective monitor panel mode selector switch 2 [>]	1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter.			
			Between L11 (Female) (2) and (1)	When monitor panel mode selector switch 2 [>] is turned ON.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (5) and L11 (Female) (1)		Resistance	1✕ and below
			Wiring harness between L11 (Female) (2) and chassis ground		Resistance	1✕ and below
	3	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L21 (Female) (5) and L11 (Female) (1)	Voltage between L21 (Female) (5), L11 (Female) (1) and chassis ground		1V and below
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (5) and chassis ground	When monitor panel mode selector switch 2 [>] is turned ON.	Voltage	1V and below
				Other than above.	Voltage	20 - 30V

Related circuit diagram

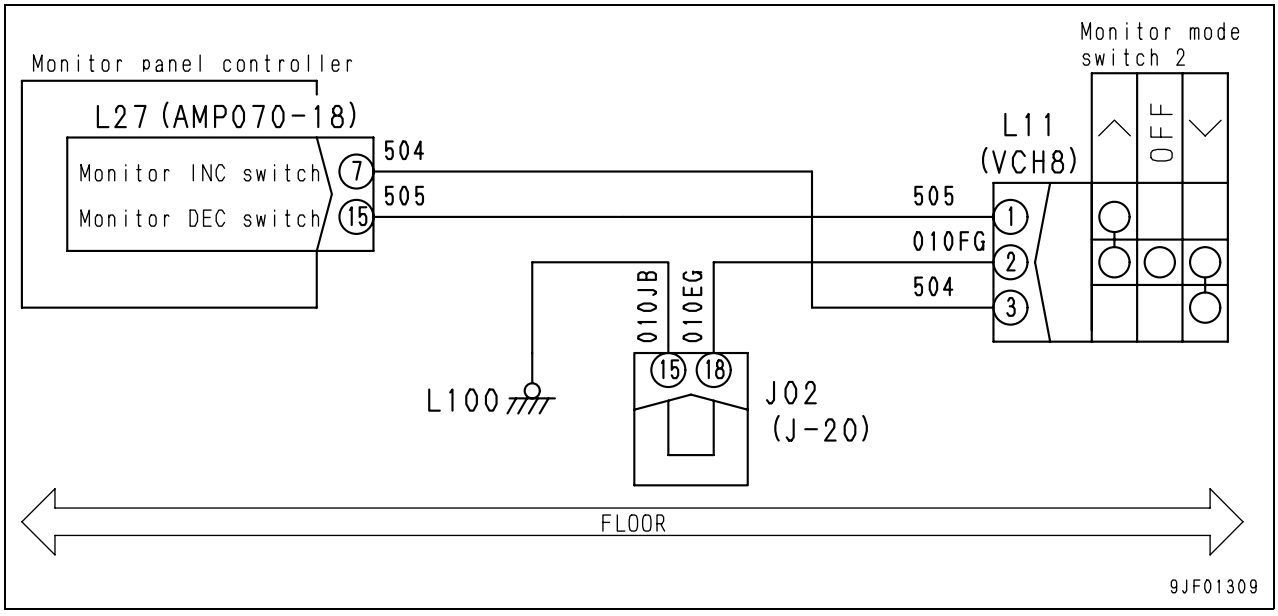


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Input failure in monitor panel mode selector switch 2 [>] (Panel switch 4)
-	-	-		
Description of Trouble	• The monitor panel mode selector switch 2 [>] (Panel switch 4) input circuit is always in the OPEN state.			
Machine monitor or controller Reaction	• Activates an alarm.			
Effect on Machine	• The monitor does not work.			
Related Information				

Possible Causes and Standard Values		Causes	Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective monitor panel mode selector switch 2 [>]	1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter.			
			Between L11 (Female) (2) and (1)	When monitor panel mode selector switch 2 [>] is turned ON.	Resistance	1✕ andbelow
				Other than above.	Resistance	1M✕ and above
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L27, L11. 3) Connect T-adapter.			
			Wiring harness between L27 (Female) (15) and L11 (Female) (1)		Resistance	1✕ andbelow
			Wiring harness between L11 (Female) (2) and chassis ground		Resistance	1✕ andbelow
	3	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect Connectors L27, L11. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L27 (Female) (15) and L11 (Female) (1)	Voltage between L27 (Female) (15), L11 (Female) (1) and chassis ground		1V and below
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L27 (Female) (15) and chassis ground	When monitor panel mode selector switch 2 [>] is turned ON.	Voltage	1V and below
				Other than above.	Voltage	20 - 30V

Related circuit diagram



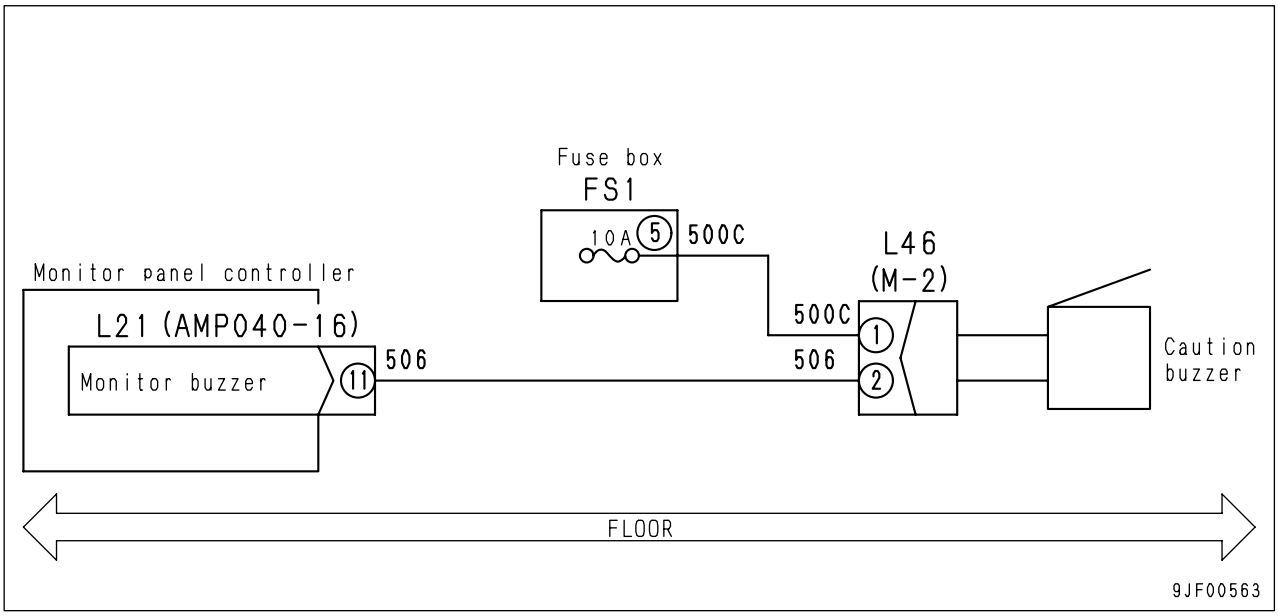
Troubleshooting Code [MON-13] (The alarm buzzer does not sound or stop)

Speed meter specification (STD)

Action Code	Failure Code	Controller Code	Trouble	The alarm buzzer does not sound or stop
-	-	-		
Description of Trouble	• The alarm buzzer does not sound or stop.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The alarm buzzer does not sound or stop.			
Related Information				

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L46. 3) Connect T-adapter.			
			Wiring harness between L21 (Female) (11) and L46 (Female) (2)		Resistance	1Ω and below
			Wiring harness between L46 (Female) (1) and fuse FS1 (5)		Resistance	1Ω and below
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L21, L46. 3) Connect T-adapter.			
			Wiring harness between L46 (Female) (1) and fuse FS1 (5)	Resistance between L46 (Female) (1), fuse FS1 (5) and chassis ground		1MΩ and above
			★ In the above case, the fuse is blown.			
			Wiring harness between L46 (Female) (2) and L21 (Female) (11)	Resistance between L46 (Female) (2), L21 (Female) (11) and chassis ground		1MΩ and above
			★ In this case, the buzzer does not stop sounding.			
	3	Defective alarm buzzer	1) Turn starting switch OFF. 2) Disconnect connector L46. 3) Insert T-adapter. 4) Connect connector. 5) 5 seconds lapsed after the starting switch was turned ON.			
			Between L46 (Female) (2) and chassis ground	The alarm buzzer sounds.		Alarm buzzer is normal.
				The alarm buzzer does not sound.		Defective alarm buzzer.
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L21 (Female) (11) and chassis ground	Turn starting switch ON.	Voltage	20 - 30V
				For 2 seconds after the starting switch was turned ON. (The alarm buzzer sounds.)	Voltage	20 - 30V
				For 1 second after 2 seconds lapsed after the starting switch was turned ON. (The alarm buzzer does not sound.)	Voltage	1V and below

Related circuit diagram

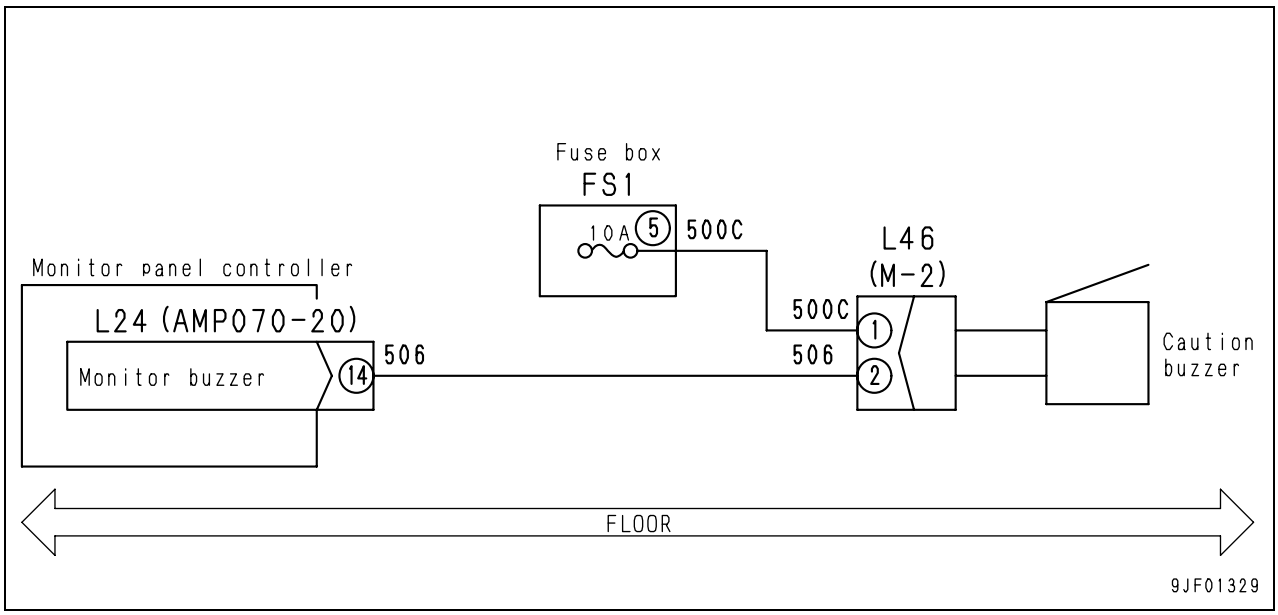


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	The alarm buzzer does not sound or stop
-	-	-		
Description of Trouble	• The alarm buzzer does not sound or stop.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The alarm buzzer does not sound or stop.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect Connectors L24, L46. 3) Connect T-adapter.			
			Wiring harness between L24 (Female) (14) and L46 (Female) (2)		Resistance	1✕ and below
			Wiring harness between L46 (Female) (1) and fuse FS1 (5)		Resistance	1✕ and below
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect Connectors L24, L46. 3) Connect T-adapter.			
			Wiring harness between L46 (Female) (1) and fuse FS1 (5)	Resistance between L46 (Female) (1), fuse FS1 (5) and chassis ground		1M✕ and above
			★ In the above case, the fuse is blown.			
			Wiring harness between L46 (Female) (2) and L24 (Female) (14)	Resistance between L46 (Female) (2), L24 (Female) (14) and chassis ground		1M✕ and above
			★ In this case, the buzzer does not stop sounding.			
	3	Defective alarm buzzer	1) Turn starting switch OFF. 2) Disconnect connector L46. 3) Insert T-adapter. 4) Connect connector. 5) 5 seconds lapsed after the starting switch was turned ON.			
			Between L46 (Female) (2) and chassis ground	The alarm buzzer sounds.		Alarm buzzer is normal.
				The alarm buzzer does not sound.		Defective alarm buzzer.
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L24. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (Female) (14) and chassis ground	Turn starting switch ON.	Voltage	20 - 30V
				For 2 seconds after the starting switch was turned ON. (The alarm buzzer sounds.)	Voltage	20 - 30V
				For 1 second after 2 seconds lapsed after the starting switch was turned ON. (The alarm buzzer does not sound.)	Voltage	1V and below

Related circuit diagram



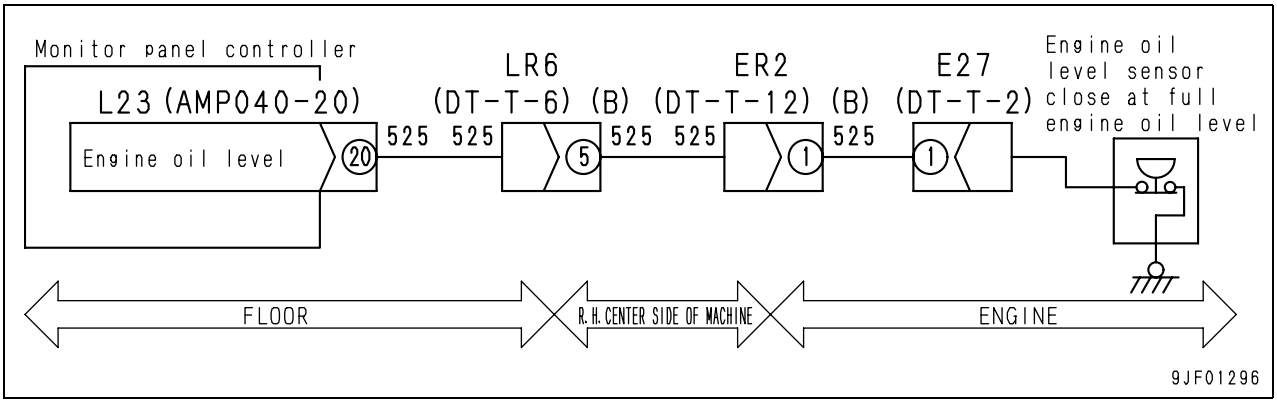
Troubleshooting Code [MON-14] Engine oil level caution lamp does not light up

Speedometer specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Engine oil level caution lamp does not light up
-	-	-		
Description of Trouble	• The engine oil level sensor circuit is kept closed.			
Machine monitor or controller Reaction	• None in particular.			
Effect on Machine	• While the engine oil level is insufficient, the radiator coolant caution lamp does not light up.			
Related Information	• The input signal of the engine oil level sensor can be checked with the monitoring function (Code: 40903, D_IN_27).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective engine oil level sensor	1) Turn starting switch OFF. 2) Disconnect connector E27. 3) Connect T-adapter.			
			Between E27 (male) (1) and chassis ground	Oil level is normal	Resistance	Max. 1 Ω
				Oil level is insufficient (low)	Resistance	Min. 1 MΩ
	2	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L23 and E27. 3) Connect T-adapter.			
			Wiring harness between L23 (female) (20) and E27 (female) (1)	Resistance between L23 (female) (20), E27 (female) (1) and chassis ground	Resistance	Max. 1 Ω
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Connect T-adapter.			
			Between L23 (female) (20) and chassis ground	Oil level is normal	Resistance	Max. 1 V
				Oil level is insufficient (low)	Resistance	20 - 30 V

Related circuit diagram

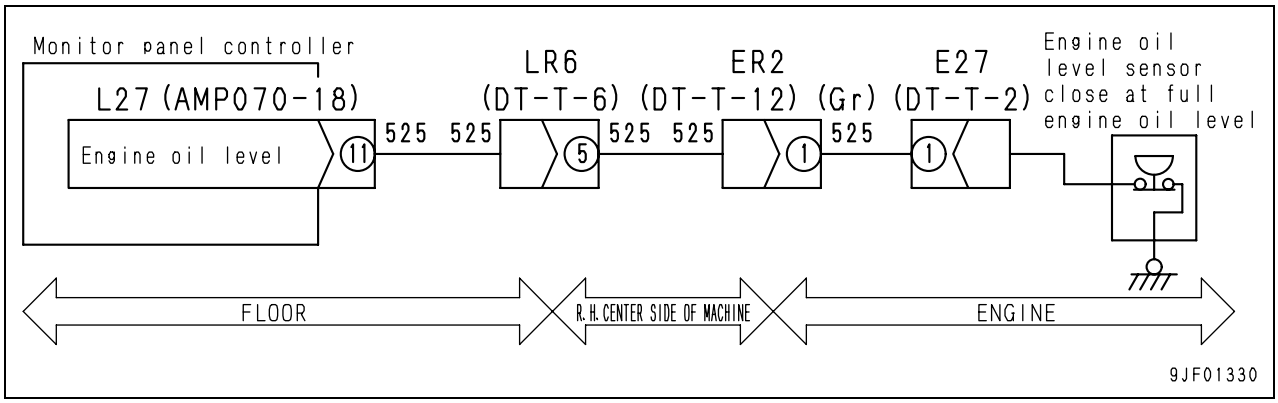


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Engine oil level caution lamp does not light up
-	-	-		
Description of Trouble	• The engine oil level sensor circuit is kept closed.			
Machine monitor or controller Reaction	• None in particular.			
Effect on Machine	• While the engine oil level is insufficient, the radiator coolant caution lamp does not light up.			
Related Information	• The input signal of the engine oil level sensor can be checked with the monitoring function (Code: 40903, D_IN_27).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective engine oil level sensor	1) Turn starting switch OFF. 2) Disconnect connector E27. 3) Connect T-adapter.			
			Between E27 (male) (1) and chassis ground	Oil level is normal	Resistance	Max. 1 Ω
				Oil level is insufficient (low)	Resistance	Min. 1 MΩ
	2	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L27 and E27. 3) Connect T-adapter.			
			Wiring harness between L27 (female) (11) and E27 (female) (1)	Resistance between L27 (female) (11), E27 (female) (1) and chassis ground	Resistance	Max. 1 Ω
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Connect T-adapter.			
			Between L27 (female) (11) and chassis ground	Oil level is normal	Resistance	Max. 1 V
				Oil level is insufficient (low)	Resistance	20 - 30 V

Related circuit diagram



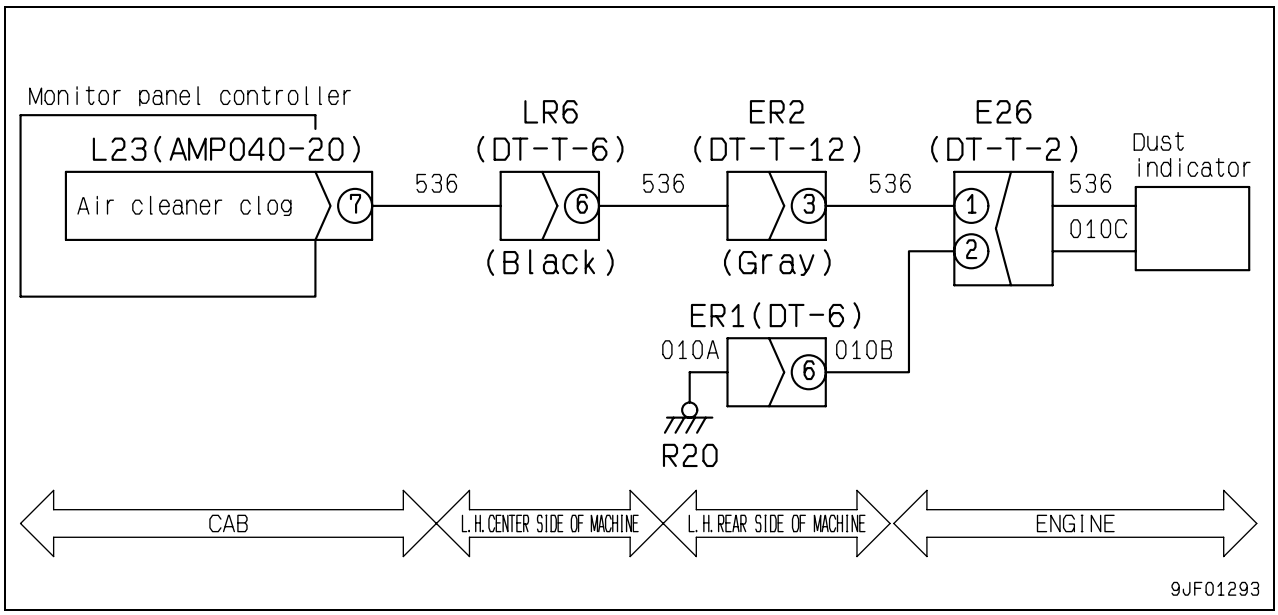
Troubleshooting Code [MON-15] Air cleaner clogging indicator lamp does not light up

Speedometer specification (STD)

Action Code	Failure Code	Controller Code	Trouble	Air cleaner clogging caution lamp does not light up
-	-	-		
Description of Trouble	• While the air cleaner is clogged, the sensor circuit is open (clogging is not detected).			
Machine monitor or controller Reaction	• None in particular.			
Effect on Machine	• The air cleaner clogging caution lamp does not light up.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	1	Defective dust indicator (air cleaner clogging sensor)	1) Turn starting switch OFF. 2) Disconnect connector E26. 3) Connect T-adapter. 4) Connect connector. 5) Start engine.		
			Between E26 (female) (1) and (2)	Air cleaner is normal	Voltage: 20 - 30 V
				Air cleaner is clogged	Voltage: Max. 1 V
	2	Disconnection in wiring harness (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector E26. 3) Connect T-adapter.		
			Wiring harness between L23 (female) (7) and E26 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between E26 (female) (2) and chassis ground	Resistance	Max. 1 Ω
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector E23. 3) Connect T-adapter. 4) Connect connector. 5) Start engine.		
			Between L23 (female) (7) and chassis ground	Air cleaner is normal	Voltage: 20 - 30 V
				Air cleaner is clogged	Voltage: Max. 1 V

Related circuit diagram

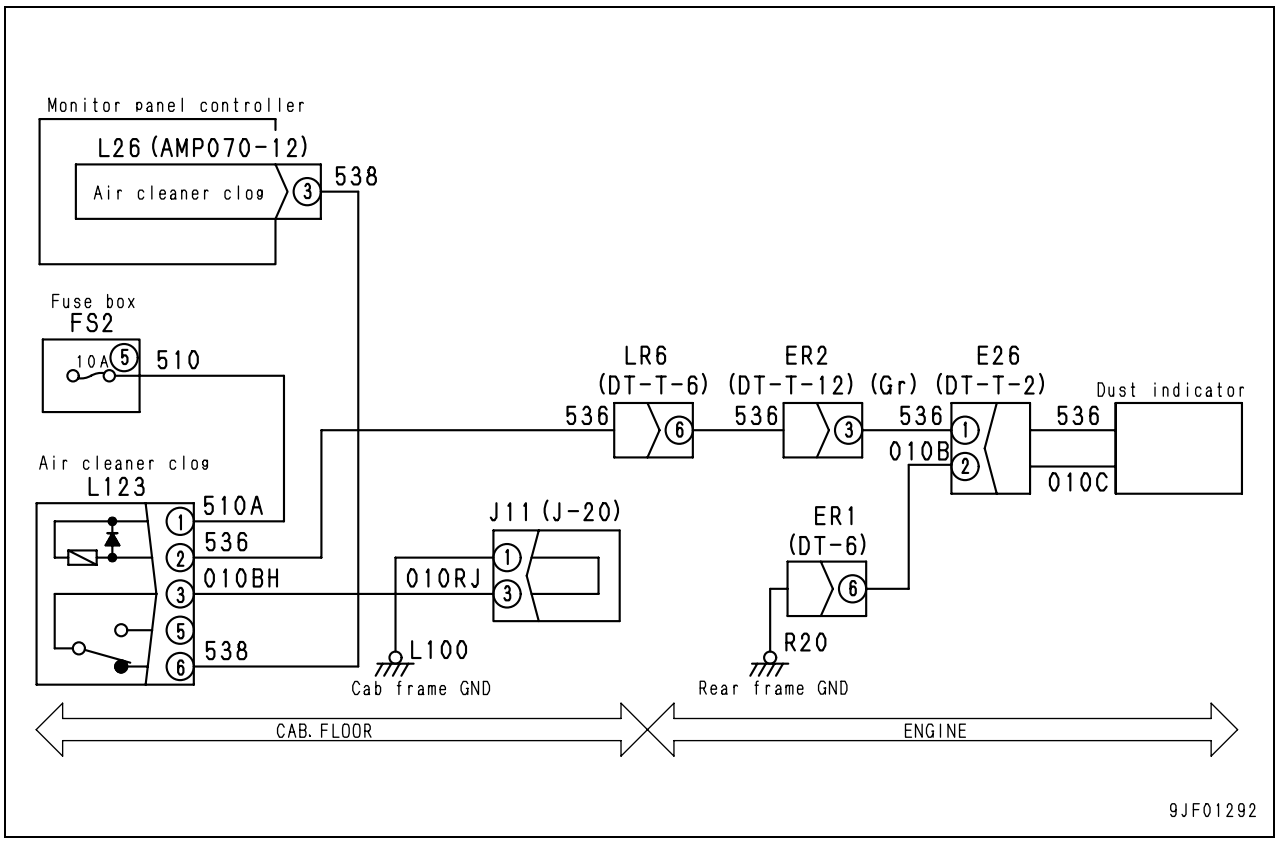


Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Air cleaner clogging caution lamp does not light up
-	-	-		
Description of Trouble	• While the air cleaner is clogged, the sensor circuit is open (clogging is not detected).			
Machine monitor or controller Reaction	• None in particular.			
Effect on Machine	• The air cleaner clogging caution lamp does not light up.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Clogging of air cleaner	Clean or replace.			
	2	Defective dust indicator (air cleaner clogging sensor)	1) Turn starting switch OFF. 2) Disconnect connector E26. 3) Connect T-adapter. 4) Start engine.			
			Between E26 (female) (1) and (2)	Air cleaner is normal.	Resistance	Min. 1 MΩ
				Air cleaner is clogged.	Resistance	Max. 1 Ω
	3	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L123 and E26. 3) Connect T-adapter.			
			Wiring harness between L123 (female) (2) and E26 (female) (1)		Resistance	Max. 1 Ω
	4	Disconnection in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L123 and E26. 3) Connect T-adapter.			
			Between E26 (female) (3) and L123 (female) (6)	Resistance between E26 (female) (3), L123 (female) (6) and chassis ground		Min. 1 MΩ
	5	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L26. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON. 6) Start engine.			
			Between L26 (female) (3) and chassis ground	Air cleaner is normal.	Voltage	Max. 1 V
				Air cleaner is clogged.	Voltage	20 - 30 V
	6	Defective air cleaner clogging relay (L123)	1) Turn starting switch OFF. 2) Replace L123 with normal relay. 3) Connect (1) and (2) of connector E26. 4) Start engine.			
			Replace air cleaner clogging relay (L123).	Condition does not become normal.		Relay (L123) is normal.
				Condition becomes normal.		Relay (L123) is defective.
			1) Turn starting switch OFF. 2) Disconnect connector L123. 3) Check relay L123.			
			Between L123 (male) (1) and (2)		Resistance	200 - 400 Ω
			1) Turn starting switch OFF. 2) Disconnect connector L123. 3) Check relay L123. 4) Apply test voltage between L123 (male) (1) and (2).			
			Between L123 (male) (3) and (6)	When 24 V is applied between (1) and (2)	Resistance	Max. 1 Ω
				When 24 V is not applied between (1) and (2)	Resistance	Min. 1 MΩ

Related circuit diagram



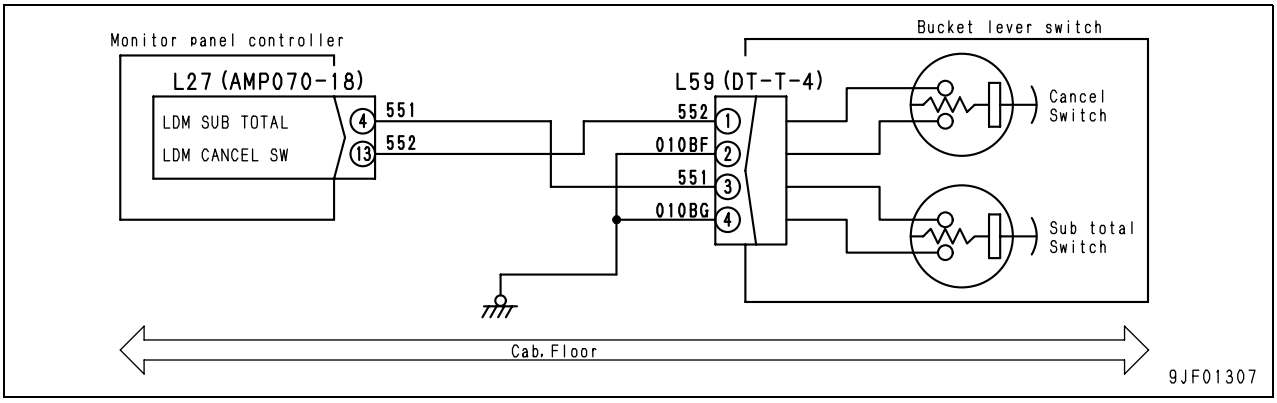
Troubleshooting Code [MON-16] Defective cancel switch

Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Defective cancel switch
-	-	-		
Description of Trouble	• The cancel switch input circuit is open.			
Machine monitor or controller Reaction	• None in particular.			
Effect on Machine	• The weight indicated by the load meter cannot be canceled.			
Related Information	• The cancel switch input signal (0/1) can be checked with the monitoring function (Code: 40904, D_IN_33).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective cancel switch (BUCKET LEVER FOR OPT LDM)	1) Turn starting switch OFF. 2) Disconnect connector L59. 3) Connect T-adapter.			
			Between L59 (female) (1) and (2)	When cancel switch is turned ON	Resistance	Max. 1 Ω
				When cancel switch is turned OFF	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connectors L27 and L59. 3) Connect T-adapter.			
			Wiring harness between L27 (female) (13) and L59 (female) (1)		Resistance	Max. 1 Ω
	3	Short circuit with power source in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L27 and L59. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between L27 (female) (13) and L59 (female) (1)	Voltage between L27 (female) (13), L59 (female) (1) and chassis ground		Max. 1 V
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Turn starting switch ON.			
			Between L27 (13) and chassis ground	When cancel switch is turned ON	Voltage	Max. 1 V
				When cancel switch is turned OFF	Voltage	20 - 30 V

Related circuit diagram



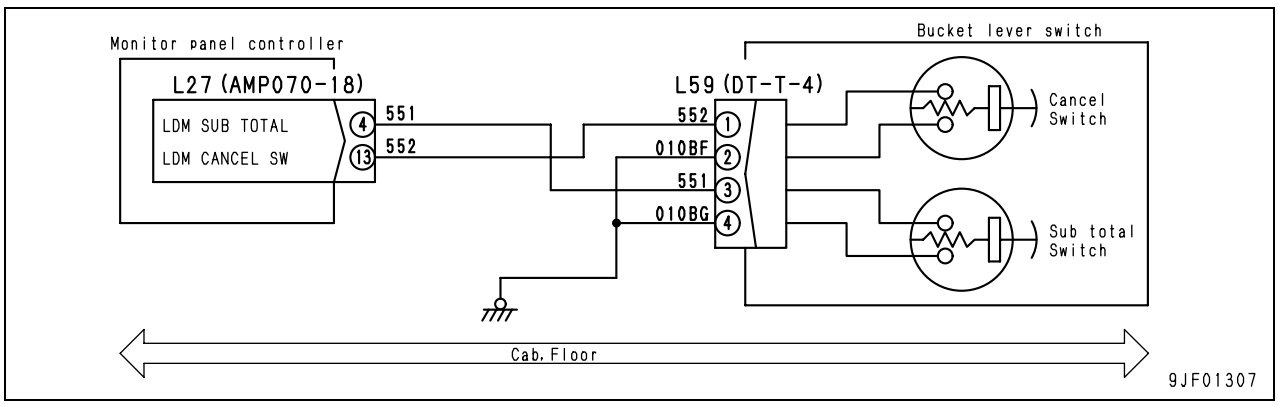
Troubleshooting Code [MON-17] Defective subtotal switch

Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Defective subtotal switch
-	-	-		
Description of Trouble	• The subtotal switch input circuit is open.			
Machine monitor or controller Reaction	• None in particular.			
Effect on Machine	• The subtotal of the load meter cannot be obtained.			
Related Information	• The subtotal input signal (0/1) can be checked with the monitoring function (Code: 40904, D_IN_32).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective subtotal switch (BUCKET LEVER FOR OPT LDM)	1) Turn starting switch OFF. 2) Disconnect connector L59. 3) Connect T-adapter.			
			Between L59 (female) (3) and (4)	When subtotal switch is turned ON	Resistance	Max. 1 Ω
				When subtotal switch is turned OFF	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connectors L27 and L59. 3) Connect T-adapter.			
			Wiring harness between L27 (female) (4) and L59 (female) (3)		Resistance	Max. 1 Ω
	3	Short circuit with power source in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L27 and L59. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Wiring harness between L27 (female) (4) and L59 (female) (3)	Voltage between L27 (female) (4), L59 (female) (3) and chassis ground		Max. 1 V
	4	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L27. 3) Insert T-adapter. 4) Turn starting switch ON.			
			Between L27 (4) and chassis ground	When subtotal switch is turned ON	Voltage	Max. 1 V
				When subtotal switch is turned OFF	Voltage	20 - 30 V

Related circuit diagram



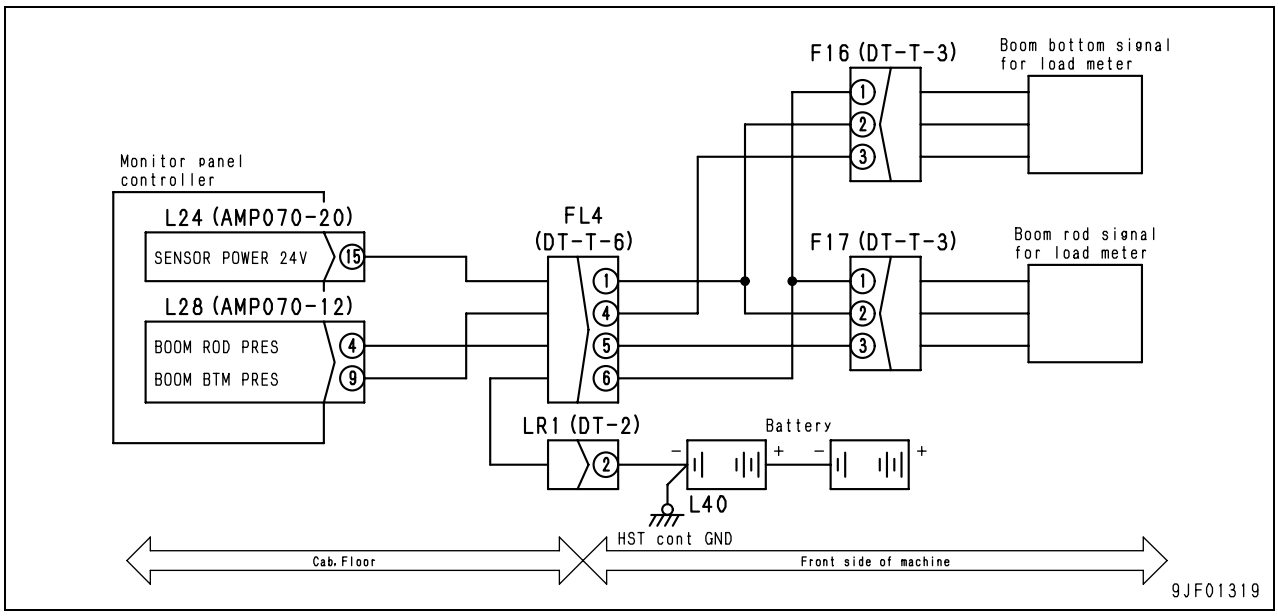
Troubleshooting Code [MON-18] Defective bottom pressure sensor (Short circuit with power source)

Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Defective bottom pressure sensor (Short circuit with power source)
-	-	-		
Description of Trouble	• The input voltage from the bottom pressure sensor is above 5.3 V.			
Machine monitor or controller Reaction	• None in particular.			
Effect on Machine	• The alarm is turned ON. • The load is displayed abnormally.			
Related Information	• The bottom pressure signal (0.01 MPa) can be checked with the monitoring function (Code: 40400).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective boom pressure sensor (on bottom side)	1) Turn starting switch OFF. 2) Disconnect connector F16. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between F16 (B) and (A)		Voltage	20 - 30 V
			Between F16 (C) and (A)	When operated	Voltage	0.7 - 5.3 V
				When opened to atmosphere	Voltage	0.5 - 1.5 V
	2	Short circuit with power source in wiring harness (Contact with power supply wiring harness)	1) Turn starting switch OFF. 2) Disconnect connectors F16. 3) Connect T-adapter.			
			Wiring harness between L28 (female) (9) and F16 (female) (C)	Voltage between L28 (female) (9), F16 (female) (C) and chassis ground		Max. 1 V
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connectors L24 and L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (15) and chassis ground		Voltage	20 - 30 V
			Between L28 (9) and chassis ground	When operated	Voltage	0.7 - 5.3 V
				When opened to atmosphere	Voltage	0.5 - 1.5 V

Related circuit diagram



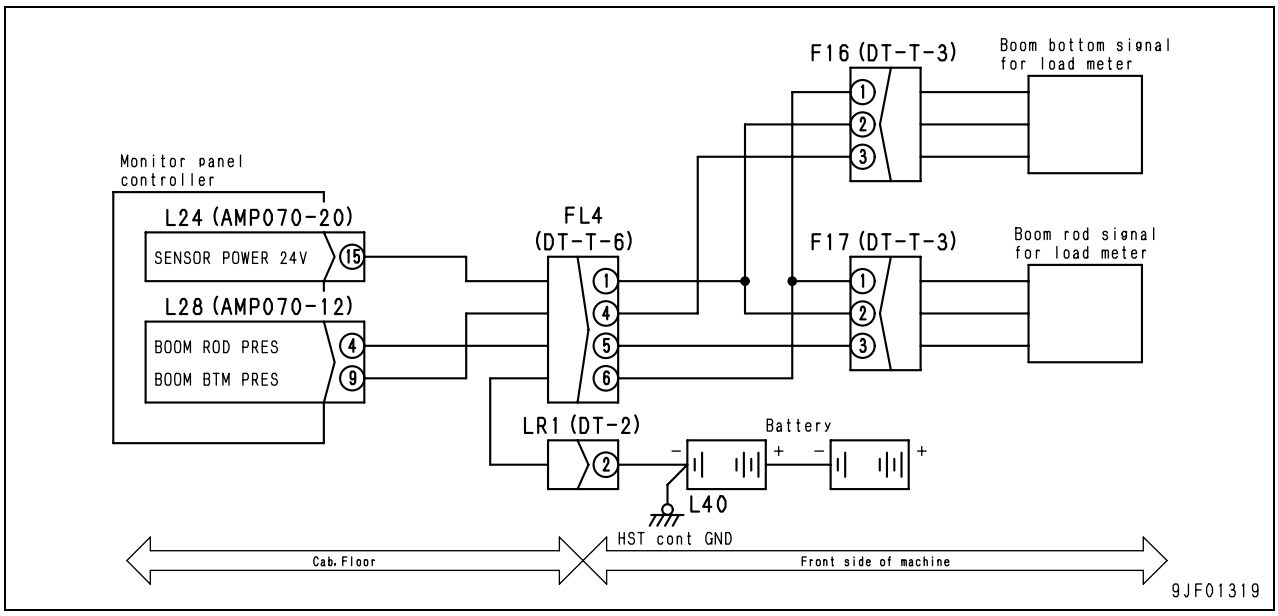
Troubleshooting Code [MON-19] Defective head pressure sensor

Load meter specification (If equipped)

Action Code	Failure Code	Controller Code	Trouble	Defective head pressure sensor
-	-	-		
Description of Trouble	• The input voltage from the head pressure sensor is above 5.3 V.			
Machine monitor or controller Reaction	• None in particular.			
Effect on Machine	• The alarm is turned ON. • The load is displayed abnormally.			
Related Information	• The head pressure signal (0.01 MPa) can be checked with the monitoring function (Code: 40500).			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective boom pressure sensor (on head side)	1) Turn starting switch OFF. 2) Disconnect connector F16. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between F17 (B) and (A)		Voltage	20 - 30 V
			Between F17 (C) and (A)	When operated	Voltage	0.7 - 5.3 V
				When opened to atmosphere	Voltage	0.5 - 1.5 V
	2	Short circuit with power source in wiring harness (Contact with power supply wiring harness)	1) Turn starting switch OFF. 2) Disconnect connectors F17. 3) Connect T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Wiring harness between L28 (female) (4) and F17 (female) (C)	Voltage between L28 (female) (4), F17 (female) (C) and chassis ground		Max. 1 V
	3	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connectors L24 and L28. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L24 (15) and chassis ground		Voltage	20 - 30 V
			Between L28 (4) and chassis ground	When operated	Voltage	0.7 - 5.3 V
				When opened to atmosphere	Voltage	0.5 - 1.5 V

Related circuit diagram



Troubleshooting Code [MON-20] The wiper does not function

★ Defects in the wiper system is given in the TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE), so see the section for TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE).

Troubleshooting Code [MON-21] The lamps do not work properly

★ Defects in the lamp system (lamps do not work properly) is given in the TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE), so see the section for TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE).

TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE)

BEFORE TROUBLESHOOTING ELECTRICAL SYSTEM

FUSE BOX CONNECTION TABLE

★ This connection chart shows the equipment that each fuse box power source supplies power directly to ("switch power source" means the power supplied when the starting switch is ON; "permanent power source" means the power supplied when the starting switch is OFF).

Category	Fuse No.	Fuse capacity	Power supply destination
Permanent power source (Fuse box 1)	1	20A	Starting switch
	2	10A	Hazard lamp
	3	10A	HST control A
	4	10A	Parking brake 1
	5	10A	Meter, panel
	6	10A	Car radio A, Room lamp
	7	10A	Spare power supply (battery +24 V)
Switch power source (Fuse box 1)	8	10A	Head lamp (left side)
	9	10A	Head lamp (right side)
	10	10A	Turn signal lamp
	11	10A	Back lamp, stop lamp
	12	20A	HST control B
	13	10A	Work equipment positioner
	14	10A	Wiper
	15	10A	Car radio B
Switch power source (Fuse box 2)	1	20A	Air conditioner A
	2	20A	Air conditioner B
	3	10A	Beacon lamp
	4	10A	-
	5	10A	Load-meter
	6	20A	DC converter
	7	10A	Spare power supply (+24 V when key is ON)
	8	10A	Parking brake 2
	9	10A	Horn
	10	10A	Side marker lamp (left side)
	11	10A	Side marker lamp (right side)
	12	20A	Front working lamp
	13	20A	Rear working lamp
	14	10A	(Spare 1)
	15	10A	(Spare 2)

INFORMATION CONTAINED IN TROUBULESHOOTING TABLE

★ The troubleshooting table and the related circuit diagrams contain the following information. Grasp their contents fully before proceeding to actual troubleshooting work.

Action Code	Failure Code	Controller Code	Trouble	Trouble displayed in trouble data
Panel display	Panel display	Panel display		
Description of Trouble	• Condition when machine monitor or controller detected trouble.			
Machine monitor or controller Reaction	• Action to take to protect system or equipment when machine monitor or controller detected trouble.			
Effect on Machine	• Condition that appeared as problem on machine when action (given above) was taken by machine monitor or controller.			
Related Information	• Information related to troubleshooting or error that occurred.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting
Possible Causes and Standard Values	1 2 3 4 5	Probable cause when trouble occurred (the numbers are index numbers and do not indicate the order of priority)	<Data to fill in> • Normal standard values used to judge probable cause • Remarks regarding decision-making <Condition when wiring harness is defective> • Disconnection There is defective connection of connector or disconnection in wiring harness • Short circuit with ground Wiring harness not wired to ground (GND) circuit is in contact with ground (GND) circuit • Short circuit with power source Wiring harness not wired to power supply (24 V) circuit is in contact with power supply (24 V) circuit <Points to remember when troubleshooting> 1) Method of displaying connector No. and handling T-adapter Unless there is special instruction, insert or connect the T-adapter as follows • If there is no indication for the male or female terminal of the connector No., disconnect the connector and insert the T-adapter in both the male and female terminals • If there is indication for the male or female terminal of the connector No., disconnect the connector and connect the T-adapter to only the terminal indicated (either the male terminal or female terminal) <Points to remember when troubleshooting> 2) Given order for pin numbers and handling tester lead Unless there is a special instruction, connect tester (+) lead and (-) lead as follows to carry out troubleshooting • Connect the (+) lead to the wiring harness for the pin No. given first • Connect the (-) lead to the wiring harness for the pin No. given last

Related circuit diagram

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

- Connector No.: Indicates (Type - numbers of a pin) (color)
- Arrow: Roughly indicates the location in the machine where it is installed.

white 20-605

Troubleshooting Code [E-1] (The engine does not start)

Speed meter specification (STD)

a) - 1 Defective starting motor system (When direction selector actuation switch is turned OFF)

Action Code	Failure Code	Controller Code	Trouble	The engine does not start a) Defective starting motor system
-	-	-		
Description of Trouble	• The engine does not start due to defective starting motor system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The engine does not start.			
Related Information	• If the failure code D5ZHL6 for abnormality in starting switch C input is given, carry out troubleshooting first for the applicable code. • If the fuses are blown, check the wiring harness is short-circuited with the ground.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective battery	Specific gravity		1.26V and above	
			Voltage		24V and above	
	2	Defective battery relay	1) Turn starting switch OFF. 2) Replace battery relay with normal relay. 3) Turn starting switch ON.			
			When battery relay is replaced, does condition becomes normal?	No	Battery relay is normal.	
				Yes	Battery relay is defective.	
			1) Turn starting switch OFF. 2) Disconnect battery relay. 3) Check relay unit.			
			Between battery relays R15 and R16		Resistance	30 - 70Ω
			1) Turn starting switch OFF. 2) Disconnect battery relay. 3) Check relay unit. 4) Apply normal voltage between battery relays R15 and R16.			
			Between battery relays R04 and R01	Apply 24 V between R15 and R16.	Resistance	1Ω and below
				Do not apply 24 V between R15 and R16.	Resistance	1MΩ and above
	3	Defective neutral safety relay (L106)	1) Turn starting switch OFF. 2) Interchange relay (L106) with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when neutral safety relay (L106) is interchanged with normal relay?	The condition is abnormal.		Relay (L106) is normal.
				The condition is normal.		Defective relay (L106)
			1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check.			
			Between L106 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check. 4) Applies impressed voltage between L106 (Male) (1) - (2)			
			Between L106 (Male) (3) and (5)	Applies 24V impressed voltage between L106 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L106 (Male) (1) - (2)	Resistance	1MΩ and above
	4	Defective directional lever	1) Turn starting switch OFF. 2) Disconnect connector L15. 3) Connect T-adapter.			
			Between L15 (Female) (1) and (3)	When directional lever is turned N.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	5	Defective multi-function related relay (L133, L136, L137)	1) Turn starting switch OFF. 2) Interchange relay (one of L133, L136, or L137) with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when neutral safety relay (one of L133, L136, or L137) is interchanged with normal relay?	The condition is abnormal.		Relay (L133, L136, L137) is normal.
				The condition is normal.		Defective relay (L133, L136, L137)
			1) Turn starting switch OFF. 2) Disconnect one of connectors L133, L136, or L137. 3) Solid part check.			
			Between (Male) (1) - (2) of one of L133, L136, or L137		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect one of connectors L133, L136, or L137. 3) Solid part check. 4) Applies impressed voltage between (Male) (1) - (2) of one of L133, L136, or L137			
			Between (Male) (3) - (5) of one of L133, L136, or L137	Applies 24V impressed voltage between L106 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L106 (Male) (1) - (2)	Resistance	1MΩ and above
	6	Defective diode (D08, D15) ★ Only when defect occurs in both at the same time	1) Turn starting switch OFF. 2) Replace both diodes (D08, D15) with normal diodes. 3) Turn starting switch START.			
			The condition is abnormal.		Diode (D08, D15) is normal.	
			The condition is normal.		Defective diode (D08, D15)	
			Measure from (2) end with diode range		Continuity	
			Measure from (1) end with diode range		Discontinuity	
	7	Defective diode (D07)	1) Turn starting switch OFF. 2) Replace diode (D07) with normal diode. 3) Turn starting switch START.			
			The condition is abnormal.		Diode (D07) is normal.	
			The condition is normal.		Defective diode (D07)	
			Measure between (1) Ω (2) with diode range		Continuity	
			Measure between (3) Ω (2) with diode range		Continuity	
			Measure between (2) Ω (3) with diode range		Discontinuity	
			Measure between (2) Ω (1) with diode range		Discontinuity	
			Measure between (1) Ω (3) with diode range		Discontinuity	
			Measure between (3) Ω (1) with diode range		Discontinuity	
			★ Put (+) pole of tester in contact with left side.			
	8	Wiring harness discontinuity (Disconnection or defective contact) ★ Starting motor related harness	1) Turn starting switch OFF. 2) Disconnect connector L106, D08, D15, terminal E01, R01 and E10. 3) Connect T-adapter.			
			Wiring harness between L106 (Female) (5) and D08 (Female) (2)		Resistance	1Ω and below
			Wiring harness between L106 (Female) (5) and D15 (Female) (2)		Resistance	1Ω and below
			Wiring harness between D08 (Female) (1) and E01 (Female) (1)		Resistance	1Ω and below
			Wiring harness between D15 (Female) (1) and E01 (Female) (1)		Resistance	1Ω and below
			Wiring harness between R01 and starting motor terminal B (E10)		Resistance	1Ω and below
	9	Wiring harness discontinuity (Disconnection or defective contact) ★ Battery relay related harness	1) Turn starting switch OFF. 2) Disconnect connector D07, E02, terminal R16, R15, R07, R04, R02 and R05. 3) Connect T-adapter.			
			Wiring harness between R16 and chassis ground		Resistance	1Ω and below
			Wiring harness between R15 and D07 (Female) (2)		Resistance	1Ω and below
			Wiring harness between E02 (Female) (2) and R15		Resistance	1Ω and below
			Wiring harness between R04 and R02		Resistance	1Ω and below
			Wiring harness between R01 and R05		Resistance	1Ω and below
			Wiring harness between battery and R04		Resistance	1Ω and below

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	10	Wiring harness discontinuity (Disconnection or defective contact) ★ Starting switch related harness	1) Turn starting switch OFF. 2) Disconnect connector L02, D07, terminal R03 and fuse FS1. 3) Connect T-adapter.			
			Wiring harness between L02 (Female) (1), FS1 (1) and R03		Resistance	1✕ and below
			Wiring harness between L02 (Female) (2) and D07 (Female) (1)		Resistance	1✕ and below
			Wiring harness between L02 (Female) (2) and L23 (Female) (1)		Resistance	1✕ and below
	11	Wiring harness discontinuity (Disconnection or defective contact) ★ Directional lever related harness	1) Turn starting switch OFF. 2) Disconnect connector L15, terminal R06 and fuse FS1. 3) Connect T-adapter.			
			Wiring harness between L15 (Female) (1), FS1 (2) and R06		Resistance	1✕ and below
			Wiring harness between L15 (Female) (3) and L106 (Female) (1)		Resistance	1✕ and below
			Wiring harness between L106 (Female) (2) and chassis ground		Resistance	1✕ and below
	12	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect connector E01, E02, D07. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between E01 (Female) (2), E02 (Female) (1) and D07 (Female) (3)	Voltage between E01 (Female) (2), E02 (Female) (1) and chassis ground		1V and below
	13	Defective starting switch	1) Disconnect starting switch terminal. 2) Solid part check.			
			Turn starting switch START.	Between terminal B and C		1✕ and below
	14	Defective starting motor	1) Solid part check.			
			• If the check of the individual part shows that it is normal, the starting motor is normal.			
	15	Defective alternator	Between alternator terminal R [E02 (1)] and chassis ground	Engine started (Throttle 1/2 and above)	Voltage	26.5 - 29V
				Engine stopped	Voltage	1V and below
	16	Defective short connector TEL	1) Turn starting switch OFF. 2) Disconnect connector TEL. 3) Connect T-adapter.			
			Wiring harness between TEL (Female) (7) and (8)		Resistance	1✕ and below

a) - 2 Defective starting motor system (When the directional selector actuation switch is turned ON)

★ Perform the inspection and troubleshooting in this section in addition to a) -1.

Action Code	Failure Code	Controller Code	Trouble	The engine does not start a) Defective starting motor system
-	-	-		
Description of Trouble	• The engine does not start due to defective starting motor system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The engine does not start.			
Related Information	• If the failure code D5ZHL6 for abnormality in starting switch C input is given, carry out troubleshooting first for the applicable code. • If the fuses are blown, check the wiring harness is short-circuited with the ground. • When the directional selector actuation switch is operated, the directional lever must be in the "N" position and the directional selector switch must be in the "N" position.			

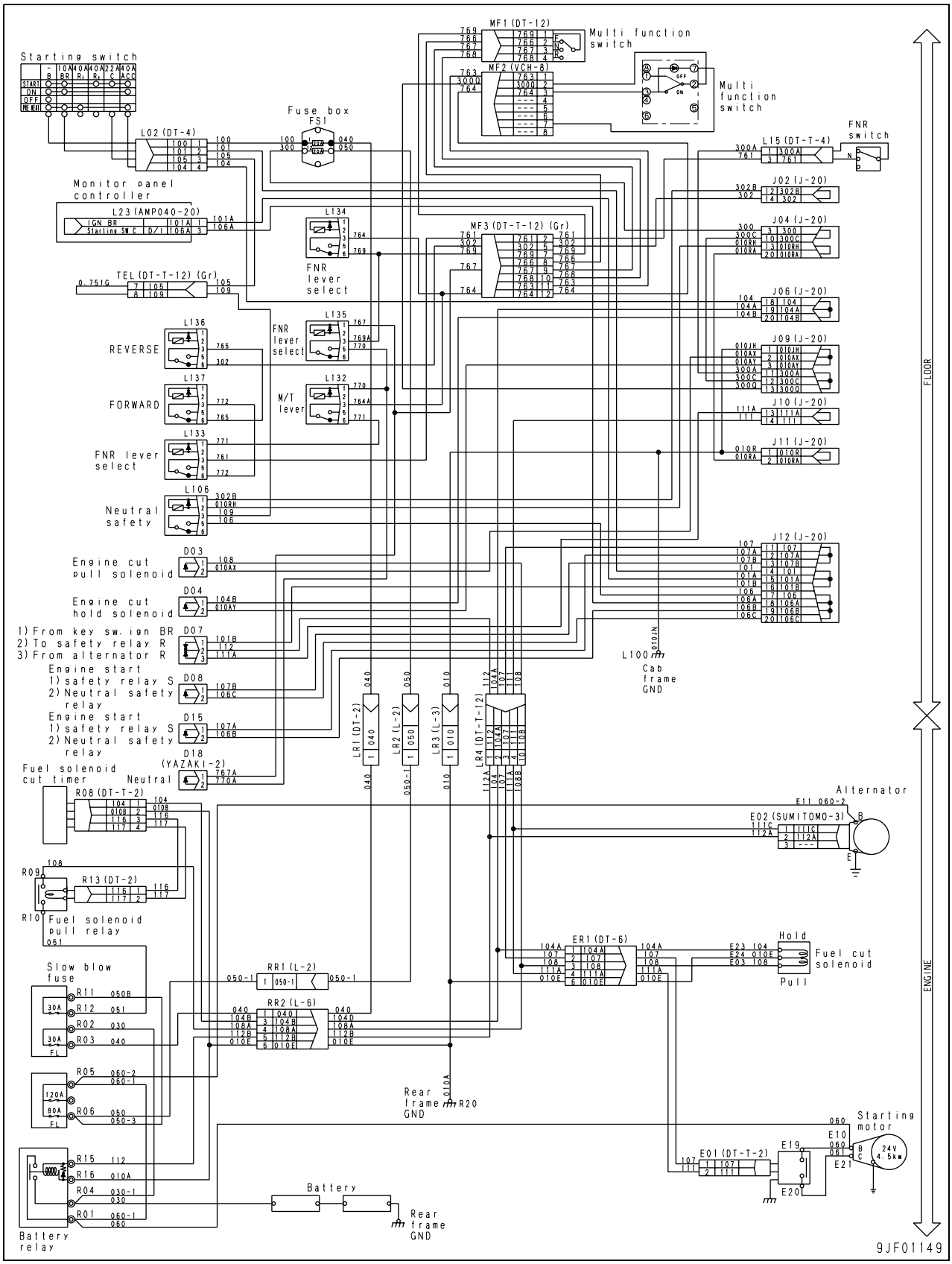
	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective battery	Specific gravity		1.26V and above	
			Voltage		24V and above	
	2	Defective neutral safety relay (L132, L133, L134)	1) Turn starting switch OFF. 2) Interchange relay (L132, L133, L134) with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when neutral safety relay (L132, L133, L134) is interchanged with normal relay?	The condition is abnormal.		Relay (L132, L133, L134) is normal.
				The condition is normal.		Defective relay (L132, L133, L134)
			1) Turn starting switch OFF. 2) Disconnect connector L132, L133, L134. 3) Solid part check.			
			Between L132, L133, L134 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L132, L133, L134. 3) Solid part check. 4) Applies impressed voltage between L132, L133, L134 (Male) (1) - (2)			
			Between L132, L133, L134 (Male) (3) and (5)	Applies 24V impressed voltage between L132, L133, L134 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L132, L133, L134 (Male) (1) - (2)	Resistance	1MΩ and above
	3	Defective directional select switch	1) Turn starting switch OFF. 2) Disconnect connector MF1. 3) Connect T-adapter.			
			Between MF1 (Female) (1) and (3)	When direction select switch is turned N.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above
	4	Defective diode (D18) ★ Only when defect occurs in both at the same time	1) Turn starting switch OFF. 2) Replace both diodes (D18) with normal diodes. 3) Turn starting switch START.			
			The condition is abnormal.		Diode (D18) is normal.	
			The condition is normal.		Defective diode (D18)	
			Measure from (2) end with diode range		Continuity	
			Measure from (1) end with diode range		Discontinuity	

b) Defective fuel cut solenoid system

Action Code	Failure Code	Controller Code	Trouble	The engine does not start b) Defective fuel cut solenoid system
-	-	-		
Description of Trouble	• The fuel cut solenoid system is defective, so the engine does not start.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The engine does not start.			
Related Information	• If the failure code D5ZHL6 for abnormality in starting switch C input is given, carry out troubleshooting first for the applicable code. • If the fuses are blown, check the wiring harness is short-circuited with the ground.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective fuel cut solenoid pull relay (R13)	1) Turn starting switch OFF. 2) Interchange relay (R13) with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when pull relay (R13) is interchanged with normal relay?	The condition is abnormal.		Relay (R13) is normal.
				The condition is normal.		Defective relay (R13)
			1) Turn starting switch OFF. 2) Disconnect connector L104. 3) Solid part check.			
			Between R13 (Male) (1) and (2)		Resistance	50 - 90Ω
			1) Turn starting switch OFF. 2) Disconnect connector R13. 3) Solid part check. 4) Applies impressed voltage between R13 (Male) (1) - (2)			
			Between R13 (Male) (3) and (5)	Applies 24V impressed voltage between R13 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between R13 (Male) (1) - (2)	Resistance	1MΩ and above
	2	Defective fuel cut solenoid	1) Turn starting switch OFF. 2) Disconnect terminal E03, E23, E24. 3) Connect T-adapter. 4) Solid part check.			
			Between E23 and E24		Resistance	43 - 53Ω
			Between E03 and E24		Resistance	0.8 - 1.2Ω
	3	Defective fuel cut solenoid timer	1) Turn starting switch OFF. 2) Disconnect connector R08. 3) Insert T-adapter. 4) Connect connector.			
			Between R08 (1) and (2)	Turn starting switch ON.	Voltage	20 - 30V
				Turn starting switch OFF.	Voltage	1V and below
			Between R08 (3) and (4)	2 - 4 sec after turning starting switch ON	Voltage	16V and above
				Other than above.	Voltage	1V and below
	4	Defective diode (D03 or D04)	1) Turn starting switch OFF. 2) Replace diode (D03 or D04) with a normal diode. 3) Turn starting switch START.			
			The condition is abnormal.		Diode (D03 or D04) is normal.	
			The condition is normal.		Defective diode (D03 or D04)	
	5	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L02, D03, D04, D08, D15, terminal E01, E03, E11, E23, E24, R05, R08, R09, R10, R12 and R13. 3) Connect T-adapter.			
			Wiring harness between E24 and chassis ground		Resistance	1Ω and below
			Wiring harness between D03 (Female) (2) and chassis ground		Resistance	1Ω and below
			Wiring harness between E03 and R09		Resistance	1Ω and below
			Wiring harness between D04 (Female) (2) and chassis ground		Resistance	1Ω and below
			Wiring harness between E23 and L02 (Female) (4)		Resistance	1Ω and below
			Wiring harness between E23 and R08 (Female) (1)		Resistance	1Ω and below
			Wiring harness between R08 (Female) (2) and chassis ground		Resistance	1Ω and below
			Wiring harness between R08 (Female) (3) and R13 (Female) (1)		Resistance	1Ω and below
			Wiring harness between R08 (Female) (4) and R13 (Female) (2)		Resistance	1Ω and below
			Wiring harness between R10 and R12		Resistance	1Ω and below
			Wiring harness between R11 and R06		Resistance	1Ω and below
	6	Defective starting switch	1) Disconnect starting switch terminal. 2) Solid part check.			
			Turn starting switch START.	Between terminal B and ACC		1Ω and below

Related circuit diagram



Load meter specification (If equipped)

a) - 1 Defective starting motor system (When direction selector actuation switch is turned OFF)

Action Code	Failure Code	Controller Code	Trouble	The engine does not start a) Defective starting motor system
-	-	-		
Description of Trouble	• The engine does not start due to defective starting motor system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The engine does not start.			
Related Information	• If the failure code D5ZHL6 for abnormality in starting switch C input is given, carry out troubleshooting first for the applicable code. • If the fuses are blown, check the wiring harness is short-circuited with the ground.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective battery	Specific gravity		1.26V and above	
			Voltage		24V and above	
	2	Defective battery relay	1) Turn starting switch OFF. 2) Replace battery relay with normal relay. 3) Turn starting switch ON.			
			When battery relay is replaced, does condition becomes normal?	No	Battery relay is normal.	
				Yes	Battery relay is defective.	
			1) Turn starting switch OFF. 2) Disconnect battery relay. 3) Check relay unit.			
			Between battery relays R15 and R16		Resistance	30 - 70Ω
			1) Turn starting switch OFF. 2) Disconnect battery relay. 3) Check relay unit. 4) Apply normal voltage between battery relays R15 and R16.			
			Between battery relays R04 and R01	Apply 24 V between R15 and R16.	Resistance	1Ω and below
				Do not apply 24 V between R15 and R16.	Resistance	1MΩ and above
	3	Defective neutral safety relay (L106)	1) Turn starting switch OFF. 2) Interchange relay (L106) with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when neutral safety relay (L106) is interchanged with normal relay?	The condition is abnormal.		Relay (L106) is normal.
				The condition is normal.		Defective relay (L106)
			1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check.			
			Between L106 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check. 4) Applies impressed voltage between L106 (Male) (1) - (2)			
			Between L106 (Male) (3) and (5)	Applies 24V impressed voltage between L106 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L106 (Male) (1) - (2)	Resistance	1MΩ and above
	4	Defective directional lever	1) Turn starting switch OFF. 2) Disconnect connector L15. 3) Connect T-adapter.			
			Between L15 (Female) (1) and (3)	When directional lever is turned N.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	5	Defective multi-function related relay (L133, L136, L137)	1) Turn starting switch OFF. 2) Interchange relay (one of L133, L136, or L137) with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when neutral safety relay (one of L133, L136, or L137) is interchanged with normal relay?	The condition is abnormal.		Relay (L133, L136, L137) is normal.
				The condition is normal.		Defective relay (L133, L136, L137)
			1) Turn starting switch OFF. 2) Disconnect one of connectors L133, L136, or L137. 3) Solid part check.			
			Between (Male) (1) - (2) of one of L133, L136, or L137		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect one of connectors L133, L136, or L137. 3) Solid part check. 4) Applies impressed voltage between (Male) (1) - (2) of one of L133, L136, or L137			
			Between (Male) (3) - (5) of one of L133, L136, or L137	Applies 24V impressed voltage between L106 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L106 (Male) (1) - (2)	Resistance	1MΩ and above
	6	Defective diode (D08, D15) ★ Only when defect occurs in both at the same time	1) Turn starting switch OFF. 2) Replace both diodes (D08, D15) with normal diodes. 3) Turn starting switch START.			
			The condition is abnormal.		Diode (D08, D15) is normal.	
			The condition is normal.		Defective diode (D08, D15)	
			Measure from (2) end with diode range		Continuity	
			Measure from (1) end with diode range		Discontinuity	
	7	Defective diode (D07)	1) Turn starting switch OFF. 2) Replace diode (D07) with normal diode. 3) Turn starting switch START.			
			The condition is abnormal.		Diode (D07) is normal.	
			The condition is normal.		Defective diode (D07)	
			Measure between (1) Ω (2) with diode range		Continuity	
			Measure between (3) Ω (2) with diode range		Continuity	
			Measure between (2) Ω (3) with diode range		Discontinuity	
			Measure between (2) Ω (1) with diode range		Discontinuity	
			Measure between (1) Ω (3) with diode range		Discontinuity	
			Measure between (3) Ω (1) with diode range		Discontinuity	
			★ Put (+) pole of tester in contact with left side.			
	8	Wiring harness discontinuity (Disconnection or defective contact) ★ Starting motor related harness	1) Turn starting switch OFF. 2) Disconnect connector L106, D08, D15, terminal E01, R01 and E10. 3) Connect T-adapter.			
			Wiring harness between L106 (Female) (5) and D08 (Female) (2)		Resistance	1Ω and below
			Wiring harness between L106 (Female) (5) and D15 (Female) (2)		Resistance	1Ω and below
			Wiring harness between D08 (Female) (1) and E01 (Female) (1)		Resistance	1Ω and below
			Wiring harness between D15 (Female) (1) and E01 (Female) (1)		Resistance	1Ω and below
			Wiring harness between R01 and starting motor terminal B (E10)		Resistance	1Ω and below
	9	Wiring harness discontinuity (Disconnection or defective contact) ★ Battery relay related harness	1) Turn starting switch OFF. 2) Disconnect connector D07, E02, terminal R16, R15, R07, R04, R02 and R05. 3) Connect T-adapter.			
			Wiring harness between R16 and chassis ground		Resistance	1Ω and below
			Wiring harness between R15 and D07 (Female) (2)		Resistance	1Ω and below
			Wiring harness between E02 (Female) (2) and R15		Resistance	1Ω and below
			Wiring harness between R04 and R02		Resistance	1Ω and below
			Wiring harness between R01 and R05		Resistance	1Ω and below
			Wiring harness between battery and R04		Resistance	1Ω and below

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	10	Wiring harness discontinuity (Disconnection or defective contact) ★ Starting switch related harness	1) Turn starting switch OFF. 2) Disconnect connector L02, D07, terminal R03 L25 and fuse FS1. 3) Connect T-adapter.			
			Wiring harness between L02 (Female) (1), FS1 (1) and R03		Resistance	1✕ andbelow
			Wiring harness between L02 (Female) (2) and D07 (Female) (1)		Resistance	1✕ andbelow
			Wiring harness between L02 (Female) (2) and L25 (Female) (10)		Resistance	1✕ andbelow
	11	Wiring harness discontinuity (Disconnection or defective contact) ★ Directional lever related harness	1) Turn starting switch OFF. 2) Disconnect connector L15, terminal R06 and fuse FS1. 3) Connect T-adapter.			
			Wiring harness between L15 (Female) (1), FS1 (2) and R06		Resistance	1✕ andbelow
			Wiring harness between L15 (Female) (3) and L106 (Female) (1)		Resistance	1✕ andbelow
			Wiring harness between L106 (Female) (2) and chassis ground		Resistance	1✕ andbelow
	12	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect connector E01, E02, D07. 3) Connect T-adapter. 4) Turn starting switch ON.			
			Wiring harness between E01 (Female) (2), E02 (Female) (1) and D07 (Female) (3)	Voltage between E01 (Female) (2), E02 (Female) (1) and chassis ground		1V and below
	13	Defective starting switch	1) Disconnect starting switch terminal. 2) Solid part check.			
			Turn starting switch START.	Between terminal B and C		1✕ andbelow
	14	Defective starting motor	1) Solid part check.			
			• If the check of the individual part shows that it is normal, the starting motor is normal.			
	15	Defective alternator	Between alternator terminal R [E02 (1)] and chassis ground	Engine started (Throttle 1/2 and above)	Voltage	26.5 - 29V
				Engine stopped	Voltage	1V and below
	16	Defective short connector TEL	1) Turn starting switch OFF. 2) Disconnect connector TEL. 3) Connect T-adapter.			
			Wiring harness between TEL (Female) (7) and (8)		Resistance	1✕ andbelow

a) - 2 Defective starting motor system (When the directional selector actuation switch is turned ON)

★ Perform the inspection and troubleshooting in this section in addition to a) -1.

Action Code	Failure Code	Controller Code	Trouble	The engine does not start a) Defective starting motor system
-	-	-		
Description of Trouble	• The engine does not start due to defective starting motor system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The engine does not start.			
Related Information	• If the failure code D5ZHL6 for abnormality in starting switch C input is given, carry out troubleshooting first for the applicable code. • If the fuses are blown, check the wiring harness is short-circuited with the ground. • When the directional selector actuation switch is operated, the directional lever must be in the "N" position and the directional selector switch must be in the "N" position.			

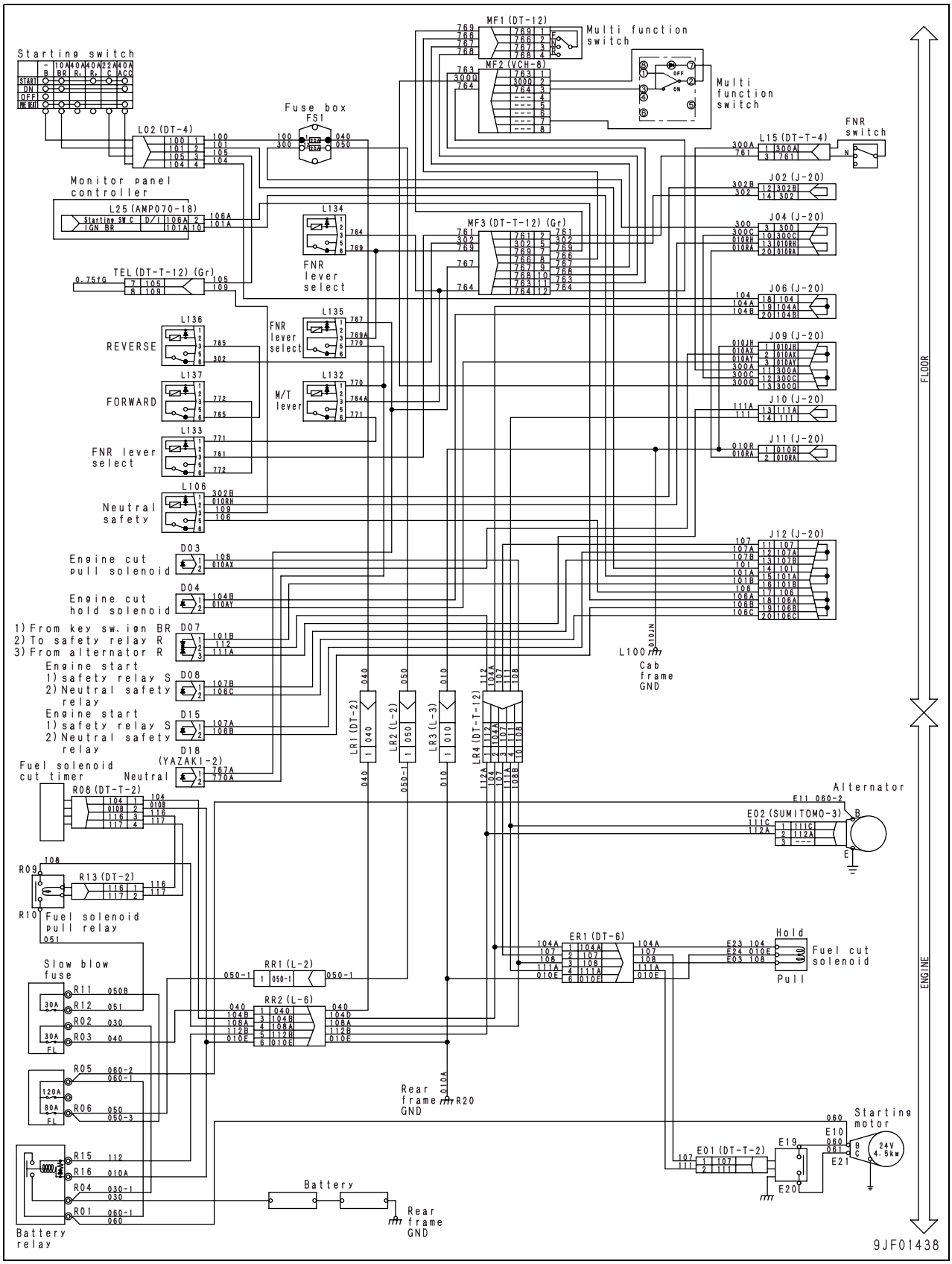
	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective battery	Specific gravity		1.26V and above	
			Voltage		24V and above	
	2	Defective neutral safety relay (L132, L133, L134)	1) Turn starting switch OFF. 2) Interchange relay (L132, L133, L134) with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when neutral safety relay (L132, L133, L134) is interchanged with normal relay?	The condition is abnormal.		Relay (L132, L133, L134) is normal.
				The condition is normal.		Defective relay (L132, L133, L134)
			1) Turn starting switch OFF. 2) Disconnect connector L132, L133, L134. 3) Solid part check.			
			Between L132, L133, L134 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L132, L133, L134. 3) Solid part check. 4) Applies impressed voltage between L132, L133, L134 (Male) (1) - (2)			
			Between L132, L133, L134 (Male) (3) and (5)	Applies 24V impressed voltage between L132, L133, L134 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L132, L133, L134 (Male) (1) - (2)	Resistance	1MΩ and above
	3	Defective directional select switch	1) Turn starting switch OFF. 2) Disconnect connector MF1. 3) Connect T-adapter.			
			Between MF1 (Female) (1) and (3)	When direction select switch is turned N.	Resistance	1Ω and below
				Other than above.	Resistance	1MΩ and above
	4	Defective diode (D18) ★ Only when defect occurs in both at the same time	1) Turn starting switch OFF. 2) Replace both diodes (D18) with normal diodes. 3) Turn starting switch START.			
			The condition is abnormal.		Diode (D18) is normal.	
			The condition is normal.		Defective diode (D18)	
			Measure from (2) end with diode range		Continuity	
			Measure from (1) end with diode range		Discontinuity	

b) Defective fuel cut solenoid system

Action Code	Failure Code	Controller Code	Trouble	The engine does not start b) Defective fuel cut solenoid system
-	-	-		
Description of Trouble	• The fuel cut solenoid system is defective, so the engine does not start.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The engine does not start.			
Related Information	• If the failure code D5ZHL6 for abnormality in starting switch C input is given, carry out troubleshooting first for the applicable code. • If the fuses are blown, check the wiring harness is short-circuited with the ground.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective fuel cut solenoid pull relay (R13)	1) Turn starting switch OFF. 2) Interchange relay (R13) with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when pull relay (R13) is interchanged with normal relay?	The condition is abnormal.		Relay (R13) is normal.
				The condition is normal.		Defective relay (R13)
			1) Turn starting switch OFF. 2) Disconnect connector L104. 3) Solid part check.			
			Between R13 (Male) (1) and (2)		Resistance	50 - 90Ω
			1) Turn starting switch OFF. 2) Disconnect connector R13. 3) Solid part check. 4) Applies impressed voltage between R13 (Male) (1) - (2)			
			Between R13 (Male) (3) and (5)	Applies 24V impressed voltage between R13 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between R13 (Male) (1) - (2)	Resistance	1MΩ and above
	2	Defective fuel cut solenoid	1) Turn starting switch OFF. 2) Disconnect terminal E03, E23, E24. 3) Connect T-adapter. 4) Solid part check.			
			Between E23 and E24		Resistance	43 - 53Ω
			Between E03 and E24		Resistance	0.8 - 1.2Ω
	3	Defective fuel cut solenoid timer	1) Turn starting switch OFF. 2) Disconnect connector R08. 3) Insert T-adapter. 4) Connect connector.			
			Between R08 (1) and (2)	Turn starting switch ON.	Voltage	20 - 30V
				Turn starting switch OFF.	Voltage	1V and below
			Between R08 (3) and (4)	2 - 4 sec after turning starting switch ON	Voltage	16V and above
				Other than above.	Voltage	1V and below
	4	Defective diode (D03 or D04)	1) Turn starting switch OFF. 2) Replace diode (D03 or D04) with a normal diode. 3) Turn starting switch START.			
			The condition is abnormal.	Diode (D03 or D04) is normal.		
			The condition is normal.	Defective diode (D03 or D04)		
	5	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L02, D03, D04, D08, D15, terminal E01, E03, E11, E23, E24, R05, R08, R09, R10, R12 and R13. 3) Connect T-adapter.			
			Wiring harness between E24 and chassis ground		Resistance	1Ω and below
			Wiring harness between D03 (Female) (2) and chassis ground		Resistance	1Ω and below
			Wiring harness between E03 and R09		Resistance	1Ω and below
			Wiring harness between D04 (Female) (2) and chassis ground		Resistance	1Ω and below
			Wiring harness between E23 and L02 (Female) (4)		Resistance	1Ω and below
			Wiring harness between E23 and R08 (Female) (1)		Resistance	1Ω and below
			Wiring harness between R08 (Female) (2) and chassis ground		Resistance	1Ω and below
			Wiring harness between R08 (Female) (3) and R13 (Female) (1)		Resistance	1Ω and below
			Wiring harness between R08 (Female) (4) and R13 (Female) (2)		Resistance	1Ω and below
			Wiring harness between R10 and R12		Resistance	1Ω and below
			Wiring harness between R11 and R06		Resistance	1Ω and below
	6	Defective starting switch	1) Disconnect starting switch terminal. 2) Solid part check.			
			Turn starting switch START.	Between terminal B and ACC		1Ω and below

Related circuit diagram



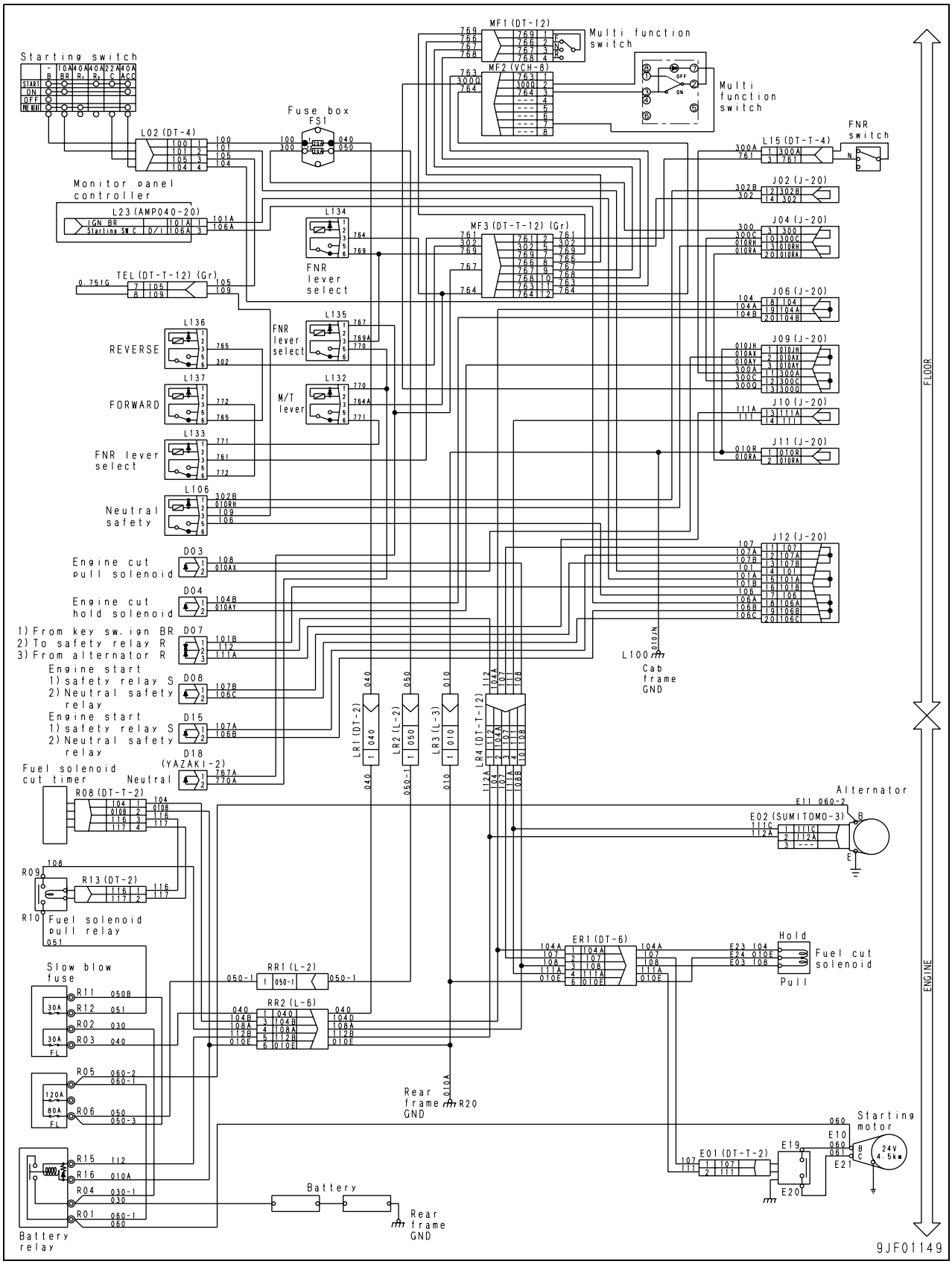
Troubleshooting Code [E-2] (The engine does not stop)

Action Code	Failure Code	Controller Code	Trouble	The engine does not stop
-	-	-		
Description of Trouble	• The engine does not stop.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The engine does not stop.			
Related Information	• If the failure code D5ZHL6 for abnormality in starting switch C input is given, carry out troubleshooting first for the applicable code.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective fuel cut solenoid	1) Turn starting switch OFF. 2) Disconnect terminal E03, E23, E24. 3) Connect T-adapter. 4) Solid part check.			
			Between E23 and E24		Resistance	43 - 53Ω
			Between E03 and E24		Resistance	0.8 - 1.2Ω
	2	Defective fuel cut solenoid timer	1) Turn starting switch OFF. 2) Disconnect connector R08. 3) Insert T-adapter. 4) Connect connector.			
			Between R08 (1) and (2)	Turn starting switch ON.	Voltage	20 - 30V
				Turn starting switch OFF.	Voltage	1V and below
	3	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect connector L02, D03, D08, terminal E03, E23 and R09. 3) Connect T-adapter. 4) Turn starting switch OFF.			
			Wiring harness between E03, R09 and D03 (Female) (1)	Voltage between E03 (Harness side) and chassis ground		1V and below
			Wiring harness between E23, L02 (Female) (4) and R08 (Female) (1)	Voltage between E23 (Harness side) and chassis ground		1V and below

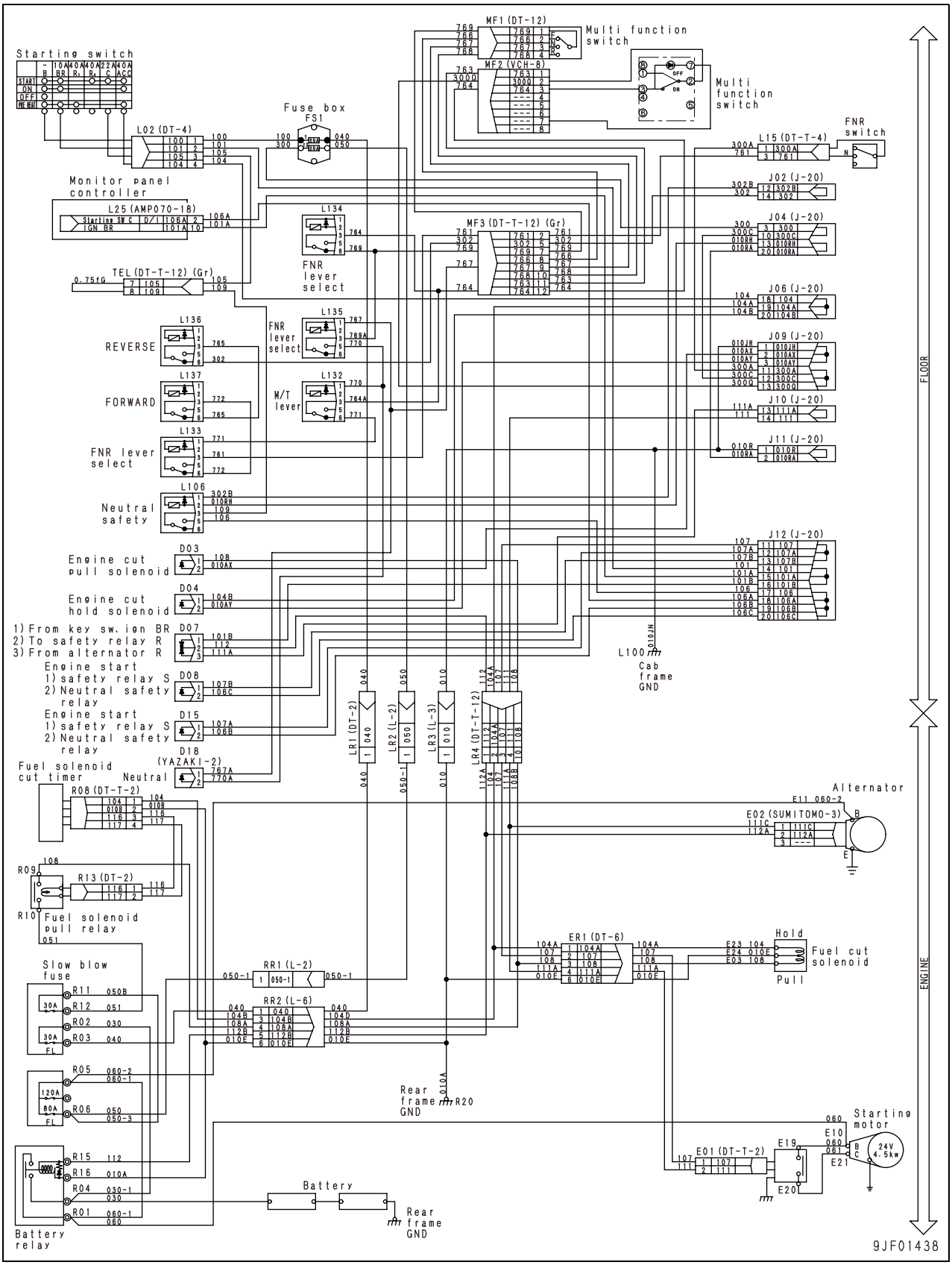
Related circuit diagram

Speed meter specification (STD)



Related circuit diagram

Load meter specification (If equipped)



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Troubleshooting Code [E-3] (Preheating is impossible or constant)

Speed meter specification (STD)

a) Preheating is impossible

Action Code	Failure Code	Controller Code	Trouble	Preheating is impossible or constant a) Preheating is impossible
-	-	-		
Description of Trouble	• Preheating is impossible. (The engine water temperature at 0°C and below.)			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Preheating is impossible.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective intake air heater relay	1) Turn starting switch OFF. 2) Disconnect heater relay terminal E06, E07, E08. 3) Solid part check.			
			Between E06 and chassis ground		Resistance	19 - 25Ω
			Between E07 and E08	When relay is ON (impressed voltage 24V between E06 - chassis ground).	Resistance	1Ω and below
				When the relay OFF (Other than above).	Resistance	1MΩ and above
	2	Defective intake air heater (Ribbon heater)	1) Turn starting switch OFF. 2) Disconnect heater terminal E09. 3) Solid part check.			
			Between heater terminal E09 and chassis ground		Resistance	0.17 - 0.27Ω
	3	Defective auto-preheating relay (L115)	1) Turn starting switch OFF. 2)Replace relay L115 with normal relay 3) Turn starting switch ON.			
			Does condition become normal when automatic preheating relay L115 is replaced with normal relay?		Condition is abnormal.	Relay L115 is normal.
					Condition is normal.	Defective relay L115.
			1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check.			
			Between L115 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check. 4) Applies impressed voltage between L115 (Male) (1) - (2)			
			Between L115 (Male) (3) and (5)	Applies 24V impressed voltage between L115 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L115 (Male) (1) - (2)	Resistance	1MΩ and above
	4	Defective diode (D05)	1) Turn starting switch OFF. 2) Replace diode (D05) with normal diode. 3) Turn starting switch ON.			
			Condition is abnormal.		Diode (D05) is normal.	
			Condition is normal.		Defective diode (D05)	
			Measure between (2) ⇔ (1) with diode range		Continuity	
			Measure between (2) ⇔ (3) with diode range		Continuity	
			Measure between (1) ⇔ (2) with diode range		No continuity	
			Measure between (1) ⇔ (3) with diode range		No continuity	
			Measure between (3) ⇔ (2) with diode range		No continuity	
			Measure between (3) ⇔ (1) with diode range		No continuity	
			★ Put (+) pole of tester in contact with left side.			

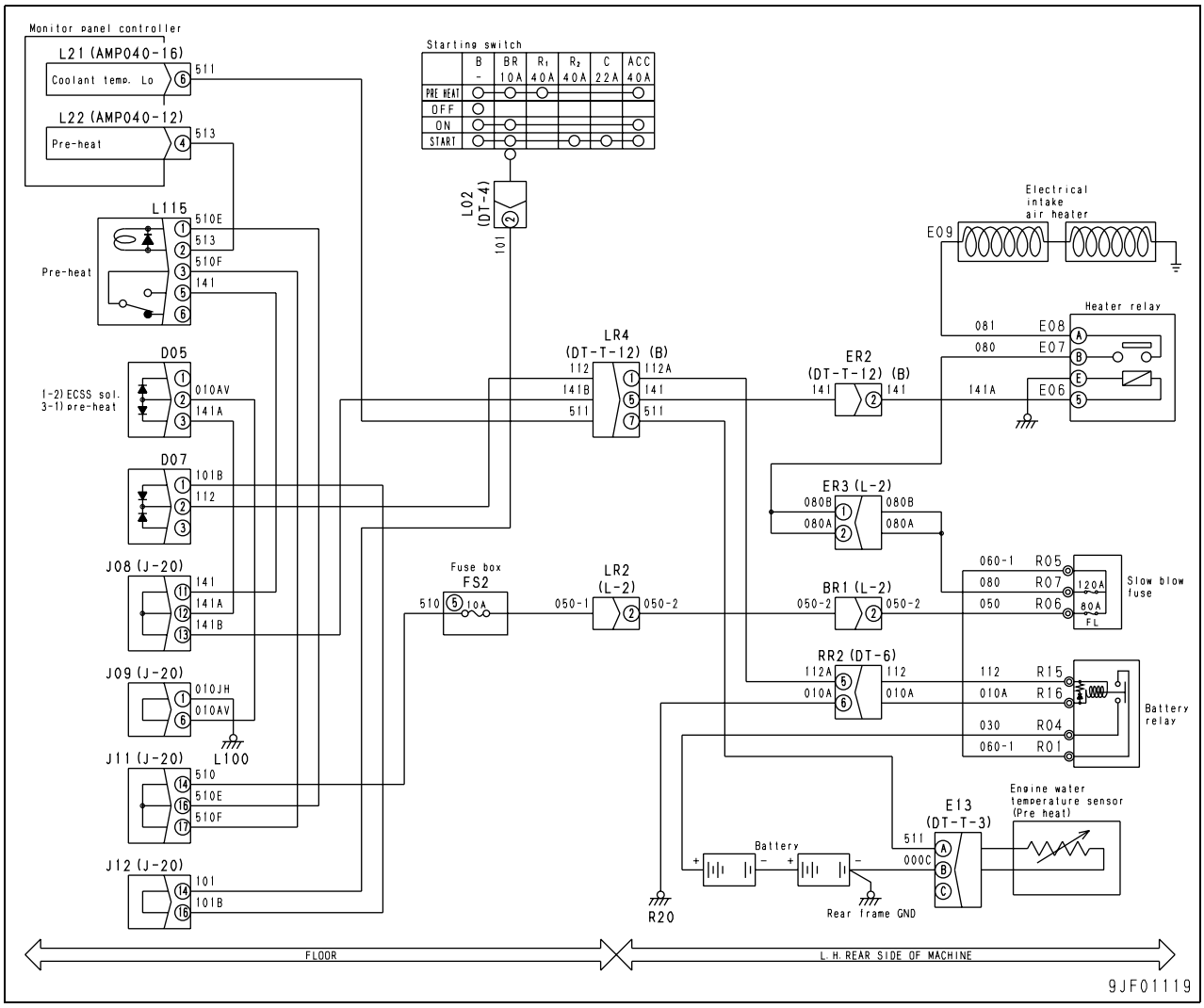
	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	5	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L115, L22, fuse FS2 (5), E06, E07 and E08. 3) Connect T-adapter.			
			Wiring harness between E08 and E09		Resistance	1Ω and below
			Wiring harness between R07 and E07		Resistance	1Ω and below
			Wiring harness between E06, J08 and L115 (Female) (5)		Resistance	1Ω and below
			Wiring harness between fuse FS2 (5) and L115 (Female) (3)		Resistance	1Ω and below
			Wiring harness between fuse FS2 (5) and L115 (Female) (1)		Resistance	1Ω and below
			Wiring harness between L115 (Female) (2) and L22 (Female) (4)		Resistance	1Ω and below
	6	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector D05, L115, L22, fuse FS2 (5), E06, E07 E08, E09 and R07. 3) Connect T-adapter.			
			Wiring harness between E08 and E09 *	Resistance between E08, E09 and chassis ground		1MΩ and above
			Wiring harness between R07 and E07 *	Resistance between R07, E07 and chassis ground		1MΩ and above
			Wiring harness between E06, J08 and L115 (Female) (5) *	Resistance between E06, J08, L115 (Female) (5) and chassis ground		1MΩ and above
			Wiring harness between fuse FS2 (5) and L115 (Female) (3) *	Resistance between fuse FS2 (5), L115 (Female) (3) and chassis ground		1MΩ and above
			Wiring harness between fuse FS2 (5) and L115 (Female) (1) *	Resistance between fuse FS2 (5), L115 (Female) (1) and chassis ground		1MΩ and above
			Wiring harness between J08 (Female) (12) and D05 (Female) (3) *	Resistance between J08 (Female) (12), D05 (Female) (3) and chassis ground		1MΩ and above
			★ Item 6 above is wiring harness related to intake air heater (ribbon heater) ★ If it is marked * , the fuse is blown			
			Wiring harness between L21 (Female) (6) and E13 (A)	Resistance between L21 (Female) (6), E13 (A) and chassis ground		1MΩ and above
			★ The above is wiring harness related to the engine water temperature (low temperature) sensor			
	7	Defective engine water temperature (Low temperature) sensor	1) Turn starting switch OFF. 2) Disconnect connector E13. 3) Connect T-adapter.			
			Between E13 (Male) (A) and (B)	Normal temperature (25°C).	Resistance	3.1 - 5.7kΩ
				When 100°C	Resistance	0.2 - 1.0kΩ
	8	Defective junction connector (J06, J09, J11)	1) Turn starting switch OFF. 2) Replace junction connector (J06, J09, J11) with normal junction connector			
			Condition is abnormal.	Junction connector (J06, J09, J11) is normal.		
			Condition is normal.	Defective junction connector (J06, J09, J11).		

b) Preheating is constant

Action Code	Failure Code	Controller Code	Trouble	Preheating is impossible or constant b) Preheating is constant
-	-	-		
Description of Trouble	• Preheating is constant.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Preheating is constant.			
Related Information	• If the failure code DGE3L6 for abnormality in engine water temperature (low temperature) sensor related is given, carry out troubleshooting first for the applicable code. • The engine water temperature (low temperature) is displayed by real-time monitoring code 04103.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective intake air heater relay	1) Turn starting switch OFF. 2) Disconnect heater relay terminal E06, E07, E08. 3) Solid part check.			
			Between E06 and chassis ground		Resistance	19 - 25Ω
			Between E07 and E08	When relay is ON (impressed voltage 24V between E06 - chassis ground).	Resistance	1Ω and below
				When the relay OFF (Other than above).	Resistance	1MΩ and above
	2	Defective auto-preheating relay (L115)	1) Turn starting switch OFF. 2) Replace relay L115 with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when automatic preheating relay L115 is replaced with normal relay?		Condition is abnormal.	Relay L115 is normal.
					Condition is normal.	Defective relay L115.
			1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check.			
			Between L115 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check. 4) Applies impressed voltage between L115 (Male) (1) - (2)			
			Between L115 (Male) (3) and (5)	Applies 24V impressed voltage between L115 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L115 (Male) (1) - (2)	Resistance	1MΩ and above
	3	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect connector L115, L22, fuse FS2 (5), E06, E07 and E08. 3) Connect T-adapter. 4) 1 minute after starting switch is turned ON.			
			Wiring harness between E08 and E09	Voltage between E08, E09 and chassis ground		1V and below
			Wiring harness between E06, J06 and L115 (Female) (5)	Voltage between E06, J08, L115 (Female) (5) and chassis ground		1V and below
	4	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L22 and L115. 3) Connect T-adapter.			
			Wiring harness between L22 (female) (4) and L115 (female) (2)	Resistance between L22 (female) (4), L115 (female) (2) and chassis ground		1MΩ and above
	5	Defective mechanical monitor	1) Turn starting switch OFF. 2) Disconnect connector L22. 3) Insert T-adapter. 4) Connect connector. 5) 1 minute after starting switch is turned ON.			
			Voltage between L22 (4) and chassis ground			16 V and above

Related circuit diagram



Load meter specification (If equipped)

a) Preheating is impossible

Action Code	Failure Code	Controller Code	Trouble	Preheating is impossible or constant a) Preheating is impossible
-	-	-		
Description of Trouble	• Preheating is impossible. (The engine water temperature at 0°C and below.)			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Preheating is impossible.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective intake air heater relay	1) Turn starting switch OFF. 2) Disconnect heater relay terminal E06, E07, E08. 3) Solid part check.			
			Between E06 and chassis ground		Resistance	19 - 25Ω
			Between E07 and E08	When relay is ON (impressed voltage 24V between E06 - chassis ground).	Resistance	1Ω and below
				When the relay OFF (Other than above).	Resistance	1MΩ and above
	2	Defective intake air heater (Ribbon heater)	1) Turn starting switch OFF. 2) Disconnect heater terminal E09. 3) Solid part check.			
			Between heater terminal E09 and chassis ground		Resistance	0.17 - 0.27Ω
	3	Defective auto-preheating relay (L115)	1) Turn starting switch OFF. 2)Replace relay L115 with normal relay 3) Turn starting switch ON.			
			Does condition become normal when automatic preheating relay L115 is replaced with normal relay?		Condition is abnormal.	Relay L115 is normal.
					Condition is normal.	Defective relay L115.
			1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check.			
			Between L115 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check. 4) Applies impressed voltage between L115 (Male) (1) - (2)			
			Between L115 (Male) (3) and (5)	Applies 24V impressed voltage between L115 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L115 (Male) (1) - (2)	Resistance	1MΩ and above
	4	Defective diode (D05)	1) Turn starting switch OFF. 2) Replace diode (D05) with normal diode. 3) Turn starting switch ON.			
			Condition is abnormal.		Diode (D05) is normal.	
			Condition is normal.		Defective diode (D05)	
			Measure between (2) Ω (1) with diode range		Continuity	
			Measure between (2) Ω (3) with diode range		Continuity	
			Measure between (1) Ω (2) with diode range		No continuity	
			Measure between (1) Ω (3) with diode range		No continuity	
			Measure between (3) Ω (2) with diode range		No continuity	
			Measure between (3) Ω (1) with diode range		No continuity	
			★ Put (+) pole of tester in contact with left side.			

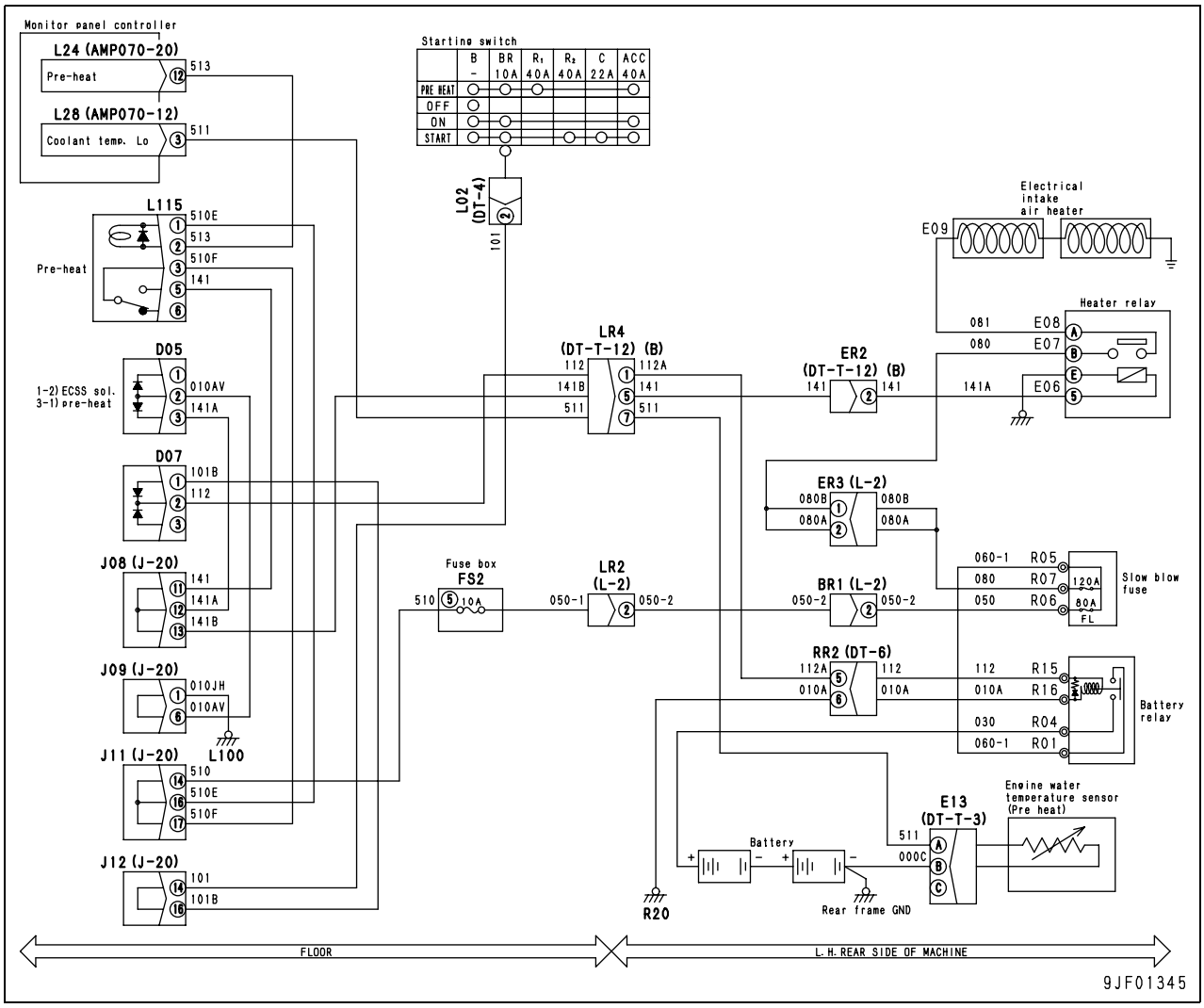
	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	5	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L115, L24, fuse FS2 (5), E06, E07 and E08. 3) Connect T-adapter.			
			Wiring harness between E08 and E09		Resistance	1Ω and below
			Wiring harness between R07 and E07		Resistance	1Ω and below
			Wiring harness between E06, J08 and L115 (Female) (5)		Resistance	1Ω and below
			Wiring harness between fuse FS2 (5) and L115 (Female) (3)		Resistance	1Ω and below
			Wiring harness between fuse FS2 (5) and L115 (Female) (1)		Resistance	1Ω and below
			Wiring harness between L115 (Female) (2) and L24 (Female) (12)		Resistance	1Ω and below
	6	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector D05, L115, L28, fuse FS2 (5), E06, E07 E08, E09 and R07. 3) Connect T-adapter.			
			Wiring harness between E08 and E09 *	Resistance between E08, E09 and chassis ground		1MΩ and above
			Wiring harness between R07 and E07 *	Resistance between R07, E07 and chassis ground		1MΩ and above
			Wiring harness between E06, J08 and L115 (Female) (5) *	Resistance between E06, J08, L115 (Female) (5) and chassis ground		1MΩ and above
			Wiring harness between fuse FS2 (5) and L115 (Female) (3) *	Resistance between fuse FS2 (5), L115 (Female) (3) and chassis ground		1MΩ and above
			Wiring harness between fuse FS2 (5) and L115 (Female) (1) *	Resistance between fuse FS2 (5), L115 (Female) (1) and chassis ground		1MΩ and above
			Wiring harness between J08 (Female) (12) and D05 (Female) (3) *	Resistance between J08 (Female) (12), D05 (Female) (3) and chassis ground		1MΩ and above
			★ Item 6 above is wiring harness related to intake air heater (ribbon heater) ★ If it is marked * , the fuse is blown			
			Wiring harness between L28 (Female) (3) and E13 (A)	Resistance between L28 (Female) (3), E13 (A) and chassis ground		1MΩ and above
			★ The above is wiring harness related to the engine water temperature (low temperature) sensor			
	7	Defective engine water temperature (Low temperature) sensor	1) Turn starting switch OFF. 2) Disconnect connector E13. 3) Connect T-adapter.			
			Between E13 (Male) (A) and (B)	Normal temperature (25°C).	Resistance	3.1 - 5.7kΩ
				When 100°C	Resistance	0.2 - 1.0kΩ
	8	Defective junction connector (J06, J09, J11)	1) Turn starting switch OFF. 2) Replace junction connector (J06, J09, J11) with normal junction connector			
			Condition is abnormal.	Junction connector (J06, J09, J11) is normal.		
			Condition is normal.	Defective junction connector (J06, J09, J11).		

b) Preheating is constant

Action Code	Failure Code	Controller Code	Trouble	Preheating is impossible or constant b) Preheating is constant
-	-	-		
Description of Trouble	• Preheating is constant.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Preheating is constant.			
Related Information	• If the failure code DGE3L6 for abnormality in engine water temperature (low temperature) sensor related is given, carry out troubleshooting first for the applicable code. • The engine water temperature (low temperature) is displayed by real-time monitoring code 04103.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective intake air heater relay	1) Turn starting switch OFF. 2) Disconnect heater relay terminal E06, E07, E08. 3) Solid part check.			
			Between E06 and chassis ground		Resistance	19 - 25Ω
			Between E07 and E08	When relay is ON (impressed voltage 24V between E06 - chassis ground).	Resistance	1Ω and below
				When the relay OFF (Other than above).	Resistance	1MΩ and above
	2	Defective auto-preheating relay (L115)	1) Turn starting switch OFF. 2) Replace relay L115 with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when automatic preheating relay L115 is replaced with normal relay?		Condition is abnormal.	Relay L115 is normal.
					Condition is normal.	Defective relay L115.
			1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check.			
			Between L115 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check. 4) Applies impressed voltage between L115 (Male) (1) - (2)			
			Between L115 (Male) (3) and (5)	Applies 24V impressed voltage between L115 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L115 (Male) (1) - (2)	Resistance	1MΩ and above
	3	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect connector L115, L24, fuse FS2 (5), E06, E07 and E08. 3) Connect T-adapter. 4) 1 minute after starting switch is turned ON.			
			Wiring harness between E08 and E09	Voltage between E08, E09 and chassis ground		1V and below
			Wiring harness between E06, J06 and L115 (Female) (5)	Voltage between E06, J08, L115 (Female) (5) and chassis ground		1V and below
	4	Short circuit with chassis ground in wiring harness	1) Turn starting switch OFF. 2) Disconnect connectors L24 and L115. 3) Connect T-adapter.			
			Wiring harness between L24 (female) (12) and L115 (female) (2)	Resistance between L24 (female) (12), L115 (female) (2) and chassis ground		1MΩ and above
	5	Defective mechanical monitor	1) Turn starting switch OFF. 2) Disconnect connector L24. 3) Insert T-adapter. 4) Connect connector. 5) 1 minute after starting switch is turned ON.			
			Voltage between L24 (12) and chassis ground			16 V and above

Related circuit diagram



Troubleshooting Code [E-4] (The parking brake (Mechanical type) does not function)

Speed meter specification (STD)

a) Parking brake dragging prevention does not function (mechanical type)

Action Code	Failure Code	Controller Code	Trouble	The parking brake (Mechanical type) does not function a) Parking brake dragging prevention does not function (mechanical type)
-	-	-		
Description of Trouble	• Parking brake dragging prevention does not function			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Parking brake dragging prevention does not function			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective parking brake neutral safety relay (L112)	1) Turn starting switch OFF. 2) Replace relay L112 with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch.			
			Does condition become normal when parking brake neutral safety relay L112 is replaced with normal relay?		Condition is abnormal.	Relay L112 is normal.
					Condition is normal.	Defective relay L112.
			1) Turn starting switch OFF. 2) Disconnect connector L112. 3) Solid part check.			
			Between L112 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L112. 3) Solid part check. 4) Applies impressed voltage between L112 (Male) (1) - (2)			
			Between L112 (Male) (3) and (5)	Applies 24V impressed voltage between L112 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L112 (Male) (1) - (2)	Resistance	1MΩ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector D01, L19, L112, T01. 3) Connect T-adapter.			
			Wiring harness between L112 (Female) (5) and J08 (7), (9) and T01 (Female) (2), (4)	Resistance between L112 (Female) (5), T01 (Female) (4) and chassis ground		1MΩ and above
			Wiring harness between L112 (Female) (5) and J08 (7), (8) and T01 (Female) (2)	Resistance between L112 (Female) (5), T01 (Female) (2) and chassis ground		1MΩ and above
	3	Defective diode (D01)	1) Turn starting switch OFF. 2) Replace diode D01 with normal diode. 3) Turn starting switch ON.			
			Condition is abnormal.		Diode (D05) is normal.	
			Condition is normal.		Defective diode (D01)	
			Measure between (2) → (1) with diode range		Continuity	
			Measure between (2) → (3) with diode range		Continuity	
			Measure between (1) → (2) with diode range		Discontinuity	
			Measure between (1) → (3) with diode range		Discontinuity	
			Measure between (3) → (2) with diode range		Discontinuity	
			Measure between (3) → (1) with diode range		Discontinuity	

white 20-631

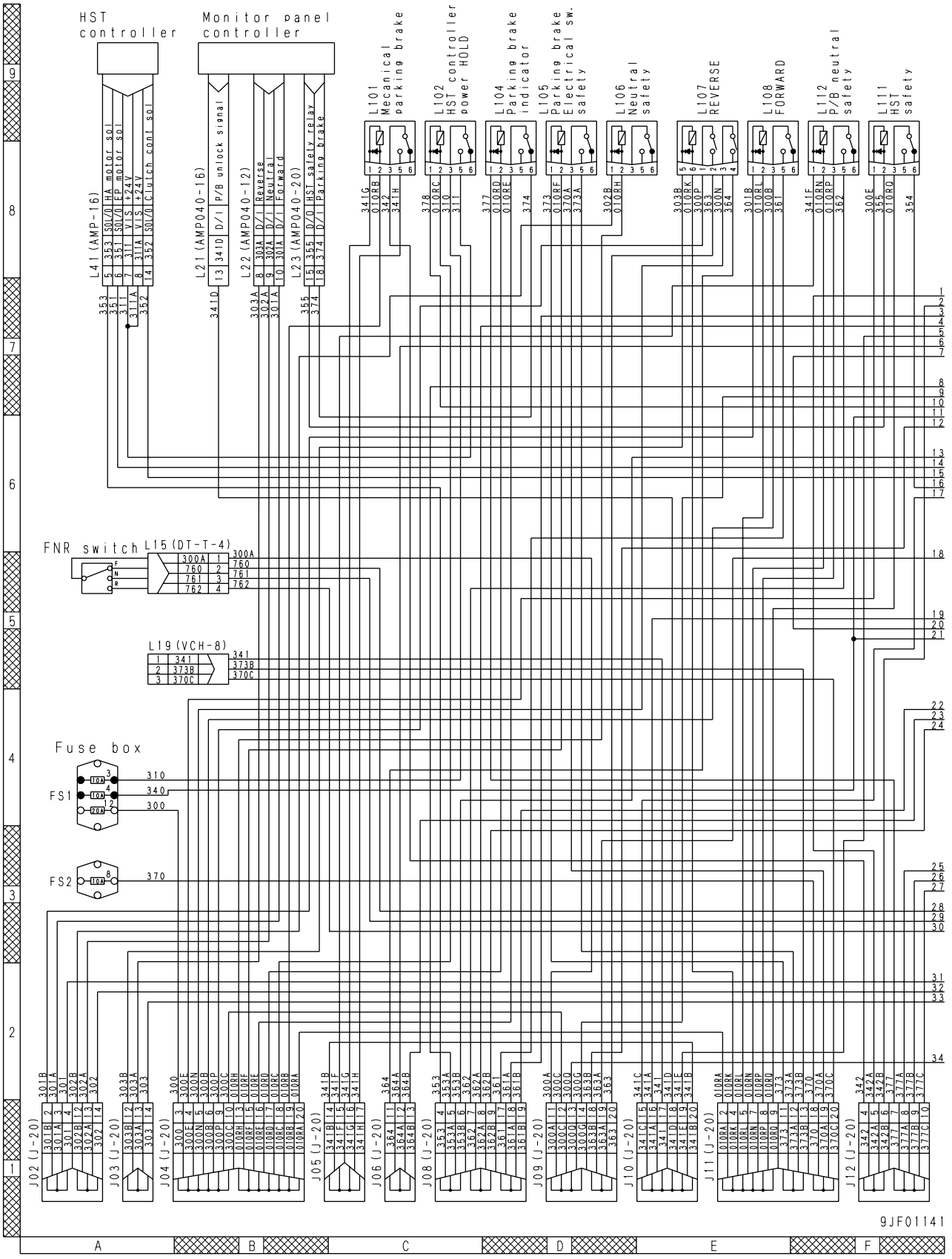
b) Parking brake "non-applied" indicator does not light up (mechanical type)

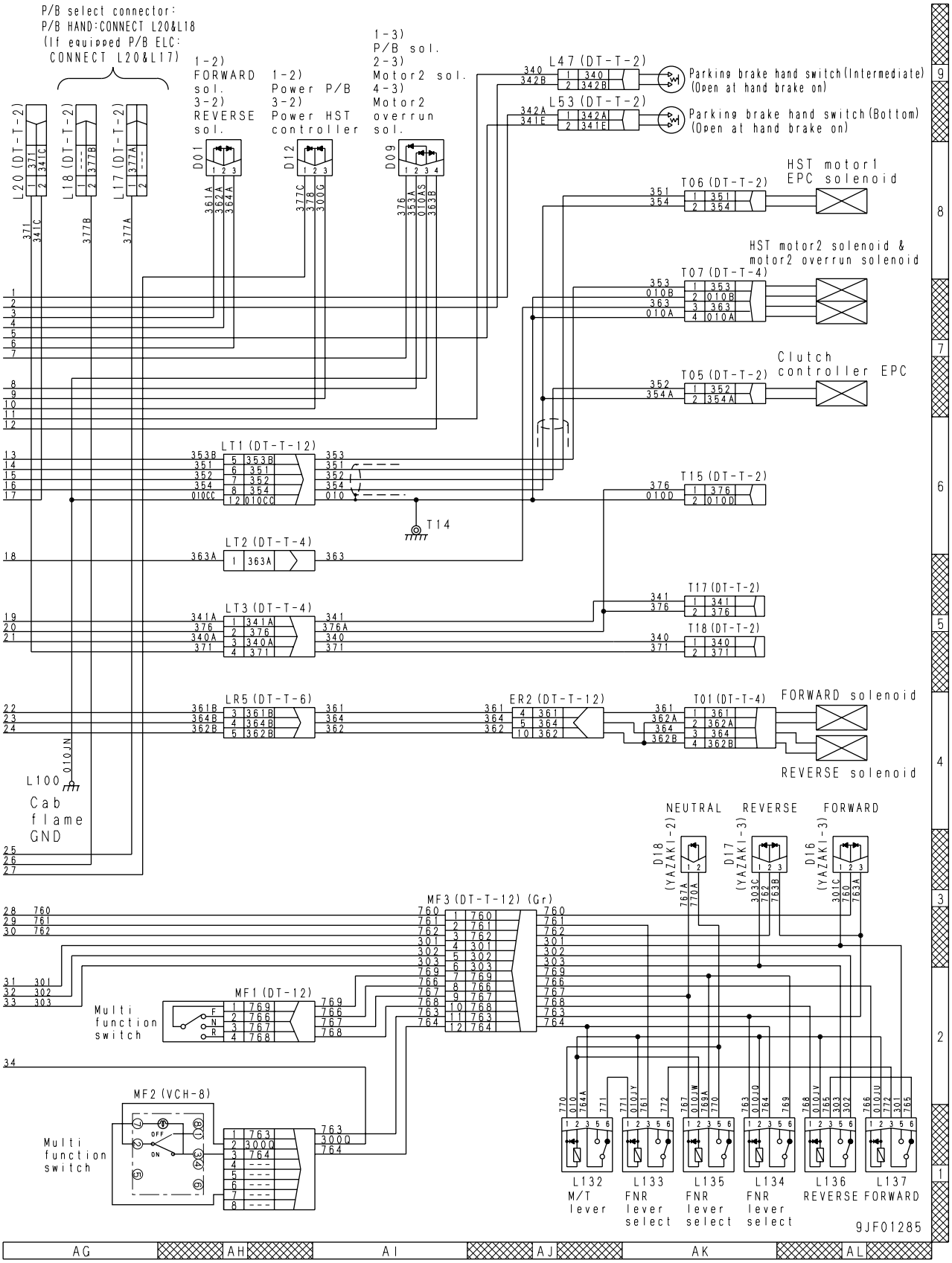
Action Code	Failure Code	Controller Code	Trouble	The parking brake (Mechanical type) does not function b) Parking brake "non-applied" indicator does not light up (mechanical type)
-	-	-		
Description of Trouble	• Parking brake "non-applied" indicator does not light up			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Parking brake "non-applied" indicator does not light up			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective parking brake lowest switch	1) Turn starting switch OFF. 2) Disconnect connector L53. 3) Connect T-adapter.			
			Between L53 (Male) (3) and (2)	Place parking brake lever LOCK.	Resistance	1MΩ and above
				Place parking brake lever FREE.	Resistance	1Ω and below
	2	Defective parking brake middle switch	1) Turn starting switch OFF. 2) Disconnect connector L47. 3) Connect T-adapter.			
			Between L47 (Male) (3) and (1)	Place parking brake lever LOCK to MIDDLE.	Resistance	1MΩ and above
				Place parking brake lever MIDDLE to FREE.	Resistance	1Ω and below
	3	Defective mechanical type parking brake relay (L101)	1) Turn starting switch OFF. 2) Replace relay L101 with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch.			
			Does condition become normal when parking brake relay L101 is replaced with normal relay?	Condition is abnormal.		Relay L101 is normal.
				Condition is normal.		Defective relay L101.
			1) Turn starting switch OFF. 2) Disconnect connector L101. 3) Solid part check.			
			Between L101 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L101. 3) Solid part check. 4) Applies impressed voltage between L101 (Male) (1) - (2)			
			Between L101 (Male) (3) and (5)	Applies 24V impressed voltage between L101 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L101 (Male) (1) - (2)	Resistance	1MΩ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	4	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L47, L53, fuse FS1 terminal. 3) Connect T-adapter.			
			Wiring harness between fuse FS1 (4) and L47 (Female) (1)		Resistance	1✕ andbelow
			Wiring harness between L47 (Female) (2) and J12 (6), (7) and L53 (Female) (1)		Resistance	1✕ andbelow
			Wiring harness between L53 (Female) (2) and J10 (19), (18) and L21 (Female) (13)		Resistance	1✕ andbelow
			Wiring harness between L53 (Female) (2) and J10 (Female) (19), (20) and J05 (14), (16) and L101 (Female) (1)		Resistance	1✕ andbelow
			Wiring harness between L53 (Female) (2) and J10 (Female) (19), (20) and J05 (14), (17) and L101 (Female) (5)		Resistance	1✕ andbelow
			Wiring harness between L101 (Female) (2) and chassis ground		Resistance	1✕ andbelow
			Wiring harness between L47 (Female) (2) and J12 (Female) (6), (4) and L101 (Female) (3)		Resistance	1✕ andbelow
	5	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector L101, L47, L53, both ends of fuse FS1 terminal. 3) Connect T-adapter.			
			Wiring harness between fuse FS1 (4) and L47 (Female) (1)	Resistance between L47 (Female) (1) and chassis ground		1M✕ and above
			Wiring harness between L47 (Female) (2) and J12 (6), (5) and L53 (Female) (1)	Resistance between L47 (Female) (2), L53 (Female) (1) and chassis ground		1M✕ and above
			Wiring harness between L47 (Female) (2) and J12 (6), (4) and L101 (Female) (3)	Resistance between L47 (Female) (2), L101 (Female) (3) and chassis ground		1M✕ and above
			★ In the above case, the fuse is blown.			
	6	Defective junction connector (J05), (J10) and (J12)	• Carry out inspection, and if any abnormality is found, repair or replace.			
	7	Defective machine monitor	1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch			
			Between L21 (13) and chassis ground	Place parking brake lever LOCK to MIDDLE.	Voltage	1V and below
				Place parking brake lever FREE.	Voltage	20 - 30V

Related circuit diagram




P/B select connector:
P/B HAND:CONNECT L20&L18
(If equipped P/B ELC:
CONNECT L20&L17)
1-2) FORWARD sol.
3-2) REVERSE sol.
1-2) Power P/B
3-2) Power HST controller
1-3) P/B sol.
2-3) Motor2 sol.
4-3) Motor2 overrun sol.
L47 (DT-T-2)
Parking brake hand switch(Intermediate)
(Open at hand brake on)
L53 (DT-T-2)
Parking brake hand switch(Bottom)
(Open at hand brake on)
HST motor1 EPC solenoid
T06 (DT-T-2)
HST motor2 solenoid & motor2 overrun solenoid
T07 (DT-T-4)
Clutch controller EPC
T05 (DT-T-2)
LT1 (DT-T-12)
T15 (DT-T-2)
T14
LT2 (DT-T-4)
T17 (DT-T-2)
LT3 (DT-T-4)
T18 (DT-T-2)
LR5 (DT-T-6)
ER2 (DT-T-12)
T01 (DT-T-4)
FORWARD solenoid
REVERSE solenoid
L100
Cab flame GND
NEUTRAL
REVERSE
FORWARD
D18 (YAZAKI-2)
D17 (YAZAKI-3)
D16 (YAZAKI-3)
MF3 (DT-T-12) (Gr)
MF1 (DT-T-12)
Multi function switch
MF2 (VCH-8)
Multi function switch
L132 M/T lever
L133 FNR lever select
L135 FNR lever select
L134 FNR lever select
L136 REVERSE
L137 FORWARD
9JF01285
AG
AH
AI
AJ
AK
AL

Load meter specification (If equipped)

a) Parking brake dragging prevention does not function (mechanical type)

Action Code	Failure Code	Controller Code	Trouble	The parking brake (Mechanical type) does not function a) Parking brake dragging prevention does not function (mechanical type)
-	-	-		
Description of Trouble	• Parking brake dragging prevention does not function			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Parking brake dragging prevention does not function			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective parking brake neutral safety relay (L112)	1) Turn starting switch OFF. 2) Replace relay L112 with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch.			
			Does condition become normal when parking brake neutral safety relay L112 is replaced with normal relay?		Condition is abnormal.	Relay L112 is normal.
					Condition is normal.	Defective relay L112.
			1) Turn starting switch OFF. 2) Disconnect connector L112. 3) Solid part check.			
			Between L112 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L112. 3) Solid part check. 4) Applies impressed voltage between L112 (Male) (1) - (2)			
			Between L112 (Male) (3) and (5)	Applies 24V impressed voltage between L112 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L112 (Male) (1) - (2)	Resistance	1MΩ and above
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector D01, L19, L112, T01. 3) Connect T-adapter.			
			Wiring harness between L112 (Female) (5) and J08 (7), (9) and T01 (Female) (2), (4)	Resistance between L112 (Female) (5), T01 (Female) (4) and chassis ground		1MΩ and above
			Wiring harness between L112 (Female) (5) and J08 (7), (8) and T01 (Female) (2)	Resistance between L112 (Female) (5), T01 (Female) (2) and chassis ground		1MΩ and above
	3	Defective diode (D01)	1) Turn starting switch OFF. 2) Replace diode D01 with normal diode. 3) Turn starting switch ON.			
			Condition is abnormal.		Diode (D05) is normal.	
			Condition is normal.		Defective diode (D01)	
			Measure between (2) Ω (1) with diode range		Continuity	
			Measure between (2) Ω (3) with diode range		Continuity	
			Measure between (1) Ω (2) with diode range		Discontinuity	
			Measure between (1) Ω (3) with diode range		Discontinuity	
			Measure between (3) Ω (2) with diode range		Discontinuity	
			Measure between (3) Ω (1) with diode range		Discontinuity	

b) Parking brake "non-applied" indicator does not light up (mechanical type)

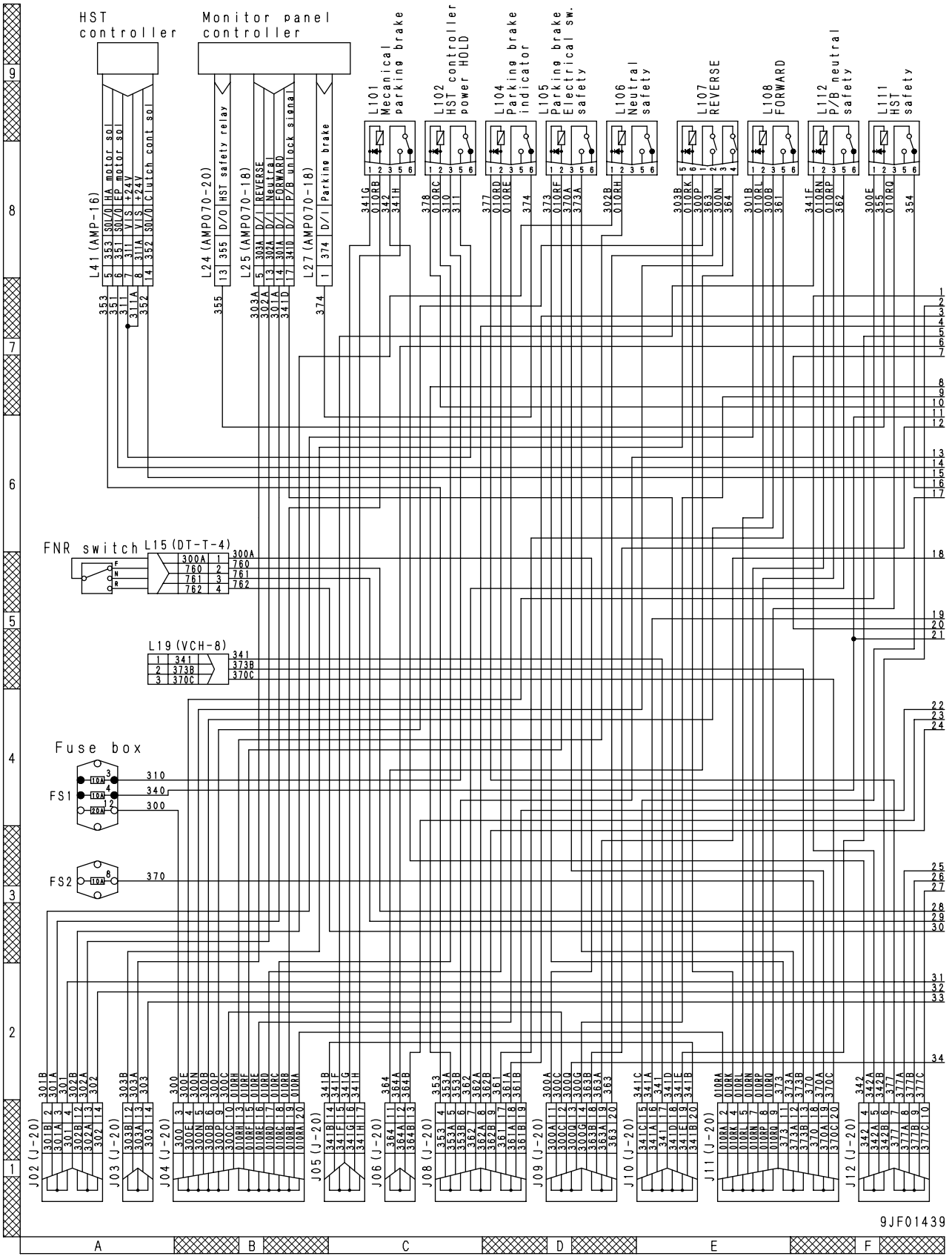
Action Code	Failure Code	Controller Code	Trouble	The parking brake (Mechanical type) does not function b) Parking brake "non-applied" indicator does not light up (mechanical type)
-	-	-		
Description of Trouble	• Parking brake "non-applied" indicator does not light up			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Parking brake "non-applied" indicator does not light up			
Related Information				

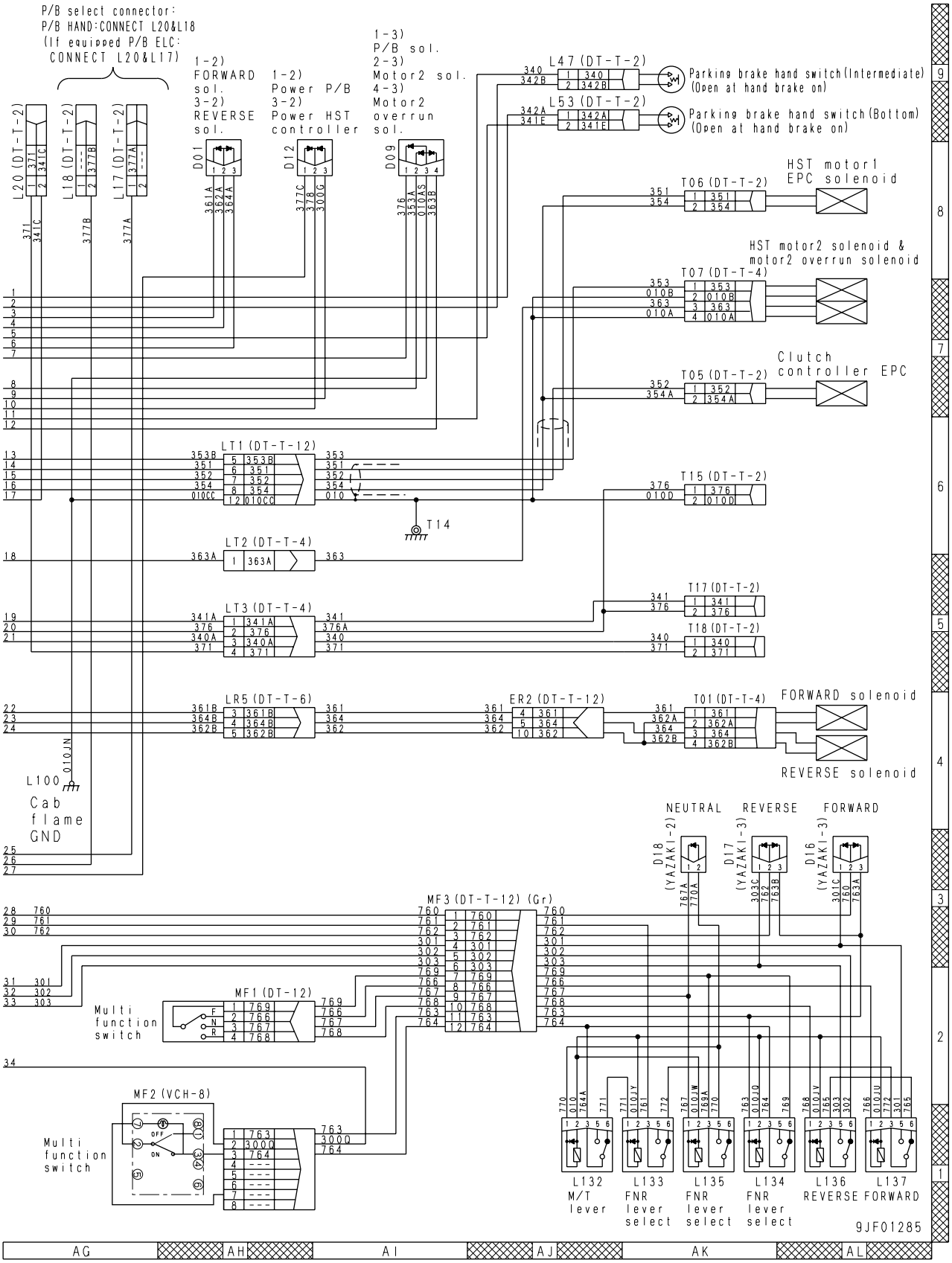
	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective parking brake lowest switch	1) Turn starting switch OFF. 2) Disconnect connector L53. 3) Connect T-adapter.			
			Between L53 (Male) (3) and (2)	Place parking brake lever LOCK.	Resistance	1MΩ and above
				Place parking brake lever FREE.	Resistance	1Ωandbelow
	2	Defective parking brake middle switch	1) Turn starting switch OFF. 2) Disconnect connector L47. 3) Connect T-adapter.			
			Between L47 (Male) (3) and (1)	Place parking brake lever LOCK to MIDDLE.	Resistance	1MΩ and above
				Place parking brake lever MIDDLE to FREE.	Resistance	1Ωandbelow
	3	Defective mechanical type parking brake relay (L101)	1) Turn starting switch OFF. 2) Replace relay L101 with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch.			
			Does condition become normal when parking brake relay L101 is replaced with normal relay?	Condition is abnormal.		Relay L101 is normal.
				Condition is normal.		Defective relay L101.
			1) Turn starting switch OFF. 2) Disconnect connector L101. 3) Solid part check.			
			Between L101 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L101. 3) Solid part check. 4) Applies impressed voltage between L101 (Male) (1) - (2)			
			Between L101 (Male) (3) and (5)	Applies 24V impressed voltage between L101 (Male) (1) - (2)	Resistance	1Ωandbelow
				Does not apply voltage between L101 (Male) (1) - (2)	Resistance	1MΩ and above

<table>
<tr><td rowspan="12">Possible Causes and Standard Values</td><td colspan="2">Causes</td><td colspan="5">Standard Value in Normal State and Remarks on Troubleshooting</td></tr>
<tr><td rowspan="8">4</td><td rowspan="8">Wiring harness discontinuity (Disconnection or defective contact)</td><td colspan="5">1) Turn starting switch OFF. 2) Disconnect connector L47, L53, L25 fuse FS1 terminal.
3) Connect T-adapter.</td></tr>
<tr><td colspan="3">Wiring harness between fuse FS1 (4) and L47 (Female) (1)</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td colspan="3">Wiring harness between L47 (Female) (2) and J12 (6), (7) and L53 (Female) (1)</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td colspan="3">Wiring harness between L53 (Female) (2) and J10 (19), (18) and L25 (Female) (17)</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td colspan="3">Wiring harness between L53 (Female) (2) and J10 (Female) (19), (20) and J05 (14), (16) and L101 (Female) (1)</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td colspan="3">Wiring harness between L53 (Female) (2) and J10 (Female) (19), (20) and J05 (14), (17) and L101 (Female) (5)</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td colspan="3">Wiring harness between L101 (Female) (2) and chassis ground</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td colspan="3">Wiring harness between L47 (Female) (2) and J12 (Female) (6), (4) and L101 (Female) (3)</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Wiring harness ground fault</td><td colspan="5">1) Turn starting switch OFF. 2) Disconnect connector L101, L47, L53, both ends of fuse FS1 terminal. 3) Connect T-adapter.</td></tr>
<tr><td colspan="2">Wiring harness between fuse FS1 (4) and L47 (Female) (1)</td><td colspan="2">Resistance between L47 (Female) (1) and chassis ground</td><td>1M✕ and above</td></tr>
<tr><td colspan="2">Wiring harness between L47 (Female) (2) and J12 (6), (5) and L53 (Female) (1)</td><td colspan="2">Resistance between L47 (Female) (2), L53 (Female) (1) and chassis ground</td><td>1M✕ and above</td></tr>
<tr><td colspan="2">Wiring harness between L47 (Female) (2) and J12 (6), (4) and L101 (Female) (3)</td><td colspan="2">Resistance between L47 (Female) (2), L101 (Female) (3) and chassis ground</td><td>1M✕ and above</td></tr>
<tr><td colspan="5">★ In the above case, the fuse is blown.</td></tr>
<tr><td>6</td><td>Defective junction connector (J05), (J10) and (J12)</td><td colspan="5">• Carry out inspection, and if any abnormality is found, repair or replace.</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Defective machine monitor</td><td colspan="5">1) Turn starting switch OFF. 2) Disconnect connector L25. 3) Insert T-adapter.
4) Connect connector. 5) Turn starting switch</td></tr>
<tr><td rowspan="2">Between L25 (17) and chassis ground</td><td>Place parking brake lever LOCK to MIDDLE.</td><td>Voltage</td><td>1V and below</td></tr>
<tr><td>Place parking brake lever FREE.</td><td>Voltage</td><td>20 - 30V</td></tr>
</table>

white 20-639

Related circuit diagram




P/B select connector:
P/B HAND:CONNECT L20&L18
(If equipped P/B ELC:
CONNECT L20&L17)
1-2) FORWARD sol.
3-2) REVERSE sol.
1-2) Power P/B
3-2) Power HST controller
1-3) P/B sol.
2-3) Motor2 sol.
4-3) Motor2 overrun sol.
L47 (DT-T-2)
Parking brake hand switch(Intermediate)
(Open at hand brake on)
L53 (DT-T-2)
Parking brake hand switch(Bottom)
(Open at hand brake on)
HST motor1 EPC solenoid
T06 (DT-T-2)
HST motor2 solenoid & motor2 overrun solenoid
T07 (DT-T-4)
Clutch controller EPC
T05 (DT-T-2)
LT1 (DT-T-12)
T15 (DT-T-2)
T14
LT2 (DT-T-4)
T17 (DT-T-2)
LT3 (DT-T-4)
T18 (DT-T-2)
LR5 (DT-T-6)
ER2 (DT-T-12)
T01 (DT-T-4)
FORWARD solenoid
REVERSE solenoid
L100
Cab flame GND
NEUTRAL
REVERSE
FORWARD
D18 (YAZAKI-2)
D17 (YAZAKI-3)
D16 (YAZAKI-3)
MF3 (DT-T-12) (Gr)
MF1 (DT-T-12)
Multi function switch
MF2 (VCH-8)
Multi function switch
L132 M/T lever
L133 FNR lever select
L135 FNR lever select
L134 FNR lever select
L136 REVERSE
L137 FORWARD
9JF01285
AG
AH
AI
AJ
AK
AL

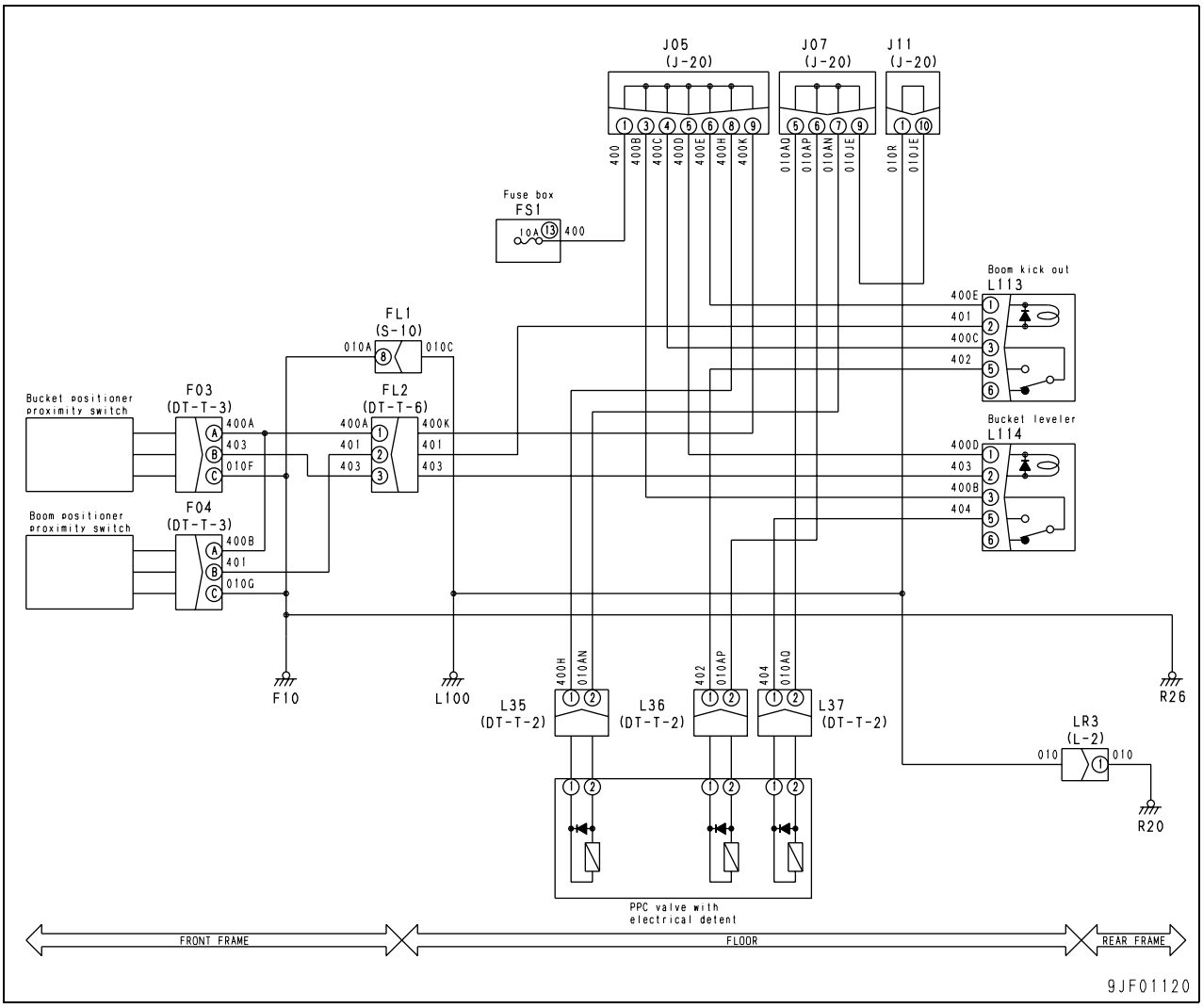
Troubleshooting Code [E-5] (Defective boom kick-out function and cancellation)

Action Code	Failure Code	Controller Code	Trouble	Defective boom kick-out function and cancellation
-	-	-		
Description of Trouble	• Boom kick-out does not function or cannot be cancelled due to defective boom kick-out proximity switch system, lift arm PPC detent system and lift arm detent relay system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Boom kick-out does not function or cannot be cancelled.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective lift arm detent relay (L113)	1) Turn starting switch OFF. 2) Disconnect connector L113. 3) Replace lift arm detent relay (L113) with normal relay. 4) Operate boom kick-out.			
			Boom kick-out function is normal.		Defective relay L113.	
			Boom kick-out does not function.		Relay L113 is normal.	
			1) Turn starting switch OFF. 2) Disconnect connector L113. 3) Connect T-adapter.			
			Between L113 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L113. 3) Solid part check. 4) Applies impressed voltage between L113 (Male) (1) - (2)			
			Between L113 (Male) (3) and (5)	Applies 24V impressed voltage between L113 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L113 (Male) (1) - (2)	Resistance	1MΩ and above
	2	Defective lift arm PPC detent	1) Turn starting switch OFF. 2) Disconnect connector L36. 3) Connect T-adapter.			
			Between L36 (Male) (1) and (2)		Resistance	30 - 50Ω
	3	Defective lift arm positioner proximity switch	1) Turn starting switch OFF. 2) Disconnect connector F04. 3) Interchange lift arm positioner proximity switch (F04) with bucket positioner proximity switch (F03). 4) Operate boom kick-out.			
			Boom kick-out function is normal.		Defective boom kick-out proximity switch F04	
			Boom kick-out does not function.		Boom kick-out proximity switch F04 is normal.	
	4	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector F04, L113, L36 and fuse FS1 terminal. 3) Connect T-adapter.			
			Wiring harness between F04 (Female) (A) and fuse FS1 (13)		Resistance	1Ω and below
			Wiring harness between F04 (Female) (B) and L113 (Female) (2)		Resistance	1Ω and below
			Wiring harness between F04 (Female) (C) and chassis ground		Resistance	1Ω and below
			Wiring harness between L113 (Female) (1) and fuse FS1 (13)		Resistance	1Ω and below
			Wiring harness between L113 (Female) (3) and fuse FS1 (13)		Resistance	1Ω and below
			Wiring harness between L113 (Female) (5) and L36 (Female) (1)		Resistance	1Ω and below
			Wiring harness between L36 (Female) (2) and chassis ground		Resistance	1Ω and below
			★ With all the above items, the boom kick-out does not function			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	5	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector F04, L113, L36 and fuse FS1 terminal. 3) Connect T-adapter.		
			Wiring harness between F04 (Female) (B) and L113 (Female) (2)	Resistance between F04 (Female) (B), L113 (Female) (2) and chassis ground	1M✕ and above
			Wiring harness between L113 (Female) (5) and L36 (Female) (1)	Resistance between L113 (Female) (5), L36 (Female) (1) and chassis ground	1M✕ and above
			★ In this case, the boom kick-out detent does not function (lever returns to neutral)		
			Wiring harness between F04 (Female) (A) and fuse FS1 (13)	Resistance between F04 (Female) (A), FS1 (13) and chassis ground	1M✕ and above
			Wiring harness between L113 (Female) (1) and fuse FS1 (13)	Resistance between L113 (Female) (1), fuse FS1 (13) and chassis ground	1M✕ and above
			Wiring harness between L113 (Female) (3) and fuse FS1 (13)	Resistance between L113 (Female) (3), fuse FS1 (13) and chassis ground	1M✕ and above
			★ In this case, the fuse is blown and no detents function (lever returns to neutral)		
	6	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect connector L113, L36. 3) Connect T-adapter. 4) Turn starting switch ON.		
			Wiring harness between L113 (Female) (5) and L36 (Female) (1)	Voltage between L113 (Female) (5), L36 (Female) (1) and chassis ground	1V and below
			★ In this case, the boom kick-out does not function (lever does not return to neutral)		

Related circuit diagram



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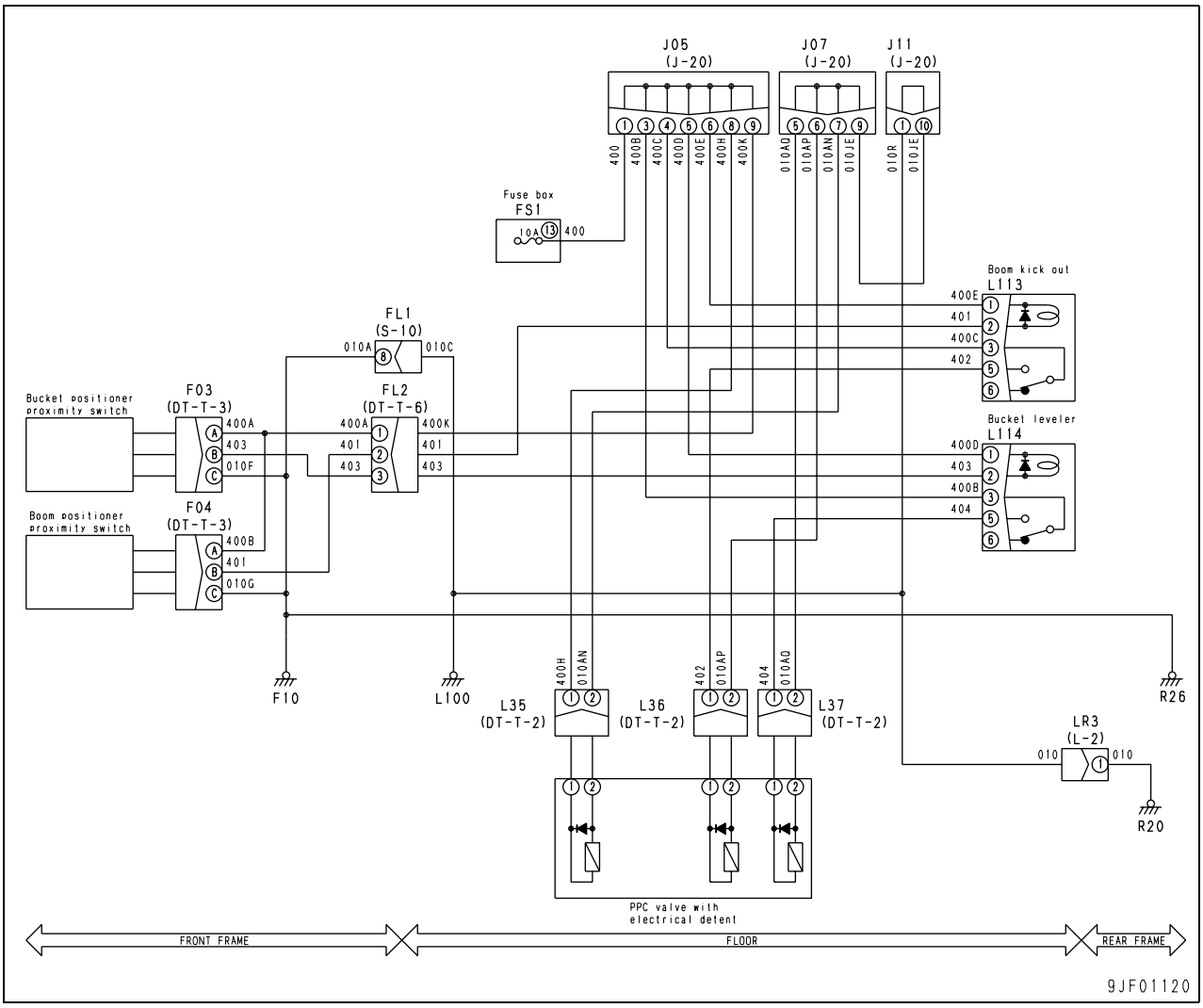
Troubleshooting Code [E-6] (Defective bucket positioner function and cancellation)

Action Code	Failure Code	Controller Code	Trouble	Defective bucket positioner function and cancellation
-	-	-		
Description of Trouble	• Bucket positioner does not function or cannot be cancelled due to defective bucket positioner proximity switch system, bucket PPC detent system and bucket detent relay system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Bucket positioner does not function or cannot be cancelled.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective bucket detent relay (L114)	1) Turn starting switch OFF. 2) Disconnect connector L114. 3) Replace bucket detent relay (L114) with normal relay. 4) Operate bucket positioner.			
			Bucket positioner function is normal.		Defective relay L114.	
			Bucket positioner does not function.		Relay L114 is normal.	
			1) Turn starting switch OFF. 2) Disconnect connector L114. 3) Connect T-adapter.			
			Between L114 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L114. 3) Solid part check. 4) Applies impressed voltage between L114 (Male) (1) - (2)			
			Between L114 (Male) (3) and (5)	Applies 24V impressed voltage between L114 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L114 (Male) (1) - (2)	Resistance	1MΩ and above
	2	Defective bucket PPC detent	1) Turn starting switch OFF. 2) Disconnect connector L37. 3) Connect T-adapter.			
			Between L37 (Male) (1) and (2)		Resistance	30 - 50Ω
	3	Defective bucket positioner proximity switch	1) Turn starting switch OFF. 2) Disconnect connector F03. 3) Interchange bucket positioner proximity switch (F03) with lift arm positioner proximity switch (F04). 4) Operate bucket positioner.			
			Bucket positioner function is normal.		Defective bucket positioner proximity switch F03	
			Bucket positioner does not function.		Bucket positioner proximity switch F03 is normal.	
	4	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector F03, L114, L37 and fuse FS1 terminal. 3) Connect T-adapter.			
			Wiring harness between F03 (Female) (A) and fuse FS1 (13)		Resistance	1Ω and below
			Wiring harness between F03 (Female) (B) and L114 (Female) (2)		Resistance	1Ω and below
			Wiring harness between F03 (Female) (C) and chassis ground		Resistance	1Ω and below
			Wiring harness between L114 (Female) (1) and fuse FS1 (13)		Resistance	1Ω and below
			Wiring harness between L114 (Female) (3) and fuse FS1 (13)		Resistance	1Ω and below
			Wiring harness between L114 (Female) (5) and L37 (Female) (1)		Resistance	1Ω and below
			Wiring harness between L37 (Female) (2) and chassis ground		Resistance	1Ω and below
			★ With all the above items, the bucket positioner does not function			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	5	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector F03, L114, L37 and fuse FS1 terminal. 3) Connect T-adapter.		
			Wiring harness between F03 (Female) (B) and L114 (Female) (2)	Resistance between F03 (Female) (B), L114 (Female) (2) and chassis ground	1M✕ and above
			★ In this case, the bucket positioner detent does not function (lever does not return to neutral)		
			Wiring harness between L114 (Female) (5) and L37 (Female) (1)	Resistance between L114 (Female) (5), L37 (Female) (1) and chassis ground	1M✕ and above
			★ In this case, the bucket positioner does not function (lever returns to neutral)		
			Wiring harness between F03 (Female) (A) and fuse FS1 (13)	Resistance between F03 (Female) (A), FS1 (13) and chassis ground	1M✕ and above
			Wiring harness between L114 (Female) (1) and fuse FS1 (13)	Resistance between L114 (Female) (1), fuse FS1 (13) and chassis ground	1M✕ and above
			Wiring harness between L114 (Female) (3) and fuse FS1 (13)	Resistance between L114 (Female) (3), fuse FS1 (13) and chassis ground	1M✕ and above
			★ In this case, the fuse is blown and no detents function (lever returns to neutral)		
	6	Hot short-circuiting between harnesses	1) Turn starting switch OFF. 2) Disconnect connector L114, L37. 3) Connect T-adapter. 4) Turn starting switch ON.		
			Wiring harness between L114 (Female) (5) and L37 (Female) (1)	Voltage between L114 (Female) (5), L37 (Female) (1) and chassis ground	1V and below
			★ In this case, the bucket positioner does not function (lever does not return to neutral)		

Related circuit diagram

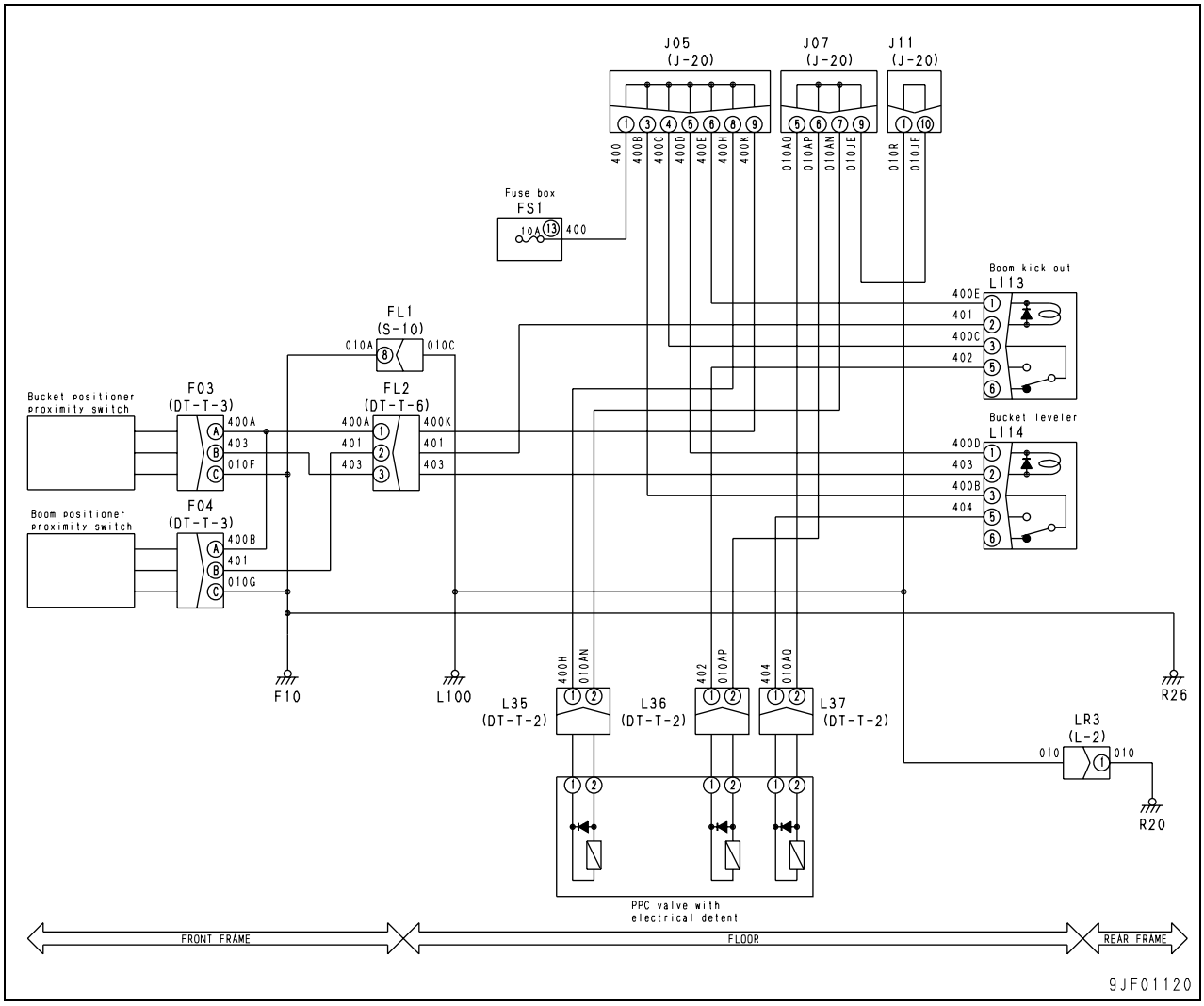


Troubleshooting Code [E-7] (Defective lift arm FLOATING holding function and cancellation)

Action Code	Failure Code	Controller Code	Trouble	Defective lift arm FLOATING holding function and cancellation
-	-	-		
Description of Trouble	• Lift arm FLOATING holding does not function or cannot be cancelled due to defective lift arm FLOATING PPC detent system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Lift arm FLOATING holding does not function or cannot be cancelled.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	1	Defective lift arm FLOATING PPC detent	1) Turn starting switch OFF. 2) Disconnect connector L35. 3) Connect T-adapter.		
			Between L35 (Male) (1) and (2)	Resistance	30 - 50Ω
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L35 and fuse FS1 terminal. 3) Connect T-adapter.		
			Wiring harness between fuse FS1 (13) and L35 (Female) (1)	Resistance	1Ω and below
			Wiring harness between L35 (Female) (2) and chassis ground	Resistance	1Ω and below

Related circuit diagram



Troubleshooting Code [E-8] (The wiper does not function)

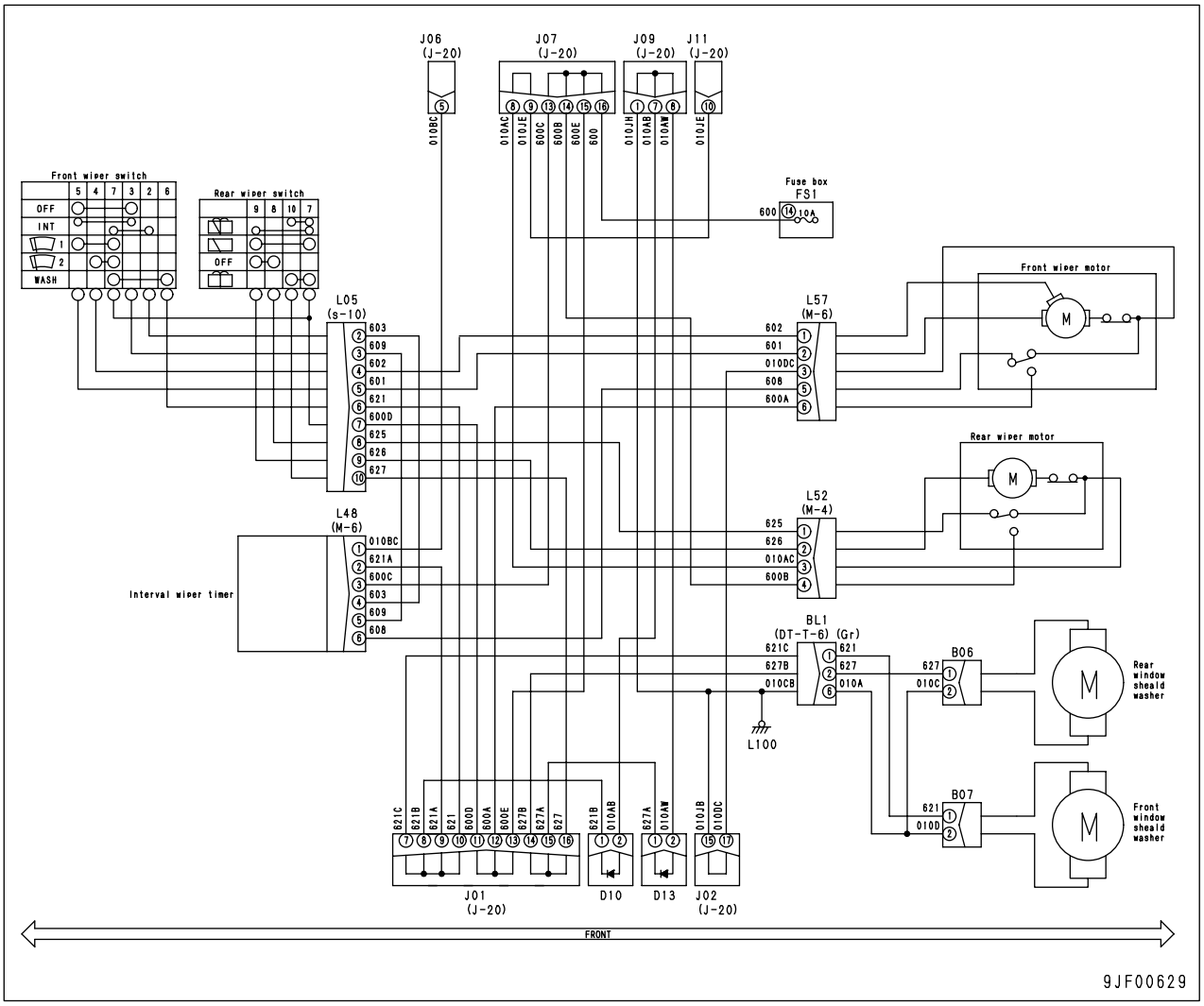
a) The rear wiper does not function

Action Code	Failure Code	Controller Code	Trouble	The wiper does not function a) The rear wiper does not function
-	-	-		
Description of Trouble	• The rear wiper does not function due defective rear wiper, switch, timer or wiring harness.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The rear wiper does not function.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective rear wiper motor	1) Turn starting switch OFF. 2) Disconnect connector L57. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L57 (6) and chassis ground		Voltage	20 - 30V
			Between L57 (2) and chassis ground	Turn wiper switch Lo.	Voltage	20 - 30V
			Between L57 (1) and chassis ground	Turn wiper switch Hi.	Voltage	20 - 30V
			• When the wiper switch is turned OFF during running of the wiper, the voltage is applied between the L57 (Female) (5) and chassis ground until the wiper motor stops.			
	2	Defective wiper timer	1) Turn starting switch OFF. 2) Disconnect connector L48. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L48 (3) and chassis ground		Voltage	20 - 30V
			Between L48 (4) and chassis ground	Turn wiper switch INT	Voltage	20 - 30V
			Between L48 (2) and chassis ground	Turn wiper switch WASHER	Voltage	20 - 30V
			Between L48 (5) and chassis ground (The voltage is output intermittently by wiper switch INT)		Voltage	20 - 30V ✕ 0V OV ✕ 20 - 30V (Repeated)
	3	Defective rear wiper switch	1) Turn starting switch OFF. 2) Disconnect connector L05. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L05 (Male) (7) and (5)	Turn wiper switch Lo.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
			Between L05 (Male) (7) and (4)	Turn wiper switch Hi.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
			Between L05 (Male) (7) and (2)	Turn wiper switch INT	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
			Between L05 (Male) (3) and (5)	Turn wiper switch INT	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	4	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L05, L48, L57 and fuse FS1 terminal. 3) Connect T-adapter.		
			Wiring harness between L05 (Female) (2) and L48 (Female) (4)	Resistance	1V and below
			Wiring harness between L05 (Female) (3) and L48 (Female) (5)	Resistance	1V and below
			Wiring harness between L05 (Female) (5) and L57 (Female) (2)	Resistance	1V and below
			Wiring harness between L05 (Female) (4) and L57 (Female) (1)	Resistance	1V and below
			Wiring harness between L48 (Female) (6) and L57 (Female) (5)	Resistance	1V and below
			Wiring harness between fuse FS1 (14) and L05 (Female) (7)	Resistance	1V and below
			Wiring harness between fuse FS1 (14) and L48 (Female) (3)	Resistance	1V and below
			Wiring harness between fuse FS1 (14) and L57 (Female) (6)	Resistance	1V and below
	5	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector L05, L48, L52, L57 and fuse FS1 terminal. 3) Connect T-adapter.		
			Wiring harness between L05 (Female) (2) and L48 (Female) (4)	Resistance between L05 (Female) (2), L48 (Female) (4) and chassis ground	1M✕ and above
			Wiring harness between L05 (Female) (3) and L48 (Female) (5)	Resistance between L05 (Female) (3), L48 (Female) (5) and chassis ground	1M✕ and above
			Wiring harness between L05 (Female) (5) and L57 (Female) (2)	Resistance between L05 (Female) (5), L57 (Female) (2) and chassis ground	1M✕ and above
			Wiring harness between L05 (Female) (4) and L57 (Female) (1)	Resistance between L05 (Female) (4), L57 (Female) (1) and chassis ground	1M✕ and above
			Wiring harness between L48 (Female) (6) and L57 (Female) (5)	Resistance between L48 (Female) (6), L57 (Female) (5) and chassis ground	1M✕ and above
			Wiring harness between fuse FS1 (14) and L05 (Female) (7)	Resistance between L05 (Female) (7) and chassis ground	1M✕ and above
			Wiring harness between fuse FS1 (14) and L48 (Female) (3)	Resistance between L48 (Female) (3) and chassis ground	1M✕ and above
			Wiring harness between fuse FS1 (14) and L57 (Female) (6)	Resistance between L57 (Female) (6) and chassis ground	1M✕ and above

Related circuit diagram



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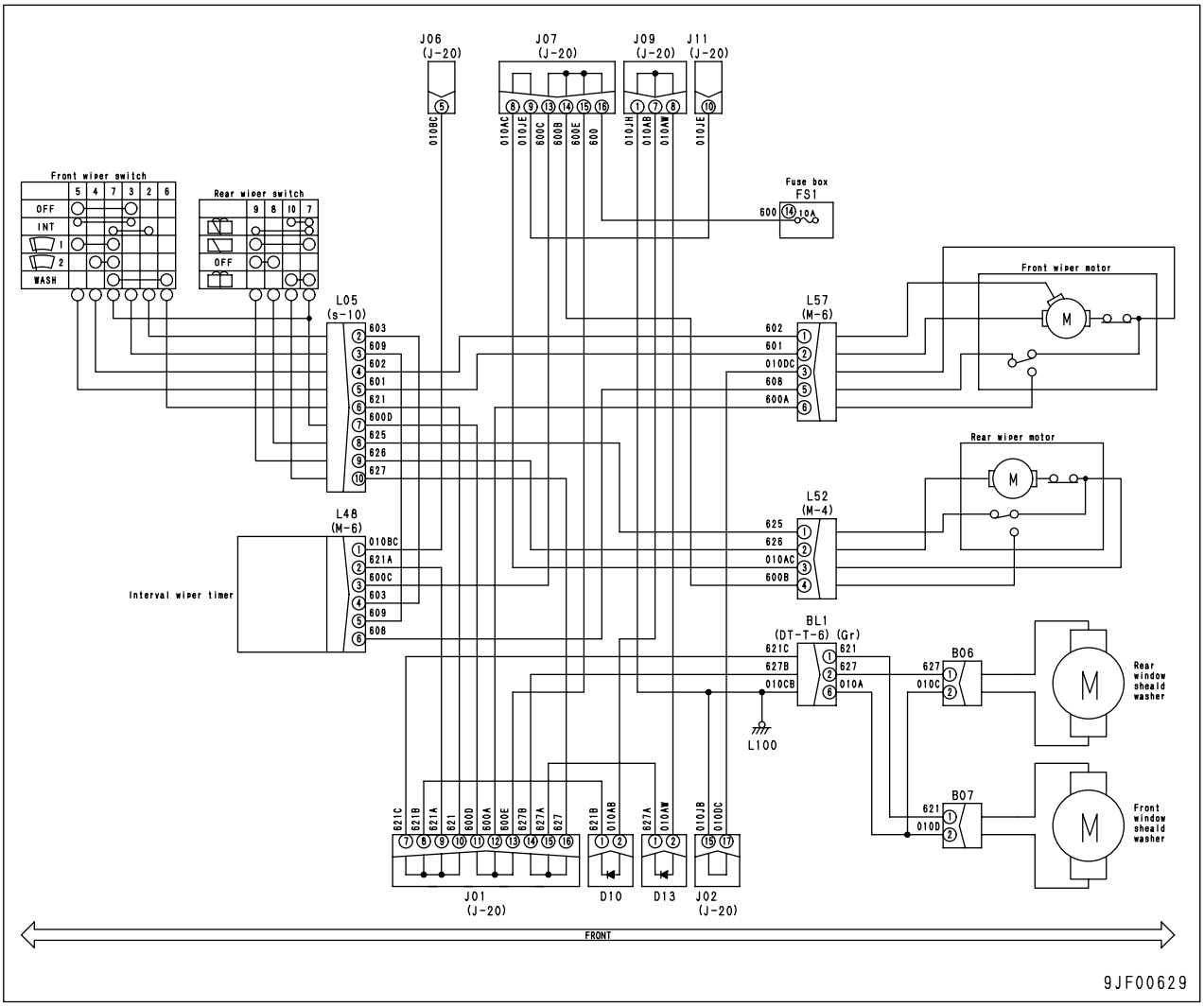
b) The rear wiper does not function

Action Code	Failure Code	Controller Code	Trouble	The wiper does not function b) The rear wiper does not function
-	-	-		
Description of Trouble	• The rear wiper does not function due defective rear wiper, switch, timer or wiring harness.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The rear wiper does not function.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective rear wiper motor	1) Turn starting switch OFF. 2) Disconnect connector L52. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L52 (4) and chassis ground		Voltage	20 - 30V
			Between L52 (2) and chassis ground	Turn wiper switch Lo.	Voltage	20 - 30V
			• When the wiper switch is turned OFF during running of the wiper, the voltage is applied between the L52 (Female) (1) and chassis ground until the wiper motor stops.			
	2	Defective rear wiper switch	1) Turn starting switch OFF. 2) Disconnect connector L05. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L05 (Male) (7) and (9)	Turn wiper switch Lo.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
			Between L05 (Male) (8) and (9)	Turn wiper switch OFF.	Resistance	1✕ and below
				Other than above.	Resistance	1M✕ and above
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L05, L52 and fuse FS1 terminal. 3) Connect T-adapter.			
			Wiring harness between L05 (Female) (8) and L52 (Female) (1)		Resistance	1✕ and below
			Wiring harness between L05 (Female) (9) and L52 (Female) (2)		Resistance	1✕ and below
			Wiring harness between fuse FS1 (14) and L05 (Female) (7)		Resistance	1✕ and below
			Wiring harness between fuse FS1 (14) and L57 (Female) (6)		Resistance	1✕ and below
	4	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector L05, L48, L52, L57 and fuse FS1 terminal. 3) Connect T-adapter.			
			Wiring harness between L05 (Female) (8) and L52 (Female) (1)	Resistance between L05 (Female) (8), L52 (Female) (1) and chassis ground		1M✕ and above
			Wiring harness between L05 (Female) (9) and L52 (Female) (2)	Resistance between L05 (Female) (9), L52 (Female) (2) and chassis ground		1M✕ and above
			Wiring harness between fuse FS1 (14) and L05 (Female) (7)	Resistance between L05 (Female) (7) and chassis ground		1M✕ and above
			Wiring harness between fuse FS1 (14) and L52 (Female) (4)	Resistance between L52 (Female) (6) and chassis ground		1M✕ and above
			★ In the all above cases, the fuse is blown.			

Related circuit diagram



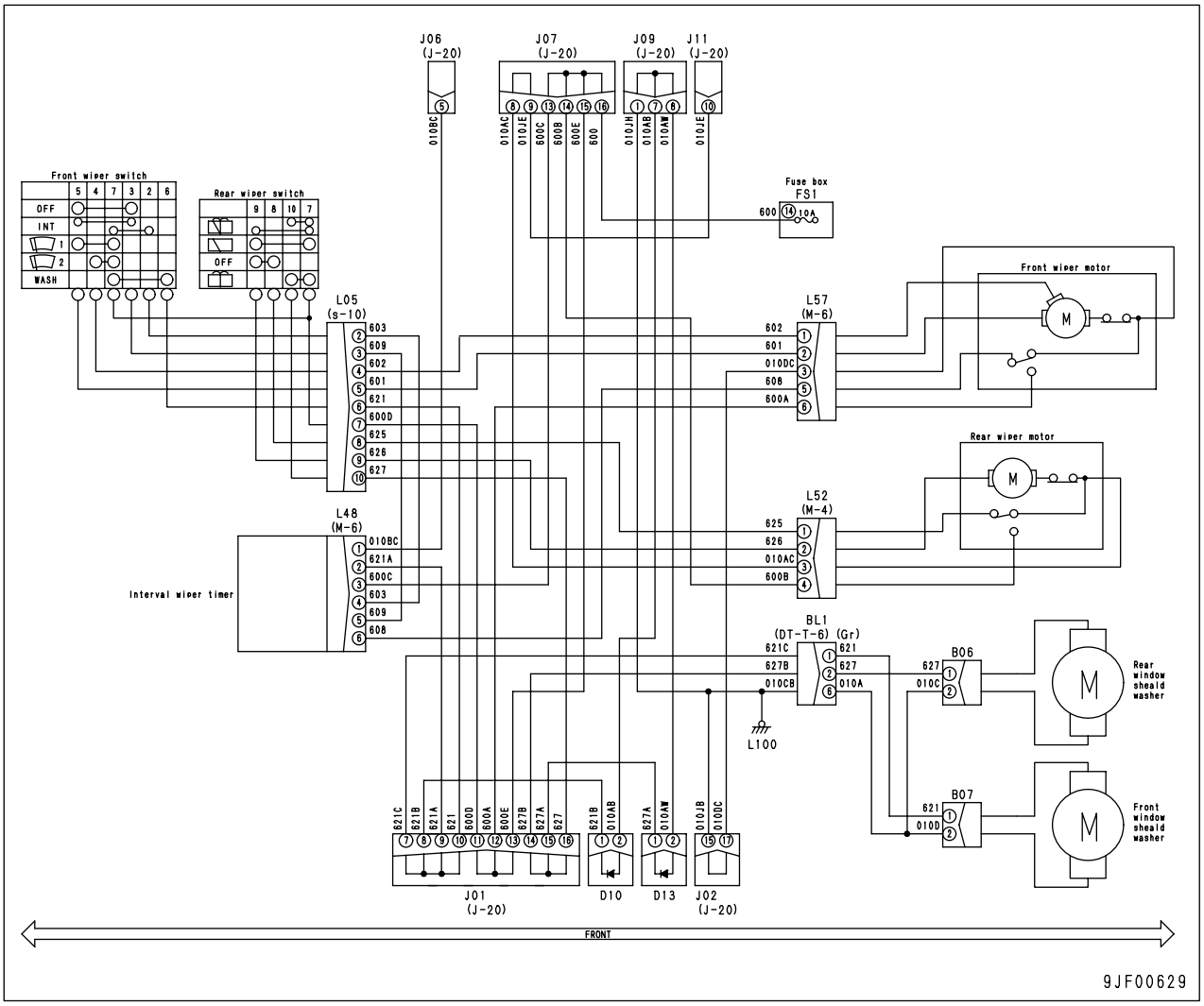
Troubleshooting Code [E-9] (The window washer does not function)

Action Code	Failure Code	Controller Code	Trouble	The window washer does not function
-	-	-		
Description of Trouble	• The window washer does not function due defective window washer motor, switch, timer (Front only) or wiring harness.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The window washer does not function.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective window washer motor	1) Turn starting switch OFF. 2) Disconnect connector B07, B06. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			• Front washer motor			
			Between B07 (1) and chassis ground		Voltage	20 - 30V
			• Rear washer motor			
			Between B06 (1) and chassis ground		Voltage	20 - 30V
	2	Defective wiper switch	1) Turn starting switch OFF. 2) Disconnect connector L05. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			• Common to front switch and rear switch.			
			Between L05 (Male) (7) and chassis ground		Voltage	20 - 30V
			1) Turn starting switch OFF. 2) Disconnect connector L05. 3) Connect T-adapter.			
			• Front switch			
			Between L05 (Male) (7) and (6)	Turn washer switch ON.	Resistance	1Ω and below
				Turn washer switch OFF.	Resistance	1MΩ and above
			• Rear switch			
			Between L05 (Male) (7) and (10)	Turn washer switch ON.	Resistance	1Ω and below
				Turn washer switch OFF.	Resistance	1MΩ and above
			Between L05 (Male) (7) and (9), (10)	Turn washer and wiper low switch ON.	Resistance	1Ω and below
	3	Defective wiper timer (Relay)	1) Turn starting switch OFF. 2) Disconnect connector L48. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Wiring harness between L48 (3) and chassis ground		Voltage	20 - 30V
			Wiring harness between L48 (2) and chassis ground	Turn washer switch ON.	Voltage	20 - 30V
			Wiring harness between L48 (5) and chassis ground (0.2 to 0.8 sec. after the washer switch was turned ON)		Voltage	20 - 30V

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	4	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L05, L48, B06, B07 and fuse FS1 terminal. 3) Connect T-adapter.		
			• Front side		
			Wiring harness between L05 (Female) (6) and B07 (Female) (1)	Resistance	1✕ and below
			Wiring harness between L05 (Female) (6) and L48 (Female) (2)	Resistance	1✕ and below
			Wiring harness between L05 (Female) (3) and L48 (Female) (5)	Resistance	1✕ and below
			• Rear side		
			Wiring harness between L05 (Female) (10) and B06 (Female) (1)	Resistance	1✕ and below
			• Common to front and rear side.		
			Wiring harness between fuse FS1 (14) and L05 (Female) (7)	Resistance	1✕ and below
	5	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector L05, L48, L52, L57, D10, D13 and fuse FS1 terminal. 3) Connect T-adapter.		
			• Front side		
			Wiring harness between L05 (Female) (6) and B07 (Female) (1)	Resistance between L05 (Female) (6), B07 (Female) (1) and chassis ground	1M✕ and above
			Wiring harness between L05 (Female) (6) and L48 (Female) (2)	Resistance between L05 (Female) (6), L48 (Female) (2) and chassis ground	1M✕ and above
			Wiring harness between L05 (Female) (3) and L48 (Female) (5)	Resistance between L05 (Female) (7), L48 (Female) (5) and chassis ground	1M✕ and above
			• Rear side		
			Wiring harness between L05 (Female) (10) and B06 (Female) (1)	Resistance between L05 (Female) (10), B06 (Female) (1) and chassis ground	1M✕ and above
			• Common to front and rear side.		
			Wiring harness between fuse FS1 (14) and L05 (Female) (7)	Resistance between L52 (Female) (7) and chassis ground	1M✕ and above
			★ In the all above cases, the fuse is blown.		

Related circuit diagram



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Troubleshooting Code [E-10] (Lamps do not work properly)

a) Neither high beam nor low beam of headlamp light up

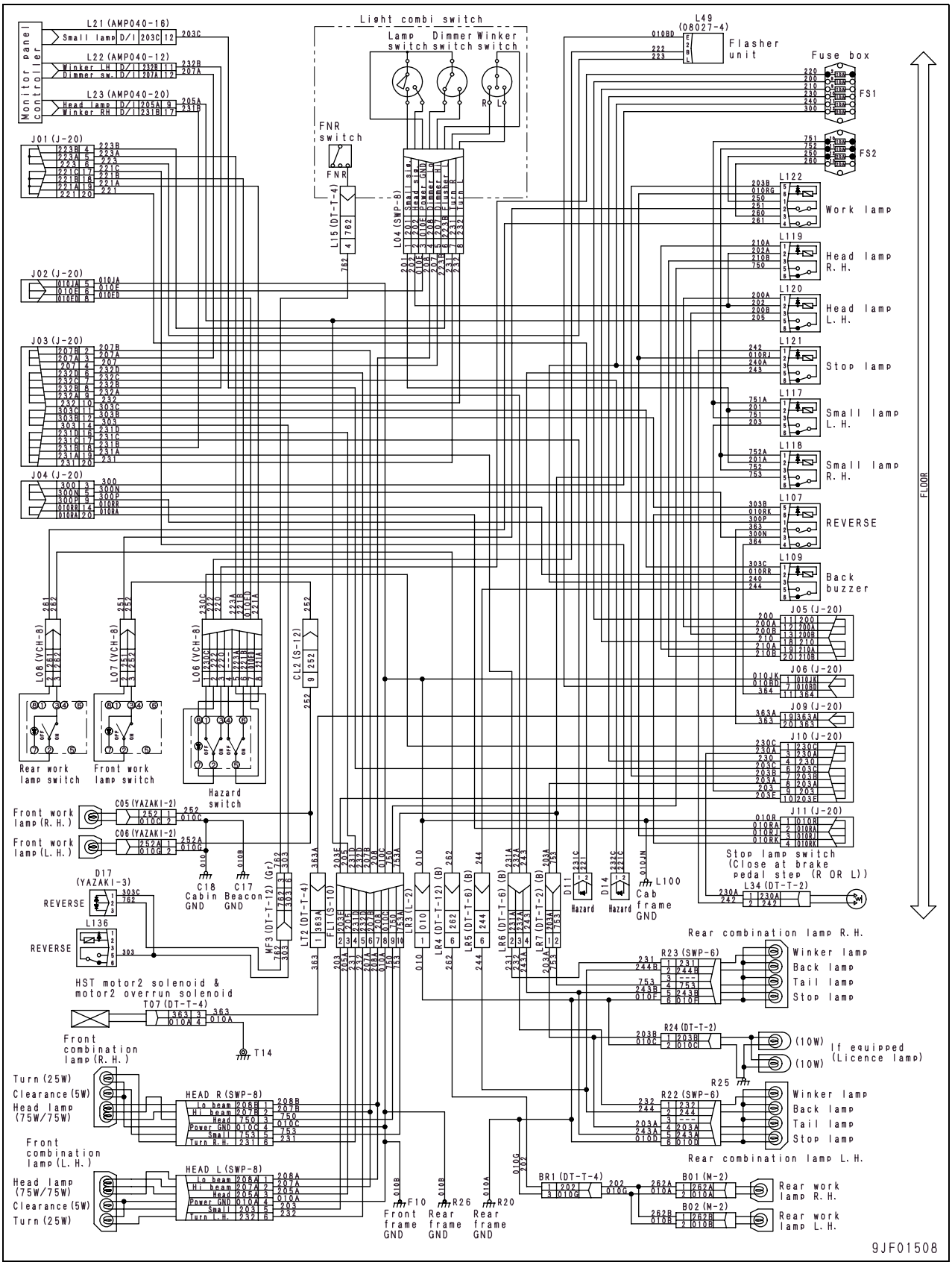
Action Code	Failure Code	Controller Code	Trouble	Lamps do not work properly a) Neither high beam nor low beam of headlamp light up
-	-	-		
Description of Trouble	• Head lamp (Hi beam and Lo beam) does not light ON due to defective switch, lamp or wiring harness (Ground fault) in the head lamp system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Head lamp (Hi beam and Lo beam) does not light ON when the lamp switch is turned STEP 2.			
Related Information	• If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and relay, between fuse and lamp) • When circuits for other lamp systems are normal			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective head lamp	1) Turn starting switch OFF. 2) Disconnect connector HEAD L, HEAD R. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between HEAD L (3) and chassis ground	Turn lamp switch STEP 2 and dimmer switch Lo.	Voltage	20 - 30V
			Between HEAD L (3) and chassis ground	Turn lamp switch STEP 2 and dimmer switch Hi.	Voltage	20 - 30V
			Between HEAD R (3) and chassis ground	Turn lamp switch STEP 2 and dimmer switch Lo.	Voltage	20 - 30V
			Between HEAD R (3) and chassis ground	Turn lamp switch STEP 2 and dimmer switch Hi.	Voltage	20 - 30V
	2	Defective lamp switch and dimmer switch	1) Turn starting switch OFF. 2) Disconnect connector L04. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L04 (Male) (2) and (3)	Turn lamp switch OFF.	Resistance	1MΩ and above
				Turn lamp switch 1 STEP.	Resistance	1MΩ and above
				Turn lamp switch STEP 2.	Resistance	1Ω and below
			Between L04 (Male) (4) and (3)	Turn dimmer switch Lo.	Resistance	1Ω and below
				Turn dimmer switch Hi.	Resistance	1MΩ and above
			Between L04 (Male) (5) and (3)	Turn dimmer switch Lo.	Resistance	1MΩ and above
				Turn dimmer switch Hi.	Resistance	1Ω and below

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	3	Defective head lamp relay (Left side) (L120)	1) Turn starting switch OFF. 2) Replace relay L120 with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when the headlamp relay (left) L120 is replaced with normal relay?	Condition is abnormal.		Relay L120 is normal.
				Condition is normal.		Defective relay L120.
			1) Turn starting switch OFF. 2) Disconnect connector L120. 3) Solid part check. 4) Applies impressed voltage between L120 (Male) (1) - (2)			
			Between L120 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L120. 3) Solid part check.			
			Between L120 (Male) (3) and (5)	Applies 24V impressed voltage between L120 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L120 (Male) (1) - (2)	Resistance	1MΩ and above
	4	Defective head lamp relay (Right side) (L119)	1) Turn starting switch OFF. 2) Replace relay L119 with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when headlamp relay (right) L119 is replaced with normal relay?	Condition is abnormal.		Relay L119 is normal.
				Condition is normal.		Defective relay L119.
			1) Turn starting switch OFF. 2) Disconnect connector L119. 3) Solid part check.			
			Between L119 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L119. 3) Solid part check. 4) Applies impressed voltage between L119 (Male) (1) - (2)			
			Between L119 (Male) (3) and (5)	Applies 24V impressed voltage between L119 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L119 (Male) (1) - (2)	Resistance	1MΩ and above
	5	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L04, L120, L119, HEAD L, HEAD R and fuse FS1 terminal (8), (9). 3) Connect T-adapter.			
			★ When both sides are defective (in this case, clearance lamp also does not light up)			
			Wiring harness between L04 (Female) (3) and chassis ground		Resistance	1Ω and below
			★ When left side is defective			
			Wiring harness between L120 (Female) (5) and HEAD L (Female) (3)		Resistance	1Ω and below
			Wiring harness between fuse FS1 terminal (8) and L120 (Female) (1), (3)		Resistance	1Ω and below
			Wiring harness between L120 (Female) (2) and L04 (Female) (2)		Resistance	1Ω and below
			★ When right side is defective			
			Wiring harness between L119 (Female) (5) and HEAD R (Female) (3)		Resistance	1Ω and below
			Wiring harness between fuse FS1 terminal (9) and L119 (Female) (1), (3)		Resistance	1Ω and below
			Wiring harness between L119 (Female) (2) and L04 (Female) (2)		Resistance	1Ω and below

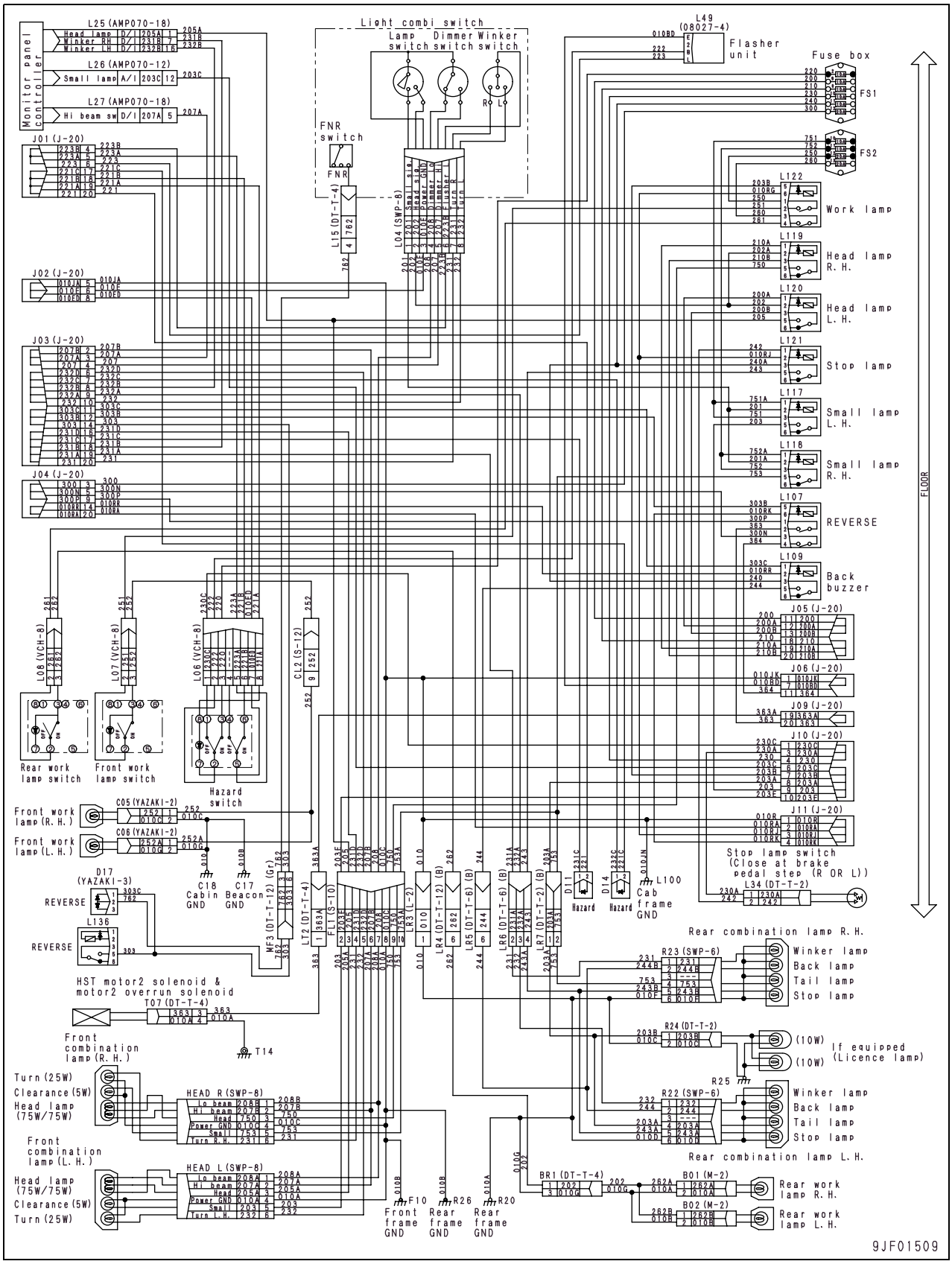
Related circuit diagram

Speed meter specification (STD)



Related circuit diagram

Load meter specification (If equipped)



b) Head lamp (Lo beam) does not light ON

Action Code	Failure Code	Controller Code	Trouble	Each lamps does not function b) Head lamp (Lo beam) does not light ON
-	-	-		
Description of Trouble	• Head lamp (Lo beam) does not light ON due to defective switch, lamp or wiring harness (Ground fault) in the head lamp system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Head lamp (Lo beam) does not light ON when the lamp switch is turned STEP 2.			
Related Information	• If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and lamp) • When circuits for other lamp systems are normal			

Possible Causes and Standard Values	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
	1	Defective head lamp	1) Turn starting switch OFF. 2) Disconnect connector HEAD L, HEAD R. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between HEAD L (3) and chassis ground	Turn lamp switch STEP 2 and dimmer switch Lo.	Voltage	20 - 30V
			Between HEAD R (3) and chassis ground	Turn lamp switch STEP 2 and dimmer switch Lo.	Voltage	20 - 30V
	2	Defective lamp switch and dimmer switch	1) Turn starting switch OFF. 2) Disconnect connector L04. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L04 (Male) (2) and (3)	Turn lamp switch OFF.	Resistance	1M✕ and above
				Turn lamp switch 1 STEP.	Resistance	1M✕ and above
				Turn lamp switch STEP 2.	Resistance	1✕ andbelow
			Between L04 (Male) (4) and (3)	Turn dimmer switch Lo.	Resistance	1✕ andbelow
				Turn dimmer switch Hi.	Resistance	1M✕ and above
			Between L04 (Male) (5) and (3)	Turn dimmer switch Lo.	Resistance	1M✕ and above
				Turn dimmer switch Hi.	Resistance	1✕ andbelow
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L04, HEAD L, HEAD R. 3) Connect T-adapter.			
			Wiring harness between L04 (Female) (4) and HEAD L (Female) (1)		Resistance	1✕ andbelow
			Wiring harness between L04 (Female) (4) and HEAD R (Female) (1)		Resistance	1✕ andbelow

Related circuit diagram

★ See "TROUBLESHOOTING CODE [E-10.(a)]".

c) Head lamp (Hi beam) does not light ON

Action Code	Failure Code	Controller Code	Trouble	Each lamps does not function c) Head lamp (Hi beam) does not light ON
-	-	-		
Description of Trouble	• Head lamp (Hi beam) does not light ON due to defective switch, lamp or wiring harness (Ground fault) in the head lamp system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Head lamp (Hi beam) does not light ON when the lamp switch is turned STEP 2.			
Related Information	• If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and lamp) • When circuits for other lamp systems are normal			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective head lamp	1) Turn starting switch OFF. 2) Disconnect connector HEAD L, HEAD R. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between HEAD L (3) and chassis ground	Turn lamp switch STEP 2 and dimmer switch Hi.	Voltage	20 - 30V
			Between HEAD R (3) and chassis ground	Turn lamp switch STEP 2 and dimmer switch Hi.	Voltage	20 - 30V
	2	Defective lamp switch and dimmer switch	1) Turn starting switch OFF. 2) Disconnect connector L04. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L04 (Male) (2) and (3)	Turn lamp switch OFF.	Resistance	1MΩ and above
				Turn lamp switch 1 STEP.	Resistance	1MΩ and above
				Turn lamp switch STEP 2.	Resistance	1Ω and below
			Between L04 (Male) (4) and (3)	Turn dimmer switch Lo.	Resistance	1Ω and below
				Turn dimmer switch Hi.	Resistance	1MΩ and above
			Between L04 (Male) (5) and (3)	Turn dimmer switch Lo.	Resistance	1MΩ and above
				Turn dimmer switch Hi.	Resistance	1Ω and below
	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L04, HEAD L, HEAD R. 3) Connect T-adapter.			
			★ When left side is defective			
			Wiring harness between L04 (Female) (5) and J03 (4), (2) and HEAD L (Female) (2)		Resistance	1Ω and below
			★ When right side is defective			
			Wiring harness between L04 (Female) (5) and J03 (4), (2) and HEAD R (Female) (2)		Resistance	1Ω and below

Related circuit diagram

★ See "TROUBLESHOOTING CODE [E-10.(a)]".

d) Clearance lamp (Small lamp) does not light ON

Action Code	Failure Code	Controller Code	Trouble	Each lamps does not function d) Clearance lamp (Small lamp) does not light ON
-	-	-		
Description of Trouble	• Clearance lamp (Small lamp) does not light ON due to defective switch, lamp or wiring harness (Ground fault) in the clearance lamp system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Clearance lamp (Small lamp) does not light ON when the lamp switch is turned STEP 1.			
Related Information	• If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and lamp) • When circuits for other lamp systems are normal			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective clearance lamp	1) Turn starting switch OFF. 2) Disconnect connector HEAD L, HEAD R. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between HEAD L (5) and chassis ground	Turn lamp switch STEP 1.	Voltage	20 - 30V
			Between HEAD R (5) and chassis ground	Turn lamp switch STEP 1.	Voltage	20 - 30V
	2	Defective lamp switch	1) Turn starting switch OFF. 2) Disconnect connector L04. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L04 (Male) (2) and (3)	Turn lamp switch OFF.	Resistance	1MΩ and above
				Turn lamp switch STEP 1.	Resistance	1Ω and below
	3	Defective small lamp relay (Left side) (L117) ★ When left side is defective	1) Turn starting switch OFF. 2) Replace relay L117 with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when small lamp relay (left) L117 is replaced with normal relay?	Condition is abnormal.		Relay L117 is normal.
				Condition is normal.		Defective relay L117.
			1) Turn starting switch OFF. 2) Disconnect connector L117. 3) Solid part check.			
			Between L117 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L117. 3) Solid part check. 4) Applies impressed voltage between L117 (Male) (1) - (2)			
			Between L117 (Male) (3) and (5)	Applies 24V impressed voltage between L117 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L117 (Male) (1) - (2)	Resistance	1MΩ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	4	Defective small lamp relay (Right side) (L118) ★ When right side is defective	1) Turn starting switch OFF. 2) Replace relay L118 with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when small lamp relay (right) L118 is replaced with normal relay?	Condition is abnormal.		Relay L118 is normal.
				Condition is normal.		Defective relay L118.
			1) Turn starting switch OFF. 2) Disconnect connector L118. 3) Solid part check.			
			Between L118 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L118. 3) Solid part check. 4) Applies impressed voltage between L118 (Male) (1) - (2)			
			Between L118 (Male) (3) and (5)	Applies 24V impressed voltage between L118 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L118 (Male) (1) - (2)	Resistance	1MΩ and above
	5	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L04, L117, L118, HEAD L, HEAD R and fuse FS2 terminal (10), (11). 3) Connect T-adapter.			
			★ When both sides are defective (in this case, headlamp also does not light up)			
			Wiring harness between L04 (Female) (3) and chassis ground		Resistance	1Ω and below
			★ When left side is defective			
			Wiring harness between L117 (Female) (5) and J10 (9), (10) and HEAD L (Female) (5)		Resistance	1Ω and below
			Wiring harness between fuse FS2 (10) and L117 (Female) (1), (3)		Resistance	1Ω and below
			Wiring harness between L117 (Female) (2) and L04 (Female) (1)		Resistance	1Ω and below
			Wiring harness between HEAD L (Female) (4) and chassis ground		Resistance	1Ω and below
			★ When right side is defective			
			Wiring harness between L118 (Female) (5) and HEAD R (Female) (5)		Resistance	1Ω and below
			Wiring harness between fuse FS2 (11) and L118 (Female) (1), (3)		Resistance	1Ω and below
			Wiring harness between L118 (Female) (2) and L04 (Female) (1)		Resistance	1Ω and below
			Wiring harness between HEAD R (Female) (4) and chassis ground		Resistance	1Ω and below

Related circuit diagram

★ See "TROUBLESHOOTING CODE [E-10.(a)]".

e) Turn signal lamp does not blink

Action Code	Failure Code	Controller Code	Trouble	Each lamps does not function e) Turn signal lamp does not blink
-	-	-		
Description of Trouble	• Turn signal lamp does not blink due to defective switch, lamp or wiring harness (Ground fault) in the turn signal lamp system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Turn signal lamp does not blink			
Related Information	• If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and lamp) • When circuits for other lamp systems are normal			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective turn-signal switch	1) Turn starting switch OFF. 2) Disconnect connector L04. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L04 (Male) (6) and (7)	Turn turn-signal switch RIGHT.	Resistance	1✕ and below
				Turn turn-signal switch LEFT.	Resistance	1M✕ and above
			Between L04 (Male) (6) and (8)	Turn turn-signal switch RIGHT.	Resistance	1✕ and below
				Turn turn-signal switch LEFT.	Resistance	1M✕ and above
	2	Defective hazard switch	1) Turn starting switch OFF. 2) Disconnect connector L06. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L06 (Male) (1) and (2)	Turn hazard switch OFF.	Resistance	1✕ and below
				Turn hazard switch ON.	Resistance	1M✕ and above
			Between L06 (Male) (3) and (2)	Turn hazard switch OFF.	Resistance	1✕ and below
				Turn hazard switch ON.	Resistance	1M✕ and above
			★ When hazard switch does not function			
			Between L06 (Male) (5) and (6)	Wiring harness discontinuity (Disconnection or defective contact)	Resistance	1M✕ and above
				1) Turn starting switch OFF. 2) Disconnect connector L04, L119, L120, HEAD L, HEAD R and fuse FS1 terminal (8), (9). 3) Connect T-adapter.	Resistance	1✕ and below

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	3	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L04, L119, L120, HEAD L, HEAD R and fuse FS1 terminal (8), (9). 3) Connect T-adapter.		
			★ When both sides are defective (in this case, headlamp also does not light up)		
			Wiring harness between L04 (Female) (3) and chassis ground	Resistance	1✕ andbelow
			★ When left side is defective		
			Wiring harness between L04 (Female) (8) and J03 (10), (6) and HEAD L (Female) (6)	Resistance	1✕ andbelow
			Wiring harness between HEAD L (Female) (4) and chassis ground	Resistance	1✕ andbelow
			Wiring harness between L04 (Female) (8) and J03 (10), (9) and R22 (Female) (1)	Resistance	1✕ andbelow
			Wiring harness between R22 (Female) (6) and chassis ground	Resistance	1✕ andbelow
			Wiring harness between J01 (Female) (17) and D12 (2), (1) and J03 (7)	Resistance	1✕ andbelow
			★ When right side is defective		
			Wiring harness between L04 (Female) (7) and J03 (20), (16) and HEAD R (Female) (6)	Resistance	1✕ andbelow
			Wiring harness between HEAD R (Female) (4) and chassis ground	Resistance	1✕ andbelow
			Wiring harness between L04 (Female) (7) and J03 (20), (19) and R23 (Female) (1)	Resistance	1✕ andbelow
			Wiring harness between R23 (Female) (6) and chassis ground	Resistance	1✕ andbelow
			Wiring harness between J01 (Female) (20) and D11 (2), (1) and J03 (17)	Resistance	1✕ andbelow
			★ When both sides are defective		
			Wiring harness between fuse FS1 (10) and J10 (4), (1) and L06 (Female) (1)	Resistance	1✕ andbelow
			Wiring harness between fuse FS1 (2) and L06 (Female) (3)	Resistance	1✕ andbelow
			Wiring harness between L06 (Female) (2) and L49 (Female) (B)	Resistance	1✕ andbelow
			Wiring harness between L49 (Female) (E) and chassis ground	Resistance	1✕ andbelow
			Wiring harness between L49 (Female) (L) and J01 (Female) (6)	Resistance	1✕ andbelow
			Wiring harness between L04 (Female) (6) and J01 (Female) (4)	Resistance	1✕ andbelow
			★ When hazard switch does not function		
			Wiring harness between L06 (Female) (5) and J01 (Female) (4)	Resistance	1✕ andbelow
			Wiring harness between L06 (Female) (6) and J01 (Female) (18)	Resistance	1✕ andbelow

Related circuit diagram

★ See "TROUBLESHOOTING CODE [E-10.(a)]".

f) Working lamp does not light ON

Action Code	Failure Code	Controller Code	Trouble	Each lamps does not function f) Working lamp does not light ON
-	-	-		
Description of Trouble	• Working lamp does not light ON due to defective switch, lamp or wiring harness (Ground fault) in the clearance lamp system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Working lamp does not light ON.			
Related Information	• If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and lamp) • When circuits for other lamp systems are normal • When side lamps do not light up, carry out troubleshooting first for side lamp system.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective working lamp	1) Turn starting switch OFF. 2) Disconnect connector C05, C06, B01 or B02. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between C05 (1) and chassis ground	Turn front working lamp switch ON.	Voltage	20 - 30V
				Turn front working lamp switch OFF.	Voltage	1V and below
			Between C06 (1) and chassis ground	Turn front working lamp switch ON.	Voltage	20 - 30V
				Turn front working lamp switch OFF.	Voltage	1V and below
			Between B01 (1) and chassis ground	Turn rear working lamp switch ON.	Voltage	20 - 30V
				Turn rear working lamp switch OFF.	Voltage	1V and below
			Between B02 (1) and chassis ground	Turn rear working lamp switch ON.	Voltage	20 - 30V
				Turn rear working lamp switch OFF.	Voltage	1V and below
	2	Defective working lamp switch	1) Turn starting switch OFF. 2) Disconnect connector C05, C06, B01 or B02. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L07 (Male) (2) and (3)	Turn front working lamp switch ON.	Resistance	1Ω and below
				Turn front working lamp switch OFF.	Resistance	1MΩ and above
			Between L08 (Male) (2) and (3)	Turn rear working lamp switch ON.	Resistance	1Ω and below
				Turn rear working lamp switch OFF.	Resistance	1MΩ and above
	3	Defective working lamp relay (L122)	1) Turn starting switch OFF.2) Replace relay L122 with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when working lamp relay L122 is replaced with normal relay?	Condition is abnormal.		Relay L122 is normal.
				Condition is normal.		Defective relay L122.
			1) Turn starting switch OFF. 2) Disconnect connector L122. 3) Solid part check.			
			Between L122 (Male) (1) and (2)		Resistance	200 - 400Ω
			1) Turn starting switch OFF. 2) Disconnect connector L122. 3) Solid part check. 4) Applies impressed voltage between L122 (Male) (1) - (2)			
			Between L122 (Male) (3) and (5)	Applies 24V impressed voltage between L122 (Male) (1) - (2)	Resistance	1Ω and below
				Does not apply voltage between L122 (Male) (1) - (2)	Resistance	1MΩ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	4	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector L04, L119, L120, HEAD L, HEAD R and fuse FS1 terminal (8), (9). 3) Connect T-adapter.		
			★ When all lamps are defective		
			Wiring harness between L117 (Female) (5) and L122 (Female) (1)	Resistance	1✕ andbelow
			Wiring harness between L122 (Female) (2) and chassis ground	Resistance	1✕ andbelow
			★ When front lamps are defective		
			Wiring harness between L122 (Female) (2) and L07 (Female) (2)	Resistance	1✕ andbelow
			Wiring harness between fuse FS2 (12) and L122 (Female) (1)	Resistance	1✕ andbelow
			Wiring harness between L07 (Female) (3) and C05 (Female) (1), C06 (Female) (1)	Resistance	1✕ andbelow
			Wiring harness between C05 (Female) (2), C06 (Female) (2) and chassis ground	Resistance	1✕ andbelow
			★ When rear lamps are defective		
			Wiring harness between L122 (Female) (4) and L08 (Female) (2)	Resistance	1✕ andbelow
			Wiring harness between fuse FS2 (13) and L122 (Female) (3)	Resistance	1✕ andbelow
			Wiring harness between L08 (Female) (3) and B01 (Female) (1), B02 (Female) (1)	Resistance	1✕ andbelow
			Wiring harness between B01 (Female) (2), B02 (Female) (2) and chassis ground	Resistance	1✕ andbelow

Related circuit diagram

★ See "TROUBLESHOOTING CODE [E-10.(a)]".

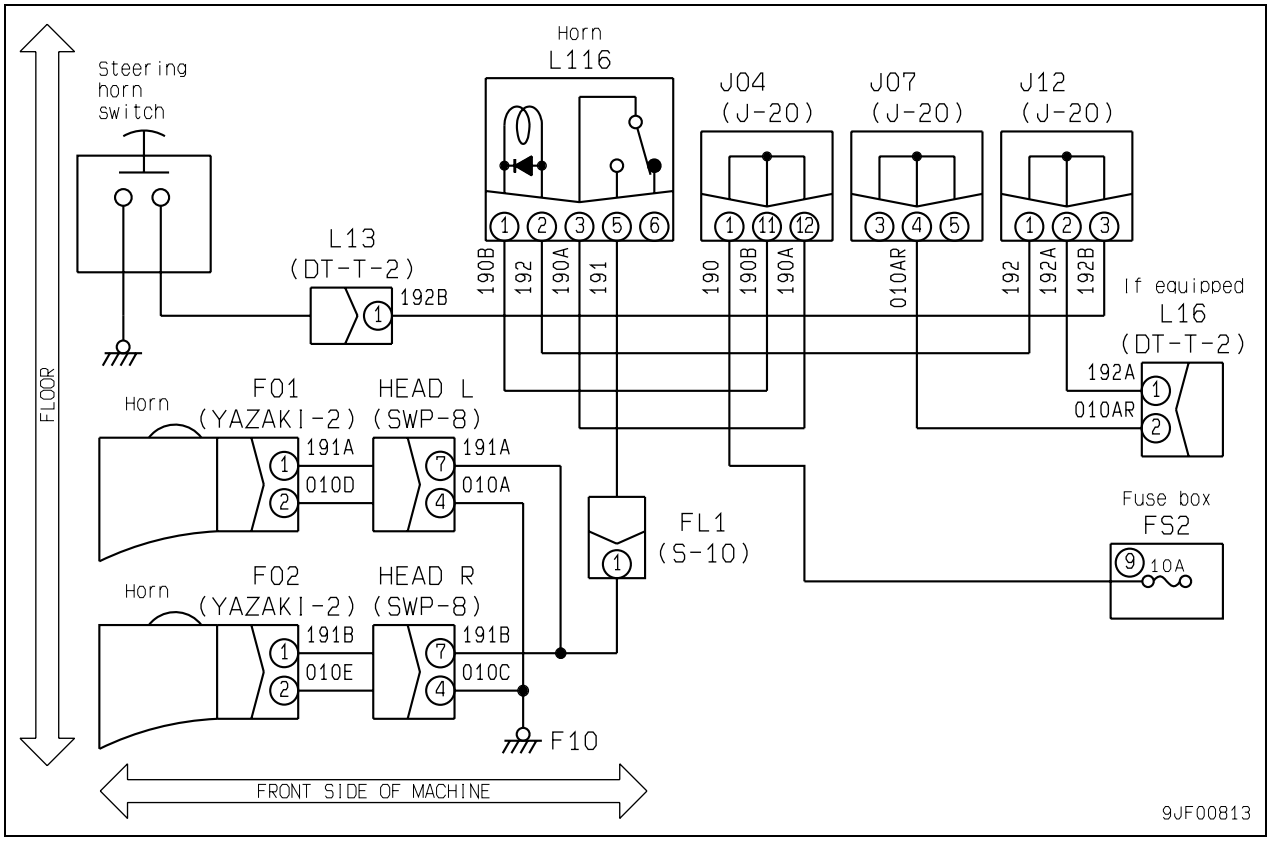
Troubleshooting Code [E-11] (The horn does not sound)

Action Code	Failure Code	Controller Code	Trouble	The horn does not sound
-	-	-		
Description of Trouble	• Horn does not sound due to defective switch, relay, horn or wiring harness in the horn system.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The horn does not sound.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Defective horn switch	1) Turn starting switch OFF. 2) Disconnect connector L13. 3) Connect connector.			
			Between L13 (Male) (1) and chassis ground	Push horn switch ON	Resistance	1✕ andbelow
				Horn switch OFF	Resistance	1M✕ and above
	2	Defective horn relay (L116)	1) Turn starting switch OFF. 2) Disconnect connector L116. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON.			
			Between L116 (1), (3) and chassis ground		Voltage	20 - 30V
			Between L116 (2) and chassis ground		Voltage	20 - 30V
			Between L116 (2) and chassis ground		Voltage	1V and below
			Between L116 (5) and chassis ground		Voltage	20 - 30V
			1) Turn starting switch OFF. 2) Replace relay L116 with normal relay. 3) Turn starting switch ON.			
			Does condition become normal when horn and lamp relay L116 is replaced with normal relay?	Condition is abnormal.		Relay L116 is normal.
				Condition is normal.		Defective relay L116.
			1) Turn starting switch OFF. 2) Disconnect connector L116. 3) Solid part check.			
			Between L116 (Male) (1) and (2)		Resistance	200 - 400✕
			1) Turn starting switch OFF. 2) Disconnect connector L116. 3) Solid part check. 4) Applies impressed voltage between L116 (Male) (1) - (2)			
			Between L116 (Male) (3) and (5)	Applies 24V impressed voltage between L116 (Male) (1) - (2)	Resistance	1✕ andbelow
				Does not apply voltage between L116 (Male) (1) - (2)	Resistance	1M✕ and above
	3	Defective horn	1) Turn starting switch OFF. 2) Disconnect connector F01, F02. 3) Insert T-adapter. 4) Connect T-adapter. 5) Turn starting switch ON.			
			Between F01 (Male) (1) and (2)	Push horn switch ON	Voltage	20 - 30V
				Horn switch OFF	Voltage	1V and below
			Between F02 (Male) (1) and (2)	Push horn switch ON	Voltage	20 - 30V
				Horn switch OFF	Voltage	1V and below

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values			1) Turn starting switch OFF. 2) Disconnect connector L13, L116 and fuse FS2 (9) terminal. 3) Connect T-adapter.		
	4	Wiring harness discontinuity (Disconnection or defective contact)	Wiring harness between fuse FS2 (9) and L116 (Female) (1), (3)	Resistance	1✕ and below
			Wiring harness between L116 (Female) (5) and L13 (Female) (1)	Resistance	1✕ and below
			Wiring harness between L116 (Female) (5) and F02 (Female) (1)	Resistance	1✕ and below
			Wiring harness between F01 (Female) (2), F02 (Female) (2) and chassis ground	Resistance	1✕ and below
	5	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector L116, F01, F02 and fuse FS2 (9) terminal. 3) Connect T-adapter.		
			Wiring harness between fuse FS2 (9) and L116 (Female) (1), (3) *1	Resistance between fuse FS2 (9), L116 (Female) (1), (3) and chassis ground	1M✕ and above
			Wiring harness between L116 (Female) (2) and L13 (Female) (1) *2	Resistance between L116 (Female) (2), L13 (Female) (1) and chassis ground	1M✕ and above
			Wiring harness between L116 (Female) (5) and F01 (Female) (1), F02 (Female) (1)	Resistance between L116 (Female) (5), F01 (Female) (1), F02 (Female) (1) and chassis ground	1M✕ and above
			★ In case of *1 above, fuse is blown ★ In case of *2 above, horn does not stop sounding		

Related circuit diagram



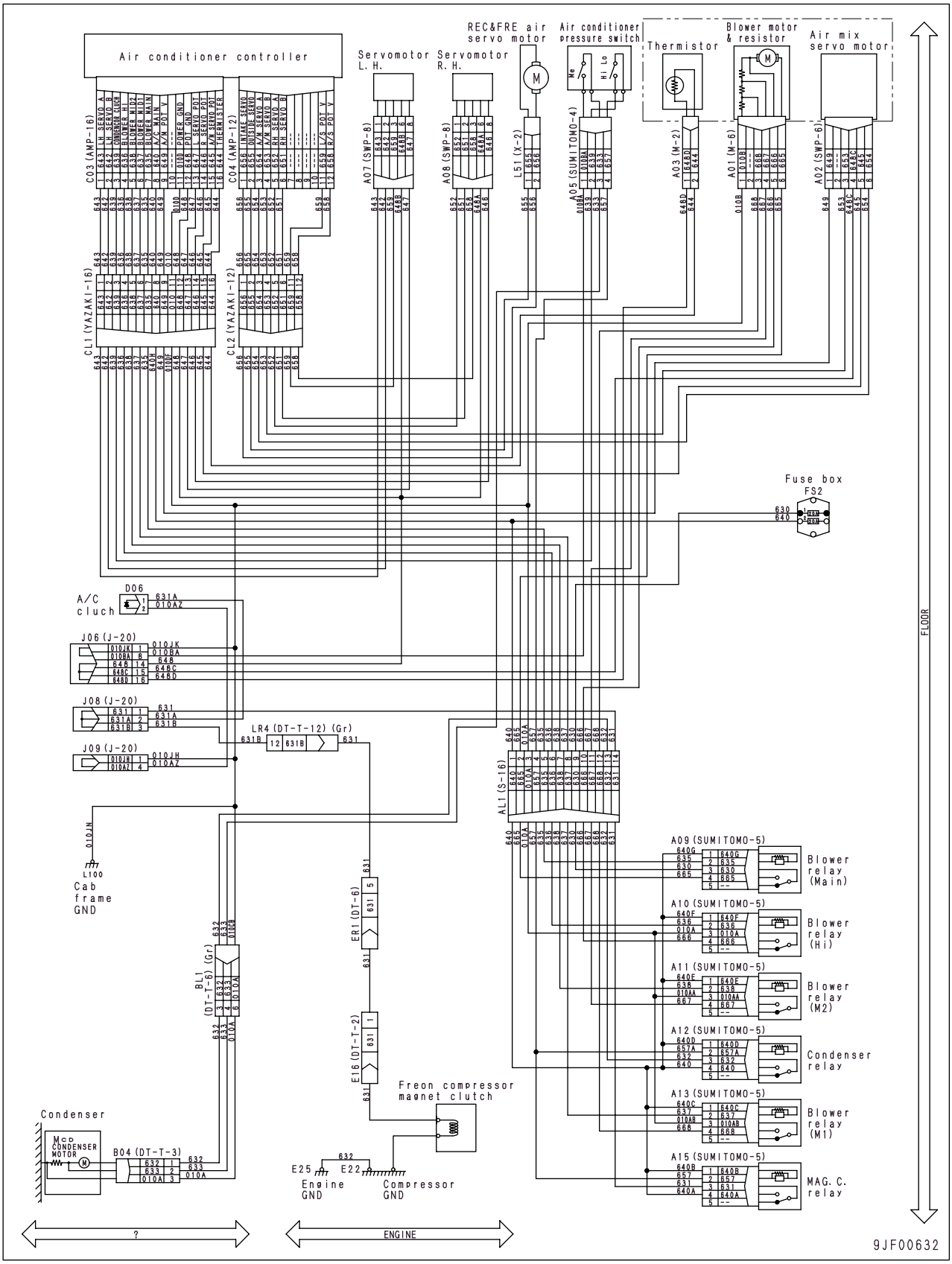
Troubleshooting Code [E-12] (Defective the air conditioner)

a) The air conditioner does not work

Action Code	Failure Code	Controller Code	Trouble	Defective the air conditioner a) The air conditioner does not work
-	-	-		
Description of Trouble	• The air conditioner does not work.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• The air conditioner does not work.			
Related Information	• If fuse FS2 (2) is blown, check wiring harness between fuse FS2 (2) - C03 (Female) (8) for short circuit with ground.			

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	1	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector C03, fuse FS2 terminal. 3) Connect T-adapter.		
			Wiring harness between fuse FS2 (2) and C03 (Female) (8)	Resistance	1✕ andbelow
			Wiring harness between C03 (Female) (11) and chassis ground	Resistance	1✕ andbelow
	2	Defective air conditioner control panel	★ Check the control panel, and if any abnormality is found, repair or replace.		

Related circuit diagram



b) Air does not flow out or amount of air cannot be adjusted.

Action Code	Failure Code	Controller Code	Trouble	Defective air conditioner b) Air does not flow out or amount of air cannot be adjusted.
-	-	-		
Description of Trouble	• Air does not flow out or amount of air cannot be adjusted.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Air does not flow out or amount of air cannot be adjusted.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	1	Power supply wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector A09, A10, A11, A13 and fuse FS2 terminal. 3) Connect T-adapter.		
			Wiring harness between fuse FS2 (2) and A09 (Female) (1)	Resistance	1✕ and below
			Wiring harness between fuse FS2 (2) and A10 (Female) (1)	Resistance	1✕ and below
			Wiring harness between fuse FS2 (2) and A11 (Female) (1)	Resistance	1✕ and below
			Wiring harness between fuse FS2 (2) and A13 (Female) (1)	Resistance	1✕ and below
			Wiring harness between fuse FS2 (1) and A09 (Female) (3)	Resistance	1✕ and below
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector C03, A09, A10, A11, A12 and fuse FS2 terminal. 3) Connect T-adapter.		
			Wiring harness between C03 (Female) (7) and A09 (Female) (2)	Resistance	1✕ and below
			Wiring harness between C03 (Female) (4) and A10 (Female) (2)	Resistance	1✕ and below
			Wiring harness between C03 (Female) (5) and A11 (Female) (2)	Resistance	1✕ and below
			Wiring harness between C03 (Female) (6) and A13 (Female) (2)	Resistance	1✕ and below
			Wiring harness between A09 (Female) (4) and A01 (Female) (6)	Resistance	1✕ and below
			Wiring harness between A10 (Female) (4) and A01 (Female) (5)	Resistance	1✕ and below
			Wiring harness between A11 (Female) (4) and A01 (Female) (4)	Resistance	1✕ and below
			Wiring harness between A13 (Female) (4) and A01 (Female) (3)	Resistance	1✕ and below
			Wiring harness between A10 (Female) (3) and chassis ground	Resistance	1✕ and below
			Wiring harness between A11 (Female) (3) and chassis ground	Resistance	1✕ and below
			Wiring harness between A13 (Female) (3) and chassis ground	Resistance	1✕ and below
			Wiring harness between A01 (Female) (1) and chassis ground	Resistance	1✕ and below
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector A01, A05, A09, A10, A11, A13 and fuse FS2 terminal. 3) Connect T-adapter.		
			Wiring harness between fuse FS1 (2) and A09 (Female) (1) *	Resistance between fuse FS1 (2), A09 (Female) (1) and chassis ground	1M✕ and above
			Wiring harness between fuse FS1 (2) and A10 (Female) (1) *	Resistance between fuse FS1 (2), A10 (Female) (1) and chassis ground	1M✕ and above
			Wiring harness between fuse FS1 (2) and A11 (Female) (1) *	Resistance between fuse FS1 (2) and A11 (Female) (1) and chassis ground	1M✕ and above
			Wiring harness between fuse FS1 (2) and A13 (Female) (1) *	Resistance between fuse FS1 (2), A13 (Female) (1) and chassis ground	1M✕ and above
			Wiring harness between fuse FS1 (2) and A12 (Female) (1) *	Resistance between fuse FS1 (2), A12 (Female) (1) and chassis ground	1M✕ and above
			Wiring harness between fuse FS1 (2) and A15 (Female) (1) *	Resistance between fuse FS1 (2), A15 (Female) (1) and chassis ground	1M✕ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	3	Wiring harness ground fault	Wiring harness between fuse FS1 (2) and A09 (Female) (3) *	Resistance between fuse FS1 (2), A09 (Female) (3) and chassis ground	1MΩ and above
			Wiring harness between C03 (Female) (7) and A09 (Female) (2)	Resistance between C03 (Female) (7), A09 (Female) (2) and chassis ground	1MΩ and above
			Wiring harness between C03 (Female) (4) and A10 (Female) (2)	Resistance between C03 (Female) (4), A10 (Female) (2) and chassis ground	1MΩ and above
			Wiring harness between C03 (Female) (5) and A11 (Female) (2)	Resistance between C03 (Female) (5), A11 (Female) (2) and chassis ground	1MΩ and above
			Wiring harness between C03 (Female) (6) and A13 (Female) (2)	Resistance between C03 (Female) (6), A13 (Female) (2) and chassis ground	1MΩ and above
			Wiring harness between A09 (Female) (4) and A01 (Female) (6)	Resistance between A09 (Female) (4), A01 (Female) (6) and chassis ground	1MΩ and above
			Wiring harness between A10 (Female) (4) and A01 (Female) (5)	Resistance between A10 (Female) (4), A01 (Female) (5) and chassis ground	1MΩ and above
			Wiring harness between A11 (Female) (4) and A01 (Female) (4)	Resistance between A11 (Female) (4), A01 (Female) (4) and chassis ground	1MΩ and above
			Wiring harness between A13 (Female) (4) and A01 (Female) (3)	Resistance between A13 (Female) (4), A01 (Female) (3) and chassis ground	1MΩ and above
			Wiring harness between A05 (Female) (2) and C03 (Female) (3)	Resistance between A05 (Female) (2), C03 (Female) (3) and chassis ground	1MΩ and above
			★ If marked * above, fuse is blown		
	4	Defective blower main relay A09	1) Turn starting switch OFF. 2) Replace relay A09 with normal relay. 3) Turn starting switch ON. 4) Start air conditioner		
			Does condition become normal when relay is replaced with normal relay?	Condition is normal.	Defective relay.
				Condition is abnormal.	Relay is normal.
	5	Defective blower Hi relay A10	1) Turn starting switch OFF. 2) Replace relay A10 with normal relay. 3) Turn starting switch ON. 4) Start air conditioner		
			Does condition become normal when relay is replaced with normal relay?	Condition is normal.	Defective relay.
				Condition is abnormal.	Relay is normal.
	6	Defective blower M2 relay A11	1) Turn starting switch OFF. 2) Replace relay A11 with normal relay. 3) Turn starting switch ON. 4) Start air conditioner		
			Does condition become normal when relay is replaced with normal relay?	Condition is normal.	Defective relay.
				Condition is abnormal.	Relay is normal.
	7	Defective blower M1 relay A13	1) Turn starting switch OFF. 2) Replace relay A13 with normal relay. 3) Turn starting switch ON. 4) Start air conditioner		
			Does condition become normal when relay is replaced with normal relay?	Condition is normal.	Defective relay.
				Condition is abnormal.	Relay is normal.
	8	Defective blower motor	1) Turn starting switch OFF. 2) Replace motor with normal motor. 3) Turn starting switch ON. 4) Start air conditioner		
			Does condition become normal when motor is replaced with normal motor?	Condition is normal.	Defective motor.
				Condition is abnormal.	Relay is motor.
	9	Defective blower resister	1) Turn starting switch OFF. 2) Disconnect connector A01. 3) Solid part check.		
			Between A01 (Female) (1) and (3)	Resistance	2.8Ω
			Between A01 (Female) (1) and (4)	Resistance	4.8Ω
			Between A01 (Female) (1) and (5)	Resistance	4.0Ω
	10	Defective air conditioner control panel	★ Check the control panel, and if any abnormality is found, repair or replace.		

Related circuit diagram

★ See "TROUBLESHOOTING CODE [E-12.(a)]".

c) Does not cool or temperature cannot be adjusted.

Action Code	Failure Code	Controller Code	Trouble	Defective air conditioner c) Does not cool or temperature cannot be adjusted.
-	-	-		
Description of Trouble	• Does not cool or temperature cannot be adjusted.			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Does not cool or temperature cannot be adjusted.			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	1	Power supply wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector A12, A15 and fuse FS2 terminal. 3) Connect T-adapter.		
			Wiring harness between fuse FS2 (2) and A12 (Female) (1), (4)	Resistance	1Ω and below
			Wiring harness between fuse FS2 (2) and A15 (Female) (1), (4)	Resistance	1Ω and below
	2	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector A02, A03, A05, A07, A08, A12, A15, B04, C03, C04 and J06. 3) Connect T-adapter.		
			Wiring harness between A05 (Female) (1) and chassis ground	Resistance	1Ω and below
			Wiring harness between A05 (Female) (2) and C03 (Female) (4)	Resistance	1Ω and below
			Wiring harness between A05 (Female) (3) and B04 (Female) (2)	Resistance	1Ω and below
			Wiring harness between A05 (Female) (4) and A12 (Female) (2), A15 (Female) (2)	Resistance	1Ω and below
			Wiring harness between A12 (Female) (3) and B04 (Female) (1)	Resistance	1Ω and below
			Wiring harness between A15 (Female) (3) and E16 (Female) (1)	Resistance	1Ω and below
			Wiring harness between B04 (Female) (3) and chassis ground	Resistance	1Ω and below
			Wiring harness between compressor magnet clutch (-) terminal and chassis ground	Resistance	1Ω and below
			Wiring harness between C03 (Female) (16) and A03 (Female) (2)	Resistance	1Ω and below
			Wiring harness between A03 (Female) (1) and J06 (16), (15) and C03 (Female) (12)	Resistance	1Ω and below
			Wiring harness between A03 (Female) (1) and J06 (16), (15) and A02 (Female) (4)	Resistance	1Ω and below
			Wiring harness between A02 (Female) (1) and C03 (Female) (9)	Resistance	1Ω and below
			Wiring harness between A02 (Female) (3) and C04 (Female) (4)	Resistance	1Ω and below
			Wiring harness between A02 (Female) (5) and C03 (Female) (15)	Resistance	1Ω and below
			Wiring harness between A02 (Female) (6) and C04 (Female) (3)	Resistance	1Ω and below
	3	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector A02, A03, A05, A12, A15, B04, C03, C04 and fuse FS2 terminal. 3) Connect T-adapter.		
			Wiring harness between fuse FS1 (2) and A12 (Female) (1), (4) *	Resistance between fuse FS1 (2), A12 (Female) (1), (4) and chassis ground	1MΩ and above
			Wiring harness between fuse FS1 (2) and A15 (Female) (1), (4) *	Resistance between fuse FS1 (2), A15 (Female) (1), (4) and chassis ground	1MΩ and above
			Wiring harness between A05 (Female) (3) and B04 (Female) (2) *	Resistance between A05 (Female) (3), B04 (Female) (2) and chassis ground	1MΩ and above
			Wiring harness between A05 (Female) (4) and A12 (Female) (2), A15 (Female) (2)	Resistance between A05 (Female) (4), A12 (Female) (2), A15 (Female) (2) and chassis ground	1MΩ and above

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	3	Wiring harness ground fault	Wiring harness between A12 (Female) (3) and B04 (Female) (1)	Resistance between A12 (Female) (3), B04 (Female) (1) and chassis ground	1MΩ and above
			Wiring harness between A15 (Female) (3) and E16 (Female) (1)	Resistance between A15 (Female) (3), E16 (Female) (1) and chassis ground	1MΩ and above
			Wiring harness between C03 (Female) (16) and A03 (Female) (2)	Resistance between C03 (Female) (16), A03 (Female) (2) and chassis ground	1MΩ and above
			Wiring harness between A03 (Female) (1) and J06 (16), (15) and C03 (Female) (12)	Resistance between A03 (Female) (1), C03 (Female) (12) and chassis ground	1MΩ and above
			Wiring harness between A03 (Female) (1) and J06 (16), (15) and A02 (Female) (4)	Resistance between A03 (Female) (1), A02 (Female) (4) and chassis ground	1MΩ and above
			Wiring harness between A02 (Female) (1) and C03 (Female) (9)	Resistance between A02 (Female) (1), C03 (Female) (9) and chassis ground	1MΩ and above
			Wiring harness between A02 (Female) (3) and C04 (Female) (4)	Resistance between A02 (Female) (3), C04 (Female) (4) and chassis ground	1MΩ and above
			Wiring harness between A02 (Female) (5) and C03 (Female) (15)	Resistance between A02 (Female) (5), C03 (Female) (15) and chassis ground	1MΩ and above
			Wiring harness between A02 (Female) (6) and C04 (Female) (3)	Resistance between A02 (Female) (6), C04 (Female) (3) and chassis ground	1MΩ and above
			★ If marked * above, fuse is blown		
	4	Defective compressor clutch relay A15	1) Turn starting switch OFF. 2) Replace relay A15 with normal relay. 3) Turn starting switch ON. 4) Start air conditioner		
			Does condition become normal when relay is interchanged with normal relay?	Condition is normal.	Defective relay.
				Condition is abnormal.	Relay is normal.
	5	Defective pressure switch	1) Turn starting switch OFF. 2) Disconnect connector A05. 3) Connect T-adapter. 4) Turn starting switch ON.		
			Between A05 (Male) (1) and (2)	Turn air conditioner switch OFF.	Resistance	1MΩ and above
				When air conditioner switch is ON and cooling is in operation	Resistance	1Ω and below
	6	Defective thermister	1) Turn starting switch OFF. 2) Disconnect connector ACTH. 3) Turn starting switch ON. 4) Start air conditioner.		
			Between A03 (Male) (1) and (2)	Temperature: 25°C	37 - 50kΩ
				Temperature: 100°C	3.5 - 4.0kΩ
	7	Defective temperature control servo motor	1) Turn starting switch OFF. 2) Replace motor with normal motor. 3) Turn starting switch ON. 4) Start air conditioner		
			Does condition become normal when servo motor is interchanged with normal motor?	Condition is normal.	Defective motor.
				Condition is abnormal.	Motor is normal.
	8	Defective air conditioner compressor	1) Turn starting switch OFF. 2) Replace compressor with normal compressor. 3) Turn starting switch ON. 4) Start air conditioner		
			Does condition become normal when air conditioner compressor is replaced with normal compressor?	Condition is normal.	Defective air conditioner compressor.
				Condition is abnormal.	Air conditioner compressor is normal.
	9	Defective diode (D06)	Turn starting switch OFF. 2) Replace diode D06 with normal diode.		
			Replace diode D06 with normal diode	Condition is normal.	Defective diode D06.
				Condition is abnormal.	Diode D06 is normal.
	10	Defective air conditioner control panel	★ Check the control panel, and if any abnormality is found, repair or replace.		

Related circuit diagram

★ See "TROUBLESHOOTING CODE [E-12.(a)]".

d) Impossible to switch between recirculated air and fresh air

Action Code	Failure Code	Controller Code	Trouble	Defective air conditioner d) Impossible to switch between recirculated air and fresh air
-	-	-		
Description of Trouble	• Air conditioner system is defective, so it is impossible to switch between recirculated air and fresh air			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Impossible to switch between recirculated air and fresh air			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting			
Possible Causes and Standard Values	1	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector C04, L51. 3) Connect T-adapter.			
			Wiring harness between C04 (Female) (1) and L51 (Female) (2)		Resistance	1✕ andbelow
			Wiring harness between C04 (Female) (2) and L51 (Female) (1)		Resistance	1✕ andbelow
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector C04, L51. 3) Connect T-adapter.			
			Wiring harness between C04 (Female) (1) and L51 (Female) (2)	Resistance between C04 (Female) (1), L51 (Female) (2) and chassis ground		1M✕ and above
			Wiring harness between C04 (Female) (2) and L51 (Female) (1)	Resistance between C04 (Female) (2), L51 (Female) (1) and chassis ground		1M✕ and above
	3	Defective air conditioner control panel	★ Check the control panel, and if any abnormality is found, repair or replace.			

Related circuit diagram

★ See "TROUBLESHOOTING CODE [E-12.(a)]".

e) Impossible to switch vents

Action Code	Failure Code	Controller Code	Trouble	Defective air conditioner e) Impossible to switch vents
-	-	-		
Description of Trouble	• Impossible to switch vents			
Machine monitor or controller Reaction	• No reaction.			
Effect on Machine	• Impossible to switch vents			
Related Information				

	Causes		Standard Value in Normal State and Remarks on Troubleshooting		
Possible Causes and Standard Values	1	Wiring harness discontinuity (Disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector A03, A07, A08, C03, C04, J06. 3) Connect T-adapter.		
			Wiring harness between A07 (Female) (1) and C03 (Female) (1)	Resistance	1✕ and below
			Wiring harness between A07 (Female) (2) and C03 (Female) (2)	Resistance	1✕ and below
			Wiring harness between A07 (Female) (3) and C04 (Female) (11)	Resistance	1✕ and below
			Wiring harness between A07 (Female) (8) and C03 (Female) (13)	Resistance	1✕ and below
			Wiring harness between A08 (Female) (1) and C04 (Female) (5)	Resistance	1✕ and below
			Wiring harness between A08 (Female) (2) and C04 (Female) (6)	Resistance	1✕ and below
			Wiring harness between A08 (Female) (3) and C04 (Female) (12)	Resistance	1✕ and below
			Wiring harness between A08 (Female) (8) and C03 (Female) (14)	Resistance	1✕ and below
			Wiring harness between A03 (Female) (1) and J06 (16), (14) and A07 (Female) (6)	Resistance	1✕ and below
			Wiring harness between A03 (Female) (1) and J06 (16), (14) and A08 (Female) (6)	Resistance	1✕ and below
	2	Wiring harness ground fault	1) Turn starting switch OFF. 2) Disconnect connector ACP1, ACP2, ACM2. 3) Connect T-adapter.		
			Wiring harness between A07 (Female) (1) and C03 (Female) (1)	Resistance between A07 (Female) (1), C03 (Female) (1) and chassis ground	1M✕ and above
			Wiring harness between A07 (Female) (2) and C03 (Female) (2)	Resistance between A07 (Female) (2), C03 (Female) (2) and chassis ground	1M✕ and above
			Wiring harness between A07 (Female) (3) and C03 (Female) (11)	Resistance between A07 (Female) (3), C03 (Female) (11) and chassis ground	1M✕ and above
			Wiring harness between A07 (Female) (8) and C03 (Female) (13)	Resistance between A07 (Female) (8), C03 (Female) (13) and chassis ground	1M✕ and above
			Wiring harness between A08 (Female) (1) and C04 (Female) (5)	Resistance between A08 (Female) (1), C04 (Female) (5) and chassis ground	1M✕ and above
			Wiring harness between A08 (Female) (2) and C04 (Female) (6)	Resistance between A08 (Female) (2), C04 (Female) (6) and chassis ground	1M✕ and above
			Wiring harness between A08 (Female) (3) and C04 (Female) (12)	Resistance between A08 (Female) (3), C04 (Female) (12) and chassis ground	1M✕ and above
			Wiring harness between A08 (Female) (8) and C03 (Female) (14)	Resistance between A08 (Female) (8), C03 (Female) (14) and chassis ground	1M✕ and above
			Wiring harness between A03 (Female) (1) and J06 (16), (14) and A07 (Female) (6)	Resistance between A03 (Female) (1), J06 (16), (14), A07 (Female) (6) and chassis ground	1M✕ and above
			Wiring harness between A03 (Female) (1) and J06 (16), (14) and A08 (Female) (6)	Resistance between A03 (Female) (1), J06 (16), (14), A08 (Female) (6) and chassis ground	1M✕ and above
	3	Defective air conditioner control panel	★ Check the control panel, and if any abnormality is found, repair or replace.		

Related circuit diagram

★ See "TROUBLESHOOTING CODE [E-12.(a)]".

white 20-682

TROUBLESHOOTING OF HYDRAULIC, MECHANICAL SYSTEM (H MODE)

METHOD OF USING TROUBLESHOOTING CHART

This troubleshooting chart, like the other troubleshooting charts (YES/NO type), determines the location from the problem of occurring on the machine and categorizes the problem under one of the main components, such as the steering system or work equipment hydraulic system. Use the following procedure to carry out accurate troubleshooting swiftly.

Step 1. Ask operator questions

The questions to ask the operator are given under the problem. If the answer to the question matches the content given, the cause given after the arrow is the probable cause.
Keeping the content of the questions in mind, read the matrix and proceed with Step 2 and Step 3 to pinpoint the correct cause.

Example: Steering wheel will not turn
Ask the operator and check the following points.

- Did the problem suddenly start?

✕ Broken part in steering equipment

- Was the steering wheel heavy before?

✕ Internal wear, defective seal in steering related equipment

Step 2. Checks before troubleshooting

Before measuring the oil pressure or starting the troubleshooting, confirm the checks before starting items, check for leakage of oil, or for loose bolts.
This will prevent wasting time when troubleshooting.
The items given under Checks before troubleshooting are checks that are particularly important to make about the condition of the machine before starting the actual troubleshooting.

Example: Checks before starting troubleshooting

- Is oil level and type of oil in hydraulic tank correct?
- Is there any oil leakage from steering valve or demand valve?
- Is steering linkage adjusted properly?

Step 3. Method of reading matrix

1) Operate the machine when carrying out troubleshooting of the items in the Troubleshooting column. If any problems occur as the result of the troubleshooting, put a check against the item.
   ★ When carrying out the troubleshooting, check the easier items first. It is not necessary to follow the number order.
2) Find the matching cause in the Causes column.
   If a problem is found, the ○ marks on the same line as the troubleshooting are the causes. (In Troubleshooting item 2 in the same diagram on the right the cause is c or e.)
   When there is one ○ mark
   Carry out troubleshooting for the other items marked with ○ in the same Causes column to check if the problem occurs, then make repairs.
   When there are two ○ marks
   Go to Step 3) to narrow down the cause.

1. Steering wheel does not turn ✕ Problem (example)

Ask the operator the following questions.
- Did the problem suddenly start?
  Yes = Equipment related to steering broken
- Was there previously any symptom, such as heaviness of the steering wheel?
  Yes = Wear of equipment related to steering, defective seal

Checks before troubleshooting (example)

- Is the oil level in the hydraulic tank correct? Is the type of oil correct?
- Is there any leakage of oil from the steering valve or Orbitroll?
- Has the safety bar been removed from the frame?

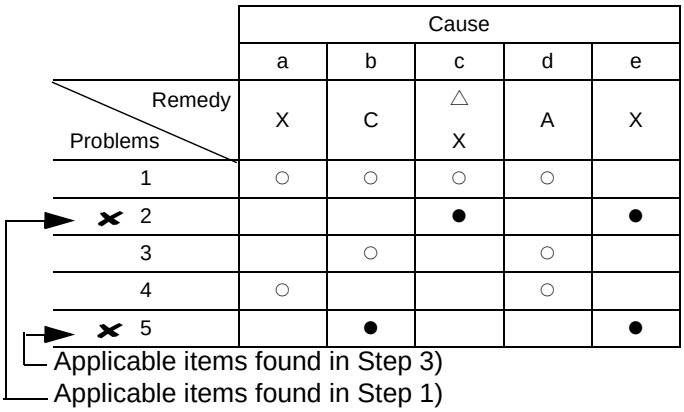
<Example 1>

No.	Remedy / Problems
1	Steering wheel does not turn in either direction (left and right)
2	In Item 1, movement of work equipment is abnormal
3	Steering wheel turns only in one direction (left or right)
4	Steering wheel is heavy and does not turn

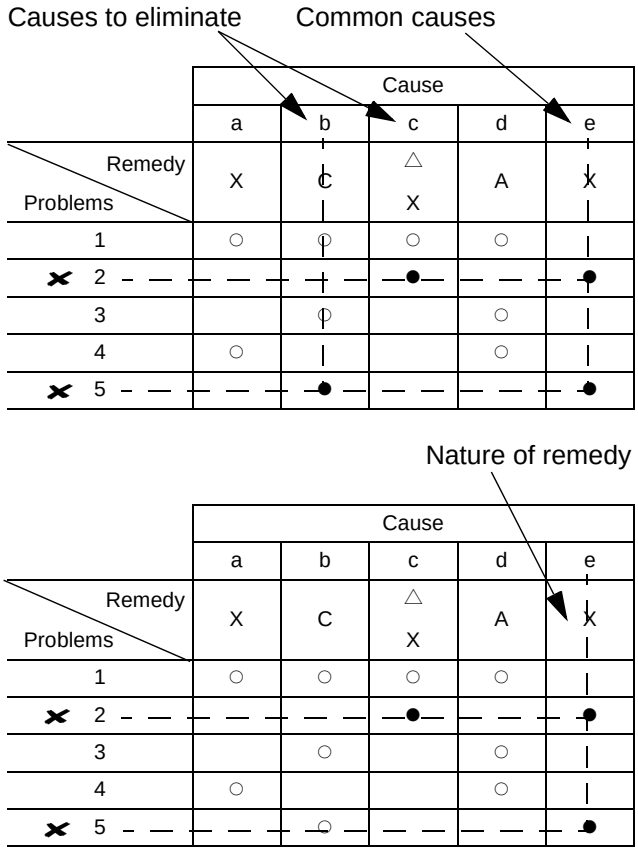
<Example 2>

	Cause				
Remedy / Problems	a	b	c	d	e
	X	C	△ X	A	X
1	○	○	○	○	
2			●		●
3		○		○	
4	○			○	
5		○			○

3) Operate the machine and carry out troubleshooting of the items not checked in Step 1). Operate the machine in the same way as in Step 1), and if any problem occurs, put a check against the item. (In Troubleshooting item 5 in the diagram on the right, the problem was re-enacted.)
4) Find the matching cause in the cause column.
In the same way as in Step 2), if a problem is found, the ○ marks on the same line for the troubleshooting item are the causes. (In Troubleshooting item 5 in the diagram on the right, the cause is b or e.)



5) Narrow down the causes.
Of the causes found in Step 2) and Step 4), there are common items (○ marks on the line for each troubleshooting item and in the same Cause column as each other) that have causes common with the problem items found in the troubleshooting in Step 1) and Step 3).
★ The items that are not common (items that do not have ○ marks in the same cause common as each other) are probably not the cause, so they can be eliminated.
(The causes for Troubleshooting item 2 in the diagram on the right are c or e, and the causes in Troubleshooting item 5 are b or e, so Cause e is the common cause.)
6) Repeat the operation in Steps 3), 4), and 5) until the cause is narrowed down to 1 item (1 common item).
★ If cause items are 2 or more, continue until number of items becomes minimum.



7) Remedy
After narrowing down the common causes, taken the action given in the remedy line.
X: Replace △: Repair A: Adjust C: Clean

FAILURE CODE AND CAUSE TABLE

Part causing problem / Failure Code		Damper	HST pump							HST motor 2			HST motor 1		Inching valve	Inching valve linkage
			Pump body (Piston pump end)	Pump body (Charge pump end)	High pressure relief valve	High pressure cut-off valve	Low pressure relief valve (Charge relief valve)	DA valve	forward and reverse solenoid valve	Motor body	Mode selector solenoid valve (SOL a)	Angle stopper solenoid valve (SOL b)	Motor body	Angle stopper control solenoid valve		
HST related	Does not travel forward or in reverse	○	○	○		○	○	○	○	○			○		○	○
	Does not travel forward (reverse is normal)				○				○							
	The machine does not start at reverse (Forward is normal)				○				○							
	Speed is slow in both forward and reverse		○	○			○	○		○	○	○	○	○	○	○
	The travel speed is slow at forward (Reverse is normal)				○				○							
	The travel speed is slow at reverse (Forward is normal)				○				○							
	Rimpull is weak in both forward and reverse					○				○			○	○	○	○
	The thrusting force is weak at forward (Reverse is normal)				○											
	The thrusting force is weak at reverse (Forward is normal)				○											
	Engine stalls when traveling or engine speed drops excessively							○				○		○		
	The gear is not shifted											○		○		
Steering wheel	The steering wheel does not turn															
	The steering wheel is heavy															
	There is play in steering wheel or excessive shock															
	Machine deviates naturally to one side when traveling															
Brake	The brake does not work or does not work well															
	The brake is not released or is dragged															
Work equipment system	The lift arm does not rise or lower			○			○									
	The lift arm moves slowly or the lift arm rising force is insufficient						○									
	When the lift arm rising, the lift arm comes to move slowly at specific height															
	The lift arm cylinder cannot be hold down the bucket (The bucket rises in the air)															
	Hydraulic drift of the lift arm occur often															
	The lift arm wobbles during operation															
	When the control lever is switched from "HOLD" to "RAISE", the lift arm falls temporarily															
	The bucket does not tilt back			○			○									
	The bucket moves slowly or the tilting-back force is insufficient						○									
	The bucket comes to operate slowly in he midst of tilting-back															
	The bucket cylinder cannot be hold down to bucket															
	Hydraulic drift of the bucket occur often															
	The bucket wobbles during travel with cargo (The work equipment valve is set to "HOLD")															
	When the control lever is switched from "HOLD" to "TILT", the bucket falls temporarily															
	The control levers of the lift arm and bucket do not move smoothly and heavy															

Clutch solenoid	Clutch	Transfer	Work equipment and steering pump	Brake pump	Steering valve: Orbit-roll	Steering valve: Priority valve	Steering valve: Relief valve	Steering valve: Safty valve	Steering cylinder	Tire inflation pressure	Accumulator charge valve	Brake valve	Slack adjuster	Axle: Brake disc and plate	Axle: Brake piston	Wheel brake linkage	Cut-off valve: Cut-off relief valve	Cut-off valve: Unload valve	Cut-off valve: Check valve	Work equipment control valve: Main relief valve	Work equipment control valve: Lift arm spool	Work equipment control valve: Bucket spool	Work equipment control valve: Suction and safety valve	Work equipment control valve: Suction valve	Lift arm cylinder	Bucket cylinder	Lift arm PPC valve	Bucket PPC valve	Cushion valve	Troubleshooting No.
○	○	○																												
																														H-1
○	○																													
																														H-2
○	○	○																												
																														H-3
																														H-4
○	○																													H-5
			○		○	○	○		○																					H-6
			○		○	○	○		○																					H-7
					○				○																				○	H-8
								○	○	○																				H-9
				○							○	○	○	○	○	○														H-10
													○	○	○															H-11
																	○	○	○	○	○				○		○			H-12
			○			○											○	○	○	○	○				○		○			H-13
																									○					H-14
			○			○														○	○				○		○			H-15
																									○					H-16
																														H-17
																					○									H-18
			○			○											○	○	○	○		○				○		○		H-19
			○			○											○	○	○	○		○	○			○		○		H-20
																										○				H-21
			○			○														○		○	○			○		○		H-22
																						○	○			○				H-23
																							○							H-24
																						○								H-25
																											○	○		H-26

H-1 The machine does not start

Ask the operator about the following:
- Has the machine come not start suddenly?
  - ✗ Breakage of HST pump and motor related equipment
- Was there any problem of not traveling before?
  - ✗ Internal wear of HST pump and motor related equipment, defective seal

Inspection before diagnosis
- Are the oil level in the hydraulic tank and the oil type appropriate?
- Is inching valve linkage properly adjusted?
- Is the any external oil leak found around the hydraulic piping, pump and motor?

		Cause														
			HST pump							HST motor 2	HST motor 1	Others				
		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
		Damper	Pump body (Piston pump end)	Pump body (Charge pump end)	High pressure relief valve	High pressure cut-off valve	Low pressure relief valve (Charge relief valve)	DA valve	forward and reverse solenoid valve	Motor body	Motor body	Inching valve	Inching valve linkage	Clutch solenoid	Clutch	Transfer
No.	Diagnosis \ Remedy	△ X	△ X	△ X	△ X	△ X	△ X	△ X	△ X	△ X	△ X	△ X	△ X A	△ X	△ X	△ X
1	Does not travel forward or in reverse	○	○	○		○	○	○	○	○	○	○	○	○	○	○
2	Does not travel forward (reverse is normal)				○				○							
3	The machine does not start at reverse (Forward is normal)				○				○							
4	Does not travel forward or in reverse, motor makes sound of rotation													○	○	○

H-2 The travel speed is slow

Ask the operator about the following:
- Did the travel speed suddenly becomes slower?
  - ✔ Breakage of HST pump and motor related equipment
- Was there any problem of travel speed becoming slower before?
  - ✔ Internal wear of HST pump and motor related equipment, defective seal

Inspection before diagnosis
- Are the oil level in the hydraulic tank and the oil type appropriate?
- Is the inching valve linkage adjusting appropriate?
- Is inching valve linkage properly adjusted?
- Is the any external oil leak found around the hydraulic piping, pump and motor?

No.	Diagnosis \ Remedy	Cause: HST pump a: Pump body (Piston pump end) △X	HST pump b: Pump body (Charge pump end) △X	HST pump c: High pressure relief valve △X	HST pump d: Low pressure relief valve (Charge relief valve) △X	HST pump e: DA valve △X	HST pump f: forward and reverse solenoid valve △X	HST motor 2 g: Motor body △X	HST motor 2 h: Mode selector solenoid valve (SOL a) △X	HST motor 2 i: Angle stopper solenoid valve (SOL b) △X	HST motor 1 j: Motor body △X	HST motor 1 k: Angle stopper control solenoid valve △X	Others l: Inching valve △X	Others m: Inching valve linkage △X A	Others n: Clutch solenoid △X	Others o: Clutch △X
1	Travel speed is slow in both forward and reverse	○	○		○	○		○	○	○	○	○	○	○	○	○
2	The travel speed is slow at forward (Reverse is normal)			○			○									
3	The travel speed is slow at reverse (Forward is normal)			○			○									
4	Maximum travel speed in both forward and reverse is approx. 4 km/h											○				
5	Maximum travel speed in both forward and reverse is approx. 18 km/h									○						
6	Abnormal sound comes from motor in both forward and reverse when travel speed is 10 km/h or more														○	○

H -3 The thrusting force is weak

★ When the travel speed is slow, carry out troubleshooting for H-2 first.

No.	Diagnosis \ Remedy	Cause									
		HST pump		HST motor 2	HST motor 1		Others				
		a	b	c	d	e	f	g	h	i	j
		High pressure relief valve	High pressure cut-off valve	Motor body	Motor body	Inclination control solenoid valve	Inching valve	Inching valve linkage	Clutch solenoid	Clutch	Transfer
		△ X	△ X	△ X	△ X	△ X	△ X	△ X A	△ X	△ X	△ X
1	Rimpull is weak in both forward and reverse		○	○	○	○	○	○	○	○	○
2	The thrusting force is weak at forward (Reverse is normal)	○									
3	The thrusting force is weak at reverse (Forward is normal)	○									
4	Rimpull is weak in both forward and reverse, but maximum travel speed is reached the linee.					○			○	○	

H-4 Engine stalls when traveling or engine speed drops excessively

Ask the operator about the following:
- Was there any problem before?
  - ✔ Dirt in HST pump, motor related equipment

Inspection before diagnosis
- Is the any external oil leak found around the hydraulic piping, pump and motor?

No.	Diagnosis \ Remedy	Cause: HST pump a — DA valve: △ X	Cause: HST motor 2 b — Inclination stopper solenoid valve (SOLb): △ X	Cause: Others c — Inclination control solenoid valve: △ X
1	Engine stalls when traveling or engine speed drops excessively	○	○	○
2	Machine moves when the direction the lever is at F or R and engine is at Li	○		

H-5 The gear is not shifted

★ If the speed range switch and the monitor display do not match, check the electrical wiring.
★ When the travel speed is slow, carry out troubleshooting for H-2 first.

No.	Diagnosis \ Remedy	Cause: HST motor 2 (a) Inclination stopper solenoid valve (SOLb) △ X	Cause: HST motor 1 (b) Inclination control solenoid valve △ X	Cause: Others (c) Clutch solenoid △ X	Cause: Others (d) Clutch △ X
1	The gear is not shifted	○	○	○	○

H-6 The steering wheel does not turn

Ask the operator about the following:
- Did the problem suddenly start?
  - ✔ Breakage of steering related equipment
- Was there previously any symptom, such as heavy steering?
  - ✔ Internal wear of steering related equipment, defective seal

Inspection before diagnosis
- Are the oil level in the hydraulic tank and the oil type appropriate?
- Has the safety bar been removed from frame?

No.	Diagnosis \ Remedy	Cause: Hydraulic pump a: Defective hydraulic pump or PTO Steering pump and switch pump	Others b: Priority valve: Steering	Others b: Priority valve: Spool	Others b: Priority valve: Relief valve	Others c: Obit-roll	Others d: Internal defective steering cylinder (Defective piston seal)	Others e: Emergency steering valve (*1)
		△ X	X	X	X	X	△ X	△ X
1	Steering wheel does not turn in both directions (left and right)	○	○	○	○	○	○	
2	In condition in Item 1, movement of work equipment is abnormal	○						
3	In condition in Item 1, movement of work equipment is normal		○					
4	Steering wheel turns only in one direction (left or right)					○	○	
5	Steering wheel is heavy and does not turn	○	○	○	○			
6	Oil pressure of steering circuit is low or there is no pressure					○		
7	Emergency steering does not function in both directions (left and right)							○

★ There is a close connection between the steering circuit and work equipment circuit, so if any abnormality is felt in the steering, check the operation of the work equipment also.

★ If the steering pump is abnormal (broken), check the priority valve at the same time.

*1. This warning is given only when the emergency steering is installed.

H-7 The steering wheel is heavy

Ask the operator about the following:
- Did the problem suddenly start?
  - ✗ Breakage of steering related equipment
- Was there previously any symptom, such as heavy steering?
  - ✗ Internal wear of steering related equipment, defective seal

Inspection before diagnosis
- Are the oil level in the hydraulic tank and the oil type appropriate?
- Is there any abnormality in steering gear box,column, linkage?
- Is steering valve control lever stopper adjusted properly?
- Is the any external oil leak found around the hydraulic piping, valve and cylinder?
- Is there any gouging of center hinge pin bearing and steering cylinder pin, bushing?
- Is the tire inflation pressure correct?

Check for abnormalities
- Measure operating effort of steering wheel and time taken to turn steering, and check standard judgment value table to see if there is any abnormality.

No.	Diagnosis \ Remedy	Cause: Hydraulic pump — The steering pump is defective	Hydraulic pump — The hydraulic pump is defective	Valve — Internal defective steering cylinder (Defective piston seal)	Others — Priority valve — Spool	Others — Priority valve — Relief valve	Others — Obit-roll internal defect	Others — Clogging of hydraulic oil return filter, defective bypass valve	Others — Clogging of oil cooler
		a		b	c		d	e	f
		△ X		△ X	△ X A	△ X	△ X	△ X C	△ X C
1	Steering wheel is heavy when turned in both directions (left and right)	○		○	○	○	○		
2	Steering wheel is heavy when turned in one direction (left and right)			○			○		
3	Steering wheel is heavy particularly when engine is running at low speed	○		○	○	○			
4	Lift arm lifting speed is slow when engine is running at full speed	○			○				
5	Steering wheel is heavy and there is jerking	○					○		
6	Hydraulic oil overheats				○	○			○
7	Oil pressure of steering circuit is low or there is no pressure			○		○			
8	Pressure rises in return piping of steering cylinder							○	

H-8 Steering wheel shakes or jerks

Checks before troubleshooting
- Is the hydraulic oil level correct? Is the type of oil correct?
- Is there any play in the center hinge pin bearing or steering cylinder pin or bushing?
- Is there any variation in the tire inflation pressure?
- Is the steering wheel play correct?

Check for abnormalities
- Operate at a safe place and check how the steering wheel shakes and under what conditions.
  - ★ In cases where the steering wheel is heavy but does not shake, go to "H-7 The steering wheel is heavy".

No.	Diagnosis \ Remedy	Cause: Valves a — Defect inside drbitrol — △ X	Cause: Cylinder b — Defect inside steering cylinder (inside surface of cylinder, piston seat, nut, bolt) — △ X	Cause: Valves c — Defective cushion valve — △ X
1	Chassis shakes when traveling on rough road surface	○	○	○
2	Shakes when steering is suddenly turned during operation or travel	○	○	○
3	Chassis shakes when accelerating during travel operations	○	○	○
4	Chassis shakes when engine is started	○		
5	Excessive shock when steering wheel is turned back			○

H-9 Machine deviates naturally to one side when traveling

Causes: Defective steering
- Defective operation of safety valve

: Oil leakage inside steering cylinder

: Variation in tire inflation pressure

H-10 The brake does not work or does not work well

Ask the operator about the following:
- Has the brake come not to work suddenly?
  - ✗ Breakage of brake equipment
- Has the brake come not to work gradually?
  - ✗ Wear of lining and disc, defective seal

Inspection before diagnosis
- Is the oil level in the hydraulic tank appropriate?
- Is the play of brake pedal appropriate?
- Oil leak from brake tube and connector, deformation of tube.
- Tire air pressure and state of tire read.

Check abnormality
- Measure the braking force and check referring to the standard value table if the brake does not work practically.

No.	Diagnosis \ Remedy	Cause										
		a	b	c	d	e	f	g	h	i	j	k
		Defective brake piston seal in axle	Defective operation of brake piston in axle	Defective slack adjuster	Wear or abnormality of brake lining in axle	Metal contact due to complete wear of brake lining in axle	Mixing of air in brake circuit	Defect inside brake valve	Defective seal of accumulator piston, insufficient gas pressure	Defective operation of accumulator charge valve	Defective brake pump (For charge)	Brake linkage
		△ X	△ X	X	△ X	△ X	△	X	△ X	X	△ X	
1	When the brake pedal is stepped on, only a little resistance is felt	○					○	○		○		○
2	When the brake pedal is stepped on, a strong resistance is felt							○				○
3	When the brake works, an abnormal noise occurs from the axle brake				○	○						
4	When the four wheels are jacked up, the axle is placed on a table and the brake is applied at the first forward speed, only a specific wheel rotates	○	○		○	○						
5	An airflow is observed in bleeding air from brake circuit, and the brake returns to normal after the bleeding						○					
6	Brake oil leaks abnormally from the axle during inspection	○										
7	Much metal powders are mixed in the axle oil					○						
8	The brake pedal leg-power and stroke are normal, but the brake does not work well		○	○	○	○	○	○	○	○	○	
9	The brake does not work often when the engine is stopped	○		○			○	○	○	○		
10	The accumulator is not charged, and a buzzer sounds								○	○	○	
11	The brake works after some time lag			○			○	○				

H-11 The brake is not released or is dragged

Ask the operator about the following:
- Has the brake pedal returned completely?
- Is the parking brake released completely?

Check abnormality
- Abnormal heat of brake.
- Does the machine travel smoothly inertia on a level ground?

No.	Diagnosis \ Remedy	Cause a: Defective brake piston seal in axle △ X	Cause b: Defective operation of brake piston in axle △ X	Cause c: Defective slack adjuster △ X	Cause d: Wear or abnormality of brake lining in axle △ X
1	The brake pedal is released, but the brake is still applied	○	○	○	○
2	When the brake pedal is released, oil is drained from the air bleeder, the circuit oil pressure drops and the brake is released	○			○
3	When the four wheels are jacked up, the axle is placed on a table, the engine is stopped, the parking brake is released and the tires are rotated by hand but a specific tire hardly rotates		○	○	○

H-12 The lift arm does not rise or lower

Ask the operator about the following:
- Has the lift arm come not to work suddenly?
  - ✔ Seizure or breakage of each equipment

  Did any abnormal noise occur at the time (And where)?
- Was there the phenomenon that the lift arm worked slowly?
  - ✔ Wear of parts or deformation of spring

Inspection before diagnosis
- Is the oil level in the hydraulic tank appropriate?
- Is the stroke of the lift arm control lever appropriate?
- Is the engine speed appropriate?

		Cause												
		Tank to Pump				Priority valve	Cut-off valve			HST pump	PPC valve	Work equipment valve		Cylinder
		a	b	c	d	e	f	g	h	i	j	k	l	m
		Clogging of pump suction port or mixing of much air in oil	Defective steering pump	Defective work equipment pump	Defective HST charge pump	Defective operation of spool	Defective cut-off relief valve	Defective unload valve	Defective check valve	Defective low-pressure relief valve	Defective operation of spool	Defective operation of main relief valve	Breakage inside valve body (Lift arm spool)	Damage of lift arm cylinder piston seal
No.	Remedy / Diagnosis	C △	△ X	△ X	△ X	X	△ X	△ X	△ X	△ X	△ X	△ X	X	X
1	The bucket cannot operate and the lift arm cannot rise	○	○	○	○	○	○	○	○	○		○	○	
2	The bucket operates but the lift arm cannot rise										○		○	
3	The lift arm can rise without load but cannot rise when loaded	○	○	○								○		
4	The hydraulic pump causes an abnormal noise	○	○	○	○									
5	Large hydraulic drift of lift arm cylinder												○	○
6	When the engine is at full throttle, the steering operation is heavy and slow	○	○											

H-13 The lift arm moves slowly or the lift arm rising force is insufficient

Inspection before diagnosis
- Is the stroke of the lift arm control lever appropriate?

Check of Abnormality
- Rising force and speed problem are closely related, and this problem occurs as insufficient rising speed at first. Measure the lift arm rising speed when the lift arm is loaded and make sure referring to the criterion table that the speed is abnormal.

No.	Diagnosis \ Remedy	Cause: Tank to Pump		Priority valve	Cut-off valve			HST pump	PPC valve	Work equipment valve		Cylinder
		a	b	c	d	e	f	g	h	i	j	k
		Clogging of pump suction port or mixing of much air in oil	Defective work equipment pump and steering pump	Defective operation of spool	Defective cut-off relief valve	Defective unload valve	Defective check valve	Defective low-pressure relief valve	Defective operation of spool	Defective operation or improper adjustment of main relief valve	Wear or breakage inside valve body (Lift arm spool)	Damage of lift arm cylinder piston seal
		C △	△ X	△ X	△ X	△ X	△ X	△ X	△ X	A X	X	△ X
1	The bucket tilting force and speed are abnormal, and the lift arm rising speed is slow	○	○	○	○	○	○	○		○		
2	The bucket tilting force and speed are normal, and the lift arm rising speed is slow								○		○	○
3	When the oil temperature rises in No. 1, the lift arm speed becomes very slow		○								○	
4	The hydraulic pump causes an abnormal noise	○	○									
5	Large hydraulic drift of lift arm cylinder										○	○
6	The relief oil pressure from the relief valve of the work equipment valves is low									○		
7	The relief oil pressure from the relief valve of the work equipment valves is too high									○		

H-14 When rising, the lift arm comes to move slowly at specific height

Inspection before diagnosis

- Deformation of lift arm cylinder in appearance

Cause

- Expansion of lift arm cylinder tube or damage inside

★ For other abnormal phenomena during lift arm rise, see "H-13. The lift arm moves slowly or the lift arm rising force is insufficient."

H-15 The lift arm cylinder cannot hold down the bucket (The bucket rises in the air)

See "H-13. The lift arm moves slowly or the lift arm rising force is insufficient."

Inspection before diagnosis

- Is the stroke of the lift arm control lever appropriate?

Cause

- Defective seat of suction valve on the lift arm cylinder rod side of work equipment valve
- Oil leak from lift arm cylinder piston seal

H-16 Hydraulic drifts of the lift arm occur often

Ask the operator about the following:

- Have hydraulic drifts come to occur often suddenly? ✕ Wastes pinched in valve or damage of parts
- Have hydraulic drifts come to occur often gradually? ✕ Wear of parts

Inspection before diagnosis

- Is the lift arm spool at the neutral position? ✕ The spool detent is defective

Diagnosis and Cause

- Does any leaking noise occur inside the lift arm cylinder when hydraulic drift is measured? ✕ The cylinder packing is defective

H-17 The lift arm wobbles during operation

The bucket and the lift arm moves up and down as the topography goes in digging or leveling with the lift arm control lever in the "HOLD" position.

Diagnosis and Cause

Check at first the hydraulic drift and if the lift arm cylinder can lift the machine

1. When the hydraulic drift is more than the standard value, see "H-15. Hydraulic drifts of the lift arm occur often."
2. When the lift arm cylinder cannot lift the machine, see "H-15. The lift arm cylinder cannot hold down the bucket."
3. When the lift arm cylinder comes to enable to lift the machine after the lift arm is operated several times with the normal hydraulic drift and after the lift arm cylinder operates to full stroke ✕ The cause is vacuum generated inside the cylinder

★ Frequent hydraulic drifts ✕ The suction valve on the lift arm cylinder rod side is defective

H-18 When the control lever is switched from "HOLD" to "RAISE," the lift arm falls temporarily

Check of Phenomenon

- When the control lever is switched from "HOLD" to "RAISE" gradually at low idling of the engine, the lift arm falls temporarily due to its own weight. When the control lever is completely set to "RAISE," the lift arm returns to normal.

Cause

- Improper adhesion of lift arm spool check valve of the work equipment valve

H-19 The bucket does not tilt back

Ask the operator about the following:
- Has the bucket come not to work suddenly o Seizure or breakage of each equipment
- Did any abnormal noise occur at the time (And where)?
- Was there the phenomenon that the bucket worked slowly?
  ✔ Wear of parts or deformation of spring

Inspection before diagnosis
- Is the stroke of the bucket control lever appropriate?

No.	Diagnosis \ Remedy	Cause: Tank to Pump a: Clogging of pump suction port or mixing of much air in oil	Tank to Pump b: The steering pump is defective	Tank to Pump c: The hydraulic pump and the switch pump are defective	Tank to Pump d: The HST charge pump (which is used as PPC pump, too) is defective	Priority Valve e: Defective operation of spool	Cut-off valve f: Defective cut-off relief valve	Cut-off valve g: Defective unload valve	Cut-off valve h: Defective check valve	HST pump i: The low-pressure relief valve is defective	PPC Valve j: The spool is defective	Work Equipment Valve k: Defective operation of main relief valve	Work Equipment Valve l: Breakage inside valve body (Bucket spool)	Cylinder m: Damage of bucket cylinder piston seal
		C △		△ X	△ X	X	△ X	△ X	△ X	△ X	△ X	A X	X	X
1	The lift arm cannot operate and the bucket cannot tilt back	○		○	○	○	○	○	○	○		○	○	
2	The bucket can lift the machine but cannot tilt back, or the lift arm operates but the lift arm cannot tilt back										○		○	○
3	The bucket can tilt back without load but cannot in digging or scooping up	○		○								○		
4	The hydraulic pump causes an abnormal noise	○		○	○									
5	Large hydraulic drift of bucket cylinder												○	○
6	When the engine is at full throttle, the steering operation is heavy and slow	○	○											

H-20 The bucket moves slowly or the tilting-back force is insufficient

Inspection before diagnosis
- Is the stroke of the bucket control lever appropriate?
- Seizure of work equipment linkage bushing (Does any abnormal noise occur?)

Check of Abnormality
- Make sure in an actual operation that the tilting-back force is insufficient.
- Measure the operating speed of the bucket, and make sure referring to the criterion value table that the speed is abnormal

No.	Diagnosis \ Remedy	Cause: Tank to Pump a: Clogging of pump suction port or mixing of much air in oil	Tank to Pump b: The hydraulic pump and the switch pump are defective	Priority valve c: Defective operation of spool	Cut-off valve d: Defective cut-off relief valve	Cut-off valve e: Defective unload valve	Cut-off valve f: Defective check valve	HST pump g: Defective operation of low-pressure relief valve	PPC valve h: Defective operation of spool	Work equipment valve i: Defective operation or improper adjustment of main relief valve	Work equipment valve j: Defective operation of safety valve (With suction valve) on bucket cylinder bottom side	Work equipment valve k: Wear or breakage inside valve body (Bucket spool)	Cylinder l: Damage of bucket cylinder piston seal
	Remedy	C △	△ X	△ X	△ X	△ X	△ X	△ X	△ X	A X	△ X	X	X
1	The lift arm rising force and speed are abnormal, and the bucket tilting force and speed are abnormal	○	○	○	○	○	○	○		○			
2	The lift arm rising force and speed are normal, and the bucket tilting force and speed are abnormal								○		○	○	○
3	When the oil temperature rises in No. 1, the bucket speed becomes worse		○									○	
4	The hydraulic pump is causing an abnormal noise	○	○										
5	Large hydraulic drift of bucket cylinder										○	○	○
6	The relief oil pressure from the relief valve of the work equipment valves is low		○							○	○		
7	The relief oil pressure from the relief valve of the work equipment valves is too high									○			

H-21 The bucket comes to operate slowly in he midst of tilting-back

Inspection before diagnosis
- Deformation of bucket cylinder in appearance

Cause
- Expansion of bucket cylinder tube or damage inside
  For other abnormal phenomena during bucket operation, see "H-20. The bucket moves slowly or the tilting-back force is insufficient."

H-22 The bucket cylinder cannot hold down the bucket

See "H-20. The bucket moves slowly or the tilting-back force is insufficient."

Inspection before diagnosis
- Is the stroke of the bucket control lever appropriate?

Cause
- Defective seat of suction valve on the bucket cylinder rod side of work equipment valve
- Oil leak from bucket cylinder piston seal

H-23 Hydraulic drifts of the bucket occur often

Ask the operator about the following:
- Have hydraulic drifts come to occur often suddenly? ✕ Wastes pinched in valve or damage of parts
- Have hydraulic drifts come to occur often gradually? ✕ Wear of parts

Inspection before diagnosis
- Is the bucket lever (PPC valve) at the neutral position? ✕ Seizure of link bushing or the spool detent is defective

Check of Abnormality
- Refer to the criterion value table and check if the hydraulic drift of the bucket occurs often practically

Cause
- Oil leak in bucket cylinder
- Improper adhesion of safety valve (With suction valve) on the bottom side
- Improper oil tight of bucket spool

H-24 The bucket wobbles during travel with cargo (The work equipment valve is set to "HOLD")

Inspection before diagnosis

- Pin of work equipment linkage and "play of bushing" (Is any abnormal noise heard?)

Cause

- Defective seal of bucket cylinder piston
- Defective operation of safety valve (With suction valve) on bucket cylinder rod side. For other abnormal phenomena, refer to diagnoses for relevant abnormal phenomena.

H-25 When the control lever is switched from "HOLD" to "TILT," the bucket falls temporarily

Check of Phenomenon

- When the control lever is switched from "HOLD" to "RAISE" gradually at low idling of the engine, the bucket falls temporarily due to its own weight. When the control lever is completely set to "TILT," the bucket returns to normal.

Cause

- Improper adhesion of bucket spool check valve of the work equipment valve

H-26 The control levers of the lift arm and bucket do not move smoothly and heavy

Check of Abnormality

- Refer to the criterion value table and check if the lever operating efforts are large practically.

		Cause
		PPC valve
		a
		Defective operation of relief valve
No.	Remedy / Diagnosis	C △
1	Becomes heavy in some places during operation regardless of oil pressure and oil temperature	○
2	Becomes heavy overall during operation regardless of oil pressure and oil temperature	○

white 20-724

TROUBLESHOOTING OF ENGINE (S MODE)

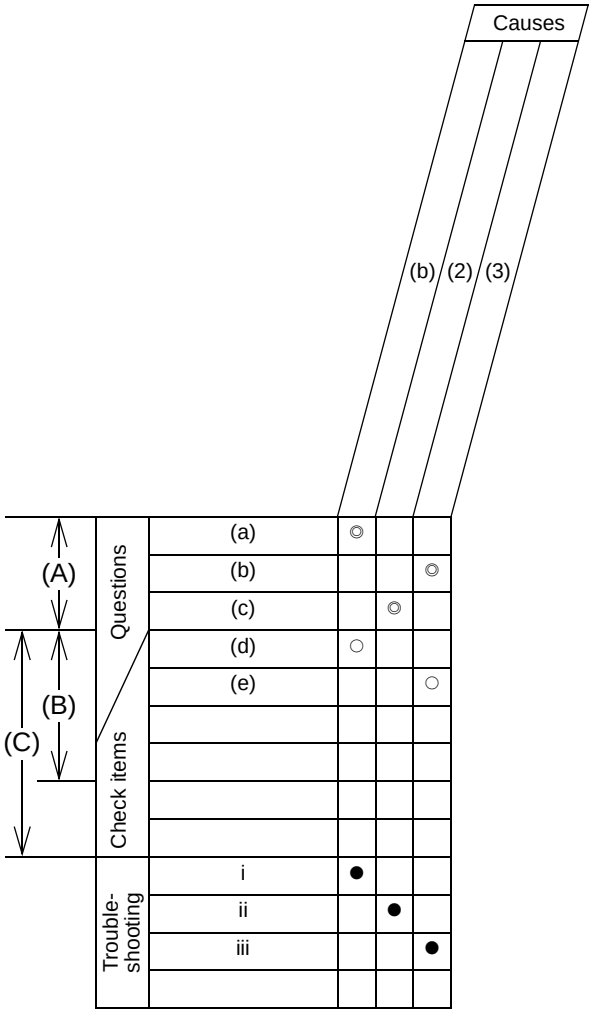
METHOD OF USING TROUBLESHOOTING CHARTS

This troubleshooting chart is divided into three sections: **questions**, **check items**, and **troubleshooting**. The questions and check items are used to pinpoint high probability causes that can be located from the failure symptoms or simple inspection without using troubleshooting tools.
Next, troubleshooting tools or direct inspection are used to check the high probability causes to make final confirmation.

[Questions]
Sections (A) + (B) in the chart on the right corresponds to the items where answers can be obtained from the user. The items in B are items that can be obtained from the user, depending on the user's level.

[Check items]
The serviceman carries out simple inspection to narrow down the causes. The items under (C) in the chart on the right correspond to this.
The serviceman narrows down the causes from information (A) that he has obtained from the user and the results of (C) that he has obtained from his own inspection.

[Troubleshooting]
Troubleshooting is carried out in the order of probability, starting with the causes that have been marked as having the highest probability from information gained from **[Questions]** and **[Check items]**.



The basic method of using the troubleshooting chart is as follows.
Items listed for **[Questions]** and **[Check items]** that have a relationship with the Cause items are marked with !, and these, causes that have a high probability are marked with T.
Check each of **[Questions]** and **[Check items]** in turn, and marked the ! or T in the chart for items where the problem appeared. The vertical column (Causes) that has the highest number of points is the most probable cause, so start troubleshooting for that item to make final confirmation of the causes.

*1. For [Confirm recent repair history] in the [Questions] Section, ask the user, and mark the Cause column with # to use as reference for locating the cause of the failure. However, do not use this when making calculations to narrow down the causes.
*2. Use the # in the Cause column as reference for [Degree of use (Operated for long period)] in the **[Questions]** section as reference. As a rule, do not use it when calculating the points for locating the causes, but it can be included if necessary to determine the order for troubleshooting.

			Causes						
			Seized turbocharger, interference	Clogged air cleaner element	Worn piston ring, cylinder	Clogged, seized injection nozzle	Improper injection timing	Defective injection pump (excessive injection)	
*1	Confirm recent repair history								
*2	Degree of use of machine	Operated for long period		△	△	△			
			◎						

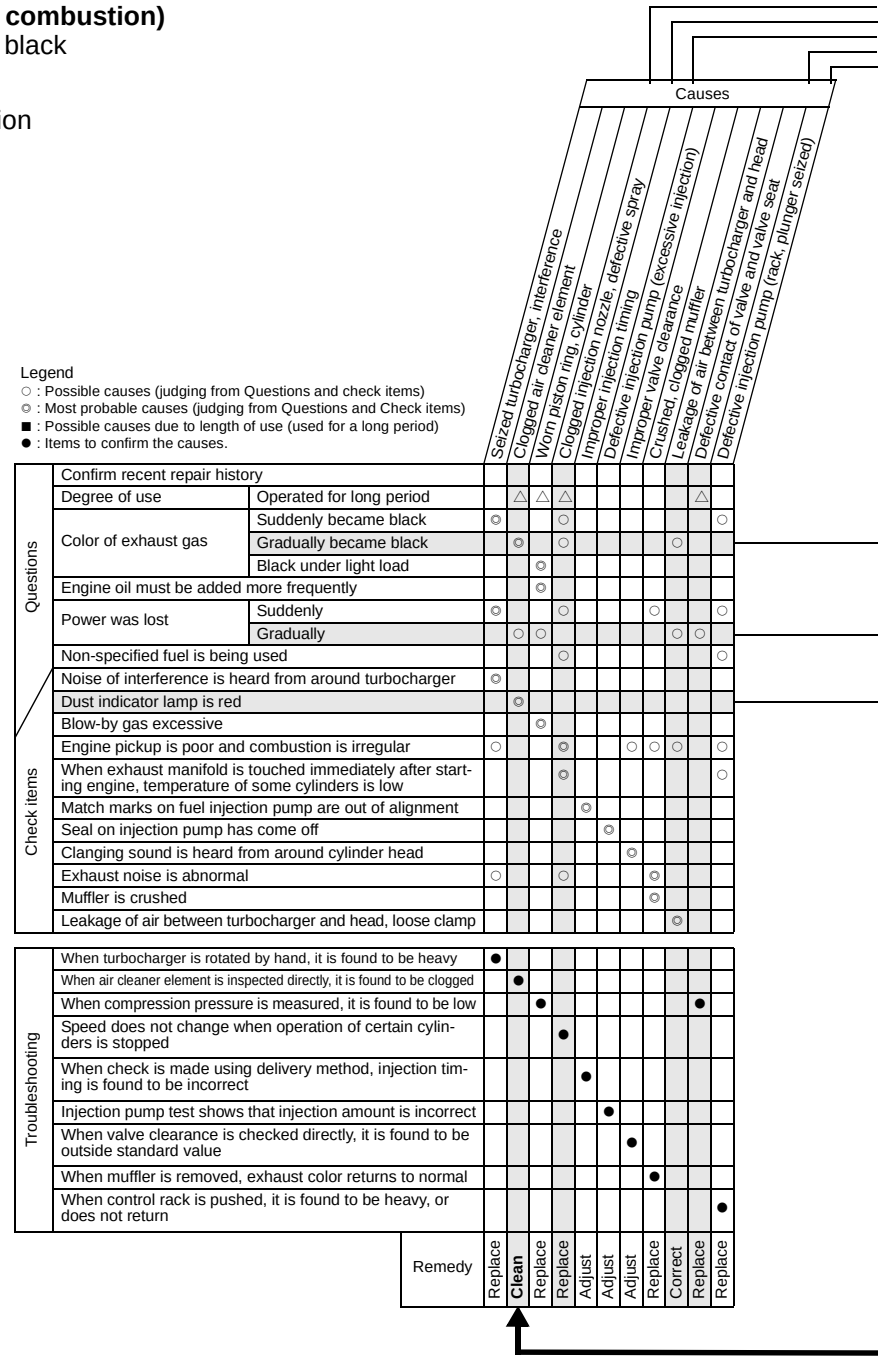
- **Example of troubleshooting when exhaust gas is black**

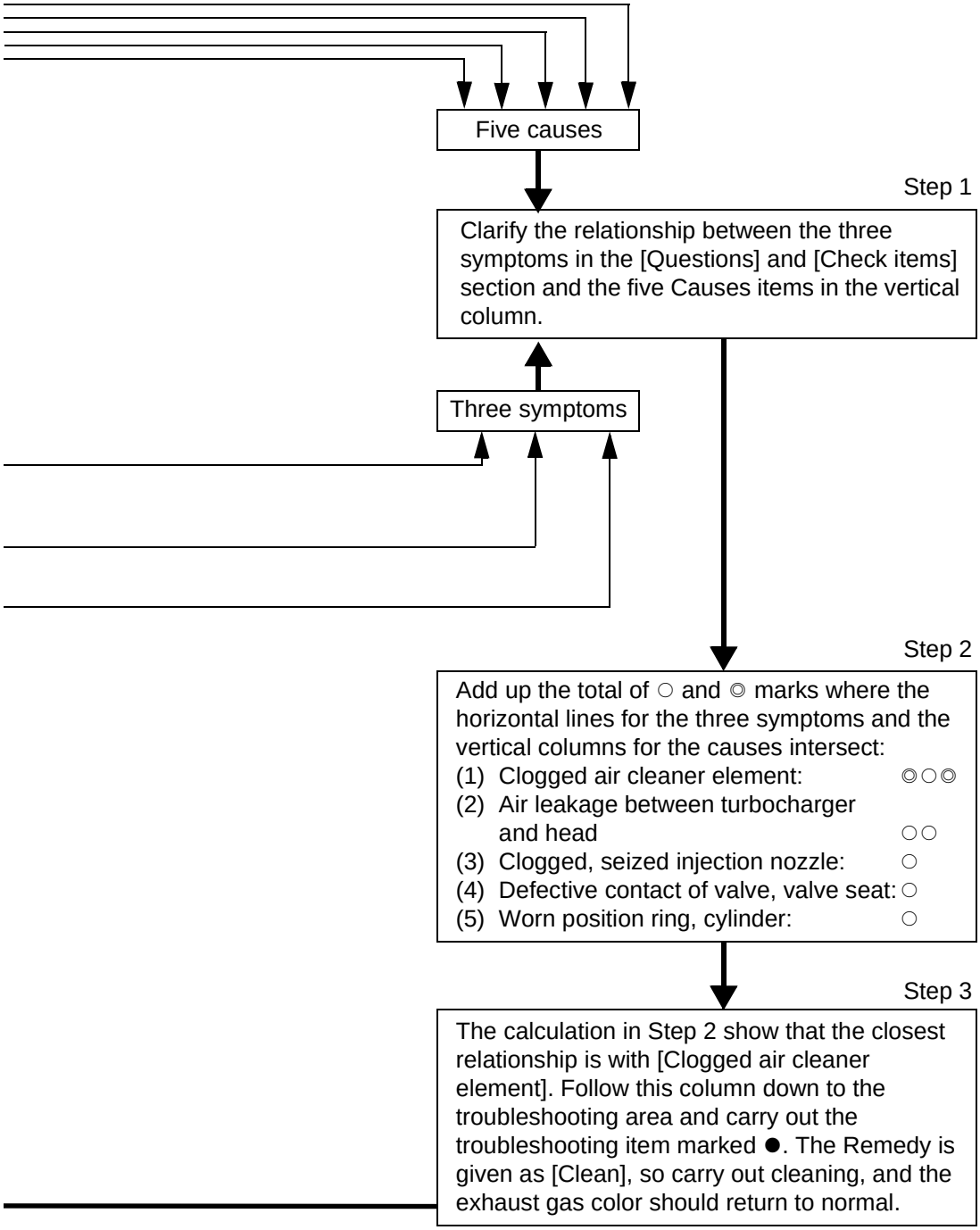
  Let us assume that [Clogged air cleaner] is taken to be the cause of black exhaust gas. Three symptoms have causal relationship with this problem: [Exhaust gas slowly became black], [Power slowly became weaker], and [Dust indicator is red].
  If we look from these three symptoms to find the causes, we find that there is a relationship with five causes.
  Let us explain here the method of using this causal relationship to pinpoint the most probable cause.

S-7 Exhaust gas is black (incomplete combustion)

General causes why exhaust gas is black

- Insufficient intake of air
- Improper condition of fuel injection
- Excessive injection fuel




Five causes
Step 1
Clarify the relationship between the three symptoms in the [Questions] and [Check items] section and the five Causes items in the vertical column.
Three symptoms
Step 2
Add up the total of ○ and ◎ marks where the horizontal lines for the three symptoms and the vertical columns for the causes intersect:
(1) Clogged air cleaner element: ◎○◎
(2) Air leakage between turbocharger and head ○○
(3) Clogged, seized injection nozzle: ○
(4) Defective contact of valve, valve seat: ○
(5) Worn position ring, cylinder: ○
Step 3
The calculation in Step 2 show that the closest relationship is with [Clogged air cleaner element]. Follow this column down to the troubleshooting area and carry out the troubleshooting item marked ●. The Remedy is given as [Clean], so carry out cleaning, and the exhaust gas color should return to normal.

S-1 Starting performance is poor (Starting always takes time)

General causes why exhaust smoke comes out but engine takes time to start

- Defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel
  (At ambient temperature of -10°C or below, ASTM D975 No. 2 diesel fuel is used)

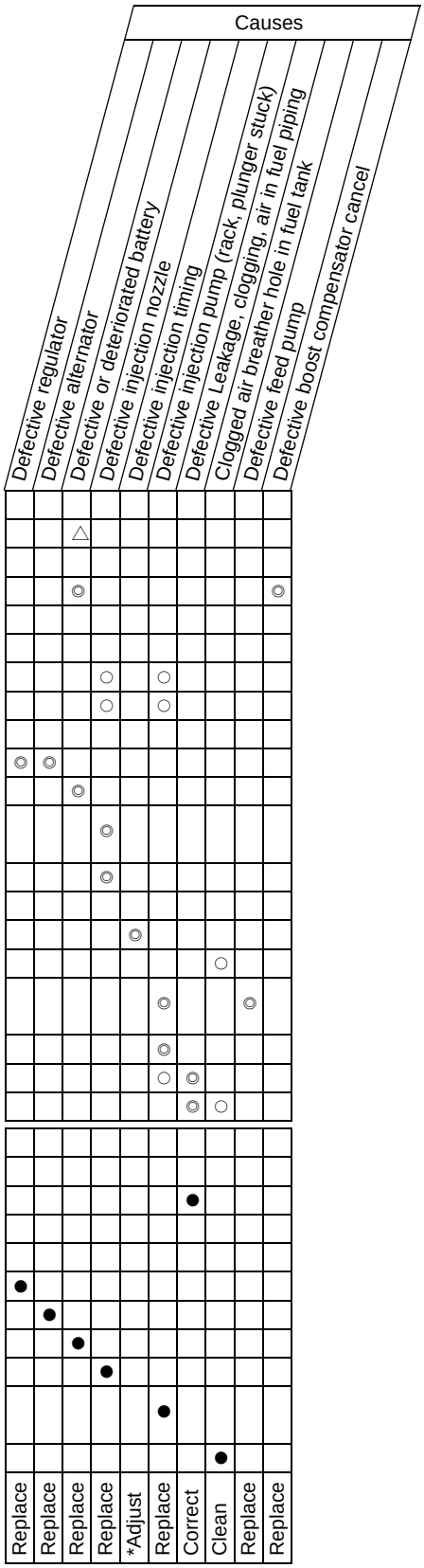
★ Battery charging rate

Ambient temperature \ Charging rate	100%	90%	80%	75%	70%
20°C	1.28	1.26	1.24	1.23	1.22
0°C	1.29	1.27	1.25	1.24	1.23
-10°C	1.30	1.28	1.26	1.25	1.24

- The specific gravity should exceed the valve for the charging rate of 70% in the above table.
- In cold areas the specific gravity must exceed the value for the charging rate of 75% in the above table.

			Causes: Worn piston ring, cylinder	Defective contact of valve, valve seat	Clogged air cleaner element	Clogged fuel filter, strainer	Clogged feed pump gauze filter	Electrical intake air heater
Questions	Confirm recent repair history							
	Degree of use of machine	Operated for long period			△	△	△	
	Ease of starting	Gradually became worse	◎	◎	○	○	○	
		Starts when warm						◎
	Indicator lamp does not light up							◎
	Engine oil must be added more frequently		◎					
	Replacement of filters has not been carried out according to operation Manual				◎	◎	◎	
	Non-specified fuel has being used					○	○	
Check items	Dust indicator lamp is red				◎			
	Battery charge lamp is ON							
	Starting motor cranks engine slowly							
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low							
	Engine does not pick up smoothly, and combustion is irregular		○	○				
	Blow-by gas is excessive		◎					
	Timing lock on fuel injection pump does not match							
	Mud is stuck to fuel tank cap							
	When Engine is cranked with starting motor, 1) Little fuel comes out even when injection pump piping sleeve nut is loosened					◎	◎	
	2) Little fuel comes out even when fuel filter air bleed plug is loosened							
	Leakage from fuel piping							
	There is hunting from engine (rotation is irregular)					○	○	
Troubleshooting	When compression pressure is measured, it is found to be low		●	●				
	When air cleaner element is inspected directly, it is found to be clogged				●			
	When fuel filter, strainer are inspected directly, they are found to be clogged					●		
	When feed pump strainer is inspected directly, it is found to be clogged						●	
	Heater mount does not become warm							●
	Is voltage 26 - 30V between alternator terminal B and terminal E with engine at low idling?	Yes						
		No						
	Either specific gravity of electrolyte or voltage of battery is low							
	Speed does not change when operation of certain cylinders is stopped							
	When control rack is pushed, it is found to be heavy or does not return (check after removing fuel injection pump)							
	When fuel tank cap is inspected directly, it is found to be clogged							
	Remedy		Replace	Correct	Clean	Clean	Clean	Replace

* Use a test stand


Causes
Defective regulator
Defective alternator
Defective or deteriorated battery
Defective injection nozzle
Defective injection timing
Defective injection pump (rack, plunger stuck)
Clogged air breather hole in fuel tank
Defective feed pump
Defective boost compensator cancel
Replace
Replace
Replace
Replace
*Adjust
Replace
Correct
Clean
Replace
Replace

S-2 Engine does not start

(1) Engine does not turn

General causes why engine does not turn

- Internal parts of engine seized
  - ★ If internal parts of the engine are seized, carry out troubleshooting for "Engine stops during operations".
- Defective electrical system
- Failure in power train

			Causes: Defective wiring of starting circuit	Defective or deteriorated battery	Defective starting motor	Broken ring gear	Defective safety relay or safety switch	Defective battery relay	Defective battery terminal connection	Defective fuel cut solenoid	Defective starting switch
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period		△		△					
	Condition of horn when starting switch is turned ON	Horn sounds	◎						○		○
		Horn volume is low		◎							
	When starting switch is turned to START, pinion moves out, but	Speed of rotation is low		◎							
		Makes grating noise			◎	◎					
		Soon disengages pinion again					◎				
		Makes rattling noise and does not turn		○	○		○				
Check items	When starting switch is turned to START, pinion does not move out		◎	○							○
	When starting switch is turned to ON, there is no clicking sound		Troubleshooting of defective wiring in starting circuit	○				◎			
	Battery terminal is loose								◎		
	When starting switch is turned ON, linkage is not actuated									◎	
	When battery is checked, battery electrolyte is found to be low			◎							
Troubleshooting	Specific gravity of electrolyte, voltage of battery is low			●							
	For the following conditions 1) - 5), turn the starting switch OFF, connect the cord, and carry out troubleshooting										
		1) When terminal B and terminal C of starting switch are connected, engine starts									●
		2) When terminal B and terminal C of starting motor are connected, engine starts			●						
		3) When terminal B and terminal C of starting safety relay are connected, engine starts				●					
		4) When terminal of safety switch and terminal B of starting motor are connected, engine starts				●					
		5) There is no 24V between battery relay terminal b and terminal E					●				
	When ring gear is inspected directly, tooth surface is found to be chipped				●						
	Cannot be moved by hand even when linkage of fuel cut solenoid is disconnected								●		
		Remedy	-	Replace	Replace	Replace	Replace	Replace	Replace	Replace	Replace

(2) Engine turns but no exhaust smoke comes out (Fuel is not being injected)

General causes why engine turns but no exhaust smoke comes out

- Supply of fuel impossible
- Supply of fuel is extremely small
- Improper selection of fuel (particularly in winter)

★ Standards for use of fuel

KIND OF FLUID	AMBIENT TEMPERATURE				
	-4 -20	14 -10	32 0	50 10	68°C 20°F
Diesel fuel	ASTM D975 No. 1		ASTM D975 No. 2		

		Causes: Broken, injection pump drive shaft, key	Defective injection pump (rack, plunger seized)	Seized broken feed pump piston	Clogged fuel filter, strainer	Clogged feed pump strainer	Insufficient fuel in tank	Clogged leaking fuel piping	Clogged air breather hole in fuel tank	Defective fuel cut solenoid	Improper fuel used
Questions	Confirm recent repair history										
	Degree of use of machine — Operated for long period				△	△			△		
	Exhaust smoke suddenly stops coming out (when starting again)	◎	◎	◎							
	Replacement of filters has not been carried out according to Operation Manual				◎	◎					
	Fuel tank is found to be empty						◎				
	There is leakage from fuel piping							◎			
	Mud is stuck to fuel tank cap								◎		
	When starting switch is turned ON, linkage is not actuated									◎	
	When fuel filter is drained, fuel does not come out										◎
Check items	When engine is cranked with starting motor, 1) No fuel comes out even when fuel filter air bleed plug is loosened	◎			○	○					○
	2) No fuel spurts out even when injection pump piping sleeve nut is loosened	◎	◎	◎							
	Rust and water are found when fuel tank is drained				○	○					○
Troubleshooting	Inspect injection pump directly	●									
	When control rack is pushed, it is found to be heavy, or does not return		●								
	Inspect feed pump directly			●							
	When fuel filter, strainer are inspected directly, they are found to be clogged				●						●
	When feed pump strainer is inspected directly, it is found to be clogged					●					
	When fuel cap is inspected directly, it is found to be clogged								●		
	Cannot be moved by hand even when linkage of fuel cut solenoid is disconnected									●	
	Remedy	Replace	Replace	Replace	Replace	Replace	Replace	Replace	Replace	Replace	Replace

(3) Exhaust smoke comes out but engine does not start (Fuel is being injected)

General causes why exhaust smoke comes out but engine not start

- lack of rotating force due to defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel and oil

		Causes: Defective, broken valve system (valve, rocker lever etc.)	Defective injection pump (rack, plunger stuck)	Worn piston ring, cylinder liner	Clogged fuel filter, strainer	Clogged feed pump strainer	Clogged air cleaner element	Defective electrical intake air heater	Leakage, clogging, or deteriorated battery	Clogged injection nozzle, defective spray	Clogged air breather hole in fuel tank cap	Improper fuel used
Questions / Check items	Confirm recent repair history											
	Degree of use of machine — Operated for long period			△	△	△				△		
	Suddenly failed to start	◎	◎									
	When engine is cranked, abnormal noise is heard from around cylinder head	◎										
	Engine oil must be added more frequently			◎								
	Non-specified fuel is being used		○							○		
	Replacement of filters has not been carried out according to Operation Manual				◎	◎	◎					
	Rust and water are found when fuel tank is drained				◎	◎						
	Dust indicator lamp is red						◎					
	Indicator lamp does not light up							◎				
	Starting motor cranks engine slowly								◎			
	Mud is stuck to fuel tank cap										○	
	When fuel lever is placed at FULL position, it does not contact stopper		○									
	When engine is cranked with starting motor, 1) Little fuel comes out even when fuel filter air bleed plug is loosened		◎									
	2) No fuel comes out even when fuel filter air bleed plug is loosened				◎	◎						○
	There is leakage from fuel piping								◎			
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low									◎		
	When fuel filter is drained, no fuel comes out											◎
Troubleshooting	Remove head cover and check directly	●										
	When control rack is pushed, it is found to be heavy, or does not return		●									
	When compression pressure is measured, it is found to be low			●								
	When fuel filter, strainer are inspected directly, they are found to be clogged				●							●
	When feed pump strainer is inspected directly, it is found to be clogged					●						
	When air cleaner element is inspected directly, it is found to be clogged						●					
	Heater mount does not become warm							●				
	Either specific gravity of electrolyte or voltage of battery is low								●			
	When feed pump is operated, there is no response, or operation is too heavy									●		
	Speed does not change when operation of certain cylinders is stopped										●	
	When fuel tank cap is inspected directly, it is found to be clogged											●
	Remedy	Replace	Replace	Replace	Clean	Clean	Clean	Correct	Replace	Correct	Clean	Clean

S-3 Engine does not pick up smoothly (Follow-up is poor)

General causes why engine does not pick up smoothly

- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injection
- Improper fuel used

			Causes: Clogged air cleaner element	Clogged fuel filter, strainer	Clogged feed pump strainer	Clogged injection nozzle, defective spray	Seized injection pump plunger	Worn piston ring, cylinder liner	Seized turbocharger, interface	Improper valve clearance	Clogged air breather hole in fuel tank cap	Clogged, leaking fuel piping	Defective contact of valve and valve seat
Questions / Check items	Confirm recent repair history												
	Degree of use of machine	Operated for long period	△	△	△			△					△
	Replacement of filters has not been carried out according to Operation Manual		◎	◎	◎								
	Non-specified fuel is being used			◎	◎	◎	◎						
	Engine oil must be added more frequently							◎					
	Engine pick-up suddenly became poor					○			◎		○	○	
	Rust and water are found when oil is drained			◎	◎								
	Dust indicator lamp is red		◎										
	Noise of interference is heard from around turbocharger								◎				
	Color of exhaust gas	Blue under light load				○		◎					
		Black	◎			◎			◎				○
	Clanging sound is heard from around cylinder head									◎			
	Mud is stuck to fuel tank cap										◎		
	There is leakage from fuel piping											◎	
	High idling speed under no load is normal, but speed suddenly drops when load is applied			◎	◎					○			
	There is hunting from engine (rotation is irregular)			○	◎	○				○			
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low					◎	○						
	Blow-by gas excessive							◎					
Troubleshooting	When air cleaner element is inspected directly, it is found to be clogged		●										
	When fuel filter, strainer are inspected directly, they are found to be clogged			●									
	When feed pump strainer is inspected directly, it is found to be clogged				●								
	Speed does not change when operation of certain cylinders is stopped					●							
	When control rack is pushed, it is found to be heavy, or does not return						●						
	When compression pressure is measured, it is found to be low							●					●
	When turbocharger is rotated by hand, it is found to be heavy								●				
	When valve clearance is checked directly, it is found to be outside standard value									●			
	When fuel tank cap is inspected directly, it is found to be clogged										●		
	When feed pump is operated, operation is too light or too heavy											●	
		Remedy	Clean	Clean	Clean	Correct	Replace	Replace	Replace	Adjust	Clean	Correct	Replace

S-4 Engine stops during operations

General causes why engine stop during operations

- Seized parts inside engine
- Insufficient supply of fuel
- Overheating
  - ★ If there is overheating and the engine stops, carry out troubleshooting for overheating.
- Failure in power train
  - ★ If the engine stops because of a failure in the power train, carry out troubleshooting for the chassis.

			Causes: Broken, seized piston, connecting rod	Broken, seized crankshaft bearing	Broken dynamic valve system (valve, rocker lever, etc.)	Broken, seized gear train	Broken pump auxiliary equipment	Broken fuel pump drive shaft, key	Insufficient fuel in tank	Clogged fuel filter, strainer	Clogged feed pump strainer	Broken, seized feed pump piston	Clogged, leaking fuel piping	Clogged air breather hole in fuel tank	Defective injection pump (rack, plunger stuck)	Failure in power train	
Questions	Confirm recent repair history																
	Degree of use of machine	Operated for long period							△	△							
	Condition when engine stopped	Abnormal noise was heard and engine stopped suddenly	◎	◎	◎	◎	◎	◎			○			○	◎		
		Engine overheated and stopped	◎	○			○										
		Engine stopped slowly							◎	○	○						
		There was hunting and engine stopped							◎	○	○			○			
	Replacement of filters has not been carried out according to Operation Manual									◎	◎						
Check items	Non-specified fuel is being used									○	○	○			○		
	Fuel level lamp lights up								◎								
	Fuel tank is found to be empty								◎								
	When feed pump is operated, operation is too light or too heavy									○	○		◎				
	Mud is stuck to fuel tank cap													◎			
	Engine rotates, but stops when power train is operated															◎	
	When it is attempted to turn by hand using barring tool	Does not turn at all	◎	◎													Troubleshooting of chassis
		Turns in opposite direction			◎												
		Moves amount of backlash				◎	◎										
		Shaft does not turn						◎									
	Rust and water are found when tank is drained									◎	◎						
	Metal particles are found when oil is drained		◎	◎						○	○						
Troubleshooting	Remove oil pan and inspect directly		●	●													
	Remove head cover and inspect directly				●												
	When gear train is inspected, it does not turn					●											
	Rotates when pump auxiliary equipment is removed						●										
	When fuel filter, strainer are inspected directly, they are found to be clogged									●							
	When feed pump strainer is inspected directly, it is found to be clogged										●						
	Inspect feed pump directly											●					
	When control rack is pushed, it is found to be heavy, or does not return														●		
		Remedy	Replace	Replace	Replace	Replace	Replace	Add	Clean	Clean	Replace	Replace	Correct	Clean	Replace	-	

S-5 Engine does not rotate smoothly (Hunting)

General causes why engine does not rotate smoothly

- Air in fuel system
- Defective governor mechanism
- Defective electric governor mechanism (engine with electric governor)
  - ★ If hunting stops when electric governor rod is disconnected, carry out troubleshooting for the chassis.

			Causes: Defective operation of governor	Defective adjustment of governor	Defective operation of control rack	Low idling speed is too low	Insufficient fuel in tank	Clogged feed pump strainer	Clogged fuel filter, strainer	Clogged air in circuit between fuel tank and feed pump	Clogged air in circuit between feed pump and nozzle	Clogged air breather hole in fuel tank
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period					△	△				
	Condition of hunting	Occurs at a certain speed range	◎	◎	◎	○						
		Occurs at low idling	○			◎		○	○	○	○	
		Occurs even when speed is raised	○	○	○							○
		Occurs on slopes					◎					
	Replacement of filters has not been carried out according to Operation Manual							◎	◎			
Check items	Fuel tank is found to be empty						◎					
	Rust and water are found when tank is drained							○	○			
	Leakage from fuel piping									◎	◎	
	When feed pump is operated, 1) No response, light, return is quick									◎		
	2) No response, light, return is normal									◎		
	Engine speed sometimes rises too far		◎	◎								
	Engine is sometimes difficult to stop		◎		◎							
	Seal on injection pump has come off			◎		◎						
Troubleshooting	When governor level is moved it is found to be stiff		●		●							
	When injection pump is tested, governor is found to be improperly adjusted			●								
	When control rack is pushed, it is found to be heavy, or does not return				●							
	When fuel tank cap is inspected directly, it is found to be clogged					●						●
	When feed pump strainer is inspected directly, it is found to be clogged							●				
	When fuel filter, strainer are inspected directly, they are found to be clogged								●			
		Remedy	Adjust	Adjust	Adjust	Adjust	Add	Clean	Clean	Correct	Correct	Clean

S-6 Engine lacks output (or lacks power)

General causes why engine lacks output

- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injection
- Improper fuel used
  (if non-specified fuel is used, output drops)
- Lack of output due to overtaking
  - ★ If there is overheating and lack of output, carry out troubleshooting for overheating.

			Causes: Clogged air cleaner element	Seized turbocharger, interference	Worn piston ring, cylinder	Clogged fuel filter, strainer	Clogged feed pump strainer	Clogged injection nozzle, defective spray	Seized injection pump plunger	Improper valve clearance	Defective contact of valve and valve seat	Bent fuel lever linkage, defective adjustment	Clogged, leaking fuel piping	Clogged air breather hole in fuel tank	Defective boost compensator diaphragm	Defective westgate diaphragm
Questions	Confirm recent repair history															
	Degree of use of machine	Operated for long period	△		△	△	△				△					
	Power was lost	Suddenly		◎											◎	◎
		Gradually	○		○	○	○	○			○					
	Engine oil must be added more frequently				◎											
	Replacement of filters has not been carried out according to Operation Manual		◎			◎	◎									
	Non-specified fuel is being used					◎	◎	◎	◎							
Check items	Dust indicator lamp is red		◎													
	Color of exhaust gas	Black	◎	◎												
		Black under light load			◎											
	Noise of interference is heard from around turbocharger			◎												
	Blow-by gas excessive				◎										○	
	Engine pickup is poor and combustion is irregular			◎				○					○	○		
	High idling speed under no load is normal, but speed suddenly drops when load is applied					◎	◎							○		
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low							◎	○							
	There is hunting from engines (rotation is irregular)					○	○						○	○		
	Clanging sound is heard from around cylinder head								◎							
	High idling speed of engine is low								○			◎				
	Leakage from fuel piping												◎			
Troubleshooting	When air cleaner element is inspected directly, it is found to be clogged		●													
	When turbocharger is rotated by hand, it is found to be heavy			●							●					
	When compression pressure is measured, it is found to be low				●						●					
	When fuel filter, strainer are inspected directly, they are found to be clogged					●										
	When feed pump strainer is inspected directly, it is found to be clogged						●									
	Speed does not change when operation of certain cylinders is stopped							●								
	When control rack is pushed, it is found to be heavy, or does not return								●							
	When valve clearance is checked directly, it is found to be outside standard value									●						
	When level is placed at FULL position, it does not contact stopper										●					
	When feed pump is operated, operation is too light or too heavy											●				
	When fuel tank cap is inspected directly, it is found to be clogged												●			
		Remedy	Clean	Replace	Replace	Clean	Clean	Correct	Replace	Adjust	Replace	Adjust	Correct	Clean	Replace	Replace

S-7 Exhaust smoke is black (Incomplete combustion)

General causes why exhaust smoke is black

- Insufficient intake of air
- Improper condition of fuel injection
- Excessive injection of fuel

			Causes: Seized turbocharger, interference	Clogged air cleaner element	Worn piston ring, cylinder	Clogged injection nozzle, defective spray	Improper injection timing	Defective injection pump (excessive injection)	Improper valve clearance	Crushed, clogged muffler	Leakage of air between turbocharger and head	Defective contact of valve and valve seat	Defective injection pump (rack, plunger seized)
Questions	Confirm recent repair history												
	Degree of use of machine	Operated for long period		△	△	△						△	
	Color of exhaust gas	Suddenly became black	◎			○							○
		Gradually became black		◎		○					○		
		Black under light load			◎								
	Engine oil must be added more frequently				◎								
	Power was lost	Suddenly	◎			○				○			○
		Gradually		○	○						○	○	
	Non-specified fuel is being used					○							○
Check items	Noise of interference is heard from around turbocharger		◎										
	Dust indicator lamp is red			◎									
	Blow-by gas excessive				◎								
	Engine pickup is poor and combustion is irregular		○			◎			○	○	○		○
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low					◎							○
	Timing lock on fuel injection pump does not match						◎						
	Seal on injection pump has come off							◎					
	Clanging sound is heard from around cylinder head								◎				
	Exhaust noise is abnormal		○			○				◎			
	Muffler is crushed									◎			
	Leakage of air between turbocharger and head, loose clamp										◎		
Troubleshooting	When turbocharger is rotated by hand, it is found to be heavy		●										
	When air cleaner element is inspected directly, it is found to be clogged			●									
	When compression pressure is measured, it is found to be low				●							●	
	Speed does not change when operation of certain cylinders is stopped					●							
	When check is made using delivery method, injection timing is found to be incorrect						●						
	Injection pump test shows that injection amount is incorrect							●					
	When valve clearance is checked directly, it is found to be outside standard value								●				
	When muffler is removed, exhaust color returns to normal									●			
	When control rack is pushed, it is found to be heavy, or does not return												●
		Remedy	Replace	Clean	Replace	Replace	Adjust	Adjust	Adjust	Replace	Correct	Replace	Replace

S-8 Oil consumption is excessive (or exhaust smoke is blue)

★ Do not run the engine at idling for more than 20 minutes continuously. (Both low and high idling)

General causes why oil consumption is excessive

- Abnormal combustion of oil
- External leakage of oil
- Wear of lubrication system

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

S-9 Oil becomes contaminated quickly

General causes why oil becomes contaminated quickly

- Entry of exhaust gas due to internal wear
- Clogging of lubrication passage
- Improper fuel
- Improper oil used
- Operation under excessive load

			Causes: Worn piston ring, cylinder liner	Clogged breather, breather hose	Clogged oil filter	Worn valve, valve guide	Clogged oil cooler	Clogged turbocharger oil drain tube	Defective seal at turbocharger turbine end	Exhaust smoke is black
Questions / Check items	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△		△			△		
	Engine oil must be added more frequently		◎							
	Non-specified fuel is being used				○					
	Color of exhaust gas	Black under light load	◎							
		Black								◎
	Amount of blow-by gas	Excessive	◎			○		○	○	
		None		◎						
	When oil filter is inspected, metal particles are found		○		◎	○				
	When exhaust pipe is removed, inside is found to be dirty with oil					◎				
	Engine oil temperature rises quickly						◎			
Troubleshooting	When compression pressure is measured, it is found to be low		●			●				
	When breather element is inspected directly, hose is broken or is found to be clogged with dirty oil			●						
	When oil filter is inspected directly, it is found to be clogged				●					
	When oil cooler is inspected directly, it is found to be clogged						●			
	Turbocharger oil drain tube is clogged							●		
	Excessive play of turbocharger shaft								●	
	When safety valve is directly inspected, spring is found to be catching or broken									
		Remedy	Replace	Clean	Replace	Replace	Clean	Clean	Replace	-

Carry out troubleshooting for "Exhaust smoke is black".

S-10 Fuel consumption is excessive

General causes why fuel consumption is excessive

- Leakage of fuel
- Improper condition of fuel injection
- Excessive injection of fuel

			Causes: Defective injection pump (excessive injection)	Defective nozzle holder spray	Defective injection pump plunger	Defective fuel injection timing	External leakage from fuel piping, fuel filter	Leakage of fuel inside head cover	Defective oil seal inside feed pump (piston)	Defective adjustment of fuel control linkage
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period		△	△				△	
	Condition of fuel consumption	More than for other machines of same model	◎			○				
		Gradually increased		○	○					
		Suddenly increased					○	○		
	Exhaust smoke color	Black	◎	○		○				○
		White						○		
Check items	Seal on injection pump has come off		◎							
	There is irregular combustion			◎						
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low			◎	○					
	Match mark on injection pump is misaligned					◎				
	There is external leakage of fuel from engine						◎			
	Engine oil level rises and smells of diesel fuel		○					◎	◎	
	Engine low idling and high idling speeds are high		○							◎
Troubleshooting	Injection pump measurement shows that injection amount is excessive		●							
	Speed does not change when operation of certain cylinders is stopped			●						
	When control rack is pushed, it is found to be heavy, or does not return				●					
	When check is made using delivery method, injection timing is found to be incorrect					●				
	Remove head cover and inspect directly							●		
	Remove feed cover and inspect directly								●	
	When engine speed is measured, low and high idling speeds are found to be high									●
		Remedy	Adjust	Replace	Replace	Adjust	Correct	Correct	Correct	Adjust

S-11 Oil is in cooling water, or water spurts back, or water level goes down

General causes why oil is in cooling water
- Internal leakage in lubrication system
- Internal leakage in cooling system

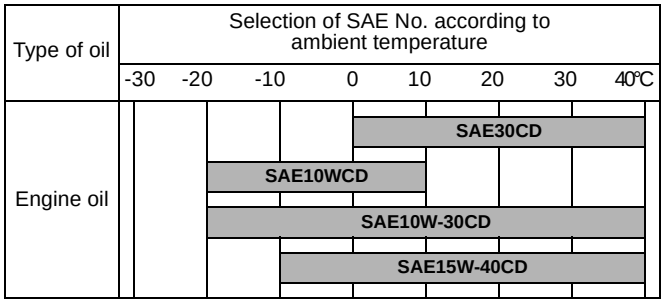
			Causes: Broken oil cooler core, O-ring	Broken cylinder head, head gasket	Broken power train oil cooler	Holes caused by pitting	Internal cracks in cylinder block
Questions	Confirm recent repair history						
	Degree of use of machine	Operated for long period	△			△	
	Oil level	Suddenly increased	○	○	○		
		Gradually increased				○	○
	Hard water is being used as cooling water		○			○	
Check items	Engine oil level has risen, oil is cloudy white		◎			○	○
	Excessive air bubbles inside radiator spurts back			◎			
	Hydraulic oil, transmission oil is cloudy white				◎		
	When hydraulic oil transmission oil is drained, water is found				◎		
Trouble-shooting	Pressure-tightness test of oil cooler shows there is leakage		●		●		
	Pressure-tightness test of cylinder head shows there is leakage			●			
	Remove oil pan and inspect directly					●	●
Remedy			Replace	Replace	Replace	Replace	Replace

S-12 Oil pressure caution lamp lights up (Drop in oil pressure)

General causes why oil pressure lamp lights up

- Leakage, clogging, wear of lubricating system
- Defective oil pressure control
- Improper oil used (improper viscosity)
- Deterioration of oil due to overheating

★ Standards for engine oil selection



			Causes: Clogged oil filter	Worn bearing, journal	Clogged strainer inside oil pan	Clogged oil pipe inside oil pan	Broken suction pipe brazing	Defective oil pump	Lack of oil in oil pan	Defective regulator valve	Defective relief valve	Leaking, crushed hydraulic piping	Defective oil pressure sensor	Defective oil level sensor	Water, fuel in oil
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period	△	△				△							
	Replacement of filters has not been carried out according to Operation Manual		◎												
	Non-specified fuel is being used		○	○											
	Caution lamp lights up		◎							○					
Check items	Condition when oil pressure lamp lights up	Lights up at low idling		◎						○					
		Lights up at low, high idling			◎	◎	◎	◎	○	○	○				
		Lights up on slopes							◎						
		Sometimes lights up								◎	◎		○	○	
	There is crushing, leakage from hydraulic piping (external)										◎				
	Oil level sensor lamp lights up								◎				◎		
	When oil level in oil pan is inspected, it is found to be low								◎						
	Metal particles are found when oil is drained			◎											
	Metal particles are stuck to oil filter element			◎				○							
	Oil is cloudy white or smells of diesel oil														◎
Troubleshooting	When oil filter is inspected, it is found to be clogged		●	●											
	Remove oil pan and inspect directly				●	●	●								
	Oil pump rotation is heavy, there is play							●							
	There is catching of relief valve or regulator valve, spring or valve guide is broken								●	●					
	When oil level sensor is replaced, oil level sensor lamp goes out												●		
	When oil pressure is measured, it is found to be within standard valve													●	
		Remedy	Clean	Clean	Clean	Clean	Correct	Replace	Add	Adjust	Adjust	Correct	Replace	Replace	-

Carry out troubleshooting for "Oil level rises".

S-13 Oil level rises (Water, fuel in oil)

★ If there is oil in the cooling water, carry out trouble-shooting for "Oil is in cooling water".

General causes why oil level rises

- Water in oil (milky white)
- Fuel in oil (diluted, and smells of diesel fuel)
- Entry of oil from other component

		Causes: Broken oil cooler core, O-ring	Defective nozzle holder sleeve	Broken cylinder head, head gasket	Worn, damaged rear seal surface	Defective pump auxiliary equipment seal	Leakage of fuel from piping inside head cover	Defective part inside injection pump	Defective thermostat	Holes made by pitting	Cracks inside cylinder block
Questions	Confirm recent repair history										
	Degree of use of machine / Operated for long period		△		△	△				△	
	There is oil in radiator cooling water	◎	○	○						○	○
	Fuel must be added more frequently						◎	◎	◎		
Check items	Exhaust smoke is white		◎				○		○		
	When engine is first started, drops of water come from muffler		◎								
	Leave radiator cap open. When engine is run at idling, an abnormal number of bubbles appear, or water spurts back			◎						○	
	Oil level goes down in clutch, TORQFLOW transmission, or damper chamber				◎						
	Oil level goes down in hydraulic tank					◎					
	Engine oil smells of diesel fuel						◎	◎	◎		
	Water temperature is low								◎		
Troubleshooting	Pressure-tightness test of oil cooler shows there is leakage	●									
	Pressure-tightness test of cylinder head shows there is leakage		●								
	When compression pressure is measured, it is found to be low			●							
	Inspect rear seal directly				●						
	When pump auxiliary equipment is removed, seal is found to be damaged					●					
	Remove head cover and inspect directly						●				
	Remove injection pump and inspect directly							●			
	Defective contact with thermostat seal valve								●		
	Remove oil pan and check directly									●	●
	Remedy	Replace	Replace	Replace	Correct	Replace	Correct	Replace	Correct	Replace	Replace

S-14 Water temperature becomes too high (Overheating)

General causes why water temperature becomes too high

- Lack of cooling air (deformation, damage of fan)
- Drop in heat dissipation efficiency
- Defective cooling circulation system
- Rise in oil temperature in power train

★ Carry out troubleshooting for chassis.

			Causes: Broken water pump	Clogged, crushed radiator fins	Clogged radiator core	Defective thermostat (does not open)	Defective water temperature gauge	Lack of cooling water	Fan belt slipping, worn fan pulley	Clogged, broken oil cooler	Defective pressure valve	Broken cylinder head, head gasket	Holes made by pitting	Rise in torque converter oil temperature
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period		△	△						△	△		
	Condition of overheating	Suddenly overheated	◎					○	○					
		Always tends to overheat		◎	◎	○			○					
	Water temperature gauge	Rise quickly				◎		○						
		Does not go down from red range					◎							
Check items	Radiator water level sensor lights up							◎						
	Fan belt whines under sudden load								◎					
	Cloudy white oil is floating on cooling water									◎				
	Cooling water flows out from overflow hose										◎			
	Excessive air bubbles inside radiator, water spurts back											◎		
	Engine oil level has risen, oil is cloudy white								○				◎	
	There is play when fan pulley is rotated		◎											
	Radiator shroud, inside of underguard are clogged with dirt or mud			◎					◎					
	When light bulb is held behind radiator, no light passes through			◎										
	Water is leaking because of cracks in hose or loose clamps							◎						
	When belt tension is inspected, it is found to be loose								◎					
	Power train oil temperature enters red range faster than engine water temperature													◎
Troubleshooting	Temperature difference between top and bottom radiator tanks is excessive		●											
	Temperature difference between top and bottom radiator tanks is slight			●										
	When water filler port is inspected, core is found to be clogged				●									
	When function test is carried out on thermostat, it does not open					●								
	When water temperature is measured, it is found to be normal						●							
	When oil cooler is inspected directly, it is found to be clogged								●					
	When measurement is made with radiator cap tester, set pressure is found to be low									●				
	When compression pressure is measured, it is found to be low										●			Carry out troubleshooting for chassis.
	Remove oil pan and inspect directly											●		
		Remedy	Replace	Correct	Correct	Replace	Replace	Add	Correct	Replace	Replace	Replace	Replace	-

S-15 Abnormal noise is made

★ Judge if the noise is an internal noise or an external noise.

General causes why abnormal noise is made

- Abnormality due to defective parts
- Abnormal combustion
- Air sucked in from intake system

			Causes: Excessive wear of piston ring, cylinder (liner less engine)	Seized turbocharger, interference	Missing, seized bushing	Clogged, seized injection nozzle	Defective injection pump (rack, plunger seized)	Defective injection pump (excessive injection)	Deformed fan, fan belt interference	Defective adjustment of valve clearance	Broken dynamic valve system (valve, rocker lever, etc.)	Improper gear train backlash	Leakage of air between turbocharger and cylinder head	Defect inside muffler (dividing board out of position)
Questions / Check items	Confirm recent repair history													
	Degree of use of machine	Operated for long period	△											
	Condition of abnormal noise	Gradually occurred	○					○						
		Suddenly occurred		○	○					○				
	Non-specified fuel is being used					○	○							
	Engine oil must be added more frequently		◎											
	Color of exhaust gas	Black under light load	◎											
		Black		◎					○			○		
	Metal particles found in oil filter		◎		◎									
	Blow-by gas excessive		◎											
	Noise of interference is heard from around turbocharger			◎										
	Engine pickup is poor and combustion is abnormal					◎								
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low					◎	○							
	Seal on injection pump has come off							◎						
	Abnormal noise is loud when accelerating engine					○	○	○	○	○		○		
	Clanging sound is heard from around cylinder head									◎	◎			
	Leakage of air between turbocharger and cylinder head, loose clamp												◎	
	Vibrating noise is heard from around muffler													◎
Troubleshooting	When compression pressure is measured, it is found to be low		●											
	When turbocharger is rotated by hand, it is found to be heavy			●										
	Remove gear cover and inspect directly				●							●		
	Speed does not change when operation of certain cylinders is stopped					●								
	When control rack is pushed, it is found to be heavy, or does not return						●							
	Injection pump test shows that injection amount is incorrect							●						
	Fan is deformed, belt is loose								●					
	When valve clearance is checked, it is found to be outside standard value									●				
	Remove cylinder head cover and inspect directly										●			
	When muffler is removed, abnormal noise disappears													●
	Remedy		Replace	Replace	Replace	Replace	Correct	Replace	Correct	Replace	Correct	Replace	Replace	Replace

S-16 Vibration is excessive

★ If there are abnormal noise together with the vibration, carry out troubleshooting also for "Abnormal noise is made".

General causes why vibration is excessive

- Defective parts (abnormal wear, breakage)
- Improper combustion
- Abnormal combustion

			Causes							
			Worn connecting rod, main bearing	Worn cam bushing	Loose engine mounting bolts, broken cushion	Broken part inside output shaft (damper)	Center of engine and power train misaligned	Improper gear train backlash	Defective dynamic valve system (valve, rocker lever, etc. stuck)	Defective injection pump (excessive fuel injection)
Questions / Check items	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△	△	△					
	Condition of vibration	Suddenly increased				○			○	
		Gradually increased	○	○	○					
	Non-specified fuel is being used		○	○						
	Metal particles are found in oil filter		◎	◎						
	Metal particles are found when oil is drained		◎	◎						
	Oil pressure is low at low idling		○	○						
	Vibration occurs at mid-range speed				○	○				
	Vibration follows engine speed				○	○	○	○		
	Exhaust smoke is black								◎	○
	Seal on injection pump has come off									◎
Troubleshooting	Remove oil pan and inspect directly		●							
	Remove side cover and inspect directly			●						
	Inspect directly for loose engine mounting bolts, broken cushion				●					
	Inspect inside of output shaft (damper) directly					●				
	When face runout and radial runout are inspected, they are found to be incorrect						●			
	Remove front cover and inspect directly							●		
	Remove head cover and inspect directly								●	
	Injection pump test shows that injection amount is incorrect									●
		Remedy	Replace	Replace	Replace	Replace	Correct	Correct	Replace	Adjust

30 DISASSEMBLY AND ASSEMBLY

HOW TO READ THIS MANUAL

REMOVAL AND INSTALLATION OF ASSEMBLIES

Special tools

- Special tools that are deemed necessary for removal or installation of parts are listed.
- List of the special tools contains the following kind of information.
  1) Necessity
     - ■: Special tools which cannot be substituted, should always be used.
     - ●: Special tools which are very useful if available, can be substituted with commercially available tools.
  2) Distinction of new and existing special tools
     - N: Tools with new part numbers, newly developed for this model.
     - R: Tools with upgraded part numbers, remodeled from already available tools for other models.
     - Blanks: Tools already available for other models, used without any modification.
  3) Circle mark (○) in sketch column:

     A circle mark means that a sketch of the special tool is presented in the section of Sketches for Special Tools.

★ Part No. of special tools starting with 79*T means that they are locally made parts and as such not interchangeable with those made by Komatsu in Japan e.g. 79*T---xxx---xxxx.

Removal

- The REMOVAL Section contains procedures, precautions and the amount of oil or water to be drained.
- Various symbols used in the REMOVAL Section are explained and listed below.

 : This mark indicates safety-related precautions which must be followed when doing the work.

★ : This mark gives guidance or precautions when doing the procedure.

[*1] : This mark shows that there are instructions or precautions for installing parts.

 : This mark shows oil or water to be drained.

 : Mass of a part or component.

Installation

- Except where otherwise instructed, install parts is the reverse order of removal.
- Instructions and precautions for installing parts are shown with [*1] mark in the INSTALLATION Section, identifying which step the instructions are intended for.
- Marks shown in the INSTALLATION Section stand for the following.

 : This mark indicates safety-related precautions which must be followed when doing the work.

★ : This mark gives guidance or precautions when doing the procedure.

 : This mark stands for a specific coating agent to be used.

 : This mark indicates the specified torque.

 : This mark indicates an amount of oil or water to be added.

Sketches of special tools

- Various special tools are illustrated for the convenience of local manufacture.

DISASSEMBLY AND ASSEMBLY OF ASSEMBLIES

Special tools

- Special tools which are deemed ncessary for disassembly and assembly are listed in this section.
- List of the special tools contains the following kind of information.
  1) Neccessity
     - ■: Special tools which cannot be substituted, should always be used.
     - ●: Special tools which are very useful if available, can be substituted with commercially available tools.
  2) Distinction of new and existing special tools
     - N: Tools with new part numbers, newly developed for this model.
     - R: Tools with upgraded part numbers, remodeled from already available tools for other models.
     - Blanks: Tools already available for other models, used without any modification.
  3) Circle mark (○) in sketch column:

     A circle mark means that a sketch of the special tool is presented in the section of Sketches for Special Tools.

★ Part No. of special tools starting with 79*T means that they are locally made parts and as such not interchangeable with those made by Komatsu in Japan e.g. 79*T---xxx---xxxx.

Disassembly

- The DISASSEMBLY Section contains procedures, precautions and the amount of oil or water to be drained.
- Various symbols used in the DISASSEMBLY Section are explained and listed below.

 : This mark indicates safety-related precautions which must be followed when doing the work.

★ : This mark gives guidance or precautions when doing the procedure.

 : This mark shows oil or water to be drained.

Assembly

- Section titled ASSEMBLY contain procedures, precautions and the know-how for the work, as well as the amount of oil or water to be added.
- Various symbols used in the ASSEMBLY Section are explained and listed below.

 : This mark indicates safety-related precautions which must be followed when doing the work.

★ : This mark gives guidance or precautions when doing the procedure.

 : This mark stands for a specific coating agent to be used.

 : This mark indicates the specified torque.

 : This mark indicates an amount of oil or water to be added.

Sketches of special tools

- Various special tools are illustrated for the convenience of local manufacture.

PRECAUTIONS WHEN CARRYING OUT OPERATION

[When carrying out removal or installation (disassembly or assembly) of units, be sure to follow the general precautions given below when carrying out the operation.]

1. Precautions when carrying out removal work

- If the coolant contains antifreeze dispose of it correctly.
- After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.
- When draining oil, prepare a container of adequate size to catch the oil.
- Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
- To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors. Do not pull the wires.
- Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
- Check the number of thickness of the shims, and keep in a safe place.
- When raising components, be sure to use lifting equipment of ample strength.
- When using forcing screws to remove any components, tighten the forcing screws uniformly in turn.
- Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.

★ **Precautions when handling piping during disassembly**

Fit the following blind plugs into the piping after disconnecting it during disassembly operations.

1) Face seal type hoses and tubes

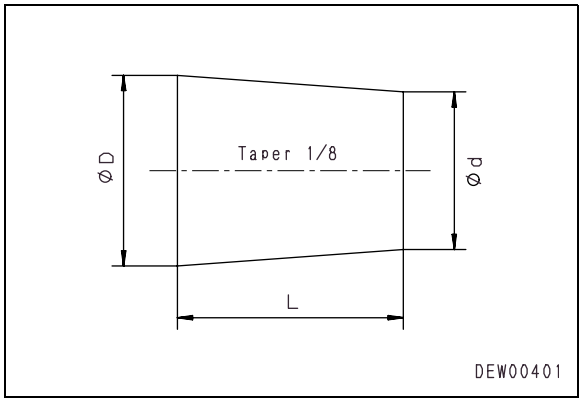
Nominal number	Plug (nut end)	Nut (elbow end)
02	07376-70210	02789-00210
03	07376-70315	02789-00315
04	07376-70422	02789-00422
05	07376-70522	02789-00522
06	07376-70628	02789-00628

2) Split flange type hoses and tubes

Nominal number	Flange (hose end)	Sleeve head (tube end)	Split flange
04	07379-00400	07378-10400	07371-30400
05	07379-00500	07378-10500	07371-30500

3) If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Part Number	Dimensions (mm)		
		D	d	L
06	07049-00608	6	5	8
08	07049-00811	8	6.5	11
10	07049-01012	10	8.5	12
12	07049-01215	12	10	15
14	07049-01418	14	11.5	18
16	07049-01620	16	13.5	20
18	07049-01822	18	15	22
20	07049-02025	20	17	25
22	07049-02228	22	18.5	28
24	07049-02430	24	20	30
27	07049-02734	27	22.5	34



2. Precautions when carrying out installation work

- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
- Install the hoses without twisting or interference.
- Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- Bend the cotter pins and lock plates securely.
- When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2 – 3 drops of adhesive.
- When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- Clean all parts, and correct any damage, dents, burrs, or rust.
- Coat rotating parts and sliding parts with engine oil.
- When press fitting parts, coat the surface with anti-friction compound (LM-P).
- After fitting snap rings, check that the snap ring is fitted securely in the ring groove.
- When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
- When using eyebolts, check that there is no deformation or deterioration, screw them in fully, and align the direction of the hook.
- When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.

★ When operating the hydraulic cylinders for the first time after reassembling cylinders, pumps and other hydraulic equipment removed for repair, always bleed the air as follows:

1) Start the engine and run at low idling.
2) Operate the work equipment control lever to operate the hydraulic cylinder 4 – 5 times, stopping the cylinder 100 mm from the end of its stroke.
3) Next, operate the hydraulic cylinder 3 – 4 times to the end of its stroke.

★ When using the machine for the first time after repair or long storage, follow the same procedure.

SPECIAL TOOL LIST

★ Tools with part number 79○T-○○○-○○○○ cannot be supplied (they are items to be locally manufactured).
★ Necessity: ■: Cannot be substituted, should always be installed (used).
●: Extremely useful if available, can be substituted with commercially available part.
★ New/remodel: N: Tools with new part numbers, newly developed for this model.
R: Tools with upgraded part numbers, remodeled from items already available for other models.
Blank: Tools already available for other models, used without any modification.
★ Tools marked ○ in the Sketch column are tools introduced in special sketches (See SKETCHES OF SPECIAL TOOLS).

Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks
Fuel injection pump assembly	A	1	795-799-1131	Gear	■	1			Removal, installation of fuel injection pump
		2	795-799-1390	Remover	■	1			
Nozzle holder assembly		3	795-799-1171	Puller	●	1			Removal of nozzle holder assembly
Cylinder head assembly		4	790-331-1110	Wrench	■	1			Tightening of cylinder head bolt
Transfer assembly and parking brake assembly	D	1	790-201-2840	Spacer	■	1			Press fitting of output shaft bearing
		2	793T-417-1110	Push tool	■	1	N	○	
		3	790-101-5201	Push tool kit	■	1			Press fitting of parking brake case oil seal
			• 790-101-5311	• Plate		1			
			• 790-101-5221	• Grip		1			
			• 01010-51225	• Bolt		1			
		4	793T-417-1120	Push tool	■	1	N	○	Press fitting of parking brake case dust seal
			790-101-5221	Grip	■	1			
			01010-81225	Bolt	■	1			
		5	799-301-1500	Oil leak tester	■	1			
		6	799-401-3200	Adapter	●	1			Removal, installation of parking brake cylinder rod pin
		7	02789-00315	Cap	●	1			
		8	799-101-5160	Nipple	●	1			
		9	790-190-1500	Pump	●	1			
Axle housing assembly	H	1	793T-623-1170	Push tool	■	1		○	Press fitting of axle shaft bearing inner race
			793T-422-1440	Push tool	■	1	N	○	
		2	793T-422-1410	Seal support	■	2	N	○	Axle shaft oil seal support
			01010-80860	Bolt	■	6			
			793T-422-1420	Seal support	■	2	N	○	
			01010-80860	Bolt	■	6			
		3	793T-659-1110	Push tool	■	1		○	Press fitting of axle shaft bearing inner race
			790-201-2750	Spacer	■	1			
		4	793T-422-1430	Holder	■	1	N	○	Adjustment of axle shaft bearing shim

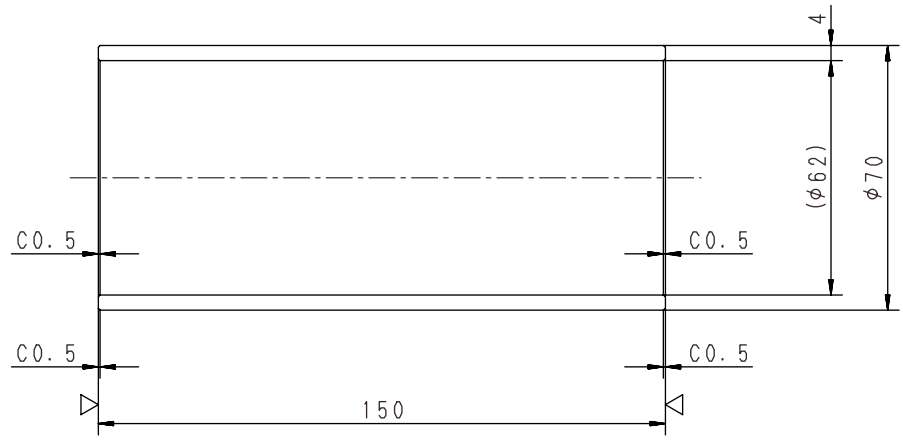
Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks
Differential assembly	H	5	799-301-1500	Oil leak tester	■	1			Check of operation of clutch piston
		6	797-101-1211	Wrench	■	1			Removal, installation of pinion shaft nut
		7	793-615-1100	Wrench	■	1			No-load operating torque of anti-slip differential
		8	790-201-2840	Push tool	■	1			Press fitting of pinion shaft bearing
		9	797T-423-1320	Push tool	■	1		○	
		10	797T-423-1130	Push tool	■	1		○	Press fitting of pinion shaft cage oil seal
		11	793-520-2202	Installer	●	3			Installation of brake piston and check for brake oil leakage
		13	790-190-1500	Pump assembly	■	1			Check for brake oil leakage
		14	799-401-3100	Adapter	■	1			Check for brake oil leakage
		15	0289-0-00210	Cap nut	■	1			Check for brake oil leakage
		16	799-101-5160	Nipple	■	1			Check for brake oil leakage
Hydraulic cylinder assembly	U	1	790-502-1003	Repair stand	■	1			Disassembly, assembly of hydraulic cylinder
			790-101-1102	Hydraulic pump	■	1			
		2	790-102-2303 or 790-102-3802	Wrench assembly (for steering)	■	1			Removal, installation of cylinder head
		3	790-302-1340	Socket (for boom)	■	1			Removal, installation of piston nut
		4	790-201-1702	Push tool kit	■	1			Press fitting of cylinder head bushing
			790-101-5021	• Grip		1			
			01010-50816	• Bolt		1			
			790-201-1821	• Push tool (boom)		1			
			790-201-1831	• Push tool (bucket)		1			
			790-201-1741	• Push tool (steering)		1			
		5	790-201-1500	Push tool kit	■	1			Installation of dust seal
			790-101-5021	• Grip		1			
			01010-50816	• Bolt		1			
			790-201-1630	• Plate (boom)		1			
			790-201-1640	• Plate (bucket)		1			
			790-201-1550	• Push tool (steering)		1			
		6	790-720-1000	Expander	●	1			Installation of piston ring

Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks
Hydraulic cylinder assembly	U	7	796-720-1680	Ring (boom and bucket)	●	1			
			07281-01589	Ring (boom and bucket)	●	1			
			796-720-1740	Ring (steering)	●	1			
			07281-00809	Ring (steering)	●	1			
		8	790-102-4300	Wrench assembly (for boom and bucket)	■	1			
			790-102-4310	Pin	■	2			
Installation of operator's cab glass	X	1	799-703-1200	Service tool kit	■	2			Collection and supply of air conditioner refrigerant
			799-703-1100	Vacuum pump (100 V)	■	1			
			799-703-1110	Vacuum pump (220 V)	■	1			
			799-703-1120	Vacuum pump (240 V)	■	1			
			799-703-1400	Gas leak tester	■	1			
		2-1	793-498-1120	Clear plate	■	2			Adjustment of clearance of window glass
		2-2	793-498-1130	Plate	■	2			
		2-3	793-498-1110	Magnet	■	2			
		3	793-498-1210	Lifter (Suction cup)	■	2			Removal, installation of window glass

SKETCH OF SPECIAL TOOLS

Note) We will not be liable for any result of use of special tools manufactured according to the following drawings.

D2 Push tool

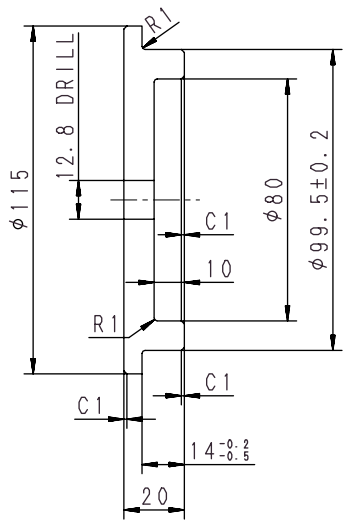


9JF00891

HEAT TREATMENT	MATERIAL
----	STKM13A
PART NAME	Q'TY
PUSH TOOL	1
793T-417-1110 △	

Numerical values and units within curly brackets are for reference

D4 Push tool



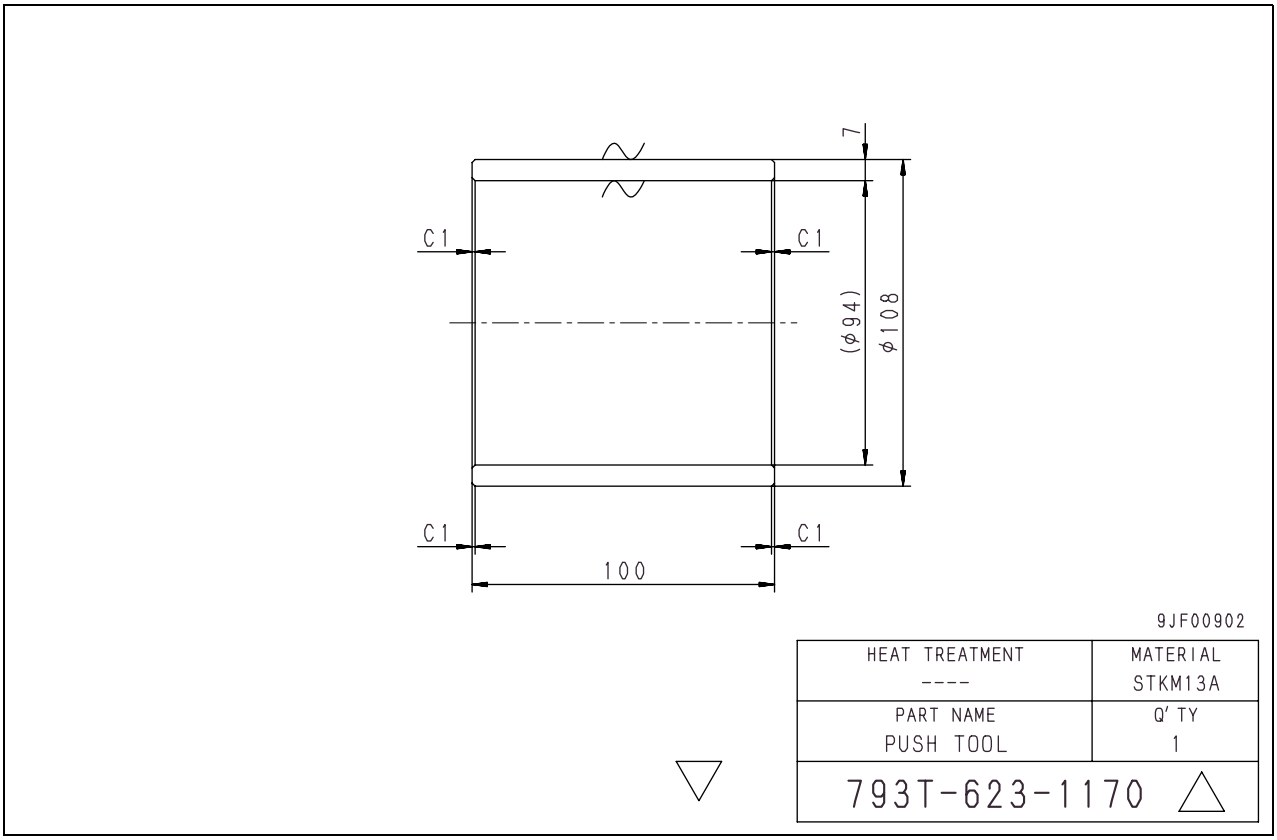
9JF00892

HEAT TREATMENT	MATERIAL
----	SS400
PART NAME	Q'TY
PUSH TOOL	1
793T-417-1120 △	

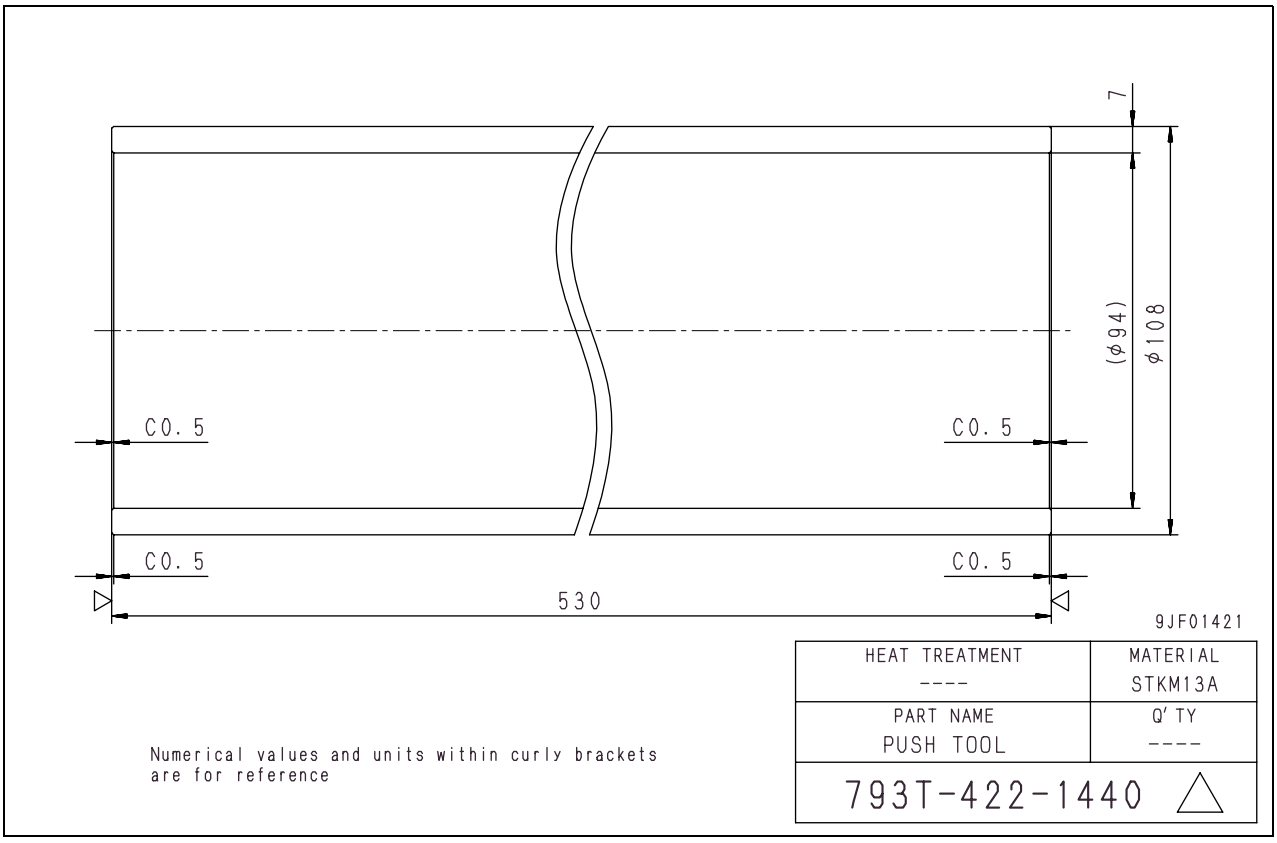
Numerical values and units within curly brackets are for reference ▽

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

H1-1 Push tool ★When using this tool, connect H1-2 to it.

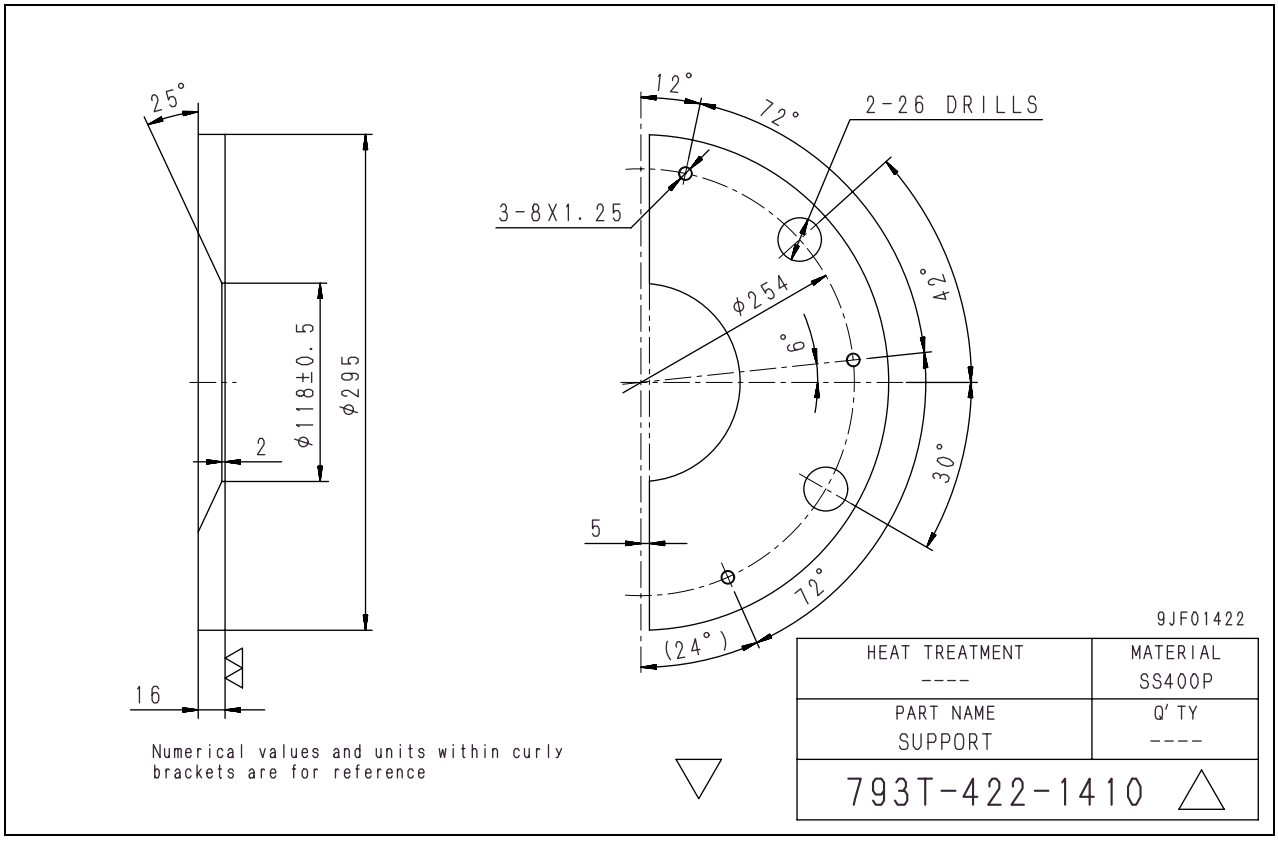


H1-2 Push tool ★When using this tool, connect H1-1 to it.

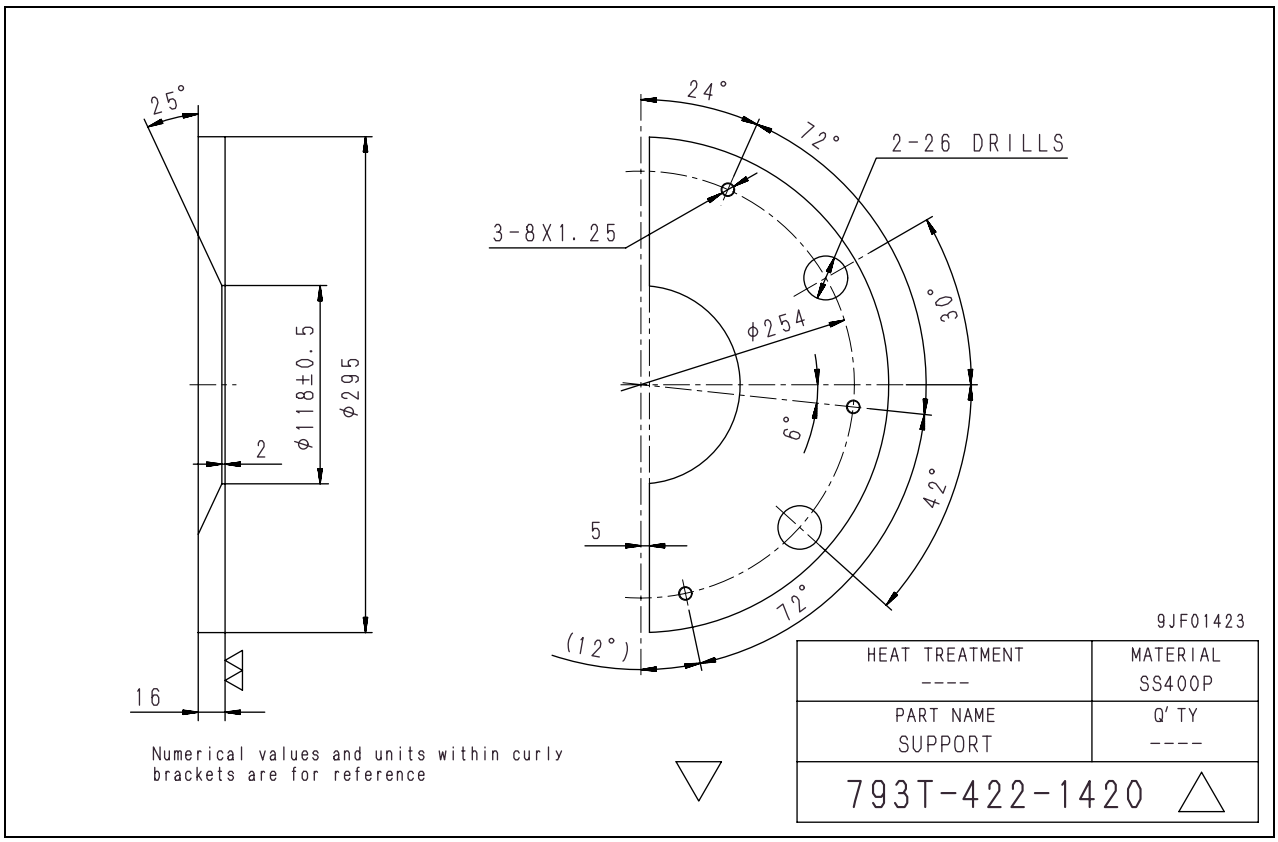


Note: Komatsu cannot accept any responsibility for special tools manufactured according to these skeches.

H2 Seal support

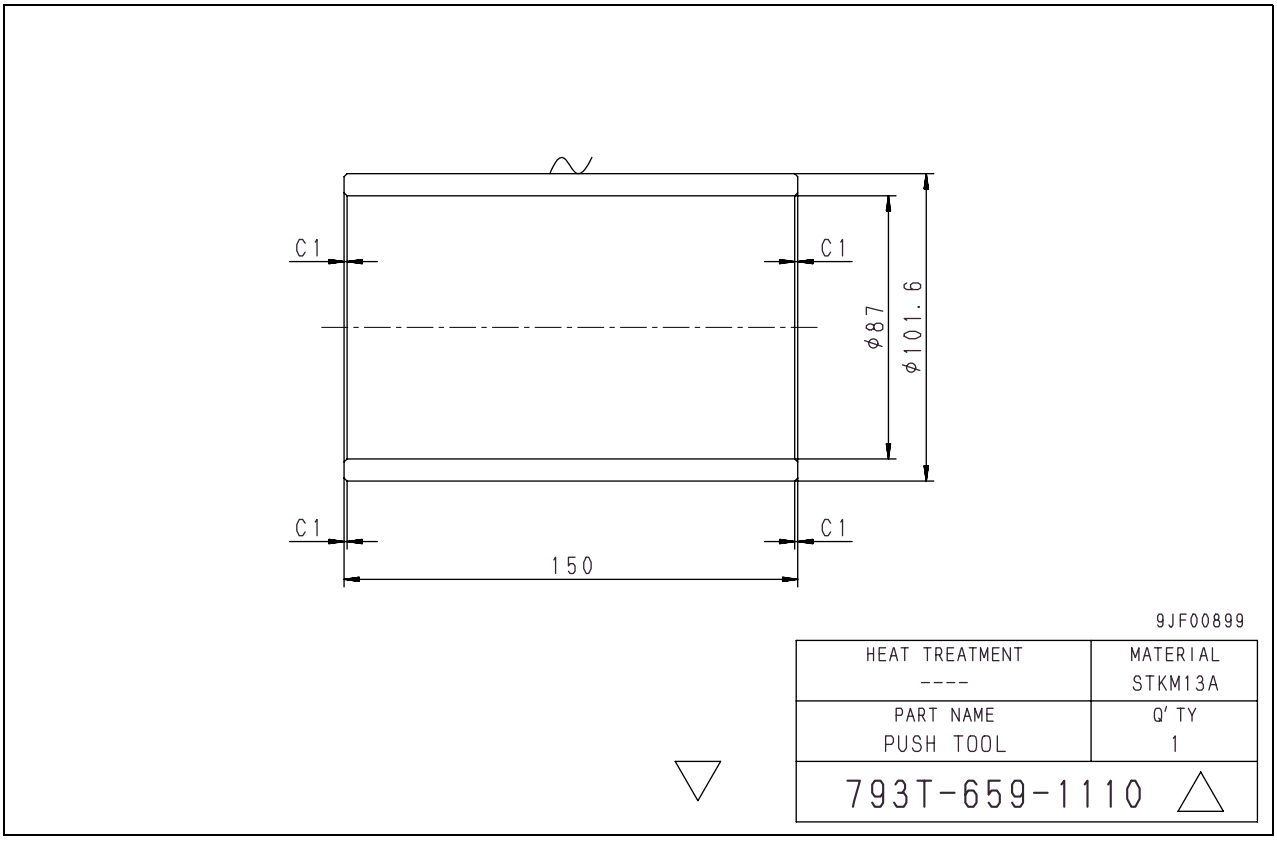


H2 Seal support

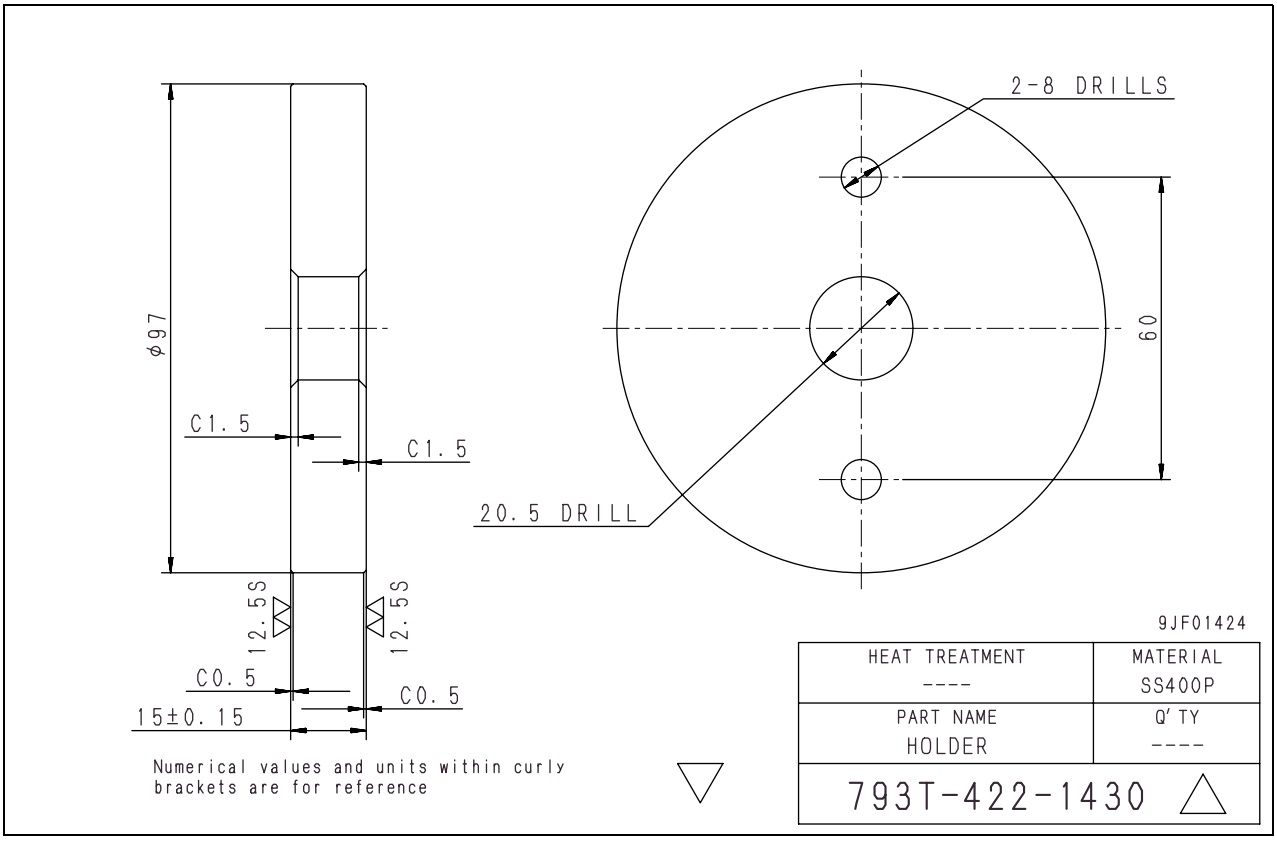


Note: Komatsu cannot accept any responsibility for special tools manufactured according to these skeches.

H3 Push tool

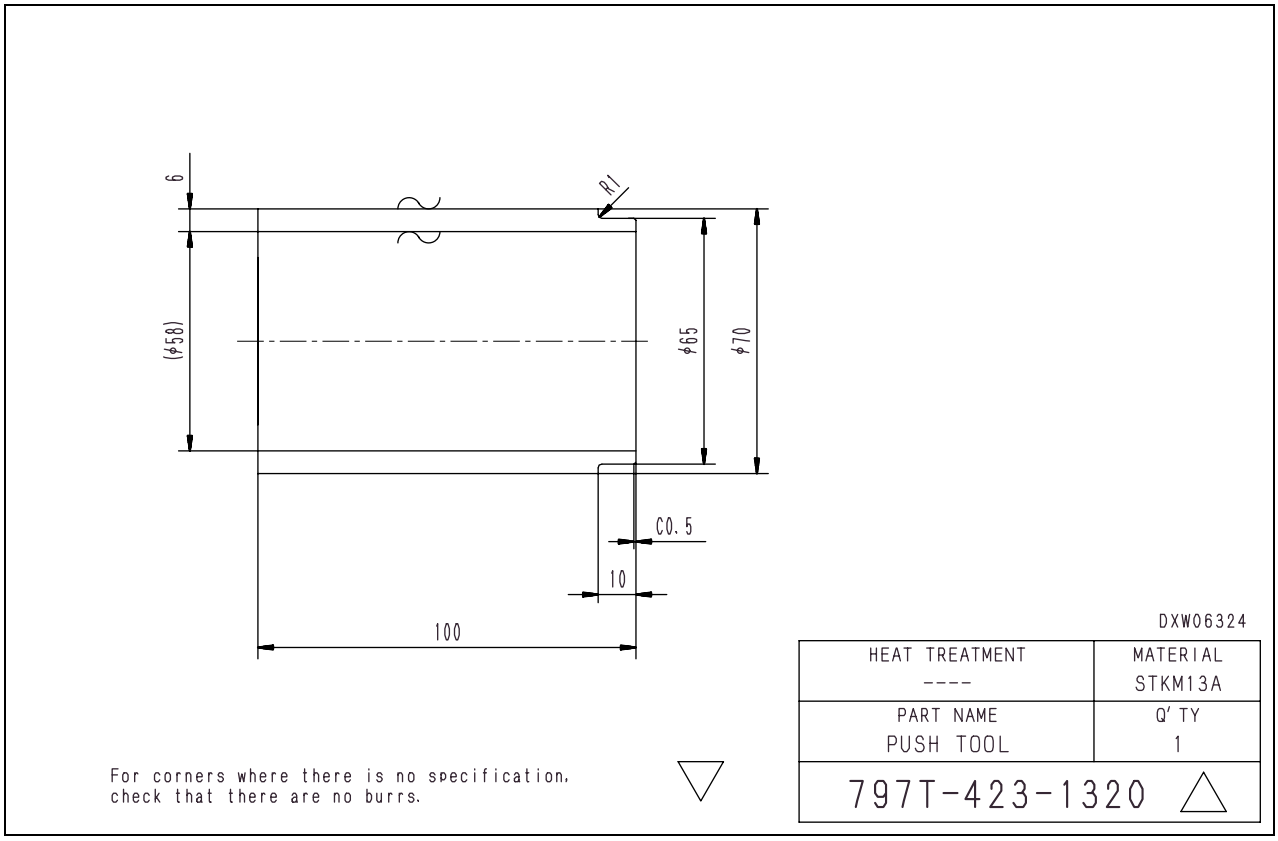


H4 Holder

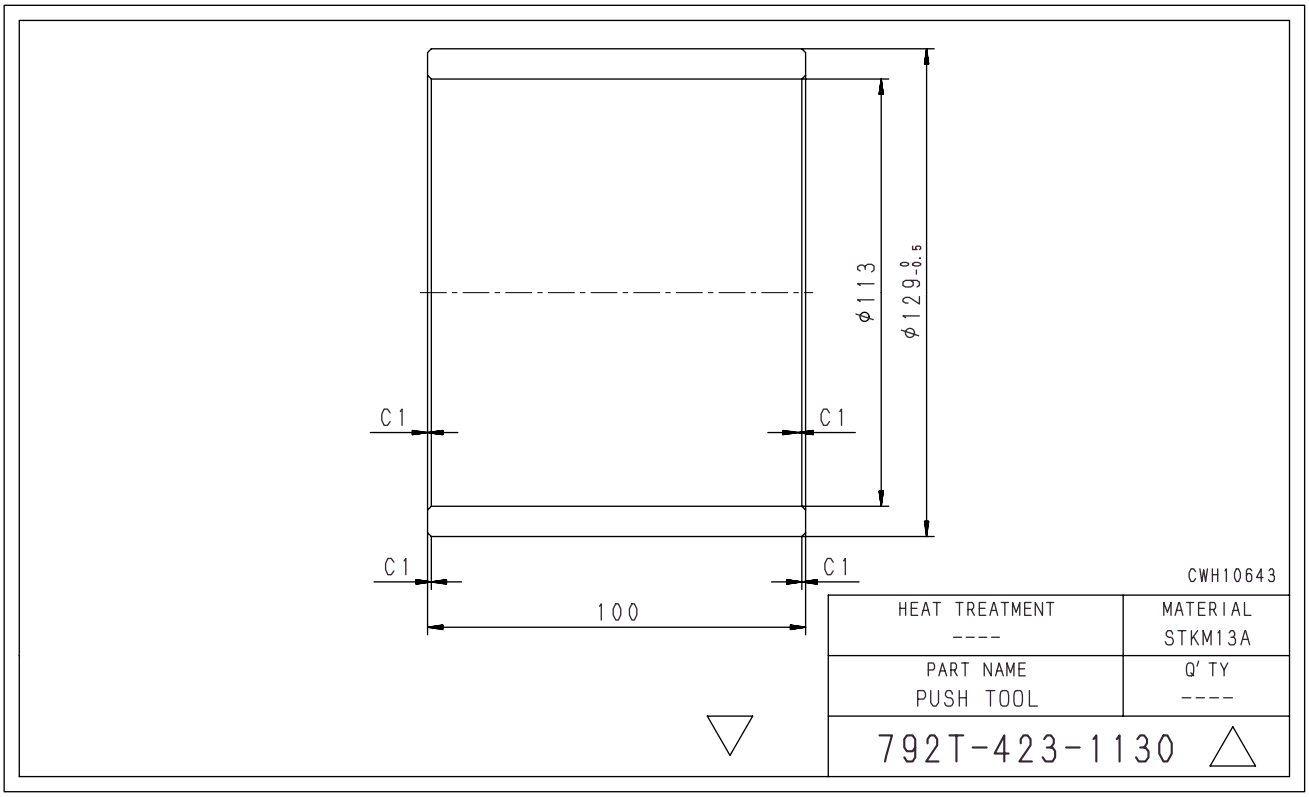


Note: Komatsu cannot accept any responsibility for special tools manufactured according to these skeches.

H9 Push tool



H10 Push tool



REMOVAL, INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY

SPECIAL TOOLS

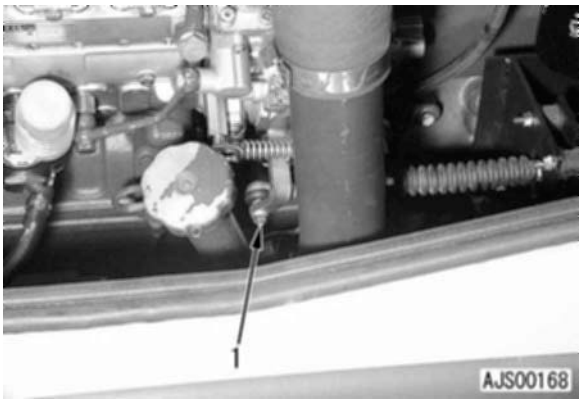
Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
A	1	795-799-1131	Gear	■	1		
	2	795-799-1390	Remover	■	1		

REMOVAL

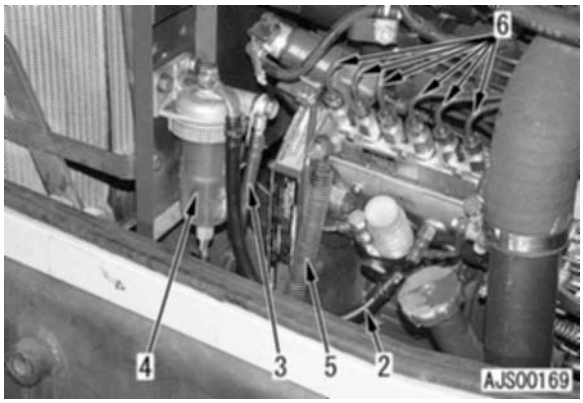
Lower the work equipment to the ground and stop the engine.

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

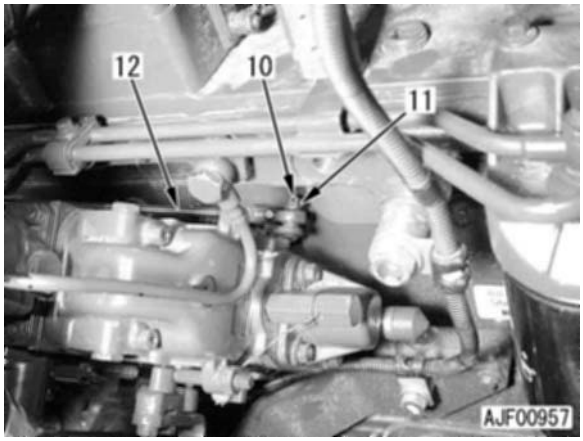
1. Open the engine right side cover.
2. Remove fuel control cable mounting nut (1) and disconnect the fuel control cable from the fuel injection pump. [*1]



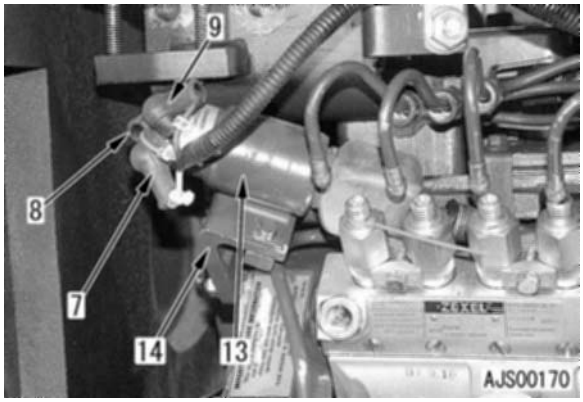
3. Disconnect fuel supply hoses (2) and (3).
4. Disconnect fuel filter (4).
5. Disconnect fuel return hose (5).
6. Remove 6 fuel injection tubes (6). [*2]



7. Remove cotter pin (10) and nut (11), and then remove engine stop solenoid rod (12) from the fuel injection pump.

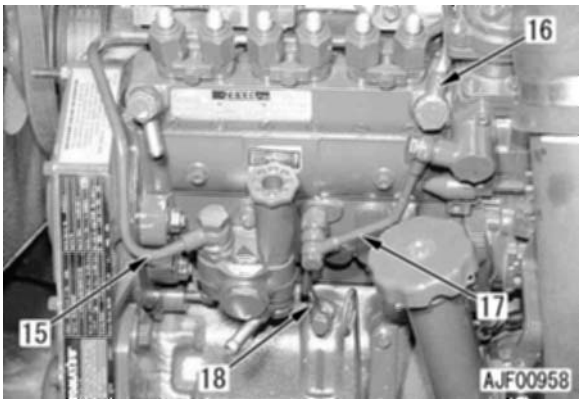


8. Disconnect engine stop solenoid terminals PULL (7), HOLD (8), and GND (9). [*3]
9. Remove engine stop solenoid (13) and bracket (14) together. [*4]

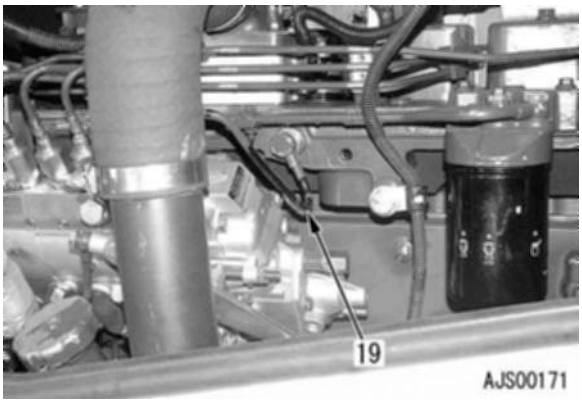


10. Remove fuel tubes (15) and (16). [*5]

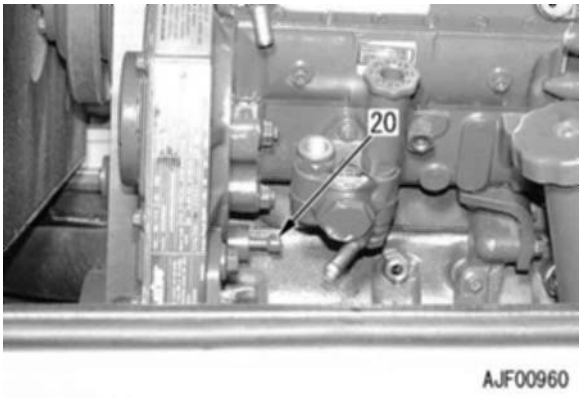
11. Remove lubrication tubes (17) and (18).



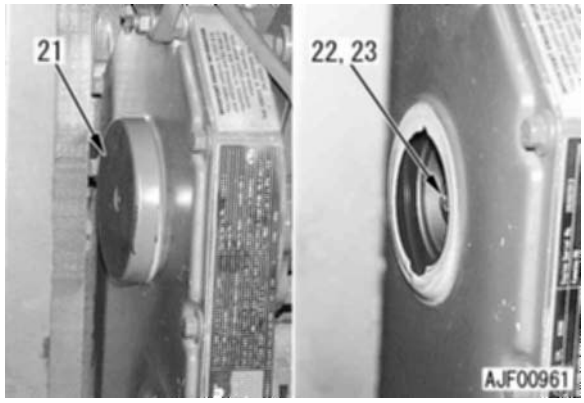
12. Remove boost compensator tube (19).



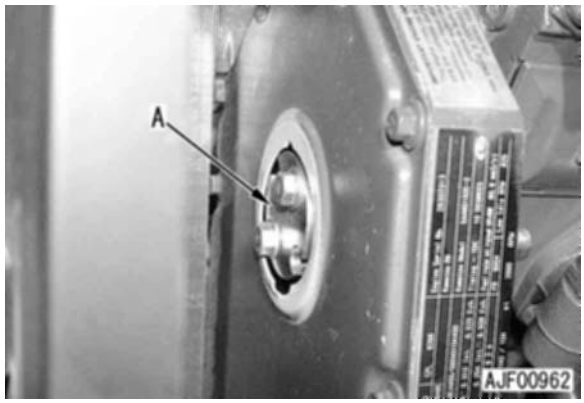
13. Using timing pin (20), match the timing gear to the fuel injection timing.
    Gear: Use tool A1.
    ★ For details, see TESTING AND ADJUSTING, Testing and adjusting fuel injection timing.



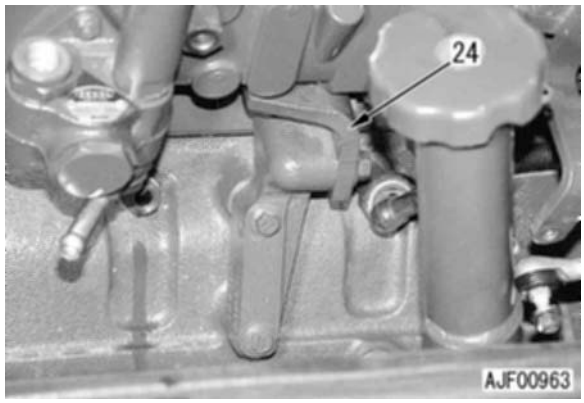
14. Remove cap (21).
    ★ Use a filter wrench, etc. to remove the cap.
15. Remove fuel injection pump nut (22) and washer (23).
    ★ Take care not to drop the nut and washer into the case.



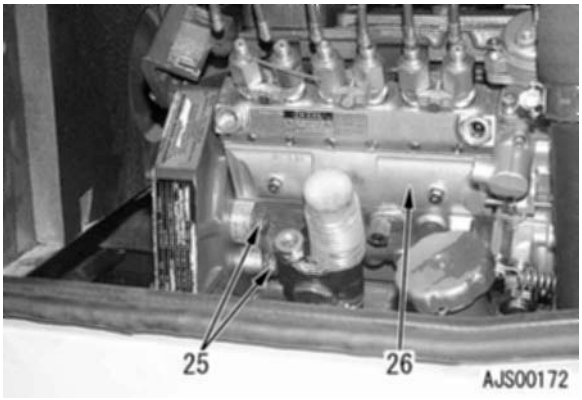
16. Using tool **A2**, disconnect the fuel injection pump shaft and pump drive gear.



17. Remove fuel injection pump bracket (24).



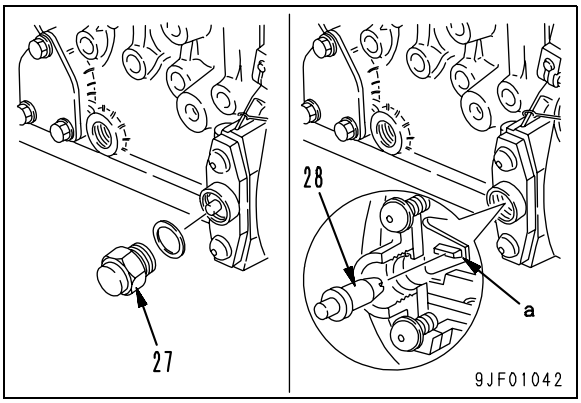
18. Remove 4 fuel injection pump mounting nuts (25) and fuel injection pump assembly (26).



INSTALLATION

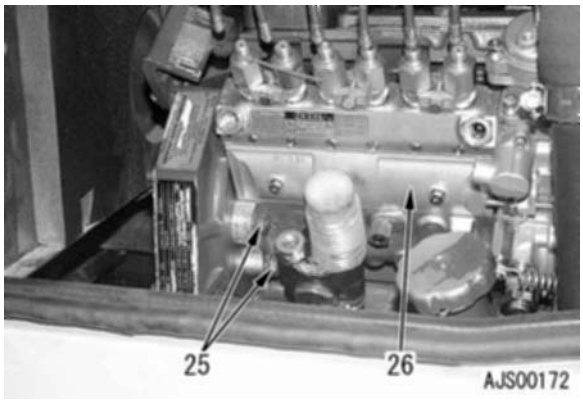
★ Install the fuel injection pump assembly according to the following procedure.

1. Check that the timing pin is matched to the injection timing.
   ★ For details, see TESTING AND ADJUSTING, Testing and adjusting fuel injection timing.
   ★ See step 13 of the removal procedure.
2. Remove plug (27) and turn over timing pin (28) of the fuel injection pump, and then install them to the fuel injection pump again.
   ★ Check that the cut of the pin is meshed with projection (a) in the pump.



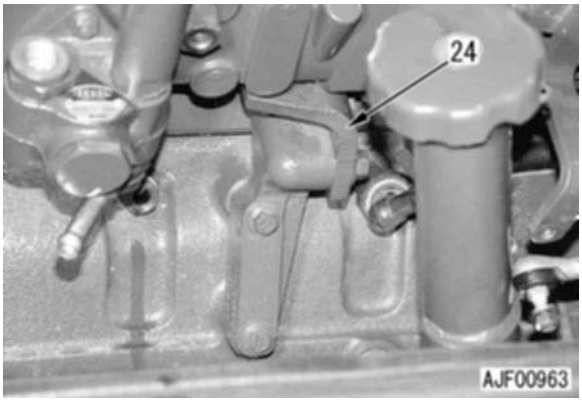
3. Install fuel injection pump assembly (26) and tighten 4 nuts (25).

Fuel injection pump mounting nut: **9.8 ± 2 Nm {1.0 ± 0.2 kgm}**



4. Install fuel injection pump bracket (24).

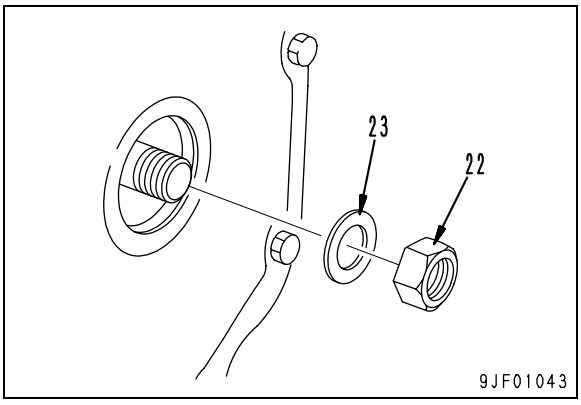
   Fuel injection pump bracket mounting bolt (on injection pump side): **22 ± 2 Nm {2.2 ± 0.2 kgm}**



5. Install washer (23) and tighten fuel injection pump nut (22) temporarily.
   ★ Take care not to drop the nut and washer into the case.

   Tighten the nut to the following torque temporarily so that it will not damage the timing pin.

   Temporary tightening torque of fuel injection pump nut: **12.5 ± 2.5 Nm {1.27 ± 0.25 kgm}**



6. Disengage the timing pin of the fuel injection pump on the timing gear side from projection (a) and return it to the original position.
7. Tighten fuel injection pump nut (22) permanently.

   Permanent tightening torque of fuel injection pump nut: **95 ± 10 Nm {9.7 ± 1.01 kgm}**

★ After the above step, carry out installation in the reverse order to REMOVAL, 1 - 14.

[*1]
★ Adjust the fuel control cable. For details, see TESTING AND ADJUSTING, Measuring, testing operating force of accelerator pedal.

[*2]

Fuel injection tube nut (on injection pump side): **24 ± 4 Nm {2.45 ± 0.41 kgm}**
Fuel injection tube nut (on nozzle holder side): **30 ± 5 Nm {3.06 ± 0.51 kgm}**

[*3]

Engine stop solenoid terminal: **0.98 - 1.27 Nm {0.1 - 0.13 kgm}**

★ Set the cap sideways so that water will not collect.

[*4]

Engine stop solenoid bracket mounting nut: **14 - 21 Nm {1.4 - 2.1 kgm}**

★ Adjust the engine stop solenoid. For details, see TESTING AND ADJUSTING, Adjusting engine stop solenoid.

[*5]

Fuel tube joint bolt (on fuel filter side): **19.6 - 29.4 Nm {2.0 - 3.0 kgm}**

- **Bleeding air**
  Bleed air from the fuel system.

REMOVAL, INSTALLATION OF NOZZLE HOLDER ASSEMBLY

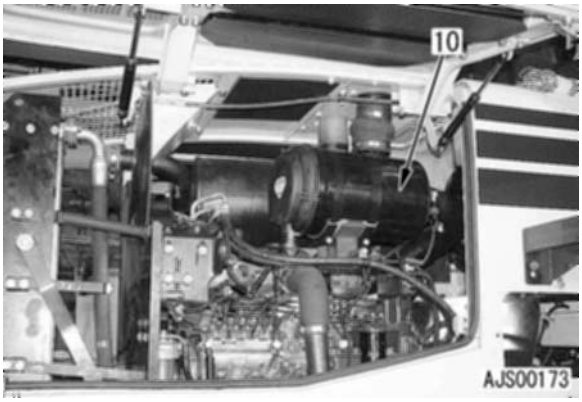
SPECIAL TOOLS

Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
A	3	795-799-1171	Puller	■	1		

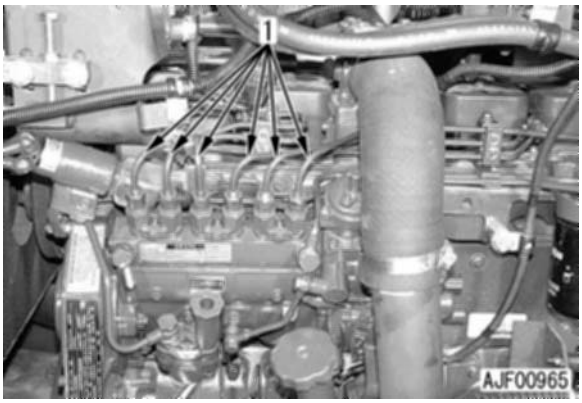
REMOVAL

Lower the work equipment to the ground and stop the engine.

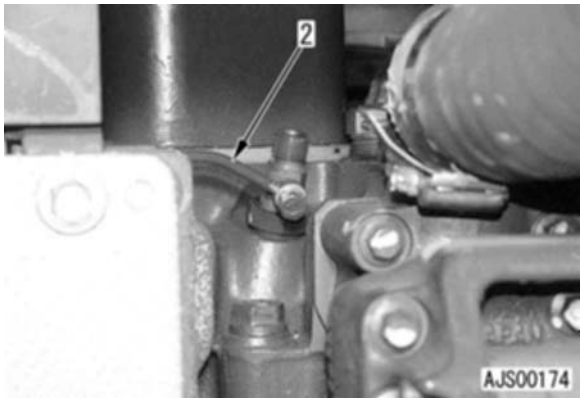
1. Open the engine right and left side covers.
2. Remove air cleaner (10).



3. Remove fuel injection tubes (1). [*1]

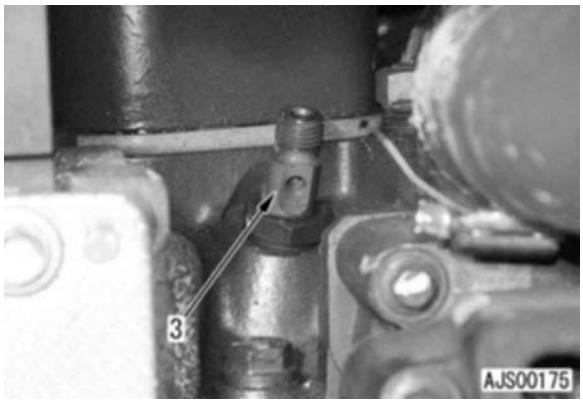


4. Remove spill tube (2). [*2]

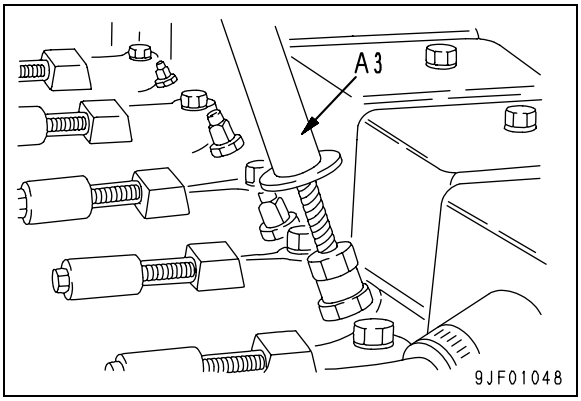


5. Loosen and remove nozzle holder assembly (3). [*3]

★ Take care that dirt and foreign matter will not enter the mounting part of the nozzle holder assembly



★ If the nozzle holder is difficult to remove, use tool **A3**.



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Fuel injection tube nut (on injection pump side): **24 ± 4 Nm {2.45 ± 0.41 kgm}**
Fuel injection tube nut (on nozzle holder side): **30 ± 5 Nm {3.06 ± 0.51 kgm}**

[*2]

Spill tube joint bolt: **9 Nm {0.9 kgm}**

[*3]

Nozzle holder:
60 Nm ± 9 Nm {6.1 ± 0.9 kgm}

- **Bleeding air**
  Bleed air from the fuel system.

REMOVAL, INSTALLATION OF CYLINDER HEAD ASSEMBLY

SPECIAL TOOLS

Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
A	3	795-799-1171	Puller	■	1		
	4	790-331-1110	Wrench	■	1		

REMOVAL

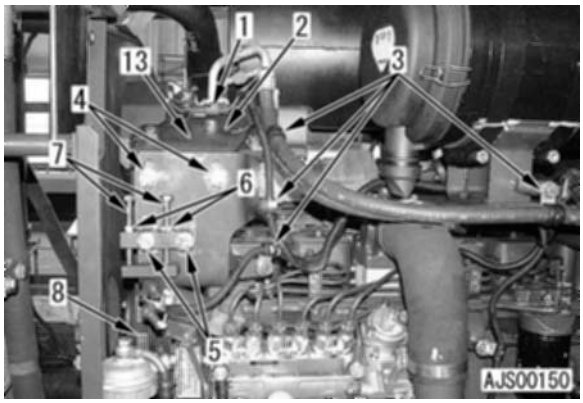
Stop the vehicle on a level place and set the safety bar to the frame.

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

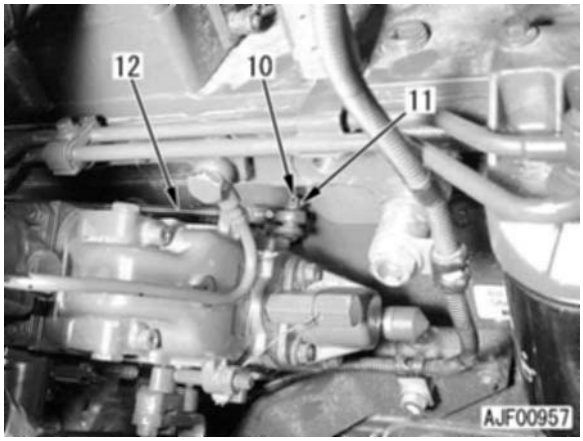
Disconnect the cable from the negative (-) terminal of the battery.

1. Remove the engine hood assembly. For details, see Removal, Installation of engine assembly.
2. Drain the coolant.

   Coolant: **17 ℓ**
3. Remove the air conditioner compressor according to the following procedure.
   1) Disconnect wiring connector E16 (1) and ground terminal E22 (2). [*1]
   2) Remove clamps (3) (4 pieces).
   3) Loosen 2 mounting bolts (4) and 2 mounting bolts (5).
   4) Loosen 2 locknuts (6) and 2 adjustment bolts (7).
   5) Remove air conditioner compressor belt (8). [*2]
   6) Remove 2 mounting bolts (4), 2 mounting bolts (5), and air conditioner compressor and bracket assembly (13).
      ★ Place the air conditioner piping by the side of the engine without disconnecting it.

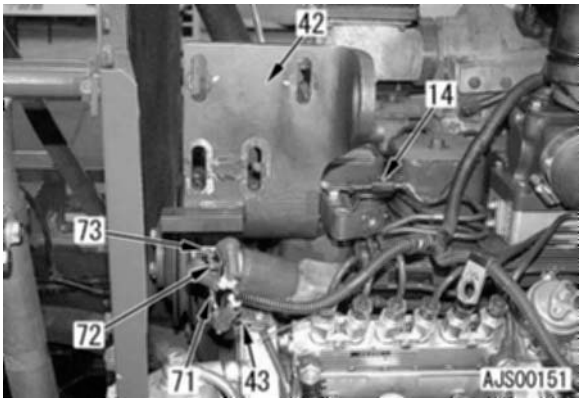


4. Remove cotter pin (10) and nut (11), and then remove engine stop solenoid rod (12) from the fuel injection pump.



5. Disconnect the following engine stop solenoid terminals and wiring connectors. [*3]
   ★ Disconnect the wiring harness clamps, too.
   - (71): PULL [*21]
   - (72): HOLD [*21]
   - (73): GND [*21]
   - (14): E14
6. Remove air compressor bracket (42).

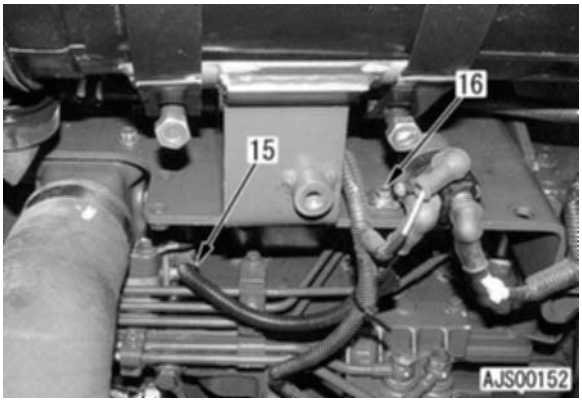
7. Remove engine stop solenoid bracket (43). [*4]



8. Disconnect intake air heater terminal.
   - (15): E09

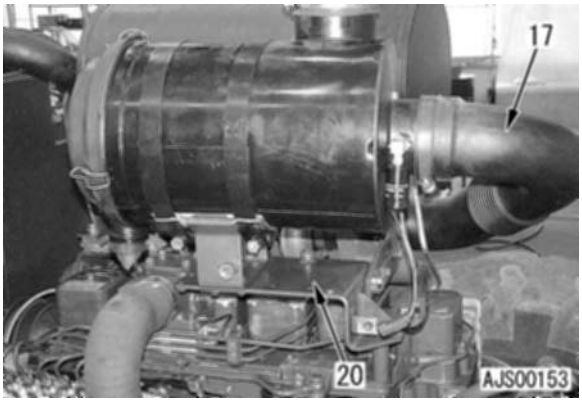
   [*5]

9. Remove the mounting bolts of heater relay (16).



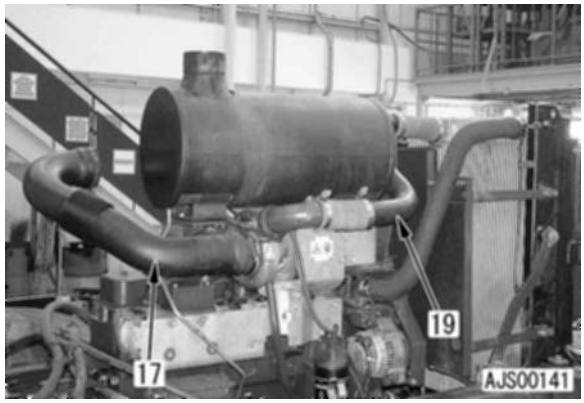
10. Disconnect air hose (17) between the air cleaner and turbocharger. [*6]

11. Remove air cleaner and bracket assembly (20).

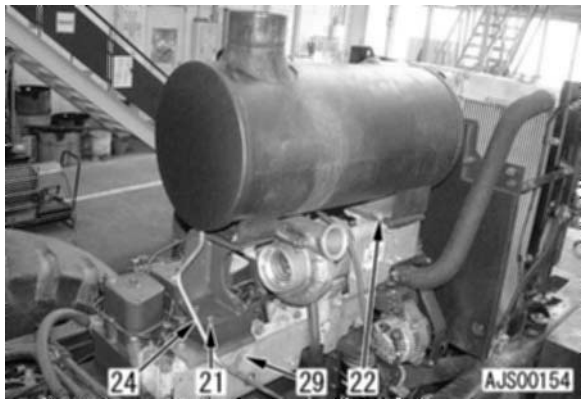


12. Remove hose (19) on the upper side of the after-cooler. [*7]

13. Remove air hose (17) between the air cleaner and turbocharger. [*6]



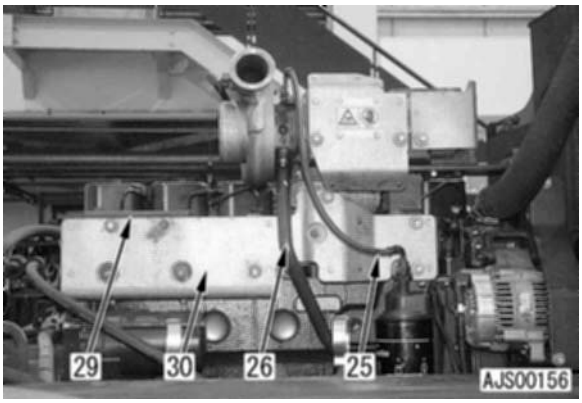
14. Remove the muffler according to the following procedure.
    1) Remove 4 mounting bolts (21).
    2) Remove 4 mounting bolts (22).
    3) Remove drain tube mounting bolt (29) and drain tube (24).



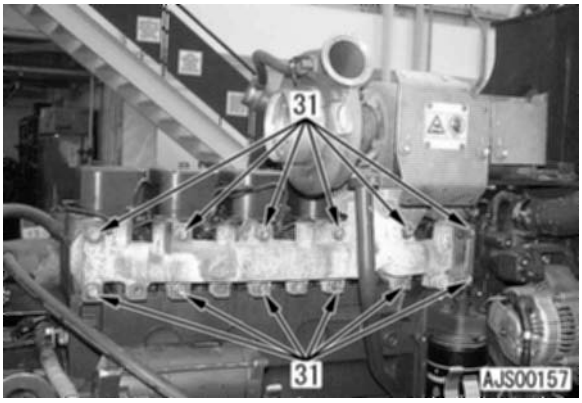
15. Lift off muffler and bracket assembly (23).

    Muffler and bracket assembly: **35 kg**

16. Remove the turbocharger and exhaust manifold assembly according to the following procedure.
    1) Disconnect turbocharger lubrication tubes (25) and (26). [*8]
    2) Remove exhaust manifold heat insulation cover (30). [At this time, bracket (29) comes off, too.]

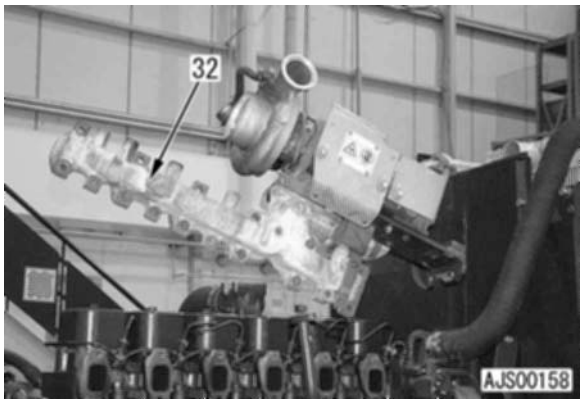


17. Remove mounting bolts (31) of the turbocharger and exhaust manifold assembly (12 pieces). [*9]



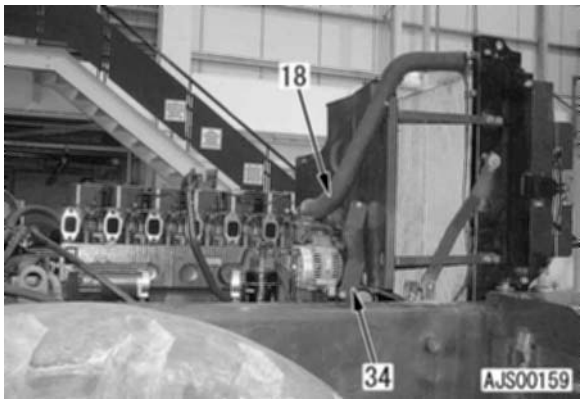
    1) Lift off turbocharger and exhaust manifold assembly (32).

    Turbocharger and exhaust manifold assembly: **40 kg**



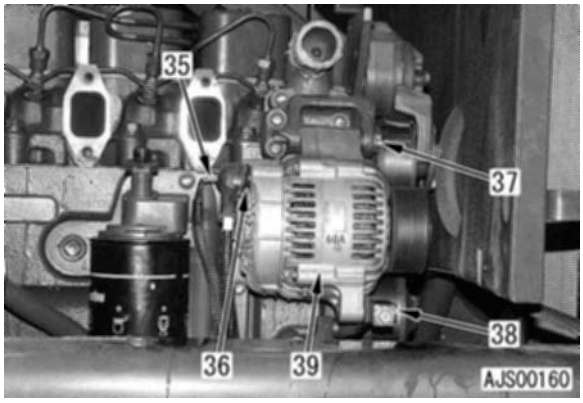
18. Remove alternator belt cover (34) and alternator belt.

19. Disconnect radiator inlet hose (18). [*10]

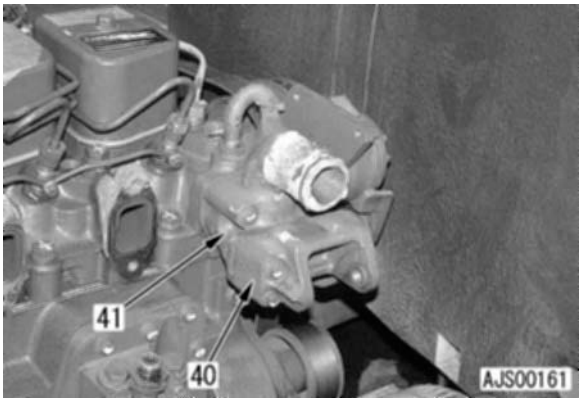


20. Disconnect wiring connector E02 (35) and alternator terminal E11 (36). [*11]

21. Remove mounting bolts (37) and (38) and alternator (39).

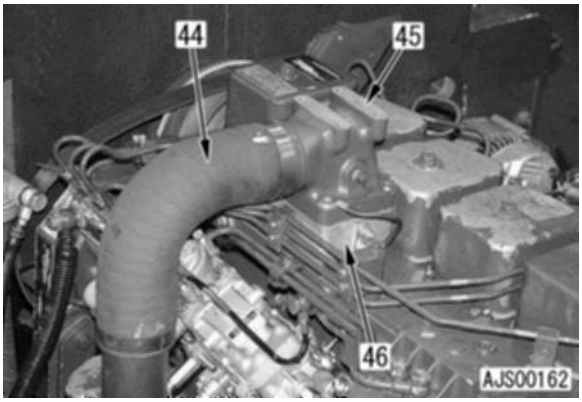


22. Remove alternator bracket (40) and thermostat and housing assembly (41) together. [*12]



23. Remove air hose (44). [*13]

24. Remove air intake connector (45) and heater (46).

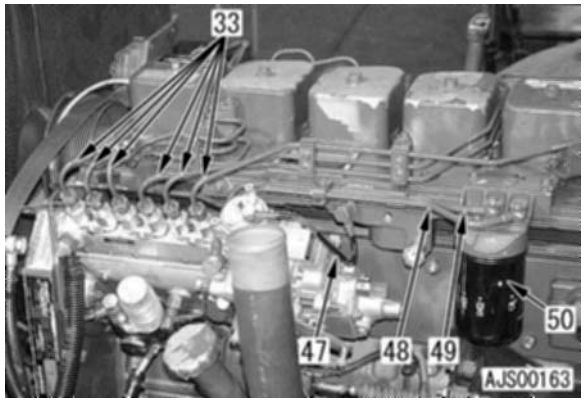


25. Remove boost compensator tube (47).

26. Remove fuel tubes (48) and (49).

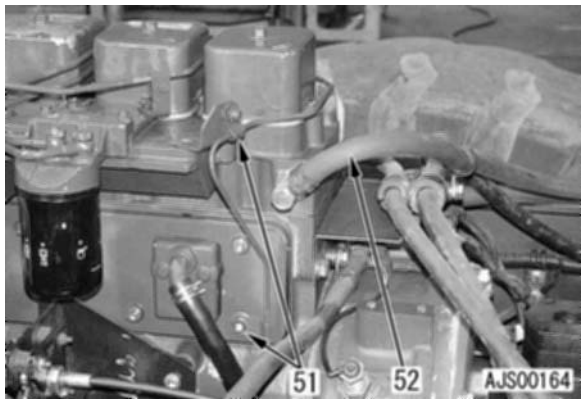
27. Remove fuel filter (50).

28. Disconnect 6 fuel injection tubes (33). [*14]



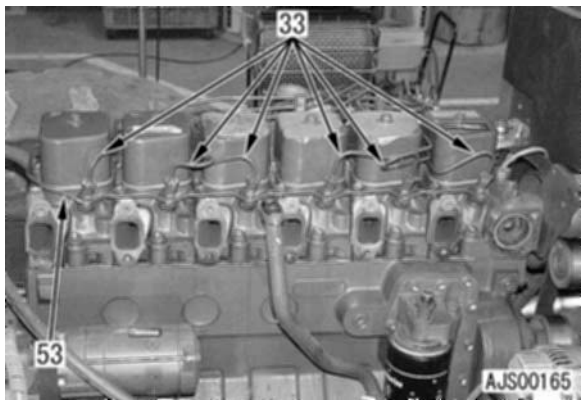
29. Remove spill tube clamp (51).

30. Disconnect heater hose (52).



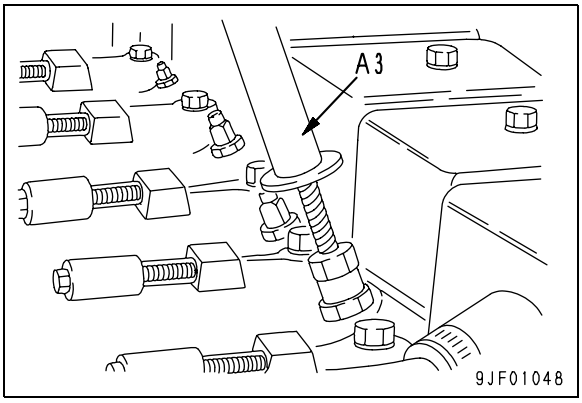
31. Remove 6 fuel injection tubes (33). [*14]

32. Remove spill tube (53). [*15]

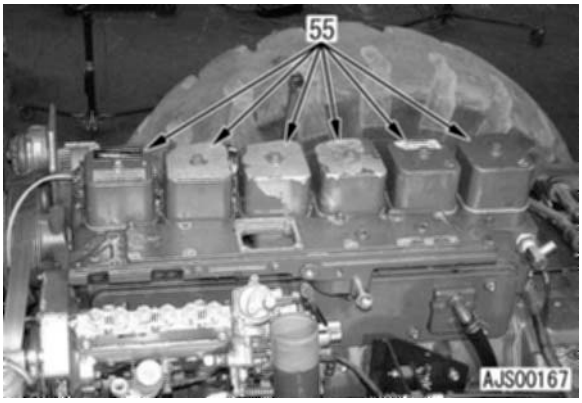


33. Remove 6 nozzle holders (54). [*16]

★ If the nozzle holder is difficult to remove, use tool **A3**.

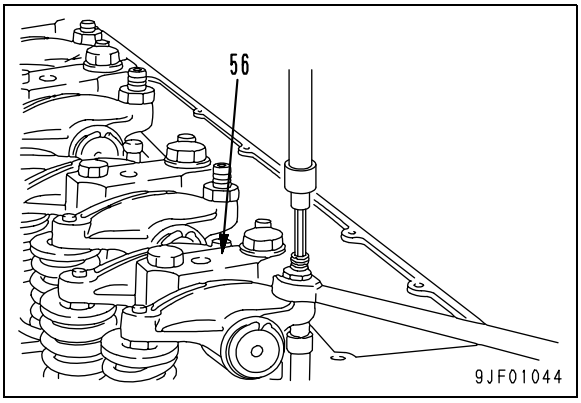


34. Remove 6 cylinder head covers (55). [*17]

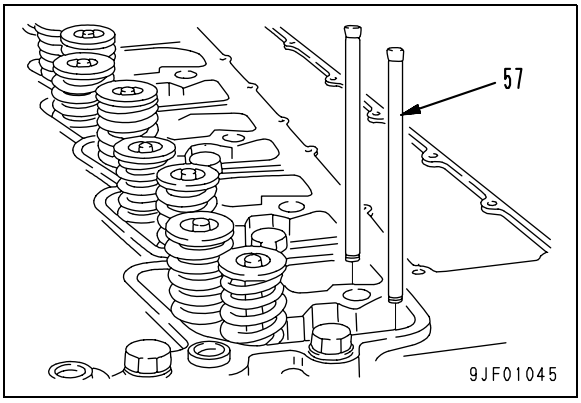


35. Remove rocker arm (56). [*18]

★ Loosen the locknut, and then loosen adjustment screw by 2 - 3 turns.



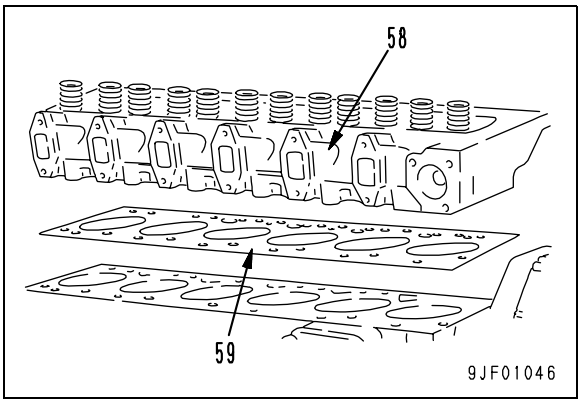
36. Remove push rods (57). [*19]



37. Lift off cylinder head assembly (58). [*20]

Cylinder head assembly: **55 kg**

38. Remove cylinder head gasket (59). [*21]



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Ground terminal:
59 - 74 Nm {6 - 7.5 kgm}

[*2]

★ Adjust the tension of the air conditioner compressor belt. For details, see TESTING AND ADJUSTING, Testing and adjusting air conditioner compressor belt tension.

[*3]

Engine stop solenoid terminal:
0.98 - 1.27 Nm {0.1 - 0.13 kgm}

★ Set the cap sideways so that water will not collect.

[*4]

Engine stop solenoid bracket mounting nut: **14 - 21 Nm {1.4 - 2.1 kgm}**

[*5]

Intake air heater terminal:
2.45 - 2.94 Nm {0.25 - 0.3 kgm}

[*6]

Air hose clamp:
9.8 ± 0.5 Nm {1.0 ± 0.05 kgm}

[*7]

Aftercooler hose clamp:
10.5 + 0.5 Nm {107 ± 5 kgcm}

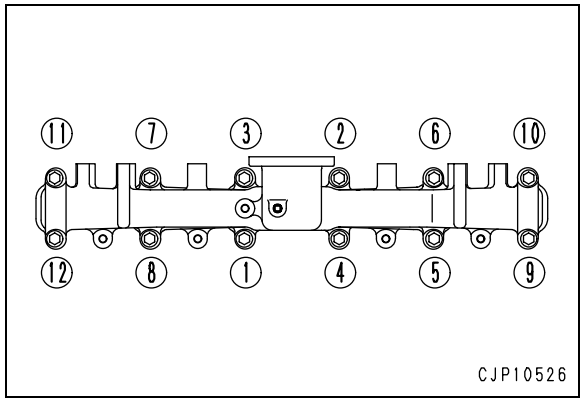
[*8]

Mounting nut of turbocharger lubrication tube (25): **35 ± 5 Nm {3.57 ± 0.51 kgm}**
Mounting bolt of turbocharger lubrication tube (26): **24 ± 4 Nm {2.45 ± 0.41 kgm}**

[*9]

★ Tighten the exhaust manifold mounting bolts in 3 times according to the following procedure.

Exhaust manifold mounting bolt:
1st time: Tighten the bolts to **24 ± 4 Nm {2.45 ± 0.41 kg}** in the order of 1 - 12.
2nd time: Tighten the bolts to **43 ± 6 Nm {4.38 ± 0.61 kg}** in the order of 1 - 12.
3rd time: Tighten the bolts to **43 ± 6 Nm {4.38 ± 0.61 kg}** again in the order of 1 - 4.



[*10]

Mating face of hose:
Gasket sealant (ThreeBond 1208E or equivalent)

Radiator hose clamp:
8.8 ± 0.5 Nm {90 ± 5 kgcm}

[*11]

Mounting torque of alternator terminal E11: **5.9 - 9.80 Nm {0.6 - 1.0 kgm}**

[*12]

Thermostat housing mounting bolt:
24 ± 4 Nm {2.45 ± 0.41 kgm}

[*13]

Air hose clamp:
8.8 ± 0.5 Nm {90 ± 5 kgcm}

[*14]

Fuel injection tube nut (on injection pump side): **24 ± 4 Nm {2.45 ± 0.41 kgm}**
Fuel injection tube nut (on nozzle holder side): **30 ± 5 Nm {3.06 ± 0.51 kgm}**

[*15]

Spill tube: **9 Nm {0.9 kgm}**

[*16]

Nozzle holder: **60 ± 9 Nm {6.12 ± 0.92 kgm}**

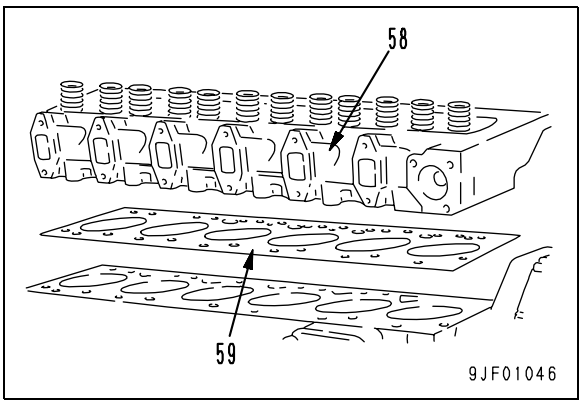
[*17]

Cylinder head cover mounting bolt: **24 ± 4 Nm {2.45 ± 0.41 kgm}**

[*18] [*19] [*20] [*21]

★ Install the rocker arm assembly and cylinder head assembly according to the following procedure.
★ Check that there is not dirt or foreign matter on the mounting face of the cylinder head or in the cylinder.

1. Set cylinder head gasket (59) to the cylinder block.
   ★ Check that the gasket is matched to the hole of the block.
2. Sling cylinder head assembly (58) and set it to the cylinder block.

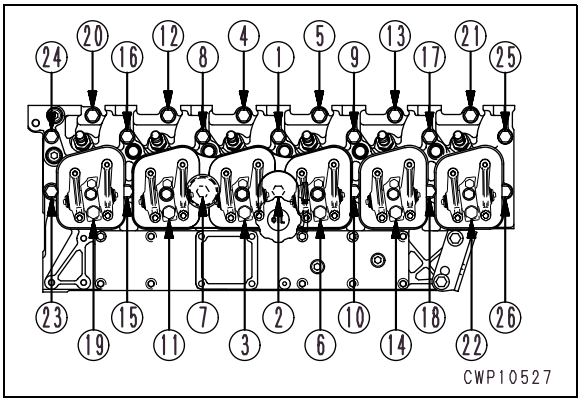


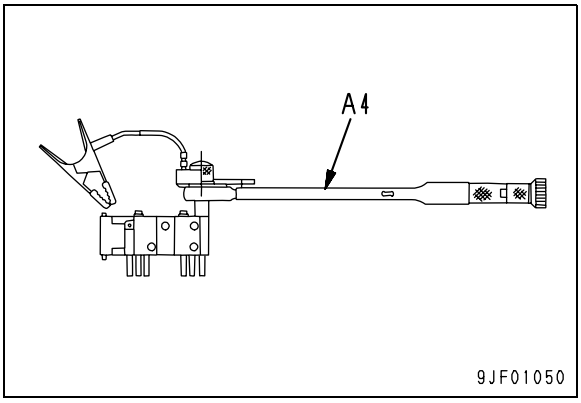
3. Tighten the cylinder head bolts in 3 times in the order shown in the following figure.

Threads and seat of mounting bolt: Engine oil

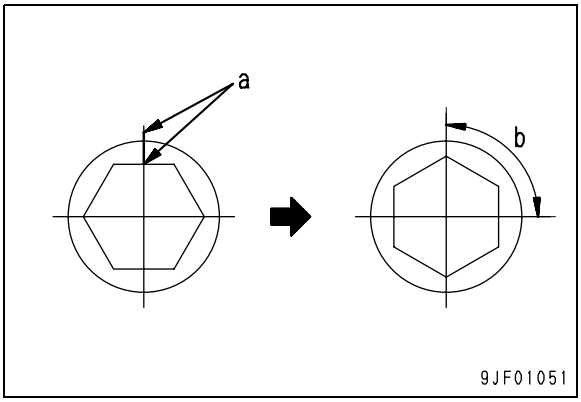
Cylinder head bolt:
1st time: Tighten the bolts to **90 ± 5 Nm {9.18 ± 0.51 kgm}** in the order of 1 - 26.
2nd time: Tighten the bolts to **120 ± 5 Nm {12.24 ± 0.51 kgm}** in the order of 3, 6, 11, 14, 19, and 22.
3rd time:

- When using tool **A4**:
  Using angle tightening wrench **A4**, tighten the bolts by **90° ± 5°** in the order of 1 - 26 (Angle tightening).

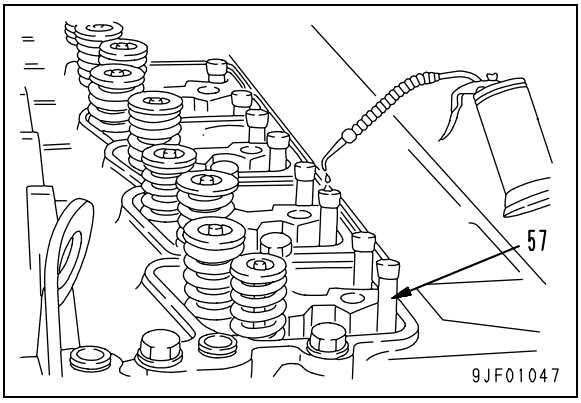




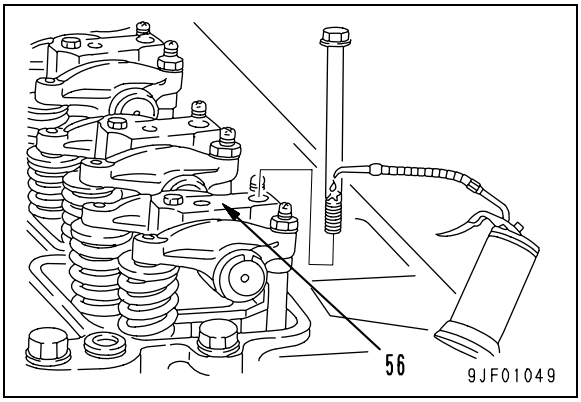
- When not using tool **A4**:
  Make marks on the bolts and cylinder as shown in (a), and then tighten each bolt by the angle of (b) (**90° ± 5°**).



4. Install push rods (57).
   ★ Apply engine oil to the push rod.

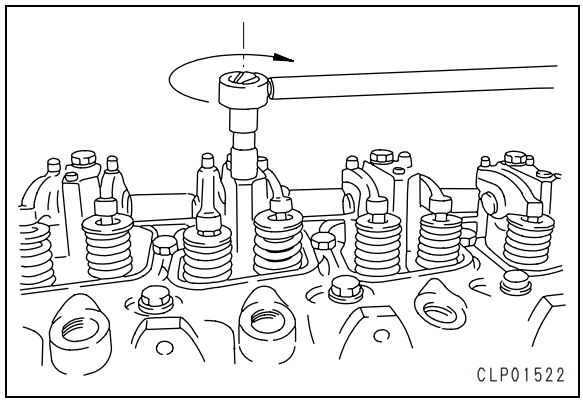


5. Install rocker arm assembly (56) and tighten the mounting bolts with the fingers.
   ★ Check that the ball of the adjustment screw is fitted to the socket of push rod (57).
   ★ Apply engine oil to the threads and seats of the mounting bolts 8 mm and 12 mm in diameter.



6. Tighten the rocker arm assembly mounting bolts (8 mm in diameter).

   Rocker arm mounting bolt:
   24 ± 4 Nm {2.45 ± 0.41 kgm}



7. Adjust the valve clearance. For details, see TESTING AND ADJUSTING, Adjusting valve clearance.

- **Refilling with water**
  Add water through the water filler to the specified level. Run the engine to warm the water. Then, check the water level again.

- **Bleeding air**
  Bleed air from the fuel system.

REMOVAL, INSTALLATION OF ENGINE ASSEMBLY

REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

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

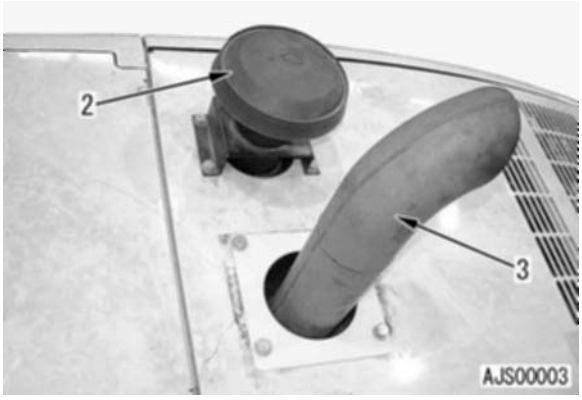
Disconnect the cable from the negative (–) terminal of the battery.

1. Drain the coolant.

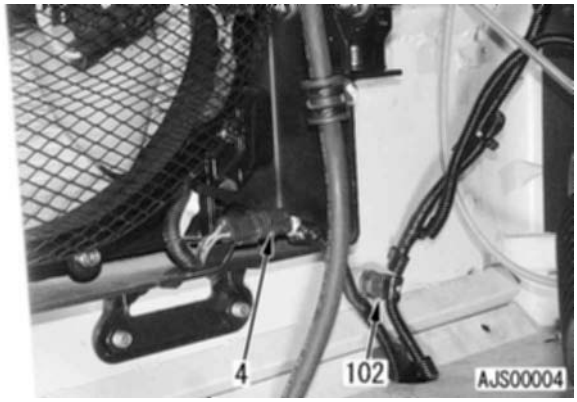
   Coolant: **17 ℓ**

2. Remove the engine hood assembly according to the following procedure.
   1) Remove right and left fenders (1).
   2) Remove right and left brackets (100).
   3) Remove right and left inspection covers (101).

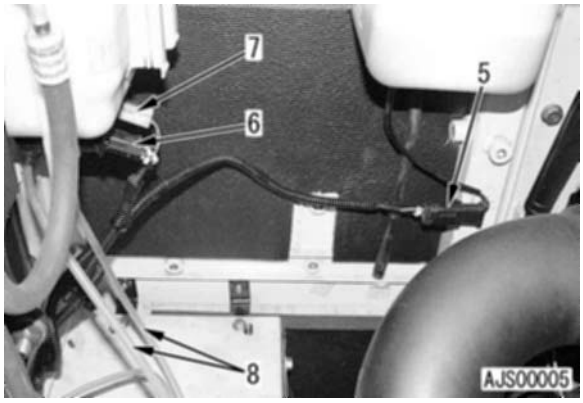
   4) Remove pre-cleaner (2). [*1]
   5) Remove muffler (3).



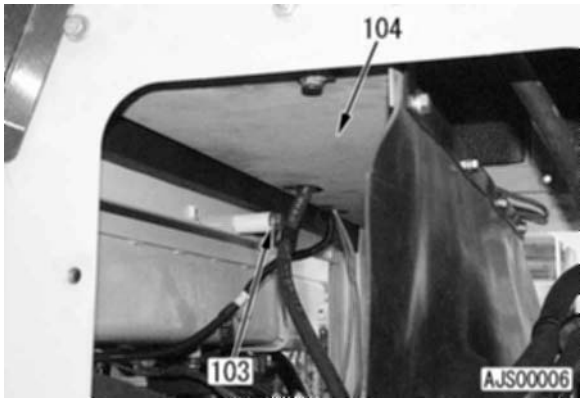
   6) Disconnect wiring connector B05 (4) and clamp (102) from the front side of the engine hood.



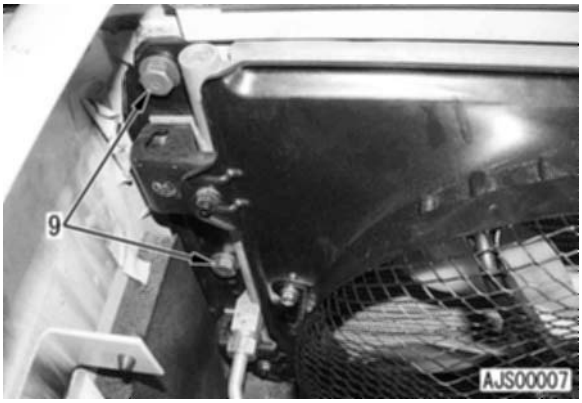
   7) Disconnect wiring connectors B06 (5), B07 (6), and B08 (7) from the front side@of the engine hood.
   8) Disconnect 2 windshield washer hoses (8).



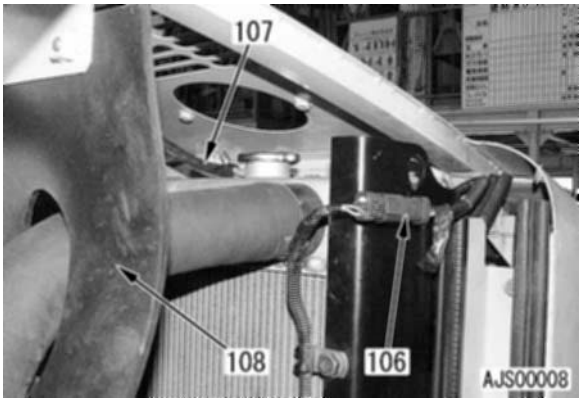
   9) Disconnect cover (104) and clamp (103) from the front side of the engine hood.



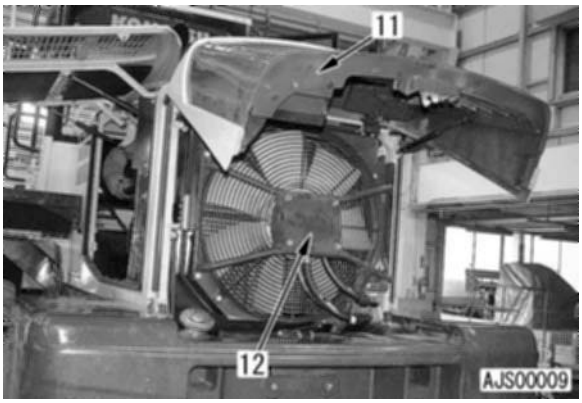
10) Remove 2 condenser mounting bolts (9) from each side.
★ Lower the condenser onto the engine without disconnecting the air conditioner piping.



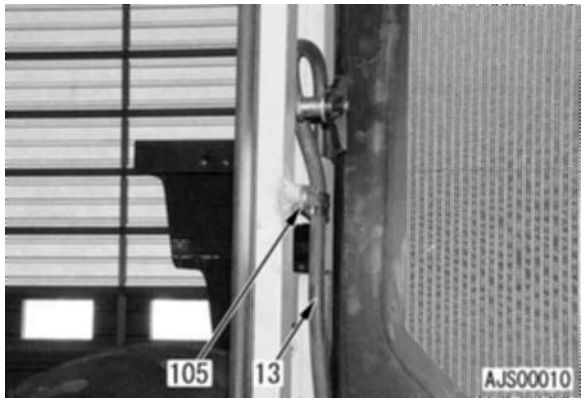
11) Disconnect reservoir tank hose (107) and connector BR1 (106).
12) Remove the 2 lower mounting bolts of rubber (108) at the rear of the engine.



13) Open grille (11) and fan guard (12).

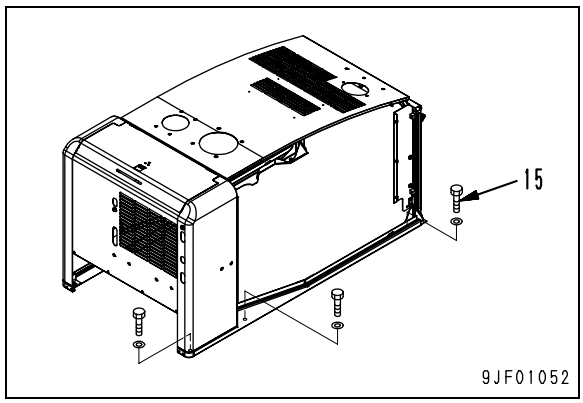


14) Remove fuel tank air bleeding hose (13) from clamp (105).



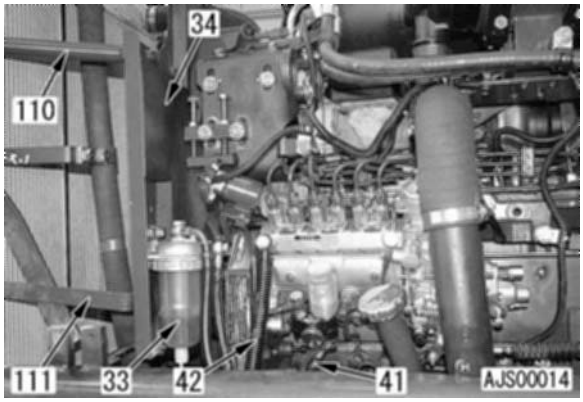
15) Remove right and left covers (14).

16) Remove 3 engine hood mounting bolts (15) from each side.

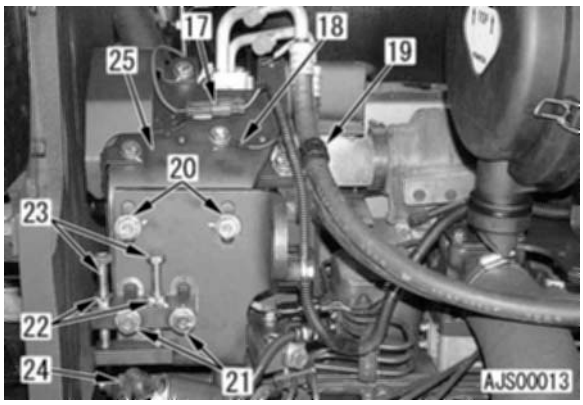


17) Lift off engine hood assembly (16).
★ Take care not to damage the condenser.

3. Remove bulkhead (34) between the cooler and engine according to the following procedure.
1) Disconnect fuel supply hose (41) and fuel return hose (42).
2) Remove fuel filter (33).
★ Bind the fuel filter to the engine with ropes, etc.
3) Remove right and left stays (110) and (111).
4) Remove bulkhead (34).

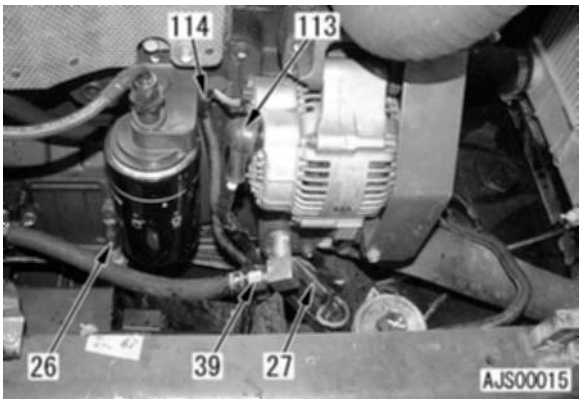


4. Remove the air conditioner compressor according to the following procedure.
1) Disconnect wiring connector E16 (17) and ground terminal E22 (18). [*2]
2) Remove hose clamp (19).
3) Loosen 2 mounting bolts (20) and 2 mounting bolts (21).
4) Loosen 2 locknuts (22) and 2 adjustment bolts (23).
5) Remove air conditioner compressor belt (24). [*3]
6) Remove 2 mounting bolts (20), 2 mounting bolts (21), and air conditioner compressor and bracket assembly (25).
★ Place the air conditioner piping by the side of the engine without disconnecting it.



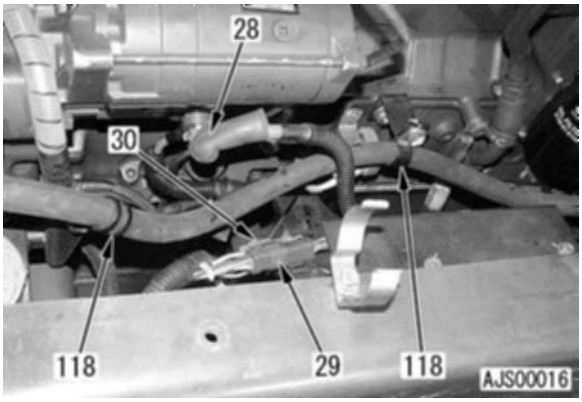
5. Disconnect heater hose (39).

6. Disconnect the following wiring connectors and terminals.
- (26): Engine ground [*4]
- (27): E13
- (113): E11 alternator terminal [*5]
- (114): E02 alternator connector

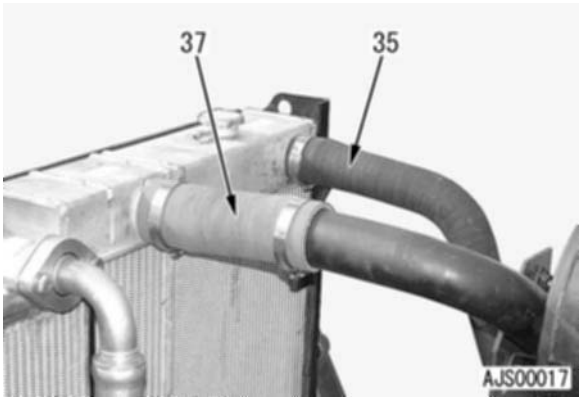


- (28): E10 starting motor + [*6]
- (29): ER1
- (30): ER2, ER3 --- On the back side of (30)

7. Disconnect heater hose clamp (118).



8. Disconnect radiator inlet hose (35) and aftercooler upper hose (37). [*7], [*8]

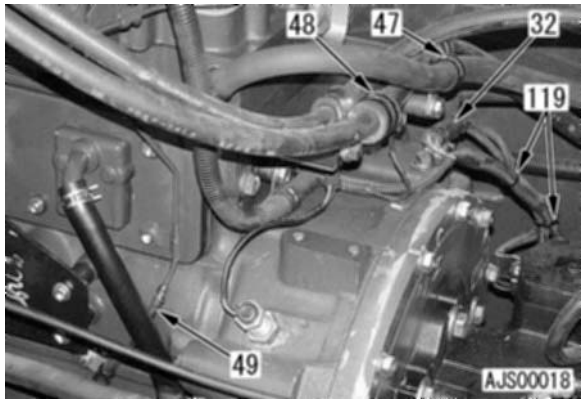


9. Disconnect tie wrap (119).

10. Disconnect connector T01 (32).

11. Disconnect heater hose clamp (47) and air conditioner hose clamp (48).

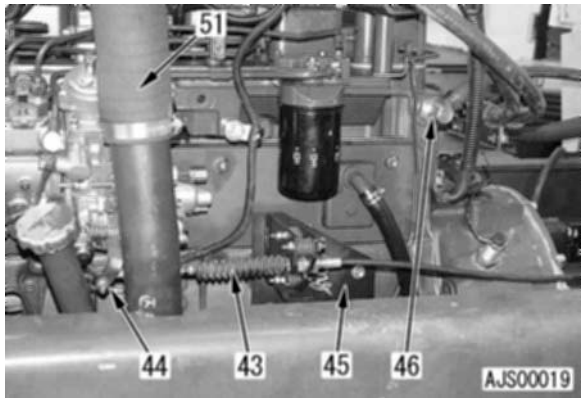
12. Disconnect spill hose (49).



13. Disconnect heater hose (46).

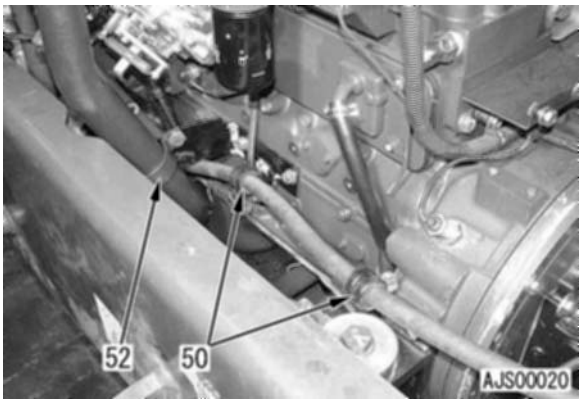
14. Remove mounting nut (44) of fuel control cable (43), and then remove the fuel control cable and bracket (45) together. [*9]
    - ★ Move the fuel control cable and bracket assembly to the outside of the engine.

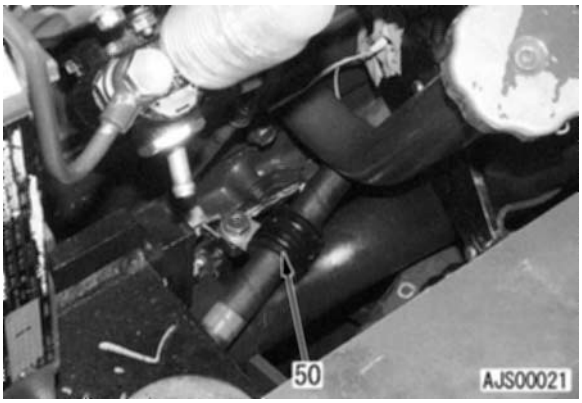
15. Remove air intake hose (51).



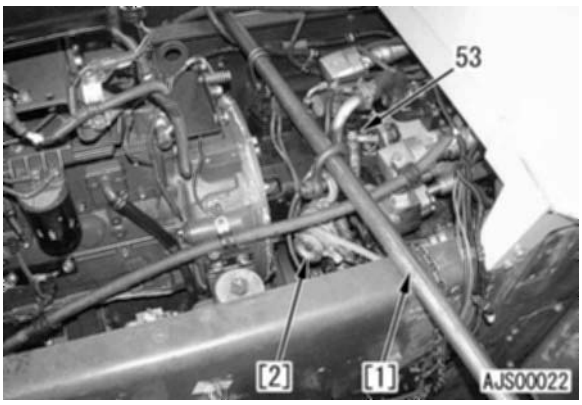
16. Disconnect 3 fan motor hose clamps (50) from the engine block.
    ★ You may remove 1 more fan motor hose clamp from the HST pump.

17. Remove air intake hose (52).
    ★ Place the air intake tube to the frame with strings, etc.

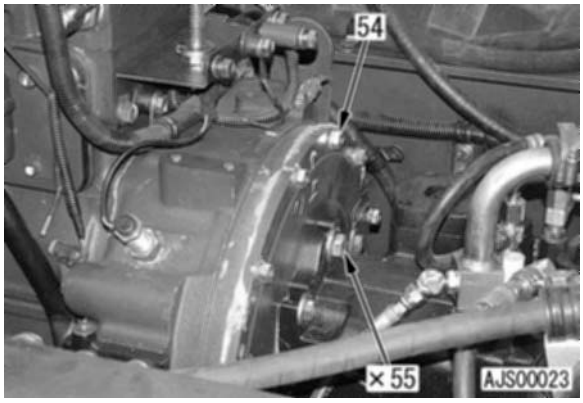




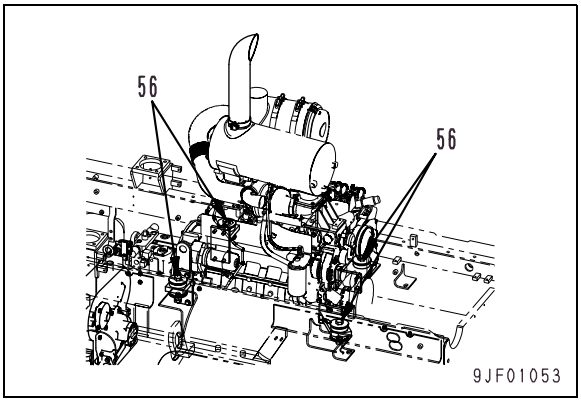
18. Place pipe [1] across the frame, and then secure HST pump assembly (53) and pipe [1] with lever block [2].



19. Remove all damper cover mounting bolts (54). [*10]
    ★ Do not disconnect the engine from the HST pump unit by removing HST pump mounting bolts (55).
    If the engine assembly is disconnected from the HST pump mounting part, meshing of the gear is not seen when the engine assembly is installed again. As a result, the damper may be damaged.

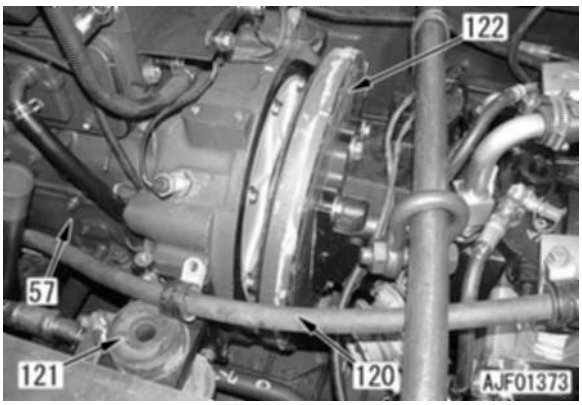


20. Remove 4 engine mounting bolts (56). [*11]



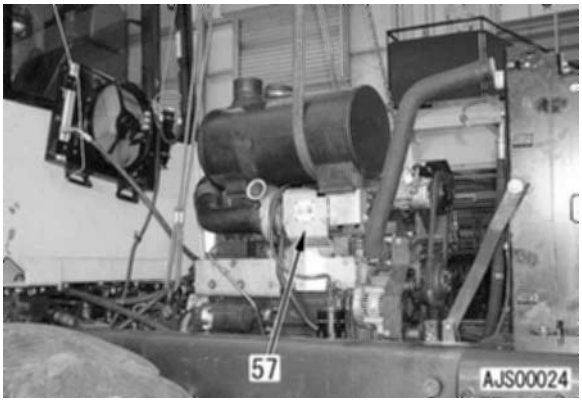
21. Sling engine assembly (57) a little and move it to the rear to disconnect it from damper cover and HST pump assembly (122). [*12]

22. While slinging engine assembly (57) a little, pass fan motor hose (120) along the outside of engine mount (121), and then lift up engine assembly (57) carefully.



23. Sling engine assembly (57) slowly to remove it.
    - ★ Check that all the wires and pipes are disconnected.
    - ★ Take care not to damage the radiator, aftercooler, and hydraulic oil cooler.

    Engine assembly: **650 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Precleaner mounting bolt:
8.8 ± 0.5 Nm {90 ± 5 kgcm}

[*2]

Air conditioner compressor ground terminal: **59 - 74 Nm {6 - 7.5 kgm}**

[*3]

★ Adjust the tension of the air conditioner compressor belt. For details, see TESTING AND ADJUSTING, Testing and adjusting air conditioner compressor belt tension.

[*4]

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

[*5]

Mounting torque of alternator terminal E11: **5.9 - 9.80 Nm {0.6 - 1.0 kgm}**

[*6]

Starting motor + terminal:
17.7 - 24.5 Nm {1.8 - 2.5 kgm}

[*7]

Mating face of radiator hose:
Gasket sealant (ThreeBond 1208E or equivalent)

Radiator hose clamp:
8.8 ± 0.5 Nm {90 ± 5 kgcm}

[*8]

Aftercooler hose clamp:
10.5 + 0.5 Nm {107 ± 5 kgcm}

[*9]

★ Adjust the fuel control cable. For details, see TESTING AND ADJUSTING, Measuring, testing operating force of accelerator pedal.

[*10]

Mating face of damper cover:
Gasket sealant (LG-6)

Damper cover mounting bolt:
58.8 - 73.5 Nm {6 -7.5 kgm}

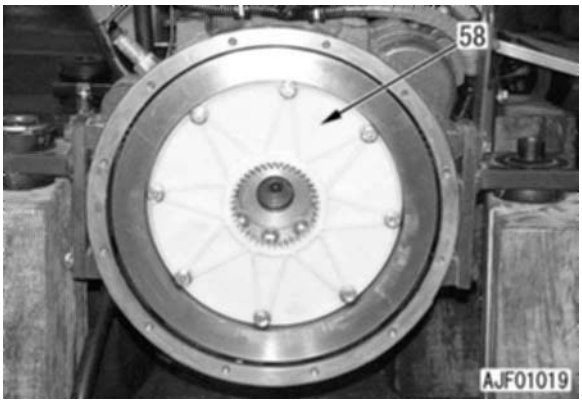
[*11]

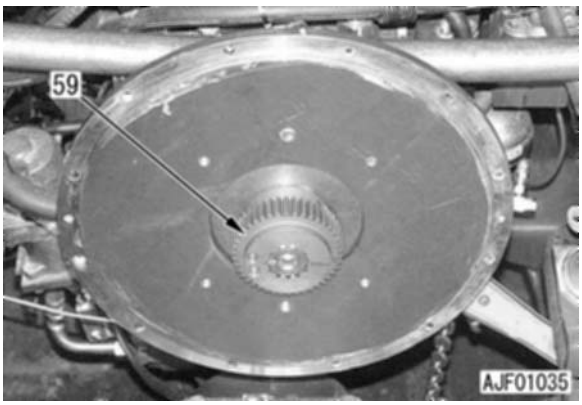
Engine mounting bolt:
610 - 765 Nm {62.5 - 78 kgm}

[*12]

★ When installing the engine assembly, position it carefully and mesh the gears of damper flange (58) and HST pump boss (59).

★ Take care not to damage flange (58).





- **Bleeding air**
  Bleed air from the fuel system.

- **Refilling with water**
  Add water through the water filler to the specified level. Run the engine to warm the water. Then, check the water level again.

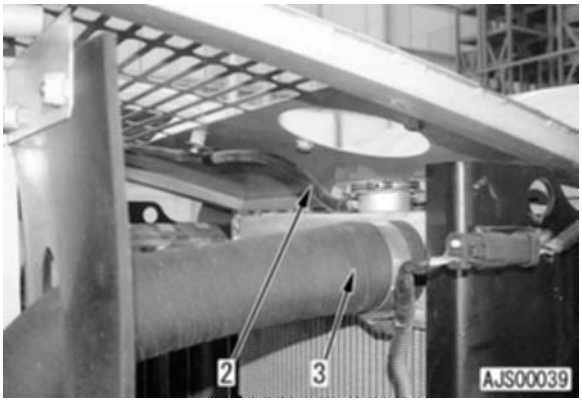
REMOVAL, INSTALLATION OF RADIATOR ASSEMBLY

REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

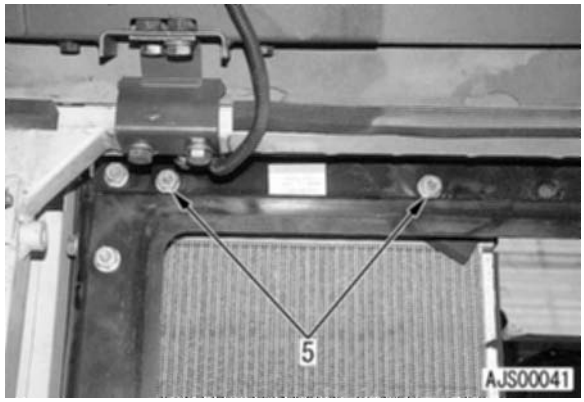
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

1. Drain the coolant.
   Coolant: **17 ℓ**
2. Remove air aftercooler. For details, see Removal, installation of air aftercooler.
3. Disconnect reservoir tank hose (2).
4. Disconnect radiator inlet hose (3). [*1]



5. Disconnect radiator outlet hose (4). [*2]

6. Remove 2 radiator assembly upper mounting bolts (5).



7. Raise radiator assembly (6) and pull it out to the left to remove.
   ★ Take care not to damage the core.

INSTALLATION

- Carry out installation in the reverse order to removal.

[*1] [*2]

Mating face of hose: **Gasket sealant (ThreeBond 1208E or equivalent)**

Radiator hose clamp:
8.8 ± 0.5 Nm {90 ± 5 kgcm}

- **Refilling with water**
  Add water through the water filler to the specified level. Run the engine to warm the water. Then, check the water level again.

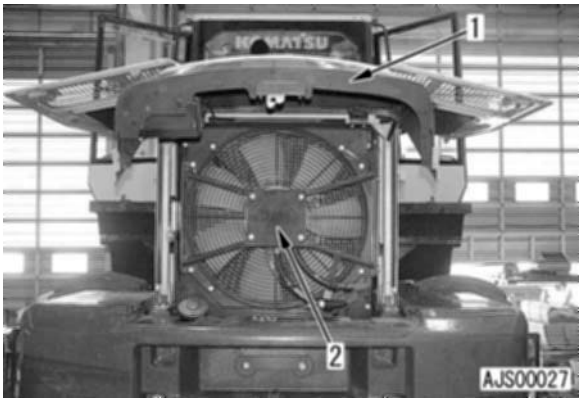
REMOVAL, INSTALLATION OF AIR AFTERCOOLER

REMOVAL

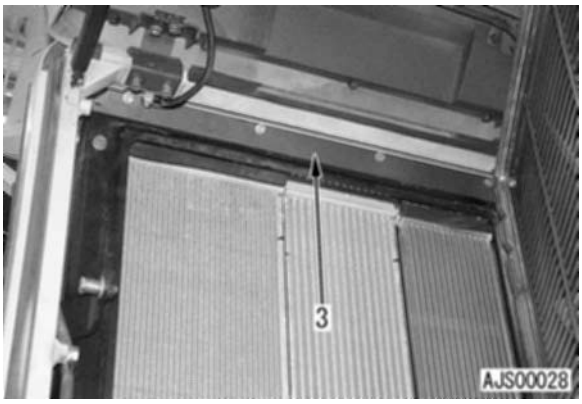
Stop the vehicle on a level place and set the safety bar to the frame.

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

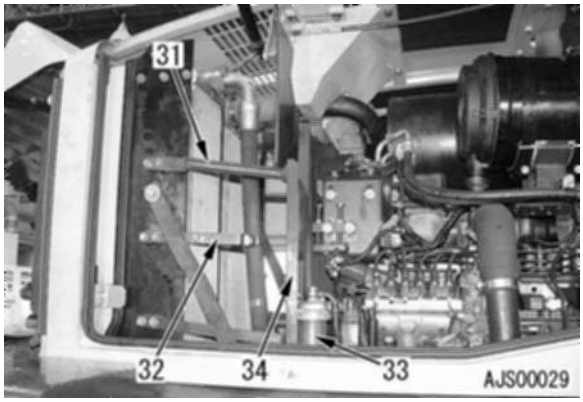
1. Open grille (1) and fan guard (2).



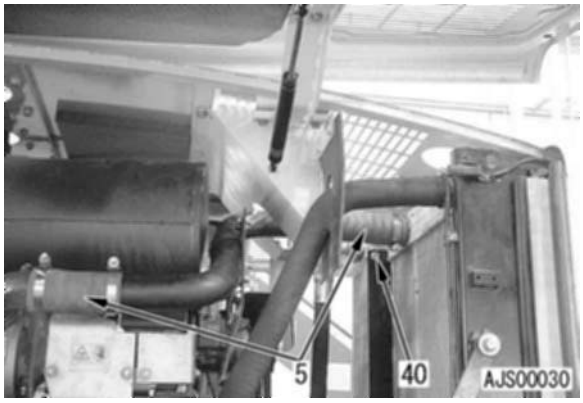
2. Remove cover (3).



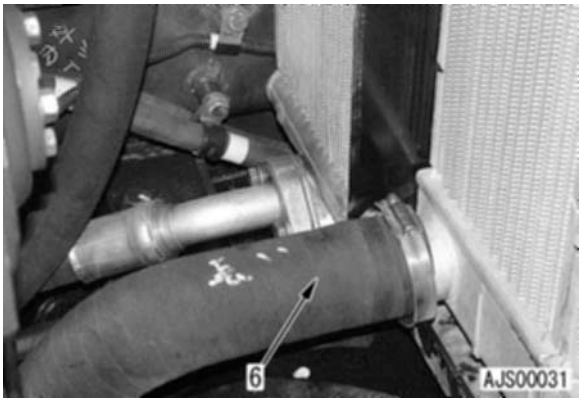
3. Remove bulkhead (34) between the cooler and engine according to the following procedure.
   1) Remove fuel filter (33).
      ★ Bind the fuel filter to the engine with ropes, etc.
   2) Remove right and left stays (31) and (32).
   3) Remove bulkhead (34).



4. Remove 2 upper and lower mounting bolts (40) of the left side of the oil cooler.
5. Disconnect upper air hose (5). [*1]

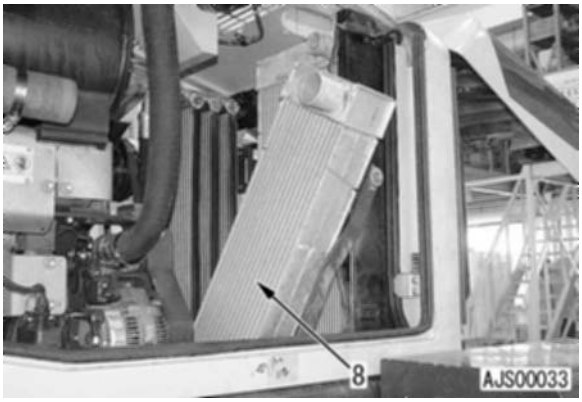


6. Disconnect lower air hose (6). [*1]



7. Remove 2 air aftercooler upper mounting bolts (7).
   ★ At this time, the plate secured together with the air aftercooler falls. Take care.

8. Raise air aftercooler (8) and pull it out to the left.
   ★ Take care not to damage the core.



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Air hose clamp:
10.5 ± 0.5 Nm {107 ± 5 kgcm}

REMOVAL, INSTALLATION OF HYDRAULIC OIL COOLER ASSEMBLY

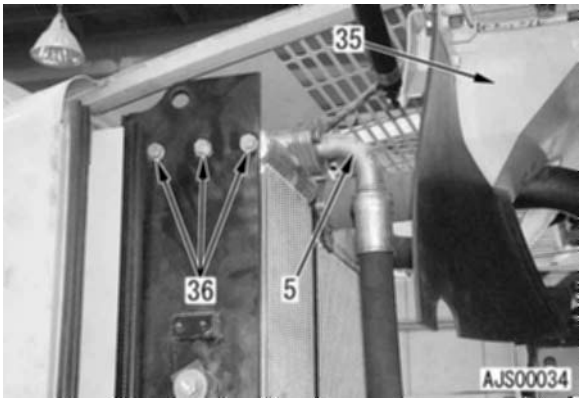
REMOVAL

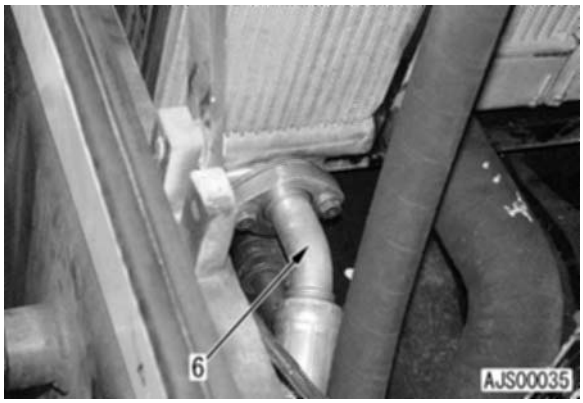
Stop the vehicle on a level place and set the safety bar to the frame.

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

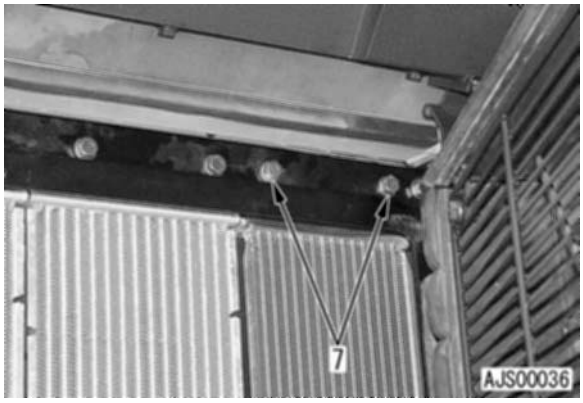
Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

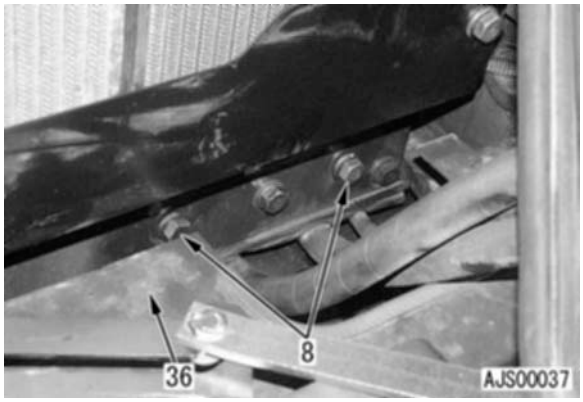
1. Perform Removal, installation of air aftercooler, Steps 1 - 5 (on the 1st page), to remove the parts to the upper air hose.
2. Remove bracket (35).
3. Disconnect oil cooler upper hose (5) and lower hose (6). (At this time, the plate between the flange and oil cooler comes off, too.)
   ★ Since oil will leak, prepare an oil receiver and oil stop plugs.
4. Remove 3 oil cooler side mounting bolts (36).





5. Remove 2 oil cooler upper mounting bolts (7) and 2 lower mounting bolts (8).
   ★ Move plate (36) and remove the left lower bolts.





6. Raise oil cooler (9) and pull it out to the left.
   ★ Take care not to damage the core.

INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Air hose clamp:
10.5 ± 0.5 Nm {107 ± 5 kgcm}

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

REMOVAL, INSTALLATION OF COOLING FAN AND FAN MOTOR ASSEMBLY

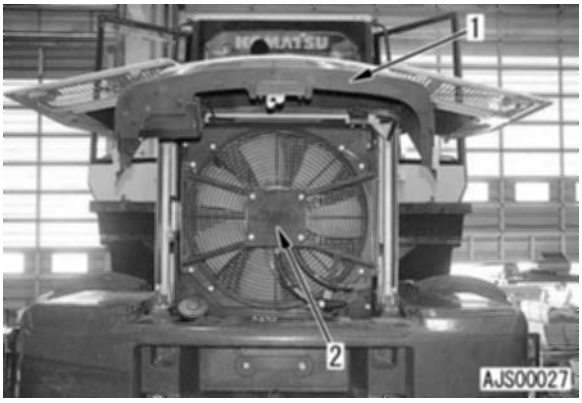
REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

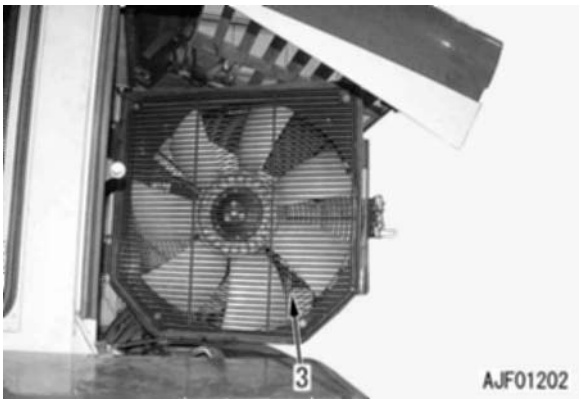
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

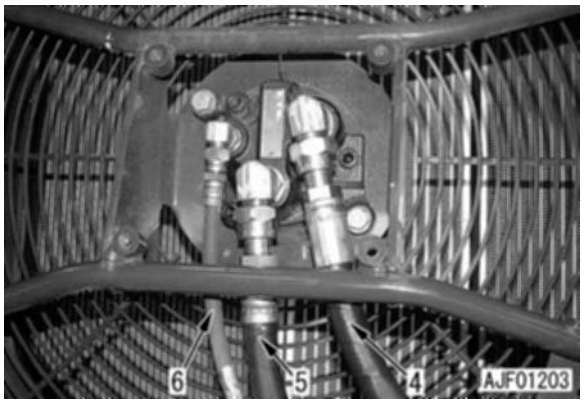
1. Open grille (1) and remove cover (2).



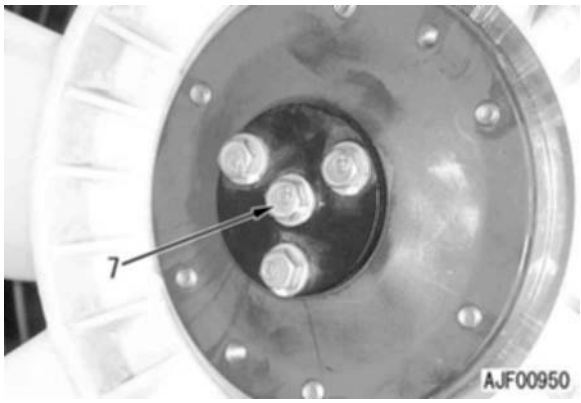
2. Open the fan guard assembly and remove guard (3).

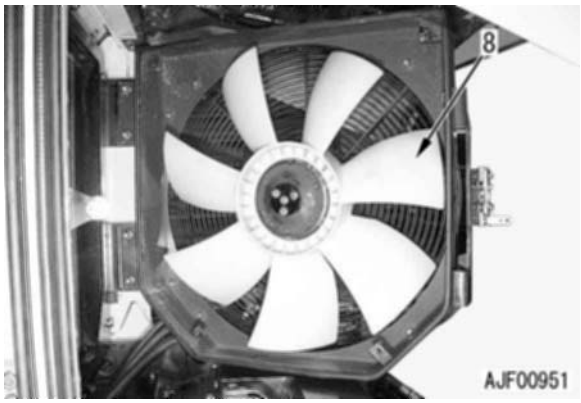


3. Disconnect IN-port hose (4), OUT-port hose (5), and Dr-port hose (6).
   ★ Since oil will leak, prepare an oil receiver and an oil stop plug.

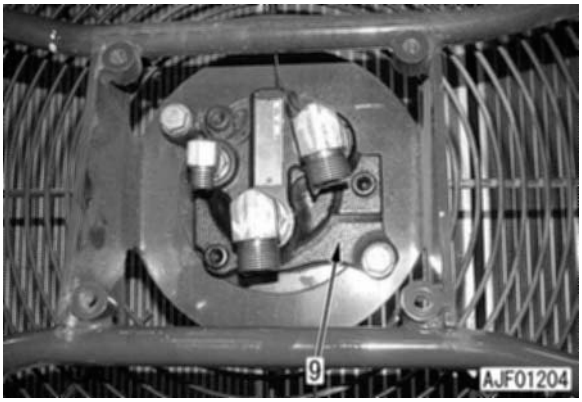


4. Remove 1 fan mounting bolt (7) and cooling fan (8). [*1]





5. Remove the 2 mounting bolts and fan motor assembly (9).



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Mounting bolt:
27 - 34 Nm {2.8 - 3.5 kgm}

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

REMOVAL, INSTALLATION OF FUEL TANK ASSEMBLY

REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

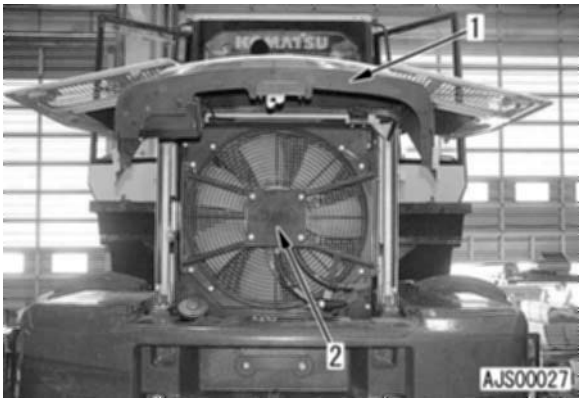
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Disconnect the cable from the negative (–) terminal of the battery.

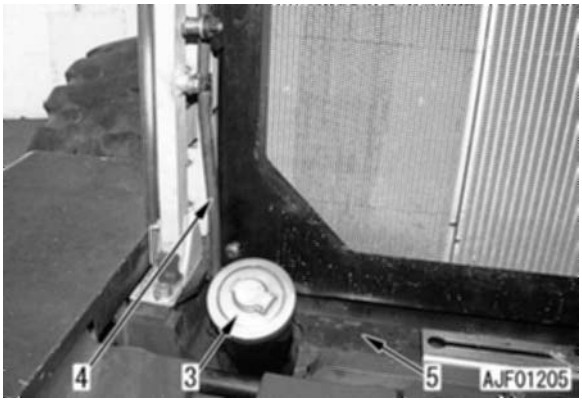
1. Drain the fuel.

   Fuel tank: **228 ℓ** (When full)

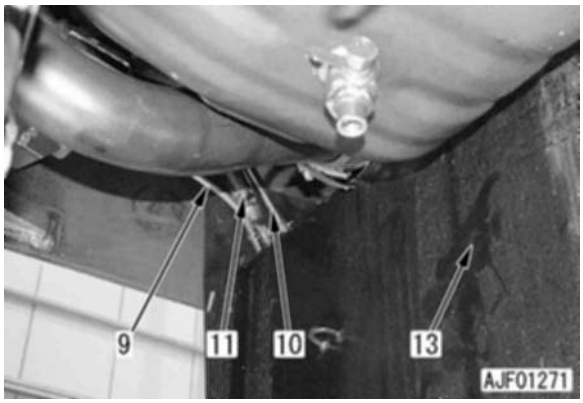
2. Open grille (1) and fan guard (2).



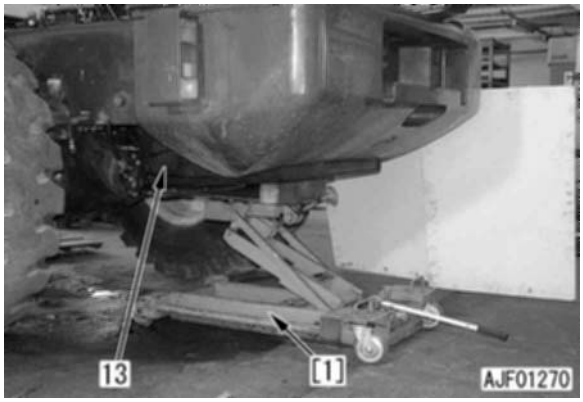
3. Remove oil filler cap (3).
4. Remove the clamp of fuel tank air bleeding hose (4). [*2]
5. Remove the mounting bolts of cover (5).



6. Disconnect spill hose (9), fuel supply hose (10), and fuel return hose (11) from the top of fuel tank (13).
   - ★ Mark all the hoses with tags to prevent mistakes in the mounting position when installing.
   - ★ Disconnect the fuel hose clamp from the fuel tank.

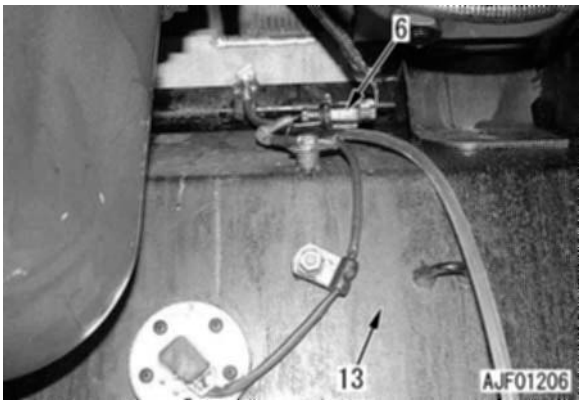


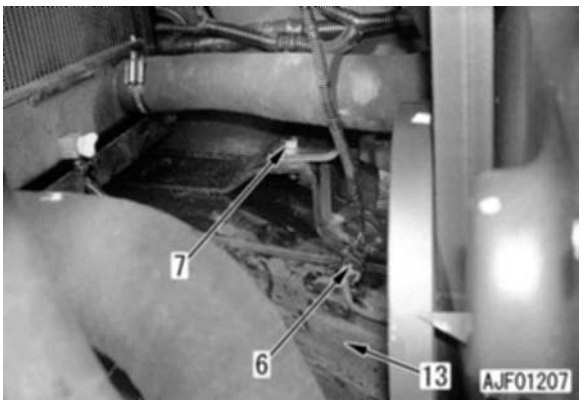
7. Support the bottom of fuel tank (13) with transmission jack [1].



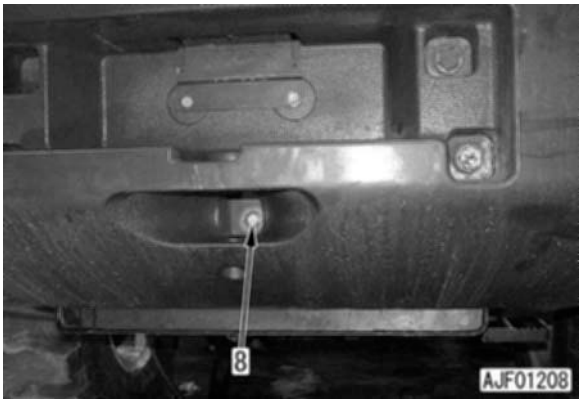
8. Open the engine left side cover and disconnect wiring connector R21 (6) from the top of fuel tank (13).

9. Remove 2 upper mounting bolts (7) on both sides.



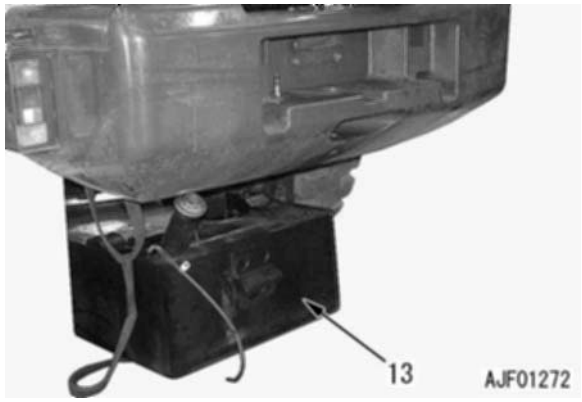


10. Remove rear mounting bolt (8).



11. Lower transmission jack [1] and sling fuel tank (13). Pull out transmission jack [1] and remove fuel tank (13). [*1], [*2]
    - ★ Take extreme care that the fuel tank will not come off the transmission jack and sling.
    - ★ Since the fuel tank has a long suction pipe, it cannot be removed on the transmission jack.

    Fuel tank assembly: **110 kg (excluding fuel)**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Fuel tank mounting bolt: **245 - 309 Nm {25 - 31.5 kgm}**

12. [*2]
    When installing, pass fuel tank air bleeding hose (4) from underside before clearance is eliminated.
    - **Refilling with fuel (Fuel tank)**
      Add fuel through the fuel filler.

    Fuel tank: **228 ℓ (When full)**

REMOVAL, INSTALLATION OF TRANSFER

REMOVAL

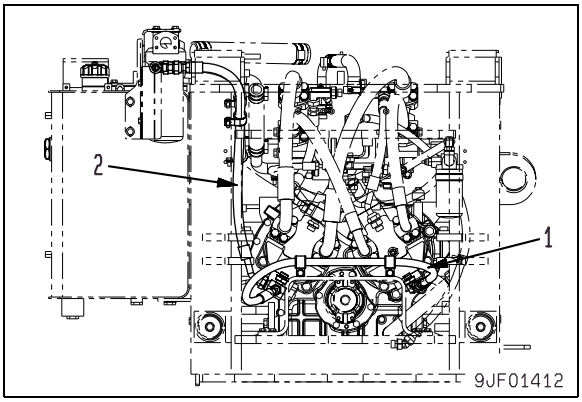
Stop the vehicle on a level place and set the safety bar to the frame.

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

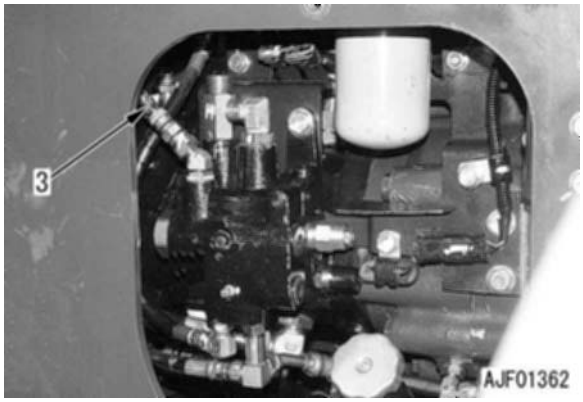
Press the brake pedal at least 100 times to release the residual pressure in the brake accumulator circuit.

Disconnect the cable from the negative (–) terminal of the battery.

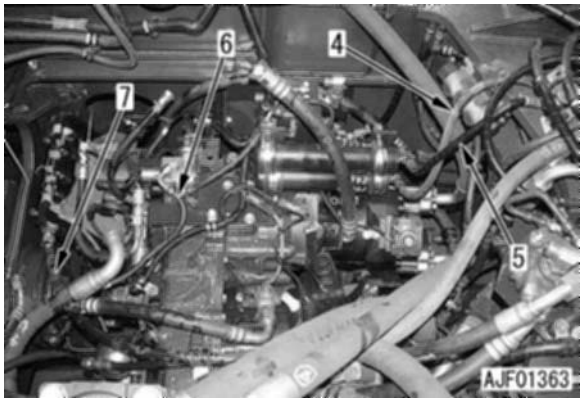
1. Remove the operator's cab assembly. For details, see Removal, installation of operator's cab.
2. Remove the HSS pump and 4-gear pump assembly. For details, see Removal, installation of HSS pump and 4-gear pump assembly.
3. Disconnect motor 1 drain hose (1) and motor 2 drain hose (2).



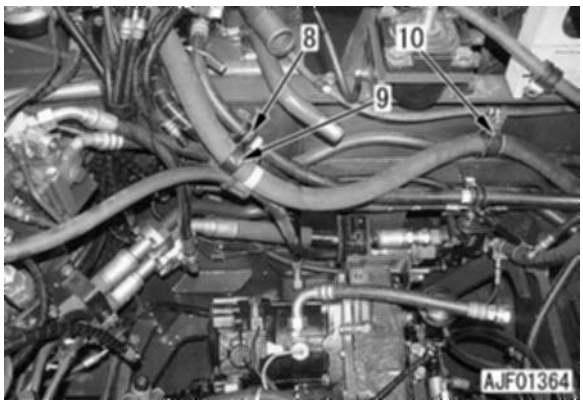
4. Disconnect accumulator charge valve drain hose (3).



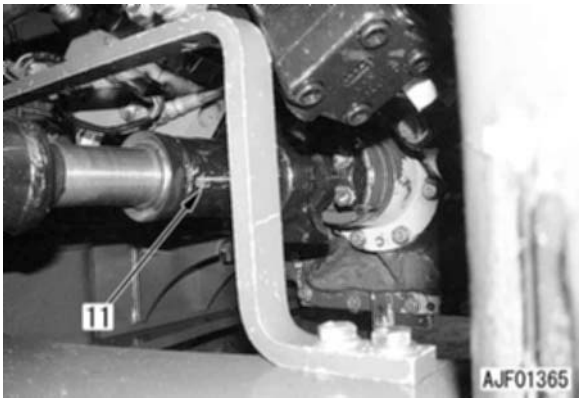
5. Disconnect PA-port hose (4) and PB-port hose (5) from the brake valve.
6. Disconnect clutch valve P-port hose (6).
7. Disconnect transfer cooler hose (7).



8. Disconnect clamps (8), (9), and (10).

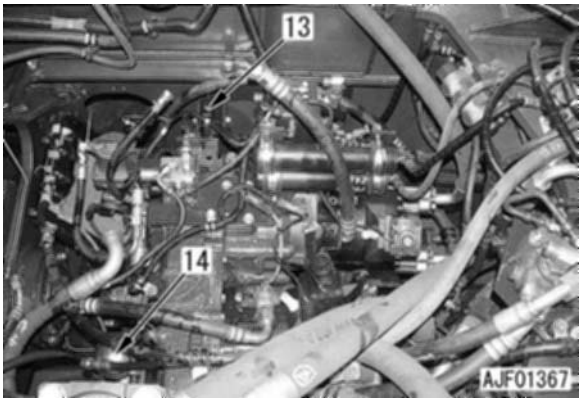


9. Disconnect front drive shaft (11) from the transfer side. [*1]



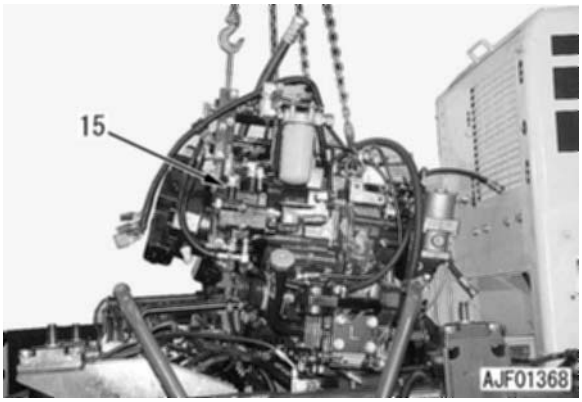
10. Remove rear drive shaft (12). [*2]

11. Sling the transfer assembly temporarily and remove 2 transfer cushions (13) on right and left sides, and then remove the 2 transfer mounting bolts on right and left sides. [*3]
    ★ After removing the right cushion, remove accumulator and bracket assembly (14).



12. Lift off transfer assembly (15).
    ★ Check that all the wires and pipes are disconnected, and then sling the assembly slowly.

    Transfer and HST motor assembly: **420 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1] [*2]

Drive shaft mounting bolt: **59 - 74 Nm {6.0 - 7.5 kgm}**

★ When installing the drive shaft, check that the key way of the spider cap is fitted in the key way of the mating yoke, and then tighten the mounting bolts.
★ When installing the rear drive shaft, check that the lateral runout of the rear axle and transfer from each other is less than 3 mm. If the runout is 3 mm or larger, shift the transfer cushion and transfer mount to reduce the runout.

[*3]

Transfer mount mounting bolt: **662 - 828 Nm {67.5 - 84.5 kgm}**

DISASSEMBLY, ASSEMBLY OF TRANSFER ASSEMBLY

SPECIAL TOOLS

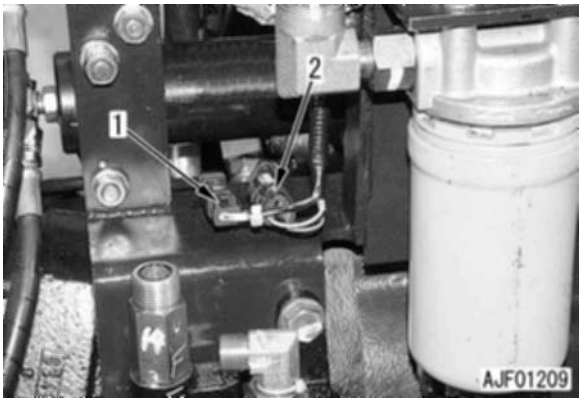
Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
D	1	790-201-2840	Spacer	■	1		
	2	793T-417-1110	Push tool	■	1	N	○
	3	790-101-5201	Push tool kit	■	1		
		• 790-101-5311	• Plate		1		
		• 790-101-5221	• Grip		1		
		• 01010-51225	• Bolt		1		
	4	793T-417-1120	Push tool	■	1	N	○
		790-101-5221	Grip	■	1		
		01010-81225	Bolt	■	1		
	5	799-301-1500	Oil leak tester	■	1		
	6	799-401-3200	Adapter	●	1		
	7	02789-00315	Cap	●	1		
	8	799-101-5160	Nipple	●	1		
	9	790-190-1500	Pump	●	1		

DISASSEMBLY

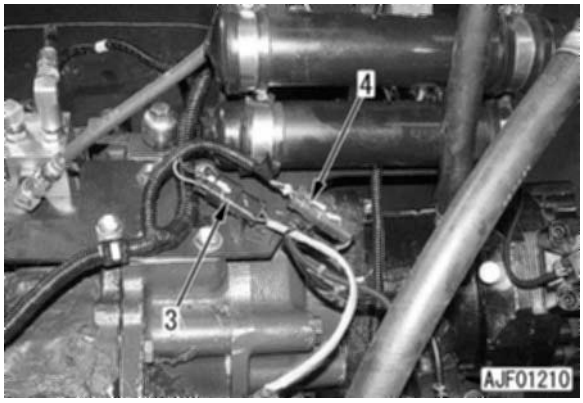
1. Drain the transfer oil.

   Draining transfer oil: **6.5 ℓ**

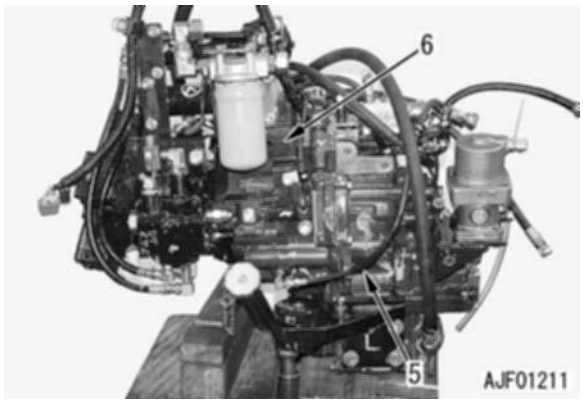
2. Brake accumulator
   1) Remove the speed sensor from the transfer case top.
   2) Disconnect wiring connectors T06 (1) and T11 (2).



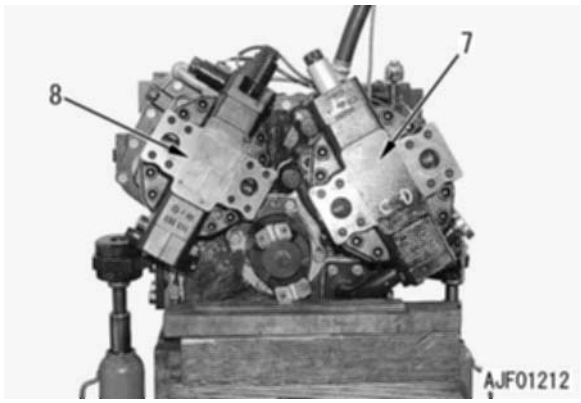
   3) Disconnect wiring connectors T10 (3) and T07 (4).



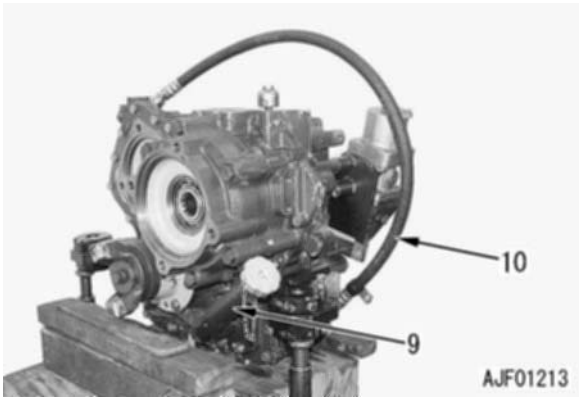
   4) Disconnect clutch port hose (5).
   5) Remove the 6 mounting bolts and bracket assembly (6).



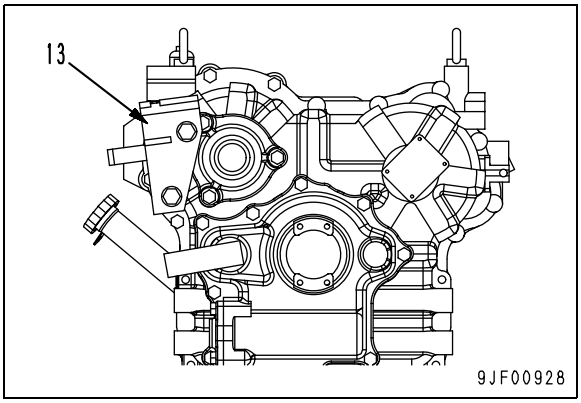
3. HST motor
   1) Remove the 4 mounting bolts and lift off HST motor 1 (7).
   2) Remove the 4 mounting bolts and lift off HST motor 2 (8).



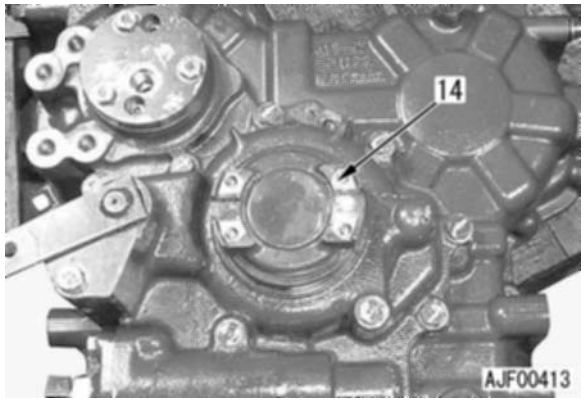
4. Oil supply pipe and hose
   1) Remove oil supply pipe (9).
   2) Remove hose (10) from the transfer case strainer.



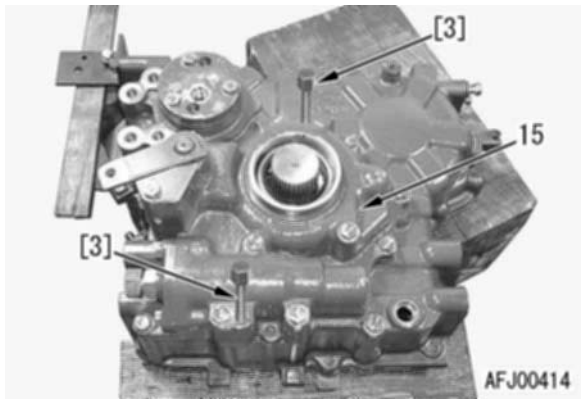
5. Parking brake cylinder
   1) Remove parking brake cylinder bracket (13).



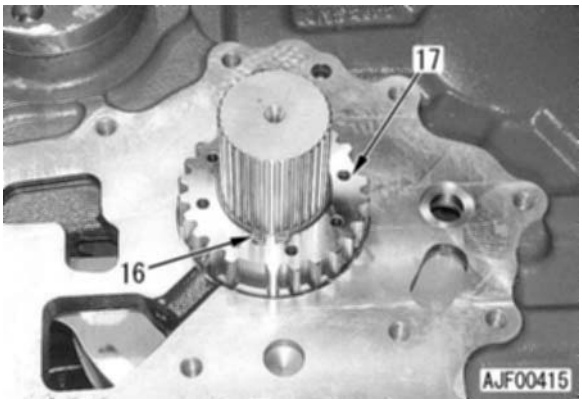
6. Parking brake assembly
   1) Set the transfer assembly to a block with the parking brake side up.
   2) Remove coupling (14) on the parking brake side.



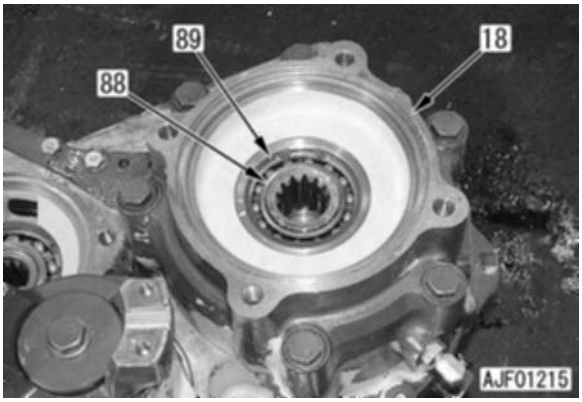
   3) Remove the mounting bolts. Using forcing screws [3], remove parking brake assembly (15).
      ★ For disassembly and assembly of the parking brake assembly, see DISASSEMBLY, ASSEMBLY OF PARKING BRAKE ASSEMBLY.



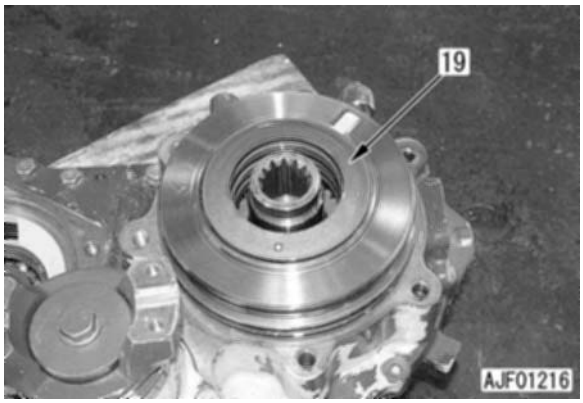
7. Hub
   1) Remove snap ring (16).
   2) Remove hub (17).



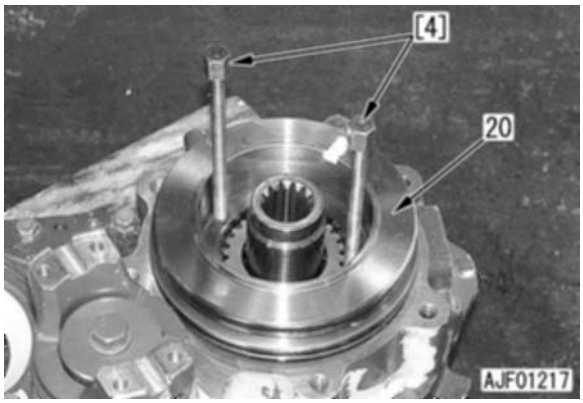
8. Belleville springs
   1) Turn over the case and remove cage (18) from the HST motor mounting section.
      ★ Loosen the mounting bolts evenly and gradually to release the belleville springs, and then remove the cage.
         • Free height of belleville springs (7-piece set): **57.4 mm**
         • Installed height of belleville springs (7-piece set): **44.8 mm**
         • Installed load of belleville springs (7-piece set): **21,500 N {2,190 kg}**



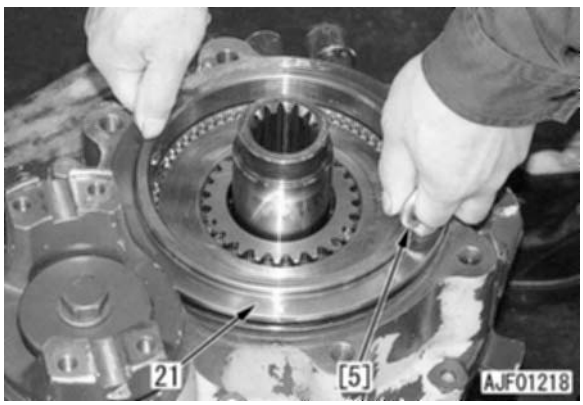
   2) Remove 7 belleville springs (19).
      ★ Check the directions of the belleville springs.
      ★ The 1st belleville spring (The one on the top) has a yellow mark.
      ★ When any belleville spring needs to be replaced, replace all of the 7 springs as a set.



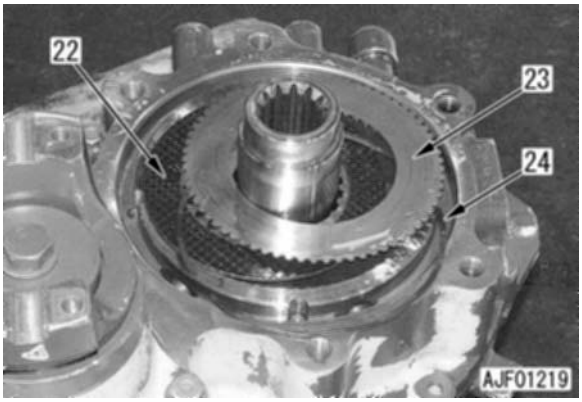
9. Piston and spacer
   1) Using 2 forcing screws [4], remove piston (20).



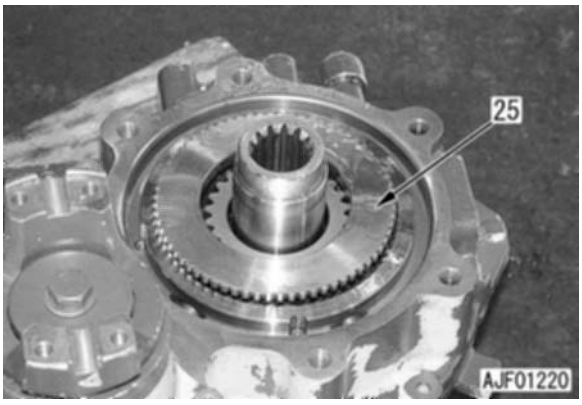
   2) Using 2 eyebolts [5], remove spacer (21).



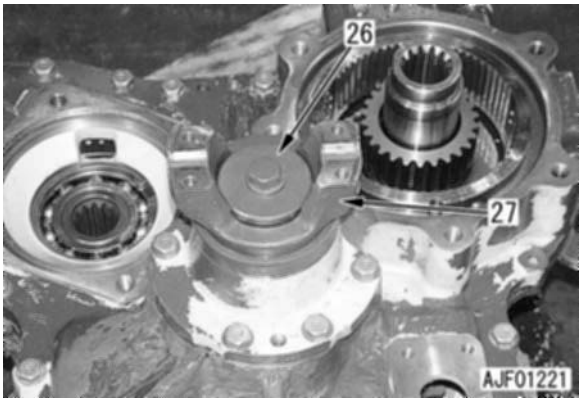
10. Clutch discs, plates, and springs
    1) Remove 7 discs (22), 8 plates (23), and 7 wave springs (24).



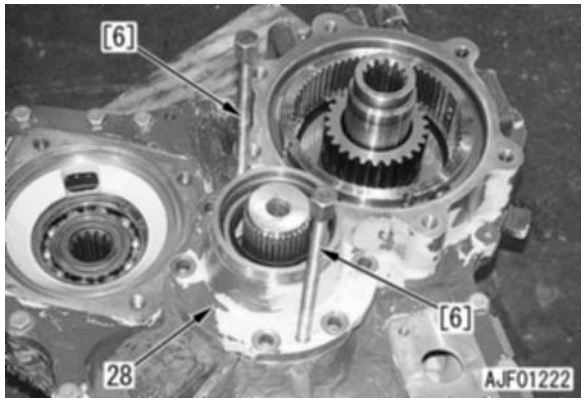
    2) Remove end plate (25).



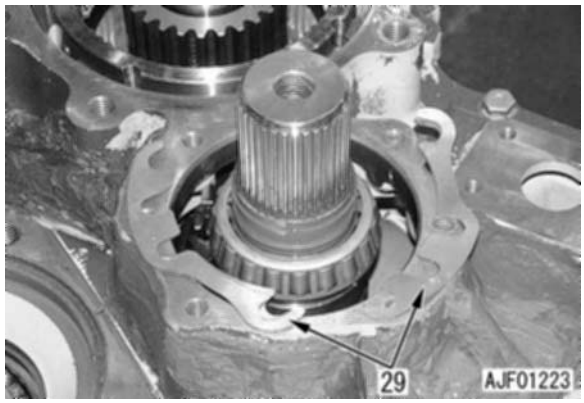
11. Coupling
    1) Remove the mounting bolts and holder (26).
    2) Remove coupling (27).



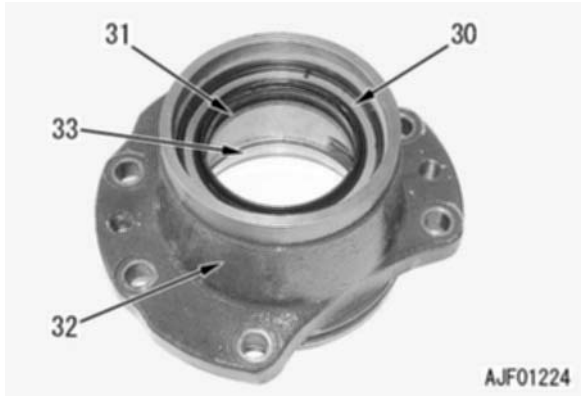
12. Cage assembly
    1) Remove the mounting bolts. Using forcing screws [6], remove cage assembly (28).



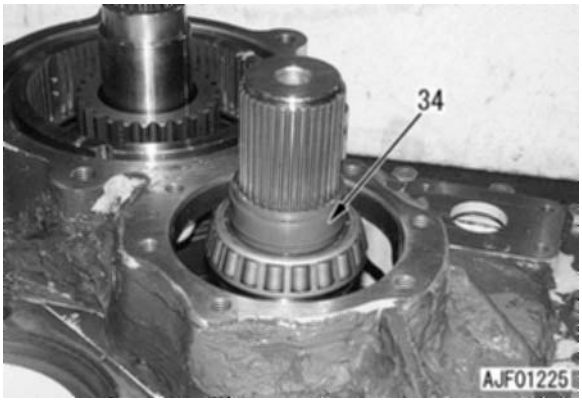
    2) Remove shims (29).
       ★ Check the thickness and quantity of the shims.



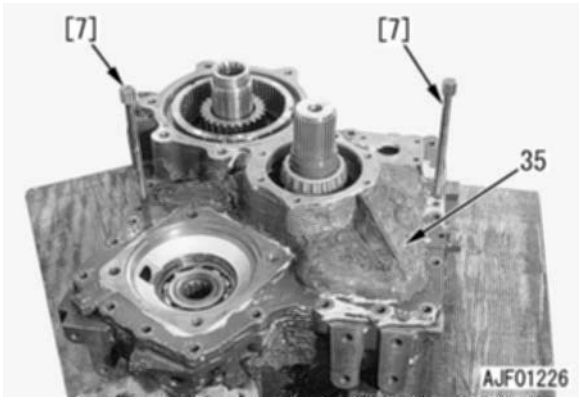
    3) Remove dust seal (30) and oil seal (31) from cage (32).
    4) Remove outer race (33).



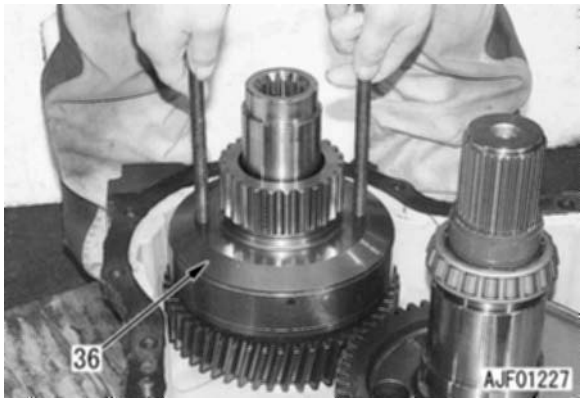
13. Spacer
    1) Remove spacer (34).



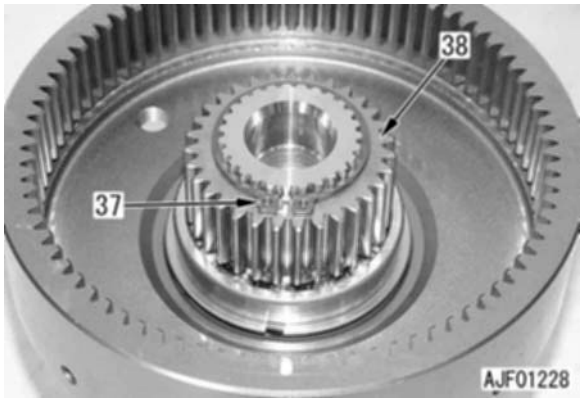
14. Front case
    1) Remove the mounting bolts. Using forcing screws [7] and screwdrivers, remove front case (35).
       ★ Take care not forget to remove the bolts on the rear case side (5 pieces).
       ★ When using screwdrivers, take care not to scratch the case mating face.
       ★ Front case (35) shown in the photo is different from the full-scale production front case.



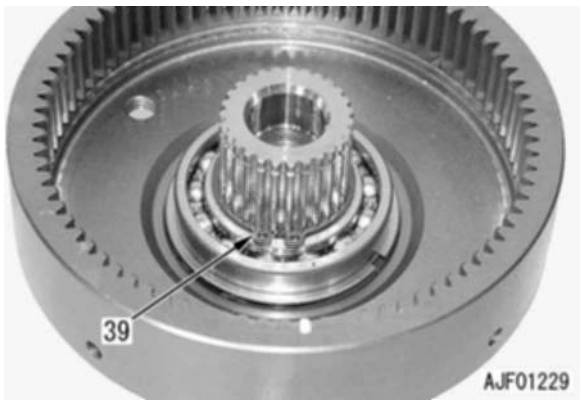
15. Removal of HST motor 1 shaft and ring gear
    1) Remove HST motor 1 shaft and ring gear assembly (36).



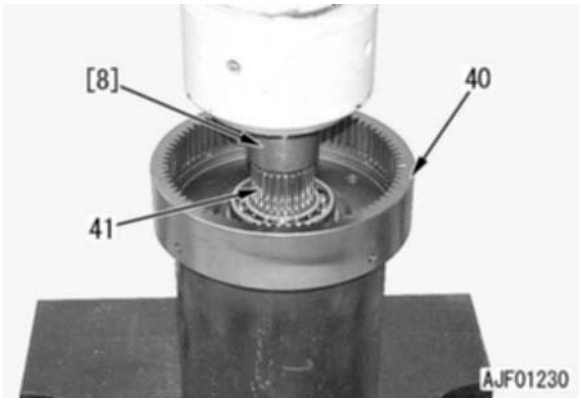
16. Disassembly of HST motor 1 shaft and ring gear assembly
    1) Remove snap ring (37) and sun gear (38).



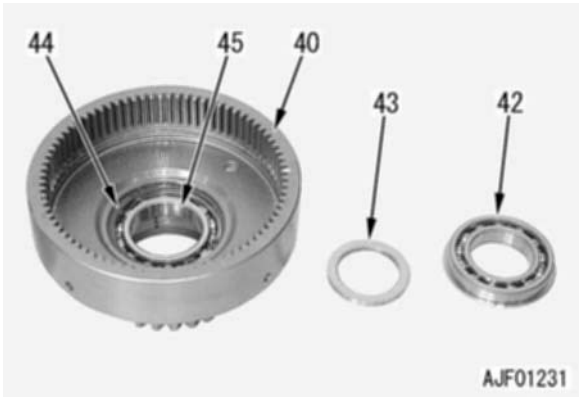
    2) Remove snap ring (39).



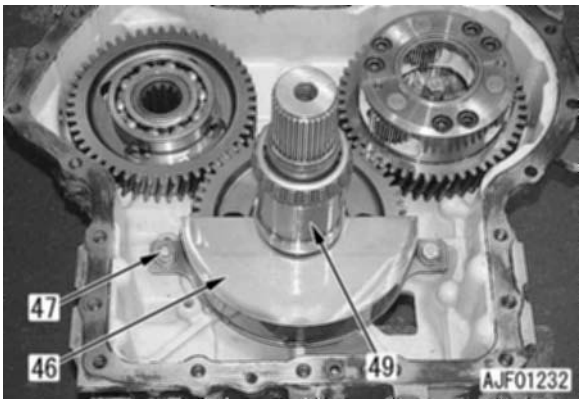
3) Supporting ring gear (40) and using push tool [8] and a press, push out HSS motor 1 shaft (41).



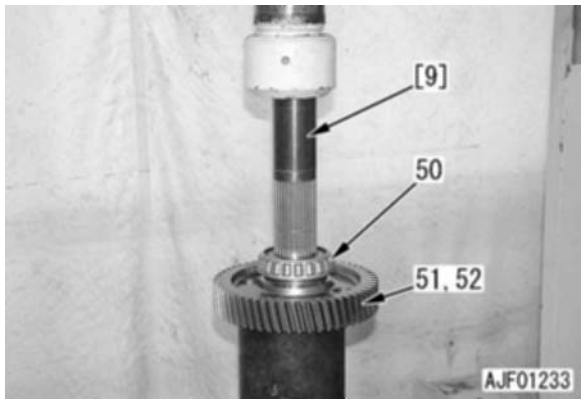
4) Remove bearing (42) and spacer (43) from ring gear (40).
5) Remove snap ring (44) and bearing (45).



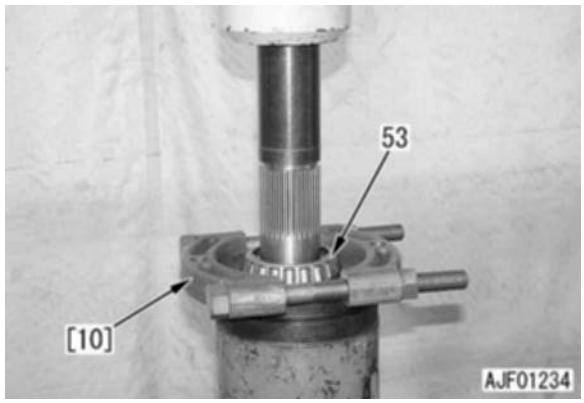
17. Removal of output shaft and gear assembly
    1) Remove 2 mounting bolts (47) of cover (46).
    2) Remove output shaft and gear assembly (49) and cover (46).



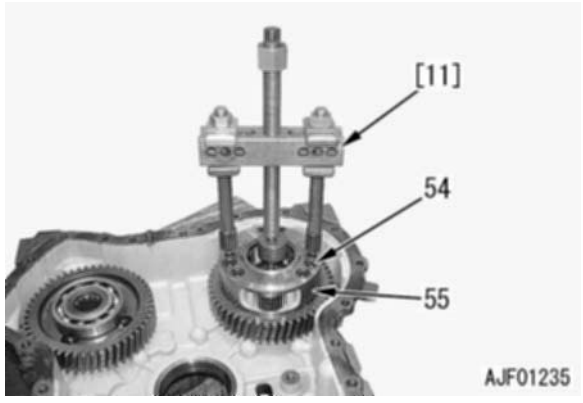
18. Disassembly of output shaft and gear assembly
    1) Using push tool [9], remove rear bearing (50).
    2) Remove gear (51) and spacer (52).



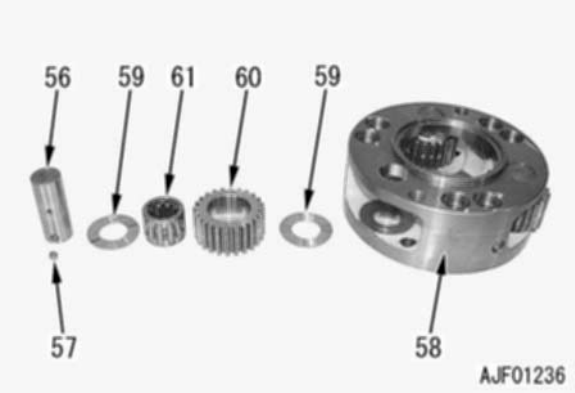
3) Using puller [10], remove front bearing (53).



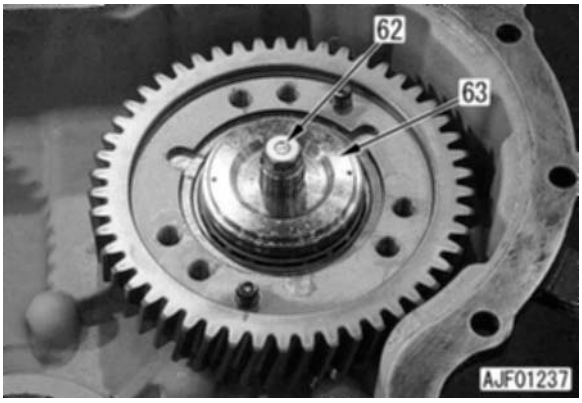
19. Removal of carrier assembly
    1) Remove 6 bolts (54).
    2) Using tool [11], remove carrier assembly (55).



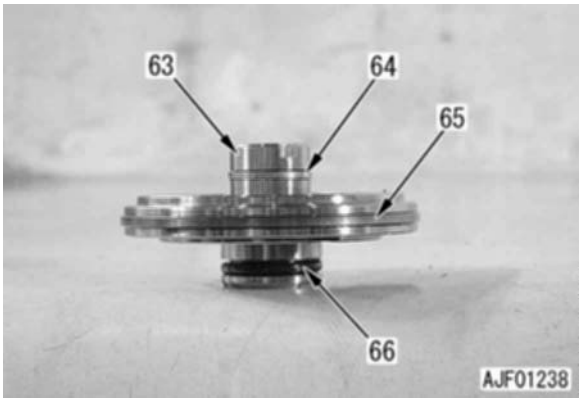
20. Disassembly of carrier assembly
    1) Remove shaft (56) ball (57) from carrier (58).
       ★ Keep the ball carefully.
    2) Remove 2 thrust washers (59), planetary gear (60), and bearing (61) (at 3 places).



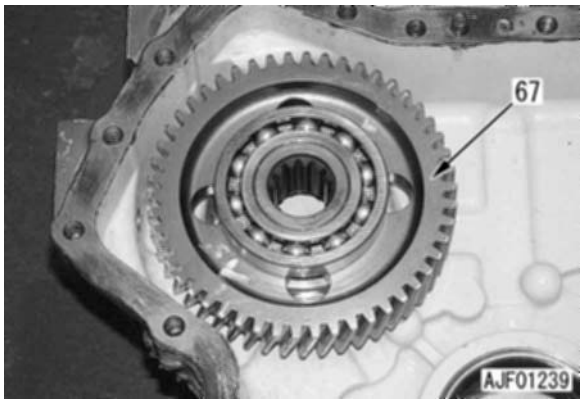
21. Holder
    1) Remove mounting bolt (62) and holder (63).



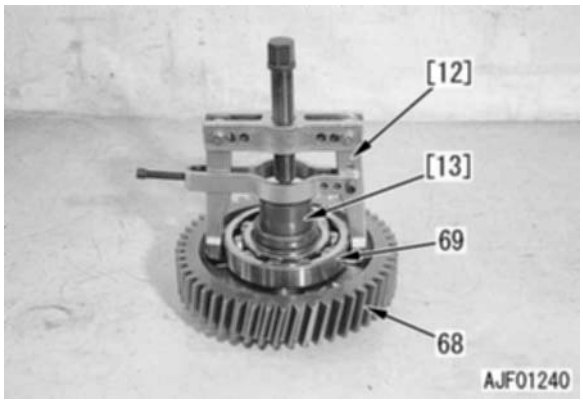
    2) Remove seal rings (64) and (65) and O-ring (66) from holder (63).



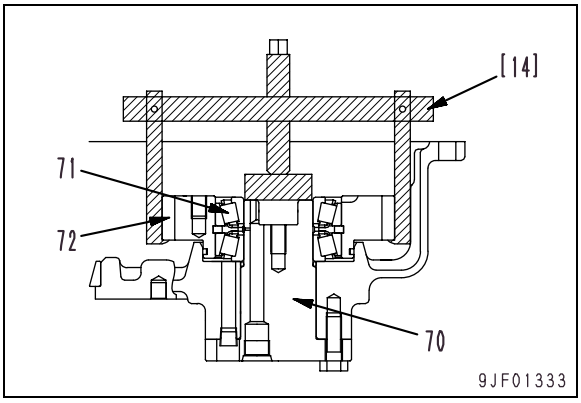
22. Removal of HST motor 2 gear and bearing assembly
    1) Remove HST motor 2 gear and bearing assembly (67).



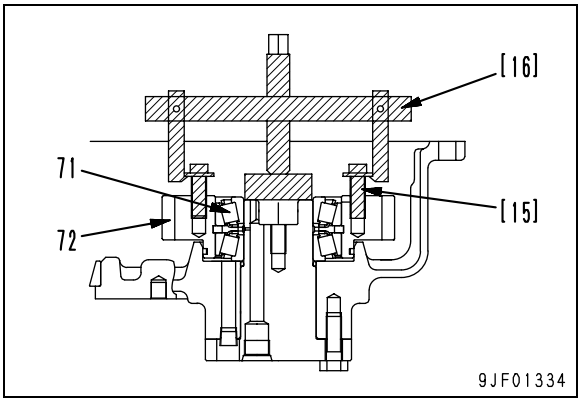
23. Disassembly of HST motor 2 gear and bearing assembly
    1) Using puller [12] and tool [13], remove 2 bearings (69) from HST motor 2 gear (68).



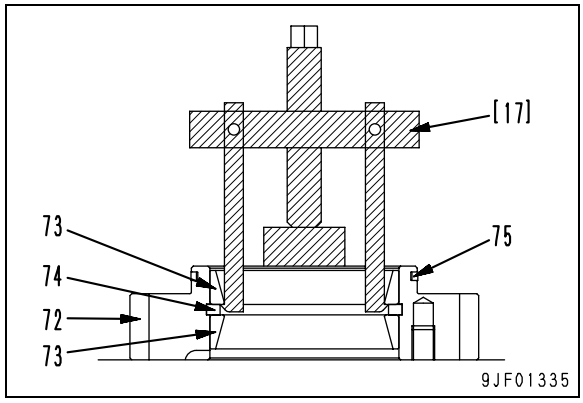
24. Removal of HST motor 1 gear and outer races
* Do not remove HST motor 1 gear shaft (70). (If it is removed forcibly and reused, it can cause a trouble.)
1) Using puller [14], remove bearing (71) and HST motor 1 gear and outer races (72).



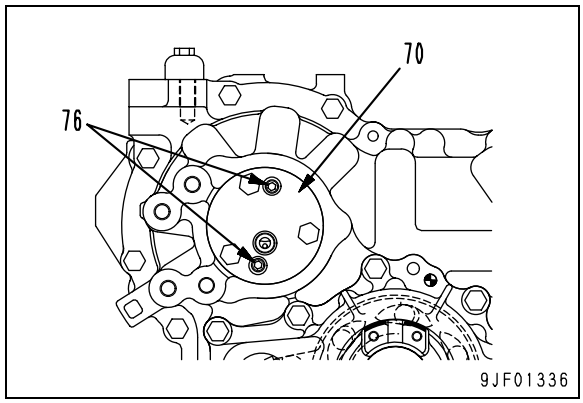
★ If the claws of puller [14] are so thick that they cannot be inserted between the gear and case, screw 3 bolts [15] (M14) into the carrier mounting holes of HST motor 1 gear (72) by 15 mm. Then, using 3-claw puller [16], remove bearing (71) and HST motor 1 gear (72).



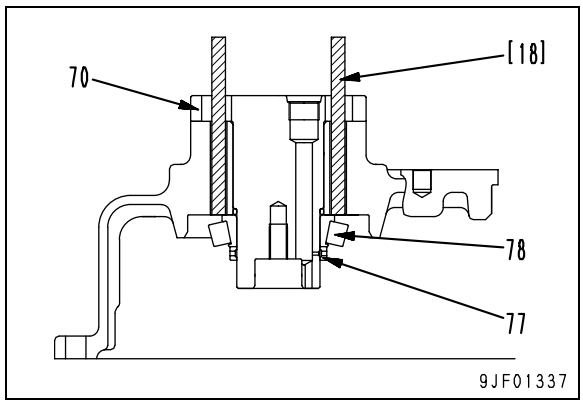
25. Disassembly of HST motor 1 gear and outer races
1) Using puller [17], remove 2 outer races (73) from HST motor 1 gear (72), and then remove spacer (74).
2) Remove seal ring (75).



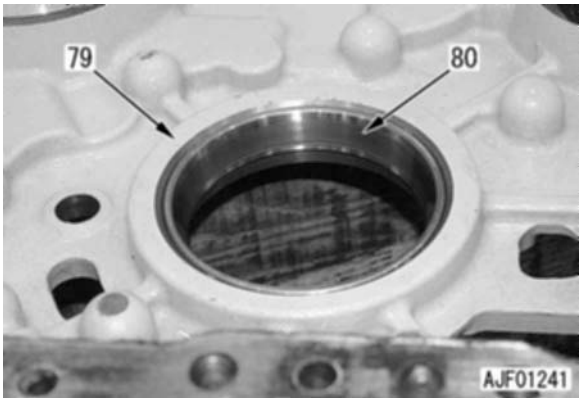
26. Bearing
1) Remove 2 plugs (76) from shaft (70).



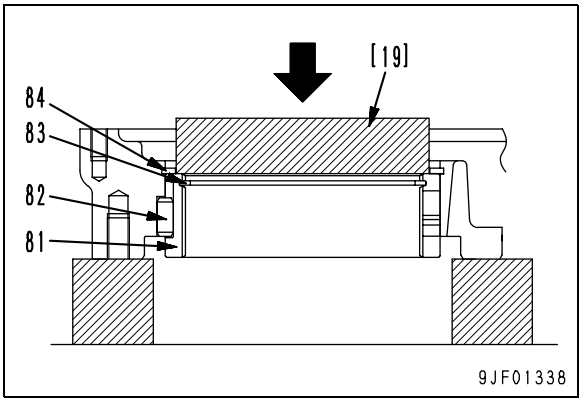
2) Remove spacer (77).
3) Insert 2 push tools [18] in the plug holes and hit them evenly to remove bearing (78) from shaft (70).
★ Do not remove shaft (70).



27. Rear case
    1) Remove outer race (80) from rear case (79).



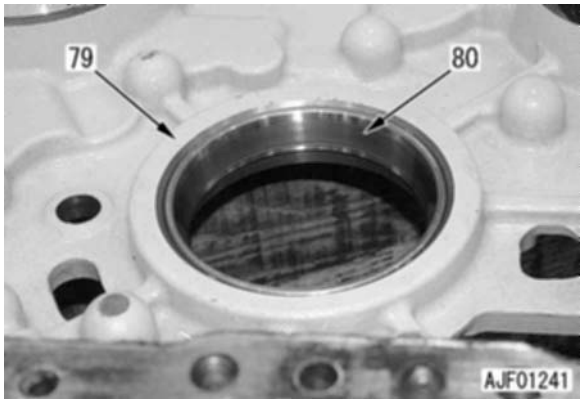
28. Clutch housing
    1) Using push tool [19], remove clutch housing (18) and 3 pins (82).
    2) Remove snap ring (83) from clutch housing (81).
    3) Remove snap ring (84).



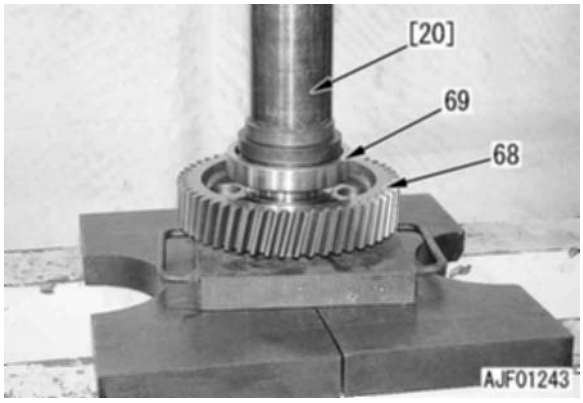
ASSEMBLY

★ Clean the all parts and check them for dirt or damage. Coat their sliding surfaces with oil (TO10, EO10-CD) before installing.
★ Before icing a bearing in dry ice for expansion fit, drop about 6 cc of EO10-CD or EO-30CD onto it and rotate it 10 turns.

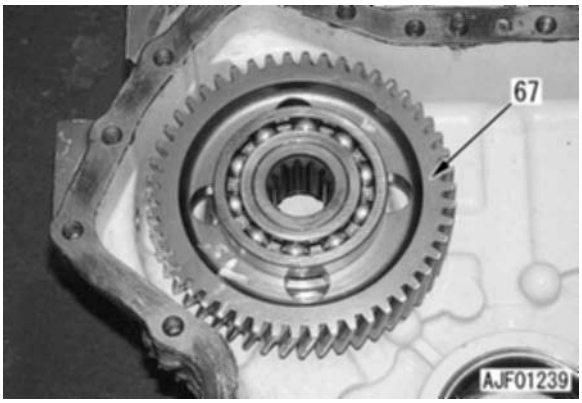
1. Rear case
    1) Press fit outer race (80) of the output shaft to rear case (79).



2. Assembly of HST motor 2 gear and bearing assembly
    1) Using push tool [20], press fit 2 bearings (69) to HST motor 2 gear (68).
        ★ After press fitting the bearings, apply transfer oil to them and rotate them.

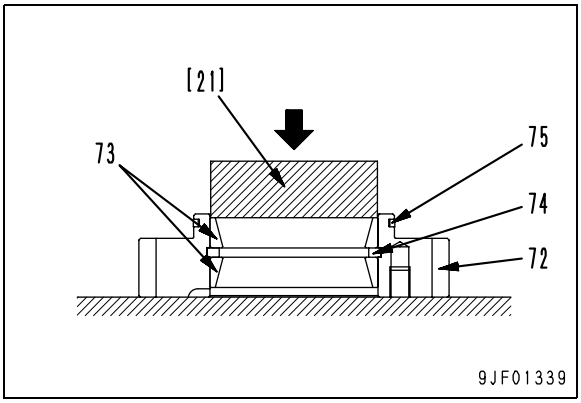


3. Installation of HST motor 2 gear and bearing assembly
   1) Install HST motor 2 gear and bearing assembly (67).

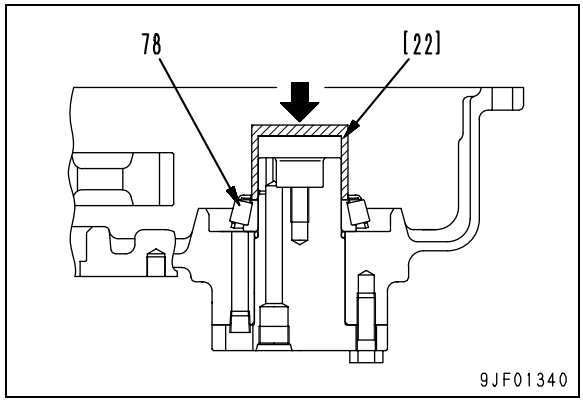


4. Assembly of HST motor 1 gear and outer races
   1) Install spacer (74) to HST motor 1 gear (72).
   2) Using push tool [21], press fit 2 outer races (73) to HST motor 1 gear (72).
   3) Install seal ring (75) to HST motor 1 gear (72).

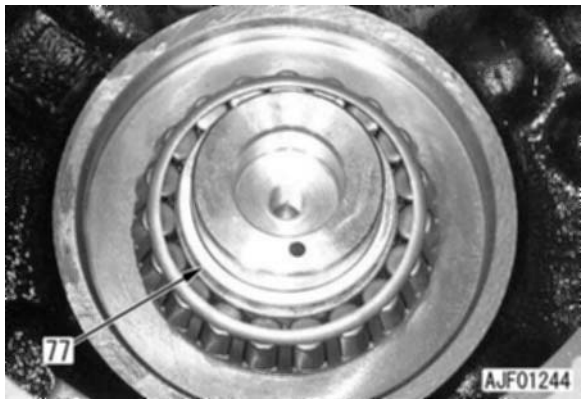
Seal ring: **Grease (G2-LI)**



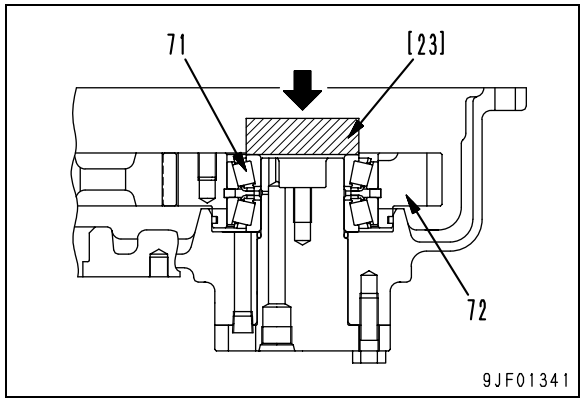
5. Bearing and HST motor 1 gear
   1) Using push tool [22] and the press, press fit bearing (78).



   2) Install spacer (77).

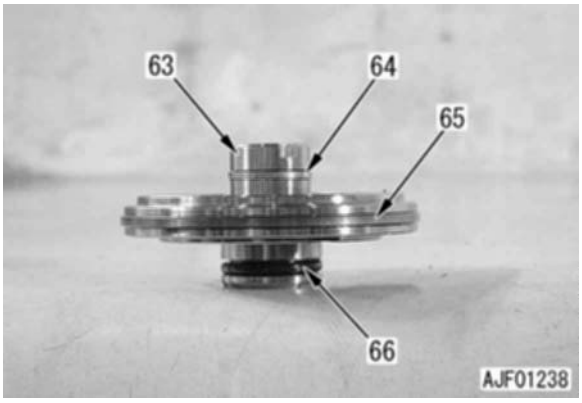


   3) Install HST motor 1 gear (72).
   4) Using push tool [23] and the press, press fit bearing (71).
      - Projection of bearing from shaft: **0.92 - 2.13 mm**



6. Holder
   1) Install seal rings (64) and (65) and O-ring (66) to holder (63).

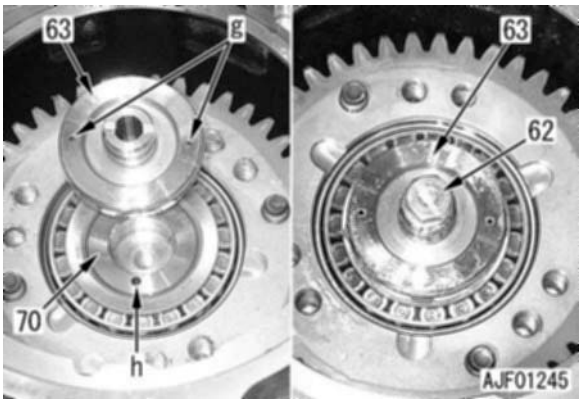
      Seal ring and O-ring: **Grease (G2-LI)**



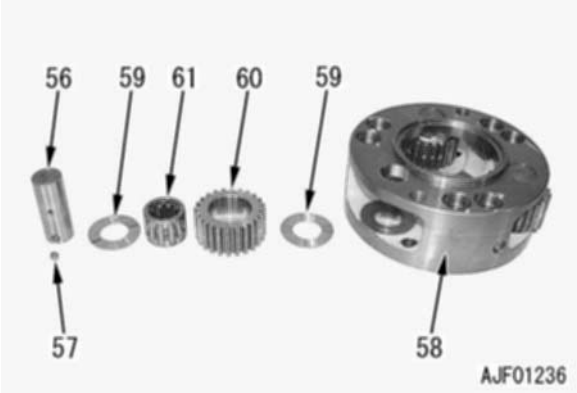
   2) Install holder (63) and tighten the mounting bolt.
      ★ Set the hole 2 mm in diameter (g) on the top of the holder horizontally [Set it at 90 degrees to the hole 4.5 mm in diameter (h) on shaft (70)].

      Mounting bolt: **Adhesive (LT-2)**

      Mounting bolt: **88.2 - 107.8 Nm {9 - 11 kgm}**



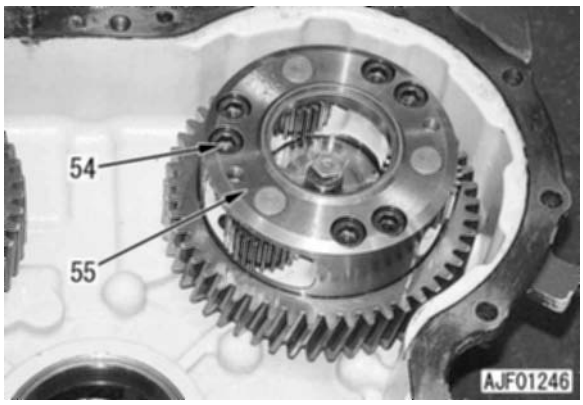
7. Assembly of carrier assembly
   1) Set planetary gear (60), bearing (61), and 2 thrust washers (59) to carrier (58) (at 3 places).
   2) Install pinion shaft (56) to carrier (58), matching their ball holes to each other, and then install ball (57).



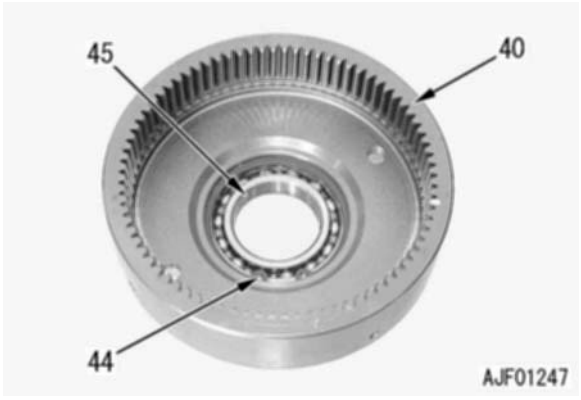
8. Installation of carrier assembly
   1) Install carrier assembly (55), matching it to the dowel pin of the HST motor 1 gear.
   2) Tighten mounting bolts (54).

      Mounting bolt: **Adhesive (LT-2)**

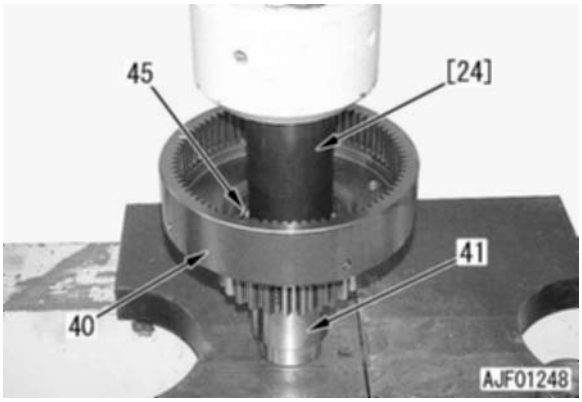
      Mounting bolt: **137 - 196 Nm {14 - 20 kgm}**



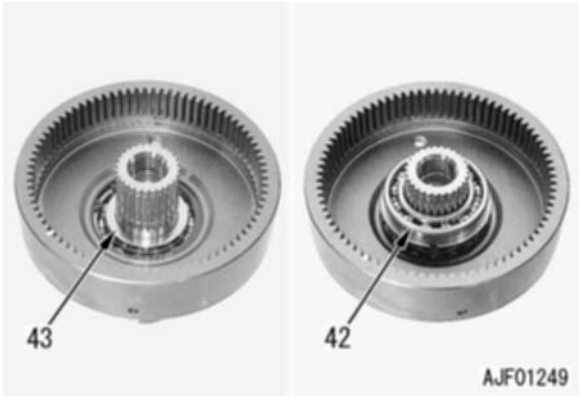
9. Assembly of HST motor 1 shaft and ring gear assembly
   1) Install bearing (45) to ring gear (40), and then install snap ring (44).



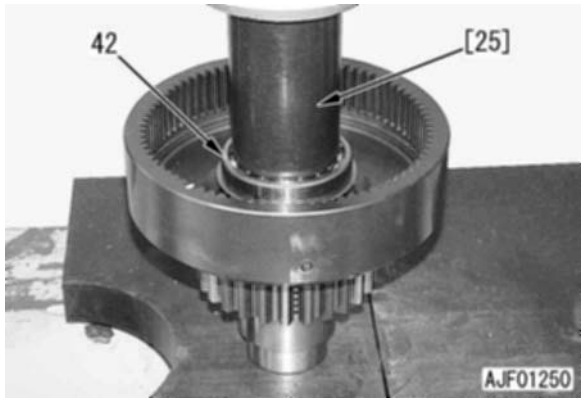
   2) Set ring gear (40) to HST motor 1 shaft (41). Using push tool [24] and the press, press fit bearing (45).



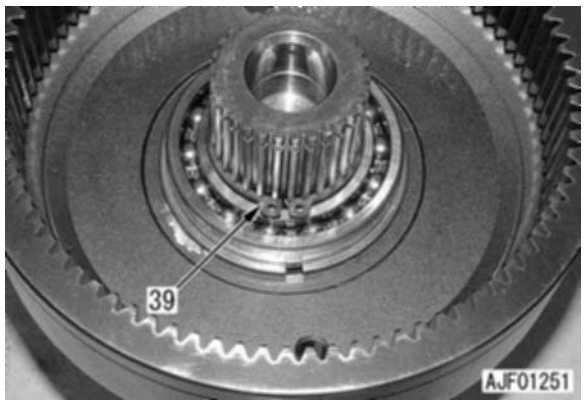
   3) Install spacer (43) and set bearing (42).
      ★ Take care of the setting direction of the bearing (flanged).



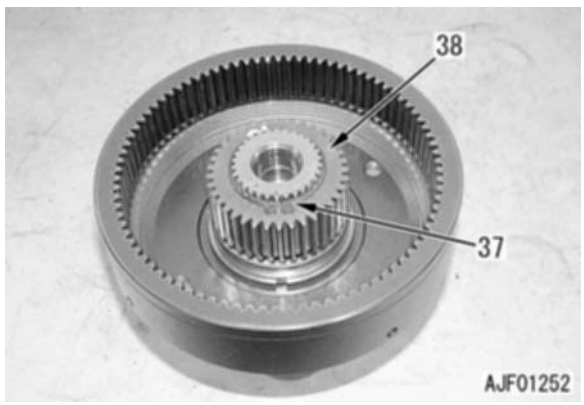
   4) Using push tool [25] and the press, press fit bearing (42).



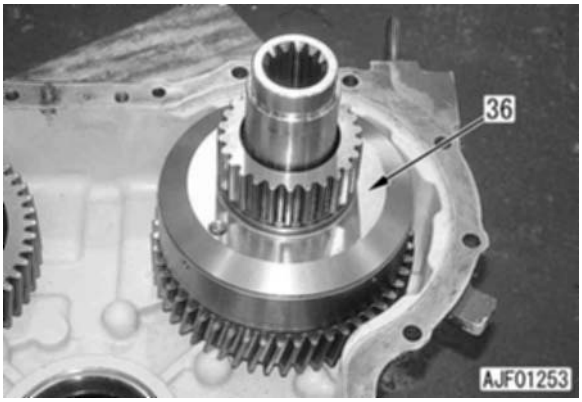
   5) Install snap ring (39).



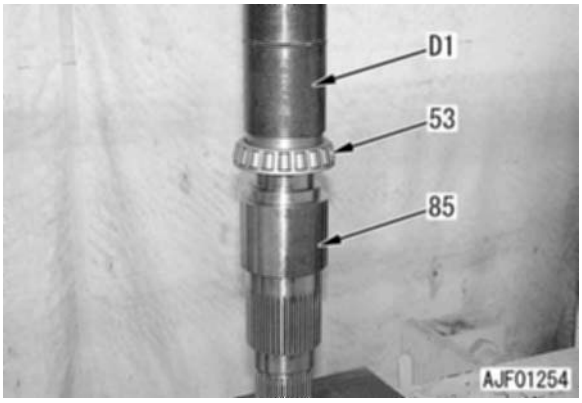
   6) Install sun gear (38) and snap ring (37).



10. Installation of HST motor 1 shaft and ring gear
    1) Install HST motor 1 shaft and ring gear assembly (36).

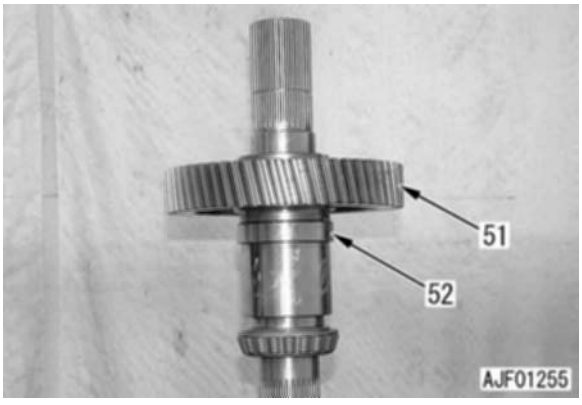


11. Assembly of output shaft and gear assembly
    1) Using tool **D1** and the press, press fit front bearing (53) until it touches output shaft (85).
       ★ After press fitting the bearing, apply transfer oil to it and rotate it.

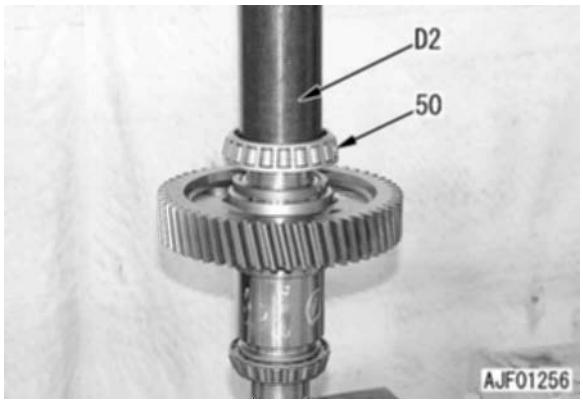


    2) Rotate the shaft and set spacer (52).
    3) Install output gear (51).

       Gear spline: **Grease (LM-G)**



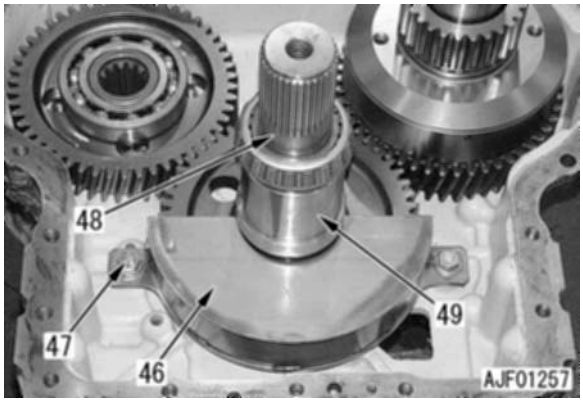
    4) Using tool **D2** and the press, press fit rear bearing (50).
       ★ After press fitting the bearing, apply transfer oil to it and rotate it.



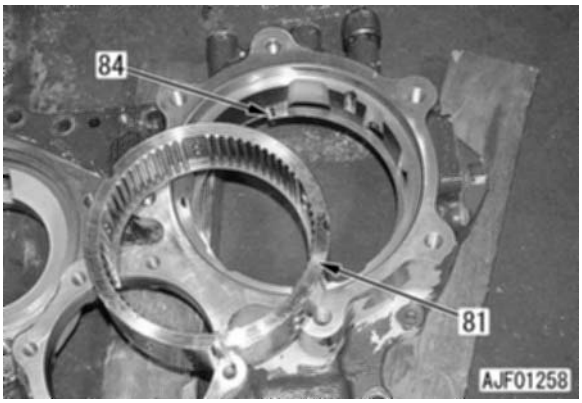
12. Installation of output shaft and gear assembly
    1) Put cover (46) over the gear and install output shaft and gear assembly (49) to the rear case.
    2) Secure cover (46) with bolts (47).
       ★ Check that cover (46) does not interfere with the inside of the gear.

       Mounting bolt: **Adhesive (LT-2)**

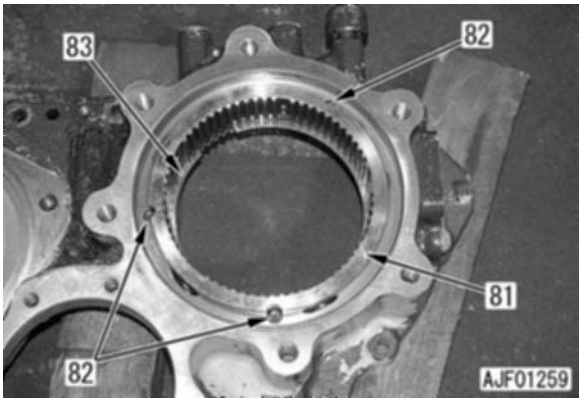
       Mounting bolt:
       98 - 123 Nm {10 - 12.5 kgm}



13. Clutch housing
    1) Install snap ring (84) to the front case.
    2) Install clutch housing (81) and 3 pins (82).

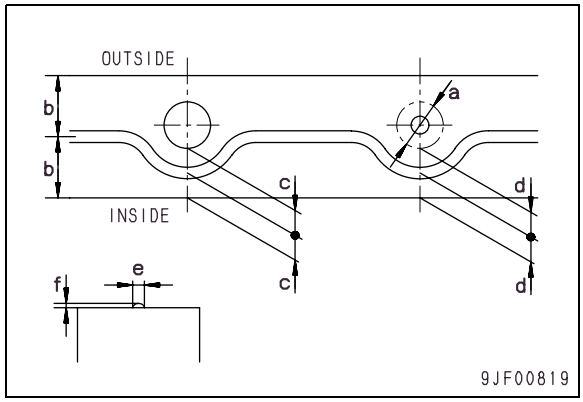


    3) Install snap ring (83)



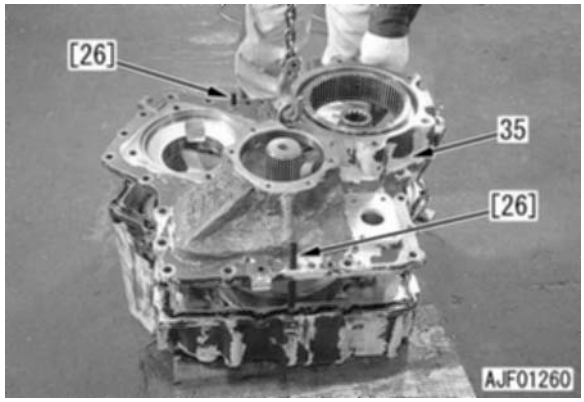
14. Front case
    ★ Use the front case and rear case as an assembly.
    ★ When installing the cases, match the match marks on their tops to each other.
    1) Apply gasket sealant to the rear case according to the following procedure.
        ★ Apply the gasket sealant to forcing screw contact part (a), similarly to the dimensions for each bolt hole.
        ★ Apply the gasket sealant so that dimensions (b) and (c) will be the same respectively.
        ★ Apply the gasket sealant so that dimension (e) x dimension (f) will be 2 - 5 mm.

        Gasket sealant:
        ThreeBond 1207B or equivalent

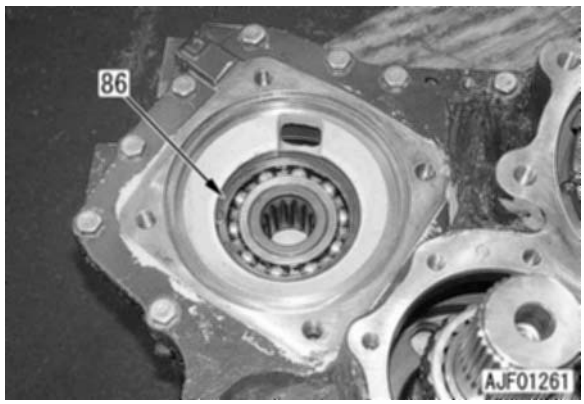


    2) Set guide pin [26] and install front case (35).

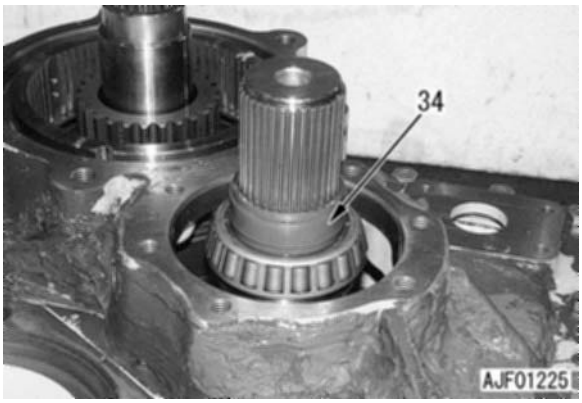
        Mounting bolt:
        98 - 123 Nm {10 - 12.5 kgm}



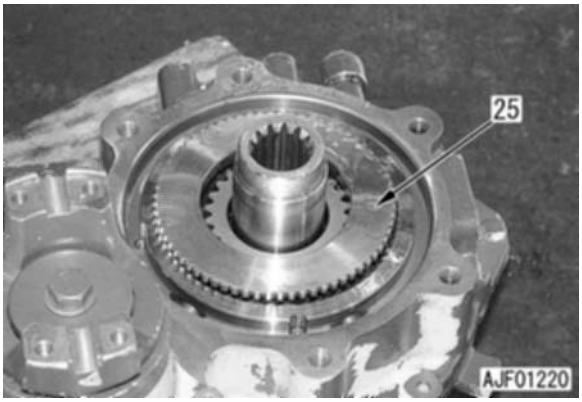
    3) Install snap ring (86) on the HST motor 2 side.



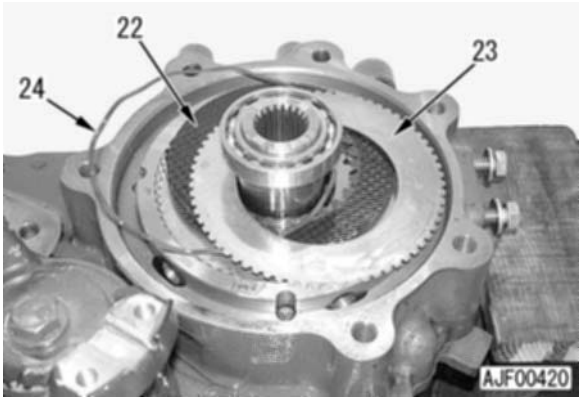
4) Install spacer (34) of the output shaft.

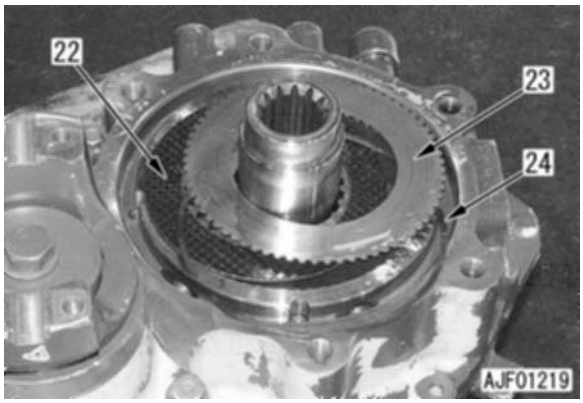


15. Clutch discs, plates, and springs
    1) Install end plate (25).



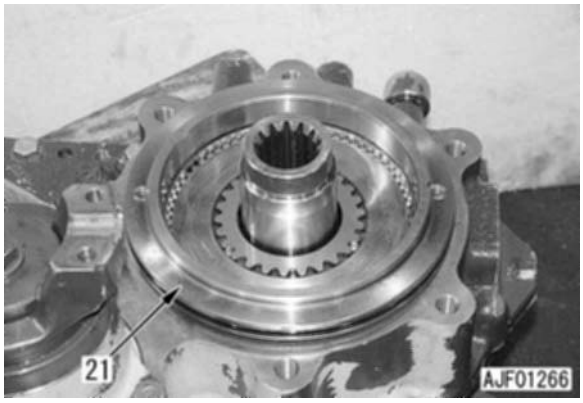
2) Install 7 discs (22), 7 wave springs (24), and 8 plates (23).
   ★ Soak the discs in clean transfer oil for at least 2 minutes before installing them.





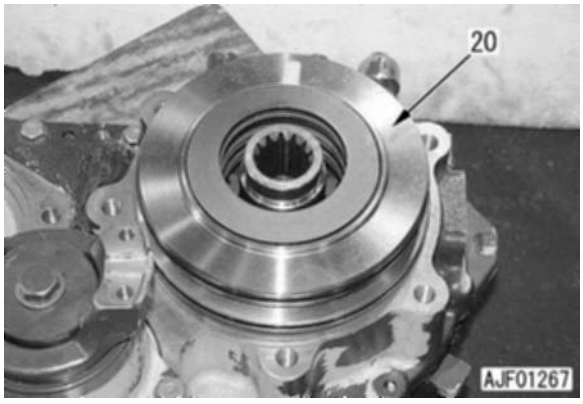
16. Spacer and piston
    1) Install the O-ring and spacer (21).

       O-ring: **Grease (G2-LI)**

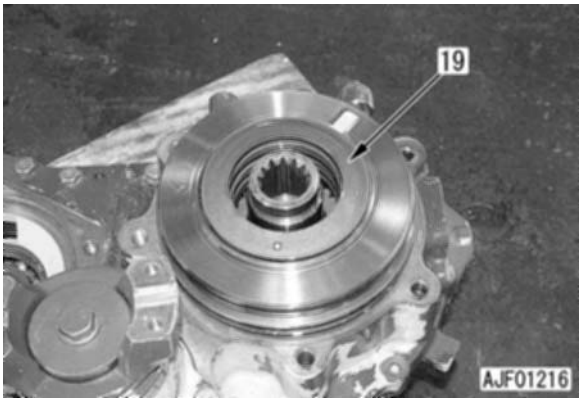


2) Install the O-ring and piston (20).

   O-ring: **Grease (G2-LI)**



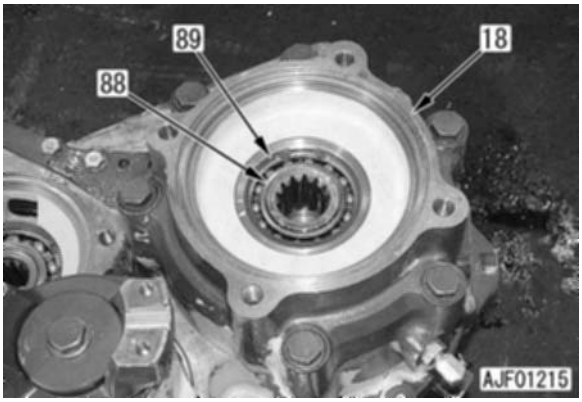
17. Belleville springs
    1) Set the 1st one (bottom one) of the 7 belleville springs (19) with the convex side up.
    2) Set the 2nd, 4th, and 6th belleville springs in the opposite direction to the 1st one and set the 3rd and 5th ones in the same direction as the 1st one. (There are no marks on the 1st - 6th springs.)
    3) Set the 7th belleville spring with the yellow mark side up.
       ★ When any belleville spring needs to be replaced, replace all of the 7 springs as a set.

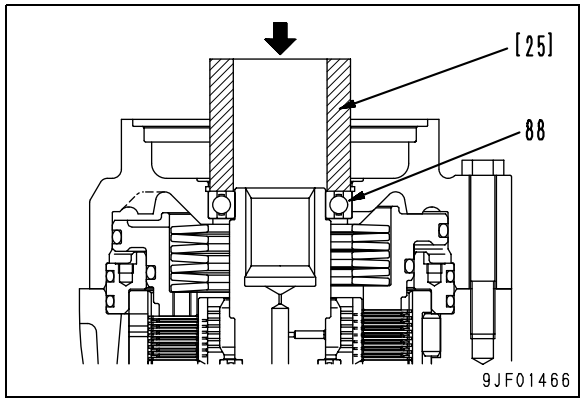


18. Cage
    1) Install cage (18).
       ★ Tighten the mounting bolts evenly and gradually.
       • Installed load of belleville springs (7-piece set): **21.500 N {2,190 kg}**

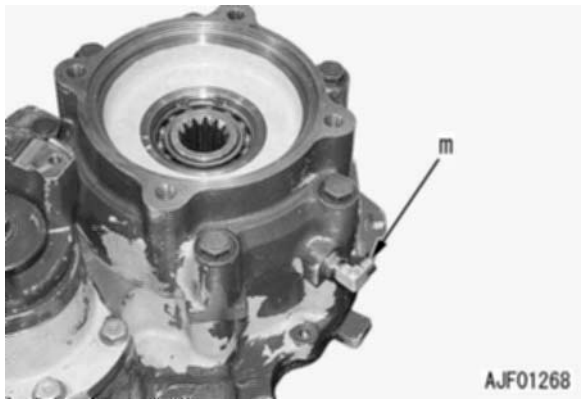
       Mounting bolt: **245 - 308 Nm {25 - 31.5 kgm}**

    2) After installing cage (18), press fit bearing (88) with push tool [25] and install snap ring (89).



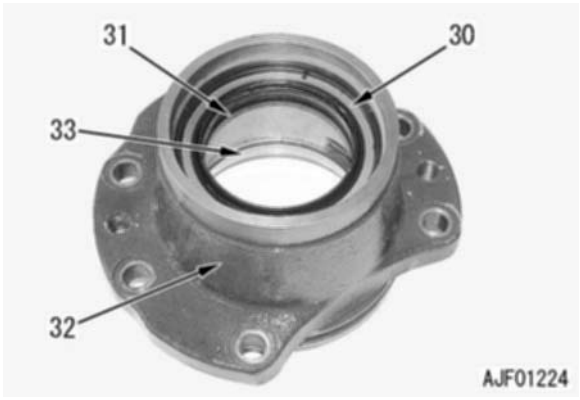


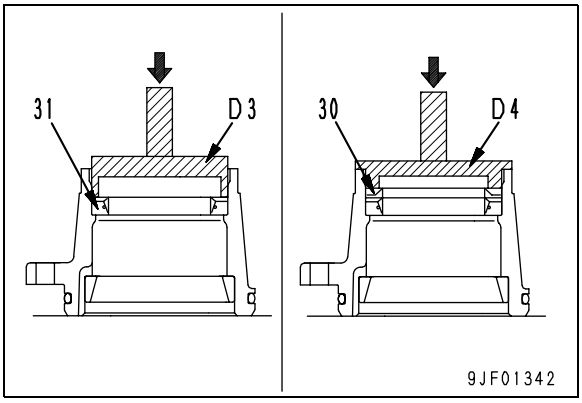
19. Operation test of transfer clutch
    1) Using tool **D5**, apply oil pressure to transfer clutch disengagement port (m).
       ★ When the oil pressure is applied, if the transfer clutch is disengaged, it is operating normally.
       • Clutch disengaging oil pressure: **1.52 MPa {15.5 kg/cm^2}**



20. Cage assembly
    1) Press fit outer race (33) to cage (32).
    2) Using tools **D3** and **D4**, press fit oil seal (31) and dust seal (30) to cage (32).

       Lips and clearances of oil seal and dust seal: Silicone grease (ThreeBond 1855 or equivalent)

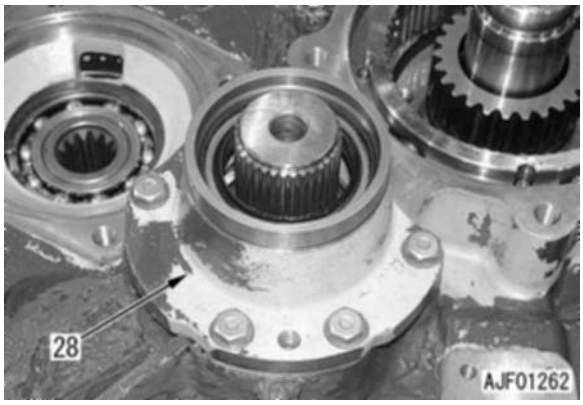


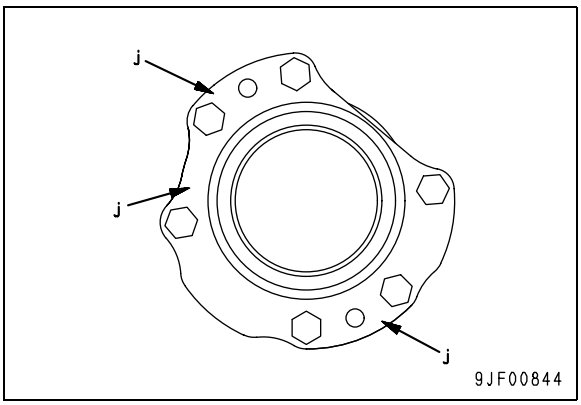


21. Adjusting pre-load on output shaft taper roller bearing
    1) Install cage (28) without inserting any shim.

       Mounting bolt:
       4.80 ± 0.98 Nm {0.5 ± 0.1 kgm}

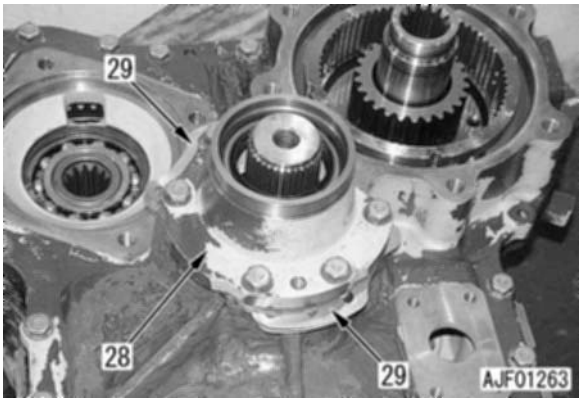
    2) Rotate the output shaft 20 turns and check the tightening torque of the mounting bolts tightened in step 1).
       ★ If the tightening torque has changed, repeat steps 1) and 2), and then check again.
    3) If the tightening torque has not changed, measure the clearances at 3 places (j) of cage (28) and obtain average (k).
       ★ To confirm that the bearing is not leaning, check that the dispersion of clearances at 3 places (j) is 0.15 mm or less. If the dispersion is large, the bearing is not installed normally or there is another cause. In this case, eliminate the cause and reduce the dispersion to 0.15 mm or less.



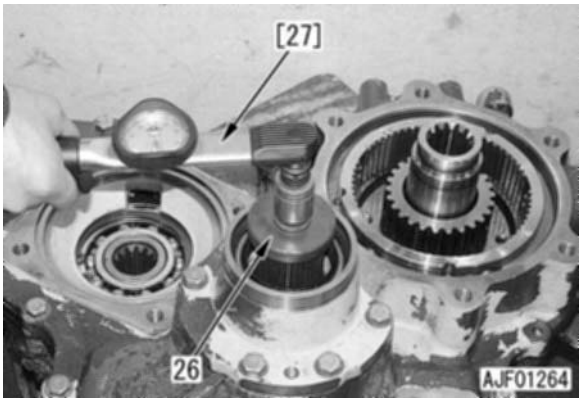


4) Calculate shim thickness (t).
   - Shim thickness (t) = Average of clearance (k) + 0.15 mm to 0.20 mm
5) Insert selected shim (29) between cage assembly (28) and the front case.
6) Tighten the cage mounting bolts.

   Mounting bolt:
   98 - 122.5 Nm {10 - 12.5 kgm}



7) Install holder (26) and the holder mounting bolt to the output shaft.
8) Set torque wrench [27] to the holder mounting bolt and measure the rotating torque of the output shaft.
   ★ Measure the rotating torque without installing the front and rear couplings.
   - Rotating torque of output shaft:
     4.9 - 6.7 Nm {0.5 - 0.7 kgm}



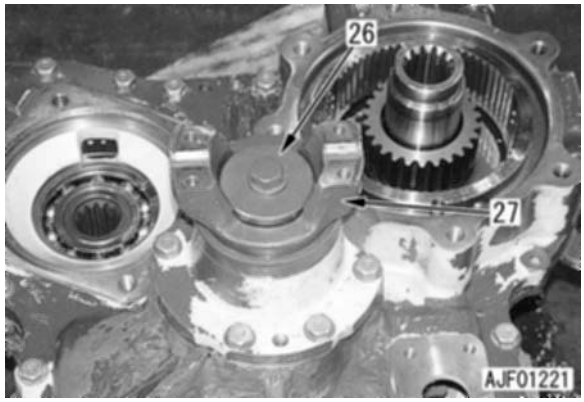
22. Coupling
    1) Install coupling (27) on the cage side.

       Spline of coupling: **Lubricant containing molybdenum disulfide (LM-G)**

    2) Install holder (26) and tighten the mounting bolt.

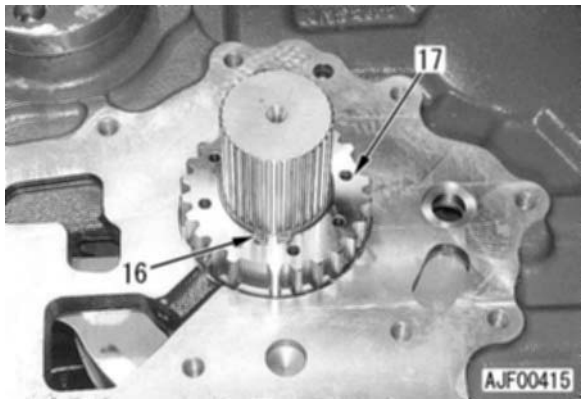
       Mounting bolt: **Adhesive (LT-2)**

       Mounting bolt:
       245 - 308.7 Nm {25 - 31.5 kgm}

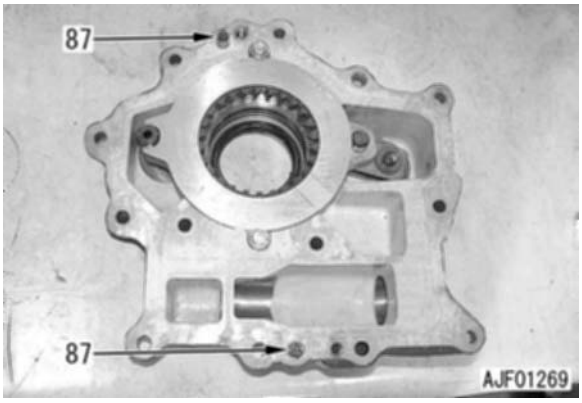


23. Hub
    1) Turn over the transfer assembly, install hub (17).
    2) Install snap ring (16).

       Spline of output shaft: **Lubricant containing molybdenum disulfide (LM-G)**



24. Parking brake assembly
    1) Remove 2 dowel pins (87) from the parking brake assembly.
       ★ The dowel pins may be left on the transfer case side.

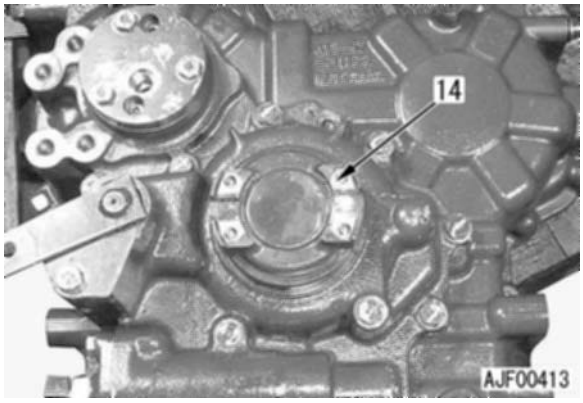


    2) Install parking brake assembly (15).
       ★ After the all internal teeth of the disc are meshed with the spline and the clearance between the parking brake housing and transfer case is eliminated, tighten the mounting bolts.
       ★ If the mounting bolts are tightened while there is clearance between the parking brake housing and transfer case and the internal teeth of the disc are shifted from the spline, the disc will be broken. Accordingly, remove the dowel pins and check securely in advance that there is not clearance.
       ★ Do not reuse the gasket but fit new one to the case side.
    3) Drive in the dowel pins and tighten the mounting bolts.

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

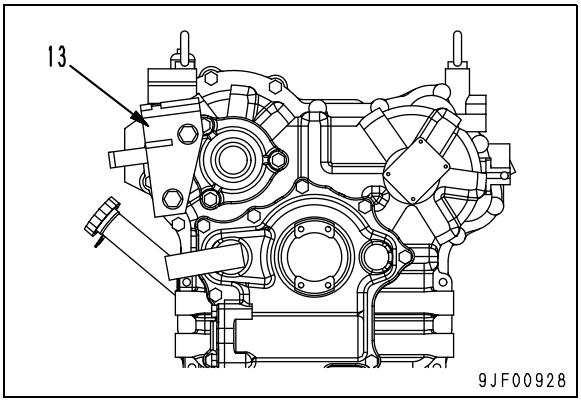
25. Coupling
    1) Install coupling (14).

Spline of coupling: **Lubricant containing molybdenum disulfide (LM-G)**

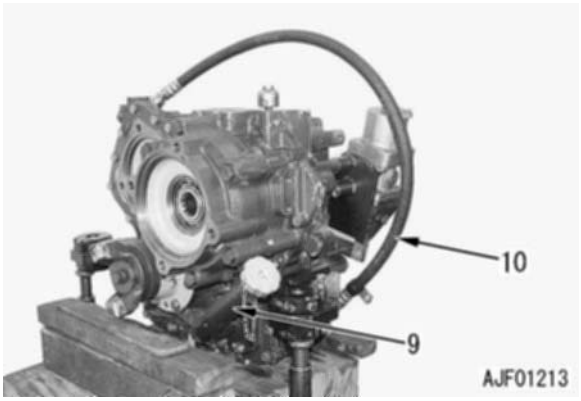


26. Parking brake cylinder
    1) Install parking brake cylinder bracket (13).

Mounting bolt:
245 - 309 Nm {25 - 31.5 kgm}



27. Oil supply pipe and hose
    1) Connect hose (10) to the transfer case strainer.
    2) Install oil supply pipe (9).



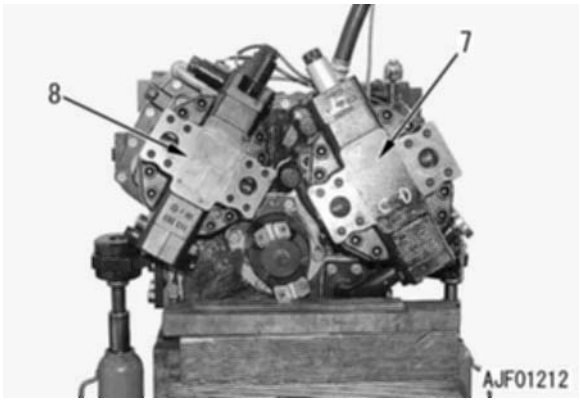
28. HST motor
    1) Sling and install HST motor 2 (8).

    Spline of HST motor 2: **Lubricant containing molybdenum disulfide (LM-G)**

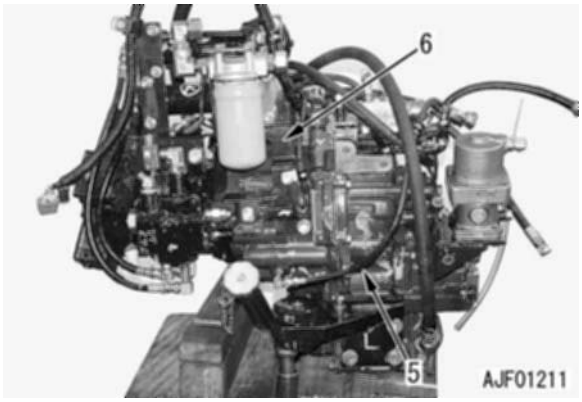
    Mounting bolt:
    245 - 309 Nm {25.0 - 31.5 kgm}

    2) Sling and install HST motor 1 (7).
    ★ Do not apply LM-G to the spline of HST motor 1.

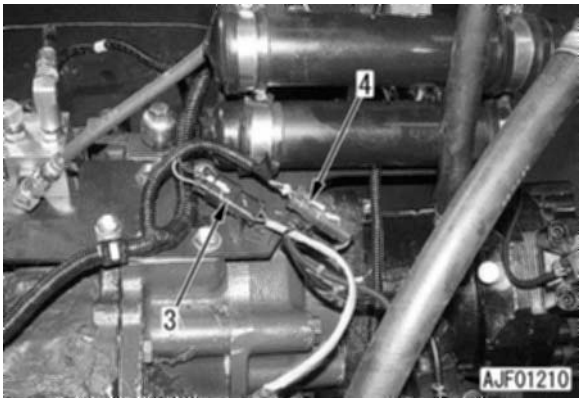
    Mounting bolt:
    245 - 309 Nm {25.0 - 31.5 kgm}



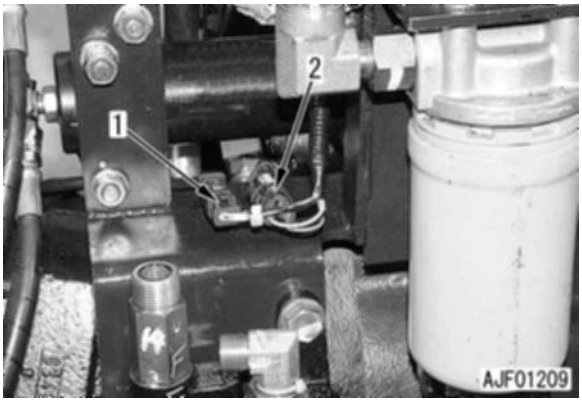
29. Brake accumulator
    1) Install brake accumulator and transfer oil filter bracket assembly (6) with the 6 mounting bolts.
    2) Connect clutch port hose (5).



    3) Connect wiring connectors T10 (3) and T07 (4).



    4) Connect wiring connectors T06 (1) and T11 (2).



    5) Install the speed sensor to the transfer case top.

REMOVAL, INSTALLATION OF PARKING BRAKE ASSEMBLY

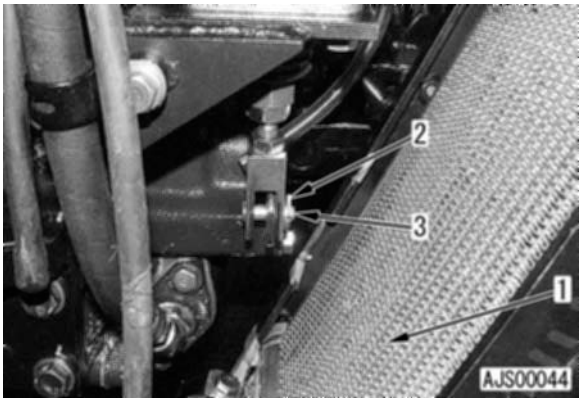
REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

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

Keep in mind that "the parking brake is removed" = you cannot apply the parking brake.

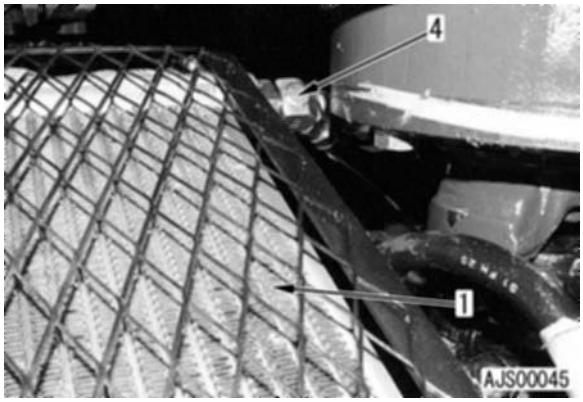
1. Turn the parking brake OFF (Release it).
2. Remove cotter pin (2) and pin (3) of the parking brake cylinder. [*2]
   - ★ The parking brake cylinder is at the front of the inside of the left rear wheel.
   - ★ The left rear wheel is removed in the photo.

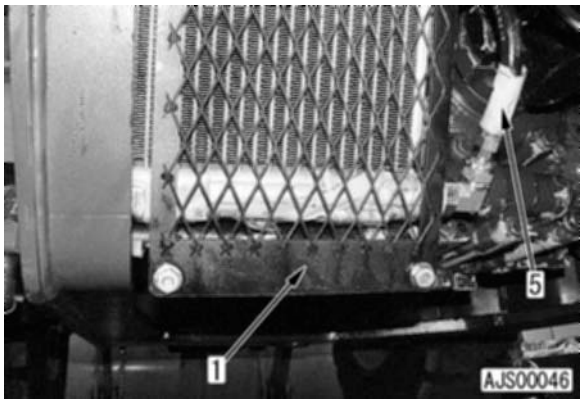


3. Drain the transfer oil.

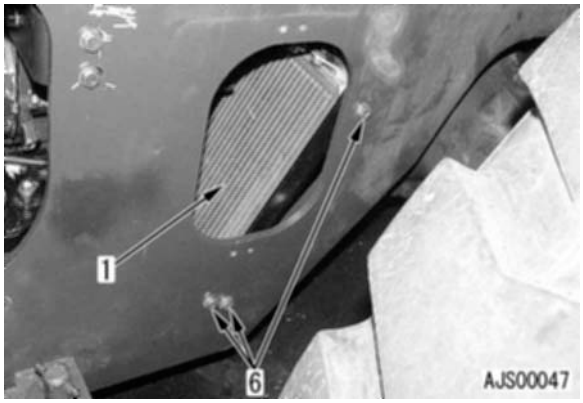
   Transfer case: **6.5 ℓ**

4. Disconnect the upper hose (4) and lower hose (5) of transfer oil cooler (1).

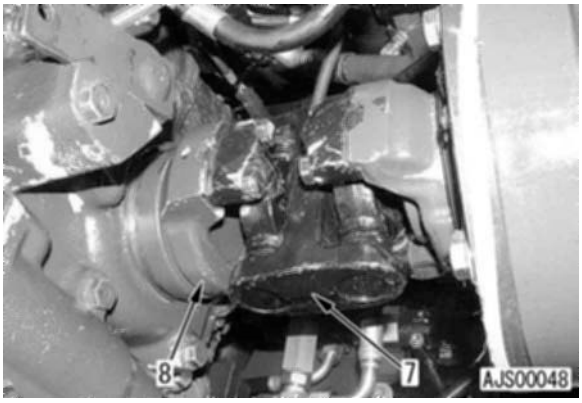




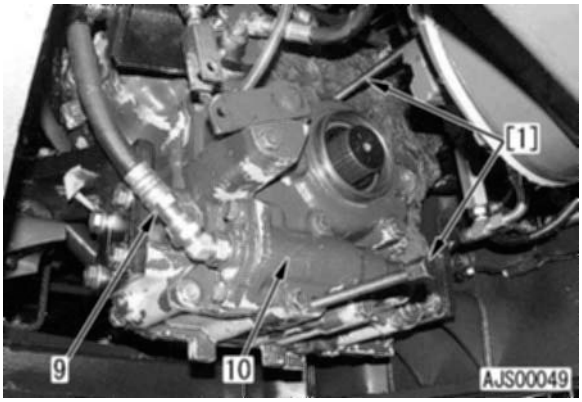
5. Remove 3 mounting bolts (6) of transfer oil cooler (1).



6. Remove rear drive shaft (7). [*1]
7. Remove coupling (8).



8. Disconnect transfer lubricating oil pump hose (9).
9. Remove the parking brake mounting bolts. Then, using forcing screws [1], remove parking brake assembly (10). [*3]



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Rear drive shaft mounting bolt:
59 - 74 Nm {6.0 - 7.5 kgm}

★ When installing the drive shaft, check that the key way of the spider cap is fitted in the key way of the mating yoke, and then tighten the mounting bolts.
★ When installing the rear drive shaft, check that the lateral runout of the rear axle and transfer from each other is less than 3 mm. If the runout is 3 mm or larger, shift the transfer cushion and transfer mount to reduce the runout.

[*2]

★ After inserting cotter pin (2) in pin (3), open it to 180 degrees.

[*3]

★ Using guide bolts, install the parking brake.

Parking brake mounting bolt:
98 - 123 Nm {10 - 12.5 kgm}

- Refilling with oil (Transfer case)

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

Transfer case: **6.5 ℓ**

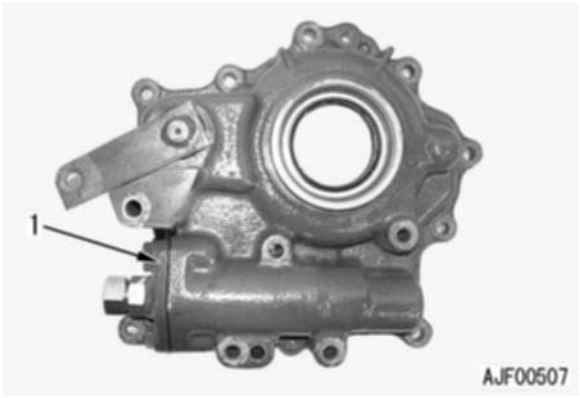
DISASSEMBLY, ASSEMBLY OF PARKING BRAKE ASSEMBLY

SPECIAL TOOLS

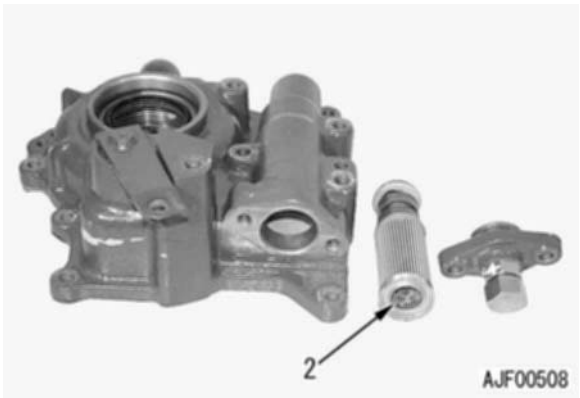
Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
D	3	790-101-5201	Push tool kit	■	1		
		• 790-101-5301	• Plate		1		
		• 790-101-5221	• Grip		1		
		• 01010-51225	• Bolt		1		
	4	793T-417-1120	Push tool	■	1	N	○
		790-101-5221	Grip	■	1		
		01010-81225	Bolt	■	1		

DISASSEMBLY

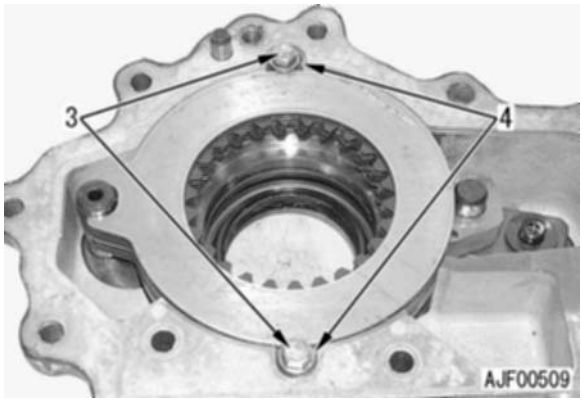
1. Strainer
   1) Remove cover (1).



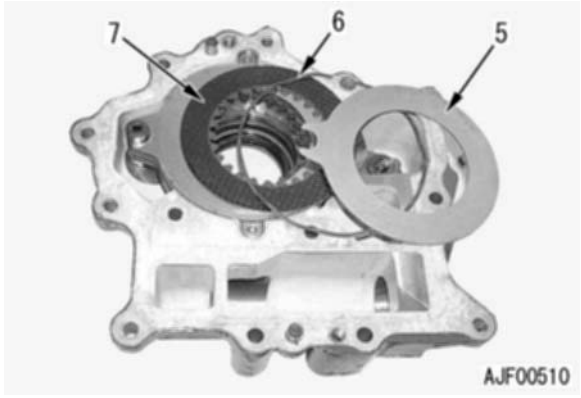
   2) Remove strainer (2).



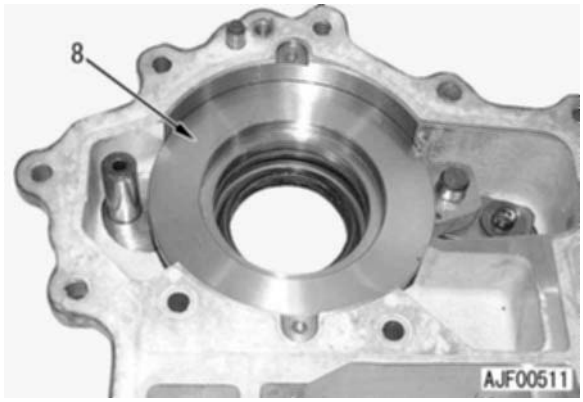
2. Plates, discs, and springs
   1) Remove 2 clamping bolts (3) and 2 spacers (4).
      ★ Since the spring tension is applied, loosen the 2 clamping bolts evenly.



   2) Remove 5 plates (5), 4 wave springs (6), and 4 discs (7).

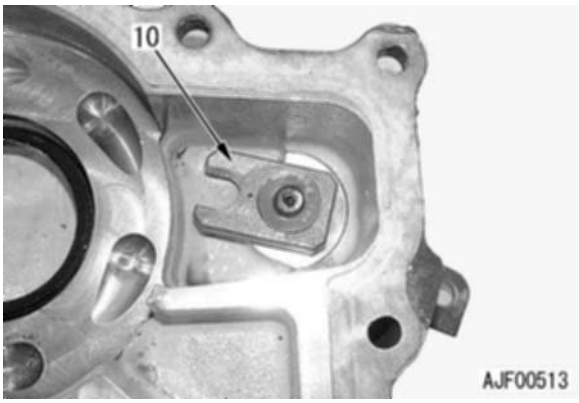


3. Cam plate
   1) Remove cam plate (8).

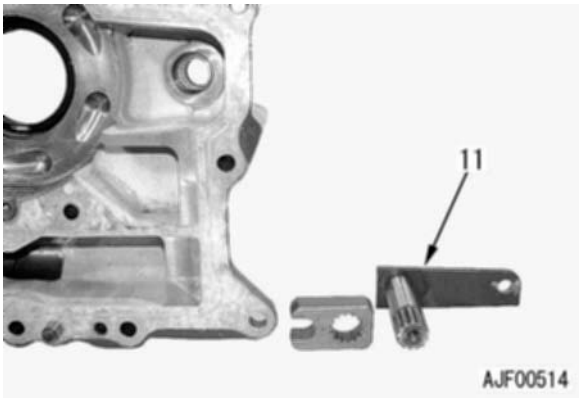


4. Ball
   1) Remove 6 balls (9).

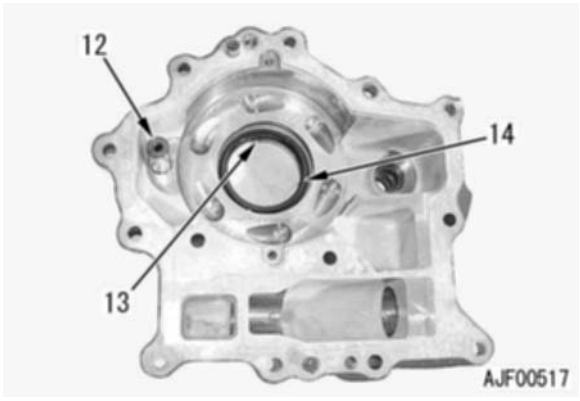
5. Lever
   1) Remove the mounting bolt and lever (10).



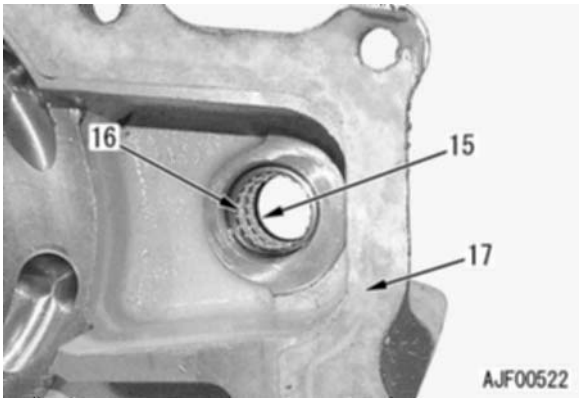
   2) Remove lever (11).



6. Pin
   1) Remove pin (12).
7. Dust seal and oil seal
   1) Remove dust seal (13) and oil seal (14).



8. Oil seal and bearings
   1) Remove oil seal (15).
   2) Remove 2 bearings (16) from parking brake case (17).



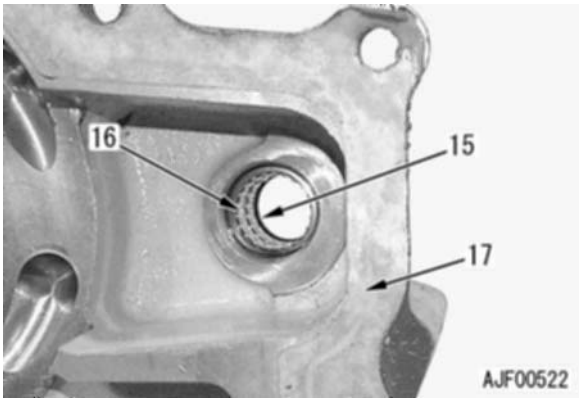
ASSEMBLY

★ Clean the all parts and check them for dirt or damage. Coat their sliding surfaces with transfer oil (E010-CD) before installing.
★ Do not reuse the gasket but remove it completely.

1. Oil seal and bearings.
   1) Install 2 bearings (16) to parking brake case (17).
   2) Install oil seal (15).

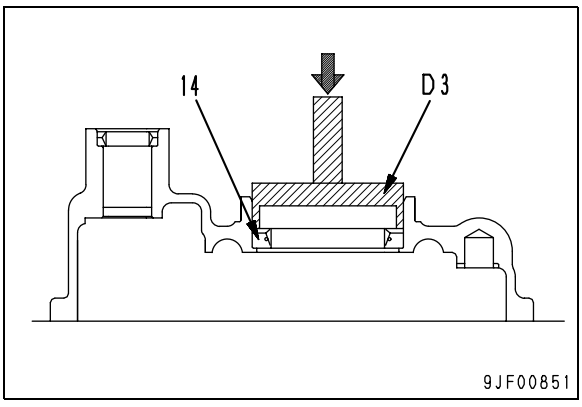
      Oil seal: **Grease (G2-LI)**

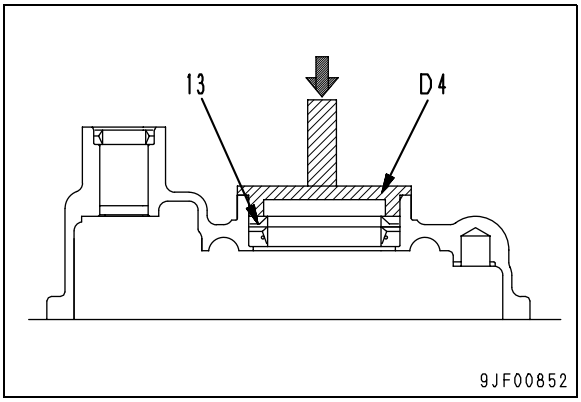
      (Although the gasket is fitted to the parking brake fitting face in the drawing, perform the work without fitting the gasket.)



2. Oil seal and dust seal
   1) Using tools **D3** and **D4**, press fit oil seal (14) and dust seal (13).

      Lips and clearances of oil seal and dust seal: **Silicone grease (ThreeBond 1855 or equivalent)**



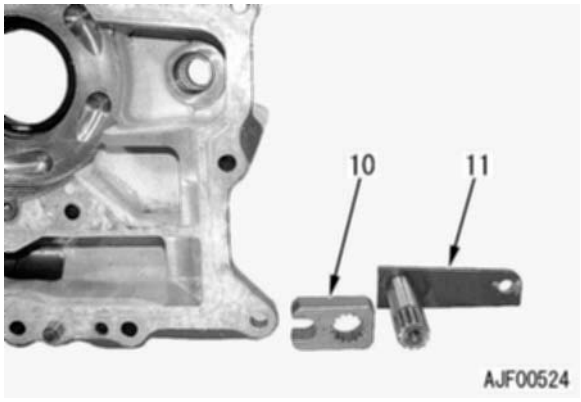


3. Pin
   1) Install pin (12).
      ★ Install the pin with the grooved part outward.
      ★ Check that dirt is not sticking to the ball groove and inside of the housing.

      (Although the gasket is fitted in the drawing, perform the work without fitting the gasket.)

4. Lever
   1) Install levers (11) and (10).

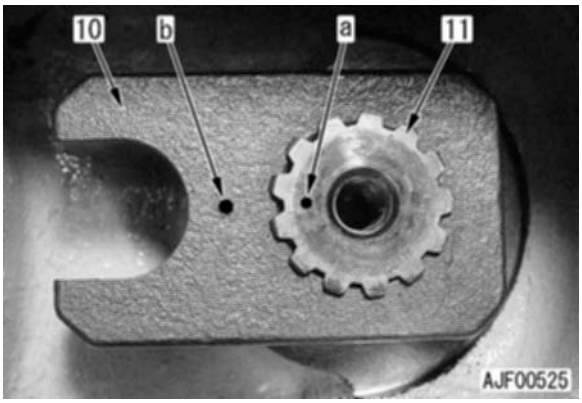
      (Perform the work with the gasket removed.)



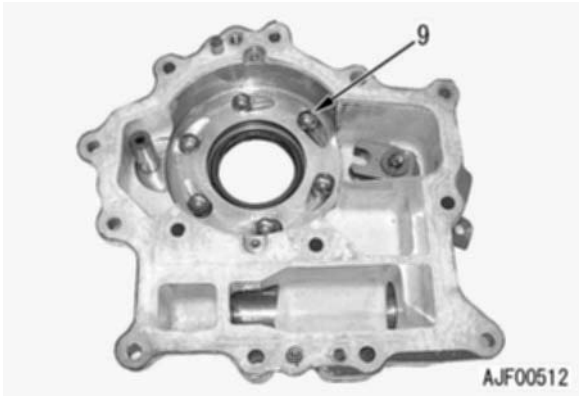
★ When installing the levers (11) and (10), match their match marks (a) and (b).

Mounting bolt: **Adhesive (LT-2)**

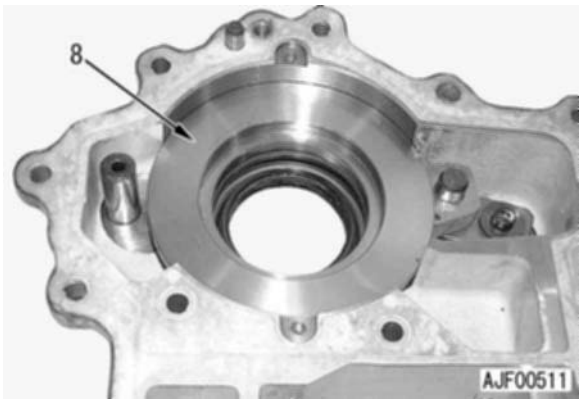
Mounting bolt:
27 - 34 Nm {2.8 - 3.5 kgm}



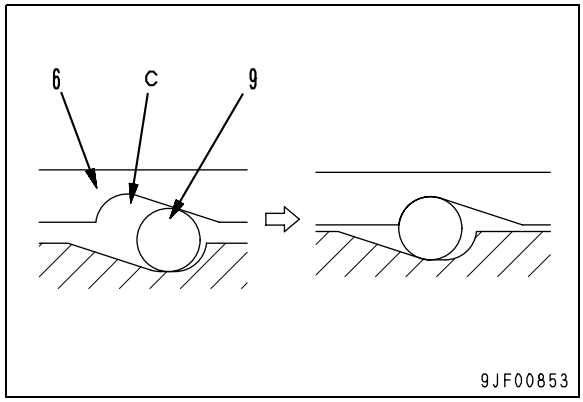
5. Balls
   1) Install 6 balls (9).
      ★ Check that dirt is not sticking to the balls.
      (Perform the work with the gasket removed.)



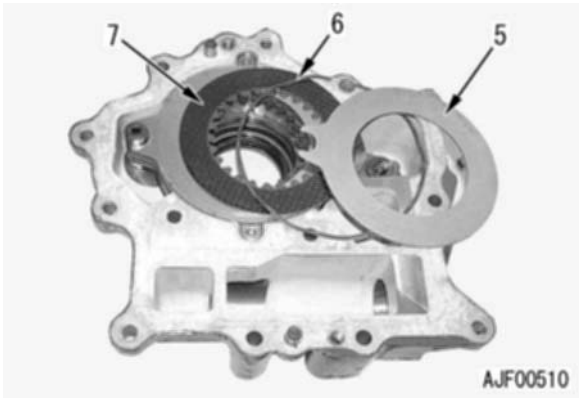
6. Cam plate
   1) Install cam plate (8).
      ★ Check that dirt is not sticking to the ball grooves, inside of parking brake housing, cam plate, discs, and plates.
      (Perform the work with the gasket removed.)



★ Move the cam plate (8) several times so that balls (9) will be fitted to grooves "c" of cam plate (8).
★ Check that the cam plate does not hitch on the housing.



7. Plates, disc, and springs
   1) Install 4 discs (7), 4 wave springs (6), and 5 plates (5).
      ★ Soak the disc in clean transfer oil for at least 2 minutes before installing them.
      ★ Check that dirt is not sticking to the discs and plates.
      (Perform the work with the gasket removed.)

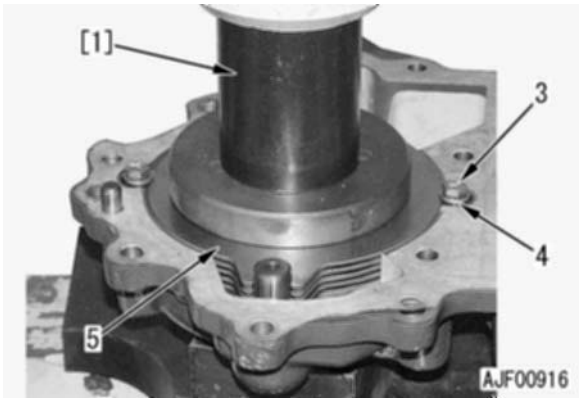


2) Using push tool [1], press plate (5) lightly with a press and install 2 spacers (4) and 2 clamping bolts (3).
   - ★ Take care not to press plate (5) too much and not to damage it.
   - ★ Press plate (5) until it is flush with the parking brake case.
   - ★ Move the lever and check that it returns normally.

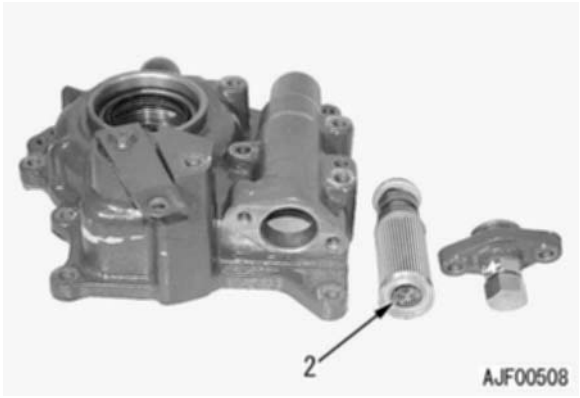
   Clamping bolt: **Adhesive (LT-2)**

   Clamping bolt:
   19.6 - 27.4 Nm {2.0 - 2.8 kgm}

   (Perform the work with the gasket removed.)



8. Strainer
   1) Install strainer (2).



2) Install the O-ring and cover (1).

   O-ring: **Grease (G2-LI)**

   Mounting bolt:
   98 - 122.5 Nm {10 - 12.5 kgm}

REMOVAL, INSTALLATION OF FRONT AXLE ASSEMBLY

REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

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

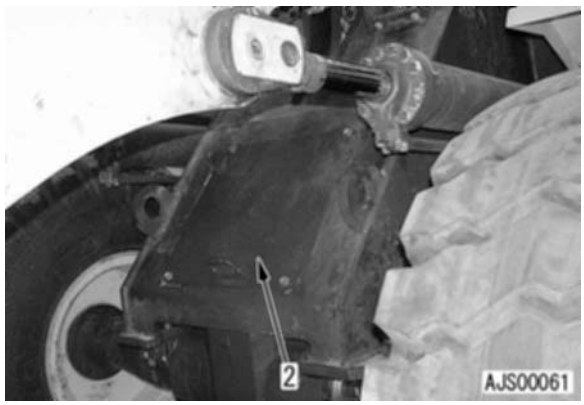
Release the remaining pressure in the brake accumulator circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.

1. Raise the front part of the chassis with the work equipment and set blocks [1] under the frame at the rear of the front wheel to float the front part of the chassis.

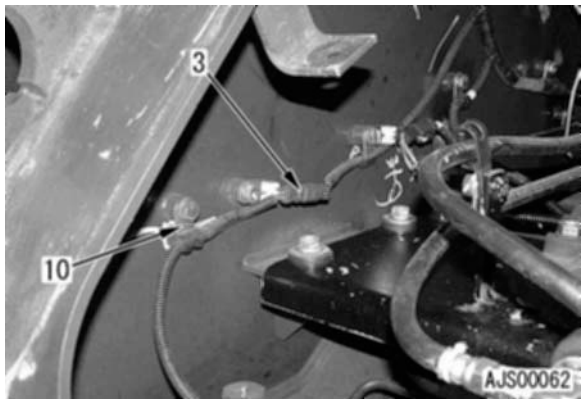
2. Lift off the front wheel (1). [*1]
   ★ Lift off the front wheel on the other side similarly.

   Front wheel (1 side): **340 kg**

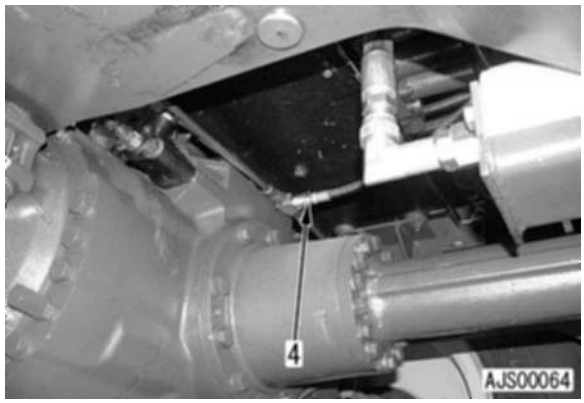
3. Remove work equipment upper cover (2).



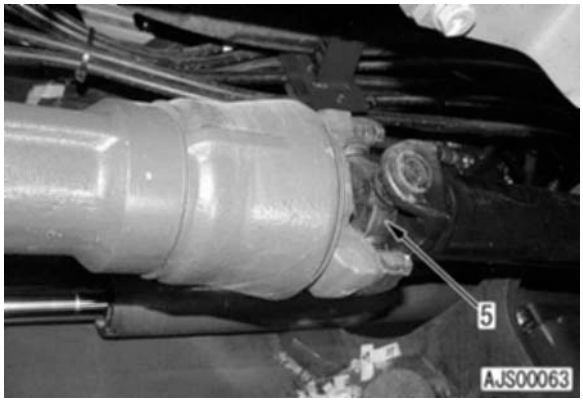
4. Disconnect wiring connector F14 (3) and clamp (10).



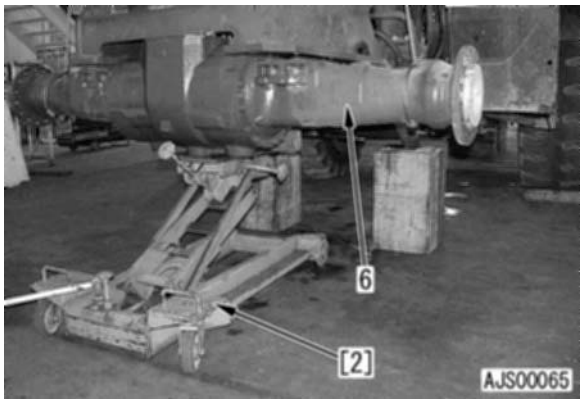
5. Disconnect brake hose (4).



6. Disconnect front drive shaft (5). [*2]



7. Sling front axle assembly (6) temporarily and support it on jack [2]. Remove the 4 mounting bolts on both sides and front axle assembly (6). [*3]



Front axle assembly: **720 kg**

INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Front wheel mounting bolt:
824 - 1030 Nm {84 - 105 kgm}

[*2]

★ When installing the drive shaft, check that the key way of the spider cap is fitted to the key way of the mating yoke, and then tighten the mounting bolts.

Front drive shaft mounting bolt:
59 - 74 Nm {6.0 - 7.5 kgm}

[*3]

Front axle mounting bolt:
1325 - 1470 Nm {135 - 150 kgm}

- **Bleeding air**
  Bleed air from the brake system. For details, see TESTING AND ADJUSTING, Bleeding air from brake system.

REMOVAL, INSTALLATION OF REAR AXLE ASSEMBLY

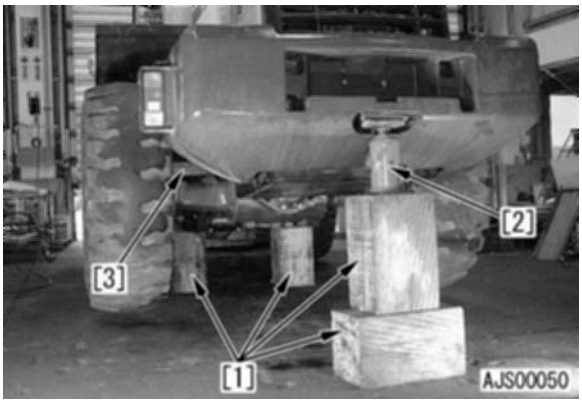
REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground and stop the engine.

Release the remaining pressure in the brake accumulator circuit. For details, see TESTING AND ADJUSTING, Bleeding air from brake accumulator circuit.

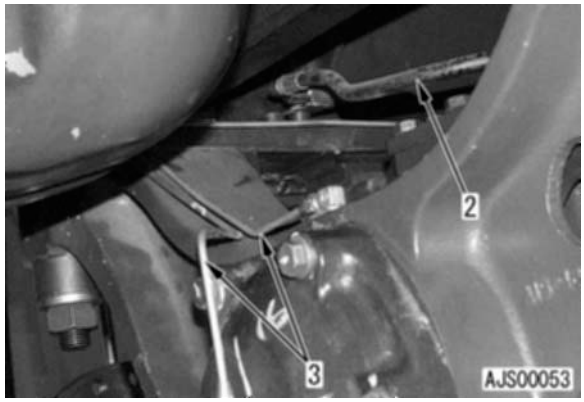
1. Raise the chassis with the work equipment (See Removal, installation of front axle assembly, 1.) and set blocks [1] under the rear frame in front of the rear wheel.
2. Lower the work equipment to the ground horizontally and raise the rear part of the chassis, and then support the counterweight on blocks [1] and jack [2].
3. Set blocks [3] between top of each side of the rear axle and the rear frame and fix the rear wheel so that it will not lean.

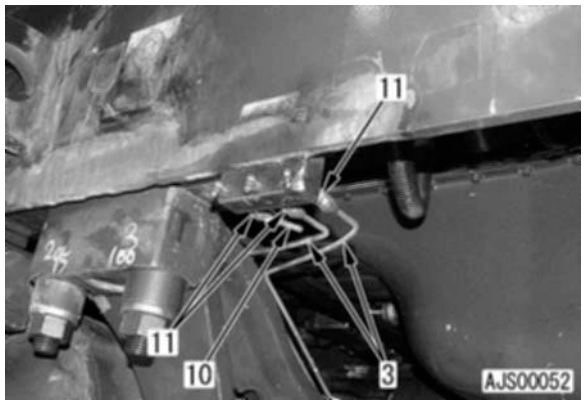


4. Lift off the rear wheel (1). [*1]
   ★ Lift off the rear wheel on the other side similarly.

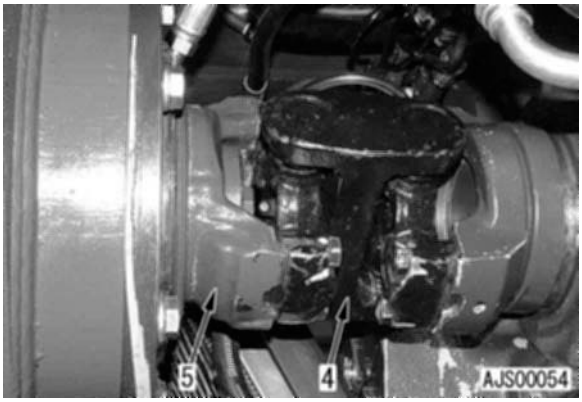
   Rear wheel (1 side): **340 kg**

5. Disconnect brake hose (2) from the frame.
6. Disconnect 2 grease tubes (3).
7. Disconnect grease tube (10).
8. Remove 3 grease fittings (11). (If they are not removed, the axle assembly will collide with them when the axle assembly is pulled out backward in step 12.)

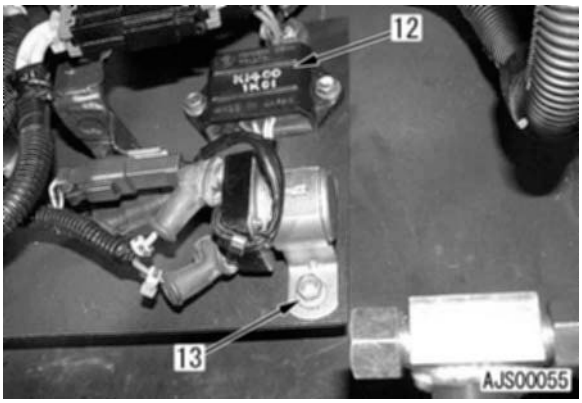




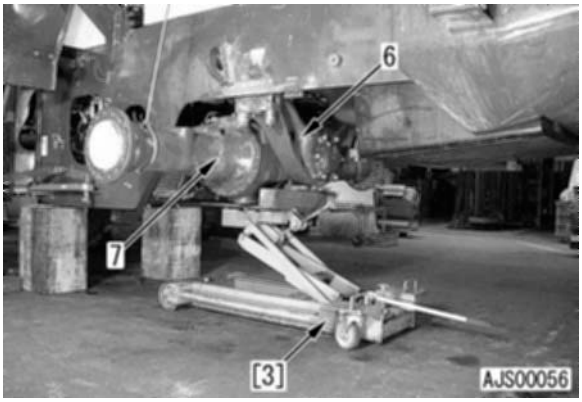
9. Remove rear drive shaft (4). [*2]
   ★ Take care not to damage dust seal (8) with coupling (5) in step 12.



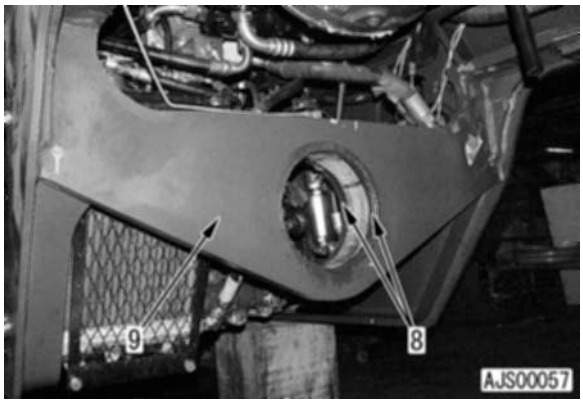
10. Remove bracket (13) of timer (12) and switch (relay) above the left mounting bolt of support (6). [*3]



11. Sling rear axle assembly (7) temporarily, support it on jack [3], and remove the mounting bolts of support (6). [*4]

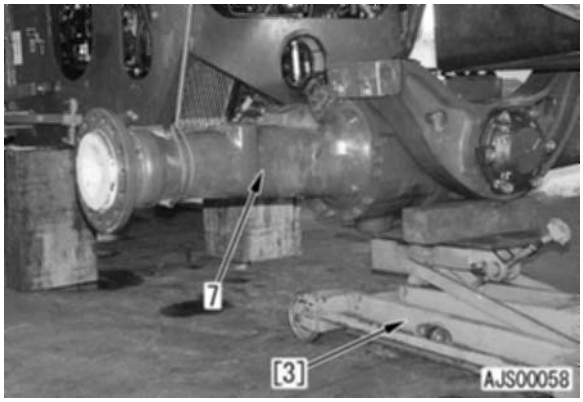


12. Pull out the rear axle assembly backward to disconnect it from the rear frame assembly.
   ★ When disconnecting the rear axle assembly, take care not to damage dust seal (8) of rear frame (9).



13. Lower the crane and jack [3] simultaneously to remove rear axle assembly (7).

Rear axle and support assembly: **770 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Rear wheel mounting bolt:
824 - 1030 Nm {84 - 105 kgm}

[*2]

★ Check that the radial runout of the rear axle from the transfer in lateral direction is not larger than 3 mm. If it is larger than 3 mm, reduce it by moving the transfer mount.

★ When installing the drive shaft, check that the key way of the spider cap is fitted to the key way of the mating yoke, and then tighten the mounting bolts.

Rear drive shaft mounting bolt:
59 - 74 Nm {6.0 - 7.5 kgm}

[*3]

★ When removing and installing the mounting bolts of support (6), take care not to hit the removed electronic parts with a tool, a bolt, etc.

[*4]

Support mounting bolt:
1325 - 1470 Nm {135 - 150 kgm}

- **Bleeding air**
  Bleed air from the brake system. For details, see TESTING AND ADJUSTING, Bleeding air from brake system.

DISASSEMBLY, ASSEMBLY OF AXLE HOUSING ASSEMBLY

SPECIAL TOOLS

Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
H	1	793T-623-1170	Push tool	■	1		○
		793T-422-1440	Push tool	■	1	N	○
	2	793T-422-1410	Seal support	■	1	N	○
		01010-80860	Bolt	■	1		
		793T-422-1420	Seal support	■	1	N	○
		01010-80860	Bolt	■	1		
	3	793T-659-1110	Push tool	■	1		○
		790-201-2750	Spacer	■	1		
	4	793T-422-1430	Holder	■	1	N	○

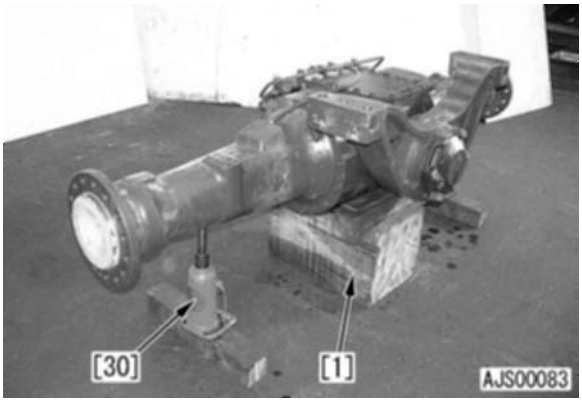
DISASSEMBLY

★ The following photos and illustrations show the rear axle housing as an example.

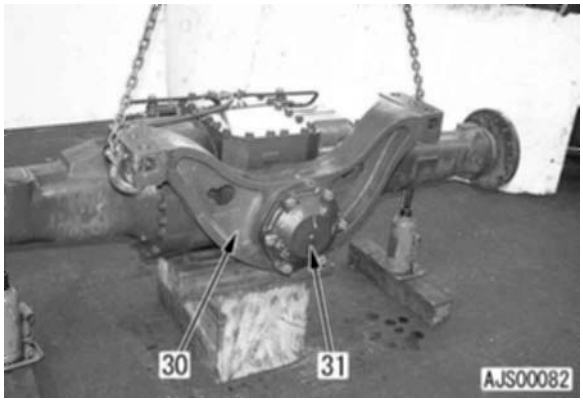
1. Draining oil

   Axle (Each of front and rear axles): **27 ℓ**

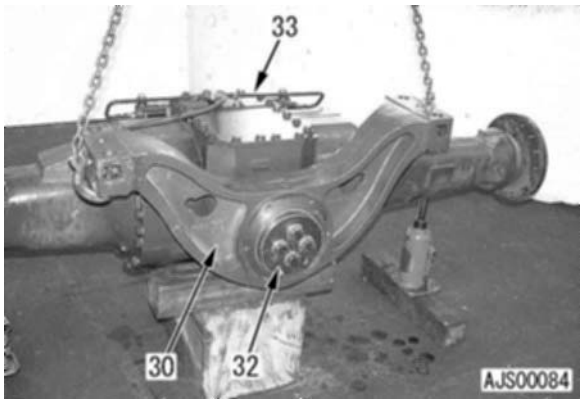
2. Axle assembly
   1) Set the axle assembly on block [1] and jack [30].
      ★ Set jack [30] so that the axle assembly will not lean when the housing assembly on one side is removed.



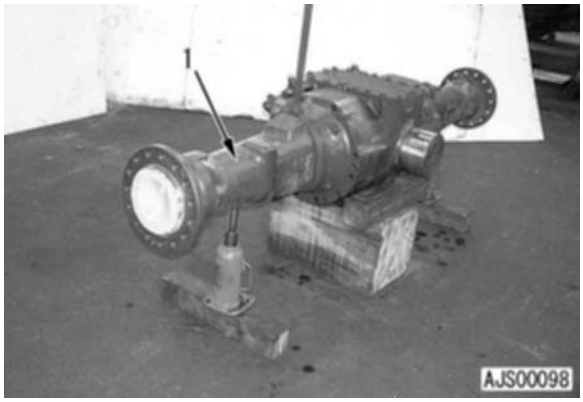
   2) Sling rear support (30) temporarily and remove cover (31).



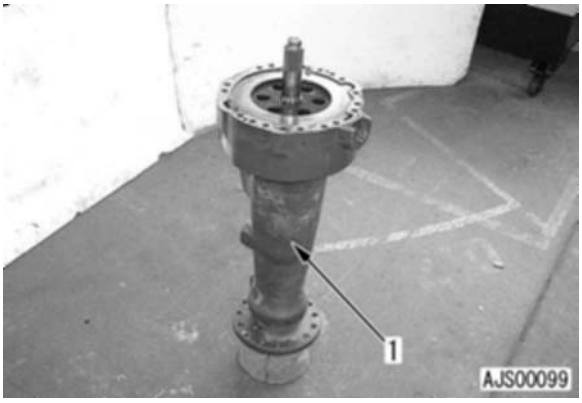
   3) Remove thrust plate (32) and rear support (30).
   4) Remove brake tube and hose assembly (33).



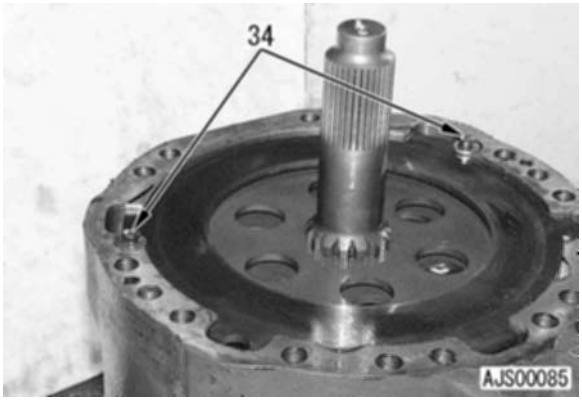
3. Axle housing assembly
   1) Sling axle housing assembly (1) temporarily and remove the housing mounting bolts and axle housing assembly (1).
      ★ When removing both axle housing assemblies, make match marks on the housings and differential case so that the housing assemblies will not be mistaken.



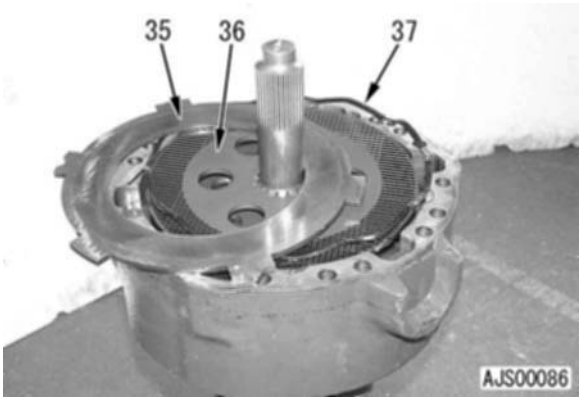
2) Set axle housing assembly (1) with the brake side up.



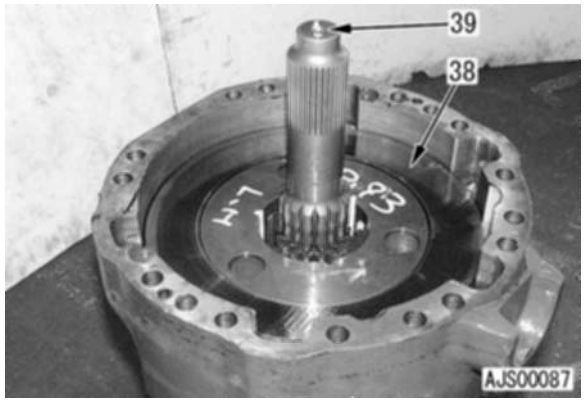
4. Brakes
   ★ Remove both brakes according to the following procedure.
   1) Remove 2 inside hexagon bolts (34).



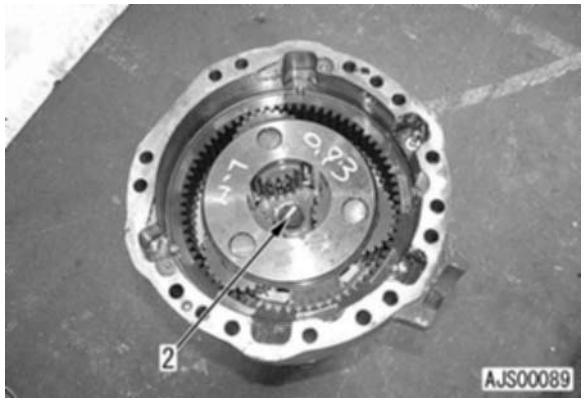
   2) Remove 2 plates (35), 2 discs (36), and 2 wave springs (37).



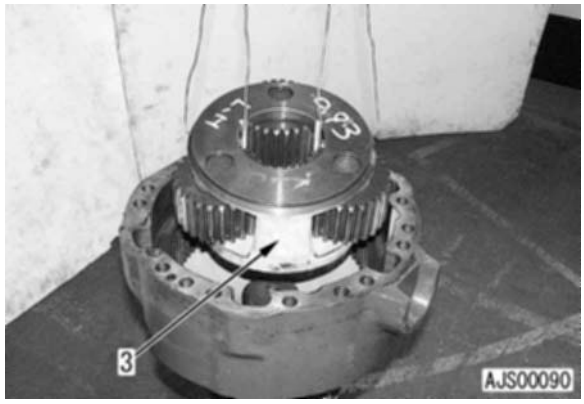
   3) Remove end plate (38).
   4) Remove sun gear shaft (39).



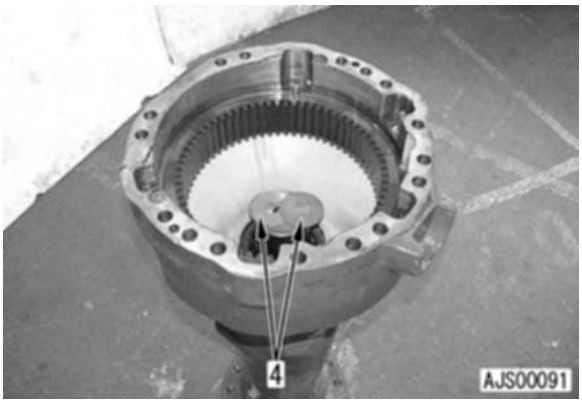
5. Planetary carrier assembly
   1) Remove axle shaft mounting bolt (2).



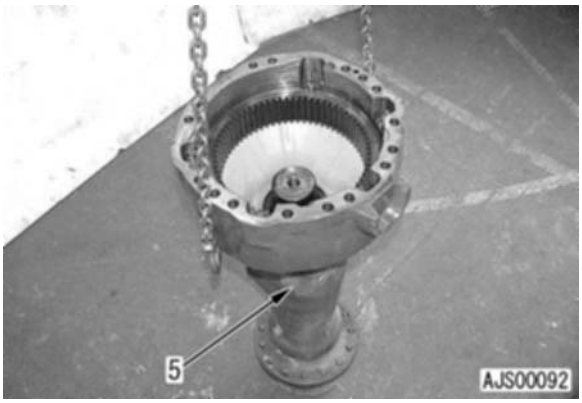
   2) Remove planetary carrier assembly (3).



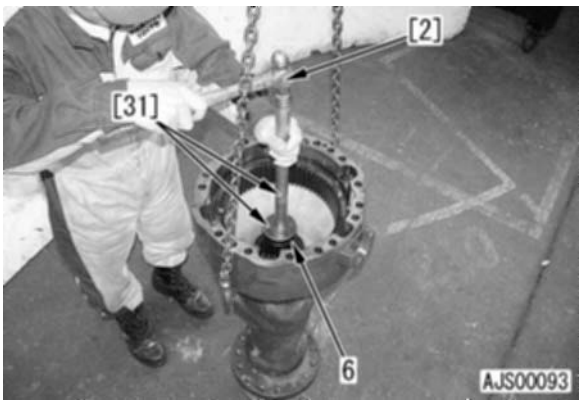
3) Remove shim (4).
★ Check the thickness and quantity of the shims.



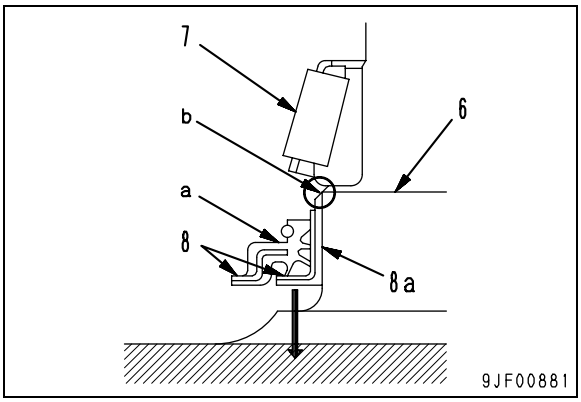
6. Axle shaft
1) Sling axle housing assembly (5) about 20 mm.



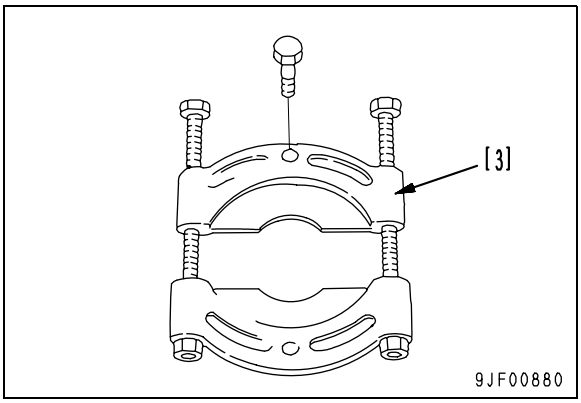
2) Apply push tool [31] to the end of axle shaft (6) and hit it with copper hammer [2] to drive out the shaft.
★ The bearing on the planetary carrier side will be removed.



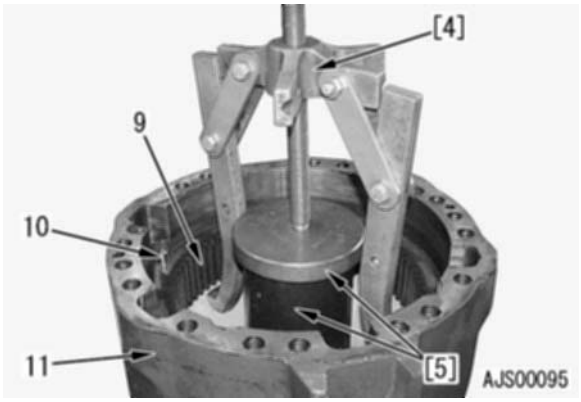
7. Axle shaft bearing
★ Do not heat the bearing to remove it or cut it with gas.
1) When removing bearing (7) from axle shaft (6), evenly push in part (a) around the oil seal and sleeve (8) with a screwdriver toward the flange.
2) Make clearance (b) at the contact part of bearing (7) and sleeve (8a) to hitch the claws of the puller.



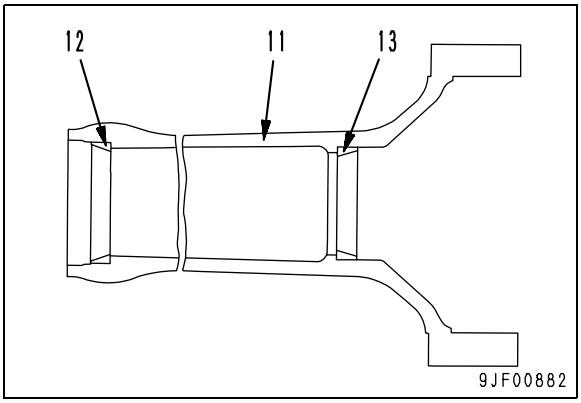
3) Install bearing puller [3] securely to clearance (b).
4) Tighten the bolts of bearing puller [3] to remove bearing (7).
5) Remove oil seal (8).



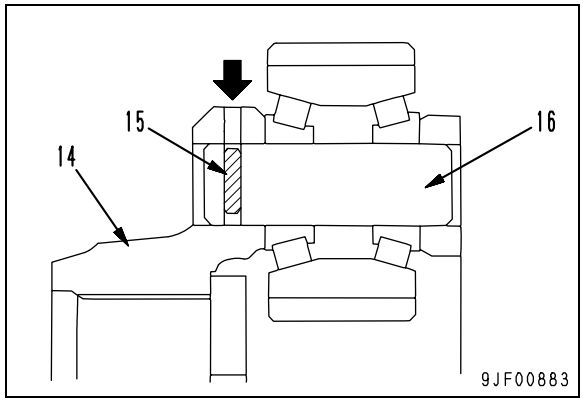
8. Axle housing
   1) Remove 3 pins (10) from axle housing (11). (You can pull them out with the hand.)
   2) Using puller [4], pull up ring gear (9) evenly to remove it from axle housing (11).
      ★ Install spacer [5] to the bolt end of puller [4] to adjust the height.
      ★ Take care that the claws of the puller will not come off the ring gear.

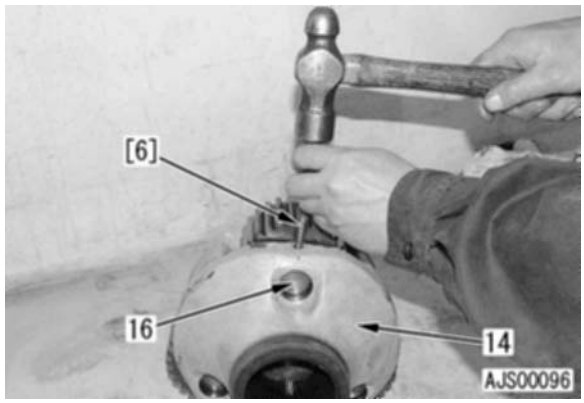


   3) Remove outer races (12) and (13) from axle housing (11).

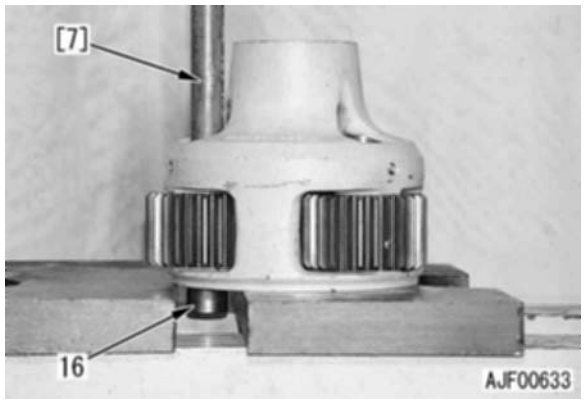


9. Planetary carrier
   1) Using push tool [6], drive in roll pin (15) of planetary carrier (14) until it is in the range of shaft (16).
      ★ Take care not to drive in the roll pin too deep.

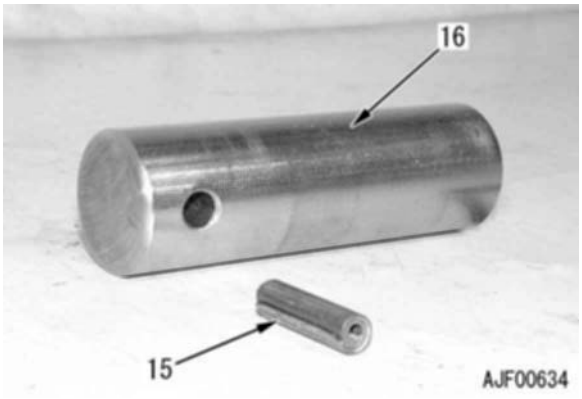




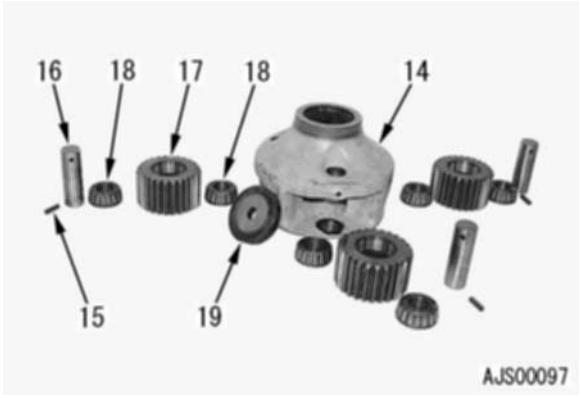
   2) Using push tool [7], push out shaft (16) with a press.



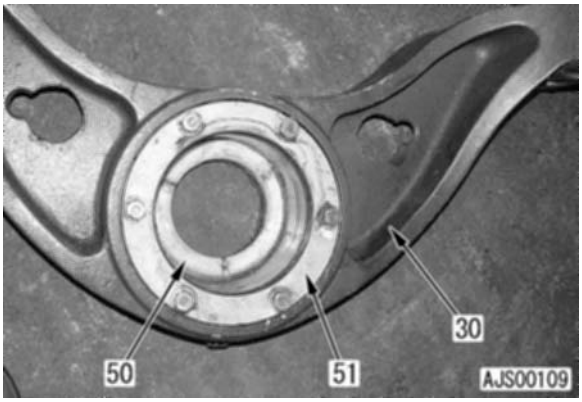
3) Pull roll pin (15) out of removed shaft (16).



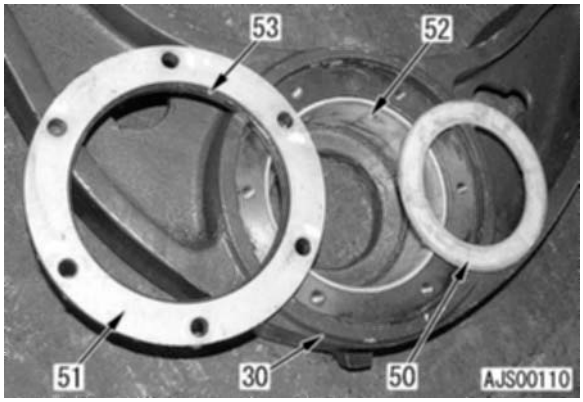
4) Remove pinion gear (17) and 2 bearings (18) from planetary carrier (14).
5) Similarly, remove the 2nd and 3rd pinion gears (17) and 2 sets of shaft (16), roll pin (15), and bearing (18) from planetary carrier (14).
6) Remove spacer (19) from planetary carrier (14).



10. Rear axle support (Rear axle only)
1) Remove thrust washer (50) and retainer (51) from rear axle support (30).

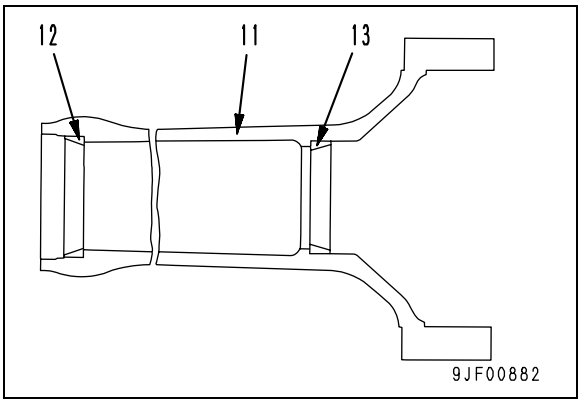


2) Remove bushing (52) from rear axle support (30) and remove packing (53) from the retainer.

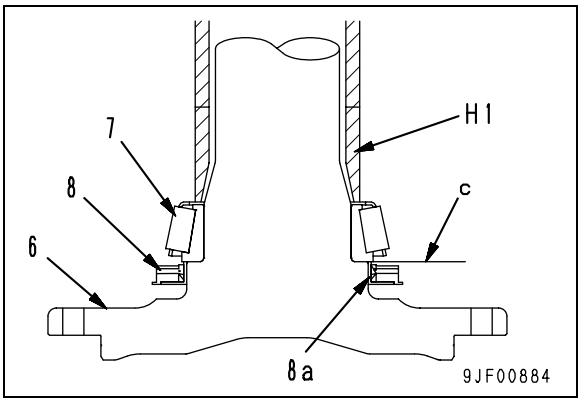


ASSEMBLY

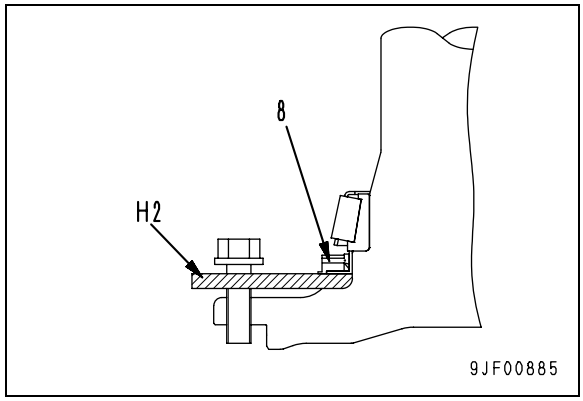
1. Axle housing and axle shaft
   1) Press fit bearing outer races (12) and (13) to axle housing (11).



   2) Using tool **H1**, press fit seal (8) and bearing (7) to axle shaft (6) simultaneously.
      ★ Press fit the seal and bearing until oil seal sleeve (8a) is flush with shaft end (c), and then check that there is not clearance between oil seal sleeve (8a) and bearing (7).



   3) Install tool **H2** under oil seal (8).
      ★ Adjust tool **H2** so that its top will lightly touch oil seal (8) and the clearance will be even.



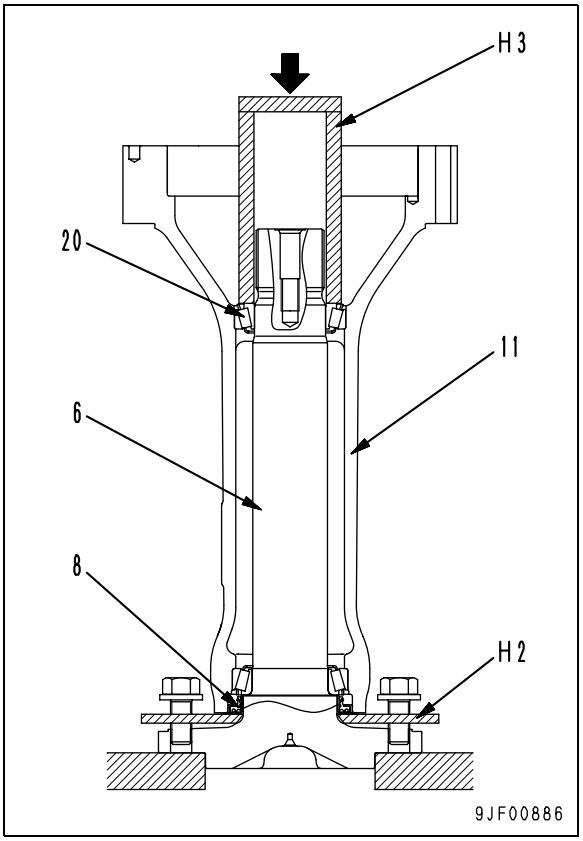
2. Axle shaft bearing
   1) Erect axle shaft (6) on the block and fix it securely.
   2) Sling axle housing (11) vertically, and then lower it slowly.
      ★ Insert the axle housing by utilizing its weight.

      Fitting part of oil seal and bearing: **Axle oil**

      ★ After installing the housing, leave tool **H2** installed until stop 4).
   3) Using tool **H3**, press fit bearing (20) to axle shaft (6).
      ★ Press fit the bearing, turning the axle housing with the hand.

      Outside of bearing: **Axle oil**

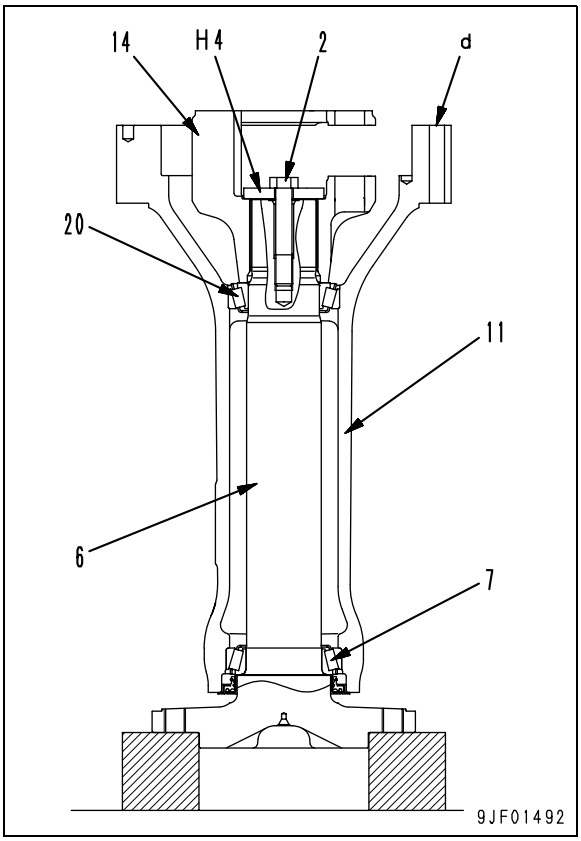
   4) Remove tool **H2** horizontally.
      ★ Check that oil seal (8) does not lean.
      ★ Fit the end face of axle housing (11) to the flange of oil seal (8) (Reduce the clearance to below 0.2 mm.)



3. Adjusting end play
   1) Install planetary carrier (14) to the spline of axle shaft (6) and tighten tool **H4** with mounting bolt (2).
      ★ Install planetary carrier (14) without gear.
      ★ Remove the all adhesive from the bolt hole of the axle shaft and mounting bolt.
   2) Turning axle housing (11), tighten holder mounting bolt (2).

      Mounting bolt: **490 - 607.6 Nm {50 - 62 kgm}**

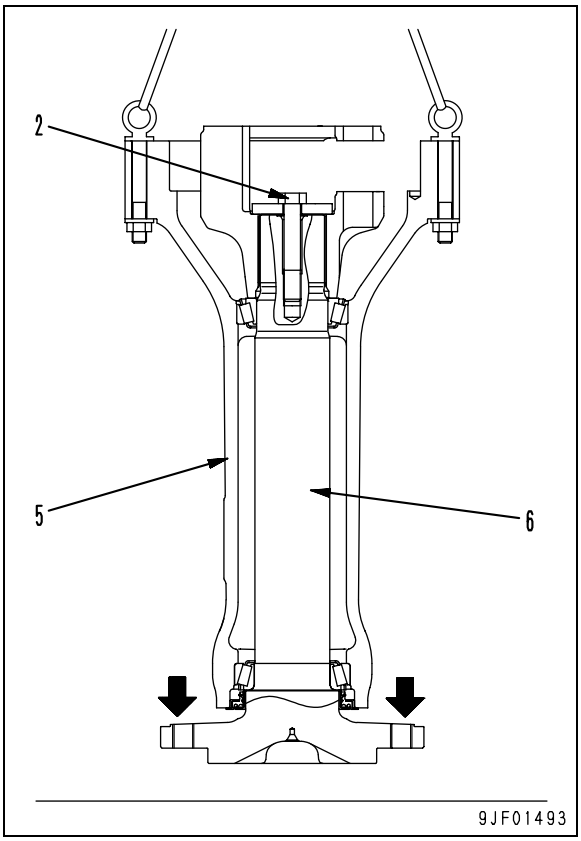
      ★ Fit the bearings sufficiently and check that the end play is 0 - 0.1 mm.
   3) After fitting bearings (7) and (20) sufficiently, measure the starting effort at hole (d) of axle housing (11).
      • Starting effort
        (Common to front and rear)
        (Including resistance of seal and planetary carrier)
        25.5 - 94 N {2.6 - 9.6 kg}



★ If the starting effort is less than the standard value, press fit the bearings again and repeat the work from step 2.

★ If the starting effort exceeds the standard value, adjust it according to the procedure shown on the next page.

4) Loosen holder mounting bolt (2) 1 - 2 turns.
5) Sling axle shaft and housing assembly (5) 20 - 30 mm by installing wire ropes to 2 parts, similarly to installation of the axle hosing.
6) Turning axle shaft (6), hit the flange with a copper hammer in the direction of the arrow to drive out axle shaft (6).
7) Repeat steps 2) and 3) so that the starting effort will be in the standard value range.

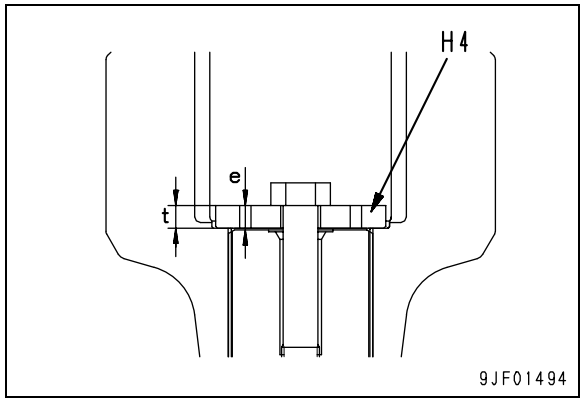


8) Selecting shim
Using a depth micrometer, measure distance (e) from the end of tool **H4** to the end of the axle shaft.

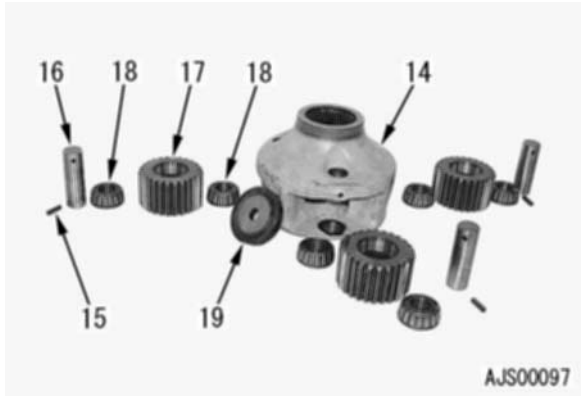
★ Set the value obtained by subtracting thickness (t) of tool **H4** from dimension (e) as (e-t).

• Thickness of shim = (e-t) $^{+0.05}/_{0}$

9) After deciding the thickness of the shim, remove planetary carrier (14).



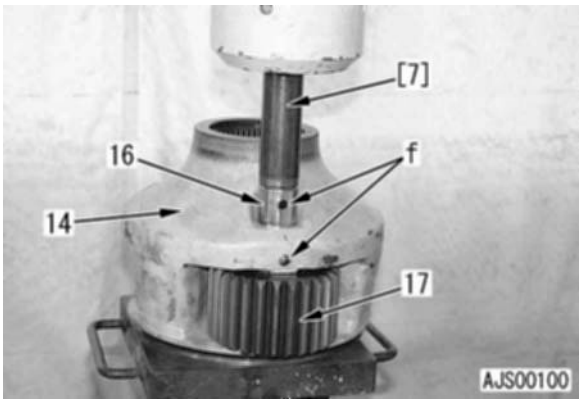
4. Planetary carrier



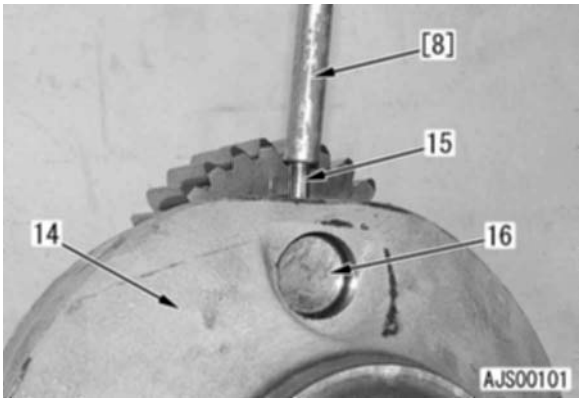
1) Put 2 bearings [18] in 1st gear [17] and install them to planetary carrier (14).

★ Using push tool [8] and matching pin holes (f), press fit shaft (16).

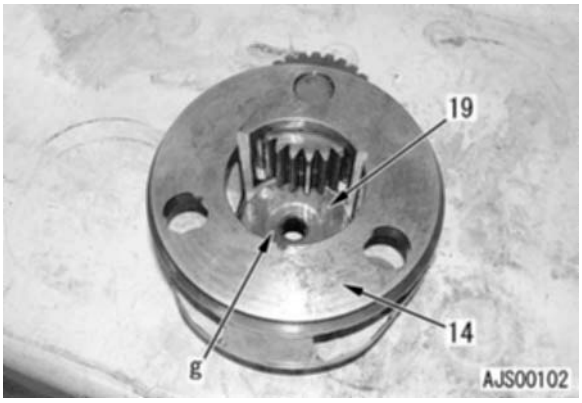
Shaft: **Axle oil**



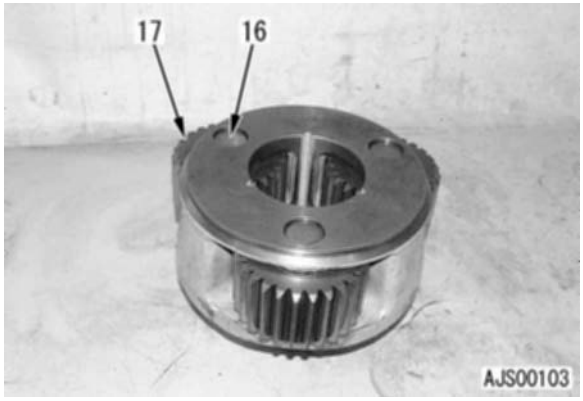
★ Matching the holes of shaft (16) and roll pin (15), drive roll pin (15) through push tool [8] so that it will be flush with planetary carrier (14).



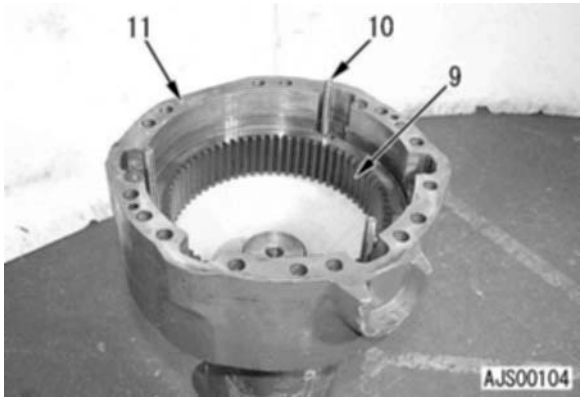
2) Install spacer (19) in planetary carrier (14).
   ★ Insert the spacer from (g) side of planetary carrier (14) before installing 2nd gear (17).



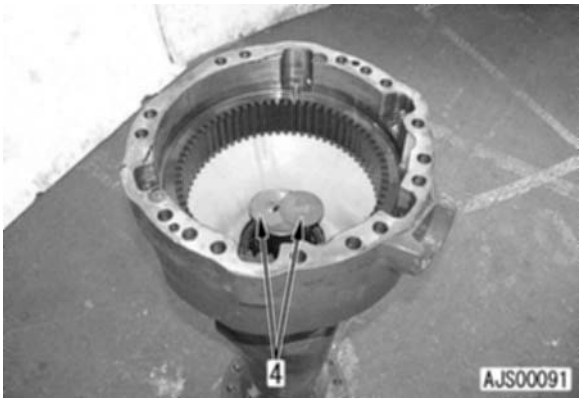
3) Similarly to 1), install 2nd and 3rd gears [17] to planetary carrier [14].
   ★ Using push tool [8] and matching pin holes (f), press fit shaft (16).
   ★ Matching the holes of shaft (16) and roll pin (15), drive roll pin (15) through push tool [8] so that it will be flush with planetary carrier (14).
4) Hit the end of shaft (16) and the differential side of gear (17) lightly to push back the bearing and check that the gear rotates smoothly.



5. Ring gear
   1) Install ring gear (9) to axle housing (11) and insert 3 pins (10).
      ★ Match the pin holes of the housing and ring gear.

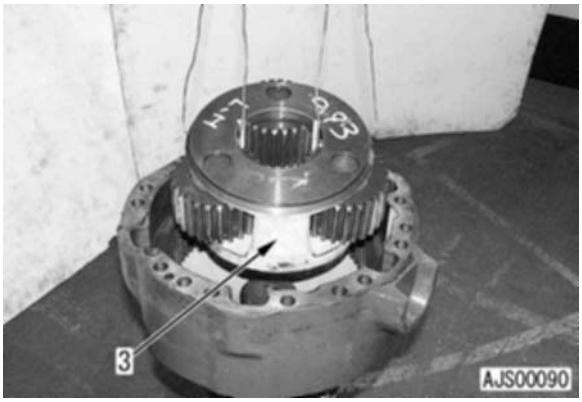


6. Planetary carrier assembly
   1) Install shim (4) selected in steps 3.-8) to the end of the axle shaft.



   2) Sling and install planetary carrier assembly (3).

      When installing the planetary carrier, take care not to catch your fingers in the gear.

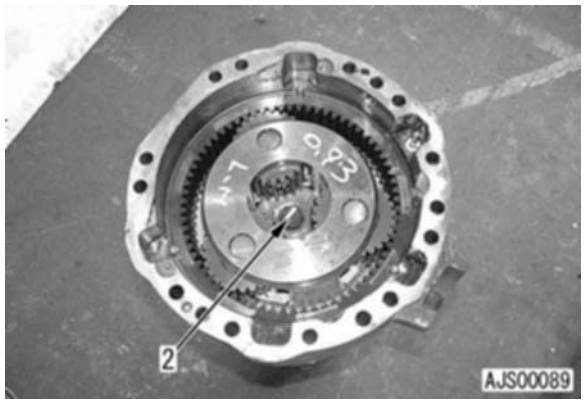


   3) Tighten mounting bolt (2).
      ★ Degrease and clean the bolt hole of the axle shaft and mounting bolt.

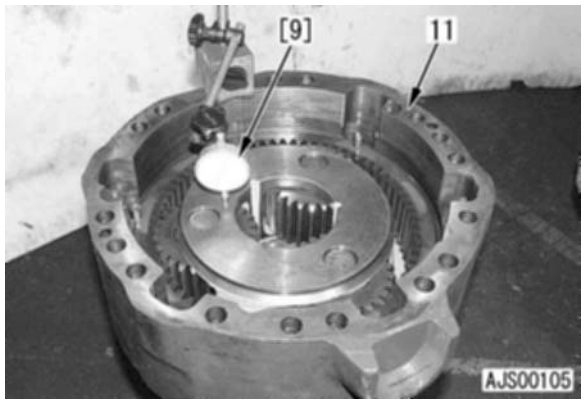
      Mounting bolt: **Adhesive (LT-2)**

      Mounting bolt:
      490 - 608 Nm {50 - 62 kgm}

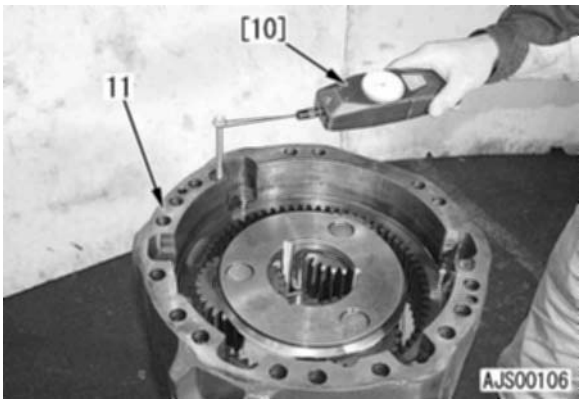
      ★ Clean the shaft end and planetary carrier spline thoroughly before installing.



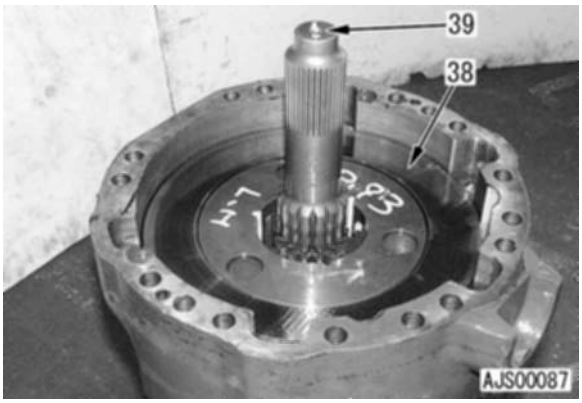
   4) Install dial gauge [9] to axle housing (11) and measure the end play of the planetary carrier.
      • End play of planetary carrier:
      0 - 0.1 mm
      ★ If the end play is out of the standard range, change the thickness of the shim in 1) and repeat the above procedure.



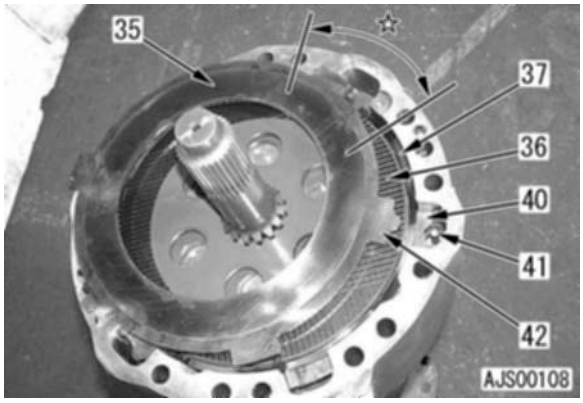
5) Rotate axle housing (11) 10 or more turns to fit it. Then, using push-pull gauge [10], measure the starting effort at the mounting bolt hole of the axle housing assembly.
   - Starting effort
     (Common to front and rear)
     (Including resistance of seal and planetary carrier)
     25.5 - 94 N {2.6 - 9.6 kg}
   - ★ If the starting effort exceeds the above range, adjust it again, referring to 3 ADJUSTING END PLAY above.

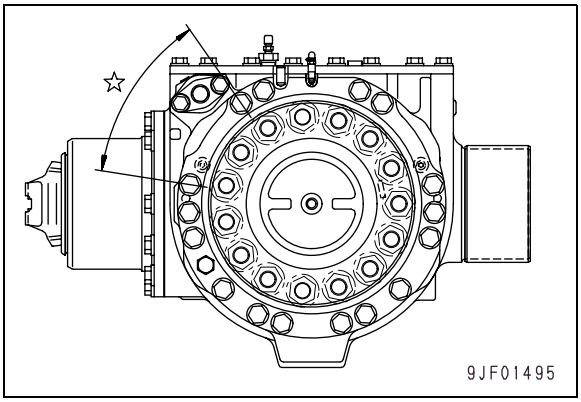


7. Brake
   1) Install end plate (38).
   2) Install sun gear shaft (39).

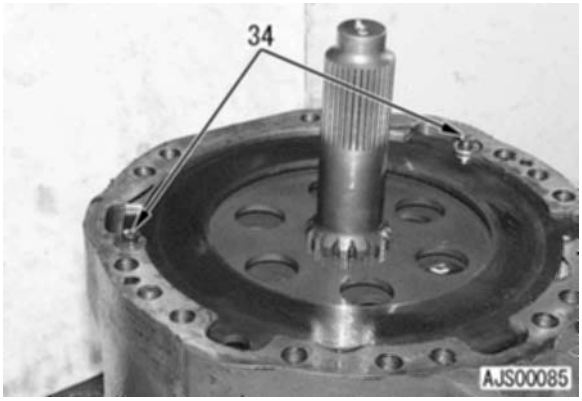


3) Install 2 discs (36), 2 wave springs (37), and 2 plates (35) in order from the bottom, observing the following precautions.
   - ★ Match the notches of the 2 springs to each other and set them in the range marked with ☆.
     The range marked with ☆ is on the left side of wear gauge (41) in the left axle (as shown in the photo) and on the right side of wear gauge (41), or symmetrically opposite to the photo, in the right axle.
   - ★ When the axle is installed, the notches of the springs, ☆, and brake port must be set as shown in the following figure.
   - ★ Match the concave lug of lower plate (40) to wear gauge (41).
   - ★ Match the convex lug of upper plate (35) to wear gauge (41).
   - ★ Wear gauge (41) is seen before upper plate (35) is set but not seen after upper plate (35) is set.





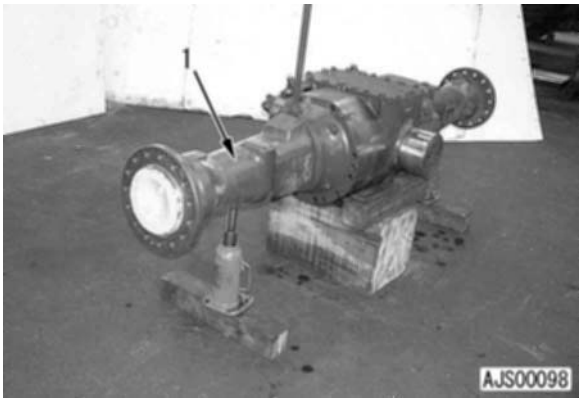
4) Install 2 inside hexagon bolts (34).



8. Axle housing assembly
   1) Degrease and clean the mating faces of the axle housing and differential housing and apply gasket sealant all over them.

      Mating faces of housings: **Gasket sealant (LOCTITE 515 or equivalent)**

   2) Sling axle housing assembly (1) horizontally and install it carefully, matching it to the spline grooves of the sun gear shaft.
      ★ Set a jack under axle housing assembly (1) to prevent the axle housing assembly from falling down.

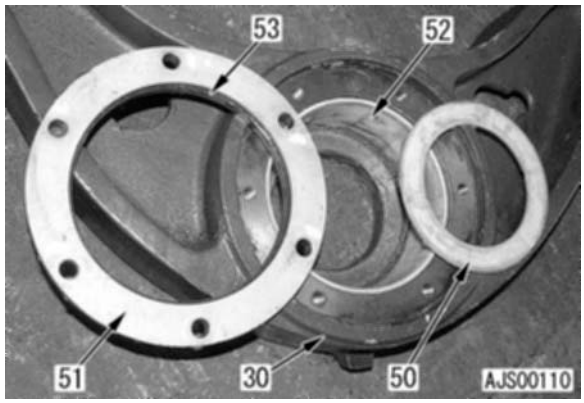


   3) Tighten the axle housing mounting bolts in the diagonal order.

      Mounting bolt:
      245 - 309 Nm {25.0 - 31.5 kgm}

9. Rear axle support
   1) Fit packing (53) to retainer (51) and install bushing (52), thrust washer (50), and retainer (51) to rear axle support (30).
      ★ Clean and dry the inside of the support to insert the bushing.
      ★ Press fit the bushing with a press having a surface plate and keep the support and bushing in parallel.
      ★ Secure clearance of 0.5 between the end of the bushing and the bottom of the mounting part.
      ★ Set thrust washer (50) with the groove up (Direct the grove toward the retainer).
      ★ Direct the lip of the packing toward the outside of the rear axle support (toward the axle).

      Inside of packing: **Grease (G2-LI)** (Apply thinly)

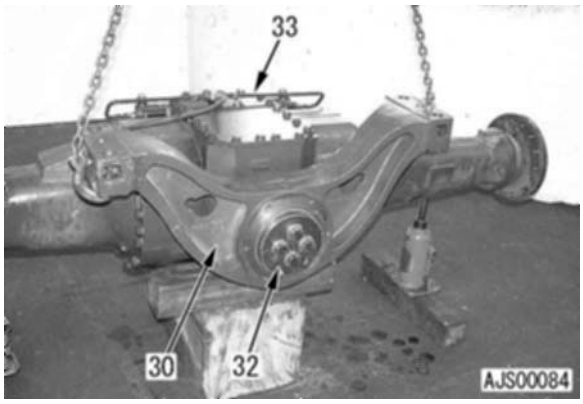


   2) Sling and install rear axle support (30) and install thrust plate (32).

      Periphery of pivot mounting part: **Grease (G2-LI)**

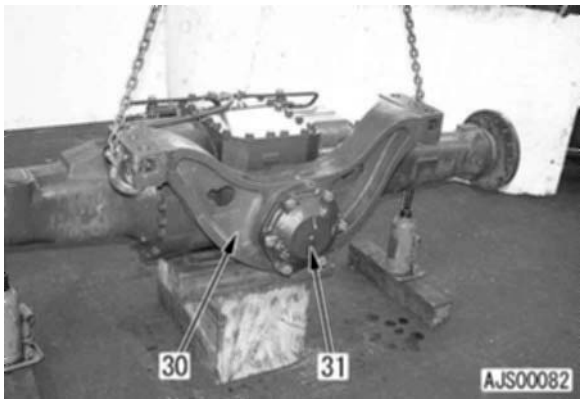
      Mounting bolt:
      490 - 608 Nm {50 - 62 kgm}

3) Install brake tube and hose assembly (33).



4) Install cover (31).

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



- **Refilling with oil (Axle housing)**
  Tighten the drain plug and add oil through the oil filler to the specified level, and then check the oil level.

Drain plug:
127.4 - 176.4 Nm {13 - 18 kgm}

Oil filler plug:
93.1 - 122.5 Nm {9.5 - 12.5 kgm}

Axle (Each of front and rear): **27 ℓ**

DISASSEMBLY, ASSEMBLY OF DIFFERENTIAL ASSEMBLY

SPECIAL TOOLS

Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
H	5	799-301-1500	Oil leak tester	■	1		
	6	797-101-1211	Wrench	■	1		
	7	793-615-1100	Wrench	■	1		
	8	790-201-2840	Push tool	■	1		
	9	797T-423-1320	Push tool	■	1		○
	10	797T-423-1130	Push tool	■	1		○
	11	793-520-2202	Installer	●	3		
	13	790-190-1500	Pump assembly	■	1		
	14	799-401-3100	Adapter	■	1		
	15	0289-0-00210	Cap nut	■	1		
	16	799-101-5160	Nipple	■	1		

★ Prepare 1 slack adjuster, part No.418-43-37302, to make a tool. (Modify it, referring to step 13, Checking for brake oil leakage.)

★ Since the slack adjuster modified into a tool has the same appearance as an ordinary slack adjuster, make a mark on it for distinction.

★ Since the slack adjuster is a safety-critical part, do not install it to the vehicle and use it as a slack adjuster again once it is disassembled and modified into a tool.

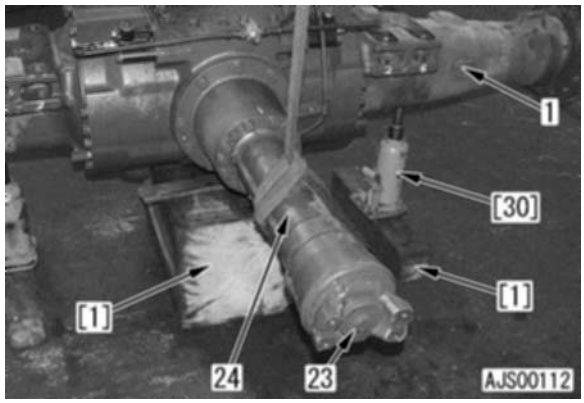
1. Draining oil

   Axle (Each of front and rear axles): **27 ℓ**

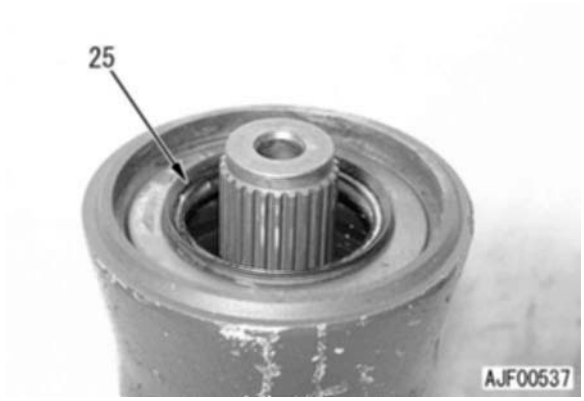
   ★ When disassembling the rear differential
   - Perform DISASSEMBLY, ASSEMBLY OF AXLE HOUSING ASSEMBLY up to 3. 1) to remove the rear axle support, brake tube, hose assembly, and right and left axle housings.
   - Perform the procedure in and after 6. Differential assembly and after.

   ★ Perform following steps 2 - 5 when disassembling the front differential.

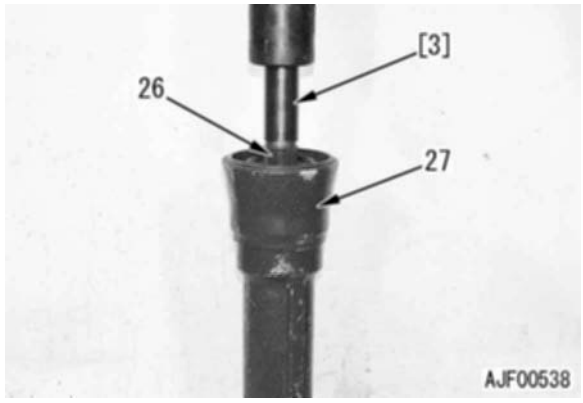
2. Removal of long cage assembly (For only front differential)
   1) Set the axle assembly on block [1] and jack [30].
   2) Remove coupling (23).
      ★ Remove the coupling protector only when it needs to be removed.
   3) Remove long cage assembly (24).



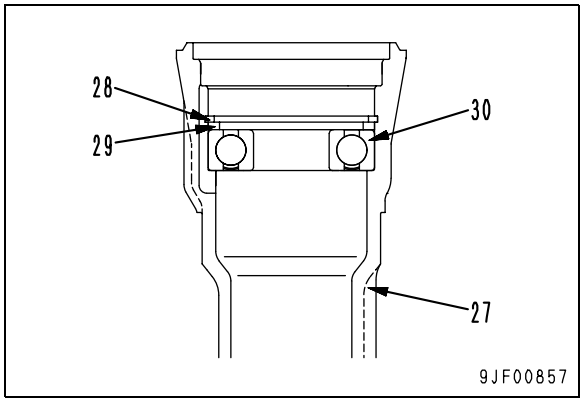
3. Disassembly of long cage assembly (For only front differential)
   1) Remove oil seal (25).



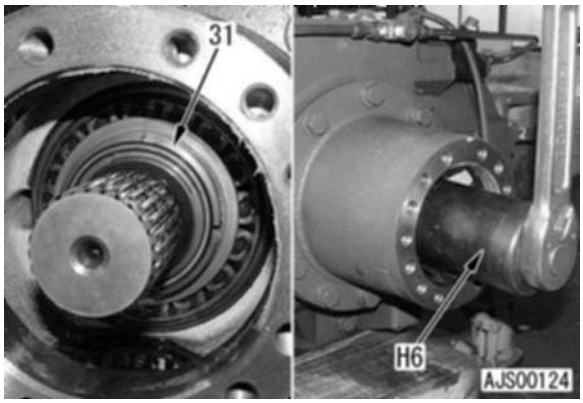
   2) Using push tool [3], push shaft (26) with a press to remove it from long cage (27).



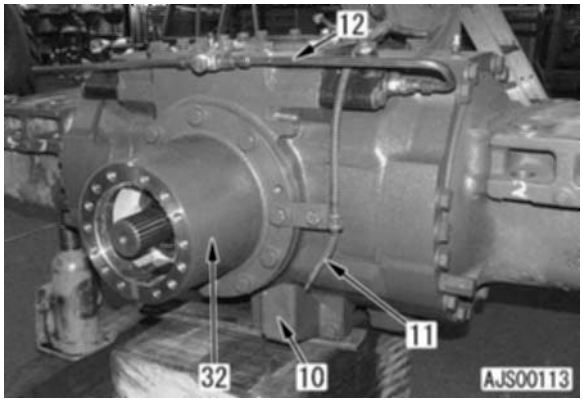
3) Remove snap ring (28) and ring (29), and then remove bearing (30) from long cage (27).



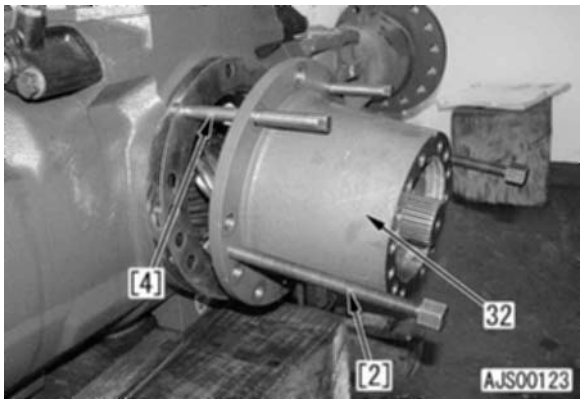
4. Removal of front cage assembly (Front differential)
   1) Using tool **H6**, loosen nut (31) before removing the cage assembly.



   2) Remove cover (10).
   3) Remove the axle oil temperature sensor (which is hidden by cover (10)) and wiring harness (11) together.
   4) Remove brake tube assembly (12).
   5) Remove the mounting bolts of front cage assembly (32).

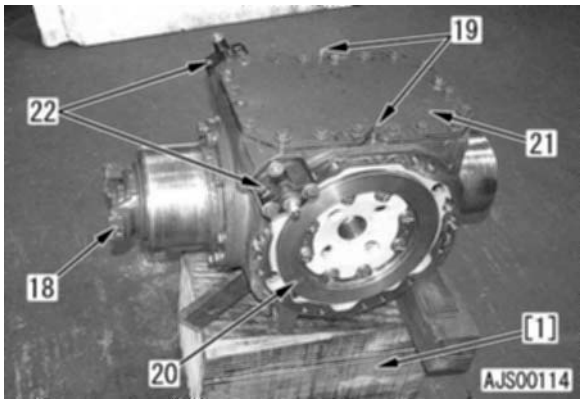


   6) Using forcing screw [2], guide bolt [4], remove front cage assembly (32).
      ★ Check the thickness and quantity of the shims.

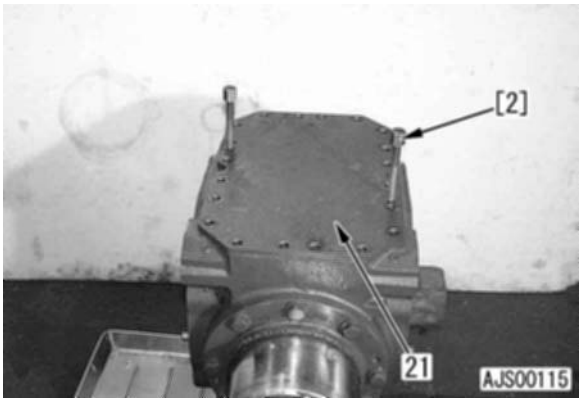


5. Axle housing
   ★ Referring to DISASSEMBLY, ASSEMBLY OF AXLE HOUSING ASSEMBLY, 3. Axle housing assembly, 1), remove the right and left axle housings.

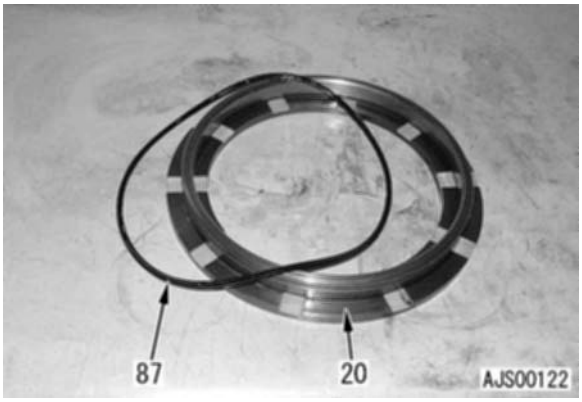
6. Differential assembly
   1) Place and stabilize differential assembly on block [1].
      ★ The photo shows the rear differential.
      ★ Remove the right and left rear differentials according to the same procedure.
   2) Remove 2 slack adjusters (22).
   3) Remove 2 bleeder screws (19).
   4) Remove piston (20).
   5) Remove coupling (18).
      ★ Perform this step for only rear differential.
   6) Remove the mounting bolts of top cover (21).



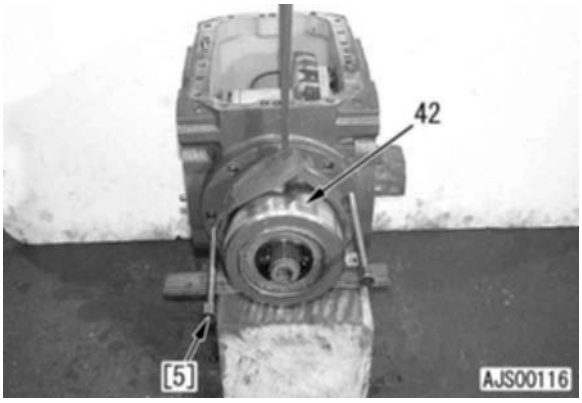
7) Using forcing screws [2], remove top cover (21).



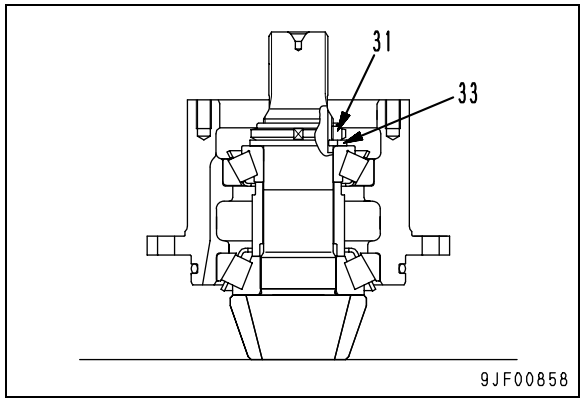
8) Remove seal (87) from piston (20).



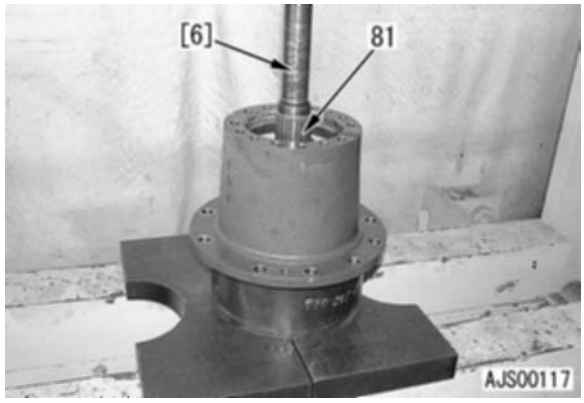
7. Removal of rear cage assembly (For rear differential)
   1) Remove the mounting bolts. Using forcing screw [5], remove rear cage assembly (42).
      ★ Check the thickness and quantity of the shims.



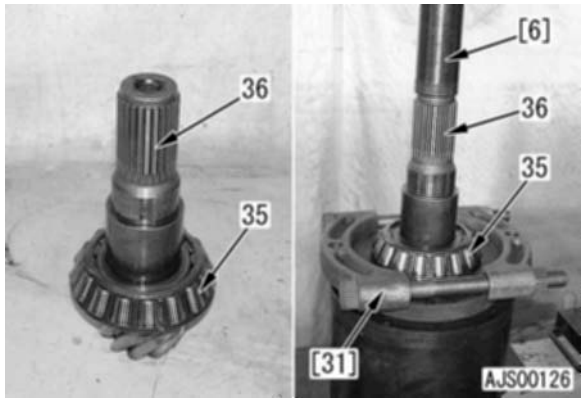
8. Disassembly of front cage assembly (For front differential)
   1) Remove nut (31) and holder (33).



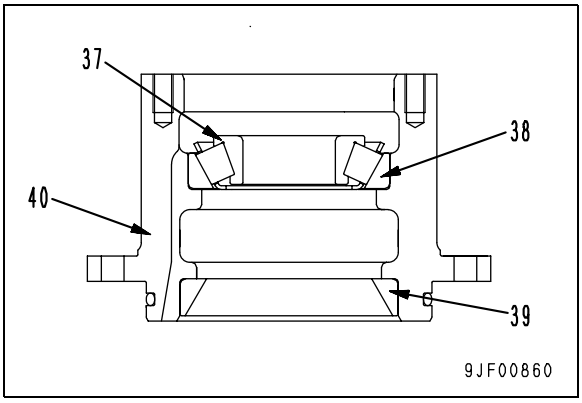
   2) Using push tool [6], push out pinion gear assembly (81) with a press.



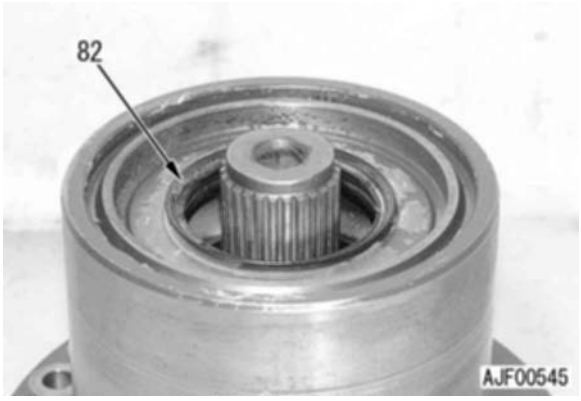
   3) Using bearing puller [31] and push tool [6], push bearing (35) out of pinion gear (36) with a press.



4) Remove bearing (37), outer races (38) and (39) from cage (40).

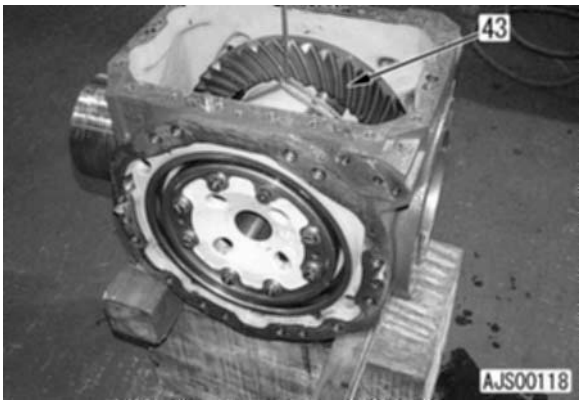


9. Disassembly of rear cage assembly (For rear differential)
   1) Remove oil seal (82).

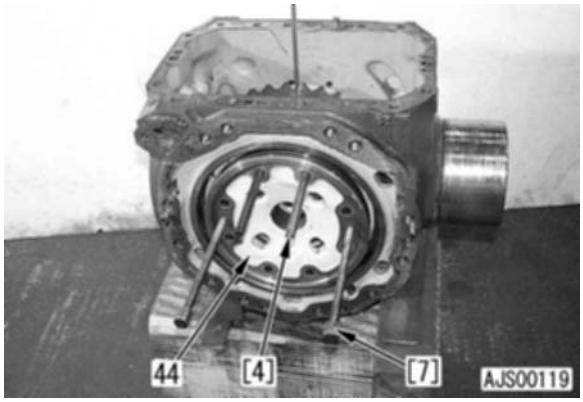


   2) For the further disassembly procedure for the rear cage assembly, see steps 2) - 4) in 8. DISASSEMBLY OF FRONT CAGE ASSEMBLY shown above.

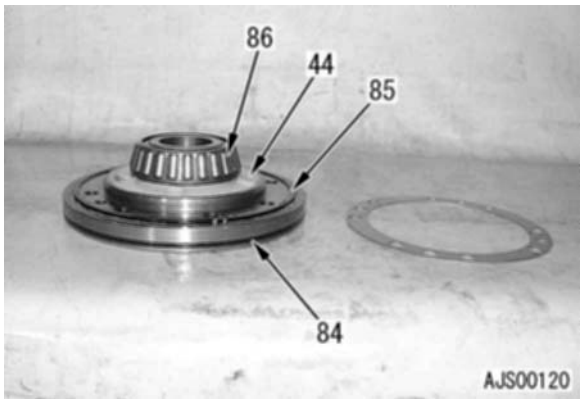
10. Bearing carriers
   1) Sling differential carrier assembly (43) temporarily.



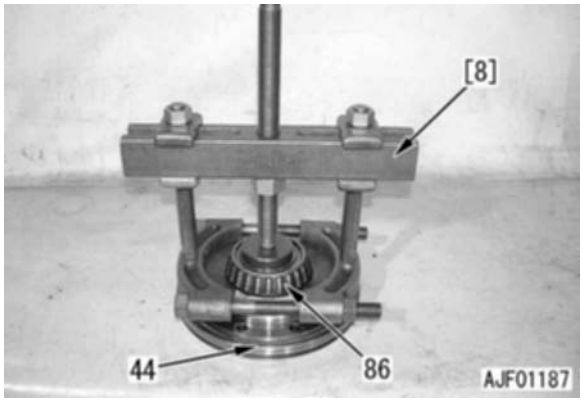
   2) Remove the mounting bolts and both bearing carriers (44), using guide bolt [4] and forcing screws [7].
      ★ Make marks on both bearing carriers so that they will not be mistaken.
      ★ Check the thickness and quantity of the shims.



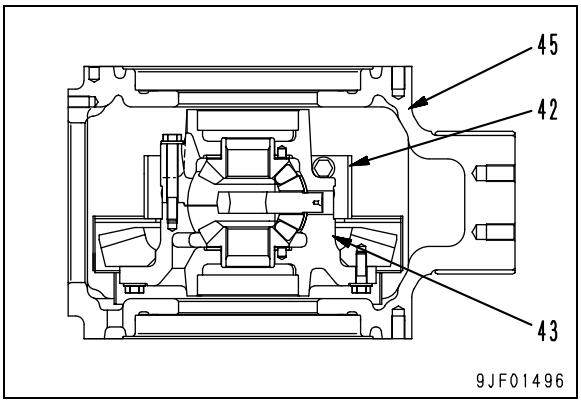
   3) Remove seal (84) and ring (85) from each bearing carrier (44).
      ★ Keep the seal, ring, and shim as a set.

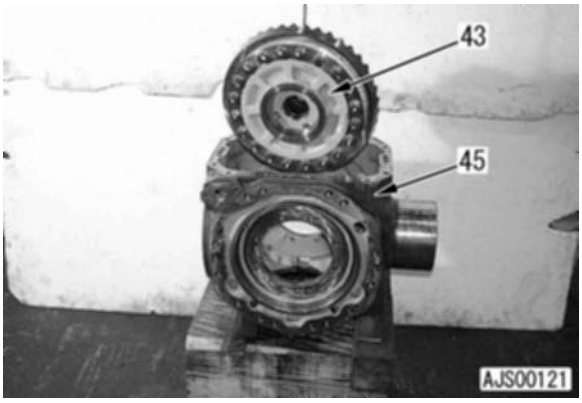


   4) Using puller [8], remove bearing (86).

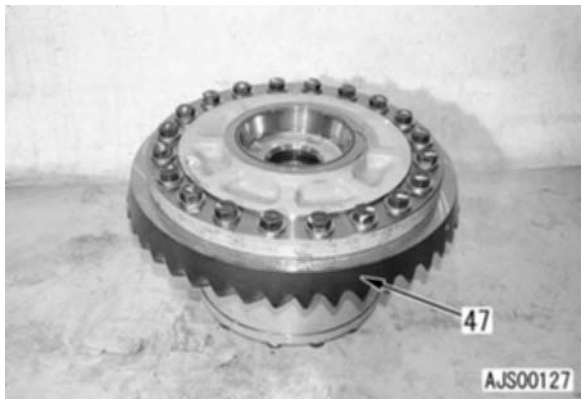


11. Removal of differential carrier assembly
    1) Lift off differential carrier assembly (43) from differential housing (45).
       ★ Take care that the sling will not come off.
       ★ Do not damage the differential carrier assembly by hitting it against the differential case.
    2) Remove the 5 mounting bolts and gear cover (42).

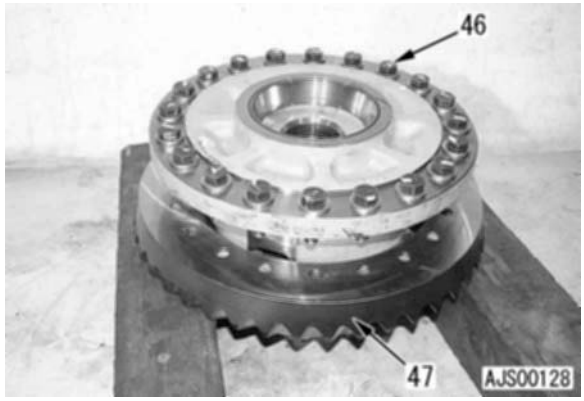




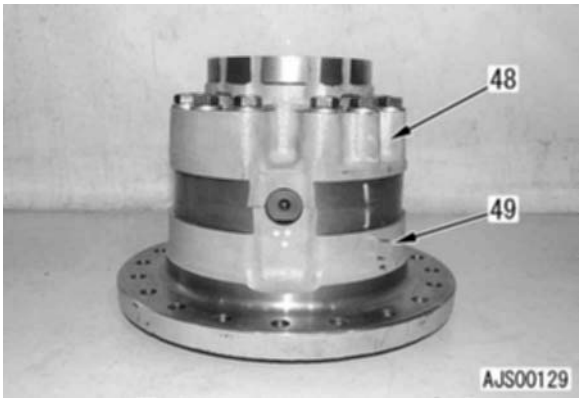
12. Disassembly of standard differential carrier assembly
    ★ When keeping the parts on both sides, make marks on them so that they will not be mistaken.
    1) ★ Before disconnecting the bevel gear and case, make match marks on them.



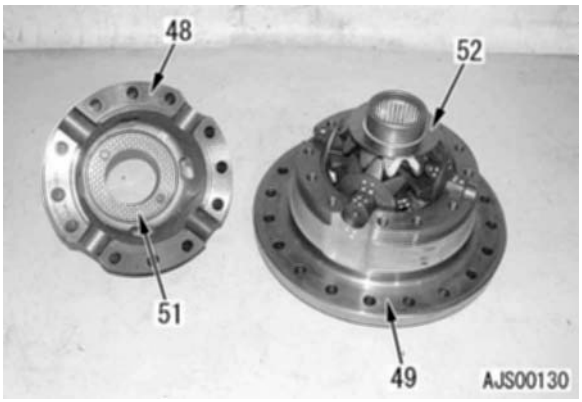
    2) Remove 20 mounting bolts (46) and bevel gear (47).



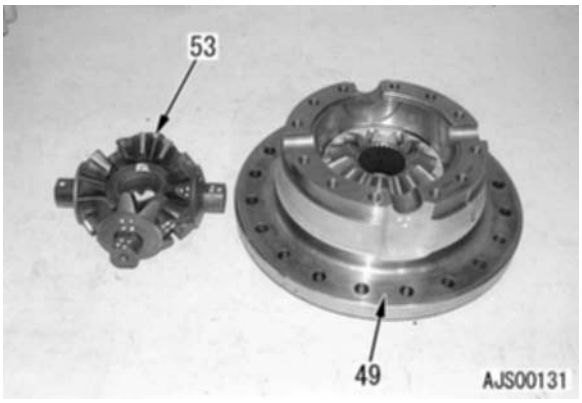
3) Place the case assembly upside down and remove case (48).
   ★ Before disconnecting, make match marks on the cases.



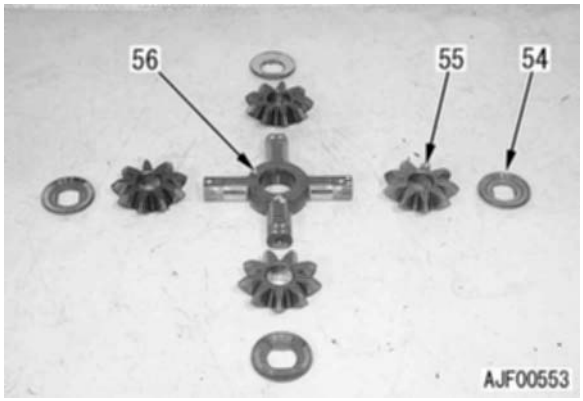
4) Remove washer (51) and side gear (52).



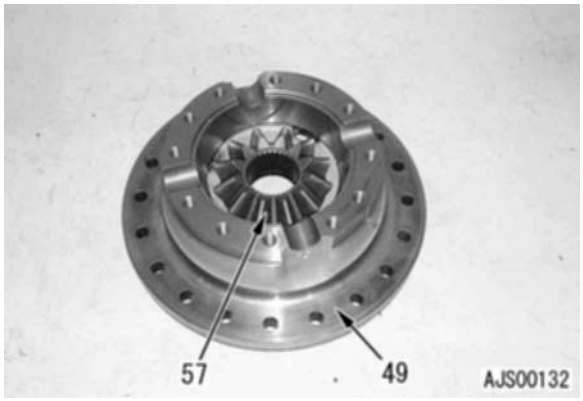
5) Remove pinion gear assembly (53).



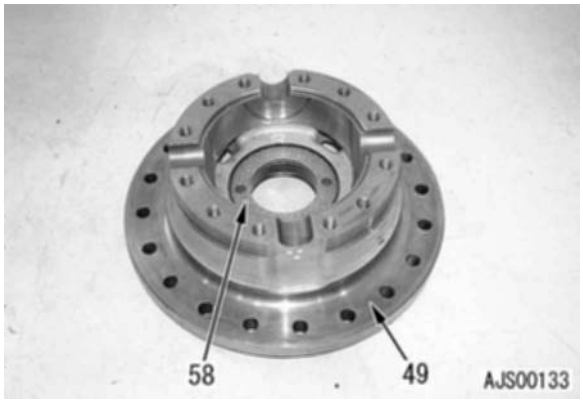
6) Remove 4 spherical washers (54) and 4 pinion gears (55) from spider shaft (56).



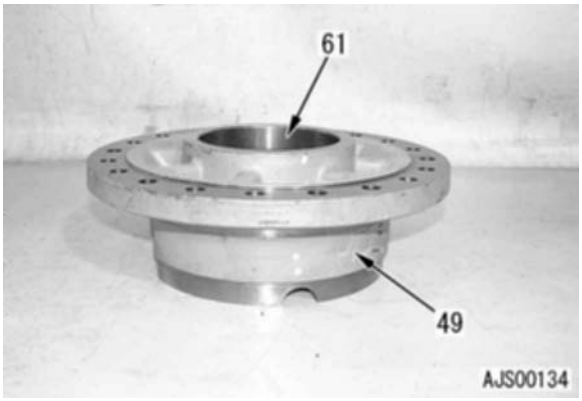
7) Remove side gear (57).



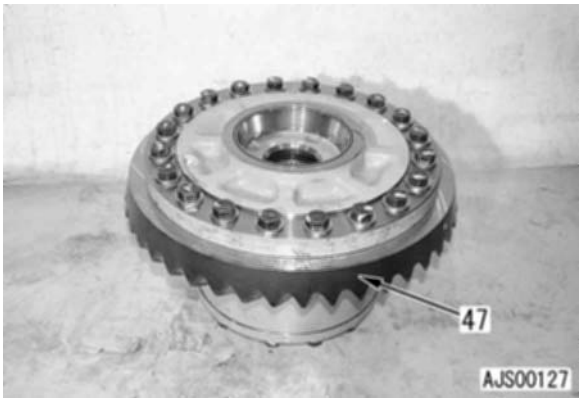
8) Remove washer (58).



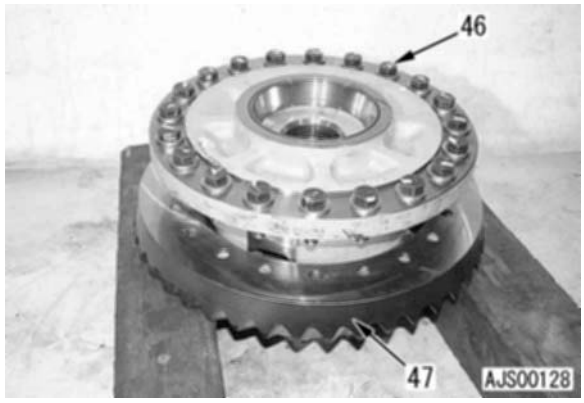
9) Using a puller, remove outer race (61) from case (49).
★ Remove the outer race of case (48) on the opposite side similarly.



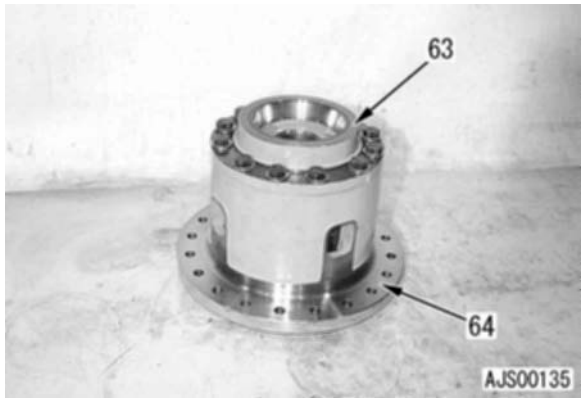
13. Disassembly of anti-slip differential assembly (If equipped)
★ If the vehicle is equipped with the anti-slip differential assembly, disassemble it according to the following procedure.
★ When keeping the parts on both sides, make marks on them so that they will not be mistaken.
1) ★ Before disconnecting the bevel gear and case, make match marks on them.



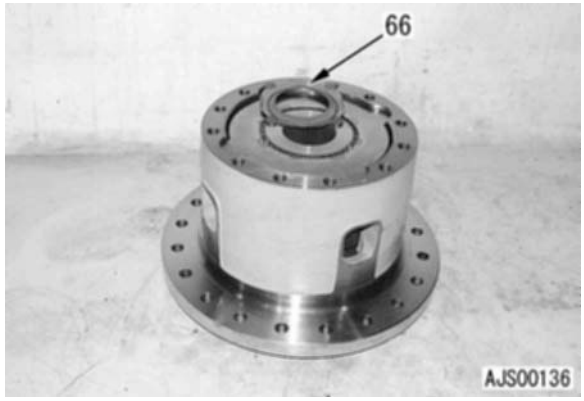
2) Remove 20 mounting bolts (46) and bevel gear (47).



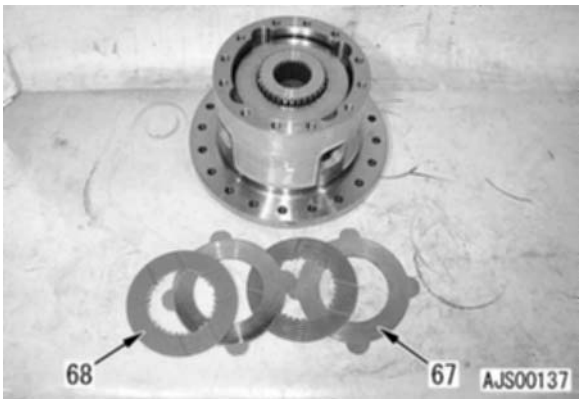
3) Place the case upside down and remove cover (63).
★ Before disconnecting the cover, make match marks on it and case.



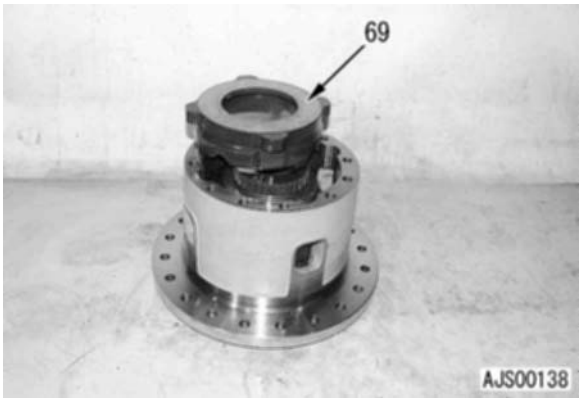
4) Remove washer (66).



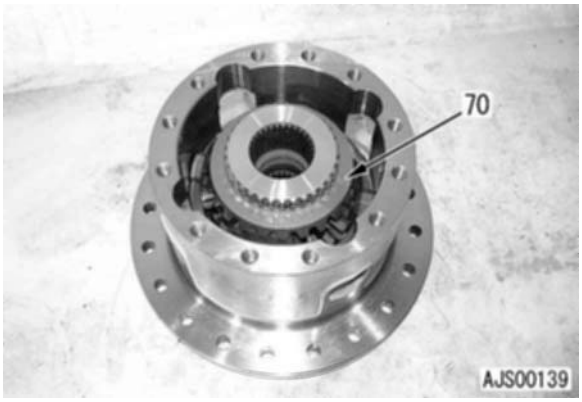
5) Remove 2 plates (67) and 2 discs (68).



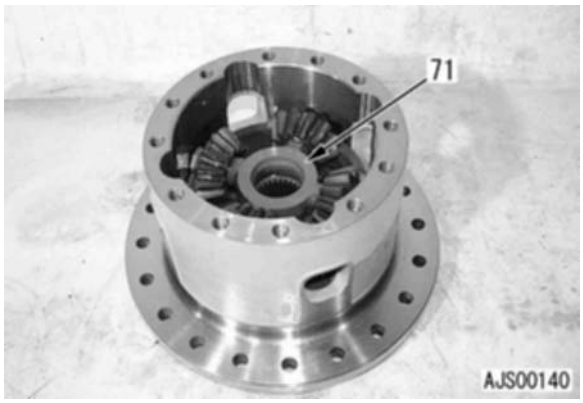
6) Remove pressure ring (69).
   ★ Insert a finger in the hole on the side of the case to raise the pressure ring.



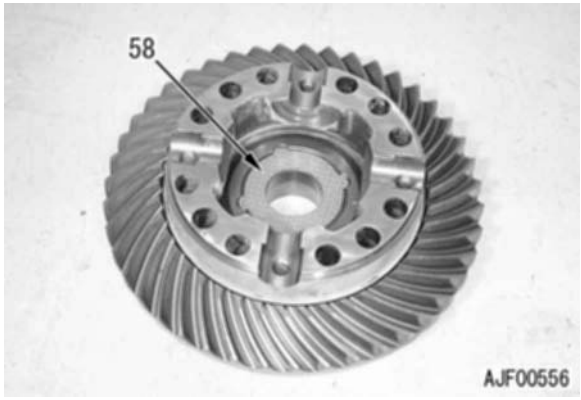
7) Remove side gear (70).



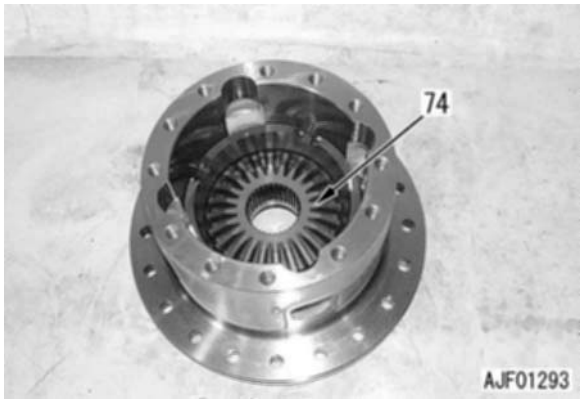
8) Remove pinion gear assembly (71).



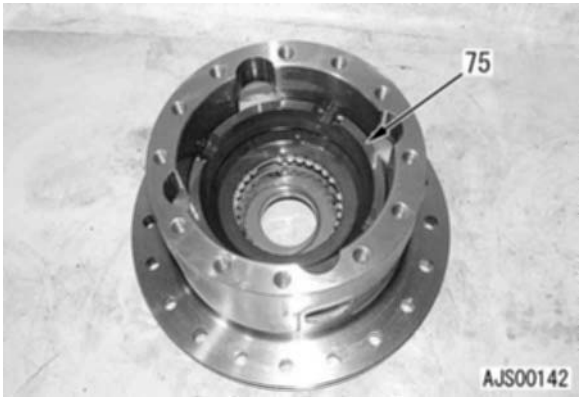
9) Remove 4 pinion gears (72) from spider shaft (73).



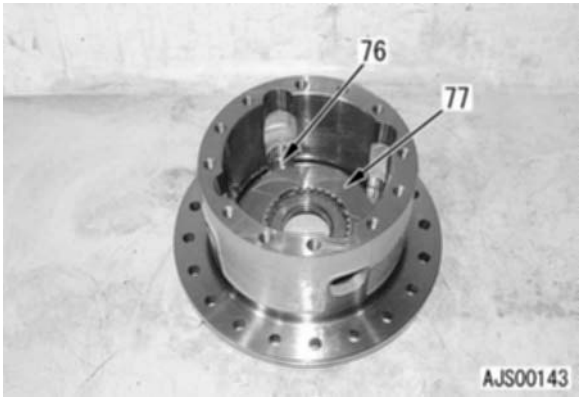
10) Remove side gear (74).



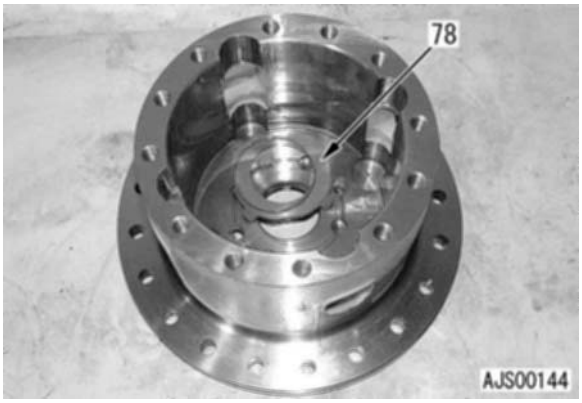
11) Remove pressure ring (75).



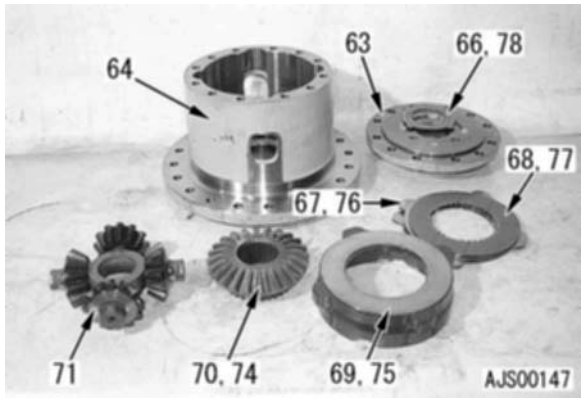
12) Remove 2 plates (76) and 2 discs (77).



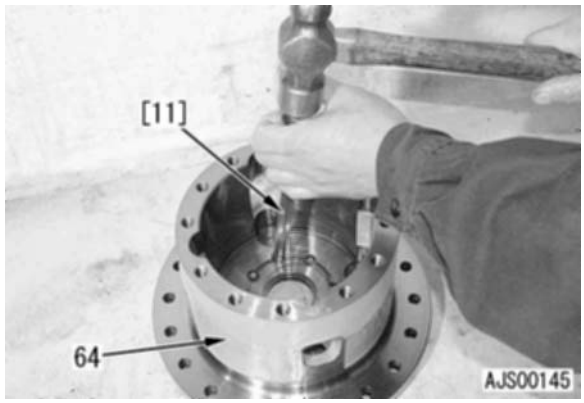
13) Remove washer (78).

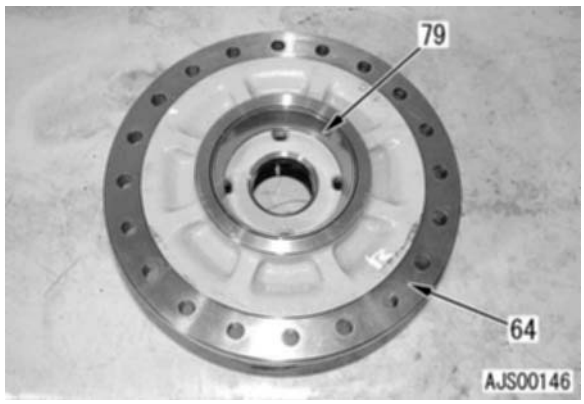


★ Removed parts



14) Using push tool [11], remove outer race (79) from inside of case (64). Similarly, using push tool [11], remove the outer race from inside of cover (63).

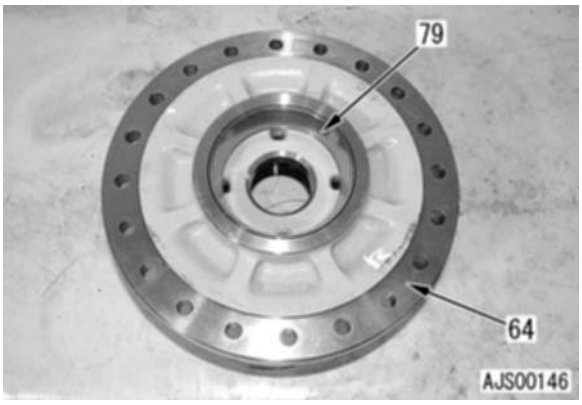




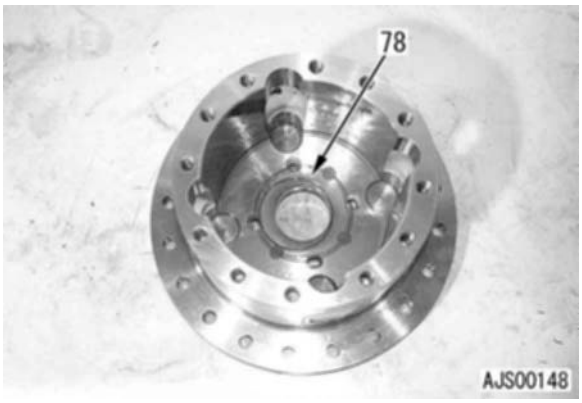
ASSEMBLY

★ Clean the all parts and check them for dirt or damage. Coat their sliding surfaces with axle oil (AX080, see Operation Manual, Komatsu genuine parts list) before installing.

1. Assembly of anti-slip differential assembly (Optional)
   1) Install outer race (79) to case (64).
   2) Similarly, install outer race (79) to cover (63).

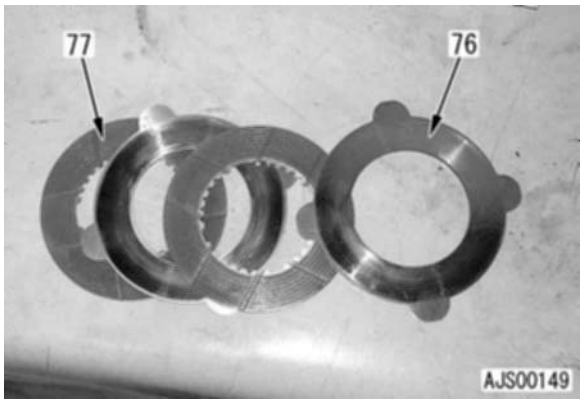


   3) Install washer (78).

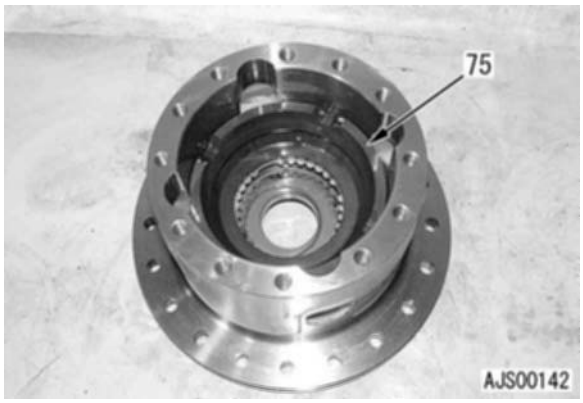


   4) Install 2 plates (76), 2 discs (77), 2 plates (76), and 2 discs (77) in order from the bottom.

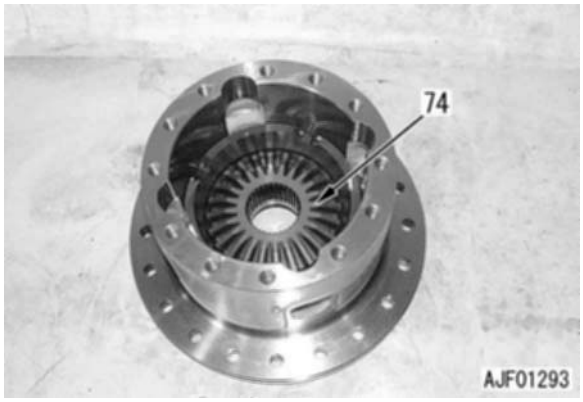
Before installing the discs and plates, soak them in axle oil (AX080, see Operation Manual, Komatsu genuine parts list).



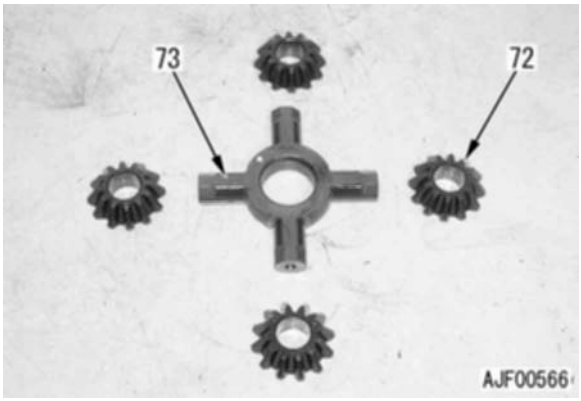
   5) Install pressure ring (75).



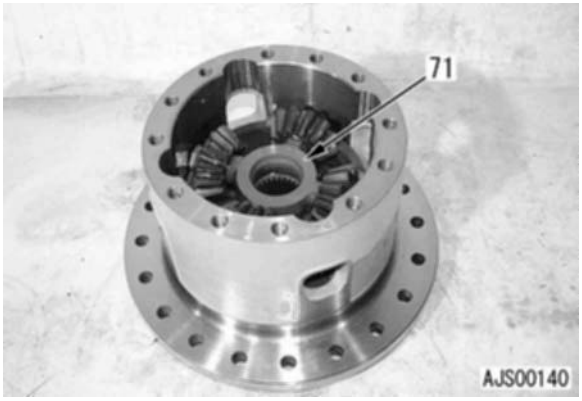
   6) Install side gear (74).



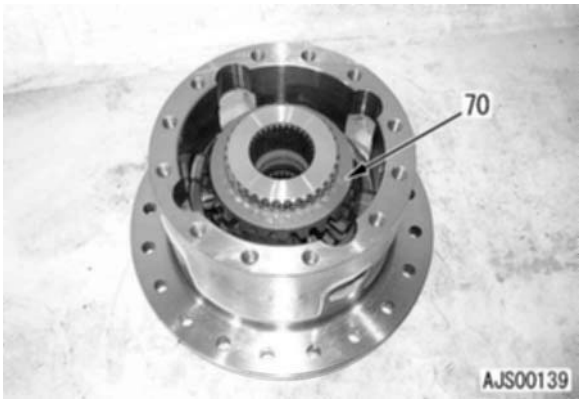
7) Install 4 pinion gears (72) to spider shaft (73).



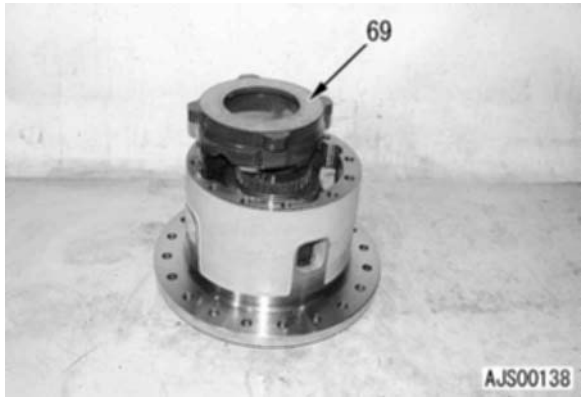
8) Install pinion gear assembly (71).



9) Install side gear (70).

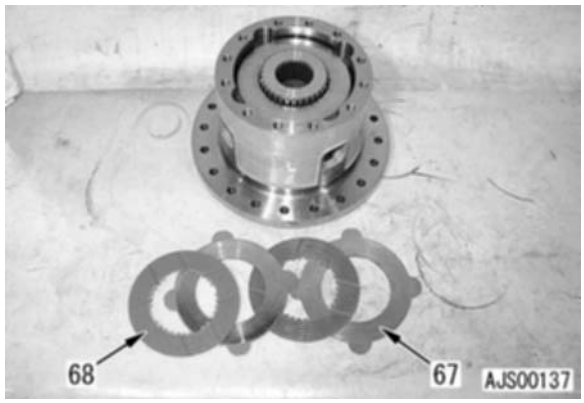


10) Install pressure ring (69).

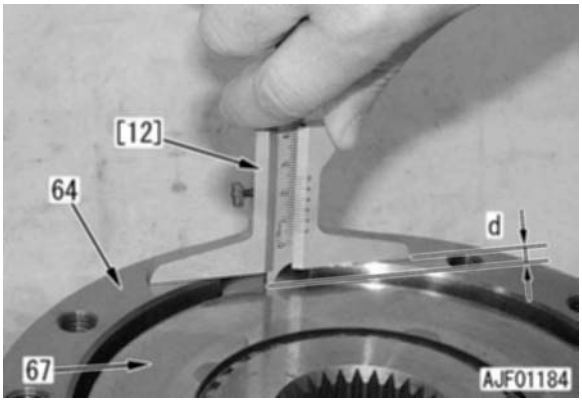


11) Install 2 discs (68), 2 plates (67), 2 discs (68), and 2 plates (67) in order from the bottom.

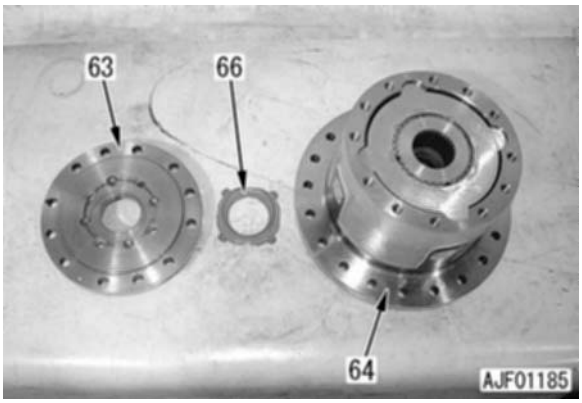
Before installing the discs and plates, soak them in axle oil (AX080, see Operation Manual, Komatsu genuine parts list).



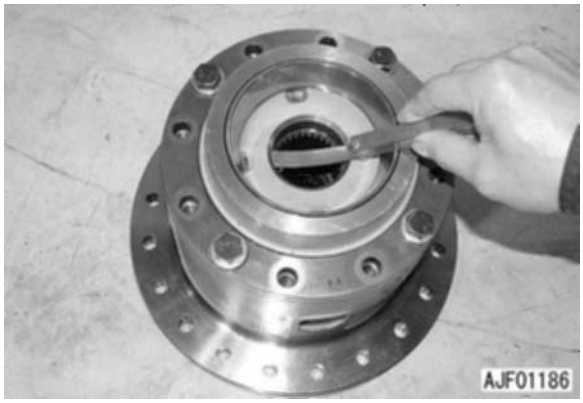
12) Selection of thickness of plate
   i) Using depth gauge [12], measure distance (d) between the end of case (64) and plate (67).
      ★ Distance dd [(d) – 4.8 mm] is the clearance between the case and plate.
   ii) Select the thickness of the plate so that distance dd [(d) – 4.8] will be 0.2 - 0.6 mm.
      ★ Replace the plates on both sides so that their thickness (total of 2 pieces) will be the same and assemble them according to the procedure in and after 4) shown above.
      • Varieties of plate thickness:
        3.0 mm, 3.1 mm

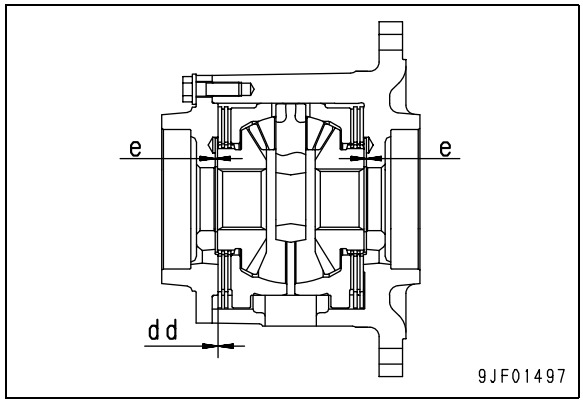


13) Fit washer (66) to cover (63), and then install cover (63) temporarily.
   ★ There are grooves on both sides of the washer.
   ★ Apply axle oil or grease thinly to the washer so that it will stick to the cover.
   ★ When installing the cover, match the match marks made when it was removed.



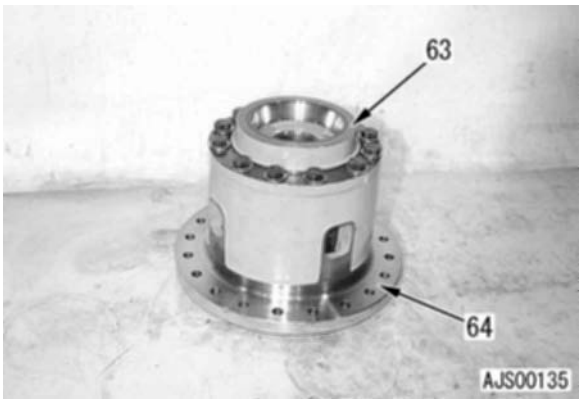
14) Adjust the clearance of the side gear in the axial direction.
   i) Measure clearance (e) between the side gear and washer through the shaft holes on both sides of the anti-slip differential.
      • Clearance (e):
        0.15 - 0.35 mm (on each side)
      ★ If the clearance is out of the standard range, replace the washer with new one.
      ★ There are washers 2.0 mm and 2.1 mm thick.





15) Install cover (63).

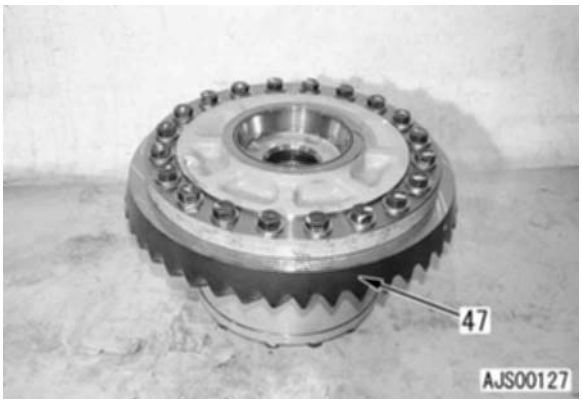
Mounting bolt:
98 - 123 Nm {10 -12.5 kgm}



16) Turn over the assembly and install bevel gear (47).
★ When installing the bevel gear, match the match marks made when it was removed.

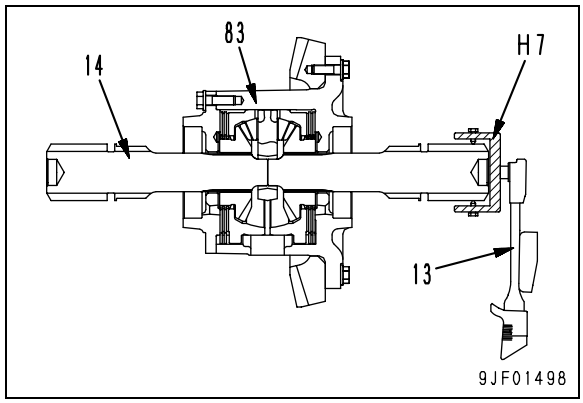
Mounting bolt: **Adhesive (LT-2)**

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

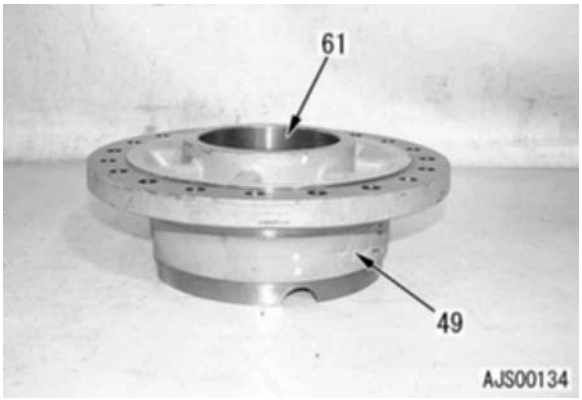


★ Referring to DISASSEMBLY, ASSEMBLY OF AXLE HOUSING ASSEMBLY, disassemble the brakes of the right and left axle housings and take out sun gear shafts (14) which will be used in the next step.

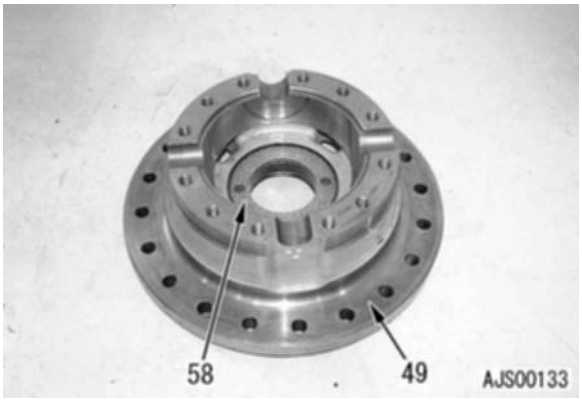
17) Measure the no-load operation torque.
i) Install sun gear shafts (14) to both sides of anti-slip differential assembly (83).
ii) Fix the sun gear shaft on one side and install tool **H7** to the sun gear shaft on the other side.
iii) Install torque wrench [13] to tool **H7** and measure the no-load operation torque.
★ When measuring, let the case rotate freely.
• No-load operation torque:
Max. 10 Nm {Max. 1.0 kgm}
• If the no-load operation torque exceeds the standard value, disassemble the anti-slip differential again and perform 11) SELECTION OF THICKNESS OF PLATE and 15) ADJUSTMENT OF SIDE GEAR IN AXIAL DIRECTION.



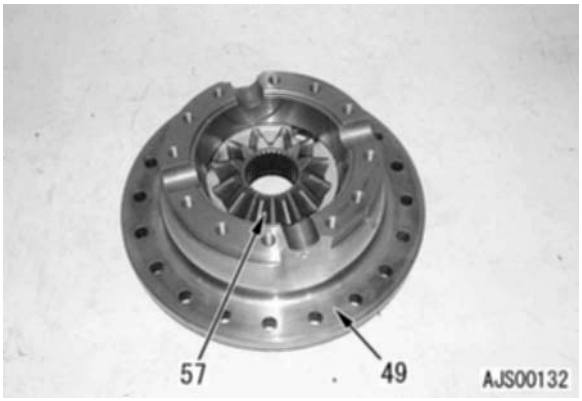
2. Assembly of standard differential carrier assembly
   1) Install outer race (61) to case (49) on the bevel gear side.
   2) Similarly, install outer race (61) to the case (48) on the opposite side.



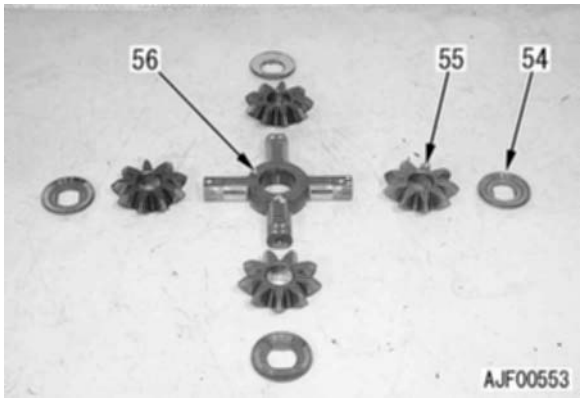
   3) Install washer (58) to case (49) on the bevel gear side.
      ★ Install the washer with the dimpled side up (toward the side gear).



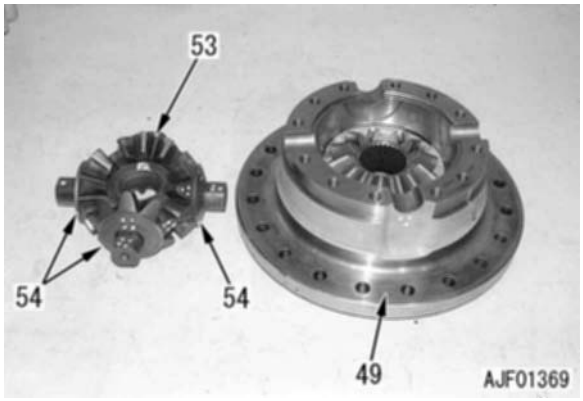
   4) Install side gear (57).



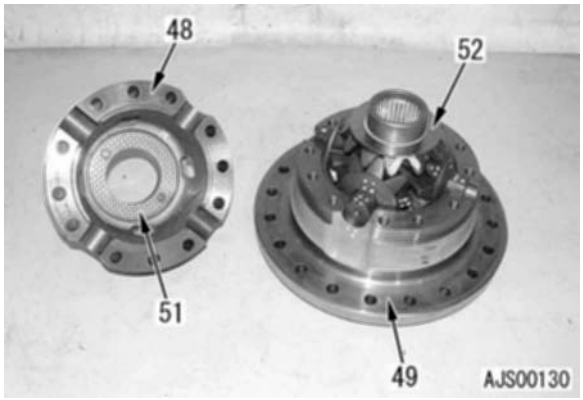
   5) Install 4 pinion gears (55) and 4 spherical washers (54) to spider shaft (56).



   6) Install pinion gear assembly (53).

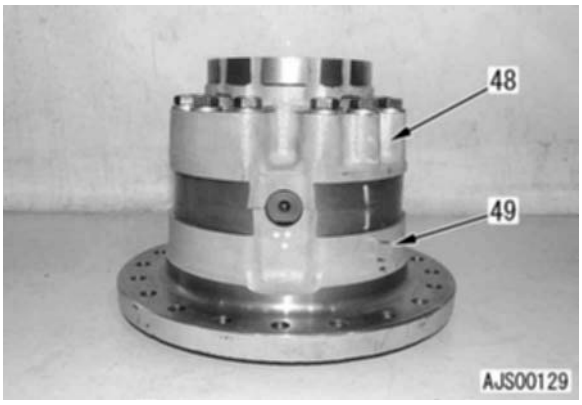


   7) Install side gear (52).
   8) Install washer (51) to case (48).
      ★ Install the washer with the dimpled side up (toward the side gear).
      ★ Apply axle oil or grease thinly to the washer so that it will stick to the case.



9) Install case (48).
★ When installing the case, match the match marks made when it was removed.

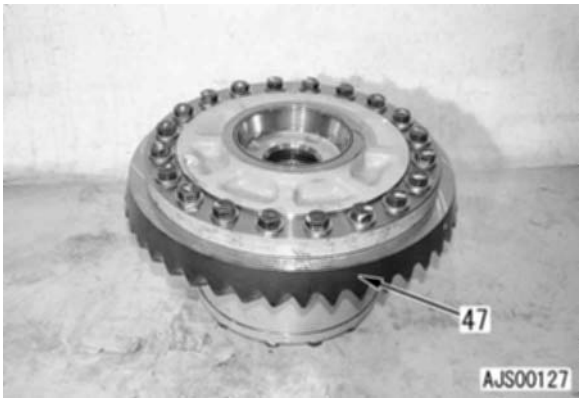
Mounting bolt:
98 - 123 Nm {10 - 12.5 kgm}



10) Turn over the assembly and install bevel gear (47).
★ When installing the bevel gear, match the match marks made when it was removed.

Mounting bolt: **Adhesive (LT-2)**

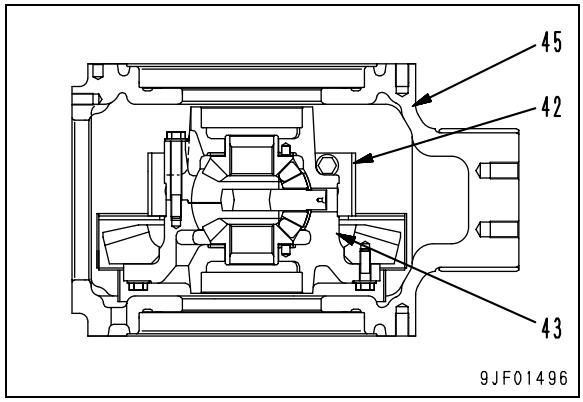
Mounting bolt:
98 - 123 Nm {10 - 12.5 kgm}

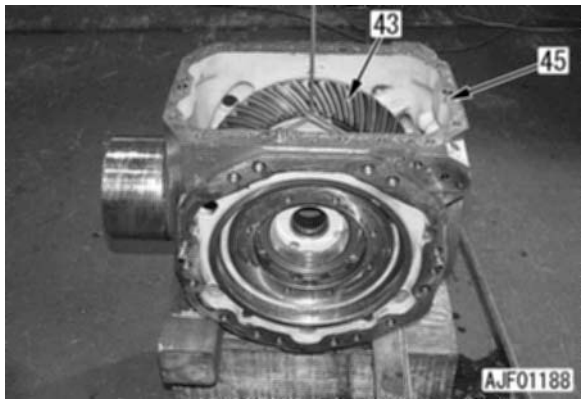


3. Installation of differential assembly
1) Install gear cover (42).

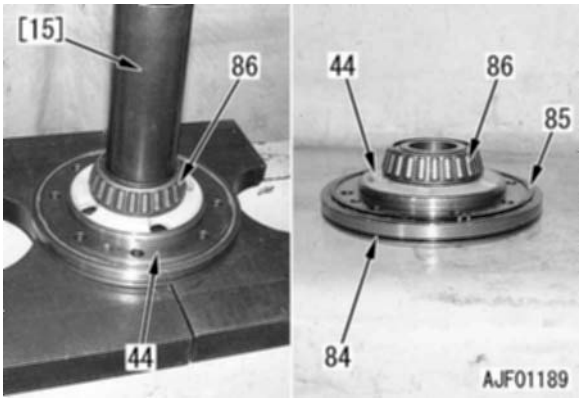
Mounting bolt:
98 - 123 Nm {10 - 12.5 kgm}

2) Sling differential carrier assembly (43) and set it to the mounting section of differential case (45).
★ Take care that the sling will not come off.
★ Do not damage the differential carrier by hitting it against the differential case.





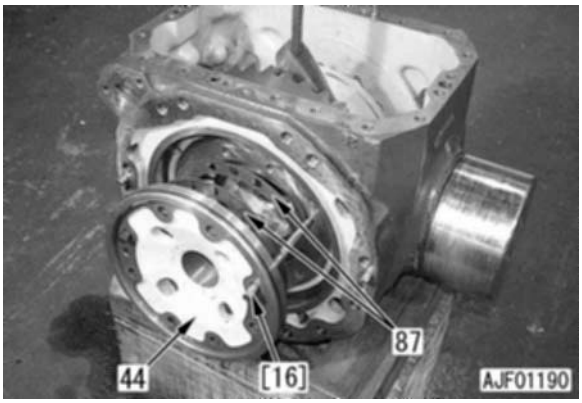
4. Bearing carrier
   1) Using push tool [15] and a press, press fit bearing (86) to bearing carrier (44).
   2) Install ring (85) and seal (84) to bearing carrier (44).



   3) Apply axle oil to the bearing. Using guide bolt [16], install shims (87) and bearing carriers (44) on both sides.
      ★ Install the shims of the thickness and quantity checked when disassembled to each bearing carrier.
      ★ Turning the bevel gear, tighten the mounting bolts.

      Bearing: **Axle oil**

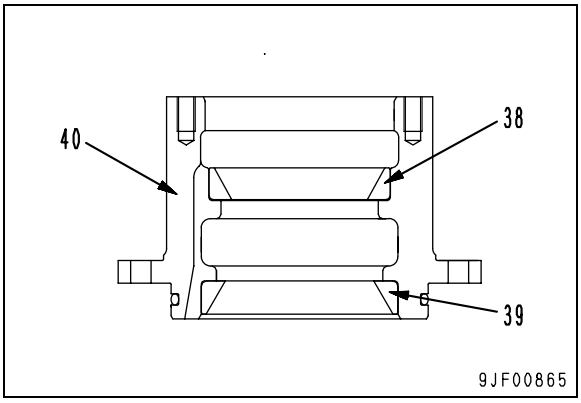
      Mounting bolt:
      98 - 122.5 Nm {10- 12.5 kgm}



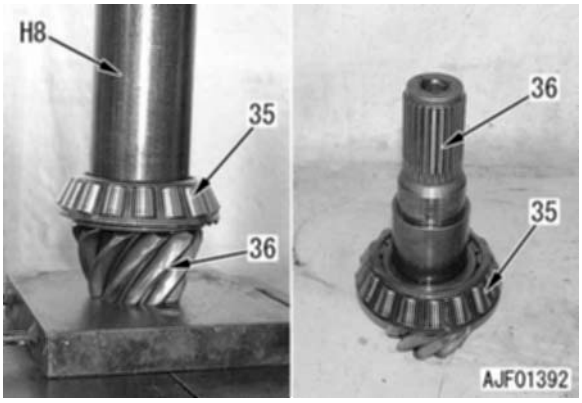
      ★ Rotate the bearing several turns to spread the axle oil to every part of the bearing.

   4) Using push-pull gauge [17], measure the starting torque of the bevel gear in the tangential direction.
      • Starting torque:
      6.9 - 19.6 N {0.7 - 2.0 kg}
      ★ If the starting torque is out of the standard range, adjust it by increasing or decreasing the shim thickness.
      • Varieties of shim thickness:
      0.05 mm, 0.2 mm, 0.3 mm, 0.8 mm
      ★ Limit the shim thickness after the adjustment to 0.3 - 1.25 mm on each side.

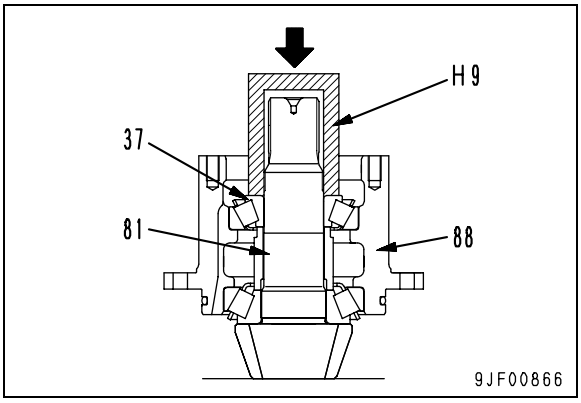
5. Assembly of front cage assembly (For front differential)
   1) Install outer races (39) and (38) to cage (40).



   2) Using push tool **H8** and a press, install bearing (35) to pinion gear (36).

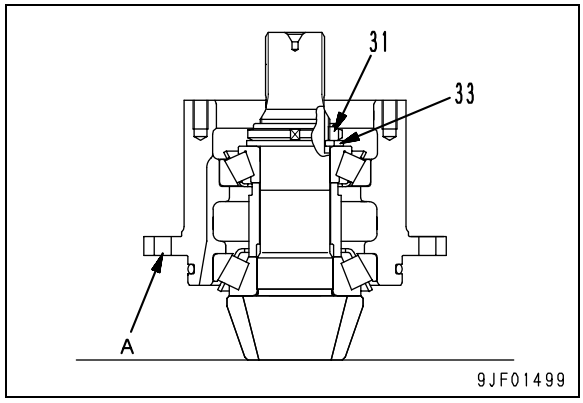


   3) Erect pinion gear assembly (81) and install cage assembly (88).
   4) Install bearing (37) to pinion gear assembly (81).
      ★ Install the bearing by shrink fit at temperature below 100°C or by using tool **H9** and a press.



   5) Install holder (33) and nut (31).
      ★ Replace nut (31) with new one.
   6) Using tool **H6** (See 4. REMOVAL OF FRONT CAGE ASSEMBLY), tighten nut (31) to the specified torque.
      ★ Secure assembly by gripping the outside of the pinion gear in a vise.

Mounting nut:
441 - 539 Nm {45 - 55 kgm}



   7) Apply axle oil to the bearing and rotate the cage several turns to spread the axle oil to every part of the bearing, and then measure the following.

Bearing: **Axle oil**

- End play: **0 - 0.165 mm**
- Starting torque at cage mounting hole A: **0 - 60.8 N {0 - 6.2 kg}**

★ If the cage is heavy to rotate, replace the bearing, and then check the starting torque again.

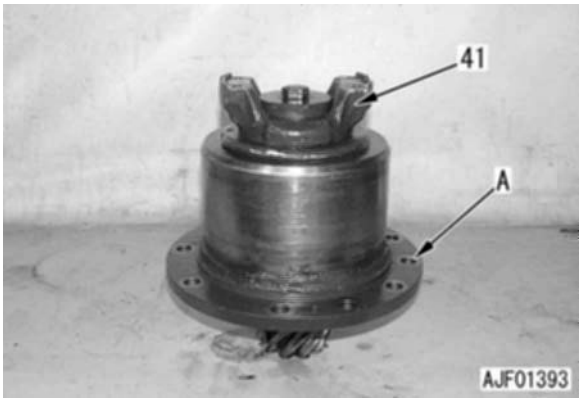
6. Assembly of rear cage assembly (For rear differential)
   1) Referring to 5 ASSEMBLY OF FRONT CAGE ASSEMBLY, steps 1) - 4), assemble the rear cage assembly.
   2) Apply axle oil to the bearing and rotate the cage several turns to spread the axle oil to every part of the bearing.

      Bearing: **Axle oil**

   3) Install coupling (41).

      Contact surfaces of coupling and bearing: **Lubricant containing molybdenum disulfide (LM-G or LM-P)**

      Mounting bolt:
      245 - 309 Nm {25.0 - 31.5 kgm}

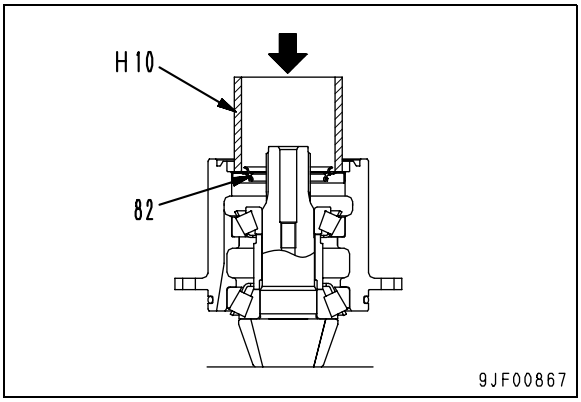


   4) Rotate the cage several turns to spread the axle oil to every part of the bearing, and then measure the following.
      - End play: **0 - 0.165 mm**
      - Starting torque at cage mounting hole A: **0 - 60.8 N {0 - 6.2 kg}**

      ★ If the cage is heavy to rotate, replace the bearing, and then check the starting torque again.

   5) Remove coupling (41). Using tool H10, press fit oil seal (82).

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



   6) Install coupling (41).

      Mounting bolt: **Adhesive (LT-2)**

      Mounting bolt:
      245 - 309 Nm {25.0 - 31.5 kgm}

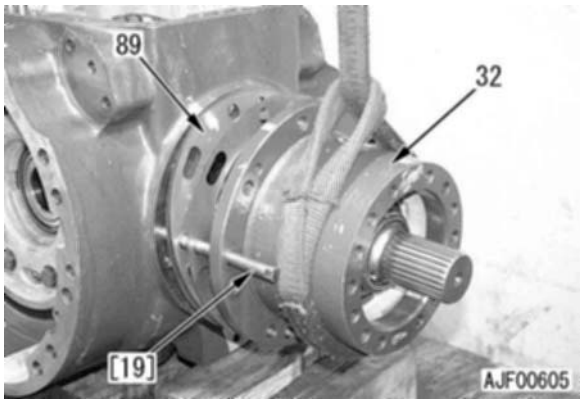
7. Installation of front cage assembly (For front differential)
   1) Install guide bolt [19] to the differential case assembly, and then install shim (89), O-ring, and front cage assembly (32).

      ★ Install the shims of the thickness and quantity checked when disassembled to each bearing carrier.

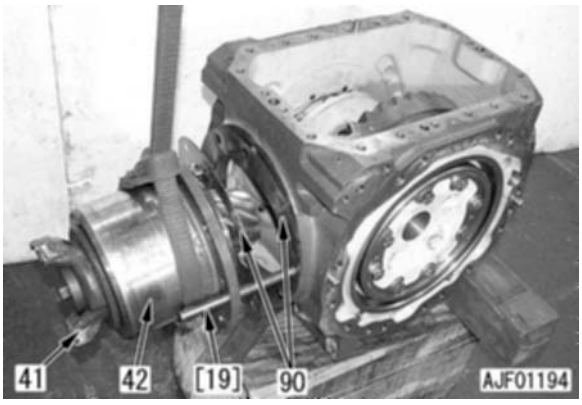
      ★ Install the shims with the thinnest one on the cage side.

      - Adjustment allowance of shims:
        0.74 - 1.4 mm
      - Varieties of shim thickness:
        0.05 mm, 0.2 mm, 0.3 mm, 0.6 mm

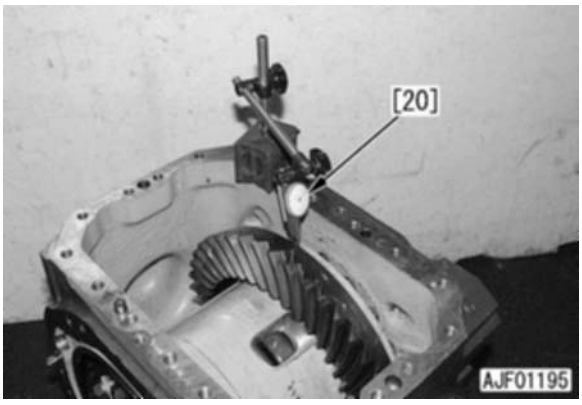
      Mounting bolt:
      157 - 196 NM {16 - 20 kgm}



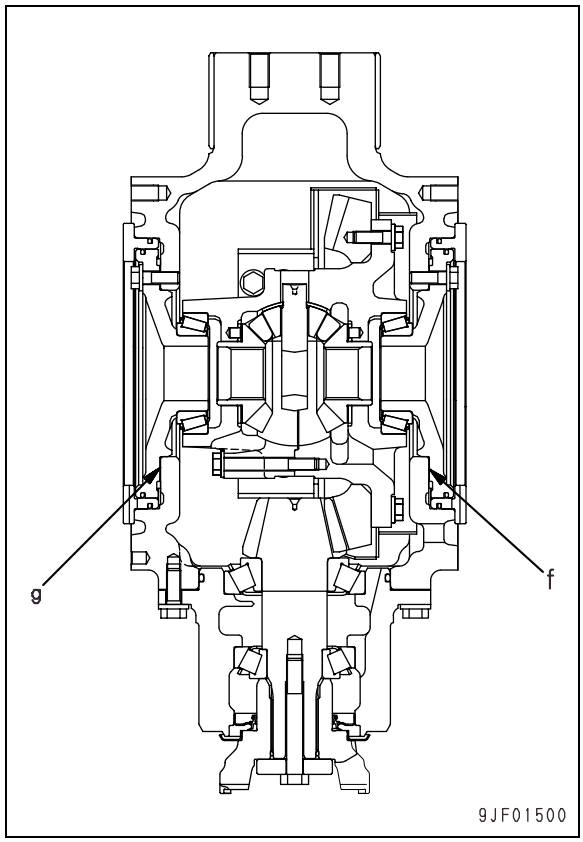
8. Installation of rear cage assembly (For rear differential)
   1) Install guide bolt [19] to the differential case assembly, and then install shim (90), O-ring, and rear cage assembly (42).
      ★ For the adjustment of the shims and tightening torque, see 7 INSTALLATION OF FRONT CAGE ASSEMBLY.

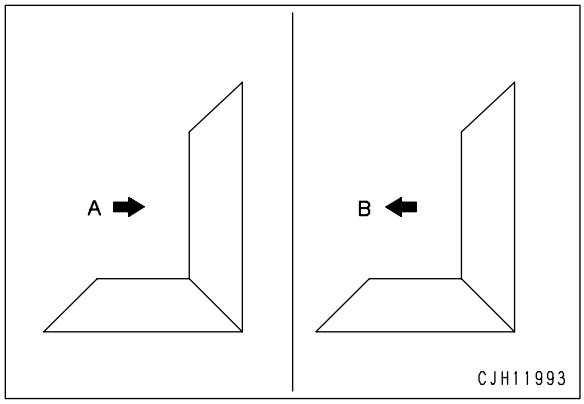


9. Adjusting backlash
   1) Measure the backlash of the bevel gear with dial gauge [20].
      • Standard backlash: **0.20 - 0.33 mm**
      ★ Measure the backlash at 3 places on the periphery of the bevel gear and check that the dispersion of the measured values is 0.1 mm or less.

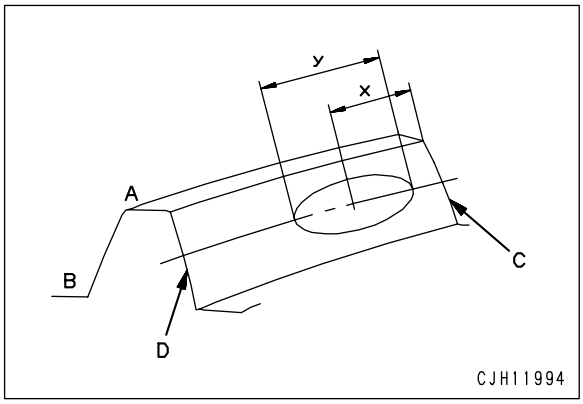


   2) If the measured backlash is out of the standard range, adjust it by moving a part of the shims on either side to the opposite side.
      ★ Do not change the total thickness of the shims on both sides.
      ★ If the backlash is insufficient, move a part of shims (**g**) to the shims (**f**). (Move the bevel gear in direction A, or to the right in the figure.)
      ★ If the backlash is too large, move a part of shims (**f**) to the shims (**g**). (Move the bevel gear in direction B, or to the left in the figure.)

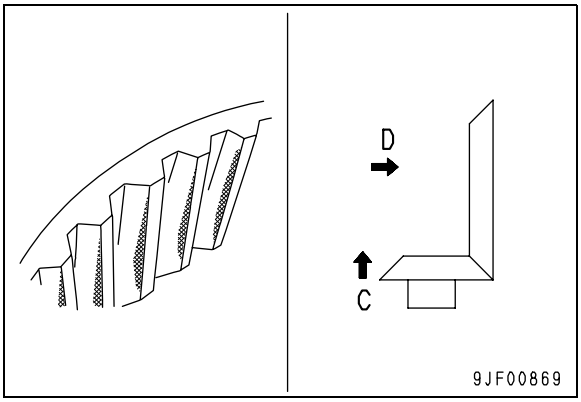




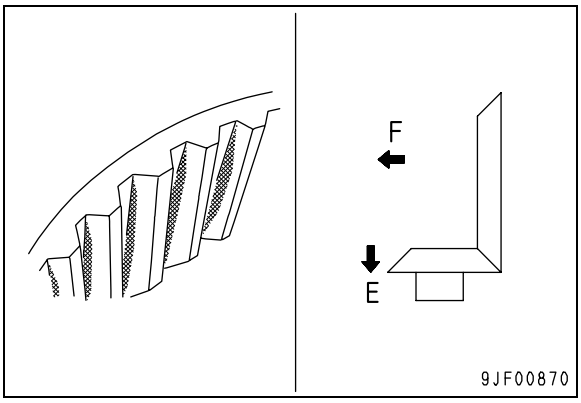
10. Testing tooth contact
    1) Apply red lead thinly to the surfaces of the bevel gear teeth and turn the bevel gear in the forward and reverse directions, then check the tooth contact pattern on the bevel gear.
       ★ The center of the tooth contact must be as follows.
         • Middle of tooth height
         • Point on tooth at which distance of "**x**" from small end "**C**" is 24 ± 4 mm
       ★ Width "**y**" of the tooth contact must be 31 ± 3 mm.
       ★ Check that there is not a strong contact at tip "**A**", bottom "**B**", small end "**C**", or large end "**D**".



11. Adjusting tooth contact
    1) If the tooth contact pattern is not proper, adjust the tooth contact.
       ★ Adjust the toot contact by increasing or decreasing the shims on both sides of the bearing carrier (to move the bevel gear) and the shims of the cage assembly (to move the bevel pinion).
       ★ After adjusting the tooth contact, check the backlash again.
    2) If the bevel pinion is too far from the bevel gear, the tooth contact pattern is as follows. In this case, adjust the tooth contact according to the following procedure.
       • Decrease the shims of the cage assembly (on the bevel pinion side) to move the cage assembly in the direction (**C**).
       • Adjust the shims on both sides of the bearing carrier to move bevel gear in the direction of (**D**) far from the bevel pinion.
       ★ Do not change the total thickness of the shims on both sides of the bearing carrier.

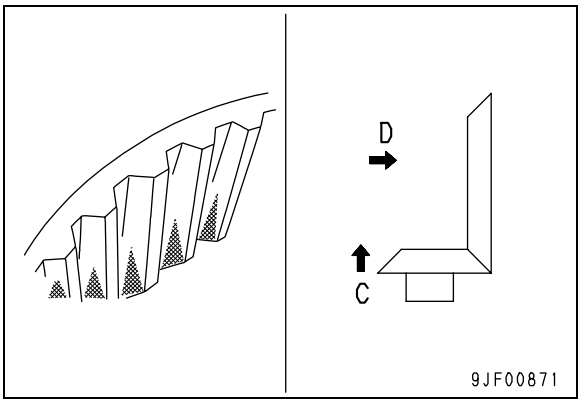


    3) If the bevel pinion is too close to the bevel gear, the tooth contact pattern is as follows. In this case, adjust the tooth contact according to the following procedure.
       • Increase the shims of the cage assembly (on the bevel pinion side) to move the cage assembly in the direction (**E**).
       • Adjust the shims on both sides of the bearing carrier to move bevel gear in the direction of (**F**) close to the bevel pinion.
       ★ Do not change the total thickness of the shims on both sides of the bearing carrier.



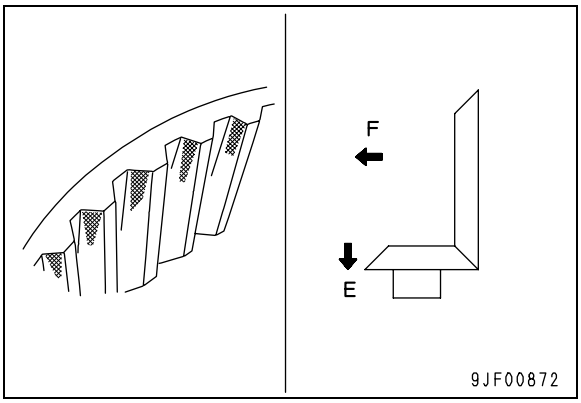
4) If the bevel gear is too close to the bevel pinion, the tooth contact pattern is as follows. In this case, adjust the tooth contact according to the following procedure.
   - Decrease the shims of the cage assembly (on the bevel pinion side) to move the cage assembly in the direction (**G**).
   - Adjust the shims on both sides of the bearing carrier to move bevel gear in the direction of (**D**) far from the bevel pinion.

   ★ Do not change the total thickness of the shims on both sides of the bearing carrier.



5) If the bevel gear is too far from the bevel pinion, the tooth contact pattern is as follows. In this case, adjust the tooth contact according to the following procedure.
   - Increase the shims of the cage assembly (on the bevel pinion side) to move the cage assembly in the direction (**E**).
   - Adjust the shims on both sides of the bearing carrier to move bevel gear in the direction of (**F**) close to the bevel pinion.

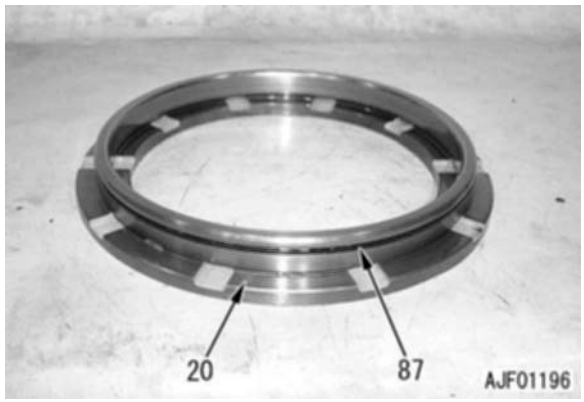
   ★ Do not change the total thickness of the shims on both sides of the bearing carrier.



12. Brake

   ★ Install both brakes according to the same procedure.

   1) Install seal (87) to piston (20).

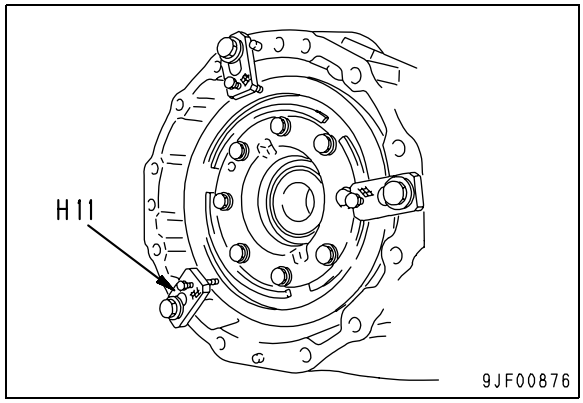


Thinly apply differential oil to the piston and piston mounting section.

   2) Using tool **H11**, press fit piston (20) evenly.

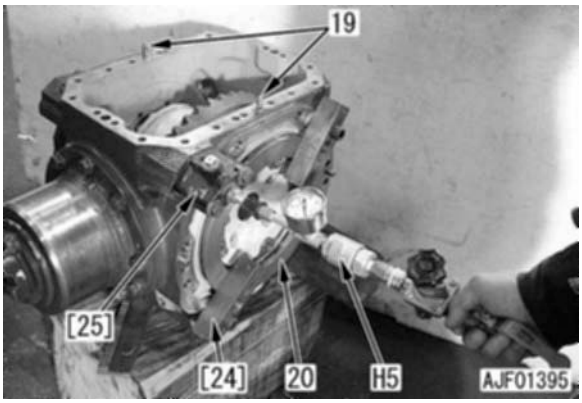
   ★ Press fit the piston until it touches the housing.

   ★ Do not hit the piston with a plastic hammer, etc. to press fit it. (If it is press fitted so, it and its O-ring will be damaged.)



3) Install bleeder screw (19).
4) Install tool **[25] (See the next step)**.
   ★ You may install tool **[25]** when checking for brake oil leakage.
5) Set installer [24] (**equivalent to** tool **H11**). Using tool **H5**, supply air into the brake oil port to fit the piston.

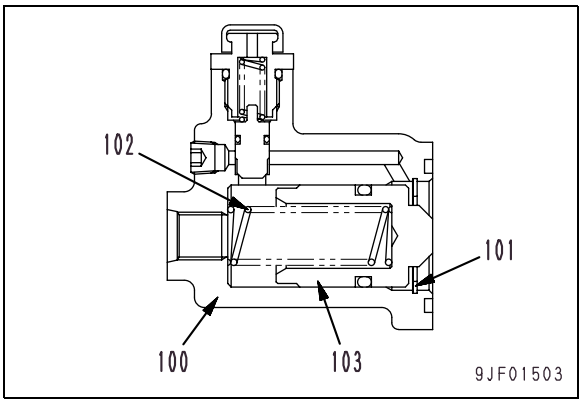
   ⚠ If the air is supplied without setting installer [24], the piston will jump out, and that is dangerous.



13. Brake oil leakage test
    - **Make tool [25].**
      Remove snap ring (101), piston (103), and spring (102) from slack adjuster (100) (Part No. 418-43-37302).

    ★ Action of the piston of the slack adjuster lowers pressure during the low-pressure leakage test. To prevent this, make tool [25].

    ★ **Since the slack adjuster is a safety-critical part, do not install it to the vehicle and use it as a slack adjuster again once it is disassembled and modified into a tool.**

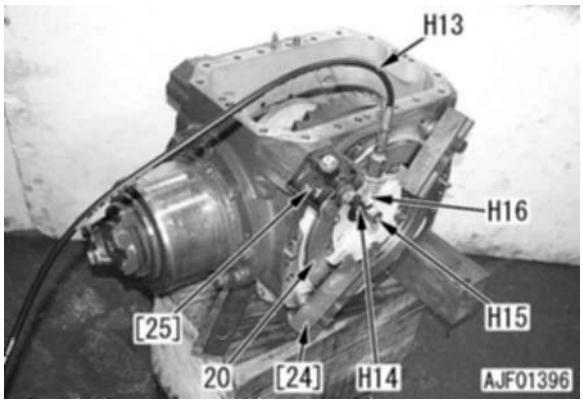


★ **Since tool [25] has the same appearance as a disassembled slack adjuster, make a mark on it for distinction.**

1) Keep installer [24] (**equivalent to** tool **H11**) set.

   ⚠ If the brake oil leakage test is performed without setting installer [24], the piston will jump out, and that is dangerous.

2) Install tool **[25]**, adapter **H14**, plug **H15**, nipple **H16** and pump **H13** to the brake port and bleed all air from the brake system through the bleeder.
   ★ Bleed air by operating pump **H13**.



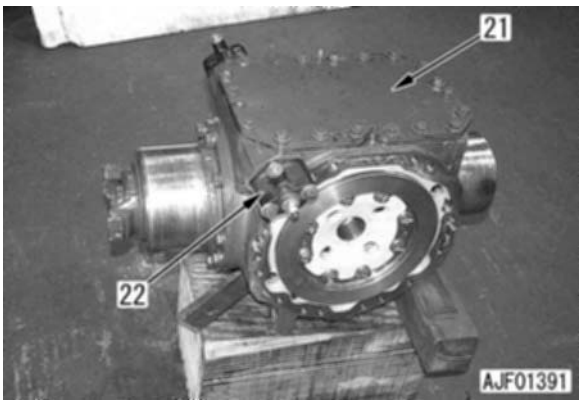
3) Perform the low-pressure oil leakage test.
   ★ Operate tool **H13** to raise the pressure to 98 kPa {1 kg/cm^2}.
   ★ Leave the system at 98 kPa {1 kg/cm^2} for 5 minutes and check that the pressure does not lower at all.
   ★ If the oil leaks (If the pressure drops more than the standard), remove the brake piston and check the seals for damage.
   ★ If the hose is moved while the pressure is measured, the pressure fluctuates. Accordingly, do not move the hose.

4) Perform the high-pressure oil leakage test.
   - ★ If oil leakage is not detected by the low-pressure brake oil leakage test, operate tool **H13** to raise the pressure to 4,410 kPa {45 kg/cm^2}.
   - ★ Leave the system at 4,410 kPa {45 kg/cm^2} for 5 minutes and check that the pressure does not drop more than 98 kPa {1 kg/cm^2}.
   - ★ If the oil leaks (If the pressure drops more than the standard), remove the brake piston and check the seals for damage.
   - ★ If the hose is moved while the pressure is measured, the pressure fluctuates. Accordingly, do not move the hose.
5) Remove pump **H13**, nipple **H16**, adapter **H14**, plug **H15**, tool **[25]**, and installer **[24]** (**equivalent to** tool **H11**).

14. Top cover
    1) Install top cover (21).
    2) Install slack adjusters (22) to the right and left.
       - ★ Take care that the O-ring will not come off.
       - ★ **Since tool [25] and slack adjuster (22) have the same appearance, check them carefully.**

       Mating face of cover: **Adhesive (LOCTITE 515 or equivalent)**

       Mounting bolt: **98 - 122.5 Nm {10 - 12.5 kgm}**



15. Axle housing
    1) Referring to DISASSEMBLY, ASSEMBLY OF AXLE HOUSING, 8. Axle housing assembly, install the right and left housings.
    2) For the rear differential, perform step 9 below to install the rear axle support and the brake tube and hose assembly.
       - ★ Perform steps 16 - 18 below for only the front differential.

16. Axle oil temperature sensor (For only front axle)
    1) Install axle oil temperature sensor (11).
       - ★ Install the axle oil temperature sensor to the back side of cover (10).

       Threads: **Gasket sealant (LG-5)**

       Axle oil temperature sensor: **29.4 - 49 Nm {3 - 5 kgm}**

    2) Install cover (10).

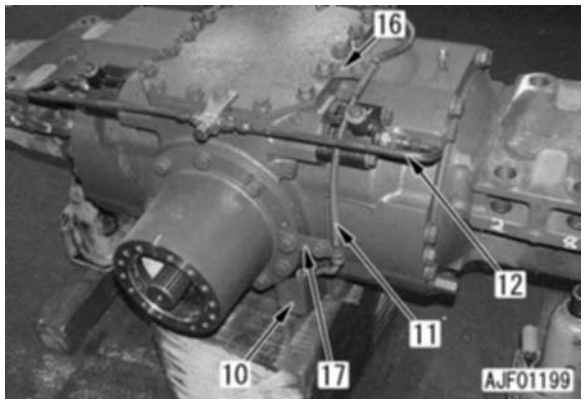
       Mounting bolt: **98 - 122.5 Nm {10 - 12.5 kgm}**

    3) Install oil temperature sensor clamps (16) and (17).

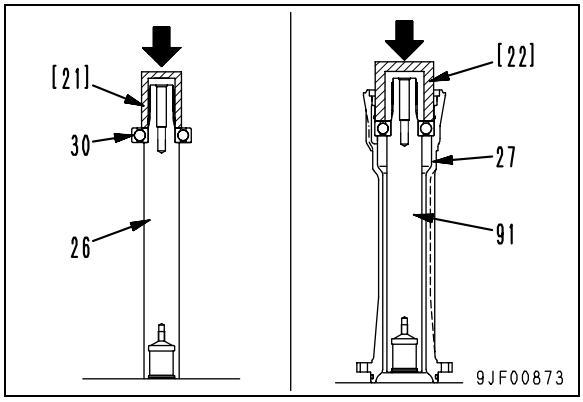
       Mounting bolts (16) and (17): **98 - 122.5 Nm {10 - 12.5 kgm}**

    4) Install brake tube assembly (12).

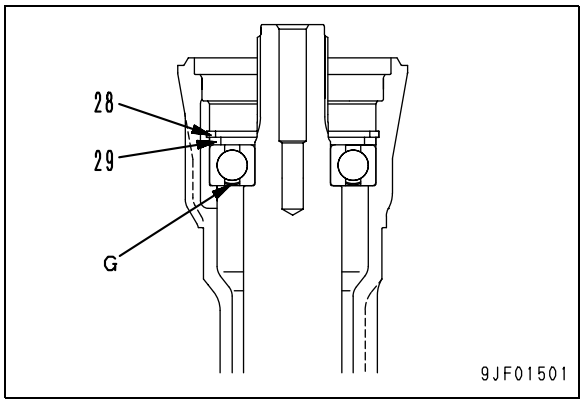
       Mounting bolt: **98 - 122.5 Nm {10 - 12.5 kgm}**



17. Disassembly of long cage assembly (For only front differential)
    1) Using push tool [21], press fit bearing (30) to shaft (26) with a press.
       ★ Direct the shield side (G) of the bearing down.
    2) Using push tool [22], press fit shaft and bearing assembly (91) to long cage (27).



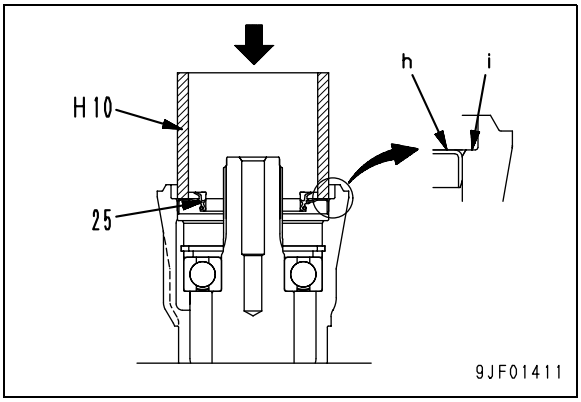
    3) Install ring (29) and snap ring (28).
       ★ Check that part G (the shield side of the bearing) is on the lower side.



    4) Using tool **H10**, press fit oil seal (25).

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

       ★ Set top (h) of the oil seal rim flush with end face (i) of the cage.



18. Installation of long cage assembly (For only front differential)
    1) Sling and install long cage assembly (24).

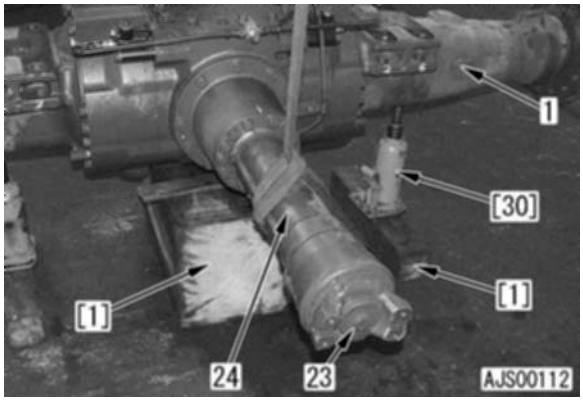
       Mounting bolt:
       98 - 123 Nm {10 - 12.5 kgm}

    2) Install coupling (23).

       Contact surfaces of coupling and bearing: **Lubricant containing molybdenum disulfide (LM-G) or (LM-P)**

       Mounting bolt: **Adhesive (LT-2)**

       Mounting bolt:
       245 - 309 Nm {25.0 - 31.5 kgm}



- **Refilling with oil (Axle housing)**
  Tighten the drain plug and add oil through the oil filler to the specified level.

Drain plug:
127.4 - 176.4 Nm {13 - 18 kgm}

Oil filler plug:
93.1 - 122.5 Nm {9.5 - 12.5 kgm}

Axle (Each of front and rear): **27 ℓ**

REMOVAL, INSTALLATION OF HST PUMP AND 4-GEAR PUMP ASSEMBLY

REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

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

Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

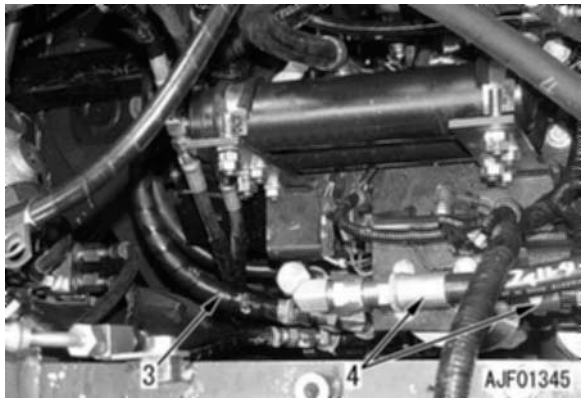
Disconnect the cable from the negative (–) terminal of the battery.

1. Drain the hydraulic oil.

   Hydraulic tank: **89 ℓ**

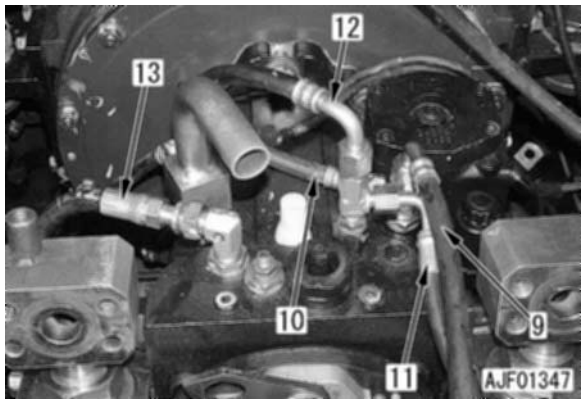
2. Remove the operator's cab assembly. For details, see Removal, installation of operator's cab.
3. Disconnect the following tubes and hoses.
   - (1): 4 HST pump discharge hoses
   - (2): Hose between charge valve port (A) and fan motor (IN) hose

- (3): Hose between charge valve port (P) and brake/fan pump
- (4): 2 HST filter hoses

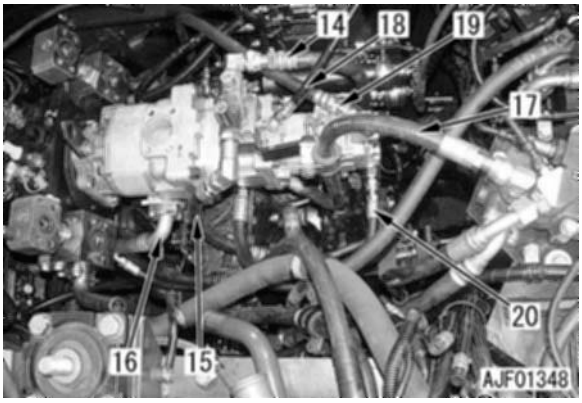


- (5): Steering pump suction tube
- (6): HST pump port (G) hose
- (7): HST pump port (S) hose
- (8): Parking brake solenoid port (T) hose

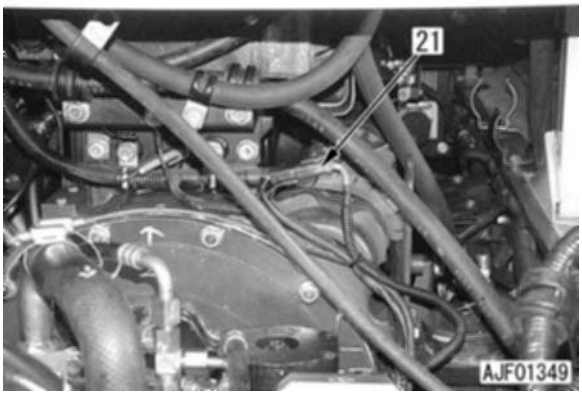
- (9), (10): HST pump port (PS) hose
- (11), (12): HST pump port (YS) hose
- (13): HST pump port (G) hose



- (14): HST motor M1 port (T2) hose
- (15): HST motor M2 port (T2) hose
- (16): Steering priority valve port (P) hose
- (17): Hose between work equipment pump and cut-off valve port (P)
- (18): Transfer clutch valve port (T) hose
- (19): Transfer lubrication hose
- (20): Transfer cooler inlet hose

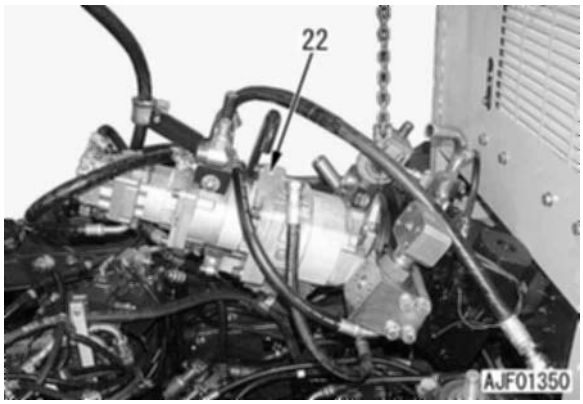


- (21): Disconnect wiring connector (T05).



4. Sling HST pump and 4-gear pump assembly (22) temporarily, and then remove its 5 mounting bolts and it. [*1]

HST pump and 4-gear pump assembly: **150 kg**



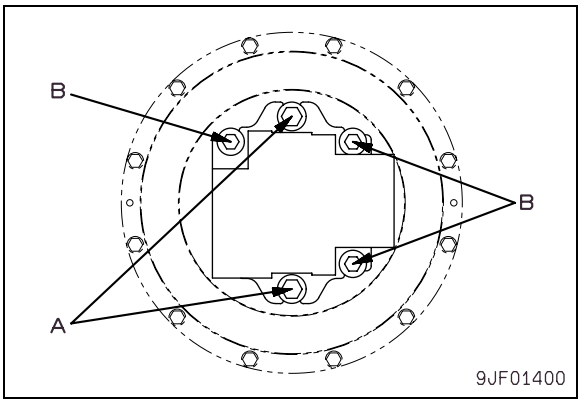
INSTALLATION

- Carry out installation in the reverse order to removal.

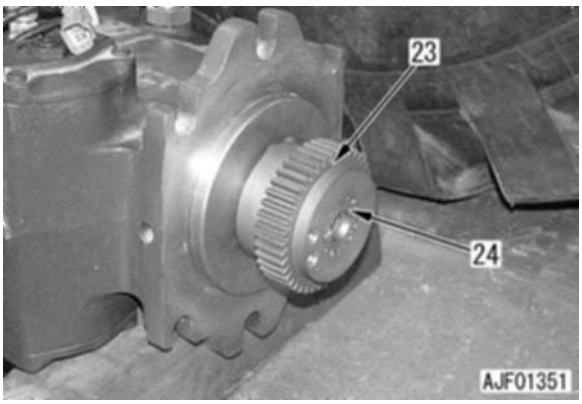
[*1]

Mating face of pump:
Gasket sealant (LG-6)

Mounting bolt:
A: 245 - 309 Nm {25.0 - 31.5 kgm}
B: 98 - 123 Nm {10.0 - 12.5 kgm}

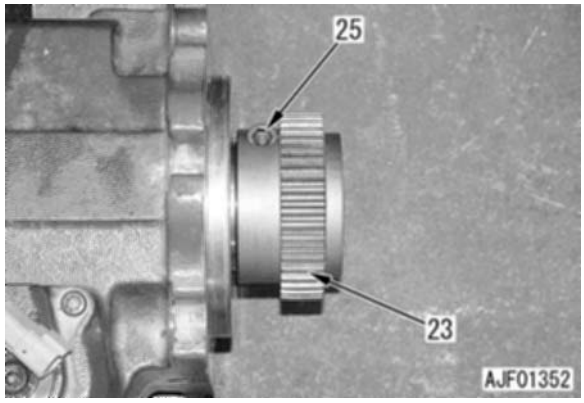


1. If boss (23) was removed from the HST pump assembly, install it according to the following procedure.
   ★ Install boss (23) so that it will be flush with the shaft end of pump (24).
   - Level difference between boss and pump shaft end: **Max. 0.5 mm**



2. Tighten mounting bolt (25) of boss (23).

Mounting bolt:
210 Nm {21.4 kgm}



- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

Hydraulic tank: **89 ℓ**

REMOVAL, INSTALLATION OF HST MOTOR 1 ASSEMBLY

REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

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

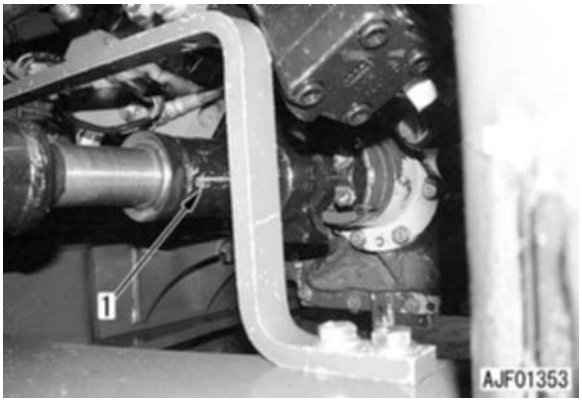
Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

Disconnect the cable from the negative (–) terminal of the battery.

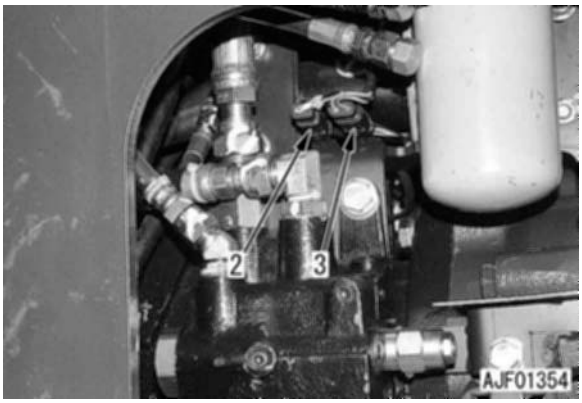
1. Drain the hydraulic oil.

   Hydraulic tank: **89 ℓ**

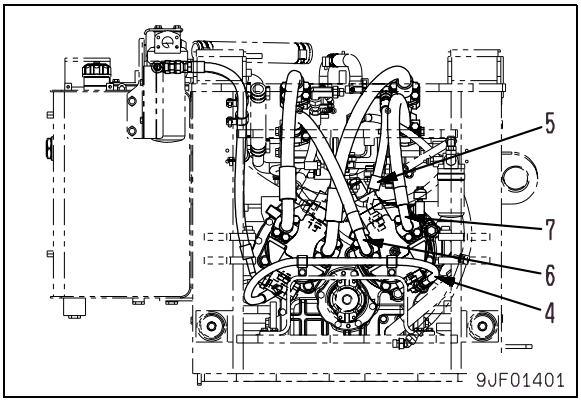
2. Disconnect front drive shaft (1) from the transfer side.



3. Disconnect wiring connectors (T06) (2) and (T11) (3) from motor 1.

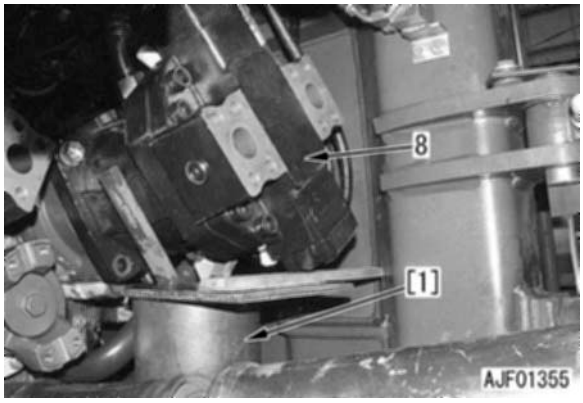


4. Disconnect port T1 hose (4) and port T2 hose (5).
5. Disconnect port A hose (6) and port B hose (7).



6. Support motor 1 assembly (8) with tool [1] placed on the transmission jack and remove 4 motor 1 mounting bolts. [*1]
7. Supporting motor 1 assembly (8) with the hand, lower the transmission jack gradually to remove motor 1 assembly (8).

   Motor 1 assembly: **65 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]


Motor 1 assembly mounting bolt:
245 - 309 Nm {25.0 - 31.5 kgm}

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

  
  Hydraulic tank: **89 ℓ**

REMOVAL, INSTALLATION OF HST MOTOR 2 ASSEMBLY

REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

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

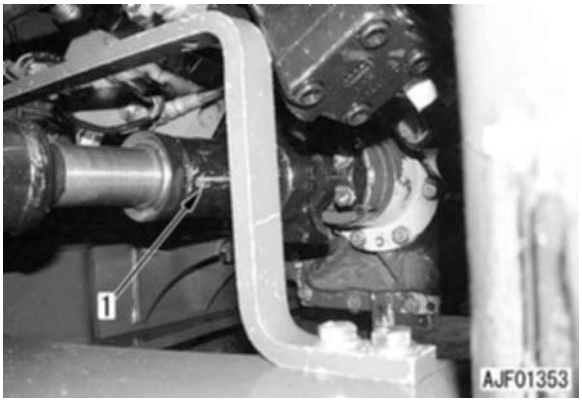
Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

Disconnect the cable from the negative (–) terminal of the battery.

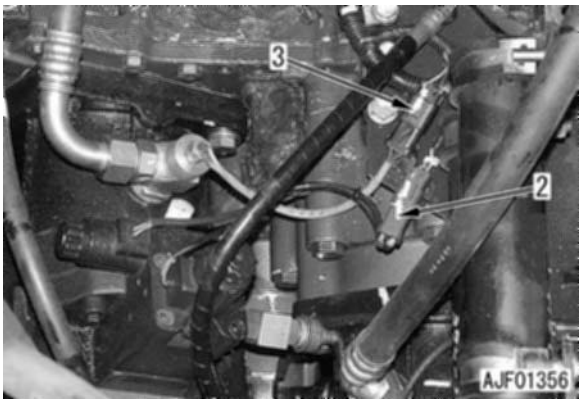
1. Drain the hydraulic oil.

   Hydraulic tank: **89 ℓ**

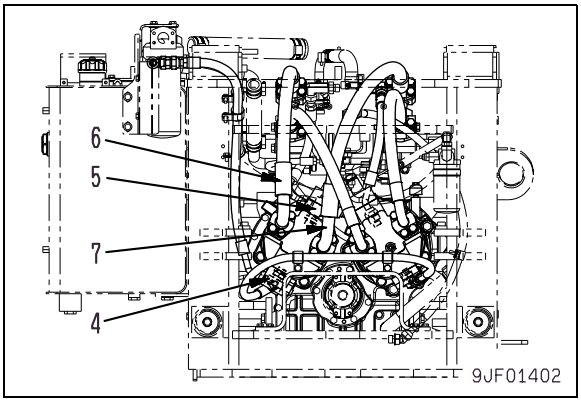
2. Disconnect front drive shaft (1) from the transfer side.



3. Disconnect wiring connectors (T07) (2) and (T10) (3) from motor 2.

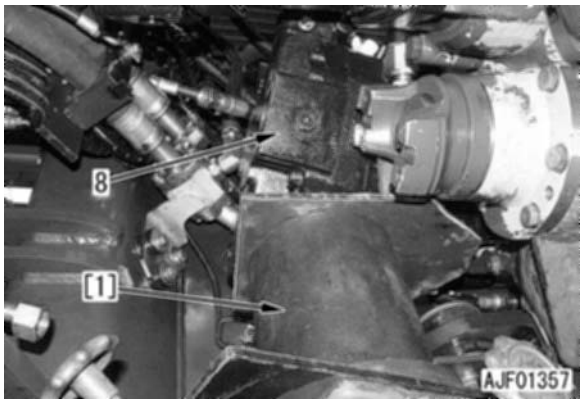


4. Disconnect port T1 block and hose (4) and port T2 block and hose (5).
5. Disconnect port A hose (6) and port B hose (7).



6. Support motor 2 assembly (8) with tool [1] placed on the transmission jack and remove 4 motor 2 mounting bolts. [*1]
7. Supporting motor 2 assembly (8) with the hand, lower the transmission jack gradually to remove motor 2 assembly (8).

   Motor 2 assembly: **70 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]


Motor 2 assembly mounting bolt:
245 - 309 Nm {25.0 - 31.5 kgm}

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

  
  Hydraulic tank: **89 ℓ**

REMOVAL, INSTALLATION OF WORK EQUIPMENT CONTROL VALVE ASSEMBLY

REMOVAL

Stop the vehicle on a level place and, apply the parking brake, and put chocks under the tires.

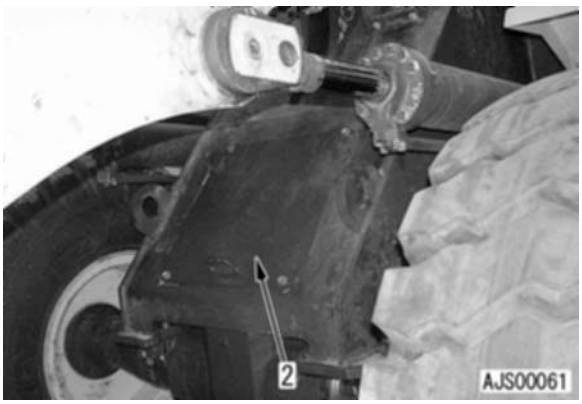
Support the boom securely.

Stop the engine, and then slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

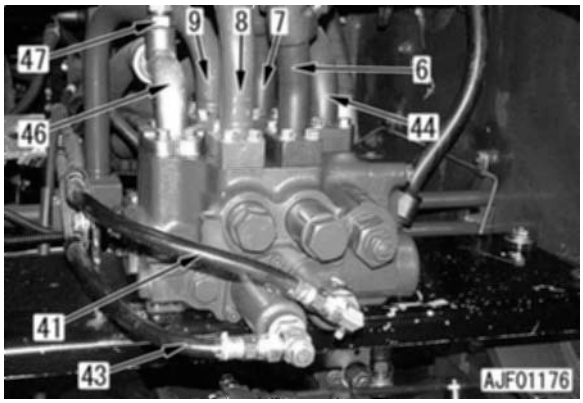
Operate the work equipment control lever 2 - 3 times to release the residual pressure in the work equipment circuit.

1. Raise the boom, dump the bucket, and support the boom with block [1] and square bar [2].

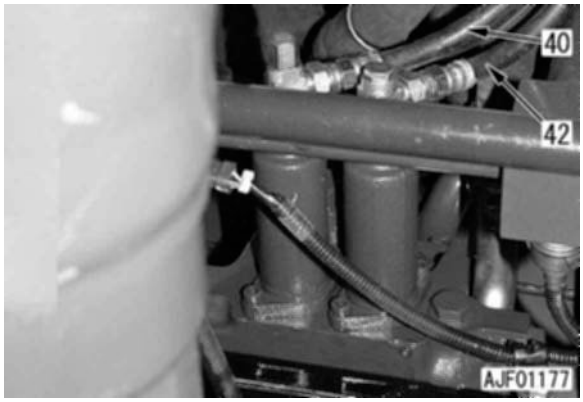
2. Remove the work equipment valve upper cover (1).



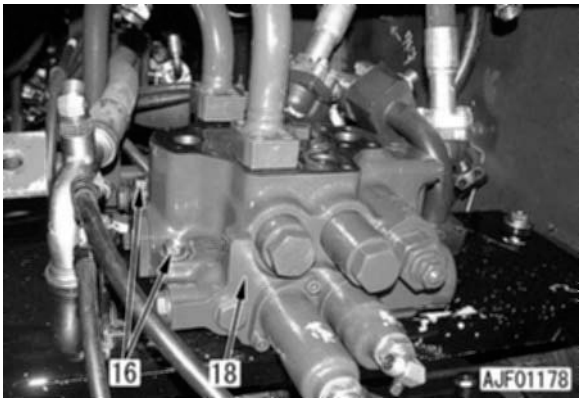
3. Disconnect the following hoses and tubes. [*1]
   - ★ Mark all the hoses and tubes with tags to prevent mistakes in the mounting position when installing.
   - ★ Since oil will leak through the disconnected hoses and tubes, prepare oil receivers.
   - (6): Port A1 hose
   - (7): Port B1 hose
   - (8): Port A2 tube
   - (9): Port B2 tube
   - (40): Bucket DUMP PPC hose
   - (41): Bucket TILT PPC hose
   - (42): Boom LOWER PPC hose
   - (43): Boom RAISE PPC hose
   - (44): Port P hose
   - (46), (47): Port T hoses



   - ★ This is the view from the rear lower part of the work equipment valve.

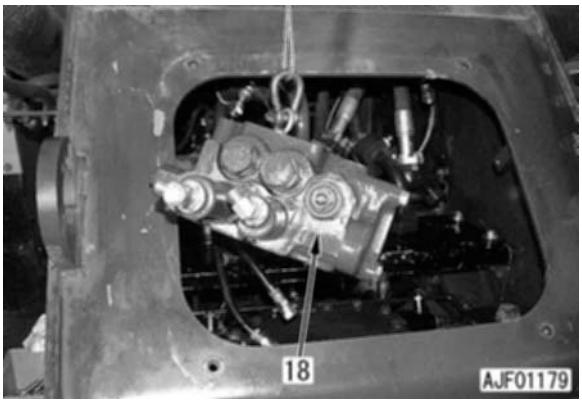


4. Remove 3 mounting bolts (16) and move work equipment control valve (18) toward you.



5. Lift off work equipment control valve assembly (18).

Work equipment control valve assembly: **65 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

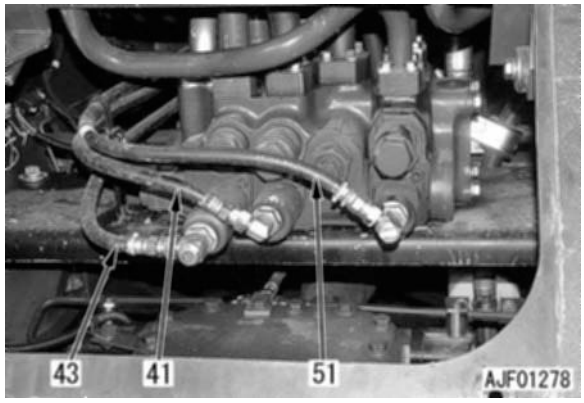
★ Connect PPC hoses (40) - (43) according to their band colors as shown below.

★ Connect each PPC hose having an even No. to the rear of the PPC hose having a corresponding odd No. on the work equipment valve: Connect (40) to the rear of (41), (42) to the rear of (43), and (50) to the rear of (51).

- Work equipment lever specification: 2-lever
- Work equipment lever specification: Joystick (If equipped)
- Work equipment lever specification: 3-lever (If equipped)

No.	Connecting point	Band color
(40)	Bucket DUMP	Blue
(41)	Bucket TILT	Red
(42)	Boom LOWER	Orange
(43)	Boom RAISE	Yellow
(50)	(PULL)	Green
(51)	(PUSH)	White/Red

- Work equipment lever specification: 3-lever (If equipped)



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

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

REMOVAL, INSTALLATION OF TRAVEL DAMPER VALVE ASSEMBLY

REMOVAL

Stop the vehicle on a level place and, apply the parking brake, and put chocks under the tires.

Disconnect the cable from the negative (–) terminal of the battery.

Stop the engine, and then slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

Operate the work equipment control lever 2 - 3 times to release the residual pressure in the work equipment circuit.

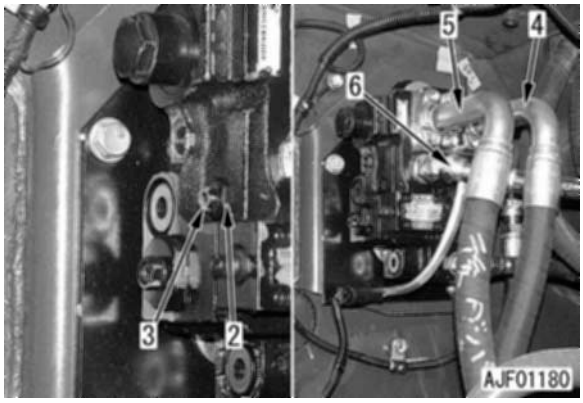
1. Since the travel damper valve is installed on the inside of the left turn signal of the front frame, bend the chassis to the right on a level place.

2. Release the residual pressure in the travel damper circuit.

   1) Loosen locknut (2).
   2) Loosen adjustment screw (3) by 1/2 - 1 turn to release the pressure in the accumulator circuit for the travel damper.
      ★ Adjustment screw (3) is painted red.
   3) After releasing the residual pressure, return adjustment screw (3) and tighten locknut (2) securely.

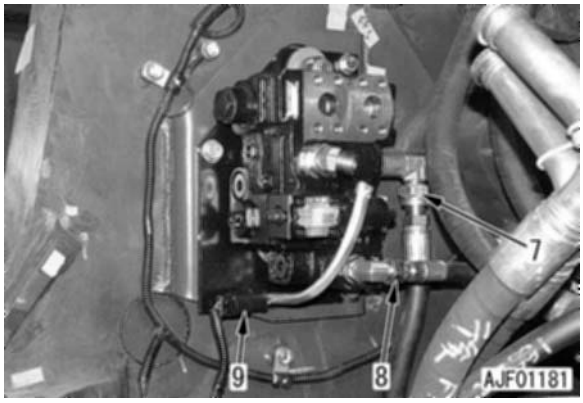
      Mounting bolt:
      13 ± 0.6 Nm {1.3 ± 0.06 kgm}

3. Disconnect the following hoses and tubes. [*1]
   ★ Mark all the hoses and tubes with tags to prevent mistakes in the mounting position when installing.
   ★ Since oil will leak through the disconnected hoses and tubes, prepare oil receivers.
   - (4): Port A hose
   - (5): Port B hose
   - (6): Port T hose



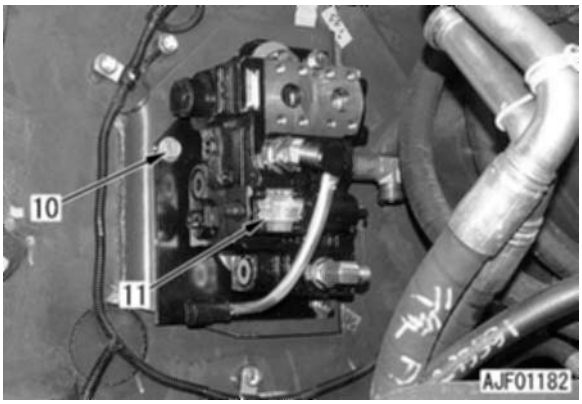
   - (7): Port SP hose
   - (8): Port P hose

4. Disconnect wiring connector F07 (4).



5. Remove 3 bracket mounting bolts (10) and lift off travel damper valve assembly (11).

   Travel damper valve assembly: **25 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

REMOVAL, INSTALLATION OF HYDRAULIC TANK ASSEMBLY

REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

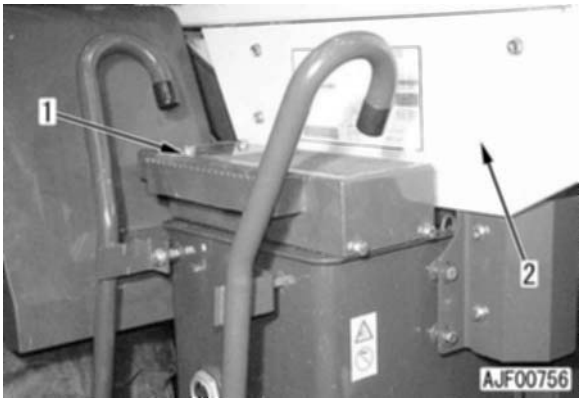
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Operate the work equipment control lever 2 - 3 times to release the residual pressure in the work equipment circuit.

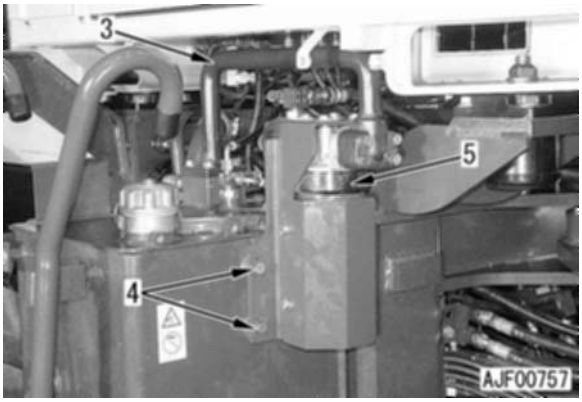
1. Remove hydraulic tank upper cover (1).

   Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

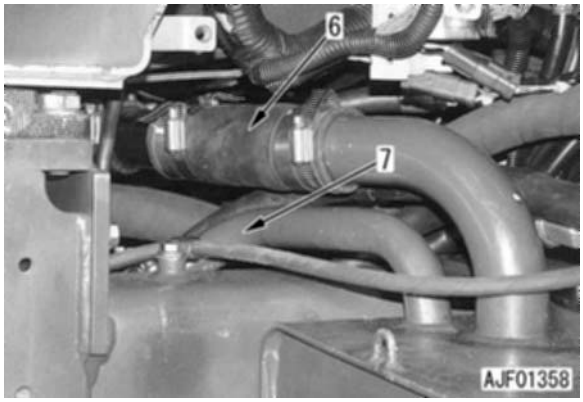
2. Remove cab right undercover (2).

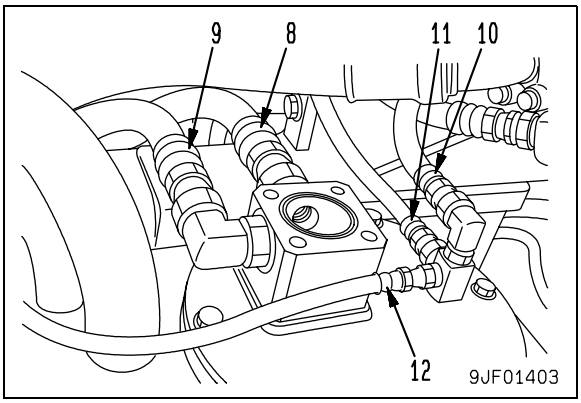


3. Remove tube (3) from the hydraulic oil filter.
4. Remove hydraulic oil filter cover mounting bolts (4) and move hydraulic oil filter cover assembly (5) and its hoses to under the operator's cab.

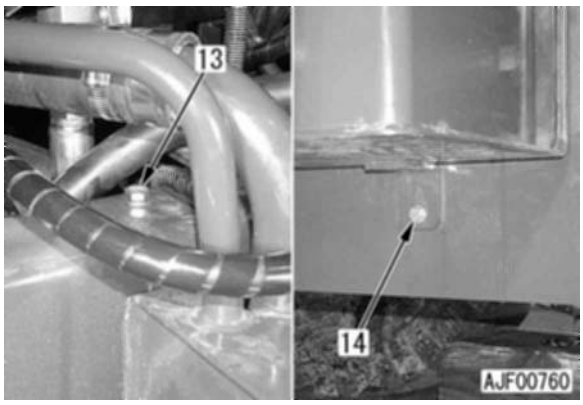


5. Disconnect 7 hoses (6), (7), (8), (9), (10), (11), and (12) from the hydraulic tank. [*1]





6. Sling the hydraulic tank assembly temporarily and remove 1 upper mounting bolt (13) and 2 lower mounting bolts (14). [*2]



7. Lift off hydraulic tank (15) and ladder together.

Hydraulic tank and ladder assembly:
160 kg (including hydraulic oil)

INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Inserting parts of hoses (6) and (7):
Gasket sealant (ThreeBond 1208D or equivalent)

Hose clamp: **8.8 ± 0.5 Nm {90 ± 5 kgcm}**

[*2]

Hydraulic tank mounting bolt:
98 - 123 Nm {10 - 12.5 kgm}

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

REMOVAL, INSTALLATION OF WORK EQUIPMENT ASSEMBLY

REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

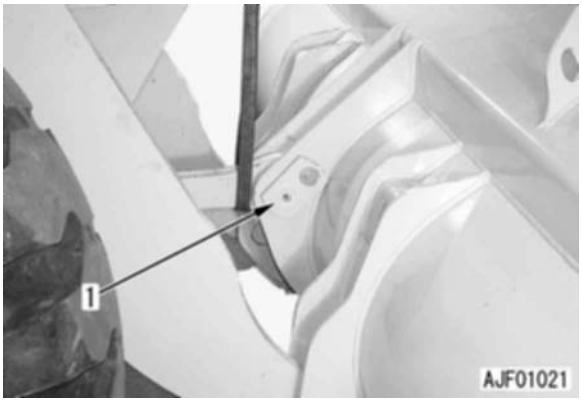
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

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

1. Sling the bucket link temporarily and remove bucket link pin (1). [*1]

   Bucket link: **45 kg**

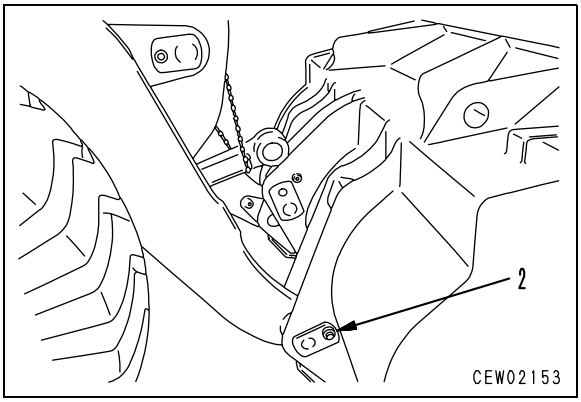
   ★ Secure the bucket link to the tilt lever with wires, etc.
   ★ Check the thickness and quantity of the shims.



2. Remove bucket hinge mounting pin (2). [*2]

   Never insert your fingers in the pin holes.

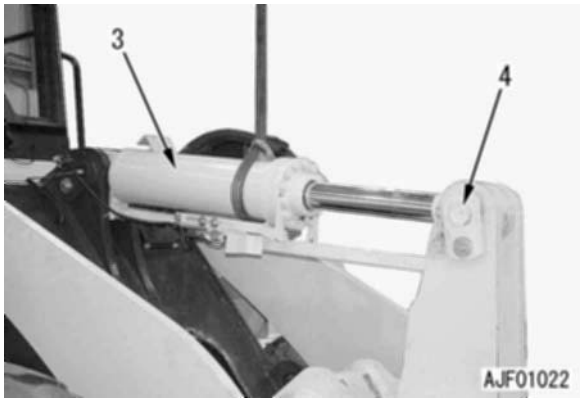
   ★ Check the thickness and quantity of the shims.



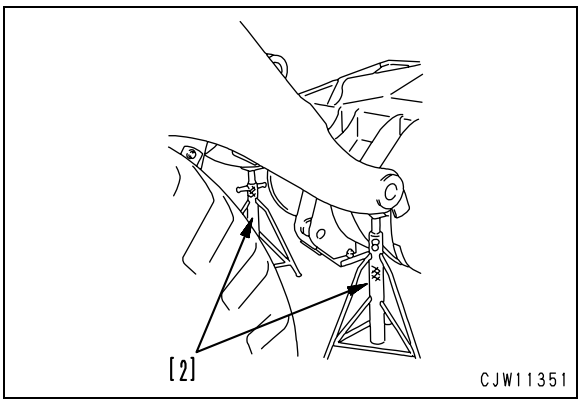
3. Move the machine to the rear and disconnect the bucket.
4. Sling bucket cylinder assembly (3) temporarily and pull out rod-side pin (4) to disconnect the cylinder rod and tilt lever. [*3]

   ★ Install block [1] between the cylinder bottom and frame.
   ★ Check the thickness and quantity of the shims.

   Bucket cylinder assembly: **130 kg**

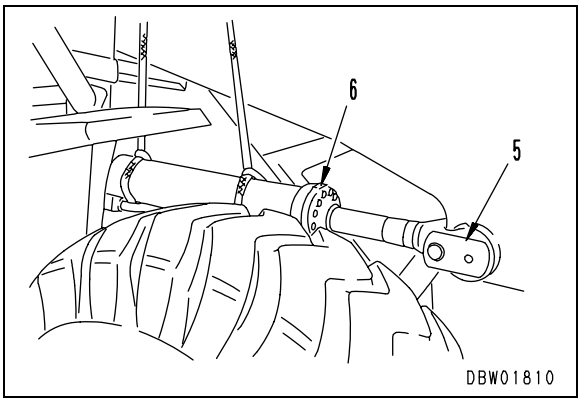


5. Set supports [2] under the end of the lift arm and release the residual pressure in the hydraulic piping.

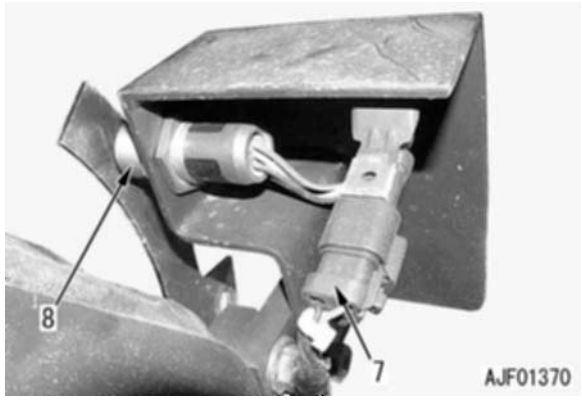


6. Sling lift cylinder assembly (6) temporarily and remove mounting pin (5). [*4]
   - ★ Check the thickness and quantity of the shims.
   - ★ When lowering the lift cylinder assembly, put a block on the axle.

   Lift cylinder assembly (1 pieces): **110 kg**

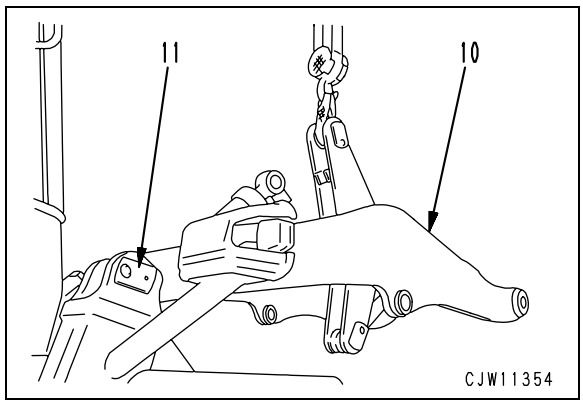


7. Disconnect boom positioner proximity switch connector F04 (7).
8. Remove boom kick-out switch (8). [*5]



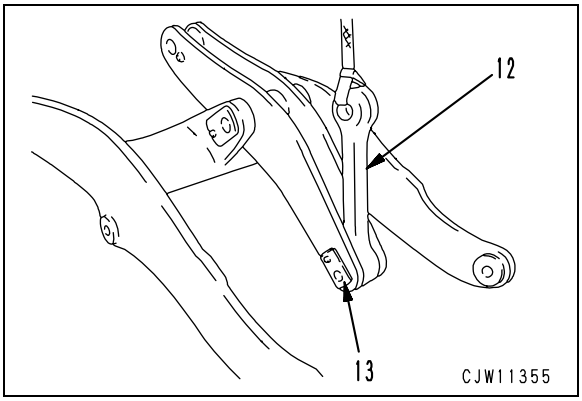
9. Sling lift arm and tilt lever and bucket link assembly (10) temporarily and pull out mounting pin (11). [*6]
   - ★ Check the thickness and quantity of the shims.
10. Lift off lift arm and tilt lever and bucket link assembly (10).

    Lift arm and tilt lever and bucket link assembly: **1250 kg**



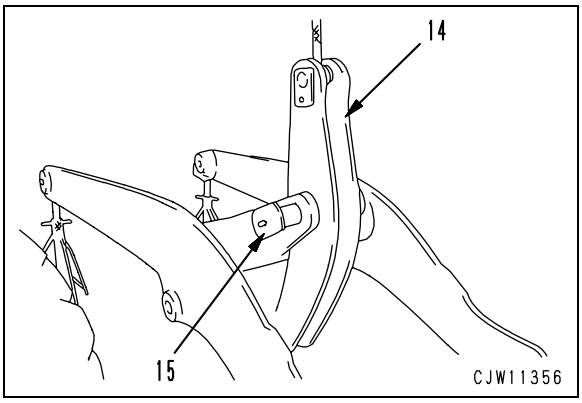
11. Sling bucket link assembly (12) temporarily, pull out mounting pin (13), and remove the bucket link assembly from the tilt lever assembly. [*7]

Bucket link tilt lever assembly: **300 kg**

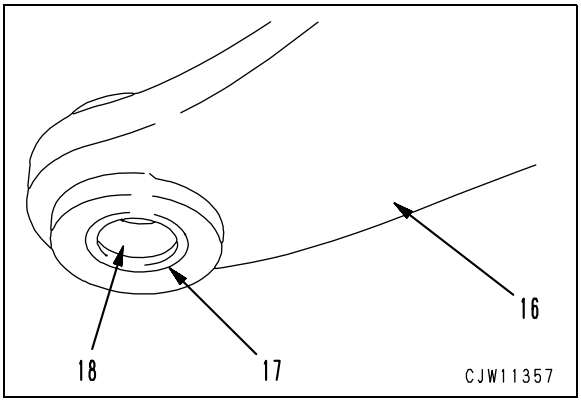


12. Sling tilt lever assembly (14) temporarily and pull out mounting pin (15). [*8]
13. Lift off tilt lever assembly (14).

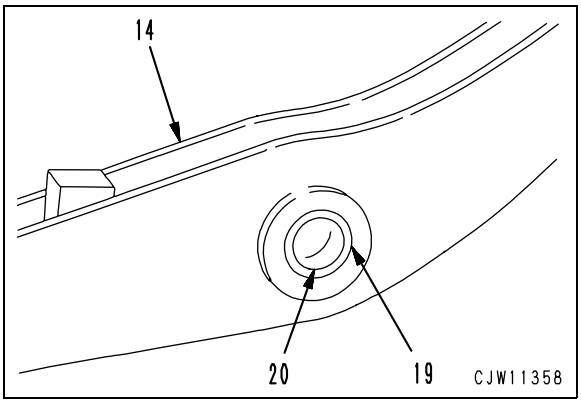
Tilt lever assembly: **260 kg**



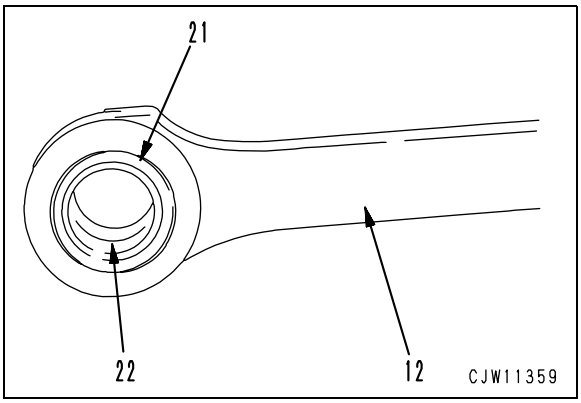
14. Pull dust seal (17) and bushing (18) out of lift arm (16). [*9]



15. Pull dust seal (19) and bushing (20) out of tilt lever (14). [*9]



16. Pull dust seal (21) and bushing (22) out of bucket link (12). [*9]



INSTALLATION

- Carry out installation in the reverse order to removal.

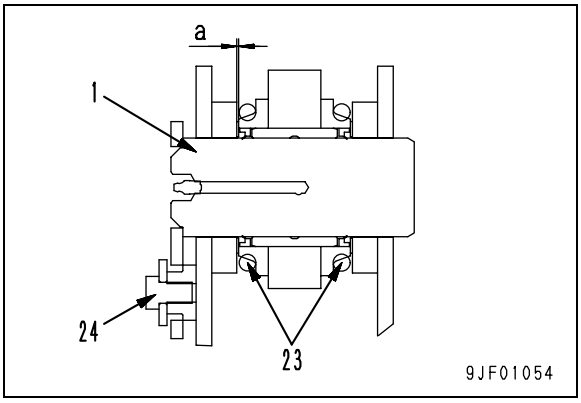
When aligning the pin holes, use a bar. Never insert your fingers in the pin holes.

★ Apply specified lubricant to the seal so that the seal will not be damaged when the pin is inserted.
★ Supply grease to each pin until it comes out through the joint.

[*1]
Procedure for installing bucket link pin

1. Sling the bucket link and install cord ring (23), aligning the holes for mounting pin (1).
2. Insert shims on both sides so that clearances (a) on both sides will be the same.
   - Clearance (a) (On each side): **Max. 1.5 mm**
   - Varieties of shim thickness: **1.5, 3.0 mm**
3. Install mounting pin (1) and lock it with bolt (24).

Never insert your fingers in the pin holes.



★ Take care that the cord ring will not be caught.
★ Take care not to damage the pin and seal.
★ Before installing the pin, apply lubricant to the inside of the bushing and the seal.

Inside of bushing and seal: **Lubricant containing molybdenum disulfide (LM-P or equivalent) or Hyper White (G2-T)**

★ After installing the pin, supply lubricant.

Lubricant: **Lubricant containing molybdenum disulfide (LM-G or equivalent) or Hyper White (G1-T)**

[*2]
Procedure for installing bucket hinge pin

1. Operate the control lever to align the holes for bucket mounting pin (2) and install cord ring (25).
2. Insert a shim in clearance (b).
   - Clearance (b) (On each side): **Max. 1.5 mm**
   - Varieties of shim thickness: **1.5, 3.0 mm**
3. Install mounting pin (2) and lock it with bolt (26).

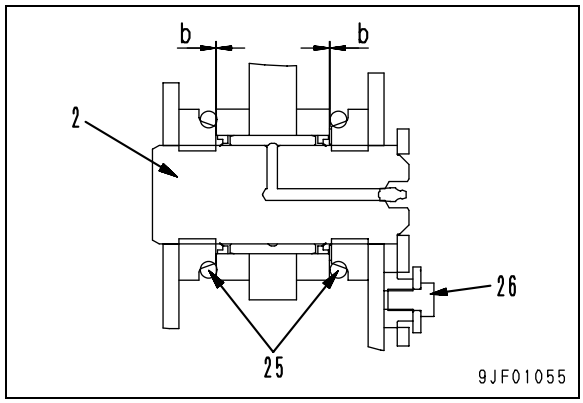
Never insert your fingers in the pin holes.

★ Take care that the cord ring will not be caught.
★ Take care not to damage the pin and seal.
★ Before installing the pin, apply lubricant to the inside of the bushing and the seal.

Inside of bushing and seal: **Lubricant containing molybdenum disulfide (LM-P or equivalent) or Hyper White (G2-T)**

★ After installing the pin, supply lubricant.

Lubricant: **Lubricant containing molybdenum disulfide (LM-G or equivalent) or Hyper White (G1-T)**



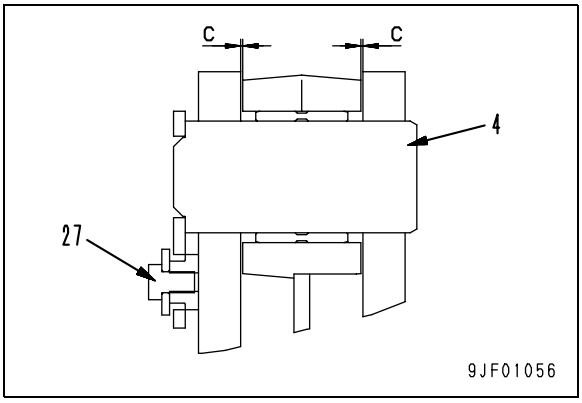
[*3]
Procedure for installing bucket cylinder pin (on rod side)

1. Insert a shim in clearance (c).
   - Clearance (c) (On each side): **Max. 1.5 mm**
   - Varieties of shim thickness: **1.5, 3.0 mm**
2. Install mounting pin (4) and lock it with bolt (27).

   Never insert your fingers in the pin holes.

   ★ Take care not to damage the pin and seal.
   ★ Before installing the pin, apply lubricant to the inside of the bushing and the seal.

   Inside of bushing and seal: **Lubricant containing molybdenum disulfide (LM-P or equivalent) or Hyper White (G2-T)**



3. Adjust the bucket positioner. For details, see TESTING AND ADJUSTING, Testing adjusting bucket positioner.

[*4]
Procedure for installing boom cylinder pin (on rod side)

When starting the engine, check that the forward-reverse lever is in neutral and the parking brake is applied.

1. Insert a shim in clearance (d).
   - Clearance (d) (On each side): **Max. 1.5 mm**
   - Varieties of shim thickness: **Only 1.5 mm**
2. Install mounting pin (5) and lock it with bolt (28).

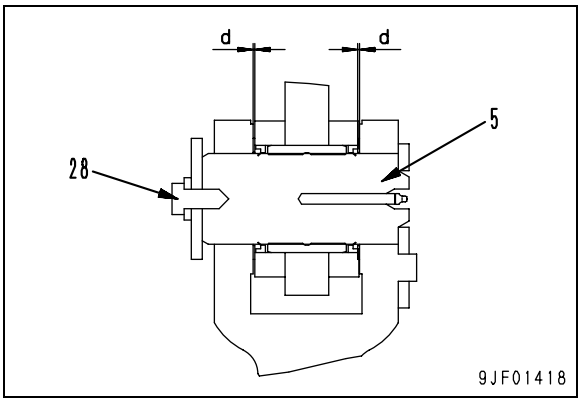
   Never insert your fingers in the pin holes.

   ★ Take care not to damage the pin and seal.
   ★ Before installing the pin, apply lubricant to the inside of the bushing and the seal.

   Inside of bushing and seal: **Lubricant containing molybdenum disulfide (LM-P or equivalent) or Hyper White (G2-T)**

   ★ After installing the pin, supply lubricant.

   Lubricant: **Lubricant containing molybdenum disulfide (LM-G or equivalent) or Hyper White (G1-T)**



[*5]
★ Adjust the boom kick-out. For details, see TESTING AND ADJUSTING, Testing and adjusting boom kick-out.

[*6]
Procedure for installing boom pin (on frame side)

1. Insert a shim in clearance (e).
   - Clearance (e) (On each side): **Max. 1.5 mm**
   - Varieties of shim thickness: **1.5, 3.0 mm**
2. Install mounting pin (11) and lock it with bolt (29).

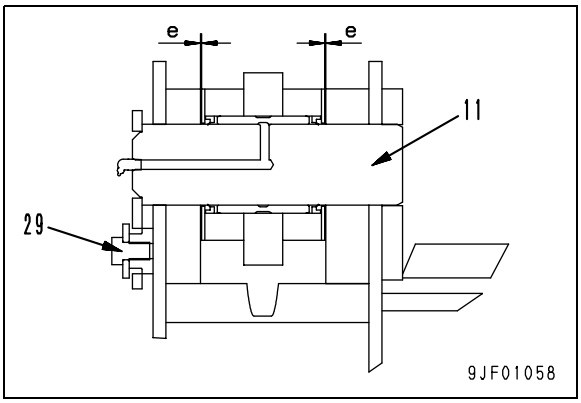
Never insert your fingers in the pin holes.

★ Take care not to damage the pin and seal.
★ Before installing the pin, apply lubricant to the inside of the bushing.

Inside of bushing and seal: **Lubricant containing molybdenum disulfide (LM-P or equivalent) or Hyper White (G2-T)**

★ After installing the pin, supply lubricant.

Lubricant: **Lubricant containing molybdenum disulfide (LM-P or equivalent) or Hyper White (G2-T)**



[*7]
Procedure for installing bucket link pin

★ It is not necessary to insert a shim in clearance (f).
★ Secure the bucket link to the bell crank with wires, etc.

1. Install cord ring (30), aligning the holes for bucket link mounting pin (13).
2. Install mounting pin (13) and lock it with bolt (31).

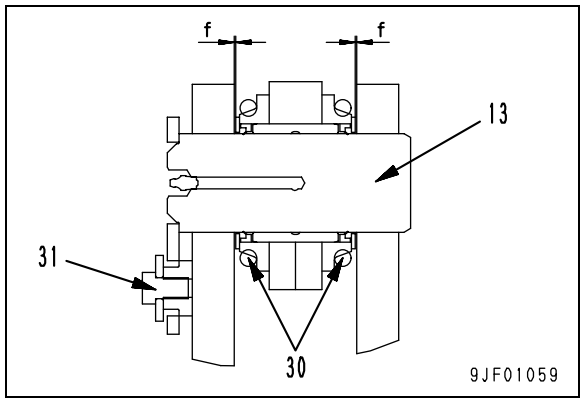
Never insert your fingers in the pin holes.

★ Take care that the cord ring will not be caught.
★ Take care not to damage the pin and seal.
★ Before installing the pin, apply lubricant to the inside of the bushing and the seal.

Inside of bushing and seal: **Lubricant containing molybdenum disulfide (LM-P or equivalent) or Hyper White (G2-T)**

★ After installing the pin, supply lubricant.

Lubricant: **Lubricant containing molybdenum disulfide (LM-P or equivalent) or Hyper White (G2-T)**



[*8]
Procedure for installing bell crank center pin

★ It is not necessary to insert a shim.

1. Install the mounting pin and lock with the bolt.

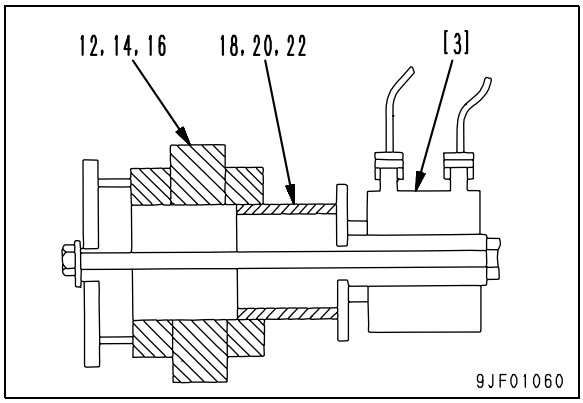
Never insert your fingers in the pin holes.

★ Take care not to damage the pin and seal.
★ Before installing the pin, apply lubricant to the inside of the bushing and the seal.

Inside of bushing and seal: **Lubricant containing molybdenum disulfide (LM-P or equivalent) or Hyper White (G2-T)**

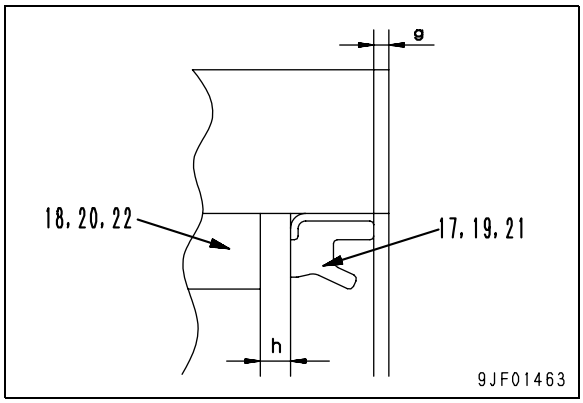
[*9]

★ Press fit bushings (18), (20), and (22) to boom (16), bell crank (14), and bucket link (12) respectively with hydraulic cylinder [3], etc., and then install dust seals (17), (19), and (21).



★ Press fit the dust seals with the lips out.

- Installed dimension (g): **0.25 - 0.8 mm**
- Installed dimension (h): **2 - 3 mm**



DISASSEMBLY AND ASSEMBLY OF HST PUMP ASSEMBLY

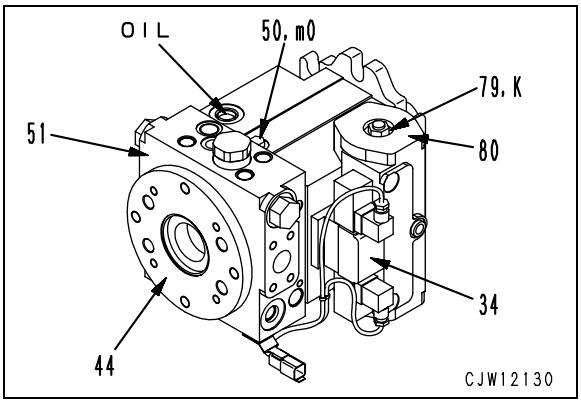
SPECIAL TOOLS LIST

Sym-bol	Part No.	Part name	Neces sity	Q'ty	New/ Remodel	Sketch
K1	790-201-2720	Push tool	●	1		
K2	790-201-2730	Push tool	■	1		
	790-201-2830	Push tool	■	1		
K3	790-201-2740	Push tool	●	1		

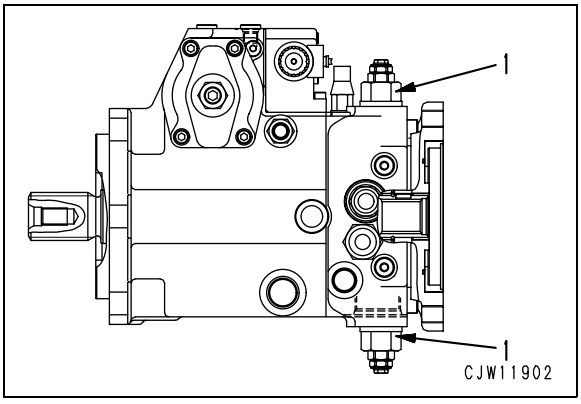
DISASSEMBLY

★ If the pump body is disassembled, the assembly special tool will be required. See ASSEMBLY 3. 5).

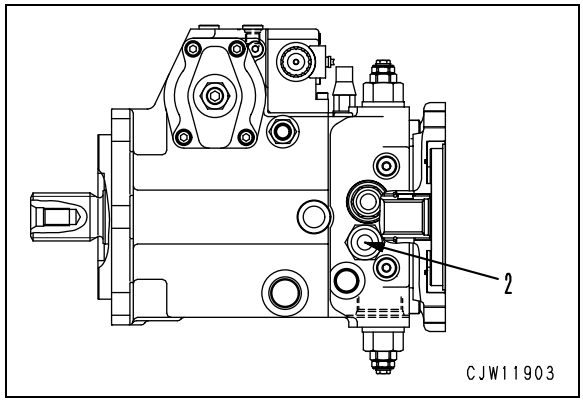
★ General view



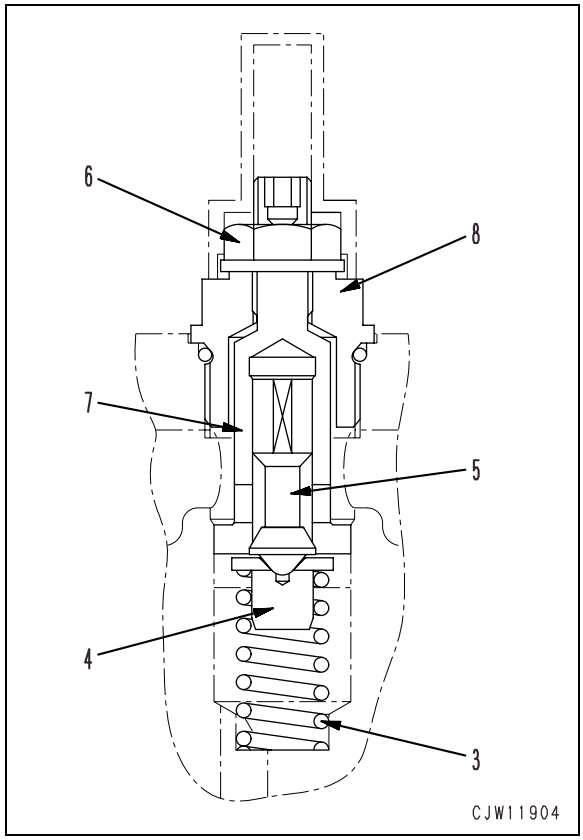
1. High pressure relief valve assembly
   1) Remove 2 high pressure relief valve assemblies (1).
      ★ Do not change adjustment screw.
      ★ Control: O-ring, housing.
      ★ Do not disassemble the high pressure relief valve assemblies, except the O-rings and backup rings.



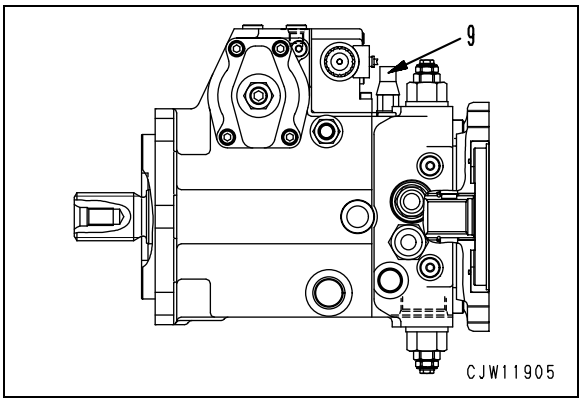
2. Low pressure valve assembly.
   1) Remove low pressure valve assembly (2).
      ★ Do not change adjustment screw.



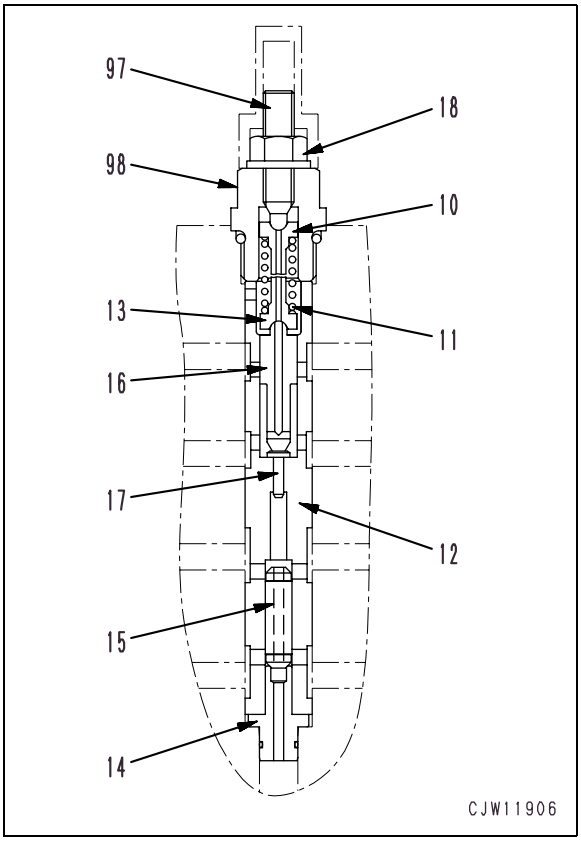
   2) Disassemble the low pressure relief valve according to the following procedure, if necessary.
      ★ Before loosening the adjustment screw, check the adjustment dimension.
      i) Remove spring (3) and spring seat (4).
      ii) Remove piston (5).
      iii) Remove locknut (6).
      iv) Remove adjustment screw (7) from holder (8).



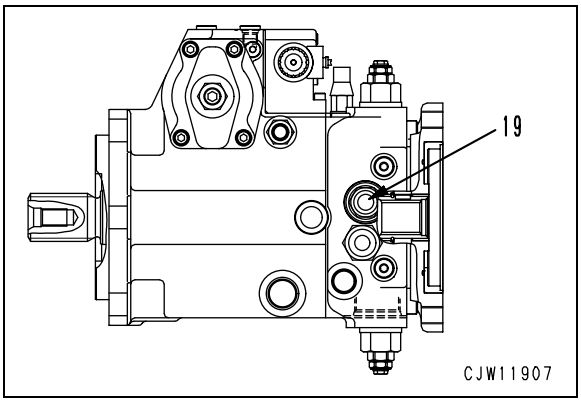
3. High pressure cut-off valve assembly
   1) Remove high pressure cut-off valve assembly (9)
      ★ Unscrew setting cartridge completely.
      ★ Control: O-ring, housing.



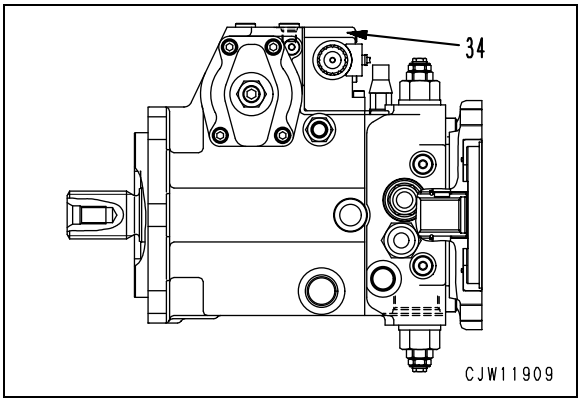
   2) Disassemble the high pressure cut-off valve according to the following procedure, if necessary.
      ★ Before loosening the adjustment screw, check the adjustment dimension.
      i) Remove spring seat (10) and spring (11) from the pump case.
      ii) Remove barrel assembly (12) from the pump case.
      iii) Remove spring seat (13), and shuttle spool (15) from barrel (12).
      iv) Remove spool (16) and piston (17) from barrel (12).
      v) Screw a bolt of M3 x 140 or longer one and pull valve seat (14) out of the pump case.
      vi) Remove locknut (18), and then remove adjustment screw (97) from holder (98).



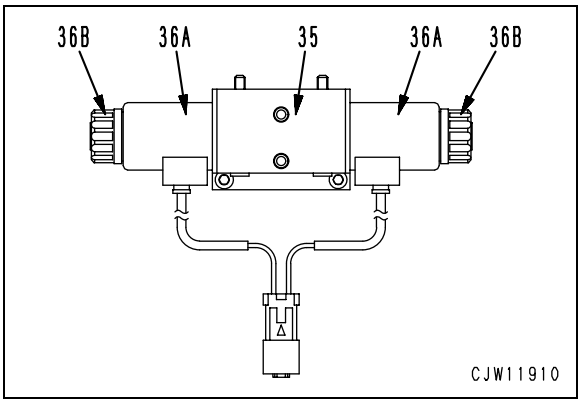
4. Remove speed-related valve (DA) valve assembly
   1) Remove speed-related valve assembly (19).



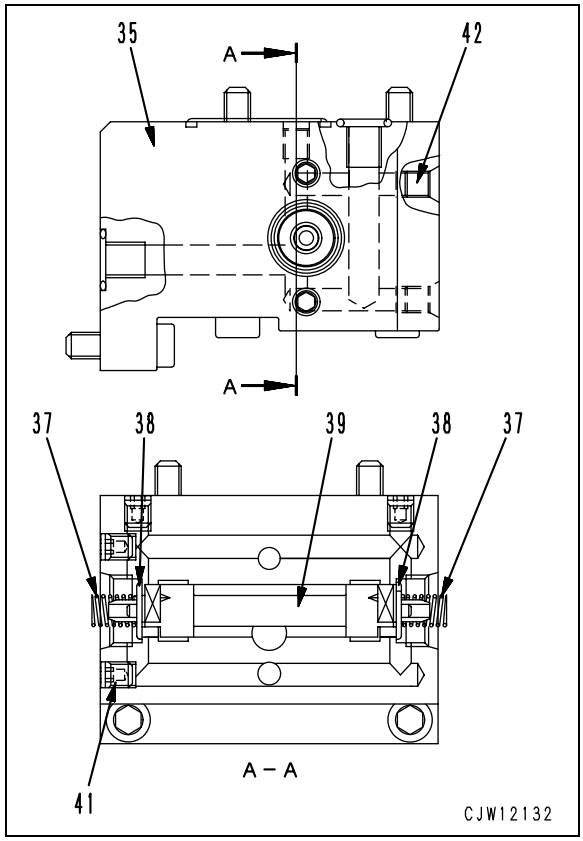
5. Forward-reverse solenoid valve (34)
   1) Remove forward-reverse solenoid valve assembly (34).



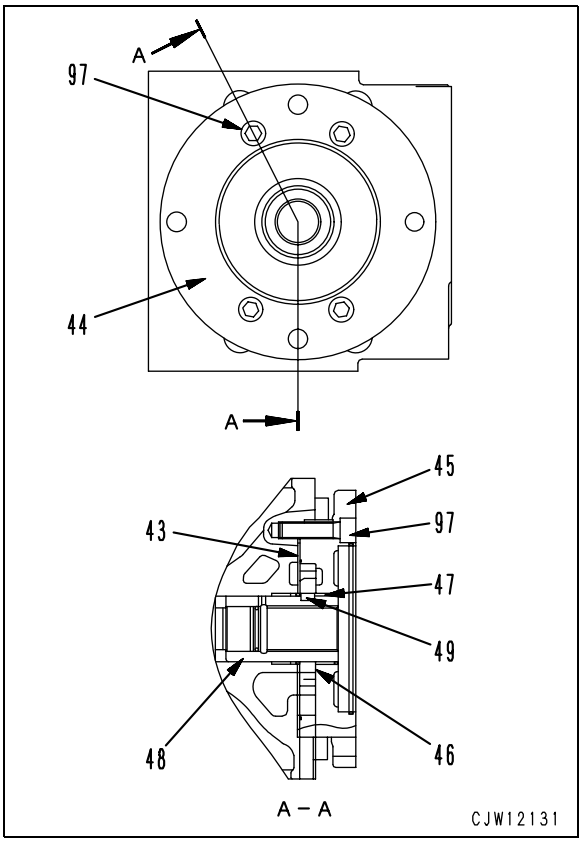
   2) Remove 2 solenoid valves (36) from forward-reverse solenoid valve assembly (34).
      ★ Remove cap (36B) by turning it and remove coil (36A) by pulling it from the solenoid valve, and then remove the tube from the valve housing assembly (35).



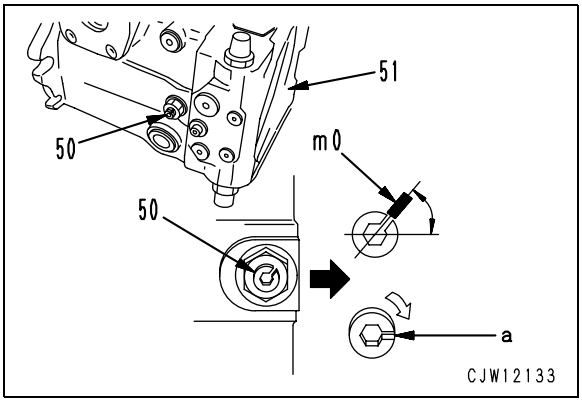
   3) Disassemble the valve housing assembly (35) according to the following procedure.
      i) Remove 2 springs (37) and 2 collars (38).
      ii) Remove piston (39).
      ★ Do not remove 4 plugs (41) and plug (42) from housing.



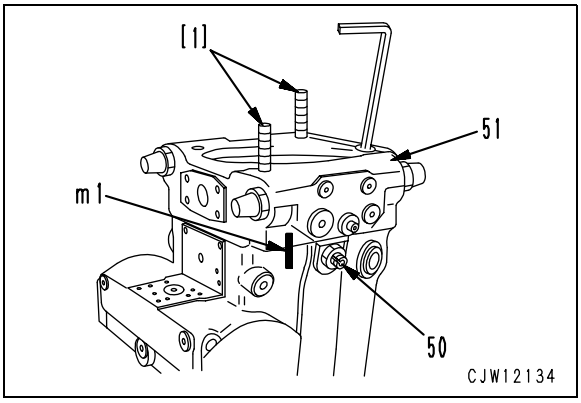
6. Charge pump assembly (44)
   1) Remove the 4 mounting bolts (97) and charge pump assembly (44).
   2) Remove wear plate (43).
   3) Remove gear (46).
   4) Remove coupling (48) and key (49).
   ★ Do not remove bearing metal (47) from flange (45).



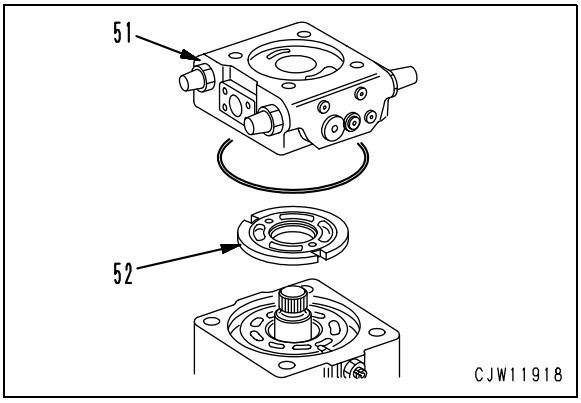
7. Port plate Ass'y (51)
   1) Mark the position (angle) of the indexing screw (50), m0.
   ★ Record setting measure.(angle)
   2) Set the indexing screw to disassembly position (a).(0 degree.)



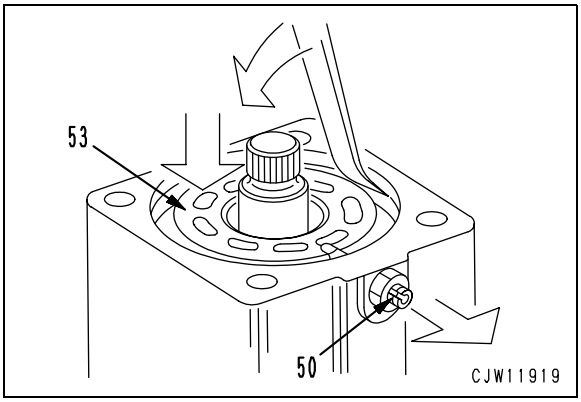
   3) Mark position of the port plate, m1.
   4) Loosen port plate fixation.



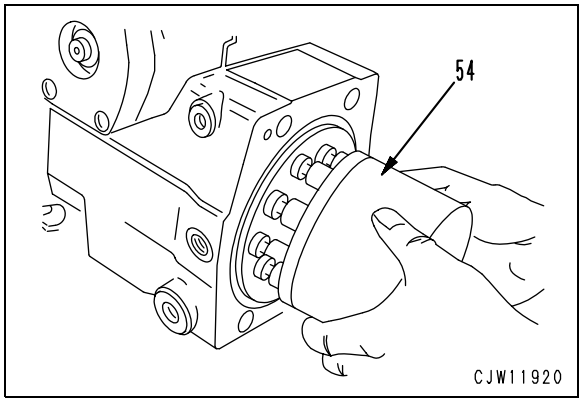
   5) Lift off port plate Assembly (51) and control plate (52).



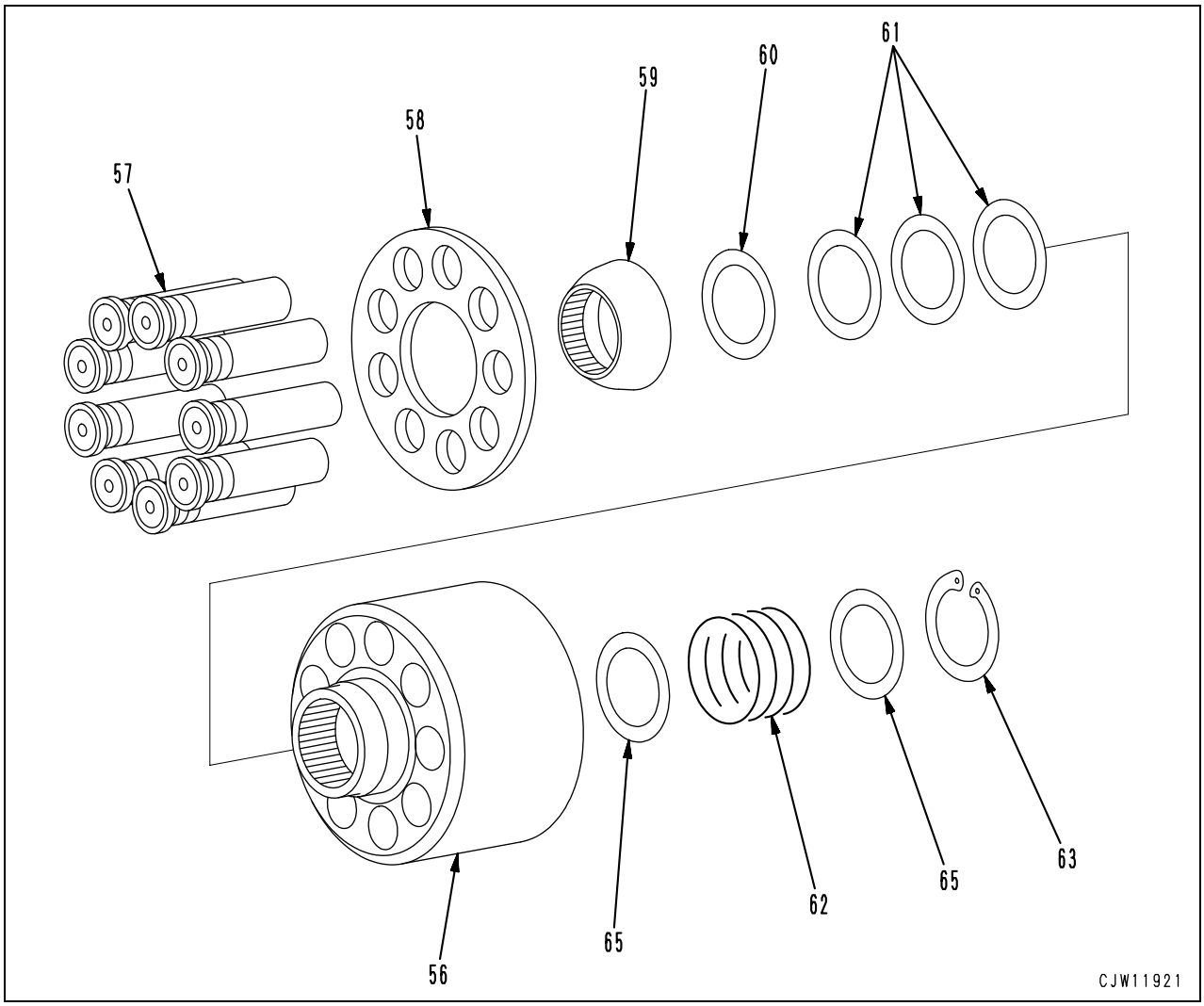
8. Cylinder block, Piston assembly (54)
   1) Press the cylinder (53) to the bottom.
   2) Remove fixing indexing screw (50).



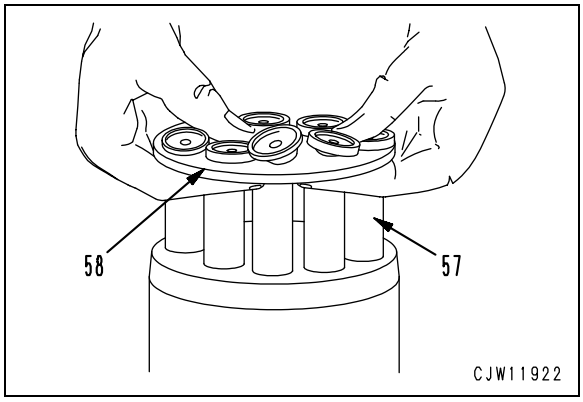
3) Remove cylinder block and piston assembly (54).



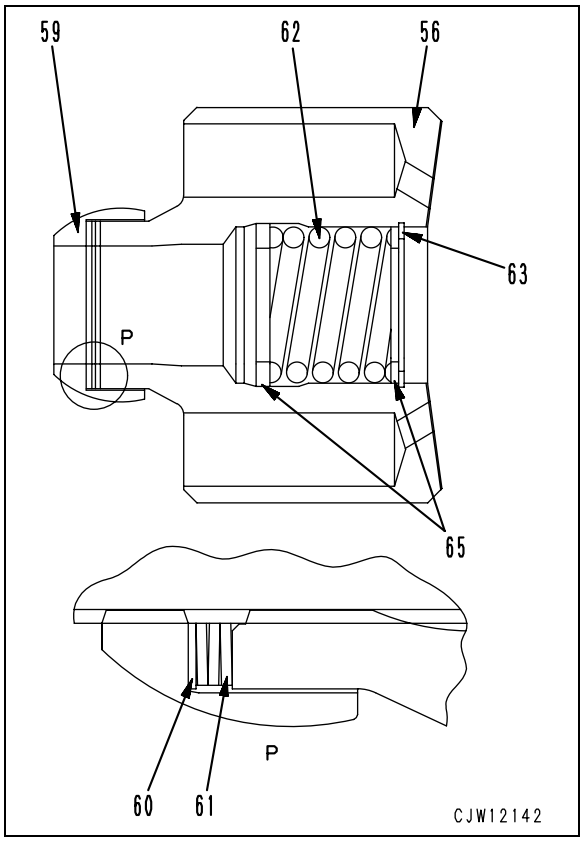
4) Disassemble the cylinder block and piston assembly (54) according to the following procedure.



i) Remove the assembly of pistons (57) and retainer (58) from cylinder block (56).
ii) Remove 9 pistons (57) from retainer (58).



iii) Remove retainer guide (59) from cylinder block (56).
iv) Remove shim (60) and spring (61).



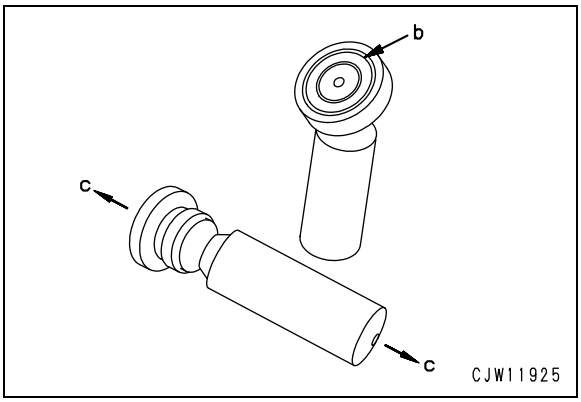
★ When any of cylinder block (56), control plate (52), retainer guide (59), retainer (58), and shim (60) needs to be replaced, replace the whole cylinder block since a dimension of shim (60) must be adjusted.

v) Remove snap ring (63) from the cylinder block.

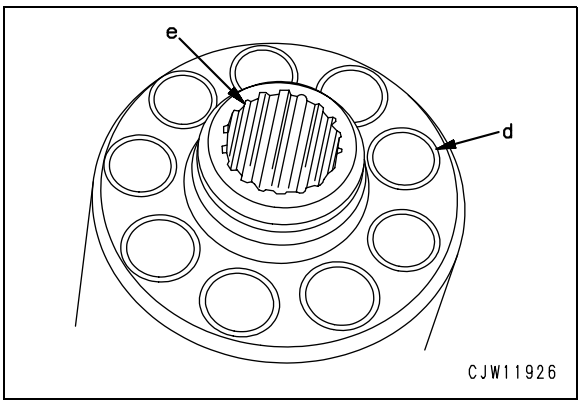
⚠ Snap ring (63) will jump out. Take care.

vi) Remove spring (62) and 2 shims (65).

★ Check of pistons
- Check that there are no scratches or metal deposits on sliding surface (b), and there is no axial play (c), (otherwise: pistons must be replaced in sets).

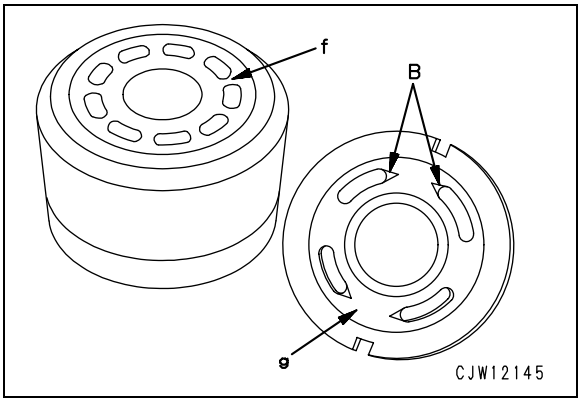


★ Check of cylinder block and control plate.
- Cylinder bores (d), splines (e).

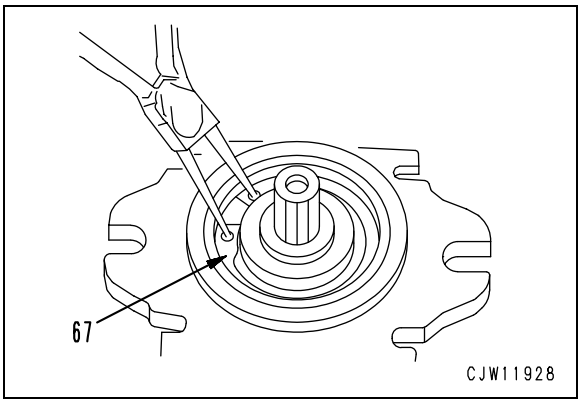


- Cylinder surface (f) free of scoring.
- Control plate (g) without scoring.

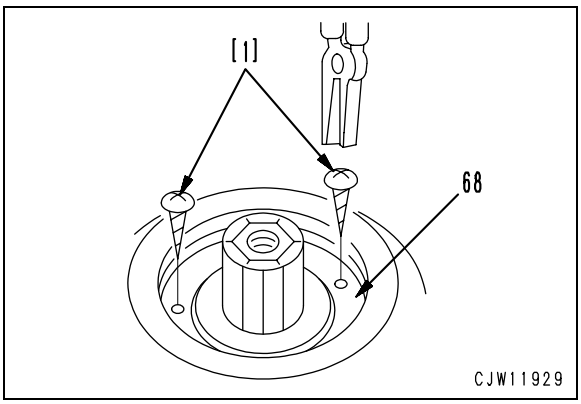
★ Fit faces f and g (having notch B on the ellipse) together.



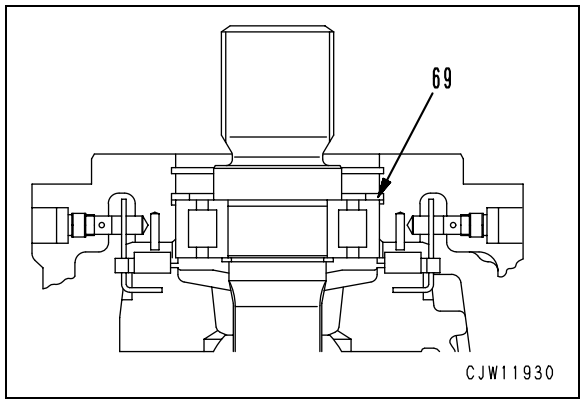
9. Seal
   1) Protecting the drive shaft (66).
   2) Remove snap ring (67).



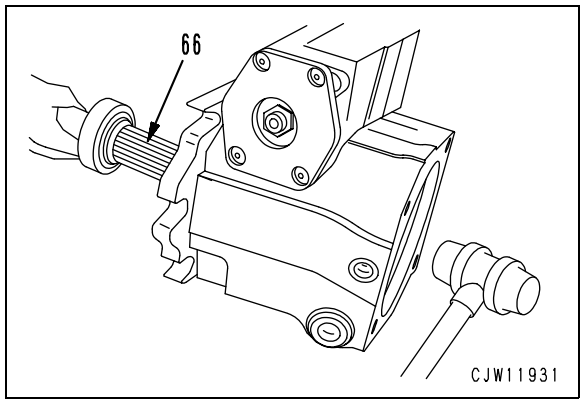
   3) Screw [1] in sheet metal screw into the holes fitted with rubber.
   4) Pull out shaft seal (68) with pliers.



   5) Remove snap ring (69).

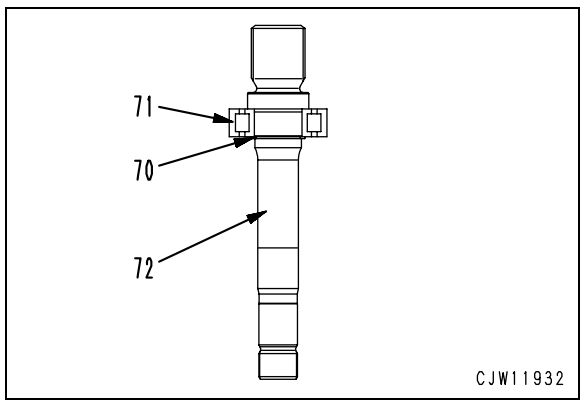


10. Drive shaft assembly
    1) Remove drive shaft assembly (66) with plastic hammer strokes.

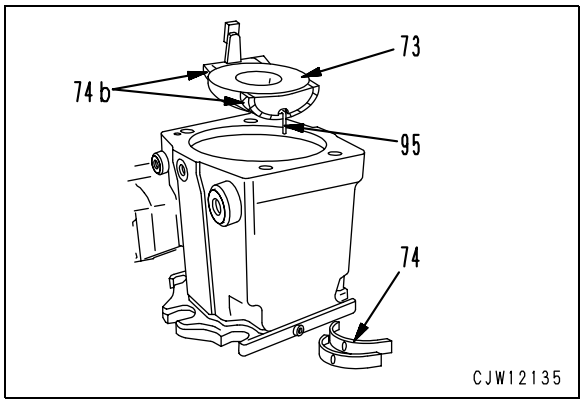


    2) Disassemble the drive shaft assembly according to the following procedure.
       i) Remove snap ring (70).
       ii) Remove bearing (71) from drive shaft (72).

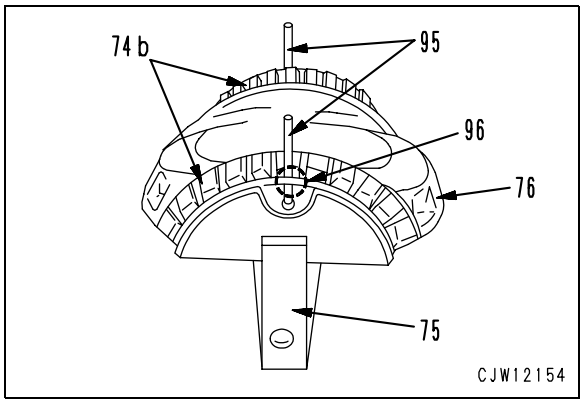
       ★ Check of drive shaft
       - Splines for damage or fretting.
       - Running surfaces.
       - Groove cut by shaft seal.



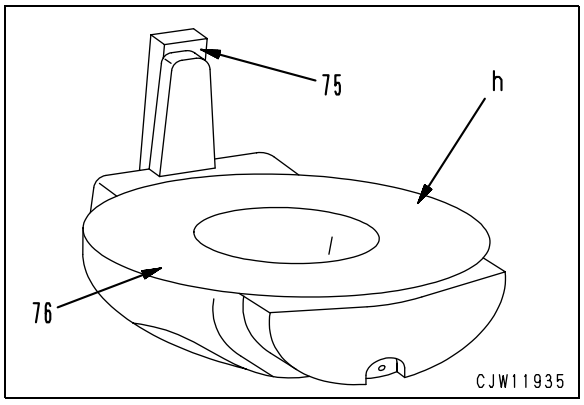
11. Swivel cradle (73), Bearing cups (74)
    1) Remove swivel cradle (73).
    2) Remove bearing cups (74).
       ★ Check
       • Bearing cups set.



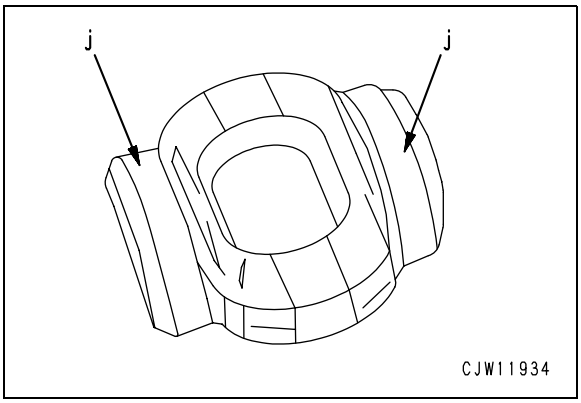
    3) Remove wire (95), articulate pin (96) and bearing (74b) from swivel cradle (73).



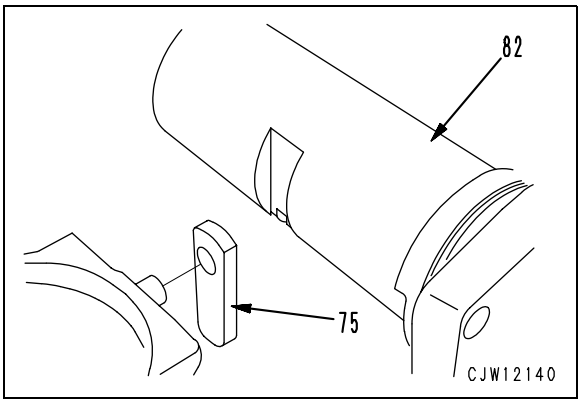
       ★ Check of cradle (76)
       • Sliding surface (h) free from scoring.



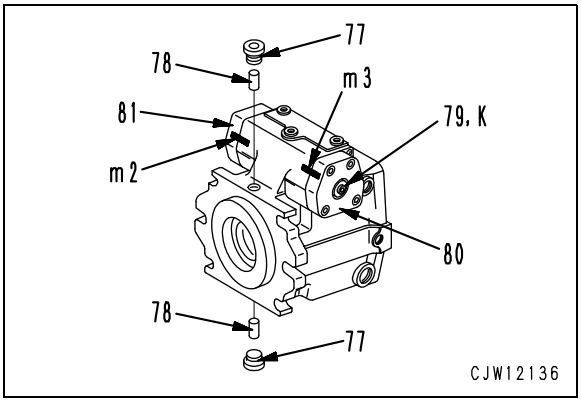
       • Bearing surfaces (j) of cradle (76).



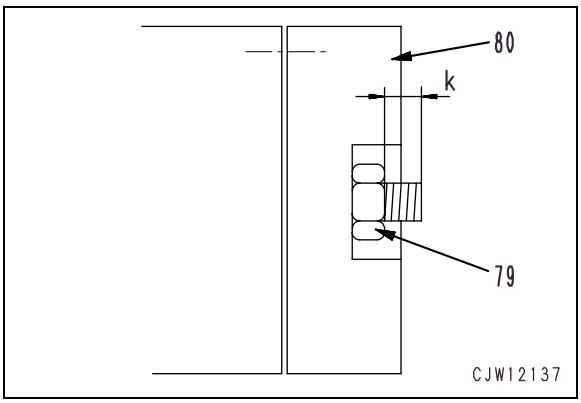
    4) Remove lever (75) from cradle (73).
       ★ Check of cradle lever (75)



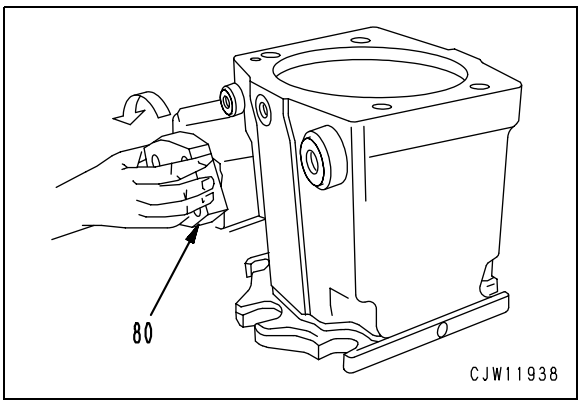
12. Servo cylinder assembly
    1) Remove plugs (77).
    2) Remove joint pins (78).



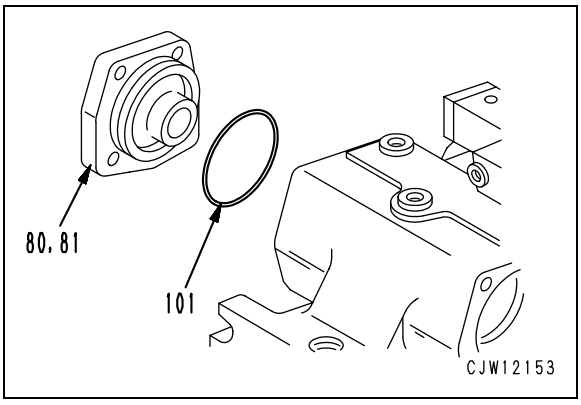
3) Mark position m2, m3 of the cover (80), (81), note measure of "zero position" (k).
4) Loosen nut (79).



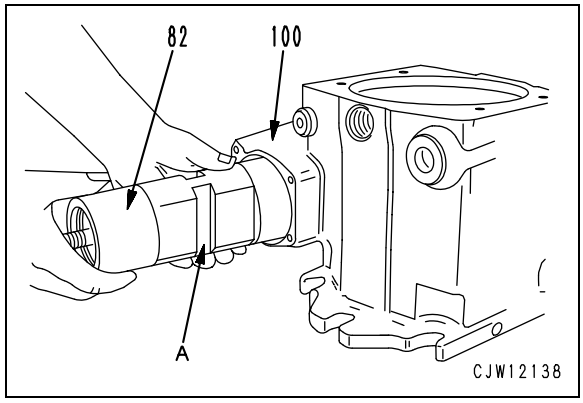
5) Remove cover (80) and (81).



6) Remove O-rings (101) from both sides.

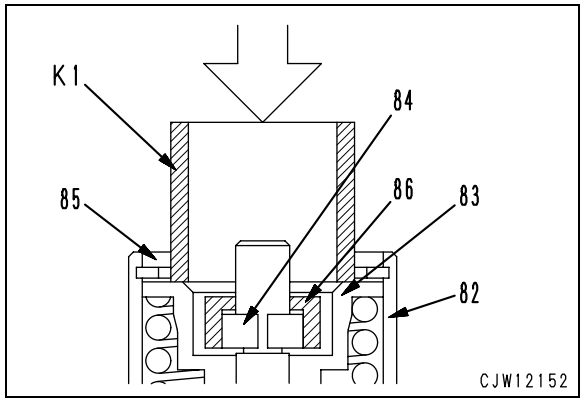


7) Remove servo piston assembly (82).

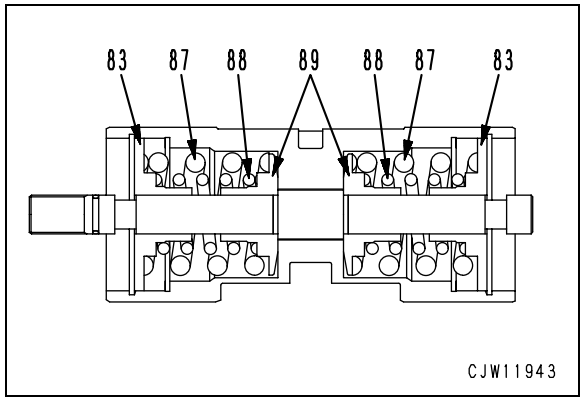


★ Check of groove A.

8) Disassemble the servo piston assembly (82) according to the following procedure.
   ★ Disassemble either side first, then disassemble the other side.
   i) Using tool K1, push collar (83).
   ii) Break and remove plastic cap (86). (Prepare new one for assembly.)
   iii) Remove ring (84).
   iv) Remove snap ring (85).

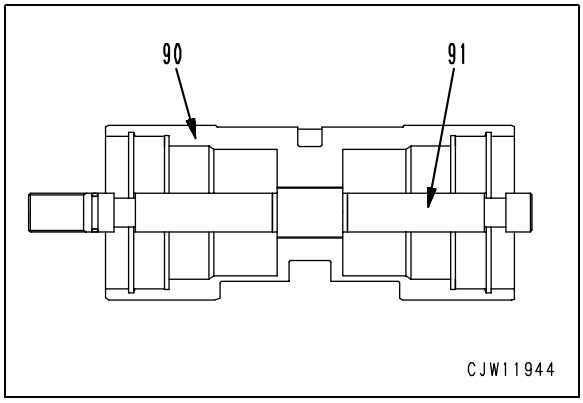


   v) Remove collar (83).
   vi) Remove large spring (87) and small spring (88).
   vii) Remove collar (89).



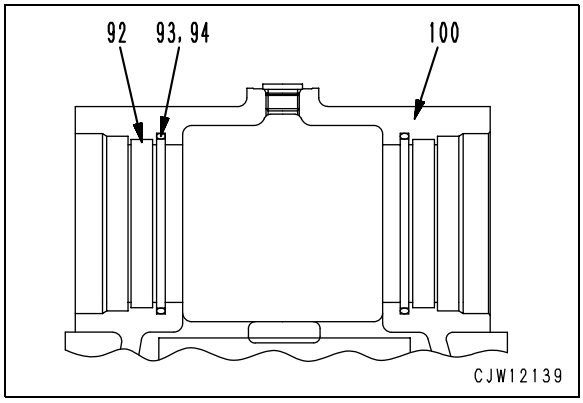
viii) Disassemble the opposite side similarly.

ix) Remove rod (91) from piston (90).



★ When any of rod (91), collar (83), snap ring (85), piston (90), and ring (84) needs to be replaced, replace all of the servo piston assembly (82) since a dimension of ring (84) must be adjusted.

13. Pump case
    1) Remove guide ring (92) from the servo cylinder mounting part (100) of pump case.
    2) Remove seal ring (93) and O-ring (94).



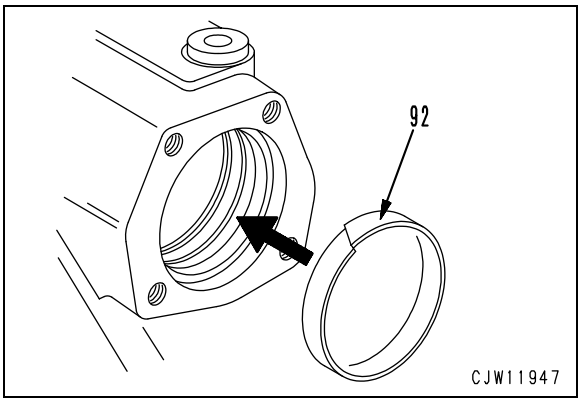
ASSEMBLY

★ Clean the all parts and remove burrs, etc.

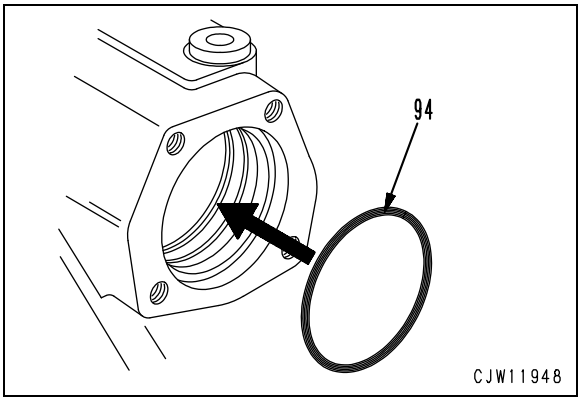
★ Coat the rotary parts and sliding parts with engine oil (EO10-CD) before installing.

★ If the tightening torque of a mounting bolt, nut, or plug is not shown in this manual, see the tightening torque table.

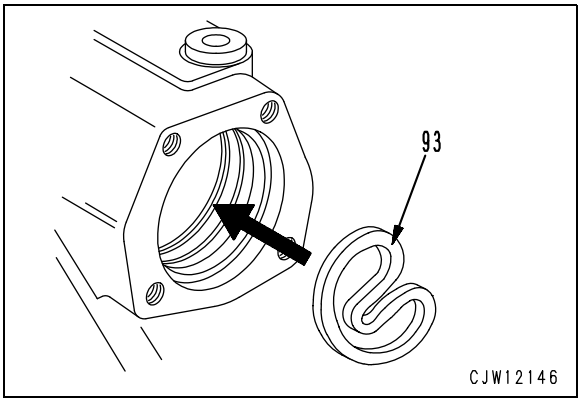
1. Pump case
    1) Install guide ring (92).



    2) Install O-ring (94).



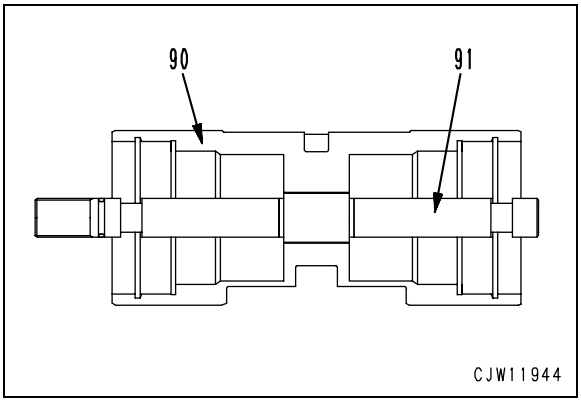
    3) Install seal ring (93) over O-ring (94).



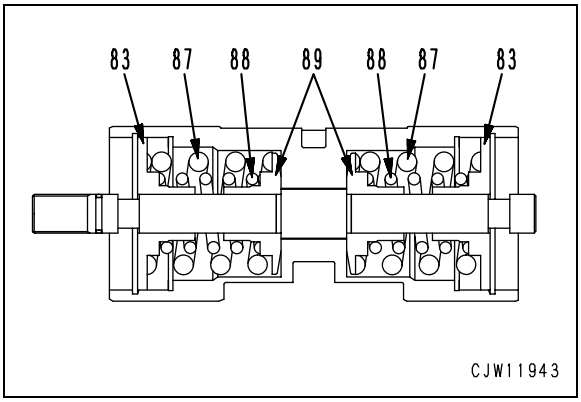
★ The deformation of the seal has to be done withcare so as not to damage the sealing edges.

★ Check the position of the seal ring (93) if necessary straighten using a finger.

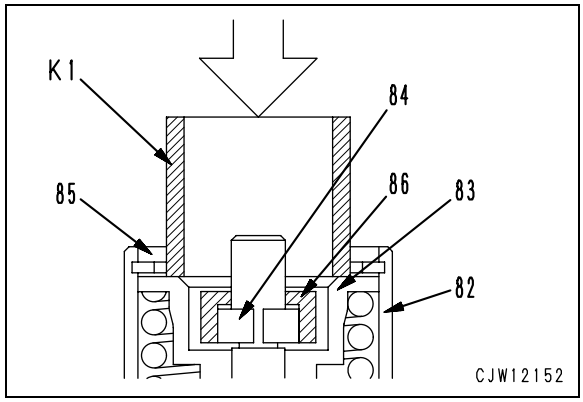
2. Servo piston assembly (82)
   ★ Assemble the servo piston assembly in an oil pan.
   1) Dip piston (90), rod (91), springs (87) and (88), collars (83) and (89) in engine oil (EO10-CD).
   2) Assemble the servo piston assembly according to the following procedure.
      i) Install rod (91) to piston (90).



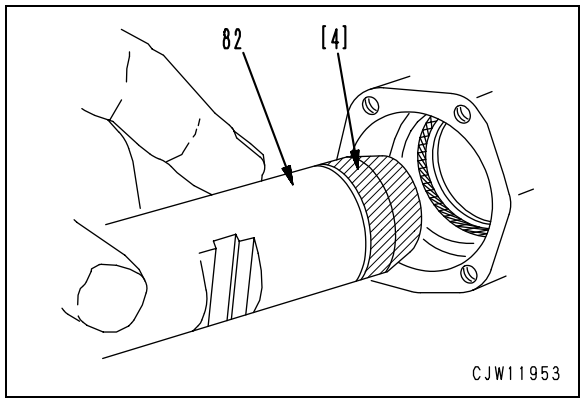
★ Assemble either side first, then assemble the other side.
   ii) Install collar (89).
   iii) Install small spring (88) and large spring (87).
   iv) Install collar (83).



v) Using tool K1, push collar (83).
vi) Install snap ring (85).
vii) Install ring (84).
viii) Install new plastic cap (86).
ix) Turn over upside down.
x) Assemble the opposite side similarly.

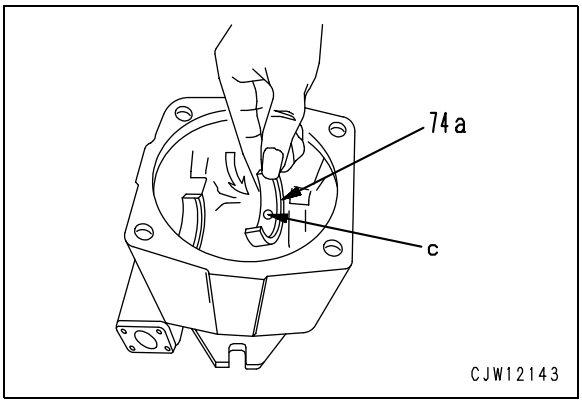


3) Insert guide thorn [4] into the servo piston Assembly (82).
4) Grease slightly guide thorn [4].
5) Install servo piston Assembly (82) with guide thorn [4].

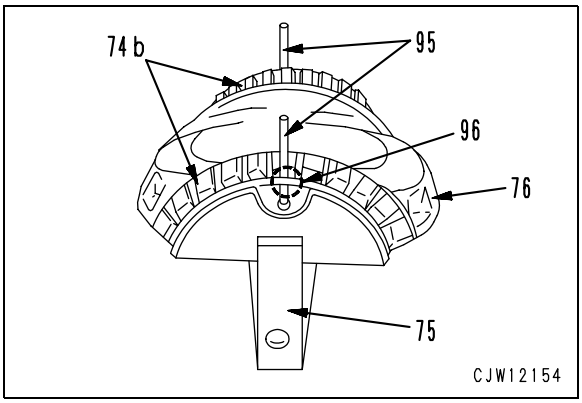


★ When any of rod (91), collar (83), snap ring (85), piston (90), and ring (84) needs to be replaced, replace all of the servo piston assembly (82) since a dimension of ring (84) must be adjusted.

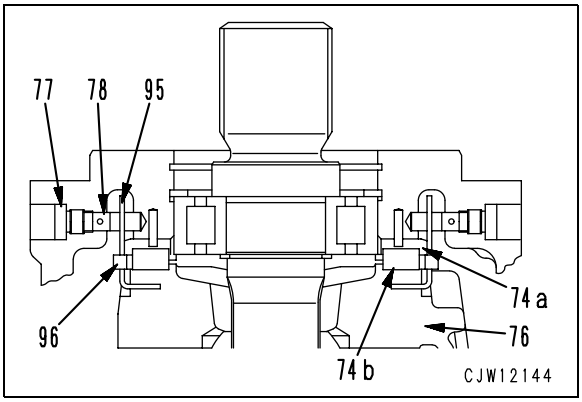
3. Cradle, Bearing cups
   1) Insert bearing cup set (74a).
   ★ Fit hole c of cup set (74a) to the pin in the case.



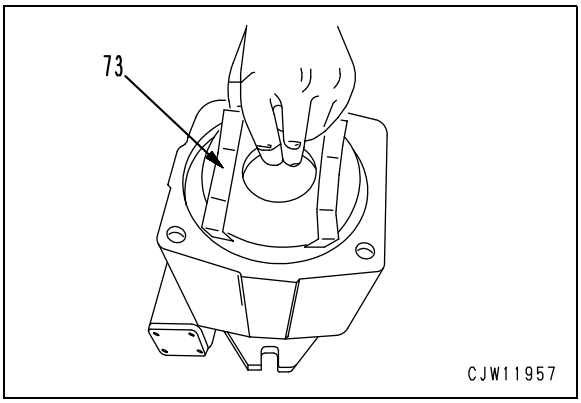
   2) Swivel cradle (73)
   Assemble bearing (74b), wire (95), lever (75) and articulating pin (96) to the cradle (76).



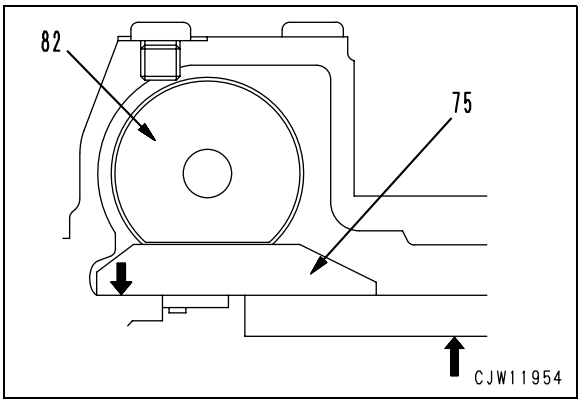
   ★ Completed cradle holding device



   3) Insert completely swivel cradle (73) into housing.
   ★ Assistance: Devices, e.g. clamp, rubber rings, grease and string.
   ★ Pay attention for correct seat of the swivel cradle (73) in the housing.



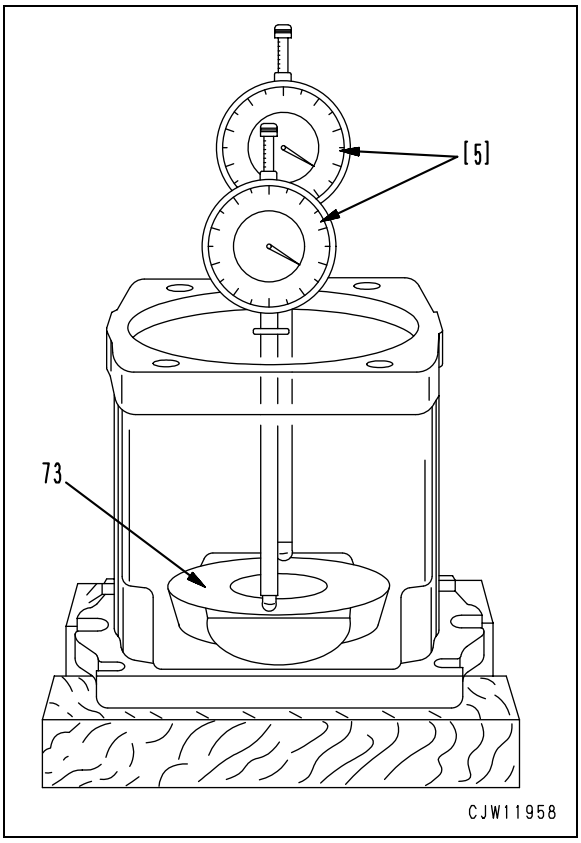
   ★ Sliding stone guidance in the piston (82).



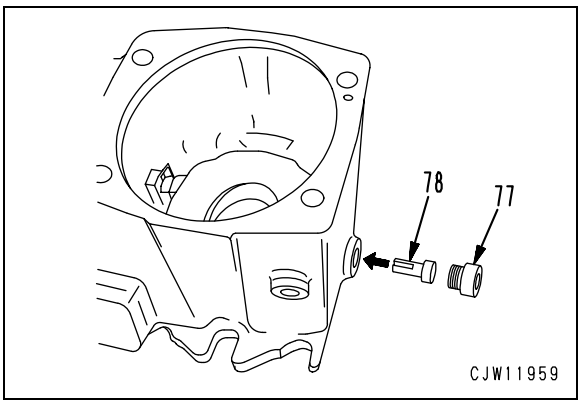
Remove auxiliary device.

★ Check: Location of the swivel-bearing in the bearing.

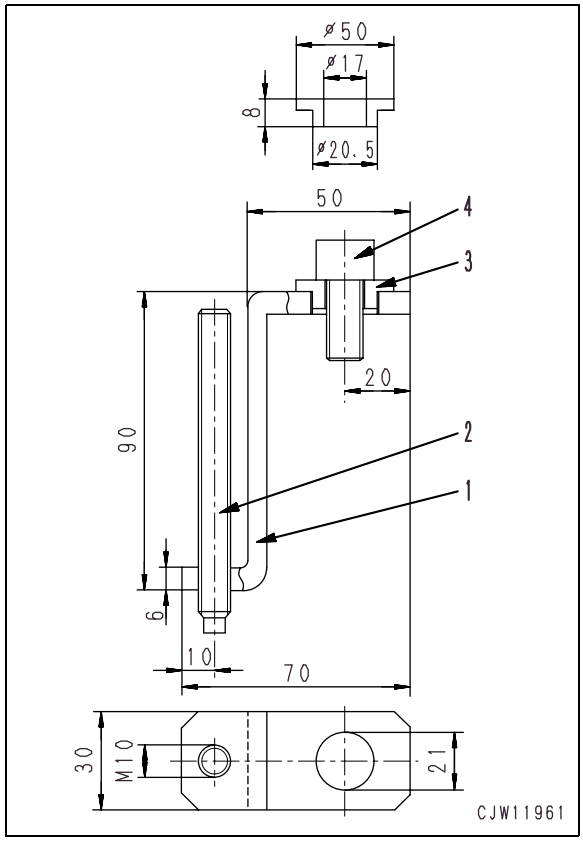
- Centralise the swivel (73) by using a measuring device (dial gauge or depth mesurement [5])
- Check points 1 and 2 - they should have the same dimension.



4) Fit joint pin (78) and plug (77).
★ Pinch wire (95) in pin (78).

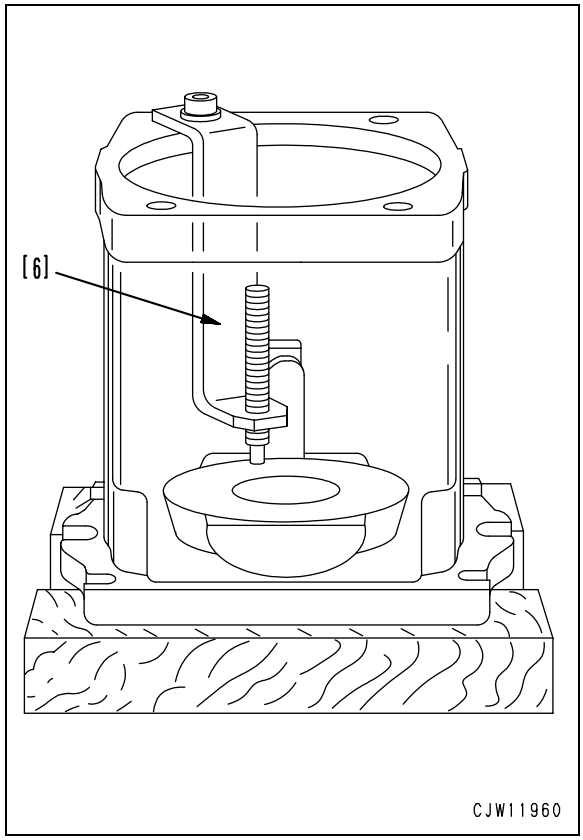


5) Make holding devices [6] (2 pieces).
★ Holding device [6] "swivel cradle"



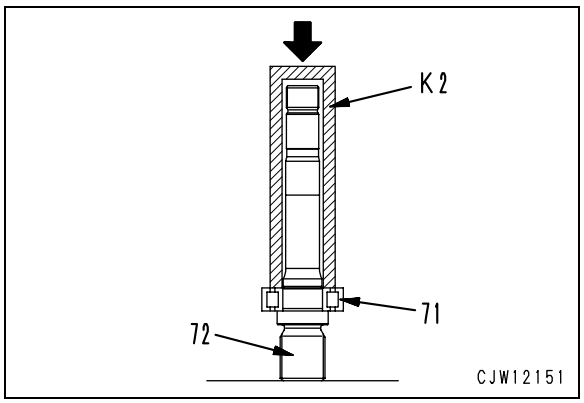
6) Hold swash plate in position utilising the seat screw.

Do not use force.

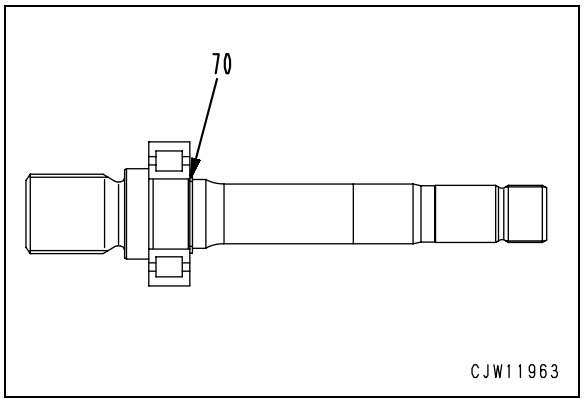


7) Install second holding device [6] diagonally and fix the swash plate.

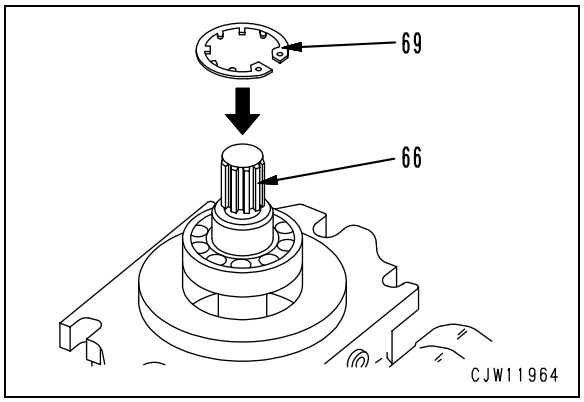
4. Drive shaft assembly
   ★ Install the bearing to the shaft in the correct direction.
   1) Install the ring to the shaft first, and then install the bearing to the shaft.
   2) Using tool K2, press fit bearing (71) to drive shaft (72).



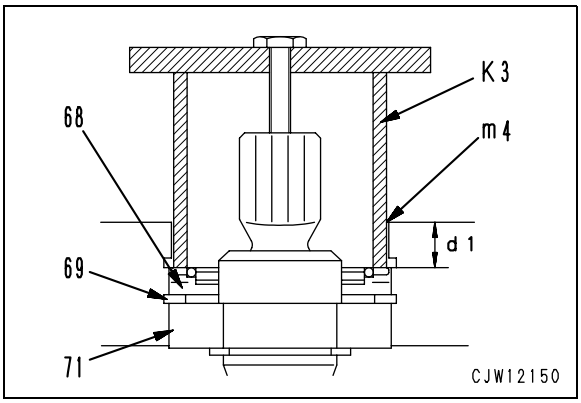
   3) Install snap ring (70).



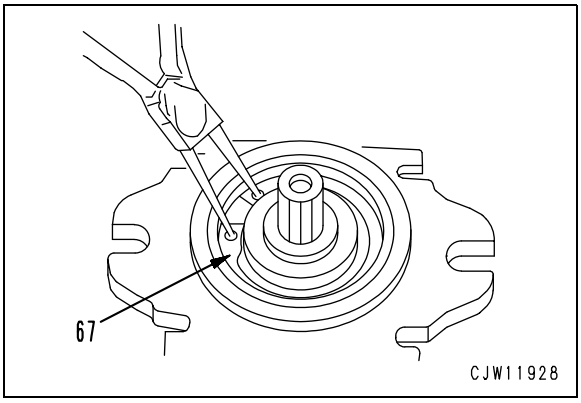
   4) Install drive shaft assembly (66).
   5) Install snap ring (69).



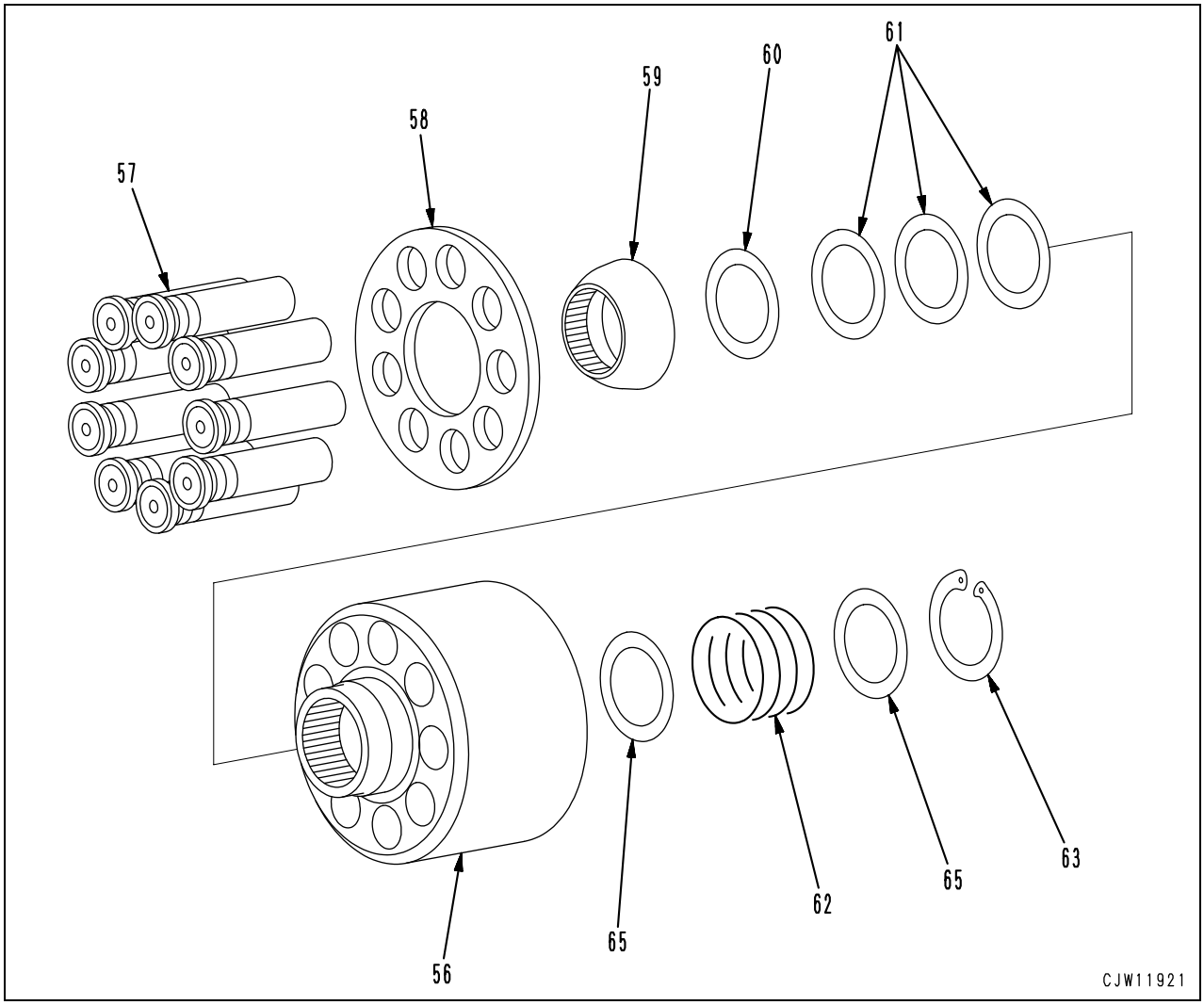
   ★ Before setting seal (68), perform the following procedures.
   6) Measure depth d1 to the groove bottom of snap ring (67).
   7) Make a mark of the insertion depth of push tool K3 (finishing position) (m4 = d1) on push tool K3.
   8) Using tool K3, press fit seal (68).
   ★ Threads of shaft: 5/8-11UNC-2B, Thread depth: 36 mm



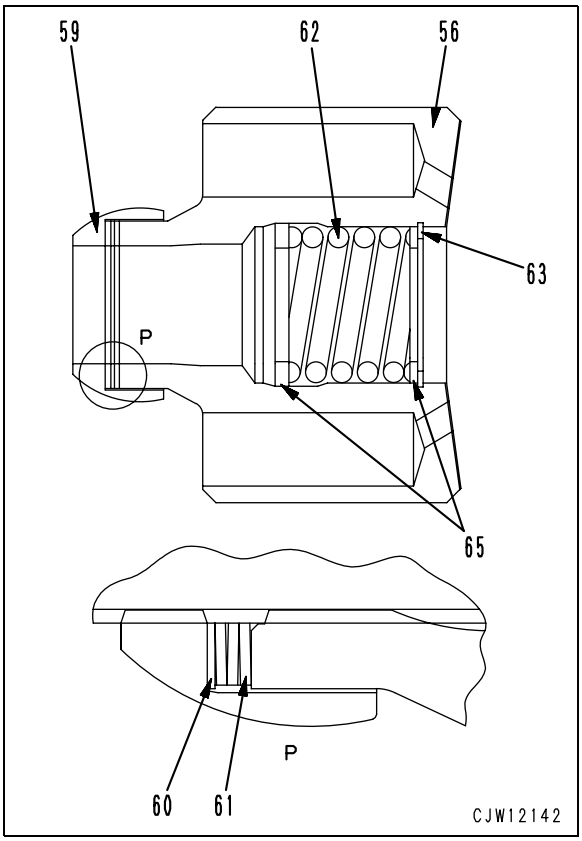
   9) Install snap ring (67).



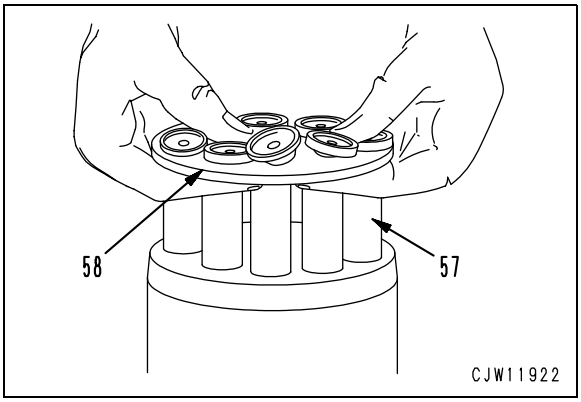
5. Cylinder block, Piston assembly
   1) Assemble the cylinder block and piston assembly according to the following procedure.



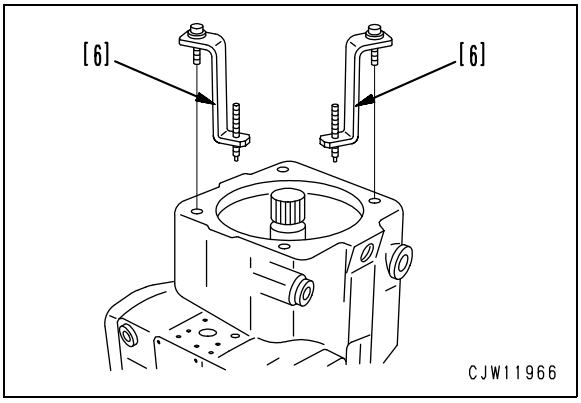
i) Install 2 shims (65) and spring (62) to the cylinder block.
ii) Compress spring (62) and install snap ring (63).
iii) Install spring (61) and shim (60) to cylinder block (56).
★ When any of cylinder block (56), control plate (52), retainer guide (59), retainer (58), and shim (60) needs to be replaced, replace the whole cylinder block since a dimension of shim (60) must be adjusted.
iv) Install retainer guide (59).



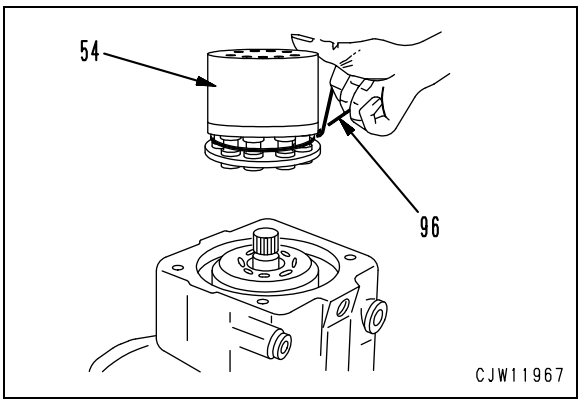
v) Install 9 pistons (57) to retainer (58).
vi) Install piston and retainer assembly to cylinder block (56).
★ Oil piston and piston pad.



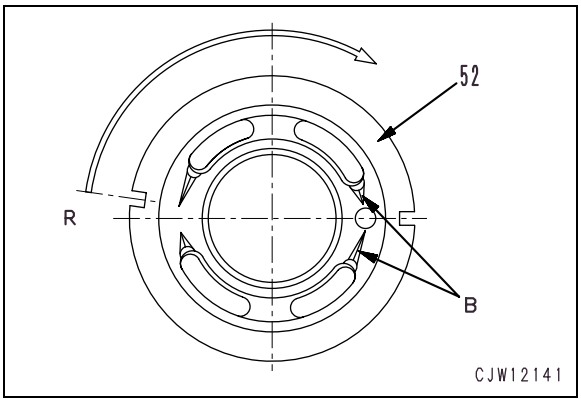
2) Remove holding device [6].
★ Fit cylinder complete with pistons and retaining device.



3) Assembly aid:
Hold the cylinder block and piston Assembly (54) by using an O-ring (96).



6. Control plate (52)
   - ★ Control plate clockwise rotation - indexed in the direction of rotation.
   - ★ Noise grooves are machined - in based on direction of rotation.
   - ★ Notch B is seen on 1 side.

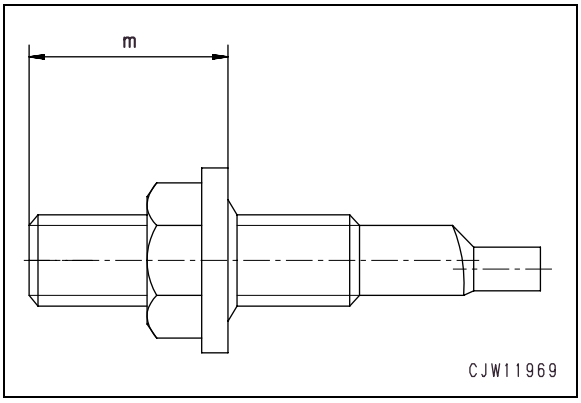


   - ★ indexing screw Basic setting - indexing screw (50) (The end is eccentric.)

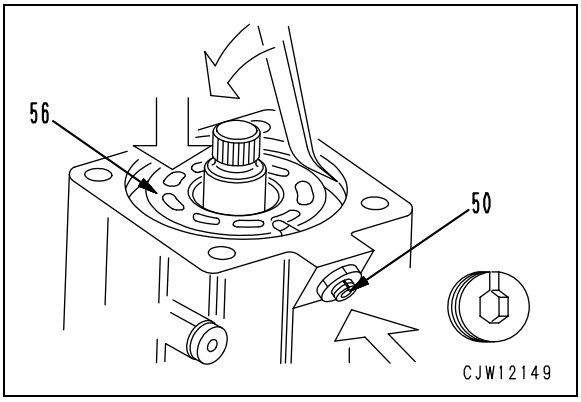
     Dimension m:

     29 ± 0.75 mm ... WA270-5

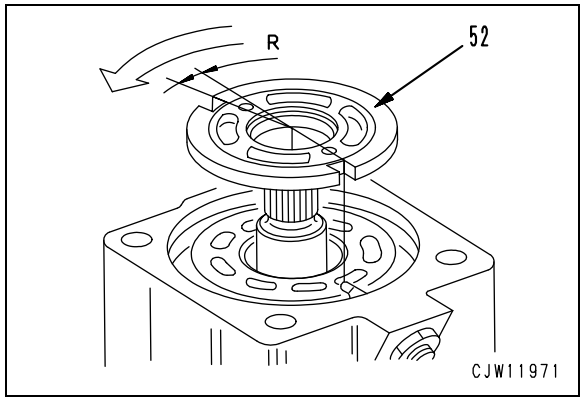
     20 ± 0.75 mm ... WA320-5

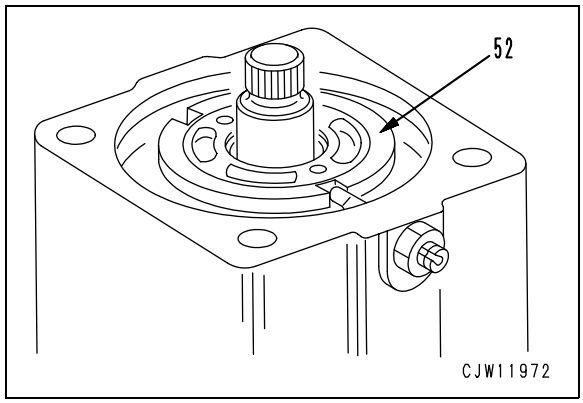


   1) Press the cylinder block (56) to the bottom.
   2) Screw in the indexing screw (50).
      - ★ Groove in mounting position. (The groove is directed up in the following figure.)



   3) Insert the control plate (52) - clockwise rotation.
   - ★ Insert the control plate so that notch B will not be seen.

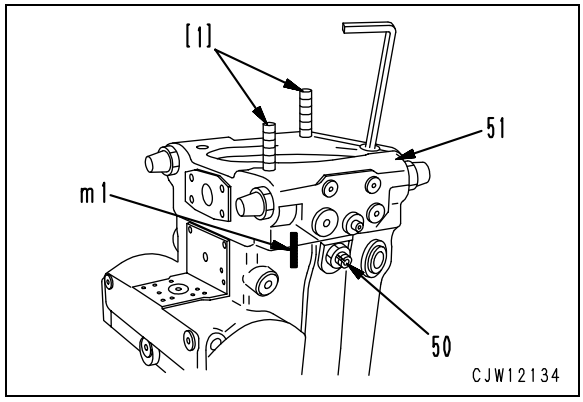




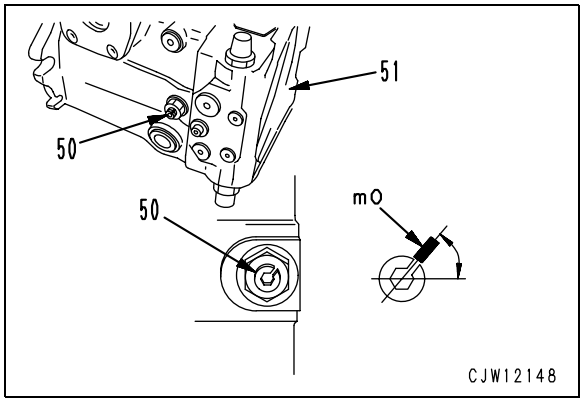
7. Port plate (51)
   1) Assemble port plate (51), matching m1.

      Spring preloaded!

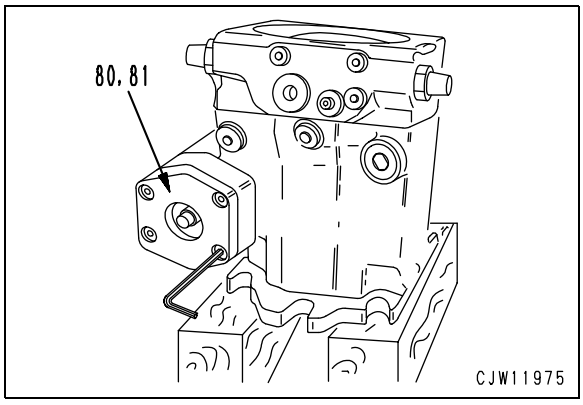
   2) Insert port plate Assembly (51) into housing, guidance with two guide bolts [1] that screwed opposite angle.



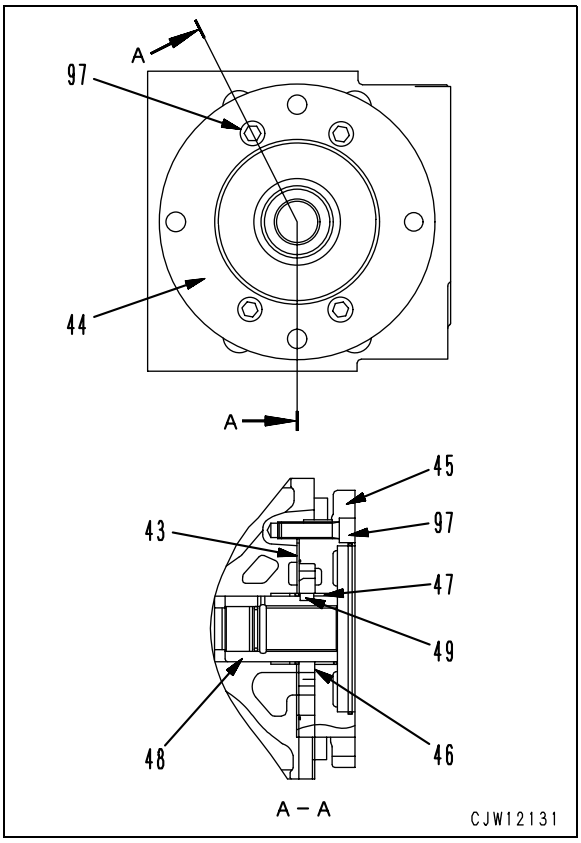
3) Locking screw (50) - Observe adjusting measure, the angle m0.



8. Servo piston cover
   1) Install servo piston covers (80) and (81) to both sides match mark position m2, m3.
   ★ Cover (80) will be removed because of filling oil.



9. Charge pump assembly (44)
   1) Install wear plate (43)
   2) Install coupling (48) and key (49).
      ★ Bearing metal (47) is already in the flange (45).
   3) Install gear (46) to flange (45).
   4) Install charge pump assembly (44) with the 4 mounting bolts (97).



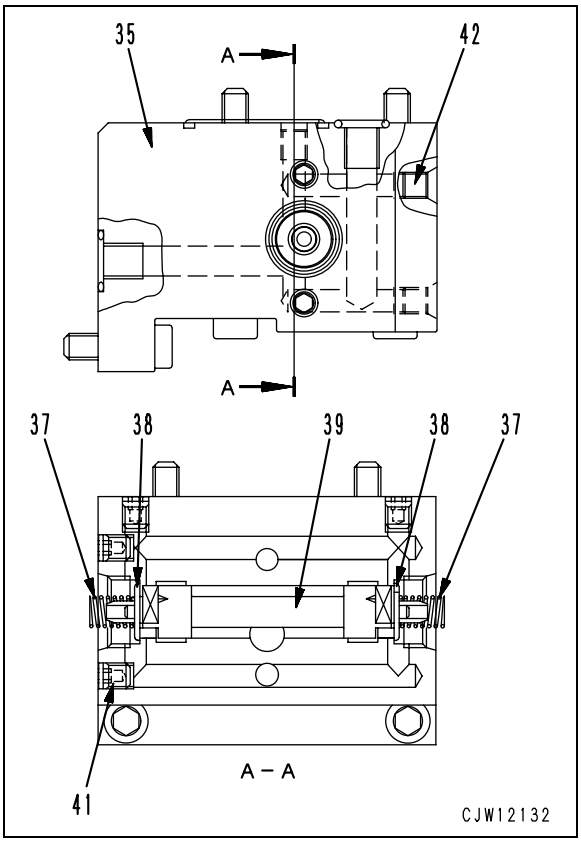
10. Forward-reverse solenoid valve (34)
    1) Assemble the valve housing assembly (35) according to the following procedure.
       i) Install plug (42) to housing.

       Threads of plug: **ThreeBond No. 1305**

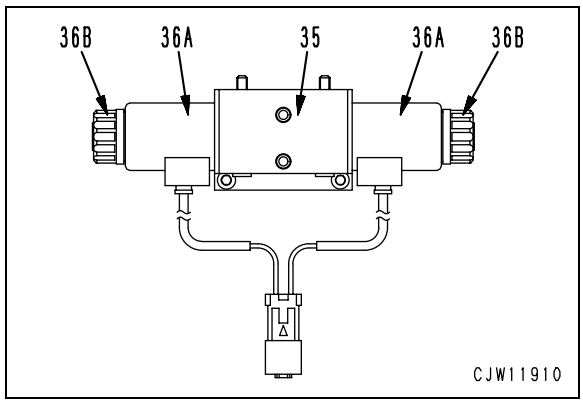
       ii) Install 4 plugs (41).

       Plug: **5.6 Nm {0.57 kgm}**

       iii) Install piston (39).
       iv) Install 2 collars (38) and 2 springs (37).

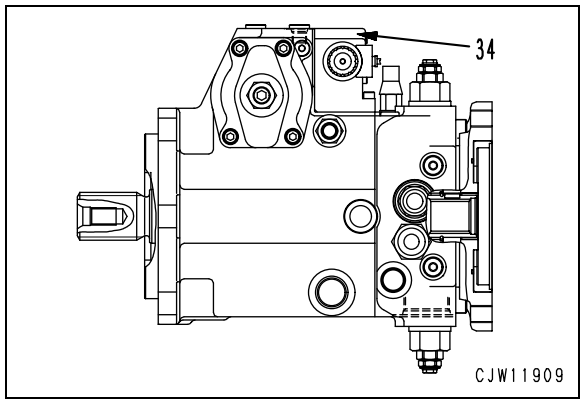


    2) Install 2 solenoid valves (36) to the valve housing assembly (35).
       ★ Fit the tube to the solenoid valve housing and install coil (36A) and cap (36B).

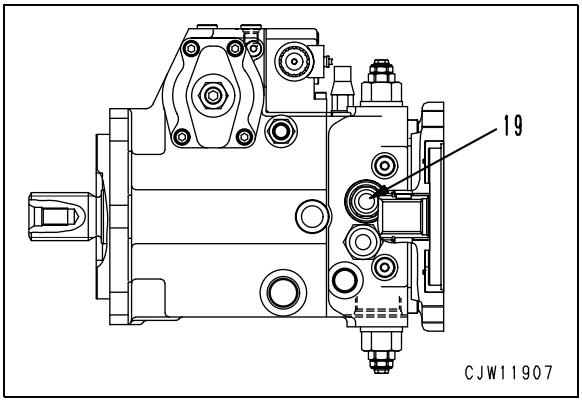


    3) Install forward-reverse solenoid valve assembly (34).

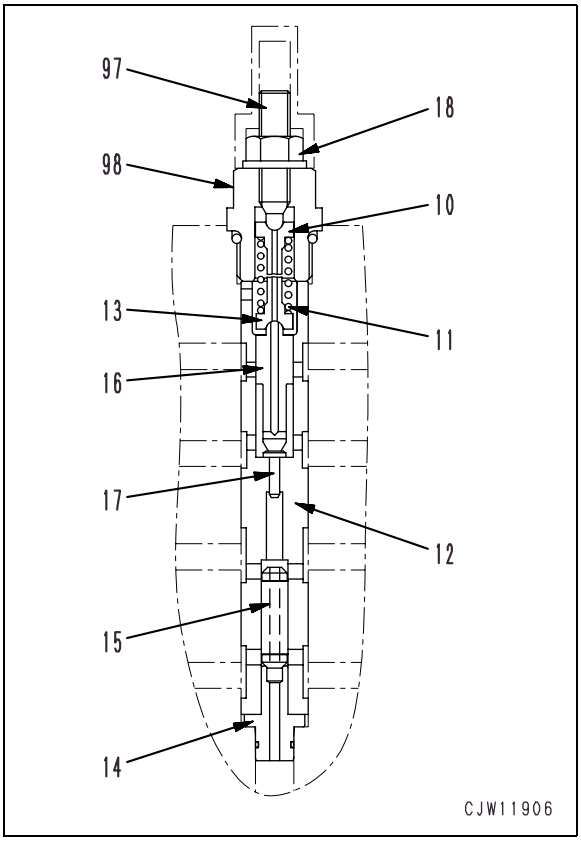
       Mounting bolt: **10.4 Nm {1 kgm}**



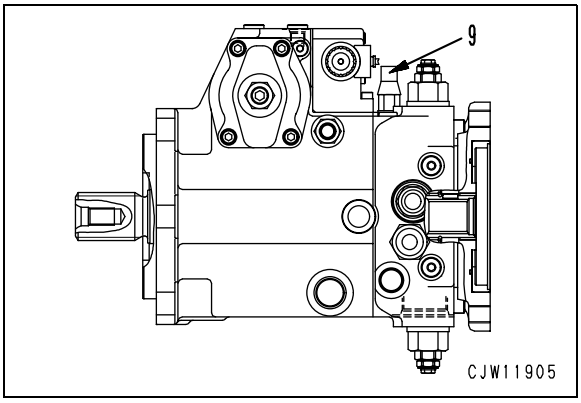
11. Speed-related valve (DA valve)
    1) Fit the O-ring and install speed-related valve assembly (19).



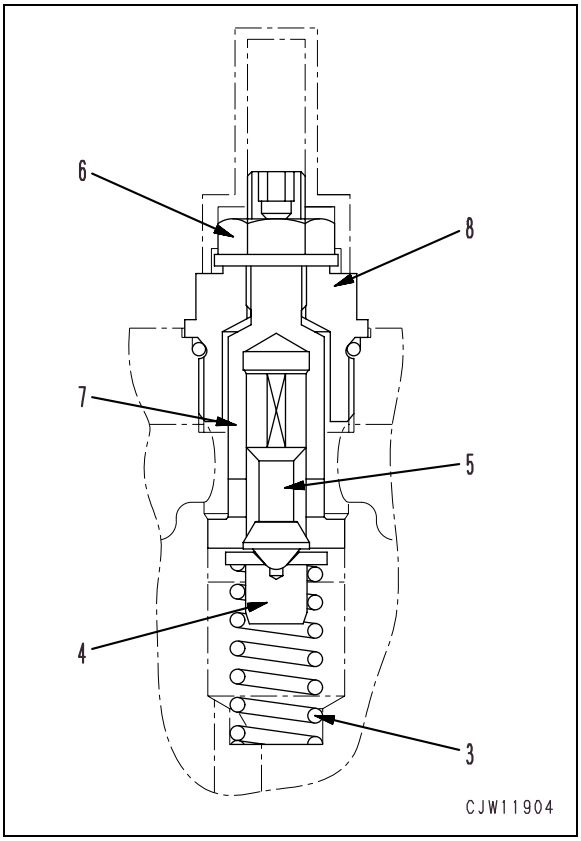
12. High pressure cut-off valve assembly
    1) Assemble the high pressure cut-off valve assembly according to the following procedure.
        i) Install adjustment screw (97) and locknut (18) to holder (98).
        ii) Install piston (17) and spool (16) to barrel (12).
        iii) Install shuttle spool (15), valve seat (14), and spring seat (13) to barrel (12).
        iv) Install barrel assembly (12) to the pump case.
        v) Install spring (11) and spring seat (10) to the pump case.
        ★ Set the spring to the dimension measured before disassembly.



    2) Fit the O-ring and install high pressure cut-off valve assembly (9).
        ★ After installing the pump assembly to the machine, adjust the high pressure cut-off valve assembly. For details, see TESTING AND ADJUSTING, Testing and adjusting HST oil pressure.

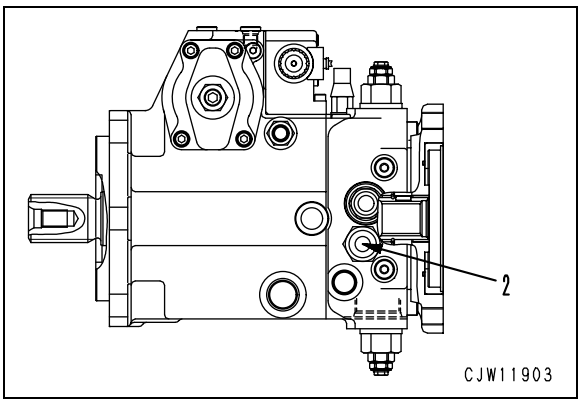


13. Low pressure relief valve assembly
    1) Assemble the low pressure relief valve assembly according to the following procedure.
        i) Install adjustment screw (7) to holder (8).
        ii) Install the locknut (6).
        iii) Install piston (5).
        iv) Install spring seat (4) and spring (3) to the pump case.



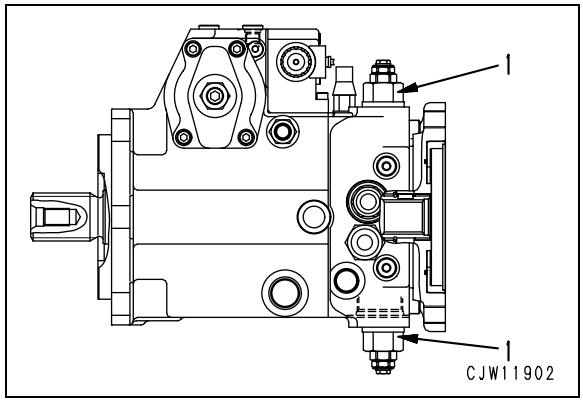
    2) Fit the O-ring and install low pressure relief valve assembly (2).

        Low pressure relief valve assembly: **70 Nm {7.14 kgm}**



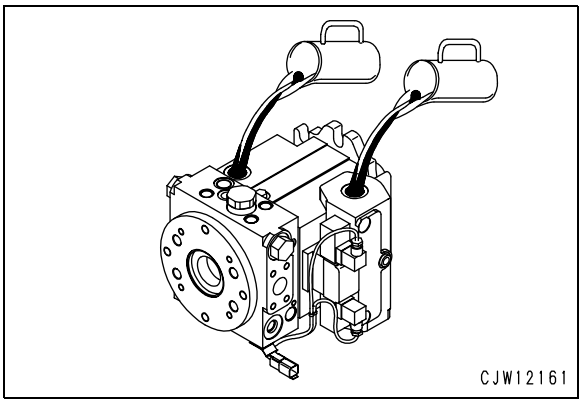
14. High pressure relief valve assembly
    Fit the O-ring and install 2 high pressure relief valve assemblies (1).

        High pressure relief valve assembly:
        200 ± 10 Nm {20.39 ± 1.02 kgm}



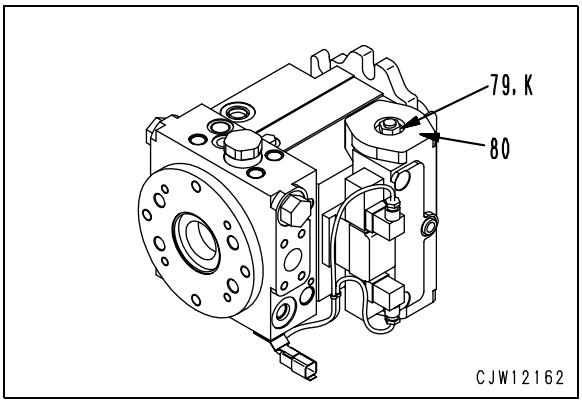
15. Filling with oil
    ★ Remove servo piston cover (80). (See next item.)

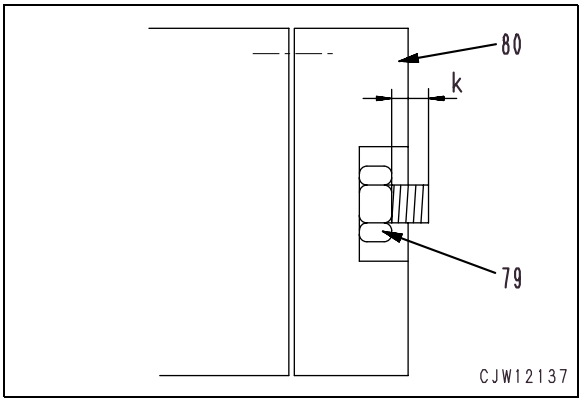
    Fill up hydraulic aggregates with medium before start-up.



16. Servo piston cover (80).
    1) Install servo piston cover (80) match mark position m3.
    2) Adjust zero position according to measure, K.

    Adjustments of the correct zero position to be carried out after installation into the machine or on the bench test.





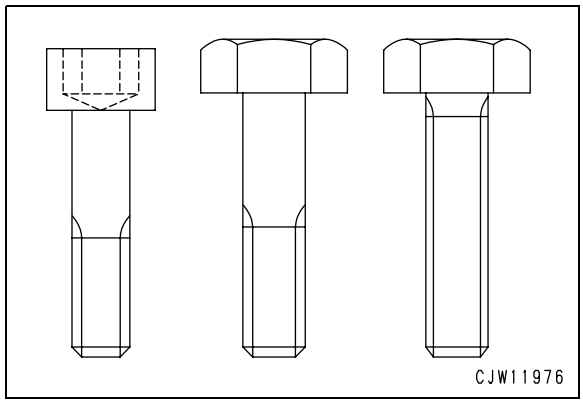
17. Before starting
    - Observe the operating instructions before starting.
    - Check the machine for remarkable faults.
    - Do not operate the machine with defective instruments, warning lights or control elements.
    - All safety devices must be in a secure position.
    - Do not carry with you movable objects or secure them to the machine.
    - Keep oily and inflammable material away from the machine.
    - Before entering the driver's cabin, check if persons or obstacles are beside or beneath the machine.
    - Be careful when entering the driver's cabin, use stairs and handles.
    - Adjust your seat before starting.

18. Tightening torque table

★ If the tightening torque of a mounting bolt, nut, or plug is not shown in this manual, tighten that part according to the following tightening torque table.

1) Bolts

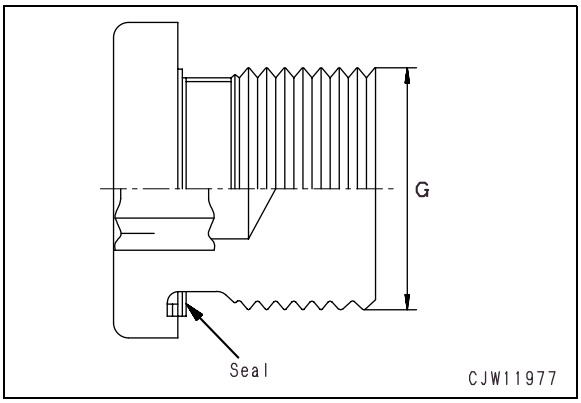
The values stated are vaild for bolts with metric ISO threads to DIN 13 part 13, as well as head areas to DIN 912 socked head cap screws, DIN 913 hexagon bolt or DIN 933 hexagon bolts with threads up to the head.



Thead	Tensile strength class					
	8.8		10.9		12.9	
	Nm	kgm	Nm	kgm	Nm	kgm
M3	1.1	0.11	1.6	0.16	1.9	0.19
M4	3.1	0.32	4.5	0.46	5.3	0.54
M5	6.1	0.62	8.9	0.91	10.4	1.06
M6	10.4	1.06	15.5	1.58	18	18.4
M8	25	2.55	37	3.77	43	4.38
M10	51	5.20	75	7.65	87	8.87
M12	87	8.87	130	13.26	150	15.30
M14	140	14.28	205	20.90	240	24.47
M16	215	21.92	310	31.61	370	37.73
M18	300	30.59	430	43.85	510	52.01
M20	430	43.85	620	63.22	720	73.42
M22	580	59.14	830	84.64	970	98.91
M24	740	75.46	1060	108.09	1240	126.44

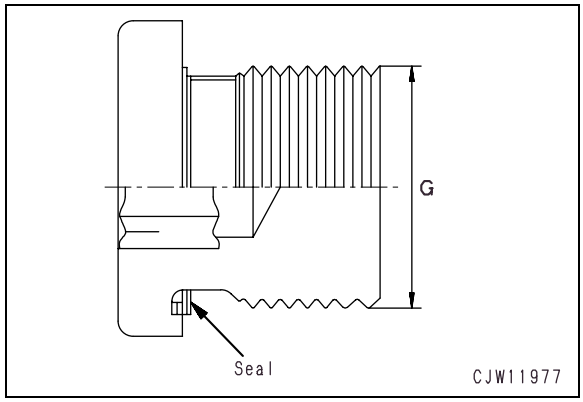
(2) Plugs

i) Plugs with internal hexagon and profile seal ring



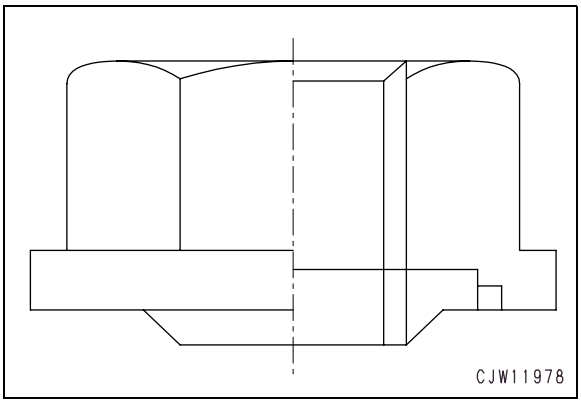
Thead	Tightening torque		Thead	Tightening torque	
	Nm	kgm		Nm	kgm
M8 x 1	5	0.51	G 1/8 A	10	1.02
M10 x 1	10	1.02	G 1/4 A	30	3.06
M12 x 1.5	20	2.04	G 3/8 A	35	3.57
M14 x 1.5	30	3.06	G 1/2 A	60	6.12
M16 x 1.5	35	3.57	G 3/4 A	90	9.18
M18 x 1.5	40	4.08	G 1 A	140	14.28
M20 x 1.5	50	5.10	G 11/4 A	240	24.47
M22 x 1.5	60	6.12	G 11/2 A	300	30.59
M26 x 1.5	70	7.14			
M27 x 2	90	9.18			
M30 x 1.5	100	10.20			
M33 x 2	140	14.28			
M42 x 2	240	24.47			
M48 x 2	300	30.59			

ii) Plugs with internal hexagon, O-ring and UNF-, UN- threads to SAE J 514



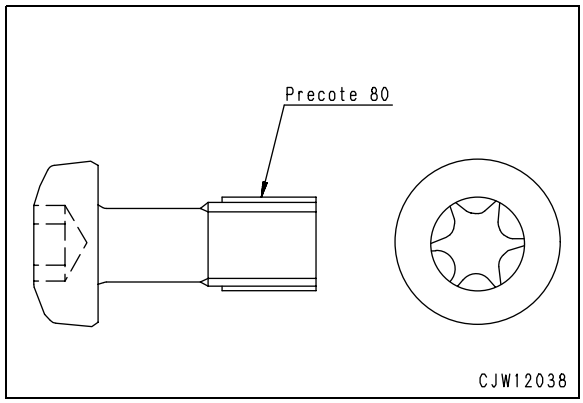
Thead	Tightening torque		Thead	Tightening torque	
	Nm	kgm		Nm	kgm
7/16-20UNF	15	1.53	M12 x 1.5	20	2.04
1/2-20UNF	20	2.04	M14 x 1.5	30	3.06
9/16-18UNF	25	2.55	M27 x 1.5	90	9.18
3/4-16UNF	72	7.34			
7/8-14UN	127	12.95			
11/16-12UN	147	14.99			
13/16-12UN	173	17.64			
15/16-12UN	198	20.19			
15/8-12UN	320	32.63			
17/8-12UN	390	39.77			

(3) SEAL-LOCK - sealing nuts



Thead	Tightening torque	
	Nm	kgm
M6	10	1.02
M6 x 0.5	11	1.12
M8	22	2.24
M8 x 1	24	2.45
M10	40	4.08
M10 x 1	44	4.49
M12	69	7.04
M12 x 1.5	72	7.34
M14	110	11.22
M14 x 1.5	120	12.24
M16	170	17.34
M16 x 1.5	180	18.35

(4) Oval head screw
Oval head screw with inner TORX, thread precoated with "procote 80"



Thead	Tensile strength class			
	10.9		11.9	
	Tightening torque			
	Nm	kgm	Nm	kgm
M3	2.1	0.21	---	---
M4	4.7	0.48	---	---
M5	9.1	0.93	9.5	0.97
M6	15.8	1.61	---	---
M8	37.7	3.84	---	---

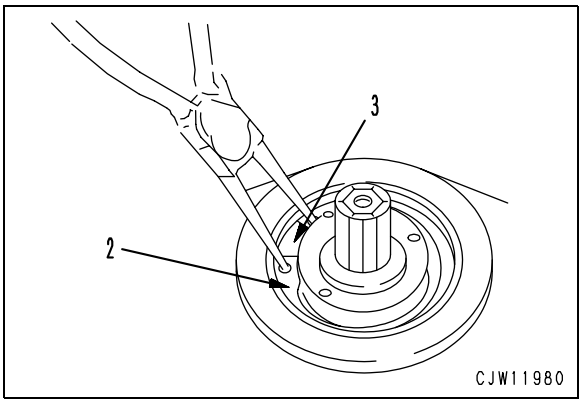
DISASSEMBLY AND ASSEMBLY OF HST MOTOR ASSEMBLY

SPECIAL TOOLS LIST

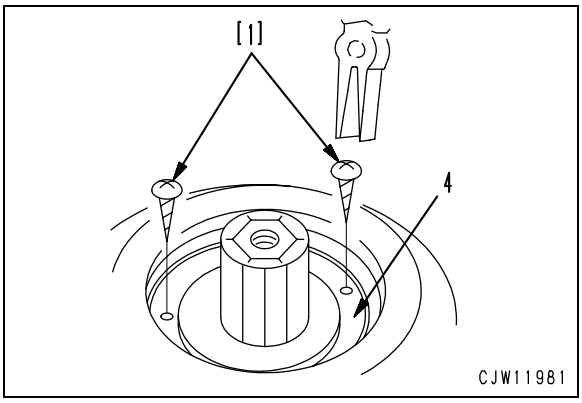
Sym-bol	Part No.	Part name	Neces sity	Q'ty	New/ Remodel	Sketch
M1	02010-21057	Bolt	●	1		
M2	790-201-2740	Push tool	■	1		
	793T-417-1120	Push tool	●	1		
	02010-21057	Bolt	●	1		

DISASSEMBLY

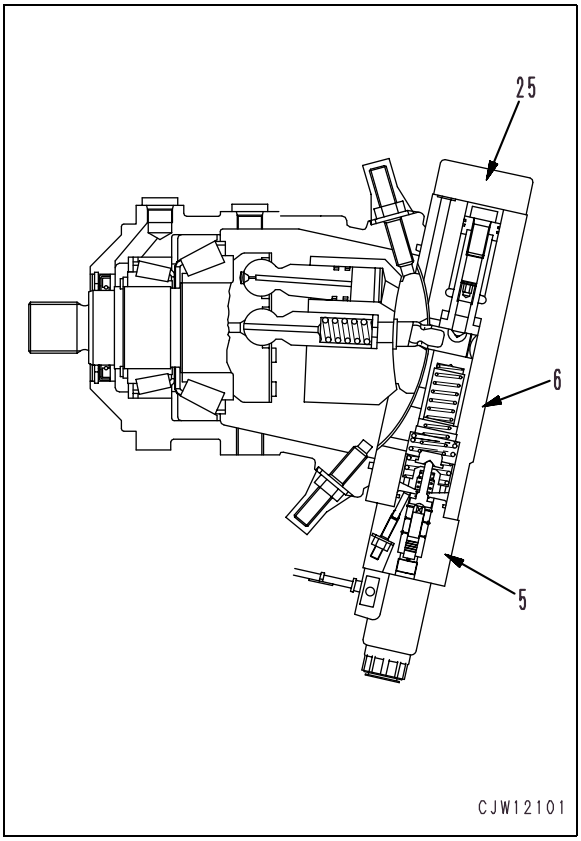
1. Seal
   1) Protecting the driver shaft by tape.
   2) Remove snap ring (2) and shim (3).



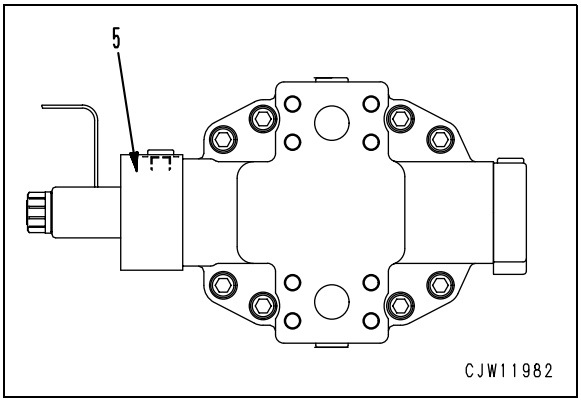
   3) Screw [1] in sheet metal screw into the holes fitted with rubber.
   4) Pull out shaft seal (4) with pliers.



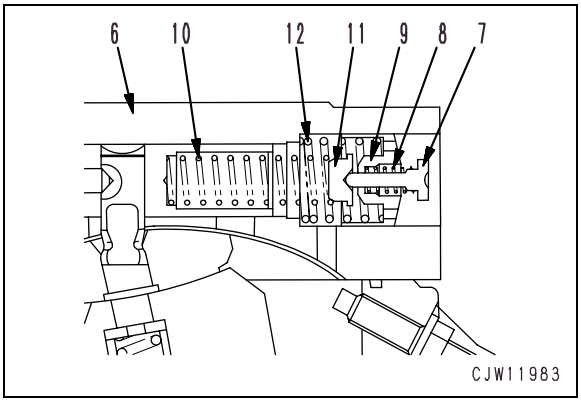
2. EP servo valve assembly and cover (HST motor 1)



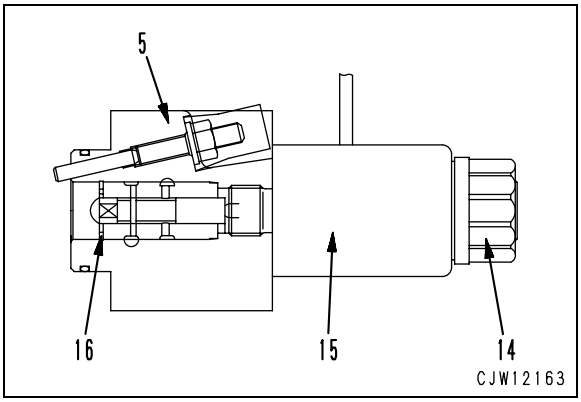
   1) Remove 4 mounting bolts and solenoid valve and housing assembly (5).
      ★ Take care of the spring which may jump out.



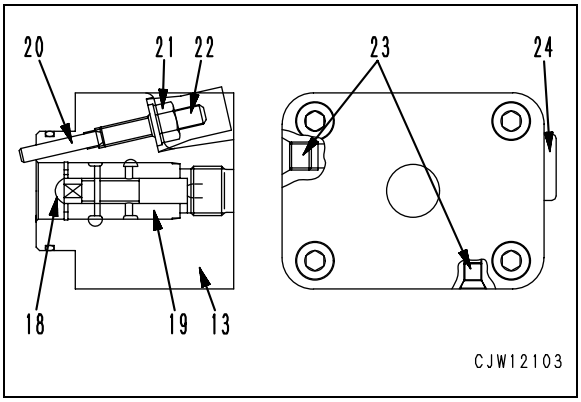
2) Remove spring seat (7) and spring (8) from port plate (6).
3) Remove spring seat (9) and spring (12).
4) Remove spring seat (11) and spring (10).



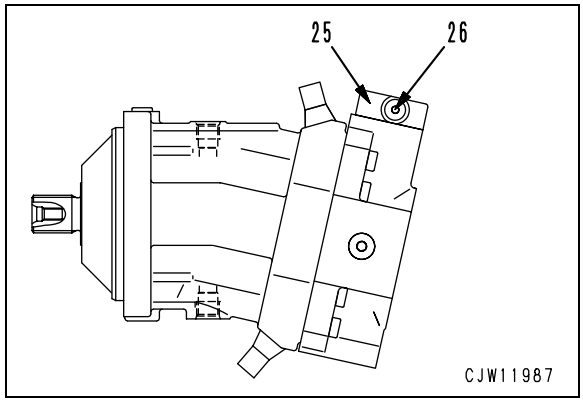
5) Disassemble the solenoid and housing assembly (5).
   i) Remove caps (14), coil (15) and snap ring (16) of the solenoid in order.



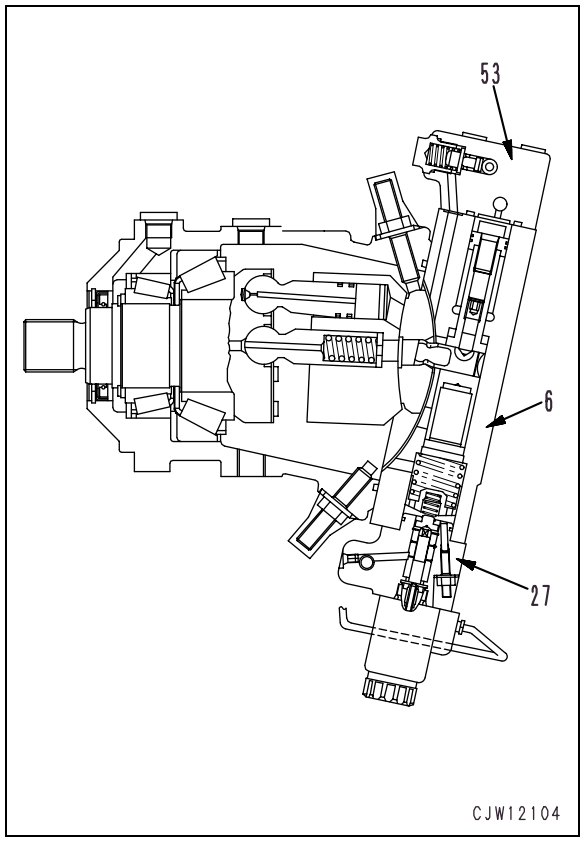
   ii) Remove spool (18) and bushing (19) from housing (13).
   iii) Remove pin (20)
   ★ Do not remove nut (21) and screw 22.
   iv) Remove plugs (24) from housing (13).
   ★ Do not remove plug (23).



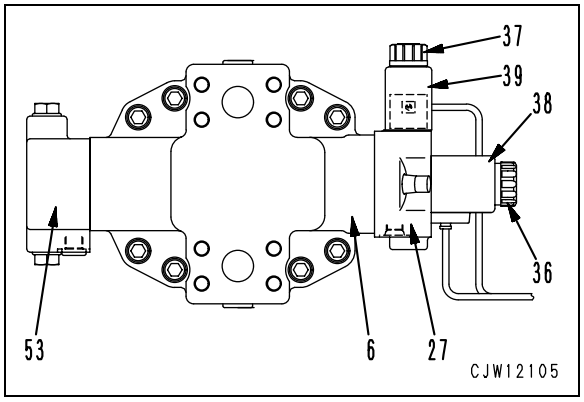
6) Cover
   i) Remove cover (25)
   ii) Remove plug (26) from cover (25).



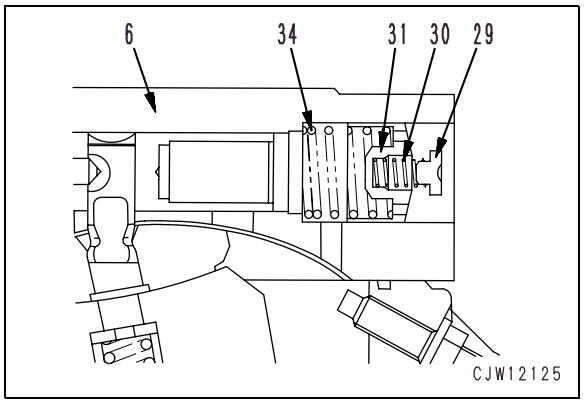
3. HA servo valve and forward-reverse shuttle valve assembly and flushing valve assembly (HST motor 2)



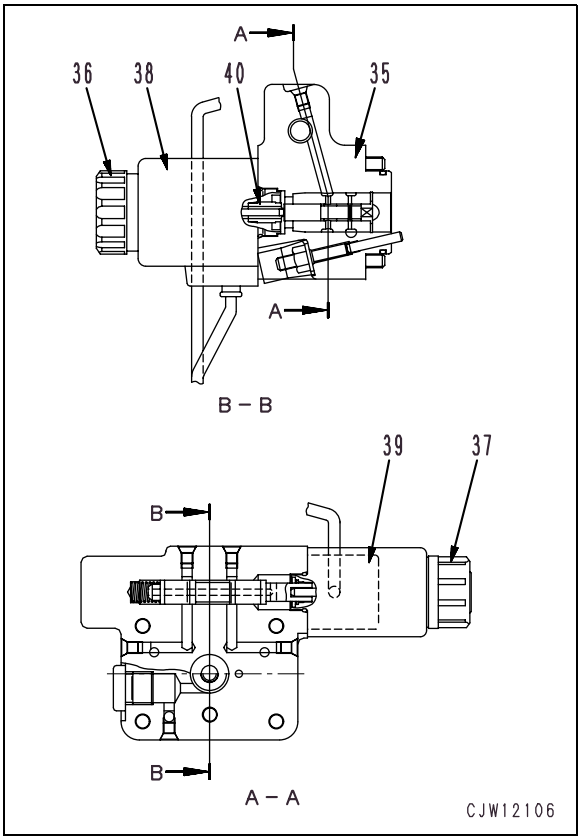
1) Remove the 4 mounting bolts and solenoid valve and housing assembly (27) from port plate (6).
   ★ Take care of the spring which may jump out.



2) Remove spring seat (29) and spring (30) from port plate (6).
3) Remove spring seat (31) and spring (34).

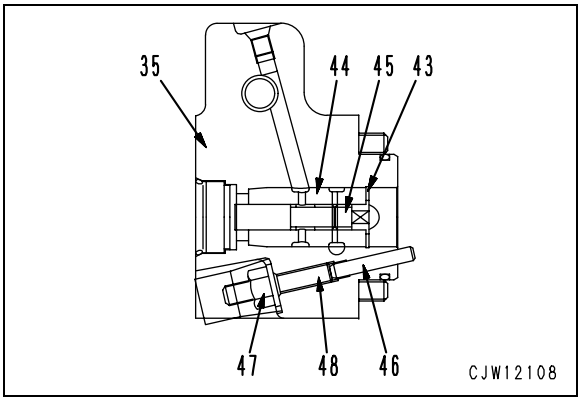


4) Disassemble 2 solenoids and housing assembly (27).
   i) Remove caps (36) and (37), coils (38) and (39), and bush (40) of the solenoid in order.

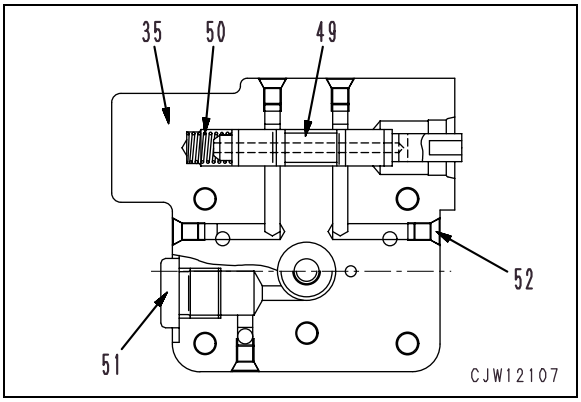


Disassemble the housing assembly according to the following procedure.

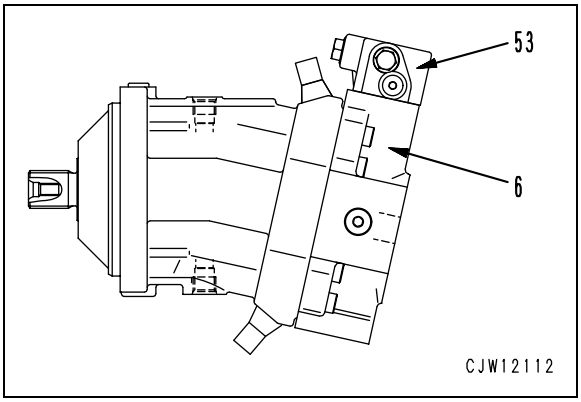
ii) Remove snap ring (43), control bushing (44), and control piston (45) from housing (35).
iii) Remove pin (46).
★ Do not remove nut (47) and screw (48).



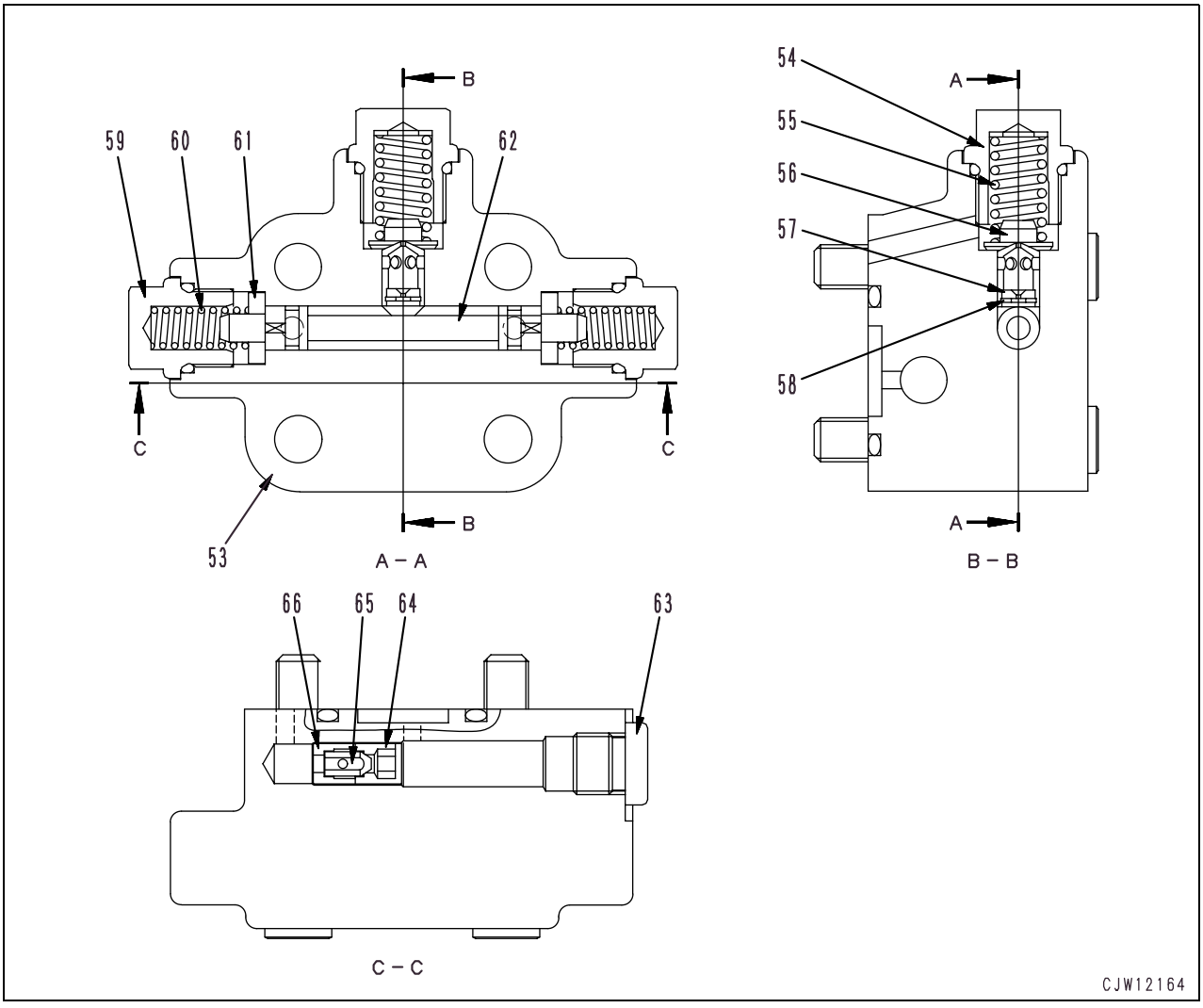
iv) Remove control piston (49) and spring (50) from housing (35).
v) Remove plug (51).
★ Do not remove 5 plugs (52).



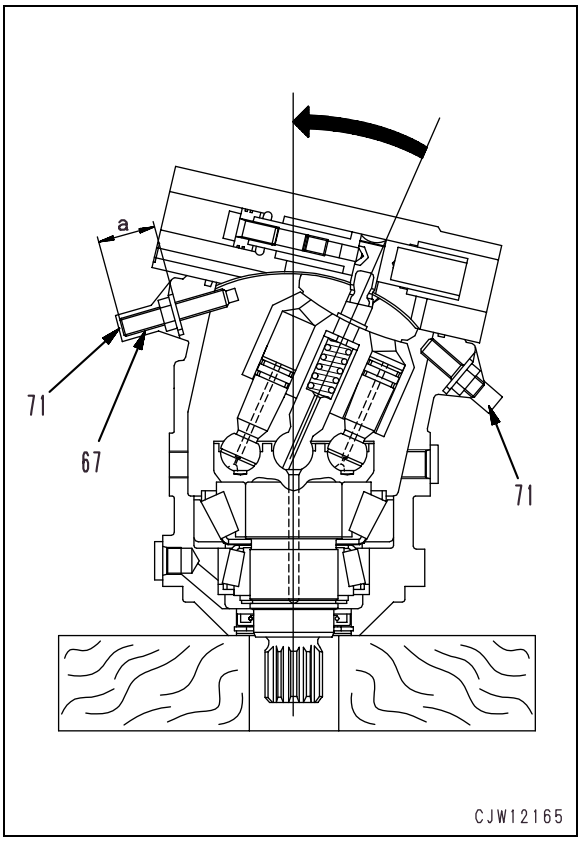
5) Remove flushing valve assembly (53) from port plate (6).



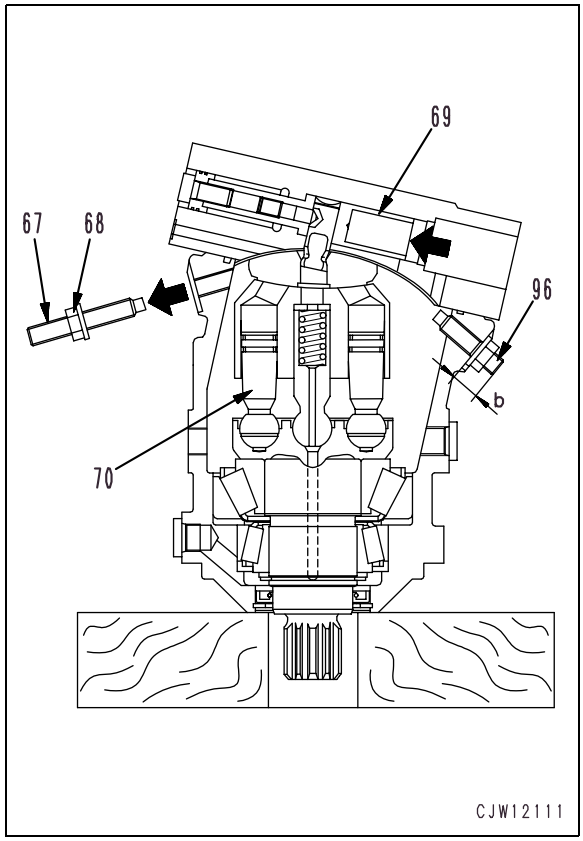
6) Disassemble the flushing valve assembly (53) according to the following procedure.
   i) Remove plug (54).
   ii) Remove spring (55), plunger (56), orifice (57), and snap ring (58).
   iii) Remove 2 plugs (59).
   iv) Remove spring (60), spring seat (61), and spool (62).
   v) Remove plug (63).
   vi) Remove guide (64), orifice (65), and guide (66).



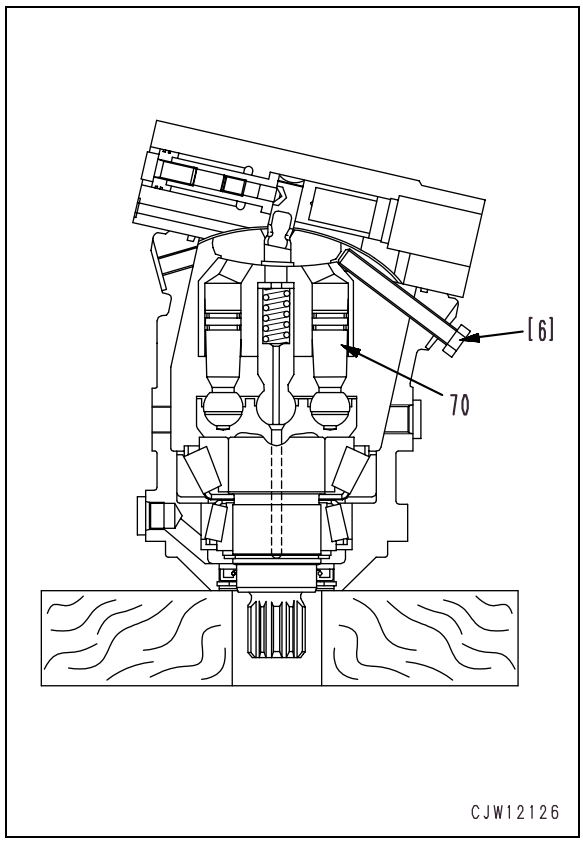
4. Preparation of removal of port plate (6) assembly (Common to HST motors 1 and 2)
   1) Break and remove plastic cap (71) and check installed dimension (a) of Qmin-screw (67).



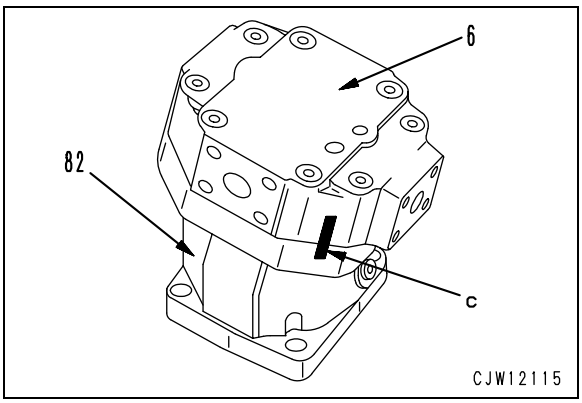
   2) Loosen locknut (68) and remove Qmin-screw (67).
   3) Push piston (69) to set the angle of rotary group (70) to 0 degree.
   4) Break and remove plastic cap (71) and check installed dimension (b) of Qmax-screw (96).
   5) Remove Qmax-screw (96).
      ★ Plastic cap (71) is used to prevent rusting. Since a spare for it is not supplied, apply paint or take another rust-preventive measure after assembling.



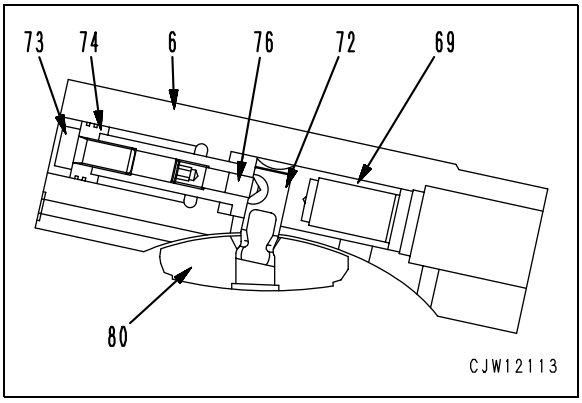
   6) Insert screw [6] to Qmax-screw and fix rotary group (70).
      screw [6] : M12 x 120 mm or longer.



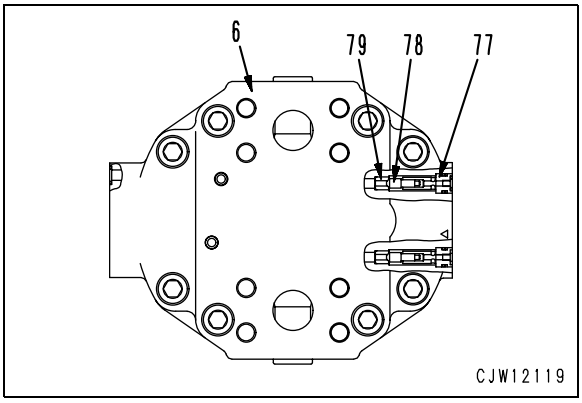
7) Make match marks (c) between port plate (6) and housing (82).
8) Remove port plate assembly (6).



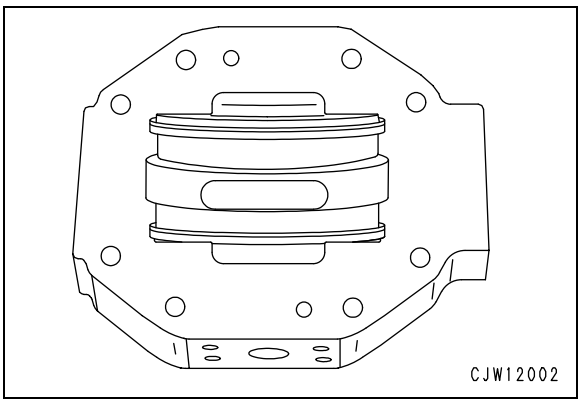
5. Disassemble the port plate (6) assembly according to the following procedure.
   i) Remove control lens (80).
   ii) Remove bolt (73) and piston (74).
   ★ Do not remove screw (76), rod (72), piston (69).



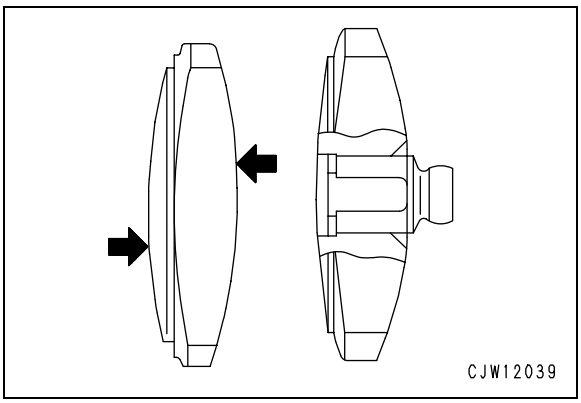
   iii) Screw a bolt of M4 and pull out valve guide (77).
   iv) Remove poppet (78).
   v) Remove valve seat (79).



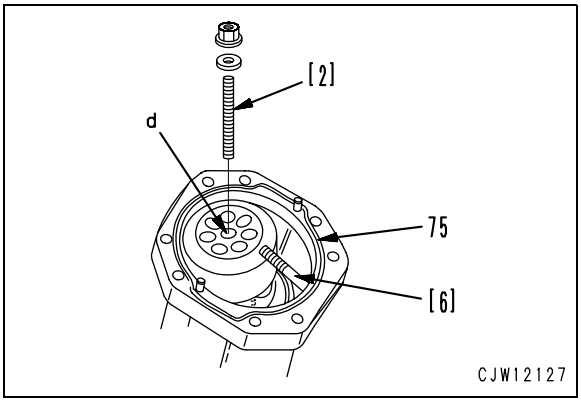
★ Check of port plate
- Sliding surface and side guides free of scoring and no wear.



★ Check of control plate
Faces smooth and even, free of cracks and scoring.

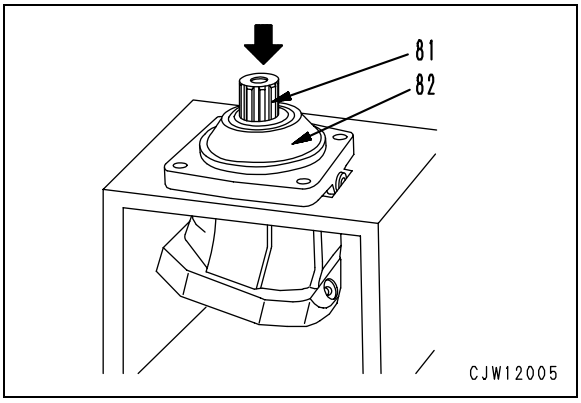


6. Removal of shaft and rotary group assembly (81)
   1) Remove O-ring (75).
   2) Screw [2] in threaded pin into center pin (d)
      ★ Fix the cylinder with disc and locknut.
      - Screw size:M6 x 92 mmWA270-5
        M8 x 105 mmWA320-5
   3) Remove screw [6].

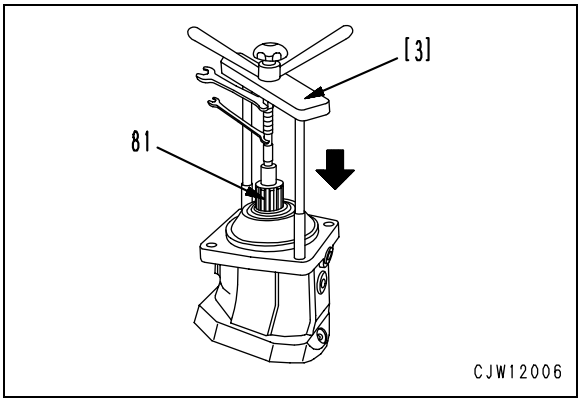


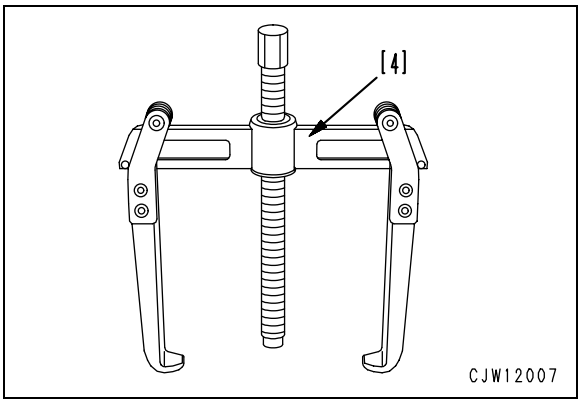
4) Push the shaft end with a press to remove shaft and rotary group assembly (81) from housing (82).

If the bearings are used again do not hit on the drive shaft.



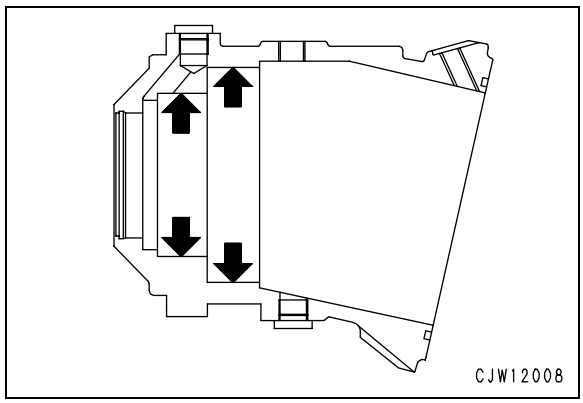
★ If a press is not available, push the shaft end with tool [3] or [4] to remove rotary group assembly (81).





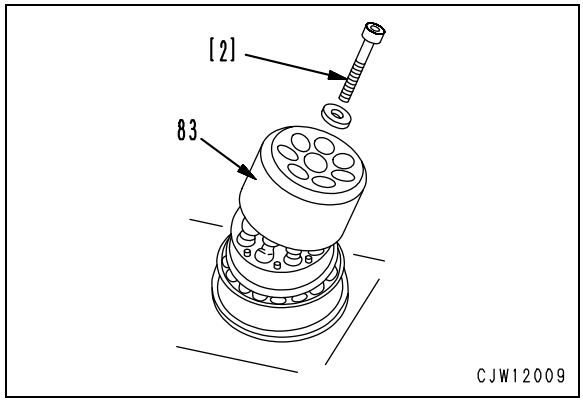
★ Check of housing

- Sliding surface and slide guides free of scoring and no wear.

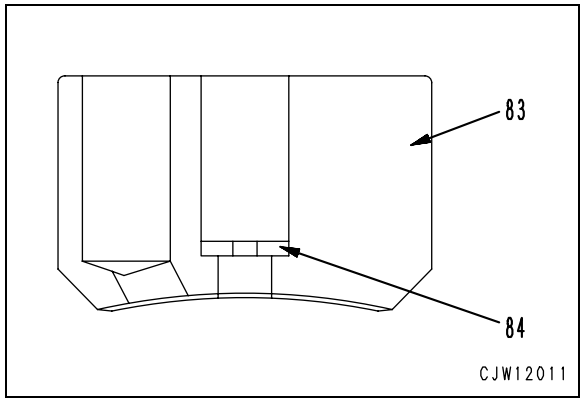


★ Since shaft and bearing are used as an assembly, do not remove the bearing.

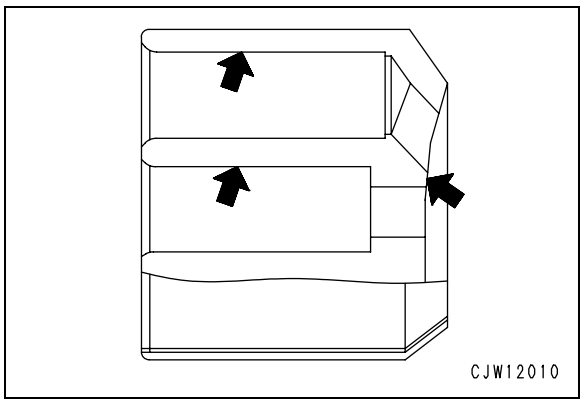
7. Disassembly of rotary group assembly (70)
   1) Remove screw [2].
   2) Remove cylinder block (83).



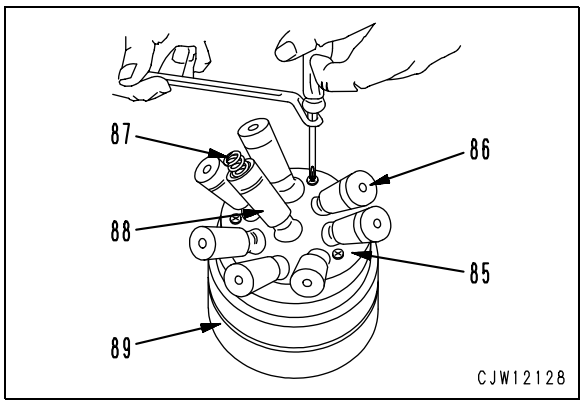
3) Remove shim (84) from cylinder block (83).



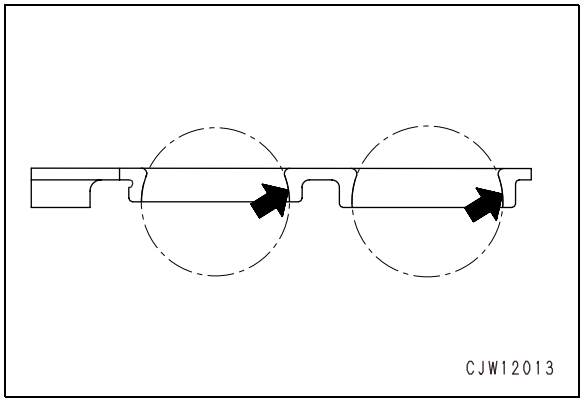
★ Check of cylinder block (83)
- Bores free of scoring, no evidence of wear.



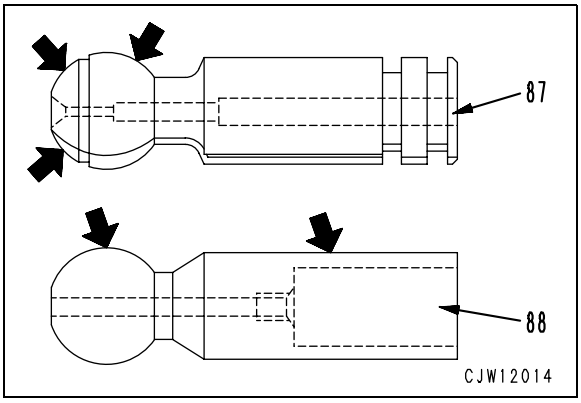
4) Remove retaining ring assembly (85).
   ★ Screws are glued. Warm it up to max. 120°C and remove with Torx-tools.
5) Remove 7 pistons (86), spring (87), and center pin (88) from shaft and bearing assembly (89).



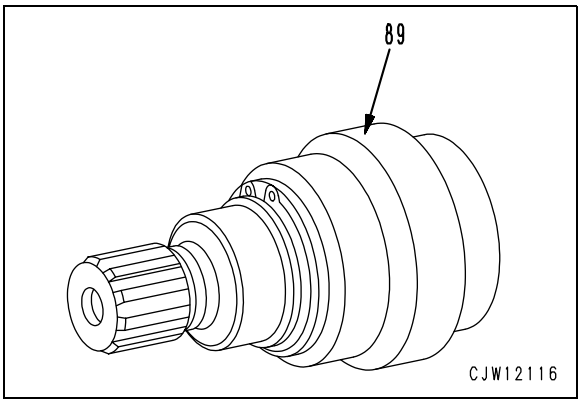
★ Check of retaining ring (85)
- No scoring and no evidence of wear.



★ Check of piston and center pin
- No scoring and no pittings.



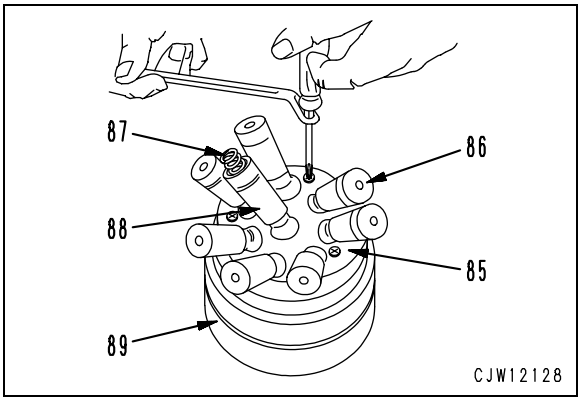
★ Do not disassemble the drive shaft and bearing assembly (89). (If the drive shaft and bearing assembly is defective, replace it whole.)



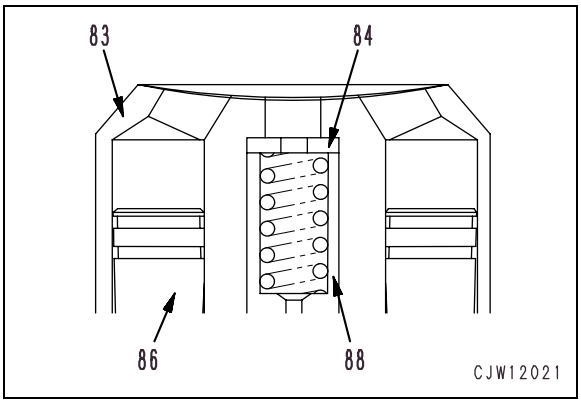
ASSEMBLY

★ Clean the all parts and remove burrs, etc.
★ Coat the rotary parts and sliding parts with engine oil (EO10-CD) before installing.
★ If the tightening torque of a mounting bolt, nut, or plug is not shown in this manual, see the tightening torque table.

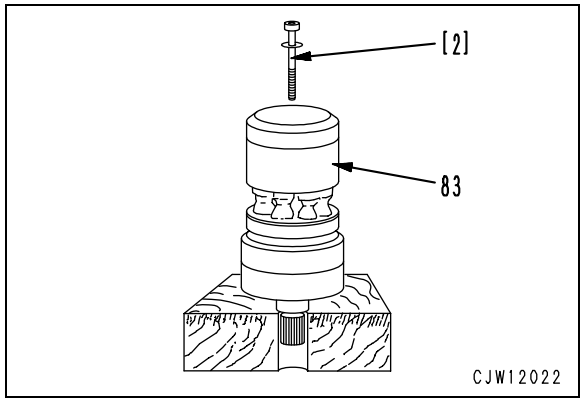
1. Assembly of rotary group assembly (70)
   ★ If the drive shaft and bearing assembly (89) is defective, replace it whole. (The parts of this assembly cannot be supplied loose.)
   1) Install 7 pistons (86), center pin (88), and spring (87) to the drive shaft and bearing assembly (89).
   2) Install retaining ring assembly (85) with the screw.
      ★ For the tightening torque of the screw, see TIGHTENING TORQUE TABLE.



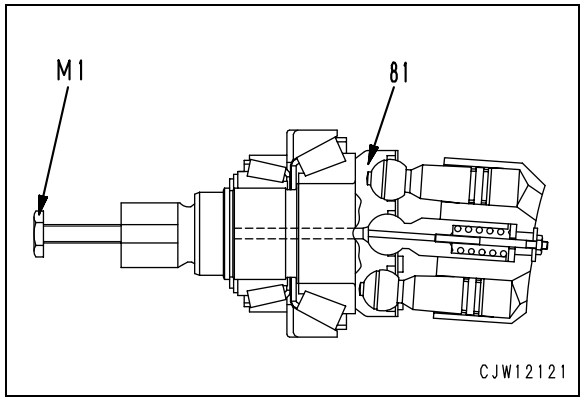
   3) Insert shim (84), center pin (88), and piston (86) in cylinder block (83).
      ★ Make sure all parts are fitted in correctly.



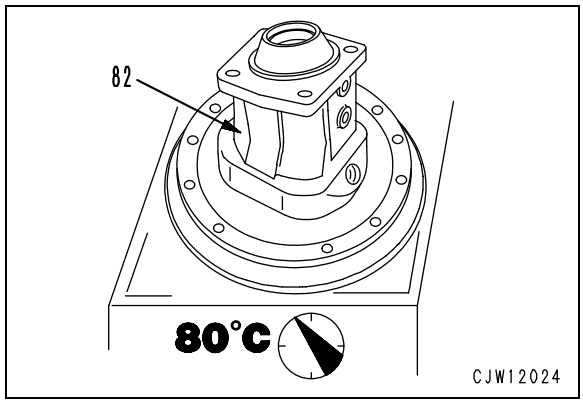
   4) Insert the piston to the end of cylinder block (83) and secure it with screw [2].



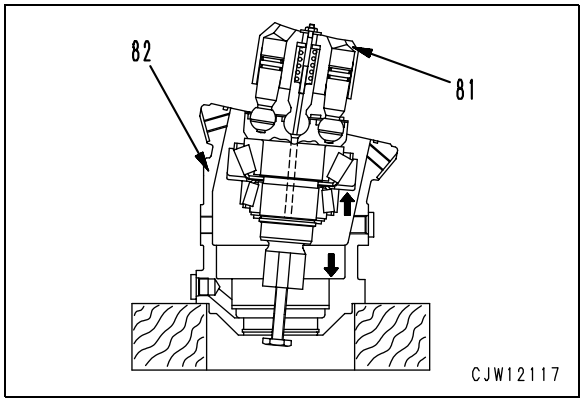
   5) Set bolt M1 to the shaft and rotary group assembly (81) and protect the drive shaft by type.
      ★ Threads of shaft: 5/8-11UNC-2B, Thread depth: 36 mm



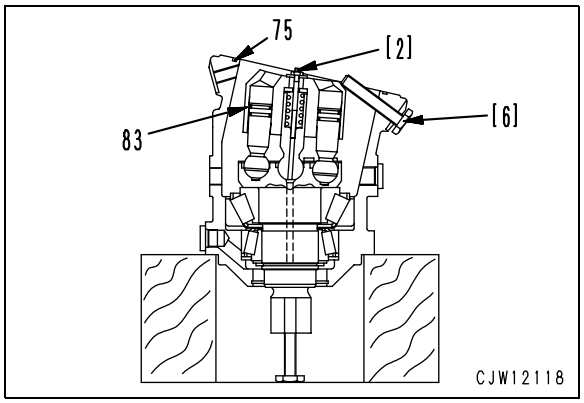
2. Installation of rotary group assembly
   1) Heat housing (82) to 80°C.



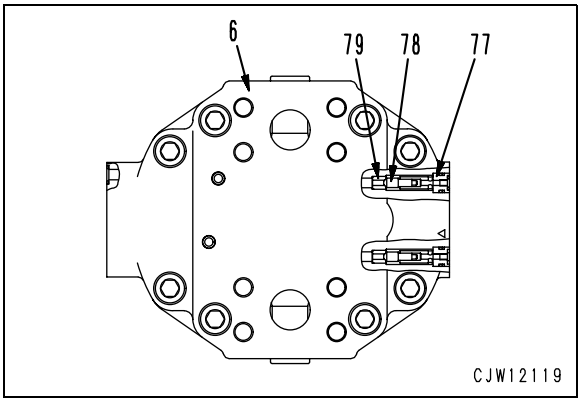
2) Insert the shaft and rotary group assembly (81) into housing (82) to seat position.



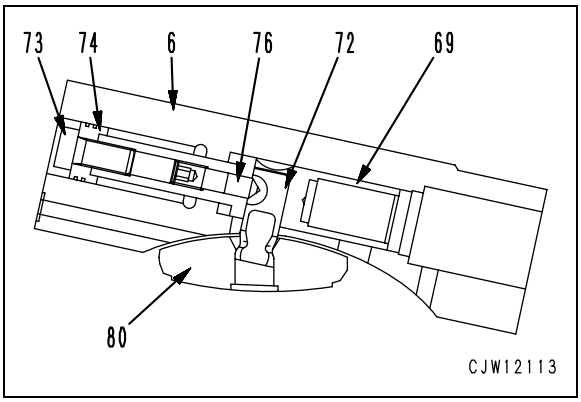
3) Insert screw [6] (M12 x 120 mm or longer). (Fix the tapered part of cylinder block (83) and set the angle to 0 degree.)
4) Remove screw [2].
5) Install the O-ring (75) to the housing.



3. Port plate (6) assembly
   1) Assemble the port plate (6) assembly according to the following procedure.
      i) Install valve seat (79).
      ii) Install poppet (78).
      iii) Install valve guide (77).

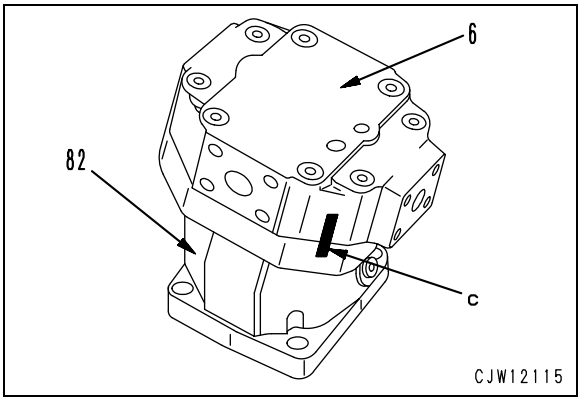


      ★ Piston (69), rod (72), screw (76) are already in the port plate (6).
      iv) Install piston (74) and bolt (73).
      v) Thinly apply grease to control plate (80), and then install it to the sliding surface of the port plate (6) assembly.

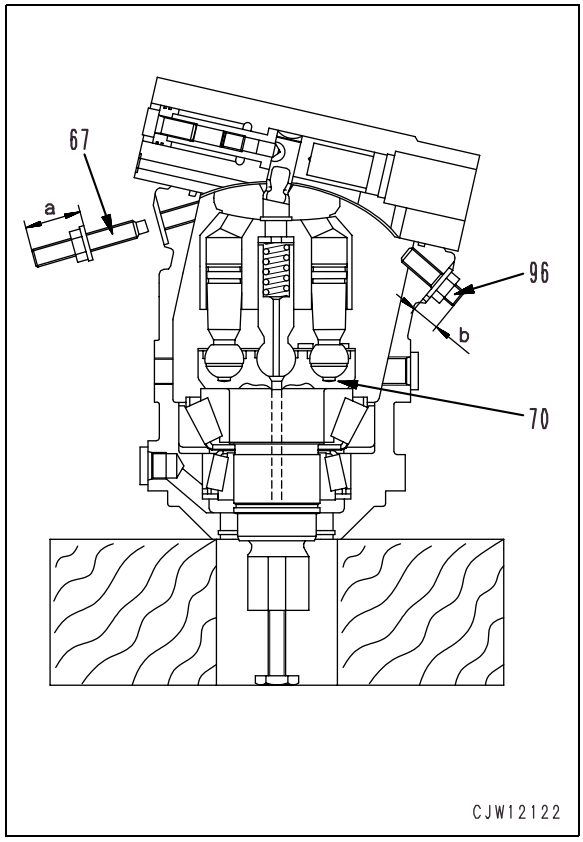


★ Take care of assembly design!

2) Install port plate (6) assembly to housing (82), matching marks (c) made when it was removed.



4. Installation of Qmin-screw (67) and Qmax-screw (96).
   1) Remove screw [6] and set Qmax-screw (96). (b) is the value measured at the time of disassembly.
      ★ When bolt is changed
      i) HST motor 2 (HA type) of WA320-5
      ★ The value of (the bolt length - b) must be the same as that calculated at the time of disassembly.
      ii) HST motor 1 (EP type)
      ★ Since the bolt is used to plug the hole simply, do not replace it with long one.
   2) Swivel rotary group (70) to "starting position".
   3) Set Qmin - screw (67) to dimension (**a**).
      ★ (a) (the bolt length –a) is important for all the type.
      ★ Tighten fixing screws (67), (96) with torque.



5. HA servo valve and forward-reverse shuttle valve assembly and flushing valve assembly (53) (HST motor 2)
   1) Assemble the flushing valve assembly according to the following procedure.
      i) Install guide (66), orifice (65), and guide (64).

      Guide (66): **3 Nm {0.31 kgm}**

      Guide (64): **8 Nm {0.81 kgm}**

      ii) Install plug (63).

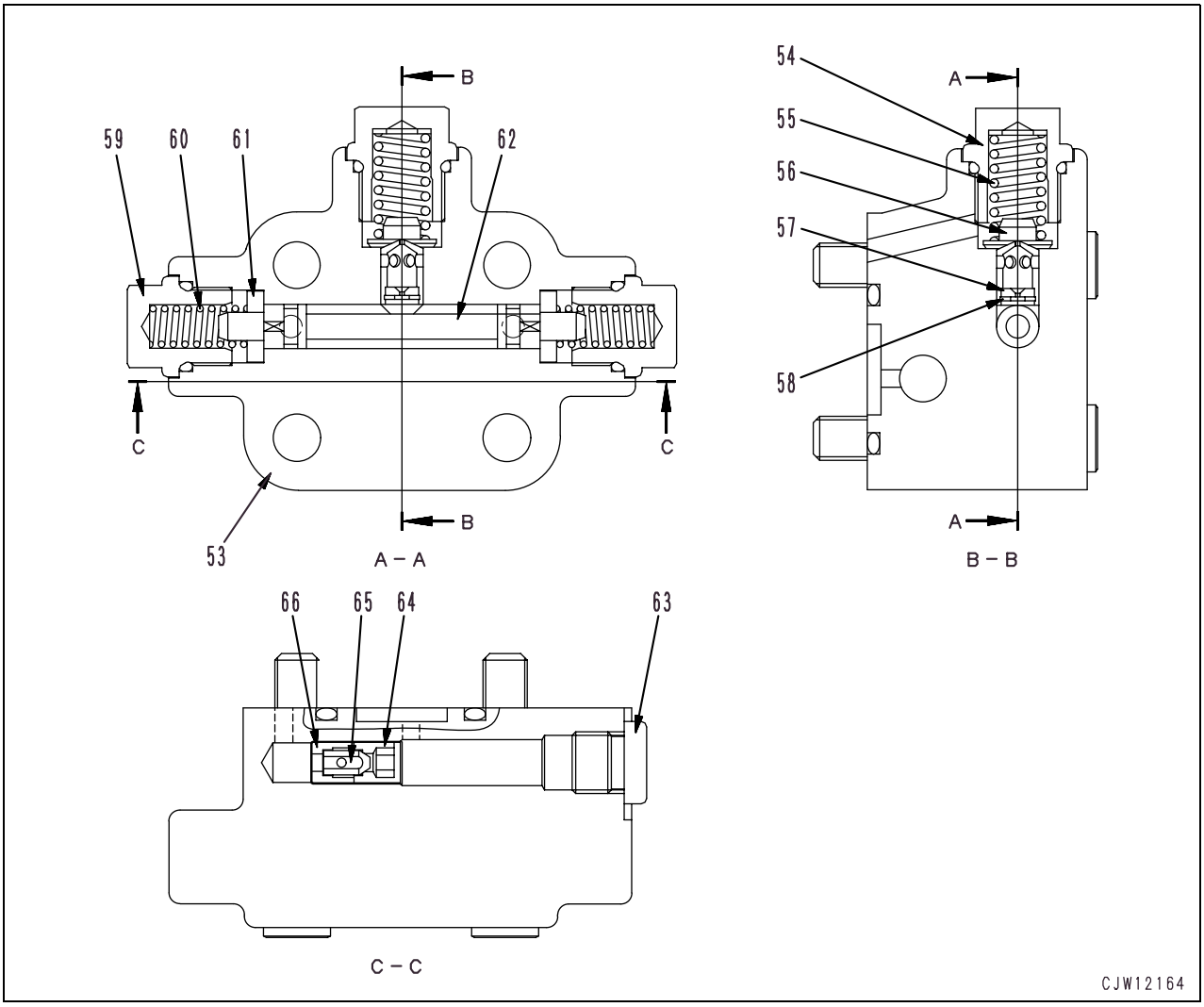
      Plug: **29 - 38 Nm {2.96 - 3.89 kgm}**

      iii) Install spool (62), spring seat (61), and spring (60).
      iv) Install 2 plugs (59).

      Plug: **40 Nm {4.1 kgm}**

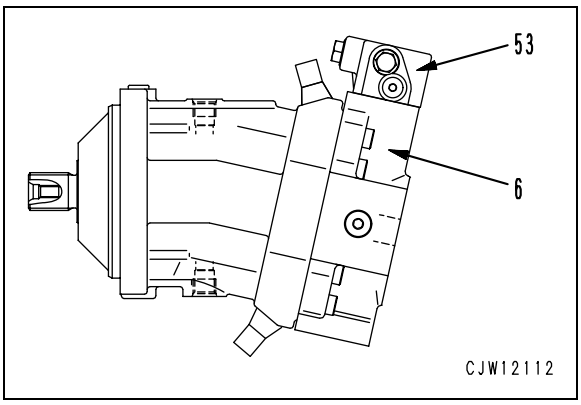
      v) Install snap ring (58), orifice (57), plunger (56), and spring (55).
      vi) Install plug (54).

      Plug: **50 Nm {5.1 kgm}**

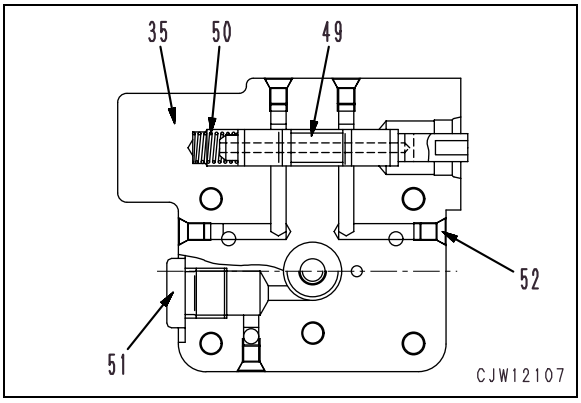


2) Install flushing valve assembly (53) to port plate (6).

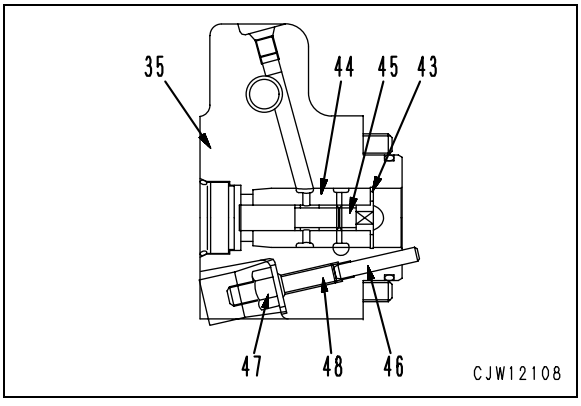
Plug:
55 - 60 Nm {5.61 - 6.12 kgm}



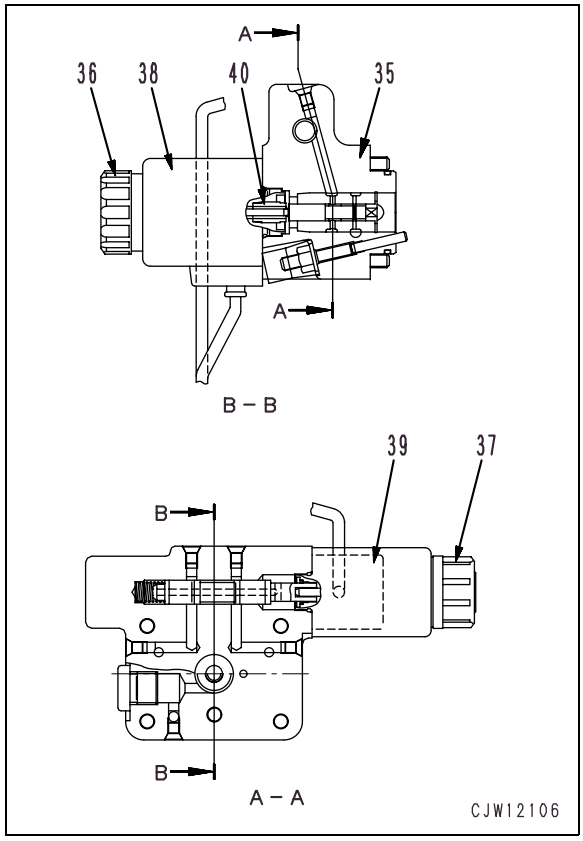
3) Assemble the housing assembly (27) according to the following procedure.
   i) Install plug (51) to housing (35).
   ii) Install spring (50) and control piston (49) to housing (35).
   ★ 5 plugs (52) are already in the houseing (35).



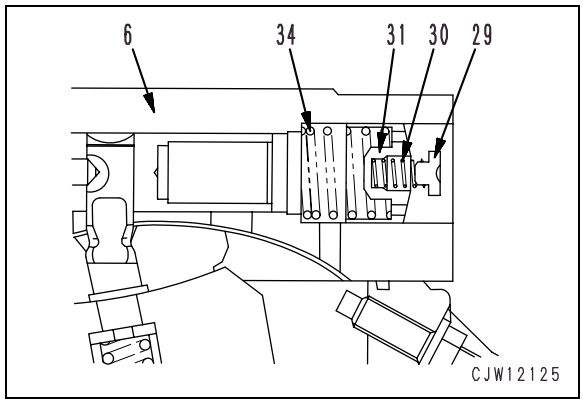
   iii) Install pin (46).
   iv) Install control piston (45) and control bushing (44).
   v) Install snap ring (43).



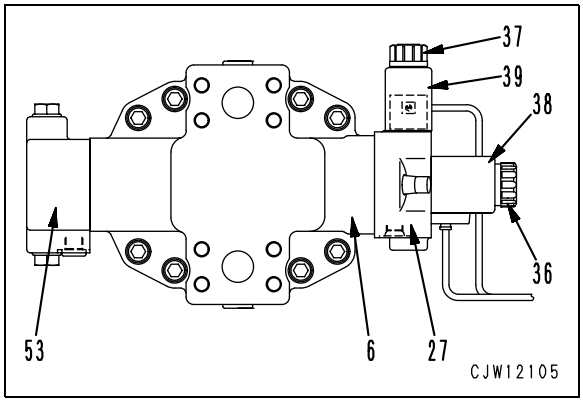
   vi) Install 2 solenoids to housing (35).
   ★ Install bush (40), coils (39) and (38), and caps (37) and (36) of the solenoid in order.



4) Install spring (34) and spring seat (31) to the port plate.
5) Install spring (30) and spring seat (29).



6) Install solenoid valve and housing assembly (27) with the 4 mounting bolts to port plate (6).

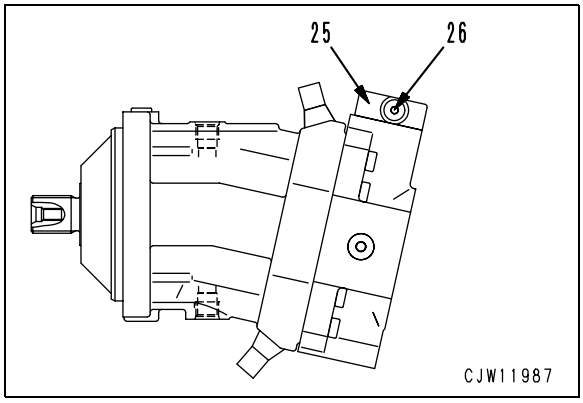


6. EP servo valve assembly and cover (HST motor 1)
   1) Cover
      i) Install plug (26) to cover (25).

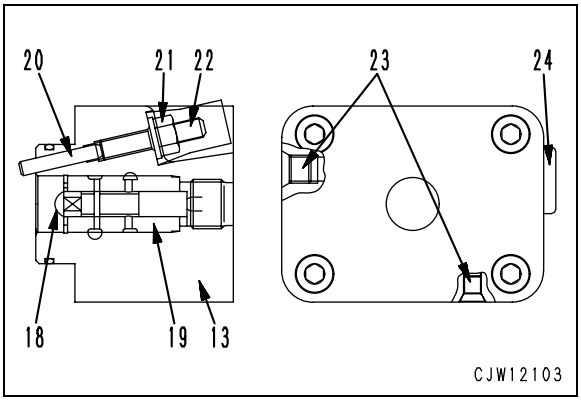
      Plug: **29 - 38 Nm {3.0 - 3.9 kgm}**

      ii) Install cover (25).

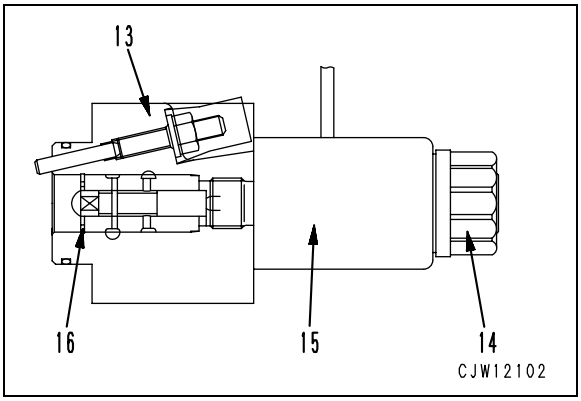
      Mounting bolt: **39 - 49 Nm {4.0 - 5.0 kgm}**



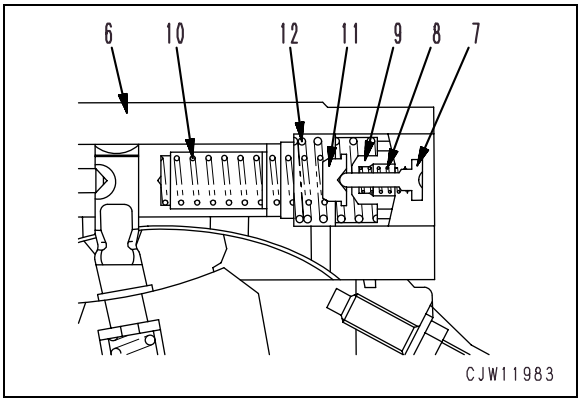
2) Assemble the housing assembly (5) according to the following procedure.
   i) Install plug (24) to housing (13).
   ii) Install pin (20).
   iii) Install bushing (19) and spool (18) to housing (13).
   ★ Plugs (23) are already in the houseing (13).



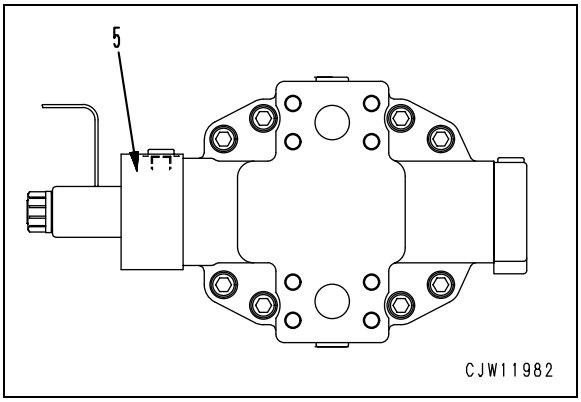
iv) Install snap ring (16), coil (15), and cap (14) in order to housing assembly (13).



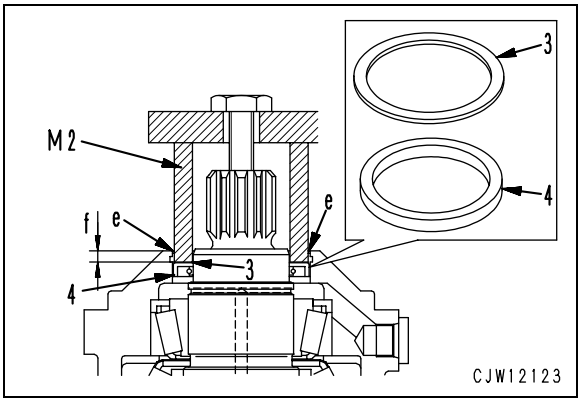
3) Install spring (10) and spring seat (11) to port plate (6).
4) Install spring (12) and spring seat (9).
5) Install spring (8) and spring seat (7).



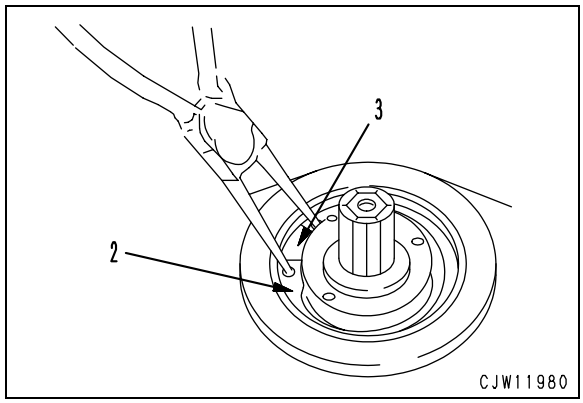
6) Install solenoid valve and housing assembly (5) with the 4 mounting bolts.



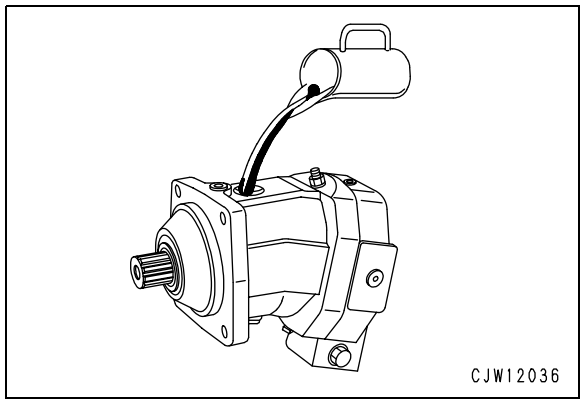
7. Seal (Common to HST motors 1 and 2)
   1) Before setting seal (4), measure depth f to the groove bottom of snap ring (2).
   2) Make a mark of insertion depth e of M2, f + thickness of shim (3), on pushtool M2.
   3) Using push tool M2, press fit seal (4).
   4) Install shim (3).



5) Install snap ring (2).



8. Filling with oil
   Fill up hydraulic aggregates with medium before start-up.



9. Tightening torque table

★ If the tightening torque of a mounting bolt, nut, or plug is not shown in this manual, see DISASSEMBLY, ASSEMBLY OF HST PUMP ASSEMBLY, Tightening torque table.

10. Before starting
    - Observe the operating instructions before starting.
    - Check the machine for remarkable faults.
    - Do not operate the machine with defective instruments, warning lights or control elements.
    - All safety devices must be in a secure position.
    - Do not carry with you movable objects or secure them to the machine.
    - Keep oily and inflammable material away from the machine.
    - Before entering the driver's cabin, check if persons or obstacles are beside or beneath the machine.
    - Be careful when entering the driver's cabin, use stairs and handles.
    - Adjust your seat before starting.

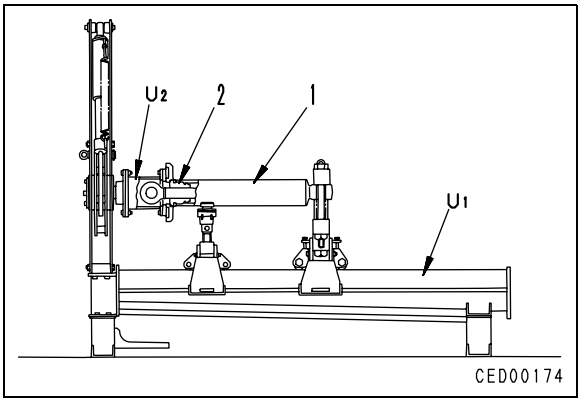
DISASSEMBLY, ASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

SPECIAL TOOLS

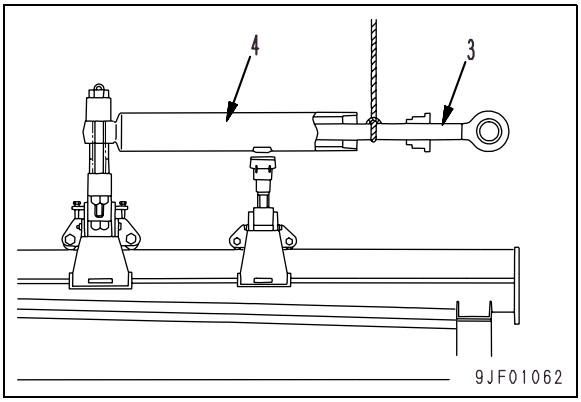
Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
U	1	790-502-1003	Repair stand	■	1		
		790-101-1102	Hydraulic pump	■	1		
	2	790-102-2303 or 790-102-3802	Wrench assembly (for steering)	■	1		
	3	790-302-1340	Socket (for boom)	■	1		
	4	790-201-1702	Push tool kit	■	1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
		790-201-1821	• Push tool (boom)		1		
		790-201-1831	• Push tool (bucket)		1		
		790-201-1741	• Push tool (steering)		1		
	5	790-201-1500	Push tool kit	■	1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
		790-201-1630	• Plate (boom)		1		
		790-201-1640	• Plate (bucket)		1		
		790-201-1550	• Push tool (steering)		1		
	6	790-720-1000	Expander	●	1		
	7	796-720-1680	Ring (boom and bucket)	●	1		
		07281-01589	Ring (boom and bucket)	●	1		
		796-720-1740	Ring (steering)	●	1		
		07281-00809	Ring (steering)	●	1		
	8	790-102-4300	Wrench assembly (for boom and bucket)	■	1		
		790-102-4310	Pin	■	2		

DISASSEMBLY

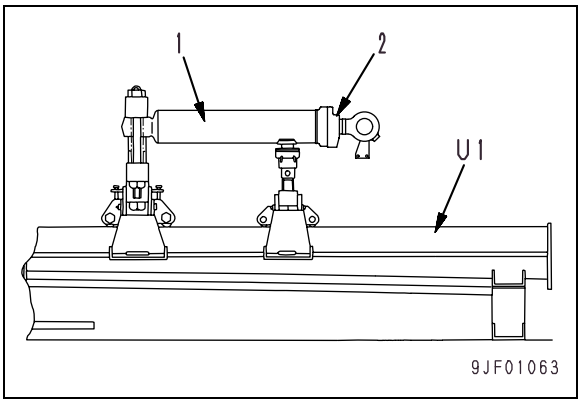
1. Cylinder assembly
   Set cylinder assembly (1) to tool **U1**.
2. Cylinder head and piston rod assembly (Steering cylinder)
   1) Using tool **U2**, remove cylinder head (2) from the cylinder.



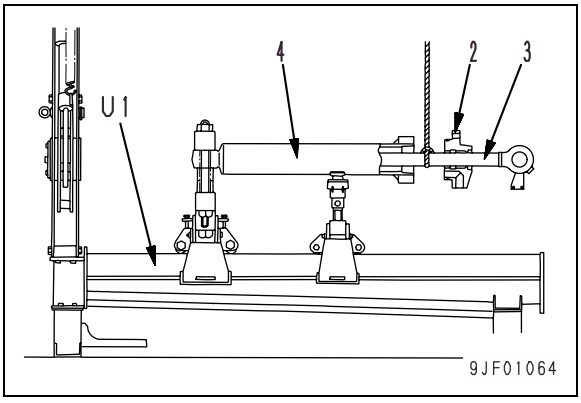
   2) Pull cylinder head and piston rod assembly (3) out of cylinder (4).
      ★ Since oil will flow out when the piston rod assembly is pulled out of the cylinder, prepare an oil receiver.



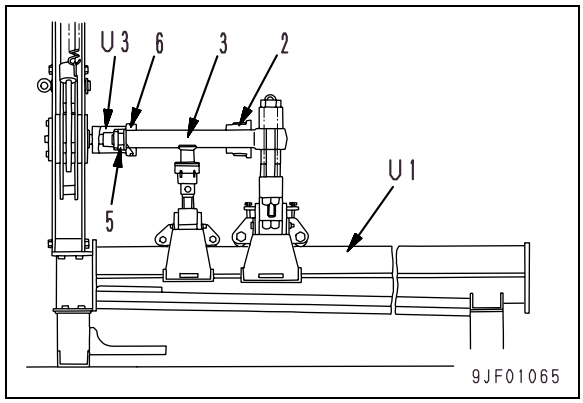
3. Cylinder head and piston rod assembly (Bucket cylinder and boom cylinder)
   1) Remove the mounting bolt of cylinder head assembly (2).
   • Width across flats of bolt: **24 mm**



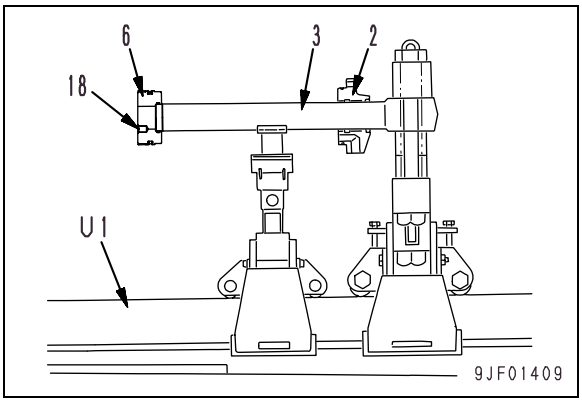
   2) Pull cylinder head and piston rod assembly (3) out of cylinder (4).
      ★ Since oil will flow out when the piston rod assembly is pulled out of the cylinder, prepare an oil receiver.

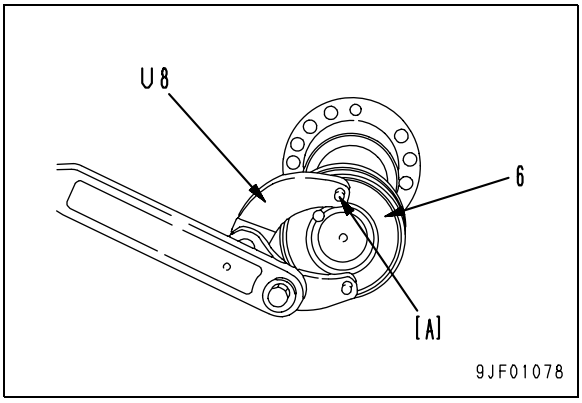


4. Piston and cylinder head (Steering cylinder)
   1) Set cylinder head and piston rod assembly (3) to tool U1.
   2) Using tool U3, remove nut (5).
      • Width across flats of nut (Steering): **46 mm**
   3) Remove piston assembly (6) and cylinder head assembly (2).



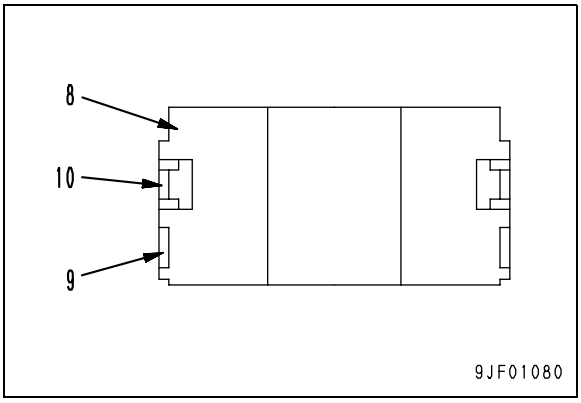
5. Piston and cylinder head (Bucket cylinder and boom cylinder)
   1) Set cylinder head and piston rod assembly (3) to tool **U1**.
   2) Remove lock screw (18) of the piston assembly.
      ★ Screw size: M12 x 1.75
      ★ If screw (18) is so caulked that it cannot be removed, tighten it and apply a tap to the threads of the piston assembly, and then remove it.
   3) Using tool **U8**, remove piston assembly (6).
   4) Remove cylinder head assembly (2).



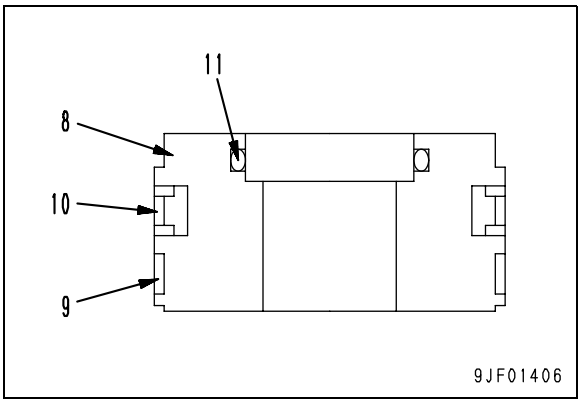


   ★ When not using tool U8, loosen the piston assembly by using 2 holes (B).
   • Hole (B): ϕ**10 mm**

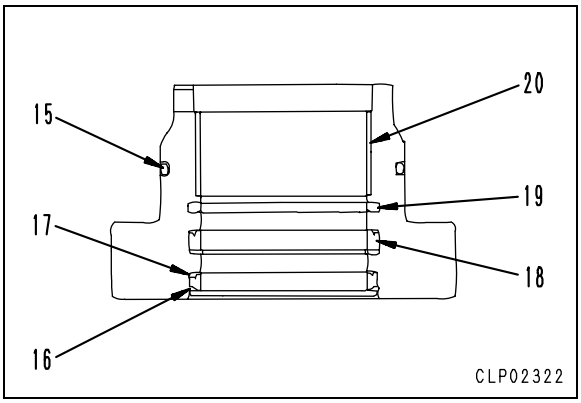
6. Disassembly of piston assembly
   1) Remove wear ring (9) and piston ring (10) from piston (8).



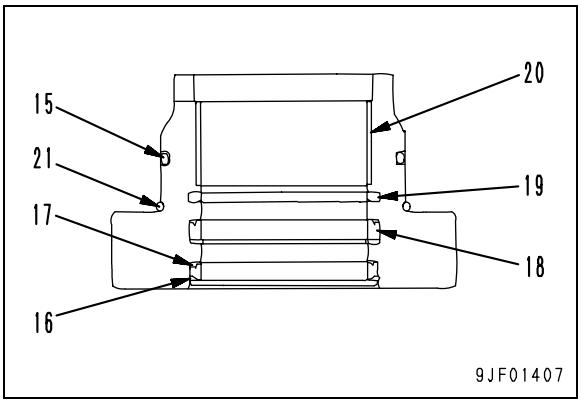
      ★ For only the bucket cylinder and boom cylinder.
   2) Remove O-ring and backup ring (11).



7. Disassembly of cylinder head assembly
   1) Remove O-ring and backup ring (15).
   2) Remove snap ring (16) and dust seal (17).
   3) Remove rod packing (18).
   4) Remove buffer ring (19).
   5) Remove bushing (20).
   6) Remove O-ring (21). (For only the steering cylinder)
      ★ Bucket cylinder and boom cylinder



★ Steering cylinder

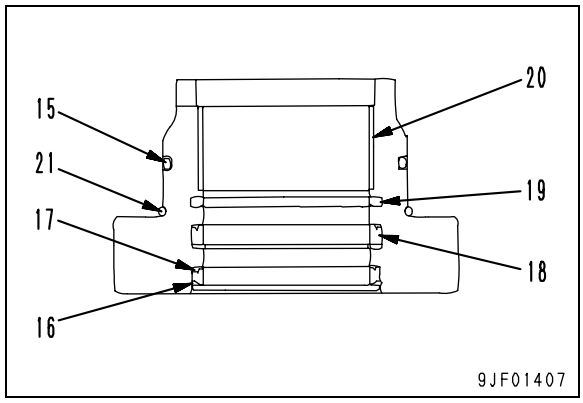


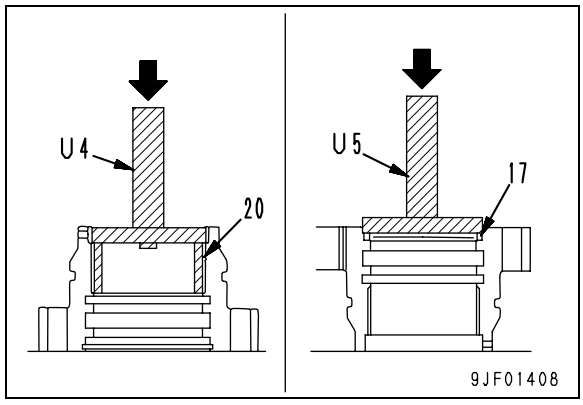
ASSEMBLY

★ Take care not to damage the packings, dust seals, O-rings, etc.

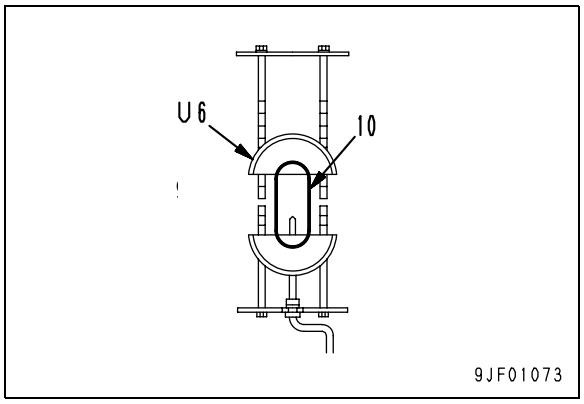
★ Do not insert each backup ring forcibly, but warm it in water at 50 - 60°C and then insert it.

1. Assembly of cylinder head assembly
   1) Using tool **U4**, press fit bushing (20).
   2) Install buffer ring (19).
   3) Install rod packing (18).
   4) Using tool **U5**, install dust seal (17) and secure it with snap ring (16).
   5) Install backup ring and O-ring (15).
      ★ For only the steering cylinder.
   6) Install O-ring (21).

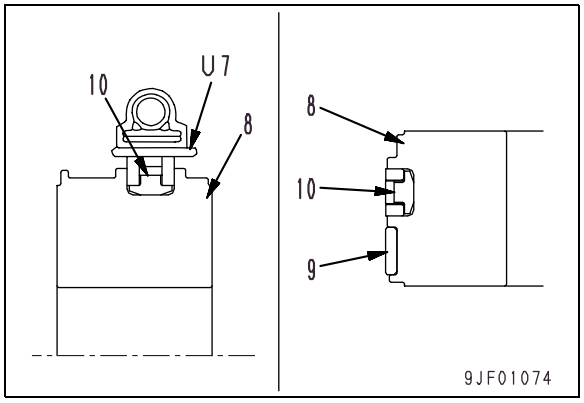




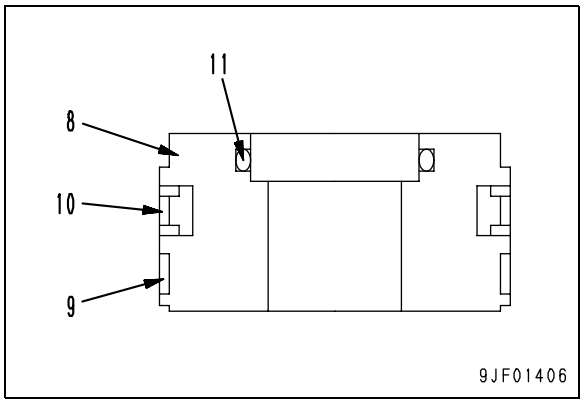
2. Assembly of piston assembly
   1) Using tool **U6**, expand piston ring (10).
      ★ Set the tool to the piston ring and turn its handle by 8 - 10 turns to expand the piston ring.



   2) Remove piston ring (10) from tool **U6** and install it to piston (8).
   3) Using tool **U7**, shrink piston ring (10).
   4) Install wear ring (9).



      ★ For only the bucket cylinder and boom cylinder.
   5) Install backup ring and O-ring (11).

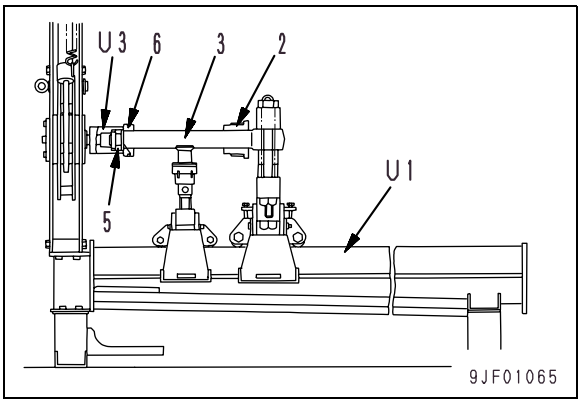


3. Assembly of cylinder head and piston rod assembly (Steering cylinder assembly)
   1) Set cylinder head and piston rod assembly (3) to tool **U1**.
   2) Install cylinder head assembly (2) and piston assembly (6) to the piston rod.
   3) Using tool **U3**, tighten nut (5) to the specified torque.
      ★ Degrease and clean the threads of nut (5) and piston rod.

      Threads of piston rod:
      Liquid adhesive (LOCTITE No. 262 or equivalent)

      • Width across flats of nut: **46 mm**

      Nut (Steering):
      785 ± 78.5 Nm {80 ± 8.0 kgm}



4. Assembly of cylinder head and piston rod assembly (Bucket cylinder and boom cylinder)
   1) Set piston rod (19) to tool **U1**.
   2) Install cylinder head assembly (2).
      • **When reusing the rod and piston assembly, assemble them according to the following procedure.**
   3) Using tightening tool **U8**, tighten piston assembly (6) until the screw holes are aligned.
      Go to 6).
      • **When replacing either or both of the rod and piston, assemble the new parts according to the following procedure.**
   4) Using tool **U8**, install piston assembly (6).

      When threading lock screw:
      294 ± 29.4 Nm {30 ± 3 kgm}

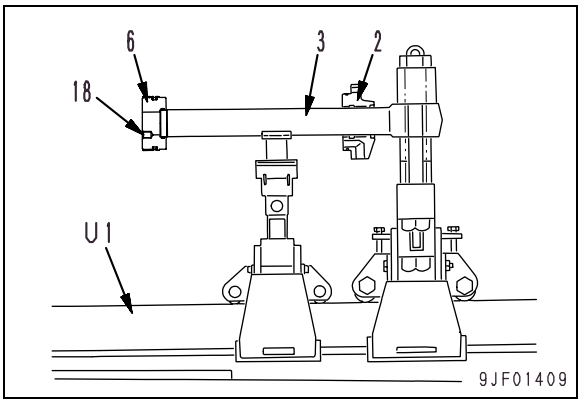
5) Make 1 screw hole to install screw (18).
★ Make 1 hole horizontally with a drill at the V-groove of the threaded parts of piston assembly (6) and rod (3).

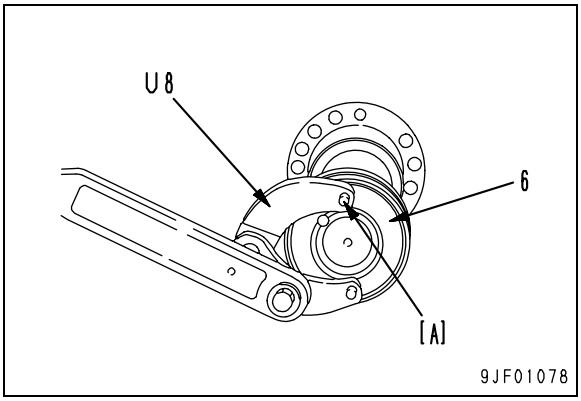
Diameter of tap drill hole	Depth of tap drill hole	Tap to be used	Tapping depth
10.3	27	12 X 1.75	20

6) Install lock screw (18) and caulk 4 points around it with a punch.
★ Degrease and clean the fitting part of the lock screw.

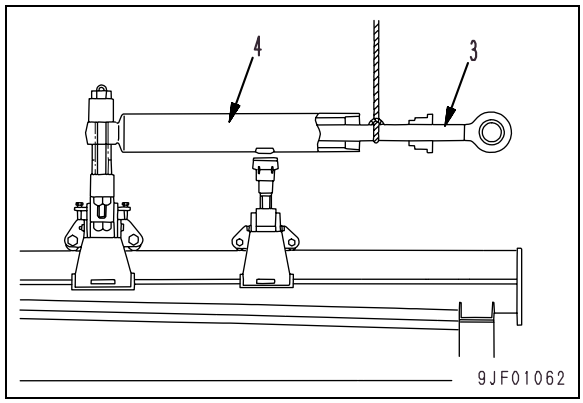
Threads of lock screw:
Liquid adhesive (LOCTITE No. 262 or equivalent)

Lock screw:
58.9 - 73.6 Nm {6 - 7.5 kgm}





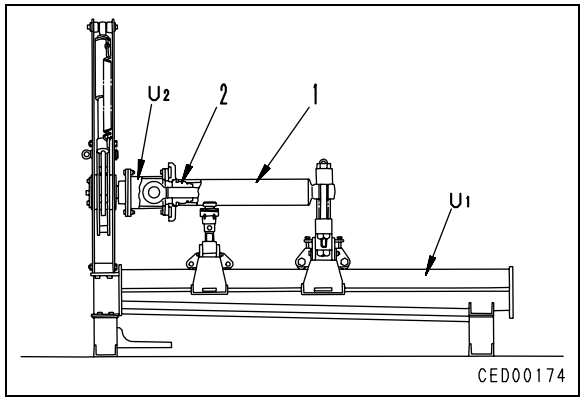
5. Cylinder head (Steering cylinder)
1) Set cylinder (4) to tool **U1**.
2) Sling cylinder head and piston rod assembly (3) and install cylinder (4).



3) Using tool **U2**, install cylinder head assembly (2) to the cylinder.

Cylinder head:
539 ± 54.0 Nm {55 ± 5.5 kgm}

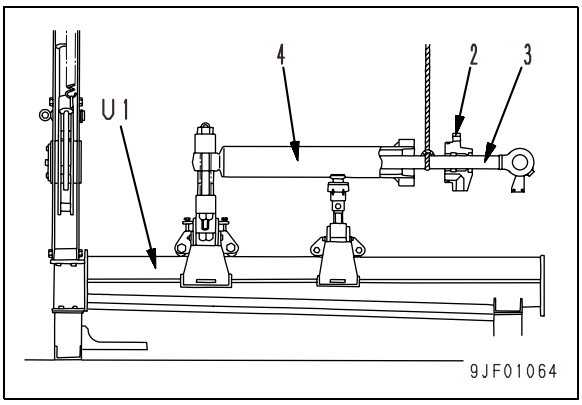
4) Remove cylinder assembly (1) from tool **U1**.



6. Cylinder head (Bucket cylinder and boom cylinder)
   1) Set cylinder (4) to tool **U1**.
   2) Sling cylinder head and piston rod assembly (3) and install cylinder (4).
   3) Install cylinder head assembly (2) to the cylinder.

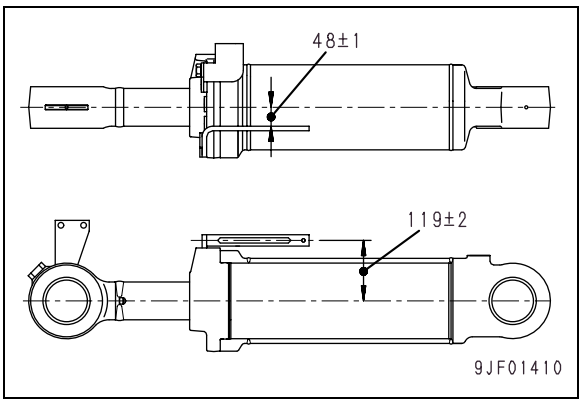
      Cylinder head (Bucket):
      250 ± 24.5 Nm {25.5 ± 2.5 kgm}

      Cylinder head (Boom):
      162 ± 14.5 Nm {16.5 ± 1.5 kgm}



★ For only the bucket cylinder.

   4) Tighten the bolts of the leveler plate so that the leveler plate will be installed as shown in the figure.



   5) Remove cylinder assembly (1) from tool **U1**.

REMOVAL, INSTALLATION OF OPERATOR'S CAB ASSEMBLY

SPECIAL TOOLS

Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
X	1	799-703-1200	Service tool kit	■	2		
		799-703-1100	Vacuum pump (100 V)	■	1		
		799-703-1110	Vacuum pump (220 V)	■	1		
		799-703-1120	Vacuum pump (240 V)	■	1		
		799-703-1400	Gas leak tester	■	1		

REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

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

Operate the work equipment control lever 2 - 3 times to release the residual pressure in the work equipment circuit.

Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

Connect tool X1 to the air conditioner compressor hose valve and collect the refrigerant (R134a).

Disconnect the cable from the negative (–) terminal of the battery.

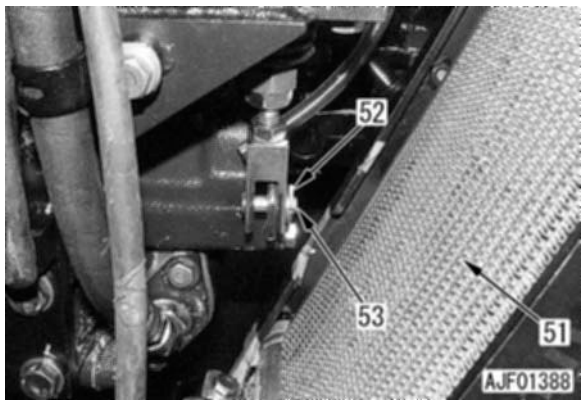
* The operator's cab and the floor frame of this vehicle are made as a unit.

1. Remove right and left fenders (1), right and left brackets (2), and left inspection cover (3).

2. Remove covers (4) and (5) from the right and left operator's cab.

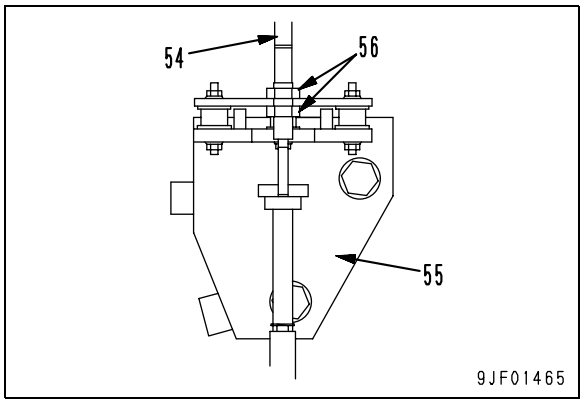
Keep in mind that you cannot apply the parking brake (the parking brake is released).

3. Turn the parking brake OFF (Release it).
4. Remove cotter pin (52) and pin (53) from the parking brake connecting part.
(Part (51) is the transfer oil cooler.) [*5]
   ★ These cotter pin and pin are at the front part of inside of the left rear wheel.

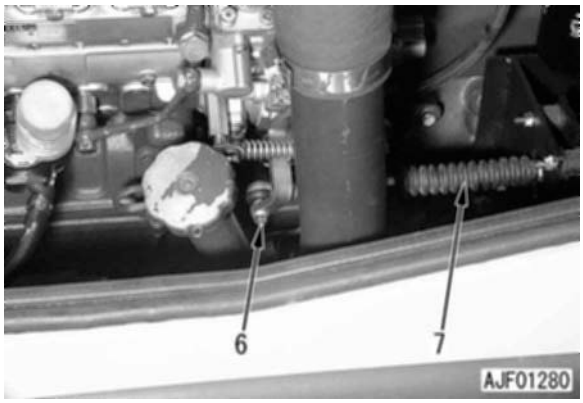


   ★ The left rear wheel is removed in the photo.

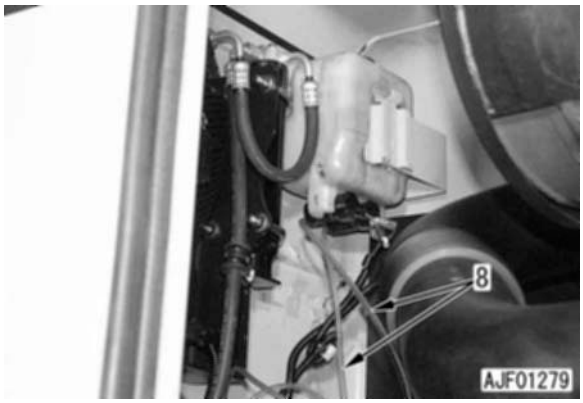
5. Measure the installed height of the parking brake wire up to locknut (56).
6. Loosen locknut (56) and disconnect parking brake wire (54) from parking brake bracket (55). [*6]



7. Open the engine right cover.
8. Remove fuel control cable mounting nut (6) and bracket locknut and disconnect fuel control cable (7) from the fuel injection pump. [*1]

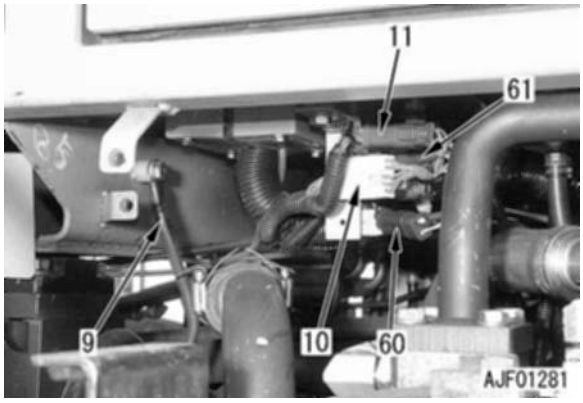


9. Disconnect 2 water hoses (8).



10. Disconnect cab ground wire (9) from the right side of the operator's cab.

11. Disconnect the following wiring connectors.
    ★ Right side of operator's cab
    - (10): FL1
    - (11): FL2
    - (60): FL3 (Emergency steering: If equipped)
    - (61): FL4 (Far side)

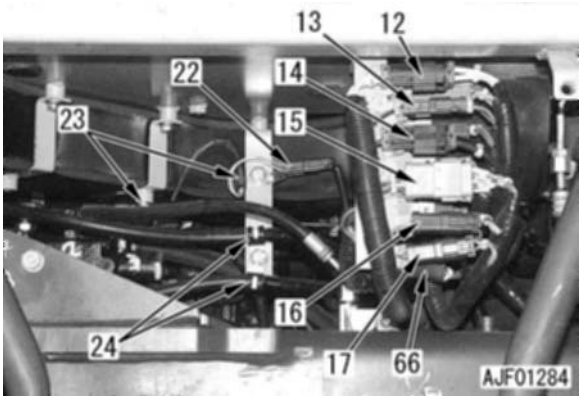


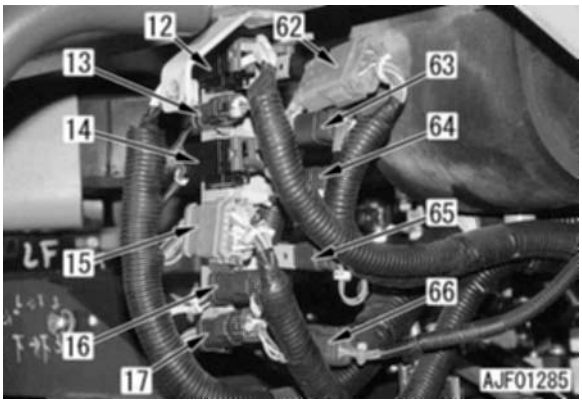
    ★ Left side of operator's cab

    From top of near side
    - (12): LR2
    - (13): LR1
    - (14): LR3
    - (15): LT1
    - (16): LT2
    - (17): LT3

    From top of far side
    - (62): LR4
    - (63): LR6
    - (64): LR5
    - (65): LR7
    - (66): BL1 | R1
    - (22): L34

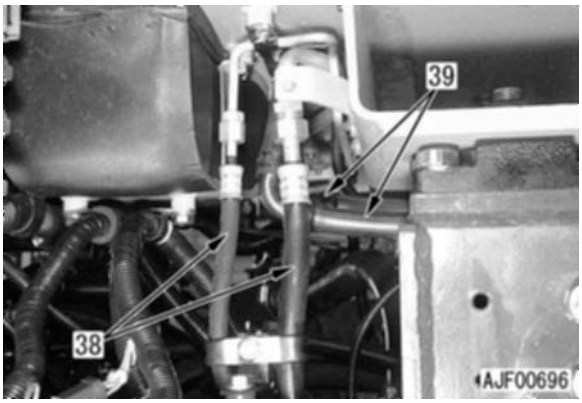
12. Disconnect wire clamp (23) and brake valve hose clamp (24).





13. Disconnect 2 air conditioner hoses (38).

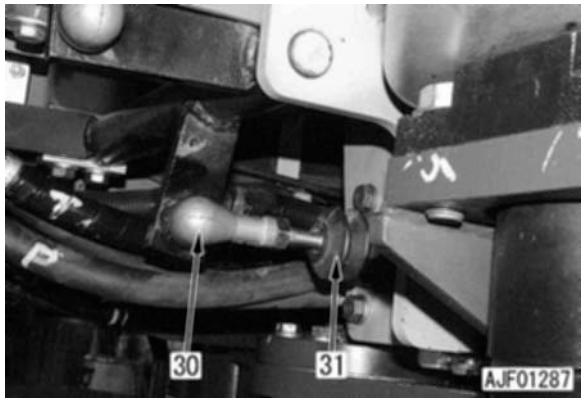
14. Disconnect 2 heater hoses (39).
    ★ Before disconnecting the hoses, put tags to them and check their mounting positions.



15. Disconnect wire clamp (67).

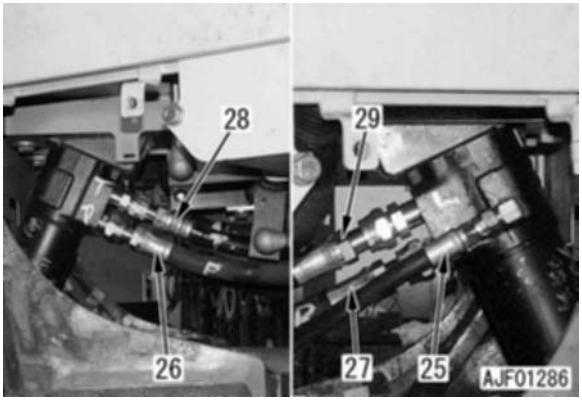
16. Remove the locknut and disconnect brake valve linkage (30). [*2]

17. Remove the mounting bolt and place brake valve (31) on the frame.

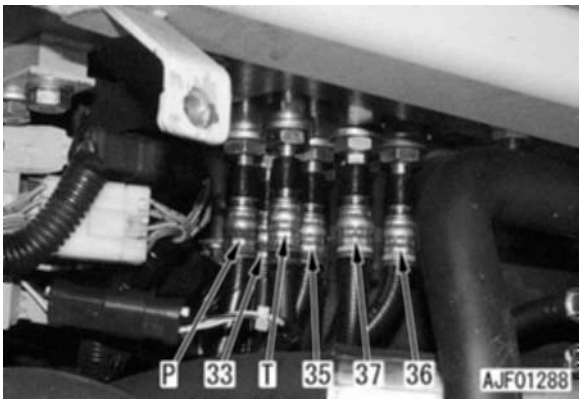


18. Disconnect hoses (25) - (29) from the orbit-roll valve.
    - (25): Port LS hose (Right)
    - (26): Port P hose (Left lower)
    - (27): Port R hose (Right lower)
    - (28): Port T hose (Left upper)
    - (29): Port L hose (Right upper)

    [*3]
    ★ Before disconnecting the hoses, put tags to them and check their mounting positions.
    ★ Since oil will flow out of the disconnected hoses and tubes, prepare an oil receiver.



19. Disconnect 8 PPC hoses (32) - (37), P, and T.
    ★ Since oil will flow out of the disconnected hoses and tubes, prepare an oil receiver.



    ★ Layout of hose Nos. (Seen from right below)

●37 ●36
●T => Front of chassis
●35 ●34
●P
●33 ●32

    ★ The band colors of PPC hoses (32) - (37) and hoses T and P are as follows.

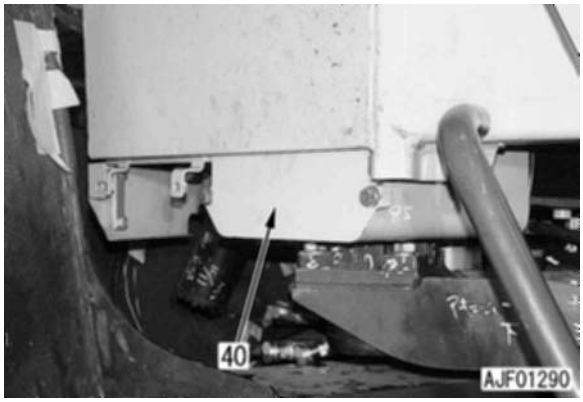
    1) Work equipment control lever specification: 2-lever
    2) Work equipment control lever specification: 3-lever (If equipped)

No.	Connecting point	Band color
(32)	(PULL)	(Green)
(33)	(PUSH)	(White/Red)
(34)	Bucket DUMP	Blue
(35)	Bucket TILT	Red
(36)	Boom LOWER	Orange
(37)	Boom RAISE	Yellow
(P)	Pump	Red/Blue
(T)	Tank	Blue/Black

    3) Work equipment control lever specification: joystick (If equipped)

No.	Connecting point	Band color
(32)	Boom LOWER	Orange
(33)	Bucket TILT	Red
(34)	Bucket DUMP	Blue
(35)	Boom RAISE	Yellow
(36)	(PULL)	(Green)
(37)	(PUSH)	(White/Red)
(P)	Pump	Red/Blue
(T)	Tank	Blue/Black

20. Remove 2 right and left mount covers (40).



21. Remove 4 operator's cab mounting nuts (41).[*4]

22. Lift off operator's cab assembly (42).
    ★ Check that all the wires and pipes are disconnected.

    Operator's cab: **810 kg**

INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

★ Adjust the fuel control cable. For details, see TESTING AND ADJUSTING, Testing and adjusting fuel accelerator pedal assembly.

Mounting nut of ball joint: **11.8 - 14.7 Nm {1.2 - 1.5 kgm}**

Locknut: **44 - 59 Nm {4.5 - 6.0 kgm}**

[*2]

★ Adjust the brake linkage. For details, see TESTING AND ADJUSTING, Testing and adjusting brake pedal linkage.

[*3]

★ Orbit-roll valve hoses

Port LS: **14.7 - 24.5 Nm {1.5 - 2.5 kgm}**

Ports P, R, T, and L: **53.9 - 73.5 Nm {5.5 - 7. 5 kgm}**

[*4]

Operator's cab mounting nut: **824 - 1030 Nm {84 - 105 kgm}**

[*5]

★ After inserting cotter pin (52) in pin (53), open it to 180 degrees.

[*6]

Parking brake wire locknut: **34.3 - 58.8 Nm {3.5 - 6.0 kgm}**

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

  
  Hydraulic tank: **89 ℓ**

- **Bleeding air from PPC circuit**
  Hold the work equipment control lever to a stroke end to relieve the oil for about 1 minute. Perform this operation once for each stroke end of the work equipment control lever.

- **Refilling with water**
  Add water through the water filler to the specified level. Run the engine to circulate the water through the system. Then, check the water level again..

- **Charging air conditioner with refrigerant**
  Using tool **X1**, charge the air conditioner circuit with refrigerant (R134a).

REMOVAL, INSTALLATION OF OPERATOR'S CAB GLASS (STUCK GLASS)

SPECIAL TOOLS

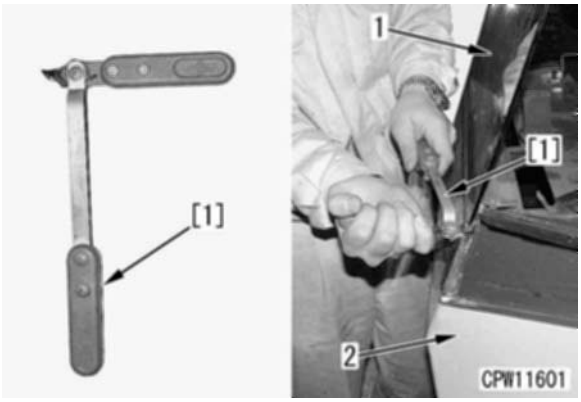
Symbol			Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
X	2	1	793-498-1120	Clear plate	■	2		
		2	793-498-1130	Plate	■	2		
		3	793-498-1110	Magnet	■	2		
	3		793-498-1210	Lifter (Suction cups)	■	2		

REMOVAL

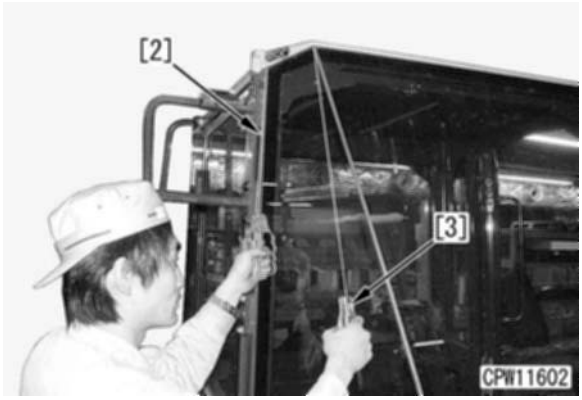
★ All sides of each glass of the operator's cab of this vehicle are stuck.

★ Remove the window glass to be replaced according to the following procedure.

1. Using seal cutter [1], cut the adhesive between broken window glass (1) and operator's cab (2).

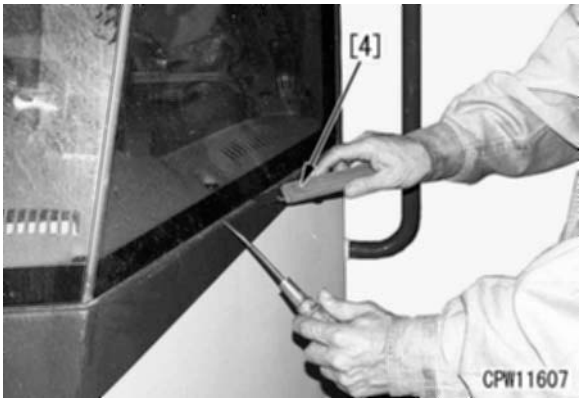


★ If the glass is narrow, you may cut the adhesive by the following method. Insert a fine wire [2] (piano wire, etc.) in the adhesive and grip its both ends with priors [3], etc. (or hold them by winding them onto something) and cut the adhesive with the wire.



★ The broken window glass may be removed with knife [4] and a screwdriver. (If the screwdriver is applied directly to the normal window glass, the glass will be broken.)

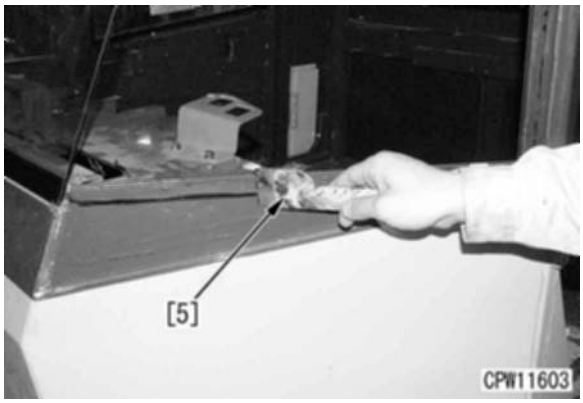
★ When using knife [4], insert a screwdriver in the cut to widen it and move the knife forward.



2. Remove the window glass.

INSTALLATION

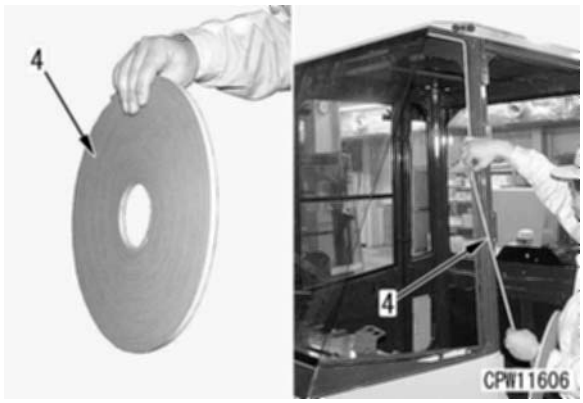
1. Using scraper [5], remove the remaining adhesive.
   ★ Do not scratch the paint.



2. Remove oil, dust, dirt, etc. from the sticking surfaces of cab (2) and window glass (3) with white gasoline.
   ★ If the sticking surfaces are not cleaned well, the glass may not be stuck perfectly.
   ★ Clean the all black part on the back side of the window glass.
   ★ After cleaning the sticking surfaces, leave them for at least 5 minutes to dry.

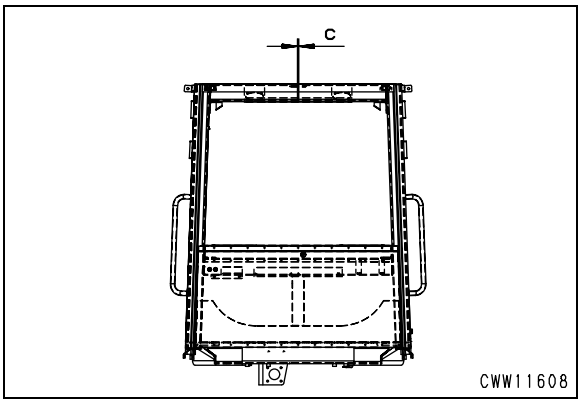
3. When the adhesive was removed with the scraper, if any paint was flaked off, coat the bare part with paint.
   ★ If the glass is installed without repairing the bare part, that part will be rusted.
   ★ Do not apply paint to a part which will be coated with primer.

4. Stick both-sided adhesive tape (4) along the inside edge of the glass sticking section.
   • Size of both-sided adhesive tape: 7 x 4.8 mm
   ★ When sticking the both-sided adhesive tape, do not touch the cleaned surface as long as possible.
   ★ Do not remove the release tape of the both-sided adhesive tape on the glass sticking side before sticking the glass.

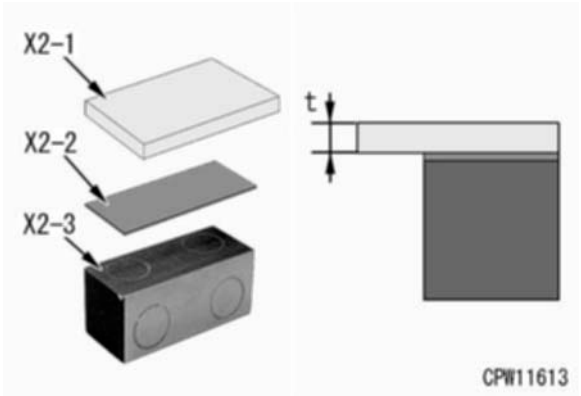


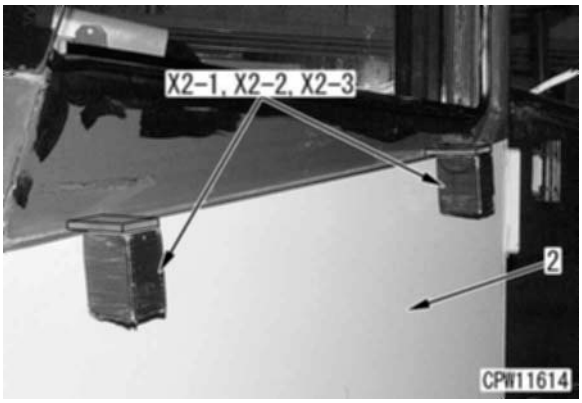
   ★ Take care the corner (part "b") of both-sided adhesive tape will not float.

★ When sticking the both-sided adhesive tape around a side or a rear window glass, start at center of the top and make a clearance of about 5 mm at end joint (c).

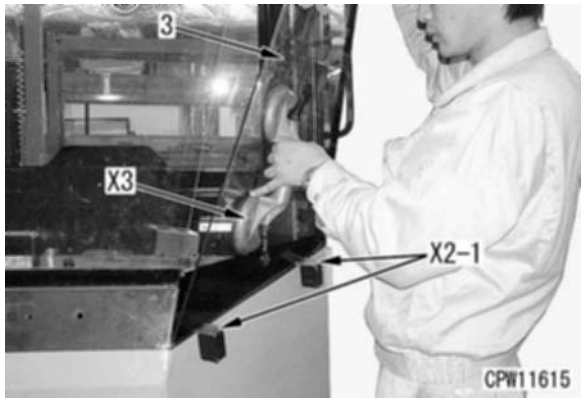


5. Position the replacement glass.
   1) Stick **X2-2** (thin steel sheet) to tool **X2-1** (spacer) with adhesive.
      • Spacer thickness (t): 5 mm
   2) Match tool **X2-3** (magnet) to tools **X2-1** and **X2-2** and set them to the 2 lower places of the window glass sticking part of operator's cab (2).

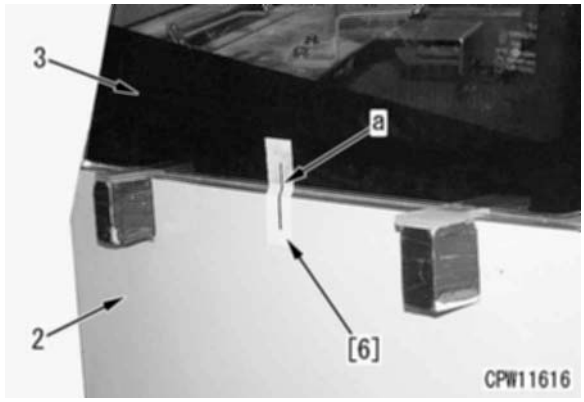




   3) Using tool **X3** (suction cups), place window glass (3) on tool **X2-1** (5 mm spacer) and match it to the operator's cab.

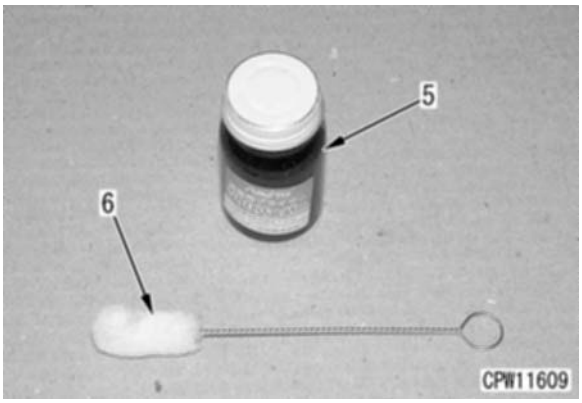


   4) Check the clearance between window glass (3) and operator's cab (2) on both sides and adjust it evenly.
   5) Stick tape [6] between window glass (3) and operator's cab (2) and draw positioning line "a".
   6) Cut the tape between window glass (3) and operator's cab (2) with a knife, and then remove the window glass.
      ★ Do not remove the tapes left on the window glass and operator's cab before installing the window glass.



6. Apply primer.
   ★ The using limit of primer (5) is 4 months after the date of manufacture. Do not use primer (5) after this limit.
   ★ Use the primer within 2 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.)

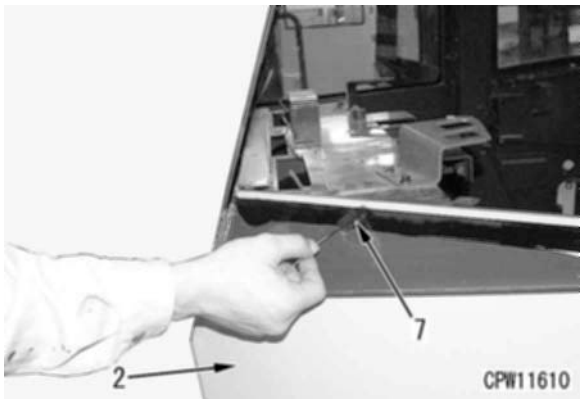
1) Stir the primers for paint and glass sufficiently before using them.
   ★ If the primer has been stored in a refrigerator, leave it at the room temperature for at least half a day before stirring it. (If the primer is unpacked just after taken out of the refrigerator, water will be condensed. Accordingly,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

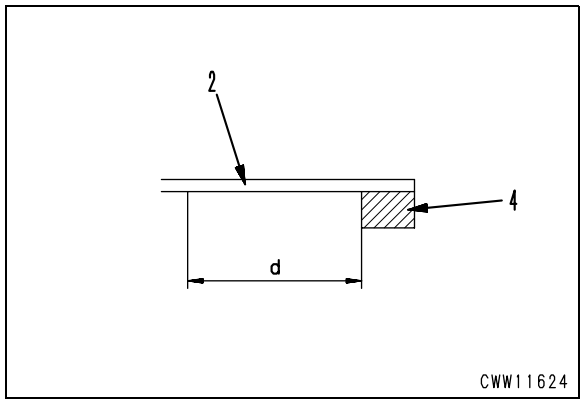


3) Evenly apply paint primer (7) to the parts on the outside of both-sided adhesive tape on operator's cab (2) which will be coated with the adhesive.

   Paint primer: **SUNSTAR PAINT PRIMER 580 SUPRE**

   ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)
   ★ Parts to be coated with primer: Apply the primer all over dimension (d) on the outside of the both-sided adhesive tape.
      • Dimension to apply primer (d): 23 mm
   ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.
   ★ If the glass primer is applied by mistake, wipe it off with white gasoline. (If wrong primer is applied, the glass will not be stuck.)

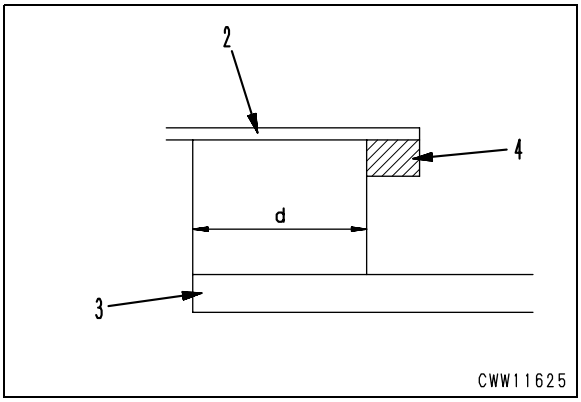


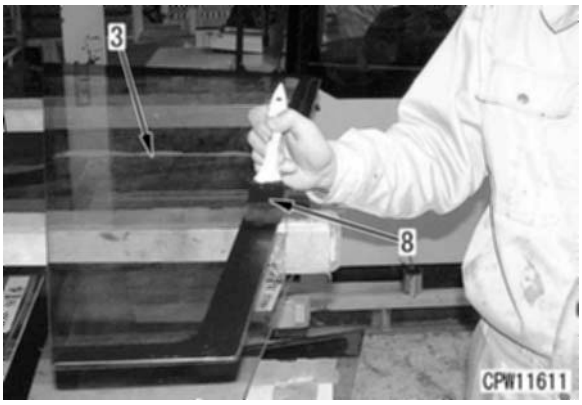


4) Evenly apply glass primer (8) to the black part of window glass (3) to be stuck.

   Glass primer: **SUNSTAR GLASS PRIMER 580 SUPRE**

   ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)
   ★ Parts to be coated with primer: Apply the primer to the sticking surface of window glass (3) and all over dimension (d) on both-sided adhesive tape (4) and operator's cab (2).
      • Dimension to apply primer (d): 23 mm
   ★ Do not apply the primer to the boarder about 5 mm wide between the black part and transparent part of the glass.
   ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.
   ★ If the paint primer is applied by mistake, wipe it off with white gasoline. (If wrong primer is applied, the glass will not be stuck.)





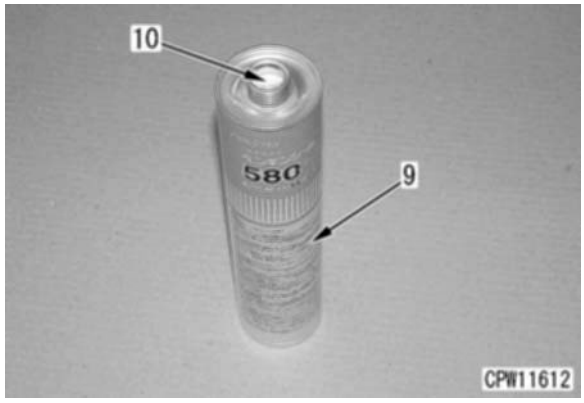
7. Apply adhesive.
   ★ Use either of the 2 types of the adhesive.

   Adhesive (Summer):
   SUNSTAR PENGUINE SEAL 580 SUPER "S"

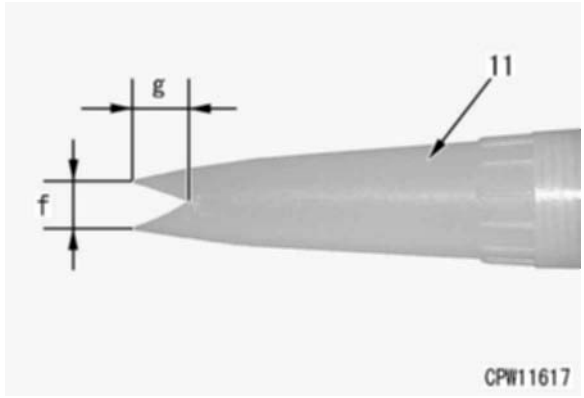
   Adhesive (Winter):
   SUNSTAR PENGUINE SEAL 580 SUPER "W"

   ★ The using limit of the adhesive is 4 months after the date of manufacture. Do not use the adhesive after this limit.
   ★ Keep the adhesive in a dark place where the temperature is below 25°C.
   ★ Never heat the adhesive higher than 30°C.
   ★ When reusing the adhesive, remove the all hardened part from the nozzle tip.

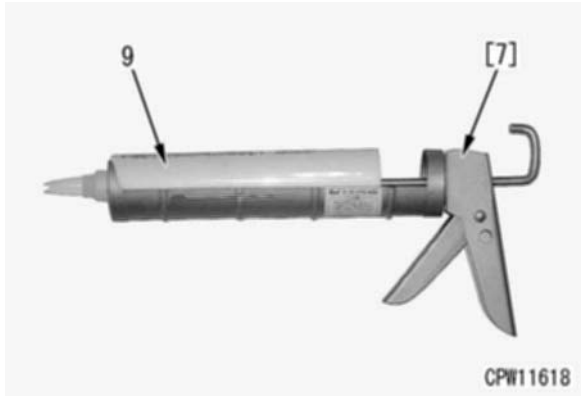
1) Break aluminum seal (10) of the outlet of adhesive cartridge (9) and install the nozzle.



2) Cut the tip of the adhesive nozzle (11) so that dimensions (f) and (g) will be as follows.
   - Dimension (f): 10 mm
   - Dimension (g): 12 mm

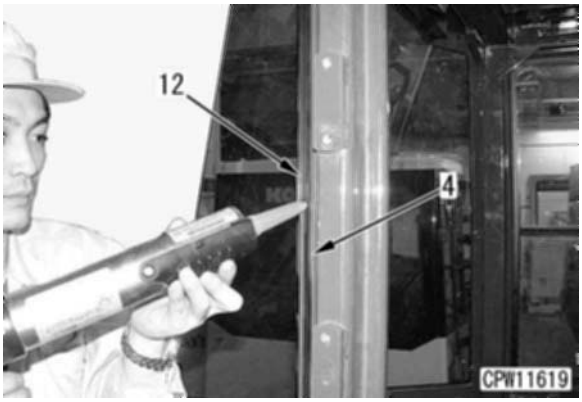


3) Set adhesive cartridge (9) to caulking gun [7].
   ★ An electric caulking gun is more efficient.

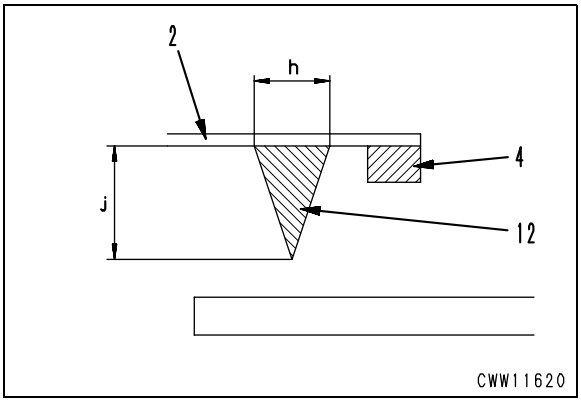


4) Remove release tape (13) of the both-sided adhesive tape on the glass side.

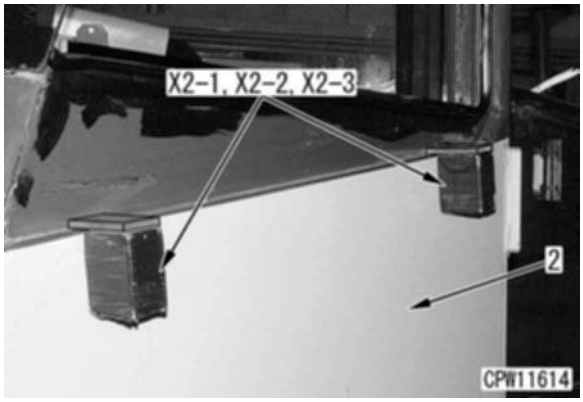
5) Apply adhesive (12) to the outside of both-sided adhesive tape (4) of the operator's cab.
   ★ Before applying the adhesive, check that the primer is applied to the surface to which the adhesive will be applied.



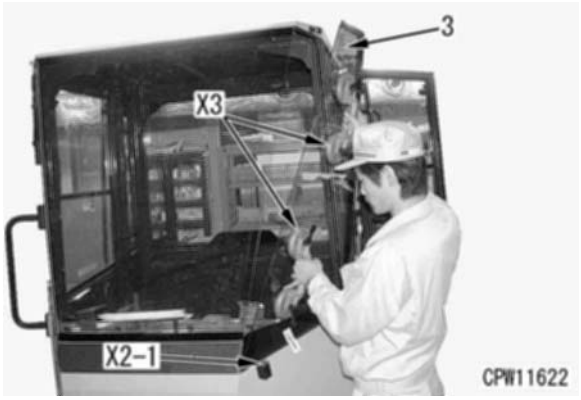
   ★ Apply adhesive (12) to dimensions (h) and (j) of both-sided adhesive tape (4) of operator's cab (2).
      • Dimension (h): 10 mm
      • Dimension (j): 12 mm (Approx. twice as high as adhesive tape)
   ★ Apply adhesive (12) higher than both-sided adhesive tape (4).
   ★ Apply the adhesive evenly.



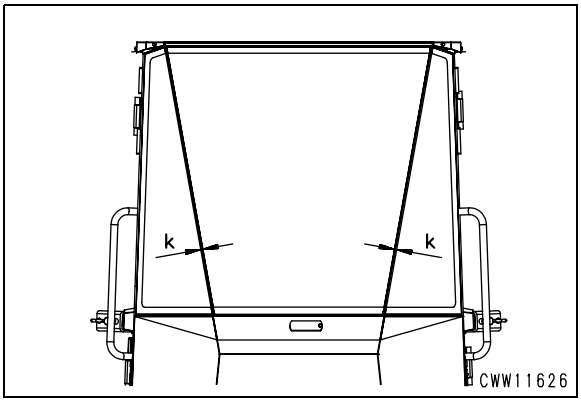
8. Install window glass (3).
   ★ If the glass is positioned wrongly, the adhesive must be removed and cleaned, and then the primer and adhesive must be applied again. Accordingly, position the glass carefully when sticking it.
   1) Similarly to step 1, match tools **X2-1**, **X2-2**, and **X2-3** and set them to the 2 lower places of the window glass sticking part of operator's cab (2).



   2) Using tool **X3**, raise and place window glass (3) on tool **X2-1** (5-mm spacer) and stick it to the operator's cab.
      ★ Match the lines of the match tapes stuck in step 1.
      ★ Stick the glass within 10 minutes after applying the adhesive.
      ★ Before sticking the glass, check that the primer is applied to the surface to which the glass will be stuck.



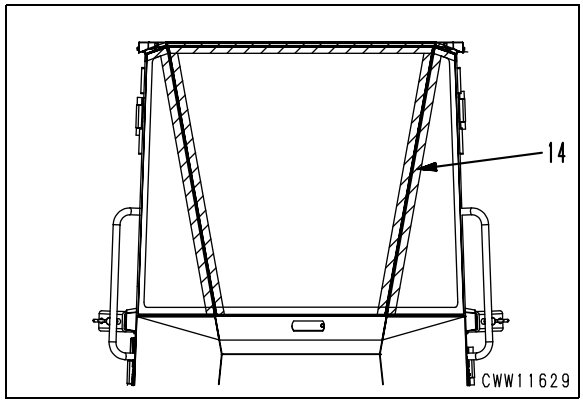
★ Check clearance (k) between the front side of the front glass and each side and adjust it evenly.
- Clearance (k): 5 mm



3) After sticking window glass (3), press it evenly.
★ Press all over the window glass to the degree that the window glass will be stuck to the both-sided adhesive tape.
★ Do not press the window glass to strongly.

9. Cure the stuck window glass for a certain time.
★ Curing time before removing tool **X2-1** (5-mm spacer) (at temperature of 20°C and humidity of 60%): **10 hours**
★ Curing time before operating vehicle: **1 day**

10. If the front glass and both front glasses are replaced, seal them.
1) Stick masking tapes (14) along the parts to be sealed shown in the figure.
★ Stick the masking tapes to both inside and outside of the operator's cab.



2) Fill the joint of the glasses with caulking material (15).
   ★ The usable period of the following caulking material is 4 months after the date of manufacture. Do not use the caulking material after its usable period.

   Caulking material: **SUNSTAR PENGUINE SEAL NO. 2505**

3) Remove the caulking material projected from the joint with cardboard [8], etc.

4) Remove the masking tapes from the window glass.

11. Remove the primer and adhesive from the operator's cab and window glass.
   ★ Using white gasoline, wipe off the adhesive before it is dried up.
   ★ When cleaning the glass, do not give an impact to it.

COATING MATERIALS

Category	Komatsu code	Part No.	Q'ty	Container	Main applications, featuresr	
Primer	SUNSTAR, PAINT PRIMER 580 SUPER	417-926-3910	20 mℓ	Glass container	For sticking cab glass	• Used as primer for cab. (Using limit: 4 months)
	SUNSTAR, GLASS PRIMER 580 SUPER		20 mℓ	Glass container		• Used as primer for cab. (Using limit: 4 months)
Adhesive	SUNSTAR, PENGUINE SEAL 580 SUPER "S" or "W"		320 mℓ	Polyethylene container		• "S" and "W" are used as adhesive for glass at high temperature (summer) and low temperature (winter) respectively. (Using limit: 4 months)
	SIKA JAPAN, SIKAFLEX 256 HV	20Y-54-39850	310 mℓ	Polyethylene container		• Used as adhesive for glass. (Using limit: 6 months)
Caulking material	SUNSTAR, PENGUINE SEAL NO. 2605	417-926-3920	320 mℓ	Polyethylene container		• Used to seal joint of glasses (Using limit: 4 months)
	SEKISUI SILICONE SEALANT	20Y-54-55130	333 mℓ	Polyethylene container		• Used to seal front window (Using limit: 6 months)

REMOVAL, INSTALLATION OF CENTER HINGE PIN

SPECIAL TOOLS

Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
Y	1	790-101-5201	Push tool kit	■	1		
		• 790-101-5281	• Plate		1		
		• 790-101-5221	• Grip		1		
		• 01010-51225	• Bolt		1		
	2	793-840-1410	Push tool kit	■	1		
	3	793-840-1420	Push tool kit	■	1		
	4	793-415-1180	Push tool kit	■	1		

REMOVAL

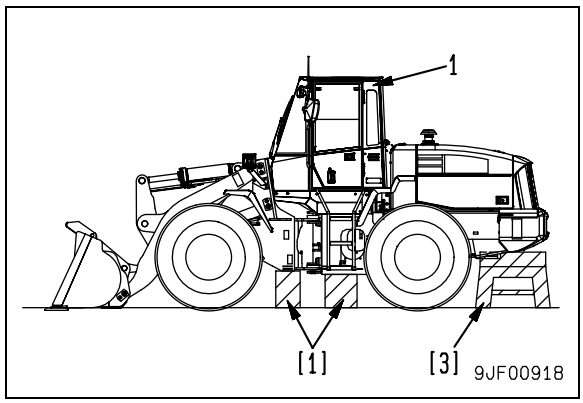
Stop the vehicle on a level place and set the safety bar to the frame.

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

Disconnect the cable from the negative (–) terminal of the battery.

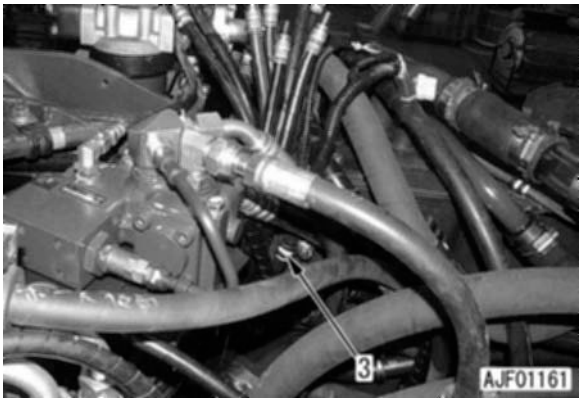
1. Raise the front part of the chassis with the work equipment and set blocks [1] under the frame at the rear of the front wheel to float the front part of the chassis.

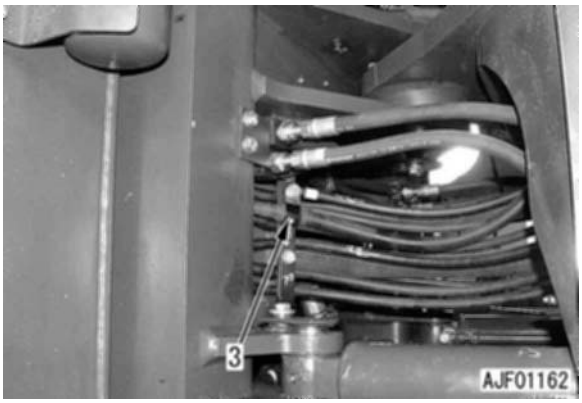
2. Set the work horizontally, place blocks [1] under both sides of the rear frame, raise the counterweight with hydraulic jack [2], and set stands [3].



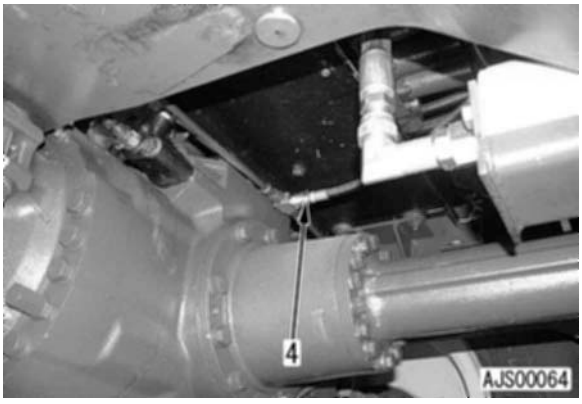
3. Remove operator's cab assembly (1). For details, see Removal of operator's cab assembly.
4. Remove work equipment valve top cover (2).

5. Disconnect all wiring harness clamps (3) between the front frame and rear frame from the rear frame.
   ★ Disconnect all wiring harness clamps (3) on the rear frame side. (Not all the wiring harness clamps to be disconnected are shown in the photo.)

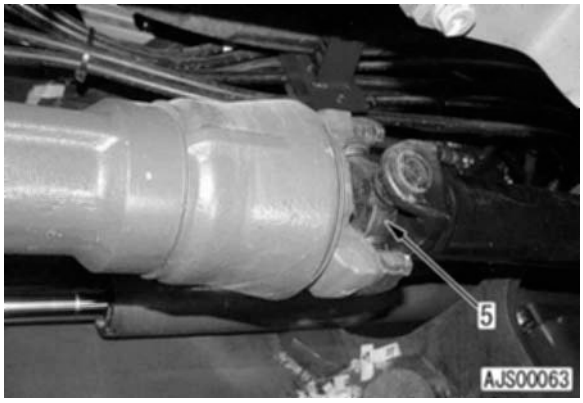




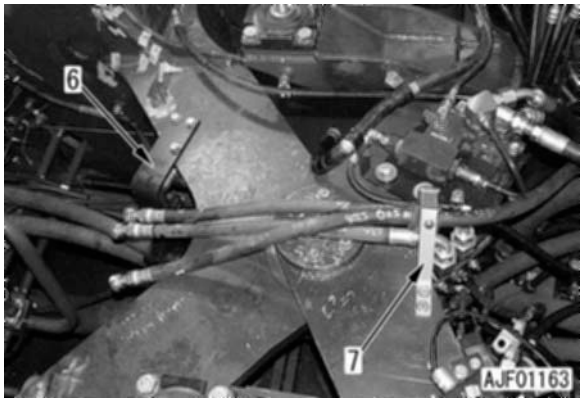
6. Disconnect brake hose (4). [*1]



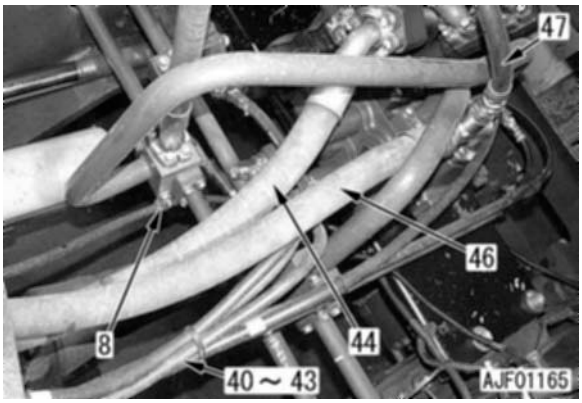
7. Disconnect front drive shaft (5). [*2]

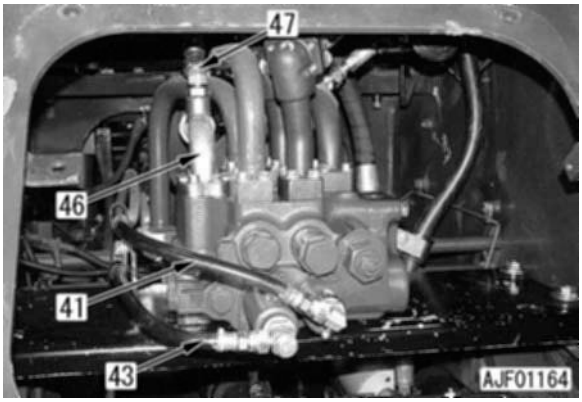


8. Remove 2 hose clamp brackets (6) and (7).

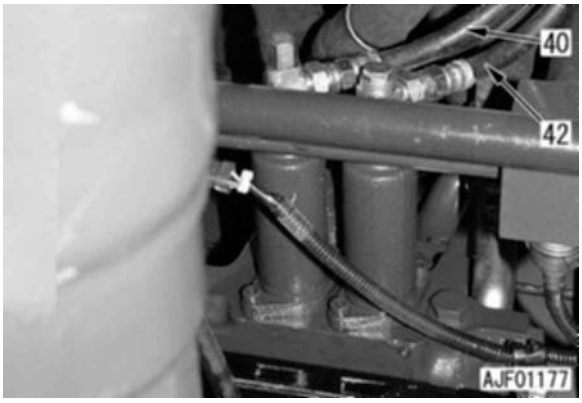


9. Remove brake hose clamp (8).
10. Disconnect PPC hoses (40) - (43) from the work equipment valve. [*3]
11. Disconnect port P hose (40) and port T hoses (46) and (47).
    ★ Since oil will leak through the disconnected hoses and tubes, prepare oil receivers.

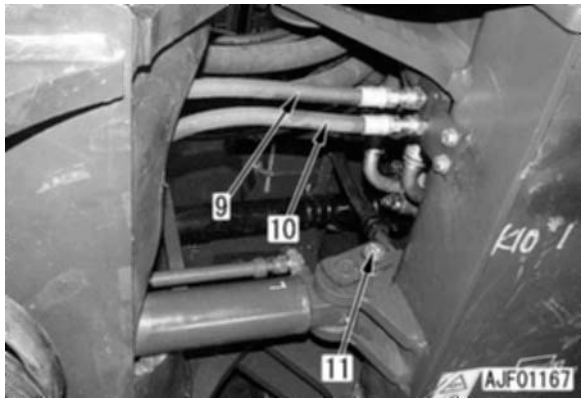




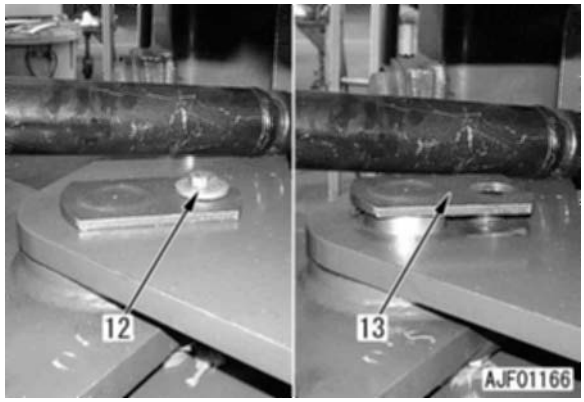
★ This is the view from the rear lower part of the work equipment valve.



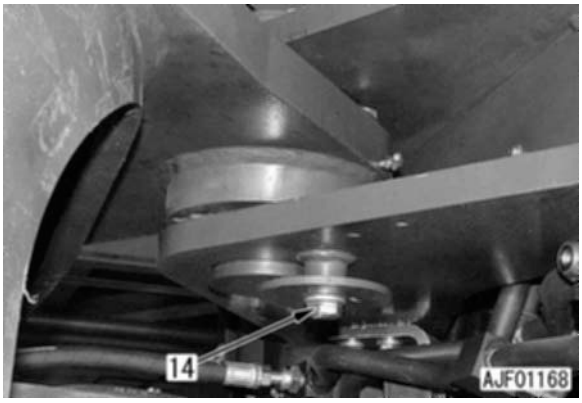
12. Remove pins (11) and hoses (9) and (10) from the bottom side of the right and left steering cylinders, and then disconnect the right and left steering cylinders. [*4]
    ★ Check the thickness and quantity of the shims.



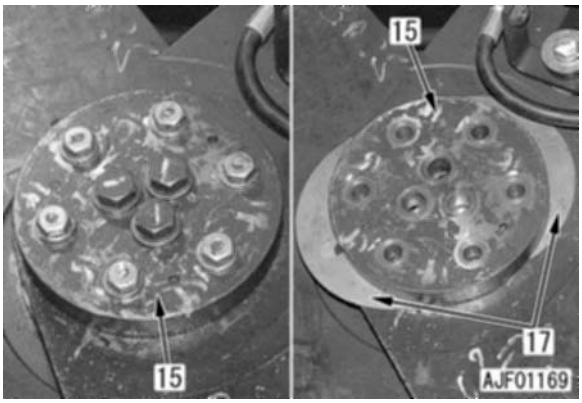
13. Remove the lower hinge pin. [*5]
    1) Remove lock bolt (12).
    2) Remove lower hinge pin (13).



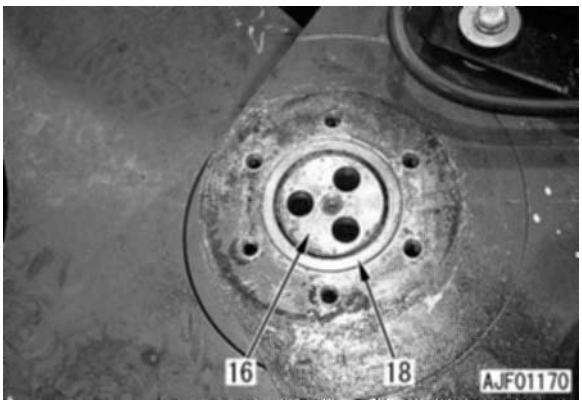
14. Remove the upper hinge pin. [*6]
    1) Remove mounting bolt (14).



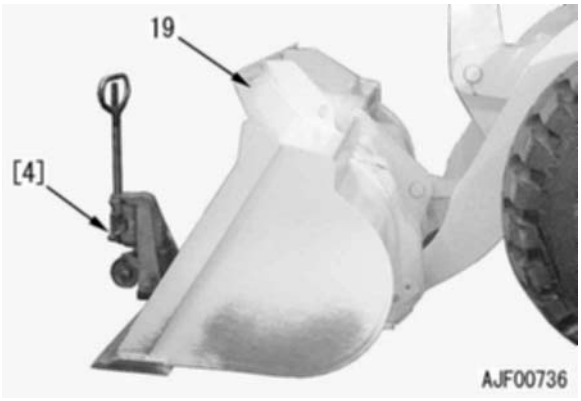
    2) Remove the mounting bolts, cover (15), and shim (17).
       ★ Check the thickness and quantity of the shims.



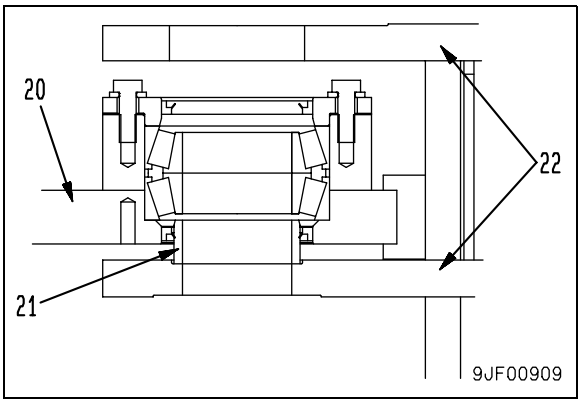
    3) Adjust the height of the front frame and rear frame with the hydraulic jack so that you can pull out the pin easily, and then remove upper hinge pin (16). [*7]
    4) Remove upper spacer (18).



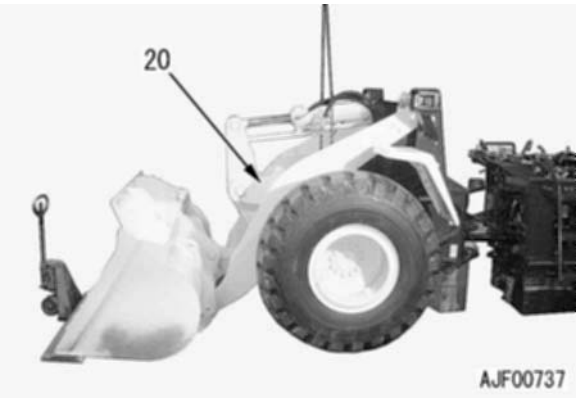
15. Disconnect the front frame and rear frame. [*8]
    1) Set hand lift truck [4] under bucket (19).



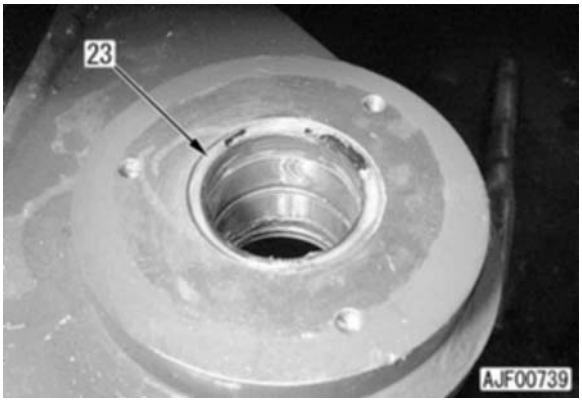
    2) Using a bar, etc., raise front frame assembly (20) by 2 - 3 mm to move lower spacer (21) under the upper hinge from rear frame assembly (22).
       ★ You may raise the front frame assembly by 2 - 3 mm with a large-sized crane, if available.



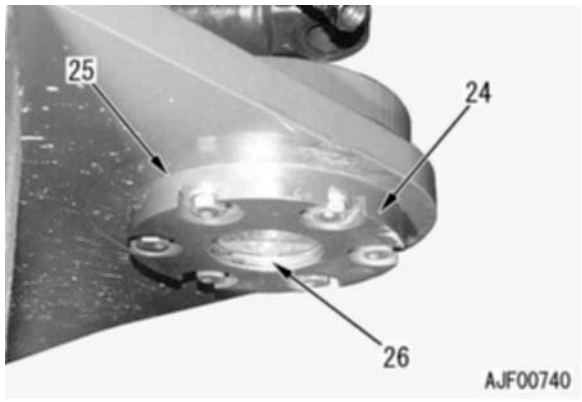
3) Turn the tires to move front frame assembly (20) forward.
   ★ WA270-5 is shown in the photo. WA320-5 is disassembled similarly, however.



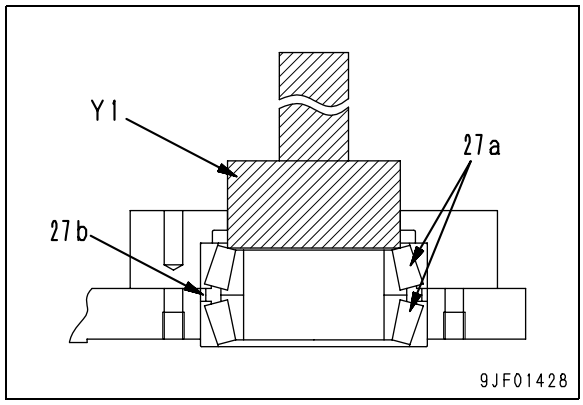
16. Disassemble the lower hinge of the front frame. [*9]
   1) Remove dust seal (23).



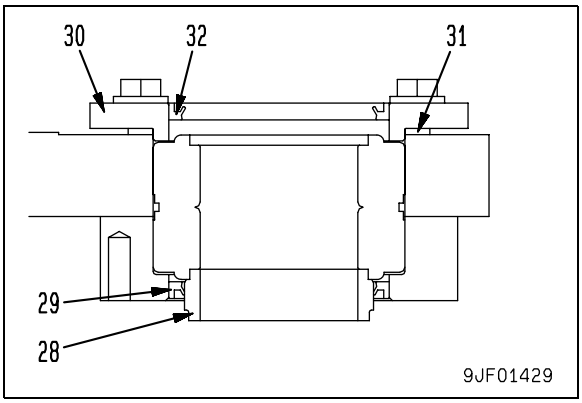
2) Remove retainer (24) and shim (25).
   ★ Check the thickness and quantity of the shims.
3) Remove dust seal (26) from retainer (24).
   ★ WA270-5 is shown in the photo. WA320-5 is disassembled and assembled similarly, however. (The number of the bolts used for WA320-5 is 10, however.)



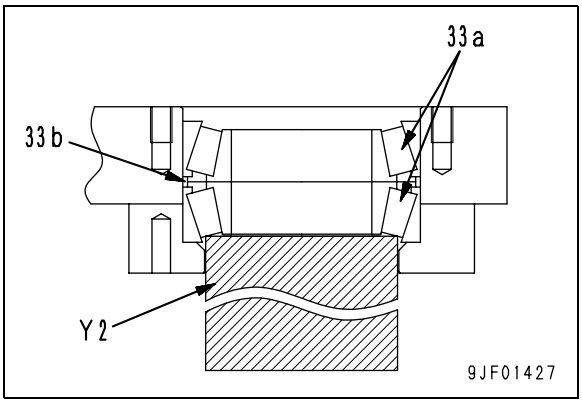
4) Using push tool [Y1], remove bearing (27a) and spacer (27b).



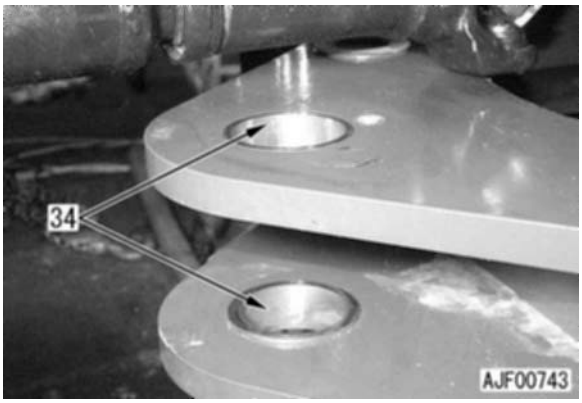
17. Disassemble the upper hinge of the front frame. [*10]
    1) Remove lower spacer (28).
    2) Remove dust seal (29).
    3) Remove retainer (30) and shim (31).
       ★ Check the thickness and quantity of the shims.
    4) Remove dust seal (32) from retainer (30).



    5) Using push tool [Y2], remove bearing (33a) and spacer (33b).



18. Remove 2 bushings (34) from the lower hinge of the rear frame. [*11]



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

★ Bleed air from the brake. For details, see TESTING AND ADJUSTING, Bleeding air from brake system.

[*2]

Front drive shaft mounting bolt:
59 - 74 Nm {6.0 - 7.5 kgm}

★ When installing the drive shaft, check that the key way of the spider cap is fitted in the key way of the mating yoke, and then tighten the mounting bolts.

[*3]

★ Connect PPC hoses (40) - (43) according to their band colors as shown below.

★ Connect each PPC hose having an even No. to the rear of the PPC hose having an corresponding odd No. on the work equipment valve: Connect (40) to the rear of (41), (42) to the rear of (43), and (50) to the rear of (51).

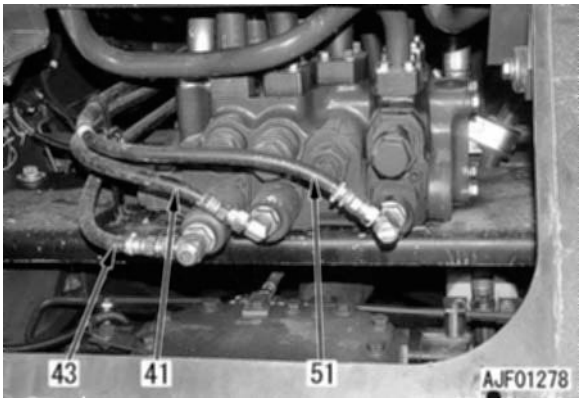
- Work equipment lever specification: 2-lever
- Work equipment lever specification: Joystick (If equipped)

No.	Connecting point	Band color
(40)	Bucket DUMP	Blue
(41)	Bucket TILT	Red
(42)	Boom LOWER	Orange
(43)	Boom RAISE	Yellow

- Work equipment lever specification: 3-lever (If equipped)

No.	Connecting point	Band color
(40)	Bucket DUMP	Blue
(41)	Bucket TILT	Red
(42)	Boom LOWER	Orange
(43)	Boom RAISE	Yellow
(50)	(PULL)	Green
(51)	(PUSH)	White/Red

- Work equipment lever specification: 3-lever (If equipped)



[*4]

★ Adjust the shim so that the total of the upper and lower clearances between the frame and cylinder will be less than 0.5 mm.

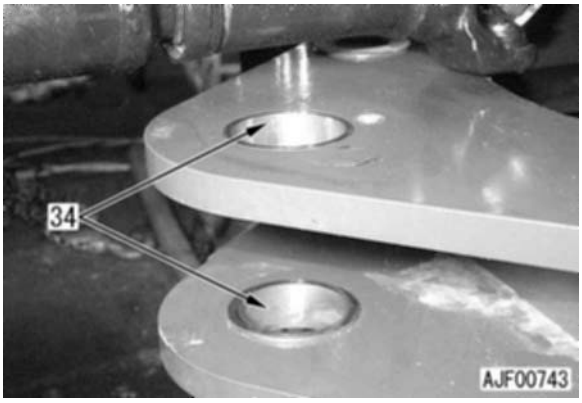
- Varieties of shim thickness: **0.5 mm, 1 mm**

Inside of bushing on cylinder side and dust seal: **Lubricant containing molybdenum disulfide (LM-P)**

[*9] [*10] [*11]

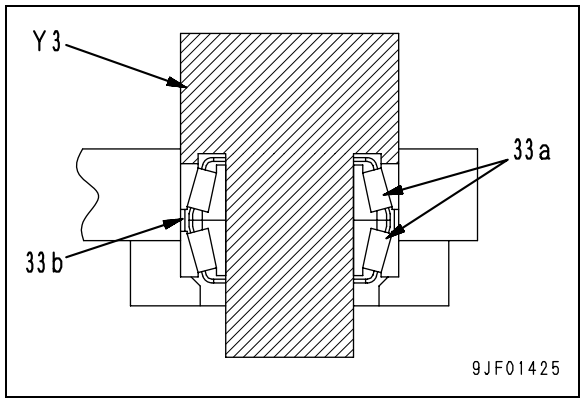
★ Assemble the upper hinge and lower hinge according to the following procedure.

1. Install 2 bushings (34) to the lower hinge of the rear frame.



2. Assemble the upper hinge of the front frame.
   1) Using push tool [Y3], press fit bearing (33a) and spacer (33b) to the front frame.
      ★ Since the clearance of bearing (33a) and spacer (33b) is adjusted properly, do not change their combination.
      ★ Since bearing (33a) and spacer (33b) are an assembly, always replace them as a set.
      ★ Press fit bearing (33a) and spacer (33b) securely so that a clearance will not be made between the bearing and frame.

      Bearing: **Grease (G2-LI)**

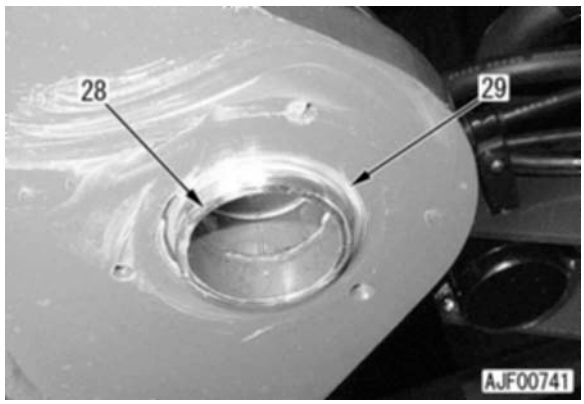


   2) Press fit dust seal (29) to the front frame.
      ★ Press fit the dust seal with the lip out.

      Lip of dust seal: **Grease (G2-LI)**

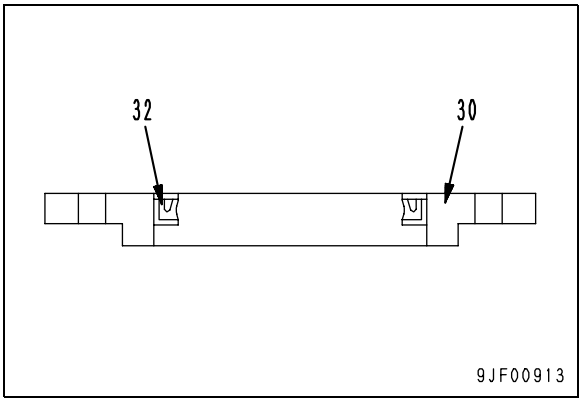
   3) Install lower spacer (28).
      ★ Install the spacer with the chamfered part on the bearing side.

      Lower spacer: **Lubricant containing molybdenum disulfide (LM-P)**



4) Press fit dust seal (32) to retainer (30).
   ★ Press fit the dust seal with the lip out.

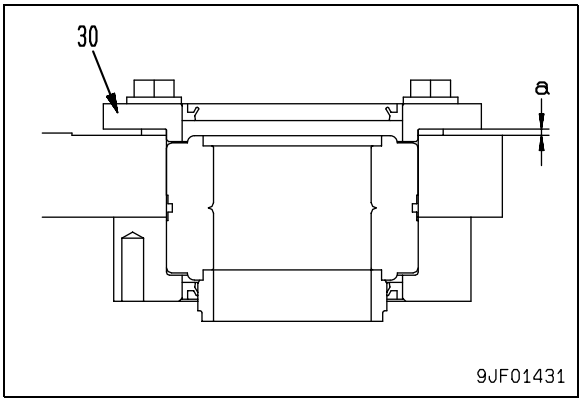
   Lip of dust seal: **Grease (G2-LI)**



5) Tighten the 3 mounting bolts of retainer (30) evenly.

   Retainer mounting bolt:
   19.6 ± 10% Nm {2 ± 10% kgm}

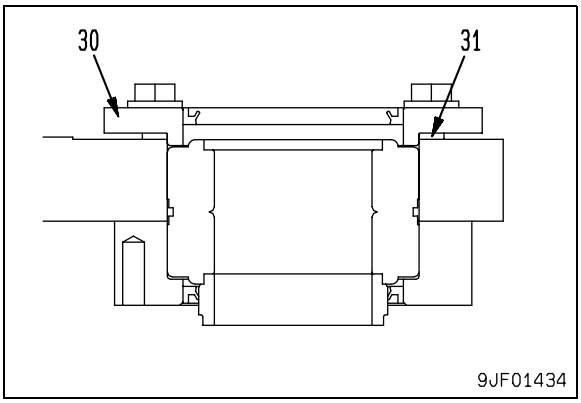
6) Measure clearance "a" between retainer (30) and front frame with a feeler gauge, and then select shims so that the maximum clearance will be less than 0.1 mm when the shims are inserted.
   - Standard shim thickness: **2 mm**
   - Varieties of shim thickness:
     0.1 mm, 0.5 mm, 1.0 mm



7) Insert selected shim (31) and tighten the 6 mounting bolts.

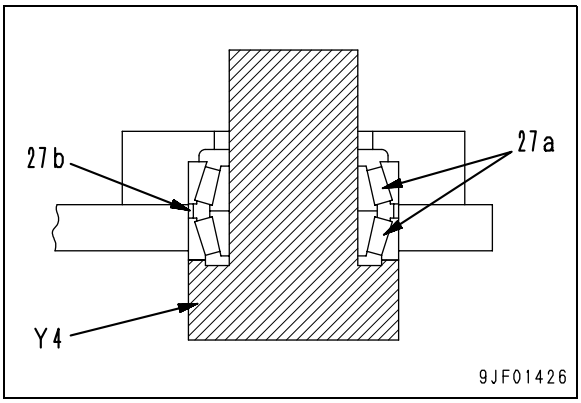
   Mounting bolt:
   Adhesive (LOCTITE #2701)

   Mounting bolt:
   98 - 123 Nm {10.0 - 12.5 kgm}



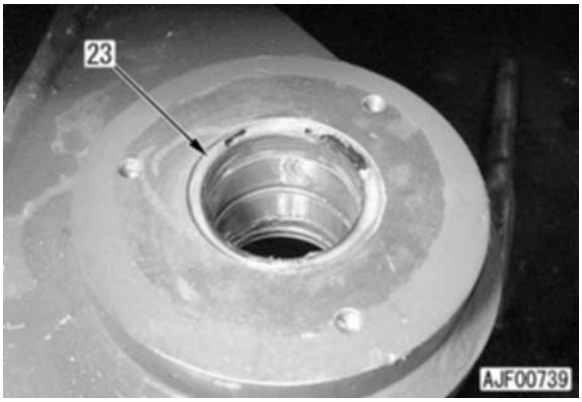
3. Assemble the lower hinge of the front frame.
   1) Using push tool [Y4], press fit bearing (27a) and spacer (27b) to the front frame.
      ★ Since the clearance of bearing (27a) and spacer (27b) is adjusted properly, do not change their combination.
      ★ Since bearing (27a) and spacer (27b) are an assembly, always replace them as a set.
      ★ Press fit bearing (27a) and spacer (27b) securely so that a clearance will not be made between the bearing and frame.

      Bearing: **Grease (G2-LI)**



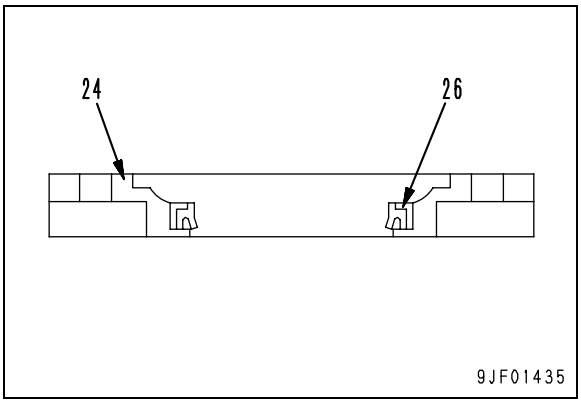
2) Press fit dust seal (23) to the front frame.
   ★ Press fit the dust seal with the lip out.

   Lip of dust seal: **Grease (G2-LI)**



3) Press fit dust seal (26) to retainer (24).
   ★ Press fit the dust seal with the lip out.

   Lip of dust seal: **Grease (G2-LI)**

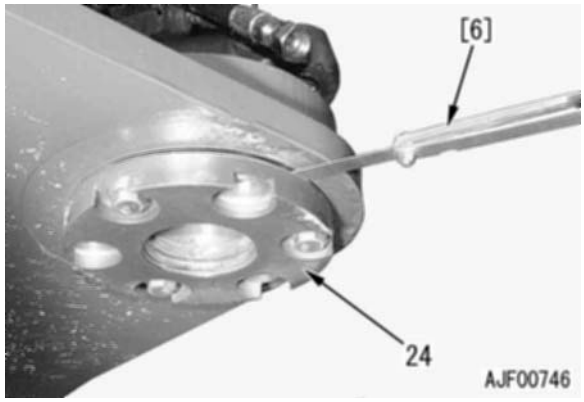


4) Tighten the 3 mounting bolts of retainer (24) evenly.

   Retainer mounting bolt:
   19.6 ± 10% Nm {2 ± 10% kgm}

5) Measure the clearance between retainer (24) and front frame with feeler gauge [6], and then select shims so that the maximum clearance will be less than 0.1 mm when the shims are inserted.
   - Standard shim thickness: **1 mm**
   - Varieties of shim thickness:
     0.1 mm, 0.5 mm

   ★ WA270-5 is shown in the photo. WA320-5 is disassembled and assembled similarly, however. (The umber of the bolts used for WA320-5 is 10, however.)

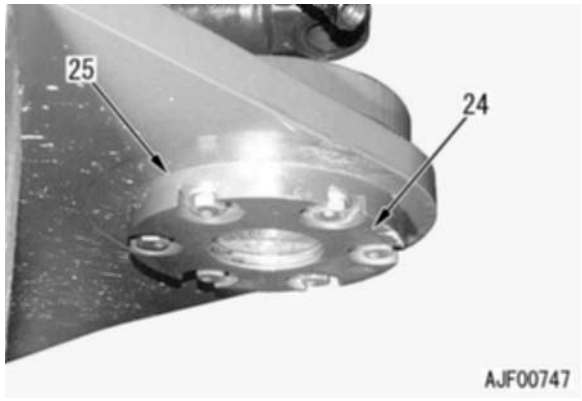


6) Insert selected shim (25) and tighten the 10 mounting bolts.

   Mounting bolt:
   Adhesive (LOCTITE #2701)

   Mounting bolt:
   98 - 123 Nm {10.0 - 12.5 kgm}

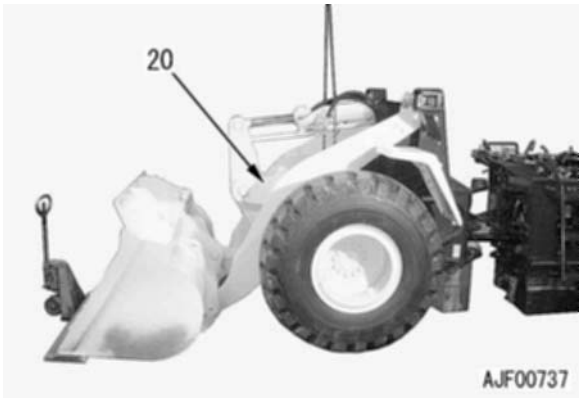
   ★ WA270-5 is shown in the photo. WA320-5 is disassembled and assembled similarly, however. (The number of the bolts used for WA320-5 is 10, however.)



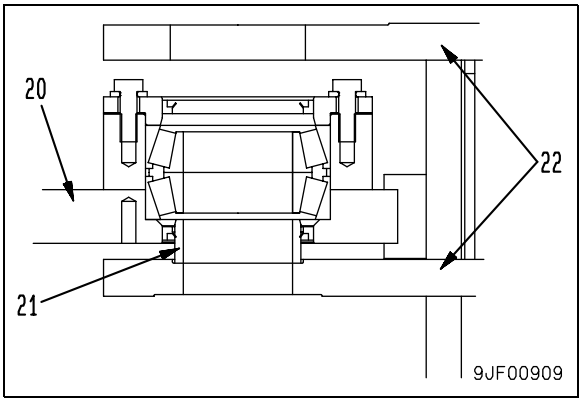
[*5] [*6] [*7] [*8]

★ Install the upper hinge pin and lower hinge pin according to the following procedure.

1. Set hand lift truck [4] under the bucket and turn the tires to move the front frame assembly toward the rear frame.



2. Using a bar, etc., raise front frame assembly (20) by 2 - 3 mm to move spacer (21) to the spacer of rear frame assembly (22).
   ★ You may raise the front frame assembly by 2 - 3 mm with a large-sized crane, if available.

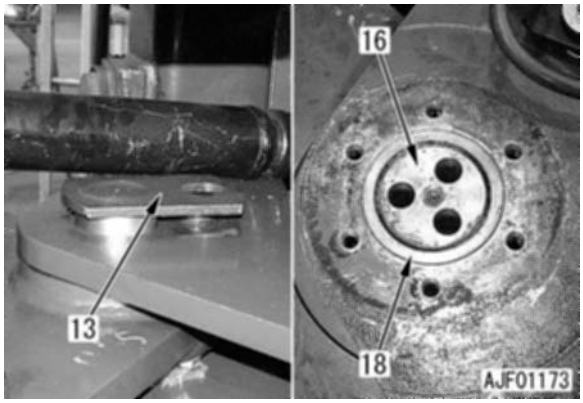


3. Align the upper and lower pin holes.
   ★ Using a hydraulic jack, adjust the height of the front and rear frames and align the pin holes.

   When aligning the pin holes, use a bar. Never insert your fingers in the pin holes.

4. Insert lower hinge pin (13) and upper hinge pin (16) to the end.
5. Install upper spacer (18).
   ★ Install the spacer with the chamfered part on the bearing side.

   Upper spacer: **Lubricant containing molybdenum disulfide (LM-P)**

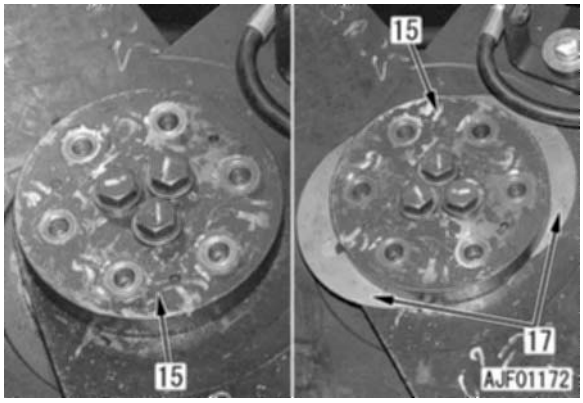


6. Secure cover (15) of upper hinge pin (16) with the 3 bolts at the center.
   ★ Do not insert the shim for the upper hinge pin.

   Mounting bolt: **Adhesive (LOCTITE #2701)**

   Mounting bolt: **186 - 226 Nm {19 - 23 kgm}**

7. Measure the clearance between the underside of cover (15) and the rear frame top with a feeler gauge, and then select shims (17) so that the maximum clearance will be less than 0.2 mm when the shims are inserted.
   - Standard shim thickness: **1 mm**
   - Varieties of shim thickness: **0.1 mm, 0.5 mm**

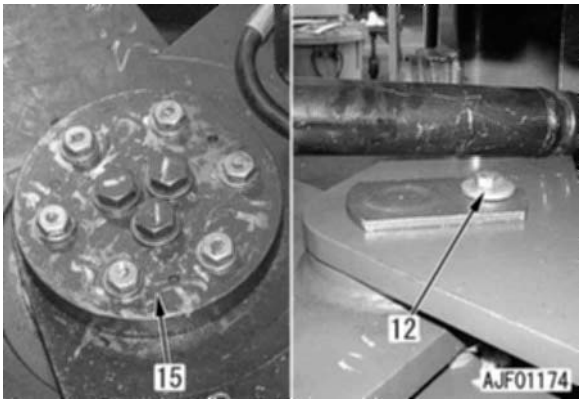


8. Insert selected shim (17) between cover (15) and the rear frame and tighten the 6 mounting bolts.

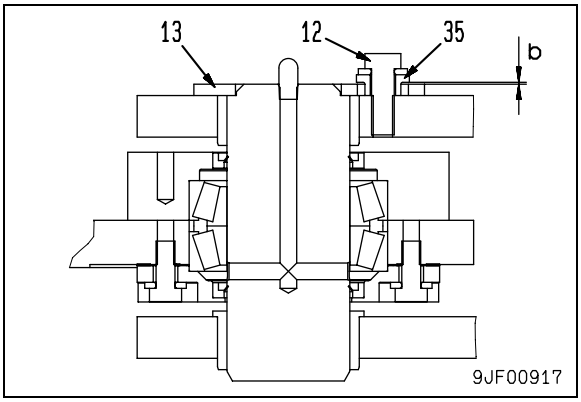
   Mounting bolt:
   Adhesive (LOCTITE #2701)

   Mounting bolt:
   98 - 123 Nm {10.0 - 12.5 kgm}

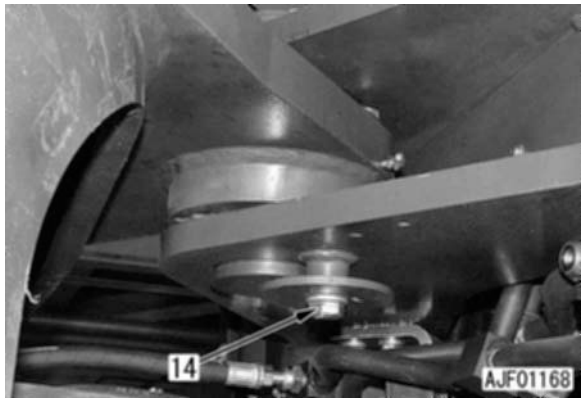
9. Install lock bolt (12) of lower hinge pin (13).



★ A clearance of 1 mm should be made at (b) between bushing (35) and lower hinge pin (13).



10. Install mounting bolt (14) of upper hinge pin (16).



- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

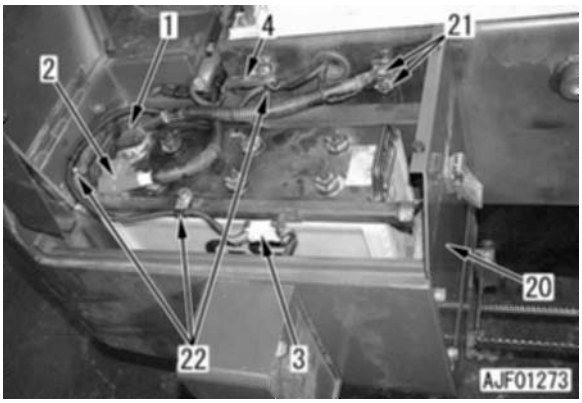
REMOVAL, INSTALLATION OF COUNTERWEIGHT

REMOVAL

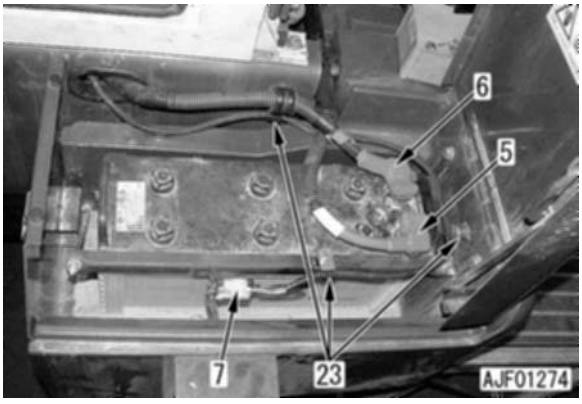
Stop the vehicle on a level place and set the safety bar to the frame.

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

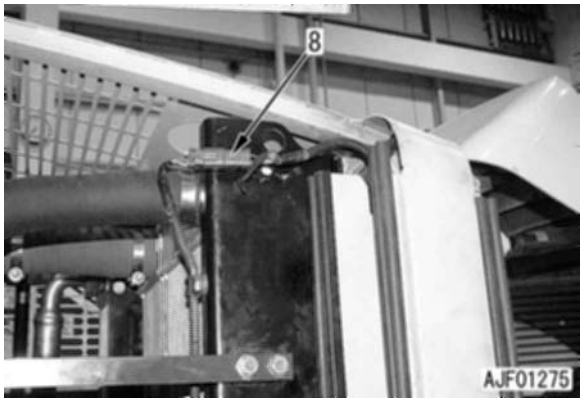
1. Disconnect battery negative (–) terminal (1) and ground terminal (21) from the right side, and then disconnect battery terminal (2).
2. Disconnect wiring connectors R23 (3) and R24 (4).
3. Disconnect wire clamp (22).
4. Remove side cover (20).



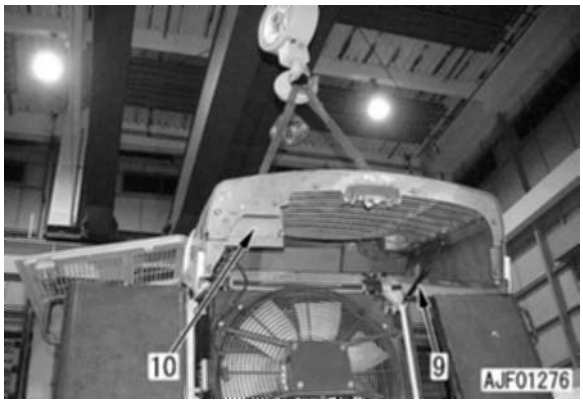
5. Disconnect battery terminals (5) and (6) from the left side. [*2]
6. Disconnect wiring connector R22 (7).
7. Disconnect wire clamp (23).



8. Open the engine left side cover and disconnect wiring connector BR1 (8).

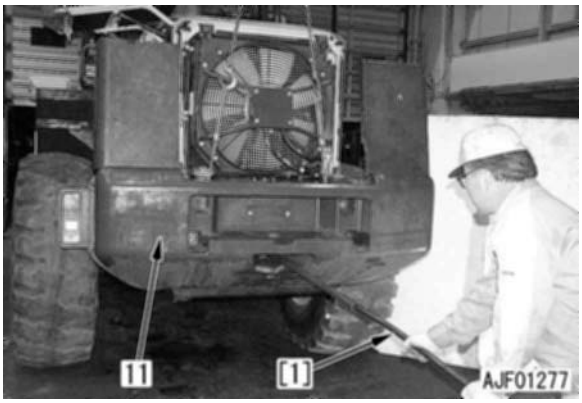


9. Open grille (10) and sling it temporarily.
10. Disconnect both damper gas cylinders (9).
11. Remove the 4 mounting bolts and lift off grille (10).



12. Sling counterweight (11) temporarily and remove the mounting bolt, and then remove the counterweight. [*1]
    ★ When removing the counterweight, insert bar [1] in its rear part to balance it.

    Counterweight and batteries (both) assembly: **2,020 kg**



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Mounting bolt:
824 - 1030 Nm {84 - 105 kgm}

[*2]

Battery terminal tightening torque:
11.8 - 19.6 Nm [1.2 - 2.0 kgm}
Ground terminal tightening torque:
59 - 74 Nm {6 - 7.5 kgm}

REMOVAL, INSTALLATION OF AIR CONDITIONER UNIT ASSEMBLY

SPECIAL TOOLS

Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
X	1	799-703-1200	Service tool kit	■	2		
		799-703-1100	Vacuum pump (100 V)	■	1		
		799-703-1110	Vacuum pump (220 V)	■	1		
		799-703-1120	Vacuum pump (240 V)	■	1		
		799-703-1400	Gas leak tester	■	1		

REMOVAL

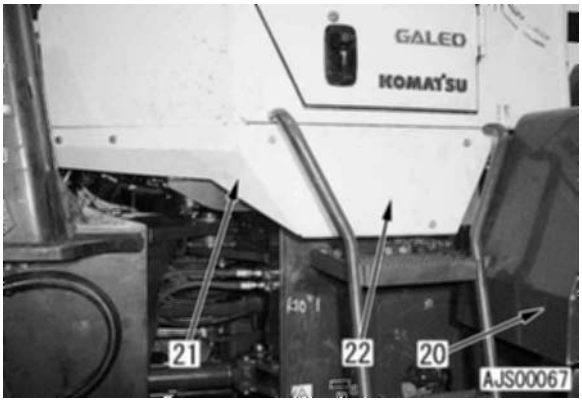
Stop the vehicle on a level place and set the safety bar to the frame.

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

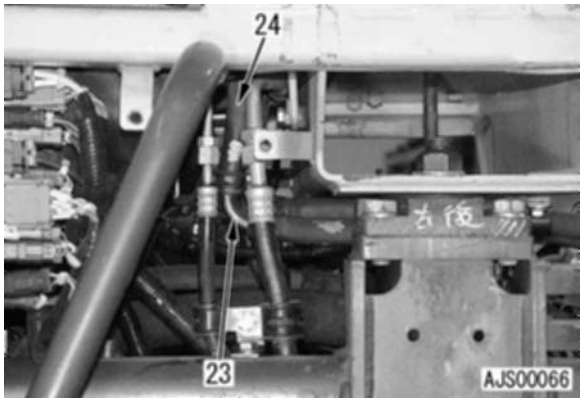
Disconnect the cable from the negative (–) terminal of the battery.

Connect tool X1 to the air conditioner compressor hose valve and collect the refrigerant (R134a).

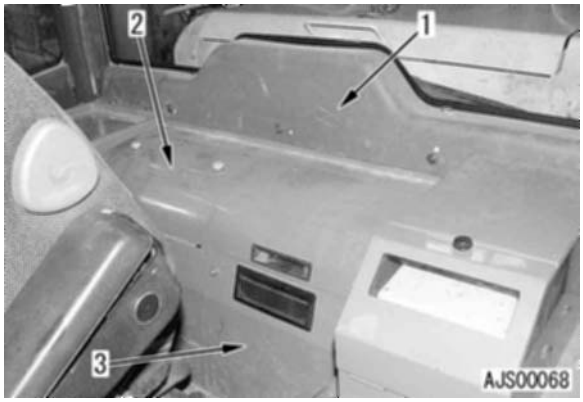
1. Remove left fender (20) and operator's cab left lower covers (21) and (22).



2. Disconnect 2 heater hoses (24) from tube (23).
   ★ Disconnect the heater hoses from the air conditioner unit.

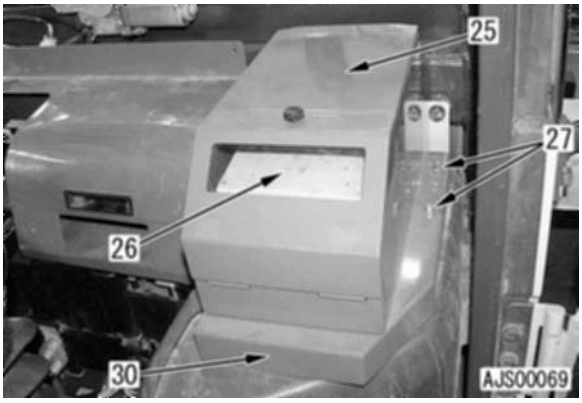


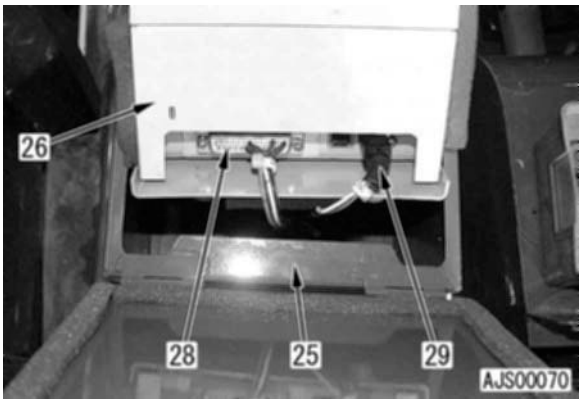
3. Remove covers (1), (2), and (3).



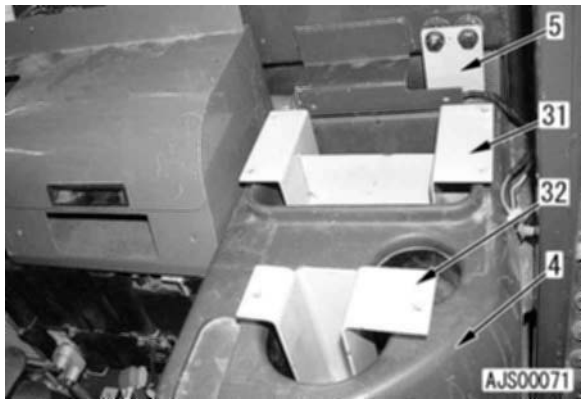
★ If equipped: Load meter specification

4. Removal of load meter (If equipped)
   1) Remove 4 bolts (27) and disconnect load meter unit (26) and cover (25) together from bracket (30).
      ★ Since the wires are short, take care not to strain them.
   2) Remove the 4 bolts at the bottom of cover (25) and disconnect load meter unit (26) and cover (25).
   3) Disconnect connectors (28) and (29) from the rear of load meter unit (26).
   4) Remove bracket (30).

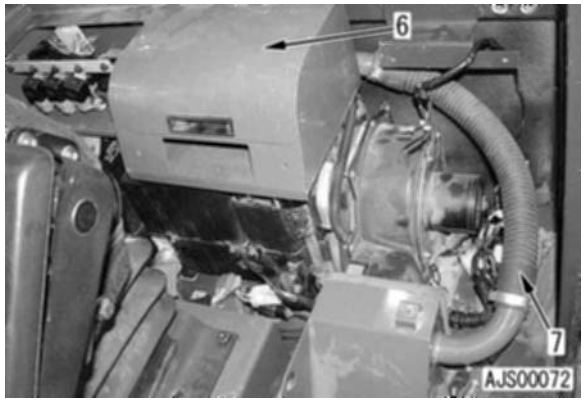




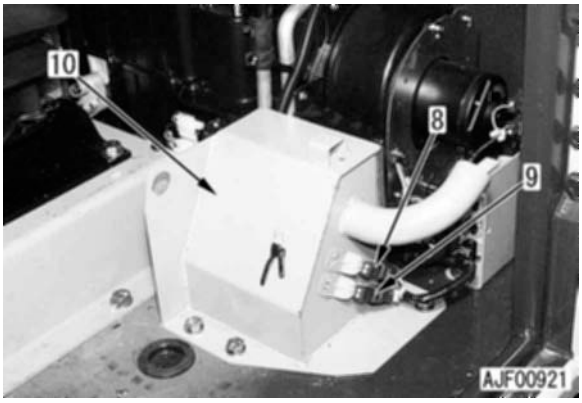
5. Remove brackets (31), (5), and (32) and cover (4) in order.
   ★ Brackets (31) and (32) are installed to only the machine with load meter specification.



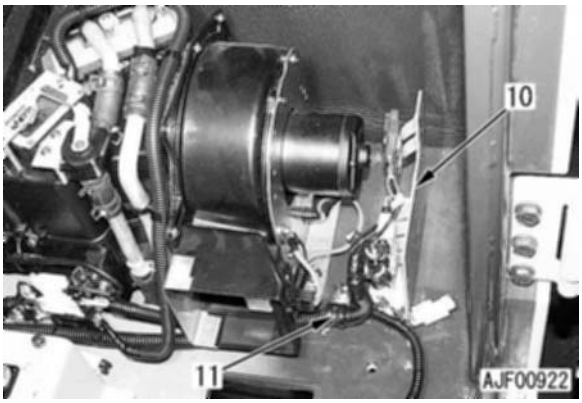
6. Remove console box (6).
7. Remove defroster hose (7).



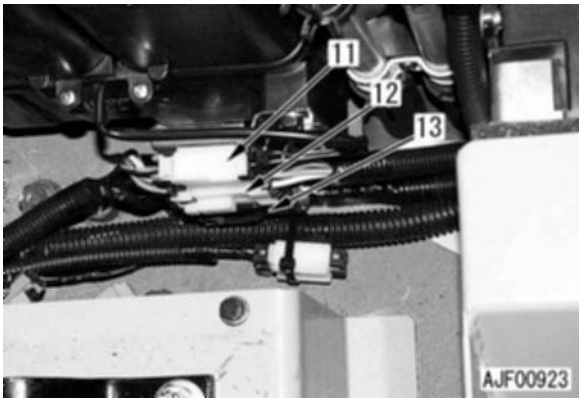
8. Remove wiring connectors L53 (8) and L47 (9).
9. Remove box (10).



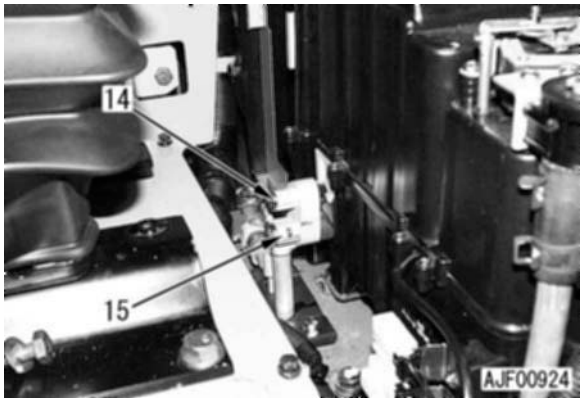
10. Remove wiring connector bracket (10).
11. Disconnect clamp (11).



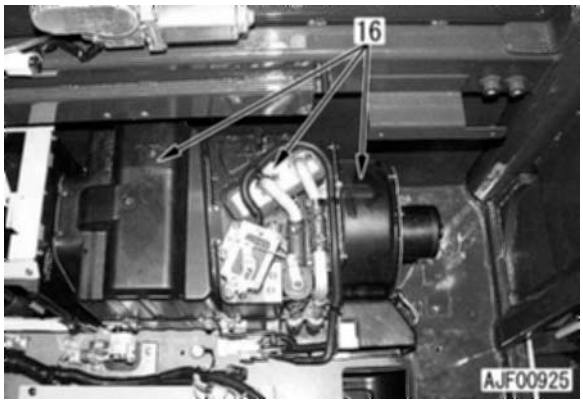
12. Disconnect wiring connectors A03 (11), A01 (12), and A02 (13).



13. Disconnect air conditioner pipes (14) and (15). [*1]



14. Remove the mounting bolts and air conditioner unit assembly (16).



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

O-ring:
Compressor oil for new refrigerant (NO-OIL8)

- **Charging air conditioner with refrigerant**
  Using tool **X1**, charge the air conditioner circuit with refrigerant (R134a).

REMOVAL, INSTALLATION OF AIR CONDITIONER COMPRESSOR ASSEMBLY

SPECIAL TOOLS

Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
X	1	799-703-1200	Service tool kit	■	2		
		799-703-1100	Vacuum pump (100 V)	■	1		
		799-703-1110	Vacuum pump (220 V)	■	1		
		799-703-1120	Vacuum pump (240 V)	■	1		
		799-703-1400	Gas leak tester	■	1		

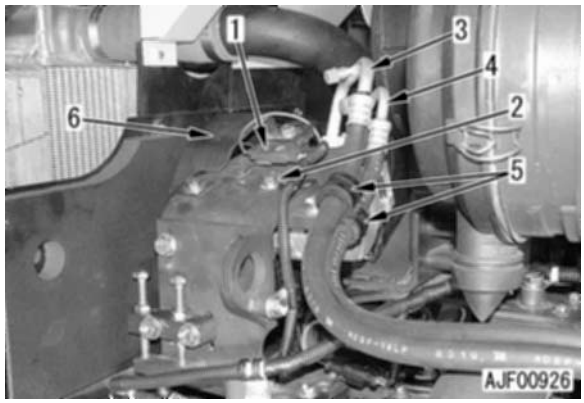
REMOVAL

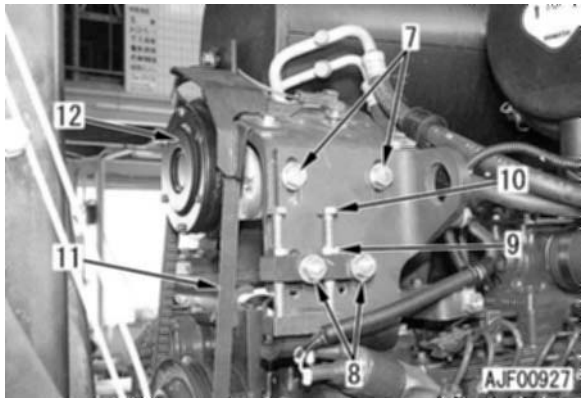
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

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

Connect tool X to the air conditioner compressor hose valve and collect the refrigerant (R134a).

1. Open the engine left side cover.
2. Disconnect wiring connector E16 (1) and ground terminal E22 (2).
3. Disconnect air conditioner pipes (3) and (4). [*1]
4. Disconnect 2 air conditioner pipe clamps (5).
5. Remove cover (6).
6. Loosen 2 mounting bolts (7) and 2 mounting bolts (8).
7. Loosen 2 locknuts (9) and 2 adjustment bolts (10).
8. Remove air conditioner compressor belt (11). [*2]
9. Remove 2 mounting bolts (7), 2 mounting bolts (8), and air conditioner compressor bracket assembly (12).





INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

O-ring:
Compressor oil for new refrigerant (NO-OIL8)

[*2]

★ Adjust the tension of the air conditioner compressor belt. For details, see TESTING AND ADJUSTING, Testing and adjusting air conditioner compressor belt tension.

- **Charging air conditioner with refrigerant**
  Using tool **X1**, charge the air conditioner circuit with refrigerant (R134a).

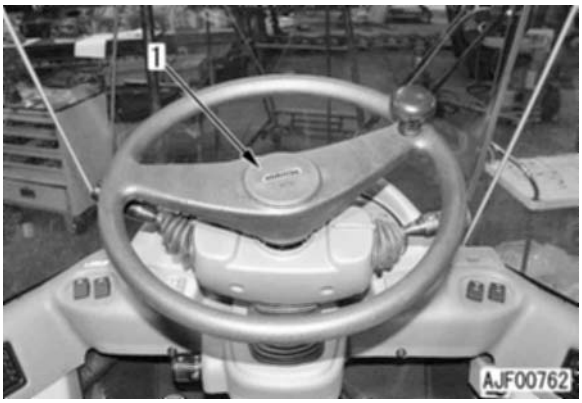
REMOVAL, INSTALLATION OF MONITOR PANEL

REMOVAL

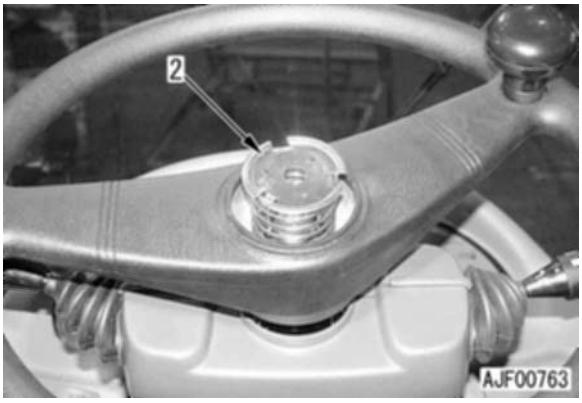
Disconnect the cable from the negative (–) terminal of the battery.

★ The removal procedures for the standard monitor panel and that with load meter specification are the same up to 9. 1). (The standard monitor panel and that with load meter specification are different in the display and the backside connector.)

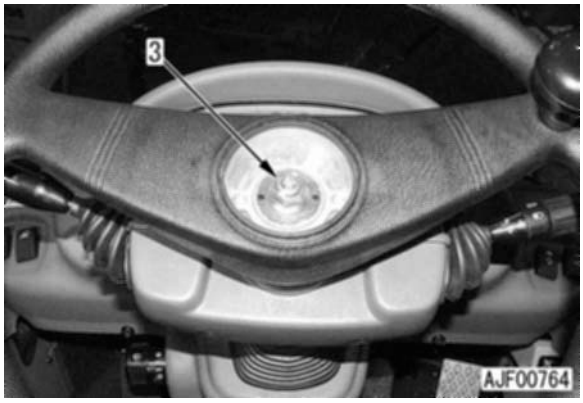
1. Remove pad (1) from the steering wheel.



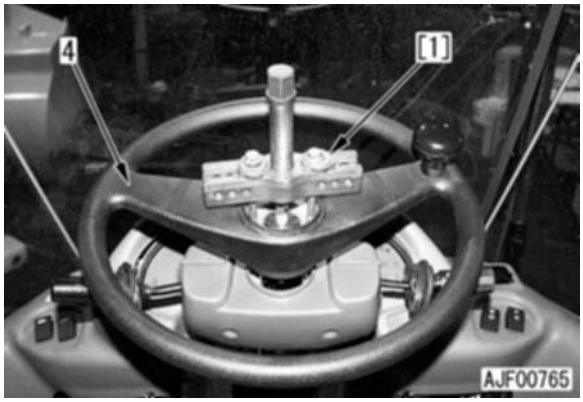
2. Remove contact assembly (2).



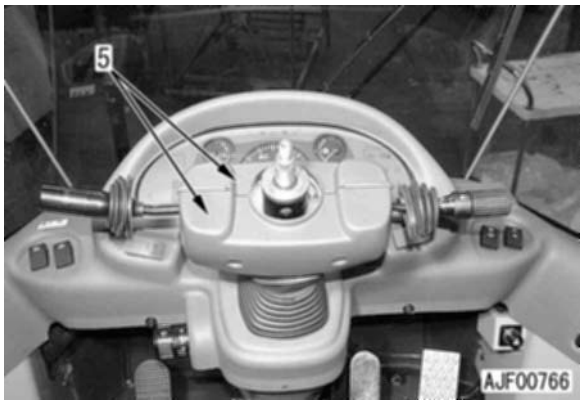
3. Remove steering wheel mounting nut (3). [*1]



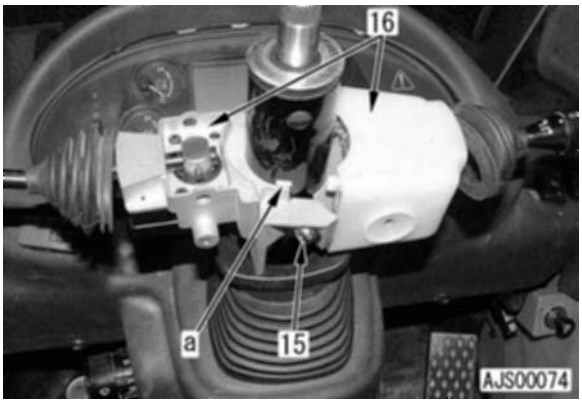
4. Using puller [1], remove steering wheel (4) from the steering column.



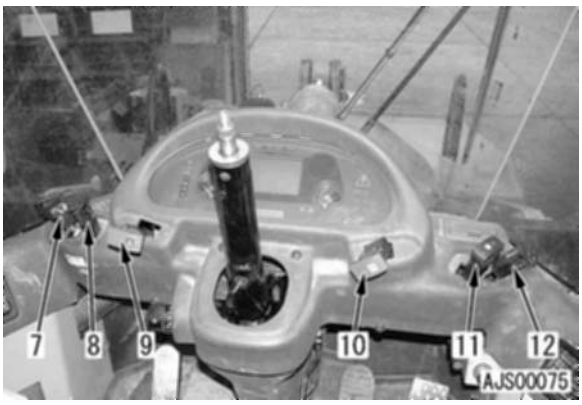
5. Remove cover (5). [*2]

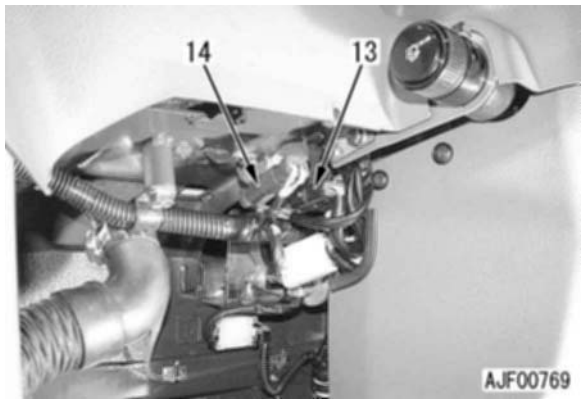


6. Make a mark of the installed height (a) of light and FNR switch assembly (16) in advance, then loosen crossed screw (15) and remove light and FNR switch assembly (16). [*3]

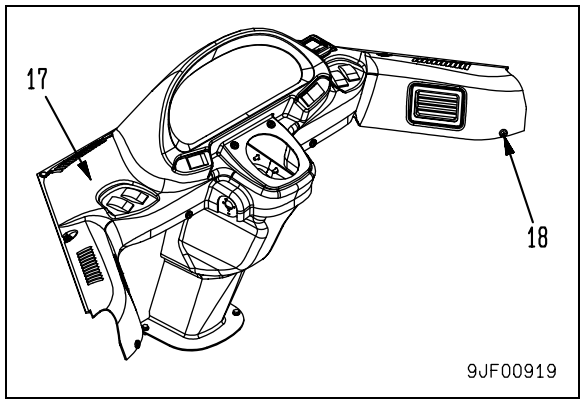


7. Remove the following wiring connectors.
   ★ Before disconnecting switch connectors (7) - (12) above the front panel cover, pull out the switch upward.
   - (7): L07
   - (8): L08
   - (9): L06
   - (10): L19
   - (11): L10
   - (12): L11
   - (13): L04
   - (14): L15

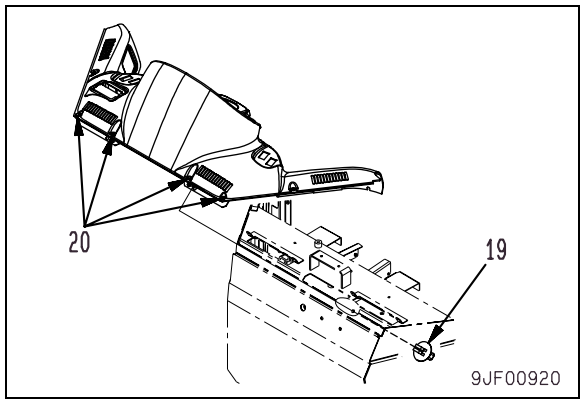




8. Remove the front panel cover. [*4]
   1) Remove 8 mounting bolts (18) of front panel cover (17).

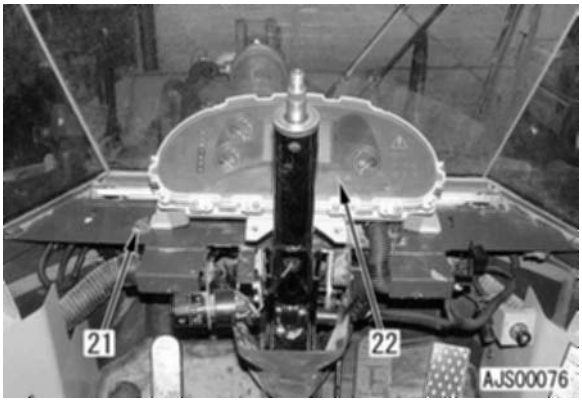


   2) Press the heads of 4 clips (19) to unlock them, and then remove those clips from the front panel cover.

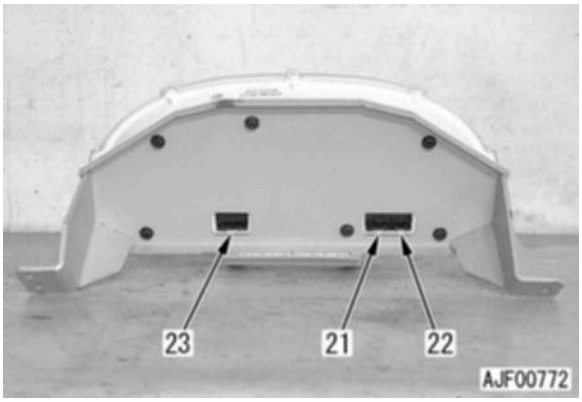


   3) Remove front panel cover (17).
      ★ Take care not to damage the painted surface in the operator's cab.

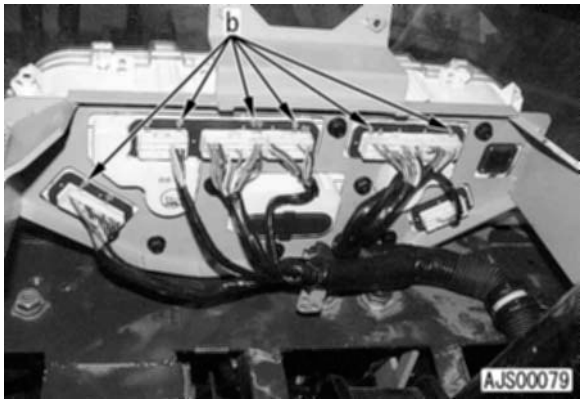
9. Remove monitor panel and bracket assembly (22) according to the following procedure.
   1) Remove 3 bracket mounting bolts (21).
      ★ Since the wires are short, take care not to strain them.



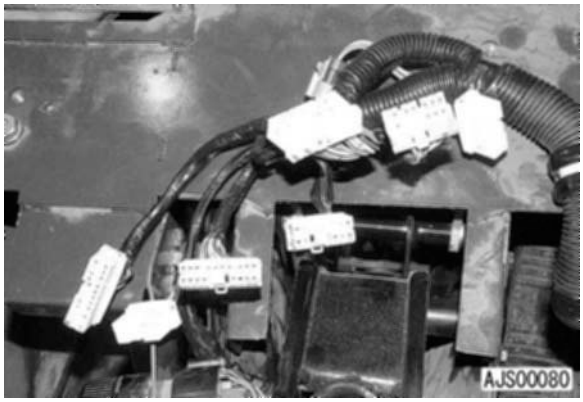
      ★ Standard
   2) Disconnect monitor panel wiring connectors L21 (21), L22 (22), and L23 (23) from the points on the back side of the monitor panel shown in the figure.



      ★ Load meter specification (If equipped)
   3) Turn over monitor panel and bracket assembly (22).
   4) Make marks (b) on the places corresponding to the wiring connectors of the monitor panel, and then disconnect the wiring connectors.
      ★ Since the wires are short, take care not to strain them.

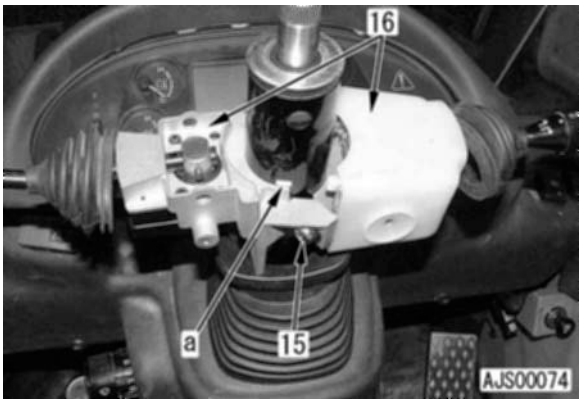


      ★ Separate the wiring connectors into 7 pieces.



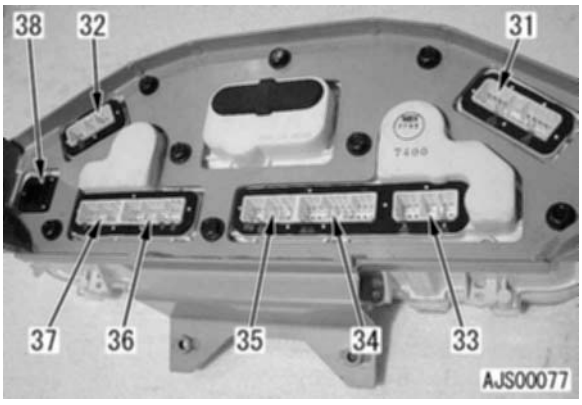
10. Remove monitor panel (23) from bracket (24). [*5]

★ The standard monitor panel is shown in the photo. The monitor panel with service meter specification is similar to the standard one.



★ Correspondence table of wiring connectors (Load meter specification)

- (31): L24
- (32): L30
- (33): L29
- (34): L25
- (35): L26
- (36): L27
- (37): L28
- (38): No connectors correspond.



INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Steering wheel mounting nut:
29 ± 2.9 Nm {3.0 ± 0.3 kgm}

[*2]

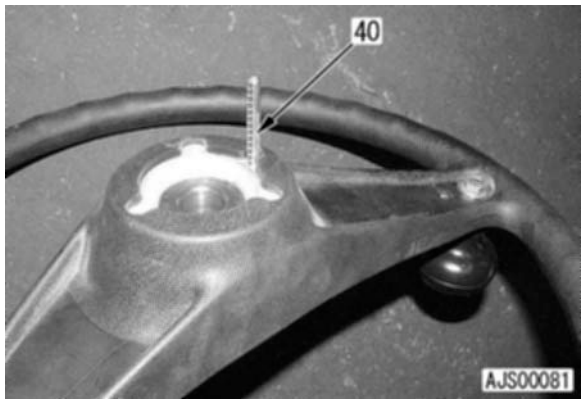
Cover mounting bolt (Fine thread):
1.97 - 2.45 Nm {0.2 - 0.25 kgm}

Cover mounting bolt (Coarse thread):
5.88 Nm {0.6 kgm}

[*3]

Crossed screw:
4.9 - 7.84 Nm {0.5 - 0.8 kgm}

★ If you forgot to make a mark of the height, set the height of the steering wheel so that rod (40) under the steering wheel can reset the turn signal.



[*4]

Front panel cover mounting bolt:
3.44 - 4.4 Nm {0.35 - 0.45 kgm}

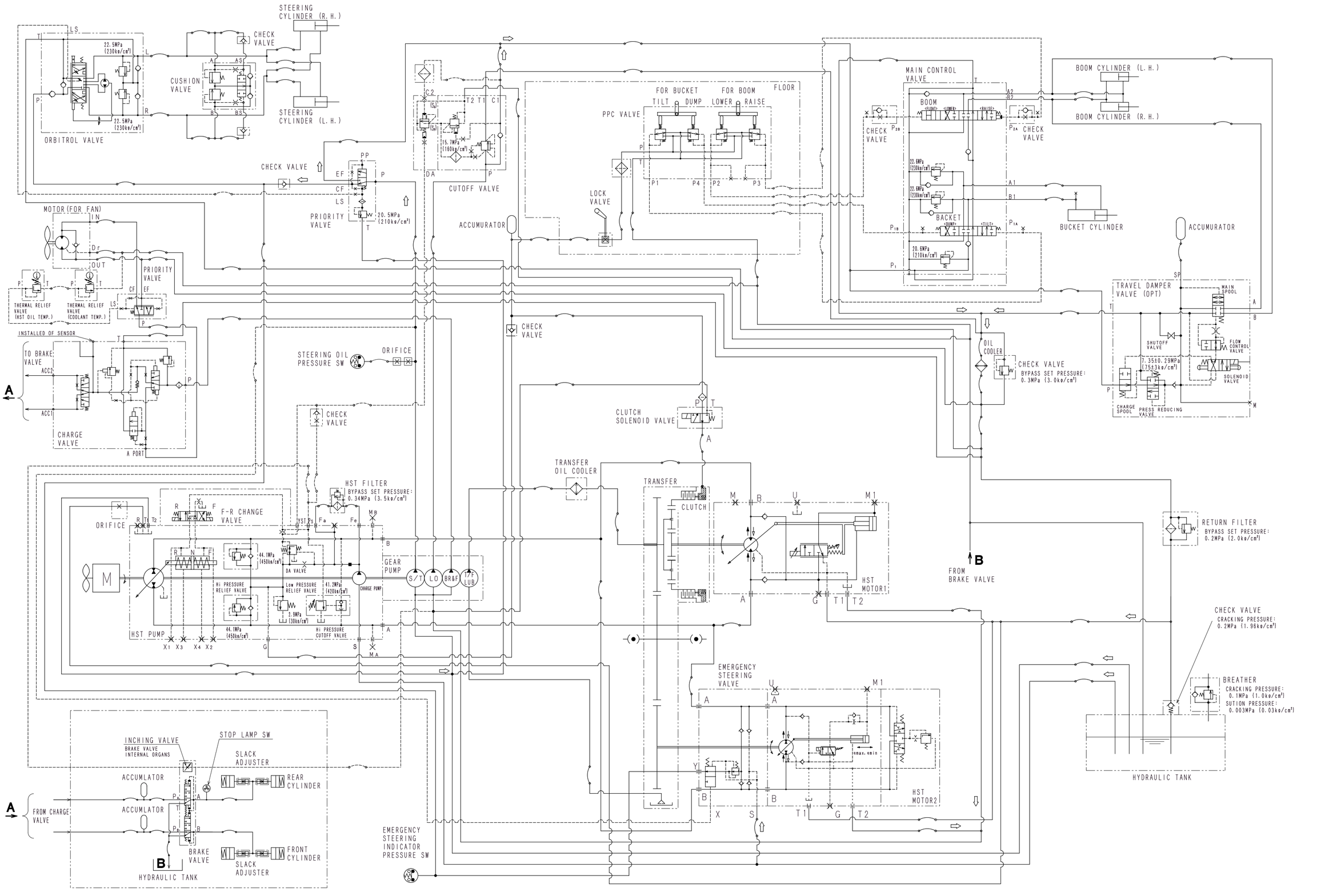
[*5]

Monitor panel mounting bolt:
2.75 - 3.53 Nm {0.28 - 0.30 kgm}

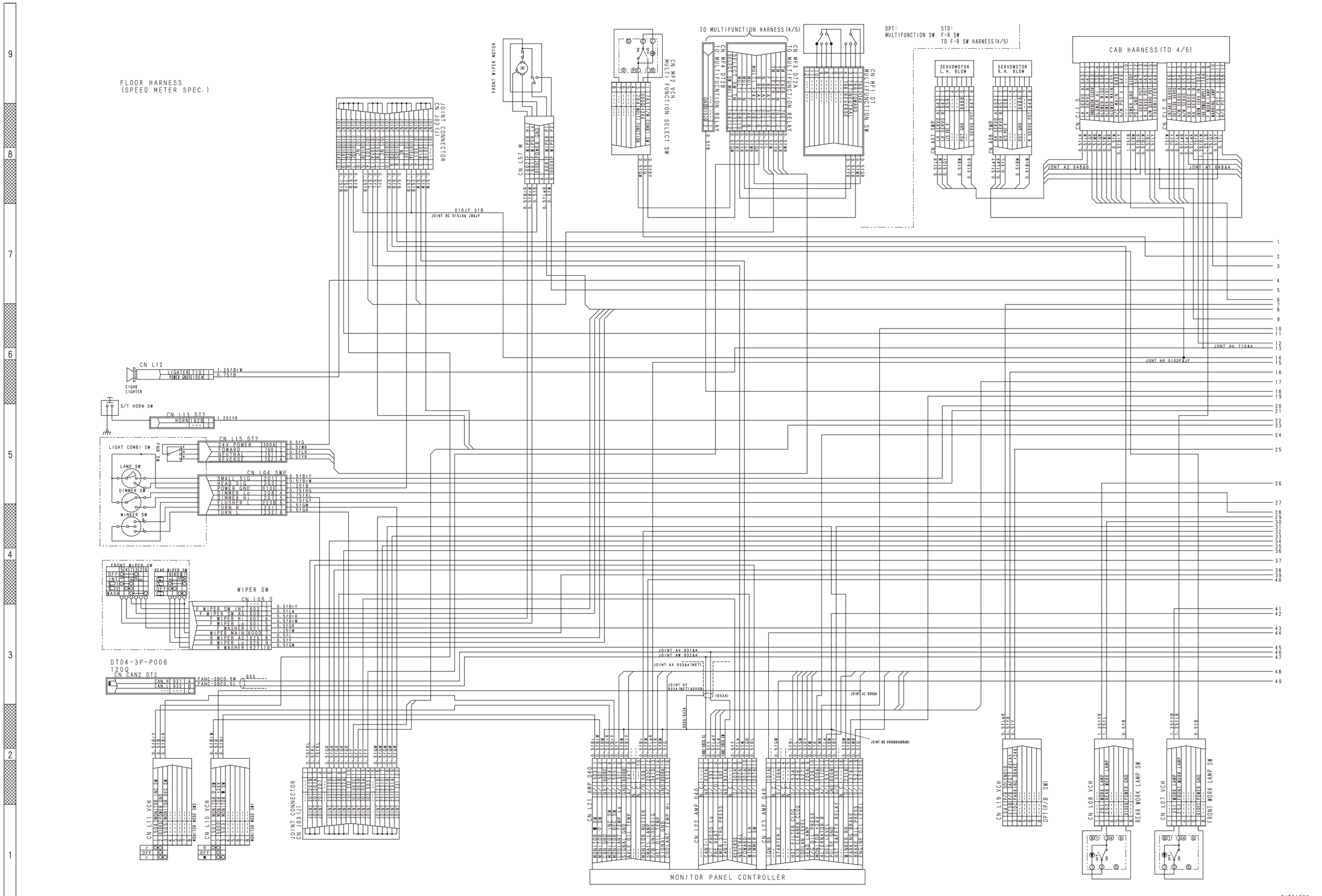
white 30-220

90 OTHERS

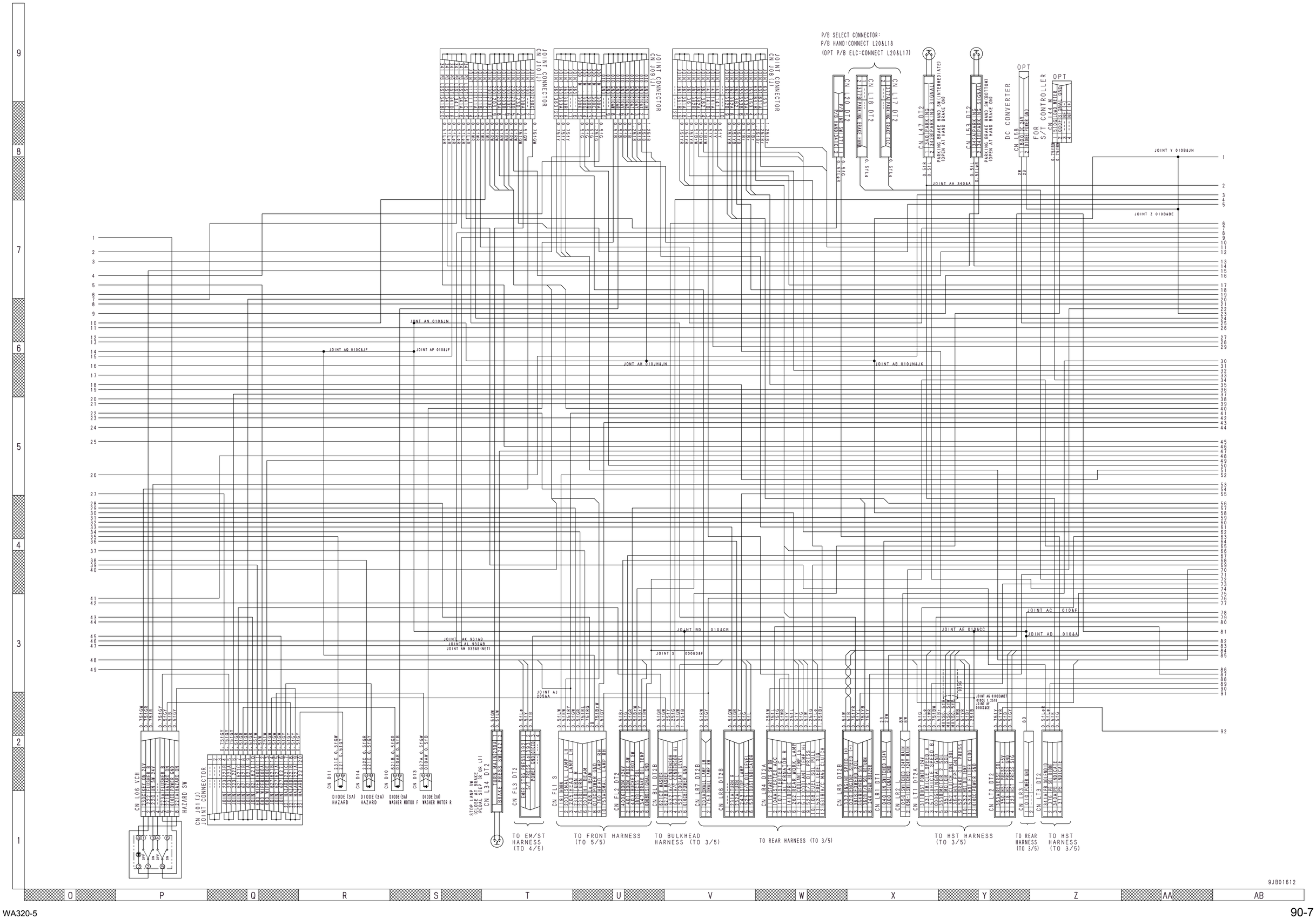
HYDRAULIC CIRCUIT DIAGRAM



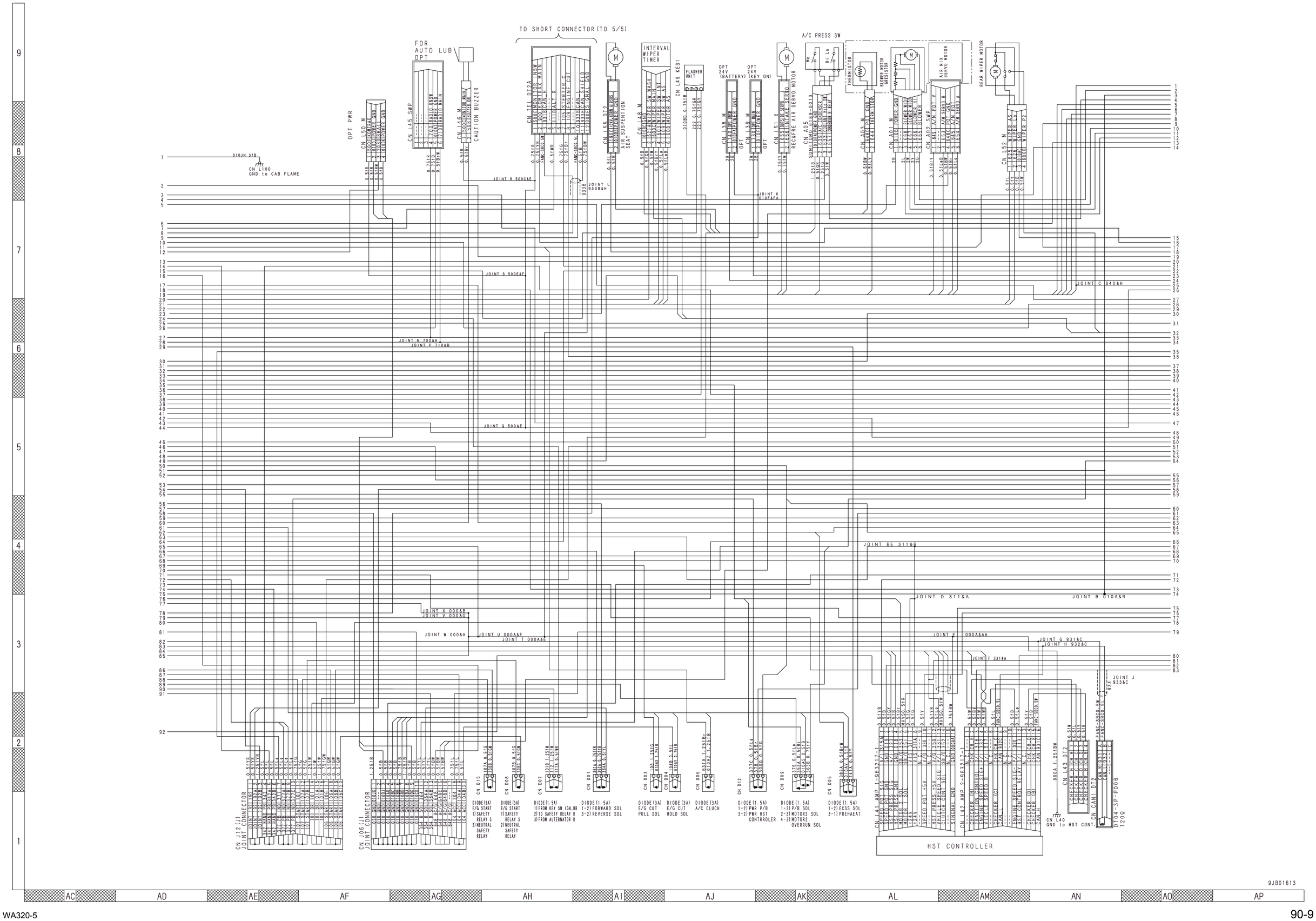
ELECTRICAL CIRCUIT DIAGRAM 1/5 (1/4)
(Machines equipped with speed meter)



ELECTRICAL CIRCUIT DIAGRAM 1/5 (2/4)
(Machines equipped with speed meter)

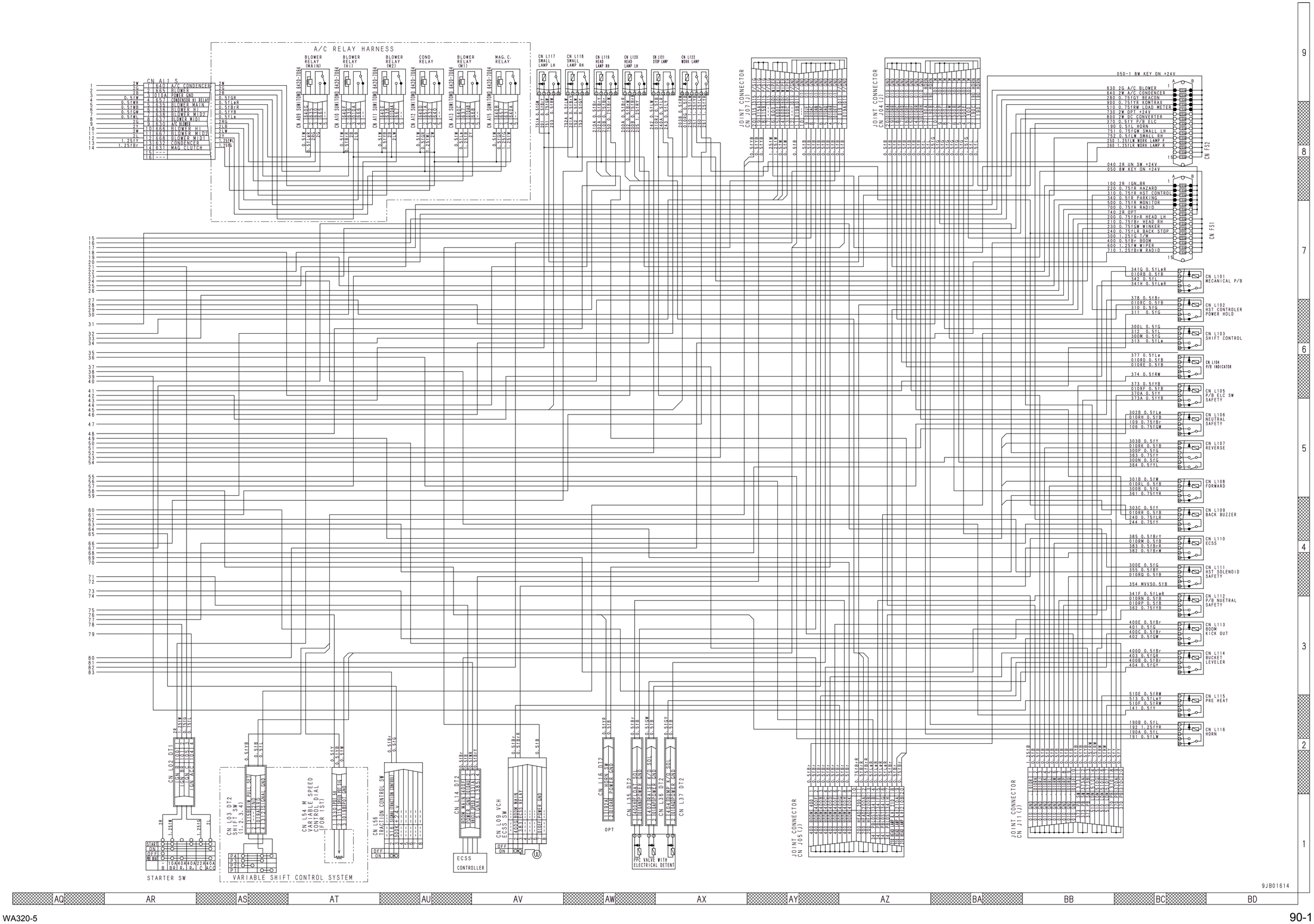


ELECTRICAL CIRCUIT DIAGRAM 1/5 (3/4)
(Machines equipped with speed meter)

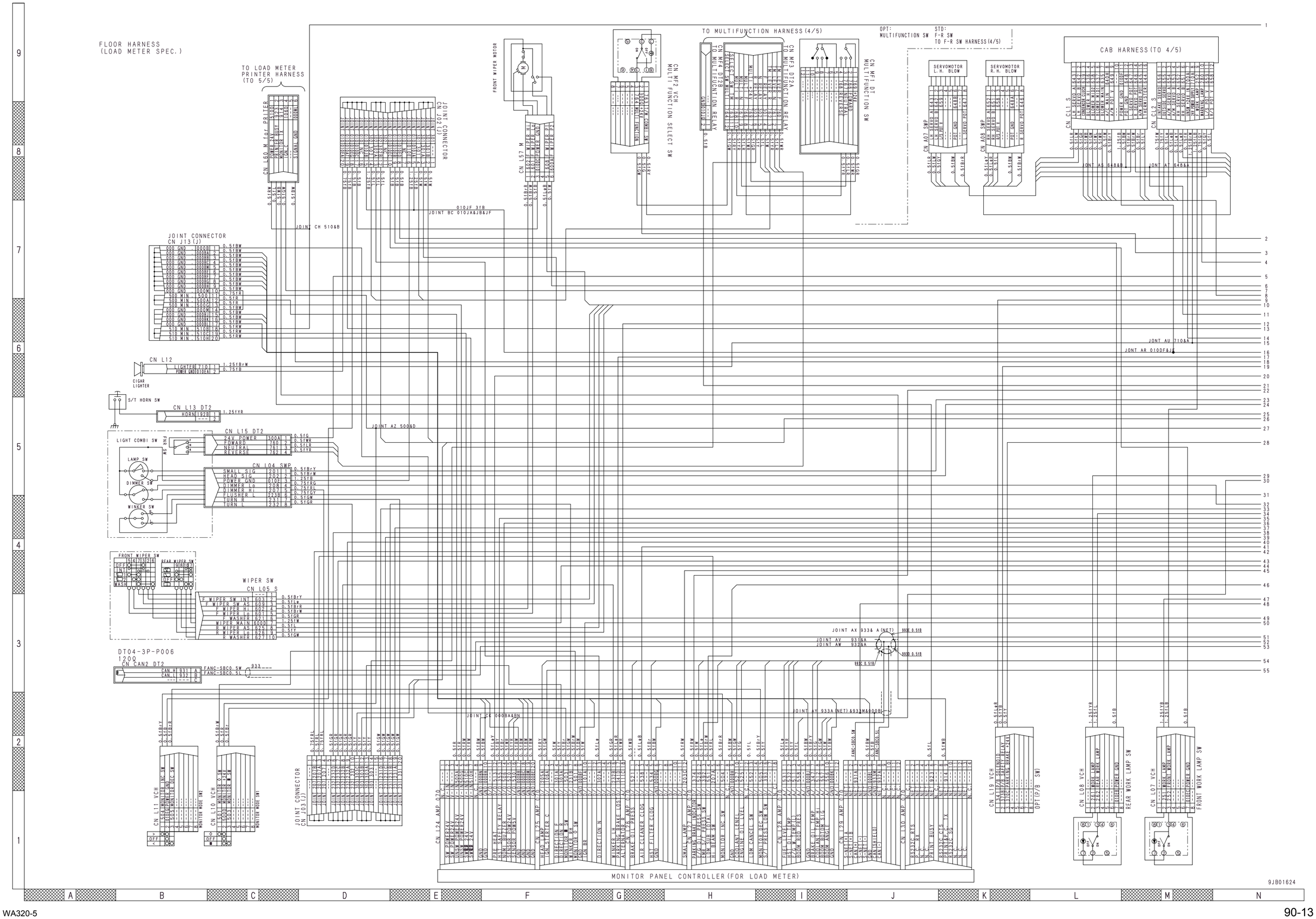


9JB01613

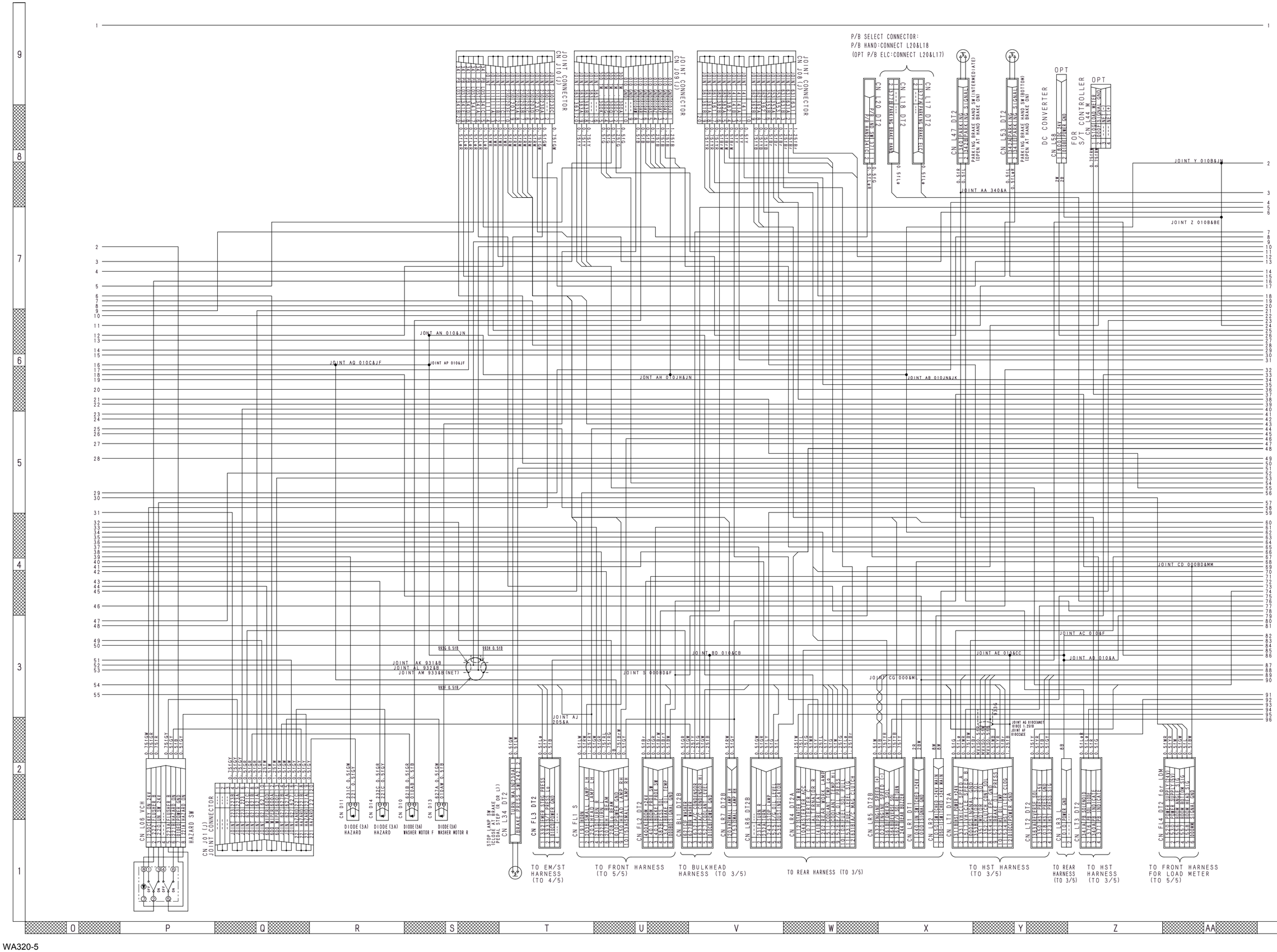
ELECTRICAL CIRCUIT DIAGRAM 1/5 (4/4)
(Machines equipped with speed meter)



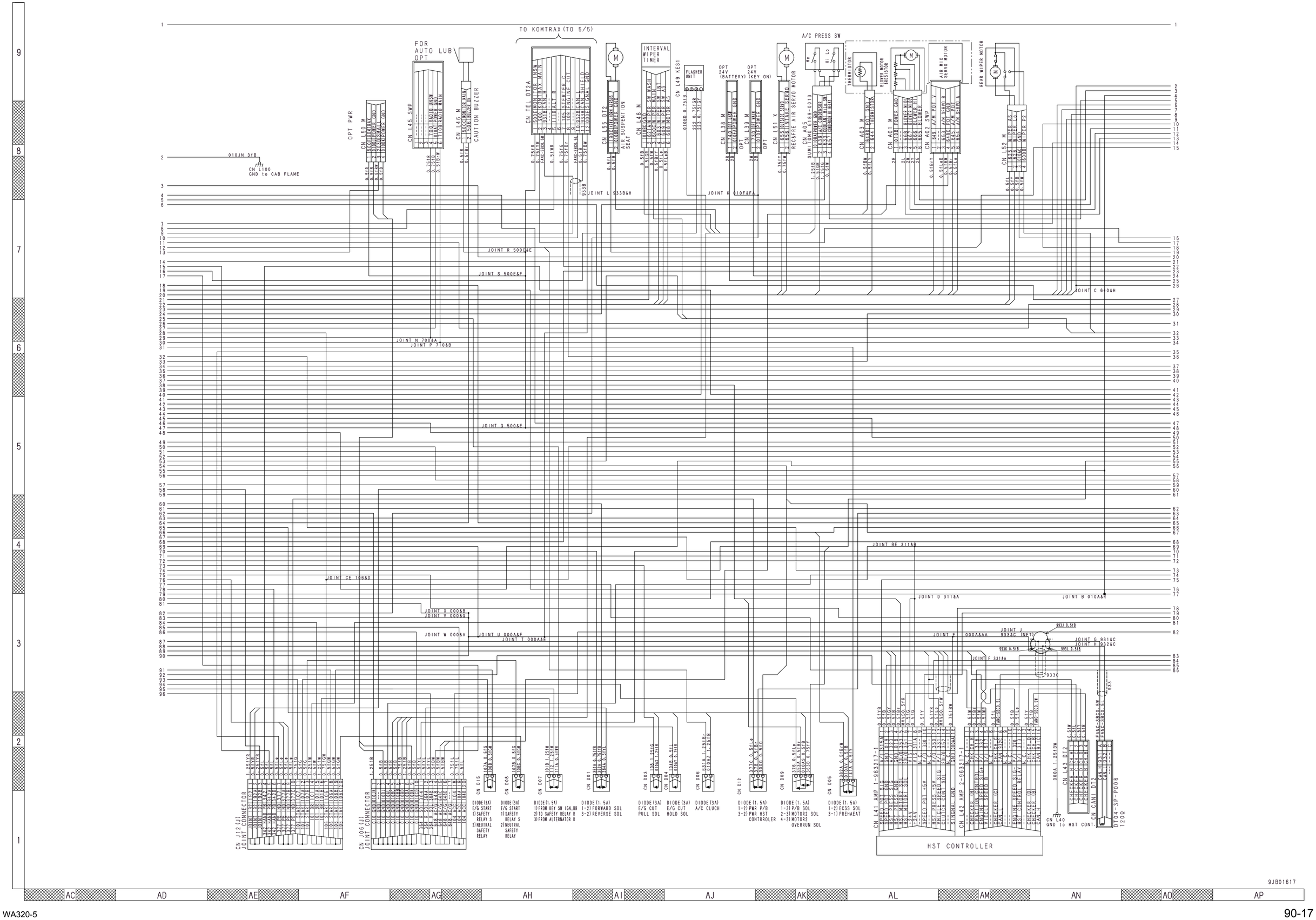
ELECTRICAL CIRCUIT DIAGRAM 2/5 (1/4)
(Machines equipped with load meter)



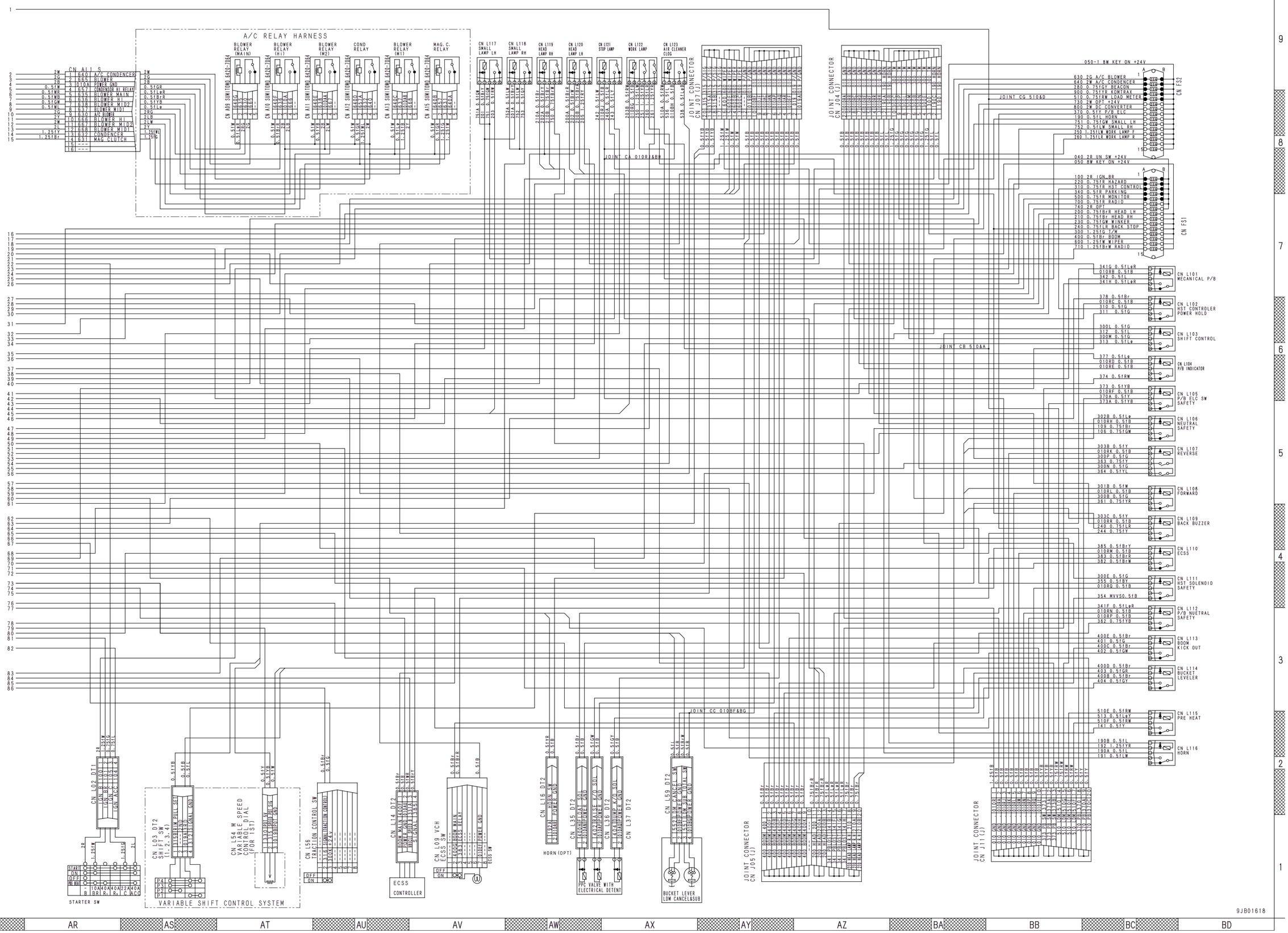
ELECTRICAL CIRCUIT DIAGRAM 2/5 (2/4)
(Machines equipped with load meter)



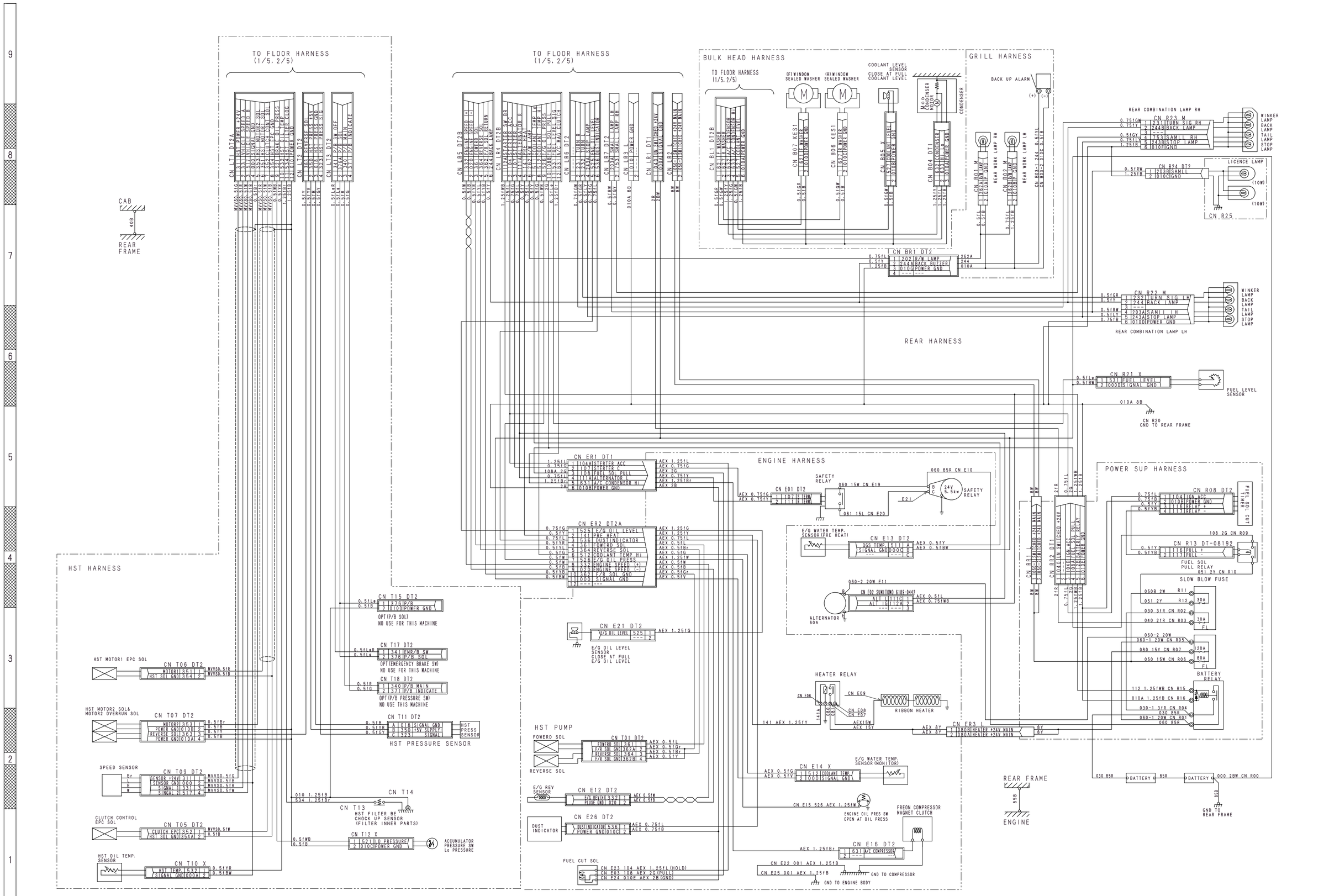
ELECTRICAL CIRCUIT DIAGRAM 2/5 (3/4)
(Machines equipped with load meter)



ELECTRICAL CIRCUIT DIAGRAM 2/5 (4/4)
(Machines equipped with load meter)

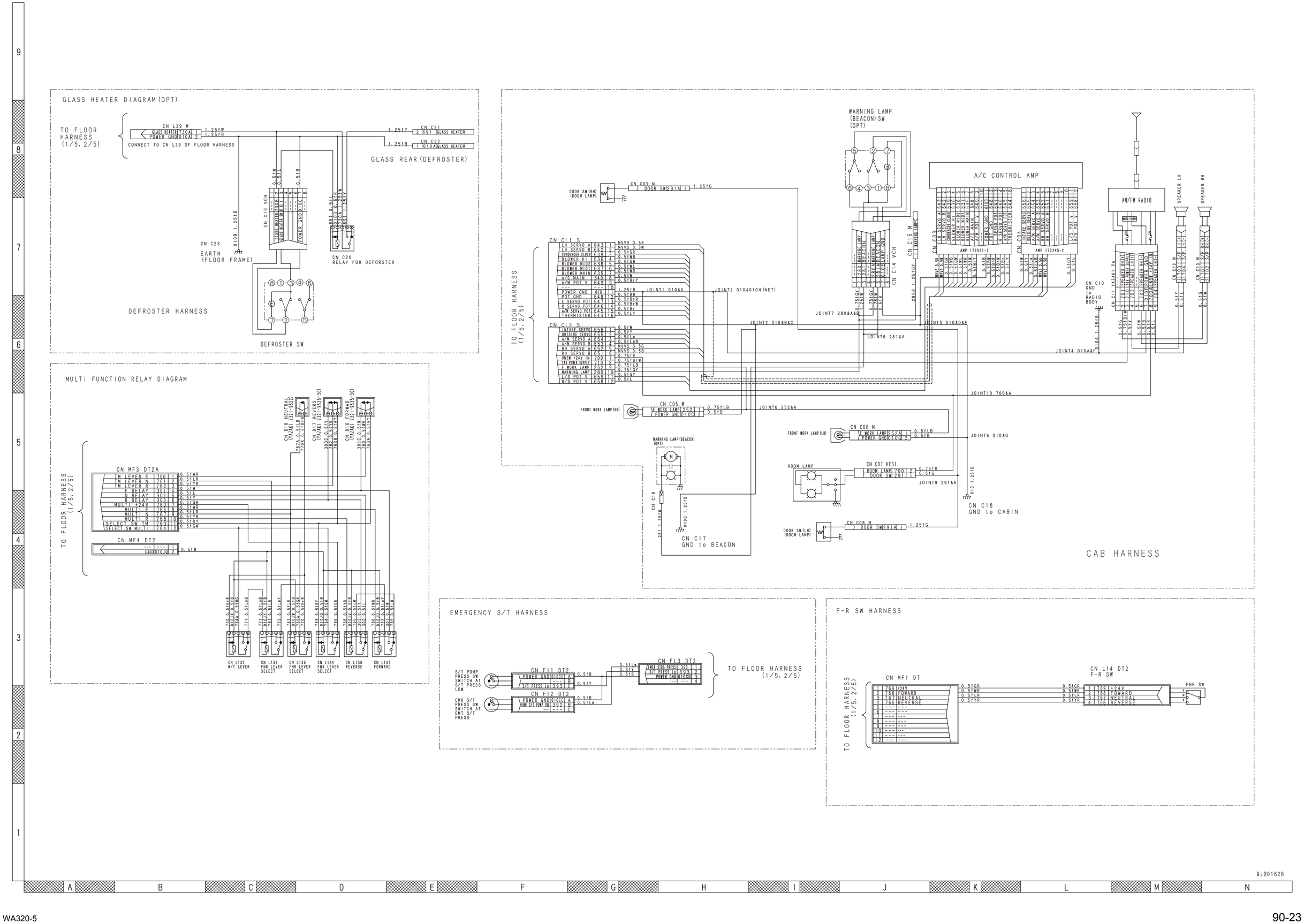


ELECTRICAL CIRCUIT DIAGRAM 3/5

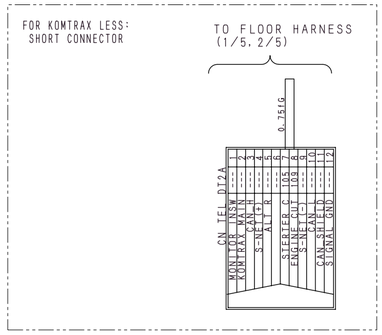


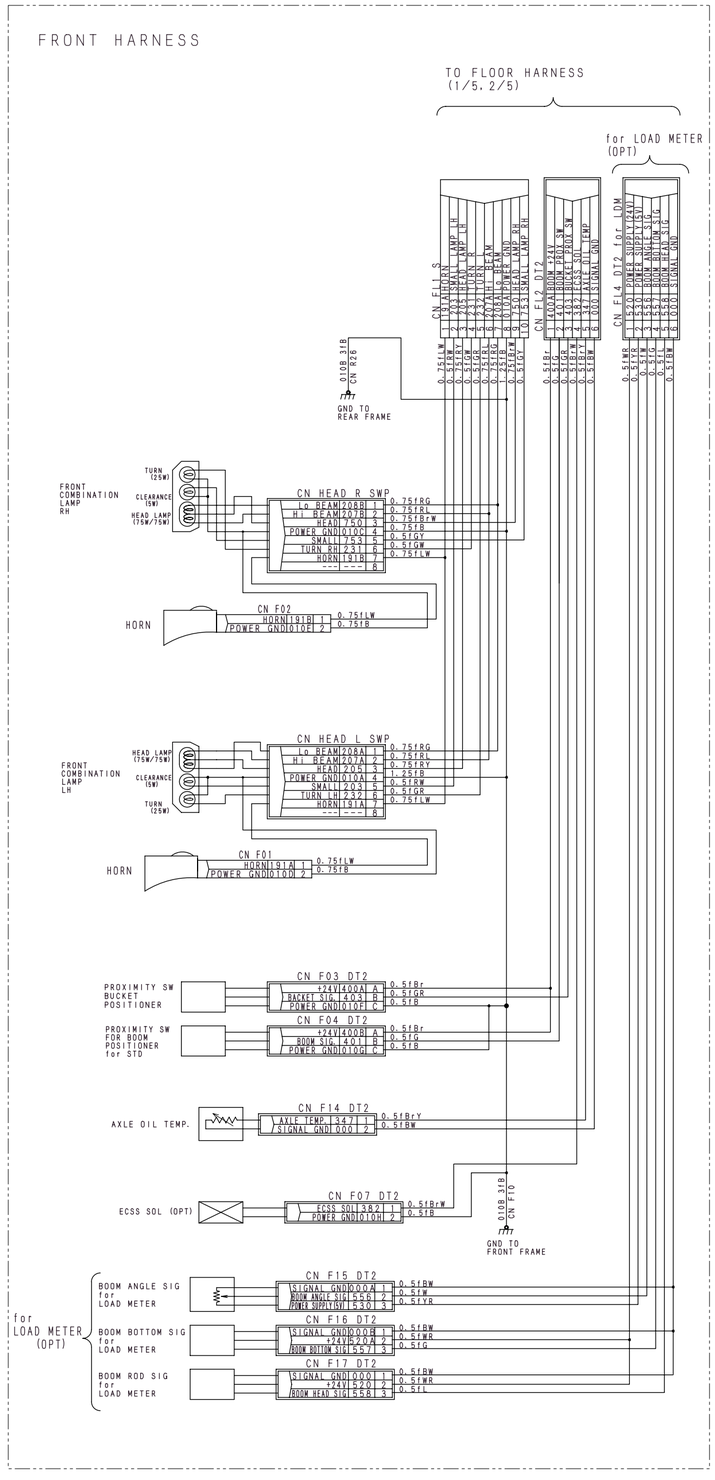
9JB01625

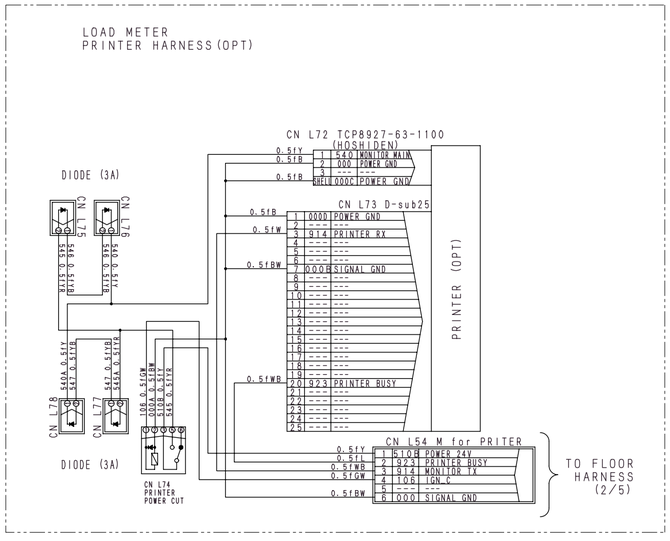
ELECTRICAL CIRCUIT DIAGRAM 4/5



ELECTRICAL CIRCUIT DIAGRAM 5/5





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